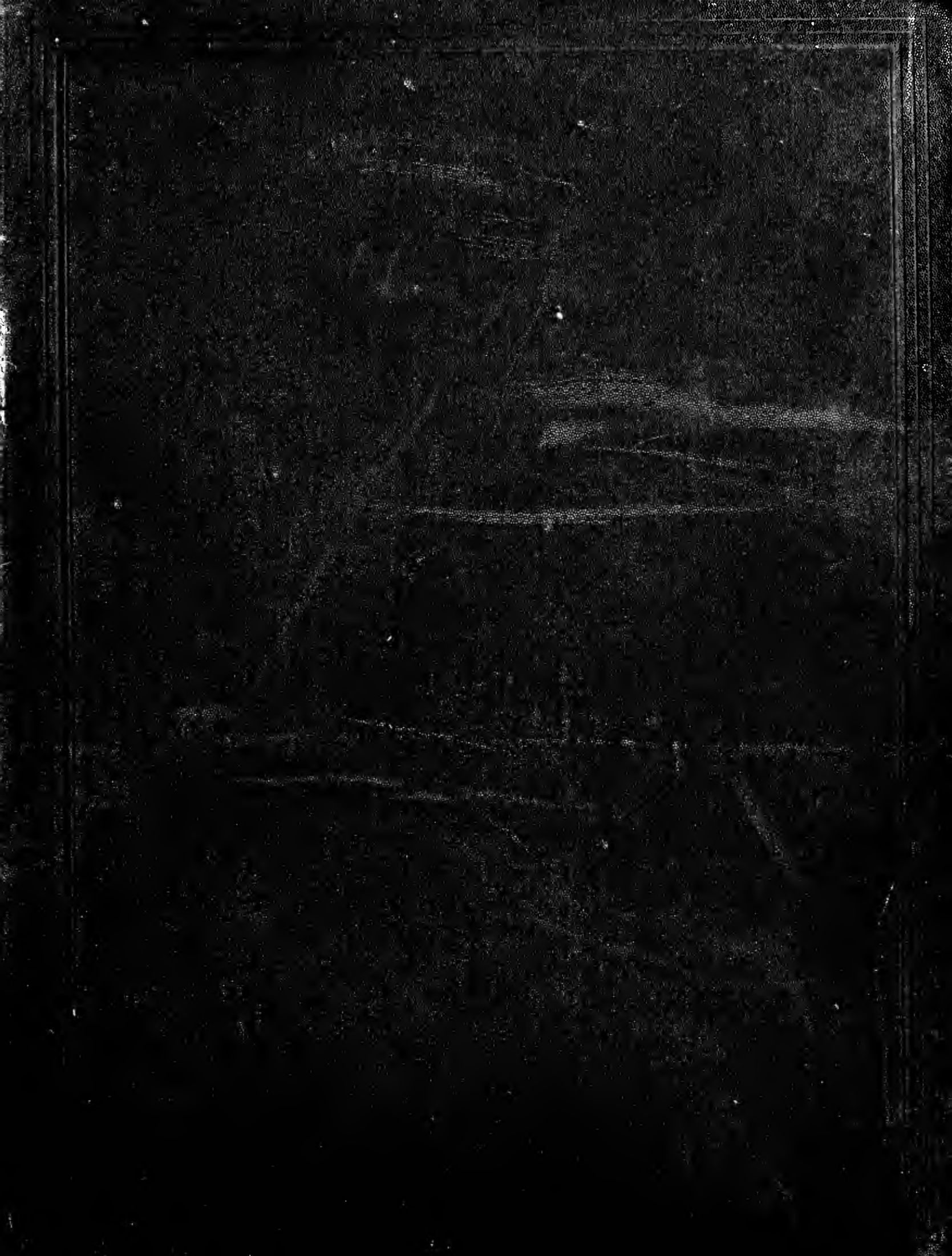


DEPARTMENT OF THE INTERIOR.

REPORT

OF THE

UNITED STATES GEOLOGICAL SURVEY

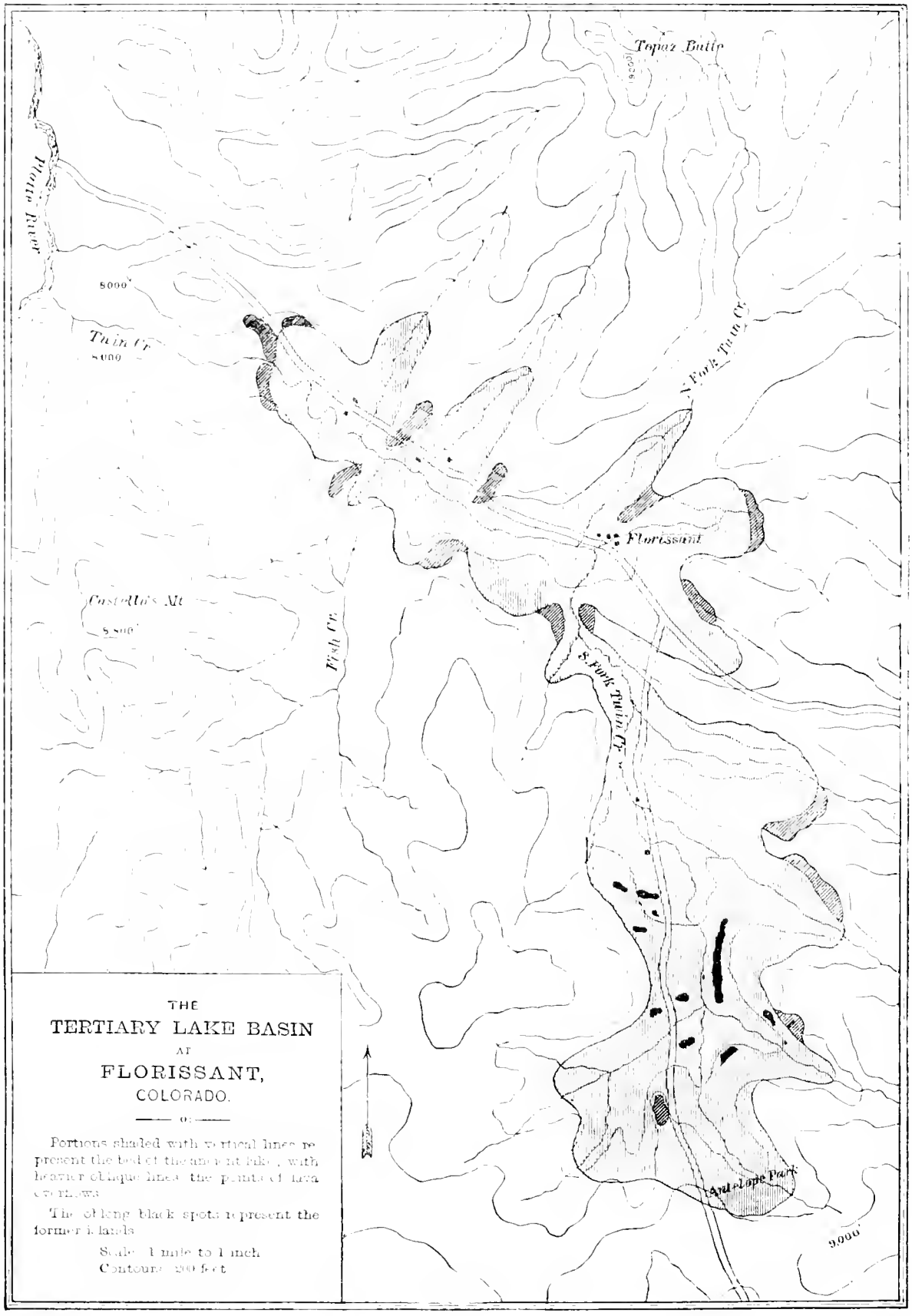
OF

THE TERRITORIES.

F. V. HAYDEN,
UNITED STATES GEOLOGIST-IN-CHARGE.

VOLUME XIII.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1890.



THE

TERTIARY LAKE BASIN

AT

FLORISSANT,

COLORADO.

Portions shaded with vertical lines represent the bed of the ancient lake, with heavier oblique lines the points of lava overflows.

The oblong black spots represent the former islands.

Scale 1 mile to 1 inch
Contours 200 feet

UNITED STATES GEOLOGICAL SURVEY OF THE TERRITORIES.

THE TERTIARY INSECTS OF NORTH AMERICA.

BY

SAMUEL H. SCUDDER.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1890.

NOTE.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY.
Washington, D. C., May 16, 1890.

On the 27th of September, 1882, at the request of Dr. F. V. Hayden, the completion of the publications of the United States Geological and Geographical Survey of the Territories, formerly under his charge, was committed to the charge of the Director of the Geological Survey by the following order from the honorable the Secretary of the Interior:

DEPARTMENT OF THE INTERIOR,
Washington, September 27, 1882.

Maj. J. W. POWELL,
Director U. S. Geological Survey:

SIR: The letter of Prof. F. V. Hayden, dated June 27, bearing your indorsement of July 20, relating to the unpublished reports of the survey formerly under his charge, is herewith returned.

You will please take charge of the publications referred to in the same, in accordance with the suggestions made by Professor Hayden.

It is the desire of this office that these volumes shall be completed and published as early as practicable.

Very respectfully,

H. M. TELLER,
Secretary.

Of the publications thus placed in charge of the Director of the United States Geological Survey the accompanying volume is the third to be issued, the preceding being "The Vertebrata of the Tertiary Formations of the West," by Edward D. Cope, and "Contributions to the Fossil Flora of the Western Territories," by Leo Lesquereux.

J. W. POWELL,
Director.

CONTENTS.

ILLUSTRATIONS.

ERRATA.

Page 15, eleventh line from bottom, *for* specimen *read* individual.

Page 28, line eighteen, *for* specimens *read* species.

Page 71, under Aranea columbiæ, *for* Pl. 11 *read* Pl. 2.

Page 202. The two paragraphs immediately preceding Forficulariæ belong on page 203, immediately preceding Labidromma.

Page 203, line three, *for* cricket *read* crickets.

Page 203, before Labidromma, insert the two paragraphs on page 202, immediately preceding Forficulariæ.

Page 225, line one, *for* interspaces *read* interspace; line two, *insert* that *before* above.

Page 244, in table, *for* 3. Geranchum *read* 3. Gerancon; *for* 13. Amalanchum *read* 13 Amalancon; *for* 15. Anconotus *read* 15. Anconatus.

Page 245, under C. absens, the third line *should read*: Fore wing nearly three times as long as broad. First oblique vein nearly straight, etc.

Page 248, in three headings, *for* Geranchon *read* Gerancon.

Page 249, in heading, *for* Geranchon *read* Gerancon.

Page 256, line twenty, *before* parts *insert* except at base.

Page 316, lines 5 and 6, *for* possibly Inmniferous *read* highly decorated.

Page 343, line 4, *for* in the to-day *read* to-day in the.

Page 362, line 20, *for* referred *read* referable.

Page 446, line 15, and in several places on succeeding pages, *for* punctæ *read* puncta.

Page 610, lines 13 and 14, *for* abdomen *read* thorax.

LETTER OF TRANSMITTAL.

U. S. GEOLOGICAL SURVEY,
DIVISION OF FOSSIL INSECTS,
Cambridge, March 14, 1890.

SIR: It is a source of great regret to me that the volume herewith transmitted could not have been published during Dr. Hayden's life. It contains the first fruits of an undertaking inspired by him and encouraged by his aid. The extent of the task he intrusted to me more than a dozen years ago has been, with the interference of other duties, the occasion of the delay in its execution. The material has grown beyond all expectation, far beyond anything that could have been anticipated.

As originally planned, when the Florissant beds were first carefully exploited, the fossil insects other than those from Florissant were first to be disposed of, and the latter were then to be taken up by orders. The plates were accordingly executed (before the completion of the text) with that plan in view, and the first ten plates herewith transmitted contain very nearly all the extra-Florissant insects known ten years ago. Since then their number has perhaps doubled. The succeeding plates contain the lower orders of Florissant arthropods, ending with the Hemiptera.

The text has been made to conform in large measure to the same plan, except that the insects of different localities and of different horizons have been arranged in one systematic series. Descriptions of a considerable number of species have been introduced for completeness' sake which are not figured, but of every one of these drawings have been finished and will be given in some future publication. The early portion of the text was written many years ago—the Arachnida and Termitina in 1881, most of the Odonata in 1882, the Ephemeridæ and Planipennia in 1883, and the Trichoptera and Orthoptera in 1884; and, as the general remarks prefixed to each group were written on the completion of the study of that group, and would now have to be modified in some slight particulars, I have thought best to let these remarks remain as written, and to append at the

end of each general paragraph the date of writing. To rewrite the whole would unnecessarily delay the appearance of the work, and the dates will explain otherwise unaccountable, though generally very slight, omissions of later material.

The new portions of the Coleoptera, Diptera, and Hymenoptera were mostly written a year ago, and during the past year the Hemiptera, much the most extensive group in the volume, have been elaborated. In the four later orders the general remarks and summaries attached to the genera, families, etc., of the earlier groups are omitted, because these orders will form the subject of future separate consideration, and the basis for generalization will then be greatly increased; the representation of these orders in the present volume is very meager, including next to no species from Florissant.

The publication of this volume will give the first opportunity for any good comparisons between the long known Tertiary insects of Europe and those of any other country: so far as the lower orders of insects are concerned—the only ones here at all fully elaborated—they show that the material already gathered within the last two decades in America is at least as rich as that of the well gleaned fields of Europe. The present volume contains descriptions of 1 species of Myriapoda, 34 of Arachnida, 66 of Neuroptera, 30 of Orthoptera, 266 of Hemiptera, 112 of Coleoptera, 79 of Diptera, 1 of Lepidoptera, and 23 of Hymenoptera, in all 612 species. For the lower orders, that is, those here fully treated, these numbers are already slightly in excess of those obtained from the European Tertiaries, if the rich amber fauna of the Baltic is excluded; for the corresponding numbers for the European species from the rocks would be approximately as follows: Myriapoda, 1; Arachnida, 24 (recently, however, nearly doubled); Neuroptera, 59; Orthoptera, 36; and Hemiptera, 218; a total of 338 species against 397 for the American rocks. There is no doubt that this excess would be found even greater in the higher orders by the material already many years in hand; and the extent of the insect-bearing rocks of the West, which as yet have been touched only here and there, is so immeasurably greater than that of similar European strata that only the lack of students in this field of American paleontology can prevent our deposits from assuming a commanding position in the world.

Very respectfully, yours,

SAMUEL H. SCUDDER.

Hon. J. W. POWELL,
Director U. S. Geological Survey, Washington, D. C.

THE TERTIARY INSECTS OF NORTH AMERICA.

By Samuel H. Scudder.

INTRODUCTION.

That creatures so minute and fragile as insects, creatures which can so feebly withstand the changing seasons as to live, so to speak, but a moment, are to be found fossil, engraved, as it were, upon the rocks or embedded in their hard mass, will never cease to be a surprise to those unfamiliar with the fact. "So fragile," says Quinet[1], "so easy to crush, you would readily believe the insect one of the latest beings produced by nature, one of those which has least resisted the action of time; that its type, its genera, its forms, must have been ground to powder a thousand times, annihilated by the revolutions of the globe, and perpetually thrown into the crucible. For where is its defense? Of what value its antennæ, its shield, its wings of gauze, against the commotions and the tempests which change the surface of the earth? When the mountains themselves are overthrown and the seas uplifted, when the giants of structure, the mighty quadrupeds, change form and habit under the pressure of circumstances, will the insect withstand them? Is it it which will display most character in nature? Yes! The universe flings itself against a gnat. Where will it find refuge? In its very diminutiveness, its nothingness."

The pages and plates of the present volume bear testimony to the fact that our tertiary strata have preserved remnants of an ancient host, so varied in structure, so closely also resembling their brethren of to-day, that nearly or quite every prevalent family-group in the entire range of the insect-world has already been demonstrated to have then existed. While often fragmentary and crushed, sometimes beyond recognition, a not insignificant number are sufficiently preserved for us to repopulate the past;

[1] E. Quinet: La Création, vol. 1, p. 197.

sometimes, too, are they preserved in such a wonderful manner that in tiny creatures with a spread of wings scarcely more than a couple of millimeters one may count under the microscope the hairs fringing the wings.

In attempting thus to restore the past world of our insects, two or three general features have been forced upon my attention, which may well be mentioned here. One of them is the remarkable fact that in hardly a single instance has the same species been found at two distinct localities. These localities, it is true, are in some instances separated by hundreds or even thousands of miles, and analogy with the present distribution of insects would lead us to expect more or less profound changes in passing from one to another. But at other times the distance is not great, or at any rate not great enough to make this a satisfactory reason. It is more probable that the beds in which they occur are not altogether synchronous; and we are led to believe that in the separation of horizons insects will give more precise and definite distinctions than may be gained by the study of the plant remains of the same beds. The data at our disposal are not yet sufficiently varied to enable us to speak with any confidence, but when the other groups of Florissant insects, not considered in the present volume, are worked out, and the new material that is at hand from the other principal localities has been fairly studied, it may be found that we are armed with a new weapon of attack in solving the immediate succession of the Tertiary series of the West in their finer subdivisions.

Another point to which attention may be drawn is the very considerable number and quite extraordinary proportion of species which so far are represented by a single specimen. Leaving out of consideration certain marvelously prevalent forms in the beds of Florissant, such as certain Formicidæ, Alydina, etc., one working these beds, from which many thousands of insects have already been taken, may confidently expect that every third or fourth specimen will prove something new. A quite similar statement can be made of all, or all but one, of the other localities where insects have been found in our Tertiary deposits: it surely indicates that with all the rich results of the explorations so far undertaken we are only upon the threshold of our possible knowledge. We find a richness of fauna far exceeding anything before supposed possible.

The interest of the Tertiary fauna is further enhanced by the discovery that no inconsiderable proportion of the species in this fauna must be re-

ferred to genera not now extant. Granted that our knowledge of the subtropical forms of this continent (with which as a whole at least our Florissant fauna seems to be akin) is much too meager to be of great service; granted also that in many cases we are forced to establish new genera upon what would be regarded among recent animals as too slender grounds: it is nevertheless true that an unexpectedly large number of forms can not be forced into modern genera already established; in many cases, throughout whole groups, kindred differences from modern types are found which indicate considerable changes of structure in the intervening epochs along parallel lines. In illustration of this we would call special attention to the differences observed in the genera of plant-lice, and, in several places among other Hemiptera as well as among the Coleoptera, to the decided differences in the relative length of various members of the body. My own belief, which springs from the comparisons instituted in the study of this fauna, is that a much larger proportion of genera should really have been founded, and that, for every type which may turn up in Central American explorations of the near future identical with those now established upon the fossils alone, it will be necessary to separate from the familiar surroundings in which I have placed it some other of the insects from the same beds.

It should be stated that the larger part of the plates in this volume were engraved before the insects were studied, except in a cursory manner to separate the species; the insects are therefore not always properly grouped, and the legends upon the plates are in part inaccurate.

In the enumeration of the specimens at the end of the specific descriptions the numbers of the obverse and reverse of the same specimen are always connected by "and" without any intervening comma, and this typographical method is employed only for expressing this relation.

In the study of these extinct insects much assistance has been received from friends, to whom my cordial thanks are due; for valuable suggestions from the late Dr. J. L. LeConte, from Baron R. von Osten Sacken, Edward Burgess, Esq., and Drs. G. H. Horn and H. A. Hagen; for the open collections of the late G. D. Smith, Esq., and of Messrs. E. P. Austin and Samuel Henshaw; and for important aid in obtaining typical series of modern insects in various groups by Messrs. E. P. Austin, P. R. Uhler, E. P. Van Duzee, Edward Burgess, Dr. A. Forel, and most especially Mr. Samuel Henshaw.

LOCALITIES WHERE TERTIARY INSECTS HAVE BEEN FOUND IN AMERICA.

Florissant, Colorado.—The Tertiary lake basin at Florissant,[1] already famous for its prolific beds of plants and insects, is situated in a narrow valley high up in the mountains at the southern extremity of the Front Range of Colorado, at no great distance from Pike's Peak.

The basin is shown on Sheet 13 of the geological atlas of Colorado, published by Dr. Hayden's survey, and its outlines are marked with considerable accuracy, although upon a comparatively small scale. The ancient lake lies in the valley of the present South Fork of Twin Creek, and of the upper half of the main stream of the same after the South Fork has joined it. Following the old stage road from South Park to Colorado Springs, and leaving it just above the railway station at Florissant, and then taking the road which leads over the divide toward Cañon City, we pass between the Platte River and the Arkansas divide, through the entire length of the basin. This road crosses the South Platte a short distance, say a kilometer and a half, below the mouth of Twin Creek, climbs a long gradual slope on the east bank of the river to an open grassy glade about 2,500 meters above the sea, and then descends a little more than three kilometers from the river to join the valley of Twin Creek. One scarcely begins the descent before his attention is attracted by the outcropping of drab-colored shales, which continue until almost the very summit of the divide is reached and the descent toward the Arkansas begun, a traveling distance of not far from 13 kilometers. The shales may indeed be seen for several kilometers on the farther side of this divide, but no organic remains have yet been found in them.

By climbing a neighboring peak, thrice baptized as Crystal Mountain, Topaz Butte, and Cheops Pyramid, and known to the old miners as Slim Jim, we obtained an admirable bird's-eye view of the ancient lake and the

[1] This account of Florissant is taken almost bodily from a paper by Prof. Arthur Lakes and myself (Bull. U. S. Geol. Surv. Terr., vol. 6, 1881, pp. 279, seq.).

surrounding region. To the southeast is Pike's Peak; to the west South Park and the cañon of the South Platte, shown by a depression; to the extreme south the grand cañon of the Arkansas; while to the north a few sharp, ragged, granite peaks surmount the low wooded hills and ravines characteristic of the nearer region. Among these hills and ravines, and only a little broader than the rest of the latter, lies, to the south, the ancient Florissant Lake basin, marked by an irregular L-shaped grassy meadow, the southern half broader and more rolling than the northwestern, the latter more broken and with deeper inlets.

Recalling its ancient condition it will appear that this elevated lake must have been a beautiful, though shallow,[1] sheet of water. Topaz Butte, and a nameless lower elevation lying eight kilometers to its southwest, which we may call Castello's Mountain, guarded the head of the lake upon one side and the other, rising 300 or 400 meters above its level. It was hemmed in on all sides by nearer granitic hills, whose wooded slopes came to the water's edge; sometimes, especially on the northern and eastern sides, rising abruptly, at others gradually sloping, so that reeds and flags grew in the shallow waters by the shore. The waters of the lake penetrated in deep inlets between the hills, giving it a varied and tortuous outline: although only about 16½ kilometers long and very narrow, its margin must have measured over 70 kilometers in extent. Still greater variety was gained by steep promontories, 20 meters or more in height, which projected abruptly into the lake from either side, nearly dividing it into a chain of three or four unequal and very irregular open ponds, running in a northwest-southeast direction, and a larger and less indented sheet, as large as the others combined, connected with the southwesternmost of the three by a narrow channel, and dotted with numerous long and narrow wooded islets just rising above the surface.

The ancient outlet of the whole system was probably at the southern extremity; at least the marks of the lake deposits reach within a few meters of the ridge which now separates the waters of the Platte and Arkansas; the nature of the basin itself, and the much more rapid descent of the present surface on the southern side of this divide lead to this conclusion. At the last elevation of the Rocky Mountain chain the drainage flow of this immediate region was reversed; the elevation coming from a southerly or south-

[1] The shallowness of the lake is indicated by the character of the fish, the sun cracking of some of the shales and the erect sequoia stumps.

easterly direction (perhaps from Pike's Peak), the lake, or series of lakes, was drained dry by emptying at the northwestern extremity. The drainage of the valley now flowed into a brook which followed the deeper part of its former floor, and the waters of the region have since emptied into the Platte and not the Arkansas, passing in their course between Topaz Butte and Castello's Mountain.

The promontories projecting into the lake on either side are formed of trachyte or other volcanic lavas, apparently occurring in fissures directly athwart the general course of the northwestern or upper series of lakes, and masses of the same occur at many different points along the ancient shore, such as the western corner where the waters of the lake were finally discharged; in the neighborhood of the village; along the eastern wall of the lowermost of the chain of upper lakes, near where the present road divides; and at points along both eastern and western walls of the lower southern lake. In general the trachytic flows seem to be confined to the edges of the lacustrine basin, but some, if not all, of the mesas or ancient islands of the southern lake have trachytic flows over them; and toward the southern extremity of the lake what was once a larger island now forms a rounded hill with steep northern walls, crowned by heavy beds of dark trachyte, and its slopes covered with quantities of vesicular scoriæ. The rough and craggy knoll immediately overlooking the present village of Florissant, the reputed scene of Indian combats,[1] is witness of hotter times than those; vertical cylindrical holes, with smooth walls, in which a man could hide from sight, funnels scored by heat, mark, perhaps, the presence of former geysers; the basaltic rocks themselves are deeply fissured by the breaking up of the planes of divisions between the columns, affording the best protection to the Ute and Arapahoe warriors. But the very shales of the lake itself, in which the myriad plants and insects are entombed, are wholly composed of volcanic sand and ash; 15 meters or more thick they lie, in alternating layers of coarser and finer material. About half of this, now lying beneath the general surface of the ground, consists of heavily-bedded drab shales, with a conchoidal fracture, and is totally destitute of fossils. The upper half has been eroded and carried away, leaving, however, the fragmentary remains of this great ash deposit clinging to the borders of the basin and surrounding the islands; a more convenient arrange-

[1] Their rude fortifications still crown the summit.

ment for the present explorer could not have been devised. That the source of the volcanic ashes must have been close at hand seems abundantly proved by the difference in the deposits at the extreme ends of the lake as will be shown in the sections to be given. Not only does the thickness of the beds differ at the two points, but it is difficult to bring them into anything beyond the most general concordance.

There are still other proofs of disturbance. Around one of the granitic islands in the southern lake basin the shales mentioned were capped by from one and a half to two and a half meters of sedimentary material, reaching nearly to the crown of the hill, the lowest bed of which, a little more than three decimeters thick, formed a regular horizontal stratum of small volcanic pebbles and sand (A and B of Dr. Wadsworth's note, further on), while the part above is much coarser, resembling a breccia, and is very unevenly bedded, pitching at every possible angle, seamed, jointed, and weather-worn, curved and twisted, and inclosing pockets of fine laminated shales, also of volcanic ash, in which a few fossils are found (C of Dr. Wadsworth's note). These beds cap the series of regular and evenly stratified shales (D of the same note), and are perhaps synchronous with the disturbance which tilted and emptied the basin. The uppermost evenly bedded shales then formed the hard floor of the lake, and these contorted beds the softer, but hardening, and therefore more or less tenacious, deposits on that floor.

The excavation of the filled-up basin we must presume to be due to the ordinary agencies of atmospheric erosion. The islands in the lower lake take now as then the form of the granitic nucleus; nearly all are long and narrow, but their trend is in every direction both across and along the valley in which they rest. Great masses of the shales still adhere equally on every side to the rocks against which they were deposited, proving that time alone and no rude agency has degraded the ancient floor of the lake.

The shales in the southern basin dip to the north or northwest at an angle of about two degrees, and according to the contours of the Hayden Survey, the southern end of the ancient lake is now elevated nearly two hundred and fifty meters above the extreme northwestern point. The greater part of this present slope of the lake border will be found in the southern half, where it can not fail to at once strike the observant eye, the southernmost margin close to the summit of the divide being nearly two hundred meters higher than the margin next the hill by the forks of the road.

Our examination of the deposits of this lacustrine basin was principally made in a small hill, from which perhaps the largest number of fossils have been taken, lying just south of the house of Mr. Adam Hill, now owned by Mr. Thompson, and upon his ranch. Like the other ancient islets of this upland lake, it now forms a mesa or flat-topped hill about ten or a dozen meters high, perhaps a hundred meters long and twenty-five broad. Around its eastern base are some of the famous petrified trees—huge, upright trunks, standing as they grew, which are reported to have been five or six meters high at the advent of the present residents of the region. Piecemeal they have been destroyed by vandal tourists, until now not one of them rises more than a meter above the surface of the ground, and many of them are entirely leveled; but their huge size is attested by the relics, the largest of which can be seen to have been three or four meters in diameter. These gigantic trees appear to be Sequoias, as far as can be told from thin sections of the wood submitted to Dr. George L. Goodale. As is well known, remains of more than one species of Sequoia have been found in the shales at their base.

At the opposite sloping end of this mesa a trench was dug from top to bottom to determine the character of the different layers, and the section exposed was carefully measured and studied. In the work of digging this trench we received the very ready and welcome assistance of our companion, Mr. F. C. Bowditch, and of Mr. Hill.

From what information we could gain about the wells in this neighborhood and from a shaft sunk obliquely in the side of a hill near the northwestern extremity, it would appear that the present bed of the ancient Florissant lake is entirely similar in composition for at least ten meters below the surface, consisting of heavily bedded non-fossiliferous shales, having a conchoidal fracture. Above these basal deposits, on the slope of the hill, we found the following series, from above downward, commencing with the evenly bedded strata:

SECTION IN SOUTHERN LAKE.

(*By S. H. Scudder and A. Lakes.*)

	Centimeters.
1. Finely laminated, evenly bedded, light-gray shale; plants and insects scarce and poorly preserved	3.2
2. Light-brown, soft and pliable, fine-grained sandstone; unfossiliferous	5
3. Coarser, ferruginous sandstone; unfossiliferous	3.8
4. Resembling No. 1; leaves and insect remains	21
5. Hard, compact, grayish-black shale, breaking with a conchoidal fracture, seamed in the middle with a narrow strip of drab shale; fragments of plants	28

6. Ferruginous shale; unfossiliferous	1.5
7. Resembling No. 5, but having no conchoidal fracture; stems of plants, insects, and a small bivalve mollusk	9
8. Very fine gray ochreous shale; non-fossiliferous	0.5
9. Drab shales, interlaminated with finely divided paper shales of light-gray color; stems of plants, reeds, and insects	46
10. Crumbling ochreous shale; leaves abundant, insects rare	7.5
11. Drab shales; no fossils	7.5
12. Coarse, ferruginous sandstone; no fossils	3.8
13. Very hard drab shales, having a conchoidal fracture and filled with nodules; unfossiliferous	63
14. Finely laminated yellowish or drab shales; leaves and fragments of plants, with a few insects	30
15. Alternating layers of darker and lighter gray and brown ferruginous sandstone; no fossils	10
16. Drab shales; leaves, seeds, and other parts of plants, with insects, all in abundance	62
17. Ferruginous, porous, sandy shales; no fossils	5.7
18. Dark gray and yellow shales; leaves and other parts of plants	9
19. Interstratified shales, resembling 17 and 18; leaves and other parts of plants, with insects	17.8
20. Thickly bedded chocolate-colored shales; no fossils	41
21. Porous yellow shale, interstratified with seams of very thin drab-colored shales; plants	7.5
22. Heavily bedded chocolate-colored shales; no fossils	30
23. Thinly bedded drab shales; perfect leaves, with perfect and imperfect fragments of plants, and a few broken insects	20
24. Thinly bedded light drab shales, weathering very light; without fossils	20
25. Thick bedded drab shales, breaking with a conchoidal fracture; also destitute of fossils	18
26. Coarse arenaceous shale; unfossiliferous	9
27. Gray sandstone, containing decomposing fragments of some white mineral, perhaps calcite; no fossils	178
28. Coarse, ferruginous, friable sandstone, with concretions of a softer material; fragments of stems perhaps	60
29. Thinly bedded drab shales, having a conchoidal fracture, somewhat lignitic, with fragments of roots, etc	25
30. Dark-chocolate shales, containing yellowish concretions; filled with stems and roots of plants	25
Total thickness of evenly bedded shales ("D," of Dr. Wadsworth's note) above floor deposits (Meters)	6.668

The bed which has been most worked for insects and leaves, and in which they are unquestionably the most abundant and best preserved, is the thick bed, No 16, lying half-way up the hill, and composed of rapidly alternating beds of variously colored drab shales. Below this, insects were plentiful only in No. 19, and above it in Nos. 7 and 9; in other beds they occurred only rarely or in fragments. Plants were always abundant where insects were found, but also occurred in many strata where insects were either not discovered, such as Nos 18 and 21 in the lower half and No. 6 in the upper half, or were rare, as in Nos. 10 and 14 above the middle and No. 23 below; the coarser lignites occurred only near the base.

The thickest unfossiliferous beds, Nos. 20 and 27, were almost uniform in character throughout, and did not readily split into laminæ, indicating an enormous shower of ashes or a mud flow at the time of their deposition; their character was similar to that of the floor-beds of the basin.

These beds of shale vary in color from yellow to dark brown. Above them all lay, as already stated, from fifteen to twenty-five decimeters of coarser, more granulated sediments, all but the lower bed broken up and greatly contorted. These reached almost to the summit of the mesa, which was strewn with granitic gravel and a few pebbles of lava.

Specimens of these upper irregular beds, and also of the underlying shales, were submitted to Dr. M. E. Wadsworth, of Cambridge, Massachusetts, now of Houghton, Michigan, who caused thin sections to be made from them and has furnished the following account of their microscopical structure:

TUFA FROM FLORISSANT.

The method and scheme of classification employed here is that briefly sketched in the Bulletin of the Museum of Comparative Zoölogy (vol. 5, pp. 275–287). By this system only do we think that the inclosed fragments could be named, for they contain so few crystals that in most cases the base is the principal thing upon which the decision must rest.

A.—THE FINER DEPOSIT JUST ABOVE THE SHALES.

A medium-grained gray tufa, containing crystals and fragments of feldspar, augite, etc., cemented by a fine earthy groundmass.

In the thin section it is seen to be an epitome of the volcanic rocks of the Cordilleras. The groundmass holds fragments of basalt, andesite, trachyte, and rhyolite, with detached minerals derived from them.

The basaltic fragments have in part a dense globulitic base porphyritically holding ledge-formed plagioclase crystals and a few augite granules. Some of the basalt is quite coarsely crystallized, approaching the doleritic type. Olivine was observed in some of the fragments, but it is largely altered to a reddish-brown serpentine. Magnetite is abundant. In many of the fragments the groundmass has decomposed to a reddish-brown mass, which is untransparent and holds clear crystals of plagioclase. The basaltic fragments have suffered more from alteration and decomposition than any others in the tufa.

Of andesite, both varieties pointed out by us (loc. cit., p. 280) occur in this tufa. The first, which is nearest the basalt in composition, has a brown glass as its base, filled with microlites. This base holds minute rectangular and oblong crystals of feldspar. Large microlites of augite and grains of magnetite were seen. Fragments of this are common, and are clear and unaltered. The second variety of andesite was seen to have a dense gray micro-felsitic base, holding ledge-formed feldspars and magnetite grains. Some contained the reddish-brown fibers of the destroyed hornblende. Fragments of this variety of andesite are quite abundant.

The trachyte has a light gray, felty, and glassy base, some fragments showing besides this only faint traces of polarization caused by incipient feldspars. Other fragments show minute, well-formed crystals that appear to be sanidin. Grains of magnetite occur scattered through the base. This is also quite abundant, and it, as well as the basalt and andesite, surpasses the rhyolite in amount.

The rhyolite occurs in the form of a more or less clear glass, often cellular. The cells are often drawn out in the direction of the original flow, forming a fibrous struct

ure, which when of a grayish or reddish brown color resembles woody fiber. Some of the fragments contain elliptical cells, and a few shards of water-clear glass free from inclusions were seen.

Many crystals, entire or broken, are scattered throughout the groundmass of the tufa. These crystals belong to plagioclase, sanidin, olivine, magnetite, augite, and quartz. But little quartz was observed; one crystal contained trichites and vapor cavities. The trichites are the same as those commonly seen in the quartz of granite, but this appears to have been derived from the lava. The feldspar contains inclusions of base, glass, and microlites, and through these the rock from which the feldspar was derived can often be told. The augites have the characters of andesitic augite. A little palagonite and one crystal of microline were seen.

The groundmass of the tufa is composed of comminuted and decomposed material derived from the lavas before described. In the groundmass trachytic and rhyolitic material appears to predominate.

This specimen was chosen for description, as it best represented the general characters of the tufas.

B.—The coarser deposit just above the shales.

This is more coarsely fragmental than any of the others, and is composed of a yellowish brown earthy groundmass, holding fragments of quartz, feldspar, basalt, etc. Some of the fragments appear to belong to the older rocks, but none of them were seen in the section. Under the microscope the tufa is similar to the first one described, but its fragments are larger and sometimes better marked. Some kaolinized feldspars and a little biotite were seen. The hornblende in the andesite is in the usual broken forms, with blackened edges.

C.—A specimen from finer portion of the upper contorted beds.

A yellowish earthy groundmass holding crystals and fragments of augite and feldspar. On one side is a layer of fine detritus, composed of the same material as the groundmass of the more coarsely fragmental portion. Its microscopic characters are similar to those of A, except that its materials are more decomposed and sanidin is more abundant. One kaolinized feldspar was observed.

D.—Three specimens of the insect-shales.

These are brownish and grayish brown shales, being simply the finer material of the tufas laid down in laminæ of varying thickness and coarseness. One is very thinly bedded.

This volcanic material has evidently been worked over by water, but the conditions can of course best be told in the field. So far, however, as we can judge by microscopic examination, when the water commenced its work the material was in loose unconsolidated deposits. That it was thrown out as an ash, or rather deposited as a *moya* near its present location, is the most probable supposition. It seems then to have been taken up by the waves and spread out as it is now found. The reason for this opinion is that the fragments are not worn, as they would naturally be if they had been derived directly from solid rock by water action, and the decomposition is not so great as we should expect. The deposition appears to have been gentle but comparatively rapid, for there is no sign of violence or even of such decomposition as we should expect in slow deposition; and showers of ashes falling on still water or a lake acting on an unconsolidated tufa bank answer best the conditions called for here. It is

probable from the kaolinized feldspars and the macroscopic fragments of apparently older rocks that the latter are present in the tufa to some extent. This can best be explained by the supposition that it was deposited as a *moya* or mudflow within reach of the waters that have worked it over and deposited it in its present position. As we said before, the field evidence must be relied upon mainly in deciding such questions as these.

M. E. WADSWORTH.

CAMBRIDGE, MASSACHUSETTS, *April* 15, 1880.

Another section, less carefully measured and noted with less detail than the other, was taken at the extremity of one of the promontories jutting in a southwesterly direction into the middle of the upper chain of lakes, about three kilometers west of the present post-office. The top of the hill was covered with granitic gravel and loose bowlders of dark scoriaceous trachyte; below this we found, passing, as before, from above downward, the following succession:

SECTION IN THE NORTHWESTERN LAKE.

(*By S. H. Scudder and A. Lakes.*)

	Decimeters (estimated).
1. Finely laminated yellow-drab shales; no fossils	12
2. Coarse decomposing yellowish shales; no fossils	12
3. Fine compact drab shales; perfect remains of plants and insects	15
4. Arenaceous shales; very lignitic	6
5. Heavily bedded, coarse-grained, crumbling sandstone, of a grayish-yellow and whitish color, becoming ferruginous in places; partially lignitic	60
6. Chocolate and drab colored shales having a conchoidal fracture, passing below into whitish paper-like shales inclosed between coarse arenaceous laminæ; plants and insects	45
Total thickness of shales above floor deposits. (Meters, estimated)	15

These measurements, being estimated, are undoubtedly too great. The composition of this bluff is coarser in character than that of the section in the southern extension of the lake. The lignitic beds, which have been used for quarrying purposes, contain numerous fragments of reeds and roots not well preserved. The lower portions of the section correspond better with the other than do the upper beds, where it is difficult to trace any correspondence: No. 3 of the northwestern seems, however, to correspond to No. 16 of the southern series. The whitish paper shales lying at the base of this appear to be entirely absent from the southern section, and the distorted beds which crown the mesa are not apparent in the bluff, or, if present, are wholly regular. A more careful and detailed section of the bluff (for which we had not time), and particularly the tracing of the beds along the wall of the lake, would probably bring to light better correspondences.

Judging from the present physical condition of the basin, its age is marked as later than the movements which closed the Cretaceous epoch and earlier than the last upheaval in the Tertiary, which seems to have taken place during or after Miocene times, but there are no physical data yet at hand to warrant definite conclusions on this head.

The insects preserved in the Florissant basin are wonderfully numerous, this one locality having yielded in a single summer more than double the number of specimens which the famous localities at Oeningen, in Bavaria, furnished Heer in thirty years. Having visited both places I can testify to the greater prolificness of the Florissant beds. As a rule the Oeningen specimens are better preserved, but in the same amount of shale we still find at Florissant a much larger number of satisfactory specimens than at Oeningen, and the quarries are fifty times as extensive and far more easily worked.

The examination of the immense series of specimens found at Florissant has not yet critically covered the whole field. It may, nevertheless, be interesting to make the single comparison with the Oeningen insect fauna which the number of individuals will furnish. This is indicated by the following table:

Percentage of representation by—	At Florissant.	At Oeningen.
Hymenoptera	40	14
Lepidoptera	0.04	0.1
Diptera	30	7
Coleoptera	13	48
Hemiptera	11	12
Neuroptera	5	17
Orthoptera	0.25	3
Arachnida	0.25	0.5
	99.54	101.6

It will be seen that in all the orders that are well represented the proportion of specimens of each is very different, with the sole exception of the Hemiptera, while the same groups (Orthoptera, Arachnida, and Lepidoptera) are feebly represented in both. The greatest difference occurs in the Diptera, which are less than 7 per cent. of the whole at Oeningen and about 30 per cent. at Florissant; in the Hymenoptera, which have less than 14 per cent. at Oeningen and 40 per cent. at Florissant, due largely to the

prodigious number of ants; while the case is reversed in Coleoptera, which form nearly one-half the specimens found at Oeningen and only 13 per cent. at Florissant. We possess no count of the specimens found at Radoboj, in Croatia, which is regrettable, since the fauna of Florissant appears to agree much better with it than with any other in one or two points, such as the comparatively minor part played by the Coleoptera and the great number of ants; these latter number fifty-seven species in Radoboj, and five hundred specimens have been found of one of them. Still the comparison can not be carried very closely into other departments; for instance, only one rhynchophorous coleopteron has been reported from Radoboj, while they are very numerous and rich in species at Florissant, and local causes must have had much to do with the fauna of each of these localities. It is hardly worth while to institute any inquiries into the proportion of the groups represented at Florissant and in amber, since the nature of the entombment is entirely different.

Since so far as the Florissant insects are concerned only the lower orders are reported upon in the present volume, it may be worth while to present a rapid sketch of the higher orders, to complete in however imperfect a way the partial view of the Florissant insect fauna which the volume affords.

About three-fifths of the Coleoptera belong to the normal series and two-fifths to the rhynchophorous division. There are eighty to ninety specimens of Carabidæ, including, perhaps, twenty-five species; many of them are very fine and perfect, especially in the sculpturing of the elytra. Water-beetles are not so numerous as would be anticipated; indeed, there are very few specimens, with perhaps half a dozen species; there are no large species such as occur abundantly at Oeningen; the largest of our species, perhaps an Hydrophilus, not exceeding twelve millimeters in length. The Staphylinidæ are rather more numerous than the ground-beetles, with over thirty species, some of them tolerably large. There are half a dozen species of Nitidulidæ. Some sixty or more Scarabæidæ show considerable variety, there being nearly thirty species among them. Nearly as many Buprestidæ have quite as great variety of form; a considerable number of them are large and nearly all fairly preserved, some remarkably perfect: one species, Chrysobothris haydeni, has been described. Elateridæ are more abundant, numbering more than one hundred species, many of them in beautiful condi-

tion; they are abundant in species, over forty having been separated, and are mostly of a medium, none of a large, size. Considerably over one hundred specimens are to be referred to the Meloidæ, Mordellidæ, and Malacodermata, but the specimens do not appear to be very well preserved, although about forty species may be distinguished. The Cerambycidæ are very beautiful, furnishing thirty or more specimens, representing more than half as many species; one fine species of a new extinct genus, Parolamia rudis, has already been described, and there are others equally fine. There are a dozen or more species of Bruchidæ, one of which, Spermophagus vivificatus, has been published. Chrysomelidæ are not uncommon; thus far I have recognized about two dozen species among the sixty or eighty specimens; one, Oryctoscirtetes protogæus, belonging to a new genus, has already been published. Nearly twenty species of Tenebrionidæ have been separated, rarely represented by more than a single specimen each, and there are also a few (from two to ten species each) of Silphidæ, Histeridæ, Dermestidæ, Ptinidæ, and Coccinellidæ, and a single species each of Cleridæ and Telephoridæ, the latter already described under the name of Chauliognathus pristinus. Two specimens of Rhynchophora, Anthonomus defossus and Eurhinus occultus, have been described; I have already mentioned the predominance of this type in opposition to the European Tertiaries; the species are very numerous, nearly one hundred and twenty having been separated, with over five hundred specimens, and among them are a goodly number of large and fine species; but some of the minutest are most admirably preserved; especially is this true of the sculpturing of the thorax and elytra; no attempt, however, has yet been made to do more than rudely separate the species, so that no details can now be given.

Nearly a third of all the specimens I have seen from Florissant belong to the Diptera. Culicidæ and Chironomidæ are abundant, but not generally very perfect. Tipulidæ are abundant and admirably preserved; of the larger forms alone there appear to be several hundred specimens, and apparently a considerable number of species; the smaller Tipulidæ, including the Limnobina, are also abundant and well preserved. Many beautiful Mycetophilidæ occur, probably twenty or thirty species. Bibionidæ are the prevailing type among the Diptera; there must be a thousand specimens belonging to this family, and on a cursory view there appears to be no great variety; probably both here and in the ants, as in some gen-

era of plants, it will appear that there are vast numbers of a single species; a great many specimens are represented by bodies only, or these accompanied by insignificant fragments of wings, but even putting all these aside there remain a goodly number with tolerably perfect wings, and some in which almost every part of the body is preserved; taken as a whole, however, they are perhaps less perfect than specimens of almost any other family. There are a dozen or more Stratiomyidæ, of two or three species, and several species of Midasidæ or Hirmoneuridæ, one admirable specimen of the latter family having been described as belonging to a new genus under the name of Palembolus florigerus. There are nearly half a hundred Asilidæ and Therevidæ, many of them exquisitely preserved, some of great size, and among them a fair variety of forms. Bombylidæ are somewhat less abundant, but show some superb specimens of great size and in wonderful preservation; there are certainly six or eight species. Syrphidæ are more abundant than the last, nearly fifty specimens having been found in which the patterns of the abdominal colors are generally well marked, and among which we find a considerable variety; they have been studied by one very familiar with that group, Dr. S. W. Williston, and the results of his examinations are given in his Synopsis of the North American Syrphidæ (pp. 281-283), published by the U. S. National Museum. There is a vast host of Muscidæ and allied groups, of which no account has yet been taken, and with which no doubt many other forms are still commingled, but three or four species of very pretty Ortalidæ may be mentioned with ten or a dozen specimens, and there are a large number of Empidæ.

A few Lepidoptera occur. The butterflies, seven in number, have been described in the Eighth Annual Report of the present Geological Survey. They all represent distinct and extinct genera. Six of the seven belong to the Nymphalidæ, the seventh to the Pierinæ. Of the Nymphalidæ all but one are Vanessidi. The exception is of special interest, since it belongs to the Libytheinæ, the family of living butterflies the most meager in numbers, though found in every quarter of the globe. To be able to add that still an eighth butterfly, found since the others were described, belongs to a second extinct genus of Libytheinæ (which I have called Barbarothea) is certainly marvelous. Besides these I have set aside about a dozen specimens of perhaps eight species of moths, but they are obscure, mostly of small size, perhaps Pyralidæ or Tortricidæ, and, excepting one described in

this work, have not been critically studied. A single caterpillar has been found, and the structure of its skin has been studied by Dr. C. S. Minot,[1] but without any very satisfactory results.

No Hymenoptera have yet been described. About a dozen specimens are referred to Apidæ and Andrenidæ; several species are represented, but most of them are badly preserved; the largest appears to be a Bombus. Of Vespidæ and other large wasp-like Hymenoptera about seventy or eighty specimens have been found, referable to about thirty species, one of which is a large Scolia or allied genus; several are Sphegidæ, including an Ammophila; one, which seems to be a Polistes, shows traces of a blue-green metallic tint; another, apparently one of the Pompilidæ, represents a species with a large subapical fuliginous spot on the wing; another, perhaps of the same family, has a circular clear spot in the center of the wing, surrounded with fuliginous. The ants are the most numerous of all insects at Florissant, comprising, perhaps, a fourth of all the specimens; they form more than three-fourths, perhaps four-fifths, of all the Hymenoptera; I have already about four thousand specimens of perhaps fifty species (very likely many more); they are mostly Formicidæ, but there are not a few Myrmicidæ and some Poneridæ. I have noticed no Mutillidæ. Ichneumonidæ are very numerous; of minuter forms, having an expanse of wing of less than a centimeter, there are nearly two hundred specimens, unusually well preserved; judging from a cursory examination they are exceedingly numerous in species, perhaps eighty all told, and many genera are represented; the larger forms, whose wings expand more than a centimeter, are even more numerous both in species and individuals, and most of them are very fine, including a great variety, among which are especially noticeable a good assortment of species of Pimpla and allied genera; I have looked in vain for Pelecinus, or any long-tailed Rhyssæ or Thalessæ. The Braconidæ, Chalcididæ, Cynipidæ, and Chrysidæ, exceedingly few fossil species of which have ever been described, are very abundant, but have not been fairly separated from each other and from other small species; together they number nearly two hundred and fifty specimens and probably fifty species; among others there is a Chrysis, showing metallic green reflections on the abdomen, and also more than half a dozen species of Chalcididæ, with expanded femora, represented by over twenty specimens.

[1] Arch. f. mikr. Anat., vol. 28, pp. 46–47, 1886.

Finally, there are about sixty Tenthredinidæ of fourteen or fifteen species and several genera, besides a single species of Urocerida.

Animal remains besides those of insects are rare at Florissant. The most abundant is a species of thin-shelled Planorbis, which is not uncommon, and always occurs in a more or less crushed condition; it is the only mollusk yet found there (excepting a Physa or allied form and a single small specimen of a bivalve, referred to above in the section from the southern lake), and according to Dr. C. A. White is probably undescribed, although very similar to a species found in the Green River shales, differing from it principally in its smaller size.

Fishes rank next in numbers. Eight species have been found, belonging to four genera. Of Amiidæ we have Amia scutata and A. dictyocephala; of Cyprinodonts, Trichophanes foliarum and T. copei; of Catostomidæ, Amyzon pandatum, A. commune, and A. fusiforme; and of Siluridæ, Rhineastes pectinatus. All the species have been described by Cope, excepting T. copei, which was published by Osborn, Scott, and Speir.

Several bird's feathers have been found in these beds, and a single tolerably perfect passerine bird, with bones and feathers, has been described by Mr. J. A. Allen under the name of Palæospiza bella, and admirably illustrated by Blake. No other figure of a Florissant animal has yet been published. Besides these, Cope has described a plover, Charadrius sheppardianus, and writes that a finch is also found in these beds.

The plants, though less abundant than the insects, are exceedingly numerous, several thousand specimens having been studied by the late Mr. Leo Lesquereux. About one hundred and sixty species have been described or indicated, of which the apetalous plants show the larger number, sixty-eight species; the next most abundant group is the polypetalous division, forty species, the gamopetalous having twenty-five, the Coniferæ eight, and the lower plants nineteen species.

Among the exogenous plants the following polypetalous families are represented: the Malvaceæ by a rare species of Sterculia, besides some flowers with long stamens, which are referred, doubtfully, to the genus Bombax. Of Tiliaceæ, a species of Tilia has been found. Of Rutaceæ, one species of Ailanthus and one of Xanthoxylon. No less than ten species of Rhus represent the Anacardiaceæ, and two species each of Palinrus and Rhamnus the Rhamnaceæ. The Celastraceæ show three species of Celastrus and one

of Celastrites, known only by a few leaves. The Sapindaceæ are very numerous in individuals; a species of Acer is represented by leaves, flowers, and fruits, but not yet described; leaves of a Staphylea occur with five species of Sapindus and one of Dodonæa. The flora has a large number of Leguminosæ, eleven species occurring, of eight genera, Cytisus, Dalbergia, Cercis, Podogonium, Cassia, Leguminosites, Acacia and Mimosites; Lesquereux formerly referred some of them to Robinia and Colutea. The Rosaceæ show an Amygdalus, leaves of Rosa, and a species of Spiræa, with very finely preserved leaves of an Amelanchier, scarcely distinguishable from some of the varieties of the living species. Numerous leaves of Weinmannia of three species represent the Saxifragaceæ, and, finally, a species of Aralia and another of Hedera, the Araliaceæ.

Among the gamopetalous plants the Ericaceæ are represented by what is probably Vaccinium reticulatum Al. Br., together with a species of Andromeda; no less than six species of Ilex represent the Aquifoliaceæ; two of Diospyros, and one each of Bumelia and Macreightia, the Sapotaceæ; a species of Myrsine, so common in the European Tertiaries, but in our country represented only by this single leaf, the Myrsineæ. Convolvulaceæ show two species of Porana, and the Apocynaceæ a single species of Apocynophyllum.[1] Oleaceæ have a flowering branch of Olea and eight species of Fraxinus, one regarded as identical with a European Tertiary plant.

The apetalous angiosperms show a great variety of forms at Florissant, and among them many are referred to species from foreign Tertiaries. A species of Banksia and seven of Lomatia represent the Proteaceæ; a species of Pimelia the Thymelaceæ; one of Santalum the Santalaceæ. Urticaceæ are the most numerous of all plants; four species of Ulmus occur, one found also in the European Tertiaries; another formerly thought to be identical with a second European species but now regarded as distinct, and two others, one of them found also in western Colorado; of Celtis there is one species, whose leaves have a close affinity to the existing C. occidentalis and its Texan variety; two species of Ficus are identical with European species; but the mass of specimens—nearly or quite one-half of all that have been brought from this locality—represent species of Planera; two species only occur, one identical with a European form; the other known only from Florissant and the White River, and in the former very variable; Lesquereux

[1] In the text of his last report Lesquereux refers this to Alkali, Wyoming, but in his table to Florissant.

has seen at least two thousand specimens. The Juglandaceæ are represented by single specimens of Pterocarya americana and Juglans thermalis, besides two other species of Juglans, one of them European, three of Carya, all European, and one Engelhardtia, also European. The Cupuliferæ show one species each of Ostrya and Castanea, three of Carpinus, one of them European, and seven of Quercus, of which five are European species. The Myricaceæ are the next most abundant type after Planera, being represented by no less than fifteen species of Myrica, of which six are European. Of Betulaceæ two species of Betula occur and two of Alnus, one of the latter European. Salicaceæ are tolerably abundant; there are four species of Populus, all now regarded as European, though Lesquereux first looked on them as new; and two peculiar species of Salix, besides four identical with European species. Finally, there are one or two undetermined plants in this group represented by parts of flowers or seeds.

Among the Coniferæ there is considerable variety, eight species occurring, of six genera, most of them represented in the European flora. There are, first, two species of Pinus, one European; a species of Widdringtonia; well preserved branches of a European Taxodium; abundant remains of a European Glyptostrobus; a couple of leaves of a European Podocarpus; as well as two species of Sequoia, one European, the other indigenous. The presence of the last-named genus is also well attested by their cones and by the remains of gigantic silicified trunks in an erect position.

Finally, in the lower orders of plants the following have been found: Of the Palmæ, a large specimen of a Sabal and a fruit referred to Palmocarpon; of the Araceæ, a species of Acorus, first described from Spitzenberg; of the Typhaceæ, finely preserved leaves of a Typha; of the Naiadaceæ, two species of Potamogeton and one of Najadopsis; of the Lemnaceæ, a species of Lemna; of the Gramineæ, fragments of leaves of Phragmites; of Filices, numerous specimens of five genera, Sphenopteris, Adiantites, Lastræa, Pteris, and Diplazium, the last a European species; of Rhizocarpæ, many specimens of two species of Salvinia; of Musci, one species each of Fontinalis and Hypnum, and of Characeæ, two specimens of a Chara.

According to Mr. Lesquereaux, such an assemblage of plants indicates a climate like that of the northern shores of the Gulf of Mexico at our epoch. "The preponderance of conifers, of shrubs, . . . of trees of small

size, . . . gives to the flora a general aspect which recalls that of the vegetation of uplands or valleys of mountains." Palms are almost entirely absent, only a single specimen of one species of Sabal having occurred, with a fruit of Palmocarpon. "The leaves of some species are extremely numerous, none of them crumpled, folded, or rolled, as if driven by currents, but flat, as if they had been embedded in the muddy surface of the bottom when falling from the trees or shrubs along the borders of a lake."

It is remarkable for the almost complete absence of hard fruits, and this, with the presence of flowers, of unripe carpels of elm and maple, and of well-preserved branches of Taxodium, which in the living species "are mostly detached and thrown upon the ground in winter time or early spring," led Mr Lesquereaux to believe that the deposition of the vegetable materials took place in the spring time, and that the lake gradually dried during summer.

To this we may add that the occurrence of Acorus, of Typha, and especially of Potamogeton, leads to the conclusion that the water of the lake was fresh, and not saline or brackish, equally proved by the fish, according to Cope, and by the presence of larvæ of Odonata and other insects whose earlier stages are passed only in fresh water.

Neither the groups of fishes which have been found, nor the water-plants, nor the water-insects, nor the mollusks exclude Mr. Lesquereux's suggestion of the annual drying of the body of the lake; moreover, certain thin layers are found overlying coarser deposits, which are sun-cracked through and through. But, on the other hand, the thickness of the paper shales, upon which most of the fossil remains are found, and which are composed of uniform layers of triturated flakes of volcanic products, being necessarily the result of the long-continued action of water, excludes this idea. The structure of the rocks rather indicates a quiet deposition of the materials in an unruffled lake through long periods, interrupted at intervals by the influx of new lava-flows or the burying of the bottom sediments beneath heavy showers of volcanic ashes.

The testimony of the few fishes to the climate of the time is not unlike that of the plants, suggesting a climate, Prof. E. D. Cope informs me, like that at present found in latitude 35° in the United States; while the insects, from which, when they are completely studied, we may certainly draw more definite conclusions, appear from their general ensemble to prove the same

or a somewhat warmer climate. If we inquire what testimony the lower orders of Florissant insects bear to the climate of that district in Tertiary times, there is only one answer to be given: the present distribution of their allies certainly points to a considerably warmer climate than now—a climate which may, perhaps, best be compared to the middle zone of our Southern States. The known living species of the genera to which they belong are in general credited to regions like Georgia in this country and the two shores of the Mediterranean in Europe, or even more southern districts. Further remarks on this point will be found in the body of the volume.

As noted above, the superabundance of specimens of single species of plants (Planera and Myrica) is repeated in the insects, where certain species of Formicidæ among Hymenoptera, of Bibionidæ among Diptera, of Cercopida and of Alydina among Hemiptera, are to be counted by fifties and hundreds.

The only other general feature which may already be noted among the insects is an unexpected paucity of aquatic larvæ or the imagos of water-insects. Hardly a dozen neuropterous larvæ have come to hand, very few aquatic Hemiptera in any stage, and of Hydrophilidæ and other water beetles no great number. The paucity of neuropterous larvæ is the more remarkable from the abundance of Phryganidæ, while not a single larva-case has been found.

As to the age of these deposits, the opinions of Lesquereux, based on the study of Tertiary plants, and of Cope, drawn from his knowledge of Tertiary fishes, are far more harmonious than one would expect from their known divergence of view concerning the testimony of the fossils to the age of other Tertiary beds in the West. Such disparity of ideas did hold at first, Mr. Lesquereux maintaining in his earlier notices of the flora the probability of its later Miocene age; in the Tertiary Flora he placed it in the "Upper Green River" division of his "fourth group," together with the flora of Elko, Nevada, the Green River beds being placed directly beneath them. In Hayden's report for 1876 he refers the Florissant deposits to the upper Miocene. In his review of Saporta's Monde des Plantes,[1] while still considering this flora as Miocene, he points out certain important relations which it bears to the flora of Aix, in Provence, then considered as Eocene.

[1] Amer. Jour. Sci., ser. 3, vol. 17, 1879, p. 279.

But later, after a more careful revision, drawn from more extended sources, he writes that while, by the presence of many genera, "there is an evident relation of the Florissant flora with that of the European Miocene, yet by the affinities and even identity of some of the species with those of the flora of the gypsum of Aix, which, according to Saporta, includes types related to those of the whole extent of the Tertiaries from the upper Cretaceous to the Oligocene and above, I should rather refer this group to the lower Miocene or Oligocene."

Both Lesquereux and Cope agree in placing the Florissant beds at the same horizon as those of Elko, Nevada, and also those directly above the Fish-cut beds at Green River, Wyoming. Lesquereux has identical species also from White River, Colorado, among specimens communicated by Mr. Denton. Cope calls the Florissant and Elko deposits the Amyzon beds, from the prevalence of that type of fish, and refers them to the "later Eocene or early Miocene." Mr. Clarence King places the Green River deposits in the middle Eocene, but considers the Elko deposits of the same age. We may therefore provisionally conclude, from the evidence afforded by the plants and vertebrates, that the Florissant beds belong in or near the Oligocene.

At present no geological conclusions can be drawn from what is known of the insects. So far as specific and generic determinations has proceeded, scarcely anything identical has been found in the Green River and Florissant beds, but some remarkable affinities have been noticed. To attempt, however, to draw any conclusion as to the age of either of these deposits, and especially of that of Florissant, before a closer examination is made would be folly. Almost the entire series of fossil insects from the beds of Aix, Oeningen, and Radoboj requires a careful generic revision, and until this is done it will be difficult to make much use of the information given us in the works of European authors. This should not be considered as reflecting upon the character of these works, for it must be remembered that they were nearly all completed thirty years ago and could not be expected to meet present demands. It is, indeed, probable that the richer American fields, the exploitation of which has only just begun, may yet be found the best basis for the study of the relationship of the Tertiary insect faunas of Europe.

White River.—Fossil insects were first discovered on the lower White River in western Colorado and eastern Utah by Mr. William Denton during

his passage down the river on horseback in 1865, and his brief and cursory account of the geological structure of the region is, I believe, the first and only one until the parties of the Hayden Survey entered the region ten or more years later. Brief reports of the geological and topographical character of the country were made by Drs. C. A. White and F. M. Endlich, and Messrs. G. B Chittenden and G. R. Bechler. None of these, however, obtained any insects, excepting Dr. White, who in a single locality found a few poor specimens. On a visit to the place in the summer of 1889, however, I was able to rediscover the beds in which they were found by Mr. Denton east of the Colorado-Utah line, and to greatly extend the stations at which they could be found. In the two localities on the lower White River where Denton found fossil insects, "Chagrin Valley" and "Fossil Cañon," as he called them, the general topographical features were the same, bluffs or buttes of a thousand or more feet in thickness being composed of evenly bedded stratified deposits. "Chagrin Valley" must be identified with the valley of Douglas Creek, though it was not here but five or six miles lower down the White River that Denton really obtained his fossils, at a point where, to one traveling westward, Green River beds first appear in mass and are readily accessible, probably in the immediate vicinity of Cañon Butte, where the old Indian trail on the south side of the river cuts off a sharp bend and passes directly over many favorable outcrops. It was in fact at precisely this place that I obtained from the rocks collections agreeing most closely in general appearance and character with those secured by Denton This locality is in Colorado a few miles east of the Utah boundary. His other locality is represented by him to be fifty or sixty miles farther down the river, but still at some distance from its mouth. The distance is no doubt exaggerated, and the locality on the north side of the river, certainly in Utah, not improbably near the mouth of Red Bluff Wash. I made no search for this place.

It may in brief be said that the Green River beds in the bluffs on each side of the White River Cañon near the boundary line between Utah and Colorado, but especially on the northern side, are filled for over a thousand feet with insect remains; the highest and the lowest beds respectively yielded me the best results, but hardly a level could be found where patient search did not reveal some relics. though perhaps of no value; the more prolific beds were oftentimes simply crammed with remains, frequently in

an exquisite state of preservation. Vegetable remains, excepting of a very fragmentary nature, were rare, and most of the insects, like those obtained by Denton, of a small size; excepting, indeed, dipterous larvæ, which were found in quite incredible numbers, square rods of stone near the higher levels being absolutely covered with them in multitudes of places.

The insects obtained by Mr. Denton and Dr. White at these localities are all included in the present volume, but no reference is made to those found by myself in 1889. The age of the deposit can hardly be said to be as yet determined, but the leaves found by Mr. Denton (presumably at "Fossil Cañon") were regarded by Mr. Lesquereux as more certainly synchronous with those of Florissant than with those of the Green River beds, and in any event all three are of very nearly the same age.

Green River, Wyoming.—All the insects described in this volume from Green River were obtained at a single spot, next what is known as the Fish-Cut, where the railway cuts through the rocks, about three or four kilometers west of the crossing of Green River. Even here they have been found only within the compass of one or two square meters of ground, and by repeated visits this "pocket" has now been entirely chipped away. There is no doubt that other equally prolific pockets will be found in the same immediate vicinity, especially in the more favorable exposures east of the river, as one such was found during the summer of 1889. It is by no means improbable that the beds at this locality and those at White River may prove to belong to the floor of one and the same Tertiary lake to which King gave the name of Gosiute Lake. About one hundred and fifty different insects have been found here, besides many others not yet described. They are most commonly Coleoptera, this order being represented by fully one-third of the species. Hemiptera and Diptera come next with almost equal representation, or about twenty-three per cent each. Next come the Hymnoptera with eight per cent. The other orders are about equally and meagerly represented, the Lepidoptera not at all.

Fossil, Wyoming.—A few species of insects have been found in the bluffs facing the town of Fossil at the head of Twin Creek, a tributary of Bear River, bluffs which are famous for the immense number of fossil fish they have furnished. As a rule the insects are scarce, and, like the fish, belong to a very limited number of species, in this case mostly Coleoptera and Diptera. In the present work only two or three are mentioned.

Horse Creek, Wyoming.—At a point three miles south of this creek, which empties into the Green River from the west near its source, and about two miles west of Green River, a thin, hard layer of white limestone was found by Dr. A. C. Peale covered with petrified larval cases of caddis-flies, which are described below under the name of Indusia calculosa.

Quesnel, British Columbia.—The discovery of the different localities for fossil insects in British Columbia by the Geological Survey of Canada has been due entirely to the investigations of Dr. George M. Dawson. On the left bank of the Fraser River, at the town of Quesnel, he discovered a series of clays, sands, and gravels, their upturned edges covered by the valley deposits, in one of which series (a stratum of fire-clay eight or nine inches thick) insects and plants were found, the beds being exposed on the river bank at a low stage of the water. Nearly twenty species of plants were met with, mostly of apetalous families in the neighborhood of the Cupuliferæ, such as the beech, walnut, oak, birch, and poplar, and a considerable number of insects. Such of these as are included in the present report consist of twenty-five species, nearly all Hymenoptera and Diptera, and especially the latter, and, what is very unusual, only a single beetle. Sir William Dawson, who determined the plants, regarded them as to a great extent identical with those from the Miocene of Alaska, but adds: "Whether the age of these beds is Miocene or somewhat older may, however, admit of doubt." Apart from an uncharacteristic egg-cocoon of a spider, none of the insect remains can be regarded as identical with any found elsewhere.

Nicola, North Similkameen, and Nine Mile Creek, British Columbia.—The other localities at which remains of insects have been found, though in smaller numbers, lie at no great distance apart to the south of Quesnel and south of the Canadian Pacific Railway, near our own border. One of these localities is upon the Nicola River, two miles above its junction with the Coldwater, at the base of a series of beds containing coal. Another is on the North Fork of the Similkameen River, three miles from its mouth; the beds here, on the bank of the river, "include a layer of lignite about a foot thick, which rests in black, rather earthy, carbonaceous clays, and is overlain by fifteen feet or more of very thinly bedded almost paper-like yellow gray siliceous shales," which contain plants and insects. The third is on Nine Mile Creek, flowing into Whipsaw Creek, a tributary of the Similka-

meen, where a small section of hard laminated clays occurs with layers of softer arenaceous clay. Seven species were obtained from the first-named locality, five from the second, and four from the third. The Nicola locality is remarkable for yielding only Coleoptera; from Nine Mile Creek come three species of Coleoptera and one of Hemiptera; while the Similkameen locality, like Quesnel, affords us Hymenoptera, Diptera, and Hemiptera—three species of the last—but no Coleoptera. There can be no doubt, Dr. Dawson informs me, "that the specimens from the North Similkameen and Nine Mile Creek represent deposits in different portions of a single lake. A silicifying spring, probably thermal, must, however, have entered the lake near the first-named place, as evidenced by the character of some of the beds, in which fragments of plants, with a few fresh-water shells, have been preserved." The insects of each locality are specifically distinct from those of any of the others. As to their age, Dr. Dawson, the only geologist who has studied them, remarks that we shall "probably err little in continuing to call the Tertiary deposits of the interior as a whole Miocene, and in correllating them with the beds attributed to the same period to the southward in the basin lying east of the Sierra Nevada."

Scarboro, Ontario.—In the vicinity of Toronto, on the north shore of Lake Ontario, Mr. George J. Hinde has discovered vegetable and animal remains in thin seams in clay beds which he regards as interglacial, lying as they do upon a morainal till of a special character and overlain by till of another and quite distinct kind. His account of the locality and the reasons for his conclusions have been given by him in full.[1] Among the material found by him was a considerable number of the elytra and other parts of beetles, an assemblage indeed larger than has ever before been found in such a deposit in any part of the world, and they are mostly in excellent condition. Twenty-nine species have been obtained, some of them in considerable numbers. Five families and fifteen genera are represented; they are largely Carabidæ, there being six or seven species each of Platynus and Pterostichus and species also of Patrobus, Bembidium, Loricera, and Elaphrus. The next family in importance is the Staphylinidæ, of which there are five genera, Geodromicus, Arpedium, Bledius, Oxyporus, and Lathrobium, each with a single species. The Hydrophilidæ are represented by Hydrochus and Helophorus, each with one species; and the Chrysomelidæ

[1] Canadian Jour. Sci., new series, vol. 15, 1887, pp. 388–413.

by two species of Donacia. Finally, a species of Scolytidæ must have made certain borings under the bark of juniper.

Most of these are described and figured in the present volume. Looking at them as a whole and noting the distribution of the species to which they seem to be most nearly related, they are plainly indigenous to the soil, but would perhaps be thought to have come from a somewhat more northern locality than that in which they were found; not one of them can be referred to existing species, but the nearest allies of not a few of them are to be sought in the Lake Superior and Hudson Bay region, while the larger part are inhabitants of Canada and the northern United States, or the general district in which the deposit occurs. In no single instance were any special affinities found with any characteristically southern forms, though several are most nearly allied to species found there as well as in the north. A few seem to be most nearly related to Pacific forms, such as the Elaphrus and one each of the species of Platynus and Pterostichus. On the whole, the fauna has a boreal aspect, though by no means so decidedly boreal as one would anticipate under the circumstances.

Port Kennedy, Pennsylvania.—The only locality remaining to be noticed is Port Kennedy, in southeastern Pennsylvania, where the clays in the bone caves have furnished about a dozen species of Coleoptera, described by Dr. G. H. Horn, in 1876, but now first figured. His descriptions are reprinted in the present work, with the results of my own study of the same material.

DESCRIPTIONS OF GENERA AND SPECIES.

MYRIAPODA Linné.

Myriapoda from the Tertiary rocks are almost unknown, a single species a little larger than ours having been figured by Bertkau from Rott under the name of Iulus antiquus Heyden. Other species have been indicated. Serres, for instance, speaks of one found near Montpellier, allied to the living I. sabulosus, and this mention has been quoted by Meyer, Keferstein, and Geinitz. Hope also catalogues one from Aix, and Cotta mentions one, perhaps I. terrestris, from Tharand, Saxony, which is probably a recent inclosure, and is quoted by Brullé and Berendt. Besides these diplopods Hope catalogues a Scolopendra from Aix, and Keferstein, on the authority of Aldrovandi, mentions a Scolopendra from Glarus, in Switzerland.

The Baltic amber, however, contains a considerable number of species, twenty diplopods having been recorded and most of them described, belonging to the genera Craspedosoma (seven species), Polyxenus (five species), Iulus (four species), and Enzonus, Lophonotus, Blaniulus, and Polydesmus (one species each). The chilopods have a less number of species, fifteen, representing the genera Lithobius (eight species), Geophilus (three species), and Cermatia and Scolopendra (two species each). All these genera excepting Enzonus are represented among living forms.

The single species found in America belongs to the diplopods. (November, 1881.)

Order DIPLOPODA Gervais.

Family IULIDÆ Leach.

As in the case of the Rott species described by Bertkau, the form described below is only referred to the genus Iulus in a broad sense, its preservation being very defective. It is smaller than the European species.

IULUS Linné.

Iulus telluster.

Pl. 6, Fig. 15.

Iulus telluster Scudder, Bull. U. S. Geol. Surv. Terr., vol. 4, 1878, p. 776.

The single specimen is so fragmentary that it can only be referred to Iulus in a broad generic sense. The piece is composed of ten or twelve segments, probably from near the middle of the body, lying in a straight line and crushed, with no trace of any appendages. The segments appear to be composed of a short anterior and a larger posterior division, each independently and very slightly arched; the posterior division is about twice as long as the anterior, and each is transversely, regularly, and very finely striate, parallel to the anterior and posterior margins of the segments. The foramina can be detected on some of the segments, and by their aid the width of the body can be more accurately determined.

As crushed, the body is 2.3^{mm} broad, but its probable true width is 1.5^{mm}, while the segments are each about 0.8^{mm} long; the fragment preserved measures 8.5^{mm} long.

Green River, Wyoming, one specimen, No. 154, F. C. A. Richardson.

The object represented on Pl. 12, Fig. 1, was at one time thought to be a myriapod and accordingly figured, but examination proved it to be the broken section of the cone of Sequoia, not uncommonly found at Florissant.

ARACHNIDES Latreille.

Up to the present writing a little more than two hundred and fifty species of Arachnides have been described as found in Tertiary deposits. Of these about one hundred and ninety are true spiders, while the remainder are mostly Acarina (thirty-seven species), Opiliones (eleven species), or Chernetidæ (nine species). All but a single species, Aranea columbiæ, described below, are from European beds, and nine-tenths of them are preserved to us in the Eocene amber. Were this means of restoring the ancient Tertiary fauna unknown to us, our information at the present day would be based upon twenty-four species, although in addition to these half a dozen more are indicated by simple reference to genera or families. This number is already exceeded by those described below from a single locality, Florissant alone having yielded more than thirty species. Whether we examine the American or European species preserved in stratified deposits we find an almost total absence of any but true spiders or Araneides; in each (including the one herewith figured) a single species of Acarina has been described, though a number of others are credited without description to European strata. In Prussian amber, on the contrary, though Araneides are vastly in the majority, the other groups of Arachnides form 27 per cent of the entire number of species, distributed mainly in the three groups mentioned above.

This greater proportion of true Araneides in Tertiary deposits, a proportion exaggerated at the present day, can scarcely be well compared to what we find in the older deposits, from the extreme paucity of their remains in the latter. Brodie has found only a single species (which he considers a true araneid) in the secondary strata of England, and the European Jura has furnished merely half a dozen arachnids (nominal species, perhaps reducible to four), of which only a single one is referable to the Araneides, Hasseltides, considered one of the Agalenides by Weyenbergh. In the paleozoic formations, again, a dozen species are known, all but three of which have been considered scorpions, Phrynidæ or Chernetidæ, or else placed in their vicinity, while one of the other three has not been placed

by its describer among the true spiders, but named Arthrolycosa only from its somewhat marked araneid features. The remaining two are considered by their describers as true araneides and seem to be the only true precursors of this group known to us from the paleozoic rocks; the proportion therefore of the Araneides to other Arachnides is reversed between Paleozoic and Cenozoic times.

In the present volume we are able to more than double the number of Arachnides (apart from the amber inclosures) which are hitherto known from Tertiary strata, and, as we shall see further on, find some interesting points of comparison between the European and American spider fauna of Tertiary times. (February, 1881.)

Since the above was written the number of known Paleozoic Arachnides has greatly increased and a large proportion of them have been placed in a distinct order, Anthracomarti Karsch, with eight or ten genera. (October, 1889.)

In the classification of the remains of these animals, from the almost complete absence of such characteristic parts as the details of the structure of the ocelli and palpi, it has been impossible to do much more than to indicate the probable affinities of the species to living types by means of the general resemblances which the form of the cephalothorax and abdomen and the relative length of the legs furnish. In a few instances these can hardly fail to furnish us with sufficiently clear evidence, while in others the reference is plainly open to a greater or less degree of doubt, which it is hoped future material will eventually extinguish.

Order ACARINA Nitzsch.

Acarina are by no means rare in Tertiary deposits, the group being better represented than any other Arachnides excepting the true spiders, and it is quite in keeping with this fact that the only arachnid yet discovered in the American strata not belonging to the Araneides should fall in this group. Yet the group is unrepresented even in Mesozoic strata, while the scorpions and their allies, nearly unknown in Tertiary beds, are proportionally abundant in earlier times. The amber of the Baltic is particularly rich in Acarina, thirty-five species being recorded therefrom, while apart from the Araneides this group is almost if not quite the only one represented in the stratified deposits of Europe; feebly represented, indeed,

for we have only one species (referred to Limnochares) described by Heyden from Rott; another from the same locality based upon leaf-galls and called Phytoptus antiquus, and a third indicated merely (Acarus) by Heer, as found at Oeningen. (November, 1881.)

Gourret has latterly described among the arachnids of Tertiary Aix a couple of genera of Acarina with one species each which he regards as belonging to the Trombididæ. (October, 1889.)

IXODES Latreille.

No fossil species have before been referred to this genus or anywhere near it. The nearest is Acarus, which is only distantly related, belonging indeed to a distinct subfamily. The species of Ixodes, like other ticks, bury themselves in the flesh of animals to suck their blood. (November, 1881.)

Ixodes tertiarius.

Pl. 6, Fig. 12.

Ixodes tertiarius Scudder, Zittel, Handb. d. Palæont., I, ii, 733, Fig. 906 (1885).

Although there are few definite salient points in the structure of the single specimen known, its general appearance and its size make it tolerably evident that it belongs to the Ixodidæ or Ricini and probably to Ixodes proper. The body is of a very regular obovate form, twice as long as broad, with a slight indication of a frontal shield of a triangular shape (not represented in the plate and perhaps illusory), formed by two sulcations meeting at right angles and terminating just within the front pair of legs on either side. The rostrum is not preserved, but the right palpus (poorly given on the plate) is slender and 0.2^{mm} long, or rather projects beyond the body to that amount. Nearly all the legs are present, but the hinder legs of the left side have been crowded out of place and appear on the right side below those which properly belong there, and which apparently are the upper four there seen. The legs are apparently complete, except the terminal appendages, as they all taper rather rapidly at the end, after the manner of ticks; they are stout, short, and of similar length, extending beyond the body by about the width of the latter.

Length of body, 3.5^{mm}; breadth of same, 1.75^{mm}.

Fish-Cut, Green River, Wyoming. Dr. A. S. Packard, No. 258.

Order ARANEIDES Latreille.

As stated above, by far the larger part of the fossil Arachnides known are true spiders, about one hundred and ninety species having been described from the Tertiary deposits of Europe, and more than thirty being added to the total list in this volume. These last are distributed among the larger groups as follows: Saltigradæ (all Attides), three; Citigradæ, none; Laterigradæ (all true Thomisides), three; Territelariæ, none; Tubitelariæ (Agalenides, one; Drassides, five; Dysderides, two) = eight; Retitelariæ (all Theridides), four; Orbitelariæ (all Epeirides), fourteen = thirty-two. By this it appears that nearly half are Epeirides, and that after these the Drassides are best represented. A comparison of this result with the fossil spiders of Europe is shown by the following table, in which the percentages of the groups represented are compared in each country with the total representation in each:

Percentages of groups of Tertiary spiders in Europe and in America.

Suborders.	Percentage.	
	Europe.	America.
Saltigradæ	8	9
Laterigradæ	16	9
Tubitelariæ	36	21
Retitelariæ	29	12
Orbitelariæ	8	44
	97	98

This shows that America is far the richer in Orbitelariæ, and Europe much better represented in Retitelariæ, less but still considerably better in Laterigradæ and Tubitelariæ, while the Saltigradæ have an almost equivalent representation in the two countries.

If, however, we eliminate from the inquiry the species entombed in amber, and compare only those recovered from the rocks in which they have been preserved, we shall reach perhaps a more just comparison, although the data will be far more meager, America with its thirty-two species being actually better represented than Europe with its twenty-two species, all belonging to the same five larger groups which are represented in America.

Percentages of groups of Tertiary spiders in Europe and America, excluding those found in amber.

Suborders.	Percentage.	
	Europe.	America.
Saltigradæ	0.5	9
Laterigradæ	20	9
Tubitelariæ	23	24
Retitelariæ	41	12
Orbitelariæ	14	44
	98.5	98

The excess of proportion in America of Orbitelariæ is here nearly as great as is shown in the former table, but is not so great as the now heightened proportion in Europe of Retitelariæ, while the Tubitelariæ are now the ones in which the proportion is similar in each, the Laterigradæ the only one where the proportion remains nearly the same as before, and the Saltigradæ are nearly lost sight of in Europe, a single species being known.

If now we carry the analysis a little further we shall find more interesting relations, as will appear from the following table, in which all the groups represented in Europe are introduced, and both the total fauna and the species from the strata tabulated:

Number of species of Tertiary spiders found in Europe and in America, by families.

Suborders.	Families.	In Europe, including those in amber.	In Europe, excluding those in amber.	In America.
Saltigradæ	Attides	14	1	3
	Eresoidæ	2	0	0
Citigradæ	Lycosoidæ	2	0	0
Laterigradæ	Philodrominæ	4	0	0
	Thomisides	21	1	3
	Uncertain	6	0	0
Territelariæ	Theraphosoidæ	1	0	0
Tubitelariæ	Dysderides	14	0	1
	Drassides	38	2	5
	Agalenides	12	3	2
	Hersilioidæ	3	0	0
	Uncertain	2	0	0
Retitelariæ	Scytodoidæ	1	0	0
	Theridides	54	9	4
Orbitelariæ	Epeirides	16	3	14

Here it appears at a glance that exactly the same groups are represented in the stratified deposits of Europe and America in every instance, excepting the Dysderides, which is unrepresented in Europe and has a single member in America. It also appears that only those groups which are represented abundantly in amber (and all of them) are also represented to some extent in the American fauna and (excepting, as before, the Dysderides) in the European rocks. Exception should perhaps be made for the European amber genus Archæa, the position of which in the Laterigradæ is uncertain, and of which Thorell says: "This genus may perhaps for the present best be taken as the type of a separate family" of Laterigradæ (European spiders, p. 232). Six species are known, and they are classed above as uncertain. The relation brought out in this table is certainly striking, but it should be noticed at the same time that the Drassides and Theridides, and especially the latter, are enormously represented in the Baltic amber, and in comparison with them (though not by any means to the same extent in comparison with the other groups) feebly represented in the stratified deposits of Europe and America.

We may venture one further investigation, although little weight can be given to it from the meagerness of the data, viz, a comparison of the percentage of representation of the different larger groups in the different horizons of Tertiary times in Europe with that of Florissant, where all the American species so far known have been found.

Percentage of groups of Tertiary spiders of Florissant, Colorado, compared with those of Europe.

Suborders.	Florissant.	Amber and Aix; Ligurian (Oligocene).	Rott; Aquitanian (Lower Miocene).	Oeningen; Tortonian (Upper Miocene).
Saltigradæ	9	9	0	0
Laterigradæ	9	16	13	30
Tubitelariæ	24	37	25	30
Retitelariæ	12	28	37	30
Orbitelariæ	44	8	25	10
	98	98	100	100

As this table shows so great a difference between the percentage of representation in the Oligocene and Lower Miocene of Europe that it can scarcely prove very instructive, it still seems to indicate a greater difference between the Florissant deposits and those of Oeningen than between the

former and either of the others; and although the proportionate numbers of Tubitelariæ and Orbitelariæ of Florissant and especially of the former group are more nearly like those of Rott, the representation of the groups in general allies Florissant on the whole with the Oligocene rather than with the Lower Miocene of Europe.

Of extinct genera there have certainly been proposed a very large number for the European Araneidæ, more than half the genera to which the species have been referred having been described as new and peculiar to Tertiary times; these genera include about two-fifths of the species. Among the genera are some remarkable forms, such as Archæa and Mizalia, each of which is considered by Thorell and others as representing a distinct family.[1] Two only of the thirteen genera to which the American species are referred are described as new, and to them are referred seven of the thirty-two species. Other genera, not before recognized in a fossil state, but here recorded from American strata, are Titanœca, Tetragnatha, and Nephila. To enter into details, seventy-one genera of Araneidæ have been described from the Tertiaries, sixty-six from Europe, and thirteen (below) from America, eight being common to both. Of these seventy-one genera thirty-seven are accounted extinct, thirty-five from Europe, and two from America, none of these being found in both countries. The European genera are, as may be supposed, largely composed of amber species, no less than fifty-two, including thirty-two extinct genera, being confined to amber deposits, besides others which they possess in common with the stratified beds.

If it be asked what indications the fossil spiders of Florissant give as to the climate of that district in Tertiary times, there is but one answer which can be given: that the present distribution of their allies certainly points to a considerably warmer climate than now, a climate which may perhaps best be compared to the middle zone of our Southern States. The known living species of the genera to which they belong are in general credited to regions like Georgia in this country and the two shores of the Mediterranean in Europe; but our own species are so little known that nothing can be said very definitely upon their immediate relationship with exotic or indigenous forms. The presence of species of Theridium, Linyphia, Tetlneus, and Epeira, including two-fifths of the species, has no special significance, but Thomisus, Segestria, Clubiona, Anyphæna, and Titanœca, and especially

[1] A good critical review of the described fossil species of Araneides will be found in Thorell's European Spiders, pp. 223–233.

Parattus, Tetragnatha, and Nephila certainly present an ensemble the indications of which can not be overlooked. (November, 1881.)

Since the above was written a notable addition to our knowledge of the Arachnides of Tertiary Europe has been made by Gourret in a paper on those of Aix, in which among others eighteen species of Araneides are described, including Eresoidæ (two species), Lycosoidæ (two species), Theraphosoidæ (one species), Dysderides (one species), Hersilioidæ (two species), Urocteoidæ (two species), Enyoidæ (one species), none of which families had before been found in European rocks, and the last two not even in amber. (October, 1889.)

In the measurements of legs in the Araneides the length of the femur is the distance of the apex of the femur beyond the margin of the cephalothorax, no account being taken of the coxa, unless it is specially mentioned; so too the first joint of the tarsus, which according to arachnologists is consolidated with the tibia, is here regarded (in the measurements) as a part of the tibia, and the second and third joints of the tarsi are alone measured as tarsi, except when, as in Tethneus hentzii and Thomisus defossus, separate account is taken of them.

Suborder SALTIGRADÆ Latreille.

As in the north temperate zone to-day, so in Tertiary times, the two families of Saltigradæ, Attides and Eresoidæ, are very unequally represented in species, only two fossil species of the latter family being known against seventeen of the former. The two Eresoidæ are amber species; of the Attides, thirteen are known from amber, one from Aix in Provence, and three from Florissant, Colorado, described below. (November, 1881.)

Since this was written Gourret has described one species of each of these two families from Aix.

Family ATTIDES Koch.

The fossil species of this family of jumping spiders hitherto recorded are all confined to the Prussian amber excepting one, a species referred to a new genus, Attoides, described by Brongniart from Aix. The amber species are referred to four genera, Euophrys (one), Gorgopis (five), Propetes (five), and Steneattus (one), besides an undescribed species referred by Menge to Salticus. The species of Gorgopis were formerly referred to Phidippus, a genus richly represented to-day in North America, and it

is therefore interesting to notice that the three species described below and referred to a new and aberrant genus of the family, Parattus, are more nearly related to Gorgopis than apparently to any other known, and that the amber genus contains nearly one-half of the species of this family preserved in Europe from Oligocene times. The species of this family are spread all over the world, both in tropical and temperate regions, but seem to be comparatively rare in Africa south of the desert. (November, 1881.)

Gourret has added another species from Aix, referred to an extinct genus, Attopsis.

PARATTUS, gen. nov. (*πάρος*, *ἄττω*).

The three species here referred to the Attoidæ seem to belong to a distinct genus allied to Gorgopis of the Prussian amber, in that the posterior eyes are placed far behind the others, but differing markedly from that, as from all members of the family, so far as I know, in two points: (1) The exterior eyes of the first row are placed a little in advance of the median pair of the same row, and (2), more particularly, they are as large as or scarcely smaller than these median eyes. The anterior row, therefore, is formed of four very large, nearly equal and nearly equidistant eyes, arranged in a gentle curve opening forward; the eyes of the second row, so far as known, are minute and situated within and behind and in close proximity to the median eyes of the anterior row, while those of the third row, so far as known, are of medium size, placed at a greater or less distance apart in the middle of the cephalothorax, as in the American genus Phidippus and the amber Gorgopis. The American genus Phidippus is confined to the warmer parts of the continent and to a large extent to the tropics, so that the presence of this somewhat allied genus indicates, so far as such analogy indicates anything, a warmer climate in early times for Florissant.

Table of the species of Parattus.

Cephalothorax and abdomen well rounded, with convex sides .....1. *P. resurrectus.*
Cephalothorax quadrate, with nearly straight sides.
  Small species; cephalothorax less than twice as long as broad; abdomen quadrate..2. *P. evocatus.*
  Large species; cephalothorax more than twice as long as broad; abdomen round ...3. *P. latitatus.*

1. Parattus resurrectus.

Pl. 11, Fig. 26 (♀?).

Cephalothorax broad oval, subquadrate, the sides gently convex, the two ends broadly rounded; front regularly semicircular; the two middle eyes of the anterior row very large, circular, situated just behind the front edge; the lateral eyes of the same row nearly or quite as large, circular,

forming with these a very slightly curved row, opening forwards, of equidistant eyes. Eyes of second row from one-eighth to one-tenth the size of those of the first row, situated behind and within the middle anterior pair, so that lines drawn through the middle of the large and small ones would meet in a right angle behind the small ones and leave them distant from each other by about their own diameter: the outer edge of either of the small ones is behind the inner edge of one of the large ones; the eyes of the third row are not discernible on either of the specimens, and on one the lateral eyes, on the other the eyes of the second row, can not be seen.

Palpi of the male with the tip very large, conchiform, as if made of three whorls, the middle twice as large as the other two together and subglobose, the terminal small and globular. Only one palpus is exposed, but the other may partially be seen through the cephalothorax. Abdomen short ovate, somewhat larger than the cephalothorax, being somewhat longer and slightly broader, subacuminate at tip, with a pair of short styles darkest in a broad mediodorsal band. Legs moderately long and slender, subequal, not greatly tapering, furnished throughout and rather abundantly with generally alternate, divergent, long, and tapering spines, fully as long as the width of the joint from which they rise.

Length of body, 4.85^{mm}; cephalothorax, 2^{mm}; abdomen, 2.85^{mm}; width of cephalothorax, 1.6^{mm}; abdomen, 1.7^{mm}; longer axis of middle section of palpal swelling, 0.8^{mm}; length of whole swelling, 1.45^{mm}; length of first pair of legs, 5.5^{mm}; second pair, 5.5^{mm}; third pair, 4^{mm} (?); fourth pair, 4.75^{mm}. Excepting in the palp the measurements are those of the female.

One of the specimens is a male; the other, the palpi of which are not preserved, is judged to be a female merely from its variation from the other in its larger abdomen. The species is readily distinguished from the others by the rounded outline of the cephalothorax both on the sides and on the strongly convex front.

Florissant. One ♂, No. 1081; one ♀, Nos. 8282 and 8459.

2. Parattus evocatus.

Cephalothorax subquadrate, somewhat less than twice as long as broad, slightly broadest posteriorly, with straight, scarcely divergent sides; anterior and posterior margins broadly convex, the lateral angles well rounded off; eyes of anterior row large, round, equal, equidistant, the middle ones at less than their own diameter from the front edge and from

each other, the whole arranged in a slightly curving row opening forward; eyes of second row indistinguishable; those of third row rounded oval, obliquely placed, situated each in the center of either lateral half of the cephalothorax. Abdomen slightly longer than the cephalothorax, of the same width, with nearly straight sides, rounded off anteriorly and tapering to a subangulate apex on the posterior third or fourth. The cephalothorax is blackish in the middle posteriorly, and all the abdomen but the terminal tapering part is nearly black. Legs very poorly and imperfectly preserved, but evidently tolerably stout and furnished with abundant, divergent, tapering, slender spines.

Length of body, 6.65^{mm}; cephalothorax, 3^{mm}; abdomen, 3.65^{mm}; breadth of cephalothorax anteriorly, 1.8^{mm}; posteriorly, 2^{mm}; abdomen, 1.5^{mm}; length of first pair of legs, 7.5^{mm}.

The specimen is presumed to be a female from some faint traces of a slender palpus. The squareness of the form distinguishes this from the preceding species; from P. latitatus it differs by its smaller size and proportionally shorter cephalothorax as well as by the more rounded front of the latter.

Florissant. One ♀, No. 12005.

3. Parattus latitatus.

Cephalothorax quadrate, nearly three times as long as broad, equal, with straight and parallel sides, the extreme anterior and posterior angles rounded off; front nearly straight between the rounded angles. Eyes of anterior row large, equal, circular, subequidistant, the middle pair situated their own diameter behind the front, the lateral ones at the front, forming thus a curving series opening forward; eyes of second row not discernible in the single specimen; those of third row also doubtful, but apparently represented by a pair of spots considerably smaller than the anterior eyes, slightly nearer together than the middle pair and situated a little in front of the middle. Across the middle of the cephalothorax, or rather a little behind it, is a straight, raised, black line, in front of which the cephalothorax is black in a very large round patch. Abdomen almost globular, shorter than the cephalothorax but much broader, covered profusely with dusky and blackish hairs. Legs moderately slender and long, armed sparsely with very long and slender tapering spines longer than the breadth of the femora.

Length of body, 7.65mm; cephalothorax, 4.2mm; abdomen, 3.5mm; breadth of cephalothorax, 1.7mm; abdomen, 3.2mm.

The legs are imperfect in the single specimen known, and as no palpi are preserved the sex is uncertain. The species differs from both the preceding in its much larger size: from P resurrectus also in its very quadrate cephalothorax, and from P. evocatus in its globular abdomen.

Florissant. No. 9823.

Suborder LATERIGRADÆ Thorell.

The two families of crevice-inhabiting crab-spiders which have been found fossil in Tertiary deposits, Thomisides and Philodrominæ, are both (the former particularly) common at the present day in Europe and North America. The fossil species belong mostly to the former, only four species of Philodrominæ having been recorded, all from amber, while twenty-one Thomisides are known, not including those described below, all of which also fall here. In this statement the strange amber genus Archæa is not included, since, though placed by both Menge and Thorell in this group, it differs strikingly from the other members and should form a family group apart from them, having no known affinities with any of the species from the stratified deposits of Europe or America. (November, 1881.)

Two additional species of Thomisides have lately been described from Aix by Gourret. (October, 1889.)

Family THOMISIDES Sundevall.

All but four of the fossil Thomisides described up to the present time come from amber and represent the genera Athera (one species), Clythia (five species), Ocypete (four species), Opisthophylax (one species), Syphax (five species), and Thomisus (one species). Thomisus is also represented, with Xysticus, by two species each in the stratified deposits of Oeningen and Rott, the latter locality furnishing one Xysticus, the former the remaining species. The species described below appear pretty certainly to fall in the Thomisides proper and probably also in the vicinity of Thomisus or Xysticus. The family is widely distributed in all parts of the world. (November, 1881.)

The two species recently described by Gourret from Aix are regarded as types of extinct genera which he terms Amphithomisus and Pseudothomisus. (October, 1889.)

THOMISUS Walckenaer.

Three species of Thomisides occur in the Tertiaries of Colorado, and apparently all of them (one is mutilated) belong to the true Thomisinæ, in which the hinder two pairs of legs are much weaker than the others. As the cephalothorax is in all cases poorly preserved or lost, it is impossible to speak at all definitely of their generic relations, and therefore I have placed all of them in the typical genus Thomisus, from which the family derives its name, and which, or Xysticus, its near ally, they closely resemble in general appearance. In all the abdomen is nearly round. It is interesting to find, as observed above, that the species of this family from the stratified deposits of the European Tertiaries have also been placed in Thomisus and Xysticus, though none of them appear to be very closely allied to our species.

This genus is widely spread, but nearly all the species belong to the warm temperate regions of Europe and North America. (November, 1881.)

Table of the species of Thomisus.

Tibiæ of hinder pairs of legs broader at tip than at base, and much broader than the tarsi....1. *T. resutus.*
Tibiæ of hinder pairs of legs of equal width throughout.
Small species; femora of first pair of legs half as long again as those of second pair; tarsi as broad as the tibiæ..... 2. *T. disjunctus.*
Large species; femora of first and second pairs of legs of about equal length; last tarsal joint slenderer than the tibiæ..... 3. *T. defossus.*

1. Thomisus resutus.

Pl. 11, Fig. 13.

Abdomen plump, short ovate, about a fourth longer again than broad, the base broad, the sides well rounded, the hinder extremity full, with the extreme apex squarely truncate. Only a fragment of the cephalothorax remains, showing the broad attachment of the abdomen. The two hinder pairs of legs only are preserved, showing limbs of considerable length, bent forward, the femora nearly as long as the abdomen, longer than the tibiæ and flattened, largest in the middle; the tibiæ are straight, completely consolidated with the first tarsal joint as in spiders generally, also flattened, slender at base and gradually though slightly increasing in size apically, a peculiarity which is not shown in the plate; the tarsi are much slenderer, not flattened, and longer than the tibiæ, the first joint alone being nearly as

long as they; the whole leg is devoid of armature or clothing and none is perceptible on the abdomen.

Length of abdomen, 3^{mm}; breadth, 2.5^{mm}; length of third pair of legs, 5.3^{mm}; its femora, 1.85^{mm}; tibiæ, 1.65^{mm}; tarsi, 1.8^{mm}; first joint of same, 1.2^{mm}; second joint, 0.6^{mm}; fourth pair of legs, 7.45^{mm}; its femora, 2.75^{mm}; width of same, 0.5^{mm}; its tibiæ, 1.5^{mm}; width of same at base, 0.25^{mm}; at tip, 0.4^{mm}; its tarsi, 3.2^{mm}; width of same, 0.1^{mm}; length of first joint, 2^{mm}; second joint, 1.2^{mm}.

A single specimen is preserved, in which all anterior to the two hinder pairs of legs is lost. The species is readily distinguished from either of those here described by the unequal width of the tibiæ, as well as for the disparity in width between the tibiæ and tarsi. As the front legs are wanting, this may not so properly be referable as the others to the Thomisides rather than the Philodrominæ.

Florissant. Nos. 5502 and 7521.

2. Thomisus disjunctus.

Pl. 11, Fig. 9.

Cephalothorax obscure in both specimens, and apparently preceded by a slender beak, more than half as long as the abdomen and divided into two lateral halves closely united; they seem to be a pair of elongated cheliceres, but are poorly preserved in both cases. Abdomen rounded, short oval, about a fourth longer than broad, with both ends equally rounded. Legs long and slender, the two front pairs longer than the hinder two, the first also considerably longer than the second; the femora are long and slender (the front pair about as long as the abdomen), flattened and tapering at either end; the tibiæ and first tarsal joint are completely consolidated into a single piece, so that the line of demarkation can not be seen, and are very slender, equal, as long as the femora; the other tarsal joints are together less than half as long as the previous member and scarcely slenderer than it, terminating in a slightly curved delicately pointed claw as long as the width of the tarsus.

Length of abdomen, 1.75^{mm}; breadth, 1.45^{mm}; length of first pair of legs, 4.2^{mm}; its femur, 1.8^{mm}; tibia, 1.7^{mm}; tarsus, 0.7^{mm}; second pair, 2.85^{mm}; femur, 1.2^{mm}; tibia, 1.15^{mm}; tarsus, 0.5^{mm}; tibia of third pair, 1.05^{mm}; tarsus, 0.4^{mm}; fourth pair, 2.2^{mm}; femur, 1^{mm}; tibia, 0.8^{mm}; tarsus,0.4^{mm}.

The sex of both specimens is uncertain. The species is readily distinguished from the others by its small size, slender and long legs, and the complete consolidation of the tibia and first tarsal joint.

Florissant. Nos. 9677, 10377.

3. Thomisus defossus.

Pl. 11, Fig. 23, ♂.

Cephalothorax bent at a strong angle with the abdomen and perhaps distorted in the single specimen known, but as preserved it is of an oval shape, slenderer than the abdomen, but not much smaller, half as long again as broad, similarly and fully rounded at either end, the sides not strongly convex; it appears to have a median transverse constriction and incision. Nothing can be made out of the eyes, but a single large, black, subcircular, palpal swelling (represented of the same tint with the rest and merged with the cephalothorax on the plate) lies bordering the middle of the front, a little broader than long. Abdomen very broad ovate, not more than a third to a fourth longer than broad, the base slightly broadest and broadly rounded, the apex similarly rounded and the sides between the well-rounded corners nearly straight; a faint separation into three or four segments can also be seen, and the surface is sparsely covered with minute short black hairs. Front pairs of legs much larger than the hinder, showing that the species is one of the true Thomisinæ, the femora large, swollen in the middle and depressed, the front pairs much longer than, the hinder pairs nearly as long as, the abdomen; the tibiæ proper are very distinctly separated from the first joint of tarsi (in the other species it is reckoned with them in the measurements), excepting on the hindmost legs having a distinct oval form of their own, about half as long again as broad; the first joint of the tarsi is only a little shorter than the femora (on these same legs) and with the tibia longer than the femora; it is armed sparingly with long and slender recumbent spines; the second and third joints of the tarsi are subequal, together shorter than the first joint, and besides their sparse clothing of short fine black hairs the tip is armed with a single short blunt claw.

Length of cephalothorax, 3.5^{mm}; breadth, 2.1^{mm}; length of abdomen, 4.2^{mm}; breadth, 2.7^{mm}; length of first pair of legs (as preserved), 7.75^{mm}; its femora, 3.5^{mm}; tibia (proper), 1.1^{mm}; (true) first joint of tarsi, 2.4^{mm}; second joint (as preserved), 1^{mm}; femora of second pair of legs, 3^{mm}; third pair of

legs, 7.15^{mm}; its femora, 2.6^{mm}; its tibia (proper), 0.8^{mm}; (true) first joint of tarsi, 2^{mm}; second joint, 1^{mm}; third joint, 0.75^{mm}; femora of fourth pair of legs, 3^{mm}; its tibia (proper), 1^{mm}; combined tibia and first joint of tarsi (as preserved), 3.5^{mm}.

This species is very readily separated from the others by its size, and undoubtedly belongs to a genus distinct from them; the specialization of the tibia proper is sufficient indication of this.

Florissant. One ♂, No. 4742.

Suborder TUBITELARIÆ Thorell.

This group of spiders, given to the construction of silken tubes above ground, is considered by Thorell as the most lowly organized of the Araneides, and it is interesting to find that it is far better represented in the Tertiary deposits than any other, comprising more than one-third of the species now known and 36 per cent. of the fossil species of Europe. It is equally remarkable for its diversity of form, all the families which are rich in genera in Europe at the present time being well represented in the Tertiaries of that country, and particularly in amber, both in genera and species; especially, as we shall see below, is this true of the Drassides, a group which is only surpassed in the number of its fossil species and the variety of its genera by the Theridides. It is, however, neither of these families, but the Epeirides, which predominates in the American Tertiaries, though next to these the Tubitelariæ stand pre-eminent, and particularly the family of Drassides, already mentioned. The same three families, viz, Dysderides, Drassides, and Agelenides, which are best represented in the European Tertiaries and are most abundant in species at the present day, are also present in the American strata, the first by a single species, the second by five, and the last by two, in all one-fourth of the American Araneides. (November, 1881.)

Family DYSDERIDES Koch.

Three genera of this family, Dysdera (four species), Segestria (eight species), and Therea (two species), have been found in Prussian amber, and comprise all the fossil species known up to the present time. To this list we can add from America one species, belonging to the genus most richly represented in amber. So far as known the living species of this

family, which are not numerous, are almost exclusively confined to the European fauna (especially the Mediterranean district) and to South America. (November, 1881.)

Gourret has recently described a species of this family from Aix, the first known from the European rocks; it is referred to an extinct genus, Prodysdera. (October, 1889.)

SEGESTRIA Latreille.

A single species is referable to this genus, and with little doubt, as it bears a striking resemblance to the living S. senoculata (Linn.) of Europe. Eight species of the genus have been found in the European Tertiaries, all from the amber of the Baltic, and two others are reported as known to Menge from the same source. All the described amber species are smaller than the American species, and have longer legs and more elongated cephalothorax, being evidently more nearly related to one another than to the American form. The living species of the genus are found in southern Europe, northern Africa, and Chili, with a single one in New Zealand. A warm temperate climate is therefore indicated. (November, 1881.)

Segestria secessa.

Pl. 11, Fig. 28 (♀).

Female.—Cephalothorax short, rounded ovate, about one-fourth longer than broad, with no distinction of cephalic and thoracic areas, the front broadly rounded, obscure, with no trace of eyes. Mandibles very stout, tapering, rounded at the tip, half as long again as broad, half as long as the cephalothorax, and together as broad at base as the front of the cephalothorax. Palpi slender, longer than the cephalothorax. Abdomen rather long ovate, about twice as long as the cephalothorax, and a little broader, broadest in the middle, tapering only a little toward the base, considerably toward the acuminate tip. Whole body of an almost uniformly dark color. Legs subequal, moderately long, and pretty slender, tapering a little only, the tibiæ and tarsi furnished above with lateral rows of very long tapering spines which do not diverge, but lie along the sides base to tip.

Length of body, 9.5^{mm}; cephalothorax, 2.75^{mm}; abdomen, 5.25^{mm}; breadth of cephalothorax, 2.25^{mm}; abdomen, 2.65^{mm}; length of cheliceres,

1.5mm; extent of palpi beyond corselet, 3.5mm; length of first pair of legs, 10mm; its femora, 3mm; tibiæ, 1.5mm; tarsi, 5.5mm; second pair, 9.5mm; femora and tibiæ, 3.75mm; tarsi, 5.75mm; third pair, 6.6mm; femora and tibiæ, 2.6mm; tarsi, 4mm; fourth pair, 10.2mm; femora, 2.4mm; tibiæ, 2mm; tarsi, 5.8mm.

Florissant. Two ♀, Nos. 205, and 1.806 and 1.818 of the Princeton collections.

Family DRASSIDES Sundevall.

This family is richly represented in Tertiary species; indeed, excepting Theridides, more richly than any other family of Araneides, being represented in Europe by the genera Anatone (three species), Clubiona (eight species), Macaria (five species), Melanophora (five species), Pythonissa (ten species), and Sosybius (two species), as well as by one species each of Anyphæna, Drassus, Erithus, Heteromma, and Idmonia. Every one of these are amber species, excepting one Clubiona and one Macaria from Oeningen. Our own fauna has besides this yielded four species of Clubiona and one of Anyphæna, both genera represented in amber, and one also at Oeningen. The present distribution of the species of this family is over the whole world, but the borders of the Mediterranean, eastern Europe, and western South America appear to be far the most richly represented. Some of the genera are confined to one or the other of these regions and nearly all to warm temperate regions. (November, 1881.)

CLUBIONA Latreille.

A number of species appear to fall here, although it is difficult to tell whether they should not rather be referred to the lycosoid genus Dolomedes or its vicinity, so uncertain are the clews we have to their real position; until more satisfactory specimens can be obtained they may be placed here, the more so as the species all bear some resemblance to the amber spiders referred to the same genus, C. eversa to C. tomentosa, C. arcana to C. sericea and C. lanata, C. latebrosa to C. attennata, and C. ostentata to C. microphthalma. The Oeningen species seems to be very different, with its rounded abdomen. Very few genera of spiders are so richly endowed with fossil species as this, Theridium indeed being the only one which surpasses it, and next to it comes Pythonissa, a genus of the same family as this. The genus is widely spread in modern times. A few species are common throughout the greater part of Europe, others are confined to the Mediter-

ranean region, a very few are found in the East Indies, and a very large number are reported from Chili; the genus is therefore mostly confined to warm temperate regions. (November, 1881.)

Table of the species of Clubiona.

Cephalothorax oblong oval, nearly or more than one-half longer than broad.
- Last palpal joint of male large; abdomen about equally rounded anteriorly and posteriorly, half as long again as the cephalothorax ..... 1. *C. eversa.*
- Last palpal joint of male small; abdomen tapering posteriorly and but little longer than the cephalothorax ..... 3. *C. latebrosa.*

Cephalothorax roundish oval, only one-fourth or one-third longer than broad.
- More than five millimeters long; abdomen much larger and longer than cephalothorax ..... 2. *C. arcana.*
- Less than five millimeters long; abdomen scarcely larger and but little longer than cephalothorax ..... 4. *C. ostentata.*

1. Clubiona eversa.

Pl. 11, Fig. 22 (♂).

Male.—Cephalothorax obovate, equally rounded at the two ends, more than half as long again as broad; the cephalic and thoracic portions not separable; front bluntly rounded, the eyes too poorly preserved to allow any statement concerning them. Palpi nearly as long as the cephalothorax, the last joint very large, ovate, subacuminate at tip, the longer diameter almost equaling the breadth of the cephalothorax. Abdomen ovate, half as long again and nearly half as broad again as the corselet, almost equally rounded at the two ends, but largest near the base and tapering slightly more behind than in front. Whole body of a nearly uniform brown, but in one specimen the swollen palpal joint blackish. Legs moderately long, not very unequal, tapering, abundantly furnished with dark divergent spines, about as long as the width of the tibiæ.

Length of body, 5.2^{mm}; cephalothorax, 2.1^{mm}; abdomen, 3.1^{mm}; width of cephalothorax, 1.65^{mm}; abdomen, 2^{mm}; extension of palpi beyond corselet, 1.7^{mm}; longer diameter of last joint of same, 0.7^{mm}; length of first pair of legs, 6.75^{mm}; its femora, 2.25^{mm}; tibiæ, 2^{mm}; tarsi, 2.5^{mm}; second pair, 6.75^{mm}; its femora, 2.3^{mm}; tibiæ, 2.2^{mm}; tarsi, 2.25^{mm}; third pair, 5.1^{mm}; its femora, 1.6^{mm}; tibiæ, 1.5^{mm}; tarsi, 2^{mm}; fourth pair, 6.6^{mm}; its femora, 2.1^{mm}; tibiæ, 2.2^{mm}; tarsi, 2.3^{mm}.

This species is not very far removed from the amber species, C. tomentosa, but is slightly larger than it and has a less tapering cephalothorax.

Florissant. Two ♂, Nos. 5944, 8551.

2. Clubiona arcana.

Pl. 11, Fig. 4 (♂).

Male.—Cephalothorax roundish oval, about one-third longer than broad, the cephalic and thoracic portions completely blended, the front in the single individual obscure with no trace of eyes. Cheliceres apparently pretty large, the palpi very long, longer than the prothorax, the last joint large and swollen, ovate, more than half as long again as broad, and black. Abdomen a little paler than the brownish cephalothorax, long ovate, considerably longer and somewhat broader than the cephalothorax. Legs not very long, tapering considerably, amply provided with more or less divergent slender spines as long as or slightly longer than the femora.

Female.—Cephalothorax ovate, about one-third longer than broad, the cephalic and thoracic portions completely blended. Palpi nearly or quite as long as the cephalothorax. Abdomen sometimes lighter than the cephalothorax, long ovate, considerably longer and sometimes a little broader than it. Legs as in the male, the spines perhaps a little shorter, and on the tarsi arranged to a certain extent in rows, not noticeable on the male.

Length of body, ♂ 5.25^{mm}, ♀ 6.65^{mm}; of cephalothorax, ♂ 1.75^{mm}, ♀ 2.15^{mm}; of abdomen, ♂ 3.5^{mm}, ♀ 4.5^{mm}; breadth of cephalothorax, ♂ 1.3^{mm}, ♀ 1.4^{mm}; of abdomen, ♂ 1.4^{mm}, ♀ 1.75^{mm}; extent of palpi beyond cephalothorax, ♂ 2^{mm}, ♀ 2^{mm}; longer diameter of last palpal joint, ♂ 1.15^{mm}, shorter diameter, ♂ 0.5^{mm}; length of first pair of legs, ♂ 7.5^{mm}, ♀ 6.75^{mm}; its femora, ♂ 2.05^{mm}, ♀ 2.4^{mm}; tibiæ, ♂ 2.9^{mm}, ♀ 2.35^{mm}; tarsi, ♂ 2.55^{mm}, ♀ 2^{mm}; second pair, ♂ 6.45^{mm}, ♀ 6^{mm}; its femora, ♂ 1.8^{mm}, ♀ 2.2^{mm}; tibiæ, ♂ 2.5^{mm}, ♀ 1.65^{mm}; tarsi, ♂ 2.35^{mm}, ♀ 2.15^{mm}; third pair, ♂ 5.35^{mm}, ♀ 5.5^{mm}; its femora, ♂ 1.35^{mm}, ♀ 1.8^{mm}; tibiæ, ♂ 2^{mm}, ♀ 1.85^{mm}; tarsi, ♂ 2^{mm}, ♀ 1.85^{mm}; fourth pair, ♂ 7.75^{mm}, ♀ 8.3^{mm}; its femora, ♂ 2.15^{mm}, ♀ 3^{mm}; tibiæ, ♂ 2.6^{mm}, ♀2.55^{mm}; tarsi, ♂ 3^{mm}, ♀ 2.75^{mm}.

This species agrees very well in size with C. eversa (only males of course compared), or is slightly smaller, and the legs if anything a little longer; the cephalothorax is rounder and the palpal swelling much more elongated. It is somewhat like both C. sericea and C. lanata of the Prussian amber, but is somewhat smaller and has longer legs than they.

Florissant. One ♂, No. 2831; three ♀, Nos. 3253, 7087, 8082, besides a ♀ from the Princeton collection, Nos. 1.807 and 1.819.

3. Clubiona latebrosa.

Pl. 11, Fig. 18 (♂).

Male.—Cephalothorax oval, largest behind the middle, tapering considerably at either end, with no distinction in outline between the cephalic and thoracic portions; front obscure with no eyes preserved. Cheliceres pretty large. Palpi very long, almost as long as the cephalothorax, terminal joint moderately stout, obpyriform. Abdomen paler than the cephalothorax, much larger than it by reason of its greater breadth, but only about one-fourth longer, largest near the base, tapering apically to a blunt tip, its basal two-thirds covered sparsely with long, stout, dark-tipped, faintly clubbed hairs. Legs long and slender, subequal, the femora and tibiæ furnished not very abundantly with moderately long, delicately tapering, very finely pointed, slightly divergent spines.

Length of body, 9.1^{mm}; cephalothorax, 4^{mm}; abdomen, 5.1^{mm}; breadth of cephalothorax, 1.6^{mm}; abdomen, 2.6^{mm}; extension of palpi beyond front of cephalothorax, 3^{mm}; length of first pair of legs, 8.75^{mm}; second pair, 11^{mm}; third pair, 9^{mm}; fourth pair, 9.5^{mm}.

This species differs from all the others here described in its tapering abdomen and its proportionally considerably longer legs; the palpal swelling is also slenderer than usual. In its tapering abdomen as well as in other features it comes pretty near the amber species, C. attenuata, being also of the same size; it differs from it in its longer legs.

Florissant. One ♂, No. 6492.

4. Clubiona ostentata.

Pl. 11, Fig. 24 (♂).

Male.—Cephalothorax broad oval, about one-half longer than broad, well rounded, with no distinction between cephalic and thoracic portions; front well rounded, but too poorly preserved to show any eyes. Cheliceres large. Palpi very long, fully as long as the cephalothorax. The apical joint very stout, obpyriform, being largest at some distance beyond the middle, beyond rapidly tapering to an obtuse angle; it is blackish and bears within its apical two-thirds a stout ribbon bent in the middle at less than a right angle, the bend broadly curved, and the apical half tapering to a point which extends just beyond the margin of the swelling. Abdomen only a little

larger than the cephalothorax, ovate, largest in the middle, tapering almost equally in either direction, the apex slightly angled, the surface very sparsely clothed with long, extremely delicate, tapering hairs. Legs moderately long, delicately tapering, sparsely furnished with scarcely divergent spines about as long as the diameter of the joint on which they are seated.

Female.—The single specimen is rather poorly preserved, hardly admitting of description. It is stouter than the male. The cephalothorax appears to be roundish quadrate, broadest behind, scarcely longer than broad, the hind margin very broadly, the front somewhat narrowly, convex. The abdomen is somewhat larger than the cephalothorax, but only a little longer, broadest anteriorly, pretty well rounded behind. Legs much as in the male, but with slight traces of spines.

Length of body, ♂ 5.4^{mm}, ♀ 4.75^{mm}; cephalothorax, ♂ 2.65^{mm}, ♀ 2.25^{mm}; abdomen, ♂ 2.75^{mm}, ♀ 2.5^{mm}; breadth of cephalothorax, ♂ 1.75^{mm}, ♀ 2.15^{mm}; abdomen, ♂ 1.6^{mm}, ♀ 2^{mm}; extent of palpi beyond cephalothorax, ♂ 1.35^{mm}; length of palpal swelling, ♂ 0.75^{mm}; length of first pair of legs, ♂ 7^{mm}, ♀ 6.2^{mm}; femora, ♂ 2^{mm}, ♀ 1.5^{mm}; tibiæ, ♂ 2.25^{mm}, ♀ 2.6^{mm}; tarsi, ♂ 2.75^{mm}, ♀ 2.1^{mm}; second pair of legs, ♂ 6.65^{mm}, ♀ 6.1^{mm}; femora, ♂ 2^{mm}, ♀ 1.6^{mm}; tibiæ, ♂ 2.25^{mm}, ♀ 2.25^{mm}; tarsi, ♂ 2.4^{mm}, ♀ 2.25^{mm}; third pair of legs, ♂ 5.15^{mm}; femora, ♂ 1.25^{mm}; tibiæ, ♂ 1.9^{mm}; tarsi, ♂ 2^{mm}; fourth pair of legs, ♂ 6.9^{mm}, ♀ 4.6^{mm}; femora, ♂ 2^{mm}, ♀ 0.85^{mm} (?); tibiæ, ♂ 2^{mm}, ♀ 1.75^{mm} (?); tarsi, ♂ 2.9^{mm}, ♀ 2^{mm}.

This species is considerably smaller than any of the others, and is further distinguished from them by the near equality in size of the cephalothorax and abdomen It resembles a little C. microphthalma of the Baltic amber, and is of the same size as it, but the cephalic portion of the cephalothorax is not distinguished by a constriction as there, and our species has somewhat stouter legs.

Florissant. Two ♂, Nos. 199, 5507 and 5910; one ♀, No. 9624.

ANYPHÆNA. Sundevall.

To this genus I refer a single species, manifestly belonging in this vicinity, and approaching it, so far as may be judged by the general appearance of the specimen, as closely as any other form. Traces of the eyes can be seen in this specimen, and if correctly interpreted their arrangement is not exactly that of Anyphæna, although it is not very different from that

of this and allied genera of Drassidæ. For the present, at least, it may remain here.

A single species of Anyphæna has before been recorded in a fossil state, A. fuscata, found in amber, but it differs very much from our species, and the arrangement of the eyes in particular is altogether different. All the species of the genus now living have been found in southern Europe and Algeria excepting one, which is reported from the Pacific Islands; and our species thus indicates a warmer climate than the locality at present enjoys.

Anyphæna interita.

Pl. 11, Fig. 5.

Cephalothorax subcircular, the cephalic and thoracic portions wholly blended, the anterior and posterior margins a little flattened, so as to be nearly straight, fully as broad as long, furnished with short, tapering hairs. Eyes apparently formed of two approximated pairs of small ocelli close together in a slightly curved line opening forward next the middle of the front margin; two slightly larger directly behind each of these pairs, and slightly more distant from each other than either is from the pair in front, and two much larger lateral ocelli situated next the front base of the front pair of legs close to the margin, and forming with the posterior middle eyes a very slightly curved series of nearly equidistant ocelli opening forward. The pair of approximated eyes and the one in their rear are faint and more or less conjectural. If this position of the eyes is correct the spider should not be placed in Anyphæna, but would certainly appear to fall near it and Clubiona. Cheliceres very stout, projecting in front of the cephalothorax by half the length of the latter, and together considerably more than half as broad as it, well rounded apically. Palpi of female rather longer than the cephalothorax, moderately stout. Abdomen apparently pedunculate, the peduncle long and slender, the abdomen plump oval, well and very regularly rounded in front, and but for the rapid tapering of the extreme apex rather more broadly rounded behind. Legs short, subequal, moderately stout, especially the femora, tapering throughout, well armed with pretty large tapering spines of equal length on the whole leg, and about as long as the width of the tibiæ, somewhat divergent and irregularly disposed on the femora, beyond arranged apparently in two or three rows and scarcely at all divergent.

Length of body (as preserved), 11.5mm; of cephalothorax, 2.75mm; of abdomen (without pedicel), 6mm; of pedicel, 1mm; breadth of cephalothorax, 3.1mm; of abdomen, 4.1mm; length of cheliceres, 1.6mm; of palpi beyond corselet, 3.3mm; of first pair of legs, 8mm; its femora, 2.5mm; tibiæ, 2.6mm; tarsi, 2.9mm; of second pair of legs, 9.2mm; its femora, 2.6mm; tibiæ, 3.25mm; tarsi, 3.35mm; of third pair of legs, 7.5mm; its femora, 2.3mm; tibiæ, 2.5mm; tarsi, 2.7mm; of fourth pair of legs, 10.75mm; its femora, 2.9mm; tibiæ, 3.2mm; tarsi, 4.15mm.

Florissant One ; (and reverse), Nos. 8269 and 8281.

Family AGALENIDES Koch.

This family of Tubitelariæ is also fairly represented in Tertiary times, three species each having been found in amber, of the genera Amaurobius and Tegenaria, and one each of Agalena and Argyroneta, besides which Oeningen furnishes an Argyroneta and Rott an Argyroneta and a Histopona. To this list we can add from this country two species of Titanœca, more nearly allied apparently to the amber species of Amaurobius than to any other fossils. Far the largest part of the species of this family are known from Europe, but a few from America. (November, 1881.)

Gourret has recently described a Tegenaria from Aix.

TITANŒCA Thorell.

Two species are placed in this genus from their close general resemblance to the type of the same, Hahn's Theridium quadriguttatum of Europe. The genus has never before been found fossil, but is not far removed from Amaurobius, of which three species are known in the European Tertiaries. The living species of the genus are confined, so far as I discover, to the Mediterranean district and central Europe, as are most of the species of Amaurobius, but a few of the latter are reported from the warmer parts of America. As in so many other cases, therefore, the presence of these species indicates a warm temperate climate. (November, 1881.)

Table of the species of Titanœca.

Cephalothorax small and oval, about half as long as the abdomen..... 1. *T. ingenua.*
Cephalothorax large and elongate, about three-fourths the length of the abdomen.....2. *T. hesterna.*

1. Titanœca ingenua.

Pl. 11, Figs. 29, 32 (♀).

Cephalothorax oval, about half as long again as broad, largest a little behind the middle, the front not produced but regularly rounded, the lateral curve being slightly convex throughout its course, and thus showing no line of separation between the cephalic and thoracic portions. Arrangement of eyes not determinable. Cheliceres stout. Palpi moderately stout, equal, about as long as the cephalothorax, the terminal joint roundly pointed at tip. Abdomen plump, subrotund, at least four or five times larger than the cephalothorax, being more than twice as broad and fully twice as long as it, slightly more tapering at the base than at the apex, only half as long again as broad, and of a uniform tint, or possibly a little duskier along the medio-dorsal portion. Legs moderately slender, short, subequal, abundantly furnished with hairs, which seem (conspicuously in one specimen, No. 13520, less distinctly in others) to be more abundant laterally than upon the upper surface, and armed with many very long and slender only slightly diverging spines on all the legs, and especially on the femora and tibiæ of the two hinder pairs. All the specimens appear to be females.

Length of body, 9.6^{mm}; of cephalothorax, 3.1^{mm}; abdomen, 6.5^{mm}; breadth of cephalothorax, 2.4^{mm}; abdomen, 5.9^{mm}; length of first pair of legs, 8^{mm}; second pair, 7.6^{mm}; third pair, 7^{mm}; fourth pair, 8.75^{mm}.

The shape of the cephalothorax and abdomen sufficiently separate this species from the following, with which otherwise it agrees closely in general appearance.

Florissant. Four ♀, Nos. 9792, 11203, 13520, 14031.

2. Titanœca hesterna.

Cephalothorax obpyriform, the cephalic portion a little produced and tapering anteriorly less than the fully rounded thoracic part, and somewhat truncate anteriorly, the front scarcely convex, the posterior border well rounded; the widest portion of the cephalothorax is in the middle of the thoracic part or of the hinder two-thirds of the whole, and it is nearly half as long again as broad. Arrangement of eyes not determinable. Cheliceres stout. Palpi moderately stout, equal, a little shorter than the cephalothorax, the apical joint roundly pointed at tip. Abdomen ovate, about

half as broad again as the cephalothorax, nearly twice as long as broad, but only half as long again as the cephalothorax, tapering apically as much as if not more than basally. Legs moderately slender, short, subequal, abundantly furnished with hairs and with spines, even to the tips of the tarsi, especially on the two hinder pairs of legs, much as in T. ingenua and with the same thinness of covering above as there, one specimen especially (12977) showing it in the same marked degree as one of the preceding species. As there also, all the specimens appear to be females.

Length of body, 7.1^{mm}; cephalothorax, 2.3^{mm}; chelicères, 1.5^{mm}; abdomen, 5^{mm}; breadth of cephalothorax anteriorly, 1.4^{mm}; greatest breadth, 2.1^{mm}; breadth of abdomen, 2.75^{mm}; length of first pair of legs, 7^{mm}; second pair, 7.3^{mm}; third pair, 5.5^{mm}; fourth pair, 8^{mm}.

The slenderer form of the whole body and the less disparity in size between the cephalothorax and abdomen mark this species as distinct from the preceding.

Florissant. Four ♀, Nos. 5656, 12006, 12977, and Princeton collection, No 1.809.

Suborder RETITELARIÆ Thorell.

Next to the last equivalent group, these spiders, which make a loose web or snare apparently constructed without any regular plan, are the most numerous in Tertiary deposits, forming in Europe, as we have seen, 29 per cent of the total fauna. This, as before, is dependent in large measure upon their representation in amber, which contains forty-eight of the fifty-five described species. The number known from the European strata is, however, greater than in any other of the larger groups, while the American species of the same here brought to light are for once considerably less numerous than the European. All the species belong to the Theridides, which is also far the richest in forms at the present day. (November, 1881.)

Family THERIDIDES Koch.

There is no single family of spiders so abundantly represented in Tertiary deposits as the Theridides. No less than fifty-four species, or more than one-fourth the whole number of fossil Araneides of Europe, belong to this group and represent fourteen genera. Theridium is richest, with sixteen species; then follow Thyelia with eleven; Zilla, Micryphantes, and

Ero with five each; Linyphia with three, Corynites and Erigone with two, and Anandrus,[1] Clya, Dielacata, Euryopus, Flegia, and Schellenbergia with one each. Flegia, Corynitis, Anandrus, Thyelia, Clya, Dielacata, and Schellenbergia are all peculiar to the Tertiaries, Schellenbergia to Oeningen, the others to amber. Nearly all the species are from amber, but beside the Schellenbergia from Oeningen there is a species of Erigone and two of Linyphia from Rott, and two species of Theridium from Oeningen as well as another from Aix.

America, however, does not bear her proportionate share in this representation, being poorer even than the stratified deposits of Europe, whereas in every other group it is either better represented or falls short by only a single species. There is a single species of Linyphia, two of Theridium, and some egg-cocoons referred for convenience to the comprehensive genus Aranea. That two of the three species known in the perfect state should belong to the genus most highly favored in the European Tertiaries is a point worth noting.

The family is best represented in Europe (especially in the Mediterranean district) and warm temperate America, but a few have been found in the East Indies. (November, 1881.)

Gourret, in his recent investigation of the spiders of Aix, found but a single species of this family among the eighteen Araneides described by him. He referred it to Ariamnes.

ARANEA Linné.

Under this broad generic name are placed notices of some egg-cocoons which are like those made by species of this group and which have been found at no less than three distinct localities. I am not aware that any such remains have before been noticed.

Aranea columbiæ.

Pl. 11, Figs. 1, 2.

Aranea columbiæ Scudder, Rep. Progr. Geol. Surv. Can., 1876–'77, 463–464 (1878).

Among the stones obtained by Mr. Dawson in British Columbia are several containing the flattened remains of the egg-cocoons of Araneides. There are no less than eight of them, of different shapes and sizes, occurring

[1] Anandrus is credited with one species, but it is not described (Menge, Lebenszeichen, etc., p. 7).

by pairs, none of them reverses of others. They occur on stones numbered 38 to 41. As the form of the egg-cocoons in Araneides is so various, and the number of specimens found indicates a probability of obtaining at some time the probable constructor of the webs, I have only applied an ancient, broad generic name to these products of the insect, for the sake of indicating the nature of all the fossil remains from Quesnel. It is probable that the spider will be found most nearly allied to Theridium, species of which construct pedunculate egg-cocoons not very different from these. The cocoons vary slightly in size, and more in shape, owing no doubt to their varying position when crushed; probably they were globular, or possibly slightly oval in shape; averaging about five millimeters in the longer and four millimeters in the shorter diameter; of a firm structure; testaceous in color, and hung by a slender thread, less, or much less than quarter the length of the egg-cocoon (averaging, perhaps, one millimeter in length), to a thickened mass of web, attached to some object or to the insect's web.

That they have been preserved by pairs upon the stones has no significance, and, indeed, may be due simply to the way the stones were broken; for they lie at varying distances apart, with no sign of connection, and placed with no definite relations to each other. Two of them show no sign of the pedicel, but this is certainly due to poor preservation; and a single one, the least circular (40*a*) not only has no pedicel, but appears to be formed of a lighter, flimsier tissue, and may belong to a different species. The following are the longer and shorter diameter, and length of pedicel, of each specimen:

Number of specimen.	Long diameter.	Short diameter.	Length of pedicel.
	Mm.	*Mm.*	*Mm.*
No. 38*b*	5.0	3.5	1.5
No. 38*c*	6.0	4.0	0.8
No. 39*a*	4.0	3.6	1.2
No. 39*b*	4.0	3.5	.....
No. 40*a*	5.5	2.5	.....
No. 40*b*	5.2	3.7	1.0
No. 41*a*	5.0	3.9	(*)
No. 41*b*	4.5	4.2	(*)

* Base only of pedicel preserved.

The egg-cocoon of a spider (No. 4201), of exactly the same size, shape, and general appearance as those described above, excepting that from

a break in the stone there is no trace of a pedicel, was found by me in the shales at Green River, Wyoming.

A single specimen (No. 8935), of an egg-cocoon was also found at Florissant, Colorado, having the same general appearance, but with no trace of a pedicel and slightly larger than any of the others, being 6^{mm} long and 4^{mm} broad. It is of course impossible to say that it is the same species.

Still another (No. 1.173) was brought by the Princeton expedition from Florissant, differing in the opposite direction, being considerably smaller and so preserved as to appear broader than long. It is provided with a pedicel 1.4^{mm} long, but is itself only 2^{mm} long and 2.5^{mm} broad.

Quesnel, Green River, Florissant.

THERIDIUM Walckenaer.

No less than sixteen fossil species of this genus have been described, thirteen from amber, one from the beds of Aix, at about the same horizon, and two from Oeningen. Those from Oeningen and Aix are very different from the two here described, and those figured from amber are scarcely nearer, though T. opertaneum bears some resemblance to T. granulatum, and T. seclusum to T. hirtum. The vast majority of the numerous known living species of this genus are from Europe, but not a few occur in our country, especially in the Southern States, and one or two are reported from other parts of the world. It is therefore almost exclusively a north temperate genus, but is by no means confined to the warmer parts, and its occurrence at Florissant has no special significance as to the climate of the times. (November, 1881.)

Table of the species of Theridium.

Large species; the cephalothorax much longer than broad (♀) ..... 1. *T. opertaneum.*
Small species; the cephalothorax nearly circular (♂) ..... 2. *T. seclusum.*

1. THERIDIUM OPERTANEUM.

Pl. 11, Fig. 3 (♀).

Female.—Cephalothorax elongated, comparatively slender, nearly equal, about twice as long as broad. Legs slender, imperfectly preserved, not very long, sparsely furnished with rather short delicate spines, not longer than the width of the legs. Abdomen very large, nearly globular, nearly three times as broad as the cephalothorax, of a greenish tinge, though the whole body is brown.

Length of body, 11^{mm}; of cephalothorax, 5^{mm}; breadth of same, 2.2^{mm}; of abdomen, 6.4^{mm}; length of first pair of femora, 6^{mm}; second pair, 5^{mm}; second tibiæ, 4^{mm}; third femora, 2^{mm}; third tibiæ, 2.4^{mm}; fourth femora, 3.25^{mm}.

Besides its very much greater size, this species differs greatly from the other in the form of the cephalothorax.

Florissant. One ♀, No. 13521, preserved on a dorsal view.

2. Theridium seclusum.

Pl. 11, Fig. 20 (♂).

Male.—Cephalothorax stout, square oval, a little longer only than broad, the front broadly and regularly rounded. Cheliceres rather stout, as long as half the width of the corselet, tapering a little, rounded at the apex, the outer edge straight, the inner rounded. Last joint of palpi nearly as large as the cheliceres, oval, on a stalk as long as the cephalothorax. These two parts are incorrectly represented on the plate, where the palpi and cheliceres appear as one great piece. Abdomen rather small, oval, narrower than the cephalothorax, but of about the same length. Legs long and slender, the first pair particularly long, and the second pair considerably longer than the fourth, which is unusually slender: all the legs are furnished with numerous spines, apparently arranged in three rows and clustered much more numerously at the distal end of the femora and tibiæ than elsewhere; the spines are moderately slender and about as long as the width of the joints, separated from one another by about their own length, sometimes a little less.

Length of body, 4.5^{mm}; of abdomen, 2.25^{mm}; width of cephalothorax, 1.65^{mm}; of abdomen, 1.2^{mm}; length of cheliceres, 0.75^{mm}; of first pair of legs, 15^{mm}; its femora, 4.5^{mm}; tibiæ, 4.5^{mm}; tarsi, 6^{mm}; second pair of legs, 12^{mm}; femora, 3.75^{mm}; tibiæ, 3.75^{mm}; tarsi, 4.5^{mm}; third pair of legs, 5.25^{mm}; femora, 1.4^{mm}; tibiæ, 1.1^{mm}; tarsi, 2.75^{mm}; fourth pair of legs, 9^{mm}; femora, 3.5^{mm} (?); tibiæ, 1.5^{mm} (?); tarsi, 4^{mm}.

The species is very much smaller than T. opertaneum, besides having a very different corselet.

Florissant. Nos. 2286, 7816, 9026. All the specimens appear to be males.

LINYPHIA Latreille.

Two species of this genus have been described from Rott, and one (formerly considered two) species from amber. The single species we can here add to the number is tolerably nearly allied to the amber species, as well as to L. rottensis of the Rhenish brown coal, though it is much larger than the latter. The living species are found abundantly in all parts of Europe, excepting possibly the most southern, and several species are recorded from Georgia and from Chili. Its presence at Florissant would rather indicate a mean temperate climate. The species are lively and savage in character, constructing a rather complicated sheet of web, under the middle of which they lie in wait in an inverted position for their prey. (November, 1881.)

LINYPHIA RETENSA.

Pl. II, Figs. 25, 27 (♂).

A single male and its reverse represent this species; the reverse was broken, and the posterior portion figured before its anterior half was found; hence the specimen is numbered three times; it is tolerably well preserved, especially the legs. The better preserved half shows a nearly uniform dusky figure upon the stone, but on the reverse the abdomen is much darker, almost black, and the palpi also are darker than the cephalothorax. The latter is regularly oval, the anterior extremity the more pointed: upon this some ocelli may be seen, of which there are apparently two approximate but independent ones next the middle, and on one side a pair of confluent eyes of the same size, all next the anterior edge. The last palpal joint is large, subcircular, or somewhat pyriform, furnished interiorly with a stout, strongly bent ribbon, and is perched on a stalk long enough to carry it by its own width beyond the margin of the corselet. Abdomen regularly obovate, a trifle broader in front than behind, somewhat longer than the corselet, and roundly pointed behind. Legs very long and slender, excepting the third pair, which are short, all the femora rather sparsely furnished with very delicate spines.

Length of body, 7.1^{mm}; of abdomen, 4^{mm}; breadth of cephalothorax, 2^{mm}; of abdomen, 2.15^{mm}; diameter of palpal swelling, 1^{mm}; length of first pair of legs, 19^{mm}; second pair, 15.5^{mm}; third pair, 6.9^{mm}; fourth pair, 14^{mm}; first pair femora, 6^{mm}; tibiæ, 7^{mm}; tarsi, 6^{mm}; second pair femora, 5^{mm};

tibiæ, 5.5[mm]; tarsi, 5[mm][1]; third pair of femora, 2.5[mm]; tibiæ, 2.4[mm]; tarsi, 2[mm]; fourth pair of femora, 4.5[mm]; tibiæ, 4.5[mm]; tarsi, 5[mm].

This species differs from L. cheiracantha in its considerably larger size, the absence of distant spines upon the legs, and its much more slender cephalothorax and longer legs.

Florissant. One ♂, Nos. 12976 and 13212 and 14032.

Suborder ORBITELARIÆ Thorell.

The symmetrical-web constructing spiders, though not rare in Tertiary deposits, are not so common as their abundance in recent times would lead one to anticipate, for, as we have seen, only 8 per cent of the European fossil spiders belong to this group, and all or nearly all of them are Epeirides. In this number are not included two or three species described by older authors under the name of Aranea, the precise location of which is and must probably always remain uncertain. Thirteen species are credited to amber, two to Rott, and one to Oeningen. In our own country the case is very different, for nearly one-half of our species (44 per cent) are to be referred to this group, and all also are Epeirides. It is the one considerable point in which the American fauna may be contrasted with the European. In Rott alone of all the European localities (where the Orbitelariæ form one-fourth of the known fauna) do we have any approach to the proportionate number of this great group. (November, 1881.)

Family EPEIRIDES Sundevall.

The genera of Epeirides represented in the European Tertiaries are Epeira (five species), of which two come from Rott and one from Oeningen, Græa (four species), Antopia (three species), Onca (two species), and Epeiridion and Siga (one species each). The American fauna is nearly as rich, richer for once than the amber, whence come all the European species except those specified above, embracing seven or more species of Epeira, four of an extinct genus, Tetlmeus, and one each of Tetragnatha and Nephila, genera before unknown in the fossil state. Not only, then, is the American fauna peculiar for its richness in species of this family, but no other shows so many novel forms for the Tertiary epoch. One of these latter genera predominates in America and the other is a tropical genus, which lends addi-

[1] The terminal part of the right tarsi as given in Fig. 27 does not belong to the tarsi.

tional interest to their discovery. The species are spread all over the globe in both temperate and torrid regions. (November, 1881.)

At Aix, Gourret found but a single member of this family, which he referred to a distinct genus called Cercidiella.

TETRAGNATHA Latreille.

This genus has never before been recognized in a fossil state. Although represented in every continent, it is only in America and particularly in the warmer parts of North America that it is at all abundant: here some species range north to New England, but it is essentially a genus of the Southern States; these spiders frequent the borders of ponds and hence it is not strange that we should find them in the lake deposits of Florissant, although their presence there certainly indicates a warmer climate than the present. The species here described does not appear to have special affinities with the American species with which I have been able to compare it, being stouter bodied than they. (November, 1881.)

TETRAGNATHA TERTIARIA.

Pl. 11, Fig. 11 (♂).

Tetragnatha tertiaria Scudder, Zittel, Handb. d. Paleont., I, ii, 744, Fig. 927 (1885).

A single male and its reverse represent the under surface of this species; as preserved, it is of a pale rusty color, the cephalothoracic appendages much darker than the abdomen, which is as pale as the legs, or than the cephalothorax, which is nearly as pale. The cephalothorax is circular or scarcely longitudinally oval, the exposed ventral portion between the bases of the mandibles and legs shield-shaped or heart-shaped. The mandibles are very large, longer than the cephalothorax, broader on the apical than on the basal half and thus formed of two parts, a basal, straight, equal piece, as broad as the third or fourth legs and about double the length of the coxæ, and an apical ovate portion, not unlike the apical joint of the palpi, somewhat longer than the basal portion and fully half as broad again as the front legs. Beyond these, and separated from them by a little space, and therefore supported by a long pedicel, which however is not preserved, are the apical palpal joints, a little smaller than the apical portion of the mandibles and of about the same shape, in the interior of which a strongly curved corneous thread can be made out, forming more than a complete

circle. The legs, of which only the third and fourth pairs are perfect, are very long, excepting the third pair; the femora and perhaps the tibiæ have a superior series of alternately diverging, slender, very distant spines, farther from one another than their own lengths. The abdomen is long obovate, subcylindrical, a little the largest at the base, as long as the cephalothorax and cheliceres together.

Length of body, 10^{mm}; of abdomen, 5^{mm}; breadth of cephalothorax, 2.5^{mm}; of abdomen, 2.3^{mm}; length of mandibles, 3.2^{mm}; breadth of the basal portion, 0.7^{mm}; of the apical portion, 1.3^{mm}; greatest diameter of last palpal joint, 1.25^{mm}; least diameter of same, 1.15^{mm}; length of femora of first pair of legs, 8.75^{mm}; of second, 7^{mm}; of third, 3.5^{mm}; of fourth, 7^{mm}; length of third pair of legs, 9.5^{mm}; of fourth pair, 18.5^{mm}.

Florissant. One ♂, Nos. 5000 and 5898.

TETHNEUS, gen. nov. (Θνήσκω).

Under this name are here grouped several evidently nearly allied species of spiders, which closely resemble in general aspect those placed under Epeira, but which differ also from them in certain features, and in these same characteristics appear to differ also from all other Epeirides, to which family they evidently belong. They are compact in form, with short and stout legs of not very unequal length, and in particular the first two pairs of legs are unusually heavy. The second and fourth pairs of legs are of nearly equal length, or the second pair may be slightly longer; the femora of the first and second pairs of legs are at base as broad as or even broader than half the width of the cephalothorax, and the longest legs are less, generally considerably less, than twice as long as the body. The species are of medium size.

Table of the species of Tethneus.

Cephalic and thoracic portions of the corselet separated by a distinct rectangular incision.
- Last palpal joint of male globose ..... 1. *T. guyoti.*
- Last palpal joint of male elongated ..... 4. *T. provectus.*

No line of demarkation between the two parts of the corselet.
- Smaller species, cephalothorax regularly obovate ..... 2. *T. obduratus.*
- Larger species, cephalothorax ovate, nearly pyriform ..... 3. *T. hentzii.*

1. TETHNEUS GUYOTI.

Pl. 11, Figs. 8 (♂), 10 (♀).

Cephalothorax roundly obovate, not much longer than broad, broadest behind the middle, the cephalic separated from the thoracic portion by a deep incision, reaching nearly to the middle of the whole section; and behind

it is a distinct, short, median furrow. The front is well rounded; nothing can be said of the eyes; the last palpal joint of the male is very large and globose, the basal joints evidently short. Abdomen a little larger than the cephalothorax and of the same general form, but more regularly obovate. Legs, especially in the male, rather short, the femora being also very stout; tibiæ and tarsi (but not the femora) furnished with a superior row of irregularly alternating, somewhat divergent, long and slender spines on either side.

Length of body, ♂ 7.75, ♀ 8.5^{mm}; of cephalothorax, ♂ 3.5, ♀ 4.25^{mm}; width of same, ♂ 3.8, ♀ 3.25^{mm}; length of abdomen, ♂ 4.25, ♀ 4.25^{mm}; width of same, ♂ 4, ♀ 3.5^{mm}; diameter of last palpal joint, ♂ 1.4^{mm}; length of first pair of legs, ♂ 12.75–12, ♀ 13.5^{mm}; its tibia, ♂ 4.2–4^{mm}; tarsi, ♂ 5.1–4.5^{mm}; width of femora, ♂ 1.2–1, ♀ 0.8^{mm}; second pair, ♂ 11.75–10.5, ♀ 14.25^{mm}; its tibia, ♂ 4–3.25^{mm}; tarsi, ♂ 3.75–3.75^{mm}; third pair, ♂ 7.75–6.5, ♀ 8.5^{mm}; its tibia, ♂ 2.5–2, ♀ 2.5^{mm}; tarsi, ♂ 2.5–2.25, ♀ 3.5^{mm}; fourth pair, ♂ 9.25–8, ♀ 12.75^{mm}; its tibia, ♂ 3.25–2.5, ♀ 4^{mm}; tarsi, ♂ 3–2.5, ♀ 4.25^{mm}.

The second measurements of the legs of the male are of a smaller individual. It will be seen that the second pair of legs are proportionately longer in the female than in the male, where they are shorter than in the first pair.

The species is represented by four individuals, one of them in duplicate. All but one are males and, excepting one male, all are tolerably preserved.

Named for the late Prof. Arnold Guyot, to whose kindness I am indebted for the opportunity of studying the Princeton collection of Florissant insects.

Florissant. ♀, No. 320; ♂, Nos. 8265, 8311, and from the Princeton collection, one ♂, Nos. 1.808 and 1.854.

2. Tethneus obduratus.

Pl. 11, Fig. 31 (♀).

This species is represented by a single rather poor specimen, pretty certainly affiliated with the others of this genus, but smaller than any of them. The cephalothorax is of a very regular obovate form, nearly half as long again as broad, with a small, circular, dark, central spot; no line of demarkation of the cephalic and thoracic portions can be seen; the front is

strongly convex, but no certain trace of the eyes can be made out. The palpi (female) are stout and large, tapering apically, but bluntly pointed. The legs are very stout, but unfortunately hardly any of them perfect.

Length of cephalothorax, 3.6^{mm}; breadth, 2.7^{mm}; projection of palpi beyond front, 2^{mm}; their breadth, 0.4^{mm}; breadth of fore femora, 1^{mm}; length of femora of first pair of legs, 2^{mm}; tibiæ, 3^{mm}; femora of second pair of legs, 2.5^{mm}; tibiæ, 3^{mm}; tarsi, 3^{mm}; femora of third pair, 1.5^{mm}; tibiæ, 2^{mm}; tarsi, 2.5^{mm}; femora of fourth pair, 2.25^{mm}.

Florissant. One ♀, No. 7177.

3. Tethneus hentzii.

Pl. 11, Fig. 14 (♂).

Tethnæus hentzii Scudder, Zittel, Handb. d. Palæont., I, ii, 744, fig. 928 (1885).

This species is represented by seven individuals, one of them in duplicate and all of them males. About half of them are well preserved. The cephalothorax is short ovate, almost pyriform, broadest behind and strongly convex in front, with no demarkation between the cephalic and thoracic portions of the corselet; although there are traces of the eyes, their position and relations can not be satisfactorily determined. Palpi short, the terminal joint barely separated entirely from the front, very large and globose, a little longer than broad by reason of a broad bulbous protrusion of the anterior extremity, which, however, is not clearly apparent in all the specimens by their mode of preservation; in one specimen the upper anterior extremity, and that only, is covered with rather long and close bristly hairs, forming an open tuft. Abdomen nearly circular, a little longer than broad, only a little larger than the cephalothorax and of a lighter color than it, with a darker, broad, median patch not so deep in tint as the cephalothorax. Legs short, stout, tapering, spinous, and hairy throughout, of not greatly unequal length, the femora very stout and tapering more rapidly near the tip than elsewhere.

Length of body, 6.5^{mm}; width of same, 3^{mm}; length of cephalothorax, 3.5^{mm}; of abdomen, 3.25^{mm}; longer diameter of last joint of palpi, 1.4^{mm}; length of first pair of legs, 13.75^{mm}; its coxa, 1.4^{mm}; femur, 3.1^{mm}; tibia, 1^{mm}; first tarsal joint, consolidated with the tibia, 2.75^{mm}; the tarsus proper, 5^{mm}; length of second pair of legs, 11.5^{mm}; its coxa, 1.5^{mm}; femur, 2.7^{mm}; tibia, 1^{mm}; first tarsal joint, 2.3^{mm}; tarsus proper, 4^{mm}; length of third pair

of legs, 7.25mm; its coxa, 0.75mm; femur, 2mm; tibia, 0.8mm; first tarsal joint, 1.3mm; tarsus proper, 2.4mm; length of fourth pair of legs, 9.25mm; its coxa, 0.75mm; femur, 2.75mm; tibia, 1mm; first tarsal joint, 1.75mm; tarsus proper, 3mm.

Named for the American arachnologist, the late Prof. N. M. Hentz.

This species differs from T. guyoti in wanting any distinct demarkation of the thoracic and cephalic portions of the corselet, in the spiny character of the femora, and in the longer and more tapering legs. It is also smaller.

Florissant. Seven ♂, Nos. 1226, 1447, 3860, 6600, 8533 and 8635, 8689, 14982.

4. Tethneus provectus.

Pl. 11, Fig. 21 (♀).

Four specimens, one of them in duplicate and all of them tolerably preserved, represent both sexes of this species. Cephalothorax of female (that of the male too vague for determination of form) rounded subquadrate, broadest and subangulated behind the middle, the rapidly narrowing front almost straight anteriorly, and scarcely more than one-fourth the width of the posterior portion; cephalic separated from the thoracic portion of the corselet by a rectangular incision and by the slightly concave curve of the sides of the anterior half; the cephalic is also distinctly darker than the thoracic region. Nothing can be said of the eyes. The last palpal joint of the male is large, rounded quadrate, about twice as long as broad; the palpi of the female are as stout as the base of the front tarsi, hairy, tapering only on the apical half of the terminal joint, rather bluntly pointed, extending nearly as far beyond the front as the whole length of the cephalothorax. Abdomen as dark as the cephalic portion of the corselet, in the female plump, rounded, slightly ovate, considerably larger than the cephalothorax, the apex almost angulated; in the male rounded subfusiform, much longer than the cephalothorax, but not greatly broader. Legs very hairy but without conspicuous spines, the femora very stout, and at the tip rapidly tapering, the rest of the legs diminishing in size less noticeably than in the preceding species.

Length of body, 6.5mm; of cephalothorax, 3mm; of abdomen, 3.5mm; breadth of cephalothorax, 2.8mm; of abdomen, 3.1mm; extension of palpi

beyond front, 2.2^{mm}; length of first pair of legs, 9.25^{mm}; its tibia, 3.25^{mm}; tarsi, 2.4^{mm}; second pair of legs, 8^{mm}; its tibia, 2.75^{mm}; tarsi, 2.4^{mm}; third pair of legs, 5.5^{mm}; fourth pair of legs, 7^{mm}; its tibia, 2.3^{mm}; tarsi, 2.3^{mm}. The measurements are all taken from the female.

This species is of about the same size as the last, but differs from it in its slenderer form, the shape of the cephalothorax, slightly slenderer and less tapering legs, as well as in the clothing of the same.

Florissant. One ♂, three ♀, Nos. 8141, 13519 and 13522, 13524 (♀), 14991 (♂).

EPEIRA Walckenaer.

Only a very few species have been described in a fossil state under this generic name. Heyden figured a Gea krantzii from the Miocene beds of Rott on the Rhine which Thorell considers an Epeira and which is about the size of E. delita, but which does not resemble any of our species. Heer figures an Epeira molassica from Oeningen, considerably larger than any of the Florissant Epeiræ, but perhaps more nearly resembling E. delita than any of the others. Menge names but does not describe an E. eogena from amber, three millimeters long, or of about the size of our smallest species; and finally Bertkau has more recently described and figured a second species from Rott, under the name of E. tröschelii, which bears no small resemblance to our E. meekii, with which also it agrees very well in size.

Seven species are here described and others indicated, this genus being the only one represented on both continents in Tertiary times which is richer in species in America. The genus is found in all parts of the world, and its occurrence in such numbers in the Florissant beds is a point of no significance beyond the comparison just made with the European Tertiaries. (October, 1881.)

Table of the species of Epeira.

Cephalic distinctly separated from the thoracic part of the cephalothorax.
- Large species; front of cephalothorax excised in the male ..... 1. *E. meekii.*
- Small species; front of cephalothorax regularly convex in the male ..... 2. *E. abscondita.*

Cephalic and thoracic portions of the cephalothorax completely blended.
- Abdomen narrowed in front and behind.
  - Abdomen distinctly ovate ..... 3. *E. delita.*
  - Front of abdomen quadrate, as broad as in the middle ..... 4. *E. cinefacta.*
- Abdomen nearly globular.
  - Larger species; abdomen smaller than cephalothorax ..... 5. *E. vucanalis.*
  - Smaller species; abdomen larger than cephalothorax ..... 6. *E. emertoni.*

1. Epeira meekii.

Pl. 11, Figs. 2 (♀), 17 (♂).

Cephalothorax of the male large, the thoracic portion nearly circular, scarcely longer than broad, and distinctly separated from the cephalic portion, which is subquadrate, expanding anteriorly, the sides scarcely curved, at the extreme front parallel, the front deeply and angularly incised, the whole about half as large as the thoracic portion. Cephalothorax of female moderately large, compact, the thoracic portion as in the male, but only a little larger than the square thoracic portion, the latter being equally broad in front and behind, with scarcely convex sides and a slightly excised front, and sparsely furnished, especially along the front, with stiff bristles resembling those of the palpi. The cephalothorax is marked by a rather broad, dark, median band and two fainter, dark, extreme lateral bands. Abdomen globular, scarcely longer than broad, a little shorter (♂) or a little longer (♀) than the cephalothorax, the median portion very broadly marked with brown, deepening toward the middle. Some of the eyes can be seen at the edge of the front in the female, showing simply that they are of the usual size and the two outer separated by their own diameter. The palpi of the female are tolerably stout, stouter than the tarsi, as long as the cephalothorax, abruptly terminated, and furnished somewhat abundantly with bristles, considerably longer than the width of the palpi; those of the male have the apical portion large, hemispherical, and hairy, convexity forward, together nearly as large as the cephalic portion of the cephalothorax, and separated from that by a peduncle as long as it; from the inner edge of one projects a gently subfusiform, slender, arcuate ribbon, as long as the width of the terminal joint and directed forward, with the convexity inward. The tibiæ are armed above on either side with a row of distant bristles, scarcely longer than the width of the tibia and farther apart than their length; in the female a few scattered bristles also occur on the femora, especially on the front pair. The fourth pair of legs is shorter than the second in the male, equal to or scarcely longer than the second in the female; the third pair of legs is not perfectly preserved in either of the male specimens, but in the female is half the length of the first.

Length of body, ♂ 7^{mm}, ♀ 8^{mm}; of cephalothorax, ♂ 2.8^{mm}, ♀ 3.5^{mm}; of abdomen, ♂ 4.2^{mm}, ♀ 4.5^{mm}; width of same, ♂ 3^{mm}, ♀ 4.2^{mm}; length of first

pair of legs, ♂ 16.5mm, ♀ 14mm; tibiæ, ♂ 5mm, ♀ 4mm: tarsi, ♂ 5mm, ♀ 5.75mm; second pair of legs, ♂ 15mm, ♀ 12.75mm; tibiæ, ♂ 3.25mm, ♀ 2.5mm: tarsi, ♂ 6mm, ♀ 5.5mm: third pair of legs, ♀ 7mm; tibiæ, ♀ 1.75mm: tarsi, ♀ 3mm: fourth pair of legs, ♂ 12mm, ♀ 13mm: tibiæ, ♂ 3.5mm, ♀ 3.5mm; tarsi, ♂ 4.4mm, ♀ 5mm; length of palpi, ♂ 1.75mm, ♀ 2.1mm.

This species is readily distinguished from the others of the genus here described by its considerably larger size. It is named after the late Mr. F. B. Meek, much of whose paleontological work was done in conjunction with Dr. Hayden. It resembles in general appearance as well as in size the less well preserved E. tröschelii Bertkau from Rott on the Rhine, but has proportionally longer legs and especially much longer hind legs; the disproportion of size between the cephalothorax and abdomen is also greater.

Florissant. Three specimens: two ♂, Nos. 9211, 8221, one ♀, No. 3204.

2. Epeira abscondita.

Pl. 11, Fig. 7 (♂).

Male.—Cephalothorax subrotund, the cephalic portion hemispherical, almost black, about half the size of the thoracic part and separated from it in the lateral outline by a distinct incision; front broadly and regularly rounded; thoracic portion with well rounded sides, the middle half very much darker than the rest, forming a broad, median, dark brown band. Abdomen subrotund, longer than broad, scarcely compressed, of the same size as the cephalothorax, with faint indications of a broad median band, deepest in tint at the extremities of the segments. The eyes can not be seen. The palpi are sessile, the terminal joint appearing just beyond the front, large and globose, perhaps a little broader posteriorly than anteriorly. The legs are stout, especially the femora, not very long, the tibiæ furnished with distant, widely divergent, delicate bristles, considerably longer than the width of the tibia, situated on either side. They are not completely preserved, but have been worked out of the stone since the plate was engraved, so that they are more perfect than would there appear. The fourth pair, though not completely preserved, is apparently longer than the second, as the basal joints are longer.

Length of body, 4.25mm; of cephalothorax, 2mm; of abdomen, 2.25mm; width of same, 1.8mm; length of first pair of legs, 11.25mm; tibiæ, 3mm; tarsi, 4.6mm; second pair of legs, 9.75mm; tibiæ, 2.5mm; tarsi, 3.4mm; third pair of

legs (broken), 5.5mm; fourth pair of legs (broken), 8mm; of part previous to tibia, 3.2mm; diameter of palpi, 0.45mm.

This species differs from E. meekii in size, in the shape of the cephalothorax, the stouter femora, and more sparsely armed tibiæ.

Florissant. One ♂, No. 7583.

3. Epeira delita.

Pl. 11, Fig. 6 (♂ ?).

Cephalothorax rounded obovate, the cephalic and thoracic portions completely blended, the sides uniformly rounded, the front very convex, with no eyes that can be seen; neither are the palpi preserved, the part figured between the front legs having no relation to the spider; it is judged to be a male from the small size of the abdomen which is ovate, no larger than the cephalothorax, largest in front of the middle, but here slightly narrower than the cephalothorax, tapering slightly behind, and well rounded at the extremity. The legs have very stout femora, those of the front pair tapering in the middle, and both femora and tibiæ and even the basal part of the tarsi, but especially the tibiæ, armed with very long, very distant, delicate, divergent spinules considerably longer than, sometimes almost twice as long as, the width of the tibiæ; the basal joint of the tibiæ tapers perceptibly. The second pair of legs is represented too long in the plate, though it is unusually long, not greatly falling behind the first pair and exceeding the fourth in length nearly as much as that exceeds the third pair.

Length of body, 4.75mm; of cephalothorax, 2.25mm; width of same, 2mm; length of abdomen, 2.5mm; of first pair of legs, 11.5mm; tibiæ, 3.5mm; tarsi, 5mm; second pair of legs, 9.8mm; tibiæ, 3.25mm; tarsi, 4.2mm; third pair of legs, 7.5mm; tibiæ, 2mm; tarsi, 2.5mm; fourth pair of legs, 9mm; tibiæ, 2.25mm; tarsi, 3.75mm.

This species agrees well with E. abscondita in size, but is readily distinguished both from it and from E. meekii in the uniform character of the cephalothorax and the relative length of the legs.

Florissant. One ♂, No. 13523.

4. Epeira cinefacta.

Pl. 11, Fig. 16 (♂).

Male.—Cephalothorax globose, blackish, the dividing line between it and the abdomen concealed by the overhanging quadrate front of the

abdomen, and the cephalic and thoracic portions completely blended; possibly it is slightly longer than broad. The eyes can not be made out; the terminal joint of the palpi (as preserved, sessile) is moderately large, globular or slightly ovate, black, but none of the internal structure can be made out. Abdomen subquadrate, tapering very slightly from in front backward, the front straight with well rounded lateral angles, the posterior extremity well rounded, the whole nearly twice as long as broad, the sides nearly straight. Legs closely resembling those of E. delita, the second pair being unusually long, but even more than in that species exceeding proportionally the extent of the fourth pair; the femora are only moderately stout, and, like the tibiæ, though to a less extent, are furnished with delicate spinules, less divergent but more abundant than usual, exceeding in length the width of the tibiæ.

Length of body, 3^{mm}; width of cephalothorax, 1^{mm}; length of abdomen, 2.25^{mm}; its width anteriorly, 1.65^{mm}; posteriorly, 1.2^{mm}; diameter of last palpal joint, 0.35^{mm}; length of first pair of legs, 9^{mm}; tibiæ, 2.9^{mm}; tarsi, 4^{mm}; second pair of legs, 8^{mm}; tibiæ, 2.1^{mm}; tarsi, 3.5^{mm}; third pair of legs, 4.85^{mm}; tibiæ, 1.3^{mm}; tarsi, 2.1^{mm}; fourth pair of legs, 6.5^{mm}; tibiæ, 2^{mm}; tarsi, 2.5^{mm}.

This species differs from all others of the genus here described in the shape of the abdomen, which is elongate, and the sides of which are not rounded but subparallel. In the characteristics of the legs, however, it resembles the preceding. A single male, represented by both obverse and reverse, is better preserved than the figure in the plate would indicate, as the form of the whole abdomen can be seen as well as of the last palpal joint. The figure morever indicates the shape of the body altogether wrongly, as the cephalothorax should be smaller and the abdomen should taper considerably behind, as the measurements show.

Florissant. One ♂, No. 8576 and 8806.

5. Epeira vulcanalis.

Male.—Cephalothorax nearly globular, scarcely longer than broad, the cephalic and thoracic portions completely blended, but marked by a large semicircular depression anteriorly, occupying a little more than the front, i. e., encroaching upon the lateral margin, and of a darker brown than the thoracic portion. Front somewhat convex, with insufficient trace of eyes. Cheliceres stout, as long as the cephalic portion of the corselet, tapering, bluntly rounded at the tip. Last joint of palpi very large, nearly as large

as the cephalic part of the corselet, blackish, globular, its proximal end as preserved lying just beyond the tip of the cheliceres, the stalk not preserved. Abdomen lighter colored than the cephalothorax, smaller than it, subglobular, a little flattened at base, with a pair of subdorsal series of black points in a slightly curving row, its convexity outward; the anal plate darker, circular, not half so large as the apical joint of palpi. Legs long, of very unequal length, the femur much stouter than the tapering parts beyond, furnished rather abundantly with diverging spines nearly to the tip.

Length of body, 3.5^{mm}; of cephalothorax, 1.7^{mm}; of abdomen, 1.5^{mm}; of cephalic portion of corselet, 0.6^{mm}; of cheliceres, 0.65^{mm}; breadth of cephalothorax, 1 6^{mm}; of abdomen, 1.6^{mm}; diameter of palpal swelling, 0.65^{mm}; length of first pair of legs, 7.25^{mm}; femora, 2^{mm}; tibiæ, 2^{mm}; tarsi, 3.25^{mm}; second pair of legs, 6^{mm}; femora, 1.4^{mm}; tibiæ, 2^{mm}; tarsi, 2.6^{mm}; third pair of legs, 2.9^{mm}; tarsi, 1.4^{mm}; fourth pair of legs, 4.7^{mm}; femora, 1.65^{mm}; tibiæ, 1.25^{mm}; tarsi, 1.8^{mm}.

This species resembles E. emertoni in general aspect, but is much larger than it, and differs from it in several important points, such as the rotundity and especially the much greater size of the cephalothorax as compared with the abdomen, and the greater stoutness of the femora.

Florissant. One ♂, No. 5784.

6. Epeira emertoni.

Pl. 11, Figs. 15 (♂), 19 (♀).

Male.—Cephalothorax dark brown, subglobose, a little longer than broad, the cephalic only distinguished from the thoracic portion by a slight bend in the curved outline; front well rounded with no sign of eyes; last joint of palpi blackish, very large, globular, more than half as large as the cephalic portion of the cephalothorax, nearly twice as broad as the length of the basal joints, containing a falcate ribbon of slender and uniform width, nearly as long as the diameter of the joint, bent at its distal edge, bluntly pointed at the tip, which is situated near the middle. Abdomen light brown, globular, slightly larger than the cephalothorax. Legs moderately long, rather sparsely haired, the femora tolerably stout and furnished with distant, slender, divergent spinules, hardly so long as the width of the joint, and which also appear in one or two places only on the tibiæ.

Female.—Cephalothorax black, globular, with no sign of distinction between the cephalic and thoracic portions; neither eyes nor palpi are pre-

served. Abdomen dark brown, especially in a very broad median band occupying fully half the width of the dorsal aspect, short ovate, nearly half as broad again as the cephalothorax, and only about one-third as long again as broad. Legs apparently rather short (they are not well preserved and mostly bent beneath the body), sparsely haired, with slight trace of spinules.

Length of body, ♂ 2.25mm, ♀ 3.75mm; of cephalothorax, ♂ 1mm, ♀ 1.35mm; width of same, ♂ 0.9mm, ♀ 1.3mm; length of abdomen, ♂ 1.25mm, ♀ 2.4mm; width of same, ♂ 1mm, ♀ 1.8mm; diameter of last palpal joint, ♂ 0.35mm; length of first pair of legs, ♂ 4.65mm, ♀ 3.25mm (plus tarsi); tibiæ, ♂ 1.5mm, ♀ 1mm; tarsi, ♂ 1.75mm; of second pair of legs, ♂ 4.2mm, ♀ 2.6mm (plus tarsi); tibiæ, ♂ 1.3mm, ♀ 0.8mm; tarsi, ♂ 1.75mm; of third pair of legs, ♂ 2mm; of fourth pair of legs, ♂ 3.25mm.

It is possible of course that this ♂ and ♀ do not belong together, in which case the male as the most perfectly preserved should be considered the type of the species. It is smaller than any other of the species referred here to Epeira, excepting perhaps the one to which no name is given, and it differs from all in the globular or nearly globular form of the cephalothorax as well as in other characteristics, as will appear on comparing the descriptions. The species is named for Mr. J. H. Emerton, whose papers on North American Arachnidæ have been of much assistance to the writer.

Florissant. One ♂, one ♀, Nos. 8777, 5117.

A single specimen, apparently a female, which is also provisionally referred to this species, is considerably smaller than the other female and has more densely hairy legs (almost the only parts preserved), the lengths of which are as follows: first pair, 3.5mm; second pair, 3.25mm; third pair, 1.7mm; fourth pair, 3.25mm.

Florissant. One ♀. No. 10998.

Epeira sp.

Pl. 11, Fig. 1.

A single specimen, figured in Pl. 11, Fig. 1, is the only representative of a species apparently of Epeira, certainly distinct from the others, but too poorly preserved to indicate more. The outlines of the body are almost altogether obliterated, and it can only be said that it is one of the smallest species, being larger only than the smallest specimen referred to E. emertoni, but clearly distinct from that in the much greater stoutness of the femora, which are indeed unusually robust, and the length of the third pair

of legs, which appear nearly to equal the fourth. It is impossible to say to what sex it belongs.

Length of first pair of legs, 5.5^{mm}; of third pair, 7^{mm}; tibia, 2^{mm}; tarsi, 2.5^{mm}; of femora and tibia of fourth pair, 4^{mm}; width of its femora, 0.7^{mm}; length of its tibia, 2^{mm}.

Florissant. No. 9285.

Epeira sp.

Several specimens represent legs of the same or allied species of spider of about the size of Epeira riparia Hentz; the femora and tibiæ and the sides of the tarsi are abundantly supplied with longitudinal rows of fine, long, black spines, the claw double. Another preserves the spines alone of the same sort of leg.

Length of femora, 7^{mm}; of tibiæ, 7.75^{mm}; of tarsi, 3.25^{mm}; of claw, 0.3^{mm}; of spines, 0.75^{mm}.

Green River, Wyoming. Nos. 3, 4^{a}, 36, 4199, 4200.

Epeira sp.

Still another, from the same locality as the last, shows the hairy, subfusiform, ovate body of a spider apparently a little smaller than the above.

Length of abdomen, 4.5^{mm}; breadth of same, 1.8^{mm}.

Green River, Wyoming. No. 63.

Nephila Leach.

This interesting tropical genus has never before been found fossil, and although the species here described differs considerably from any with which I have been able to compare it, it is interesting to see some special points of comparison with a common species of our Southern States, as will be noticed further on. Its presence at Florissant decidedly indicates a warmer climate than the present, though not necessarily one much warmer

Nephila pennatipes.

Pl. 11, Fig. 12.

Nephila pennatipes Scudder, Zittel, Handb. d. Palæont., I, ii, 744, Fig. 926 (1885).

Cephalic portion of corselet square, with rounded angles, the front margin slightly excised in the middle; two eyes only can be made out, situated posterior to the front margin by nearly their own diameter, of moderate size, less than one-fourth the width of the terminal joint of the palpus, and placed rather nearer the middle line than the outer edge of the body. Palpi stout, not very long, bluntly rounded at tip and extending in

front of the body by a little more than half the width of the front of the corselet. (These organs are incorrectly given in the plate, which was drawn before the specimen had been properly prepared.)

The first pair of legs are the longest, the third the shortest, and the second and fourth of equal length, moderately slender, the first and fourth, and to a less degree the second, furnished at the extremity of the tibiæ with a brush of coarse divergent hairs, giving this portion of the leg the appearance of being about half as broad again as it should be: all the joints of the legs can not be made out, but, to judge by analogy, the brush would appear to occupy about half (the distal half) of the tibia; there appears to be no such brush on the third pair of legs, nor any marked increase of hairiness or stoutness of the hairs at the tips of the femora. The legs have also been worked out of the stone since the plate was drawn, so that they are nearly complete, with the exception of the appendages. With this omission the tarsi compose scarcely less than two-fifths of the whole leg.

The thoracic portion of the cephalothorax is subglobular, a little broader than the corselet and just equaling the width of the abdomen at its greatest at the end of the basal third; the abdomen is oblong ovate, about two and a half times longer than broad, with well rounded apex.

Length of body, 14^{mm}; of abdomen, 8.5^{mm}; width, 3.7^{mm}; length of palpi beyond the front of body, 2^{mm}; length of first pair of legs, 26^{mm}; first tarsal joint, 8.25^{mm}: second joint, 2.25^{mm}; of hair-tuft, 3.5–3.75^{mm}; second pair of legs, 23^{mm}: first tarsal joint, 7.25^{mm}: second joint, 2.25^{mm}; of hair-tuft, 2.5^{mm}; third pair of legs, 13.5^{mm}; first tarsal joint, 4.5^{mm}; second joint, 1.5^{mm}; fourth pair of legs, 23^{mm}; first tarsal joint, 7^{mm}: second joint, 2^{mm}; of hair-tuft, 4.5^{mm}; diameter of eyes, 0.12^{mm}.

The general resemblance of this spider to Nephila plumipes Koch of our southern Atlantic sea-board, familiar to us by the researches of Wilder, will strike every American naturalist at a glance. It is, however, a much smaller species, if the fossil be fully grown, and differs from it in some striking points, very probably of generic importance. The eyes differ considerably, although the position of only two of those of the fossil species is known; the corselet is squarer in the fossil, and per contra the abdomen is oval and not quadrate; while the tarsi are unusually long in proportion to the whole leg; the tufts of hairs occur only on the extremity of the tibiæ. Nephila is essentially a tropical genus.

Florissant. One ♀, No. 11651.

NEUROPTERA Linné.

Using this term in its large sense, as, for convenience, we have done here, there is no group of fossil insects more interesting. In no other, unless it be the cockroaches among Orthoptera, do we find a considerable representation in all the rocks which have yielded fossil remains Still the time has, perhaps, not yet come for a careful historical survey of the group, since we are annually receiving large additions to our knowledge of the extinct types, and a considerable number of those known have been insufficiently studied. Such a study, too, belongs essentially to the student of the older types, and would be less appropriate here, for it may certainly be stated with confidence that the types of existing Neuroptera were thoroughly established at the beginning of the Tertiaries. With a single exception, Ballostoma, no large group existed then and has since expired, nor is there a single existing type of any prominence which has not been found in the Tertiaries, unless we look upon the aberrant and until lately hardly known Scolopendrella as belonging here. Yet a large proportion of the genera of Tertiary Neuroptera are extinct; that is, differentiation has gone on with the lapse of time, until the original characteristic features of an early group have been lost and new ones taken their place, and no species referred to in the following pages exists at the present time. The differences between the Tertiary and existing forms are never very great, usually rather small, but they are constant and everywhere found.

The number of known Tertiary Neuroptera is considerable. For the sake of graphic comparison I have presented the facts as far as possible in the following table, where, in the European columns, the numbers at the right are the real total, the others representing those known from the rocks alone (excluding the amber) for the sake of comparing more fairly the yield of the European and American rocks. The numbers on the American side represent with a single exception (Phryganea hyperborea from Greenland) the result of my own studies only, and therefore the numerical estimate is presumably more correct than in the European; in the latter I have endeavored to give a fair statement of the numbers, including a considerable proportion of mere indications, the value of which had to be weighed, sometimes in a somewhat summary manner.

Tabular statement of the known species of Tertiary Neuroptera.

		European.			European.	
	American.	Excl. amber.	Incl. amber.	American.	Excl. amber.	Incl. amber.
Ballostoma	1					
Lepismatidæ (Cinura)	1	0	18			
Podurida (Collembola)	0	0	10			
Thysanura				2	0	28
Termitina				6	10	16
Embidina				0	0	1
Psocina				1	0	13
Perlina				0	1	11
Ephemerina				6	1	7
Agrionidæ	8	9	10			
Calopterygidæ	0	1	2			
Agrionina	**8**	**10**	**12**			
Gomphidæ	0	3	5			
Æschnidæ	2	4	5			
Æschnina	**2**	**7**	**10**			
Cordulidæ	0	2	2			
Libellulidæ	1	15	15			
Libellulina	**1**	***17**	**17**			
Odonata				11	34	39
Sialidæ	0	1	2			
Raphidiidæ	4	0	1			
Sialina	**4**	**1**	**3**			
Hemerobidæ	2	1	8			
Chrysopidæ	4	0	0			
Hemerobina	**6**	**1**	**8**			
Ascalaphina	0	2	2			
Myrmeleontina	0	1	1			
Coniopterygidæ	0	0	1			
Panorpidæ	2	1	4			
Planipennia				12	6	19
Hydroptilidæ	0	0	2			
Rhyacophilidæ	0	0	2			
Hydropsychidæ	17	0	16			
Leptoceridæ	2	0	5			
Sericostomidæ	0	0	4			
Limnophilidæ	†2	†2	3			
Phryganidæ	4	†5	8			
Trichoptera				25	7	40
Total				63	59	174

Grand total, 237.

* This number is largely made up of larvæ, which may be the same as some of the imagos.

† Including larval cases.

This table brings to light some curious discordances when the species from the American and European rocks are compared. This indeed is marked in every instance where the numbers are considerable on either side, excepting in the Termitina, where we have six American to ten European species. Europe shows a decided superiority in the Odonata, where thirty-four species are offset by only eleven species in America; and it is not a little curious (though not unexpected, considering the nature of the deposit) that it is here only that the amber fauna adds scarcely at all to the European preponderance. The American Thysanura find no counterpart in the European rocks, though the amber fauna counts no less than twenty-eight species, while the American representatives of the Ephemerina (six species), the Planipennia (twelve species), and the Trichoptera (twenty-five species) far outweigh the European examples, Ephemerina (one species), Planipennia (six species), Trichoptera (seven species). This American preponderance is in every instance counterbalanced when the total Tertiary yield of Europe is brought to view, the Ephemerina showing seven species, the Planipennia nineteen species, and the Trichoptera forty species.

If the smaller groups are considered, there are some closer correspondences, as when we find eight species of American Agrionina to ten in the European rocks, two American to one European Hemerobidæ and Panorpidæ, two American to two European Limnophilidæ, and four American to five European Phryganidæ. The discrepancies, however, are not less marked, for we find of groups unrepresented in European rocks four species each of Raphidiidæ and Chrysopidæ, seventeen of Hydropsychidæ, and two of Leptoceridæ in American strata, which in the first two instances are hardly or not at all represented in amber. On the other hand, the European rocks show species of Calopterygidæ (one), Gomphidæ (three), Cordulidæ (two), Sialidæ (one), Ascalaphina (two), and Myrmeleontidæ (one), where the American rocks are wholly destitute. On the whole, the European rocks, as compared with the American, are rich in Odonata and poor in Ephemerina, Planipennia, and Trichoptera. While, if the entire Tertiary yield of Europe is considered, America nowhere shows a considerable preponderance of forms excepting in the small planipennian groups of Raphidiidæ and Chrysopidæ, while Europe has a very striking preponderance in Thysanura, Psocina, Perlina, Æschnina, Libellulina, and Hemerobidæ, having in none of these cases less than four times as many species as America. (February, 1884.)

Order THYSANURA Latreille.

All we have hitherto known of fossil Thysanura has been derived from inclusions in amber,[1] of which about eighteen species of six or seven genera of Lepismatidæ and ten species of four genera of Poduridæ are known; among them are some very remarkable forms. Florissant has yielded two species of this group, the first that have been found in rock deposits, and one of them in considerable numbers, representing a species of exceptional interest.

Suborder BALLOSTOMA Scudder.

For characters see under the single species, at the end.

PLANOCEPHALUS Scudder.

PLANOCEPHALUS ASELLOIDES.

(See figures in text below.)

Planocephalus aselloides Scudd., Mem. Nat. Acad. Sciences, III, 85-90 Figs. (1885); in Zittel, Handb. Paleont., I, ii, 772, Fig. 972 (1885); Bertk., Sitzungsb. niederrh. Gesellsch. Natur. u. Heilk., 1885, 298 (1885).

Among the remains of animals in my hands found in the ancient lake basin of Florissant are about forty specimens of an onisciform arthropod, about a centimeter in length, whose affinities have proved very perplexing. This does not result from poorness of preservation, for among the numerous specimens apparently all the prominent external features are found completely preserved, and even the course of some of the internal organs may occasionally be traced; but it presents such anomalies of structure that we are at a loss where to look for its nearest kin.

It appears to be an aquatic animal. Its body consists of three large subequal thoracic joints, and an abdomen about half as large again as any one of them, with occasional indications of a feeble division into four segments. These are the only jointed divisions that can be found in the body, there being no distinct head. The thoracic segments are so considered because each bears a pair of legs, which occur nowhere else. Their dorsal plates are large, flat longitudinally, and arched transversely, smooth, and deeply and narrowly notched in the middle of the front margin. The first plate, in which the median notch is more conspicuous and open than in the

[1] Since this was written Brongniart has described a species from the Carboniferous deposits of Commentry, France.

others, also narrows and becomes more arched in front, so as to form a sort of hood. The legs are very broad and compressed, and adapted to swimming, which was apparently their use, as there would be no need of such compression to crawl into chinks when the body is so much arched. They consist of a femur, tibia, and two tarsal joints, terminated by a single curved claw. The femur is very large, subovate, inserted (presumably by a coxa) in large cavities, those of opposite sides separated by their own width, and situated a little behind the middle of each segment. The tibia is also very large and subovate, but more elongated and squarer at the ends, being about twice as long as broad, and fringed on the anterior edge by a row of delicate hairs as long as the width of the joint. Of the two tarsal joints, the

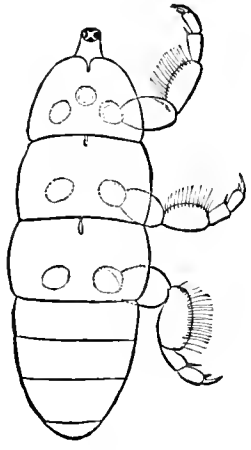


Fig. 1.

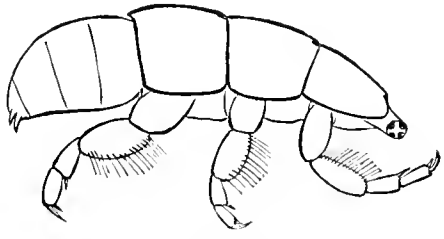


Fig. 2.

Fig. 3.

Fig. 1, dorsal view; Fig. 2, lateral view; Fig. 3, transverse sectional view of Planocephalus aselloides from the Oligocene of Florissant, Colorado, restored, and magnified about six diameters.

basal is a little the larger, being both longer and stouter. Each is armed at the tip internally with a tolerably stout spine of moderate length, and together they are a little longer than the tibia, much slenderer, and quadrate in form. The terminal claw is about half as long as the terminal joint. The hind legs are somewhat stouter and the middle pair a little shorter than the others; but otherwise they closely resemble each other.

The different segments of the thorax, as stated, are protected above by the development of distinct chitinous plates, the lower edges of which are clearly marked, and extend downward to the concealment, on a side view, of the lower part of the body. The abdomen, however, seems to have no such specialization of the integument of the upper surface. It is stout, apparently well rounded transversely, and tapers to a produced but blunt tip, which is armed with a pair of slightly recurved stout claws, two or

three times as long as the leg-claws, arranged as if to drag the body backward. The abdomen is faintly divided into four segments, often entirely obscured. Of these the terminal usually appears shorter than the others, which are subequal.

These divisions of the body are all that appear to have belonged to the animal; and it is the most remarkable fact in its organization that it certainly had no distinct chitinous head. This is the more surprising from the clearness with which the thoracic segments are marked. All that one can find preserved is what appears to be a ring of buccal plates terminating anteriorly the alimentary canal, and which was evidently capable of being thrust forward a long distance beyond the body. If it were not for the unusual preservation of the alimentary canal we should be forced to consider the head as lost from all the specimens, notwithstanding the nearly perfect preservation of the other parts; but in several specimens the alimentary tube can be traced with ease half through the body, terminating in front in these more or less clearly preserved chitinous plates, arranged to form a circle a little smaller than the coxal cavities. What is most remarkable is the extension of this alimentary tube and accompanying buccal plates like a proboscis far beyond the limits of the body; sometimes forward (apparently through the anterior notch) to a distance in front of the first segment equal to half the length of the latter; more often directed downward as well as outward, perhaps between the front legs, and occasionally extending beyond the body to nearly or quite *the entire length of the same*. It seems to leave its direct course within the body at about the middle of the first thoracic segment, directly in front of which position the buccal plates appear in one or two specimens, apparently in the position of repose. The various positions in which these buccal plates are found outside the body, both when their connection with the tube is traceable and when it is obscure or fails, shows how perfectly movable a proboscis the creature possessed. The external parts of the head, then, may be said to have been probably composed entirely of a flexible, extensible membrane capable of protrusion as a fleshy proboscis, separated by no line of demarkation from the first thoracic segment, and bearing as appendages only a series of buccal plates for mouth-parts, and beyond this nothing—neither cranium, eyes, antennæ, nor palpi. In the absence of eyes, one would naturally look for the development of tactile organs of some sort: but nothing of the kind is

discoverable on the most careful special search, unless such an office may be performed by long delicate hairs which seem, in some few instances, to be scattered distantly over the projected mouth-tube.

A special study of the buccal plates in the twenty-four or twenty-five specimens which best show them gives no very satisfactory explanation of their form and relations. They have been said to form a ring, because in a considerable number they are so arranged; but it may be doubted whether this appearance is not due to the flaking of the chitinous parts. Like the lips of the notches of the thoracic segments, the buccal apparatus was evidently more dense and thicker than other tegumentary parts, for these are darker colored than the other parts and often carbonaceous. In this condition the central portions seem liable to flake away and leave the thinner edges with ragged fragments of the carbonaceous inner portions attached, thus frequently forming a sort of irregular ring of dark chitine. On the other hand, it is just as common for fragments to become chipped out from the edges, or for rounded bits to fall out here and there, producing thereby an almost endless variety of present appearances. Among these it is difficult to trace the clew to the original arrangement and form of the plates. One might anticipate that these would have occurred around the central orifice of a proboscis; and if anything of this sort was present it would appear the most probable (though extremely doubtful) that there were four subtriangular plates of pretty large size, the lateral the larger, nearly meeting by their tips at the center. From specimens, however, which are least broken, it would seem quite as probable that the apparatus consisted of two attingent or overlapping circular plates, placed transversely, densest centrally, which by their consolidation form an oval rounded mass. How such a pair of plates, or compound plates, could have subserved any purpose in the procuring of food I can not understand, but that such is their not unfrequent appearance, especially when seen through and protected by the thoracic shield of the first segment, is nevertheless the fact. It is to be hoped that other specimens may set this matter at rest. Those at hand allow no more definite statement than has been made. About three-fourths of the specimens of this species show the buccal plates more or less distinctly. In all but three they lie outside the body, usually at a distance from it of about half the length of the first thoracic segment. In a fourth specimen they lie half protruding at the front edge of the body.

These buccal plates, as already stated, are the only hard parts of the head, and the only appendages. Indeed, the only claim this portion of the body has to be called the head at all is that it is certainly the anterior extremity of the digestive canal. On account of this peculiarity of the organization of the head, the creature, which is certainly widely different from anything known, may be called Planocephalus (πλανάω, κεφαλή), and on account of its onisciform body, Planocephalus aselloides.

The first impression the sight of this strange headless creature conveys is that of an isopod crustacean. But the limited number of legs at once puts its reference to the Crustacea out of question, since no abdominal legs at all are present. Even in the parasitic Crustacea, where some of the legs are aborted, the same is the case with the segments themselves and with the joints of the legs which remain. The clear distinction which obtains between the thoracic and abdominal regions, and the limitation of the jointed legs to a single pair on each thoracic segment seems to lead one strongly to the conviction that these important elements of its construction place it among insects. The structure of the legs and the small tapering abdomen furnished with small anal appendages tend to the same conclusion.

Where among insects it should be placed is more questionable. Thinking it possibly a larval form, careful search has been made among all the groups into which it could by any possibility be presumed to fall, viz, among the Neuroptera and Coleoptera, but nothing in the slightest degree seeming to be related to it could be found, and its conspicuous size rendered it the less probable that a kindred form would be overlooked On account, however, of its apterous character, and the discovery in recent years of certain curious types of animals (all of them, however, very minute), whose affinities have provoked more than usual discussion, my attention was early drawn toward certain resemblances which Planocephalus bears to the Pauropida among Myriapods and to the Thysanura, and here, if anywhere, its affinities seem likely to be found.

Its passing resemblance to the obtected forms of Pauropoda which Ryder has published under the name of Eurypauropodidæ is certainly very considerable, especially when it is remembered that the young of Pauropoda bear only three pairs of legs. The position of the more mobile part of the head of Eurypauropus beneath the cephalic shield is the same that the head of Planocephalus bears to the first thoracic shield; and the mouth parts in

both are confined to a somewhat similar circular area; there are no eyes in either, and the legs terminate in a single curved claw.

On the other hand, not only are antennæ of a highly organized character developed in Pauropoda, but the upper portion of the head carries a cephalic shield as large and conspicuous as the others; two pairs of legs are developed in the adult on every or nearly every segment of the body, and always on the abdominal to the same extent as on the thoracic segments, no abdomen being distinct from a thorax as in Planocephalus, but all the joints of the body entirely similar; the legs of the Pauropoda are formed on the myriapodal type, consisting of cylindrical undifferentiated joints, while those of Planocephalus are hexapodal in character, having a clearly defined femur and tibia, and a two-jointed tarsus conspicuously smaller and shorter than the preceding joints, of different form and apically spined.

The closer, therefore, we compare these two types the less important seem the points of resemblance and the more important the points of divergence between them; for in the clear distinction of the thorax and abdomen, the absence of abdominal legs, and the structure of the legs themselves—fundamental features of its organization—Planocephalus clearly belongs to the true hexapod type of insects.

Its probable reference to the Thysanura may be defended on both negative and positive grounds. There is no other group of hexapods to which it could be considered as more likely to belong, and there are some special thysanuran features in its structure, anomalous as it is. Since Packard has shown the reasonableness of placing the Symphyla (=Scolopendrella) of Ryder in the Thysanura, with the Collembola and Cinura as coordinate groups, the range of the Thysanura has been extended, and as a group of equivalent taxonomic value to the larger divisions of winged insects it has seemed itself to gain a better *ratio vivendi*. It is not necessary, therefore, in considering the relations of Planocephalus to Thysanura as a whole, to limit ourselves to points of comparison which it may have to one or another of its subordinate groups, but consider any points of resemblance we may find to any of these groups indifferently. The thoracic segments remind us not a little of some Cinura, while the abdomen as a whole recalls many of the Collembola, its approximated pair of specialized anal appendages being also like the variously developed organs of all Thysanura, and unlike anything we can recall in any myriapod. The legs, in the develop-

ment of the basal joints and in the smaller double-jointed tarsus, are closely related to those of some Cinura—built indeed upon the same general pattern, excepting that in Planocephalus they are specially developed for swimming. In the claw of our fossil genus we have something decidedly thysanuriform. We have heretofore spoken of the two tarsal joints as each armed apically with an interior spine, but that of the final joint arises from the base of the curving claw, and takes on more or less its direction, though only half as long as it, causing it to resemble very closely the smaller digit of the claw of both Collembola and Cinura, which is always inferior to the larger, and not infrequently, as in Lepidocyrtus, etc., straight instead of curved

Of course, the rudimentary character of the head and the entire obliteration of the cephalic plates render our fossil very distinct from any known type of Thysanura. But these features separate it quite as widely from any other group that may be suggested for it, and, taking into account the considerable development of the thoracic portions, we must look upon Planocephalus as in some sense a lowly form, descended from a type in which the head was developed at least to some extent, and this renders it more probable that we have here found its proper place. Moreover when we examine the mouth-parts of Podura, we find them partially withdrawn within the head, reduced in external presentation to a small circle at the end of a conical protrusion of the under side of the head. Take away the cephalic plates, withdraw the mouth-parts to the same protection of the first thoracic segment which they now enjoy under the cephalic dome, imagine further that the mouth-parts could be protruded to their original position when covered by a cephalic shield, and we have about the same condition of things we find in Planocephalus; indeed the extensibility of the mouth-parts beyond the thoracic shield seems quite what one might expect after the loss of the hard parts of the head; and the mouth-parts of Planocephalus bear much the same relative position to the first thoracic shield which those of Podura bear to the cephalic shield.

Assuming, then, that Planocephalus is a true hexapod, its general relations are certainly with the Thysanura rather than with any other group; while the character of the legs, the half developed double claw, and the anal appendages specialized to peculiar use are characters which are positively thysanuran. Add to this that we find in Podura something in a remote degree analogous to the extraordinary mouth-parts of Planocephalus,

which we should in vain seek elsewhere, and the probability that we find here its nearest allies is rendered very strong, and the more so from the diversity of form and type in this group since the addition to it of Scolopendrella. The discovery of a collophore or something homologous to it would, we conceive, be decisive on the point; but the lateral preservation of nearly all the specimens of this fossil, and the obscurity of the base of the abdomen in nearly all, not only forbid its determination in those yet found, but render it doubtful if it will ever be discovered.

The position of this group among the Thysanura must be an independent one between the Cinura and the Symphyla and of an equivalent value to them. For such a group the name of BALLOSTOMA is proposed, in reference to the remarkable power possessed of thrusting forward the gullet and mouth-parts. It would be characterized by the peculiarity named, by the lack of any chitinous frame-work of the head, the equal development of three thoracic segments developed dorsally as shields, and all separated from a cylindrical abdomen, which is armed at tip with a pair of hooks for crawling; legs largely developed and with expanded and flattened femora and tibiæ, the tarsi two-jointed. The principal points toward which attention should be directed for the more perfect elucidation of its structure are the buccal plates and a possible collophore.

Bertkau compares Planocephalus with an insect from the brown coal of Rott, Rhenish Prussia, described by Heyden as a mite under the name Limnochares antiquus. This Bertkau regards as a larval Galgulid, one of the Hemiptera, and he believes Planocephalus something similar; but he does not seem to me to justify this latter view, and the abundance of Planocephalus with the absence of mature Galgulidæ at Florissant seem an obstacle not easily thrown aside.

Ordinary length when extended, 7–8^{mm}; breadth, 2.5–3^{mm}; diameter, of mouth-parts, 0.5^{mm}.

Florissant. Sixty-six specimens, of which the best are Nos. 302, 574, 3508, 5229, 6933, 7907, 9782, 9896, 10551, 12807.

Suborder CINURA Packard.

Family LEPISMATIDÆ Burmeister.

This group has heretofore been found fossil only in amber, where eighteen species of six or seven genera are known; but a single species has been found in the shales of Florissant, Colorado.

LEPISMA Linné.

The species provisionally placed here seems to differ decidedly from known types in the structural characters of the legs, but the single specimen preserved being very imperfect, it is not at present generically distinguished. In the equality of the caudal setæ it is nearest Lepisma, but the legs are very different. The femora resemble closely the broad coxæ of some species of Lepisma, and would have been taken as coxæ but for the slender, elongated joint which follows; one of the legs, too, more perfectly preserved than the others, shows the short tarsus following the tibiæ, and leaves no room for doubt that the broadly expanded ovate disks on either side of the body represent the femora, to which succeed a slender, rod-like tibia of equal length and of uniform slenderness. The abdomen consists of ten joints, tapering very gently, but at the extremity more rapidly.

Two amber species were referred to this genus by Koch and Berendt, one of which was thought to be almost identical with Lepisma saccharina, but Menge pointed out that, notwithstanding the resemblance between the two, they differ at almost every point. The group is cosmopolitan.

LEPISMA PLATYMERA.

Pl. 12, Fig. 18.

A single specimen in which the head, if preserved, is separated from the body, and the greater part of the thorax is lost, but the whole of the abdomen with the caudal setæ, some of the lateral bristles, and most of the legs are fairly preserved; the latter do not appear in the figure. The abdomen is slender and only slightly tapering, excepting on the last three segments, which narrow more rapidly, so that the tip of the abdomen is about half as broad as its base. The legs are very remarkable for the size and great expansion of the femora and the contrasted linear tibiæ; the

femora are ovate flattened disks, distally subacuminate, more than twice as long as broad, as long as (fore and middle femora), or even longer than (hind femora), the width of the base of the abdomen; the tibiæ are as long as the femora and scarcely stouter than the caudal setæ, while the tarsi are scarcely if any slenderer than the tibiæ and less than half their length; a few lateral bristles nearly as long as the width of the abdomen can be seen, indicating that one such projected from either side of each abdominal segment, that borne by the last segment being somewhat longer than the others. The caudal setæ are of nearly equal length, the central slightly longer than the lateral which divaricate gently, and are nearly if not quite as long as the body. Nothing can be made of the detached head extremity more than its slenderness, it being about half the width of the base of the abdomen. Probably the body was fusiform in outline, slender, tapering from the middle of the thorax more rapidly forward than backward. The last abdominal segment is somewhat abruptly truncate.

Length of abdomen, 5.5^{mm}; breadth at base, 2^{mm}; at tip, 0.8^{mm}; probable length of fore and middle femora, 2^{mm}; their breadth, 0.8^{mm}; probable length of hind femora, 3^{mm}; their breadth, 0.9^{mm}; length of tibiæ, 1.75^{mm}; of tarsi, 0.75^{mm} (perhaps incomplete); length of outer caudal setæ, 8^{mm}; of middle caudal seta, 8.5^{mm}.

Florissant. One specimen, No. 1693.

Family TERMITINA Stephens.

It has generally been supposed that the white ants were present and tolerably well represented in paleozoic rocks, but most of the species which have been referred to this family have been shown by recent researches to belong to the Protophasmida, and the others to various neuropteroid Palæodictyoptera. At least half a dozen species are known from the mesozoic rocks, however, most of them coming from the Lias of England, Germany, and Switzerland, the most common type being the extinct genus Clathrotermes Heer, peculiar for its numerous, transverse, gently oblique cross-veins in the costal field and for the dark, quadrate spots which usually accompany these and other cross-veins. If we are to follow E. Geinitz, the species must have been exceedingly variable. Two white ants also occur in the oolite of Bavaria, which Hagen refers to Termes proper. (1885.)

The family of Termitina is represented in the Tertiaries of Europe by twenty-nine nominal species. Hagen, however, asserts that several of those purporting to come from amber are in reality copal species, and this, with synonyms and species merely nominal, reduces the actual number to seventeen. It is doubtful if one of these, T. peccanæ Massal., is a Termes at all, and if it is, its position can not be further defined The number may therefore be considered sixteen; besides this, a species has been indicated without name from the English Tertiaries.

Of these sixteen, six come from amber, belonging to three genera (Calotermes two species, Termopsis three, and Termes one); six from Radoboj, also of three genera (Hodotermes two species, Termes two, and Entermes two); and three from Oeningen, of two genera (Hodotermes two species, Termes one—the same as found at Radoboj). Besides these there is a Calotermes from Rott, and a Hodotermes from Schossnitz

The section comprising the genera having a branched scapular vein is therefore represented by eleven species (Calotermes three, Termopsis three—from amber only, Hodotermes five), while the section with simple scapular has only five species (Termes three, Entermes two). The nominal and doubtful species (and, it might be added, most of the synonyms) fall into the latter section, and should doubtless increase it somewhat. As it stands the first section has two-thirds of the fossil species.

Thirteen of these sixteen species are entered in Hagen's Monographie der Termiten; the others have since been published; and it is noteworthy that of the eighty-four modern species contained in this monograph fifty-five, or nearly two-thirds, belong to the second section; in other words, only 31 per cent of the Tertiary, but 65 per cent of the recent species, belong to the second section.

The additions to the Tertiary Termite-fauna here made are in entire keeping with these statistics; six species are described, of which four belong to the first, and two to the second, section, raising the number of Tertiary species to twenty-two, or about one-fourth the number of recent species.

Of these six species, three belong to a new extinct genus, apparently peculiar to America, but possibly including some of the species from the European Tertiaries; another is referred doubtfully, from want of sufficient data, to Hodotermes, which has yielded species from Radoboj, Oeningen,

and Schossnitz, as well as among modern types; while the other two probably fall into Eutermes, and are allied to, but considerably smaller than, the species from Radoboj placed with many modern types in the same genus. They are perhaps more nearly allied to, as they certainly agree better in size with, the two species of Termes found living in the neighboring valley of the Fontaine qui Bouille. Calotermes, which has furnished species from amber and the Rhenish basin, Termopsis, which has more fossil (amber) species than recent, and Termes proper, which is represented at Oeningen and Radoboj and in amber and the Rhenish basin, all seem to be wanting in the American Tertiaries. The composition of the white-ant fauna of the ancient Florissant, to which locality the known American fossils are confined, differs considerably from that of the localities known in the European Tertiaries, but resembles that of Radoboj more closely than it does any other, as will appear from the following table of representation:

First division.

Florissant.	Radoboj.
Parotermes insignis.	
Parotermes hagenii.	
Parotermes fodinæ.	
Hodotermes ? coloradensis.	Hodotermes haidingeri.
	Hodotermes procerus.

Second division.

	Termes pristinus.
Eutermes fossarum.	Eutermes obscurus.
Eutermes meadii.	Eutermes croaticus.

Out of one hundred and fifty-three specimens of amber white ants examined by Hagen only a single larva, and no soldier, was found; all other fossil individuals have also been winged specimens; but it is worthy of special remark that in the collection of twenty-six individuals from Florissant one is a larva. The scarcity of such forms, whether in amber or lacustrine deposits, is easily explained by the habit of life of these creatures.

The very presence of so considerable a number of Termitina (twenty-six specimens, six species[1]) in the Florissant beds is indicative of a much

[1] According to Hagen (Linn. Ent., vol. 12, p. 241) no locality in the world has yielded more than nine species of living types; they so rarely number more than four, that he had formerly indicated this as the limit, so far as known.

warmer climate formerly than the locality now enjoys. Only three species of white ants, and of these only one belonging to the section with branched scapular vein, have been recorded from the United States north of the Gulf margin, excepting on the Pacific coast, where one or two more extend as far north as San Francisco. Yet seventeen species in all are recorded from North America by Hagen in 1861, and some have since been added to the list; while his South American list (nearly all from Brazil) includes thirty-one species, of which five are repeated from the North American list. Florissant is situated in 39° north latitude, and Hagen says that the family only rarely (*vix*), and that only in the northern hemisphere, extends beyond the fortieth degree of latitude. One species occurs as far north as Manitoba. (September, 1881.)

Table of the genera of Termitina.

Scapular vein branched.
- Submarginal vein present ..... 1. *Parotermes.*
- Submarginal vein absent ..... 2. *Hodotermes.*

Scapular vein unbranched ..... 3. *Eutermes.*

1. PAROTERMES Scudder.

Parotermes Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 135 (1883).

Head rather large, short-oval in form, almost as broad anteriorly as posteriorly, well rounded behind; eyes small, ocelli wanting; antennæ longer than the head, but shorter than the head and prothorax, slender, perhaps slightly broader in the middle than at either end, composed of about twenty equal joints, shorter than broad. Prothorax from a half to a third as long as the head, narrower than or only as broad as it, broader in front than behind, subquadrate, with the hinder angles rounded off. Wings slender and straight, subequal, less than half as long again as the body, four times as long as broad; basal scale obscure in most specimens examined, moderately large, as long as the prothorax, its costal margin convex; costal margin of wing straight nearly to the tip, which tapers to a well-rounded point; marginal and mediastinal veins both present, the latter distinct and reaching nearly to the middle (sometimes only to the end of the basal third) of the costal border; scapular vein running parallel to the costal margin to the tip of the wing and emitting from five to seven very oblique gently curving superior branches at pretty regular intervals, the second arising before the middle of the vein; it also emits a couple of inferior branches

from opposite the base of two of the later branches which strike the apex of the wing, diverging from the main vein no more than the superior branches. Externomedian vein also running parallel to the costal margin throughout the greater part of the wing, and not so far removed from the scapular as the latter is from the costal margin; it has four or five simple or forked branches, mostly arising in the basal third of the wing, and with these branches takes a remarkably longitudinal course obliquely toward the hind margin and parallel to the inferior apical branches of the scapular vein; it therefore occupies the greater part of the wing. The internomedian vein is reduced to a very contracted area, consisting apparently of only a single forked vein or two in the narrowing basal part of the wing. The feeble character of the externomedian and internomedian veins, as well as of the inferior branches of the scapular vein, prevents their preservation on most of the fossils, and it is only in a few specimens that the whole or nearly the whole can be made out. There is apparently no net-work or reticulation anywhere on the membrane of the wing. The abdomen is large and ovate, generally broader than the rest of the body.

This genus, which is most nearly allied to Termopsis and Calotermes, differs from each of them in points wherein they differ from each other, and has some peculiarities of its own. It differs from Calotermes in its shorter wings (relative to the length of the body), which lack any fine reticulation, and in its want of ocelli. From Termopsis it differs in its slenderer but yet shorter wings, without reticulation, its uniform scapular vein running parallel to the costa throughout and provided with fewer and straight branches. From both it differs in the presence of distinct inferior branches to the scapular vein, but especially in the slight development of the internomedian vein, the excessive area of the externomedian vein, and the course of the latter, which is approximated much more closely than usual to the scapular vein and emits branches having an unusually longitudinal course. These last peculiarities also separate this genus still more widely from Hodotermes, with which it agrees pretty closely in many points, and in which Hagen places most of the larger Termitina described by Heer from the European Tertiaries, although they do not appear to agree with the characteristics of the genus as given by him, and certainly approach in some of their features the peculiarities of the present genus. It is, however, impossible from Heer's figures alone to judge whether they are really more closely allied

to Hodotermes or Parotermes; a nearer examination of the types themselves would perhaps decide; but at present Parotermes must be considered peculiar to the American Tertiaries.

The species are all of pretty large size. They may be separated as follows:

Table of the species of Parotermes.

Abdomen considerably broader than the thorax.
Wings produced at the apex; submarginal vein short: branches of the externomedian vein and inferior branches of scapular more oblique than the superior scapular branches.....1. *P. insignis.*
Wings rounded at the apex; submarginal vein long; branches of the submedian vein and inferior branches of the scapular as longitudinal as the superior scapular branches.....2. *P. hageni.*
Abdomen no broader than thorax .....3. *P. fodinæ.*

1. Parotermes insignis.

Pl. 12, Figs. 13, 14.

Parotermes insignis Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 137–139 (1883); in Zittel, Handb. Paleont., I, ii, 773, Fig. 974 (1885).

Head broad oval, of pretty regular shape, but broadest in the middle of the hinder half, the front and hind border broadly rounded; there is a slight median longitudinal suture in the posterior half of the head. Eyes one-fifth the diameter of the head, situated with the front margin slightly more distant from the front than from the hind border of the head and the outer margin just within or at the lateral margin of the head; they do not appear to project strongly above the surface. Antennæ scarcely so long as the head and prothorax together, composed of about twenty to twenty-two joints, the basal joints twice as broad as the stem, the others broader than long and equal throughout, not enlarged toward the middle of the antennæ. Pronotum nearly twice as broad as long, as broad as the head, the front margin nearly straight with slightly rounded corners, the hind border and sides forming one nearly uniform, broad, semicircular curve; its surface appears to be flat, or at least there is no median impressed line. Mesonotum a fourth broader than long, with a distinct median impressed line, at least in the front half, subquadrate in shape, broadest in the middle of the front half, and tapering slightly and regularly behind, the front margin broadly rounded to the shoulder of the wing. Metanotum about as long as the mesonotum and of a similar shape, but tapering more rapidly behind, and likewise with a median impressed line more distinct anteriorly. Abdomen obovate, broad, and about equally rounded at either end, in the middle nearly half as broad

again as any other part of the body, in length just about equaling the entire thorax. Abdominal appendages obscurely seen in a single individual, where they are tolerably stout, tapering slightly, very bluntly terminated, and about as long as the last abdominal segment. Legs very short, the tibiæ being shorter than the width of the thorax, and armed at tip with a pair of short straight spurs; tarsi not more than half as long as the tibiæ, but the separate joints are not determinable on any of the specimens.

Wings four times as long as broad, the middle of the front pair reaching the end of the abdomen, long and very regularly obovate, the only difference in the form of the two extremities being in the gentler tapering of the base and the straighter course of the costal margin next the base. The basal scale is triangular, about as long as the mesonotum, its costal and outer margins each a very little convex. The scapular vein, its superior branches, and the mediastinal are stout, while the other veins are very feeble and only appear under favorable preservation. The submarginal vein[1] is crowded against the margin, but does not run fairly into it before the end of the basal fifth of the wing. The mediastinal vein terminates a short distance before the middle of the wing. The scapular vein runs at only a short distance from and parallel to the margin, and emits from five to eight superior branches running in an extremely longitudinal course to the costa; usually the first branch is thrown off almost as far out as the middle of the second quarter of the wing, but where the branches are numerous three branches are thrown off before the middle of the wing; in addition to the superior veins two inferior veins are emitted in the apical third of the wing, and strike the lower margin of the wing just below the apex. The externomedian vein runs subparallel to, but a little divergent from, the scapular, and nearly as far from it as it is from the costal margin, emitting four inferior simple or forked branches which cover the greater part of the hind border with their nervules; from near the middle of the wing a superior branch is also emitted, which is soon lost. The internomedian vein is forked, and strikes the margin near the middle of the basal half.

Although in the number of branches to the scapular vein the specimen showing the wings most clearly (No. 7752) differs considerably from

[1] What I here call the submarginal vein is the short simple vein, sometimes present in, at other times absent from, Termitina, which precedes the mediastinal vein. Hagen calls it the first branch of his subcosta.

the others, the vein commencing to branch at a considerably earlier point, all the specimens agree so well in every other particular that these would appear to be individual variations. It is the largest species of the genus.

Length of body, 11.5^{mm}; breadth of thorax, 2.5^{mm}; of abdomen, 3.3^{mm}; length of antennæ, 4.25^{mm}; of front wing, 13.3^{mm}; breadth of same, 3.35^{mm}; length of middle tibia, 2^{mm}; of tarsi, 1.25^{mm}; of abdominal appendages, 0.65^{mm}.

Florissant. Four specimens, Nos. 400, 7752, 9041, 14400.

2. Parotermes hagenii.

Pl. 12, Fig. 2.

Parotermes hagenii Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 139–140 (1883).

Head roundish obovate, very regularly rounded, scarcely half as long again as broad, broadest at the eyes, which are scarcely behind the middle, and are deeply set, their outer border projecting but little beyond the contour of the head. Antennæ nearly as long as head and pronotum taken together, composed of about twenty-six joints, subequal beyond the base, a little tapering at the tip. Pronotum more than twice as broad as long, fully as broad as the head, the front margin slightly concave, the hind border and sides forming a regular broad curve. Mesonotum and metanotum shaped exactly as in P. insignis, and with a similar impressed line. Abdomen obovate, but with more parallel sides than in P. insignis, being only a little broader than the thorax, and nearly as long as the rest of the body, including the head. Abdominal appendages tolerably slender, equal, bluntly pointed, composed of five or six joints, the last of which appears to be two or three times as long as the others, which are equal; the whole is about half as long as the pronotum. Legs short, but longer than in P. insignis, the tibiæ being about as long as the width of the thorax, but they are imperfectly preserved on all the specimens.

Wings a little more than four times longer than broad, the middle of the front pair scarcely reaching the extremity of the abdomen, broadest in the middle, tapering almost as much apically as basally, the tip roundly pointed, the costal margin pretty straight until shortly before the tip, the lower margin broadly curved. The basal scale is of the same shape and size as in P. insignis, but with a stronger costal curve. The scapular vein and its superior branches are stout, its inferior branches and the veins below

feeble, so as only to appear under favorable circumstances, being visible in only half of the specimens before me. The submarginal vein of the front wing terminates at about the middle of the basal half of the wing, and about opposite the origin of the first superior scapular branch. The mediastinal vein extends about to the middle of the wing both in the front and hind wings. The scapular vein is related to the margin exactly as in P. insignis, and has five or six superior branches on the hind wing, six or seven on the front wing; on the front wing they originate at subequal distances apart, commencing usually at about the middle of the basal half of the wing, but when there are but six branches (which appears to be less commonly the case) the first originates at a greater distance from the base; on the hind wing there is greater irregularity; in one specimen, that figured (No. 8616), there are five branches on the left hind wing, the first originating beyond the middle of the wing, while on the right wing there is an additional vein, originating far before the second, at the middle of the basal half of the wing; in another specimen with only five veins (No. 8250) the basal branch originates somewhat beyond the middle of the basal half of the wing, and the others follow at subequal intervals; besides these superior there are two inferior nervules arising, the first at the end of the middle third of the wing, opposite a superior branch, and the second opposite the succeeding branch; sometimes a third vein appears beyond these; after parting from the scapular vein these take a longitudinal course and terminate at the tip of the wing. The externomedian vein runs subparallel to the scapular, diverging slightly from it and being as far from it as it is from the costal margin; it emits two or three inferior branches, the last scarcely beyond the middle of the wing, the basal ones of which appear to be forked, but all having an unusually longitudinal course, being only slightly deflected towards the lower margin. Nothing can be said of the internomedian vein.

This species differs from P. insignis by its more laterally disposed eyes, rounder head, differently shaped wings, more longitudinally disposed branches of the externomedian vein, and longer and narrower abdomen.

Length of body, 10.5–12, av. 11^{mm}; breadth of thorax, 2.1^{mm}; of abdomen, 2.6^{mm}; length of antennæ, 4^{mm}; of front wing, 13.5–15.5, av. 14^{mm}; breadth of same, 3.35^{mm}; length of middle tibia, 1.65^{mm}; of abdominal appendages, 0.65^{mm}.

Named for Dr. H. A. Hagen, the distinguished monographer of the Termitina, living and fossil.

Florissant. Seven specimens, Nos. 4629, 4652, 5224, 6030, 8250, 8616, 14167.

3. Parotermes fodinæ.

Pl. 12, Figs. 3, 22.

Parotermes fodinæ Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 141 (1883).

Head oblong obovate, half as long again as broad, the eyes large, circular, about one-fifth the diameter of the head, slightly projecting beyond the sides, the anterior edge near the middle of the head. Pronotum transversely lunate, as broad as the head, less than twice as long as broad, the front margin regularly and considerably concave, the hind margins and sides forming one uniform strongly convex curve, the anterior lateral angles rounded off. Mesonotum and metanotum obscurely preserved, but apparently formed much as in the other species, the mesonotum being of about the same width as the pronotum. Abdomen rather long and comparatively slender, scarcely if at all exceeding in width the parts in front, the sides being unusually parallel, the tip well rounded, the whole as long as the rest of the body. Abdominal appendages very small, stout, being only a little more than twice as long as broad, largest in the middle, and tapering either way, the tip blunt, the whole not longer than the diameter of the eye. Legs poorly and partially preserved in a single specimen, showing them to be much as in P. hagenii, the hind tibia being only a little shorter than the width of the mesothorax.

Wings four times as long as broad, the middle of the front pair reaching the tip of the abdomen; the exact form can not be made out, but the costal margin is straight until very near the tip, and the hind border appears to be uniform and to make the wing slightly broadest just beyond the middle. The submarginal vein is unusually long, running into the costa only a little before the middle of the wing. The mediastinal terminates not far beyond the middle The scapular vein has five or six branches in the front wing, generally five in the hind wing, the first appearing always to originate at the end of the basal third of the wing. The inferior nervules of this vein and the course of the branches of the veins below can not be determined in any of the specimens, but there are faint indications of their

presence, and nothing in them appears to distinguish this species by any marked peculiarities from the others of the genus.

This species differs from the others here described in its considerably smaller size, slender abdomen, and much smaller abdominal appendages.

Length of body, 9^{mm}; breadth of thorax, 2^{mm}; length of front wing, 13^{mm}; breadth of same, 3.25^{mm}; length of hind tibia, 2^{mm}; of abdominal appendages, 0.25^{mm}.

Florissant. Four specimens, Nos. 1247, 1253, 7608, 11190 and 14391.

2. HODOTERMES Hagen.

Hagen refers to this genus two fossil species from Oeningen and two from Radoboj. Assmann also describes a species from Schossnitz, and one of the Florissant white ants is referred here doubtfully. The fossil therefore nearly equal in number the living species, which are all inhabitants of the Old World, the most northern species being found in Egypt.

Hodotermes? coloradensis.

Pl. 12, Fig. 6.

Hodotermes? coloradensis Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 142–143 (1883).

Metanotum considerably narrower than the mesonotum, as long as broad, tapering posteriorly, the front border straight, the hind border rounded. Abdomen ovate, stout, less than twice as long as broad, the sides full, as broad as the mesothorax, posterior extremity rounded. Abdominal appendages long and slender, half as long as the metanotum, composed of at least six or seven joints, slightly tapering, terminating very bluntly.

Wings very long, the middle of the front pair lying far beyond the tip of the abdomen. Submarginal vein absent from all the wings. Mediastinal vein terminating at the middle of the front border. Scapular vein parallel to the front margin, with at least four branches in both wings, and in the front pair pretty certainly five branches, and perhaps six; the first branch originates in the front wing at the end of the basal fourth of the wing, in the hind wing a little farther out.

This species is readily distinguished from all the other fossil Termitina of North America by its very great size, the length of the wings being double that of any other. Although the specimen is very imperfect, the

tip and lower half of the wings being absent, as well as the head, prothorax, and legs, it differs so much from the species of Parotermes, in the absence of the submarginal vein and the great length of the abdominal appendages, that it probably can not be associated with them generically. In size and general appearance it agrees so fairly with the Tertiary species described by Heer, referred to Hodotermes by Hagen, that I place the species provisionally in the same genus, from which (as from all other genera so far as I know in which the structure of the wings would allow it to be placed), it differs by the great length of its anal appendages.

Length of body as preserved, 9^{mm} (probably it reached about 12); of abdomen, 6^{mm}; breadth of same, 4.5^{mm}; length of fore wing, 23^{mm} or more; of abdominal appendages, 1.25^{mm}; breadth of same, 0.3^{mm}.

Florissant. One specimen, No 6010.

3. EUTERMES Heer.

The remaining species fall into the division of Termitina in which the scapular vein is unbranched, and it is uncertain whether they should fall in Termes proper or in Eutermes, the veins below the scapular being in all cases poorly preserved or wholly obliterated. The limited number of antennal joints in such as have these preserved sufficiently for examination, and the occasional indication of a broad subscapular field in others, lead rather to the presumption that they should be placed in Eutermes. Two species have been found at Florissant. The genus has been well known in a fossil state, four species having been described from Radoboj in Croatia and five from Prussian amber. Indeed, the genus was first founded upon fossil species, but it was soon seen that many living forms belonged to the same group. The existing species, some thirty in number, belong almost exclusively to the tropics, and especially to those of the southern hemisphere.

The two species of Eutermes which have been found at Florissant may be separated by the following features:

Table of the species of Eutermes.

Head broader behind than in front, scarcely half as long again as broad; pronotum semicircular, the posterior curve uniform ..... 1. *E. fossarum.*

Head not broader behind than in front, fully half as long again as broad; pronotum very short, the hind margin more or less truncate ..... 2. *E. meadii.*

1. Eutermes fossarum.

Pl. 12, Fig. 20.

Eutermes fossarum Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 113–114 (1883).

Head very regularly obovate, a little broader behind than in front, nearly half as long again as broad, its posterior border well rounded. Eyes rather small, situated in the middle laterally, projecting but little. Antennæ scarcely if any longer than the head, rather stout, enlarging away from the base, composed apparently of less than fifteen joints. Pronotum as broad as the head and twice as broad as long, semicircular, the front border scarcely concave, the front margins slightly rounded. Mesonotum and metanotum as broad as pronotum, quadrate, equal, about half as broad again as long. Abdomen somewhat longer than the rest of the body and slightly broader than the thorax, with gently rounded sides and well-rounded tip; no abdominal appendages are discoverable on any of the specimens. Legs poorly preserved on all specimens; apparently they are of medium length.

Wings rather more than four times as long as broad, the middle of the front pair not reaching the tip of the abdomen, very uniform and regular, of nearly equal breadth throughout the middle two-thirds, the costal margin straight until just before the tip. Scapular vein parallel to the margin, the subcostal area infumated; veins below the scapular not determinable. The basal scale appears to be small, broad, triangular, its costal border swollen.

Length of body, 6.5–7.5, av. 7.15^{mm}; of abdomen, 3.5–4.5, av. 4.15^{mm}; breadth of pronotum, 1.2^{mm}; of abdomen, 1.5^{mm}; length of antennæ, 1.2^{mm}; of front wing, 7.75–9.25, av. 8.25^{mm}; breadth of same, 2^{mm}.

Florissant. Five specimens, Nos. 2329, 6049, 7393, 11752, 14980; three of them in pretty good condition.

2. Eutermes meadii.

Pl. 12, Figs. 12, 17.

Eutermes meadii Scudd., Proc. Amer. Acad. Arts and Sci., XIX, 144–145 (1883).

Head very regularly obovate, broadest just behind the middle, where the small eyes, scarcely projecting, are situated, not broader behind than in front, the hind margin strongly rounded, the whole fully half as long

again as broad. Antennæ nowhere well preserved, but apparently longer and with more numerous joints than in E. fossarum. Pronotum as broad as the head (?) and very short, probably more than twice as broad as long, the hind margin not forming with the sides a continuous curve, but in its middle half only slightly convex. Mesonotum and metanotum quadrate, broader than the head, the mesonotum somewhat the larger, at least half as broad again as long. Abdomen rather stout, longer than the rest of the body, the sides nearly parallel, the tip broadly rounded, and, as far as can be made out, unprovided with terminal appendages. Legs moderately long and stout, the tibiæ armed with a pair of spines at apex, the front tibiæ about as long as the pronotum.

Wings long, slender, and uniform, four times or slightly less than four times as long as broad, the middle of the front pair reaching the tip of the abdomen, broadest at or slightly beyond the middle, the lower border slightly arcuate throughout. Costal margin straight in the basal three-fourths of the wing. Scapular vein parallel to the margin, the subcostal area scarcely infumated. Veins below the scapular not determinable. Basal scale small, triangular, equilateral, the sides straight excepting the costal, which is very slightly convex and prominent.

This species differs from the preceding by its slightly smaller size, squarer pronotum, and differently shaped head.

Length of body, 5.25–7, av. 6.3^{mm}; of abdomen, 2.8–3.5, av. 3.2^{mm}; breadth of abdomen, 1.5^{mm}; length of wing, 7.5–8^{mm}; breadth of same, 2^{mm}.

Named for Mr. T. L. Mead, whose collection of Florissant insects he has permitted me to study.

Florissant. Four specimens, No. 19 (Coll. T. L. Mead), and Nos. 31, 1203, 8062.

A single specimen of a wingless white ant has been found, apparently belonging to this species or to E. fossarum. It measures 3.75^{mm} in length, and is of the ordinary form of the worker, with rounded head and constricted prothorax, bearing a general resemblance to the only other known fossil termite larva, figured in Berendt's work, but has the head more produced anteriorly and the abdomen less distended.

Florissant. One specimen, No. 6100.

Family PSOCINA Burmeister.

Until now this group has been found fossil only in amber, but here in considerable abundance, since several of the species are represented by twenty, thirty, or even sixty individuals; and fifteen species are recognized, about one-ninth the number of living species known, but nearly one-half as many as the species now living in Germany, according to the latest monograph by Kolbe. These fossil species are divided among ten genera as follows: Troctes, one; Sphæropsocus, one; Empheria, two; Archipsocus, two; Amphientomum, one; Epipsocus, one; Cæcilius, three; Philotarsus, two; Psocus, one; Elipsocus, one. The genera Sphæropsocus, Empheria, and Archipsocus are peculiar to amber; the first mentioned, a most remarkable form, has the front wings developed into the semblance of elytra. It is worthy of note that, while in the existing fauna of Europe the groups to which Psocus and Elipsocus belong embrace about half the species, they include only one-seventh the amber fauna. Hagen and Kolbe are at variance on the interpretation of these facts. The single imperfect specimen so far found in American deposits—the only one indeed in any rock formation—proves to belong to a distinct generic type, remarkable for the wide separation of the ocelli.

PAROPSOCUS gen. nov. (*πάρος*, Psocus).

The single insect on which this new generic group is based is very fragmentary, but seems to differ so clearly from other types of Psocina, whether living or fossil, that it can only be recognized as distinct. The head is broad, not including the eyes as broad as long, the nasus prominent, very broadly convex, almost truncate; the eyes are very large, very prominent, globose, subpedicellate, being strongly constricted at base, widening the head one-half; ocelli large, exceptionally distant, the outer paired ocelli infringing on the margin of the eyes. Antennæ with the first, second, and third joints successively narrower by one-fourth, the first and second broader than long, not large, the third joint four or five times as long as broad, cylindrical, the remaining joints on the proximal third of the antennæ two or three times as long as broad, smallest at base, apically rounded. Prothorax narrow, pedunculate, free, with its angulate apex overlapping the mesonotum, longer than broad. Mesothorax much broader than the total

width of the head. Fore tibiæ slender, longer than and not half so stout as the fore femora. Abdomen very short and stout, tapering very rapidly behind.

Perhaps this genus is as nearly related to Amphientomum as to any other. A single species is at hand.

Paropsocus disjunctus.

Pl. 5, Fig. 51.

The single specimen unfortunately shows only an insignificant fraction of neuration, and therein no distinctive parts, but only those which are common to all genera of Psocidæ. So far as can be seen, the head, thorax, antennæ, and legs are absolutely naked. The plate wrongly shows the left antenna as the tarsus of the fore leg. The third joint of the antennæ is shorter than the width of the head between the eyes.

Length of body, 1.6^{mm}; breadth of head, 0.45^{mm}; of thorax, 0.75^{mm}; length of third antennal joint, 0.3^{mm}.

Fossil Cañon, White River, Utah. One specimen, No. 33^{c}, W. Denton.

Family EPHEMERIDÆ Stephens.

Our previous knowledge of Tertiary Ephemeridæ is based entirely upon imagos and almost entirely confined to the statements made by Pictet and Hagen nearly thirty years ago in their account of amber Neuroptera. Four species of Baetis and one each of Potamanthus and Palingenia were there described, and two years earlier mention is made by Hagen, by name merely, of a second species of Palingenia, but in the subsequent work it is referred to Baetis. Here also Pictet's Palingenia is considered as more closely related to Baetis anomala, for which in his monograph of the Ephemeridæ Eaton establishes the genus Cronicus. Eaton also refers the Potamanthus to Leptophlebia. We have therefore from the amber three species of Baetis, one or probably two of Cronicus, and one of Leptophlebia. Besides these, Sendel figures a species which he classes "inter ephemeras minores," and Burmeister says he has seen "zwei individuen der gattung Ephemera" in the Berlin Museum.

From the Tertiary rocks we have only a reference by Schlotheim to an insect from Oeningen, which he says may be an Ephemera or a Phry-

ganea, Heer's undescribed Ephemera oeningensis, and a reference to an Australian species by Wilkinson.

It is not worth while to enter here upon any discussion of the pre-Tertiary Ephemeridæ, but one of the most interesting of modern discoveries is Frič's gigantic Palingenia feistmanteli from the coal.

The American remains referred here are rather unsatisfactory, consisting of a single imago and five different species of larvæ and pupæ. The earlier stages have not before been noticed in a fossil state. The least satisfactory is the imago, which is so rudely preserved that only its three caudal setæ of equal length give any clue to its relationship. The larvæ and pupæ agree closely in structural features, and, excepting E. interempta, seem to belong to one genus. The stoutness of the tibiæ, which are of nearly equal breadth with the femora, and particularly the size of the fore tibiæ where preserved, indicate pretty clearly that they were burrowing in habit and belong in the neighborhood of Ephemera and Palingenia; their legs, however, though longitudinally hairy, are not laterally fringed, as appears to be the case with such larvæ so far as they are known; and the respiratory organs of the abdomen are too poorly preserved to offer any assistance; the legs, however, are evidently flattened, and hence I have placed them in Ephemera rather than in Palingenia. They seem, however, to indicate the existence here of a distinct type, for they differ from such larvæ as are known in the form of the body, which is unusually stout at the thorax and particularly in the mesothorax, tapering anteriorly to such a degree that the head is very small, and it is also not produced anteriorly, or to a slight degree only; the abdomen tapers also either throughout its length or from the middle posteriorly; the respiratory organs, if of the form and position in which they are found in Ephemera and Palingenia, would certainly be clearly seen, whereas no sign of them appears upon the upper surface of the abdomen; there are, however, certain indications laterally which may be referred to them, and if so this would be an additional distinction. The unfringed legs, in which femur, tibia, and tarsus are of nearly uniform diameter, indicate a further difference from known types. So little, however, is known of the early stages of this group that it will be impossible to indicate the nearer affinities of these fossil larvæ until further information of living forms is obtained. (September, 1883.)

EPHEMERA Linné.

The species known only in the immature stages may be distinguished as follows:

Table of the species of Ephemera.

Outer caudal setæ fringed on both sides. Middle seta as long as the outer setæ.
- Setæ very much more widely fringed in the middle than toward either end; dorsal abdominal markings consisting of light blotches on a dark ground ..... 1. *E. tabifica.*
- Setæ only a little more widely fringed in the middle than toward the base or tip; dorsal abdominal markings consisting of light lines on a dark ground ..... 3. *E. macilenta.*

Outer caudal setæ fringed on the inner side only, and very much more broadly in the middle than near the base or tip. Middle seta shorter than the outer setæ ..... 2. *E. immobilis.*

Setæ of equal length and naked, or not noticeably fringed.
- Large species. Head less than half the width of thorax; dorsal abdominal markings of light lines ..... 4. *E. pumicosa.*
- Small species. Head considerably more than half as wide as the thorax; no dorsal abdominal marking ..... 5. *E. interempta.*

1. EPHEMERA TABIFICA.

Pupa.—This species differs somewhat in form from the other larger types, the abdomen being very nearly of equal size throughout and the thorax nearly twice as broad as it, while anteriorly the whole body tapers regularly, as in the succeeding species. The head is rounded quadrate, about half the width of the thorax. The legs are slenderer than in the succeeding species and short, the front pair no longer than the width of the thorax, the hind pair longer, being as long as the head and thorax together. The wing pads are blackish, about three times as long as broad, reniform in shape, the inner margin bent in the middle, and the basal halves of the inner margin of the two wings meeting to form an angle slightly less than a right angle, the apical half tapering to a rounded apex. The abdomen is long and slender, the apical joint more than half as broad as the basal, the dorsal surface blotched with large quadrate patches of lighter color than the ground, sometimes central, sometimes anterior and transverse, divided by a median line. The three caudal setæ are slender, less than half as long as the abdomen, equal, very broadly fringed on either side in the middle.

Length of body exclusive of setæ, 25^{mm}; breadth of thorax, 4.5^{mm}; of middle of abdomen, 2.6^{mm}; length of wing pads, 4.5^{mm}; of front legs, 4^{mm}; of hind legs, 8^{mm}; of setæ, 7^{mm}.

Florissant. One specimen, No. 13238.

2. Ephemera immobilis.

Pl. 12, Fig. 5.

Larva.—This is the largest of the ephemerid larvæ, and is represented by a single specimen and its reverse. The body is stout, largest at the mesothorax and metathorax, tapering rapidly and somewhat rounded in front, tapering gently behind, the hinder half of the abdomen more rapidly than the basal half. The head is small, about as broad as the terminal segment of the body, transversely rounded oval, less than half as broad as the thorax, and symmetrical, being rounded in front as behind; the mandibles, not represented on the plate, are not so long as the head, moderately stout, nearly straight and tapering. The front legs are nearly as long as the thorax, the femora and tibiæ, which are of equal width, nearly or quite as broad as the length of the prothorax; the tibia is a little longer than the femur and about half as long again as the tarsus, which is also somewhat slenderer. The other legs are longer and a little stouter, but retain the same relations, excepting that the tarsus is much longer, half as long again as the tibia and toward the tip tapering. The thoracic branchiæ form a pair of triangular equilateral pads, their inner margins straight and attingent at the mediodorsal line, their outer margins convex. The dorsal surface of the abdomen is ornamented by a pair of approximated subdorsal, longitudinal, curved, white streaks, convexities outward, reaching the posterior but not the anterior border of each segment. The caudal setæ are of unequal length, the outer more than one-third, the middle one nearly one-fourth, the length of the body. They are fringed, the outer ones on the inner surface only, the middle one on both sides by a delicate fringe of hairs, which increases in breadth from either end toward the middle, where the fringe is from a third to a fourth the width of the last abdominal segment.

Length of body, 21^{mm}; breadth of thorax, 5^{mm}; of head, 2.4^{mm}; length of fore tibia, 2.25^{mm}; breadth, 0.6^{mm}; length of hind tibia, 2.75^{mm}; breadth, 0.8^{mm}; length of outer caudal setæ, 8^{mm}; of middle seta, 5^{mm}.

The species differs from the other larvæ here described by its greater size and the peculiar fringing of the caudal setæ.

Florissant. One specimen, Nos. 8824 and 8828.

3. Ephemera macilenta.

Pl. 12, Figs. 4, 10.

Larva.—The body is stout but not so stout as in the last species, which is only slightly larger than this; it tapers also in a similar manner but is not so rounded anteriorly. The head and mandibles are of similar form and size, but the head is not so distinctly separated from the thorax as in that species, being continuous with the general outline of the body. The legs are considerably shorter than in the preceding species, but while agreeing with them in general structure the femora are stouter in relation to the tibiæ. The abdomen is similarly marked, but the stripes are shorter, reaching neither the anterior nor the posterior margins of the segments. The caudal setæ are of equal length, nearly half as long as the body, and fringed on either side with short ciliæ, scarcely longer than the breadth of the seta.

Length of body, 1.75^{mm}; breadth of thorax, 3.6^{mm}; of head, 1.85^{mm}; length of fore tibia, 1.9^{mm}; breadth, 0.35^{mm}; length of hind tibia, 2^{mm}; breadth, 0.35^{mm}; length of caudal setæ, 7.5^{mm}.

The brevity of the legs and the uniform brief ciliation of the caudal setæ distinguish this species from either of the other larvæ here described.

Florissant. Five specimens, Nos. 232, 1137, 7280, 10423, 13526.

4. Ephemera pumicosa.

Pl. 12, Figs. 7 (pupa), 15, 16 (larva).

Larva.—This species is both smaller and slenderer than any of the larvæ described above. It tapers in the same manner as the others, except in being more rapidly expanded at the thorax and in having the abdomen of more uniform width, a peculiarity seen also in the nymph referred to the same species. As in the other species, the head is of the same width as the extremity of the abdomen. The legs are poorly preserved in all the specimens, but seem to agree entirely with their appearance in the nymph. The abdomen is marked as in E. immobilis, but if anything with longer and straighter stripes. All the caudal setæ are of similar length, slender, but rather short, being only about one-third the length of the body; they are furthermore distinguished from those of the other species by being naked, as far as can be seen, though one specimen seems to show an apical bristle on either side at the end of each joint of the middle seta.

Length of body, 17^{mm}; breadth of thorax, 4^{mm}; of head, 1^{mm}; length of caudal setæ, 6^{mm}.

Pupa.—The form is altogether that of the larva, but the legs are better preserved, showing them to be as long in this species as in E. immobilis, but to differ in their almost uniform slenderness throughout, the tarsi being scarcely narrower than the femora. The wing pads are distinctly marked in dark brown and are reniform in shape, of nearly uniform width and nearly three times as long as broad, the basal half of their inner edges meeting at less than a right angle, and the distal halves parallel and approximate along the mediodorsal line, the outer edges gently concave and the tips well rounded. The stone is broken at the tip of the body in the only specimen, so that the caudal setæ are not preserved.

Florissant. Five specimens, Nos. 233, 1070, 1516, 10385 (larvæ), 10660 (pupa).

5. Ephemera interempta.

This smallest of the ephemerids from Florissant, represented by a nearly complete pupa and the terminal segments of what may be either larva or pupa, and which appears to belong here, differs considerably in structural features from the others. The former only will be described.

Pupa.—The body is tolerably stout, largest at the thorax where it tapers forward toward the head, which is fully three-quarters its width. Posteriorly the abdomen remains in its basal half very nearly as broad as the widest part of the thorax, and only tapers rapidly a little before the tip, which is more rounded than usual and scarcely one-third as broad as the thorax The head is rounded, a little broader than long; the legs only moderately stout, all the femora subequal and about as long as the head. The wing pads are subtriangular, tapering pretty uniformly to a rather broadly rounded tip about half as broad as the base, the inner margin bent close to the base, and the basal portions of the two pads forming an angle much broader than a right angle; they differ therefore altogether in form from the two species of which nymphs are known. The abdominal joints are more than twice as broad as long and wholly devoid of the markings which distinguish all the other species. The caudal setæ are about one-third as long as the abdomen, and unfringed. Only the base of the median seta is preserved in the type, but in the other specimen referred here it is as long as the lateral.

Length of body, 9.5^{mm}; width of head, 1.3^{mm}; of thorax, 2^{mm}; length of femora, 1.2^{mm}; of wing pad, 2^{mm}; of setæ, 2.5^{mm}.

Florissant. Two specimens, Nos. 1.582, obtained by the Princeton expedition, and 10706.

Ephemera exsucca.

Pl. 12, Fig. 9.

A single specimen, very badly preserved, but showing unmistakably the caudal setæ. The whole is preserved as I have seen no other specimen from Florissant, as if drawn on the stone with a pale blue pencil. The body is tolerably stout for an Ephemera, the abdomen tapering a little. The expanded wings are only partially preserved, but are apparently nearly as long as the body. The three caudal setæ are very slender and of exactly the same length, a little shorter than the body. No ciliation can be detected on them.

Length of body, 9^{mm}; breadth of thorax, 2^{mm}; expanse of wings, 16^{mm}; length of caudal setæ, 7^{mm}.

Florissant. One specimen, No. 5587.

Family ODONATA Fabricius.

More than thirty years ago in his work in conjunction with de Selys on the European Odonata, Dr. Hagen contributed a chapter on the fossil species of Europe, in which about half of the species enumerated (thirty-nine in number) belonged to the Secondary and half to the Tertiary period. Since then no one has done more than Dr. Hagen to add to our knowledge, especially of the Secondary species. The time has hardly come, and the species known are as yet perhaps not sufficiently numerous, to enter on any study of the relation of the Secondary and Tertiary types; but it may be stated in a general way that, omitting all mention of larval remains, we now know nearly double the number then recorded, and the Tertiary species are considerably in excess. Of these the larger part belong to the Agrionina. (January, 1882.)

To enter into a few details, the strongly limited group of dragon-flies makes its appearance in the Lias in considerable variety and apparently as highly specialized as to-day, for no less than four tribes are present, the true Agrionidæ and the Cordulidæ alone being absent. Aeschnina are the

most abundant, the Aeschnidæ being represented by a species of Aeschna at Schambelen and the Gomphidæ by one species each of Petalura and Gomphoides from England. Calopterygidæ come next, with one species each of Tarsophlebia and Heterophlebia, both extinct genera, also from England, and finally a species of Libellula from England. The same relation holds in passing upward into the oolite, where the Agrionina are added. Here we have thirty-two species, of which half are Agrionina: four Agrionidæ, and twelve Calopterygidæ of five genera, mostly extinct, namely, Isophlebia, two; Heterophlebia, two; Stenophlebia, three; Tarsophlebia, one, and Euphæa, four; three are Aeschnidæ of the genera Anax and Aeschna; eight Gomphidæ of some undetermined genera, besides Petalura and Petalia; and finally five Libellulidæ of about as many genera, yet undescribed. A species of Gomphidæ has also been found in the Wealden of England. The lithographic slates of Bavaria afford numerous, sometimes wonderfully preserved, dragon-flies, called by the workmen Stangenreiter or Schladen-Vögel, which have been carefully studied by Hagen. They lie on the stone with expanded wings and are generally larger than modern types; sometimes the most delicate veins are perfectly preserved. Most of them are referred to extinct genera.

Considering the comparative abundance of this group in the Secondary rocks one would expect to find a better representation in the Tertiaries than is the case, for, even counting all the species founded upon the immature stages as distinct from any of those established upon wings, the Tertiary species are less than twice as numerous as those from the Secondary rocks. The subfamilies are about equally represented, though the Agrionina are a little in excess, and the species are very unequally distributed among the tribes. Thus there are twenty-two species of Agrionidæ of the following genera: Agrion, seven; Lestes, five; Argya, one; Platycnemis, two; Sterope, one; Dysagrion, three; Podagrion, one; and Lithagrion, two, the last four genera being extinct; while there is but a single species of Calopterygidæ known by a pupal form, from amber, a curious reversal of the proportion in Mesozoic rocks. The Æschnina are more equally balanced between the tribes, the Gomphidæ being represented by six species, of the genera Gomphus, Gomphoides, Ictinus, and Petalura, and the Aeschnidæ by nine; of the genera Aeschna (eight) and Anax (one). The Libellulina, however, have again only a single species of Cordulidæ,

but sixteen species of Libellulidæ, all except one, a Celithemis, referred to Libellula in a broad sense. Nearly every locality where Tertiary insects are found, even including amber, has supplied its quota of this family, and some localities, such as Oeningen, have furnished the larvæ and pupæ in great numbers. (1885.)

The Odonata furnish the first opportunity that my studies have afforded of a comparison between the insect faunas of Florissant and the Green River shales. The Florissant beds have furnished six species in the perfect state besides two larvæ; the Green River shales four species in the perfect state besides fragments of another, concerning which nothing more can be said than that it probably belongs to the Libellulina. Two of the Florissant forms belong to Aeschna, besides one of the larvæ. All the remainder, four Green River species, and four from Florissant, besides a larva, belong to the Agrionina. The Green River shales are represented by one species of Podagrion and three species of Dysagrion, an extinct genus of the legion Podagrion allied to the genera Podagrion and Philogenia; the Florissant beds by two species of Agrion and two of Lithagrion, an extinct genus with the same alliances as Dysagrion; the species of Agrion are not sufficiently perfect to decide into what subgenus they will fall, but they are certainly closely related and appear to be most nearly allied to Amphiagrion or else to Pyrrhosoma or Erythromma. All the Green River species belong then to the legion Podagrion, while the Florissant species are divided between the legions Podagrion and Agrion. The resemblance of the faunas of the two localities is very apparent, though the species and even the genera are wholly distinct. The facies of both faunas is decidedly subtropical (October, 1882.)

Tribe AGRIONINA Hagen.

This group is the richest of Odonata in the Tertiaries, both in Europe and America, but curiously the legions into which it is divided by de Selys are very differently represented in the two countries. To establish better terms of comparison I have given some attention to the descriptions and figures of the mature European forms, and their study brings out some interesting points.

In Europe the legion Lestes is far the best represented; into this fall Lestes coloratus Hagen from Radoboj, first figured by Charpentier, Agrion

ligea, A. leucosia, and A. peisinoe,[1] all of Heer and from Oeningen, and probably A. iris Heer of Oeningen; a closer determination is perhaps impossible. Into it also fall Lestes vicina Hagen from Sieblos, which appears to be a Lestes in the narrowest sense, and Agrion (Steropc) parthenope Heer from Oeningen, which is either a Sympycna or exceedingly close to it. The legion next best represented is Platycnemis, since to the subgenus Platycnemis Agrion antiquum Hagen from amber and Agrion icarus Hagen from Rott pretty certainly belong. Finally, to the legion Agrion belongs Agrion aglaope Heer from Oeningen.

In America, on the other hand, the bulk of the species fall in the legion Podagrion, viz, Dysagrion fredericii, D. lakesii, and D. packardii of Green River, Podagrion abortivum from the same, and Lithagrion hyalinum and L. umbratum from Florissant. The other two species fall in the legion Agrion, viz, Agrion mascescens and A. exsularis.

The following table will show the distribution of recent and fossil species in Europe and North America:

Legion.	Recent.						Fossil.			
	Europe.		North America north of Mexico.		North America and West Indies.		Europe.		North America.	
	No.	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Pseudostigma	.....	.....	5	9	6	7	.....	.....	.....	.....
Lestes	7	18	11	21	14	17	7	70	.....	.....
Podagrion	.....	.....	.....	.....	1	1	.....	.....	6	75
Platycnemis	11	29	.....	.....	.....	.....	2	20	.....	.....
Agrion	20	53	37	70	60	71	1	10	2	25
Protoneura	.....	.....	.....	.....	3	4	.....	.....	.....	.....
Total	38	.....	53	.....	84	.....	10	.....	8	.....

Concerning the present distribution of these "legions," it may be said that Pseudostigma belongs to tropical America, Podagrion and Protoneura to the tropics and South Africa, Platycnemis to the Old World, and that Lestes and Agrion are cosmopolitan. The cosmopolitan groups and the one confined to the Old World are those, and the only ones, represented in the European Tertiaries; while one of the cosmopolitan genera well repre-

[1] Hagen considered these as most nearly allied to the species for which Selys has since established the genus Chlorolestes in the legion Podagrion, but to judge from the origin of the median and subnodal sectors they certainly belong in Lestes.

sented in the United States to-day has not yet been found in its Tertiary deposits, and three-quarters of the fossil species belong to a legion essentially tropical and two-thirds of whose living representatives occur in America; to offset this, the two other legions which are peculiarly tropical (and one of them exclusively American) are wholly unrepresented in the American Tertiaries. From what we then know at the present time the relationship of the agrionid fauna of the European and American Tertiaries was not nearly so close as the living faunas of the two countries. (September, 1883.)

Legion PODAGRION de Selys.

To this legion belong most of the fossil Agrionina of North America. The species here described are the first that have been found fossil. The recent forms of this legion—not a very prolific one—occur mainly in tropical America, though nearly half the genera and about one-third of the species belong to the East Indies and South Africa. The forms here brought to notice are mostly referable to new genera which find their place in near vicinity to the South American types. One species appears to belong to the South American genus Podagrion. The relationship of these fossils may be looked upon as well defined. Their nearest living relatives are inhabitants of Brazil, Venezuela, and Colombia.

The genera here represented may be separated in the following manner:

Table of the genera of Podagrion.

Pterostigma not more than twice as long as broad, surmounting less than two cellules; supplementary sectors few; few pentagonal cellules ..... 2. *Podagrion.*

Pterostigma more than twice as long as broad, surmounting several cellules; supplementary sectors numerous; many pentagonal cellules.

Nodal sector arising from the principal at scarcely one-fifth the distance from the nodus to the pterostigma; postcostal area exclusively or almost exclusively filled with pentagonal cells; several supplemeatary sectors between the median and subnodal sectors.....1. *Dysagrion.*

Nodal sector arising from the principal at about one-third the distance from the nodus to the pterostigma; postcostal area with tetragonal and very few or no pentagonal cells; no perfect supplementary sector between the median and subnodal sectors .....3. *Lithagrion.*

1. DYSAGRION Scudder.

Dysagrion Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 534 (1878).

This new type of Agrionina belongs to the legion Podagrion as defined by Selys-Longchamps, having a normal pterostigma, much longer than broad, the median sector arising from the principal vein near the nodus, the subnodal a little further out, and many interposed supplementary sectors.

It differs somewhat remarkably, however, from any of the genera given in that author's Synopsis des Agrionines (1862) in several points, as will be seen on reviewing the following characteristics.

The median sector arises from the principal vein more than one-third the distance from the nodus to the arculus; the submodal arises from an extension of the nodus, which in passing below the principal is directed somewhat *inward* instead of outward, a somewhat extraordinary feature; the nodal arises from the principal only as far beyond the nodus as the median originates before it, or scarcely more than one-fifth way to the pterostigma. The reticulation of the upper half of the wing is mostly tetragonal, and in the discoidal area very open, while in the lower half of the wing it is mostly pentagonal, and dense apically; this results in part from the *great number* of interposed supplementary sectors, of which there are several between the ultranodal and nodal sectors, and several between each of the following sectors as far as the upper sector of the triangle; the upper of these curve somewhat downward as they approach the apical border. The postcostal area has at first two rows of cellules, but it expands rapidly below the nodus, and then has three and afterwards even four rows. The nodus is situated at an unusual distance outward, indeed *not very far before the middle* of the wing (rather more than one-third the distance from the base), and at a third of the distance from the arculus to the pterostigma. The petiole terminates at some distance *before* the arculus and is very slender. The wing is rather full in the middle, and the apical half of the posterior border is very full, the apex falling considerably above the middle of the wing.

These characters show the nearest alliance to Philogenia, but the genus differs strikingly from that in the position of the nodus, its retreat below the principal sector, the character of the postcostal area, and in the great number of the supplementary sectors, as well as in less important characters, such as the density of the reticulation. It seems indeed to be a very aberrant member of the legion. As the members of this group are all tropical, and those to which this is most nearly allied (as indeed two-thirds of the species) are from the New World, this is an additional instance of neotropical alliances in the insect-fauna of our Tertiaries.

It is upon the wing that I would establish this genus. Yet fragments of other parts of the body occur with the wings, showing that the legs were

probably long and slender, furnished with spine-like hairs as long as the breadth of the femora. The abdomen was moderately slender, rather longer than the wings; its ninth and tenth segments a little enlarged in the ♀, the tenth half (♀), or three-quarters (♂), as long as the ninth, and the eighth half as long again (♀), or twice as long (♂), as the ninth, and a little more than half as long as the seventh. The anal appendages were as long as the tenth segment, rounded triangular (♀) or quadrate (♂).

The species of Dysagrion found at Green River may be separated by the characters drawn from the neuration of the wing in the following table:

Table of the species of Dysagrion.

Pterostigma at least four times as long as broad; quadrilateral longer than broad; middle of the area occupied by supplementary veins between the principal and subnodal sectors filled with quadrilateral cells.

Pterostigma surmounting four cells; quadrilateral nearly as broad at base as at apex. *D. fredericii.*

Pterostigma surmounting three cells; quadrilateral nearly twice as broad at apex as at base. 2. *D. lakesii.*

Pterostigma only three times as long as broad; quadrilateral slightly broader than long; middle of the area between the principal and subnodal sectors filled with pentagonal cells...3. *D. packardii.*

1. Dysagrion fredericii.

Pl. 6, Figs. 2, 5, 6, 9, 10, 14, 17.

Dysagrion fredericii Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 534–537, 775 (1878).

Several specimens of various parts of the body with wings were found by Mr. F. C. Bowditch and myself in the Green River shales, in a railway cutting by the river bank beyond Green River station. The most important are a nearly perfect wing and its reverse, which preserve all the important points of the neuration. A single antecubital appears to be present, nearer the nodus than the arculus; the principal sector, like the short sector (sector brevis), bends slightly upward just as it reaches the arculus; the cellules in the discoidal area are half as broad again as long, yet the breadth of the wing is such that the broadest part of the postcostal space, between the nodus and the middle of the wing, is more than half as broad as the rest of the wing at that point. The quadrilateral is subquadrate, about half as long again as broad, its upper and lower margins subparallel and its lower outer angle about sixty degrees; pterostigma four times as long as broad, a little dilated, oblique both within and without, but especially pointed above on the outer side, touching the costal margin throughout. The wing is wholly hyaline, excepting the infumated pterostigma, which is bordered by

thickened black veins, and surmounts four cellules at its lower margin; the veins of the wing generally are testaceous; there are twenty postcubitals.

Length of the wing, 36^{mm}; length of part beyond peduncle, 34^{mm}; breadth, 9^{mm}; distance from nodus to tip of wing, 23^{mm}; from arculus to nodus, 8^{mm}; from nodus to inner angle of pterostigma, 17^{mm}; length of pterostigma, 3.5^{mm}.

Another wing from the same beds with its reverse (Nos. 4165, 4166) is very fragmentary, showing little besides the border of the apical half of the wing with the pterostigma, and most of the postcubital nervules. I have here considered it the hind wing of the same species, from its similar size, the exact resemblance of the pterostigma, which also surmounts four cellules, and the indication of a similar profusion of intercalated supplementary nervules. It seems, however, not improbable that it may prove to be a second species of the same genus, from the great difference in form. The two borders of the outer half of the wing are nearly parallel, and the apex falls a little below the middle. This difference, however, really concerns only the posterior curve of the wing below the apex. The nodus is not preserved. Greatest breadth, 7.5^{mm}.

Considering the fragments of heads, etc., referred to under the genus as belonging to this species, we have to add Nos. 4179, 4180, and 4182 (besides No. 62 of Mr. Richardson's collection) as representing heads; Nos. 4183, 4184, the united head, thorax, and base of wings; and Nos. 4170, 4173, 4174, 4177, 4178, as parts of the abdomen. The abdomen shows a slender, dorsal, pale stripe, distinct and moderately broad on the sixth to the eighth segments, scarcely reaching either border, and posteriorly expanding into a small, round spot; and a faint dorsal line on the fourth and fifth segments, interrupted just before the tip. The appendages are simple.

Length of head (according to the mode of preservation), 4.0-4.5^{mm}; breadth of same, 5.5^{mm}; length of thorax, 5^{mm}; of pedicel of wing, 5^{mm}; of abdomen (probably 1^{mm} should be added for a break at the base), 39^{mm}; length of segments 8 to 10, 6^{mm}; breadth of ninth segment, 2.75^{mm}; of fifth segment, 2.1^{mm}; estimated length of whole body, 55^{mm}.

Named for my friend and fellow collector of Green River fossils, Mr. Frederick C. Bowditch, of Boston.

Green River, Wyoming. Three specimens, Nos. 4165 and 4166, 4167 and 4168, 15244, besides the parts of the body mentioned.

2. Dysagrion lakesii.

A nearly perfect wing and its reverse represent another species of this genus, which is more nearly allied to D. packardii than to D. fredericii, differing from the former principally in the form of the quadrilateral and the shape of the pterostigma, which, although as long as there, surmounts only three cellules. There are two antecubitals, one at, the other a little before, the arculus; the base of the principal and short sectors is straight, the cellules in the discoidal area are much as in D. fredericii, the quadrilateral is twice as long as its mean breadth, its basal margin half as long as its apical, and the vein forming the lower margin bent at a similar angle with the inferior vein of the triangle as in D. fredericii; the nodus is placed at one-third the distance from the arculus to the pterostigma. The wing is hyaline, excepting the fuliginous pterostigma, which is four times as long as broad, surmounts three cellules, and is bordered by thickened black veins; its outer margin is much more oblique than its inner; there are nineteen postcubitals.

Probable length of wing, 35^{mm}; length of part beyond peduncle, 33^{mm}; breadth, 8^{mm}; distance from arculus to nodus, 8^{mm}; from nodus to tip of wing, 22.5^{mm}; from nodus to inner corner of pterostigma, 15.5^{mm}; length of pterostigma, 3.75^{mm}.

Named for Prof. Arthur Lakes, of Colorado, my companion in exploring the fossil insect beds of the West.

Green River. One specimen, Dr. A. S. Packard, Nos. 259 and 260.

3. Dysagrion packardii.

Pl. 6, Figs. 1, 3, 11.

Dysagrion packardii Scudd., Zittel, Handb. d. Palæont., I, ii, 776, Fig. 979 (1885).

Another species of this genus is represented by a nearly complete front wing, a fragment of a wing and its reverse, and by a tolerably perfect body presumably belonging to it. The wing agrees with that of D. fredericii in form and size, but differs in the following particulars: No antecubitals exist, except in the neighborhood of the arculus, one being present nearly half-way from it to the base and another may exist in the broken part of the wing just beyond the arculus; the base of the principal and short sectors is straight; the cellules in the discoidal area are, if anything,

slenderer than in that species; the quadrilateral is of about equal length and breadth, its basal only a little more than half the length of its apical margin and the vein forming its lower margin bent at a much greater angle with the inferior vein of the triangle than in the preceding species; the nodus is placed slightly beyond one-third the distance from the arculus to the pterostigma, while in the preceding species it is placed, if anything, at less than one-third that distance; the wing is hyaline, excepting the dusky pterostigma, which is about three times as long as broad, surmounts four cellules, and is bordered by thickened black veins; there are nineteen postcubitals.

The body is slender, the legs slender, but not very long, armed with long hairs, and the abdomen, which is considerably longer than the front wing, is viewed partly from the side and partly from above; the superior male appendages are shorter than the tenth segment, quadrate, apparently of equal length and breadth, with a slightly projecting tooth at the inner tip directed inwards.

Length of entire body, 49^{mm}; head, 3^{mm}; thorax, 8.5^{mm}; fore femora, 4.25^{mm}; middle femora, 5^{mm}; hind femora, 6^{mm}; abdomen, 36^{mm}; second joint, 3.5^{mm}; third, 5^{mm}; fourth to sixth, each 6^{mm}; seventh, 4.5^{mm}; eighth, 2.5^{mm}; ninth, 1.5^{mm}; tenth, 1.1^{mm}; appendages, 0.6^{mm}; breadth of head, 4.5^{mm}; second to fifth abdominal segments (side view), 2.75^{mm}; sixth and seventh abdominal segments (top view), 1.75^{mm}; eighth, 3^{mm}; ninth, 2^{mm}; tenth, 1.75^{mm}; appendages, 0.6^{mm}; length of wing, 36.5^{mm}; of part beyond peduncle, 34.5^{mm}; breadth, 8.6; distance from arculus to nodus, 9^{mm}; from nodus to tip of wing, 22.75^{mm}; from nodus to inner angle of pterostigma, 16.75^{mm}; length of pterostigma, 3^{mm}.

Named for the world-known American entomologist, Dr. A. S. Packard, of Brown University.

Green River. Three specimens, Dr. A. S. Packard, Nos. 146, 147, 252 and 253.

2. PODAGRION de Selys.

Tropical South America claims the half dozen known living species of this genus, most of which have been found in Colombia and Venezuela. The single species we refer here is somewhat imperfect but apparently belongs here, and can certainly not be far removed from it, for it agrees with it in the character of the pterostigma and the supplementary sectors. Except this no fossil species have been found.

Podagrion abortivum.

Pl. 6, Figs. 7, 8.

Podagrion abortivum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 775-776 (1878).

The specimen represents the apical part of a wing with fragments of the middle portion. The pterostigma is a little more than twice as long as broad, and, although less oblique on the inner than on the outer side, yet lies at an angle of forty-five degrees with the costal edge, and is therefore more oblique than usual in Podagrion; its outer side is arcuate as well as very oblique, but in its entire extent the pterostigma scarcely surmounts two cellules; the outer side is much thicker than the inner, and thickens below as it passes gradually into the lower border, which, like the costal, is much thickened, and appears the more so from being independent of, although in conjunction with, the median nervure. Beyond the pterostigma the ultranodal approaches the principal nervure very closely, so that they are only half as far apart at the margin as below the pterostigma; there are two supplementary sectors, one between the ultranodal and the nodal, arising below the outer half of the pterostigma, the other between the nodal and subnodal, arising slightly farther back; both of these supplementary sectors are straight, but the nodal is slightly undulated after the origin of the supplementary sectors; all the other veins, excepting the extreme tip of the principal, are straight, and the reticulation tetragonal. The wing appears to be hyaline throughout, the pterostigma very slightly infumated, the nervures fusco-castaneous, those about the pterostigma deepening nearly to black. Apically the wing is well rounded, its apex falling in the middle and not at all produced. A species is indicated of about the size of P. macropus Sel.

Length of pterostigma along costal edge, 1.5^{mm}; of same from inner lower angle to outer upper angle, 2.1^{mm}; breadth of pterostigma, 0.65^{mm}; of wing in middle of apical half, 5.5^{mm}.

Green River. One specimen, No. 4169.

3. LITHAGRION gen. nov. (λίθος, Agrion).

Subnodal sector originating from the nodus, the median a little more than one cellule previous to it, the nodal at a little less than one-third the distance from the nodus to the pterostigma; the latter is stout, dilated, surmounts about five cellules, its inner border a little oblique, its outer slightly

oblique in the same sense. Reticulation dense, mostly tetragonal excepting in the region of the supplementary sectors of which there are two between each pair of sectors from the ultranodal to the short sector, excepting in the interspace between the submodal and the median; none excepting the upper ones are curved, and there is also a single very brief one between the short sector and the superior sector of the triangle Postcostal space simple or nearly so, the inferior sector forming it extending beyond the middle of the wing but not reaching the border. Wings enlarging considerably towards the middle, strongly petiolate nearly to the base of the quadrilateral; this is several times longer than broad, enlarging slightly away from the base, the lower side from a fourth to a third longer than the upper. Nodus situated about one-third the distance from the base to the pterostigma.

This genus is closely allied to Philogenia and Podagrion, the submodal and median sectors having a similar origin, but it is clearly distinct from either; it differs from the former in the structure of the pterostigma, which nowhere departs from the costal margin, in the straightness of the supplementary sectors, the obliquity of the apex of the quadrilateral, the greater distance of the nodus from the base of the wing and the less petiolated and more broadly expanded form of the wing. In the number and position of the supplementary sectors, however, it closely resembles it. From Podagrion it differs in the earlier departure of the nodal from the principal vein, the larger number of cellules below the pterostigma, the much greater number of supplementary sectors, and the more broadly expanded wing: it resembles it rather than Philogenia in the structure of the pterostigma, the petiolation of the wing, and the position of the nodus. It differs even more from Dysagrion, which I have placed in the same group, than from either of these two recent genera. Two species have been discovered, both from Florissant.

Table of the species of Lithagrion.

Wings clear; postcubitals few ..... 1 *L. hyalinum.*
Wings clouded except at base and apex; postcubitals numerous ..... 2. *L. umbratum*

1. Lithagrion hyalinum.

Pl. 13, Fig. 4.

A pair of wings, barely overlapping at the postcostal margin and with the tips broken beyond the middle of the pterostigma, but otherwise in admirable preservation, represent this species; they appear to be upper wings.

The wings are hyaline and are petiolated up to the base of the quadrilateral or some distance beyond the first postcostal nervule. Ultranodal sector originating from a cross vein midway between the nodus and the pterostigma, its course regular and not zigzag throughout its extent; inferior sector of the triangle straight to near its tip, where it bends a little upward, running parallel to the margin and terminating in a cross vein, a little irregular near the tip. Pterostigma dark chocolate brown, the bordering veins thickened and black; being broken its form can not be positively stated, but it appears to be nearly four times as long as its median width and considerably expanded on the under surface, probably surmounting four or five cellules; quadrilateral more than four times its breadth at base, its lower side half as long again as the upper, the outer side very oblique. Nodus rather more than one-third the distance from the base to the pterostigma; sixteen posteubitals. Wings rather slenderer than in L. umbratum.

Probable length of wing, 33^{mm}; breadth, 6.6^{mm}; distance from nodus to pterostigma, 17^{mm}; from nodus to base, 11.5^{mm}; breadth of wing in middle of petiolated portion, 1.3^{mm}.

Florissant. One specimen, No. 8619.

2. Lithagrion umbratum.

Pl. 13, Figs. 12, 14.

Two specimens, one a complete wing, the other lacking only the extreme base and an insignificant fraction of the apical margin, represent this species. Both appear to be upper wings.

The wings are hyaline at base and tip, faintly or distinctly clouded on the disk, the clouded portion having distinct lines of separation from the hyaline area; the inner line is straight and transverse, crossing the wing from the second posteubital veinlet; the outer line is bent or curved somewhat, subparallel to the apical margin, and runs from the middle of the pterostigma to a little beyond the apex of the short sector, bending on the nodal sector. The wings are petiolated very nearly up to the first postcostal nervule, which is placed shortly before the base of the quadrilateral. Ultranodal sector originating from a cross vein a little distance beyond the nodal and shortly before a point midway between the nodus and pterostigma; its course is more or less zigzag at its origin and again in the middle, but is mostly simple; inferior sector of the triangle straight in its basal half,

beyond more or less irregular, increasingly so towards its apex, where it bends upward so as more gradually to approach the border, and finally ends close to the superior sector of the triangle in a cross vein; many of the cellules in the apical half of the postcostal space are broken by cross veins forming a broken supplementary sector here, and the same thing occurs feebly in the interspace above. Pterostigma scarcely more infumated than the disk of the wing, expanding slightly in the middle, about four times as long as broad, surmounting five to six cellules. Quadrilateral very slender, five or six times as long as its basal breadth, its lower about one-fourth longer than its upper side, its outer side oblique. Nodus rather more than one-third way from the base to the pterostigma; twenty-seven postcubitals. Wings rather stouter than in L. hyalinum.

Length of wing, 34.5^{mm}; breadth in middle, 8.5^{mm}; in middle of petiole, 1.5^{mm}; distance from nodus to pterostigma, 18^{mm}; from nodus to base, 10.5^{mm}.

Florissant. Two specimens, Nos. 6927, 8163.

Legion AGRION de Selys.

All the fossil species of this group, both in Europe and America, have been referred to the genus Agrion, which is by far the richest of its members at the present day.

AGRION Fabricius.

This genus, in recent times one of the largest and most cosmopolitan of the legion to which it belongs, is represented in the rocks by a single species in Europe, A. aglaope Heer from Oeningen, and the two species from America here described. Besides these a single immature species has been found in Europe (Oeningen) and another in America (Florissant), which are placed in this group as typical of the Agrionina.

The genus is, as stated, cosmopolitan, but its richest representation is in the tropics, and in the northern hemisphere at least it is more richly developed in the New World. The two species here described from wings are not sufficiently perfect to decide into what subgenus they will fall, but they are certainly closely related to each other and appear to be most nearly allied to Amphiagrion or else to Pyrrhosoma or Erythromma.

The American fossil species of Agrion which are represented by their wings may be separated as follows:

Table of the species of Agrion.

Four antenodal cellules below the short sector; antenodal portion of the costa scarcely arched.
1. *A. mascescens.*

Three antenodal cellules below the short sector; antenodal portion of the costa noticeably arched.
2. *A. exsularis.*

1. Agrion mascescens.

Pl. 13, Figs. 8, 9.

This species is represented by a pretty well preserved specimen and its reverse showing most of the body, a part of the legs and the wings, but the latter confused by the overlying of those of one side upon those of the other. The head is preserved only enough to show its form, which has nothing peculiar, and the same may be said of the thorax. Seven joints of the slender abdomen are preserved, the second of which indicates that the specimen is a male. The head and thorax with the legs are black, but the abdomen is colorless; the legs are doubled up, the femora about as long as the breadth of the head, and the tibial spines, of which there are seven or eight in a row, are a little shorter than the interspaces between adjacent ones The wings are scarcely depressed at the nodus, the antenodal portion of the costal margin almost straight, hyaline with black veins, the pterostigma normal, rhomboidal, slightly longer than broad, alike on both wings, the only difference being in a slightly greater obliquity of the outer and inner margins (and especially of the outer) and the slightly shorter lower margin in the front wing; very pale fuliginous, fading out towards the margins, margined with heavy blackish veins, surmounting a single cellule. The inferior sector of the triangle originates far before the basal postcostal nervule, which is situated slightly nearer the second than the first antecubital nervule. The arculus is directly beneath the second antecubital nervule. There are apparently eleven postcubitals on the fore wing and there are ten on the hind wing. Quadrilateral of the fore wings with the inner and upper side of similar length and half as long as the lower side; on the hind wings the inner side is considerably shorter than the upper, and the latter nearly three-fifths the length of the lower; four antenodal cellules below the short sector; the petiolation begins unusually near the base of the wing or considerably before the first antecubital nervure. The nodal orig-

inates rather less than half-way from the nodus to the pterostigma; the subnodal terminates quite beyond the extreme tip of the pterostigma, the median below its tip, the short sector, which ends in a zigzag course, before the pterostigma and below the origin of the ultranodal; the superior sector of the triangle, which is straight to the tip, midway between the origin of the nodal and the pterostigma; and the inferior sector of the triangle, which becomes zigzag a little beyond the nodus, terminates a little before the last.

Length of wings, 21.3^{mm}; breadth, 4.6^{mm}; distance from nodus to base, 7.25^{mm}; to arculus, 3.4^{mm}; to center of pterostigma, 12.5^{mm}; breadth of head, 3.5^{mm}; diameter of eyes, 1.25^{mm}; length of thorax, 5^{mm}; of femora, 3^{mm}; of tibial spines, 0.25^{mm}; of abdomen (seven joints), 24.5^{mm}; of first joint, 0.6^{mm}; second, 1.8^{mm}; third, 4.4^{mm}; fourth, 5^{mm}; fifth, 4.6^{mm}; sixth, 4.6^{mm}; seventh, 3.4^{mm}; width of last, 1.2^{mm}.

While the venation of the wing proves that this insect belongs in the legion Agrion, the unusually short petiolation of the wing shows that it can not be referred to Telebasis, and the short spines of the tibiæ that it can not be an Argia. To which of the numerous subgenera of Agrion it should be referred can not be determined at present, but from the apparent want of postocular spots and the early origin of the interior sector of the triangle it would appear to be most nearly allied to Amphiagrion or else to Pyrrhosoma or Erythromma. If to the former its affinities are with tropical American forms; if to the latter with temperate forms of either hemisphere

Florissant. Two specimens, Nos. 6824, 7158.

2. Agrion exsularis.

Pl. 13, Fig. 6.

A single nearly perfect wing differs so slightly from A. mascescens that it would appear to belong to the same restricted genus, although from our ignorance of the length of its tibial spines it might be considered an Argia. The wing, which is apparently an upper one, is a little depressed at the nodus, the antenodal portion of the costal margin being somewhat arched, hyaline with black veins, the pterostigma normal, rhomboidal, slightly longer than broad, the outer and inner margins considerably oblique, the outer perhaps the more so, fuliginous, margined, especially within, with heavy black veins, surmounting rather more than one cellule. The inferior sector of the triangle originates before the basal postcostal nerv-

ule or just beneath the first antecubital; the petiolation therefore begins at this point; the basal postcostal lies midway between the two antecubitals; the arculus is directly beneath the second antecubital nervule; there are eleven postcubitals: quadrilateral with its inner side scarcely shorter than its upper, the latter half as long as the lower side; three antenodal cellules below the short sector. The ultranodal originates only two cellules before the pterostigma; the nodal at scarcely less than half-way from the nodus to the pterostigma; the submodal terminates just below the tip of the pterostigma, the median below its middle; the short sector, which has a zigzag course in the outer fourth of the wing, terminates apparently below the base of the pterostigma or scarcely short of it.

Length of wing, 21.65^{mm} (the extreme base is not represented in the plate, although part of it is preserved); breadth, 4.35^{mm}; distance from nodus to base, 7.65^{mm}; to arculus, 3.5^{mm}; to center of pterostigma, 12.5^{mm}.

This species differs from the preceding principally in the longer petiolation of the wing, the arching of the base of the costa, the number of antenodal cellules beyond the quadrilateral, and the more apical termination of the upper sectors.

Florissant. One specimen, No. 8146.

Agrion telluris.

Pl. 13, Fig. 10.

Two nymphs, evidently belonging to the same species, have been found, and, considering the impossibility of determining to which, if any, of the species of Agrionina found in the perfect state they belong, they are treated as distinct, following the precedent set by Heer, and followed by others. The head is full, well rounded in front, squarely truncate and a little angulated behind, about half as broad again as long, scarcely broader than the thorax; the antennæ, or such parts as are preserved, are very slender, a little shorter than the head, the basal joint twice as stout, about twice as long as broad. The legs are very long and slender, especially the hinder pair, which would reach to the base of the antepenultimate abdominal joint; the femora are narrowly and equidistantly four times barred with dark bands, the extreme bands at base and apex; the tibiæ are less than half as broad as the femora and have a broader median dusky band. The dark wing pads are long and slender, twice as long as the width of the abdomen, and less

than half as broad, nearly reaching the extremity of the third abdominal segment. The abdomen is equal, scarcely tapering apically, the joints twice as broad as long, entire, not excepting the last. The caudal flaps or tracheal pads are considerably more than half as long as the abdomen, the middle one, showing on the left in Fig. 10, long, slender, fusiform, pointed apically, largest a little beyond the middle; the lateral pair are much larger and asymmetrical, the inner flange, or the portion of the tracheal pad lying within the median rod, being subequal, but broadest just before the tip, as broad throughout as the broadest part of one flange of the median flap; the outer flange gradually expanding with a slight convexity from the base to a little beyond the middle, where it is twice as broad as the opposite flange, and then tapering rapidly, regularly, and with a scarcely perceptible concavity, to the tip of the median rod; the edges of the pads are delicately denticulate, distantly on the expanding basal portions, more densely on the apical tapering parts and especially on the outer edges of the lateral pads, the denticulations, like the median ribs, being black.

Length of body (excluding terminal flaps), 21^{mm}; of front femora, 3.25^{mm}; middle femora, 3.25^{mm}; hind femora, 5^{mm}; hind tibiæ, 6.25^{mm}; hind tarsi, 2.25^{mm}; wing pads, 6.5^{mm}; breadth of head, 3.5^{mm}; thorax, 3^{mm}; base of abdomen, 2.65^{mm}; tip of same, 2.1^{mm}; length of terminal flaps, 7.5^{mm}; breadth of lateral flaps, 2^{mm}.

In the present state of our knowledge of the larvæ of Agrionidæ it is impossible to indicate with any certainty the position of this nymph. The absence of any sign of the mask, too, will remain a difficulty when we are more familiar with the living forms, but the small size of the head and the shape of the antennæ and caudal flaps will afford good points for comparison.

Florissant. Two specimens, Nos. 13525, 14174.

Tribe ÆSCHNINA Hagen.

This group of larger Odonata seems to have been less richly endowed with species and genera than the other families both in past times and at present. The most recent study of the group by de Selys, which has just appeared, divides the Æschnidæ proper into five genera and twenty-three subgenera, of which Æschna, with more than half the subgenera, embraces more than half the one hundred and fifty known recent species and is cosmopolitan. It also embraces all the known fossils from the Tertiaries,

excepting one from Radoboj, an Anax, first described as Æschna metis by Heer. Four fossil species are known from the Old World and two are here described from the New. Of the Old World types one is merely mentioned by Hagen as found in amber and is represented only by the tip of a wing. A second, from Bornemouth in England, has been figured by Goss without a name. It appears to belong to the subgenus Basiæschna, but, as it is certainly incorrectly drawn in some particulars, it may be in those, such as the simplicity of the subnodal sector, upon which this suggestion is based. The other two, Æschna polydore and Æ. tyche from Oeningen, were described nearly thirty-five years ago by Heer, and are certainly very closely allied, though distinct, as Heer pointed out. They seem to belong pretty certainly to Æschna s. s., and are apparently not far removed from the European Æ. mixta Latr., as I judge from direct comparisons with the entire series referred by de Selys to Æschna s. s., which I have had the opportunity of studying in the Cambridge Museum through the favor of Dr. Hagen. Heer also directly compares the former to that species, as I subsequently noted. Our independently formed opinions have therefore completely coincided. These two species are also very nearly allied to one of the American forms, which, however, more closely resembles a common American species, Æ. constricta Say. The other American fossil belongs to Basiæschna. The resemblance of the Tertiary æschnid fauna of Europe and America appears therefore to have been tolerably close. (September, 1883.)

ÆSCHNA Fabricius.

All the fossil Æschnina known, excepting one (an Anax), belong to Æschna, two European and one American to Æschna proper, and one from each country to Basiæschna.[1]

The species of Æschna from Florissant known by their wings may be separated thus:

Table of the subgenera of Æschna.

Subnodal sector forked, its upper fork separated from the nodal by a single row of cells; pterostigma hardly more than three times as long as broad and only one-fourth as long as the space between it and the nodus ..... 1. *Æschna s. s.*

Subnodal sector simple, separated from the nodal by three rows of cells; pterostigma four or five times as long as broad, more than one-third as long as the space between it and the nodus.

2. *Basiæschna.*

[1] Vide supra.

1. Subgenus ÆSCHNA Selys.

This group of the genus Æschna is a cosmopolitan one, and includes a larger proportion of the species than any other. To it belong two European and one American fossil species, all closely allied, but the European more nearly related to an existing European species, Æ. mixta, the American to an existing American species, Æ. constricta, than to any others.

ÆSCHNA (ÆSCHNA) SOLIDA.

Pl. 13, Fig. 1.

A remarkably well preserved front wing, the extreme base only lost Wing of rather small size and rather slender, the middle line of the basal half bent at a slight angle with that of the apical half; tip of the wing uniformly rounded; nodulus above the principal sector strongly and rather regularly curved, much nearer the pterostigma than the base; nodal sector curved rather gently upward in the middle portion of its course but terminating some distance below the apex of the wing; subnodal sector forked widely a little before the pterostigma, the upper fork turning abruptly upward at its origin; the intercalated sector between the subnodal and median forked below the base of the pterostigma, its upper fork also curved upward and separated at tip from the lower fork of the subnodal by only a single row of cells, as usual; median and short sectors separated in the apical half (or less) by a double row of cells in the discoidal field below the triangle, first two, then three, and afterwards four or five rows of cells irregularly disposed. Pterostigma scarcely four times as long as broad, the inner and outer margins very oblique and parallel; color blackish castaneous, the bordering veins black. Antecubitals more than twenty-two (probably about twenty-five), postcubitals fifteen.

Length of wing more than 41^{mm} (probably 44^{mm}); breadth, 10.5^{mm}; distance from nodulus to base of pterostigma, 15^{mm}; length of pterostigma, 4^{mm}.

This species plainly belongs to the subgenus Æschna. By favor of Dr. Hagen I have compared it directly with all the species referred by Selys to that group, excepting a couple of rare forms, and unquestionably it is most closely allied to Æ. constricta, though closely resembling Æ. marchali. Indeed, the resemblance to Æ. constricta is closer than I have yet found between any well preserved Florissant insect and any living

type; it agrees better with it than Æ. constricta does with any other living form. The nodal sector of Æ. solida is not so strongly curved as in Æ. constricta, and the pterostigma of the fossil is slightly longer; these are the most important distinctions that were noted.

Florissant. One specimen, No. 8347.

2. Subgenus Basleschna Selys.

As was stated in the general remarks under Æschnina, Goss's unnamed Æschnid from Bornemouth, England, probably belongs to this group; an interesting fact since, so far as I know, it is exclusively an American group, and one of our own fossils falls therein. It is the only subgenus of Æschna besides Æschna proper which is known in a fossil state.

Æschna (Basleschna) separata.

Pl. 13, Fig. 15.

A complete front wing and its reverse broken near the course of the median sector and the part below crowded up against the upper portion, so as to confuse the parts next the line of fracture.

The wing is of rather small size, rather slender and straight; the tip is slightly angulated rather below the middle of the wing; nodulus placed at almost two-thirds the distance from the base to the pterostigma, scarcely directed backward above the subcostal, below that straight, directed somewhat forward and reaching the subnodal; nodal sector curved rather strongly and somewhat rapidly upward in the middle part of its course, terminating a little distance below the tip of the wing; subnodal sector simple and beyond the base of the pterostigma subparallel to the nodal; the intercalated sector between the subnodal and the median simple, but curved in the course of what would be the superior fork if it were branched, and even more strongly curved than in Æschna solida; median and short sectors separated apically by a double row of cells, but to how far from the margin can not be seen; in the discoidal field below the triangle there are at first two, then three, and afterwards four or five rows of cells, the last arranged in somewhat obscure oblique series. Pterostigma five times as long as broad, both outer and inner margin very oblique, but the outer much more so than the inner; the color uniform pale clay brown, but the thickened bordering veins black. Antecubitals twenty-three, postcubitals thirteen.

Length of wing, 44^{mm}; breadth, 10.2^{mm}; distance from base to nodulus, 21.5^{mm}; from nodulus to base of pterostigma, 13.2^{mm}; length of pterostigma, 5^{mm}.

This species differs from *E. solida* in its more pointed tip, straighter form, simple subnodal sector, which is separated from the nodal by three rows instead of one row of cells, and by the greater approximation of the nodulus to the pterostigma as well as by the greater length of the latter.

It is very closely related to *Æschna janata* Say, which Selys makes the type of his Basiaeschna. The nodal sector has precisely the same curve just before the pterostigma, and it differs mainly in the more arcuate tip of the principal nervule intercalated between the subnodal and median sectors.

Florissant. One specimen, Nos. 8164 and 11693.

ÆSCHNA LARVATA.

Pl. 13, Fig. 11.

A single specimen of a larva has been found belonging to this genus and not improbably belonging to one of the species described; but as this can not from the nature of the case be determined it will be best to give it a distinct name for ready reference. The front half of the body is rather obscure, but the outline shows the form with sufficient distinctness. The body is largest in the middle of the abdomen, scarcely decreasing in size anteriorly, but posteriorly narrowing somewhat rapidly beyond the fourth abdominal segment; the outer edges of the posterior borders of the segments are not produced; the three anal valves are distinctly seen, are very slender and finely pointed; one of the legs is preserved, showing that it is slender and of the usual form.

Length of body, 34.5^{mm}; breadth in middle of abdomen, 7.5^{mm}; at base of abdomen, 6^{mm}; at base of anal valves, 2.5^{mm}; length of latter, 3.25^{mm}; of femur of hind (?) leg, 6^{mm}; of tibia, 4.5^{mm}; of tarsi, 4.25^{mm}.

Florissant. One specimen, No. 1816.

Tribe LIBELLULINA Hagen.

A small number of species of this tribe occur in the European Tertiaries.

LIBELLULA sp.

Pl. 6, Figs. 4, 16.

(*Libellulina*) Scudd., Bull., U. S. Geol. Geogr. Surv. Terr., IV, 775 (1878).

Fragments of an abdomen in obverse and reverse are probably to be referred to Libellula only in the broadest possible sense, but they are insufficient to give further determination. They evidently represent four or five of the terminal segments of the body, there being first three segments of equal breadth and a similar length, a little longer than broad, with a slight median carina; and then three others without a median carina and with continually decreasing length, the first of them (probably the eighth segment) half as long as the preceding, but of the same width; the next half as long as the one which precedes it, but narrower, and the last still narrower (but imperfect).

Length of the fragment, 20^{mm}; of its third (seventh? abdominal) segment, 4.5^{mm}; breadth of same, 3.5.

Green River, Wyoming. One specimen, Nos. 4175 and 4176.

Suborder PLANIPENNIA Burmeister.

The collections obtained at Florissant embrace eight genera and thirteen species of planipennian Neuroptera. All of the species and four of the genera are new, and belong to four families. The Raphidiidae are the most numerous, embracing Raphidia, with a single species, and Inocellia with four; the species referred to Raphidia hardly belongs to it in a strict sense, since the costal vein is excessively short, there are no costal veinlets, and the sectors do not originate obliquely from the radius, but more indirectly by transverse veins; all the species of Inocellia, which fall into two sections, differ from living types and also from the species found in Oligocene amber of the Baltic in having no transverse series of regular discoidal areoles below the pterostigma. A single species of Osmylus represents the Hemerobidae, and differs from living forms, as does also the amber species, in the simple character of the costal nervules, the much smaller number of sectors, and the limited supply of cross-veins in the basal half of the wing, giving this region a very different appearance from its rather close reticulation in modern types. It may here be noticed that as a very general rule the neuration of the wing is much closer in modern Planipennia than in their Tertiary representatives.

There are four species of Chrysopidæ, referable to two genera, each of them extinct; Chrysopidæ have not before been recognized in Tertiary strata, the single species poorly figured by Andrä, and never carefully studied, being much more probably one of the Hemerobidæ. These two genera, called Palæochrysa and Tribochrysa, are allied to the living Nothochrysa, but differ from modern types in the zigzag course of the upper cubital vein, and in its direction, which is through the middle of the wing, as well as by the smaller number of sectors and the entire absence of any transverse series of gradate veinlets; Palæochrysa is represented by a single species, Tribochrysa by three, and the genera differ from each other in the course of the upper cubital vein, which in Palæochrysa is direct and bordered by comparatively uniform cells, while in Tribochrysa it is doubly bent in the middle, and is therefore bordered by very unequal cells. Two species of Panorpidæ have been found, one of which is referable to a new genus, Holcorpa, which differs from Panorpa in the entire absence of cross-veins, and is remarkable for the spots on the wings. All these have been discovered at Florissant only. No planipennian Neuroptera have been found in the Green River shales, but the Tertiary beds of British Columbia have furnished a single species of Hemerobidæ, belonging to an extinct genus allied to Micromus, and which I have called Bothromicromus; and we have remains of one of the Sialidæ from beds of Laramie age in Colorado, which is introduced here.

The number of species of Tertiary Planipennia is nearly doubled by the discoveries already made in the American Tertiaries, but the families, and especially the genera, are very differently represented on the two continents; thus the Raphidiidæ have in Europe only one species of Inocellia, while, on the other hand, the Hemerobidæ show one or more species each of Nymphes, Sisyra, Hemerobius, and Osmylus. The Chrysopidæ, as stated, are unrepresented, although two species are known from the Jura. The Panorpidæ have one species of Panorpa and three of Bittacus, while there are also two species of Ascalaphus and one each of Myrmeleon, Chauliodes, and Coniopteryx, belonging to families not found fossil in this country. (September, 1883.)

Family SIALINA Leach.

This family is composed of two groups, each represented in our rocks. As they differ somewhat remarkably in history and distribution, such general remarks as can be made will appear in contrasting the statements which follow under each.

Subfamily SIALIDÆ Stephens.

The Sialidæ are evidently an expiring type. A considerable number of Paleozoic forms have been referred, with more or less reason, to it or its vicinity, and certainly the resemblance of its modern genera to the bulk of the ancient neuropteroid types is greater than can be affirmed of any other modern group. Yet even in the Mesozoic period we know of comparatively few examples: Hagen refers an undescribed species from the Jura to Corydalus: Westwood figures a Sialium from the Purbecks, and the species given here, belonging to the disputed Laramie beds, is known only by its egg-masses: I have also shown that the larval Mormolucoides articulatus Hitchc. from the Connecticut River sandstones is to be regarded as a sialid. In Tertiary times, where the number of insects known is vastly increased, we find no greater representation. One species only, Chauliodes prisca, from the amber, is well known; Gravenhorst and Burmeister speak of a Semblis from amber, which may be the same as Hagen's, above mentioned: and an insect's leg from Rott has been doubtfully referred here. No species of this group has been found in the American Tertiaries. So too we find the existing species very meager as compared with other families of Neuroptera; but that some existed in American Tertiaries can not be doubted by any who will compare our huge living Corydalus with the still more gigantic Corydalites from the Laramie beds. (September, 1883.)

CORYDALITES Scudder.

Corydalites Scudder, Bull. U. S. Geol. Geogr. Surv. Terr., IV, 537 (1878).

The egg-masses thus named were described by me in 1878, but it was not until the publication of a figure of one of them in Zittel's Handbuch der Palæontologie, in 1885, that their existence in beds of quite similar age in Europe was recognized. On this point I may quote from a letter written me by the Marquis de Saporta in May, 1886:

Il m'a suffi de jeter les yeux sur votre figure 981 pour reconnaître l'identité parfaite de votre Corydalites fecundum avec des corps fossiles, ayant même aspect et même composition qui ont été recueillis en assez bon nombre et *parfaitement* conservés dans notre terrains à lignites de Fuveau près d'Aix, et justement ces lignites sont maintenant rapportés universellement au Garumnien inférieur, et même plus bas au Campanien, c'est à dire, à l'horizon de la craie supérieure. Il est donc très intéressant de constater la présence de ces nids ou réunions d'œufs de Corydalis, au même niveau, en Europe comme en Amérique et probablement dans les mêmes conditions de dépôt. Les Corydalites fecundum ont été recueillis à Trets près de Fuveau dans les lits charbonneux exploités, où ils se trouvent associés à des feuilles de Nelumbium. Il est même visible que ces Nelumbium ont vécu sur place et les Corydalites ont du vivre côte à côte et placer leurs œufs dans des mêmes lieux.

Corydalites fecundum.

Pl. 4, Figs. 5–7, 13–16, 18–21, 23.

Corydalites fecundum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 537–540 (1878); in Zittel, Handb. Palæont., I, II, 776, Figs. 981a, b (1885); White, Rep. U. S. Geol. Geogr. Surv. Terr., XI, 173–174 (1879).

Under this name I have classed an insect which laid some remarkable egg-masses, obtained in numbers by Dr. C. A. White, at Crow Creek, fifteen miles northeast of Greeley, Colorado, in lignitic beds of the Laramie group. These egg-masses are five centimeters in length by nearly two in breadth and one in height, nearly equal throughout, rounded and slightly pointed at the tips, and of a dirty yellowish brown. They are estimated to contain each about two thousand eggs definitely arranged, and coated with a covering of what was presumably albuminous matter, which also surrounds each egg. The close general resemblance of these eggs and of their clustering to that of the eggs referred by Mr. C. V. Riley to the neuropterous genus Corydalus[1] leave little doubt concerning their probable affinities. Mr. Riley's description is as follows:

The egg-mass of Corydalus cornutus is either broadly oval, circular, or (more exceptionally) even pyriform in circumference, flat on the attached side, and plano-convex [broadly convex is doubtless meant] on the exposed side. It averages 21^{mm} in length, and is covered with a white or cream colored albuminous secretion, which is generally splashed around the mass on the leaf or other object of attachment. It contains from two to three thousand eggs, each of which (Pl. 4, Figs. 17, 22) is 1.3^{mm} long and about one-third as wide [he figures them of a slenderer form], ellipsoidal, translucent, sordid white, with a delicate shell, and surrounded and separated from the adjoining eggs by a thin layer of the same white albuminous material which covers the whole. The outer layer forms a compact arch, with the anterior ends pointing inwards, and

[1] It has been suggested that these may belong rather to Chauliodes, a closely allied genus of Neuroptera; but Mr. Riley declares that they are identical with those found in the body of Corydalus.

the posterior ends showing like faint dots through the white covering. Those of the marginal row lie flat on the attached surface; the others gradually diverge outwardly, so that the central ones are at right angles with said object. Beneath this vaulted layer the rest lie on a plane with the leaf, those touching it in concentric rows, the rest packed in irregularly.[1]

In the fossil ootheca the mass is much larger and more elongated, and possesses besides one characteristic in which it differs strikingly from that of Corydalus (and on which account particularly I have used a new generic appellation), viz, the division of its mass into two longitudinal and equal halves by an albuminous wall, or rather by double albuminous walls, which may be parted above, leaving as the only connection between the two halves their common albuminous floor. There are indeed a few specimens which show no sign of this division, but a median furrow, or a deeper and more complete separation of the two halves, is so prevalent that this seems to be the only explanation to be offered for its appearance. Their absence in the few specimens is probably due to defect of preservation. The common albuminous floor and the upper and outer albuminous coating are of remarkable thickness, varying from one to three millimeters; but the coating attenuates to a mere lamella as it passes down the median furrow, so that when the mass remained quiet in the position in which it was laid, the lateral halves pressing closely against each other, the combined thickness of the two albuminous walls would together no more than equal the ordinary thickness of the albuminous partition between any two contiguous eggs. That such a partition existed even in those which do not now show it seems probable from the regularity of the furrow in every instance of its occurrence and by its prevalence; some specimens merely show a sharp groove along the middle, the halves remaining in complete juxtaposition;[2] others again are so completely separated as to be curled over and meet beneath (Figs. 19, 23).

This, together with the fact that the egg-mass is otherwise extremely regular (showing only so little plasticity as to allow one broad side to be straight, while the opposite is a little convex) and never exhibits the slightest tendency to coil longitudinally, leads me to believe that the egg-masses were laid in the water of shallow basins, upon the muddy floors, which

[1] Proc. Am. Assoc. Ad. Sci., vol. 25, pp. 277–278.

[2] These specimens are some from which weathering has removed their outer albuminous coating; perhaps, if this had remained, the furrow would have been concealed by the complete union of the attingent albuminous walls.

could be reached by the abdomen of the insect while resting upon a stone or overhanging twig. In this medium the albuminous secretion would expand to the utmost; if the bunch of eggs remained undisturbed, it would present us with the more regular hirudiniform masses that have been found; if rolled about by the disturbance of the waters, the two halves would curl toward each other more or less closely, forming a subcylindrical mass, and inclose between their approaching walls more or less of the mud in which they are rolled. This is exactly the appearance of most of them now, inclosing the same substances as that within which they and the accompanying Bulimi and other fresh-water mollusks lie embedded.[1]

These masses differ from those of Corydalus in the extraordinary amount of albuminous matter which surrounds both the entire mass (Fig. 16) and each individual egg (Fig. 7). This is perhaps to be explained by the medium in which they appear to have been laid, and will in part account for the vast size of the ootheca, which are much larger than any mass of insect eggs which I can find noticed. The size of the mass, however, is also due to the greater magnitude of the eggs themselves, which are twice as long as and proportionally larger than those of Corydalus (Figs. 17, 21), and lead to the conviction that we are to look in the rocks of the Laramie Group for an insect of great magnitude, closely allied to our Corydalus, itself the largest of all known Sialina. It can hardly be doubted that it must have been at least double the size of the living type. The number of eggs laid is about or nearly the same as in Corydalus, presuming, in either case, all to be laid at once.

Compared with the eggs, the albuminous substance surrounding them is much softer, more or less friable, and easily removed, being everywhere composed of fibers running in the same direction as the longitudinal axis of the egg. The weathering of the specimens has been such that in several instances the whole albuminous cap has been removed, and in others a large part also of the interovular partitions, leaving the eggs standing erect, each separated from its neighbors by from one-third to one-half its own thickness. In many cases the eggs can be pulled from their cells; and, although frequently flattened, they may be studied almost as well as if living.

The eggs (Fig. 21) have an average length of 2.6^{mm} and a central

[1] The deposit in which they occur is a fresh-water one; but Mr. Lesquereux informs me that brackish-water forms are found both above and below them. For details concerning the age of the deposit and the fossils associated with Corydalites, see the article by Dr. C. A. White, quoted above.

width of 0.6[mm]: they are nearly cylindrical, but faintly arcuate, slightly attenuated at the anterior extremity, and slightly tumid on the posterior half, at the tip of which they taper rapidly, rounding off to a rather broadly convex extremity, which is flattened or often sunken in a circular central space 0.1[mm] in diameter (Fig. 7), outside of which the surface is rather profusely filled with very shallow, obscure, circular pits, averaging 0.01[mm] in diameter. The anterior extremity (Figs. 5, 6) terminates in a slightly elevated, thin, subtubereulate rim, inclosing a terminal portion, whose surface gradually rises centrally to form a truncated cone, and is pitted with saucer-like depressions, gradually diminishing in size up the sides of the central extension; the latter is about as long as the breadth of its tip: its extremity (Fig. 18), 0.04–0.055[mm] in diameter, is more or less sunken, with a central circular pit (the micropyle) 0.01[mm] in diameter: while the rounded margin of the extension is made more or less irregular by the saucer-like depressions which surmount it, but have now become of extreme minuteness.

This structure of the anterior extremity of the egg agrees with what was previously known of the egg of Sialis, but no mention of the elevated point was made in Mr. Riley's description of the egg of Corydalus. It occurs there, however, as I find by examination of eggs he has kindly sent me. These eggs of Corydalus (Figs. 17, 22) also show the sunken space at the posterior end, and the sides of the egg are marked nearly as in the fossil, the surface of the latter being broken up by scarcely elevated, slight ridges into obscure, transverse, hexagonal cells, one-tenth of a millimeter long (across the egg) and one-fifth as broad, those of adjoining rows interdigitating.

In the disposition of the eggs also these masses differ from those of Corydalus, for they are arranged in a radiating manner around the longitudinal axis of the ootheca. All of them partake of this arrangement even when, as rarely happens, there are two layers in place of one over parts of the mass; in no case are any of the eggs packed in irregularly, as is the case with a portion of those of Corydalus, according to Riley. As in Corydalus, however, the posterior ends are those which are directed toward the upper albuminous coating, which in many cases shows very slight subhexagonal or circular depressions or elevations corresponding to the position of the extremity of the egg beneath, just as in Corydalus the posterior ends of the eggs show "like faint dots through the white covering." The outer albuminous coating appears in the fossil to be made up of

as many parts as there are eggs, the interovular fibrous material extending to the surface of the ootheca, forming walls to deep cells which contain eggs, and which are corked up, as it were, by plugs of albuminous material. These plugs seem to be very similar to the cell-walls, having been composed apparently of viscous threads, also running in the same direction as the longitudinal axis of the egg; but in some cases the cell-walls beyond the eggs have become blackened, while the plugs retain their normal color and separate readily from them.

When the egg-mass was undisturbed, the outermost eggs lay horizontally, and those next the median furrow vertically (Fig. 15): the division walls of the cells were therefore thinnest below, and it appears probable that the young made their escape at the bottom of the median furrow, where the outer coating is also thinnest, though not so presented in the schematic figure. Where double layers occur, the eggs of the upper seem to be in a direct line with those of the lower layer, egg for egg, as if a cell of double length were stocked with two eggs, separated by an albuminous partition, and in this case the albuminous floor and covering are thinner than usual, so that the egg-mass is not greatly enlarged nor distorted. When two layers were thus formed, the young larvæ of the upper layer must have escaped through the emptied cells of the lower.

It only remains to add that with a single exception these masses differ comparatively little in size, most of them being nearly or quite five centimeters long, although some scarcely exceed four centimeters. The single exception is of a mass only a little more than fifteen millimeters long, six millimeters broad, and three millimeters high. It shows no furrow, but may represent only one lateral half of an egg-mass, as the walls of one side are steeper than those of the other and look like the sides of a median furrow. This mass is so small that only by presuming one-half to be gone and the albuminous covering to be thinner than usual can it be regarded as belonging to the same species with the others, although evidently of a similar nature. In case it belongs to the same species, it may be looked upon as probable that a female usually deposited all her eggs in a single bunch, but that in this case some accident preventing it, the remnant was subsequently laid in a mass of much smaller dimensions, one-half of which is preserved. This is the view I am disposed to adopt.

Crow Creek, near Greeley, Colorado (Laramie group). Dr. C. A. White. Many specimens.

Subfamily RAPHIDIIDÆ Stephens.

Hitherto only one species of this group has been found in Tertiary beds, and its earlier existence is unknown; this single instance is Inocellia erigena from amber. Now, however, we find them in the rocks themselves, as five species from Florissant are before us, one belonging probably to Raphidia, the others to Inocellia. This is perhaps one of the most striking of the facts yet discovered in the American Tertiaries; for the known species of this family not only are exclusively north temperate[1], but almost exclusively gerontogeic, the only form known from this country east of the Sierra Nevadas being a (probably introduced) European species: several, however, are known from the west coast, whose insect fauna is well known to have very strong European, or at least gerontogeic, affinities. A point of additional interest is the fact that so many species of Inocellia are found and only one of Raphidia (and that doubtful), when Raphidia is very rich and Inocellia very poor in species at the present time. As already stated, the amber species is also an Inocellia. (September, 1883.)

Table of the genera of Raphidiidæ.

Pterostigma crossed by veinlets and therefore composed of more than one cell; wings three times as long as broad ..... 1. *Raphidia.*
Pterostigma composed of a single cell: wings more than three times as long as broad..... 2 *Inocellia.*

1 RAPHIDIA Linné.

The single species referred here differs considerably from modern forms in the brevity of the costal vein, the absence of costal transverse veinlets, and other features of the neuration which render its reference to Raphidia doubtful. It can not be referred to Inocellia on account of the structure of the pterostigma, and it should perhaps be considered as belonging to a distinct genus. If a true Raphidia it is the first one that has been found fossil.

RAPHIDIA (?) TRANQUILLA.

Pl. 14, Fig. 2 (♂).

A single specimen in which the head is wanting and the four wings are overlapping; the neuration is almost exactly similar in all the wings, and they are of equal size, but for the sake of clearness only one of them, an upper wing, has been drawn for the plate.

[1] It was by error that I alluded to these genera as indicative of a warmer climate for ancient Florissant in the Annual Report of the U. S. Geological and Geographical Survey for 1878, p. 292.

The wings are considerably longer than the abdomen, oval, rounded at the tip, with a gently convex inner margin and a nearly straight costal margin. The neuration is distinct and black and in the front wings as follows: The pterostigma is small, semi-oval, fuliginous, deepening centrally, situated in the middle of the apical half of the wing at the costal margin, cut obliquely by a curving transverse veinlet at its outer extremity. The costal margin is scarcely expanded at the base, and the costal vein is exceedingly short, terminating in the margin before the end of the basal third of the wing: this feature, with others in the neuration and the total absence (as far as can be seen) of costal transverse veinlets, renders it doubtful whether it belongs to Raphidia in a strict sense. The subcostal vein therefore forms a considerable part of the costal border and is widely separated from the radius and connected with it by a single transverse veinlet in the middle of the wing. The sectors do not arise obliquely from the radius, but are connected with it by straight transverse cross-veins, making two long and large pentagonal cells in the middle of the wing beneath the radius, equally broad at both ends. There are three long discoidal areolets, the uppermost narrow, the middle one shorter than the others, the outer limits of all of them nearer to the apical margin than to the inner limits, making the marginal areoles shorter than the discoidal: all the areolets of the central portions of the wing are large, being few in number, and they approach rather near the margin, with which they are connected by few, seldom and then simply furcate, marginal veinlets

Length of thorax, 1.85^{mm}; of abdomen, 5.2^{mm}; of wing, 7.75^{mm}; breadth of latter, 2.55^{mm}.

Florissant. One specimen, No. 4383 (*f*).

2. INOCELLIA Schneider.

The occurrence of a species of this genus in amber and its present existence only in the north temperate region of the Old World and of our extreme western coast, where the affinities of the fauna are decidedly European, render the discovery of four species in our Colorado Tertiaries one of special interest. It is curious, however, that they differ not only from the modern forms, but also from the amber species, I. erigena Menge, in lacking the regular arrangement of the cells below the pterostigma to form a transverse uniform series of discoidal areoles.

The species may be separated thus:

Table of the species of Inocellia.

Central sector of the front wing (or the sector which traverses the middle of the wing above the cubital cells) arising from a broken series of transverse veins connecting the radius and anal vein ..... 1. *I. veterana.*

Central sector of the front wing arising in the angle of, and bisecting, the basal cell formed by the junction of the radius and its basal branch.

Longitudinal row of cells below the radius of equal or subequal length.

Front wing about two and a half times longer than broad; cells just above the cubital cells no longer than they and shorter than those in the row just beneath the radius; prothorax strongly tapering ..... 2. *I. somnolenta.*

Front wing more than three times as long as broad; cells just above the cubital cells much longer than they and as long as those in the row just beneath the radius; prothorax equal. 3. *I. tumulata.*

Longitudinal row of cells next below the radius of very unequal length ..... 4. *I. eventa.*

1. Inocellia veterana.

Pl. 14, Fig. 1.

A single specimen has been found, in which the two front wings are preserved with an obscure body, lacking the head. This front wing is considerably longer than thorax and abdomen together, nearly four times as long as broad, the apical margin well rounded, not at all produced. The venation is distinct, dark castaneous; the pterostigma is of considerable size, faint castaneous, about four times as long as broad, equal, terminated interiorly by a transverse, exteriorly by a very oblique nervule. The costal margin is straight from the base to the pterostigma with no expansion whatever; the figure of the right wing on the plate is incorrect in this particular, a faint expanded vein being represented where none exists. The subcostal vein runs parallel with the costal vein in the basal half of the wing, and is connected with it by four or five transverse or oblique veinlets, then suddenly turns upward and joins it at some distance before the pterostigma. The radius runs parallel to the costal vein throughout, and is connected with the subcostal by two or three transverse veinlets. The sectors, or longitudinal veins of the central portion of the wing, do not arise at intervals obliquely from the radius as they do in the other species, as well as in the amber Eogena and in modern types, but together form a broken transverse veinlet, curving around from beyond the middle of the basal half of the radius to the anal vein and at intervals from the upper sector. It seems, therefore, to form a somewhat distinct group of Inocellia. There are two sectors springing from the first sector, one in the middle, the other

in the middle of the outer half, of the wing; beyond the origin of the first sector, or the broken set of transverse veinlets of which its base forms the origin, there are four or five very long subhexagonal cells just below the radius, the third from the base reaching the middle of the pterostigma. The number of sectors is so large that, omitting the marginal cells, there are six radiating series of cells between the radius and the anal vein. The cells of the marginal series are of very varying size and shape, but the veins which form them are very rarely forked.

Length of thorax and abdomen, 7.5^{mm}; of wing, 9^{mm}; breadth of same, 25^{mm}.

Florissant. One specimen, No. 1.385, obtained by the Princeton Expedition.

2. Inocellia somnolenta.

Pl. 14, Fig. 12 (♀).

One specimen belonging here, with its reverse, consists of a head and thorax with fragments of legs and wings, among the latter one nearly perfect front wing overlying part of a hind wing. The head is slender and very long oval in shape; the thorax stout with a greatly and regularly tapering prothorax forming anteriorly a very slender neck. Front wing well rounded, rather broad for its length, though its exact breadth can not be told from the broken edges. The neuration is distinct and black, the pterostigma faint, fuliginous, long, and equal, about four times as long as broad, squarely margined basally, obliquely margined distally. The costal margin is nearly straight, gently and slightly expanded, the subcostal vein terminating upon it before it reaches the pterostigma by nearly the length of the latter. Beyond the basal cell, which is bisected by the last sector, and corresponds to the cell situated within the broken series of transverse veinlets in I. veterana, there are immediately below the radius three very long subpentagonal cells, the second reaching beyond the middle of the pterostigma. Omitting the cells which border the margin, there are five radiating series of cells between the pterostigma and the anal vein: the cells are fairly large, varying much in shape but rarely more than twice as long as broad, the terminal veinlets next the margin frequently and widely forked.

Length of head, 2^{mm}; breadth of same, 0.8^{mm}; length of thorax, 4.5^{mm}; breadth of same, 2.4^{mm}; breadth of neck, 0.3^{mm}; probable length of prothorax, 2^{mm}; its breadth at base, 1.75^{mm}; length of fore wing, 7^{mm}; its probable breadth, 2.5^{mm}.

Florissant. One specimen, Nos. 9373 and 10389.

Another specimen shows the apical half of two overlapping fore wings, which differ so little from the preceding that I place it here at least provisionally; it differs principally in the point of immediate origin of one of the veins terminating in the apex, which in the specimen first described originates in the distal, in this specimen in the proximal of the two cells immediately below the pterostigma.

Florissant. One specimen, No. 2603.

3. Inocellia tumulata.

Pl. 14, Fig. 15 (♂).

The species is represented by a single specimen and its reverse in which the entire body and nearly the whole of the four wings are preserved. The head is obscure and ill-defined in part, with no appendages preserved, obpyriform in shape, being broadest in the middle of the anterior half or about three-fourths the length, the front broadly rounded, behind tapering rapidly, so that the base is narrower than the narrow neck formed of the prothoracic segment. This is nearly four times longer than broad, less than half as broad as the head and apparently equal, though the imperfection of the part renders this doubtful. The meso- and metathoracic mass is robust, nearly twice as broad as the head, while the abdomen is only a little broader than the head, equal, and somewhat longer than the rest of the body. The legs, excepting the fragment of a hind femur, are not preserved.

The wings, and especially the front pair, which is considerably longer than the hind pair, are longer than the thorax and abdomen together and more than three times as long as broad. One front wing is almost entirely preserved and separate from the others, so as to be easily studied; the other front wing, of which only a fragment can be seen, overlies the overlapping and reversed hind wings; they do not so closely overlap as to confuse the neuration greatly, and hence nearly the whole can be deter-

mined, or as far as it is preserved. The front wing is long and rather slender, slightly enlarging apically, so as to be broadest at the inner half of the pterostigma, the apex well rounded, the costal margin straight, at base broken so that one may not say whether the wings were here expanded or not. The veins of the front wing are black, of the hind wings blackish brown. The pterostigma of the front wings is of moderate size, very dark fuliginous, its proximal margin transverse, its distal very oblique; excepting its tapering apical portion, it is nearly equal in breadth or slightly enlarging in the middle and about twice as long as broad: the figure is here not quite correct. The subcostal vein is straight and strikes the costa at a little more than the pterostigma's distance before the latter; the space between it and the costa is broken by oblique cross-veins, of which only one remains near the middle of the wing. The radius runs close to the subcostal vein, and is connected with it by a single transverse vein at the middle of the wing. Beyond the basal cell, which is bisected obliquely by the last sector, there are, just below the radius, three moderately long pentagonal cells, the second reaching nearly to the middle of the pterostigma. Omitting the marginal cells, there are six radiating series of cells between the pterostigma and the anal vein; the cubital cells are large and broad, being not more than twice as broad as long, while all the other large cells of the wing are exceedingly long and slender, often several times longer than broad, scarcely, if at all, broader in the middle than at the ends, the transverse veins being comparatively few; the terminal veinlets of the apical half of the lower border are simply and widely forked.

In the hind wings, the lower half only of which is preserved, all the terminal veinlets appear to be forked, and excepting at the upper part of the apex, the sectors, which are broadly sinuous, appear to be very rarely connected by transverse veinlets even near the border; at least almost none can be detected.

Length of body, 11.8^{mm}; of head, 1.8^{mm}; breadth of same, 1^{mm}; length of prothorax, 1.6^{mm}; breadth of same, 0.35^{mm}; breadth of thorax, 1.7^{mm}; length of abdomen, 5.75^{mm}; breadth of same, 0.85^{mm}; length of fore wing, 9^{mm}; its breadth, 2.7^{mm}.

Florissant. One specimen, Nos. 956 and 4330 (♂).

4. Inocellia eventa.

One specimen of this species is preserved in which all four wings closely overlapping one another are attached to a partly preserved body sufficiently preserved to judge by the extremity of the abdomen that it was probably a male, and by its long slender and equal prothorax that it did not differ in this respect from I. tumulata. The base of the wings is too obscure for determination, but the course of the veins renders it probable that the central sector, of the hind wings at least, arises in the angle of the basal cell formed by the junction of the radius and its basal branch; and in the table it has accordingly been placed in that division of the genus. The general features of the neuration show at all events that it is more closely allied to I. tumulata than to any of the others.

In another specimen the wings are of equal length, the front pair very long and slender, being nearly four times as long as broad, the greatest breadth in the middle of the apical half, although the greater part of the apical half is subequal, the apex well rounded, but slightly produced, the costal margin straight beyond the (obscure) base. The veins of both wings are black. The pterostigma, apparently alike in both wings, is blackish fuliginous, of moderate size, its proximal margin transverse, its distal very oblique, forming a nearly continuous curve with its slightly convex lower margin, the whole a little more than twice as long as broad. The subcostal vein is gently curved and strikes the costa at the pterostigma's distance before the latter; the space between it and the costa is pretty broad and filled by numerous straight oblique veins. Below the radius the cell, whose distal extremity lies just beneath the termination of the costo-subcostal interspace, is exceptionally long, being nearly double the length of the cell beyond it, and the cells which lie beneath its distal extremity are bordered externally by a common line which lies beneath the proximal end of the pterostigma; the lower of these two cells being the longer, there is formed an oblique series of large conspicuous areoles like those of modern species but more distant from the apex of the wing. The hind wing differs from the front wing principally in form, the apical half being less equal, and in the shortness of the long subradial cell of the front wings, which is no longer than the next outside of it; the series of cross-veins originating above at the middle of the pterostigma is more broken, but falls wholly without the proximal end of the pterostigma, so that the three areoles form a vertical instead of an oblique series;

the cubital cells can not be determined in the front wing, but are apparently, as here, pretty large and broad and rarely if ever twice as long as broad, while nearly all the other large cells (especially in the front wings) are very long and slender as in I. tumulata, the transverse veins being few. The marginal veinlets of both wings are simply and widely forked on the lower, and sometimes on the apical, border.

Length of wings, 10.5^{mm}; breadth, 2.7^{mm}.

This species is evidently more nearly allied to I. tumulata than to any of the others, and differs from it, not only in the points brought out in the description, but also in the closer venation of the margin of the wing.

Florissant. Two specimens, Nos. 8319, 9391.

Family HEMEROBINA Hagen.

The two subfamilies Hemerobidæ and Chrysopidæ which form this group are oppositely represented in the Tertiaries of the Old and New Worlds. The former are well represented in Europe and poorly represented in this country; the latter are well furnished with species in this country and are unrepresented in Europe. The figures stand as follows: Hemerobidæ, four genera, six species, Europe, vs two genera, two species, America; Chrysopidæ, none, Europe, vs. two genera, four species, America. Compare this with their present distribution as indicated by Hagen in his Synopsis synonymica (1866): Hemerobidæ, ten genera, forty species, Europe, vs. eight genera, thirty-one species, America; Chrysopidæ, two genera, forty-one species, Europe, vs. one genus, thirty-one species, America. Here the relation between America and Europe is almost precisely the same in the two countries, a relation which finds no sort of explanation in the distribution of the two groups in the Tertiaries. (September, 1883.)

Subfamily HEMEROBIDÆ Stephens.

Considering the abundance of American Tertiary Neuroptera and the considerable number of Hemerobidæ (four genera, six or more species) found in the Tertiary beds of Europe—mostly in amber—it is somewhat surprising to find only a couple of species in our American Tertiaries. One of these, Osmylus, from Florissant, is also represented in amber and the two species agree together in certain features which distinguish them from

modern forms. The other, an extinct genus, Bothromicromus, from British Columbia, is very different from any the European Tertiaries possess.

OSMYLUS Latreille.

The species we have placed here agrees somewhat closely with the species from amber, Osm. pictus, referred by Hagen to this genus, but differs from it in its lack of any diverse coloring in the wings, as well as in some minor points of the neuration, as in the distance of the outer series of gradate veinlets from the outer border of the wing, their regular connection with one of the basal branches of the radius, the regularity of the inner series of gradate veinlets, as well as the structure of the cubital region. The two Tertiary species, however, agree together, and disagree with living types in the simple character of the costal nervules, the much smaller number of sectors, and the character of the basal half of the wing, where the sectorial interspaces are regular and broken by few and irregularly scattered cross-veins, instead of being so numerously supplied as to break up the field into an almost uniform and minute reticulation. The two fossil species would therefore appear to form a section apart. (September, 1883.)

OSMYLUS REQUIETUS.

Pl. 14, Figs. 3, 8.

Three specimens, two of them with their counterparts, have been found, in which the wings are particularly well preserved, and in which something also can be made out of the body and the antennæ. The body is of the usual form, the slender antennæ just about the length of the body, composed of multitudinous cylindrical, smooth joints, a little longer than broad and perfectly equal.

The wings are very large, the extremity of the abdomen reaching only as far as their middle when closed, and nearly three times as long as broad, broadest a little beyond the middle. They have the shape of those of Chrysopa, the costal margin being suddenly curved downward just before the tip to meet the upturned curve of the inner margin, which is bent beyond the middle of the wing and meets the costal margin below the middle of the tip of the wing, the latter barely angulated; besides, however, the costal margin is a little expanded near the base; the costal area, broad at the base and made a little more so by the slight deflection of the subcostal

vein near the base and opposite the expansion of the costal margin, narrows very gradually towards the apex, and by the deflection of the subcostal vein next the tip is carried to the very angulation at the apex, filled throughout with very numerous, oblique, straight, and simple cross-veins. The radius runs in exceedingly close proximity to the subcosta until the margin begins to curve decidedly downward, when it unites with it. I have not been able to detect certainly any basal or other cross-vein between the two, though there are in some specimens slight indications of what may be one near the origin of the main sector; they certainly do not occur elsewhere. The main sector originates from the radius near the base of the wing, runs near to and parallel with it to the apex, and is connected with it by many (eight or nine) cross-veins; from it arise eight or nine parallel, oblique, and nearly straight sectors, making in all about a dozen series of equal oblique interspaces in the wing, broken in the apical half of the wing by a couple of series of gradate veinlets, the outer not very far removed from the posterior margin and subparallel to it, finally merging in one of the basal branches of the radius, and from which spring the marginal veinlets which are usually delicately forked at the very border; the inner row is parallel to the outer and about as far from it as it is from the margin. Within this the interspaces are broken by a dozen or more irregularly scattered rather distant cross-veins, much as in Osm. pictus of the Prussian amber, but very different indeed from the living types of the genus, as already stated under the genus. The margins of the wings are sparsely furnished with delicate hairs, and similar hairs may be seen on some of the veins, especially near the margins, but at great distances, or farther apart than the length of the hairs. The hind wing does not differ essentially from the front wing, excepting in the width of the costal area.

Length of body, 9.75^{mm}; of antennæ, 10^{mm}; of front wing, 15.35^{mm}; breadth of same, 5.35^{mm}.

Florissant. Three specimens, Nos. 8839, 13012 and 13537, 13538 and 14168.

BOTHROMICROMUS Scudder.

Bothromicromus Scudd., Rep. Geol. Surv. Can., 1876–'77, 462 (1878).

This genus agrees with Micromus in lacking the recurrent vein above the costal vein next the base of the front wing, and differs from it in the very wide expansion of the costal area at this point and in the possession of

numerous sectors. In these respects it agrees with Drepanepteryx, but the wing is not falcate, and notwithstanding the wide expanse of the costal area the recurrent nervule is wanting, all the veinlets of this area arising next the base, as elsewhere, from the subcosta. The wing is shaped much as in Megalomus, to which, indeed, it is closely allied, being broad at the base, very gradually increasing in width apically, the extremity rounded, with no abrupt emargination or falcation, but with the inner angle strongly excised. At the base the costal area is nearly as broad as the remainder of the wing; the costal veinlets are all furcate and apparently connected, much as in Drepanepteryx, by a single line of inosculating veinlets, dividing the area in two nearly equal longitudinal halves. The costa and subcosta run side by side in the closest proximity, but are apparently separated to the apex. Sectors extremely numerous, with a single complete series of gradate veinlets in the middle of the wing, and another, apparently crossing only the lower half of the wing, more than half-way between this and the outer margin; veins and margins very shortly ciliated.

The genus also seems peculiar in the structure of the maxillary palpi, the basal joint of which is half as broad again as long: the second and third joints subequal, moniliform; the fourth apparently only half as broad as the previous, but of equal length, and the terminal again slenderer, but twice as long, being conical, pointed, and unarmed, while the others are furnished on the apical half with scattered setæ. Antennæ submoniliform, the joints near the base of equal length and breadth, the basal joint double the width of the others: no hairs can be seen upon the antennal joints.

Bothromicromus lachlani.

Pl. 2, Figs. 7–10.

Bothromicromus lachlani Scudd., Rep. Geol. Surv. Can., 1876–'77, 462–463 (1878).

One front wing and a part of the head with its appendages are preserved on No. 36, with a pale, brownish tint to the wing, while the reverse, on No. 37, is wholly colorless. The only parts of the head preserved are one eye and a portion of the other, indicated by a broad, black, annular ring; also a few of the basal joints of the antennæ, and both maxillary palpi, crossing each other and detached from the head. The wing is strongly expanded at the extreme costal base: beyond this the costal border is straight, with a scarcely perceptible emargination nearly to the tip. The

inner margin is almost equally straight, but faintly convex. The extreme tip of the wing falls in the middle of the upper half; below it the wing is strongly excised, but well rounded at the tip and lower outer angle. The shape of the wing, therefore, resembles closely that of Hemerobius hirtus of Europe. The cubitals are, if anything, more numerous than the veinlets of the costal area, and beyond the origin of the anterior cubital vein ten originate from the subcosta itself in the basal half of the wing. The first and second of these fork and subdivide several times before reaching the margin, or even long before reaching the first series of gradate veinlets, while the third to the ninth are simple, either quite or almost as far as the very margin. The tenth again forks close to its origin, and the outer sectors originate from its upper branch, which is connected with the costa by infrequent cross-nervules. The wing is of a pale woodbrown color, the veins margined with a line of dull, pale yellow, and the darker brown of the interspaces broken frequently by a slightly paler tint, so as to give the wing a minutely blotched appearance, only visible under the lens. The two series of gradate veinlets are again accompanied by a slightly darker tint, giving the wing the appearance of being crossed by two oblique, dusky lines. All the margins are minutely and sparingly ciliated, and similar black, rather distant hairs are scattered indiscriminately over the wing, both upon the membrane and veins, but showing a certain tendency to follow the course of the latter. At the extreme lower base of the wing they are seen to have their origin from minute papillæ, less than one hundredth of a millimeter in diameter, and averaging a twentieth of a millimeter apart.

Length of wing, 9.5^{mm}; greatest breadth, 4.25^{mm}; breadth at base, 3^{mm}; diameter of eye, 0.45^{mm}; length of joints of antennæ near base, 0.09^{mm}; of middle joints of maxillary palpi, 0.075^{mm}; length of maxillary palpi, 0.4^{mm}.

Named for R. McLachlan, Esq., the distinguished English neuropterologist.

Quesnel, British Columbia. Collected by Dr. G. M. Dawson, Nos. 36 and 37 of the collection.

Subfamily CHRYSOPIDÆ Brauer.

Although species referred to Chrysopa are mentioned by Andrä from the rocks of Thalheim, and by Berendt in amber, the figure given by the former and the study by Hagen of the material in the hands of the latter

render it more than probable that no Chrysopidæ are yet known from the European Tertiaries. It is therefore all the more interesting that we find at Florissant four species of this group referable to two genera hitherto unknown. (October, 1883.)

The genera may be separated by the following table:

Table of the genera of Chrysopida.

Upper cubital vein of front wing direct, bordered by comparatively uniform cells. ....1. *Palæochrysa.*
Upper cubital vein of front wing doubly bent in the middle, bordered by very unequal cells.
2. *Tribochrysa.*

1. PALÆOCHRYSA gen. nov. (παλαιός, χρυσός).

The only materials for establishing this genus are the wings, the structure of which does not accord with any known living or extinct type. The shape of the wings is much as in Chrysopa, and they are apically rounded; the costal area of the front wings, narrow at base, rapidly expands and then diminishes, being broadest within the basal fourth of the wing. By the apical union of the costal and subcostal veins the area terminates some distance before the apex of the wings, as in Hypochrysa. The cubital area is unusually broad, the anterior cubital vein running through the very middle of the wing, and the posterior cubital rather nearer the margin than to the anterior cubital, both continuing to the apex of the wing; in consequence of this and of the presence of only a single sector of the radius there are no transverse series of gradate veinlets whatever, but the secondary sectors are to be looked on as cross-veinlets uniting the principal longitudinal veins; one of the basal cubital cellules of the anterior wings is divided nearly equally, as in Nothochrysa.

It is difficult, perhaps, to say to which one of the modern genera it is most nearly allied, but it appears to resemble Hypochrysa as closely as any, though it agrees much more with the fossil genus Tribochrysa described beyond, where the distinctions between the two are pointed out.

Palæochrysa stricta.

Pl. 14, Figs. 13, 14.

Little besides the wings can be made out in the single specimen with its counterpart which represents this species. The front wings are a little more than two and a half times longer than broad; the costal margin, expanded a little near the base, is beyond that straight until it slopes down-

ward to form the well-rounded tip; the lower margin is rounded and full, especially away from the base, making the wing broadest beyond the middle. The hind wings are slenderer or about three and a half times longer than broad, broadest in the middle, the lower margin being uniformly rounded, while the costal margin, not expanded at the base, is straight throughout to the apical fourth, where the wing tapers considerably on both sides, being subacuminate, though the extreme apex is well rounded. The neuration, at least below the radius, is essentially the same in both wings, but next the costal margin differs considerably. In the front wings the subcostal vein terminates on the costa a little beyond the middle of the apical half of the wing, and is connected with the distant arching costa by seventeen or eighteen cross-veins, the proximal ones of which are transverse, the distal somewhat oblique; the radius runs close and parallel to the subcosta throughout the course of the latter, and thereafter at a similar distance from and parallel to the curve of the margin, as far as the very apex of the wing, connected nowhere to the veins above by cross-veins. In the hind wings the radius and subcosta are so closely united as to be nearly connected, and are so represented on the plate, and terminate together, apparently a little beyond the middle of the apical half of the wing; as in the front wings, the subcosta is connected by cross-veins to the proximate, straight costa. There is a single sector which springs from the radius a little before the middle of the basal half of the wing in the front wings (nearer the base in the hind wings) and runs midway between the radius and the upper cubital in a regular zigzag; the cells, thirteen or fourteen in number, formed by the cross-veins between the sector and the radius, as well as all those below, are broader than long and tolerably regular. The upper cubital vein courses regularly through the middle of the wing, and in its basal half, at least in the front wing, is nearly straight, while apically it is noticeably zigzag, terminating in the sector of the radius just before the tip of the wing. The lower cubital vein runs in a uniform course rather nearer the margin than the upper cubital vein, subparallel to the former, and is irregularly straight or zigzag, and also joins the sector of the radius or terminates against an apical cell at the tip of the wing; between the two cubital veins one of the basal cells is divided longitudinally into two nearly equal cells, as in the genus Nothochrysa (but which is not represented on the plate as it should be), where the oblique vein appears on the upper wing;

the marginal nervules are sometimes simple and straight, sometimes broadly forked, and differ on opposite wings. The vein below the lower cubital, called posteostal by McLachlan, terminates abruptly on the hinder margin, opposite the origin of the sector of the radius.

Length of fore wings, 15.75^{mm}; breadth, 5.4^{mm}; length of hind wings, 15^{mm}; breadth, 4.2^{mm}.

The four wings of this specimen are so overlaid by one another as to make a medley of veins which are very difficult to disentangle and interpret. It was kindly photographed for me by Mr. Samuel Wells, of Boston; the lines of each wing on the photograph were then traced separately, and from these tracings the drawings on the plate were made; these I believe to be true representations of the wings with the exception of the double cubital cell of both wings and the cross-veins of the costal area of the hind wing, which are not shown; the lower half of each wing, however, is more liable to misinterpretation than the upper.

Florissant. One specimen, Nos. 1798 and 7340.

2. TRIBOCHRYSA gen. nov. (*τρίβω*, *χρυσός*).

This genus, clearly allied to Palæochrysa, and with it apparently a forerunner of Hypochrysa, is represented by several species in the American Tertiaries, which are uncommonly well preserved, though the wings are the only parts which are present on all the specimens; and it is therefore mainly upon these that the genus is founded The head is nearly twice as broad as long, the front protuberant, rounded, and entire, the basal joint of the antennæ stout, bulbous, scarcely longer than broad, twice the diameter of the stalk, the latter nearly as long as or even longer than the body, slender, delicately tapering, composed of simple, cylindrical, apparently naked joints twice as long as broad. The thorax is stout, the prothorax broader than long, tapering anteriorly, otherwise subquadrate. The legs are slender. The wings extend far beyond the body, and are of the same form as in Chrysopa, the tip rounded or faintly subacuminate; in neuration they resemble closely those of Palæochrysa, but differ from it in one striking feature, and in this approach more modern types like Nothochrysa. In Palæochrysa the upper cubital vein runs in a slightly zigzag course through the middle of the wing in a regular, gentle curve nearly equidistant from the costal and inner margin, and terminates at the apex of the wings, no transverse series of gradate veinlets lying between it and the

primary sector. In Nothochrysa it runs in a perfectly straight course a little below the middle of the wing, but higher than in Chrysopa, directed toward but not distinctly reaching the middle of the outer half of the lower margin of the wing, and supporting the lower proximal end of one transverse series of gradate veinlets between it and the primary sector. In Tribochrysa it runs in a decidedly zigzag course, in the same general direction as in Nothochrysa in its proximal half, and then shifts suddenly to a higher level and follows thereafter a zigzag direction nearly parallel to the costa, through the very middle of the wing, joining, that is, the transverse series of gradate veinlets and making them a part of itself. Tribochrysa further differs from Nothochrysa and agrees with Palæochrysa in the slender number of secondary sectors or oblique cross-veins, so that the cells are larger and less elongated than in Nothochrysa and Chrysopa, standing thus at a wider distance from Hemerobius. The result of this movement of the first cubital vein is usually a striking inequality of the cells on either side of it, in contrast to their uniformity in Palæochrysa. There is here, therefore, as in Palæochrysa, no transverse series of gradate veinlets in the proper sense, as both series are directly united with the two cubital veins. A somewhat similar arrangement may be seen in Nothochrysa fulviceps, although that species differs from these more widely than most of its allies in the multiplicity of its secondary sectors. The same double cubital cell occurs below the second subradial cell as is found in Nothochrysa and Palæochrysa.

The species placed here seem to fall into two groups, one of the species differing from the others in being of a considerably larger size, having its first cubital vein originate directly from the radius, the proximal cells which lie above it less elongated than in the other species, and the upper (double) cubital cell quadrangular.

Table of the species of Tribochrysa.

Large species. First cubital vein arising directly from the radius; first transverse vein connecting radius and first cubital vein lying in direct continuation of the cross-vein closing the proximal end of the double cubital cell, making the upper, as well as the lower, cell quadrangular.

1. *T. vetuscula.*

Smaller species. First cubital vein arising from a basal cross-vein uniting the radius and second cubital vein; first transverse vein connecting radius and first cubital vein striking the upper margin of the double cubital cell, making the upper cell pentagonal, while the lower remains quadrangular.

Elongated proximal cells between the main sector of the radius and the first cubital vein, four in number, followed by half a dozen cells of subequal diameters. . . . . 2. *T. inequalis.*

Elongated proximals cells, as above, three in number, followed by five cells of subequal diameters.

3. *T. firmata.*

1. Tribochrysa vetuscula.

Pl. 14, Fig. 9.

The stone on which the single specimen referred here occurs has unfortunately been broken across the wings, and the apical half is lost; otherwise the specimen would be nearly perfect, the head, thorax, eyes, and antennæ being well preserved. The antennæ are unusually short, being a little shorter than the body and more tapering than usual in this family. The head is well rounded, the eyes neither very large nor prominent, the prothorax tapering a little anteriorly, the sides a little arcuate, the front slightly concave.

Only the basal half of the wings being preserved, little can be said of them, but the costal margin and area are much as in T. firmata, and the neuration is so peculiar as to separate the species readily from the others; there are about a dozen transverse veins in the costal area; the transverse veins uniting the radius and its sector are rather more numerous than in the other species of the genus: the cross-vein uniting at base the sector and the first cubital vein strikes the latter so as to form a continuation of the vein closing basally the double cubital cell; the upper of these two cells is scarcely smaller than the lower; the upper cubital vein arises directly from the radius without the support of a basal cross-vein; and the proximal cells between the sector of the radius and the upper cubital vein are, excepting the first (which is of irregular shape), not so disproportionately large as in the other species, being less than half as broad again as long, about as long as the subradial cells, and only a little oblique, differing in all these respects from both the other species

Length of body (estimated), 12^{mm}; of head and thorax, 4.5^{mm}; antennæ, 11^{mm}; length of wings as preserved, 9.5^{mm}; probable full length, 14^{mm}; presumed breadth, 4.5^{mm}.

Florissant. One specimen, No. 11204.

2. Tribochrysa inequalis.

Tribochrysa inequalis Scudd., Zittel, Handb. d. Palæont., I, ii, 777, Fig. 982 (1885).

The single specimen referred here has all the wings superimposed on one another, but in addition a portion of the slender antennæ and the large globular eyes can be seen, with faint traces of the head, thorax, and abdomen.

Almost the entire neuration of the upper wing can be made out as well as the lower half of that of the under wing; the front wing is three times as long as broad, the costal margin uniformly arched, the basal expansion forming only a regular part of the curve; the lower margin is similarly curved but not very full, the wing being broadest nearly as far out as the middle of the outer half; the costal area is not very broad nor unequal; the subcostal vein terminates at the end of the middle third of the wing, and is connected with the costa by twelve or thirteen cross-veins, mostly slightly oblique. There are ten subradial cells. The upper cubital vein, which springs from a short cross-vein uniting the radius and lower cubital vein, in the middle of its course and somewhat beyond the middle of the wing shifts suddenly to a higher level and follows thereafter a direction nearly parallel to the costal, instead of, as before, the inner margin; in the first half of its course it runs below the middle of the wing, in the latter half above it; consequently the four cells which lie between its proximal half and the subcosta are very much elongated subrhomboidal in form, the first subtriangular, while beyond the shift they are somewhat regularly hexagonal; on the other hand the cubital cells, scarcely longer than broad at first, become in the outer part of the wing twice as broad as long and also very oblique. The basal cubital cell is divided longitudinally into two unequal parallel cells, the upper the narrower; the cross-veins next the lower margin are simple in the basal half of the wing, simply or doubly forked on the distal half. The postcostal terminates abruptly on the hind margin, slightly farther out than the origin of the sector of the radius, and is connected near the apex by a cross-vein which is the continuation of that closing basally the double cubital cell. The neuration of the hind wing, only the lower half of which is preserved, does not differ from that of the front wing in the slightest essential particular.

This species differs from T. firmata, to which it is closely allied, by its larger size, the greater number of cells below the sector (as indicated in the table of the species), and its broader costal area.

Length of body, 11^{mm}; of front wing, 14.75^{mm}; breadth of same, 4.8^{mm}.

Florissant. One specimen, No. 7982.

3. Tribochrysa firmata.

Pl. 14, Figs. 6, 7, 10, 11.

Two specimens are at hand, each in a pretty good state of preservation, showing head and antennæ, the body and wings, the latter generally somewhat confused by overlapping or folding. The head is rather small as compared with the thorax, and well rounded, with moderately prominent eyes, and antennæ a fourth longer than the body; the prothorax is also rather slender, tapering considerably, and about as long as its posterior breadth. The thorax is stout and the abdomen half as long again as the head and thorax. The wings are about three times as long as broad, broadest in the middle of the distal half, the costal margin pretty straight in the middle, rather rapidly sloping basally, and very rapidly curving almost bending downward apically, the apical margin rounded, subacuminate, the apex rather below the middle; the inner margin is regularly and gently curved. The subcostal vein joins the costal (not shown on plate) a little beyond the middle of the distal half of the wing, and the costal area thus formed is occupied by about a dozen or more straight cross-veins; there are only eight or nine subradial cells, and the cells in the series below this, while agreeing in general character with those of T. inequalis, are less numerous than there, there being only three elongated cells directly beneath the sector of the radius and only five equiaxial cells in the same series beyond them.

The two specimens show very little difference excepting in size, though on that account they were at first presumed to be distinct.

Length of body, 8.5–7.75^{mm}; of antennæ, 9.5–10.5^{mm} (in the larger specimen no doubt imperfect); breadth of head, 1–0.85^{mm}; of thorax, 1.6–1.5^{mm}; length of fore wing, 11.25–9.75^{mm}; breadth of same, 3.85–3.25^{mm}.

Florissant. Two specimens, Nos. 670, 8792.

Family PANORPIDÆ Stephens.

If the Liassic genus Orthophlebia is to be referred to this family, this group must have been as abundant in Mesozoic times as now. Only a few Tertiary species are, however, known, and those hitherto described have unspotted wings like their ancestors of the secondary epoch. Three species of Bittacus and one of Panorpa have been described from the European

beds, all but one (a Bittacus) from amber, this Bittacus, the only relic from Tertiary rocks in Europe, coming from Radoboj.

The additions we have here to offer are of some interest. Two species have been found, both of which have heavily spotted wings, more heavily spotted than most living types; one of these, a small species, is referred to Panorpa, though doubtfully, as it differs so much from known types; the other unquestionably belongs to a distinct genus having no special alliances with any known forms. Both come from Florissant. The markings of one form dark, transverse bands on clear ground, of the other large, roundish, pale blotches on a dusky ground. (October, 1883.)

The Florissant genera may be thus distinguished:

Table of the genera of Panorpidæ.

Ramules of upper branch of radius inferior; markings consisting of large pale spots on a dark ground ..... 1. *Holcorpa.*

Ramules of upper branch of radius superior or apical; markings consisting of dark transverse bands on a clear ground ..... 2. *Panorpa.*

1. HOLCORPA Scudder.

Holcorpa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 540-542 (1878).

This name[1] is proposed for a genus of Panorpidæ, unquestionably allied to Panorpa, but differing remarkably from it in the total absence of cross-nervules in the wings, excepting, perhaps, at the base. The antennæ are probably not very long (they are not completely preserved in the single specimen studied), taper very gradually in size, are composed of joints only a little longer than broad, not in the least degree moniliform, and furnished with recumbent hairs. The wings are not so elongated nor so slender as in Panorpa, very regularly rounded, both pairs similarly formed, the hinder pair shorter than the front pair, as in Panorpa. The costa is thickened, the subcosta extends beyond the middle of the wing, but does not reach the pterostigma; the radius emits a superior fork near the base of the wing, which strikes the pterostigma, or, rather, which, by bending downward and then upward, forms the pterostigma in the middle of the apical third of the wing; the radius again forks in a similar manner still far before the middle of the wing, the upper branch emitting three parallel, equidistant, inferior branchlets, the uppermost close to the margin next the pterostigma, the lowest striking the apex of the wing; the lower radial branch forks

[1] The name I have given should perhaps be written Holchorpa; but I have disregarded the aspirate, as Linné did in constructing Panorpa.

below the middle branchlet of the upper radial branch. All these veins, excepting the pterostigmatic termination of the uppermost branch of the radial, are straight. The cubitus is also straight until it forks a little before the middle of the wing; its upper branch is a little curved, and divides just below the forking of the lowest radial branch; its lower branch forks almost immediately, emitting at once three veinlets, the middle one of which is nearly continuous with the main stem, the others curving in opposite senses on either side of it. Below this the veins are not so readily determinable, and their description is omitted until further specimens are obtained; the only variation in the neuration of the two wings consists in the middle fork of the lower branch of the cubitus, which, in the hind wing, is not continuous with the main stem, but originates a very little beyond the others from the lower fork. The legs are spinous throughout; the tibiæ are also armed at the tip with very long, straight, parallel spurs, and the tarsal joints with short spurs. The abdomen is greatly elongated, the first four joints subequal and nearly as broad as the slender thorax, but as a whole tapering slightly, and not greatly surpassed by the wings, the following joints greatly attenuated, the ninth, or terminal joint, composing the forceps, unfortunately lost.

A fossil species referred to Panorpa, and figured by Brodie[1] from the Purbeck beds of England (Panorpa gracilis Gieb.), is very small, and possibly may be more nearly related to Holcorpa than to Panorpa, for while the general arrangement of the veins, with the notable exception of the cubital, is similar to what is found in Holcorpa and very different from their disposition in Panorpa, no cross-veins whatever can be traced. The figure, however, is too small, coarsely executed, and is described by Giebel[2] as supplied abundantly with cross-veins! It certainly is not in my copy of Brodie's work.

Holcorpa maculosa.

Pl. 14, Figs. 4, 5.

Holcorpa maculosa Scudd., Bull. U. S. Geol. Surv. Terr., IV, 542 (1878); in Zittel, Handb. d. Palæont., 1, ii, 778, Fig. 984 (1885).

A single specimen with beautifully preserved wings and fragments of the rest of the body. The antennæ (which are not fully preserved) appear to have been more than half as long as the wings, the middle joints 0.17^{mm}

[1] Foss. Ins. Sec. Rocks Engl., pl. 5, fig. 18.

[2] Ins. der Vorw., 258.

long and 0.14^{mm} broad. The wings are less than three times as long as broad, and very regularly rounded; the costal vein (especially on the front wing) is thickened and covered with closely clustered, minute, spinous hairs, and similar black hairs follow in a single row the base of the radial and cubital veins. The wings are very dark, with large white or pale spots, of which three are most conspicuous, occurring similarly on all the wings. One, of a subquadrate or subovate form, broader than long, lies scarcely beyond the middle of the wing, extending from the costa to the upper branch of the cubital vein; another, nearly as large and similar in form, is subapical, extending from just beyond the last fork of the upper branch of the radial vein to or just beyond the upper fork of the lowest branch of the same; a third, smaller, transversely oval spot, lies next the inner border, below and a little outside the first mentioned, being situated just beneath the forking of the upper branch of the cubital vein; there is also more or less pale cloudiness about the basal half of the wing, and white flecks may be seen at various points near the tip, especially below the subapical spot. The abdomen resembles somewhat that of the remarkable Panorpa nemato-gaster M'Lachl. from Java, where it is greatly elongated, and possesses a curious appendage to the third joint. In the fossil species, the first three joints, taken together, taper gradually and slightly, and the third may have had a peculiar appendage at its tip, as the edge is not entire, but appears deeply excavated in the middle, possibly due, however, to its imperfect preservation; the basal half of the fourth joint partakes of the tapering of the abdomen, but its apical half is swollen and its hind margin broadly rounded; the fifth and sixth joints are a little longer and much slenderer than the preceding, subequal and cylindrical; the fifth depressed on either side at the base by a pair of foveæ; the seventh again much smaller, linear or not half the width of the sixth, increasing slightly in size apically; the eighth as large at base as the seventh at tip, enlarging slightly apically, and all the joints together half as long again as the wings. Most unfortunately, the apical joint is lost. The specimen is evidently a male.

Length of insect (excluding claw of abdomen), 30^{mm}; of abdomen (excluding claw), 23^{mm}; of front wing, 18^{mm}; breadth of same, 5.5^{mm}; length of hind wing, 16.5^{mm}; breadth of same, 5^{mm}; length of (fore or middle) tibial spurs, 1^{mm}; of one of the (hind?) tarsal joints, 1.2^{mm}.

Florissant. One specimen, No. 63.

2. PANORPA Linné.

A single species of this genus has been discovered in the Tertiaries of Europe (amber) and we add another from the Florissant beds. The former has the wings of a uniform ash-gray. The wings of the latter are heavily banded, very much more heavily than in most modern types. The living representatives of this genus belong to the northern hemisphere, and in our own country range from Canada to Mexico, so that the presence of the genus at Florissant has no particular meaning.

PANORPA RIGIDA.

The single specimen belonging here shows the tapering, attenuated abdomen of a female with the larger part of most of the wings, of which only the front pair are preserved in any recognizable manner. These show the neuration tolerably well, and it agrees better with the living Panorpa than with the contemporaneous Holcorpa; but the subcosta is unusually short, reaching just to the middle of the wing, and the cross-veins are few in number. The wing is traversed by rather narrow transverse belts of a dark color, on a clear ground, placed at equidistant intervals, besides having the entire apex of the wing dark; these belts are straight with straight edges; one traverses the middle of the wing, one lies outside of it midway between it and the apical patch, and a third as far from it toward the base of the wing; the clear area between these belts is twice as broad as the belts themselves. The costa is stout. The legs are very long and very slender, the tibiæ rather sparsely spined.

Length of wings (estimated), 11^{mm}; breadth of same, 3.5^{mm}; length of abdomen (estimated), 5^{mm}; (hind ?) tibia, (probably) 5^{mm}.

Florissant. One specimen, No. 3213.

Family TRICHOPTERA Kirby.

The rarity of remains of caddis-flies in the Tertiary rocks of Europe is not a little surprising. Only three species have been figured and a fourth mentioned, all apparently represented by single specimens (from Aix, Parschlug, Mombach, and the Isle of Wight). Another species has been described from Greenland by Heer and from Chagrin Valley, Colorado, by myself. That they were abundant is proven by the description of numer-

ous larval cases from different regions of Europe, but especially from Auvergne in France; it is also proven by their abundance where we should at first little look for them, in the Prussian amber, where, according to Hagen, they are more numerous than any other group of insects, excepting Diptera, and comprise more than half the Neuroptera and Pseudoneuroptera combined. Twenty-five species have been described (by Hagen and Pictet) and several others mentioned (by them and by Kolenati) from amber, a large proportion belonging to the Hydropsychidæ and especially to Polycentropus, of which eleven species are described.

Trichoptera are, however, by no means rare at Florissant, and, as stated above, a single species has been described from western Colorado. Indeed, the Neuroptera from the prolific lake bed of Florissant are made up in large part of Trichoptera, of which many hundred specimens have been obtained. The larger part of them, indeed, are indeterminable, but there are about one hundred specimens which show the neuration of the wings or other characteristic part with some distinctness; and while all the remains of perfect insects from the European rocks are referred to the single subfamily of Phryganidæ, at Florissant Limnophilidæ, Leptoceridæ, and especially Hydropsychidæ, are also represented. The species of this last mentioned group are also much more prolific in individuals, and the preponderance in species would be even more marked were we able to include here all the species really found, since most of those which are too imperfect to be brought forward evidently belong to this group. All these groups, and indeed all the subfamilies of Trichoptera, are represented in the Prussian amber. Hydropsychidæ are by far the most numerous, as in our own Tertiaries. Then follow in the order of abundance Leptoceridæ, Sericostomidæ, Phryganidæ, Rhyacophilidæ and Hydroptilidæ, and Limnophilidæ, the last having but one representative.

While, as we have said, the bulk of the specimens of Neuroptera found at Florissant belong to the caddis-flies, the specific variety of such as will bear description is not quite so great, as 40 per cent of all belong here; but in relation to any one other large group the number of species greatly preponderates, as the group next in size in point of species is the Odonata, which has less than 20 per cent. It is not a little curious to compare this statement with Pictet's concerning the amber caddis-flies: "Of about one hundred and twenty Neuroptera examined by me sixty-

five were Phryganidæ, and of fifty species described by me twenty-two [44 per cent] belong to this family." Of these sixty-five, moreover, forty were referred to the Hydropsychidæ. Hagen, with about seven times as many specimens before him, comes to nearly the same conclusion, for he says that nearly 60 per cent of the specimens of Neuroptera are caddis-flies, and thirty-nine of the eighty-seven species of Neuroptera given in his table, or 45 per cent, are referred to the Trichoptera.

In this enumeration no account has been taken of the occurrence of larval cases of caddis-flies in Tertiary deposits, to which reference was made above. Auvergne has been famous for these which form the so-called indusial limestone deposits, so abundant are they. They were described by Bosc as long ago as the year XIII (1805) and recently have been distinguished by Oustalet under two distinct names. Hepp also described Phryganea blumii from cases found at Leistadt and Heer P. antiqua from Oeningen. A single one has even been found in amber, with its entombed larva, and Fritsch describes one from the Cretaceous of Bohemia. In this country Dr. Peale discovered similar remains, which I have described as Indusia calculosa. The two fragments of rocks brought home from the locality in Wyoming formed doubtless the floor of a former body of water and are thickly crowded with cases lying in every direction. It is very probable that at least those described here and by Bosc and Oustalet belong to the Limnophilidæ. That in the abundant fauna found in the lake basin of Florissant, including, as we see, a large number of caddis-flies, not a single larval case should have yet been found seems a little remarkable, and the more so since not a few belong to groups, the larvæ of which are known to prefer standing to running water. It is hardly to be believed that the streams in the neighborhood of this ancient lake abounded in the larvæ of caddis-flies, while the waters of the lake itself were destitute of them. It should be remembered, however (1), that the species which construct cases of conspicuous size out of hard materials mostly belong to the Limnophilidæ, of which Florissant furnishes but one species; (2), that the larvæ of the prevailing group, Hydropsychidæ, more commonly inhabit running water, and that their cases are made of grains of stone affixed to larger stones; (3), that the bottom of the lake in which the insect deposits occur nowhere has shown, as far as I have seen, any sign of stones large enough to have served as a basis for the attachment of the smaller grains

which alone are found, and that therefore the larvæ of Hydropsychidæ must have frequented perforce the neighboring streams, where such larger stone surfaces could have been found. If cases should be found they will be likely to be those of the larger Phryganidæ (next most abundant after the Hydropsychidæ), composed of vegetable fragments. Three species and seven specimens only of this group have been found. (February, 1884.)

Subfamily HYDROPSYCHIDÆ Curtis.

Although no members of this group have been found in the stratified deposits of the Old World, about half of the numerous species described from the Baltic amber belong to it, including several genera. It is interesting, therefore, to find that about three-fourths of the Florissant caddis-flies described in this work belong here, and in the material too poorly preserved to bring before the public the greater part also belong here. Here, too, the species seem to be far the most abundant in individuals. Among those described below are not a few very aberrant forms, which I have been at a loss to determine, as certain of them seem on some accounts to be more nearly related to the Leptoceridæ. At the present day the subfamily appears also to be the most numerous in species in the northern hemisphere, and they are found all over the world. The larvæ more commonly frequent running than standing water, make fixed cases, and are believed to be to a large extent carnivorous.

Table of the genera of Hydropsychidæ.

(Only the extinct, newly described genera, in which the fifth apical cell and sometimes some of the other apical cells of the fore wings are wanting, are here tabulated.)

First apical cell present.
- Second apical cell present.
  - Median cellule one-third or scarcely more than one-third as long as the wing ..3. *Derobrochus.*
  - Median cellule one-half as long as the wing .....4. *Litobrochus.*
- Second apical cell absent .....5. *Leptobrochus.*

First apical cell absent.
- Discoidal cell open .....6. *Mesobrochus.*
- Discoidal cell closed .....7. *Paladicella.*

1. HYDROPSYCHE Pictet.

The two species placed here by us from the American Tertiaries are referred to the genus in its ancient wide sense as representative of the group to which it belongs. No fossils have previously been referred to it.

Hydropsyche? operta.

Pl. 5, Figs. 52, 53.

Phryganea operta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 762 (1877).

A single well preserved specimen with its reverse; the wings are doubled beneath the body, and unfortunately are overlaid by the larva skin of a dipterous insect, obliterating all the important parts of the neuration. On this account it is impossible to determine it with any certainty, but it can not be referred to the Phryganidæ proper, from its slender antennæ and long and slender legs. Renewed study of the specimen since the above was published in the Bulletin leads me to believe that it is one of the Hydropsychidæ and probably not far removed from Polycentropus, but the venation is too obscure to enable one to speak confidently. The first fork, however, appears to be brief and upcurved, exactly as in Polycentropus and not as given in the plate. The head is detached from the body, and faint traces of the antennæ are preserved, but detached; apparently there are two pairs of spurs to what appear to be the middle tibiæ, and the spines of the under edge of the same tibiæ are numerous. The abdomen is very well preserved on a side view.

Length of body, 8^{mm}; (portion of) antennæ, 7^{mm}; tarsi, 3.5^{mm}; wings, 10^{mm}.

Chagrin Valley, White River, Colorado. W. Denton.

Hydropsyche marcens.

Pl. 15, Fig. 7.

Only two specimens of this species are known; it seems to have a somewhat peculiar neuration, but its imperfection induces me to place it in the genus Hydropsyche in a general sense. The front wings are very long and slender, largest beyond the middle of the apical half, the apical margin rounded but with a slight acumination. The neuration is incorrectly given in the plate. No cross-veins can be accurately determined, but it seems apparent that the discoidal cell must be of unusual size, and even larger than the median cellule, which, on the other hand, must be rather smaller than usual. The legs and antennæ are long and slender.

Length of body, 9^{mm}; of front wings, 9–9.5^{mm}; of hind legs, 6^{mm}.

Florissant. Two specimens, Nos. 1618, 11205.

2. POLYCENTROPUS Curtis.

This is an important group of caddis-flies to the paleontologist, since nearly one-half of the many phryganids described from the Prussian amber belong to it, and it is interesting to find that we have at least one species in our own rocks. The present distribution of the species is mainly in Europe and North America, where they are numerous, with a few recorded from Ceylon. The larvæ, according to McLachlan, inhabit shallow, rapid streams, and form, Pictet says, no firm cases until about to change to pupæ. In speaking of the abundance of this group in the amber fauna McLachlan says: "Insects referred to Polycentropus in its broad sense seem to have been very common in the Tertiary period when amber was formed; their habit of concealing themselves in the crevices of the bark of trees probably caused their entanglement in the resin and subsequent fossilization."[1]

Polycentropus exesus.

A delicate winged, sparsely clothed species with exceedingly delicate antennæ. The body is moderately slight, the head small; basal joint of antennæ very stout, subglobular, the remainder thread-like, reaching back beyond the closed wings, the joints three to four times longer than broad and narrowly ringed with black at the incisures. Legs poorly preserved in most of the specimens, but only moderately slender, the tarsi rather densely spinous. Wings moderately slender, broadest at the anastomosis, the apex rather broadly rounded, tolerably clear, but with heavily infuscated veins; the discoidal is much longer than the median cellule, and the second apical cell is longer than the third and fourth, and of about equal length with the fifth; the anastomosis above the fifth fork lies in a curve subparallel to the apical margin.

Length of body, 7.5^{mm}; of front wing, 8^{mm}; width of same, 2.6^{mm}; length of antennæ, 11^{mm}; of hind tibiæ, 4^{mm}; of hind tarsi, 3.5^{mm}.

Florissant. Nine specimens, Nos. 67, 571, 3143, 7428, 7873, 9549, 10501, 12441, 13529.

[1] Trichoptera Europ. fauna, 398.

Polycentropus (?) eviratus.

Pl. 13, Fig. 7.

A single specimen with its reverse is placed here provisionally simply from its general resemblance to species of this group. A crushed body, heavily scaled wings, an antenna, and a fragment of a leg are all that remain. The body is stout and apparently clothed densely. The antenna is rather slender, tapering, about as half as long as the wings, and composed of joints of equal length and breadth. The wings are folded somewhat, so that their form can not fully be seen, but they are apparently not slender and are very densely scaled, concealing all neuration; the costal margin is very gently and slightly convex, curving downward to the apex only at the very tip, the apex far above the middle of the wing, and the apical margin oblique, straight, not retreating rapidly.

Length of body, 11^{mm}; of front wing, 10.5^{mm}; of antennæ, 5^{mm}.

Florissant. One specimen, Nos. 12239 and 12240.

3. DEROBROCHUS gen. nov. (*δηρός*, *βρόχος*).

A large proportion, both of the specimens and species, of Florissant caddis-flies seems to belong to this new type of Hydropsychidæ, which is allied to Polycentropus in many of its features, but is remarkable for the length of the cells and for the apparent want of any fifth apical cell. The median cellule, which is generally longer than the discoidal, is often one-third, or even more than one-third, the length of the wing, and the lower branch of the upper cubitus runs straight or nearly straight to the margin, bending sometimes near the cross-vein which, near the margin, connects it with the vein below. The uppermost apical cell, as in Polycentropus, is small, and in general the affinity of this genus to that is marked; but the absence of the fifth apical cell is believed to be sufficient ground for generic distinction, as that cell is generally found throughout the family. The cross-vein uniting the upper and lower cubitals is variously situated.

Table of the species of Derobrochus.

Base of first apical cell of front wing not, or scarcely, farther from the root of the wing than the base of some of the other apical forks.

First apical cell almost as long as the second; this not greatly longer than the third..1. *D. abstractus.*

First apical cell much shorter than the second; this nearly twice as long as the third.

First apical cell longer than the fourth .....2. *D. canulentus.*

First apical cell shorter than the fourth.

First apical cell curving upward .....4. *D. commoratus.*

First apical cell with no upward curve .....6. *D. frigescens.*

Base of first apical cell considerably, or very much, farther from the root of the wing than the base of any other apical fork.
Third and fourth apical cells about equally distant from base.
Second apical cell less than one-third as long again as the third.....3. *D. aternus.*
Second apical cell half as long again as the third.....5. *D. marcidus.*
Fourth apical cell reaching much nearer the base than the third.....7. *D. cratera.*

1. Derobrochus abstractus.

A single specimen, preserved on a side view, so as to show the upper half of the under surface of the right front wing, and in addition the upper surface of the whole of the left front wing, overlying the hind wing and confusing the neuration. Little besides the wings can be seen, but the stout cylindrical basal joint of the antennæ appears, followed by a few similar but much slenderer joints. The front wing is slender, subacuminate at tip, the costal margin falling toward the tip at about the same angle as the apical margin retreats from it, the apex itself rounded off, and rather above the middle line of the wing. The first apical cell is remarkably long, the fork originating at the end of the middle third of the wing, and of the same length as the third apical cell; the second apical cell is only a little longer. The wing is apparently clear, with the veins narrowly marked with fuscous and faintly irrorate with fuscous at their tips.

Length of body, 9^{mm}; of front wing, 11^{mm}; width of same, 3.3^{mm}.

Florissant. One specimen, No. 9377.

2. Derobrochus cænulentus.

This species is represented again by a single specimen, showing a dorsal view of a vague body with outstretched front wings, one of which is nearly complete and tolerably well preserved, showing a portion at least of the neuration with clearness. The wing is not so acuminate as in the preceding species and the apex is in the middle of the wing. The first apical cell though long is shorter than in D. abstractus, but extends farther toward the base than either the third or fourth cell, these last being much shorter than in the preceding species. The discoidal cell is apparently fully as long as the median cellule, but its limits are not clearly marked; the latter is as long as the fourth fork and very slender. The wing appears to be clear with infuscated veins, and the whole costal margin broadly but faintly infuscated.

Length of wing, 8.5^{mm}; breadth of same, 2.6^{mm}; length of median cellule, 2^{mm}.

Florissant. One specimen, No. 14444.

3. Derobrochus æternus.

This species is again represented by a single specimen but in a better state of preservation than the preceding forms. It presents a side view with the upper front wing well preserved, and the lower, though visible by drooping, obscure. The legs are tolerably well preserved but confused; they are sparsely clothed with hairs and the tibial spurs can not properly be distinguished. The front wing is slender, broadest only a little way beyond the middle, the apex well rounded, and the apical margin very oblique but full. The discoidal and median cells are about equally long and slender and nearly as long as the second apical cell, which is fully one-third the length of the entire wing. The third and fourth apical cells are of about equal length and nearly twice as long as the first. The anastomosis is very simple, the cross-veins closing the discoidal cell and uniting the sector and cubitus falling together just beyond the origin of the second apical fork. The wing as preserved is clear in the apical fourth but elsewhere irrorate with fuscous, the veins everywhere infuscated.

Length of front wing, 9.75^{mm}; breadth, 4.1^{mm}.

Florissant. One specimen, No. 5308.

4. Derobrochus commoratus.

A species closely allied to the last described, and mainly distinguishable from it by its shorter and much slenderer wings. A number of specimens appear to belong here, but none of them are very well preserved. The body is slender, the legs long and slender, but with rather stout femora, the front legs short and slight. There is a single pair of spurs on the front legs, and two pairs on the hind legs. The front wings are pretty uniformly fuliginous with fuscescent veins; it is very slender, broadest close to the apex, the tip rounded and placed considerably above the middle, the apical margin much less oblique than in D. æternus. The neuration is identical with that species.

Length of body, 8.5^{mm}; of front wing, 9^{mm}; breadth of same, 2.75^{mm}; length of fore femora, 1.6^{mm}; of fore tibia, 1.1^{mm}; of middle femora, 3.25^{mm}; of hind tibia, 2.6^{mm}.

Florissant. Ten specimens, Nos. 2661, 3237, 3343, 3350, 6848, 13539, 13542 and 14170, 14029, 14171, 14312.

5. Derobrochus marcidus.

Pl. 15, Fig. 2.

A slender winged, griseous species, not far removed from D. commoratus. The body, however, is tolerably stout, densely clothed, the head small, with very slender pale antennæ, the basal joint stout and globular, the other joints slender, about twice as long as broad, and narrowly ringed apically with fuscous. The legs are very long and delicate, the middle and hind tibiæ with two pairs of spurs. Front wings griseous, rather heavily clothed with hairs, especially along the veins, which are thereby duskier; they are slender, well rounded at the apex, and not acuminate, as would appear from the figure, where the wing is partially folded; the neuration is imperfectly shown in the plate. The first apical cell is very small, the third a little longer than the fourth and much shorter than the second, which is very long, nearly reaching the middle of the wing; the length of the discoidal and median cells can not be accurately determined.

Length of body, 6.75^{mm}; of fore femora, 1.4^{mm}; mid femora, 2.2^{mm}; mid tibiæ, 2^{mm}; hind femora, 3^{mm}; hind tibiæ, 2.75^{mm}; front wings, 7–8^{mm}; width of same, 2.75^{mm}.

Florissant. Three specimens, Nos. 9416 and 9621, 10106, 12010.

6. Derobrochus frigescens.

Pl. 15, Figs. 6, 16.

Derobrochus frigescens Scudd., Zittel, Handb. d. Palæont., I, ii, 779, Fig. 986 (1885).

A somewhat stout bodied but small species, the smallest of the genus, not very heavily clothed with scales. The head is moderately large and the antennæ very slender, with a large globose basal joint. The legs are only preserved in a fragmentary way in all the specimens. The front wings are tolerably broad, broadest only a little beyond the middle, the apex scarcely subacuminate but well rounded, the apical margin oblique but full; the first apical fork is unusually straight with no upward curve, and the cell not much shorter than the third apical cell; the second apical cell is about twice as long as the third, and the fourth falls about midway between them in length; the discoidal cell and the median are of about equal length with the second apical cell, and are very slender, particularly the median. These features are not all produced in the plate.

Length of body, 6.5^{mm}; of front wing, 7^{mm}; width of same, 2.85^{mm}.

Florissant. Seven specimens, Nos. 1027, 1718, 2677, 4633, 5433, 10900, 10953.

7. Derobrochus crateræ.

Pl. 13, Fig. 13; Pl. 15, Fig. 4.

A moderate-sized species, with dusky wings, the veins infuscated. The body is moderately stout, but no parts are fairly preserved but the front wings. These are moderately slender, the tip rounded, the apical margin oblique and only a little full, the broadest part of the wing near the middle of the outer half; the first apical cell (not shown in the figures) is very small, considerably smaller than the third, which last is only a little more than half as long as the second, which is slightly longer than its stalk; discoidal and median cells very long and slender and of about equal size.

Length of body, 7–8.5^{mm}; of front wings, 8^{mm}; breadth of same, 2.6^{mm}; length of hind wings, 6^{mm}.

Florissant. Four specimens, Nos. 2514, 5059, 14235; and from the Princeton Collection No. 1.947.

4. LITOBROCHUS gen. nov. (λιτὸς, βρόχος).

This name is proposed to include a single species of Florissant Hydropsychidæ, allied to Polycentropus and Derobrochus, and especially the latter, but differing from them in some points in the neuration of the wing. Like Derobrochus, there is no fifth apical cell in the front wing, thus clearly separating it from Polycentropus. It differs from Derobrochus in the still more intensified elongation of the interior cells, and in the minuteness of the first apical cell, which is relatively not half so large as in any species of Derobrochus. The anastomosis is also very widely separated, the median cell extending far toward the margin and being half as long as the wing itself.

Litobrochus externatus.

Pl. 15, Fig. 10.

A single specimen shows the body, fore legs, and front wings. It is a tolerably large species with moderately slender body. The front legs are small and the tibia bears a single pair of spurs. The front wings are slender, broadest before the middle of the outer half, the apex produced and nearly

in the middle of the wing, the costal margin falling obliquely to the tip over a considerable area, and the apical margin equally oblique below the apex; the contrast in the length of the first and second apical cells is very marked; the cross-vein uniting the sector and cubitus falls at the origin of the second apical cell, and the median and discoidal cells originate side by side; none of the cross-veins are shown in the plate. The wing is clear, excepting for a slight infuscation along the costal edge and the infuscation of the veins.

Length of body, 10^{mm}; of front wings, 10^{mm}; breadth of same, 3.35^{mm}; length of fore femora, 1.7^{mm}; tibiæ, 1.7^{mm}.

Florissant. One specimen, No. 14210.

5. LEPTOBROCHUS gen. nov. (λεπτὸς, βρόχος).

This genus, which includes only one species, is remarkable for lacking not only the fifth, but the second, apical cell. In other respects it does not differ from Derobrochus, except in having, as in Litobrochus, an extremely long median cell, due, however, not to the extension of the cell toward the margin, but to its basal extension by the earlier origin of the middle branch of the upper cubital vein.

Leptobrochus luteus.

Pl. 15, Figs. 1, 3.

This abundant species is rarely well preserved. It has a slender body, long and narrow wings, very slender legs, and antennæ longer, so far as known, than any other of our fossil species, being much more than twice the length of the body (including the closed wings); the joints are about four times longer than broad, very slender, and the incisures marked with fuscous; the first joint is stout and obovate. The front wings are very long and slender, the apex produced, subacuminate and scarcely above the middle; the first apical cell is tolerably small, and the discoidal cell apparently open; the median cell, however, is closed, and the cell itself exceedingly long, the closure being a little before the origin of the third apical cell, which is not quite so long as the breadth of the wing and shorter than the fourth apical cell; these features of the neuration do not appear in the figures on the plate.

Length of body, 9mm; of front wing, 9mm; breadth of same, 2.2mm; length of antennæ, 21mm.

Florissant. Sixteen specimens, Nos. 1655, 3638, 3702, 6039, 7030, 7149, 7990, 8013 and 10341, 8065, 8325, 8392, 8857, 9578, 10016, 10239, 12014.

6. MESOBROCHUS gen. nov. (*μέσος*, *βρόχος*).

This is a peculiar group, not only for the limited number of apical cells, the first as well as the fifth being absent, but also for the great and nearly equal length of all the other apical cells and the distance of the anastomosis from the apical margin; indeed, nearly or quite a third of the wing at the apex is filled only with longitudinal and parallel veins, as in some Leptoceridæ. The median cell, on the contrary, is not very long, as it is in nearly all the other genera we have here considered; the discoidal cell appears to be open, an anomalous peculiarity for one of the Hydropsychidæ.

Table of the species of Mesobrochus.

Fore wings nearly four times as long as broad ..... 1. *M. lethæus.*
Fore wings scarcely more than three times as long as broad ..... 2. *M. imbecillus.*

1. MESOBROCHUS LETHÆUS.

Pl. 15, Fig. 11.

A small slender species. Body slender, moderately clothed with scales. Antennæ with basal joint very large, as long as the head, the rest slender and cylindrical, tapering sensibly to the tip, as long as the body (without the wings). Legs very slender. Wings very long and slender, the rounded apex in the middle line and the margins curving equally to it above and below; second apical cell nearly half as long as the wing, third and fourth stopping abruptly at the anastomosis, which falls just beneath the tip of the subcostal nervure; the discoidal cell is open and the median not very long, reaching as far toward the base as to bring the base of the second apical cell over its center; the neuration as given in the plate is wrong.

Length of body, 6mm; of front wing, 7mm; width of same, 1.85mm; length of antennæ, 6mm.

Florissant. Fourteen specimens, Nos. 544, 1665, 2268, 2520, 2566, 4584, 6884, 7792, 7898, 10720, 10899, 11132, 12015 and 12789, 13540.

2. Mesobrochus imbecillus.

Pl. 15, Fig. 13.

Closely allied to the preceding, but a smaller and comparatively stouter form. The basal joint of the antennæ is cylindrical, and though very large not so stout as in that species, but the stalk is as there The legs are a little shorter and less slender. Wings shaped as in M. lethæus, but comparatively a little shorter; the neuration appears to be identical with that of the other species (it is wrongly given on the plate), excepting that the anastomosis is even farther tov the base of the wing.

Length of body, 5.5^{mm}; of front wing, 6.25^{mm}; width of same, 2^{mm}.

Florissant. Sixteen specimens, Nos. 1306 and 4423, 2177, 2364, 2984, 4908, 5462, 6861, 7042, 7568, 7883, 10225, 10407, 10430, 11005, 12234, 13138.

7. PALADICELLA gen. nov. (*παλαιός*, *α–*, *δίκελλα*).

Still another anomalous genus is found among the Florissant Hydropsychidæ, in some respects allied to Mesobrochus, since the first and fifth apical cells are wanting and the other apical cells are nearly equal and long. The other features, however, are very different, partly perhaps from the much greater comparative brevity and breadth of the wing. The third and fourth apical cells are so closely approximated as nearly to touch throughout their length, even to the very margin of the wing. The discoidal cell is closed and relatively much shorter than it would be in Mesobrochus were it closed at the same time; that is to say, the branch of the sector usually furnishing the first apical sector has a much later origin in Paladicella than in Mesobrochus. The name given is not meant to have any reference to the recent genus Adicella.

Paladicella eruptionis.

Pl. 15, Fig. 14.

This species is represented by a single specimen and its reverse, tolerably well preserved on a dorsal view with partially expanded wings. The body is moderately slender and not heavily clothed, the head rather small, front legs not very large. The wings are not slender, broadest before the apical third, with rounded contours, the well rounded apex above the middle, the apical margin more obliqne than the costal as it falls to the apex.

The wing is tolerably clear, slightly infuscated next the costa with fuscous veins. The neuration along the middle of the outer half of the wing is not correctly given in the plate; the vein above the lowest forked vein (containing the fourth apical cell) is also equally but not so widely forked, and it does not connect (excepting by a cross-vein) with the vein above, but much farther toward the base with the vein below, its fork containing the third apical cell.

Length of body, 9^{mm}; of front wing, 10.5^{mm}; breadth of same, 4^{mm}.

Florissant. One specimen, Nos. 8422 and 13004.

8. TINODES Curtis.

The single species referred here provisionally is shown by its neuration to belong elsewhere, and is merely placed here for convenience and for want of a better place. Moreover two species have been found in amber.

Tinodes (?) paludigena.

Pl. 15, Fig. 9.

An interesting little species, apparently belonging near this genus, but in which the neuration is even simpler, though being in large part obscure, the species is placed here provisionally. The body is moderately slender, the legs rather short. The front wings are not very slender, broadest in the middle of the apical half, beyond which the wing tapers rapidly and almost equally above and below to a rounded apex. Only the first and third apical cells are present and both very large and with a long stalk, the veins originating far toward the base. This alone shows it can not be a Tinodes, but the anastomosis can not be made out. The hind wing is considerably shorter than the front wing, broadest near the base, has a pretty strongly curved costal margin terminating abruptly in a pointed apex, from which the oblique apical margin retreating rapidly blends by one curve in the inner margin; the second and third apical cells only are present, of about equal and considerable length, the latter nearly reaching the middle of the wing; an interesting feature of this wing is a large spreading tuft of dark hairs longer than the width of the thorax, springing from near the base of the costal area.

Length of body, 5–6.25^{mm}; of front wing, 5.5^{mm}; of hind wing, 4^{mm}; breadth of front wing, 1.5^{mm}; of hind wing, 1.2^{mm}; length of tuft of hairs, 0.75^{mm}.

Florissant. Four specimens, Nos. 2142, 6964, 10702, 13137.

Subfamily LEPTOCERIDÆ Stephens.

No fossil species of this subfamily have been described, but Hagen mentions several species which he refers to Mystacides and Odontocerum. Two Florissant species are found, which are believed to be most nearly allied to Setodes. The larvæ of this group are found more often in running than in standing water, but frequent both; the case is usually a free sand tube; the members of the subfamily are distributed all over the world.

SETODES Rambur.

This genus, as existing at present, is found well represented in regions as wide apart and as different as North America, Europe, and the East Indies. None have before been reported fossil, and the two species we have referred here are so placed more from their general aspect than for any other more solid reason. The form and pointedness of the wings and the general structure of the antennæ and legs look evidently in this direction. The larvæ of this group inhabit both standing and running waters.

Table of the species of Setodes.

Wings at rest extending far beyond the abdomen ..... 1. *S. portionalis.*
Wings at rest not reaching the tip of the abdomen ..... 2. *S. abbreviata.*

1. Setodes portionalis.

Pl. 15, Fig. 15.

A single specimen is placed here, the pointed form of the wings, the size, and the whole aspect indicating this group of caddis-flies; the wings, however, are so thickly clothed with scales that no neuration can be distinguished. The body is tolerably slender, the antennæ and legs exceedingly long; only a portion of one antenna, as long as the body, is preserved, but this shows no indication whatever of diminution in size; it is rather stout, as stout, indeed, as the tarsi, and the joints four or five times as long as broad, cylindrical, pale brown, with dark brown incisures; the length of the basal joints is not determinable. The legs extend a long way beyond the tip of

the closed wings and are very slender; the front pair, however, are n. shorter than the others. The front wings are very slender, densely pubescent, when closed extending some way beyond the tip of the body, the portion so extended tapering to a slender but rounded tip which is near the upper margin of the wing, the costal border being almost uniformly and gently convex, and not falling rapidly next the tip, while the apical margin below the tip is exceedingly oblique until the tip of the body is reached.

Length of body, 6^{mm}; of front wing, 6^{mm}; breadth of same, 1^{mm}; length of antennal joints, 0.5^{mm}; of mid tibiæ and tarsi together, 4.5^{mm}; reach of hind legs beyond body, 3.5^{mm}.

Florissant. One specimen, No. 11754.

2. Setodes abbreviata.

A single specimen only has been found, closely allied to the preceding but with remarkably abbreviated wings. The body is moderately slender, densely pubescent, the antennæ black, of the length of the body, of the same stoutness as in the preceding, but with joints scarcely so long and densely and very finely covered with hairs. Legs not perfectly preserved but a little stouter than in S. portionalis. Wings very much shorter than the body, very slender lanceolate, the apical portion narrowing, more rapidly below than above, to a sharply pointed tip, black, densely clothed with long hair-like scales.

Length of body, 6.5^{mm}; of front wing, 3.5^{mm}; breadth of wing, 0.65^{mm}.

Florissant. One specimen, No. 5218.

Subfamily LIMNOPHILIDÆ McLachlan.

A single member of this group has been found fossil in Prussian amber, a species of Halessus. Besides this, however, several larval cases have been described, some at least of which appear to belong here, as it contains at the present day all the larger caddis-flies which ornament their larval cases with shells and other odd substances. To this list we can now add from America one of each kind, a winged insect and a larval case constructed of grains of stone. The group as it exists to-day is mainly confined to the northern hemisphere, north of the tropics, but it reappears to some extent in corresponding portions of the southern hemisphere, at least in America

LIMNOPHILUS Burmeister.

This genus has never been reported fossil, and in placing in it the species below the intention is only to indicate its affinities. The genus is boreal and wide spread, and the larvæ are generally found in standing water

LIMNOPHILUS SOPORATUS.

Pl. 15, Fig. 5.

A couple of specimens are referred here, in only one of which is the neuration sufficiently distinct to be determined with any probability, and in this it is somewhat obscure and is not fully shown in the plate; nearly all the veins and cross-veins in the outer half of the wing can, however, be traced with more or less distinctness, though the cross-veins are certainly obscure; the neuration, as thus limited, is wholly that of Limnophilus. The front wings are moderately long and narrow, the costal margin rather strongly arched in the apical half, curving downward to the bluntly acuminate apex, the apical margin sharply and very obliquely truncate. Discoidal cellules short, much shorter than its foot-stalk; anastomosis of the lower half of the wing continuous.

Length of front wing, 12.5^{mm}.

Florissant. Two specimens, Nos. 1441, 13007.

INDUSIA Bosc.

In certain parts of Auvergne, France, rocks are found which for a thickness of sometimes two meters or more are wholly made up of the remains of the cases of caddis-flies. These have been frequently mentioned by writers and were first described and figured by Bosc early in the century under the name of Indusia tubulosa. Oustalet in his recent treatise on the fossil insects of Auvergne,[1] describes two forms, one from Clermond and the other from St. Gérand, which he distinguishes under the names Phryganea corentina and P. gerandina, principally from their difference in size and strength, and a distinction in the minute shells—species of Paludina—of which the cases are composed.

These cases, like the somewhat similar ones composed of grains of stone which are described below, are all apparently made by species of Limno-

[1] Bibl. École Haut. Études; Sci. Nat., vol. 4, pp. 101–102.

philidæ,[1] the larvæ of which group are remarkable for the variety of objects they use for the construction of their cases. It would seem desirable at present, while placing Indusia in this group, to include in it all larval cases of extinct Trichoptera until they can be more definitely placed or distinguished.

These, however, are not the only instances of larval cases of Trichoptera found fossil. Hepp, in 1844,[2] describes some from the rocks at Leistadt, near Dürkheim, under the name of Phryganea blumii, and Heer a few years later in his classic work describes and figures a similar instance from Oeningen, under the name of Phryganea antiqua, in which the case was in part made up of bits of sticks. But the most surprising discovery of this sort is that of supposed larval cases of Phryganidæ in amber.[3] According to Dr. Hagen, Pictet thought them larval cases of a tineid, but Zeller believed they were trichopterous, the larvæ still remaining inclosed and appearing to belong near Mystacides. As phryganid larvæ are aquatic almost without exception, their discovery in amber is certainly surprising. A tube-like larval case, presumably trichopterous, has also been described under the name of Phryganæa micacea and figured by Fritsch[4] from the Cretaceous clay-schists of Kounic, Bohemia; and Marion[5] describes larval cases on the leaf of a fossil, Nymphæa, in Provence. very like those attached to similar leaves to-day.

Indusia calculosa.

Pl. 4, Fig. 4.

Indusia calculosa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 542–543 (1878); Ann. Rep. U. S. Geol. Geogr. Surv. Terr., XI, 638–639 (1879); in Zittel, Handb. d. Palæont., I, ii, 778, Fig. 985 (1885).

Dr. A. C. Peale, in his explorations under the Survey, discovered in deposits, which he considers as probably belonging to the upper Green River group, or possibly to the lower part of the Bridger group, beds of limestone, the upper floor of which is completely covered with petrified cases of caddis-flies, all belonging to a single species, which may bear the name we have applied to it above. They vary from 14 to 19^{mm} in length, from 4 to 5^{mm} in diameter at their open anterior extremity, and from 3 to

[1] See on this point McLachlan, Proc. Ent. Soc. Lond., 1882, 18–19.
[2] Jahresb. Pollichia, vol. 2, pp. 19–23.
[3] Berendt, Bernst. befindl. organ. Reste Vorw., vol. 2, pt. 1, p. 121.
[4] Archiv. naturw. Landesdurchf. Böhm., vol I, p. 66; Vesmír, vol. 13, p. 205.
[5] Saporta, Organ. probl. anc. mers, 24–26, Pl. 3, Fig. 2.

3.2^{mm} at their posterior end, the thickness of the walls being about 0.75^{mm}. As will be seen by these measurements, the cases are a little larger at their mouth, but otherwise they are cylindrical, taper with perfect regularity, and are straight, not slightly curved, as in many phryganid cases. They are completely covered with minute, rounded, water-worn pebbles, apparently of quartz, generally subspherical or ovate, and varying from one-third to two-thirds of a millimeter in mean diameter; they thus give the cases a granulated appearance. Nearly all the cases are filled with calcareous material, but some are empty for a short distance from their mouth, and in one case the inner lining of this part of the case has a coating of minuter calcareous particles, evidently deposited therein after the case was vacated. As the present thickness of the walls indicates (as also the size of the attached pebbles), the silken interior lining of the case must have been very stout. This follows also from the appearance of one or two which have been crushed, for they have yielded along longitudinal lines, indicating a parchment-like rigidity in the entire shell. In one of the specimens the outer coating of heavier pebbles has in some way been removed by weathering, and has left a scabrous surface, apparently produced by minute, hard grains entangled in the fibrous meshes of the web; it still, however, retains its cylindrical form.

The size of the case, its form, and the material from which it is constructed seem to indicate that it belonged to some genus of Limnophilidæ near Anabolia.

Horse Creek, Wyoming. Dr. A. C. Peale.

Subfamily PHRYGANIDÆ Stephens.

This subfamily of caddis-flies, comprising the larger species, is found only in the northern portions of the globe, and is numerous neither in species nor in genera; nevertheless it is the only group of caddis-flies whose remains have hitherto been found in rocky strata, if we except the larval cases, of which there is likely to be more or less question. And it is not a little strange that they have been found in several distinct places, ranging from Aix in the Oligocene to Parschlag in the upper Miocene. Mombach, the Isle of Wight, and Atanaterdluk, in Greenland, have also furnished species. From amber also three species are known, and now we have three more species, including a new generic form, to add from the strata of Colorado

It is not, however, as in Europe, the only subfamily represented in the strata, three others being also represented and one of them much more largely. (February, 1884.)

NEURONIA Leach.

A single small species of this genus has been described from amber by Pictet and Hagen, which the latter compares with the living N. reticulata. The one here described is the first known from the rocks, and is a considerably larger species, and with somewhat peculiar neuration. The genus is well represented at the present time over all North America, and besides is found only in Europe.

NEURONIA EVANESCENS.

Pl. 13, Fig. 3.

A single specimen of a large species of phryganid is referred to Neuronia, although the neuration appears to be somewhat abnormal, the cross neuration on either side of the sector not being continuous. The insect is preserved on a lateral view, showing the head and body, the superposed wings of one side, and all but the base of the other front wing extended below the body, together with one hind leg.

The upper half of the overlapping wings is much darker than the lower half and shows some mottling near the tip, which is not the case in the other wing. The single front wing is of a uniform brownish fuliginous tint, but broadly obscured in the middle of the wing by accident of preservation over a large pale area, in which also the veins are nearly lost. This accounts for the inaccuracy of the drawing on the plate.

The front wings are subtriangular, less than two and one-half times longer than broad, their greatest breadth in the middle of the apical half; the costal margin is gently arched in the apical half, the apex roundly pointed, the apical margin almost straight in the middle half and inclined at a rather sharp angle with the costal margin.

The shape of the wings, as well as the brevity of the discal cell, renders it probable that the species should be referred to Neuronia rather than to Phryganea or Agrypnia, though it is impossible to determine clearly whether there is a cross-vein between the subcostal vein and the costa. The radius has a broad superior arch below the extremity of the subcostal which renders it probable that it exists, and that it can not therefore be referred to Agryp-

nia. The upper branch of the sector originates earlier than usual, close to the base of the discal cell, which is short, as in Neuronia, but only because the cross-veins which terminate are carried to an unusual distance toward the middle of the wing, and are therefore widely separated from the cross-veins uniting the sector with the cubitus—an unusual feature in this subfamily, and one which with its other peculiarities renders it probable that it should be generically separated from living types. There is also lacking the zigzag arrangement of the cubital cross-veins, though their exact relation can not be determined throughout. The hind leg bears two pairs of tibial spurs, as always in this subfamily.

The length of the body is indeterminable; the length of body and wings together in repose is 24^{mm}; of front wing, 20.5^{mm}; greatest breadth of same, 8.5^{mm}; length of hind tibia, 3.65^{mm}; of hind tarsi, 4.65^{mm}.

Florissant. One specimen, No. 7728.

PHRYGANEA Linné.

Species of this genus are by no means unknown in a fossil state; indeed it is the only genus of Phryganidæ which has heretofore been represented in the rocky strata by remains of the perfect insect, and while only two species are known from amber, four have been described from Tertiary rocks (Aix, Mombach, Parschlug, and Greenland) and a fifth indicated from the Isle of Wight. Very likely some of these may be found to belong elsewhere, but their large size would lend a probability to their proper reference here, since this genus and its allies contain the largest of the caddis-flies. We have here a single species to add, represented wholly by wings, but very well preserved. The genus is mostly confined to North America and Europe.

PHRYGANEA LABEFACTA.

Pl. 13, Fig. 5 (♂).

An excellently preserved front wing, lacking only a fragment broken from the lower outer angle, represents a male. It is of a nearly uniform smoky brown tinge, with much darker distinct veins, and delicately mottled with faint, pale, circular dots which are larger and therefore more noticeable than elsewhere in the upper outer half of the wing, and are absent from the center. It is of about the size of our common Neuronia semifasciata (Say) but of a different shape, being subquadrate, about three times longer than

broad and only slightly broader apically than basally. The apex is slightly pointed and the outer margin apparently slopes more rapidly below than above the apex. Though not shown in the plate, the subcosta is united near the tip to the costa by a cross-vein, and just below the apical cell thus formed the radius has a well-marked distinct arch. The cross-vein closing the cell is not shown in the plate, nor the cross-vein just below it, into which, rather than directly into the cubitus, the first nervule below the lowest branch of the sector runs. The lower cross-veins also do not appear on the plate; they run, as in the modern Phryganea grandis, with a slight jog where they cross the basal branch of the upper cubital, obliquely from the base of the second branch of the upper cubital toward the arculus. Indeed, the venation of the lower half of the wing closely resembles that of the modern European P. grandis, which is slightly larger than the fossil species. This differs from that in only one or two points; the first apical sector parts from its stem at the middle of the discoidal cell, the lower border of the cell is as full as the upper, and the cell itself is proportionally shorter.

Two other specimens agreeing in neuration with the preceding, but with the lower nervule of the upper branch of the superior cubitus forked represent females. Like the male they are represented only by upper wings, one of them perfect, the other broken squarely at the tip by the breaking of the stone in quarrying; one is a little lighter in color than the male, and, as it were, bleached out at the apex, while the other is much darker, almost of a blackish chocolate, many of the minute spots of the mottling, especially in the upper part of the wing, appearing quadrate rather than circular. The fourth (female) fork is nearly as deep as the third, extending slightly more than half-way to the base of the branch.

Length of wing, ♂ 20.25^{mm}, ♀ 19.5^{mm}; of discoidal cell, ♂ ♀ 5.5^{mm}; breadth of wing, ♂ 7^{mm}, ♀ 7.3^{mm}.

Florissant. Three specimens, Nos. 407 (♂), 1016, 3897 (♀)

LIMNOPSYCHE gen. nov. (*λίμνη*, *ψυχή*).

This name is proposed for a genus which differs somewhat remarkably from any Phryganidæ, but which agrees at the same time in its main features with the subfamily of Phryganidæ proper. In his monograph on the Trichoptera of the European fauna, Mr. McLachlan lays much stress on

the importance in generic characteristication of the presence or absence of specified apical cellules, of which the full complement in the anterior wing is nine; of these three belong to the area of the sector. In the present genus we have an additional apical cellule in the field of the sector, one of the ramules of the lower branch of the sector being divided. In all other species of Phryganidæ proper, to which there can be no doubt that this genus belongs, both the ramules extending to the margin from either side of the cross-vein closing the discoidal cell are simple; in Limnopsyche the upper is branched, so that there exists an "apical fork" between the "first" and "second" apical forks of McLachlan's terminology. This, however, is not the only peculiarity; the anastomosis is broken into three instead of, as in true Phryganidæ, two parts, the cross-vein uniting the sector and cubitus lying far toward the tip of the wing, while the remainder of the anastomosis has its normal place near the middle of the wing. Moreover, the median cellule, which, as in other Phryganidæ proper, is open, extends nearly to the base of the wing, interrupting still more markedly the anastomosis of the lower half of the wing.

Although only a portion of the neuration can be determined in the single pretty large species referred here, this differs so much from the existing genera of true Phryganidæ that its separation from them is indispensable.

Limnopsyche dispersa.

Pl. 13, Fig. 2.

There are three specimens provisionally referred to this species, but in only one can the neuration be traced sufficiently, and it is upon this, which is figured, that the species is founded. It shows a dorsal view with indistinct traces of different appendages, but with the wings of one side expanded. Especially this is true of one; it is an upper wing, but toward the lower margin a portion of the hind wing, crumpled and folded, is more or less mixed with it, so that the figure is not perfectly clear or probably correct at this point. The main features of the neuration have been pointed out in the description of the genus, but a few special points may be added. The wing is about two and a half times longer than broad, the costal margin well rounded, bringing the rounded apex down nearly to the middle of the wing, the lower margin (apparently) full. It is pale brown without mot-

tling; the discoidal cell is very long and slender, nearly one-third the length of the wing, and occupying almost exactly the middle third longitudinally. First apical sector arising from the middle of the discoidal cell; cell between the sector and cubitus of uniform width and running almost exactly through the middle of the wing, terminating some way below the apex; cross-veins uniting the sector and cubitus more than half-way from the end of the discoidal cell to the border. As the other cross-veins are in their usual place, the anastomosis is widely scattered, whence the specific name.

The other specimens are poorly preserved; they agree with the preceding in size and present no characters in opposition to it. They show in addition portions of the antennæ, a slender stem arising from a rather stout basal joint; in both, however, the antennæ are broken shortly beyond the base.

Length of body, 8^{mm}; of front wing, 8.25^{mm}; breadth of same, 3.25^{mm}; length of hind wing, 7^{mm}.

Florissant. Three specimens, Nos. 809, 8606, 8995.

ORTHOPTERA Linné.

Although a group of great antiquity, some of its divisions (especially the cockroaches) being abundant in Paleozoic as in Mesozoic rocks, this order of insects is feebly represented in Tertiary times. Part of our lack of familiarity with the relics of those days is due to their rare occurrence in amber, a fact largely due to their generally weak and brief flight. Indeed, hardly a dozen species of the entire order are known or indicated from this source, and less than forty species, including all mere references as distinct forms, from the European rocks. This number is nearly equaled by the American species described in this volume, but this fact is largely due to the great preponderance of Forficulariæ, which comprise more than a third of the species. The numbers in the different groups are, perhaps, too small to render a particular comparison useful, but we may note that the European rocks have representatives of each family excepting the Phasmida, while the American furnish specimens of all but the Mantides. No Acridii have been found in amber, and of Locustariæ only larvæ: Forficulariæ and Mantidæ are said by older authors to have been found in amber, but none are now known, the undoubted amber remains being confined to Blattariæ, Phasmida, Locustariæ (larvæ), and Gryllides.

In comparing the European and American Tertiary orthopteran faunas some interesting points may be noted. The resemblance of both faunas in a nearly equal degree to warm temperate or subtropical types is not a little curious, combined as it is with a distinct differentiation of character; for even where the same subfamilies are represented, as they generally are, the genera of the two continents are widely different. In the few cases where species have been placed under the same generic heading it has usually been by the use of the genus in the broad sense, indicating merely subfamily affinities, and the species themselves are widely different. The resemblance between the two countries is perhaps most marked in the

Forficulariæ, though the European species have been very imperfectly presented as yet. Perhaps the most marked peculiarities in the American fauna as distinguished from the European are the abundance of Forficulariæ of a common type, the occurrence of Conocephalidæ, and the absence of Mantides, Tettigidæ, Decticidæ, and the burrowing as well as the slender Gryllides.

As a whole the Orthoptera of Florissant and the Green River deposits indicate a warmer, not infrequently in specific cases a much warmer, climate than now appertains to that region, though this is true to a less degree of the saltatorial Orthoptera in general than of the others. (July, 1884.)

It is not a little surprising to find so many American species, no less than eleven being already obtained from Florissant, a number more than double that of the European Tertiary species, and all apparently belonging to one type, not now in existence. It is not impossible that a nearer study of the European fossil species may prove that they also belong here, as one may notice in them the same simplicity in the character of the forceps.

Some of the Florissant species are of very large size, much larger than any which are found in temperate regions, and the presence of this type in such abundance, and represented in part by such gigantic forms, is a clear witness to a considerably warmer climate than now obtains in the same region even at the level of the lower plains.

Family FORFICULARIÆ Latreille.

Fossil earwigs are not unknown, but have been imperfectly studied. Heer gives wood-cuts of two, Forficula recta, which he compares with Forcinella annulipes (Luc.) Dohrn, and F. primigenia, compared with the common earwig, i. e., Forficula auricularia Linn; he also mentions a third, F. minuta, compared with Labia minor (Linn.) Leach. These all come from the Miocene of Oeningen.[1] Long ago Serres spoke of a species allied to Forficula parallela Fabr. and F. auricularia Linn. (both the same species), of which many specimens had been found at Aix in Provence.[2] Perhaps Mr. Oustalet, when he resumes again the publication of his memoirs on the fossil insects of southern France, will acquaint us more perfectly with this insect; but I saw no specimens of Forficulariæ in his hands in 1873. One,

[1] Heer, Urwelt der Schweiz, 2d edition, p. 392, figs. 267, 268.

[2] Serres, Géognosie des terrains tertiaires, 225

perhaps two, species are also reported from Prussian amber. Keferstein[1] speaks of an amber species, referring to Burmeister (Handb. Entom.) but the latter mentions only some crickets ("Acheten") "of the size of F. minor." And Germar writes that up to 1856 but a single specimen of an earwig had been found in amber, a larva agreeing so completely with the full-grown larva of Forficula auricularia that description and illustration were superfluous.[2] Gravenhorst also refers to a German species from amber.[3] Finally Massalongo describes and figures[4] a species from the Tertiaries of Monte Bolca, which he calls Forficula bolcensis, and which again he compares to F. auricularia Linn. This species, which in point of fact is much nearer F. albipennis Muehlf. than F. auricularia, seems to be a true Forficula. The same may perhaps be said of Heer's species, or at least of the two which are figured (none are described), or they may belong to the same group as the American species, though one at least of them is much smaller than any we have found. But in Heer's species we have only a few abdominal joints and the forceps from which to draw any conclusion.

A couple of species have been found in rocks older than the Tertiaries, Baseopsis forficulina Heer[5] from the Lias of Schambelen and Forficularia problematica Weyenb.,[6] found in the Jura of Solenhofen. Although the figures given of this latter insect are very obscure, Weyenbergh says it is an earwig "sans le moindre doute," and of one of the seven specimens found he says it "montre à l'extrémité de l'abdomen les deux crochets, dont l'ensemble représente une sorte de pince, et qui caractérisent le genre Forficula."

LABIDUROMMA gen. nov. (λαβίς, οὐρά, ὅμμα).

In first describing an earwig from Florissant I referred it hesitatingly to Labidura; a second species was subsequently placed in the same genus from its resemblance to the first. In my study of the much more abundant and better material now at hand I was at first inclined to refer not only these two species but all the others, including a considerable variety of forms, to the old genus Forficula, the structure of the antennæ in particular

[1] Naturg. Erdkörp., vol. 2, p. 331.
[2] Berendt, Bernst. befindl. organ. Reste Vorw., vol. 2, pt. i, p. 33.
[3] Uebers. schles. Gesellsch. vaterl. Cult., 1834, 93.
[4] Massalongo, Stud. pal., 15–16, pl. 1, figs. 5–7.
[5] Heer, Urwelt der Schweiz, 2d edition, p. 94, pl. 7, fig. 5.
[6] Arch. Mus. Teyl., vol. 2, p. 274.

according more closely with Forficula than with Labidura. But one point after another showed such distinction from Forficula that the species seem more correctly presented when placed in a distinct genus. Whether all belong there is perhaps questionable, especially when the extreme members of the genus are compared. Moreover, all the characters upon which the genus is founded are not to be found in all the species here described, as preserved in the specimens at hand; but in the order in which I have arranged them they show such a gradual passage from one to the other that notwithstanding the diversity in general aspect and in size between the first and the last, I can find no good characters in their imperfectly preserved structure by which they should be separated. The genus is without doubt nearly allied to Forficula, but it is impossible to place it there, or indeed in any known existing genus of Forficulariæ on account of the great size of the eyes. These are not only as large in front as in Cylindrogaster and Sphongophora, but instead of being shut off from the posterior half of the head, as in all living Forficulariæ known to me, they extend to the posterior margin, as may be readily seen in Figs. 3 and 12 of Pl. 16; that is, instead of being anterior they are lateral. The genus is also peculiar for the great simplicity of the forceps, which are long and rather (sometimes very) slender, and, with a single exception, where there is one basal tooth, they are entirely unarmed. The antennæ, where they are preserved, show some diversity of structure and it is partly on that account that I have hesitated about keeping them together; but as a general rule they are comparatively short, not extending backward beyond the closed tegmina, rather coarse, the joints about as numerous as in Forficula, the basal joint not very long nor stout, the joints in general shorter compared to their width than in Forficula. All the species, with perhaps one exception, are winged, and all have tegmina of the normal form. It is not a little curious that several specimens have the wings fully expanded, and these show in all their main features the same characteristics as the strangely folded wings of earwigs to-day, showing that the type was fully developed in this early Tertiary period. One may notice, indeed, a slightly greater simplicity of structure here and both greater simplicity and greater uniformity of character in the forceps of the fossil species, which seem to betoken an approach toward the origin of the type, but it is a mere suggestion, or scarcely more than that.

One of the species here described, certainly distinct from the others, is so imperfectly preserved that no name is given to it. The others may be distinguished by the following table:

Table of the species of Labidiuromma.

Species of large size with very long forceps (the total length nearly or quite 25mm).
- Male forceps almost one-half as long as body ..... 1. *L. aria.*
- Male forceps scarcely more than one third the length of body ..... 2. *L. bormansi.*

Species of smaller size and shorter forceps (only a little exceeding 20mm).
- Hind margin of last abdominal segment of male strongly angulated; no pygidium perceptible. 3. *L. mortale.*
- Hind margin of last abdominal segment of male straight or nearly straight; pygidium distinct and sometimes large.
  - Male forceps with large projecting interior tooth at base ..... 4. *L. commixtum.*
  - Male forceps with no projecting basal tooth.
    - Male forceps narrowing almost from base ..... 5. *L. tertiarium.*
    - Male forceps with equal parallel sides for some distance from base.
      - Male forceps comparatively slender, with distinct and tolerably strong falcation. 6. *L. gilberti.*
      - Male forceps broad beyond the base, with weak falcation ..... 7. *L. exsulatum.*

Species of much smaller size and generally still shorter forceps (the total length about 15mm or less).
- Male forceps stout at base, much smaller and equal beyond ..... 8. *L. lithophilum.*
- Male forceps slender and delicate throughout.
  - Male forceps less than half as long as abdomen ..... 10. *L. infernum.*
  - Male forceps fully half as long as abdomen ..... 11. *L. labens.*

1. Labidiuromma avia.

Pl. 16, Figs. 5, 22 (♂), 3, 11, 23 (♀).

Head small, rounded triangular; antennæ in no case well preserved, the longest fragments scarcely reaching the tip of the tegmina, the basal joint not precisely determinable, but apparently about twice the diameter of the stalk and subglobular; the proximal joints of the stalk are cylindrical and from two to three times as long as broad, so that if composed as usual in this genus the antennæ could not have extended beyond the tip of the tegmina; palpi shorter than the diameter of the head, nearly as stout as the antennæ, the joints half as long again as broad. Pronotum nearly circular but subquadrate, apparently longer than broad, and narrower than the head in the female (where it is better preserved than in the male specimens) and the opposite apparently in the male, where it seems to equal or surpass the head in breadth. Tegmina together considerably broader than the head, and square, of equal length and breadth; folded wings protruding beyond the tegmina to a distance of three-fourths the length of the latter. Legs moderately stout and not very short, the second joint of the tarsi apparently cordate. Abdomen equal with parallel sides. Forceps simple but of great

length, in the male as long as the abdomen beyond the wing tips, somewhat depressed, with the basal third straight, its basal half with straight and parallel sides, its apical half narrowing on the inner side, the whole inner margin pinched and perhaps a little crenulated, but not toothed nor beaded; the distal two-thirds very gently and slightly arcuate, scarcely tapering, the curve increasing slightly toward the bluntly rounded tip. In the female they are a little shorter, much slenderer and apparently cylindrical throughout, scarcely attingent at the base, with no pinching of the inner edge at the base, and very regularly and gently tapering to a more delicate but still bluntly rounded point; the arcuate curve is if anything a little stronger, and commences from the base, though the straight basal portion of the male is sometimes indicated by the origin of the arcuation (on the outer edge) at a little remove from the base. Pygidium of the male (not shown in the figures) triangular, longer than broad, half as long as the greatest breadth of the forceps, the apex broadly, bluntly rounded; in the female as long as broad and as the base of the forceps, more or less slightly truncate and rounded at apex.

Length of body, excluding forceps, ♂ 19^{mm}, ♀ 18–19^{mm}; breadth of abdomen, 3.5–4^{mm}; length of front and middle femora, 2.5^{mm}; tibiæ, 1.75^{mm}; tarsi, 1.5^{mm}; of hind femora, 2.8^{mm}; tibia, 2.3^{mm}; of forceps, ♂ 8.5^{mm}, ♀ 6.5^{mm}; breadth of same at base, ♂ 1.4^{mm}, ♀ 0.7^{mm}; in middle, ♂ 1^{mm}, ♀ 0.4^{mm}.

This is the most interesting of the Florissant species on account of its great size and the long and simple forceps. It is twice as large as any living species of Forficula.

Florissant. Eight specimens, Nos. 11740, 13544 and 13545, 13547 (♂), 2855 and 3567, 3832 and 5532, 5438, 8022, 11209 (♀).

2. Labiduromma bormansi.

Pl. 16, Fig. 1 (♂).

In the two specimens referred to this species the head and pronotum are badly preserved, but so far as can be seen appear to be much as in L. avia in relation to each other and the combined tegmina; the prothorax is, however, certainly larger, though slightly, than the head, and the antennal joints at a short distance from the head are three or four times as long as broad. The tegmina are large with broadly rounded posterior edges, and the body with straight parallel sides; the last segment is as broad apically

as basally, and the hinder edge is straight. The forceps of the male (female unknown) are very long, flattened, straight on the basal three-fifths (they are given with a slight curve in the plate), and beyond gently sickle-shaped; they taper very gently and with entire regularity to a bluntly rounded, slightly angulated tip, excepting that the basal third or more has on the inner margin a thinner, blade-like, straight flange, increasing the width by nearly one-fourth. Pygidium small, triangular, equilateral, with a blunt apical angle.

Length of body, excluding forceps, ♂ 18^{mm}; breadth of abdomen, 3.5^{mm}; length of forceps, 6.3^{mm}; breadth at base, 1.2^{mm}; in middle, 0.75^{mm}.

This species is slightly smaller than the preceding, but resembles it closely, the forceps of the male having about the size of those of the female of L. avia, though their flatness and mode of curvature, and especially of the basal opposition, evidently indicate a male.

Named for M. A. de Bormans, of Switzerland, the well known student of Forficulariæ.

Florissant. Two specimens, No. 11180, Princeton Collection, No. 1.603 (♂).

3. Labiduromma mortale.

Pl. 16, Figs. 2, 6 (♂), 20 (♀).

Head small, well rounded, a little produced anteriorly; antennæ moderately slender, probably considerably less than half the length of the body, the basal joint small, scarcely stouter than the third or fourth joint, less than twice as long as broad, its apical half cylindrical and squarely truncate; the sixth joint considerably longer than the first, and scarcely more than three times as long as broad; palpi shorter than the diameter of the head, the joints about twice as long as broad. Pronotum suborbicular, a little smaller and no broader than the head, slightly broader than long. Tegmina together considerably broader than the pronotum, perhaps almost twice as broad, the apical edge nearly straight, rounded only next the outer edge. Wings extending, when folded, as far beyond the tegmina as the length of the latter. Legs not long nor stout, the middle pair situated nearer the hind than the front pair, and of about the same length as the former, the femora flattened, about twice the width of the tibiæ. Abdomen with nearly parallel sides, a little broadest just behind the middle, the third and

sometimes the fourth segment on some specimens with faint indications of lateral plications; last segment a little longer than the preceding, narrowing slightly posteriorly with rounded posterior angles; hind margin of male strongly angulated, as shown in Fig. 6, of female straight with minute triangular pygidium. Forceps broad, flattened, stout, long, and nearly straight, as long as the four or five terminal segments, the basal two-fifths straight, equal, the attingent inner edges thickened slightly, the next two-fifths narrower, particularly by the excision of the inner edge, tapering, nearly straight, the apical fifth still narrower, more tapering, bent slightly inward and bluntly rounded at tip (♂), very broad and flattened, straight, scarcely tapering before the middle and then but slightly, the apex apparently twice as broad as in the male and bluntly rounded (♀).

Length of body, excluding forceps, ♂ 16.5–17.5^{mm}, ♀ 18^{mm}; breadthof head, 1.8^{mm}; of tegmina, 3.5^{mm}; of abdomen, 4.3^{mm}; length of middle and hind femora, 3^{mm}; of fore femora, 1.7^{mm}; middle and hind tibiæ, 2.2^{mm}; ore tibiæ, 1.2^{mm}; length of forceps, ♂ 5.5^{mm}, ♀ 4.5^{mm}?; breadth of same at base, ♂ 1.05^{mm}, ♀ 1.3^{mm}; at tip, ♂ 0.35^{mm}.

This species differs from the two preceding species by its shorter, broader, and straighter forceps. One of the specimens (Fig. 2) was taken by me in the original insect beds described by Dr. A. C. Peale.

Florissant. Six specimens, Nos. 395, 3705, 6317 (♂), 8049, 13001 (♀). No. 1.615 (♂), Princeton Collection.

4. Labiduromma commixtum.

Pl. 16, Figs. 10, 17 (♀).

Head moderately small, well rounded, the posterior border a little truncate. Pronotum considerably smaller than the head, subquadrate, of equal length and breadth. Tegmina together considerably broader than the head and nearly double the breadth of the pronotum; each of the tegmina about twice as long as broad, and the coriaceous portion of the wings extending beyond them for a distance equal to half their length. Legs slender and rather long. Abdomen slightly expanding, so as to be broadest in the middle and broader than the tegmina, yet with subparallel sides; last segment a little longer than the others, slightly broader in front than behind, the posterior margin broadly rounded. Pygidium very large, being at base one-third the width of the terminal segment, subtriangular but strongly rounded,

with very bluntly rounded apex. Forceps of male broken in the only specimen seen, but evidently pretty long and moderately stout, the portion (half?) remaining being as long as the last two segments of the abdomen, straight, equal, separated at base by the pygidium, with a very stout, sharp, triangular, interior tooth embracing the pygidium, and with two minute distant teeth or tubercles beyond; in the female distant at base, straight, flattened, simple, unarmed, tapering regularly, with not the slightest inward curve, to a bluntly rounded tip, one-third the width of the base. This peculiarity reminds me of a specimen of Labidura riparia I have seen with perfectly straight and laminate forceps[1].

Length of body, excluding forceps, ♂ 17.5^{mm}, ♀ 17.5^{mm}; breadth of head, ♂ 2.25^{mm}; of pronotum, ♂ 1.75^{mm}; of closed tegmina, ♂ 3^{mm}; of abdomen ♂ 3.5^{mm}; length of forceps, ♂ (broken) 4^{mm}, ♀ 3–3.5^{mm}; breadth at extreme base, ♂ 0.8^{mm}, ♀ 0.75^{mm}; at tip, ♀ 0.25^{mm}.

This is the only one of our American fossil species with toothed forceps.

Florissant. Three specimens, Nos. 2877 (♂), 1832, 11208 (♀).

5. Labidromma tertiarium.

Pl. 16, Figs. 18, 21 (♂), 15 (♀).

Labidura tertiaria Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 447–449; III, 259; IV, 519.

A single male specimen (Fig. 18), found by Mr. Jesse Randall, and brought home by the Survey under Dr. Hayden, formed the basis of the following description: The head, which is badly preserved, is of about equal length and breadth behind the labrum, so that as a whole it is longer than broad, but it is slightly narrower than the pronotum, and has large eyes, reaching back nearly to the hind border—characters which are scarcely in keeping with the reference of the insect to Labidura; with no other genus, however, does it accord so well. The antennæ are too fragmentary to furnish us any clew to their structure, and of the mouth parts nothing can be determined. The pronotum is of about equal length and breadth, quadrate, the anterior angles bluntly rounded, the posterior border very broadly convex, the margin nowhere elevated; there is a slight but distinct median sulcation, fading posteriorly. The rest of the thorax is of the same width as the pronotum; the tegmina are twice as long as the pronotum, squarely docked at the tip; the folded wings reach more than half as far again beyond the tip of the teg-

[1] Proc. Bost. Soc. Nat. Hist., vol. 18, pp. 324–325.

mina, and in the specimen examined are partially opened on the right side, so as to show incompletely the peculiar rayed arrangement of the nervules. The legs are short, the femora broadest in the middle, the tibiæ moderately slender and slightly bowed; but the tarsal joints are too obscure to determine their structure: the faintness of the legs probably shows that they were paler than the body, which is of a griseous brown. The joints of the abdomen can readily be distinguished, although a portion of some of them are injured, and especially of the third segment; this renders it impossible to decide certainly whether plications were present on this segment, but there are no signs of any either on this or on the better-preserved second segment: it would seem as if such plications should be seen, if present, at least on the second segment, for the abdomen is preserved on a partial side view, and the portion of the second segment where plications are to be looked for is perfectly preserved. The abdomen appears to have been equal as viewed from above, although the greater fullness in depth of the middle joints gives the specimen a great height in the middle: the last segment is large, scarcely narrowing, and furnished with a pair of stout, straight, tapering, bluntly-pointed forceps as viewed from the side, not so long as the tegmina, and apparently curved inward at the tip. The insect is slightly smaller than the common Labidura riparia (Pall.) Dohrn.

Length of body, excluding forceps, 17^{mm}; of head, 2.2^{mm}; breadth of same, 1.75^{mm}; length of pronotum, 1.9^{mm}; breadth of same, 2^{mm}; length of tegmina, 3.6^{mm}; extent of folded wings beyond tegmina, 2.5^{mm}; length of hind femora, 2.75^{mm}; of hind tibiæ, 1.75^{mm}; of forceps, 2.5^{mm}.

Since the above description was published I have seen and studied four or five more specimens, serving to modify and extend the characters before given, as follows: The head is fully as broad as and not narrower than the pronotum. The antennæ reach back to the posterior margin of the closed tegmina, and their joints are cylindrical and about four times as long as broad. The pygidium is rounded subtriangular and moderately large. The forceps of the male are very simple, being straight, with parallel sides at the very base (as far as the tip of pygidium), then narrowing rather rapidly on the inner side only, the blunt apex incurved. Of the females all the specimens are imperfect, but in the one figured the forceps appear to be laminate, tapering, entirely simple, and not incurved at the tip; the apical parts, however, are exceedingly obscure and may be wrongly

interpreted. The resemblance they show to the female of L. commixtum leads one, however, to believe this the correct view.

The species resembles the preceding, especially in the female specimens, but the forceps of the male differ considerably.

Florissant. Five specimens, Nos. 2779, 4925, 14688 (♂), 8334, 9228 (♀).

6. Labidiromma gilberti.

Pl. 16, Fig. 14 (♂).

Head small, subtriangular, with well-rounded contours. Antennæ reaching to the tip of the tegmina, apparently fourteen-jointed, the basal joint obscure, the middle joints four times as long as broad, a little larger in the middle than at the ends. Pronotum quadrate, scarcely broader than long, distinctly smaller than the head, and scarcely half as broad as the combined tegmina; posterior margin broadly rounded. Wing-veins with more widely-spread forks before the median break than in L. exsulatum. Legs short, the middle pair midway between the others and a little smaller than the hind pair, the femora broad and flattened, twice as broad as their corresponding tibiæ. Body moderately broad, with straight parallel sides; the last segment three-quarters as broad apically as basally, the apical margin nearly straight, the sides well rounded. Pygidium minute, triangular. Forceps large and long, the basal two-fifths broad, equal, straight, simple, attingent, beyond falciform, much smaller, tapering to the middle of this portion, beyond it equal, the tip bluntly rounded and a little contracted (♂); comparatively slender, straight, parallel-sided at the extreme base, beyond tapering regularly by excision of the inner margin, the tip slightly incurved and bluntly terminated (♀).

Length of body excluding forceps, ♂ 15.5^{mm}; breadth of head, 2.3^{mm}; of pronotum, 1.5^{mm}; of combined tegmina, 4.5^{mm}; of abdomen, 3.8^{mm}; length of forceps, ♂ 4.5^{mm}, ♀ 3.25^{mm}; breadth at base, ♂ 1.25^{mm}, ♀ 0.8^{mm}.

The species has a more modern look than any of the others, and in none are the forceps more falciform, reminding one to some degree of Forficula auricularia. It is named for Mr. G. K. Gilbert, of the U. S. Geological Survey.

Florissant. Three specimens, Nos. 4736, 7352 (♂), 8782 (♀).

7. Labiduromma exsulatum.

Pl. 16, Fig. 12 (♀).

Head transversely obovate, only a little broader than long, the front considerably and triangularly produced, the hinder edge almost straight in the middle. Antennæ barely reaching to the extremity of the tegmina, composed of ten joints, the first rounded obpyriform, nearly as broad as long, and not greatly stouter than the succeeding, the others cylindrical, the second scarcely longer than broad, the third and fourth half as long again as broad, the fifth nearly and the sixth more than twice as long as broad, the seventh three times as long as broad, the remainder as long as the seventh, but increasing very slightly in slenderness to the tip, which is very bluntly rounded. All the joints are not shown in Fig. 12, which represents the specimen in which the antennæ are best preserved. Terminal joint of palpi about twice as long as broad, equally rounded at each extremity, about half as broad as the antennæ. Pronotum suborbicular, a little broader than long and somewhat narrower than the head, the posterior margin well rounded. Tegmina together nearly twice as broad as the pronotum, each twice as long as broad. Wings with the main rays continuous in direction in the outer half of the wing, the branches appended interiorly and not diverging strongly at base; in the interior half widely forked, the forks continuously divergent. Legs moderately short, subequal, rather slender, the middle pair apparently inserted nearer the front than the hind pair, the tibiæ about half the width of the femora. Abdomen slender, with parallel sides in the male, fullest beyond the middle in the female. Last segment similar to the penultimate and scarcely smaller, its posterior margin gently convex. Pygidium unapparent. Forceps about as long as the last three segments, laminate, nearly straight, directed backward, the basal third straight and equal, subattingent, the remainder tapering slightly and equally with a slight falcation to a blunt, sometimes slightly incurved tip (♂); or apparently somewhat stouter and coarser than in the other sex, straight, laminate, tapering throughout with no falcation; only lateral views, however, have been obtained (♀).

Length of body, excluding forceps, ♂ 16.5^{mm}, ♀ 15^{mm}; breadth of head, ♂ 2 2^{mm}; of pronotum, ♂ 1.9^{mm}; of combined tegmina, ♂ 3.5^{mm}; of middle of abdomen, ♂ 3 5^{mm}, ♀ 4.25^{mm}; length of antennæ, 6^{mm}; of forceps, ♂ 4^{mm}, ♀ 3.25^{mm}; breadth at base, ♂ 1 2^{mm}; at tip, ♂ 0.35^{mm}.

This species is closely related to L. gilberti, but may be distinguished, at least in the male, by the lesser falcation of the forceps. The legs, too, are shorter and smaller, and the joints of the antennæ less numerous. The sexual difference in the form of the abdomen may be due to the mode of preservation, but is apparently real.

Florissant. Ten specimens, Nos. 9201, 11172 and 13002, 13549 (♂), 5503, 7707, 9442, 9967, 11521 and 13546, 13003, 13548 (♀).

8. Labidiromma lithophilum.

Pl. 16, Fig. 19 (♀).

Labidura lithophila Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 259–260 (1876).

A specimen from Florissant (sent me by A. E. Foote) and figured on the plate was formerly described by me in the following terms: It is a female; the body is much flatter than that of Labidura tertiaria, the abdomen being equal on a side view, and the whole surface appears to be minutely punctulate; the form of the head can not be determined; the antennæ approach in length the body [the first joint nearly cylindrical, scarcely enlarging at the tip, about four times as long as broad]; the comparative or actual length of the succeeding joints can not be determined; the prothorax has its hinder margin entire and flat; the tegmina are a little longer than the prothorax, their hinder edge straight and apparently oblique; the wings appear to have surpassed the tegmina; the legs are very short (especially the femora) and not stout; the abdominal joints are of equal length; the forceps are peculiar, having the appearance of being strongly bowed, although the specimen is a female; they are very stout at the base, rapidly and regularly diminish in size on the basal half (which is about equal in length to two-thirds the last abdominal joint), beyond which they are equal, about half as stout as the base, apparently bent rather strongly inward, and very broadly rounded at the tip, a form of forceps I have never seen in any living earwig.

Length of body, including forceps, 14.5^{mm}; of antennæ, 11^{mm}; pronotum, 1.85^{mm}; tegmina, 2.5^{mm}; hind femora, 1.8^{mm}; forceps, 2.25^{mm}.

The portion of the description included above in brackets has since been proved incorrect on closer study, and the whole of the antennæ in Fig. 19 incorrect. The additional specimens are very imperfect and only serve to show the general resemblance of this species to the others of the series.

Florissant. Three specimens, Nos. 231, 316, 8837 (♂).

9. Labiduromma sp.

Pl. 16, Fig. 24.

A single specimen showing the terminal half of the abdomen represents a species evidently distinct from the others by the form of the forceps; but as a fair view of even these is not presented no name is attached. The specimen shows the side view with the ventral somites turned back so as to show the body in double its width. The forceps have the aspect of those of a female, and appear to be entirely simple, slender, cylindrical, tapering on the basal third and beyond equal, the tip apparently a little incurved.

Length of forceps, 2.3mm; width (or depth), 0.25mm.

Florissant. One specimen, No. 5278.

10. Labiduromma infernum.

Pl. 16, Fig. 7 (♂).

Head roundish, of about equal length and breadth. Pronotum orbicular, apparently of the same width as the head. Tegmina twice as long as broad, together at least half as broad again as the pronotum, the hind edge a little rounded, surpassed only a little by the folded wings. Legs moderately long, the middle and hind pairs subequal and considerably longer than the front pair, the femora about twice the breadth of the tibiæ. Abdomen full, tapering posteriorly, the last segment a little longer than the others. Forceps as long as the last three segments of the abdomen, slender, subequal, regularly arcuate, and bluntly pointed at apex (♂). The only specimen being preserved on a side view a good opportunity is not afforded to determine upon the form of many of the parts. The sex is determinable by the number of abdominal segments.

Length of body, excluding forceps, 11mm; of forceps, 3mm.

Florissant. One specimen, No. 2604 (♂).

11. Labiduromma labens.

Pl. 16, Figs. 13, 16 (♂), 9 (immature).

Head suborbicular, of about equal length and breadth, the posterior margin somewhat flattened, the mouth parts roundly and not very strongly produced, the eyes very large, occupying the entire breadth of the head, the margin being nearly continuous with the outer margin of the prothorax.

Antennæ rather stout, the basal joint stout and tapering, the second short, the third, fourth, and fifth subequal, the fourth as long as and the sixth longer than the first and cylindrical. Pronotum subquadrate, broadening a little and regularly from in front backward, the angles well rounded off, at its broadest a little narrower than the head, with a median impressed line. The specimens hardly show with certainty whether the species was winged or not, but there are some signs which can hardly be satisfactorily explained unless it were provided at least with tegmina and that the tegmina were obliquely truncate at the tip, so as to form an obtuse angle with each other when closed, the angle open backward. Metathorax considerably broader than the head. Legs rather short and rather slender, the tibiæ more than half as broad as the femora. Abdomen rather long and slender, with parallel sides, of about the same width as the metathorax, the segments subequal, about three times as broad as long, the whole surface very weakly and distantly punctate. The last segments, seventh to ninth, decrease rapidly in size, together forming a half circle, so round and regular is the curve of the extremity of the body. There is a small, bluntly rounded pygidium. The forceps of the male are very slender, almost as slender as the antennæ, cylindrical, equal nearly to the tip, about as long as the last five segments, the extreme base directed inward, beyond nearly straight and slightly divergent, the apical fourth incurving slightly and tapering a very little to a blunt point.

Length of body, excluding forceps, 10.25^{mm}; of forceps, 3.4^{mm}.

Florissant. Five specimens, Nos. 5004, 6318, 7118, 11674, 14471 (♂).

Family BLATTARIÆ Latreille.

Although this group of Orthoptera is the most richly represented of all insects in the Paleozoic series, and has a great variety of forms in the Secondary rocks, most of which are much more nearly related to existing types than their predecessors of Carboniferous and Permian times, yet very few species, and those imperfectly preserved, are known from the Tertiaries. A few species occur in amber, and two or three others in various deposits. Only three species have been found in this country, and no one of them is well preserved. They all appear, however, to belong to American types, and to such as are now found only in the warmer regions. (June, 1884.)

PARALATINDIA Saussure.

This peculiar genus, which is nearly allied to the equally striking Latindia, and from which Saussure considers it should only be distinguished subgenerically, is known only by a single species from Mexico; Latindia comes from Mexico and Brazil. The occurrence of a fossil of this group, differing considerably from the known species, is a curious fact.

PARALATINDIA SAUSSUREI.

Pl. 6, Fig. 25.

Prothorax concealing the head, smooth, well rounded, triangular, a little broader than long, broadest posteriorly, the hinder margin nearly straight, the front strongly convex, almost produced, the lateral angles rounded. Tegmina extending beyond the extremity of the abdomen by about the length of the pronotum, together considerably broader than the pronotum, the costal margin pretty strongly arched. Mediastinal vein almost completely aborted, the scapular running parallel to the margin in the basal half of the wing, and furnished from the very base with slightly oblique, frequent, distinct cross-veins running to the margin and forming rhomboidal cells about twice as broad as long; the next vein is connected with the scapular by transverse, not oblique, tolerably distant cross-veins, and similar cross-veins appear more or less in the apical half of the wing. The oblique fold characteristic of this genus is clearly shown in the detached wing thrown partly forward, but the species differs from the living type in its greater size, considerably larger wings, the extreme brevity of the mediastinal vein, and the frequent distinct and little oblique branches of the scapular vein; nor is the pronotum in the least hairy.

Length of body, 5.5^{mm}?; of pronotum, 1.85^{mm}; breadth of same, 2.25^{mm}; length of tegmina, 5.2.^{mm}; breadth of overlapping tegmina at rest, 3.5^{mm}.

Named for the distinguished entomologist, Dr. Henri de Saussure, of Geneva, Switzerland.

Green River, Wyoming. One specimen, Dr. A. S. Packard, No. 137.

ZETOBORA Burmeister.

This genus has not before been found fossil, and the species at hand in some particulars more nearly resembles a Blabera; but its size accords so much better with the species of this genus that it would seem more properly placed here. Both Zetobora and Blabera are American types and characteristic of the warmer regions.

ZETOBORA BRUNNERI.

Pl. 17, Fig. 12.

A species is indicated about the size of Z. monastica Sauss. It differs from the ordinary forms of Zetobora in the regular form of its pronotum, which resembles that of a Blabera, and is scarcely broader behind than in front, very broadly rounded in front, rounded and not angulate laterally, and a little less than half as broad again as long; it is narrowly and delicately marginate but nowhere distinctly reflexed, perfectly smooth, and completely covers the orbicular head; it is light colored but edged narrowly with black. The tegmina are thin and provided with closely approximate multitudinous dark veins; their exact length can not be determined. The legs are moderately slender and show a few signs of delicate spines in such a way as to indicate that others not seen existed, and therefore nothing can be said of them.

Length of body, 17^{mm}; of pronotum, 4.6^{mm}; breadth of same, 6^{mm}; length of tegmina, 20^{mm}?; of middle femora, 5^{mm}.

Named for the distinguished orthopterologist, Dr. Carl Brunner von Wattenwyl, of Vienna.

Florissant. One specimen, No. 5122.

HOMŒOGAMIA Burm.

A single fossil species is referred here, and it is interesting to find that one of the few species described from the European Tertiaries has been referred by Heer to Heterogamia, a name then used to include both Polyphaga and Homœogamia. The species of Homœogamia are few in number and found only in the warmer parts of America.

Homœogamia ventriosa.

Pl. 17, Fig. 8.

Homœogamia ventriosus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., I, p. 447 (1876).

The remains upon which this species is based consist of the apical portion of the ventral surface of an abdomen. Five segments are seen in natural juxtaposition, showing that the apical portion of the abdomen was very regularly rounded, almost exactly semicircular, the terminal segment presenting no break in the regular continuity of the curve. This segment was ample, broader than long, and probably neither very tumid nor greatly keeled; for in the present perfectly flattened condition of the fossil there is neither break nor folding of the integument; the two segments following this are very strongly arched (the penultimate being semicircular) and greatly contracted at the middle, so that this portion is not less than half as long as the lateral parts; the anterior border of the antepenultimate segment is straight along the middle; the segment anterior to this is also arched, though not strongly, is oppositely sinuate (as are to a less extent the segments posterior to it), and also much contracted in the middle, so as to be less than half as long as at the sides; while its predecessor is slightly arcuate in the opposite direction (probably exactly transverse in life), and equal or subequal throughout. All the segments are uniformly, rather abundantly, and very delicately granulate throughout. There is no trace of cerci, but the place where they should occur is too broken to assert that they did not exist externally; still the conformation of this region would lead one to suppose that they must have been excessively minute, and perhaps altogether concealed within the segments, as in Cryptocercus Scudd.

Length of fragment, 8^{mm}; width of same, 12.25^{mm}; length of terminal segment, 3.6^{mm}; width of same, 6.3^{mm}; length of antepenultimate segment in the middle, 0.6^{mm}; at the sides, 1.85^{mm}.

I have referred this species to Homœogamia with some doubt; on some accounts it would seem to be more nearly allied to Polyphaga; but as the specimen is too fragmentary to allow of more exact determination I have preferred to place it in the New World genus rather than in its close ally, which is restricted to the Old World. Cockroaches of such large size are indigenous in warm climates only.

Florissant. One specimen, Mr. T. L. Mead, No. 8.

Family PHASMIDA Leach.

Fossils of this family are among the great rarities. Yet they have been found even in carboniferous times, as has been abundantly shown by Brongniart. In a collection of over three thousand amber insects possessed by Menge a dozen only belonged to this family and represented three different genera. But excepting in amber, they have never before been recovered from Tertiary deposits. The single specimen found at Florissant is not very far removed apparently from the curious amber genus Pseudoperla, but is more nearly allied to forms peculiar to the warmer parts of America. (June, 1884.)

AGATHEMERA Stål.

This genus is composed of few and exclusively American species having a rather stout, compact, and brief form for Phasmida. All the genera in the immediate vicinity are also American, and none of them have before been found fossil.

Agathemera reclusa.

Pl. 17, Fig. 11.

The brevity of the legs, aborted condition of the organs of flight short mesothorax, and comparatively stout abdomen not tapering apically make it tolerably certain that the species here found fossil belongs to the group formerly classed in Anisomorpha, and is more nearly related to Agathemera than any other known genus. The head is quadrate, stout, a little longer than broad; the pronotum is composed of a larger quadrate piece, narrowing rapidly in front of the insertion of the legs, posterior to the contraction about equally broad and long, but with it half as long again as broad; mesothorax a little broader posteriorly than in front and twice as broad as the head, bearing tegmina with rounded tips just reaching its posterior margin, the segment of equal length and breadth and a little longer than the other segments of the thorax; metathorax tapering apically, nearly as long as its greatest breadth, but shorter than the mesothorax, and bearing small functionless wings, not surpassing its borders. A slight raised median line on the front half of the thorax. Abdomen stout, enlarging a little in the posterior half, all the segments broader than long by about an equal amount. The last segment of the abdomen is not preserved,

but the specimen would appear to be a male. The legs are moderately stout, the hind femora reaching to about the tip of the fourth abdominal segment.

Length of body, 20^{mm}; of head, 1.5^{mm}; of pronotum, 2.75^{mm}; of mesonotum, 3^{mm}; of metanotum, 2.6^{mm}; breadth of head, 1.25^{mm}; of pronotum, 1.75^{mm}; of mesonotum, 3^{mm}; length of fore and middle femora, 3.25^{mm}; of hind femora, 4.75^{mm}; of hind tibiæ, 5^{mm}.

Florissant. One specimen, No. 5817.

Family ACRIDII Serville.

Only ten Acridii have been published as found in the European Tertiaries and most of these belong to the Œdipodidæ or have been placed there. The exceptions are Œdipoda nigrofasciolata Heer, Gomphocerus femoralis Heer and Acridium barthelemyi Hope which are probably Truxalidæ, and Tetrix gracilis Heer which is certainly a Tettigidea. The six species we have found in America are all Truxalidæ and Œdipodidæ, so that all but one of the known species belong to these two groups, the Œdipodidæ having half as many again as the Truxalidæ in general, though the two groups are equally represented in America. It is not a little remarkable that no Acrididæ proper have been found fossil. This group has a vast development in the United States, and together with Phymatidæ and Pamphagidæ, likewise totally unrepresented, is even richer in tropical regions. The subfamily best represented may be considered more than any other a denizen of the temperate regions. (July, 1884.)

Subfamily TRUXALIDÆ Stål.

Nearly a third of the known fossil Acridii belong to this group, and, as stated above, it contains one-half of the American species. The reference of Acridium barthelemyi Hope from Aix to this group is, however, somewhat doubtful, the species being imperfectly described. Œdipoda nigrofasciolata Heer from Radoboj seems to belong here rather than to the Œdipodidæ, for the vena intercalata is wholly absent and its close resemblance to the large subtropical genus Scyllina Stål renders it probable that it belongs to that group; a new resemblance is thereby discovered between the Radoboj fossils and types of the warmer parts of America. (July, 1884.)

TYRBULA gen. nov. (τύρβη).

This name is proposed for a group of Truxalidæ evidently falling in close proximity to Syrbula Stål, having linear antennæ, enlarged apically, and hind tibiæ well provided with spines. The antennæ are more distinctly clubbed than in Syrbula, the club being about twice the diameter of the stalk, composed of seven or eight joints of which the last two are very small, forming a rapidly tapering tip. The head is less prominent than in Syrbula and the eyes considerably smaller, being considerably shorter than the infraocular parts of the cheeks; otherwise the general aspect of the insect is the same. The genicular lobes are as in Syrbula. The hind tibiæ are abundantly spined, in one species even much more abundantly than in Syrbula.

Table of the species of Tyrbula.

Spines of hind tibiæ exceedingly numerous, their basal half hardly tapering.....1. *T. multispinosa.*
Spines of hind tibiæ less numerous, tapering uniformly throughout .....2. *T. russelli.*

1. Tyrbula multispinosa.

Pl. 17, Fig. 13.

This species is represented mainly by fragments of hind wings and hind legs. Of the former nothing more can be said than that they appear to have had a faint smoky tinge with numerous black, delicate veins, and that when closed they extended a very little beyond the tip of the abdomen. The hind legs are long, moderately slender, the tibiæ armed with exceptionally numerous spines which are blackish, of uniform width to beyond the middle, and then tapering, mainly by the excision of the under edge, giving them a slightly upturned appearance, five or six times longer than their breadth at the middle, and so closely set that the interspaces and the spines are of equal breadth; they decrease in length very regularly toward the base of the tibia and to a slight extent toward the apex; but just how many there are or how far they extend toward the base the imperfect nature of the only specimen preserving the tibia forbids determining; it seems probable, however, that the number exceeds twenty-five. The specimen from Florissant, preserving the femur, is placed here because its size agrees perfectly with the other specimens and its form indicates the relationship. If it is correctly placed, the femur is stouter and less delicately attenuated than in the next species.

Length of femur, 17.5^{mm}; breadth of same, 3.5^{mm}; length of hind wings, 23.5^{mm}; of longest tibial spines, 0.8^{mm}.

Green River, Wyoming. Two specimens, Nos. 138 and 140, Dr. A. S. Packard; No. 51, Prof. L. A. Lee. Florissant, Colorado. One specimen, No. 14720, collected by Miss C. H. Blatchford.

2. Tyrbula russelli.

Pl. 17, Figs. 1–4.

A couple of excellently preserved specimens, exhibiting a side view, show most of the body, the antennæ, closed tegmina with underlying wings, front and hind legs, and part of the middle legs. The head is not very prominent, with rounded vertex, moderately full retreating front, eyes rather small, superior, oval, considerably shorter than the distance from their lower edge to the base of the mandibles; the antennæ are nearly half as long as the body, straight, very slender, the apical fifth expanding to a club of twice the diameter of the stalk, the middle joints of which (Fig. 1) are nearly twice as broad as long and microscopically densely punctate. The pronotum is twice as long as the head, the posterior lobe not projecting very far; the tegmina are slender, broadly rounded apically, reaching when closed the tip of the abdomen. The legs are all very slender and delicate, the front femora not much stouter than the tibiæ, the fore and middle tibiæ with a double row of delicate, short, rather frequent spines. The hind femora scarcely reach so far as the closed tegmina, but are slender and graceful, with the middle external field well defined by superior and inferior carinæ or angles, with indications of having been twice annulate with narrow, dusky bands in the distal half, the outer annulus midway between the inner and the apex; hind tibiæ fully as long as the femora, very slender, armed with a large number (about eighteen to twenty) of delicate tapering spines, considerably longer than the width of the tibiæ, but more distant (Fig. 4) than in the preceding species; they are much broken in the specimens. Tarsi with delicate crowded spines.

Length of body, 23^{mm}; of pronotum, 4.5^{mm}; of antennæ, 10^{mm}; width of club, 0.4^{mm}; length of tegmina, 18^{mm}; width of same, 2.7^{mm}; length of fore femora, 5.5^{mm}; fore tibiæ, 5.25^{mm}; hind femora, 14.5^{mm}; width of hind femora, 2^{mm}; length of longest tibial spine, 0.5^{mm}.

Florissant. Two specimens, both apparently females, No. 11475, and the one figured, the latter obtained by Mr. Israel C. Russell, of the U. S. Geological Survey, for whom the species is named.

GOMPHOCERUS Thunberg.

Heer describes a species of this genus from Oeningen. It is of small size, like most of those of temperate America and Europe, while the species here provisionally referred to it is very much larger. I have also seen a species from Aix, labeled as a Gomphocerus by Heer, which may, perhaps, be more nearly allied to Leptysma or Arnilia. Gomphocerus and its nearer allies are rather characteristic of, or at least are at present better known from, temperate regions, and are found around the entire globe. (July, 1884.)

GOMPHOCERUS ABSTRUSUS.

Pl. 17, Fig. 6.

This species is placed here because of its general affinities as indicated by the front half of the body, which, as seen on a side view, is all that is preserved. It does not seem, on several accounts, to belong in the genus, but it plainly comes near it. The head is large and protuberant, with a prominent vertex, sharply angled as seen on a side view, with a rounded, retreating face. Antennæ slender, very slightly enlarged to a faint elongated club at the apex, nearly reaching to the tip of the pronotum. The latter short, with quadrate deflected lobes, the inferior margin straight. Tegmina large, dusky, with the interspaces between the longitudinal veins broken at base by straight cross-veins into pretty regular square or subquadrate cells.

Length of fragment, 21^{mm}; of head, 4.5^{mm}; length of face, 5.5^{mm}; length of antennæ, 8^{mm}; of pronotum, 5^{mm}; height of same, 4^{mm}.

Florissant. One specimen, Nos. 635 and 11736.

Subfamily ŒDIPODIDÆ Stal.

To this subfamily belong most of the fossil Acridii and half of the American species. Heer in his Tertiärgebilde and his Urwelt der Schweiz describes half a dozen species from Oeningen and Radoboj, referring them all to the old genus Œdipoda. Serres mentions a species from Aix which

he compares to Œdipoda cœrulescens, and I have seen an undescribed form from Aix in the hands of M. Oustalet which is apparently allied closely to Chimarocephala. Of the Radoboj species described by Heer, O. nigrofasciolata, as stated above, is probably a Scyllina and not an œdipodid. O. melanosticta is perhaps an Hippiscus, and O. haidingeri a Dissosteira, or certainly very close to it. Of the Oeningen species which Heer describes, O. fischeri looks somewhat like a Chimarocephala, and O. germari (not described) is said by Heer to belong near Pachytylus. O. oeningensis is too obscure to say that it belongs in this family. The larger part of the European species would therefore seem to have decided American affinities, Chimarocephala, Dissosteira, and Hippiscus being distinctively American.

Of the American species, one is referred to Œdipoda only in a general sense: the two others belong to new genera, one near the end, the other next the end of the series, in the vicinity of Chimarocephala and Encoptolophus, American genera.

The family finds its greatest development in the north temperate regions of the world, and is remarkably abundant in forms in North America, and particularly in the warmer and more arid parts of the United States. (July, 1884.)

NANTHACIA gen. nov. (Nanthace + grasshopper, *Otoe*).

This name is proposed for a genus of Œdipodidæ which is allied to Encoptolophus, but in which the upper ulnar vein of the preanal area of the hind wings does not extend nearly to the margin of the wing but terminates before the middle, as it does in the tegmina, in a fork which extends above to the radial and below to the lower ulnar vein.

Nanthacia torpida.

A single specimen of this has been recovered, showing a hind wing only, in which the anal area is closed and the preanal almost fully exposed. The principal radial vein runs in close proximity to the costal margin, and it is connected with the veins above by very short cross-veins, and near the tip of the wing by a stigma, as in Encoptolophus. It has two principal oblique forks, the inner arising only a little within the middle of the wing and terminating on the ulnar a little before the outer margin, the other arising rather less than a third of the way from the former to the apex and ter-

minating in the middle of the apical margin; the interspaces above the latter fork, above the base of the former and the postradial area, are filled with frequent stout and straight cross-veins, while the interspace between the radial branches is filled by more distant, often oblique, straight veins, forming squarish cells. The membrane appears to have been hyaline and the veins and cross-veins distinct and black.

Length of wings, 22^{mm}; breadth of preanal area, 2.35^{mm}.

Florissant. One specimen, No. 9100.

ŒDIPODA Latreille.

A number of European species have been referred to this genus, but only in a broad sense, and, as I have stated above under the family, may most of them be more definitely placed. Here, however, must fall both O. œningensis Heer and the American species described below, as belonging to the genus in its widest sense, and the Aix species mentioned by Serres may also probably find a place here, as Serres compares it to the type of the genus. In its most limited sense the genus is confined to the Old World. (July, 1884.)

ŒDIPODA PRÆFOCATA.

Pl. 17, Fig. 5.

The single specimen found represents the basal half of a hind wing overlying a similar part of an obscure front wing. By the venation and markings it appears to belong to the Œdipodidæ, but it is too imperfect to judge more closely of its affinities. The wing was a large one, fuliginous, with at least three parallel and equidistant curving rows of paler (or brighter) markings in the form of rather narrow bands, the middle one apparently in the middle of the wing the broadest and discontinuous, crossing most of the wing; the inner one, midway between this and the base, narrower and crossing the upper half or less of the wing. In the anal area the intercalary veins run far in toward the base of the wing, and in the outer half become broken into two or even more, so that several rows of cells lie between the anal rays next the outer portion of the wing.

Length of fragment, 23^{mm}; probable length of wing, 30^{mm}; its probable breadth, 18^{mm}; breadth of tegmina, 4^{mm}.

Florissant. One specimen, No. 7389.

TAPHACRIS gen. nov. (θάπτω, ἀκρίς).

This peculiar genus appears to fall in the Eremobidæ or near this group of Œdipodidæ, the intercalary vein of the tegmina being absent, but it does not agree with any of the known genera of that tribe. The head is large and well rounded, smooth; the vertex of moderate width, the eyes large, not prominent; antennæ cylindrical, uniform, slender, not reaching the extremity of the short pronotum. Pronotum stout, rather short, very slightly and regularly expanding from in front backward, the lobes of equal length, the anterior divided in the middle by a second transverse incision, the very slight median carina not extending to its anterior half, which is produced and angulate; tip of pronotum obtusely angulate. Tegmina longer than abdomen, the costal area broad at base but not convex; the simple subexternomedian arises in the middle of the wing and the externomedian vein has five branches beyond it, with simple cross-veins in the interspaces and no reticulation; there is no intercalary vein; the internomedian vein terminates just before the origin of the subexternomedian in a large, triangular cell (surrounded by irregular reticulation), from the lower angle of which springs a broad fork, the inner branch of which terminates at the end of the short anal vein far within the middle of the wing. The wings are as long as the tegmina, the preanal portions repeating closely, especially in the branches of the externomedian vein, the characteristics of the tegmina.

Taphacris reliquata.

Pl. 12, Figs. 8, 19.

The vertex is a little less than half the width of one of the eyes, as seen from above. Antennæ composed of about thirty-two joints, each about twice as long as broad, the whole reaching close to the tip of the pronotum. Pronotum slightly longer than its greatest breadth. Tegmina slender and nearly equal, the scapular vein closely approaching the costal margin at about three-fifths the distance from the base, the mediastinal terminating at about two-fifths the distance, the area above it forming a regular triangle broad at base and gradually narrowing, filled with oblique, but toward the base rather irregular, veins. The tegmina appear to have been more or less obscurely testaceous, and perhaps more or less blotched, but the veins are

distinctly marked: the wings are also testaceous along the costal margin, but elsewhere hyaline with blackish veins and no sign of intercalary veins between the anal rays.

Length of body, 33.5^{mm}; of head, 2.5^{mm}; of antennæ, 9^{mm}; of pronotum, 7.5^{mm}; of tegmina, 30.5^{mm}; breadth of head, 4.5^{mm}; of pronotum in front, 5^{mm}; behind, 6.75^{mm}; of middle of tegmina, 4^{mm}.

Florissant. Two specimens, Nos. 404 and 4643 (♀), 7507.

Family LOCUSTARIÆ Latreille.

Like the Acridii, this family of Orthoptera is not well represented in the Tertiary rocks: no specimens of either have been found in amber, excepting a few larvæ of this family. Yet almost all of the larger subfamilies are present both in Europe and America. The Conocephalidæ, however, which are represented in America by two species, have none in Europe, and per contra, the Decticidæ, which have three species in Europe, do not occur in America. Two of the European species can not be placed, Locustites maculata Heer from Parschlug and Decticus exstinctus Germ., from the Rhenish coal. Ten species, including two referred to only by generic names, have been found in the European Tertiaries, and five in America, besides indications of others. Unlike the Acridii, the European and American species show few points in common, the species which are referred to the same subfamilies being widely separated. (July, 1884).

Subfamily PHYLLOPHORIDÆ Stal.

The only European species of this group, which is best represented in warm, temperate, and tropical countries, is Phaneroptera vetusta Heer from Oeningen, and it is widely distinct from the single American species referred here. (July, 1884.)

LITHYMNETES Scudder.

Lithymnetes Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 532–533 (1878).

A stout-bodied genus of Phyllophoridæ, probably belonging near Steirodon, but differing from the entire series into which Steirodon and its allies fall in the great length of its ovipositor, which is at least as long as the abdomen; while in Steirodon and its allies, so far as I know them, it is seldom more than two or three times as long as broad; it is also peculiar

in the disposition of the principal radial branch of the tegmina. The head is large, full, well rounded; the eye small, almost circular, its longer diameter at right angles to the extremity of the vertex. The pronotum shows no sign of having its lateral borders cristate or even crenulate, but this may be due to imperfect preservation of the single specimen at hand, on which it is impossible to determine the form of the lateral lobes. Tegmina much longer than the body, densely reticulated, very ample, expanding at the very base, so as to be nearly equal before the extremity; this is destroyed, but is evidently formed somewhat, and perhaps exactly, as in the Steirodon series, since it tapers on either border, but more rapidly on the inner than on the costal margin, its curve indicating that the apex of the wing is above, and probably considerably above, the middle. The scapular vein, in the middle of the basal half of the wing, curves strongly toward the costal margin, nearly reaching it beyond the middle of the same, and thence following nearly parallel and in close proximity to it; in the broader part of the costal area, beyond the subcostal vein (which acts in a similar manner), it emits three or four branches, the larger ones of which fork and, with the branches of the subcostal vein, strike the costal border at equal distances apart; all these branches are straight, and are connected by irregular, weaker cross-veins, while the interspaces are filled with a still weaker, dense mesh-work. The externomedian vein, parallel to and separated distinctly from the preceding, emits the principal branch where the scapular curves upward; this branch continues the basal course of the main vein, is straight, forks at about the middle of the wing, each fork again branching at a little distance beyond, the branches of the upper fork striking the border of the wing where it seems probable the apex falls; all the branches of this fork curve a little, but only a little, downward; the second branch of the externomedian vein is emitted shortly before the middle of the wing, and does not reach the margin, dying out shortly beyond the middle of the wing. The subexternomedian vein runs above the middle of the remaining portion of the discoidal area, and emits four inferior branches, at subequal distances, the first of which forks and the second originates opposite the principal branch of the externomedian vein. Apparently the anal area is pretty long. Wings apparently extending beyond the tegmina. The legs are short, slender, the fore tibiæ apparently furnished with a moderately broad obovate foramen, the hind tibiæ of equal size throughout,

slightly longer than the hind femora, and the latter scarcely extending beyond the abdomen. Ovipositor long, broad, saber-shaped, a little upcurved.

This is one of the largest Tertiary Locustariæ known, if not the largest.

LITHYMNETES GUTTATUS.

Pl. 17, Figs. 14, 15.

Lithymnetes guttatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 533–531 (1878).

This is the largest insect I have seen from the Tertiary shales of Florissant, and is remarkable for the markings of the tegmina, which are covered throughout (with the possible exception of the anal area and the extreme base of the wing, which are obscure) with minute, circular, equidistant, pale spots, situated between the nervules; they have a mean diameter of half a millimeter, and a mean distance apart of one and a half millimeters. The head is full and regularly rounded on a side view, with no prominences. The antennæ appear to have the usual structure, but the second joint is small, and the thickness of the joints above the front of the prothorax is 0.45^{mm}, already diminishing to 0.3^{mm} at the posterior border of the same; they are broken shortly beyond this point, so that their length can not be determined. The mean diameter of the eyes is scarcely more than one-third the shortest length of the genæ. The costal margin of the tegmina is gently convex, with a regular curve throughout, or until close to the tip; the inner margin has a similar though slighter convexity; the principal branch of the externomedian vein passes through the middle of the wing. The legs are all slender, the hind femora very slight, but little incrassated toward the base, the hind tibiæ slender, equal throughout, armed at tip with a pair of small, moderately stout, black-tipped spurs, the hind tarsi about two-fifths the length of the tibiæ, the claw very slight. Ovipositor broad, gently curved, at least as long as the hind tibiæ, of nearly equal size upon the part preserved.

Length of body (excluding ovipositor), 37^{mm}; depth of head, 12.5^{mm}; larger diameter of eye, 1.85^{mm}; shorter, 1.35^{mm}; distance from lower edge of eye to upper edge of mandibles, 4^{mm}; length of preserved part of tegmina, 45.5^{mm}; probable length of same, 55^{mm}; distance from base of tegmina to front of head, 13^{mm}; from same to base of principal branch of externomedian

vein, 14.5mm; breadth of tegmina in middle, 16mm; length of fore femora,[1] 9mm; middle femora[1], 10mm; hind femora, 19mm; fore tibiæ, 9.5mm; middle tibiæ, 10.5mm; hind tibiæ, 21mm; fore tarsi, 7mm; hind tarsi, 8mm; apical spurs of hind tibiæ, 1.75mm; claw of hind tarsi, 0.9mm; greatest breadth of hind femora, 3mm; length of ovipositor (broken), 18mm; breadth at base, 3mm; at a distance of 14mm from base, 2.35mm.

The specimen is preserved on a side view, with the left (upper) tegmen and the ovipositor drooping, the other parts in a natural attitude, the legs drooping.

Florissant. One specimen, No. 11557 (♀).

Subfamily PSEUDOPHYLLIDÆ Burmeister.

The Tertiary species described by Heer from Greenland under the name of Locusta groenlandica falls probably in this family; but there is no close connection between it and the American species described below. The distribution of the family at the present day is in general similar to that of the last named. (July, 1884.)

CYMATOMERA Schaum.

This tropical or subtropical Old World genus does not properly find a representative in the American rocks, but the species here described, too imperfect for separate diagnosis, appears to fall in its near vicinity and is consequently referred here provisionally. No fossil species is known.

Cymatomera maculata.

Pl. 17, Fig. 7.

A couple of spotted fragments from near the base of the tegmina of a locustarian are placed here provisionally, because they agree better with the group represented by that genus than with any other, though they plainly can not belong to Cymatomera in any strict sense. The better of the two fragments shows the base of a broad wing, with dark brownish, longitudinal veins, spreading widely, and the spaces between them or their branches broken by very frequent, long cross-veins into short but very deep quadrangular cells, while the whole surface, largely independent of the

[1]There is some doubt about these measurements, the basal portions being obscure.

cells and even of the veins, is heavily blotched with irregular spots of paler or deeper brown. The largest and deepest of the spots is central, following the here approximated radial and ulnar veins.

Length of the fragment, 8.5^{mm}; breadth of the same (probably nearly the breadth of the base of the wing), 12.5^{mm}.

Florissant. Two specimens, Nos. 1724, 2844.

Subfamily CONOCEPHALIDÆ Stål.

Although unknown in the European Tertiaries, this subfamily of locustarians, pretty well developed in the southern half of the United States, and far more so than in Europe, is represented by two forms from the Tertiaries of Florissant, not distantly allied to forms still existing in our country. (July, 1884.)

ORCHELIMUM Serville.

This genus, not before found fossil, and represented in North America by a considerable number of species, especially in the warmer portions of the United States, is found in the shales of Florissant, a large species having been disinterred. In its broad sense the genus is widely distributed over the globe, but in a narrower one, in which our fossil will fall, it is, I believe, peculiar to America. (July, 1884.)

Orchelimum placidum.

Pl. 17, Figs. 16 (♀), 18, 19 (♂).

Though obscurely defined, especially in the very parts which are necessary to examine for close determination, the specimens at hand have so clearly the aspect of an Orchelimum that we may safely consider them as belonging to that modern genus, which Stål unites with Xiphidium. The species is a very large one, larger even than O. concinnum Scudd., which is the largest known to me, and has the angulated fastigium (seen on a side view) and retreating face characteristic of the genus. The folded tegmina and wings extend some distance beyond the abdomen, and the ovipositor, which is well preserved and permits one to see that the upper and lower blades are of equal length, is peculiar for its length and bluntness of tip. It is also much slenderer than in O. concinnum and less curved, in which respects it approaches Xiphidium.

Length of body, ♂ 31mm, ♀ 28mm: of tegmina, ♀ 29mm: of hind femur, ♂ 23mm: of ovipositor, 16mm: breadth of latter in middle, 1.1mm.

Florissant. Two specimens, Nos. 13551 (♂), 7748 and 13550 (♀).

LOCUSTA Linné.

This genus, which occurs in the Old and New Worlds alike, but in the New World only in the western portion of our country, has never before been found fossil, several species referred to Locusta belonging elsewhere. Locusta groenlandica, as stated, is probably one of the Pseudophyllidæ, and the Locusta mentioned by Serres as found at Aix is, to judge from his reference, one of the Decticidæ. A single form has been found at Florissant not unlike the living species. (July, 1884.)

LOCUSTA SILENS.

Pl. 17, Figs. 9, 10.

A single specimen showing the base of the abdomen, with a side view of the folded wings and tegmina and a portion of the hind femur, indicates a species of true Locusta about as large as L. occidentalis Thom. from California. The arrangement of the veins in the tegmina, though confused by the overlapping of the wings, is nevertheless distinctly that of Locusta proper; this does not appear in the plate, where the mediastinal and internomedian nervules are not shown, and the scapular vein made to do duty as the costal margin. The wings were apparently obscurely griseous and perhaps longitudinally streaked as in the recent species mentioned. The hind femora were slender just as in Locusta, but along the middle of the outer face in the thickest portion is a distinct though very delicate carina showing in some parts, as in Fig. 9, a very delicate spinulation. The modern species mentioned has no mid-lateral carina.

Length of tegmina, 42mm; width of same, 7mm; probable length of hind femora, 32mm: width of same, 3.5mm.

Florissant. One specimen, No. 7544.

Subfamily GRYLLACRIDIDÆ Stål.

This family has been supposed to have a great antiquity, but this may be doubted, since I have shown elsewhere that several of the species from Carboniferous deposits referred here belong rather to the neuropteroid series. We find, however, several Tertiary species referred here, two from Radoboj,

Gryllacris charpentieri Heer and G. nigeri Heer, as well as a reference to the genus by Capellini of a species found in the Italian Tertiaries. A single American species has been found. (July, 1884.)

GRYLLACRIS Serville.

All the Tertiary members of the family have been referred loosely to this genus, and it is with the same looseness, necessary from its imperfect state, that the single Florissant species is also referred to it. The presence of this form at Florissant is indicative of a much warmer climate than found at present in that latitude. (July, 1884.)

Gryllacris cineris.

Pl. 17, Fig. 17.

Though no Gryllacris proper and differing considerably even from the fossil species which have been referred here, the only specimen is too obscure to speak very positively of its affinities. The insect is of very stout form, the head large, appressed, flattened behind, convex in front, the eye tolerably large, twice as long as deep; the thorax stout, the abdomen very stout, full, tapering apically, the legs rather small, the tegmina and wings moderately ample, about as long as the body. Tegmina with a nearly straight costal margin, a prominent shoulder near the base, the tip well rounded and a little produced, the inner margin rather full; the mediastinal veins with their fan-like distribution occupy the basal third of the costal border; the scapular vein terminates on the same margin a little before the tip, and emits equidistant, parallel, oblique, superior branches throughout its course; the externomedian runs parallel to the former; in the latter half of the wing it emits inferior, longitudinal, parallel branches which occupy the whole tip of the wing, and from before the middle a single branch with one or two superior nervules parallel to the others; the nervules below this have also a longitudinal direction, but their attachments are obscure. The neuration of the hind wing is similar, but the mediastinal and scapular areas are excessively narrowed, while the lower areas are expanded as in most orthopterous hind wings. The plate is in error in making the terminal portion of the externomedian vein branch from the scapular vein.

Length of body, 25^{mm}; of head, 3^{mm}; depth of same, 6^{mm}; length of tegmina, 27^{mm}; breadth of same, 8.5^{mm}; of wing, 11.5^{mm}.

Florissant. One specimen, Nos. 4499 and 4642.

LOCUSTARIÆ sp.

Among the Orthoptera noticed in the Green River shales is a tibia and fragment of the attached femur of what is apparently the middle leg of a Locustarian about the size of a Phylloptera.

Green River, Wyoming. No. 15233.

Family GRYLLIDES Latreille.

Fossil species of this family are not numerous: only a single species has been fully described from amber, and a second figured from Oeningen. At Aix, however, they appear to be tolerably abundant, for Serres mentions no less than seven species, of which two are Gryllotalpæ (Heer also mentions a Gryllotalpa from Oeningen), one a Xya, while he compares the four others to species of Œcanthus, Gryllus, and Nemobius. Heer's Oeningen species is probably a Nemobius and the amber species one of the Trigonidii.[1] We have also seen a couple of species of Nemobius from Aix in the hands of M. Oustalet at Paris. Our own species, three in number, all appear to belong in close proximity to one another and to the Gryllidæ proper, but require for their proper elucidation to be classed in a distinct genus. They all come, curiously, from the Green River beds. (June, 1884.)

PRONEMOBIUS gen. nov. (πρό, Nemobius, nom. gen.).

Having the facies of Nemobius, but with the hind femora entirely devoid of spines, or even serrulations. The species seem to differ considerably in certain points, but as they all agree in this particular, which is unique, not only in this tribe, but among Gryllides generally, they are placed together.

The species may be separated as follows:

Table of the species of Pronemobius.

Hind femora large, exceeding 10^{mm} in length ..... 1. *P. induratus.*
Hind femora small or medium sized, less than 8^{mm} in length.
  Hind femora hairy ..... 2. *P. tertiarius.*
  Hind femora smooth ..... 3. *P. smithii.*

[1] The hind tibiæ must certainly be represented as shorter than they should be, as in other respects the representation appears to be that of a Cyrtoxiphus, in which (as in all Trigonidii) the hind tibiæ are very nearly as long as or longer than the hind femora.

1. Pronemobius induratus.

Pl. 6, Fig. 18.

This species, much the largest of the three here described, is represented by two hind legs and a portion of one of the tegmina, found in proximity to one of the legs. The wing, shown in the figure, has a portion of the costal field displayed on the left with three or four parallel veins curving toward the margin, one of them forked—an unusual circumstance; and on the right the larger portion of the basal half of the dorsal field, where the simplicity and flowing course of the veins, in which no tympanum is constructed, indicates a female. The neuration, however, is very different from the prevailing simple type of the Gryllidæ proper and much more closely resembles that of the Gryllotalpidæ or of some Eneopteridæ, the oblique veins of the middle of the wing, whose course is toward the lateral margin of the field, being offshoots of a couple of basal veins whose obliquity is toward the inner margin. The hind femora are rather slenderer than usual among Gryllidæ, but not so slender as in the Eneopteridæ and allied subfamilies, rather sparsely hairy above and with the outer face dusky, and marked by pale, oblique lines. The hind tibia is present in only one specimen and a little incomplete, so that one can not say whether it is longer or shorter than the femur; it is uniformly and rather sparsely haired throughout.

Length of fragment of wing, 7^{mm}; of hind femur, 11–12^{mm}; breadth of same, 3.25^{mm}; of fragment of hind tibia, 8.5^{mm}; breadth of same, 0.9^{mm}.

Green River, Wyoming. Two specimens, Nos. 136, 139, Dr. A. S. Packard.

2. Pronemobius tertiarius.

Pl. 6, Figs. 13, 21, 23.

Nemobius tertiarius Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 774 (1878).

This species was first described from legs only, by which it was judged that the insect must have been rather smaller than our common Nemobius vittatus (Harr.), its hind femur being 7^{mm} long, broad, and stout, especially near the base, where it measures 2.1^{mm}; its upper half is covered with exceedingly delicate, recumbent hairs directed backward; there are also a few hairs upon the slender hind tibia, which is broken just where it begins to enlarge, showing signs of the upper spines; this portion is about three-

fourths the length of the femur. The front femur and tibia, which are each only 2.25^{mm} long, also indicate a small species, and one that is unusually free from spines, no hairs even being discernible on this front leg.

Since then other and more perfect specimens have come to hand, including some a little larger, showing its size to be about that of the recent species referred to. The body has the same general form. The head seems to be a little longer in proportion to its breadth, the eyes perhaps a little smaller, the basal joint of antennæ the same. The pronotum is of the same form, but both head and pronotum are only sparsely clothed with very short hairs. All the winged specimens are females, and the tegmina are about three-quarters the length of the abdomen, much more delicately constructed than in Nemobius, the veins being more frequent and much slenderer; on the costal field they run perfectly parallel at a slight angle from the lateral angle between the fields; on the dorsal field they are less numerous, heavier, straight, and parallel, but more frequent and weaker than in Nemobius vittatus. The wings are fully half as long again as the abdomen. The ovipositor is short, not reaching to the wing tips, slender, and straight. The hind femora are shaped as in Nemobius, hairy, the hind tibiæ shorter than the femora, enlarging a little toward the tip, and hairy, but without a trace of spines; the hind tarsi are about half as long as the tibiæ, the first joint longer than the others combined, all of them cylindrical.

Length of body, 9.5^{mm}; tegmina, 6^{mm}: wings, 9.5^{mm}: ovipositor, 3.5^{mm}: hind femur, 5^{mm}; hind tibia, 4.5^{mm}: hind tarsi, 2.5^{mm}.

Green River, Wyoming. Seven specimens, Nos. 18, 20 (collected by F. C. A. Richardson); 4188 (collected by S. H. Scudder); and Nos. 135, 141, 142 and 144, 143 (collected by Dr. A. S. Packard).

3. Pronemobius smithii.

Pl. 6, Fig. 22.

Two specimens of this species are preserved, one showing a side view of the whole body, the other a nearly ventral view of the hinder half; both appear to be females, but the hinder portion of the abdomen is lost with the ovipositor, the length of which can not be determined, unless some obscure marks behind one of the specimens are to be considered as indicating that it was short as in P. tertiarius. The head as seen on a side view is as long as the pronotum, like which it is very delicately, almost imperceptibly,

scabrous and hairless; the eyes are small, scarcely more than one-fourth the diameter of the head; the tegmina less than twice as long as the pronotum; the wings very long, reaching twice as far as the tips of the hind femora; the hind legs unusually slender and smooth, neither femora nor tibiæ being even hairy; the tibiæ are not enlarged at their extremity, and the hind tarsi are about half as stout as the tibiæ, with a long basal joint.

Length of body as preserved, 7^{mm}; probable entire length, 8.5^{mm}; length of pronotum, 1.6^{mm}; of hind wings, 8.5^{mm}; of hind femora, 3.5^{mm}; breadth of same, 1.1^{mm}; length of hind tibiæ, 2.5^{mm}; breadth of same, 0.2^{mm}.

Named after Prof. S. I. Smith, of Yale College, who has contributed to our knowledge of the Orthoptera of New England. The species is smaller than the preceding, has proportionally much longer wings and a smoother integument.

Green River, Wyoming. Two specimens, Nos. 134, 145, Dr. A. S. Packard.

HEMIPTERA Linné.

With this group we reach the most important section of the present work, since it of all the lower orders of insects was far the most abundant at Florissant. As, however, the group is divisible into two great suborders under which, separately, such general statements as seem appropriate regarding the relative representation of the families will be given, we reserve here only a brief remark or two upon the relation of the two suborders.

I presume it can not be far wrong to state that the homopterous fauna of any given region of considerable extent in the north temperate zone is to the heteropterous fauna as about one to three, or, in other words, that about 25 per cent of the hemipterous fauna is homopterous. These figures are the result of the comparisons of several faunal lists. In Mr. Uhler's List of the Hemiptera of the United States west of the Mississippi (the geographical area of our present work), the Homoptera hold a still more insignificant place, forming scarcely more than 13 per cent of the whole. In tropical countries a very different proportion obtains, the Homoptera holding, or nearly holding, their own beside the Heteroptera, and subtropical countries or those which feel the direct influence of their proximity show an intermediate position; thus in Berg's Enumeration of the Argentine Hemiptera the proportion of the Homoptera to the whole is almost exactly 30 per cent Now, it is precisely this proportion, 40:93, or 30 per cent, which Heer found. the fossil Homoptera to hold in his first essay on the fossil Hemiptera of Oeningen and Radoboj. A careful enumeration of the fossil Hemiptera of Europe to-day gives the Homoptera 34 per cent of the whole fauna; but, if those from the amber (which greatly heighten the proportion of Homoptera) be excluded and we reckon those of the rocks only, the Homoptera have 27 per cent. On the other hand, if we take only the fauna of the Oligocene of Europe, including the amber, the proportion of the Homoptera amounts to 41 per cent. This clearly indicates an approach to tropical relations. Our own Tertiary fauna is almost exclusively Oligocene, and has been found in a

multitude of minor points to show distinct tropical relations, and it therefore becomes of peculiar interest to learn the numerical relation herein of the Homoptera to the Heteroptera. Now here, much as in the Oligocene of Europe, we find the Homoptera claiming 40 per cent of the whole hemipterous fauna. The significance of these figures can hardly be doubted.

The number of Tertiary Hemiptera of the whole world is now to be reckoned at 569, of which 355 are Heteroptera and 214 Homoptera. The abundance of Hemiptera in our Western Tertiaries may perhaps fairly be pictured when we remember that Heer in his first elaboration of those found in the rocks of Europe enumerated 133, and that in the present work, the first elaboration of those of America, the number is almost exactly double, 265.

In studying this group I have been greatly aided by many kind favors from my friends, Mr. P. R. Uhler, of Baltimore, and Mr. E. P. Van Duzee, of Buffalo.

Order HOMOPTERA Latreille.

The variety of forms referable to the families of Homoptera that have been found in the American rocks is not a little surprising, and it includes some remarkable forms. All the families are represented excepting the Stridulantia, and this exception is the more noticeable because the presence of this family has been signalized in several instances in the European Tertiary rocks, and species believed to belong here have even been found in the Mesozoic deposits. Yet two families, Coccidæ and Psyllidæ, occur with us, and have not yet been found in European rocks, though Coccidæ are known from the Baltic amber. In all we find represented six families, thirteen subfamilies, fifty-five genera, and one hundred and twelve species in the four hundred specimens that have been examined.

The families Coccidæ and Psyllidæ, however, are very feebly represented by a few examples only, the great bulk of the fossils both in Europe and America belonging to the four families, Aphides, Fulgorina, Jassides, and Cercopidæ; in each of these, with the possible exception of the Jassides, the variety and abundance of forms is greater in America than in Europe, even including the types from amber, while a comparison of the rock deposits alone would show a vast preponderance on the American side. In individuals the Cercopidæ easily hold the first rank, and this appears to be true in Europe as in America; next follow the Aphides, for which in variety of type and in interest America far excels. The Jassides appear to

present relatively the least interest, but the absence from American deposits of one whole division of that family, the Membracida, is rather surprising in view of their presence (though rarely) in European deposits and their relative abundance in America to-day.

The following tabular enumeration of the species and genera occurring in the European and American Tertiaries may serve to present in a clearer light the agreements and disparities between them. The American list is drawn from the descriptions in the present work, while the European is from miscellaneous sources, and includes all those genera and species which have been merely *indicated* as occurring in certain deposits, and so it might fairly be considerably reduced. It should not be overlooked, moreover, that it includes all the amber forms:

Summary list of known fossil Homoptera.

Families.	America.		Europe.	
	Genera.	Species.	Genera.	Species.
Coccidæ	1	1	6	9
Aphides	15	32	4	20
Psyllidæ	2	2	0	0
Fulgorina	16	29	7	18
Jassides	11	21	9	24
Cercopidæ	10	27	4	24
Stridulantia	0	0	1	7
Total	55	112	31	102

If we exclude the amber forms and compare the fauna of the rocks only, we shall reach a very different result, as the following table shows:

Table of fossil Homoptera from rock deposits.

Families.	America.		Europe.	
	Genera.	Species.	Genera.	Species.
Coccidæ	1	1	0	0
Aphides	15	32	3	8
Psyllidæ	2	2	0	0
Fulgorina	16	29	3	3
Jassides	11	21	8	18
Cercopidæ	10	27	4	21
Stridulantia	0	0	1	6
Total	55	112	19	56

This table shows clearly how poorly the Aphides and Fulgorina are preserved in the European as compared with the American rocks.

It has been necessary to establish a large number of new generic groups to contain the American forms, which perhaps would not have been the case to the same extent had a really good selection of existing tropical American types been accessible; for the affinities of nearly the whole homopterous fauna of our Tertiaries are plainly subtropical. It is curious to see how highly developed some apparently extinct types were in that day; the family groups were quite as trenchant as now, and while we find in some, as in Aphides, marked departures from modern structure, it in no way appears to affect the family characters or to mark any approach toward the neighboring groups. Some genera now apparently extinct seem to have attained a high degree of differentiation, as witness Aphidopsis among the Aphides, Diaplegma among the Fulgorina, Palecphora, Lithecphora, and Palaphrodes among the Cercopidæ; of all of these there were several species, and more than occur in any other generic group excepting Agallia among the Jassides, which is equal to the least prolific of them. As a general rule it is also in just these genera that the individuals are the most abundant, notably among the Cercopidæ, which as a family is almost twice as numerous as all the others together, though the least among these larger families well provided with generic distinctions; for the three genera, Palecphora, Lithecphora, and Palaphrodes, with their fifteen species, not only outnumber in specific types the other seven genera of Cercopidæ (twelve species), but they contain more than nine-tenths of the individuals of this family which have passed under my eyes.

Family COCCIDÆ.

The only fossils of this group hitherto known are some that occur in amber. Three species referred to Monophlebus were described and figured by Germar, and Menge has since added short descriptions of half a dozen species referred to Aleurodes, Coccus (2), Dorthesia, and the extinct genera Ochyrocoris and Polyclona. To these we are able to add a single species from Florissant.

MONOPHLEBUS Leach.

This is an Old World genus which has never been detected living in America. The species are largely from tropical regions, but a single one is recognized from Europe. On this account there is special interest in the

occurrence of three species of this group in Prussian amber, described by Germar in Koch and Berendt's great work, and it is still more interesting to find a species apparently belonging to this genus from the shales of Florissant, Colorado.

MONOPHLEBUS SIMPLEX.

The single specimen referred to this genus agrees better with the fossil than with recent types. It is a fairly well preserved body, with the dorsal surface uppermost, but slightly turned to one side; the wings partially expanded, and all the legs of one side showing excepting the tarsi; unfortunately no antennæ are preserved. The head is small and subcircular; the thorax large, subquadrate, tapering abruptly in front to the width of the head, which is hardly more than half the width of the thorax. Wings of the shape of those of M. pinnatus from amber, about three times as long as broad, well rounded, showing with distinctness only the subcostal vein which runs from near the base toward the costa, on approaching which it follows the thickened margin almost exactly parallel to it to the extreme tip of the wing, much as is seen to be the case in M. pinnatus, though here separated more widely from the shoulder of the wing at its base; besides these there are only visible the base of the median vein from which the subcostal takes its rise, running but an extremely short distance into the heart of the wing, and a mere spur of the lower vein which arises barely before the subcostal and runs into the heart of the wing a less distance than does the oblique basal part of the subcostal. The legs are subequal in length; the tibiæ a little longer than the femora and scarcely slenderer; all are slight. The abdomen is long oval, well rounded behind, and composed distinctly of nine joints, of which the penultimate is very slight but the preceding ones subequal, with no signs of any lateral or terminal appendages.

Length of body, 3.25^{mm}; breadth of same, 1^{mm}; length of wing, 2.5^{mm}; breadth, 0.8^{mm}; length of hind femora, 0.7^{mm}; hind tibiæ, 0.75^{mm}.

Florissant. One specimen, No. 7561.

Family APHIDES Leach.

One would hardly suppose that objects of such extreme delicacy and minute size as plant lice would be found in a fossil state. Yet they are by no means infrequent, and have even been found in the Secondary deposits of England; for in Brodie's work two objects which appear to be wingless

forms are figured, and besides these another winged plant louse of a diminutive size, showing the characteristic venation of the group. In the Tertiary rocks a considerable number of species have been found; most of these have been referred to Aphis (twelve species) and Lachnus (eight), and so belong, like the bulk of living species, to the subfamily Aphidinæ; but the Pemphiginæ are represented by a Pemphigus from Oeningen and the Schizoneurinæ by a Schizoneura from amber. Besides occurring in these localities they have also been found at Radoboj, Aix, and Ain, in Europe, and we can now add several localities in our own country. That they are not scarce in amber is shown by Menge's collection, which in 1856 included fifty-six specimens. But these are few compared with the number from Florissant, where more than one hundred specimens have been found, about seventy of them determinable, though in the other American localities—Green River and Quesnel, British Columbia—only two or three specimens have occurred. Indeed, by the present publication the number of known fossil species is doubled.

There are some remarkable features about the Florissant forms. The mass of them belong, as is the case with those from the European Tertiary rocks, to the Aphidinæ proper. But both here and in the Schizoneurinæ, to which the remainder appertain, we are met by two remarkable facts, one that the variation in the neuration of the wings is very much greater than occurs among the genera of living Aphidinæ and Schizoneurinæ, and greater also than occurs in the known Tertiary forms of Europe, requiring the establishment of a large number of genera to represent this variation; and, second, that at the same time there is one feature of their neuration in which, without an exception, they uniformly agree, and differ not only from the modern types but from the European Tertiary insects This feature is the great length and slenderness of the stigmatic cell, due to the removal of the base of the stigmatic vein to the middle (or to before the middle, sometimes even to the base) of the long and slender stigma, and its slight curvature; it is a fact of particular interest in this connection that in the only wing we know from the Secondary rocks precisely this feature occurs, as illustrated in Brodie's work (see Pl. 4, Fig. 3). So, too, the cubital space is largely coriaceous, so that the postcostal vein may be considered as exceedingly broad and merging eventually, without the intervening lack of opacity, into the stigma proper. As a general rule the wings are also very long and narrow and the legs exceedingly long. In all these charac-

teristics the American plant lice appear as a rule to differ from forms so far described from the European Tertiaries. The single winged species figured by Berendt from amber, however, shows precisely this character as far as the length of the stigmatic cell is concerned, which is about two-fifths the length of the wing. These figures are incorrectly copied by Buckton, with the remark that the neuration is abnormal, which it certainly is in his figure. It will be interesting to know whether the other species of the Baltic amber will show a similar departure from the condition of the stigmatic cell in modern types. Not a single one of the Florissant forms can be referred to an existing genus.

Table of the genera of Aphides.

Cubital vein twice forked.....**Aphidinæ.**
Cubital vein arising at less than half the distance from the first oblique to the stigmatic vein.
Stigmatic vein arising midway between the first and second forks of the cubital vein or distinctly nearer the second fork.
Origin of the stigmatic vein midway between the first and second forks of the cubital vein.
Apex of cell about three times as broad as its base .....1. *Cataneura.*
Apex of cell about six times as broad as its base .....2. *Archilachnus.*
Origin of the stigmatic vein scarcely or not before that of the second fork of the cubital vein.
Base of second oblique vein several times nearer the first oblique than the cubital vein .....3. *Geranchum.*
Base of the second oblique vein midway between the first oblique and the cubital vein .....4. *Sbenaphis.*
The stigmatic vein arising opposite the first fork of the cubital vein or distinctly nearer it than the second.
First cubital branch nearly or quite four times as long as the basal stem of the cubital vein.....5. *Aphantaphis.*
First cubital branch at most three times as long as the basal stem of the cubital vein.
First oblique vein parting from the main vein at an angle of less than 55°.
6. *Siphonophoroides.*
First oblique vein parting from the main vein at an angle of more than 70°.
7. *Lithaphis.*
Cubital vein arising at half or more than half the distance from the first oblique vein to the stigmatic vein.
Main veins arising at nearly equal distances apart .....8. *Tephraphis.*
Main veins arising at distinctly unequal distances apart.
Second oblique vein at base rarely so much as twice as near the first oblique as the cubital vein .....9. *Aphidopsis.*
Second oblique vein at base four times as near the first oblique as the cubital vein.
The first oblique vein straight, not two-thirds as long as the second oblique vein, and considerably divergent from it.....10. *Oryctaphis.*
First oblique vein curved outward, nearly as long as the second oblique vein, and hardly divergent from it .....11. *Sychnobrochus.*
Cubital vein once forked.....**Schizoneurinæ.**
Cubital vein arising at more than half the distance from the first oblique vein to the stigmatic vein .....12. *Schizoneuroides.*
Cubital vein arising at less than half the distance from the first oblique vein to the stigmatic vein.
Cubital vein forking beyond the base of the stigmatic vein.....13. *Amalanchum.*
Cubital vein forking before the base of the stigmatic vein.
Base of second discoidal cell less than three times the width of that of the first.
14. *Anconotus.*
Base of second discoidal cell more than five times the width of that of the first.
15. *Pterostigma.*

1. CATANEURA gen. nov. (*κατά*, *νευρά*).

Head very small, apparently destitute of frontal tubercles. Antennæ unknown. Fore wings with the stigmatic vein arising from the middle of the stigma. Cubital vein twice forked, the first time far from its origin, which is near the middle of the proximal half of the space between the base of the first oblique and stigmatic veins, the second time about as far beyond the origin of the stigmatic as that is beyond the first fork of the cubital vein. The second oblique vein arises a little nearer the first oblique than the cubital vein, the first at a slightly less angle, the first discoidal cell between them about three times as broad on the hind margin as at the base. Legs moderately slender, the hind femora about half as long as the fore wings. Abdomen broad ovate, apparently with a short and stout cauda.

Table of the species of Cataneura.

First discoidal cell more transverse than longitudinal; cubital vein very distant from the stigmatic, approaching the second oblique vein ..... 1. *C. absens.*

First discoidal cell as longitudinal as transverse; cubital vein approximating the stigmatic rather than the second oblique vein ..... 2. *C. rileyi.*

1. CATANEURA ABSENS.

The single specimen shows little beside the wings folded flatly over the back, but the head and thorax and one of the femora are also preserved. The fore wing is about three times as long as broad. The first oblique vein is straight and very long, parting at the postcostal at an angle of about thirty-five degrees; second oblique vein slightly sinuous, parting from the postcostal at an angle of about forty-five degrees; the first discoidal cell between them very long considering that it is more transverse than longitudinal, the base moderately narrow, the apex, as measured on the hind margin, about three times as broad as the base. Cubital vein taking an exceptionally low course, so as to be very distant from the stigmatic vein throughout, first forking half-way to the hind border, then bent outward. Stigmatic vein arcuate and divergent at base.

Length of body, 4^{mm}; of fore wing, 6.5^{mm}.

Florissant. One specimen, No. 607.

2. CATANEURA RILEYI.

The head with part of the antennæ, the thorax with most of the legs and one wing, and, obscurely, the abdomen are preserved in the single example known. The fore wing is about three and a half times longer than

broad. The first oblique vein is straight and parts from the postcostal at scarcely more than forty five degrees, and the second oblique, which is also straight, at as little less, the first discoidal cell being, nevertheless, only moderately long and narrow, and more than three times as broad on the hind margin as at base. Cubital vein broadly arcuate, occupying the middle of the space assigned to it, first forking at scarcely more than a third way to the hind margin and again at less than half-way to the tip. Stigmatic vein parting very narrowly from the stigma, so that the stigmatic cell is very slender and nearly or quite a third the length of the wing.

Length of body, 4^{mm}; of fore wing, 6^{mm}.

Named for Dr. Charles Valentine Riley, whose researches on the grape root aphid, Phylloxera, to mention only this, are widely known.

Florissant. One specimen, No. 2916.

2 ARCHILACHNUS Buckton.

Archilachnus Buckt., Monogr. Brit. Aphides, IV, 177 (1883).

The head appears to be without frontal tubercles, and the antennæ are slender, almost as long as the body (perhaps longer), with the basal joints as in Aphis. Fore wings with the stigmatic vein arising from the middle of the stigma. Cubital vein twice forked, the first time at a moderate distance from its origin, which is near the middle of the proximal half of the space between the base of the first oblique and stigmatic veins, the second time as far beyond the origin of the stigmatic as it is beyond the first fork of the cubital vein. Second oblique vein arising a little nearer the first oblique than the cubital vein, at an angle of about forty-five degrees with the postcostal, the first at a distinctly less angle, so that the first discoidal cell between them is about six times as broad on the hind margin as at the base. Legs moderately stout, the hind pair about as long as the fore wings. Abdomen broad ovate with a short and moderately stout cauda.

The genus was not separately characterized by Buckton. I do not see any special relation to Lachnus.

Table of the species of Archilachnus.

Large and stout species. Cubital vein bent at its first furcation, otherwise straight...1. *A. pennatus.*
Small and slender species. Cubital vein gently arcuate throughout the first two-thirds of its course.
2. *A. mudgei.*

1. Archilachnus pennatus.

Pl. 18, Figs. 1, 15–17.

Archilachnus pennatus Buckt., Monogr. Brit. Aphides, IV, 177, Pl. 133, Fig. 3 (1883).

As preserved, the head and thorax are uniform and considerably darker than the abdomen. The body is stout. Fore wing more than two and a half times longer than broad, with the postcostal vein thick, straight, and uniform, running into the very long and fusiform stigma, and separated by a narrow space from the margin, which is gently convex, and so a little more distant at base. First oblique vein arising at one-third the distance from the base of the wing to the stigmatic vein, straight, parting from the postcostal at an angle of about sixty degrees; second oblique vein arising very close to the first, straight, or very slightly sinuate or arcuate, parting from the postcostal at an angle of forty-five degrees; first discoidal cell much widened distally, being five or six times broader on the hind margin than at base. Cubital vein arising twice as far from the second as the second from the first oblique vein, with its first branch completely parallel to the second oblique vein, first forking at a trifle more than one-third the way out, and again about half-way from the first fork to the apex of the wing, varying in individuals, at the first fork bent slightly but beyond almost perfectly straight. The stigmatic vein is arcuate and parts sometimes widely, sometimes narrowly from the stigma, so that the stigmatic cell is of variable slenderness, though always more than a third as long as the wing.

Length of body, 4^{mm}; of fore wing, 6.6^{mm}; hind femora, 2.5^{mm}; hind tibiæ, 3.75^{mm}.

Florissant. Five specimens, Nos. 177, 4615, 6993, 9221, 12727.

2. Archilachnus mudgei.

The single specimen is excellently preserved on a dorsal view, except that the overlapping fore wings are somewhat confused, lying upon the top of the back, and that one wing is doubled upon itself. The body is rather slender, the head and thorax darker than the scarcely perceptible abdomen and apparently mottled. Fore wings with the postcostal vein and stigma as in A. pennatus, the first oblique vein arising at a little more than one-third the distance from the base of the wing to the stigmatic vein, but otherwise like the second oblique vein, as in A. pennatus; the first discoidal cell

is much more open, but how much the condition of the specimen does not show. Cubital vein arising scarcely farther from the second oblique vein than the latter is from the first, forking much as in the preceding species, but passing in a gently arcuate course midway in the space allotted to it. The stigmatic vein parts gently with a considerable arcuation, but not very widely, from the stigma, the cell being apparently about one-third the length of the wing.

Length of body, 3.5^{mm}; fore wing, 4.75^{mm}; hind femora, 2.4^{mm}; hind tibia and tarsi, 4.6^{mm}.

In memory of Benjamin Franklin Mudge, the Kansas geologist and paleontologist.

Florissant. One specimen, No. 13328.

3. GERANCHON gen. nov. (*γεραιὸς, ἀγκών*).

Wings only known. Fore wing with the stigmatic vein arising from the middle of the stigma. Cubital vein twice forked, the first time very far from its origin, which is near the middle of the proximal half of the space between the base of the first oblique and the stigmatic veins, the second time scarcely behind the base of the stigmatic vein. Second oblique vein arising many times nearer the first oblique than the cubital vein and close to the former, the first discoidal cell between them about ten times broader on the hind margin than at the base.

Table of the species of Geranchon.

Cubital vein running considerably below the middle of its area, its branches straight ....1. *G. davisii.*
Cubital vein running through the middle of its area, its branches arcuate.....2. *G. petrorum.*

1. GERANCHON DAVISII.

Only the wing is preserved and the base is broken, but it may be judged to have been fully three times as long as broad. The postcostal vein is very broad and straight, merging into the slightly thickened fusiform stigma; next the base it is rather far removed from the costal margin. The first oblique vein parts at an angle of about sixty degrees with the postcostal and is straight; the second at an angle of forty-five degrees and is straight nearly to the tip, which is lost but appears to bend outward, so that the first discoidal cell between them, very narrow at base and broadening at tip, is excessively different in width at its two extremities. Cubital vein faint at its

origin, but apparently arising four times as far from the second oblique as the second from the first; it forks at somewhat less than half-way to the hind border and runs by a series of bends at a long distance below the middle of its area, forking a second time nearly as far from the first as the first from its root. The stigmatic vein is arcuate and diverges rather widely from the stigma, but the length of the stigmatic cell can not be determined.

Length of fragment, 3.5^{mm}; probable length of wing 4.4^{mm}; breadth, 1.4^{mm}.

Named for Prof. William Morris Davis, of Harvard College.

Florissant. One specimen, No. 14053.

2. Geranchon petrorum.

Pl. 2, Fig. 6.

Lachnus petrorum Scudd., Rep. Progr. Geol. Surv. Can., 1875–'76, 279 (1877).

A fragment of a wing is sufficiently preserved to show that it should be referred here, while the exact position of the veins is different from that of the other species. The wing is unusually slender; the postcostal vein thickens apically as it merges in the stigma; the first oblique vein is straight; the second originates very close to the first, runs parallel to it only at the very base, and then bends pretty strongly outward, striking the margin of the wing nearly as far from the tip of the first oblique vein as half its own length; the origin of the cubital vein is not clear, but it is apparently not far out, in which case it runs parallel with the second oblique vein until it branches in the middle of the wing; the lower of these branches almost retains the course of the basal part of the veins, but diverges slightly from the second oblique vein, terminating very far from it on the border of the wing; the main stem, diverging from the first branch rather widely at first, almost at once runs parallel to the lower branch, and when it has continued a less distance than the main vein before its furcation, divides, the two forks diverging but slightly at base, and then very gradually converging until they are no farther apart than the bases of the first and second oblique veins, and the upper fork almost touches the stigmatic vein (probably by some displacement); together they diverge a little from the lower branch of the cubital vein; the stigmatic vein is very conspicuous, passing by a broad sweep into the heart of the wing, diverging from the stigma at a greater

angle than does the second oblique; unfortunately the tip of the wing is broken, and more than the apical half of the outer border is also wanting.

Length of fragment, 4^{mm}; estimated length of wing, 5^{mm}; width of same, 1.65^{mm}.

Quesnel, British Columbia. Dr. G. M. Dawson. One specimen, No. 19.

4. SBENAPHIS gen. nov. (*σβέννυμι*, Aphis).

Head without frontal tubercles, the front transverse. Antennæ very slender, at least nearly as long as the body. Fore wings with the stigmatic vein arising from the middle of the stigma. Cubital vein twice forked, the first time at a moderate distance from its origin, which is at or a trifle outside the middle of the space between the first oblique and stigmatic veins, the second time opposite or scarcely beyond the base of the stigmatic vein. Second oblique vein arising nearer the first oblique than the cubital vein but at varying relative distances, always close to the first oblique vein, the first discoidal cell between them being four or five times broader on the hind margin than at base. Legs slender, varying in length but shorter than the fore wings. Abdomen ovate. Some specimens seem to show a short stout cauda, which others appear to lack, and occasionally short cornicles may be detected which are apparently of uniform diameter.

Table of the species of Sbenaphis.

Second oblique vein arising midway, or about midway, between the first oblique and cubital veins. ..... 1. *S. quesneli.*

Second oblique vein arising much nearer the first oblique than the cubital vein.

Base of second discoidal cell twice as wide as that of the first; cubital vein running barely nearer the stigmatic than the second oblique vein ..... 2. *S. uhleri.*

Base of second discoidal cell nearly thrice as wide as that of the first; cubital vein running very much closer to the stigmatic than to the second oblique vein ..... 3. *S. lassa.*

SBENAPHIS QUESNELI.

Pl. 2, Figs. 4, 5; Pl. 18, Fig. 12.

Lachnus quesneli Scudd., Rep. Progr. Geol. Surv. Can., 1876–'77, 461–462 (1878).

The original description, with certain omissions and changes to correspond with the phraseology here employed, was as follows:

The remains which are preserved are a pair of overlapping front wings with torn edges, but with all the important parts of the neuration, and some of the veins of the hind wings. The body is completely crushed and all

other members are absent. The parts which can be studied are thus very similar to those found in Geranchon petrorum, described above, from the same bed. Owing to the absence of the margin, the shape of the wing can not be determined The postcostal vein is thick throughout, but broadens apically; the first and second oblique veins are both perfectly straight, originating scarcely farther apart than the width of the postcostal vein and diverging considerably. From the position in which the wings are preserved (one front wing almost exactly covering the other, and the two inclosing between them both hind wings, also almost exactly superimposed) the first and second discoidal veins of the two front wings and the two oblique veins of each hind wing form a medley of almost confluent lines, so that it is a little difficult to determine to which of the four wings and to what part of that wing each of the eight veins belongs; regarding the veins of the hind wings there may, therefore, be some error in the statement to be made, but there can be little doubt of the position and relation of the veins of the front wing, which appears to lie uppermost. The cubital vein originates at a distance beyond the base of the second oblique barely greater than the distance at which the latter is placed from the first; it makes an angle with the postcostal vein of less than forty-five degrees; is nowhere in the least degree sinuous, but is bent very slightly forward at each forking, rather more at its first than at its second; sends off its first branch at slightly less than a millimeter from its base; forms with it an angle of twenty-five degrees, and at an equal distance farther on emits its second branch at a similar or slightly smaller angle; both the branches are perfectly straight, and the upper branch of the last fork lies midway between the lower branch and the stigmatic vein; the latter is similar to that of G. petrorum from the same beds, but is not so strongly curved; the first branch of the cubital vein also divides equally the space between the second oblique and the lower branch of the last fork of the cubital vein. The oblique veins of the hind wing originate at no greater distance apart than the first and second oblique veins of the front wings, are a little less divergent than they, and equally straight.

Length of fragment of wing, 5^{mm}; its probable complete length, 6^{mm}; breadth of same, 1.35^{mm}; distance from base of front wing to the origin of the stigmatic vein, 4.1^{mm}.

To this may be added, from specimens obtained at Florissant, that the body is stout and plump and the hind femora as long as the breadth

of the thorax. In one specimen the abdomen is narrower than, in another broader than, in a third of the same width as, the thorax. The first oblique vein makes an angle with the postcostal of about fifty-five degrees and is straight; the second one of forty-five degrees and is sometimes straight, sometimes arcuate, and the base of the first discoidal cell being very narrow it is about four or five times broader on the hind margin than there.

Length of body, 2.75–4^{mm}; of fore wing, 3.5–5.5^{mm}, the last partly estimated.

Quesnel, British Columbia. Dr. G. M. Dawson. One specimen, No. 34^{a}. Florissant, Colorado. Three specimens, Nos. 2234, 3577, 9269.

2. Sbenaphis uhleri.

Body large, stout, the head and thorax darker than the abdomen, which is broader than they. Wings three times as long as broad, the postcostal straight, thickened uniformly, and running into the very long and considerably fusiform stigma. First oblique vein straight, set at an angle of fifty-five degrees with the postcostal; the second oblique vein sinuous, placed at an angle of forty-five degrees with the postcostal; the two veins moderately close only at base, so that the first discoidal cell is four or five times broader on the hind margin. Cubital vein faint at base but originating about twice as far from the second oblique vein as that from the first, arcuate on its basal half, straight and longitudinal on its apical, occupying with its branches the middle of its allotted space, first forking at less than one-third the distance to the hind margin, again opposite the base of the stigmatic vein and less than half-way from its own first fork to the apex of the wing; in its passage it approaches the stigmatic only a little more closely than the second oblique vein. Stigmatic vein parting very slightly and gradually from the stigma, so that the stigmatic cell is very narrow and about one-third the length of the wing.

Length of body, 4.75^{mm}; of fore wing, 6.75^{mm}; breadth of same, 2.25^{mm}.

Dedicated to my good friend, Mr. Philip R. Uhler, without whose faithful and disinterested work the student of American Hemiptera would be sadly at a loss.

Florissant. Two specimens, Nos. 2327, 11202.

3. Sbenaphis lassa.

This small species is represented by a single individual, with nearly all the legs preserved in an unusual manner, but the wings not so completely. The body is black throughout, the hind femora longer than the abdomen, the hind tibiæ as long as the body. The wings have the postcostal vein and stigma precisely as in the last species. The first oblique vein is straight or at the tip slightly arcuate, parting from the postcostal at an angle of about fifty degrees, the second oblique vein distinctly arcuate on its apical half, parting from the postcostal at an angle of forty-five degrees, and separated from the first by a slightly wider interval than in the other species described; the first discoidal cell is about four times as broad on the hind margin as at the base. The cubital vein, arising nearly three times as far from the second oblique vein as the latter is from the first, takes a course above the middle of the area left to it, approaching very close to the stigmatic vein; it forks first about quarter-way to the hind margin and again about opposite the stigmatic vein, which, with the stigmatic cell, is as in S. uhleri.

Length of body, 3.25^{mm}; fore wing, 5.5^{mm}; fore femora, 1.15^{mm}; fore tibiæ, 1.7^{mm}; middle femora, 1.4^{mm}; middle tibiæ, 2.3^{mm}; hind femora, 2^{mm}; hind tibiæ, 3.25^{mm}.

Florissant. One specimen, No. 12994.

5. APHANTAPHIS gen. nov. (ἄφαντος, Aphis).

Head without frontal tubercles, the antennæ being inserted in sublateral pits; they are longer than the fore wings, very slender indeed, the third joint very long. Fore wings with the stigmatic vein arising from the middle of an exceedingly slender and tapering stigma, the stigmatic cell nearly half the length of the wing. Cubital vein twice forked, the first time at a very slight distance from its origin, which is scarcely before the middle of the space between the first oblique and stigmatic veins, the second time half way thence to the tip of the wing. Second oblique vein arising slightly nearer the cubital than the first oblique vein, the first so near the base of the wing as to be very short, and the first discoidal cell between them only about twice as wide at the hind margin as at base. Legs long and slender, the hind tibiæ and tarsi nearly equaling the length of the wings.

A single species is known.

APHANTAPHIS EXSUCA.

The fore wing, which is exceptionally preserved, is long oval, almost three times as long as broad; the postcostal and all the space between it and the costal margin filled with pigment, so as to be exceptionally broad, tapering until it expands again into the long fusiform stigma. First oblique vein very close to the base, short, straight, parting from the postcostal at an angle of at least seventy degrees, not twice as long as the breadth of the base of the first discoidal cell; second oblique vein arising far from the first at an angle of fifty degrees, straight until near the tip, where it bends considerably to meet the margin, so that the first discoidal cell is hardly more than twice as broad on the hind margin as at the base. Cubital vein feeble, but uniform throughout; hardly so far removed from the second oblique vein at its origin as that from the first, first forking hardly one-sixth way to the hind margin, again fully half-way to the tip of the wing, running slightly nearer the stigmatic than the second oblique vein. Stigmatic vein arising opposite a point about one-third the distance from the first to the second forking of the cubital vein or less, far before the middle of the stigma, having a broad sweep, so that the stigmatic cell, though not narrow, is four-ninths the length of the wing.

Length of fore wing, 4 5^{mm}; breadth of same, 1.6^{mm}; length of antennæ, 6^{mm}; hind tibiæ and tarsi, 4^{mm}.

Florissant. One specimen, No. 1215.

6. SIPHONOPHOROIDES Buckton.

Siphonophoroides (pars) Buckton, Monogr. Brit. Aphides, IV, 176 (1883).

Antennæ inserted on distinct and prominent frontal tubercles, the first two joints forming together a stout, subconical mass more than twice as long as broad; the remainder of the antennæ slender, filiform, much longer than the body, as long as the fore wings, all the joints and especially the third excessively long. Fore wings with the stigmatic vein arising from the middle of the very long and slender fusiform stigma. Cubital vein twice forked, the first time tolerably far from its origin, which is usually at about one-third the distance from the base of the first oblique to that of the stigmatic vein, the second time about as far again beyond the stigmatic vein as that is beyond the first fork of the cubital vein. Second oblique vein aris-

ing somewhat but not greatly nearer the first oblique than the cubital vein, the first at a considerably wider angle, so that the first discoidal cell between them is from three or four to six or eight times as broad on the hind margin as at the base. Legs slender, the hind femora half as long as the fore wings. Abdomen ovate, rather broad, well rounded apically, with very short and stout cornicles in at least one species, but no cauda.

Buckton gave no characteristics of his genus apart from the specific description; his supposition that the abdomen was pointed was due to his taking the faint signs of the first oblique veins as the sides of the abdomen in the figure which formed the basis of his determination.

Table of the species of Siphonophoroides.

Second oblique vein parting from the postcostal at an angle of forty-five degrees..... .....1. *S. antiqua.*
Second oblique vein parting from the postcostal at an angle of thirty-five degrees.
First branch of cubital vein distant from the second oblique vein. .....2. *S. rafinesquei.*
First branch of cubital vein closely approximated to the second oblique vein .....3. *S. propinqua.*

Siphonophoroides antiqua.

Pl. 18, Figs. 3, 5, 7, 10.

Siphonophoroides antiqua Buckton, Monogr. Brit. Aphides, IV, 176, Pl. 133, Fig. 1 (1883).

This is far the most common of the Florissant Aphides, and many of the specimens are very fairly preserved. They are uniformly dark colored, or the abdomen may be a little paler or more obscure than the rest of the body. The wings are pretty slender, fully three times as long as broad. The postcostal vein is moderately thick, uniform, and running without break into the very long fusiform stigma; it is separated by a moderately wide and regularly decreasing space from the costal margin. The first oblique vein is straight and parts from the postcostal at an angle of fully sixty degrees; the second oblique is straight in its basal half, arcuate or sinuate beyond, parting from the postcostal at an angle of about forty-five degrees at a moderate distance from the first oblique vein, the first discoidal cell between them being about four times as broad on the hind margin as at the base. Cubital vein arising farther, generally about half as far again, sometimes almost twice as far, from the second oblique as that from the first oblique vein, very longitudinal in course, first forking at about two-fifths the distance to the hind margin and again at about half-way between the first forking and the tip of the wing, running about twice as near the stigmatic as the second oblique vein. Stigmatic vein arising nearer the first

than the second fork of the cubital, sometimes to a considerable degree arcuate at base but beyond horizontal, so that the stigmatic cell is both long and slender, from a third to two-fifths the length of the wing. Hind legs about as long as the antennæ.

Length of body, 4^{mm}; fore wing, 5–6^{mm}; breadth of same, 1.5–2^{mm}; length of antennæ, 5.5^{mm}; legs of one individual as follows: fore femora, 1.5^{mm}; fore tibiæ and tarsi, 2.25^{mm}; middle femora, 1.25^{mm}; middle tibiæ and tarsi, 2.15^{mm}; hind femora, 2. 25^{mm}; hind tibiæ and tarsi, 3^{mm}.

Florissant. Fifteen specimens, Nos. 1079, 1339, 1867, 2396, 2881, 3029, 5747, 7934, 8889, 9574, 10205, 11562, 13562, 14450, and, from the Princeton Collection, 1.986. Besides these, Nos. 1703, 3284, and 5491 from Florissant, should probably be referred here.

2. Siphonophoroides rafinesquei.

The greater part of the creature, excepting the abdomen, is preserved in the single specimen obtained. The antennæ are nearly as long as the hind legs and considerably longer than the wings. The wings are very slender, fully four times longer than broad. The postcostal except at base is straight, slender, and runs uninterruptedly into the exceptionally slender fusiform stigma. The first oblique vein is straight, or slightly arcuate, and parts from the postcostal at an angle of nearly sixty degrees; the second oblique vein is also straight or slightly arcuate, is moderately distant at base from the first oblique, and parts from the postcostal at an angle of forty-five degrees, so that the first discoidal cell is four times as broad on the hind margin as at the base. The cubital vein arises more than twice as far from the second oblique vein as that is from the first and only a little less than half-way from the first oblique to the stigmatic vein, forks about two-fifths way to the hind margin, and with its first fork runs completely parallel to and distant from the second oblique vein; it is bent at its fork and thereafter runs longitudinally, forking again about half-way to the tip and running close to the stigmatic vein. This last arises very much nearer the first than the second cubital fork, and except at base is but little arcuate and very longitudinal, so that the stigmatic cell is exceptionally slender and nearly half as long as the wing. Legs very slender.

Length of fore wing, 5.25^{mm}; breadth of same, 1.25^{mm}; length of antennæ, 6.5^{mm}; of hind femora, 2.5^{mm}; hind tibiæ and tarsi, 3.75^{mm}.

The eccentric Constantine Rafinesque-Schmalz made the first attempt to classify American Aphides.

Florissant. One specimen, No. 1667.

3. Siphonophoroides propinqua.

The single specimen on which this species is based is not so well preserved as the last. The antennæ are broken in the middle, but were apparently of a similar length. The wings are slender, fully three times longer than broad. The postcostal is very broad, straight, and uninterrupted. The first oblique vein is straight, and parts from the postcostal at an angle of about fifty degrees; the second is straight at base, beyond considerably arcuate, separated by a narrow distance from the first, and placed at an angle of scarcely forty degrees with the postcostal, so that the first discoidal cell between them is very long and slender, and is about four times as broad on the hind margin as at the base. The cubital vein arises nearly twice as far from the second oblique as that from the first, forks at rather less than one-third way to the hind margin, and is very arcuate in course, so that though its first fork approaches exceptionally near the second oblique vein, the main stem reaches only twice the distance from the stigmatic vein. This last vein arises opposite a point on the cubital vein one-third way from the first to the second fork, and, strongly arcuate, passes at once far into the wing, and then becomes longitudinal, the stigmatic cell being pretty large and long, about two-fifths the length of the wing. Legs very slender.

Length of fore wing, 5.5^{mm}; breadth of same, 1.5^{mm}; length of fore femora, 1.75^{mm}; fore tibiæ and tarsi, 2.5^{mm}; hind femora, 2.25^{mm}; hind tibiæ and tarsi, 4.2^{mm}.

Florissant. One specimen, No. 3738.

7. LITHAPHIS gen. nov. (λίθος, Aphis.)

Head rather small with short frontal tubercles on which the antennæ are seated in close proximity. The first two joints of the latter as in Siphonophoroides, the remainder also as there, but if anything even longer. Fore wing with the stigmatic vein arising from the middle of the stigma. Cubital vein twice forked, the first time very far from its origin (which is about a third way from the base of the first oblique to the stigmatic vein)

and about opposite the base of the stigmatic vein, the second time apparently about half-way to the tip of the wing. Second oblique vein arising slightly nearer the first oblique than the cubital vein, at rather more than half a right angle with the postcostal; first oblique vein parting much more widely, about eighty degrees, so that the first discoidal cell between them, very narrow at base, is six or more times wider there than on the hind margin. Legs moderately slender, the hind femora shorter than the abdomen, which is no broader than the thorax, twice as long as broad, and rounded.

A single species is known.

Lithaphis diruta.

The body appears to have been pretty uniformly colored. The proportions of the wings can not be determined, but the insect was one of the smaller species. The postcostal is parallel with the costa, moderately slender, especially just before the long and tapering stigma. The first oblique vein is very transverse, parting at an angle of about eighty degrees with the postcostal, and straight; the second oblique vein, arising rather close to the first, is slightly arcuate and parts from the postcostal at an angle of forty-five degrees, so that the first discoidal cell is many times broader on the hind margin than at the base. The cubital vein arises less than twice as far beyond the second oblique vein as that beyond the first, is rather straight and stiff, first forks at less than a third way to the hind margin and again about half-way to the tip, approaching the stigmatic rather than the second oblique vein. The stigmatic vein arises scarcely beyond the first furcation of the cubital, and, strongly arcuate at first, reaches widely into the wing, the stigmatic cell being large and long.

Length of body, 3^{mm}; antennæ, 5.5^{mm}; wing (probable), 4.5^{mm}.

Florissant. Three specimens, Nos. 3785, 12112, 12476. A specimen from Green River, No. 82, Prof. L. A. Lee, may perhaps belong here.

8. TEPHRAPHIS gen. nov. (τεφρόω, Aphis).

Siphonophoroides (pars) Buckton, Monogr. Brit. Aphides, IV, 176 (1883).

Head apparently much as in Lithaphis, but the front tubercles are uncertain. Antennæ constructed basally as there, separated at base by their own width, much longer than the fore wing. Fore wing with the stigmatic vein arising rather before the middle of the unusually broad

stigma. Cubital vein twice forked, the first time very near to its origin (which is about two-thirds the distance from the first oblique to the stigmatic vein), and about opposite the base of the stigmatic vein, the second time at varying distances from the first. Second oblique vein a little nearer the first oblique than the stigmatic vein, unusually transverse, the first scarcely more longitudinal, so that the first discoidal cell between them, broad at base, is not more than twice as broad on the hind margin. Legs slender, the hind femora nearly as long as the abdomen, the rest of the leg about two-thirds the length of the fore wings. Abdomen short oval, well rounded apically, no broader than the thorax. Both species are very small.

Table of the species of Tephraphis.

First discoidal cell only half as broad again on the hind margin as at base, the first and second oblique veins very nearly parallel ..... 1. *T. simplex.*

First discoidal cell twice as broad on the hind margin as at base, the first and second oblique veins distinctly divergent ..... 2. *T. walshii.*

1. Tephraphis simplex.

Pl. 18, Fig. 4.

Siphonophoroides simplex Buckton, Monogr. Brit. Aphides, IV, 176–177, Pl. 133, Fig. 2 (1883).

This is one of the smallest of the Florissant species. The antennæ, twice as long as the body, taper to a slender thread, scarcely visible on the stone. The body has the abdomen very pale and indistinct, but the rest much darker, and the legs are uniformly dark. The wings are slender, at least three times as long as broad. The posteostal vein is very heavy and straight and the stigma, hardly broader, is very long. The first oblique vein is straight and parts from the posteostal at an angle of about fifty-five degrees: the second oblique is very distant from the first, parts from the posteostal at an angle of about fifty degrees, and, at first straight and therefore almost parallel to the first oblique vein, is afterwards a little arcuate, so that the first discoidal cell is about half as broad again on the hind margin as at its base. The cubital vein, a little farther removed from the second oblique vein than the latter is from the first, runs with its first fork in a straight course, parallel to the second oblique vein, forks at one-fourth the distance from the base, and is considerably angulated, running afterwards completely parallel to the stigmatic vein, and forking again about half-way to the tip of the wing. Stigmatic vein arising closely subsequent to the first forking of the cubital vein, parting abruptly and curving

strongly, passing a variable distance into the body of the wing, and then running longitudinally; it nowhere approaches closely the cubital vein, and the stigmatic cell is at the most scarcely one-third the length of the wing.

Length of body, 2.4^{mm}; antennæ, 4.75^{mm}; wings, 3.5–4^{mm}; fore femora, 1^{mm}; fore tibiæ and tarsi, 1.25^{mm}; middle tibiæ and tarsi, 1.5^{mm}; hind femora, 1.2^{mm}; hind tibiæ and tarsi, 2^{mm}.

Florissant. Three specimens, Nos. 519, 670^{a}, 2153.

2. Tephraphis walshii.

Pl. 18, Fig. 19.

Little is preserved but the overlapping fore wings and these imperfectly. They show the insect to have been very small with slender wings, probably just about three times as long as broad. The first oblique vein is straight, and parts from the posteostal at an angle of fifty degrees; the second is also straight and parts at an angle of forty degrees, and the distance between the two being great, the first discoidal cell is wide, but on the hind margin twice as wide as at base. The cubital vein arises only a little farther from the second oblique vein than it is from the first, and at about two-thirds the distance from the first oblique to the stigmatic vein; with its first branch it is completely parallel to the second oblique vein and straight, forking first at about one-third of the distance to the hind margin; it is not abruptly bent at this fork, but curves rather rapidly to gain a longitudinal course, and forks again a little less than half-way to the tip of the wing. The stigmatic vein arises scarcely beyond the first fork of the cubital and curves rapidly to a longitudinal course, but the relative length of the slender stigmatic cell can hardly be determined.

Length of specimen, 4.25^{mm}; probable length of wing, 3.5^{mm}.

The late Benjamin D. Walsh was one of the first students of our Aphides.

Florissant. One specimen, No. 8085, lying entangled with Pterostigma recurvum.

9. APHIDOPSIS gen. nov. (Aphis, ὄψις).

Head provided with short, broad, and uniform frontal tubercles, between which, a space more than equaling the breadth of the antennæ, the front is rounded and slightly advanced. First joint of antennæ distinctly narrower than the frontal tubercles, scarcely longer than broad, scarcely narrow-

ing apically, the second much smaller, subconical, the remainder very slender, filiform, much longer than the fore wings, the third joint alone as long as the whole body. Fore wings with the stigmatic vein more than usually longitudinal, arising from before the middle of the very narrow and elongated stigma, so that the very narrow stigmatic cell is more than a third as long as the wing. Cubital vein twice forked, the first time far from its origin (a third or half way to the extremity of the first branch), which is usually about midway between the first oblique and cubital veins, but varies to some extent, and in any case only a little before the origin of the stigmatic vein, the second time not far from half-way from the first forking to the apex of the wing. Second oblique vein arising nearer the first oblique than the stigmatic vein, sometimes only to a slight extent, sometimes twice as near it, generally very straight, the first oblique at such an angle with it that the first discoidal cell between them, pretty wide at base, is from three to six times as wide on the hind margin of the wing. Legs very slender, the hind femora fully reaching the tip of the abdomen, the rest of the hind legs only a little shorter than the fore wings. Abdomen rounded ovate, somewhat broader than the thorax, fullest behind, with an extremely short and rather stout cauda, and very short and remarkably stout conical cornicles.

Table of the species of Aphidopsis.

Fore wings more than three millimeters long.
- Cubital vein arcuate throughout.
  - First cubital branch much nearer to the second cubital branch than to the second oblique vein.
    - Cubital vein approaching the stigmatic vein very closely; fore legs longer than middle legs ..... 1. *A. subterna.*
    - Cubital vein not approaching the stigmatic vein very closely; fore legs shorter than middle legs ..... 2. *A. hargeri.*
  - First cubital branch equidistant from second cubital branch and second oblique vein. 3. *A. lutaria.*
- Cubital vein angularly bent at furcations.
  - Expanse of wings nine millimeters or less; first discoidal cell normally divergent. 4. *A. margarum.*
  - Expanse of wings eleven millimeters or more; first discoidal cell not very divergent. 5. *A. dalli.*

Fore wings less than three millimeters long ..... 6. *A. emaciata.*

1. Aphidopsis subterna.

Head and thorax testaceous, slightly mottled with pallid. Antennæ as long as the fore wings. Wings slightly less than three times as long as broad, the postcostal moderately light, running uninterruptedly into the very slender elongated stigma. First transverse vein very slender, nearly

straight, but slightly arcuate, parting from the postcostal at an angle of at least fifty degrees; second oblique vein hardly heavier, very feebly arcuate, and parting from the postcostal at an angle of forty-five degrees; it is moderately distant at base from the first oblique vein, so that the first discoidal cell between them is only about four times broader on the hind margin than at the base. Cubital vein arising half as far again from the second oblique as it from the first oblique vein and only about one-third way from the latter to the stigmatic vein; it forks about one-third way to the hind margin, and its first fork is completely parallel to and somewhat distant from the second oblique vein; near its second fork it approaches twice as near the stigmatic vein as the second oblique vein. Stigmatic vein not reaching far into the wing, arising from a quarter to a third the distance from the first to the second furcation of the cubital vein, so that the stigmatic cell is slender and about two-fifths the length of the wing. Femora pale, tibiæ and tarsi dark. Abdomen plump oval, of a pale color, mottled with large, roundish, dark spots arranged in mediodorsal and lateral rows on the posterior portion of the segments; there are faint indications of a slender, slight, and rather short cauda, and distinct marks of cornicles in conical hillocks at the extreme outer sides of the here angulated abdomen.

Length of body, 3.75^{mm}; antennæ, 5^{mm}; fore wings, 5^{mm}; fore femora, 1.3^{mm}; fore tibiæ and tarsi, 2.5^{mm}; middle femora, 1.1^{mm}; middle tibiæ and tarsi, 2.4^{mm}; hind femora, 2^{mm}; hind tibiæ and tarsi, 3.3^{mm}.

Florissant. Six specimens, Nos. 219, 740, 1307, 2151, 7426, 8896.

2. Aphidopsis hargeri.

The single specimen which represents this species is preserved upon a side view, with the wings somewhat crumpled. Enough, however, can be seen to distinguish it from the preceding species in that the cubital vein runs at the ordinary distance from the stigmatic, though still distant from the second oblique vein, and though the stigmatic vein descends as deeply into the wing as in A. subterna. The origin of all the veins is the same, but the second oblique is more arcuate and its arcuation confined mostly to the apical half. But the principal difference is found in the relative length of the legs, which though stouter are also longer and have the middle pair slightly longer than the fore pair, instead of the reverse. The legs are remarkably preserved and show the single jointed tarsus and claws with great distinctness, showing them to be constructed much as in Callipterus.

Length of body, 3.5^{mm}; wings (partly estimated), 4.75^{mm}; fore legs, 4.1^{mm}; femur, 1.45^{mm}; tibia, 2.25^{mm}; tarsus, 0.4^{mm}; middle legs, 4.55^{mm}; femur, 1.75^{mm}; tibia, 2.4^{mm}; tarsus, 0.4^{mm}; hind legs, 6.5^{mm}; femur, 2^{mm}; tibia, 4^{mm}; tarsus, 0.5^{mm}.

To the memory of the faithful paleontologist, Dr. Oscar Harger, of New Haven.

Florissant. One specimen, No. 11360.

3. Aphidopsis lutaria.

Head and thorax rather darker than the abdomen, the femora rather lighter than the tibiæ. Antennæ a little longer than the fore wings. Wings fully three times longer than broad, the postcostal vein stout and running with scarcely any diminution of size into the long and very slender stigma. First oblique vein straight or scarcely arcuate, parting from the postcostal at an angle of fifty degrees; second oblique vein regularly arcuate, parting from the postcostal vein at an angle of forty-five degrees, and moderately distant from the first oblique at base, so that the first discoidal cell between them is about three or four times broader on the hind margin than at the base. The cubital vein is apparently about as far from the second oblique vein as it from the first oblique, first forks at about one-third way to the hind margin, and has throughout a gently arcuate curve by which it approaches pretty close to the stigmatic vein. This arises far back in the stigma, almost reaching the first cubital fork, is gently arcuate and has a very longitudinal course, so that the stigmatic cell is both slender and very long, not much less than half as long as the wing. Legs very slender indeed, the fore pair nearly as long as the wings and longer than the middle pair, the hind tibiæ and tarsi longer than the body.

Length of body, 3.5–3.8^{mm}; antennæ, 5.75^{mm}; fore wings, 5.25^{mm}; fore legs, 4.8^{mm}; femur, 1.8^{mm}; tibia, 2.6^{mm}; tarsus, 0.4^{mm}; middle legs, 4.25^{mm}; femur, 1.6^{mm}; tibia, 2.25^{mm}; tarsus, 0.4^{mm}; hind legs, 6.6^{mm}; femur, 2.6^{mm}; tibia and tarsus, 4^{mm}.

Florissant. Three specimens, Nos. 7433, 8773, and from the Princeton Collection, 1.834.

4. Aphidopsis margarum.

Pl. 18, Fig. 8.

This small and slender species is very dark, almost black as preserved, and pretty uniform. The antennæ so far as preserved are excessively slender and rather shorter than the wings. Wings about three times as long as broad, the postcostal vein heavy, uniform, and straight, merging into the stigma, which is twice as broad, but very long and slenderly fusiform. The first oblique vein is perfectly straight and parts from the postcostal at an angle of fully seventy-five degrees; the second oblique vein, also perfectly straight and rather distant from the first, parts from the postcostal at an angle of forty-five degrees, so that the first discoidal cell is about three times as broad on the hind margin as at the base. Cubital vein very stiff and angular, it and both its branches being rigidly straight; at each furcation it is bent, forking first at rather more than a third way to the hind margin and again about half-way to the apex of the wing, not approaching closely to the stigmatic vein; the vein originates at more than half-way from the first oblique vein to the stigmatic. The stigmatic vein arises far back, about midway between the forks of the cubital, and is very longitudinal, so that the stigmatic cell is narrow, and exceeds a third the length of the wing. Legs very slender.

Length of body, 2.5–3^{mm}; antennæ, 3.4^{mm}; wings, 3.75–4^{mm}; middle legs, 2.6^{mm}.

Florissant. Three specimens, Nos. 5380, 12190, 12683.

5. Aphidopsis dalli.

The head and thorax darker than the tolerably uniform abdomen. Antennæ at least half as long again as the body. Wings apparently about three times as long as broad, the postcostal slender, the stigma pretty large and very long. First oblique vein straight, or nearly straight, parting from the postcostal at an angle of about fifty-five degrees; second oblique rather distant from it, parting at an angle of forty-five degrees, and likewise nearly straight, so that the first discoidal cell between them is little more than twice as broad on the hind margin as at the base. Cubital vein arising more than twice as far from the second oblique vein as that from the first, and about midway between the latter and the stigmatic vein, first forking when hardly

less than half-way to the hind margin, bent at the first furcation, and passing exceedingly close to the stigmatic vein, the upper branch of the final fork in direct continuation of the main stem. Stigmatic vein arising at about one-third the distance from the first to the second furcation of the cubital vein, very longitudinal, so that the stigmatic cell is rather slender and very long, fully two-fifths the length of the wing. Legs slender, the femora tolerably stout, the fore and middle legs of equal length in all parts.

Length of body, 3.5^{mm}; antennæ, 6.5^{mm}; wings, 5^{mm}; fore legs, 3.9^{mm}; femora, 1.4^{mm}; tibiæ and tarsi, 2.5^{mm}; middle legs, 3.9^{mm}; femora, 1.4^{mm}; tibiæ and tarsi, 2.5^{mm}; hind legs, 5.1^{mm}; femora, 2.25^{mm}; tibiæ and tarsi, 2.85^{mm}. Another specimen had a body 4.75^{mm} long, with wings nearly 6.5^{mm} and hind femora 2.5^{mm} long.

In honor of Mr. William Healy Dall, the malacologist, well known also for his studies of fossil invertebrates.

Florissant. Two specimens, Nos. 9135, and from the Princeton Collection 1.1091.

6. Aphidopsis emaciata.

This diminutive species is represented by a single specimen with spread wings, without antennæ or legs. It has an expanse of only six millimeters or less. The head and thorax are uniformly dark, the abdomen uniformly light colored. The wings are as long as the body and more than three times as long as broad. The postcostal vein is broad, but not darkly pigmented, as usual, and the stigma large and distinct. First oblique vein straight, parting from the postcostal at an angle of about seventy-five degrees; the second oblique also straight, parting at an angle of about forty-five degrees, but though the wing is slender, the discoidal cell, narrow at base, is several times as broad on the hind margin as at base. Cubital vein arising about midway between the first oblique and stigmatic veins, and twice as far from the second oblique vein as this from the first; it first forks at some distance from the base, and is strongly arcuate, approaching much nearer the stigmatic than the second oblique vein. Stigmatic vein arising very far back, almost to the first furcation of the cubital vein, and, reaching down far into the wing at the start, it gives a very large stigmatic cell, almost half as long as the wing.

Length of body, 2.5^{mm}; fore wings, 2.5^{mm}.

Florissant. One specimen, No. 6405. It comes from the uppermost layers.

Aphidopsis sp.

Pl. 18, Fig. 11.

A single specimen and its reverse is the only instance of an immature plant-louse among the numerous remains of this family at Florissant. This is excellently preserved, and agrees so well in the structure of the antennæ and legs and in the form of the abdomen with the species of Aphidopsis, a prevailing type among the Florissant forms, that I venture to place it here; the more so as in the markings of the abdomen, well represented on the plate, it bears a striking resemblance to A. subterna, the most common species of Aphidopsis. Short conical markings on the outer sides of the fifth visible abdominal segment evidently mark the position of former cornicles.

Length of body, 4^{mm}; antennæ, 4^{mm}; fore legs, 3.7^{mm}; femur, 1.6^{mm}; tibia and tarsus, 2.1^{mm}; middle legs, 4^{mm}; femur, 1.3^{mm}; tibia and tarsus, 2.7^{mm}; hind legs, 3.5 ?^{mm}; femur, 1.25 ?^{mm}; tibia and tarsus, 2.25^{mm}.

Florissant. One specimen, Nos. 1044 and 4271.

10. ORYCTAPHIS gen. nov. (ὀρυκτός, Aphis).

Fore wings with the stigmatic vein arising from the middle of the exceedingly long and fusiform but moderately broad stigma. Cubital vein (by analogy with the others) twice forked, the first time very far from its origin (which is nearly midway between the base of the first oblique and stigmatic veins) and rather before than behind the base of the stigmatic vein (the plate is wrong in this respect), the second time uncertain, as the only specimens are not well preserved here. Second oblique vein arising many times nearer the first oblique than the cubital vein, so that the first discoidal cell narrow at base is several times wider on the hind margin. Legs moderately slender. Abdomen, as far as can be seen, relatively long and slender.

Table of the species of Oryctaphis.

Oblique vein scarcely divergent in basal half, afterwards distinctly divergent .....1. *O. recondita.*
Oblique veins as divergent in basal as in apical half .....2. *O. lesuerii.*

1. Oryctaphis recondita.

Pl. 18, Fig. 14.

Head and thorax black, abdomen very light. Wings apparently rather more than three times as long as broad, the postcostal stout, and the stigma very elongated. First oblique vein straight and parting from the postcostal at an angle of forty-five degrees; so also does the second oblique vein,

which arises in close proximity and scarcely diverges from the other in the first third of its course and then bends outward, so that the first discoidal cell must be three or four times broader on the hind margin than at the base. Cubital vein arising four times as far from the second oblique vein as it is from the first, and yet not quite half-way from the first oblique to the stigmatic vein: it first forks only a little less than half-way to the hind margin, and no second furcation can be seen, as the wing is broken. The stigmatic vein arises opposite the first furcation of the cubital vein and curves well down into the wing, so that the stigmatic cell is large, but its relative length can not be determined.

Length of body, 5.5^{mm}; wing, 6.25^{mm}.

Florissant. One specimen, No. 4475.

2. Oryctaphis lesueurii.

Head and thorax black, abdomen exceedingly pale. Wings apparently about three times longer than broad, the postcostal vein very heavy, angulated in the slightest possible manner next the oblique veins, the stigma very long and slender. The first oblique vein parts from the postcostal at an angle of fifty-five degrees, and is faintly sinuate; the second, arising close to it, is arcuate apically, but otherwise straight, and parts from the postcostal at an angle of forty-five degrees, so that the discoidal cell between them is about four times as broad along the hind border as at the base. Cubital vein indistinct at base, but apparently arising four times as far from the second oblique vein as this from the first, and about midway between the first oblique and the stigmatic vein; it first forks at almost half-way to the hind border, and in passing to that its first fork gradually approaches the second oblique vein. The stigmatic vein appears to arise about half-way between the two furcations of the cubital vein, but no more can be said of it from its imperfection on both wings. The fore legs are very slender.

Length of body, 4.5^{mm}: wings, 5.5^{mm}: fore femora, 1.1^{mm}: fore tibiæ and tarsi, 1.5^{mm}.

In memory of the early American paleontologist, Charles Alexandre Lesueur.

Florissant. One specimen, No. 9405.

11. SYCHNOBROCHUS gen. nov. (*συχνός*, *βρόχος*).

The fore wings with the stigmatic vein arising from the middle of the stigma and very longitudinal. Cubital vein at least once forked, far from base, and opposite the base of the stigmatic vein, arising nearly midway between the first oblique and stigmatic veins; beyond it is too poorly preserved in the only specimen known to be certain whether it forks again or not. Second oblique vein arising four times as near the first oblique as the cubital vein, at an angle of less than forty-five degrees with the posteostal vein, the first oblique, which is nearly parallel to it, curving outward in the latter part of its course, so that the first discoidal cell between them is excessively long and arcuate. Abdomen long and narrow, narrower than the thorax, twice as long as broad, and well rounded apically.

SYCHNOBROCHUS REVIVISCENS.

Pl. 18, Fig. 6.

One of the very smallest of the Aphides, unfortunately showing of the appendages only one wing. The head and prothorax are light colored, but darker than the abdomen, which shows darker transverse bands on the posterior halves of the segments. The wings are only slightly longer than the body (the abdomen being longer than usual), perhaps slightly more than three times as long as broad, the slender posteostal vein parallel throughout with the costa, the interspace more or less clouded with pigment, the stigma moderately broad and very long, reaching nearly or quite to the extreme tip of the wing. The oblique veins are both remarkably long and of nearly equal length, curving outward apically, and extending so far that even the first terminates well in the outer half of the wing; they arise close together, the first at an angle of scarcely more, the second of scarcely less, than forty-five degrees with the posteostal, and are nearly parallel, the discoidal cell being therefore arcuate and about two or three times as broad on the hind margin as at the base. The cubital vein is faint and obscure, apparently arising at a little less than half-way from the first oblique to the stigmatic vein, and four or five times farther from the second oblique than it from the first oblique vein; its first forking can not be satisfactorily determined, but it appears to be far from the base and a very little in advance of the stigmatic vein; it has the same sweep as the oblique veins. The stigmatic

vein arises tolerably early, and is considerably arcuate at base, afterwards longitudinal, the stigmatic cell being nearly or quite a third the length of the wing.

Length of body, 2.5^{mm}; fore wing, 2.75^{mm}.

Florissant. One specimen, No. 314.

Subfamily SCHIZONEURINÆ Passerini.

12. SCHIZONEUROIDES Buckton.

Schizoneuroides Buckt., Monogr. Brit. Aphides, IV, 178 (1883.)

Fore wings with the posteostal vein distant from the margin and curved in an opposite sense. Stigmatic vein arising very early, near the proximal end of the long stigma, so that the stigmatic cell is fully two-fifths the length of the wing. Cubital vein once forked far beyond the base of the stigmatic vein, and at a long distance from its own origin, which is near the middle of the outer half of the space between the first oblique and stigmatic veins, the second oblique vein arising twice as near the first as the cubital vein, but not very near the former, though somewhat nearer than represented on the plate, diverging from it at a slight angle, so that the first discoidal cell between them is nearly or quite four times as broad on the hind margin as at the base. Abdomen long oval, no broader than the thorax, about twice as long as broad, and a little pointed apically.

A single species is known.

SCHIZONEUROIDES SCUDDERI.

Pl. 18, Fig. 2.

Schizoneuroides scudderi Buckt., Monogr. Brit. Aphides, IV, 178, Pl. 133, Fig. 5 (1883); Scudd., Zittel, Handb. d. Palæont., I, II, 780, Fig. 988 (1885).

The greater portion of a body with the wings of one side represents this small species. The body is mottled and barred with dark brown. The wing is represented on the plate with altogether too full a hind margin, for the wing is really more than three times as long as broad. The middle of the base of the first discoidal cell is midway between the base of the wing and the stigmatic vein. The first oblique vein is straight, and parts from the posteostal at an angle of fifty degrees: the second gently sinuate, at an

angle of forty-five degrees with the same; the discoidal cell about four times as broad on the hind margin as at the base. The cubital vein forks about at its middle and then rather widely.

Length of body, 1.8mm; of fore wing, 4mm.

Florissant. One specimen, No. 315.

13. AMALANCON gen. nov. (ἀμαλός, ἀνηών).

Head considerably narrower than the thorax, quadrate, with the front triangularly and roundly produced to a considerable degree; no frontal tubercles. Antennæ about two-thirds as long as the body, tapering, the third joint relatively stout, about as long and at base fully as stout as the fore tibiæ, the first and second joints not one-half broader. Rostrum as long as the thorax, very slender. Fore wings very narrow, with the stigmatic vein arising very far back in the long stigma, so that the stigmatic cell is nearly half as long as the wing. Cubital vein once forked, far beyond the base of the stigmatic vein, and a long way from its own origin, which is at some distance before the middle of the space between the first oblique and the stigmatic veins; second oblique vein arising somewhat nearer the first oblique than the stigmatic vein, diverging from the former slightly, so that the first discoidal cell between them is only two or three times as broad on the hind margin as at the base.

The name is given with reference to the weakness of the cubital vein, which it shares with Anconatus.

A single species is known.

Amalancon lutosus.

Pl. 18, Fig. 13.

The dark head and thorax of an insect are all that remain of the body with a part of the legs and most of one fore wing. The thickened postcostal vein is very slightly sinuous and blends apically into the stigma. The first oblique vein is straight and at an angle of fifty degrees with the postcostal; the second also straight and at an angle of forty-five degrees with the same, the first discoidal cell being two or three times broader on the hind margin than at the base. The cubital vein, exceedingly weak, has

a course midway in the space between the second oblique and stigmatic veins, and forks about half-way to the tip of the wing. The stigmatic cell is long and slender. The whole wing is very narrow, but its exact proportions are uncertain: probably it is more than three times as long as broad.

Length of fore wing, 2.75^{mm}.

Florissant. One specimen, No. 340.

14. ANCONATUS Buckton.

Anconatus Buckt., Monogr. Brit. Aphides, IV, 177 (1883).

Head rather small, subquadrate, broader than long, the front entire and straight. No frontal tubercles. Antennæ apparently much shorter than the body, very slender, separated by twice the width of the basal joint, the first and second joints quadrate and successively smaller, the third half the width of the first. Wings narrow, the stigmatic vein arising at about the middle of a pretty large and long stigma, so that the stigmatic cell is generally about a third the length of the wing. Cubital vein very feeble, once forked before, generally considerably before, the stigmatic vein and at a moderate distance from its own origin, which is in the second fourth of the space between the first oblique and stigmatic veins. Second oblique vein arising about twice as near the first oblique as the cubital vein, diverging considerably from the first oblique vein which is unusually transverse, but the first discoidal cell is only three or four times as broad on the hind margin as at the base. Legs moderately stout but long, the middle femora being nearly as long as the width of the body, the hind femora as the length of the abdomen. Abdomen stout ovate, considerably broader than the thorax, broadest behind the middle, somewhat pointed apically, with no cauda, and only short cornicles.

Table of the species of Anconatus.

Cubital vein forking a long way before the stigmatic vein, and arising only a little before the middle of the space between the first oblique and stigmatic veins.....1. *A. dorsuosus.*

Cubital vein forking only a little before the stigmatic vein and very far from its origin, which is at about the middle of the proximal half of the space between the first oblique and stigmatic veins. 2. *A. bucktoni.*

1. Anconatus dorsuosus.

Pl. 18, Fig. 9.

Anconatus dorsuosus Buckt., Monogr. Brit. Aphides, IV, 177–178, Pl. 133, Fig. 4 (1883).

This large species is represented by several specimens, all tolerably complete with more or less spread wings. In all the body is uniformly dark, but in none is the form of the wing shown. The postcostal vein is more or less slender, and merges into the greatly elongated subfusiform stigma, which fades out shortly before the tip of the wing. The first oblique vein is straight and parts from the postcostal at an angle of about seventy degrees, while the second is more or less arcuate after a short distance from the base and its general course is at an angle of forty-five degrees with the postcostal, though the first discoidal cell is apparently only a little more than three times as broad on the hind margin as at the base. Cubital vein arising scarcely before the middle of the space between the first oblique and stigmatic veins and, running midway between the second oblique and stigmatic veins, forking at some distance before the stigmatic vein (in which the figure is not quite correct) and at about the end of one-third of its course. Stigmatic cell very slender, the stigmatic vein being only gently arcuate, and the cell nearly a third the length of the wing.

Length of body, 6^{mm}; of fore wing, 8^{mm}.

Florissant. Three specimens, Nos. 3228, 4827, 11175.

2. Anconatus bucktoni.

The body is deep black, with pale blotches on the abdomen of one specimen, which may be only flaws in the carbonaceous matter. Excepting the wings and fragments of legs, no appendages are preserved, unless it be one of the cornicles, a slender, equal, not very long, black stem protruding on one side at the place of the cornicle, and less than one-fourth the width of the abdomen. The form of the wings can not be determined, but apparently they are very narrow. The postcostal vein and stigma are as in A. dorsuosus. The first oblique vein is straight, and diverges from the postcostal at an angle of fifty degrees; the second, equally straight, as far as it can be seen (not over one-half its course), at an angle of forty degrees; the stigmatic cell not wholly determinate but perhaps wider at base than in A.

dorsuosus and exceedingly long, being nearly half as long as the wing The cubital vein arises at about the middle of the proximal half of the space between the first oblique and stigmatic veins, takes a course in the space open to it, a little below the middle, and forks only a little before the stigmatic vein, far from its base and very low down, the inferior branch being short.

Length of body, 3.5^{mm}; of fore wing, 7.5^{mm}.

Named for my friend, George Bowdler Buckton, Esq., whose monograph of the British Aphides is a monument of patient work.

Florissant. Two specimens, Nos. 2067, 14289.

15. PTEROSTIGMA Buckton.

Pterostigma Buckt., Monogr. Brit. Aphides, IV, 178 (1883).

Head and antennæ precisely as in Anconatus, excepting that the basal antennal joints are slenderer, so that the frontal space between the antennæ is several times their width.[1] Fore wings exceptionally narrow, with the straight postcostal vein distant from the convex margin, the stigmatic vein arising before the middle of the long, curving and tapering stigma, so that the cell is nearly two-fifths as long as the wing (it is shorter than would appear from the plate). Cubital vein very feeble, once forked well before the base of the stigmatic vein and at no very great distance from its own origin, which is near the middle of the space between the first oblique and the stigmatic veins. Second oblique vein arising close to the first and many times nearer it than the cubital vein, sinuous and diverging from the straighter first oblique vein at a considerable angle, so that the first discoidal cell between them is about four times broader on the hind margin than at the base. Legs very slender, but not very long. Abdomen pretty regularly oval, apically rounded.

Table of the species of Pterostigma.

Bases of the second oblique and stigmatic veins hardly more distant than the extreme breadth of the wing ..... 1. *P. recurvum.*

Bases of the second oblique and stigmatic veins more than half as distant again as the extreme breadth of the wing ..... 2. *P. nigrum.*

[1] What Buckton took for a rostrum of three joints is a broken part of the right antenna.

1. Pterostigma recurvum.

Pl. 18, Fig. 18.

Pterostigma recurvum Buckt., Monogr. Brit. Aphides, IV, 178, Pl. 133, Fig. 6 (1885).

A single specimen with expanded wings lies entangled with a species of Aphidinæ (Tephraphis walshii). The basal joints of the antennæ are preserved, and show the characteristics mentioned under the genus. The fore wings are nearly three times as long as broad, with scarcely any fullness along the hind margin, being exceptionally symmetrical. The thickened postcostal vein is almost straight, with the slightest possible curve from the margin, and in the middle of the wing blends into the exceedingly long, slender, and arcuate stigma, which curves around the tip of the wing nearly to the middle line; the costal margin is considerably arcuate at base and distant from the postcostal vein. The oblique veins as far as preserved are nearly straight and considerably divergent, but the second is only preserved in its basal half or third; it diverges from the postcostal about forty degrees, the first as much as fifty degrees. The cubital vein is very faint throughout, but arises about six times as far from the second oblique as that from the first, and at only a short distance less than half-way from the first oblique to the stigmatic vein; it has a very longitudinal course and forks narrowly, well before the base of the stigmatic vein and at from one-fourth to one-third the distance from its origin to the extremity of its lower branch. The stigmatic vein parts gently from the stigma and for most of its course is straight, the stigmatic cell being narrow, broadest apically, and nearly two-fifths as long as the wing. The openness of the first discoidal cell apically can not be determined, but seems to have been three or four times as broad here as at base. The abdomen seems to be oval, scarcely broader than the thorax, and shows no signs of cauda or cornicles.

Length of body, 4.25^{mm}; of fore wing, 5.75^{mm}.

No part of the wing is displaced by pressure, as suggested as possibly the case by Buckton; on the contrary it is exceptionally undisturbed; but as drawn on the plate the extreme base of the stigmatic vein is not given (and is in reality very faint and only visible in certain lights), while the apparent short vein close to its base is foreign to the wing. The obscure cubital vein was overlooked when the drawing was made.

Florissant One specimen, No. 8085.

2. PTEROSTIGMA NIGRUM.

Only the body, somewhat distorted, and one fore wing are preserved, which do not permit so complete a description as of the preceding species. The wing appears to be about three times as long as broad, and with the same symmetrical form seen in the preceding species. The costal vein is thick and straight, blending into the considerably thickened stigma. The oblique veins are each very gently arcuate with the opening toward the stigma, unusually oblique and little divergent, the general course of the first being scarcely more than forty-five degrees with the costal, that of the second not above forty degrees; the second is more sinuous and terminates fully as far out as opposite the base of the stigmatic vein, the first opposite the base of the cubital, so that the cell is at least four times as wide on the hind margin as at the base. The cubital vein is very faint, especially toward the base, but arises four or five times as far from the second oblique as the latter from the first oblique vein, and scarcely less than half-way from the first oblique to the stigmatic vein; it has an exceedingly longitudinal course and forks very narrowly far before the base of the stigmatic vein, but just how far the single specimen does not permit deciding. The stigmatic vein parts rather rapidly from the stigma and is strongly arcuate at base, but the form of the stigmatic cell can not be made out. The body is very black and uniform throughout, the abdomen short ovate, and well rounded, with no sign of cauda or cornicles.

Length of body, 3.5^{mm}; of wings, 5^{mm}.

Florissant. One specimen, No. 6090.

Family PSYLLIDÆ Latreille.

This little family of leaf fleas, closely allied to the Aphides, but always winged at maturity and showing some curious resemblances in neuration to the Psocidæ among Neuroptera, seems to be best represented, like the Aphides, in temperate regions. Hitherto it has not been found fossil, but the shales of Florissant have now yielded remains of two species belonging to two different groups and representing extinct genera allied to Psylla, Pachypsylla, and Psyllopsis.

Table of the genera of Psyllidæ.

Stem of the cubital vein before its fork as long as the stem of the subcostal vein.....1. *Necropsylla.*
Stem of the cubital vein before its fork distinctly shorter than that of the subcostal vein..2. *Catopsylla.*

1. NECROPSYLLA gen. nov. (νεκρος, Psylla).

This name is proposed for a species belonging to the subfamily Aphalarinæ, which shows a close resemblance to Psyllopsis. As there, the wing is membranous. The petiolus cubiti is of the same length as the discoidal part of the subcosta, and the general relation of the principal nervures is the same; it is only in minor details that it differs here, such as the exceptional length of the upper branch of the subcosta and the transverse course of the lowest branch of the cubital. But the most striking difference is in the form of the wing, which in Psyllopsis is pretty regularly obovate, the widest part of the wing in the middle, the apex well rounded. In Necropsylla, on the other hand, it is subtriangular, the broadest part just before the apex, which is very broadly rounded; both upper and lower margins are nearly straight. Little is preserved besides the wings.

When first noticed it was thought to belong to the Psocidæ, near Psoquilla and Sphæropsocus, and was accordingly figured among the Neuroptera.

A single species is known.

Necropsylla rigida.

Pl. 12, Figs. 11, 21.

Head broad, fully twice as broad as long, rounded, the nasus strongly pronounced, orbicular, very large. Whole body stout, the prothorax apparently at least three times as broad as long, the abdomen tapering a little only, and furnished at the tip with a short, slender, conical, bluntly tipped style. Wings two and a half times longer than broad, wedge-shaped, being largest near the tip and narrowing pretty regularly toward the base, though more rapidly on the basal third than beyond, the costal margin arched, the tip very fully rounded, the inner margin perfectly straight. A principal vein runs through the middle of the wing; at the end of the first third it divides into two forked stems, the cubital and subcostal, each of them forked for the first time opposite each other at about the middle of the wing; the subcostal forks only this time, its upper offshoot curving at once up toward and then following close to the costal margin, where it descends into the apical margin; the cubital runs in a straight course midway between the former and the veins below. The lower branch, on dividing,

sends one offshoot along the middle of the wing, which forks at a little more than half-way to the tip, the forks curving a little downward; the other offshoot parts widely from the upper, but when it nears the inner margin, at a little beyond the middle of the wing, it is connected by a cross-vein with the margin, while it itself passes with a strong curve to the apical margin just beyond the limits of the straight inner margin. Besides these veins there are two others, which are obscure and may originate independently or from this central vein near the base; the upper strikes the upper margin a little before the middle of the wing and runs parallel to the upper offshoot of the principal vein; the other, the anal vein, which is more uncertain, strikes the inner margin a little nearer the base, reaching it with a similar but reverse obliquity.

Length of body, 3^{mm}; breadth, 0.75^{mm}; length of wing, 2^{mm}; breadth, 0.78^{mm}.

Florissant. Four specimens, Nos. 310, 349, 7598, 12017.

2. CATOPSYLLA gen. nov. (κάτω, Psylla).

Belongs to the subfamily Psyllinæ, in which the petiole of the cubital vein is distinctly shorter than the discoidal portion of the subcostal. It is most nearly related to Psylla itself, and indeed differs from it only in the excessive length of the cubital cells, which are more than a third the length of the wing, and besides are of very simple and similar structure, in which respect it agrees better with Pachypsylla, recently described by Riley, though the cells are not so long as there and the two sides of the wing are more symmetrical in form, the apex of the wing falling exactly in the middle line; the upper cubital branch falls barely below the middle of the apex of the wing. The wing was pretty evidently membranous, and its broadest portion is in the middle of the outer half, before which it decreases regularly and gently in size, both front and hind margins being nearly straight.

A single species is known.

Catopsylla prima.

Wings fully twice as long as broad, largest in the strongly rounded apical half, decreasing regularly in size toward the base. Lower fork of subcostal vein forming with its stem a regular, very gently arcuate curve and terminating considerably above the apex of the wing, its upper branch

diverging from it angularly toward the costal margin just before the end of the proximal third of the wing, and just before reaching the margin bending abruptly outward parallel to the lower branch, not really reaching the margin until toward the apex of the wing. In the cubital vein the lowermost fork makes a continuous, regular and rather strongly arcuate curve with the discoidal portion, striking the margin just before the middle of the wing; the upper branch of the lower fork parts from this just about opposite the forking of the subcostal, while the upper fork, not so wide as the lower, arises at three-fifths the distance from the base of the wing, making the inclosed cell of unusual length for Psyllidæ; the upper branch of this fork falls scarcely below the apex of the wing, and the tips of the cubital forks fall at subequidistant intervals along the margin, the lower cell the wider.

Length of body, 3$^{m.m}$; wing, 2.5^{mm}; breadth of latter, 1.2^{mm}.

Florissant. One specimen, No. 6712.

Family FULGORINA Burmeister.

This family is fairly well represented in Tertiary deposits and by a considerable variety of forms, all the subfamilies being represented except the Tropiduchida, Derbida, and Lophopida; and, what is curious, each of the subfamilies is represented both in European and American strata, excepting only the Issida, confined to Europe, and the Achilida, found only in America, each by a single species, the one in Radoboj, the other at Florissant. In Europe the Fulgorina are represented by Pœocera in amber, the Dictyopharida by Pseudophana both in amber and at Oeningen, the Cixiida by Cixius in amber, the Delphacida by Asiraca at Aix, the Ricaniida by Ricania in amber, and the Flatida by Flata, also in amber. The only one of these genera recognized in America is Cixius, and that doubtfully; but these subfamilies are far better represented, and in some instances by new and peculiar types. Thus of Fulgorida we have Nyctophylax, Aphana, Lystra, and Fulgora, all with more than one species, from various localities; of Dictyopharida, a Dictyophara from Florissant; of Cixiida, not only Cixius but Oliarus, Diaplegma, Oliarites, and Florissantia, all but the first peculiar types and Diaplegma with no less than seven species—all these from Green River and Florissant; of Delphacida, Delphax, and Planophlebia, the latter a remarkable extinct type from British Columbia; of Ricaniida

Hammapteryx, a new genus from Green River; and of Flatida, two species of Lithopsis and one of Ficarasites, both new types and from Green River. America is therefore far richer than Europe both in the number and diversity of its fulgorine fauna, but especially in the later. About half the European species have been referred to Cixius alone, and, as we have seen, Diaplegma, a genus of Cixiida, is the most abundant American type.

Subfamily FULGORIDA Stål.

This group, which includes among its members the lantern-fly and other light-giving, or presumably light-giving, insects, has heretofore been found fossil only in amber, three species of Pœocera having been described therein. Now, however, we are able to add from the American rocks a considerable number and variety of forms, referred to four different genera, one of them, Nyctophylax, extinct and composed of large species with recurved snout.

NYCTOPHYLAX gen. nov. (*νυκτοφύλαξ*).

Large bodied insects, nearly allied to Enchophora. The head presented a recurved process of subequal diameter (as seen from the side) and tolerably stout, exceeding a little the diameter of the head; it was directed upward and a little backward, not reaching the posterior margin of the head, very bluntly pointed, laterally carinate. Legs short and moderately stout, the hind femora not surpassing the middle of the abdomen, both femora and tibiæ apparently carinate or tetraquetral throughout. Tegmina considerably surpassing the abdomen, densely reticulate in the apical fourth only. Type, N. uhleri.

Table of the species of Nyctophylax.

Larger species (tegmina twenty millimeters in length). Extreme tip of the recurved process of the head separated from the summit of the head by nearly twice its own greatest diameter..1. *N. uhleri.*
Smaller species (tegmina fifteen millimeters in length). Extreme tip of the recurved process of the head separated from the summit of the head by not more than its own greatest diameter..2. *N. vigil.*

1. NYCTOPHYLAX UHLERI.

Pl. 19, Fig. 11.

This is one of the largest of the Homoptera known in a fossil state, and from the development of the frontal process was not improbably a noctilucous insect. It is preserved on a side view; the fracture of the stone has removed a portion of the front, but has fortunately left intact the posterior

connection of the process to the vertex, by which it is seen to be here abruptly bent backward, but at the same time upward, so as to leave an angulate opening between it and the head. The head is streaked with pale, relieved by dark along the incisures, and the process is longitudinally marked in the same way, the carinæ being dark. The tegmina are broad, expanding triangularly, roundly angulate at the apex, which is in the middle of the upper half, and surpass the abdomen by about one-fifth their length; they are dark but mottled with lighter colors, and in the apical reticulate portion the nervules and cross-veins are heavily marked with white, breaking this part of the wing up into pretty regular, rectangular and longitudinal, fuliginous cells of very equal breadth, but varying in length from one to three times their breadth. The legs are dark, marked longitudinally with paler colors, and the dark abdomen is much paler in broad bands at the incisures.

Length of body, 20?^{mm}; height of thorax, 7^{mm}; length of process beyond the head, 3^{mm}; breadth of same, 1^{mm}; length of tegmina, 20^{mm}; their breadth, 8^{mm}; length of fore femora, 4^{mm}; fore tibiæ, 5^{mm}; hind femora, 5.5^{mm}; hind tibiæ, 7^{mm}.

This striking insect, the possible light bearer of the ancient Florissant nights, is named for my friend Mr. P. R. Uhler, who has done more than any one else to illumine the path of the student of Hemiptera in our country.

Florissant. One specimen, No. 11771.

2. Nyctophylax vigil.

Pl. 19, Fig. 8.

This species seems to differ from the preceding, so far as can be seen, only in its smaller size and the shorter and more abruptly recurved process of the head, the apex of which only reaches a point opposite the middle of the eye, and is removed from the summit of the head by scarcely its own greatest width. Unfortunately this part was not exposed on the stone when it was drawn, and the front of the specimen, which is preserved in nearly the same position as in that of N. uhleri, is broken to almost precisely the same extent as there. The markings are throughout the same, excepting that the pale bands at the incisures of the abdomen appear to be narrower.

Length of body, 16^{mm}; height of thorax, 4.5^{mm}; length of process beyond the head, 1.2^{mm}; breadth of same, 0.9^{mm}; length of tegmina, 14.75^{mm}.

Florissant. One specimen, No. 12088.

APHANA Burmeister.

To this genus are provisionally referred a couple of species which belong in this neighborhood, but probably not together. No other extinct species have been referred to this group, which is essentially subtropical.

APHANA ATAVA.

Pl. 5, Figs. 96, 97.

Aphana atava Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 759–760 (1877).

A single finely preserved specimen, giving the upper surface of the body, the displaced tegmina of one side, and a part of the middle leg of the opposite side, is referred provisionally to Aphana. It plainly belongs to the true Fulgorina, and seems to agree better with Aphana than with any other genus concerning which information is at hand, but it is much smaller than the species of Aphana (as it is larger than those of Pœocera), and differs from it in the structure of the head and the brevity of the tegmina. The head is small, being scarcely more than one-third the width of the body, the eyes not prominent, the front scarcely angulated, and the vertex of about equal length and breadth; it is marked above with two longitudinal blackish stripes, and the thorax with a median, and, on either side, a broad, lateral, black stripe, all of them bordered by paler parts and the median marked with a median pale line. The front of the thorax is strongly and regularly convex, and the posterior border of the mesonotum is rectangular. The tegmina are about three times as long as broad, with nearly parallel borders, the tip roundly pointed; the apical fifth is filled with fine, closely parallel, longitudinal veinlets, extending from the tip of the radial vein to the inner border, forming an area of equal width throughout. The radial vein is parallel to the costa throughout. The ulnar veins originate almost exactly as in Acræphia, but the upper one does not fork before the middle of the wing, when it sends downward a single shoot, while the lower forks almost immediately, and again emits a vein beyond the middle of the wing. The wing itself is apparently diaphanous, but is mottled lightly with faint fuliginous along the costal border, and more heavily, but irregularly, with dark fuscous on the basal half of the wing, especially next the extreme base, and in a rather broad and straight but irregularly margined and oblique band, crossing the wing from just below the sutural angle equally

backward and outward. Middle leg moderately stout; femur and tibia of equal width, straight, apparently with sharp edges. Abdomen full, rounded, broad, the extremity broadly rounded; it is dusky, especially beyond the base, the neighborhood of the spiracles darker, the fifth to the seventh segments with a medio-dorsal (or medio-ventral?) raised line marked in black.

Length of body, 9.5^{mm}; breadth of head, 1.8^{mm}; of abdomen, 5^{mm}; length of tegmina, 10^{mm}; width of same, 3.5^{mm}; length of femora (somewhat doubtful), 2^{mm}.

Chagrin Valley, White River, Colorado. One specimen, W. Denton.

Aphana rotundipennis.

Pl. 6, Fig. 27.

Aphana rotundipennis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 772 (1878).

This name is proposed for a couple of wings which seem by their obscure venation to belong in the same group as the last. They differ, however, in having a strongly bowed costa, which is curved more apically than near the base, and continues very regularly the curve of the well-rounded apex; the commissural border is perfectly straight; the principal veins fork near the base, so that there are a number of longitudinal veins a short distance therefrom; no transverse veins are discernible, nor oblique veins at the costal margin, but the longitudinal veins all fork at a similar distance from the apex, so that the apical fifth of the wing is filled with still more numerous longitudinal veins; the tegmina are broadest just beyond the middle.

Length of tegmina, 6.75^{mm}; breadth of same, 3^{mm}.

Green River, Wyoming. Two specimens, Nos. 175 (F. C. A. Richardson), 4187 (S. H. Scudder).

LYSTRA Fabricius.

The specimens that are placed here are very obscure and imperfect, and when better ones are obtained the species will very probably have to be removed elsewhere, and perhaps even to another subfamily; but what can be made out reminds one of this group as well as of any other, and they are therefore placed here provisionally, though it is plain that they do not belong together. No fossil species besides these have been recorded.

Table of the species of Lystra.

Lateral sulci of mesonotum parallel ..... 1. *L. richardsoni.*
Lateral sulci of mesonotum posteriorly convergent ..... 2. *L. leei.*

1. Lystra? richardsoni.

Pl. 6, Figs. 24, 30, 31; Pl. 7, Figs. 1, 3.

Lystra? richardsoni Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 772 (1878).

I have before me a number of specimens of a large fulgorid, apparently belonging near Lystra and Pœocera, but which have been preserved only in a fragmentary condition. Enough, however, remains to show several features: the vertex between the eyes is half as broad again as the eyes, and at least as long as broad, projecting beyond the eyes by more than the diameter of the latter and well rounded. The scutellum is large, fully as long as broad. The longitudinal veins of the tegmina are rather infrequent, forking rarely, and even toward the apex seldom connected by cross-veins; apparently all the principal veins branch at about the same points, viz, near the middle of the basal and of the apical half; the tegmina somewhat surpass the abdomen. The body is broadest at the second or third abdominal segment, and tapers rapidly to a point, the segments being equal in length.

Length of body, 16^{mm}; probable length of tegmina, 15.5^{mm}; breadth of abdomen, 5.5^{mm}.

Named for one of the earliest collectors of Green River fossil insects, Mr. F. C. A. Richardson.

Green River, Wyoming. Eleven specimens, Nos. 67, 119 (F. C. A. Richardson), 40, 41, 109 (L. A. Lee), 121, 123 (A. S. Packard), 4076, 4207 and 4208, 4212, 4217 (S. H. Scudder).

2. Lystra? leei.

Pl. 7, Fig. 2.

A species is indicated of about the same size and general form as L. richardsoni, preserved so as to show a dorsal view with the greater part of at least one of the diaphanous tegmina and the thorax, but not the head nor other appendages. The mesonotum was broad and well rounded in front, contracted behind, nearly twice as broad as long, with the interior third of each lateral half separated by a straight oblique sulcus from the parts without, as deep as the median sulcus, and apically curving abruptly inward to it; scutellum moderately large, truncate basally, triangular and almost equiangular, the apex produced finely to a point, the sides slightly concave.

Tegmina somewhat surpassing the abdomen, the longitudinal veins in general much as in L. richardsoni. Abdomen much as there.

Length of fragment, 11.5^{mm}; probable length of body, 10^{mm}; length of tegmina, 10.25^{mm}; breadth of abdomen, 5.25^{mm}.

Named for Prof. Leslie A. Lee, of Bowdoin College, a diligent collector of Green River fossil insects.

Green River, Wyoming. One specimen, No. 119, Dr. A. S. Packard.

FULGORA Linné.

The species placed here are so referred only because, appearing to belong to the subfamily of which this is a typical member, they can not be more definitely placed. No other fossil insects have been referred to this place.

Fulgora granulosa.

Pl. 6, Fig. 35.

Fulgora granulosa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 771–772 (1878).

A single specimen and its reverse show only the thorax and abdomen of an insect belonging to the subfamily of Fulgorida, but of which little more can be said. The thorax is large, globose, and black; the scutellum is about half as large as the thorax, longer than broad, and rounded at the apex; the abdomen tapers gently, its apex about half as broad as its base, and is provided with a pair of overlapping, black, roundish, oval plates, giving the appearance of an additional segment. The surface of the thorax and abdomen is thickly and uniformly granulate with circular, dark-edged elevations, averaging 0.04^{mm} in diameter; the scutellum lacks this marking, excepting at the edges, which are more minutely and profusely granulate.

Length of body, 8.5^{mm}; of thorax, 2.75^{mm}; of scutellum, 1.4^{mm}; of appendages, 1^{mm}; breadth of thorax, 2.5^{mm}; of scutellum, 1.25^{mm}; of second segment of abdomen, 2.2^{mm}.

Green River, Wyoming. One specimen, Nos. 49 and 131 (F. C. A. Richardson).

Fulgora populata.

Pl. 7, Fig. 16.

The dorsal view of a headless insect with overlapping wings but no other appendages. The mesonotum is transverse, about three times as broad as long, posteriorly truncate, anteriorly broadly rounded so as to be

only one-fourth as long on the sides as in the middle, the surface smooth or microscopically scabrous, with exceedingly scattered, pale, circular spots or pustules about 0.03[mm] in diameter. Scutellum large, nearly as broad as the mesonotum, and almost three-fourths as long as broad, the sides slightly concave, the apex produced and pointed, the surface similar to that of the pronotum but with fewer pustules Base of the tegmina and particularly of the clavus apparently very finely granulate, the neuration obscurely preserved, the tegmina apparently just reaching the tip of the abdomen.

Length of fragment, 7[mm]; of mesonotum, 0.6[mm]; breadth of same, 1.7[mm]; of abdomen, 2.8[mm].

Green River, Wyoming. One specimen, No. 111, Dr. A. S. Packard.

FULGORA OBTICESCENS.

Pl. 19, Fig. 1.

A small specimen appearing to belong in this subfamily, though certainly not in Fulgora, in which it is placed only in its ancient broad sense. A dorsal view is presented, showing little besides the body and some of the veins of the tegmina, which reached to the extremity of the abdomen. The head was half as broad as the thorax. The thorax was large and rounded subquadrate, the scutellum also large and rather bluntly angled posteriorly, the abdomen lighter colored than the rest of the body and conico-fusiform with broad, pale incisures. The fore legs were slender and linear, and the longitudinal veins of the diaphanous tegmina rather distant with scanty cross-veins.

Length of body, 4[mm]; greatest breadth, 1.25[mm].

Florissant. One specimen, No. 12069.

Subfamily DICTYOPHARIDA Stål.

A considerable group of mostly tropical forms, of which the only known fossil species are those mentioned below.

DICTYOPHARA Germar.

Two species of Pseudophana Burmeister, regarded by Stal as the same as this genus, have been described from the European Tertiaries, one from immature specimens in amber, the other a winged insect from Oeningen. The species added below is placed in this genus as typical of Dictyopha-

rida, to which the insect appears to belong. The genus is now confined to warm countries, but is found in both worlds. Heer compares the Oeningen fossil to a species found living in Georgia.

Dictyophara bouvei.

Pl. 21, Fig. 16.

A pair of specimens, both seen upon a side view, which appear to belong together. Head not protuberant in front of the eyes, well rounded. Rostrum reaching to the base of the posterior legs; it is poorly represented on the plate in a too curved line. Dorsum of thorax well arched. Legs moderately long and of medium stoutness. Tegmina four times as long as broad, surpassing a little the length of the body, rather slender and subequal, the apex subacute, obliquely subtruncate below. Wings ample, the veins of the anal area divergent, arcuate, apically distant, the outermost, falling on the border at the middle of the apical half of the wing, narrowly and very deeply forked.

Length of body, 14^{mm}; height of same, 4.5^{mm}; length of tegmina, 12^{mm}; breadth of same, 3^{mm}; length of rostrum, 4.5^{mm}.

Named for the Boston geologist, Thomas T. Bouvé, Esq.

Florissant. Two specimens, Nos. 126, 4348.

Subfamily CIXIIDA Stal.

About a third of the fossil Fulgoridæ of Europe have been referred to this subfamily. They are all from amber and are considered as species of Cixius. To this we can now add from American rocks twelve species of at least five genera, three of them, Oliarites, Diaplegma, and Florissantia, regarded as extinct types. They all belong in the vicinity of Cixius and Oliarus, and one of them, Diaplegma, has as many as seven species. The modern species of this group appear to be world wide in distribution.

CIXIUS Latreille.

To this genus as typical of the subfamily only two forms are here placed, which can hardly belong in the same generic group. Many fossil species are known in amber, but none from the rocks have before been referred here. Both the species here described and figured are very imperfect.

Cixius? hesperidum.

Pl. 6, Fig. 19.

Cixius? hesperidum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 772-773 (1878).

A single fragment, representing a nearly perfect tegmen, with obscure venation, is probably to be referred to Cixius, but is unsatisfactory; the costal border is gently and regularly convex, the tip well rounded, with no projecting apex; the tegmen appears to increase very slightly in size to a little beyond the middle, up to which point the borders are nearly parallel; the course and branching of the nervures, so far as they can be made out, seem to indicate an insect allied to Cixius, but no cross-veins can be seen

Length of tegmen, 6.2mm; its greatest breadth, 2.5mm.

Green River, Wyoming. One specimen, No. 38, F. C. A. Richardson.

Cixius? proavus.

Pl. 19, Fig. 14.

An insect apparently allied not distantly to Florissantia elegans and but little smaller than it, but with considerable difference in the neuration of the tegmina. The head is not preserved, but must have been at least as narrow as there, the thorax being transverse but triangular and longer than in Florissantia, although its apex is angularly emarginate, receiving the broadly angled base of the very large, otherwise triangular scutellum, which has a fine mesial sulcation. Tegmina surpassing the abdomen moderately, with no pterostigma, the first cross-veins, at which the longitudinal veins are forked and new cells arise, crossing the middle of the apical two-thirds of the wings, beyond which point the longitudinal veins run unforked to the margin, so that there are but a basal and an apical series of cells, the latter, about eight in number, striking the apical margin; there appear to be a few dusky spots in the middle of these apical cells.

Length of body as preserved, 10mm; breadth of same, 3 75mm; length of tegmina, 10.5mm.

Florissant. One specimen, No. 1.705, Princeton Expedition.

OLIARUS Stål.

A single species is referred here provisionally to indicate its apparently nearest alliance among living forms. The genus has never been found fossil, but all of the known fossil Cixiida are nearly allied to it.

OLIARUS? LUTENSIS.

Pl. 7, Fig. 18.

The species placed here provisionally can certainly not belong here, as the scutellum is only tricarinate, and the veins of the tegmina are smooth and continuous. Evidently, however, it comes near it, to judge from the course of the venation. The head, of which only the part lying between the eyes is preserved, is very small and narrow, little prominent; the thorax, not properly shown in the plate, transverse, equal, short, angularly bent, so that the base of the scutellum being almost as strongly angulate as its tip, the scutellum is diamond-shaped; it has three very delicate carinæ, the lateral ones divergent. The tegmina are three times as long as broad, considerably surpassing the abdomen, diaphanous, with a dusky roundish spot just below the costal edge in the middle of the apical two-thirds; just before it the main longitudinal veins first fork and are united by cross-veins in a zigzag manner, and they again fork and are to some extent again united half way from here to the tip.

Length of body, 6^{mm}; breadth of scutellum, 1.75^{mm}; length of tegmina, 7.25^{mm}.

Green River, Wyoming. One specimen, No. 112, Dr. A. S. Packard.

Possibly in this vicinity should be placed the wings figured, Pl. 7, Fig. 10, which from their obscurity and because of their being longitudinally folded I am unable to place definitely.

DIAPLEGMA gen. nov. (*διάπλεγμα*).

This name is given to an extinct group of Cixiida allied to Cixius and Oliarus with peculiar neuration. The insects are small and slender bodied, with protuberant, pointed head, antennæ apparently much as in Liburnia, a genus of Delphacida, long and slender legs, and elongate wings largest in the middle of the apical half or even third, with strongly and regularly rounded apex. The sutura clavi is very long, and the anal veins unite in one far before their tip; the radial vein forks near the middle of the wing, and each of the forks sends at its tip a cluster of two or three curved independent branches to the costal margin far out; the two ulnar branches, which separate close to the base of the wing, usually fork farther out than the radial, the upper branch of the fork of the upper ulnar vein just striking

the apex of the wing, the lower branch crossing the upper branch of the fork of the lower ulnar vein and reforking between the forks of the latter in a somewhat peculiar manner, sometimes connected by cross-veins to the lower branch of the lower ulnar fork; the lower ulnar branch forks a little earlier than the upper and directly opposite the end of the united anal veins. Venation of hind wings so far as seen a good deal as in Cixius, but the forking of the upper veins beyond the cross-veins is so deep as to run fairly up to these cross-veins.

Seven species are recognized in our Tertiary deposits.

Table of the species of Diaplegma.

The two main branches of the ulnar vein forking distinctly farther out than the first radial furcation.
Apical, radial, and ulnar veinlets reaching the margin twelve in number ..... 1. *D. haldemani.*
Apical, radial, and ulnar veinlets reaching the margin not over ten in number.
Upper ulnar branch distinctly disturbed in course at its first furcation.
Upper fork of lower ulnar vein passing in a continuous and regular curve across the upper ulnar branches to the margin ..... 2. *D. veterascens.*
Upper fork of lower ulnar vein interrupted in its regular course when it meets the upper ulnar branches ..... 3. *D. abductum.*
Upper ulnar branch with its upper fork making a continuous or almost continuous line, undeviating in course.
Tegmina nearly three times as long as broad ..... 4. *D. venerabile.*
Tegmina nearly or quite four times as long as broad.
Cross-veins uniting the ulnar branches considerably farther from the apex of the wing than the breadth of the wing where they occur ..... 5. *D. occultorum.*
Cross-veins uniting the ulnar branches only as far from the apex of the wing as the width of the wing where they occur ..... 6. *D. ruinosum.*
The lower ulnar vein forking almost exactly opposite the furcation of the radial ..... 7. *D. obdormitum.*

1. Diaplegma haldemani.

The antennæ are about as long as the tricarinate scutellum. The tegmina are about three and a half times longer than broad, with very straight costa, largest in the middle of the apical third, scarcely narrowing baseward The radial vein forks exactly at the middle of the wing, the lower ulnar branch at some distance beyond; the upper radial branch is two, the lower three forked, since the first of its forks again subdivides. Opposite the furcation of the upper radial branch the upper ulnar branch forks widely, its upper branch, an unusual circumstance and perhaps individual, forking narrowly, its lower crossing to the center of the lower ulnar fork, where it divides in two, the upper branch again forking, but there is no connection with the lowermost ulnar nervule.

Length of body, 4^{mm}; of tegmina, 4.15^{mm}; width of same, 1.15^{mm}; length of fore tibiæ, 1^{mm}; tarsi, 0.45^{mm}.

In memory of the pioneer American naturalist and philologist, the late Samuel Stehman Haldeman, Esq.

Florissant. One specimen, No. 2237.

2. Diaplegma veterascens.

There is but a single specimen of this species, but in it one of the tegmina is admirably preserved. These are a little more than three times as long as broad, broadest in the middle of the apical half, before which they narrow very regularly and very gently, and beyond which the apex is rather sharply rounded. The radial vein first forks at just about the middle of the wing, the lower ulnar at some distance beyond it; there are three clustered forks to the upper radial, two to the lower, and the cells formed by them are rather slender though short. The upper ulnar branch and its upper fork are distinctly bent where they join, and the lower fork crosses to the center of the lower ulnar fork and there divides in two, without continuing to the lowermost ulnar nervule.

Length of body, 4.5^{mm}; tegmina, 4.2^{mm}; width of same, 1.3^{mm}.

Florissant. One specimen, No. 10680.

3. Diaplegma abductum.

Pl. 15, Fig. 8.

The tegmina of this species are less than three and a half times longer than broad, very uniformly rounded at the apex, the costal and inner borders almost exactly parallel in the outer half before the tip and straight. The radial vein first forks at just about the middle of the wing, the lower ulnar scarcely before the end of the middle third; there are three clustered forks to the upper radial, the last one very strongly arcuate at base, but not connected by a cross-vein to the lower radial, which has two forks, and all their cells are short but slender. The relation of the ulnar branches to each other is peculiar: the upper ulnar branch is simply, symmetrically, and narrowly forked as far beyond the end of the middle third of the wing as the lower ulnar before it; the adjacent forks of the two branches are now united by a cross-vein immediately beyond the furcation of the upper ulnar, the two forks are angulated at the point of touch, and this cross-vein, slightly shifted outward, runs as a longitudinal vein through the middle of

the lower ulnar cell, and is apparently united, immediately after its departure, to the lowermost ulnar branch by a cross-vein parallel to the base of the upper fork of the lower ulnar branch.

Length of body, 4.8^{mm}; tegmina, 4.1^{mm}; breadth of latter, 1.25^{mm}.

Florissant. One specimen, No. 319.

4. Diaplegma venerabile.

Two specimens of this species show, one a side, the other a dorsal, view. The tegmina are nearly three times as long as broad, the costal border more than usually arcuate, which has the effect of shortening the wing. The radial vein first forks well before the middle of the wing, and the lower ulnar branch only a little beyond the middle; the upper radial is three, the lower two-branched, the cells made by them moderately broad. The upper ulnar vein runs in a straight line to the apex of the wing, and opposite the first fork of the upper radial branch sends a cross-vein to the upper fork of the lower ulnar branch, crossing it and emitting in the middle of the cell of the latter a couple of approximated veins, running longitudinally, but it can not be seen to continue to the lowermost fork of the ulnar.

Length of body, 3.75^{mm}; of tegmina, 3.7^{mm}; breadth of same, 1.2^{mm}; length of hind tibiæ, 1.35^{mm}.

Florissant. Two specimens, Nos. 2161, 4824.

5. Diaplegma occultorum.

The fore femora laterally mesially carinate. Tegmina nearly four times as long as broad, slightly broader on the apical than the basal half. The radial branches just below the middle of the wing, its branches rather distant, the upper three, the lower two-branched, striking the costal margin over a little more than the apical fourth of the wing. The ulnar veins divide close to the base of the wing and scarcely diverge, the upper branch exactly midway between the lower branch and the radial vein, and scarcely or not at all disturbed in running straight to the apex, its lower member acting more as a cross-vein, about opposite the tip of the sutura clavi, uniting it to the upper fork of the lower branch, and crossing in a bent arcuate line to the lower fork, emitting midway and approximately two subforks, and then bending upward continues distinctly to the lower fork. All the veins with long, distant, stiff hairs a little farther apart than the length of the hairs.

Length of body, 4.2^{mm}; tegmina, 3.8^{mm}; breadth of same, 1^{mm}; length of fore femora, 1^{mm}; fore tibiæ, 1^{mm}; fore tarsi, 0.6^{mm}.

Florissant. Three specimens, Nos. 2706, 5394, 7326.

6. Diaplegma ruinosum.

A single specimen and its reverse preserved on a side view represent this smallest species of Diaplegma. A portion of the neuration is obscure, but it is otherwise in good condition. The vertex projects but very slightly beyond the eyes. The tegmina are four times as long as broad, the veins heavily haired, the hairs generally set nearer together than their length. The forks of the radial branches are exceptionally short and broad, and the cross-veins uniting the ulnar branches unusually far out, almost farther out than the basal fork of the upper radial branch: radial first forking at about the middle of the wing. Hind tibiæ and the basal two joints of hind tarsi armed beneath with a pair of stout, not very long, black-tipped spines; first joint of tarsi equaling the next two, the middle one very brief.

Length of body, 3.75^{mm}; tegmina, 4.3^{mm}; width of same, 1.05^{mm}; length of fore femora, 1.2^{mm}; tibiæ, 0.8^{mm}; tarsi, 0.45^{mm}; hind femora, 1.1^{mm}; tibiæ, 1.5^{mm}; tarsi, 0.9^{mm}.

Florissant. One specimen, Nos. 611 and 4558.

7 Diaplegma obdormitum.

The specimen representing this species is not so well and continuously preserved as the others of the genus, but differs from them in one or two important points. The tegmina are slightly more than three times longer than broad; the most peculiar feature is the late division of the radial vein, which is only at a distance from the tip equal to the breadth of the wing, and almost exactly opposite the normal division of the lower ulnar branch or opposite the tip of the anal vein, while the arrangement of the subordinate reticulation and furcation of the ulnar area is almost the same as that of D. occultorum. The broken state of both wings does not certainly show how the radial vein is divided, which it would be interesting to know on account of its early character; but it would appear as if the tip of the uppermost ulnar fork curved upward, which with the late furcation of the radial and the absence of any branching in the area preserved would indicate that its ultimate branches must be many fewer than in the other species.

Length of body, 4^{mm}; tegmina, 4^{mm}; breadth of same, 1.25^{mm}.

Green River, Wyoming. One specimen, No. 127, Dr. A. S. Packard.

OLIARITES gen. nov. (Oliarus).

This name is proposed for an insect formerly placed by me in Mnemosyne, one of the Dictyopharida, but which a renewed study seems to show to belong in the vicinity of Oliarus, among the Cixiida. The head was apparently not more than half as broad as the thorax, perhaps much narrower. The thorax was transverse, equal, arcuate, into which the pretty large subtriangular scutellum with its convex base fitted. The tegmina were wholly diaphanous, very greatly surpassing the abdomen, enlarging apically with slight, fine, but smooth and in no respect arenaceous veins, all the longitudinal veins connected near the middle of the wing, but not in a line, with the cross-veins, at or beyond which each of them forked to a greater or less extent, the forks, at least in the upper half of the wing, upcurved on approaching the margin, where they are again forked and united by many cross-veins, so that the wing becomes weakly reticulate shortly before the margin.

OLIARITES TERRENTULA.

Pl. 7, Fig. 17.

Mnemosyne terrentula Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 773 (1878).

A single specimen is preserved, with an indistinct body, broken in front, and the greater part of one of the tegmina. The body is moderately broad ovate, the tip of the abdomen rounded and slightly produced. The tegmina are regularly enlarged toward the apex and rounded at the extremity, not at all truncate; the interior branch of the radial vein forks near the middle of the wing, and just beyond the first subapical transverse vein; both its branches fork before they have passed more than half-way to the marginal row of elongate cells.

Estimated length of body, 6.5^{mm}; breadth of same, 2.25^{mm}; length of tegmina, 7^{mm}; breadth of same, 2.25^{mm}; their extent beyond the abdomen, 2.2^{mm}.

Green River, Wyoming One specimen, No. 31^{d} (F. C. A. Richardson).

FLORISSANTIA gen. nov. (Florissant, nom. loc.).

This interesting genus appears to be allied to Cladodiptera, with very nearly the same general neuration of the tegmina, but differs strikingly from it in the much narrower head. The head is only half as broad as the

thorax, and, as viewed above, the eyes make up one-half of this narrow part; the front projects abruptly in front of the eyes by one-third their length, is well rounded anteriorly with brief parallel sides; the eyes are moderately large, not very tumid. The thorax is transverse, arcuate, equal, short; the scutellum very large, triangular, pointed, with nearly straight but slightly arcuate sides, attenuating the apex. Legs slender, the hind tibiæ armed externally with three distant prominent spines. Tegmina membranous, ample, the longitudinal veins first forking about the middle of the wing, the radial here dividing into two branches, which throw many apical branches to the costal margin at and beyond a pterostigma; the ulnar branches, a little farther on, subdivide into many forks, connected at their origin by cross-veins, and most of these forks, without another series of cross-veins (such as occur in Cladodiptera), again divide shortly before the apex. Abdomen broad, abruptly tapering apically to a bluntly pointed tip.

A single species is known.

Florissantia elegans.

Pl. 19, Fig. 12.

Two specimens with their reverses present a very fair view of this delicately veined insect, but the one figured does not show the head. The body, shaped like that of a diminutive Cicada, is of a uniform dark color with pale abdominal incisures; the thorax is minutely and distantly punctate; the scutellum finely sulcate down the middle; the legs are slender and apparently longitudinally streaked with pale, and the tibial spines are black. The tegmina are about three times as long as broad, the pterostigma situated just before the middle of the apical half, rounded, subquadrate, a little longer than deep; the cross-veins uniting the longitudinal series are mostly opposite the proximal end of the pterostigma, and the apical forks of the longitudinal veins are about as long as the pterostigma.

Length of body, 12.5^{mm}; breadth at base of abdomen, 4.6^{mm}; breadth of head between the eyes, 0.85^{mm}; length of tegmina, 12.25^{mm}; hind femora, 3^{mm}; hind tibiæ, 5.5^{mm}.

Florissant. Two specimens, Nos. 1.104 and 1.751, 1.783 and 1.789, Princeton Collection.

Subfamily DELPHACIDA Stal.

The only European fossil insect hitherto referred to this group is a species from Aix referred by Curtis to Asiraca, to which seven years later Giebel gave the specific name tertiaria, and Heer that of obscurum, referring it to Cicadellites, one of the Membracida. In America, besides an obscure species referred to Delphax, we have an extraordinary insect, with a very strange type of neuration, from British Columbia.

DELPHAX Fabricius.

A single fossil has been referred to this generic group, but only in its wide sense as typical of the subfamily.

Delphax senilis.

Pl. 5, Fig. 95.

Delphax senilis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 760 (1877).

A fairly preserved specimen with spread wings, but with almost no characteristic sculpture The head and exposed part of thorax are blackish; the rest of the body and the wings, especially the tegmina, dusky. The head is less than half as broad as the thorax and short. The thorax is broad and rounded, and the body nearly equal, though enlarging slightly posteriorly. The tegmina are slightly narrower and considerably longer than the body, equal, and at the tip broadly rounded; they show no trace of neuration, but the preservation of the whole is perhaps too obscure to expect it. The wings are a little shorter than the tegmina, crumpled and folded, and show a few longitudinal veins, and others, which, from the nature of the preservation, can not be traced. Legs and appendages of the head are wanting.

Length of body, 2^{mm}; tegmina, 2.4^{mm}.

White River (probably Chagrin Valley, Colorado; possibly Fossil Cañon, Utah). One specimen, W. Denton.

PLANOPHLEBIA Scudder ($\pi\lambda\acute{\alpha}\nu o\varsigma$, $\varphi\lambda\acute{\epsilon}\psi$).

Planophlebia Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, B, 185–186 (1879).

This name is proposed for a genus of Fulgorina apparently belonging to the Delphacida, but differing from all Homoptera I have seen in the remarkable trend of the principal veins of the tegmina, nearly all of which and certainly all the branches of the radial, as well as most of the branches of the ulnar vein, terminate upon the *costal* margin, the costal areole being very brief, or less than one-third the length of the tegmina. The radial vein branches very near the base of the tegmina, and its lower branch again a very little way beyond, all three of the branches running in a straight course parallel to one another, and embracing at tip the middle third of the margin. The ulnar vein forks near the outer branching of the radial vein, the upper branch soon dividing again, the lower dividing beyond the middle of the tegmina, all the branches running parallel to those of the radial vein.

I know of no homopteron the veins of whose tegmina trend as in this genus; indeed it appears to be quite abnormal in this particular. Nor can Mr. Uhler, to whom I submitted a drawing, find any form whose branched veins run toward the costal margin; but I have in vain attempted to believe that I have interchanged the two margins of the tegmina In point of neuration the tegmina approach most closely, as Mr. Uhler has pointed out to me, to those of Amphiscepa bivittata (Say), but even from this it differs widely.

PLANOPHLEBIA GIGANTEA.

Pl. 2, Fig. 16.

Planophlebia gigantea Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, B, 186 (1879).

The specimen is very fragmentary, consisting of an upper wing, of which the whole of the costal border as far as the tip, and the basal half of the inner margin, can be made out; but only three patches of the surface with its accompanying veins are preserved—a piece next the base, crossing the wing; another near the middle, which crosses rather more than three-quarters of it from the costal margin backward; and a greatly broken patch at the upper half of the tip; but from these pieces nearly the whole of the neuration, as given in the generic description, can be determined. The costal vein appears to be forked close to the base, with branches running close and subparallel to each other. There are five branches of the ulnar vein, terminating above the middle of the apical margin of the teg-

mina, but below that the veins are wholly obliterated. The sutura clavi must be very brief (as we should, perhaps, expect it to be in a wing with so short a costal areole), since no sign of it appears on the basal patch; it must terminate before the branching of the ulnar vein. The tegmina are of very large size, the costal margin regularly and gently arched, the inner margin almost straight, and the apex very regularly convex, at least on the upper half.

Length of fragment, 23.75^{mm}; estimated length of the tegmina, 25^{mm}; breadth in middle, 9.5^{mm}.

Similkameen River, British Columbia. One specimen, No. 77, Geological Survey of Canada, by Dr. G. M. Dawson.

Subfamily ACHILIDA Stål.

No fossils have heretofore been referred to this subfamily, and it is with doubt that a single species from Colorado is here regarded as a member of it.

ELIDIPTERA Spinola.

A single species doubtfully referred here has been discovered in the Oligocene of Florissant.

Elidiptera regularis.

Pl. 19, Fig. 13.

This curiously veined insect would appear to fall in the neighborhood of this genus. The whole of the neuration can not be made out, but the longitudinal veins are few and distant and apparently wholly unconnected by cross-veins until just before the apical margin where the cross-veins form, with apparently the tip of the radial nervure, a continuous vein which approaches the margin in the outer half of the wing, then curves and follows subparallel to the outer margin, with which it is connected by equidistant veins forming apical cells but little longer than broad, excepting at the costal margin, where the vein diverges from the border and the connecting veins become very oblique. The legs are slender, stiff, and straight, the hind tibiæ unarmed, the hind tarsi delicately and very briefly spined at the tip of each joint.

Length of body, 4.25^{mm}; breadth, 1.5^{mm}; length of tegmina, 4^{mm}; of hind tibiæ, 1.1^{mm}.

Florissant. One specimen, No. 12785.

Subfamily RICANIIDA Stål.

A species of Ricania has been described by Giebel from amber; besides this the only fossils possibly referable to this group are those mentioned below, one of them of extraordinary character, so that in all probability it should more properly be referred to a distinct subfamily, so greatly does it differ from all Fulgorina in the multiplicity of the principal longitudinal veins at the base of the wing, the branching of the veins of the clavus and the irregular reticulation of part at least of the corium.

HAMMAPTERYX gen. nov. (ἄμμα, πτέρυξ).

Tegmina exceptionally broad, subtriangular, with strongly rounded apex, produced more above than below. Costal margin somewhat arched at the base, the costal vein distant from it, running into it considerably beyond the middle (where it turns rapidly upward), and connected with it by numerous oblique veins. Radial vein forked at the base of the wing, and each branch again dividing before the middle, all the offshoots of the upper and the upper offshoots of the lower branch with a strong superior arcuation at the tip of the costal vein, giving the wing a knotty appearance. Ulnar vein also divided at base, each of its branches immediately dividing and again a second time at or before the middle of the wing, while both radial and ulnar nervules still farther subdivide so that multitudinous veinlets reach the border; they are further united intimately by three series of cross-veins like the gradate veinlets of Hemerobidæ among Neuroptera, but here subparallel to the outer margin, one set, the weakest and shortest, in the middle of the wing, the second and third series on either side of the middle of the outer half, but distant from each other. The anal area is occupied by delicately and longitudinally branching veins, which nowhere tend to unite apically.

HAMMAPTERYX RETICULATA.

Pl. 6, Fig. 34.

A pair of tegmina of which only the upper third is shown in one of them, while the other is nearly perfect. The two outer series of cross-veins are equidistant in the upper half of the wing, but below it approach each other by the gradual removal of the outer away from the border, the middle series being parallel to the border in this part of the wing. Within this

middle series of definitely arranged cross-veins all the longitudinal veins and their branches are united by cross-veins all the way to the base; these are straight and transverse except between the costal and upper radial veins, where the wing is more or less reticulate. The wing is more or less fuliginous, with two small, faint, round, pale spots on the costal border on either side of the curious arcuation of the veins.

Length of tegmina, 11.5^{mm}; breadth, 6.3^{mm}.

Green River, Wyoming. One specimen, No. 117, Dr. A. S. Packard.

Subfamily FLATIDA Stal.

Gravenhorst and Burmeister have both reported species of Flata as found in amber, but none were described or mentioned by Germar in Berendt's great work, neither have any been reported from the rocks. The genus Lithopsis, however, which I formerly regarded as one of the Tropiduchida, appears to belong here, the two anal veins in the clavus being distinctly separated throughout. I have now another species to add to that first described.

LITHOPSIS Scudder (λίθος, ὄψις).

Lithopsis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 773 (1878).

Body oblong, stout, and apparently cylindrical anteriorly, tapering and probably compressed posteriorly. Head broad and short, the front not produced beyond the eyes, broad, transverse, very gently convex. The united thorax and scutellum of about equal length and breadth. Tegmina surpassing considerably the tip of the abdomen, two or three times as long as broad, beyond the middle barely tapering, the sides subequal, the apex rounded, the costal margin gently convex; margino-costal area broad, broadening regularly toward the apex, and throughout its length traversed by very frequent transverse veinlets, which become more and more oblique toward the apex of the tegmina, where they are supplanted by the similarly close branches of the longitudinal veins; these are united at the origin of the forks by transverse veins in continuity with the costa itself. The radial vein is branched at the base of the tegmina, the inner ulnar vein at some distance before the middle of the wing, and both branches of this vein and the lower branch of the radial vein fork again at half the distance from the first fork of the inner ulnar vein to the tip of the wing, but they are not connected at this point by transverse veins. Wings as long as the tegmina.

This genus reminds one of the South American genus Alcestis Stål, but differs decidedly from it in the form of the tegmina, the absence of oblique inferior ramuli to the inner ulnar vein, the course of the anal veins, and the structure of the head.

Table of the species of Lithopsis.

Tegmina less than three times as long as broad ..... 1. *L. fimbriata.*
Tegmina more than three times as long as broad ..... 2. *L. elongata.*

1. Lithopsis fimbriata.

Pl. 6, Figs. 36, 37.

Lithopsis fimbriata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 774 (1878); in Zittel, Handb. d. Palaeont., I, ii, 781, Fig. 989 (1885).

A tolerably well-preserved specimen, with its reverse, together with the fragment of a wing, are the principal basis for this species. The vertex between the eyes is more than twice the width of the eyes, and is marked by a slight, median, longitudinal carina; the front of the vertex is nearly straight, does not protrude beyond the eyes, but is retracted next them, making it very broadly convex. The thorax is considerably broader than the head, but the condition of the specimens does not allow a more definite statement. The tegmina are the best preserved remains of the animal, being perfect, although somewhat obscure, partly from the veins of the underlying wings; they are more than two and a half times longer than broad; the costal margin, especially its basal half, moderately curved, the commissural margin almost perfectly straight, the apex slightly and obliquely subtruncate, so as to throw its well-rounded apex below the middle; near its extremity the margino-costal field occupies more than a third of the breadth of the tegmina, being double its width near the base; the first branching of the inner ulnar vein is as far from the apex of the tegmina as the second branching is from the base; and the third branching, where, and where only, the longitudinal veins are united by cross-nervures, is midway between the second branching and the apex; close to the apical margin there is an inconspicuous fourth series of furcations.

Length of body, 9^{mm}; of tegmina, 9.75^{mm}; breadth of the same in the middle, 3.65^{mm}; next the third branching of the longitudinal veins, 3.25^{mm}.

Green River, Wyoming. Three specimens, Nos. 143^{e} (F. C. A. Richardson), 4185 and 4189 (S. H. Scudder), 118 (Dr. A. S. Packard).

2. Lithopsis elongata.

Pl. 6, Fig. 28.

A single one of the tegmina is preserved. It differs from that of the preceding species by its far greater slenderness, being considerably more than three times as long as broad; the costal margin is strongly shouldered at the base, and beyond is very gently and faintly concave, the apex well rounded as in L. fimbriata; the marginal area of final division of the longitudinal veins is relatively much broader than in the preceding species, and the principal veins are more longitudinal and less oblique.

Length of tegmina, 9^{mm}; breadth in middle, 2.75^{mm}.

Green River, Wyoming. One specimen, No. 90, Prof. L. A. Lee.

FICARASITES gen. nov. (Ficarasa, nom. gen.).

This name is given to an insect which apparently belongs in this family in the neighborhood of Walker's genera Daradax, Epora, and Ficarasa, and especially the last named, but from whose imperfect condition little more can be said. The costal area of the tegmina is narrow but supplied regularly with rather numerous oblique veins. The radial vein is scarcely branched, the ulnar divided near the base of the wing, the upper branch again in the basal half and both at the middle of the wing, beyond which there are further subdivisions; cross-veins very few.

Ficarasites stigmaticum.

Pl. 6, Fig. 20.

The specimen representing this insect was so macerated in final deposition that the parts are separated, crumpled, and overlaid, and it is difficult to make out the whole of any one organ. Apparently the body and the tegmina were each about 10^{mm} long. The latter were furnished with a very small blackish fuliginous stigma at the tip of the costal vein at about the end of the middle third of the wing; the apical half of the wing was abundantly supplied with cross-veins.

Green River, Wyoming. One specimen, No. 144, Prof. L. A. Lee.

Family JASSIDES Amyot-Serville.

With only a single exception all the fossil species of this family that have been recognized in Tertiary deposits of any kind have been drawn from the subfamily Jassida as Stal separates them. This is equally true when we extend the ground to America, which possesses half as many species as Europe, and is the more remarkable since the Membracida, now such a prevailing type in North America, is nowhere traced in the rocks, though in Europe a single Oeningen species, imperfectly preserved, has been referred here by Heer. So, too, the vast proportion of forms in both worlds belongs to the series allied to Jassus and Bythoscopus, and not to that of which Tettigonia is the type, so that the resemblance of the Tertiary fauna in the two worlds is not slight, though the same genera appear rarely to be preserved.

TETTIGONIA Fabricius.

This genus, excessively abundant in existing species, especially in the tropics of the New World, has not been recognized in the Tertiaries of Europe. A single species from White River, Colorado, has been referred here, but its generic affinities are wholly uncertain. Not so, however, with the ones now added from Green River, Wyoming, and Florissant, Colorado, which are unmistakable members of the genus, at least in the broad sense in which Signoret employed it. Their presence in Florissant and Wyoming is in keeping with the tropical or subtropical aspect of the Tertiary insect fauna of these places.

Table of the species of Tettigonia.

Larger species; tegmina ornamented with a broad dark band around the apical margin but with no cross bands..... .....1. *T. priscomarginata.*

Smaller species; tegmina with no broad apical marginal band but with distinct cross bands.

Basal half of tegmina with a broad, dark, median streak its entire length .....2. *T. priscotincta.*

Median streak of tegmina not extending beyond the basal fourth.....3. *T. priscovariegata.*

*** The fourth species, from its imperfection, is not here noted.

1. TETTIGONIA PRISCOMARGINATA.

Pl. 7, Fig. 4.

A single specimen and its reverse with partially expanded tegmina. A species is indicated of about the size of our Aulacipes irroratus Fabr. sp., and with a head of probably the same form. The head is scarcely shorter than the transverse thorax, and the tegmina are fully three times as long as

broad. The neuration does not show clearly; there is no diminution in breadth before the rapidly rounded apex; the tegmina appear to have been clear and light colored on the disk but broadly obscured at base, at the margins, and along the principal veins, and on the apical third broadly margined throughout with brownish fuliginous, fading gradually basally.

Length of head and thorax, 3.5^{mm}; tegmina, 9^{mm}; breadth of latter, 2.75^{mm}.

Green River, Wyoming. One specimen, Nos. 34 and 35, Prof L. A Lee.

2. Tettigonia priscotincta.

Pl. 19, Fig. 9.

Head, as viewed from above, rounded, subtriangular, the front strongly convex, the ocelli situated on the vertex, the surface of the head and thorax uniform, the scutellum roundly angulated behind. Tegmina barely reaching the tip of the abdomen, pale with bold dark markings, as follows: A broad subequal stripe follows the outer edge of the sutura clavi to the middle of the wing, where it unites faintly with a narrow stripe which has followed the commissural margin to the tip of the sutura clavi and distinctly and broadly with a small round spot on the middle of the costal margin; the markings on the outer half of the wing are somewhat irregular, but may best be described as taking the form of a broad and rude **X**, one bar running from the center of the wing, just out of contact with the basal markings, to the lower apex of the wing where the margin is clouded with fuliginous, the other crossing the whole wing obliquely and recurved on the costal margin. I do not find any existing species with markings at all similar, the nearest approach being that of T. bella Walker from Silhet.

Length of body, 7.75^{mm}; breadth of head, 2^{mm}; of abdomen, 2 5^{mm}; length of tegmina, 6^{mm}; breadth, 2^{mm}.

Florissant. Two specimens, Nos. 7628, 12996.

3. Tettigonia priscovariegata.

A single specimen is preserved, of which only one of the tegmina may certainly be claimed for the species. This is very long and slender, three and a half times longer than broad, in the apical fifth tapering rapidly to the rounded tip which is in the middle of the inner half of the tegmina; it is pale with blackish brown markings, which consist, first, of a narrow mar-

gin around the entire wing, broader on the costal than the inner margin, and, second, of a series of spots connected with the margin: a small quadrangular spot longer than broad on the inner margin next the tip of the scutellar margin; opposite it a corniform spot, its broad base seated on the outer margin, its curved apex directed baseward along the middle line; across the middle of the wing and barely reaching either margin, with a slight obliquity from within outward and apexward a deeply incised subreniform spot, the outer half the larger; and midway between this and the apex a small elongate spot seated by its broad side upon the outer margin.

Partially overlain by this wing, but in any case out of normal relation to it, is a broad oval abdomen, on the opposite side of which is a very stout rounded femur, and attached to it a strong, curving, apically enlarged tibia.

Length of fragment of the tegmina, 6.5^{mm}; probable complete length of same, 7^{mm}; breadth, 2^{mm}.

Green River, Wyoming. One specimen, No. 127, Dr. A. S. Packard.

4. Tettigonia obtecta.

Pl. 5, Figs. 58, 59.

Tettigonia obtecta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 761 (1877).

A single specimen, with the merest fragments of wings and no legs, but otherwise pretty perfect, belongs, with little doubt, to this family, although its generic affinities are decidedly uncertain. The head is not quite so broad as the body, bluntly angulated in front (at an angle of about one hundred and thirty degrees); the eyes are rather small, the beak stout and about as long as the head. The abdomen is moderately stout but long, tapering to a blunt tip; the segments, eight in number, growing longer apically, the seventh being twice as long as the second.

Length of body, 7.6^{mm}; breadth of same, 2^{mm}; length of rostrum, 0.65^{mm}; diameter of eyes, 0.28^{mm}.

Chagrin Valley, White River, Colorado. One specimen, W. Denton.

BYTHOSCOPUS Germar.

The Miocene beds of Radoboj, Croatia, and the Oligocene strata of Aix in Provence, as well as the amber deposits of the same age in Prussia, have each furnished a species of Bythoscopus, to which we can add one from the presumably Oligocene shales of White River, Colorado.

Bythoscopus lapidescens.

Pl. 5, Fig. 94.

Bythoscopus lapidescens Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 761 (1877).

A single specimen, broken at the edge of a stone, and so preserving only the abdomen and part of the wings. The abdomen is long and slender, composed of nine segments, the extremity indicating that it is a female. The wing (the tegmina appear to be entirely absent) reaches the tip of the abdomen, and the apical cells are from a third to nearly half as long as the wing, the upper the longer; the apex is produced but rounded.

Probable length of body, 5.5^{mm}; length of fragment, 3.5^{mm}; breadth of abdomen, 1.5^{mm}.

Chagrin Valley, White River, Colorado. One specimen, No. 44^{b}, W. Denton.

AGALLIA Curtis.

To this genus, now found in both worlds, and never before found fossil, I refer several of Florissant species with little doubt, except that most of them are of too large size.

Table of the species of Agallia.

Large species (body exceeding eight millimeters in length); a cross-vein uniting the radial vein to the margin in the outer half of the wing.
  Tegmina more than three times as long as broad.
    Apical cells of tegmina twice as long as broad ..... 1. *A. lewisii.*
    Apical cells of tegmina only half as long again as broad ..... 2. *A. flaccida.*
  Tegmina less than three times as long as broad ..... 3. *A. instabilis.*
Small species (body less than five millimeters in length); no cross-vein uniting the radial vein to the margin ..... 4. *A. abstructa.*

1. Agallia lewisii.

Pl. 19, Figs. 7, 21.

Head relatively small, narrower than the thorax by reason of the forward narrowing of the latter, broadly rounded. The thorax is very finely wrinkled transversely. The tegmina are fully three times as long as broad, the costal margin broadly and pretty regularly convex but more rounded at the extremities than in the middle; the ulnar vein forks (and is united to the radial) at the end of the proximal third of the wing, and the latter runs into the costal margin a little before the tip, sending a cross-vein to the margin at about the middle of the apical half of the wing, opposite which a

pair of elongated subapical cells are formed between the radial and upper ulnar veins by their union through a cross-vein shortly before the marginal cross-vein; considerably more than half-way from this first-mentioned cross-vein to the apex of the wing cross-veins cut off the four apical cells. The hind wings show in their upper half two forked veins united by a cross-vein opposite the middle of the cells thus formed, and the lower, similarly, to the simple vein which follows it.

The large size of the insect and its relatively small head make it somewhat doubtful whether it should be retained in Agallia.

Length of body, 8.5^{mm}; tegmina, 5.5^{mm}; hind femora, 2^{mm}; hind tibiæ, 3.5^{mm}.

In memory of the late lamented and talented geologist, Henry Carville Lewis, of Pennsylvania.

Florissant. Four specimens, Nos. 307, 8293 and 8725, 13582, and from the Princeton Collection, Nos. 1.801 and 1.805.

2. Agallia flaccida.

Pl. 19, Fig. 18.

This species is closely allied to the last, differing principally in the denser structure of the tegmina, in which the neuration less plainly appears, and in the brevity and relative breadth of the apical cells. The shape of the tegmina is the same, being nearly equal throughout with broad apex, in contrast to the more oval form of the succeeding species; they are a little more than three times as long as broad, and the central apical cells are hardly half as long again as broad.

Length of body, 7.25^{mm}; breadth of thorax, 2.5^{mm}; length of tegmina, 5.5^{mm}; breadth, 1.65^{mm}; length of hind tibiæ, 3^{mm}.

Florissant, Colorado. Three specimens, Nos. 7858, 7979, 10158

3. Agallia instabilis.

Pl. 21, Fig. 1.

This is a stouter species than those which have preceded, with relatively shorter tegmina. A single specimen is preserved, with one of the tegmina expanded. The extremity of the abdomen has disappeared, so that the length of the animal can not be determined, but its great breadth can be seen by comparison with the width of the tegmina. The legs are slender.

The costal margin of the tegmina is greatly thickened and regularly and considerably arcuate, giving an unusually ovate shape to the whole, which is increased by the somewhat pointed though rounded apex. The tegmina, which are less than three times as long as broad, appear to be tenuous, and the veins, though not the sutura clavi, are very indistinct. The body is uniformly dark and parallel-sided.

Breadth of body, 2.5^{mm}; length of tegmina, 5 75^{mm}; breadth, 2^{mm}; length of hind tibiæ, 3.25^{mm}.

Florissant, Colorado. One specimen, No. 78.

4. Agallia abstructa.

Pl. 19, Fig. 5.

Head as broad as the uniformly broad thorax. Tegmina barely extending to the tip of the abdomen, long oval, almost three and a half times as long as broad, the costal border regularly and very little arcuate, the apex strongly convex; the ulnar vein forks at the end of the proximal third of the wing, and the upper branch is immediately united by a recurrent cross-vein, longer than the pedicel of the upper ulnar, to the radial vein, the latter running into the margin not far before the tip but uniting with it by no cross-vein; scarcely beyond the middle of the wing the radial and upper ulnar veins are united by a bent cross-vein, from the middle of which springs a veinlet, dividing the area between them, and at just about half-way to the tip all the veins are united by a transverse series of gradate cross-veins, beyond which the discontinuous longitudinal veins diverge, producing apical cells distinctly broader at the margin than at base

Length of body, 4.5^{mm}; tegmina, 3.7^{mm}; breadth of body, 1.5^{mm}; tegmina, 1.1^{mm}.

Florissant. One specimen, No. 2658.

GYPONA Germar.

The only reference of a fossil to this genus is in my first mention of the Homoptera collected by Denton on the White River, as belonging to genera "allied to Issus, Gypona, and Delphax." Since then these have been described under the genera Aphana, Delphax, Tettigonia, and Bythoscopus. The one now described below is referred here only in a general and vague sense, as it is too ill preserved to speak of it with confidence.

Gypona cinercia.

Pl. 19, Fig. 4.

The head and thorax are decidedly darker than the abdomen, and the spread, but crumpled, elytra are scarcely visible as distinct from the color of the stone except for their slightly darker edges. The head is not more than half as broad as the thorax (which shows that it can not strictly fall into Gypona), with small and rather prominent eyes. The elytra are very slender, extending beyond the abdomen, with only slight and feeble traces of nenration, and apparently very tenuous. The wings are a little shorter but broader, and so more ample.

Length of body, 8.5^{mm}; tegmina, 8^{mm}; breadth of thorax, 2.5^{mm}.

Florissant. One specimen, No. 14229.

JASSUS Fabricius.

Two species of this genus have been described from the Prussian amber, and several others (compared with different existing forms from those with which the former were compared) have been indicated by Gravenhorst from the same source. It appears, however, not to have been recognized in the rocks, and the species here referred to it is too imperfect to be sure of the correctness of the reference.

Jassus? latebræ.

Pl. 20, Fig. 19.

The head has much the form of that of Jassus spinicornis from Prussian amber; the thorax is very faintly and not very finely nor closely punctate; the tenuous and diaphanous tegmina extend a little way beyond the tip of the abdomen, and are apparently almost three times longer than broad; they are traversed by rather distant longitudinal veins, of which five reach the apical margin; the character of their furcation and anastomosis can not be determined with certainty, but wherever it can be traced appears to agree with the simpler types of Jassus.

Length of body, 3.5^{mm}; breadth of same, 1.2^{mm}; length of tegmina, 3^{mm}.

Florissant. One specimen, No. 6639.

THAMNOTETTIX Zetterstedt.

No species of this genus have been hitherto recognized among fossil insects. The larger species here described certainly belong here or in the immediate vicinity, the neuration of both tegmina and hind wings closely agreeing, as well as such other details of bodily structure as can be seen. The small species is placed here with more doubt, since it is too poorly preserved to determine with any confidence.

Table of the species of Thamnotettix.

Larger species; more than three millimeters in length.
Relatively stout bodied, with tegmina barely three times as long as broad.... ....1. *T. mutilata.*
Relatively slender bodied with tegmina considerably more than three times as long as broad. 2. *T. gannetti.*
Smaller species; less than three millimeters in length.....3. *T. fundi.*

1. THAMNOTETTIX MUTILATA.

Pl. 7, Fig. 6.

A single specimen is preserved, showing only a part of the head but the whole dorsal view of the rest of the body, with one of the tegmina partly expanded. The body is long ovoid, very regular in shape with full abdomen, hardly pinched posteriorly, but with full rounded curve. The thorax is transverse, and the scutellum large for this genus, being if any thing a little longer than the thorax The tegmina are barely three times as long as broad, with interrupted dusky maculæ along the outer half of the costal margin, and slight signs of the same along the inner margin. The hind tibiæ are obscurely seen through the body, and appear as if very densely spined with excessively minute and short spines, very different in character from those of living types.

Length of body, 4.55^{mm}; breadth, 1.4^{mm}; length of tegmina, 3.75^{mm}; breadth, 1.25^{mm}.

Green River, Wyoming. One specimen, No. 73, Prof. L. A. Lee.

2. THAMNOTETTIX GANNETTI.

Pl. 6, Fig. 33; Pl. 7, Fig. 5.

Two specimens, differing a little in size, seem to belong together, both preserved in a similar manner, showing a dorsal view with spread tegmina, and wings, though in one case part was covered when the plate was drawn. The body is rather slender, the abdomen tolerably full, but pinched

apically, so that the last two segments are much narrower than the preceding. The transverse thorax, as in the preceding species, is slightly shorter than the unusually large scutellum. The tegmina are considerably more than three times as long as broad, the veins and cross-veins rather heavily marked; there are four apical cells, which are more than twice as long as broad. The venation of the upper half of the hind wings (all that is preserved) is precisely the same as that of T. simplex of Europe, excepting that the lower cross-vein is strongly oblique instead of transverse.

Length of body, 3.3–4.1^{mm}; breadth of abdomen, 1.15–1.5^{mm}; length of tegmina, 3.1–3.5 (?)^{mm}; breadth, 0.85–0.85 (?)^{mm}.

Green River, Wyoming. Two specimens, Nos. 116, 120, Dr. A. S. Packard.

3. Thamnotettix fundi.

Pl. 19, Fig. 20.

Head roundly angulate in front, the thorax small. Tegmina slender, elongate, surpassing a little the abdomen, about three and a half times longer than broad, the costal edge nearly straight, the longitudinal veins few, distant, and faint, the substance of the wing being slightly coriaceous, or only partly diaphanous, as in our green and unicolorous living species.

Length of body, 2.85^{mm}; tegmina, 2.65^{mm}; width of body, 0.85^{mm}; tegmina, 0.75^{mm}.

Florissant. One specimen, No. 3412.

CICADULA Zetterstedt.

No fossil species of Jassida have yet been referred to this genus, and the present reference of a somewhat obscure species is by no means definite.

Cicadula saxosa.

Pl. 6, Fig. 26.

A species is indicated of about the size of our C. sexnotata, but with more opaque tegmina. Only the part of the head between the eyes is preserved, giving it a more distinct and quadrate appearance than would be otherwise the case; the front is broadly rounded. The thorax is more than twice as broad as long and the posterior angle of the scutellum is slightly more than a right angle. The tegmina are opaque, showing scarcely any veins, and these only longitudinal, the sutura clavi terminating in the middle

of the apical half: they are considerably more than three times as long as broad, subequal throughout, with well rounded apex. The abdomen is long oval, largest about one-third way from base, tapering beyond to a bluntly pointed tip.

Length of body, 2.75^{mm}; greatest breadth, 0.9^{mm}; length of tegmina, 2.5^{mm}; breadth, 0.75^{mm}.

Green River, Wyoming. One specimen, Nos. 114 and 126, Dr. A. S. Packard.

ACOCEPHALUS Germar.

Heer has described two species of this genus from the Miocene beds of Radoboj, and two of our American fossils are referred dubiously to the same group, though they differ considerably from each other in the general form of the body. Heer's species, too, strictly interpreted, should be placed elsewhere, though they are certainly near Acocephalus.

Table of the species of Acocephalus.

Slender species; body more than three times as long as broad.....1. *A. adæ.*
Stout species; body less than three times as long as broad.....2. *A. callosus.*

1. Acocephalus adæ.

Pl. 6, Fig. 29.

Acocephalus adæ Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 771 (1878).

Two specimens represent the body of apparently a species of Acocephalus. The head projects forward in a triangular form, is rounded at the extreme apex, a little broader than long, and nearly twice as broad between the small eyes as its length in advance of them. The body is slender, the abdomen slightly tapering, rounded at the apex. The tegmina extend a short distance beyond the body with parallel longitudinal veins.

Length of body, 5.25^{mm}; breadth of head, 1.4^{mm}; of middle of abdomen, 1.3^{mm}.

Green River, Wyoming. Two specimens, Nos. 72, 100, F. C. A. Richardson.

2. Acocephalus callosus.

Pl. 19, Fig. 15.

Although the figure seems to show a bluntly rounded head very uncharacteristic of Acocephalus, it evidently results from the mode of preservation, the body being crushed on a three-fourths view, obscuring the angularity of the front, which a careful examination of the specimen itself

seems to show. The eye is small, as there. The tegmina are hyaline, apparently reaching about to the tip of the abdomen (the whole of which is not preserved, but can be readily restored in the main), and has few longitudinal veins connected, a little beyond the middle and again more than half-way to the tip, by series of cross-veins. The legs are rather short and moderately stout, the middle tibiæ only half as long again as the tarsi.

Presumed length of body, 6.5^{mm}; breadth, 2.5^{mm}; length of tegmina, 5.5^{mm}; middle tibiæ, 1.7^{mm}; tarsi, 1.2^{mm}.

Florissant. One specimen, Nos. 11307 and 14385.

JASSOPSIS gen. nov. (Jassus, nom. gen.).

Allied to Thamnotettix. The thorax is rounded subquadrate, as long as broad, and the scutellum not more than half as long as the thorax. The veins of the tegmina are peculiar in that the radial parts from the costal vein and the ulnar vein from the sutura clavi at similar and very short distances from the base; there are but three apical cells.

A single species is known.

Jassopsis evidens.

Pl. 19, Fig. 16.

The single specimen is preserved so as to show a dorsal view with the tegmina unequally expanded. The head is lost but was relatively narrow, to judge by the anterior tapering of the thorax. The body is very dark and uniformly so, the posterior angle of the scutellum a right angle. The tegmina were semiopaque, with the veins heavily marked, the sutura clavi terminating in the middle of the wing; they are three and a half times longer than broad, and the costal margin is strongly arcuate, especially distally, so that the apex falls at about the middle of the lower half of the wing and is roundly pointed; cross-veins unite the principal nervures where the radial vein forks at about three-fifths the distance from the base of the wing. The abdomen is subconical, tapering pretty uniformly almost from the base, with pretty straight sides, the tip bluntly pointed.

Length of body (without head), 3.2^{mm}; breadth of abdomen near base, 1.1^{mm}; length of tegmina, 3^{mm}; breadth, 0.85^{mm}.

Florissant, Colorado. One specimen, No. 5188

CŒLIDIA Germar.

The only species of this group hitherto reported fossil is one described below from British Columbia. To this we now add another species from Wyoming. It is an American type best developed in the tropics, but not unknown in the southern United States.

Table of the species of Cœlidia.

Tegmina less than three times as long as broad ..... 1. *C. columbiana.*
Tegmina more than three times as long as broad ..... 2. *C. wyomingensis.*

1. Cœlidia columbiana.

Pl. 2, Fig. 13.

Cœlidia columbiana Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 185B (1878).

A pair of tegmina, in which most of the venation can be made out, with a crushed body and crumpled wings, represent a species of Cœlidia or an allied genus, with rather broad tegmina. The veins of the tegmina are nearly parallel to the gently arcuate costal margin, are equidistant from one another, and are united by cross-veins near the middle of the apical half of the tegmina, the lower ulnar vein, which runs only a little below the middle of the wing, forking at this point; the upper of the apical areolets, however, is considerably shorter than the others; the two ulnar veins are united by a cross-vein in the middle of the basal half of the tegmina, while not far from the middle of the tegmina the ulnar and radial veins are similarly united. The tegmina do not taper apically, the extremity is rounded and obliquely docked, and the sutura clavi is short. The hind wings are provided with an unusual number of cross-veins.

Length of tegmina, 8^{mm}; breadth, 3.25^{mm}.

Similkameen River, British Columbia. One specimen, No. 75, Geol. Surv. Canada, Dr. G. M. Dawson.

2. Cœlidia wyomingensis.

Pl. 4, Fig. 8.

A dark species appears to be indicated, the head and thorax being black and the veins of the tegmina heavily marked with dark fuliginous. The tegmina are well rounded, about three and a quarter times as long as broad, the costal margin regularly and pretty strongly convex; the pedicel

of the upper ulnar branch is slightly shorter than the cross-vein uniting it to the radial; the radial is parallel to the costa throughout; a second cross-vein unites the radial and upper ulnar where the former forks, as far from the first cross-vein as the width of the wing, and the apical series of cross-veins is half-way between this new cross-vein and the apex of the wing.

Length of tegmina as preserved, 7.5^{mm}; as restored, 8.5^{mm}; breadth, 2.5^{mm}.

Twin Creek, Wyoming. One specimen, No. 6^{b}, Dr. A. C. Peale.

DOCIMUS gen. nov. (*δόκιμος*).

This name is proposed for an insect with somewhat remarkable neuration, which reminds us somewhat of that of Walker's East Indian genus Isaca. The sutura clavi is very long, reaching to the middle of the outer half of the wing, while the apical cells, the only wholly diaphanous part of the wing, are very long, occupying fully the apical third, and are very few in number, only three reaching the apical margin, and all being bounded away from the middle line of the wing by remarkably arcuate and divergent veins, giving somewhat the aspect of a Psylla to the wing. The body is very stout, with a full abdomen, well rounded behind, and in no way pointed.

A single species is known, or possibly two.

Docimus psylloides.

Pl. 19, Figs. 6, 17.

The head is not preserved. The thorax is faintly punctate. The tegmina are fully two and a half times longer than broad; the ulnar vein forks very close to the base, and where it is united by a cross-vein to the radial these two are united by another cross-vein in the middle of the wing, beyond which the space is separated into two longitudinal cells; the radial ends near the apex in a strongly arcuate fork, which at first curves downward into the heart of the wing and then turns upward, the cell opening on the costal border at the edge of the apical border; opposite the origin of this fork the next and the last veins are abruptly but roundly bent and send cross-veins directed obliquely inward to the intermediate vein from the angles, beyond which they divaricate.

This description is based wholly upon the specimen illustrated in Fig. 17. That given in Fig. 6 and two others are too imperfect to determine that they certainly belong here, but they may form a second species of the genus with less strongly curved veins.

Length of body, 6.75^{mm}; breadth, 3^{mm}; length of tegmina, 5.5^{mm}; breadth, 2^{mm}.

Florissant. Four specimens, Nos. 4625, 4747, 9299, 10479.

Family CERCOPIDÆ Leach.

This was the prevailing type of Homoptera in Tertiary times, at least if the number of individuals be regarded. At Florissant they appear to form three-fourths of the whole bulk. As compared with Fulgorina they were there slightly less numerous in species and genera, but five times as as numerous in individuals. Most of the extinct forms have been referred by authors and especially by Germar and Heer to the existing genera Cercopis and Aphrophora, but, as we shall see, these references were so far incorrect that in several instances they belonged to the alternate subfamily and not to that to which they were referred.[1] So, too, one insect found in the Isle of Wight Tertiary is referred to an existing form, but probably without sufficient reason. As to our own species, some of them are gigantic, nearly all large, and by far the greater part of them allied to types now found only in the tropics of the New World, and yet I have been unable in any instance to refer them to existing genera, though doubtless some of them will be found so referable. The lack of sufficient tropical materials in the museums of this neighborhood compel the description of several genera as new which may prove still extant.

Subfamily CERCOPIDA Stål.

The larger part of the fossil Cercopidæ that have been described have been referred to this subfamily, but in several instances, as will be pointed out, the reference is incorrect. There remain, however, several species of Cercopis, a Cercopidium, and a Triecphora (this latter regarded as an existing

[1] There is a mistake in Heer's work on Oeningen insects in the references to the species of Cercopis on Pl. 11. The plate is correctly marked, but the separate explanation of the plate and the references in the text give a figure to C. nugeri which does not exist, and make eleven figures to the plate when there are only ten. The references to C. pallida, oeningensis, fasciata, and rectelinea, which are respectively 8, 9, 10, and 11, should be 7, 8, 9, and 10.

species by Woodward) from the European rocks and from amber, while in our own country by far the larger proportion of the Cercopidæ belong to this subfamily, and, excepting three species regarded as belonging to Cercopis, one each from British Columbia, Green River, and Florissant, all are referred to extinct generic types; these include seventeen species and six genera, one of them, Petrolystra, with two species, gigantic and possibly luminiferous insects, which must have been one of the striking features of Florissant Oligocene entomology; another, Palecphora, with six species, five of them from Florissant and one from Green River, was the prevailing homopterous type; Cercopites is known only from Green River; the remainder, with the exceptions noted, only from Florissant, and one of the prettiest, Prinecphora, was by no means rare. As a whole the aspect of the cercopid fauna was decidedly tropical.

CERCOPITES gen. nov. (Cercopis, nom. gen.).

Head relatively small, including the eyes hardly more than half as broad as the thorax, not appressed, but prominent. Thorax more or less hexagonal, much broader than long, the front border transverse or undate, the base truncate; scutellum equiangular. Tegmina large and well rounded, but little more than twice as long as broad, with convex costa, the tip slightly narrowed and sharply rounded, the radial and ulnar veins forking once each with no apparent apical cells, the radial forking scarcely before the middle of the wing, and before forking running at no great distance from and parallel to the margin.

Two species are known, both from the Wyoming Tertiaries.

Table of the species of Cercopites.

Smaller species, the wings expanding about eight millimeters; front margin of thorax straight. 1. *C. umbratilis.*

Larger species, the wings expanding about twenty millimeters; front margin of thorax undate or biconcave ..... 2. *C. calliscens.*

1. CERCOPITES UMBRATILIS.

Pl. 7, Fig. 9.

The single specimen is rather obscurely preserved, showing an upper surface with spread wings. The body is stout, the abdomen full and rounded; the front margin of the thorax is straight behind the head, but

retreats slightly at the sides, so as to give it a slightly convex aspect. The body is dark and uniform, the tegmina the same but slightly lighter over the disk; the costa is very strongly convex.

Length of body, 2.75^{mm}; breadth, 1.1^{mm}: length of tegmina as preserved, 3.5^{mm}; as restored, 3.8^{mm}.

Green River, Wyoming. One specimen, No. 108, Dr. A. S. Packard.

2. Cercopites calliscens.

Pl. 6, Fig. 32.

Head suborbicular, with scarcely protruding eyes, a little broader only than long: the ocelli are obscure, but what are apparently these are farther removed from each other than from the eyes. Thorax broadest in the middle of the anterior half, from which point it rapidly narrows both in front and behind; base straight; front margin broadly concave except for a slight and angular middle prominence, which breaks the curve in two. Body dark fuliginous. Tegmina pallid, but with a darker costal margin and a similar but broad apical band; the veins show with tolerable distinctness, though they are generally very obscure in the wings, which show a neuration in all respects typical so far as visible.

Length of body, including closed wings, 11^{mm}; breadth, 3.5^{mm}; length of tegmina, 8.5^{mm}.

Green River, Wyoming. One specimen, Nos. 104 and 115, Dr. A. S. Packard.

CERCOPIS Fabricius.

A number of species have been referred to this genus from the European Tertiaries, but, as mentioned below under that subfamily, they are mostly referable to the Aphrophorida. It is doubtful whether any of the species of true Cercopina should be classed generically with those here placed in this group, and which are known by their tegmina only; the form of the wings, as well as their neuration, differs considerably, but until more of the structure can be determined it has seemed best to class them here. It may be noted that the radial vein branches sooner than in Cercopites.

Table of the species of Cercopis.

Tegmina unicolorous.
- Larger species; the tegmina measuring fifteen millimeters in length; radial vein before forking widely distant from margin. ..... 1. *C. schuyni.*
- Smaller species; the tegmina measuring less than ten millimeters in length; radial vein before forking only moderately distant from the margin. ..... 2. *C. astricta.*

Tegmina transversely banded ..... 3. *C. suffocata.*

1. Cercopis selwyni.

Pl. 2, Figs. 14, 15.

Cercopis selwyni Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 184B–185B (1879).

A pair of nearly perfect tegmina, reverses of each other, represent a species allied, but rather distantly, to the gigantic species of Cercopida described by Heer from Radoboj. It differs from them all in neuration, in the form of the costal border and of the apex. The portion of the wing below the straight sutura clavi is broken away. The basal half of the costal margin is strongly and rather uniformly arcuate, but more strongly close to the base; the apical half of the same is nearly straight; the apical margin is a little obliquely and roundly excised, gently convex, the tip roundly angulated. The costal vein parts from the common trunk close to the base and follows close to the margin, terminating at about one-third way to the tip: the radial vein is directed toward the middle of the outer half of the costal border, until it forks, a little before the middle of the wing, when both straight branches run subparallel toward the tip; the ulnar vein also forks once, half-way between the base and the fork of the radial vein, and its straight branches, with those of the radial vein, subdivide the outer half of the wing subequally, all being evanescent toward the apical margin: the sutura clavi reaches as far as these veins are visible.

Length of wing, 16.5^{mm}; breadth of wing at tip of sutura clavi, 5^{mm}; length of sutura clavi, 14^{mm}.

Nine Mile Creek, British Columbia. One specimen, Nos. 64 and 65, Dr. G. M. Dawson, Geological Survey of Canada.

2. Cercopis astricta.

Pl. 7, Fig. 15.

Reverse and obverse of the greater part of one of the tegmina of a much smaller insect than the preceding represent this species; no part of the clavus is preserved nor even quite up to the sutura clavi. The costal margin is very strongly convex, the curve being strongest in the middle so as to appear bent; the apical area is equally full above and below, or only a trifle the fuller above, the margin strongly convex. The costal vein can not be made out, and the radial is almost equidistant from the margin, and relatively only about half as far as in the preceding species, before it

forks, when, after reaching their widest, the two forks run exactly parallel to the costal margin, fading in the darker outer third of the wing; the branches of the ulnar vein originate as in the last species, and are parallel to the radial branches, all being also equidistant.

Length of tegmina, 9mm.

Green River, Wyoming. One specimen, Nos. 110 and 125, Dr. A. S. Packard.

3. Cercopis suffocata.

Pl. 19, Figs. 2, 3.

A single one of the tegmina of an insect with the clavus gone, but very different in its markings from anything known. Its simple neuration allies it directly with the other species referred here; the radial, however, is distant throughout from the margin. The costal margin is very regularly and considerably convex, and the apex very strongly rounded, produced, and almost pointed. A broad and uniform belt of dark color follows the costal margin at the base for nearly two-fifths its course, in striking contrast to the generally pale color of the wing, and distally joins a similar transverse and slightly oblique bar crossing the wing as far as the sutura clavi; all the base of the wing, dark or light, is finely and distantly punctuate, as shown in Fig. 2; a second transverse and similarly oblique dark band, slightly broader, crosses the wing just before the apex, its inner border just striking the tip of the sutura clavi.

Length of tegmina, 8.5mm; breadth at tip of sutura clavi, 3mm.

Florissant. One specimen, No. 262.

PETROLYSTRA Scudder (πέτρος, Lystra, nom. gen.).

Petrolystra Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 530–531 (1878).

One of the most striking instances of tropical affinities in the Tertiary shales of Florissant is found in the presence of two species of a genus of huge Homoptera, rivaling the famous lantern-fly of South America in size, but differing in neuration and other features from any genus hitherto described. At first glance one would think that it belonged to the Fulgorida, a subfamily which, with Stridulantia, includes most of the larger forms of the suborder, and to be somewhat nearly allied to Paralystra: but it differs from this, and, so far as I can determine, from all Fulgorina, in the minute-

ness of the scutellum, and must be referred instead to the Cercopida, although larger than any species of that group which I find noticed, while in comparison with the temperate forms of that subfamily it is gigantic, most of our own species not exceeding one-fourth its length. The name is not very well chosen.

The body is robust, the head large, apparently flat above, about twice as broad as long, but considerably narrower than the thorax, the front regularly and very broadly convex; clypeus about half as broad as the head, somewhat convex, coarsely carinate down the middle with distinct lateral transverse rugæ; ocelli indeterminate; rostrum shorter than the breadth of the tegmina. Thorax broadening posteriorly, continuing the curve of the head; the front margin rather deeply and very broadly excised, so that its middle is straight and the lateral angles are rather sharply angulate; the hind margin with very oblique sides, so that these, if continued, would form less than a right angle with each other, but toward the middle line incurved, so that the thorax is rounded posteriorly and excised in the middle. Scutellum very small, scarcely more than half as long as the thorax and rather longer than broad, tapering more rapidly in the basal than in the apical half. The fore tibiæ apparently unarmed, and of the same length as the fore femora; the apical tarsal joint of same legs tumid, longer than the other joints combined, of which the second is less than half as long as the basal joint, the whole leg only a little longer than the breadth of the tegmina; fore coxæ apparently in close proximity. Tegmina large, nearly equal throughout, the inner base angularly excised next the posterior border of the thorax, the apex well rounded, a little produced anteriorly; it was apparently coriaceous, with little mark of any excepting some of the principal veins, which are elevated. The base of the costal part of the wing is so expanded, to give equality to the wing, that the radial vein at its base is very near the middle of the tegmina, and continues so until it forks in the middle of the basal half of the tegmina; its lower branch continues its course subparallel to the costal margin, while the upper branch curves upward and follows close to the costal margin until, like its fellow, it is lost in the membrane near the tip of the tegmina; the sutura clavi runs straight to the posterior border beyond the middle of its outer half, and midway between the two the radial originates, forking almost immediately, the forks dividing the inner area equally between them, and in the middle of the outer half of the

tegmina united to each other by a cross-vein, to which they bend; they too are lost before the tip. The wings are not sufficiently preserved to characterize, but appear to agree in general character with those of Tricephora. Abdomen more than twice as long as the rest of the body, tapering regularly to a pointed extremity.

Table of the species of Petrolystra.

Pale bands of tegmina occupying hardly more space than the dark ground..... 1. *P. gigantea.*
Pale bands almost supplanting the normal dark ground of tegmina .....2. *P. heros.*

1. Petrolystra gigantea.

Pl. 20, Figs. 5–7.

Petrolystra gigantea Scudd. Bull. U. S. Geol. Geogr. Surv. Terr., IV, 531–532 (1878); in Zittel, Handb. d. Palæont., I, ii, 781, Fig. 992 (1885).

Two nearly perfect specimens, reverses of each other, were picked up by a child just as I reached the quarries at Florissant, on my first visit to them, and another, a fragment of a wing, was afterward found in the same place. The head was apparently dark-colored, the thorax not so dark, delicately and softly shagreened, with a slight median carina The tegmina are almost similarly rugulose; the costa of the same is pretty strongly convex at base, very slightly convex beyond the middle of the basal half; the posterior border is slightly excised at the tip of the clavus, and the outer margin is oblique, being angularly excised at the posterior angle, although rounded throughout. It is dark, darkest at base and gradually grows lighter, more fuliginous toward the tip (although all the specimens do not show this), and is traversed by four equidistant transverse pale bands, the basal one reduced to a spot in the middle of the extreme base, where it occupies about one-third the width of the wing; and the apical one rather cloudy, half as broad as the breadth of the tip and as far from the tip as from either border, equal, two or three times as broad as long, sinuous or lunate; the other two are more distinct, with sharply defined borders and irregularly sinuous; the outer of the two traverses the entire wing, touching the costal border, however, by only the tip of the rounded extremity, while it expands upon the posterior border; the inner of the two is rounded at either extremity, fails of reaching either border, and is constricted just beneath the radial vein; both of these bands average in width the breadth of the interspaces.

The specimen given in Fig. 5 is presumed to be a hind wing belonging to this species, but is so folded that the course of the neuration can hardly be determined; if it is correctly given the hind wing must have been banded like the fore wing.

Length of body, 23.5^{mm}; of head, 3.75^{mm}; of thorax, 4.5^{mm}; of abdomen, 15.25^{mm}; width of head 7^{mm}; of clypeus, 3.8^{mm}; length of rostrum, 8.5^{mm}; width of thorax behind, 8.5^{mm}; length of scutellum, 3^{mm}; its breadth at base, 2.5^{mm}; length of tegmina, 29.5^{mm}; width next base, 10.5^{mm}; near tip, 8.5^{mm}.

Florissant. Three specimens, Nos. 62, 411 and 412, 11241.

2. Petrolystra heros.

Pl. 20, Fig. 8.

Petrolystra heros Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 532 (1878).

A single specimen shows one of the tegmina in a good state of preservation, together with both fore legs. It differs from P. gigantea in the broader bands of the tegmina and in the form of the latter, the posterior border being slightly fuller at the base, so as to make that part of the wing proportionally broader, while the posterior angle of the tip is not obliquely excised, making the extremity truncate rather than pointed. The bands have expanded so as to occupy the larger part of the wing: the basal spot occupies the entire base from border to border (excepting the very root) as far as an oblique transverse line, subparallel to the inner basal edge of the wing, and distant from the root nearly half the width of the wing: it also infringes upon that bordering line by a large semicircular excision in the middle: the apical spot is very nearly as long as broad, and stops just short of the margin on all three sides of the apex, and in the middle of the wing breaks through the intervening dark stripe into the outer of the two middle bands: these two middle bands are also much broader than in the other species, but not to so great a degree as the extreme bands; they reach from border to border, and are united to each other and to the basal spot along the sutura clavi; the wing therefore has the appearance rather of being pale, with three transverse dark stripes, which are broad (and the outer two triangular) on the anterior half of the tegmina, narrow, sinuous, and broken on the posterior half

Length of tegmina, 28.25^{mm}; width at base, 10.8^{mm}; at tip, 7.2^{mm}; length of fore femora, 4.5^{mm}; fore tibiæ, 5^{mm}; fore tarsi, 2.75^{mm}; first tarsal joint, 0.8^{mm}; last tarsal joint, 1.7^{mm}; claws, 0.5^{mm}.

Florissant. One specimen, No. 11829.

LOCRITES gen. nov. (Locris, nom. gen.).

Body stout. Head large, protuberant, well rounded, not angulated in front, though subtriangular. Thorax transverse, more than twice as broad as long, truncate both in front and behind. Scutellum moderately large, equiangular, the angles sharp. Tegmina large, full, about two and a half times longer than broad, with strongly curved costal margin, tapering considerably in their apical half, the apex roundly angulated; the radial vein forking well before the middle of the wing and before that widely separated from the margin, midway between which and it the costal vein runs; ulnar vein much as in the species here referred to Cercopis. Both middle and hind femora are about two-thirds as long as their respective tibiæ. Abdomen stout, tapering conically in the apical half.

To this genus evidently belongs Cercopis haidingeri Heer from Radoboj, Croatia, which is slightly larger than the larger of the two species from Florissant we place here.

Table of the species of Locrites.

Larger species; tegmina uniformly mottled in generally distributed blotches.....1. *L. copei.*
Smaller species; markings of tegmina confined to obscure transverse darker bands in the basal two-thirds of the wing .....2. *L. whitei.*

1. LOCRITES COPEI.

Pl. 21, Fig. 19.

In one of the specimens referred here, the one figured, the dorsal surface is shown, but with many of the ventral parts showing through. The tegmina, however, as in many of the insects from Florissant, appear as if bleached out, and the real markings lost: for these we have to go to the second specimen, preserved upon a side view, which shows a delicate mottling of dark, circular or transverse, minute spots, more or less clustered into larger but still small roundish blotches, pretty evenly distributed, but absent from the extreme tip; the sutura clavi is very distinct and heavy,

and the whole of the clavus obscure. The head, thorax, and scutellum appear to be uniformly and deeply sulcate (or carinate, if No. 9374 is an obverse).

Length of body, 15.5^{mm}; of tegmina, 14^{mm}; breadth of thorax, 5.5^{mm}; combined tegmina, 10^{mm}.

Named for Prof. E. D. Cope, of Philadelphia, the distinguished and versatile paleontologist and collaborator of the Hayden Survey.

Florissant. Two specimens, Nos. 9374, and of the Princeton Collection 1.903.

2. Locrites whitei.

Pl. 21, Fig. 17.

The single specimen and its reverse represent the dorsal surface of an insect with closed wings. The head is relatively broader than in the last species, with a similar though much slighter mediodorsal sulcation; the ocelli appear to be nearer together than to the eyes. The body is black, and the tegmina dark fuliginous, but permitting the black abdomen to be seen through them; the distal half appears to be uniform, but the basal half to be transversely banded by broad darker bars, between which and between the basal bar and the base the tegmina are slightly lighter than the normal ground, accentuating the bands.

Length of body, 13.25^{mm}; tegmina, 12^{mm}; breadth of thorax, 5^{mm}; combined tegmina, 7^{mm}.

Named for my colleague, Dr. C. A. White, one of the paleontological collaborators of the Hayden Survey.

Florissant. One specimen, Nos. 8313 and 8314.

PALECPHORA gen. nov. (*παλαιὸς*, *ἐκφορά*).

Allied to Triecphora in neuration, but with a more slender habit and relatively far smaller clavus. Head suborbicular, about half as broad as the thorax, the front well rounded, in no sense angulate, with a slight longitudinal carina; ocelli posteriorly placed, much nearer together than to the eyes. Thorax rather broader than long, the front and posterior margins truncate, the sides angulate, so as to be as a whole transversely hexangular, but more or less rounded, so as often to appear suborbicular; marked indis-

tinctly with a faint median sulcation and in the middle of the lateral halves, anteriorly, with posteriorly converging similar carinæ, to be seen only in clear specimens. Scutellum moderately large, subequiangular, slightly broader than long, the sides faintly concave, continuous with the angles of the thorax, the base truncate, the tip sharply pointed. Tegmina long oval, the clavus occupying not more than a fifth of the whole, which is fully two and a half times as long as broad, tapering only at the extreme tip and roundly pointed slightly above the middle line, the costal margin pretty strongly convex; the costal vein appears to be lacking; the radial with its outer fork runs in one continuous line parallel to the costal margin throughout and at a moderate distance from it; its inner fork parts from it a very little beyond the middle of the wing, the ulnar forking considerably before the middle; all these branches parallel and united by subcontinuous cross-veins parallel to the apical margin, from the middle of each of which the longitudinal veins continue to the margin, one or two of the upper ones (and especially the second) usually widely forked, forming apical cells nearly a sixth the length of the wing; besides this, straight but rather strongly oblique cross-veins connect the upper radial branch to the margin; all of this minor venation is sometimes obscured by the opacity of the membrane. Wings a little shorter than the tegmina, of the usual form, the marginal vein continuous; second and third longitudinal veins united by a straight cross-vein beyond the middle of the apical half of the wing, the second bent down to meet it; third and fourth similarly united scarcely beyond the middle of the wing, the fourth deeply forked, almost to the cross-vein, the lower branch abruptly curved at base. Legs short and slender, the fore and middle pair of nearly the same length, the hind pair a little longer; all the femora and particularly the hind pair very short, not reaching the sides of the body, scarcely broader than the slightly enlarged apex of the tibiæ; tibiæ longer than the femora, in the hind pair twice as long and with two pairs of spines; tarsi considerably shorter than the tibiæ, in the fore and middle legs shorter, in the hind legs longer, than the femora; in the hind legs the first joint is slightly shorter than the third, nearly twice as long as the second, the first and second with short spines at the apex beneath; third joint at base half as wide as the second, enlarging in the apical half. Abdomen full, long ovate, bluntly pointed.

This genus is the most abundantly represented in individuals of any of the Homoptera of Florissant. It is also rich in species. In neuration it agrees very closely with Triecphora and Tomaspis, but is much slenderer than they, has a pattern of coloration (explained under the first species) peculiarly its own, while the hind tibiæ have two pairs of spines, and the tarsi are apically spinous in a similar manner. The length of the terminal tarsal joint and the orbicular form of the head are also characteristic.

Six species have been recognized, which may be separated by the following table:

Table of the species of Palecphora.

Of large size. Fore wings more or less distinctly spotted.
Apical spots connected by a band bordering the whole apex.
A distinct spot in the center of the basal half of the wing ..... 1. *P. maculata.*
No spot in the center of the basal half of the wing ..... 2. *P. patefacta.*
No band bordering the apex.
Veins of the fore wings distinct, especially the cross-veins on the outer half of the costal border; spots numerous and usually distinct ..... 3. *P. marvinei.*
Veins of the fore wing indistinct, the spots usually more or less obscure, only that near the end of the sutura clavi distinct.
Most of the spots of the margins of the wing traceable but obscure, excepting as above. 4. *P. communis.*
Most of the spots of the margins of the wing wholly obliterated, except as above, but the base of the costa usually infuscated ..... 5. *P. prævalens.*
Of medium size. Fore wings unicolorous ..... 6. *P. inornata.*

1. Palecphora maculata.

Pl. 20, Figs. 10, 17.

This is the most profusely spotted of all the Palecphoræ. The head and body are uniformly dark, and the wings membranous and without markings, but the tegmina are generally very distinctly and always very abundantly marked with dark fuliginous, subequal spots on a pale ground. There is a heavy basal striga on the costal margin, thickening distally, all within the basal fifth of the wing, and accompanied by a triangular opposing cloud on the scutellar margin, reaching the tip of the scutellum and leaving between it and the basal striga only a narrow, longitudinal strip of pale ground at the base of the veins; next the opening of this, at the basal parting of the veins, is another longitudinally triangular spot; at the middle of the wing, seated on the costal margin and on the sutura clavi but not invading the clavus, is a pair of further spots subquadrate or subtriangular, their apices directed obliquely inward and towards the apex; in the

same median region is another subquadrate spot in the clavus seated on the margin and generally limited interiorly by the anal vein, along which it may send shoots in either direction; at equal and not great distances from the apical margin is another pair of transverse subquadrangular spots close to but not fairly seated upon the costal margin and sutura clavi, which are sometimes connected by a narrow fringing band which hugs the apical margin, though this band is sometimes reduced to an apical cloud which barely reaches the spots on either side. The spots may thus be designated as basal, subbasal, median (costo-median, suturo-median, and clavo-median), subapical, and apical. The neuration of the tegmina can rarely be distinguished except in the most general way as regards the main veins, but where the markings are most obscure, as in specimens which have somewhat of a bleached appearance, the minor neuration of the apex of the wings can be discovered faintly.

Length of body, 10.5^{mm}; of tegmina, 7.5^{mm}; breadth of thorax, 3.5^{mm}.

Florissant. Ten specimens, Nos. 622, 3016, 3458, 3534, 3734, 5344, 11237, 13324, 13557, 16351.

2. Palecphora patefacta.

Pl. 7, Fig. 7.

In this species, the only one yet found elsewhere than at Florissant, the markings of the tegmina are much the same as in P. maculata, but are somewhat reduced, and, what is more remarkable, the subbasal spot is absent; this point seems to be sufficiently clear, though the outspread tegmina are preserved in a fragmentary manner, curiously most perfect just where the spots occur, as though the pigment bore some part in their preservation No veins are visible.

Length of body, 10^{mm}; of tegmina, 8.5^{mm}; breadth of thorax, 3^{mm}.

Green River, Wyoming. One specimen, Nos. 1 and 143, Prof. Leslie A. Lee.

3. Palecphora marvinei.

Pl. 20, Figs. 11–13; Pl. 21, Figs. 9, 12.

This species is remarkable for the great distinctness with which ordinarily (the considerable distinctness invariably) the complete neuration of the apical half of the wing is seen, as described under the genus. The

markings of the tegmina are usually very distinct, especially those of the inner margin, where the subapical spot is most conspicuous. Both basal spots are present, but the scutellar much reduced and often obscure; the subbasal is always absent, as far as I have seen: of the median spots the costo-median is never present, and the suturo-median generally obscure, often removed away from the suture and frequently absent, while the clavo-median is always present and generally distinct: the subapical spot of the costal margin is never more than faintly indicated if present, and the apical marginal band invariably absent.

Length of body, 10^{mm}; of tegmina, 8^{mm}; breadth of thorax, 3.5^{mm}.

Named for the late Archibald Robertson Marvine, one of the active and acute geologists of the Hayden Survey.

Florissant. Eleven specimens, Nos. 1683, 3090, 3801, 4256, 4431, 5761, 6484, 8743, 9158 and 9254, 12978, 13578.

4. Palecphora communis.

Pl. 20, Figs. 3, 20, 21.

This species is closely allied to the last, hardly differing from it except in the obscurity, not always absolute, of the neuration of the tegmina, indicating a more coriaceous texture to the same. It is slightly smaller as a rule, though some specimens are as large as many of P. marvinei. The spots of the tegmina are also much the same as there, but though the lower subapical spot is sometimes the only one which is conspicuous it usually shares its distinction with all the others of the inner margin, while rarely are any of those of the costal margin seen at all, except the basal one, the costo-median being almost invariably absent and never conspicuous, being wrongly represented as of much too deep a tint in Fig. 3; the subbasal spot and apical band are never present, and the suturo-median spot is never more than a faint cloud.

Length of body, 9.25^{mm}; of tegmina, 7.5^{mm}; breadth of thorax, 3^{mm}.

Florissant. Thirty-four specimens, Nos. 159, 2087, 4476, 4759, 5189, 5720, 5862, 5911, 5950, 6524, 6636, 7496, 8037, 8098, 8894, 8937, 8969, 9218, 10681, 11009, 11767, 12468, 12471, 12984, 13000, 13568, 13570, 13577, 13580, 13581, 13584, 14187, and of the Princeton Collection 1.320, 1.826 and 1.830.

5. Palecphora prævalens.

Pl. 20, Fig. 1; Pl. 21, Fig. 2.

This species, by far the most common of all the Homoptera of Florissant, is least heavily marked among all those Palecphoræ which show plainly the inferior subapical spot. This is usually present, and sometimes, though very rarely, distinct, while the other spots are almost wholly obscured or appear as clouds, except, indeed, the superior costal spot, which appears as a thickening of the base of the costa slightly enlarged distally, and is rarely absent, usually tolerably distinct, almost always slender, and the costa is sometimes a little thickened beyond the enlargement at the normal spot. The species is one of the largest in size, but only to a slight degree.

Length of body, 10.5–11^{mm}; of tegmina, 8^{mm}; breadth of thorax, 3–3.5^{mm}.

Florissant. About seventy-five specimens, among which the best are Nos. 543, 829, 1364, 3315, 5239, 6050, 6807, 7742, 8008 and 8081, 8035, 10383, 11236, 11762, 13567, 13576, and from the Princeton Collection 1.710, 1.838.

6. Palecphora inornata.

Pl. 20, Fig. 15.

In striking contrast to the other species of Florissant Palecphoræ, this species is represented by a single specimen, which differs greatly from them. It is of considerably smaller size than the others (which are very uniform in this particular), and shows but the faintest trace of markings, while the whole of the tegmina is fuliginous instead of pallid, with scarcely perceptibly darker tones at the extreme tip (not given in the figure), and at the position of the inferior subapical and costo-median spots: the sutura clavi is distinctly marked by a dark line.

Length of body, 7.5^{mm}; of tegmina, 6^{mm}; breadth of thorax, 2^{mm}.

Florissant. One specimen, No. 609

LITHECPHORA gen. nov. (*λίθος*, *ἐκφορά*).

This genus is closely allied to Palecphora, having precisely the same neuration in the hind wings, but differing principally in the form and structure of the tegmina. These are less ovate in form, the margins being almost or quite parallel and the apical margin symmetrically rounded, instead of

having the apex above the middle: the costal margin also is much thickened, and in one species at least armed with short bristles; though the substance of the tegmina is tenuous, permitting the veins of the wings beneath them to be readily visible, at least in their lower half, the whole is minutely though feebly and distantly punctuate, more conspicuous on the basal than the apical half

Table of the species of Lithecphora.

Costal margin of tegmina distinctly thickened.
Tegmina with the costal margin bristled and a large pallid patch just beyond the middle..1. *L. setigera.*
Tegmina with the costal margin thickened but not bristled and with no pallid patch..2. *L. diaphana.*
Costal margin of tegmina not distinctly thickened.
Tegmina without costal markings.....3. *L. unicolor.*
Tegmina with costal markings.....4. *L. murata.*

1. Lithecphora setigera.

Pl. 20, Fig. 22.

A single specimen is known, obtained by the Princeton College Expedition. The wings of the right side are partly expanded, but the anterior extremity of the body is much broken: the margins of the tegmina are remarkably parallel, the costal edge fringed with very short spinous bristles; the apical margin is very regularly rounded, the apex falling in the middle. The body is black and the tegmina pale fuliginous, with a large roundish pallid patch on the costal margin, crossing about two-thirds of the wing, its inner border at the middle of the wing.

Length of body (partly estimated), 7.25^{mm}; breadth of thorax, 2.75^{mm}; length of tegmina, 6^{mm}.

Florissant. One specimen, No. 1.121, Princeton Collection.

2. Lithecphora diaphana.

Pl. 21, Fig. 13.

A single specimen is known, preserved on a dorsal view with the tegmina and wings half expanded. The body is dark brown, the tegmina apparently diaphanous or almost so, at least in the lower half, for the veins of the wings show through them perfectly; the costal margin is nearly straight, but has a slight and constant convexity, so that the two margins are not quite parallel; this same margin is much thickened, more so in the

basal half than the other species, but there is no sign of spinous hairs, and the tegmina are more pointed at tip.

Length of body, 8mm; of tegmina, 7mm; breadth of thorax, 2.75mm

Florissant. One specimen, No. 30.

3. Lithecphora unicolor.

Pl. 21, Figs. 4, 5, 11, 14.

This seems to be an abundant species, if all the specimens I have referred to it belong here, but not a single one is well preserved, and if correctly placed it must have been an exceptionally delicate insect. The most that can be said of it in distinction from the other species is that the tegmina are slender, fully three times as long as broad, with tolerably distinct veins throughout, the costal border slightly curved at extreme base and gradually falling to join the apical margin on the apical fourth of the wing, the apex slightly produced and perfectly symmetrical; they show no signs of thickening of the costal margin and were evidently without markings. The hind tibiæ appear to be longer than in the other species.

Length of body, 7.25mm; of tegmina,5mm; breadth of thorax, 2mm.

Florissant. About fifty specimens, of which the best are Nos. 1970, 5400, 11103, 12447, 13337, 14178.

4. Lithecphora murata.

Pl. 21, Figs. 3, 8.

This species is larger than the preceding, which it much resembles, differing from it in imitating to a certain extent the markings characteristic of Paleephoræ. The tegmina are slender, nearly three and a half times longer than broad, with the costal border strongly shouldered at base and scarcely declining at tip, the apex broadly and symmetrically rounded and in no way produced: the venation is very feeble and the markings, dark on a light ground, consist of a basal costal striga and two cloudy transverse streaks, only on the costa at all distinct and there obscure, dividing the wing into nearly equal thirds. All the specimens are poor.

Length of body, 9mm; of tegmina,6.5mm; breadth of thorax, 2.9mm.

Florissant. Three specimens, Nos. 912, 11007, 12776.

PRINECPHORA gen. nov. ($\pi\rho\grave{\iota}\nu$, $\grave{\epsilon}\nu\alpha\phi o\rho\acute{\alpha}$).

Allied to Palecphora, but of a still slenderer form, and in markings resembling Triecphora, than which it is far more slender. Head half as broad as the thorax, less than half as long as broad, very bluntly rounded, and in no sense angulate in front, the middle with an exceedingly slight longitudinal carina. Thorax as in Palecphora, as also the scutellum, excepting that it is equiangular. Tegmina slender, almost three times as long as broad, with nearly parallel sides, relatively straight costa and broadly rounded symmetrical apex; clavus occupying about one-fourth of the wing, terminating in the middle of the outer half of the same; neuration obscure but apparently with rather long apical cells Wings and neuration as in Palecphora, but the fourth longitudinal vein not quite so deeply forked and the fork more symmetrical. Legs very imperfectly preserved in the specimens known, but apparently a little longer than in Palecphora. Abdomen very full, tapering, the apical segments pinched.

A single species is known, one of the prettiest of the Florissant Homoptera.

PRINECPHORA BALTEATA.

Pl. 20. Fig. 14.

Head and thorax finely granulated, the eyes apparently margined narrowly with black. Tegmina similarly but less conspicuously granulated, blackish fuliginous, deeper in tint on the basal than on the apical half, marked with two broad, pale, transverse bands, which are broadest on the costal margin; the first occupies the base, crossing the entire wing, and is bounded outwardly by a curved line, angulate at the sutura clavi, which runs from about the end of the basal third of the costal margin inward; the second, sometimes narrowly connected with the first along the costal edge, runs from the costal margin to the sutura clavi as the amalgamation of two spots: a circular one resting on the sutura, its inner edge at the center of the wing, and a triangular one, its base seated on the costal margin and its apex about the center of the circular spot.

Length of body, 7.75^{mm}; of tegmina, 6^{mm}; breadth of thorax, 2.5^{mm}.

Florissant. Four specimens, Nos. 8886, 9198, 11774, and from the Princeton Collection, 1.604.

Subfamily APHROPHORIDA Stal.

Very few fossils have been referred to this group of Cercopidæ, as compared with the other, although in temperate regions at the present day the Aphrophorida are in excess. Heer and others have described a number of species from the European Tertiaries, both in the rocks and in amber, and these have all been referred to the single genus Aphrophora. There are, however, a number of others regarded by Heer as species of Cercopis, which must certainly be referred to the Aphrophorida, if his figures are at all correct; such are C. fasciata and C. pallida, probably also C. oeningensis and perhaps C. rectelinea. The same is true of Germar's C. melæna from amber As already stated, the species from Florissant I formerly regarded as related to Ptyelus turn out to be true Cercopida, but there nevertheless appear at this same station not only an obscure form temporarily referred to Aphrophora, but two other forms of considerable interest, one of which appears to be a distinct type, which I have called Palaphrodes, with several species, most of them tolerably abundant; the other, a single specimen, which must be referred latitudinally to the highly specialized existing Clastoptera.

PALAPHRODES gen. nov. (παλαιός, ἀφρώδης).

Stout bodied, of oval form. Head well rounded in front, nearly twice as broad as long, reaching on either side posteriorly the more sloping portion of the front of the anteriorly angulate and rounded thorax and therefore considerably narrower than it. Ocelli as far from each other as from the eyes. Thorax hexangular, the lateral sides the shortest, and after that the central portion of the posterior border, which is slightly shorter than the oblique portions, the whole thorax half as broad again as long and not carinate. Scutellum rather small, equiangular, all the sides straight or the lateral slightly concave. Tegmina broad oval, but little more than twice as long as broad, the costal margin strongly arched, the apex rounded but more or less acuminate, the neuration much as in Aphrophora. Wings ample, well rounded, with no apical emargination, a little shorter than the tegmina; the second and third and also the fourth and fifth longitudinal veins united by straight transverse or oblique cross-veins at equal distances from the margin, at about the end of the middle third of the wing, the third and fourth by a similar vein at about the center of the wing.

This genus seems to fall somewhere between Cephisus and Avernus, but the structure of the hind legs is not known. It was an abundant type in the Florissant basin, five species being already known, most of them by a considerable number of examples.

Table of the species of Palaphrodes.

Middle of the tegmina traversed, at least on the costal edge, by a black band; no long baso-costal stripe.

Middle stripe of tegmina distinctly traversing the wing transversely without change of breadth; neuration distinct ..... 1. *P. cincta.*

Middle stripe of tegmina not distinctly traversing the wing transversely without change of breadth; neuration indistinct.

Middle stripe of tegmina confined to a spot on the costal edge and thus usually somewhat obscure ..... 2. *P. obscura.*

Middle stripe of tegmina directed obliquely outward.

Subapical costal stripe of tegmina moderately oblique and moderately broad, with irregular margins ..... 3. *P. irregularis.*

Subapical costal stripe of tegmina very oblique, very slender, with sharply defined straight margins ..... 4. *P. obliqua.*

Middle of the tegmina traversed by a pale band; a long and broad baso-costal dark stripe. 5. *P. transversa.*

1. Palaphrodes cincta.

Pl. 20, Fig. 16; Pl. 21, Fig. 15.

Body uniformly dark colored, the incisures of the abdomen paler. The species is distinguished by the markings of the tegmina and the distinctness of the neuration, the latter due to its being traced in black throughout the apical half of the wing; the ground of the tegmina is pale, perhaps diaphanous; the base is blackish, making here a large triangular patch with very irregular outer outline; across the middle of the wing, separated from the basal patch by the length of the latter, is a broad, equal, straight, transverse, blackish stripe or bar often deepest in color on the costal half or becoming fuliginous on the inner half; its edges, and especially its upper, are tolerably straight. It is followed at an equal distance on the costal margin by a slender, oblique, black, and narrowing stripe just before the apical cells, generally running about half-way across the wing, parallel to the hind margin.

Length of body, 9.5^{mm}; breadth of thorax, 3.3^{mm}; length of tegmina, 8^{mm}; breadth of closed tegmina together, 5.5^{mm}.

Florissant. Thirteen specimens, Nos. 208, 582, 6908, 11238, 12094, 13555, 13573, 14234, perhaps 1632, and of the Princeton Collection 1.505, 1.813 and 1.841, 1.815 and 1.839.

Specimen No. 208, figured on Plate 21, has been mislaid and was not examined at the time when this description was drawn up.

2. Palaphrodes obscura

Pl. 21, Fig. 18.

This species differs from the preceding, to which it is most nearly allied, mainly in the obscurity of its markings, which in general follow the position of those in P. cincta. Unfortunately the most deeply marked specimen was figured, and its color has been somewhat deepened on the plate, so that the differences do not there clearly appear; ordinarily, however, besides the obscurity of the markings, the middle transverse stripe is also broadened, and so, as it were, diffused (not at all the case in the individual figured), and the subapical oblique stripe becomes a far broader, short, quadrate bar on the costal margin. It appears to be ordinarily a smaller species than the preceding, but one individual is nearly as large as the largest of that species.

Length of body, 9.25^{mm}; breadth of thorax, 3.2^{mm}; length of tegmina, 7.5^{mm}; breadth of closed tegmina together, 5^{mm}.

Florissant. Six specimens, Nos. 452, 4287, 4404, 11239, 13321, and of the Princeton Collection 1.816.

3. Palaphrodes irregularis.

Pl. 20, Figs. 2, 18; Pl. 21, Figs. 6, 7.

This species, with P. cincta the commonest of the genus, appears to differ from it very decidedly in the form, extent, and position of the darker markings beyond the basal; they occupy, indeed, so much more room where they are well developed as to cover more space than the lighter parts, so that the tegmina might quite as well, or better, be regarded as dark with light markings; the median belt occupies on the costal margin precisely the same position as in P. cincta, but in passing across the wing it immediately and considerably expands, rarely, however, without being more or less broken and blotched with pale; at the center of the wing its expansion tends to break it up into two forks, and the commissural portion is highly variable; in general, however, the proximal fork is far more intense and distinct than the distal, leaving between it and the basal patch of the tegmina an often well defined, constantly narrowing, transverse, white band, broad on the costal margin, reduced nearly to nothing on the inner, and

generally narrowing abruptly as the sutura clavi is crossed; the distal fork is directed toward the tip of the sutura clavi, but is dissipated and broken into flecks before reaching it; the subapical, slender, oblique, costal stripe is much as in P. cincta, but runs in the opposite direction and is more variable and almost always accompanied by an opposed, large, fuliginous, subquadrate, subapical cloud on the inner margin.

This appears to be one of the largest species, but is subject to considerable variation, one of the specimens referred here being one of the smallest.

Length of body, 11^{mm}; breadth of thorax, 4^{mm}; length of tegmina, 8.8^{mm}; breadth of closed tegmina together, 6^{mm}.

Florissant. Twelve specimens, Nos. 43, 854, 2101, 3864, 5058, 8233, 8536, 10364, 10689, 12090 and 12472, 14200, and of the Princeton Collection 1836.

4. Palaphrodes obliqua.

Pl. 21, Fig. 10.

This species, which seems to be rare, is slenderer than the others, but related pretty closely to the last, though it has some peculiarities tending in another direction. The body is uniformly dark, and the ground of the tegmina dark with the same dark basal patch found in all the preceding species; in this, however, the median band is not developed into two forks, as in the last species, with the proximal fork the stronger, but there is no sign of a proximal fork unless a slight general cloudiness in this direction may be looked on as a relic of the same; the distal fork, however, is well developed, united, or almost united with, and in any case directed toward so as to involve, the subapical spot of the inner margin found also in the last species; in addition, as if in recognition of the superinduced obliquity of the median band, the subapical costal striga has become more oblique than in P. irregularis, and there is a slight, slender, transverse marginal cloud.

Length of body, 10.5^{mm}; of tegmina, 6.25^{mm}; breadth of thorax, 3^{mm}.

Florissant. Two specimens, Nos. 8887, 9531.

5. Palaphrodes transversa.

This species, represented by only a single specimen, differs much more widely from the others than they among themselves. It is broader oval than they, and the markings are quite differently located. The head and body are light instead of dark, with a straight, broad, transverse, dark belt

crossing the hinder margin of the thorax, but not involving the pale scutellum. The tegmina are marked at base by two very broad, dark, longitudinal stripes, one following the costa for the basal two-fifths of the wing, and here bent inward half-way across the tegmina; the other, most intense in color as soon as the scutellum is passed, and not extending so far out as the costal patch, occupies the base of the clavus; the pale inner base of the corium is therefore nearly inclosed with dark bands; outside of these basal markings, which extend nearly to the middle of the wing, is a broad, transverse, equal, pretty sharply edged, subapical, dark band, most intense in tone on the costal half.

This insect differs so much from the others that I suspect it will be found necessary to separate it generically from them.

Length of body, 10.5^{mm}; of tegmina, 7.5^{mm}; breadth of thorax, 3.5^{mm}; of closed tegmina together, 6^{mm}.

Florissant. One specimen, No. 4521.

APHROPHORA Germar.

Half a dozen species or more referred to this genus have been found fossil in amber, and at Oeningen, Aix, Radoboj, and at Greith, in the rocks; they have been mentioned or described by Berendt, Gravenhorst, Germar, Heer, and Giebel. The single one here added, very imperfectly known, is placed here only as the group giving its name to the subfamily.

Aphrophora sp.

Pl. 19, Fig. 10.

To Aphrophora as typical of the subfamily I refer some imperfect specimens which bear a certain general resemblance to Palecphora, but which have a rounded front to the thorax, showing that they should be brought in this division. None of them are perfect enough to enable one to draw from all a proper description, for they appear to have been fragile insects. The structure of the legs appears to be as in Palecphora; the tegmina to have been delicate and semi-transparent, and to have had a large subapical costal cloud.

Length of body, 10^{mm}; of tegmina, 8^{mm}; breadth of thorax, 2.5^{mm}.

Florissant. Six specimens, Nos. 1360, 3102, 3474, 4379, 11008, 14022.

CLASTOPTERA Germar.

It is not a little surprising to find in the Florissant shales a species of this highly specialized form. Apparently the tegmina were not so remarkably convex as in modern types, but the presence of this genus indicates once more how thoroughly the present general features of insect form and structure were established even as early as in Oligocene times. It is the only fossil species known. The genus belongs to the New World, and especially to the tropics, but at least a couple of species are found on our southern Atlantic coast.

CLASTOPTERA COMSTOCKI.

Pl. 19, Fig. 22.

The head was mostly concealed under a flake of stone when the drawing for the plate was made, since removed, showing it to have had a front margin very regularly and very broadly convex, black like the very transverse thorax. The form of the dark, testaceous scutellum is not quite fairly given in the plate; half as broad at base as the thorax, it is sharply and regularly triangular, almost or quite as long as the width of the thorax, and sharply pointed posteriorly. The tegmina are about twice as long as broad, apparently nearly flat (wholly flattened on the stone), less than the apical third diaphanous, the remainder semicoriaceous and testaceous, the neuration obscured and even the sutura clavi scarcely perceptible, the clavus apparently narrower and less broadly rounded at apex than in our living forms.

Length to tip of tegmina, 2.8^{mm}; breadth across closed tegmina, 2^{mm}

Named for J. Henry Comstock, professor of entomology in Cornell University.

Florissant, Colorado. One specimen, No. 6655

Order HETEROPTERA Latreille.

Of the twenty families into which fossil Heteroptera may be divided only five are remarkable for the abundance of their representation in the existing fauna. These are the Reduviidæ, Capsidæ, Lygæidæ, Coreidæ, and Pentatomidæ; and these same families are also well represented among the fossils, containing together about four-fifths of the total heteropterous fauna. Indeed, the only other family which can be regarded as at all abundant in Tertiary times is the Physapodes, the known species surpassing those of the

Reduviidæ. Of these six families the Lygæidæ were then the most abundant, containing a little more than 25 per cent of the whole, followed hard by the Pentatomidæ with a little less than 25 per cent; the Coreidæ come next with 15 per cent, followed at nearly similar distance by the Capsidæ with 9 per cent. The Physapodes have 7 per cent and the Reduviidæ only 4½ per cent, mainly because America is so strangely poor in this group, having indeed but a couple of species, the only groups at all common in America being the four with the highest percentages. Here the relative percentages in the two worlds are very different, as will appear from the following table, the Lygæidæ having 33 per cent of the whole American fauna against 19½ per cent in Europe; the Pentatomidæ 24 per cent in America against 25½ per cent in Europe, these two striking contrasts combining to give the Lygæidæ the total preponderance, hitherto enjoyed by the Pentatomidæ; the Coreidæ 22 per cent in America against 9½ per cent in Europe, and the Capsidæ 9 per cent in America against 10 per cent in Europe.

Summary list of known fossil Heteroptera.

Families.	North America.		Europe.	
	Genera.	Species.	Genera.	Species.
Corixidæ	2	3	1	2
Notonectidæ	1	1	1	3
Nepidæ	0	0	2	1
Belostomatidæ	0	0	1	2
Naucoridæ	0	0	2	2
Galgulidæ	1	1	1	1
Saldidæ	0	0	1	1
Veliidæ	2	2	1	1
Hydrobatidæ	2	3	2	2
Limnobatidæ	0	0	2	2
Reduviidæ	2	2	7	14
Nabidæ	0	0	2	7
Aradidæ	0	*0	1	5
Tingididæ	3	3	4	5
Acanthiidæ	1	1	0	0
Capsidæ	7	13	13	20
Physapodes	3	3	4	21
Lygæidæ	26	51	6	39
Coreidæ	14	34	12	19
Pentatomidæ	16	37	14	51
Total	80	154	77	201

* What I formerly thought to be Aradidæ turned out to be Myodochina.

Of the other smaller families the only ones which surpass more than five known fossil species in all are the Nabidæ with seven species and the Tingididæ with eight; of these there have been found in America no Nabidæ whatever and the smaller half of the Tingididæ. Other families not found in America are the Nepidæ, Belostomatidæ, Naucoridæ, Saldidæ, Limnobatidæ, and Aradidæ, all but the Saldidæ having more than one species in Europe. On the other hand the only family found in America and not in Europe is the Acanthiidæ with a single species. The remaining smaller families represented on both continents vary in their numbers from one to three in America and from one to four in Europe.

If, however, we omit from this enumeration the forms which have been found in amber, and thus compare those of the rocks only, as in the following table, we shall meet with somewhat different results.

Table of fossil Heteroptera from rock deposits.

Families.	North America.		Europe.	
	Genera.	Species.	Genera	Species.
Corixidæ	2	3	1	2
Notonectidæ	1	1	1	3
Nepidæ	0	0	2	3
Belostomatidæ	0	0	1	2
Naucoridæ	0	0	2	2
Galgulidæ	1	1	1	1
Saldidæ	0	0	0	0
Veliidæ	2	2	1	1
Hydrobatidæ	2	3	0	0
Limnobatidæ	0	0	1	1
Reduviidæ	2	2	6	12
Nabidæ	0	0	2	5
Aradidæ	0	0	1	2
Tingididæ	3	3	3	4
Acanthiidæ	1	1	0	0
Capsidæ	7	13	1	1
Physapodes	3	3	4	18
Lygæidæ	26	51	6	37
Coreidæ	14	34	11	18
Pentatomidæ	16	37	14	50
Total	80	154	58	162

The principal change which may be noted here is the almost total extinction of the Capsidæ in the European representation which shows but a single species; the Saldidæ and Hydrobatidæ do not appear and the Aradidæ are notably reduced. The greatest contrasts between the European and American rocks, with an almost equal total number of species,[1] is seen in the Capsidæ, which have 8 per cent of the total fauna in America, 0.6 per cent in Europe, and the Coreidæ with 22 per cent in America and 11 per cent in Europe; these are the only cases of striking contrast in which the American fauna is the richer; the others are the Reduviidæ, 1.3 per cent for America, 7.4 per cent for Europe; the Nabidæ, none for America, 3 per cent for Europe; and the Physapodes 2 per cent for America, 11 per cent for Europe. The contrasted balance of the Lygæidæ and Pentatomidæ is well seen, America having 33 per cent of Lygæidæ and 24 per cent of Pentatomidæ, Europe 23 per cent of the former and 31 per cent of the latter.

Very little change appears in the smaller families (a relatively small number of which occur in amber) except in the entire absence of any representatives of Hydrobatidæ and Saldidæ, the former occurring in America. It is also surprising to see how little the larger families (with a single exception) are affected by the new table, amber having but the meagerest possible contribution to offer to the Pentatomidæ, Coreidæ, Lygæidæ, and Physapodes, while the single exception noted above of the Capsidæ is a startling one, amber furnishing nineteen of the twenty European Tertiary species

It may be worth while to extend some of these comparisons in a different direction, that of existing American faunas. There are, I believe, but three opportunities for such comparison. First, Mr. Uhler's Check-list of the North American Heteroptera (1886), which embraces all species known at the time, including the Mexican and West Indian; second, the same writer's valuable List of the Hemiptera of the region west of the Mississippi (1876), which represents particularly the geographical region of our Tertiary fossil Heteroptera; and, third, Mr Distant's contribution to the Biologia Centrali Americana (1880–'89), which has a decidedly more southern aspect than Uhler's general list. Distant's work has progressed only through the larger families (in reverse order to that followed here) and indeed at this writing the supplement to the first volume is not complete, and accordingly in what

[1] In the enumeration of the European species a considerable number of undescribed species are introduced whose presence has been merely indicated by statements of different naturalists.

follows I have omitted all consideration of that, to make the comparisons more equable. For the same reason, in order to use the last work at all, I have instituted comparisons only between the families there elaborated, and have used the family groups in the same sense as there, except only that I have regarded his Pyrrhocoridæ as a group of Lygæidæ.

These four families are indeed the very ones, and, as will be seen, the only ones which assume any importance in the American Tertiaries; and a comparison of their interrelation as to numbers can be shown succinctly by the following table, which exhibits the relative percentage of representation of each of these families in the different regions and times as represented in the published lists—the only available ones, and which may be supposed to represent, not the numbers, but the relations with tolerable accuracy:

Families.	American Tertiary.	Uhler; Western List.	Uhler; General List.	Distant; Central America.
Capsidæ	9.6	11.0	25.0	27.3
Lygæidæ	37.8	31.4	19.2	17.7
Coreidæ	25.1	23.1	21.6	21.7
Pentatomidæ	27.4	34.5	34.1	33.2
Total	99.9	100.0	99.9	99.9

The correspondence of the numbers in the last two columns is even less remarkable than the disturbance of the relative percentages of the Capsidæ and Lygæidæ of the western list when compared with those of the American and Central American forms; the merest indication of such an overturn is shown in the comparison of the nearer American and the more distant Central American lists; but the overturn is still more complete and in the same direction when we compare the existing and the fossil fauna of the West. The relative representation, then, of the four principal families of the Tertiary Heteroptera of the western half of our continent agrees conspicuously better with the relative representation of the existing fauna of the same geographical region than with that of the other regions of the same world. Either the physical conditions of the region in question have remained since Oligocene times in the same relative contrast to those of the other regions under comparison, or the present Heteropterous fauna of the West shows a decided relation to that which existed on the same ground in Tertiary times, or both.

As in the Homoptera, and for the same general reasons, it has been found imperative to establish in the Heteroptera a large number of new generic groups to treat them on the same principles that guide the zoologist. Characteristics of structure in antagonism to those prevalent to-day in the same groups run throughout large divisions, or even families, and must be taken into account if we are to do justice to the facts. Bringing these thus into prominence will serve the useful purpose of stimulating inquiry into their meaning and origin, which the data at present at hand seem inadequate to explain. That many of these extinct types attained a high degree of differentiation is readily seen by a glance at the tabular view at the end of the volume, where a large number of the genera will be found to have been represented by a half dozen or more species each, some of them at the time very abundant in individuals.

Family CORIXIDÆ Douglas and Scott.

This family, which first appears in the Tertiaries,[1] is very poorly represented there. Only two European species are known, one each from Oeningen and Stösschen. The latter species, very small and probably immature, is hardly recognizable except as a water-bug of some kind. That from Oeningen, referred like the other to the existing and wide-spread genus Corixa, is intermediate in character between the two species of Corixa from Florissant we are able to add here. But the most interesting form which we give below is the strange insect from Florissant, unfortunately but imperfectly preserved, which seems to combine some of the characters of Corixidæ and Notonectidæ, and to form the type of a new genus, probably most nearly allied to Sigara.

PROSIGARA gen. nov. (πρό, Sigara, nom. gen.).

This is a very curious, robust, new form of Corixidæ, which seems more nearly related to the gerontogeic Sigara than the almost cosmopolitan Corixa. It is, however, clearly distinguished from either in the great size of the head. [This is given, however, as much too large in the plate, where the femur of the left fore leg is confounded with it.] The head is even larger than in the

[1] Unless the poorly preserved insect from the white Jura of Bavaria, which Oppenheim has recently referred doubtfully to Corixa, is to be regarded as belonging here.

Notonectidæ, subrotund, but embracing the thorax posteriorly as in Corixa; it has a median sulcation. The thorax is remarkably large, broader than the head, only about twice as broad as long, well rounded, posteriorly truncate, separating off a large triangular scutellum (again like Notonecta) whose posterior sides are convex and the apex rounded; it is only a little shorter than the thorax and about half as broad as it. The hemelytra are broad and well rounded, the clavus very broad, the membrane indistinguishable from the corium, the apex well rounded, the tips of the opposite pairs overlapping as in Sigara; the veins are numerous and divergent like the rays of a fan. The legs are long and slender, the middle pair nearly as long as the body, the tarsi biarticulate, the joints subequal.

A single species is known.

PROSIGARA FLABELLUM.

Pl. 22, Fig. 12.

A single specimen, showing a dorsal view. The whole body is dark gray and the hemelytra delicately mottled, through which the dusky veins, growing darker apically, make their way, and, radiating in the broader apical part of the corium, from which the membrane is indistinguishable, form the most conspicuous feature of the markings: none of the last, however, appear in the clavus. The tarsus of the middle legs is not shown in the figure.

Length of body, 6^{mm}; breadth, 1.85^{mm}; length of tegmina, 3.5^{mm}; breadth, 1.4^{mm}; length of middle (?) leg beyond side of body, 5^{mm}.

Florissant. One specimen, No. 1098.

CORIXA Geoffroy.

As stated above, two European species of this widely distributed genus are known from the European Tertiaries, to which we are able to add two others from Florissant with well defined characteristic markings.

Table of the species of Corixa.

Tegmina more than four times longer than broad.....1. *C. vanduzeei*
Tegmina less than four times longer than broad.....2. *C. immersa.*

1. CORIXA VANDUZEEI.

Pl. 22, Fig. 17.

A very pretty species of about the size and form of C. alternata Say, but more nearly allied to C. interrupta Say, not only in markings but also

in the form of the costal field. I have seen but few of our many species of this genus, but Mr. Uhler, who has seen only the figure of the present species, informs me that it shows most resemblance in markings to C. præusta Fieb. of Europe. The thorax is dark and more or less mottled with pale, a mottling which appears to have a transverse disposition, but the condition of none of the specimens allows one to say whether it is as regularly disposed as on the hemelytra or not. On these the costal field is pallid with a dusky vein extending down the middle, and is very broad just beyond the base, being in the middle of the basal half equal to one-third the entire breadth of the hemelytra; beyond it narrows, and opposite the oblique termination of the corium is lightly marked with the faintly and delicately undulate narrow, dark, bands of the rest of the hemelytra; these are somewhat broader than the intervening pallid spaces, and traverse the corium and clavus alike with more or less but ordinarily not much interruption at the suture; on the membrane these darker bands become shattered as if by a jar which has almost but not quite destroyed at once their transverse and their linear character.

Length of body, 7.5^{mm}; of tegmina, 6^{mm}; breadth of closed tegmina, 2.5^{mm}.

Named for Mr. E. P. Van Duzee, of Buffalo, a careful student of our native Hemiptera, whose assistance has been of great service in the study of the fossil forms.

Florissant. Five specimens, Nos. 3219, 3409, 3665, 5178, 7269.

2. Corixa immersa.

Pl. 22, Fig. 16.

A robust form with more obscure markings than the preceding but very similar in character. The head and thorax are dark and uniform, and the hemelytra may best be described as dark, traversed more or less distinctly, more distinctly distally than next the base, with pale, tremulous, continuous threads, which cross corium and clavus alike but are stopped by the costal field, which is slender and nearly equal throughout; on the membrane the markings are shattered and present precisely the appearance they do in C. vanduzeei; the markings bear much resemblance to those of C. hellensii Sahlb. of Europe, as figured by Snellen.

Length of body, 6^{mm}; of tegmina, 5^{mm}; breadth of closed tegmina, 2.85^{mm}.

Florissant. Three specimens, Nos. 1456, 2238, 6978

Family NOTONECTIDÆ Stephens.

This family of water-bugs makes its first appearance in the Tertiaries, and then in very scanty numbers. But four species are known, all of them referred to the existing genus Notonecta, which has now a wide distribution. The three known European fossil species have been reported respectively from Kutschlin, Rott, and Aix. The fourth is the species from Florissant, described below.

NOTONECTA Linné.

A single small species of this genus has occurred at Florissant of a similar size as, but of a more robust form than, the species described by Deichmüller from Kutschlin; a second larger species has also been described by Heyden from Rott, and a third has been indicated by Hope from Aix. Existing species of the genus most abundant in temperate regions are found nearly all over the world.

NOTONECTA EMERSONI.

Pl. 22, Fig. 11.

A small species, of which possibly only immature individuals are at hand. The smaller showing the dorsal surface is certainly so, and the other showing the ventral surface is not clearly determinable in this respect. The description is taken mainly from the larger. It is of a very regular oval form and is apparently mature, since on one side is seen the edge of the hemelytra, or what can hardly be regarded otherwise. Fringes of combed hairs are directed obliquely backward on the sides of the abdomen, and the median forked line on its posterior portion seems to indicate the hemelytral suture of the upper surface seen through the body. The hind legs are of the usual type, terminating in a blunt point—blunter than appears in the figure, and are minutely fringed with delicate short spines. The femur, tibia, and first tarsal joint are subequal.

Length of body, 4.2mm; breadth, 1.85mm; length of hind legs, 5.35mm.

The species is named for the Massachusetts geologist, Prof. B. K. Emerson, of Amherst.

Florissant. Two specimens, Nos. 3857, 10729.

Family GALGULIDÆ Westwood.

The only fossil hitherto known as belonging to this family is an insect from the brown coal of Rott, described by Heyden as a mite under the name Limnochares antiquus, but shown by Bertkau to be a galgulid, and probably only a larval skin of one at that. Bertkau also regards the Florissant fossil, described above as a Thysanuran under the generic name Planocephalus, as a very similar creature and probably a larval galgulid, but in this I can not follow him; nor are any other Galgulidæ known among the mass of insects found at Florissant. In the similar beds at Green River, however, a single insect is preserved (all but the abdomen) which seems to present characters which show it to be the nearest related to Pelogonus, which, however, I know only from description and the figure of Dufour The present species is very remarkable for several points: the form of the head, the absence of any sign of eyes on the upper surface of the same (darker patches at the outer limits of the head probably indicate their existence at this point beneath), the flattened body, and the long, rod-like legs, the front pair longer and larger than the others, but quite similar in character (except for lacking a tarsal joint) and in no way raptorial. It shows certain resemblances to Aphelocheirus, but on the whole seems rather a member of this family than of the Naucoridæ.

NECYGONUS gen. nov. (*νέκυς, γονή*).

Body broad oval, apparently much flattened. Head subsemicircular, more than twice as broad as long, the front border strongly and uniformly rounded, hind border truncate, nearly as broad as the thorax, the eyes apparently wholly inferior, situated at the posterior outer angles. Rostrum long, lancet-shaped, not very sharply pointed, the last joint about a fourth of the total length. Antennæ long and slender, considerably longer than the width of the body, the last joint nearly as long as the tarsi. All the legs long, slender, rod-like, similar, the femora nowhere swollen but twice

as broad as their tibiæ, which equal or surpass them in length, the fore femora considerably longer than the middle pair; all the tarsi equal, but the fore tarsi two-jointed, the others three-jointed, the joints of each subequal.

This genus differs markedly from Pelogonus, to which it appears to be the most nearly allied, in the great length of the fore legs, which seem to show a relationship to the Naucoridæ, though they are in no sense raptorial. It is also peculiar for the want of eyes upon the upper surface of the head. The legs are smooth.

A single species is known.

Necygonus rotundatus.

Pl. 7, Fig. 8.

Although the abdomen is wanting, the form of the anterior part of the body, with the anterior position of the legs, would indicate that the creature was of a short oval form, very likely twice as long as broad. The flat body, both head and thorax, are of a slightly granular texture, and of a dusky color, uniform for body and legs, except that the head is slightly darker than the rest.

Breadth of body, 3.5^{mm}; head, 2.5^{mm}; length of head, 1^{mm}; rostrum, 2.6^{mm}; antennæ (as far as preserved, detached from the body), 4^{mm}; fore femora, 3.25^{mm}; tibiæ, 3.75^{mm}; tarsi, 1^{mm}; middle femora, 2.75^{mm}; tibiæ, 2.65^{mm}; tarsi, 0.9^{mm}; hind tarsi, 1.2^{mm}.

Green River, Wyoming. One specimen, No. 107, Dr. A. S. Packard.

Family VELIIDÆ Douglas and Scott.

Westwood states that species allied to Velia occur in the Secondary rocks of England, but there is no figure of them, and this is the only mention of their occurrence before the Tertiaries. Similarly their only mention in the later series is by Serres, who says that at Aix a species of "Gerris' occurs which he compares to Velia currens. In our own Tertiaries two species have occurred, at Florissant, each apparently belonging to a distinct and extinct genus; these I have called Palæovelia and Stenovelia.

Table of the genera of Veliidæ.

Hind tibiæ and first tarsal joint armed at tip with long spines ..... 1. *Palæovelia.*
Hind tibiæ and first tarsal joint not armed at tip with long spines ..... 2. *Stenovelia.*

1. PALÆOVELIA gen. nov. (παλαιός, Velia, nom. gen.).

Head much as in Microvelia, small, subtriangular, with rounded angles, a little broader than long, plunged to the eyes in the roundly emarginate prothorax, and continuing the curve of its rapidly narrowing sides, the part in front of the eyes a little shorter than they. Thorax pentagonal, the sides subequal, the lateral faces straight, the front concave, the posterior faces still more concave but a little shorter than the others, the median posterior process not reaching far back, rather acute. Body widest at the posterior sides of the thorax, the abdomen tapering but little, in its posterior third roundly narrowing, terminating in a bifid plate, the posterior part of the abdomen bluntly conical, and the entire body having a long ovate shape. Hind legs very short, only reaching the tip of the abdomen, the femora and tibiæ of nearly equal length, the tarsi longer than either, the tibiæ and first tarsal joint both armed at the tip with prominent delicate spines, the tarsi three-jointed.

A single species is known.

PALÆOVELIA SPINOSA.

Pl. 22, Fig. 13.

The single specimen appears to be seen on the ventral surface only, showing a pale gray abdomen, while all the other parts are black; the thorax and base of abdomen are clothed not very densely with exceedingly fine, short, dark hairs directed laterally outward, while beyond, an obscure dotting on the abdomen would seem to indicate similar but erect hairs. The legs are pretty thickly beset with fine, stiff hairs, the apical spines of the tibia and first tarsal joint about as long as the width of the joint, the tibiæ also with an apical or preapical spur fully twice as long.

Length of body, 3.65^{mm}; breadth, 1.85^{mm}; length of hind femur, 0.8^{mm}; tibia, 0.8^{mm}; tarsi, 1.2^{mm}.

Florissant. One specimen, No. 13325.

2. STENOVELIA gen. nov. (στενός,[1] Velia, nom. gen.)

Body robust, blunt oval. Head narrow but not very small, rounded subquadrate, about half as large as the pronotum, but rather longer than it, the

[1] The name is given in allusion to the confined surroundings of this genus of Veliidæ, not to any slenderness of form.

moderately large eyes at the very base. Antennæ four-jointed, about reaching to the base of the middle legs, the joints of nearly equal length, but the first and fourth a little the longest and the second shortest, the first cylindrical and moderately stout, the last oval, the others obovate and a little slenderer. Pronotum faintly set off from the rest of the thorax as a transverse piece more than twice as broad as long, the thorax as a whole pentagonal, the posterior border being subangulate and the posterior sides of the pentagon only slightly oblique; front margin straight and longer than any of the others, though the thorax narrows forward rather rapidly. Legs short and stout, the fore legs about half as long as the others, the hind pair the longest, though the middle and hind femora are subequal: the hind tibiæ longer than the middle tibiæ or than the femora, while the femora and tibiæ are equal in the fore and middle legs, or the tibia is only slightly longer than the femur in the middle legs; tarsi three-jointed, the joints tolerably long, the last a little shorter than the others Abdomen oval, well rounded, the last two joints sometimes produced. No trace of wings.

A single species is known.

Stenovelia nigra.

Pl. 22, Figs. 8, 14.

Whole body uniformly dead black; the pigment in some cases has broken in flakes from the legs, especially the middle and hinder pairs, giving them a mottled appearance which is purely accidental. The whole body, including the legs, uniformly smooth, with no trace of hairs or spines.

Length of body, 3.75^{mm}; breadth, 1.65^{mm}; length of antennæ, 1.1^{mm}; fore femora, 0.75^{mm}; tibiæ, 0.75^{mm}; tarsi, 0.35^{mm}; middle femora, 1.2^{mm}; tibiæ, 1.3^{mm}; tarsi, 0.8^{mm}; hind femora, 1.2^{mm}; tibiæ, 1.4^{mm}; tarsi, 0.8^{mm}.

Florissant. Twenty-three specimens, Nos. 875, 878, 1934, 2936, 3020, 3268, 3866, 6497, 7565, 9243, 9499, 9563, 9589, 10344, 10691, 10787, 10945, 12074, 12098, 12099, 12936, 14025, 14981.

Family HYDROBATIDÆ Stål.

This family was perhaps known in Mesozoic times. Oppenheim, indeed, figures two species which he refers to a new genus Halometra, supposed to belong here, but which Deichmüller has shown should be referred to the Acridii, among Orthoptera. Perhaps here, however, belong unfigured and undescribed forms from the English rocks referred by Westwood to

Hydrometra In the European Tertiaries Germar figures two insects he regards as immature and as belonging to Hydrometra or Halobates, or both, and which also appear to belong to this family. Burmeister further says that Serres mentions a "characteristic Hydrometra" from Aix, but as a comparison will show, he has evidently written Hydrometra for Ploiaria, and that is quite another insect. In our own country we have a couple of species from Wyoming and British Columbia belonging to an extinct genus, Telmatrechus, described below, related to Hygrotrechus, found in the North Temperate zone of both worlds; and a species of Metrobates, a genus peculiar to eastern North America.

TELMATRECHUS gen. nov. (τέλμα, τρέχω).

This genus is closely allied to Hygrotrechus Stal, and, combining as it does many of the features of this genus and Limnotrechus Stal, may well have been the lineal predecessor of both. The antennæ have the first joint only a little longer than the second. The eyes are not at all prominent. The thorax is relatively shorter than in Hygrotrechus. The legs are very long, the tibiæ of each pair of legs about as long as the femora of the same legs, an equality which I have not found in any other genera of Hydrobatidæ; in the fore legs the equality is perfect; in the middle legs the tibiæ are slightly longer, in the hind legs slightly shorter, than the femora; the hind femora are slightly longer than the middle pair; so far as can be told from the imperfect remains the tarsi of the middle and hind legs are very much shorter than, not a half or probably a third the length of, their respective tibiæ. The posterior lateral edges of the sixth abdominal segment are produced to a tooth precisely as in Limnotrechus.

Two species are found in the western Tertiaries.

Table of the species of Telmatrechus.

Body stout, with almost regularly tapering abdomen.....1. *T. stâli.*
Body slender, with nearly equal abdomen, tapering distinctly only at the extremity...2. *T. parallelus.*

1. TELMATRECHUS STALI.

Pl. 2, Figs. 11, 12.

Hygrotrechus stâli Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 183-181B (1879).

The thorax seems to be shorter than in Hygrotrechus, with the limits of the prosternum more visibly marked from above; the eyes do not appear to be so prominent, and the first antennal joint would seem, from the

position of the others, to be shorter than in Hygrotrechus. The insect is of about the same size as our H. remigis (Say). The head, as seen on a side view, is small and rounded; thorax minutely scabrous like the head, narrowing rather rapidly and uniformly, the posterior limit of the prosternum marked by a slight depression next the anterior coxæ, the whole thorax considerably longer than broad. Abdomen tapering, the apical angles of the sixth segment produced to a sharp but short spine, reaching the middle of the succeeding segment. Antennæ nearly (perhaps quite) as long as the head and thorax together. Fore femora equal, stout, as long as the thorax; fore tibiæ of the same length; middle and hind legs very slender; middle femora considerably more than twice as long as the fore femora, the tibiæ nearly three times as long as the fore tibiæ and of the same length as the hind femora; hind tibiæ a little more than twice as long as the fore femora; first joint of hind tarsi about one-fifth the length of the hind tibiæ. On one of the specimens, preserved on a dorsal view, a line is seen proceeding from either side of the thorax, directly in front of the middle coxæ, and passing toward and nearly to the middle of the hinder edge of the second abdominal segment with some distinctness, accompanied on the second and third segments by other lines which seem to indicate the veins of the tegmina, the first mentioned line being the sutura clavi; but all trace of lines is lost beyond the third segment, as if the wings did not extend over more than half the abdomen; on the specimen preserved on a side view, they appear to extend to the hind edge of the sixth abdominal segment. Attached to the posterior extremity of the abdomen is a pair of stout lappets, nearly straight, but curving slightly outward, equal, about twice as long as broad, rounded and very slightly produced at the tip.

In a specimen (No. 70) which I have considered an immature individual of this species, but which may possibly be a Metrobates, the middle and third femora are of equal length.

Length of body, 19.75^{mm}; of head, 1.5^{mm}; of thorax, 5^{mm}; breadth of anterior extremity of thorax, 1 75^{mm}; of posterior extremity, 3.5^{mm}; of sixth abdominal segment, 2^{mm}; length of fore femora, 5^{mm}; of fore tibiæ, 5^{mm}; of middle femora, 12.5^{mm}; of middle tibiæ, 14^{mm}; of hind femora, 14^{mm}; of hind tibiæ, 11.5^{mm}; of first joint hind tarsi, 2.3^{mm}; of abdominal lappets, 1.3^{mm}; breadth of hind femora, 0.35^{mm}; of hind tibiæ, 0.2^{mm}; of hind tarsi, 0.15^{mm}.

I name this interesting species after my lamented friend, Dr. C. Stål, of Stockholm, whose marvelous industry and keen insight into the structure of Hemiptera is known to all entomologists.

Three miles up the north fork of the Similkameen River, British Columbia. Three specimens, Nos. 70, 71 and 72, 73. Geological Survey of Canada, G. M. Dawson, collector.

2. Telmatrechus parallelus.

Pl. 4, Fig. 1.

Two specimens are at hand, neither of them quite perfect. The species differs markedly from the preceding (with which it agrees in size) in the almost perfectly parallel sides of the abdomen, which is of the same width as the thorax; it tapers only on the last two segments. The head as seen on a side view is perhaps shorter than in T. ståli, and very much smaller than the thorax; as there, both it and the thorax are minutely scabrous. The whole body is of a tolerably uniform dark testaceous color, and the segments of the middle of the abdomen are about equally long and broad, while in T. stali they are nearly twice as broad as long.

Length of body, 20^{mm}; breadth of thorax, 2.75^{mm}; of sixth abdominal segment, 2.25^{mm}; length of fore femora, 5–5.5^{mm}; fore tibiæ, 5–5.5^{mm}; middle femora, 11–13^{mm}; hind femora, 13–15^{mm}.

Twin Creek, Wyoming. Two specimens, Nos. 14601, 15076.

METROBATES Uhler.

A single species of this genus is known, inhabiting the eastern United States. A much larger and somewhat slenderer form appearing to belong here occurs in the Florissant beds. It was provisionally referred by me to Halobates before Metrobates was known to me autoptically.

Metrobates æternalis.

Pl. 22, Fig. 15.

Body considerably elongated, but solely by the prolongation of the mesonotum, which is about twice as long as broad, thus separating at considerable distance the fore and after legs; the abdomen is no longer than

the width of the thorax and tapers rapidly to a point; the wings are slender, pupaeform, ovate pads having a subbasal circular macula, a central, longitudinal costal striga, and just beyond it a strongly oblique, subtriangular, costal patch, all pallid on a blackish ground; these do not clearly appear on all specimens. The head is not well preserved on any specimen. The legs are very delicately covered with short and exceedingly fine recumbent hairs, and fringed beneath with an almost equally delicate series of short distant spinules.

Length of body, 7^{mm}; breadth, 1.75^{mm}; length of fore femora, 2^{mm}; tibiæ, 1.6^{mm}; tarsi, 1.1^{mm}; middle femora, 4.25–6^{mm}; tibiæ, 4 3^{mm}; tarsi, 2+^{mm}; hind femora, 3.5–5.5^{mm}; tibiæ, 4^{mm}.

Florissant. Three specimens, of which one is immature, Nos. 5525, 10723, 12782.

Family REDUVIIDÆ Stephens.

This family, to which so considerable a share of our north temperate bugs belongs, is represented in the European Tertiaries by a number of species and genera belonging to no less than five different subfamilies. All the genera are modern types. The Reduviina are the more common, Harpactor having six species at Oeningen and Radoboj, Evagoras one at Oeningen, while species of Reduvius (in a broad sense) are mentioned as occurring at Aix and in amber; the Piratina are represented by a Pirates at Radoboj; the Acanthaspidina by a Platymeris in amber; the Stenopodina by two species of Stenopoda at Oeningen, and the Ploëariina by a Ploiaria said to occur at Aix.

Curiously enough, the family is very meagerly displayed at present in the American Tertiaries. At my first examination many species were placed here provisionally which a closer study showed to belong elsewhere; and even the "Reduvius" described from the Green River beds belongs, as I have elsewhere shown, rather to the Corizida. There remain only a couple of forms at Florissant, each known only by a single specimen, to represent this great family. One belongs to the Acanthaspidina, but shows no affinity to the single member of this group known from amber, the other to the Saicina, and both must be referred to extinct genera, in direct and complete opposition to the European Tertiary Reduviidæ as we know them to-day.

Subfamily ACANTHASPIDINA Stal.

The only species hitherto found fossil in this subfamily group is one described many years ago as a Platymeris by Germar, and was found in Prussian amber. The one given below is the first from the rocks.

EOTHES gen. nov. (ἠώθω).

A genus of Acanthaspidina of unusually slender form. Head only a little longer than broad, the eyes of moderate size and prominent, the part in front of them about twice as long as the postocular part, the front truncate and slightly emarginate; ocelli large, situated opposite the hinder edge of the eyes, separated only by their own diameter or slightly more than that. Antennæ apparently seated on small prominences somewhat in advance of the eyes, the prominences with a small exterior spine; first joint longest, longer than the width of the thorax, second and third joints subequal, and a little slenderer and shorter than the scarcely incrassated terminal joint, the whole nearly two-thirds as long as the body. Thorax as a whole cuneiform, tapering forward regularly but not strongly, the sides almost straight, the tapering portion scarcely shorter than its breadth, unarmed; scutellum very tapering, pointed, but hardly produced into a spine. Legs long and slender, wholly unarmed, similar in form to those of Opsicœtus, the first hind tarsal joint nearly twice as long as the second and third together. Hemelytra slender, with no prominent veins, the corium elongated externally, the membranal suture very oblique and sinuous.

Apparently nearest to Opsicœtus Klug, this genus differs from it in its much slenderer form, the want of a strongly constricted neck, and the stoutness of the terminal joints of the antennæ; the structure of the tarsi is also peculiar.

A single species is known.

EOTHES ELEGANS.

Pl. 26, Fig. 5.

The whole body is dark, but is marked laterally by a black stripe which follows the outer margin of the thorax viewed from above, from the base of the hemelytra forward, and appears to cross also the head, following the inner margin of the eye and terminating on the front, the whole tolerably straight and continuous, with a slight angle in passing from the

thorax to the head; besides this the disk of the thorax is darker, leaving of a lighter color nearly the whole anterior lobe and the outer posterior angles within the black stripe, and the whole thorax is rather distantly and heavily punctate with black; the scutellum is also light colored, narrowly margined with blackish on all sides, but heavily in the lateral angles. The hemelytra have the corium dusky and the membrane fuliginous, the former with the veins punctate in black. Legs pale and uniform, except that the tips of the tibiæ and the tarsi are dusky; these are also clothed with excessively fine hairs.

Length of body, 10.15^{mm}; breadth of thorax in front, 1.08^{mm}; at greatest, 1.75^{mm}; of abdomen, 2.25^{mm}; length of antennæ, 5.6^{mm}; their apical joint, 1.55^{mm}; fore femora, 2.65^{mm}; middle femora, 2.75^{mm}; hind femora, 3.4^{mm}; hind tibiæ, 4.45^{mm}; tarsi, 1.45^{mm}; first tarsal joint, 0.9^{mm}.

Florissant. One specimen, No. 12469.

Subfamily SAICINA Stål.

The species described below is the only one of this subfamily which has ever been recognized in a fossil state.

TAGALODES gen. nov. (Tagalis, nom. gen.).

Body elongated, of nearly uniform width. Head, including the eyes, considerably broader than long, advanced considerably and rather broadly in front of the eyes; no ocelli; rostrum considerably longer than the head, the basal joint longer than the two subequal apical joints. Thorax rapidly tapering in front, the head separated from it by a short constricted neck, broadest posteriorly and slightly broader than the abdomen, and here angulate, the angle not produced laterally as a spine; scutellum triangular, of about equal length and breadth, the posterior angle more acute than the others by the slight emargination of the sides, but not produced into a spine nor even pointed. Legs long and slender, unarmed, the femora and tibiæ of nearly equal length, those of the hind legs much longer than the others, all the tarsi very short, very slender, cylindrical, armed with a pair of claws.

A single species is known.

Allied to Tagalis Stal, from which it differs in the relative brevity of the thorax and the absence of any median constriction, the simple angular posterior termination of the scutellum, the absence of spinulation on the fore

femora, and the cylindrical character of the tarsal joints. Tagalis is known to me only by Stal's description.

Tagalodes inermis.

Pl. 26, Fig. 15.

A single specimen is preserved, seen on a dorsal view with the wings of one side lost, of the other partially expanded. The head and thorax are very dark and uniform, the hemelytra with the corium, like the abdomen, dark testaceous, the membrane pale fuliginous; the veins of the membrane show a pair of very elongated parallel loops running more than half way to the margin, the upper the broader and more distinct (the lower not shown on the plate). Lateral edges of the scutellum slightly marginate, the scutellum itself with faint transverse sulcations; surface of the thorax slightly and broadly rugulose. Legs pale testaceous, the femora duskier toward the apex.

Length of body, 11.75^{mm}; breadth, 3.1^{mm}; length of hemelytra, 7^{mm}; middle femora, 4^{mm}; tibiæ, 4^{mm}; tarsi, 1^{mm}; hind tibiæ, 5.8^{mm}.

Florissant. One specimen, No. 2696.

Family TINGIDIDÆ Fieber.

Nearly all the principal European Tertiary deposits have furnished a single, but only a single, species of this family of delicate Hemiptera. That at Aix is only known as yet by Serres's reference to a species of Tingis, which he compares to T. cardui, now placed in Phyllontocheila. Novák figures a species of Monanthia from Krottensee, Heer a very obscure Tingis from Radoboj, and a species from Oeningen, well marked with long antennæ, in one place as a Tingis, in another as a Monanthia, which is more correctly referable to the latter; but what is of greater interest is an amber species referred to Tingis by Germar which belongs to the genus Eotingis established below for a Florissant species, with exceptionally long antennæ. A species of Monanthia also occurs at Florissant, apparently nearly related to the Oeningen form but with stouter antennæ, and an obscure form from the same locality is probably referable to Piesma.

PIESMA St. Fargeau and Serville.

No fossils have heretofore been referred to this genus, which forms a group apart among the Tingididæ, and which is better known in the Old

World (Europe and Africa) than in the New, but a single specimen from Florissant seems to be referable here better than elsewhere.

PIESMA? ROTUNDA.

Pl. 23, Fig. 6.

A single insect, poorly preserved, and showing a dorsal view is dubiously referred here; if correctly, then the extreme convexity of the costal area of the hemelytra is characteristic of the species, as I find no modern type with so rotund a form. The head projects considerably in front of the eyes in two parallel processes nearly as long as the rest of the head; the head is only a little narrower than the quadrangular thorax, which is nearly a third broader than long and tapers slightly forward. The abdomen is subcircular. The legs and head appendages are not preserved, but the hemelytra slightly surpass the abdomen, and the membrane, which occupies about a third of them, is filled with very faint and very large cells, through the meshes of which three or four oblique veins pass to the margin; the costal margin is followed immediately by a slight vein connected with the costa by feeble cross-veins, making subquadrate cells.

Length of body, 3.5^{mm}; including hemelytra, 3.75^{mm}; breadth of thorax, 1^{mm}; abdomen, 1.65^{mm}.

Florissant. One specimen, No. 7617.

MONANTHIA St. Fargeau and Serville.

As stated under the family, two species of this genus have been found in the European Tertiaries, one at Oeningen and the other at Krottensee, and were so referred by their describers. They differ considerably from one another, and the species we add here differs as much from each as they from each other. The characteristic features of the Oeningen species are the long antennæ, which are as long as the width of the closed hemelytra, and the very narrow head; of the Krottensee species (which seems to approach M. quadrimaculata Wolff sp. and M. wolffii Fieb., both of Europe; see the figures by Snellen), the sinuous costal margin of the hemelytra and the sinuous narrowing of the thorax; and of the Florissant species the at first biseriate, afterwards triseriate, arrangement of the reticulation of the costal area, and the tumid form of the regularly tapering thorax combined with the broad head.

MONANTHIA VETERNA.

Pl. 23, Figs. 5, 9.

Body uniformly dark, the head and thorax with much the same form as Eotingis, the thorax being largest just in advance of the rounded base and tapering forward, the head included, giving it much the form of a Xya among Orthoptera; as in Eotingis, there are no lateral vesicles: the abdomen is ovate and broader than the thorax. Antennæ nearly as long as the width of the abdomen, or slightly shorter than the head and thorax together: first two joints similar and stout, the first a little longer than broad, the second of equal length and breadth, the third slender and elongated, nearly as long as the thorax, the fourth clavate, as long as the first two together, but not quite so stout as they and as naked as the rest of the antenna. Legs rather short and stout, the hind femora just reaching the edge of the hemelytra. These extend somewhat beyond the abdomen and are somewhat coarsely reticulate, biseriately arranged on the basal half of the costal area, triseriately beyond.

Length of body, 2.7–3^{mm}; breadth of thorax, 1^{mm}; abdomen, 1.2–1.4^{mm}; length of antennæ, 1.15^{mm}.

Florissant Six specimens, Nos. 2349, 3881, 4387, 6787, 7819, 9672.

EOTINGIS gen. nov. (ἠώς, Tingis, nom. gen.).

Head triangular, about equally long and broad; antennæ of excessive length, almost as long as the body and very slender, the great length largely due to the prolongation of the middle joints, the last joint very delicately enlarged so as to be faintly clavate, the club very long and slender. The pronotum is short, narrowest in front where it equals the head, truncate both at base and apex. Thorax tapering forward with no vesicular enlargements. Abdomen oval. Legs very long and slender, all the femora of nearly equal length, the tibiæ of similar length, the whole leg nearly as long as the tegmina. These are broad and very long, extending well beyond the body, irregularly and more or less finely and uniformly reticulate throughout, the broad costal area as irregular as elsewhere.

The genus perhaps falls in the neighborhood of Gargaphia Stal.

Two species are known, one found in Prussian amber, E. quinquecarinata Germ. sp., with carinate and regularly tapering pronotum and the cos-

tal area of the hemelytra of uniform width; and the species described below from Florissant with smooth and tumid pronotum and the costal area of the hemelytra enlarging apically. They differ also in the length of the last antennal joint.

Eotingis antennata.

Pl. 23, Figs. 1, 3.

Two specimens, both figured, were all that were seen of this species when it was described; one shows a dorsal view, the other lies more upon its side; of the former the median projection in front of the head, shown upon the plate, is a mistake, and the two appendages can not be regarded as antennæ, a portion of one of which crosses the right fore femur; the right-hand apparent appendage of the head is probably the rostrum, but its apparent distal half is a mere discoloration of the stone at a different level; the left hand one is probably the left fore femur, a broken fragment of which or of a tibia appears as if attached below to the pronotum. The color appears to be uniformly dark, the legs perhaps a little paler. The last antennal joint is as long as the elongated middle joints, but it enlarges gradually toward the tip, and then, at a distance from the tip of twice its breadth, suddenly diminishes and is rounded off. The prothorax is largest a little behind the middle, and tapers considerably in front, being tumid whether viewed laterally or from above, but especially the former; it is well rounded posteriorly, truncate anteriorly, and smooth. The hemelytra extend far beyond the abdomen, and are filled with an entirely irregular reticulation, in which the meshes are approximately of the same size and of about the diameter of the antennal club; the longitudinal vein delimiting the costal area runs parallel to and distant from the costal margin in the basal half of the hemelytra, and then diverges gradually from it in a graceful curve.

Length of body, 3.65^{mm}; including tegmina, 4.5^{mm}; of tegmina, 3.75^{mm}; breadth of thorax, 1.1^{mm}; length of antennæ, 3.75^{mm}; hind femora, 1.25^{mm}.

Florissant. Four specimens, Nos. 2698, 4365, 5596, 10763.

Family ACANTHIIDÆ Leach.

The only fossil that has ever been referred to this limited group is the one described below.

LYCTOCORIS Hahn.

This genus, found in the north temperate regions of both the Old and New Worlds, but more abundant in the latter, has not before been found fossil. The single species from the Green River beds which we place here was formerly referred, doubtfully, to Rhyparochromus.

Lyctocoris terreus.

Pl. 7, Fig. 20.

Rhyparochromus? terreus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 770–771 (1878).

A single poor specimen apparently belongs to this subfamily, but is too imperfect to locate with any precision. The body is of nearly equal width, but with a full abdomen. The head is broken, but is as broad at base as the tip of the thorax, has a rounded-angular front, and its surface most minutely punctulate. The thorax was broadest behind, the sides tapering slightly, and gently convex, the front border broadly and shallowly concave, the hind border straight, more than twice as broad as the median length, the surface, like that of the head, with faint distant punctures. Scutellum rather small, triangular, pointed, of equal length and breadth, about as long as the thorax, its surface like that of the thorax, but with more distinct punctures. Abdomen full, well rounded, and very regular. Tegmina obscure (but perhaps extending only a little beyond the scutellum).

Length of body, 4^{mm}; of head, 0.6^{mm}; of thorax, 0.6^{mm}; of scutellum, 0.7^{mm}; breadth of head, 1.1^{mm}; of thorax, 1.5^{mm}; of abdomen, 2.1^{mm}.

Green River, Wyoming. One specimen, No. 4192.

Family CAPSIDÆ Westwood.

With the exception of a Miris, reported over half a century ago from Aix and never yet described, all the European fossils of this group known up to the present time are from amber. Thus Gravenhorst long ago referred half a dozen species from amber to Miris and Capsus, and Germar later described as many as thirteen species of Phytocoris from the same deposits. These genera were then used in a far broader sense than now, and the figures of Germar show at once that several genera are to be found among

them. If we were to base our judgment on the comparisons with the modern species which Gravenhorst and Germar in nearly every case instituted, we should reach the conclusion that the Capsina alone had been found, and that no less than half the divisions which Reuter founded in this subfamily were present and a large number of genera. Thus of the Plagiognatharia we have Harpocera; of the Oncotylaria, Hoplomachus (two species) and Oncotylus; of the Cyllocoraria, Etorhinus and Systellonotus; of the Capsaria, Capsus, Orthops, and Lygus; of the Phytocoraria, Homodemus, Dichrooscytus, and Phytocoris; and of the Loparia, Lopus; in all a dozen genera, and there is at least one other among those species figured by Germar which were unaccompanied by comparisons with modern types.

In America we have four of these divisions represented, viz: Cyllocoraria by Closterocoris; Capsaria by Capsus (two species) and Pœcilocapsus (five species); Phytocoraria by Aporema; and Loparia by Hadronema; while Bryocoraria, not recognized in amber, is represented by two species of Carnelus and one of Fuscus. All of these come from Florissant.

It thus appears that we may recognize among the fossils every one of the divisions instituted in the family by Reuter that have any considerable present development of species, excepting only the Miraria, and to cover the possibilities of this also there are two species of Miris not referred to modern genera, one mentioned by Gravenhorst from amber and one by Curtis at Aix. It may also be noticed that the assemblage of fossil forms shows as a whole a leaning toward American types, more noticeable, however, among the American than the European forms, the more striking being in the development of the Loparia and Bryocoraria. Not too much stress, however, should here be placed upon these considerations, as a reexamination of the amber types is necessary before certain conclusions can be drawn, and the affinities of several of the Florissant forms is vague at the best.

CLOSTEROCORIS Uhler.

A single species exists in a living state in our western Territories, with which a single striking and not uncommon Florissant species agrees well in structure but from which it differs considerably in markings. The terminal joints of the fossil species appear to be relatively longer and the second joint relatively shorter than in the existing type.

CLOSTEROCORIS ELEGANS.

Pl. 24, Fig. 7.

Head subquadrate, light colored, with a black patch posteriorly next the eyes. Antennæ with the first joint black, as long as the thorax, stouter than the tibiæ, the remaining joints blackish fuscous, the apical paler, second joint half as long as the hemelytra, third a little longer than the fourth, and with it nearly as long as the first two, the whole as long as thorax and hemelytra combined. Thorax more tumid at the base than in our living C. ornatus, but otherwise of the same shape, the base slightly more than twice as broad as the apex, pale, with a median and on each side a lateral, broad, deep black stripe, broadening posteriorly; scutellum pale, except for a broad, dusky transverse band at base. Hemelytra pale, except a slender, deep black, costal stripe extending the whole length of the corium, and a dark fuscous belt which occupies the whole clavus and, as that of one side unites with the other, follows down the inner margin of the hemelytra, fading out on the more or less but generally slightly infumated membrane, the membranal suture sometimes heavily infumated or infuscated. Legs pale fuscous, the tips of the hind femora and to a less extent the bases of the hind tibiæ broadly and heavily obscured, as are also to a less depth all the tarsi and the tips of the tibiæ.

Length of body and closed hemelytra, 7.25^{mm}; breadth of thorax at base, 2.4^{mm}; length of antennæ, 9.7^{mm}; first joint, 1.5^{mm}; second joint, 3.5^{mm}; third joint, 2.5^{mm}; fourth joint, 2.2^{mm}; hemelytra, 6.75^{mm}; hind femora, 3.65^{mm}; tibiæ, 4.85^{mm}; tarsi, 1.15^{mm}.

Florissant. Eight specimens, Nos. 2181, 2533, 4288 and 4369, 8864, 12979, 12981, 14202, 16419.

CARMELUS Distant.

The two species from Florissant described below agree so well in general features with the two species of this genus from Panama figured by Distant, and especially with C. parvus, that I place them here, though they do not agree with his descriptions as regards the antennæ, the second joint being relatively longer than he describes it, though no longer than given in both his figures. They are certainly not far removed from Phytocoris involutus Germ. from amber.

Table of the species of Carmelus.

Thorax tapering regularly with straight oblique sides ..... 1. *C. gravatus*
Thorax more or less tumid, the tapering sides distinctly convex ..... 2. *C. sepositus.*

1. Carmelus gravatus.

Pl. 24, Fig. 10.

Body very regularly oval, the hinder extremity the broader. Head triangularly but rather broadly produced in front of the eyes; first joint of antennæ a little shorter than the head, second about two and a half times as long as the first, the succeeding together as long as the second. Thorax uniform fuscous, darker or lighter in tone, the surface smooth, the base about two and a half times broader than the apex, the apex roundly and weakly emarginate, the base gently and regularly convex, the sides oblique and straight. Scutellum dark, the lateral edges transversely pectinate. Hemelytra uniformly dusky except for a deeper tint at the outer extremities of the clavus and cuneus.

Length, 5^{mm}; breadth, 2.25^{mm}.

Florissant. Eight specimens, Nos. 3669, 5300, 6220, 10418, 11230, 12457, 12475, 14208.

2. Carmelus sepositus.

Pl. 24, Fig. 6.

Body ovate, larger at the anterior than at the posterior end or of equal size. Head scarcely advanced in front of the eyes, broadly rounded: first joint of antennæ about as long as the head, the second about two and a half times longer than the first, the succeeding together as long as the second. Thorax uniformly dark, the surface smooth, the base two and a half times as broad as the apex, the apex gently, regularly, and roundly emarginate, the base very gently convex, almost transverse, the oblique and narrowing sides distinctly, sometimes considerably, convex, giving a roundness to the front of the body. Scutellum dark. Hemelytra dark, slightly duskier at the outer extremities of the corium and cuneus, the membrane faintly fuliginous.

Length, 5 5^{mm}; breadth, 2.2^{mm}.

Florissant. Three specimens, Nos. 8206, 11017 and 13558, 12103.

FUSCUS Distant.

To this genus, founded on a species from Guatemala, I refer with much hesitation a single form from Florissant, which bears a close general resemblance to the species I have placed in Carmelus, but has much shorter and

stouter hind legs. The first joint of the antennæ of the fossil, however, is stouter than in Fuscus and the second joint not so distinctly incrassated at the apex.

Fuscus? fœcatus.

Pl. 22, Fig. 5.

Head rather broadly angulate in front; first joint of antennæ distinctly shorter than the head, moderately stout and uniform; the second joint relatively slender, scarcely larger apically, about three times longer than the first. Rostrum reaching the coxæ of middle legs. Thorax punctate, blackish fuscous, posteriorly two or two and a half times as broad as anteriorly, both base and apex nearly truncate, the sides oblique, straight. Scutellum of the color of the thorax. Hemelytra dark, the color intensified along the inner margin of the clavus and at the outer extremities of the corium and cuneus. Legs dusky, the hind femora stout, twice as thick as the tibiæ and shorter than they.

Length, 6^{mm}; breadth, 2.25^{mm}.

Florissant. Five specimens, Nos. 430, 4563, 4741, 13308, 14201.

PŒCILOCAPSUS Reuter.

This genus, fairly rich in species in both the United States and Mexico, and peculiar to the New World, appears to be represented at Florissant by five tolerably closely allied species, which bear no close resemblance to any of the amber Capsidæ. The first antennal joint in all is of a similar, the second of a somewhat dissimilar, length.

Table of the species of Pœcilocapsus.

Narrowing sides of thorax convex; second joint of antennæ twice or a little more than twice as long as the first.
- Thorax smooth; tegmina heavily marked; clavus obscure ..... 1. *P. fremontii.*
- Thorax punctate; tegmina faintly marked; clavus clear ..... 2. *P. reterandus.*

Narrowing sides of thorax straight; second joint of antennæ much less or much more than twice as long as the first.
- Second joint of antennæ scarcely half as long again as the first ..... 3. *P. reternosus.*
- Second joint of antennæ three times as long as the first.
  - Thorax smooth; scutellum sharply angled ..... 4. *P. tabidus.*
  - Thorax punctate; scutellum roundly angled ..... 5. *P. ostentus.*

1. Pœcilocapsus fremontii.

Pl. 24, Fig. 3.

An elegant and well marked species not distantly related to P. ornatulus (Stal) of Mexico, but differing in the markings and in the uniform thorax.

Head uniformly dark, the sides of the frontal prominence full; basal joint of antennæ barely shorter than the head, rather slender, a little thickened apically; second joint about two and a quarter times longer than the basal joint, scarcely incrassated apically, the slender succeeding joints together about as long as the second. Thorax more than twice as broad at base as at apex, the apex emarginate, the base regularly arcuate, the tapering sides distinctly though not strongly convex, the whole blackish infumate, and smooth, in no way punctate, which is exceptional in Pœcilocapsus. Scutellum pale with a black edging. Hemelytra pale or light colored, with the whole of the clavus black, a large, transverse, fuliginous cloud at the outer extremity of the corium crossing the interior half of the hemelytra as a narrow and vague stripe, and again enlarging, but more obscurely, at the inner termination of the corium, and accompanied by a much smaller infuscation of the outer tip of the cuneus.

Length of body, 6.75^{mm}; breadth of thorax, 2^{mm}; length of second antennal joint, 1.7^{mm}.

Named for one of the earliest scientific explorers of the Rocky Mountains, Gen. John C. Frémont.

Florissant. Five specimens, Nos. 8631, 9500, 12284, 13554, and of the Princeton Collection, 1.845.

2. Pœcilocapsus veterandus.

Pl. 24, Fig. 9.

Head but slightly produced in front of the eyes, dark; basal joint of antennæ distinctly shorter than the head, a little incrassated apically; second twice as long as the first, its greater size distally than proximally scarcely perceptible, the slender succeeding joints not fully preserved on either specimen; rostrum nearly reaching the hind coxæ. Thorax fully two and a half times broader at base than at apex, but otherwise shaped exactly as in P. fremontii, the color blackish fuliginous, the surface punctate with moderately distant minute black dots. Scutellum of the color of the thorax. Hemelytra pallid throughout but the inner edge infuscated, and slight infumated spots at the outer tip of the corium and cuneus.

Length of body, 5.8^{mm}; breadth of thorax, 2.1^{mm}; length of second antennal joint, 1.45^{mm}.

Florissant. Three specimens, Nos. 8648, 8849, 11785 and 12076.

3. Pœcilocapsus veternosus.

This species closely resembles P. fremontii, but differs somewhat in markings and much in the form of the thorax and the length of the second antennal joint. The head, which is dark, is rather acutely produced in front of the eyes; basal joint of antennæ almost as long as the head and moderately stout, the second a little slenderer, slightly larger distally than proximally, exceptionally short, being scarcely half as long again as the first joint, the succeeding joints about equal and together as long as the second. Thorax fully two and a half times as broad at base as at apex, the apex roundly and shallowly emarginate, the base regularly and gently convex, the sides oblique and straight, the surface a little irregular but impunctate as in P. fremontii, somewhat obscurely mottled, dark colors prevailing posteriorly, paler anteriorly. Scutellum generally pale but with both extreme base and apex more or less infuscated, the sides transversely pectinate. Hemelytra marked as in P. fremontii, but much less heavily and in particular the clavus less obscure.

Length of body, 5.8^{mm}; breadth of thorax, 2.35^{mm}; length of second antennal joint, 1.1^{mm}.

Florissant. Two specimens, Nos. 2107, 8113.

4. Pœcilocapsus tabidus.

Pl. 24, Fig. 8.

A single specimen represents this species, not so well preserved as the others. The head is large, the part in front of the eyes exceptionally large, well produced, and with a broad rounded apex; first joint of antennæ moderately slender, equal, a little shorter than the head; the second joint exceptionally long, being almost or quite three times as long as the first, slender, and equal throughout; third joint half as long as second. Thorax less than twice as broad at apex as at base, anteriorly truncate, posteriorly gently and regularly convex, the sides oblique and straight, the surface smooth, without punctures, more or less mottled and infuscated, as is also the scutellum, which, however, is more uniformly infuscated or infumate, and has a sharp, apical angle. Hemelytra nearly pallid, but with the clavus more or less obscure, and the outer apex of corium and cuneus each with a small, distinct, triangular, fuscous spot.

Length of body, 5mm; breadth of thorax, 2mm; length of second antennal joint, 2mm.

Florissant. Three specimens, Nos. 6968, 9730, 10592.

5. Pœcilocapsus ostentus.

Pl. 24, Fig. 2.

The head is short and rounded, but very little produced in front of the eyes; first joint of antennæ slender but short, no longer than the head, which it surpasses only a little; second fully three times as long as the first, slender and equal; third two-thirds as long as second. Thorax fully twice as broad at apex as at base, anteriorly emarginate, posteriorly scarcely convex, the sides very oblique and straight; it is as long as the scutellum, delicately punctate, and blackish. Scutellum of a similar color, its apical angle rounded. Hemelytra obscure and indistinct, but apparently darker at apex than at base.

Length of body, 6.3mm; breadth of thorax, 2.25mm; length of second antennal joint, 1.3mm.

Florissant. One specimen, No. 13560. No. 7911 may also belong here, and if so the hemelytra are marked very much as in the preceding species.

CAPSUS Fabricius.

This genus (in an extended sense) has been recognized in amber by Berendt and Gravenhorst, but no fossil species have been described. The species described below are placed here dubiously, at least as regards the sense in which the genus is now ordinarily restricted. Each has a very very short thorax, similarly formed.

Table of the species of Capsus.

Less than five millimeters in length. First antennal joint scarcely broader than the second.
1. *C. obsolefactus.*

More than six millimeters in length. First antennal joint half as broad again as the second.
2. *C. lacus.*

1. Capsus obsolefactus.

Pl. 23, Fig. 13.

Head small, considerably and triangularly produced in front of the eyes, where it is angulate; first joint of antennæ slender, of about the length of the head, the second fully twice as long as the first, slender, and

nearly equal, the following subequal and together longer than the second. Thorax very faintly and distantly punctate, short, truncate in front and behind, or somewhat emarginate in front, the base more than twice the breadth of the apex, the sides oblique and nearly straight; scutellum moderately large. Legs slender but not very long. Hemelytra fuscous like the body, the membrane small and pale fuliginous.

Length, 4.75^{mm}; breadth, 2^{mm}.

Florissant. Three specimens, Nos. 851, 3480, 4500.

2. Capsus lacus.

Pl. 22, Fig. 2.

Head small, roundly and not very strongly produced in front of the eyes; first joint of antennæ rather stout, nearly or quite as long as the head, the second much slenderer, equal, as far as preserved nearly twice as long as the first. Thorax very obscurely punctate, truncate at either extremity or a little and roundly emarginate in front, the base more than twice, probably two and a half times, broader than the apex, the sides strongly oblique and straight. Legs rather stout and not long.

Length, 6.5^{mm}; breadth, 2.5^{mm}.

Florissant. One specimen, No. 128.

APOREMA gen. nov. (ἀπόρημα).

I am unable to decide upon the precise position of the insect here concerned, though it appears to belong in or near the Phytocoraria. The head, which has been uncovered since the plate was engraved, is less than half as broad as the thorax, but more than twice as broad as long, and thus exceptionally small. The thorax, about twice as broad as long, is posteriorly truncate, while the front narrows rapidly but with a rounded curve to the narrow neck; it is not carinate. The scutellum is of large size, equiangular, with perfectly straight sides. The tegmina are slender, with gently convex costa, the apical margin oblique, but the neuration can be made out in the single specimen known neither here nor in the wings. The hind legs are rather long and slender, the femora extending far beyond the sides of the body and apparently as long as the breadth of the base of the abdomen, the tibiæ still longer with a row of very short and inconspicuous

distant spines. Abdomen ovate, constricted at the base, rather broadly rounded, and not produced apically.

A single species is known.

Aporema præstrictum.

Pl. 20, Fig. 4.

The body is of a dark and tolerably uniform color. The surfaces of the thorax and scutellum are smooth, but the edges of the latter transversely wrinkled. The hemelytra are light colored or pallid, with more or less infumated costal edge, which expands into an infumated spot at the tip of the corium and of the cuneus, in the former case large, in the latter small; the inner margin is scarcely infumated and the membrane clear. Legs blackish.

Length, 6.5^{mm}; breadth of thorax, 2.65^{mm}; abdomen, 2.85^{mm}; length of hind tibiæ, 2.5^{mm}.

Florissant. One specimen, No. 9900.

HADRONEMA Uhler.

This genus so far as known is represented by a single species, found in the Rocky Mountain region and in Mexico. The larger species here added to it appears to agree better with it than with any other with which I have been able to compare it, though it is doubtful whether it really belongs here.

Hadronema cinerescens.

Pl. 24, Fig. 12.

Head small and rounded, scarcely at all advanced in front of the eyes, uniformly scabrous; first joint of antennæ moderately stout, not more than half as long as the head, the second slender, slightly incrassated in the apical half or less, less than three times as long as the first joint, the third about two-thirds as long as the second. Thorax scabrous like the head, truncate at each extremity, less than twice as broad at base as at apex, the oblique sides gently arcuate, the color of the head and thorax uniform black. Hemelytra not well preserved, the legs moderately slender, stouter and shorter than in the modern H. militaris Uhl.

Length, 6.6^{mm}; breadth, 2^{mm}.

Florissant. Two specimens, Nos. 2980, 13559.

Family PHYSAPODES Duméril.

These minute flower insects have been found in considerable numbers in Tertiary deposits. Aix, Oeningen, Rott, and amber have each yielded more than one species of Thrips, fifteen in all, of which nearly half come from Rott. Besides this Rott has furnished four species of Heliothrips and one of Phlœothrips, while an extinct genus Calothrips is represented at Aix by a single species. In our own country they have been detected only in the White River beds, where one species each of the genera Melanothrips, Lithadothrips, and Palæothrips have been found and are described below; the last two of the genera are extinct.

MELANOTHRIPS Haliday.

The only species of this genus that has been found fossil is the one described below. So far as I know Melanothrips has not been observed this country among recent insects, but only in Europe; but so little in attention has been paid to our native species of Physapodes that this is of little significance.

Melanothrips extincta.

Pl. 5, Figs. 90, 91.

Melanothrips extincta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., 1, 221 (1875).

Head small, tapering; the only appendages visible are the antennæ; these are only sufficiently preserved to recognize that they are very long and slender, longer than the thorax. The thorax is rather small, quadrate; wings nearly as long as the body, fringed on the costal border as in Palæothrips fossilis. The abdomen is composed of only eight joints, but is very long and very tapering, fusiform, the last joint produced, as usual in the physapods: the third joint is the broadest; of the wings only the costal border and a part of one of the longitudinal veins can be seen; there are no remains of legs.

Length of body, 2.2^{mm}; of antennæ, 0.8^{mm}; of head, 0.14^{mm}; of thorax, 0.5^{mm}; of abdomen, 1.56^{mm}; greatest breadth of abdomen, 0.5^{mm}.

Chagrin Valley, White River, Colorado. One specimen, W. Denton.

LITHADOTHRIPS Scudder (λιθάς, θρίψ).

Lithadothrips Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., 1, 221 (1875).

Allied to Melanothrips Haliday. The head is large, broad, globose; the eyes exceedingly large, globose, each occupying on a superior view fully one-third of the head; the antennæ very slender, equal, as long as the thorax, the joints eight or nine in number, cylindrical, equal, scarcely enlarging toward their tips. The prothorax is no larger than the head, of equal breadth with it, the whole thorax shaped as in Palæothrips. Only fragments of the wings remain, sufficient to render it probable that they agree well with the character of the group to which Melanothrips and Æolothrips belong. The legs resemble those of Palæothrips, but are slender and appear to be rather profusely supplied with hairs. The abdomen differs considerably in the two specimens referred to this genus. In one it is very broadly fusiform, the tip a little produced, nine joints visible, the apical furnished with a few hairs, and bluntly rounded at the tip; the other has the sides equal, the apex not at all produced, but very broadly rounded, only seven or eight joints vaguely definable.

A single species is known.

LITHADOTHRIPS VETUSTA.

Pl. 5, Figs. 88, 89, 102, 103.

Lithadothrips vetusta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., I, 222 (1875).

The specimens, both of which represent the upper surface of the body with fragments and vague impressions of the members, are too poorly preserved to add anything to the above description of their generic features excepting the following measurements:

First specimen: Length of body, 1.76^{mm}; of antennæ, 0.6^{mm}; of thorax, 0.6^{mm}; of abdomen, 0.87^{mm}; breadth of head, 0.28^{mm}; of thorax, 0.52^{mm}; of abdomen, 0.56^{mm}; length of fore femora, 0.37^{mm}?; breadth of same, 0.14^{mm}; length of hind femora, 0.42^{mm}; breadth of same, 0.13^{mm}.

Second specimen: Length of body, 1.96^{mm}; of antennæ, 0.76^{mm}; of thorax, 0.56^{mm}; of abdomen, 1.10^{mm}; breadth of head, 0.35^{mm}; of thorax, 0.59^{mm}; of abdomen, 0.59^{mm}.

Fossil Cañon, White River, Utah. Two specimens, W. Denton.

Palæothrips Scudder (παλαιός, Θρίψ).

Palæothrips Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., I, 222 (1875).

This genus is allied to Æolothrips Haliday. The head is small, globose; eyes rounded, much smaller than in Lithadothrips; antennæ slender, fully as long as the thorax, not more than seven-jointed, the joints cylindrical, subequal. Prothorax considerably larger than the head, the thorax as a whole very large, stout, and tumid; fore femora very stout, scarcely more than twice as long as broad; fore tibiæ also stout, a little longer than the femora; the other legs are moderately stout, long, reaching beyond the tip of the abdomen, with a few scattered rather short spinous hairs; the hind tarsi three-jointed, the last joint smaller than the others and all together two-sevenths the length of the tibiæ. Fore wings unusually broad, broadest apically, where their breadth more than equals one-fourth of their entire length, provided with two longitudinal veins, dividing the disk into three nearly equal portions, connected in the middle by a cross-vein, and with either border by other cross-veins at about one-third and two-thirds the distance from the base to the tip of the wing: the wing is heavily fringed, especially along the hind border. Hind wings veinless, nearly as long, and at the tip nearly as broad, as the fore wings. Abdomen nine-jointed, half as long again as the thorax, rather tumid, scarcely or not at all produced apically.

Palæothrips fossilis.

Pl. 5, Figs. 104, 105, 115.

Palæothrips fossilis Scudd., Proc. Bost. Soc. Nat. Hist., XI, 117—name only (1867); Bull. U. S. Geol Geogr. Surv. Terr., I, 222-223 (1875); in Zittel, Handb. d. Palæont., I, ii, 784, Fig. 999 (1885).

Head small, tapering a little in front, where, however, it is broadly rounded. The antennæ are certainly seven-jointed, and none of the apical joints show any indication of being connate, the last joint being of the same length as the two preceding it, tapering, and bluntly pointed; none of the joints show any enlargement in the middle, but the middle joints are slightly larger at the distal extremity than at the base; they appear to be destitute of hairs. The prothorax is subquadrate, a little broader than long, with rounded sides; the fore femora are unusually stout, as long as the width of the prothorax. The longitudinal veins of the fore wings approach each other somewhat abruptly in the middle, where they are united by a cross-

vein, and at the tip of the wing they curve away from each other; the two cross-veins on the lower third of the wing are respectively slightly farther from the base of the wing than the corresponding veins of the upper third; the fringe on the posterior border is largest near the tip of the wing, where the hairs are about three times as long as those on the costal border. The first hind tarsal joint is scarcely longer than broad, cylindrical; the second of about the same length but decidedly broader at apex than at base; the apical joint is nearly globular, smallest at base, as large in the middle as the base of the other joints. There are a few hairs at the tip of the abdomen and a few short ones on the hind tibiæ; the apical ones stouter than the others, resembling spines; but the insect appears to have been unusually destitute of hairs, excepting on the wings, where not only the edges but also all the veins are fringed.

Length of body, 1.6–1.8^{mm}; of antennæ, 0.58^{mm}; of fore femora, 0.32^{mm}; breadth of same, 0.14^{mm}; length of fore tibiæ, 0.32^{mm}; of hind femora, 0.38^{mm}; breadth of same, 0.11^{mm}; length of hind tibiæ, 0.42^{mm}; of hind tarsi, 0.12^{mm}; of fore wings, 1.4^{mm}; of hind wings, 1.27^{mm}; greatest breadth of fore wings, 0.37^{mm}; length of prothorax, 0.16^{mm}; breadth of same, 0.32^{mm}; length of whole thorax, 0.64^{mm}; of abdomen, 0.92^{mm}; greatest breadth of the same, 0.37^{mm}.

Fossil Cañon, White River, Utah. W. Denton.

Family LYGÆIDÆ Westwood.

This family has been recognized in the Secondary rocks by somewhat obscure fragments in England and Germany, but in Tertiary deposits the family is comparatively abundant and widespread. Curiously enough, only two species have been recorded from amber, and in Menge's Collection the family was represented by but one. Three-fourths of the known European species are those described by Heer, who referred them to few genera. It is difficult to place the larger number of those which have been recorded, but to judge in part by the living species with which some of them are compared it is plain that the Myodochina should claim about one-half of them and the Lygæina the larger part of the remainder, the others being distributable among the Cymina, Blissina, and Heterogastrina. In all there are thirty-seven species credited to six genera.

In our own country the numbers are largely in excess of this, fifty-one species being recognized, showing this family to have been one of the more important among Tertiary Heteroptera. The disposition of these in their respective subfamilies has been effected only by their evident affinities in general structure with existing members of these subfamilies, not by a demonstration of those definite characters (mostly relating to the position of the stigmata) upon which these subfamilies were founded, as that would be impossible. The result shows no small resemblance to the characteristics of the European Tertiary fauna, the prevailing type being the Myodochina and the next the Lygæina, but beyond this the resemblance fails to extend greatly, the prevailing family having nearly 73 per cent of the whole, while in Europe they claim scarcely more than 50 per cent; and again the Lygæina have less than 16 per cent of the whole, while in Europe they have about 35 per cent; further, none of the other subfamilies which appear in Europe are found at all in America, our other groups being Geocorina, Oxycarenina, and Pyrrhocorina, which find no place in Europe. But perhaps the most remarkable result of the investigation of the American forms is the large number of new generic types found to be necessary in the Myodochina, where, out of the twenty-one genera only four (with but five species together) are regarded as identical with existing types. In the Old World a single species found at Oeningen has been considered the type of an extinct genus, Cephalocoris, not found with us; but undoubtedly, to judge from the illustrations and descriptions, a more searching examination would bring out a different condition of things. Besides this, Heer has established a magazine genus, Lygæites, for all the members of the family for which he could find no place; it evidently comprises very diverse forms.

Subfamily LYGÆINA Stål.

This group of Lygæidæ holds the second rank among the fossils both in Europe and America, but its relative and absolute importance is greater in the Old World than in the New. In Europe a considerable number of species, ten or eleven, are referred to Lygæus, not including those which plainly do not belong here, but it is probable that only one of the species of Heer's magazine genus Lygæites belongs here, most of the others being more probably Myodochina; to this we may perhaps add his extinct genus Cephalocoris. All of these seem to belong to the division of Lygæaria.

In our own Tertiaries I have referred all the species to the modern genera Lygæus (three) and Nysius (five), the former belonging to the division Lygæaria, the latter to the Orsillaria. The resemblance between the Tertiary Lygæina of Europe and America is therefore not very strong.

LYGÆUS Fabricius.

This old genus having given birth to the family name, a considerable number of fossils have been referred to it. Nine have been described, one each from Aix and Krottensee, two each from Oeningen and Sieblos, and three from Radoboj; Serres also refers to four, and Curtis to one, species of the genus at Aix, and Berendt and Gravenhorst credit the genus to amber. Three of these unnamed forms, however, are compared to certain living species, which show that they can not belong here, and the species from Krottensee, L. mutilus, is certainly not a Lygæus, so that only ten or eleven species at the most, named and unnamed, can be claimed for the European Tertiaries. In America we have three, all found at Florissant.

Table of the species of Lygæus.

Anterior separated from posterior lobe of thorax by a distinct though fine tuberculate ridge. ..... 1. *L. stabilitus.*

Anterior and posterior lobes not distinctly separated.

Thorax distinctly though sparsely punctured ..... 2. *L. obsolescens.*

Thorax smooth ..... 3. *L. faculentus.*

1. LYGÆUS STABILITUS.

Pl. 22, Fig. 10; Pl. 24, Fig. 16.

Head strongly but roundly produced in front of the pretty large eyes, the surface finely rugulose, uniform black-brown, the antennæ uniformly fuscous. Thorax with ampliated lateral margins, which are finely marginate, the front margin considerably, regularly, and roundly emarginate; surface of posterior lobe coarsely, faintly, and distantly punctate, of anterior much like the head, the two separated by a slight indented carina, giving it a tuberculate appearance; the anterior lobe is dark like the head, the posterior paler but obscurely so; the scutellum in color and surface structure is like the head. The hemelytra are dark obscure, with a broad faint band crossing them when closed just beyond the tip of the scutellum, very much as in Dysdercus cinctus of the same beds, which but for the presence of ocelli this species greatly resembles.

Length of body, 8.5–9^{mm}; antennæ, 3.5^{mm}; breadth of thorax, 3^{mm}

Florissant. Three specimens, Nos. 11020 and 11235, 11219, and of the Princeton Collection, Nos. 1.811 and 1.821.

2. Lygæus obsolescens.

Pl. 24, Fig. 15.

Head strongly but roundly produced in front of the large eyes; the surface smooth, uniform; antennæ longer than in the other species, uniformly fuscous. Thorax with nearly straight sides, the anterior outer angles rounded, the front margin regularly, roundly, though not considerably, marginate; surface uniformly, very sparsely and coarsely punctate, the scutellum similar. Color of whole body uniform or nearly so, but with faint signs that the disk of the thorax was lighter than the rest and that a lighter but obscure and narrow band crossed the closed hemelytra and scutellum at the apex of the latter.

Length of body, 10^{mm}; antennæ, 4.5^{mm}; breadth of thorax, 3.5^{mm}.

Florissant. Three specimens, Nos. 421, 10454, 11218.

3. Lygæus fæculentus.

Head but little and roundly produced in front of the eyes, the surface smooth, more or less mottled, the antennæ fuscous, the second joint much darker than the succeeding. Thorax with scarcely ampliated, oblique lateral margins, the front margin gently and roundly emarginate, the whole surface smooth, fusco-fuliginous, with a pair of oblique and divergent paler lateral clouds; scutellum smooth, the disk and base fusco-fuliginous, the rest obscure pallid. Hemelytra fuliginous with no transverse pallid band, but with a narrow, pallid stripe following the sutura clavi.

Length of body, 9.75^{mm}; antennæ, 3.75^{mm}; breadth of thorax, 3 1^{mm}.

Florissant. One specimen, No. 1.835, of the Princeton Collection.

NYSIUS Dallas.

No fossil Heteroptera have been before referred to this genus, which is found all over the world, from Greenland to the Cape of Good Hope, in the East Indian and Pacific Islands, and in North and South America Five species occurring in the Florissant shales belong here or in the near vicinity, and may be separated by the following table:

Table of the species of Nysius.

Antennæ distinctly more than half as long as the body.
Head distinctly longer than broad; body relatively slender .....1. *N. vinctus.*
Head distinctly broader than long; body relatively stout .....2. *N. vecula.*
Antennæ nearly or quite half as long as the body, but not more.
Antennæ half as long as the body.
Thorax tapering considerably, the apex hardly more than half as long as the base; membrane distinctly infumated .....3. *N. tritus.*
Thorax tapering but little, the apex fully two-thirds as long as the base; membrane apparently clear .....4. *N. terræ.*
Antennæ distinctly less than half as long as the body .....5. *N. stratus.*

1. Nysius vinctus.

Body slender, three times as long as broad; head and thorax black, the abdomen blackish fuscous, antennæ and legs very dark testaceous. Head considerably longer than broad, well rounded, heavily punctate. Antennæ distinctly more than half as long as the body, the basal joint stout, the remainder slender, decreasing regularly and slightly in size from the second to the fourth. Thorax rapidly tapering forward, the apical about half the length of the basal margin, both truncate; surface heavily punctate. Apex of corium reaching scarcely beyond the middle of the abdomen, corium infuscated; membrane clear with distinct fuscous veins.

Length of body, 6^{mm}; antennæ, 3.6^{mm}; breadth of thorax, 2^{mm}.

Florissant. One specimen, No. 7310.

2. Nysius vecula.

Pl. 22, Fig. 7.

Body as compared with the preceding species relatively stout, being somewhat less than three times as long as broad; whole body with the legs blackish fuscous, antennæ slightly paler. Head broader than long, rounded subtriangular, smooth or scarcely punctate. Antennæ distinctly more than half as long as the body, the basal joint moderately stout, projecting considerably beyond the front, the remaining joints slender, the apical barely incrassated and as long as the penultimate. Thorax tapering regularly and considerably, the apical considerably more than half as long as the basal margin, both truncate, the oblique sides without ampliation; the surface rather delicately punctate. Hemelytra with corium infuscated, reaching somewhat beyond the middle of the abdomen; all the veins delicately punctate.

Length of body, 5.5–5.6^{mm}; antennæ, 3.75^{mm}; breadth of body, 2.6^{mm}.

Florissant. Seven specimens, Nos. 3601, 3739, 4886, 11522, 11549, 13153, and from the Princeton Collection 1.828.

3. Nysius tritus.

Pl. 23, Fig. 20.

Body slender, fully three times as long as broad; the head and thorax black, the abdomen blackish fuscous; corium and clavus of hemelytra blackish brown with a large, triangular, clear, pallid spot occupying the basal half or more of the corium, and also another smaller, triangular, pallid spot at its extreme apex; membrane fuliginous. Head subrotund, broader than the apex of the thorax, apparently broadly angulate in front, the surface smooth. The antennæ half as long as the body, the apical joint slightly incrassated. Thorax tapering rapidly and regularly from base to apex, the apical hardly more than half as long as the basal margin, both truncate; the surface heavily punctate, as is also that of the scutellum; veins of the hemelytra also punctate.

Length of body, 4.3mm; antennæ, 2.15mm; breadth, 1.35mm.

Florissant. Two specimens, Nos. 6142, 12465.

4. Nysius terræ.

Pl. 23, Fig. 31.

Body moderately slender, rendered less so by its slightly oval shape; head and thorax blackish brown, the abdomen a little paler; legs and antennæ dark testaceous. Head small, distinctly broader than long, rounded, with the eyes narrower than the apex of the thorax; surface smooth. Antennæ half as long as the body, the basal joint projecting but little beyond the front of the head, the apical slightly incrassated and fully as long as the penultimate joint. Thorax tapering gently from base to apex, the apical fully two-thirds as long as the basal margin, both truncate; the sides hardly ampliated; surface heavily punctate, as is also the scutellum. Corium of hemelytra reaching nearly the middle of the apical half of the abdomen, dark fuscous, with a very large, rounded, blackish fuscous spot in the middle of the apical margin; the membrane apparently clear.

Length of body, 4.1mm; antennæ, 2mm; breadth of base of thorax, 1.25mm.

Florissant. Two specimens, Nos. 4606, 7064.

5. Nysius stratus.

Pl. 23, Figs. 14, 27; Pl. 25, Figs. 2, 8.

Body rather slender, being about three times as long as broad. Head rounded, subtriangular, of about equal length and breadth, or, if anything, a little broader than long, with the eyes slightly broader than the apex of the thorax, smooth. Antennæ less than half as long as the body, the stout basal joint projecting slightly beyond the front of the head, the second joint very slender, the others gradually incrassated, so as to be fully half as broad again in the middle of the apical joint as in the middle of the second joint, the apical fully as long as the penultimate joint. Thorax trapezoidal, tapering from base to apex gradually and regularly, with straight sides, sometimes a little ampliated, the apical distinctly more than one-half as long as the basal margin, both truncate, or the apical very slightly and roundly emarginate, surface coarsely punctate like the scutellum. All the femora rather stout, the fore and middle pairs of nearly equal length, the hind pair a little longer, smooth; all the tibiæ slightly longer than their respective femora, slender. Corium of hemelytra with the apex reaching beyond the middle of the abdomen, testaceous, with blackish fuscous blotches irregularly distributed; all the veins of the corium and clavus distinctly punctate; membrane nearly clear with testaceous streaks along the veins.

Length of body, 4–5^{mm}; antennæ, 1.75–2^{mm}; breadth of body, 1.5–1.7^{mm}

This is the commonest of the Lygæidæ at Florissant.

Florissant. Twenty-five specimens, Nos. 902, 1349, 1671, 3576, 4853, 4931, 6123, 6177, 6365, 6542, 7540, 10381, 10825, 10888, 10969, 11140, 11164, 12065, 12463, 12751, 13158, 14023, 14181, 14432, and from the Princeton Collection 1.840.

Subfamily GEOCORINA Stål.

A single species referred below to Geocoris is the only fossil form ever recognized in this family.

GEOCORIS Fallén.

This cosmopolitan genus, rich in species and about equally developed in the Old and New Worlds, is more prolific in the northern than in the southern hemisphere in the New World, the opposite in the Old World. It has never been recognized in a fossil state, but a single species appears to

occur at Florissant, where its striking breadth of head and stout fore femora distinguish it from all other forms.

GEOCORIS INFERNORUM.

Pl. 23, Figs. 17, 26.

Head broadly rounded in front without the least sign of being produced, in which it differs strikingly from all existing species I have been able to examine; twice as broad as long, with the small eyes just as broad as the front of the thorax; antennæ shorter than head and thorax combined, very slender, cylindrical, with no enlargement anywhere, the second joint longest, the third and fourth successively shorter. The thorax is nearly or quite twice as broad as long with gently convex sides, scarcely narrower in front than behind, and the angles hardly rounded; the surface is very feebly punctate. Hemelytra with the corium hardly reaching beyond the middle of the abdomen, very opaque fuscous with pale patches or streaks following the course of the veins; membrane invisible. Legs short, the fore femora (when turned so as to see the broader face) very stout, rotund, not more than half as long again as broad. Abdomen very broad and full.

Length, 3.25^{mm}; breadth, 1.45^{mm}.

Florissant. Six specimens, Nos. 5640, 5734, 5864, 5888, 6483, 13152.

Subfamily OXYCARENINA Stål.

This group, much more highly developed in the Old World than in the New, has never been found fossil there; but here we have an extinct genus, Procrophius, in the shales of Florissant, with three species.

PROCROPHIUS gen. nov. (*πρό*, Crophius, nom. gen.).

The brevity of the antennæ and of the corium at once distinguish this from any living forms of Lygæidæ with which it would appear to be related, and with which from its abundance in the rocks we should perhaps the more expect to find relationship. The brevity of the corium distinguishes it from Ischnorhynchus with which its general form agrees, especially with the Central American species, and I can find nothing nearer to it than Crophius, from which it differs decidedly in the antennæ. The head is triangular, shorter than broad, together with the eyes of the same breadth as the

narrowed apex of the thorax, which is broadest at extreme base, or close to it, much broader than long, and tapers forward with greater or less rapidity and regularity. The hemelytra have the outer extremity of the corium reaching not far beyond the middle of the abdomen, and the legs are very much as in Crophius. The antennæ are at most only a little more than a third as long as the body, the first joint short and not surpassing the head, the rest slender and nearly cylindrical, the second the longest, the third and fourth equal in length, but the last slightly incrassated.

Three species occur at Florissant, one of them in great abundance.

Table of the species of Procrophius.

Hemelytra with no distinct series of punctures.
Hemelytra uniformly or almost uniformly obscure ..... 1. *P. communis.*
Hemelytra clear with a broad costal thickening ..... 2. *P. costalis.*
Hemelytra with distinct series of punctures following the main veins ..... 3. *P. languens.*

1. Procrophius communis.

Pl. 23, Figs. 12, 18, 28, 29; Pl. 24, Fig. 1.

The antennæ of this species are much stouter than in the next, and also relatively shorter. The head is more than half as long as the thorax, or a little more than that, very bluntly angled in front; thorax about as long as the anterior breadth, at least half as broad again posteriorly, tapering with great uniformity so as to show but little curvature to the sides, the surface nearly smooth, entirely without constriction next the base. Hemelytra dark and obscure, occasionally with obscure lighter patches below the costal field and next the middle of the membranal suture; membrane clear.

This is one of the commonest species of Lygæidæ at Florissant.

Length of body, 3.5^{mm}; breadth, 1.5^{mm}; length of corium, 1.5^{mm}.

Florissant. Twenty specimens, Nos. 193, 258, 1209, 1404, 1570, 2388, 4313, 4577, 4602, 5722, 5832, 6205, 6246, 6873, 7330, 11184, 11222, 11652, 12061, 12458.

2. Procrophius costalis.

Pl. 23, Fig. 8.

This species differs from the preceding in the slenderer antennæ, the more rounded sides of the pronotum, and the character of the slightly relatively longer hemelytra. The thorax is rather stouter than in P. communis, being nearly twice as broad as long, with gently rounded sides, which at

the same time taper rapidly; the surface smooth. The hemelytra are light colored, excepting for an equal, not very broad, costal thickening of a testaceous color, which appears to be characteristic. The abdomen seems to be ordinarily fuller in the apical half than in P. communis.

Length, 3.4^{mm}; breadth, 1.5^{mm}; length of corium, 1.75^{mm}.

Florissant. Five specimens, Nos. 5952, 6367, 6394, 7062, 9937.

3. Procrophius languens.

Pl. 23, Fig. 23.

A single specimen has been separated from the others on account of certain characteristics which appear to be peculiar; unfortunately the appendages of the head are not preserved, but the head itself appears to be longer and more produced than in either of the other species, and the thorax of the same form as in P. communis, tapering as rapidly and with rectilinear sides, but it is perhaps a little shorter than in P. communis and its surface a little less smooth. The hemelytra are clear throughout, and show lines of punctures along the course of the principal veins which can not be made out in either of the other species. The abdomen has the form of that of P. costalis.

Length, 3.4^{mm}; breadth, 1.5^{mm}; length of corium, 1.5^{mm}.

Florissant. One specimen, No. 6239.

Subfamily MYODOCHINA Stål.

As has been stated above, the vast majority of the American fossil Lygæidæ belong to the present group. A remarkable feature to be noticed in them—not embracing all the species, but certainly most of them—is the brevity of the antennæ, rarely half as long as the body, and usually much shorter than that. They are extraordinary, too, for the very large proportion which can not be referred to existing genera, and for their general resemblance as a whole to subtropical types. The members of the first group, the Myodocharia, seem to form, with few exceptions, a type apart, in which the posterior lobe of the thorax does not broaden from behind forward, being as a whole narrower, or at least no broader, than the anterior lobe when the latter has ampliated sides, the opposite being ordinarily the case in modern types. With a single exception or two they all come from Florissant.

Table of the genera of fossil Myodochina.

Anterior and posterior lobes of thorax with independent lateral curves.....(Div. **Myodocharia.**)
Middle femora as long as the width of the body at their insertion .....1. *Ligyrocoris.*
Middle femora shorter than the width of the body at their insertion.
Anterior lobe of thorax with the sides arcuate.
Minute species, less than four millimeters in length.....2. *Stenopamera.*
Larger species, not less than five millimeters in length.
Anterior much longer than posterior lobe of thorax.
Antennæ no longer than head and thorax; terminal joint no broader than middle of second joint .....3. *Catopamera.*
Antennæ as long as head, thorax, and scutellum; terminal joint incrassated. 4. *Phrudopamera.*
Anterior lobe of thorax a little shorter than the posterior.....5. *Cholula.*
Anterior lobe of thorax with the sides oblique and straight.
Anterior and posterior lobes of thorax about equally long.
Larger forms. Antennæ more than half as long as body; head as broad as middle of thorax; abdomen laterally expanded .....6. *Lithocoris.*
Smaller forms. Antennæ only half as long as body; head much narrower than middle of thorax; abdomen not laterally expanded.....7. *Caphocoris.*
Posterior lobe of thorax distinctly shorter than anterior.
Posterior margin of thorax angulate, the posterior lobe twice as long in the middle as at sides. ..... 8. *Eucorites.*
Posterior margin of thorax truncate, the posterior lobe of equal length throughout.
Antennæ as long as head and thorax together, or longer; head longer than broad ..... 9. *Procoris.*
Antennæ shorter than head and thorax together; head broader than long. 10. *Cercacoris.*
Anterior and posterior lobes of thorax distinguishable only, if at all, by the transverse impressed line of the upper surface.....(Div. **Rhyparochromaria.**)
Eyes small, globular; head not broader than front of thorax.
Minute species, usually less than 4mm (in one instance as much as 4.5mm) in length.
Antennæ only as long as head and thorax together.
Anterior border of thorax very much shorter than the posterior; or, if not, much longer than the length of the thorax.
Corium of hemlytra reaching only the middle of the abdomen ...11. *Trapezonotus.*
Corium of hemelytra reaching distinctly beyond the middle of the abdomen. 12. *Linnæa.*
Anterior border of thorax but little shorter than the posterior and of the same length as the thorax.....13. *Rhyparochromus*
Antennæ fully half as long as body.
Second joint of antennæ scarcely longer than third or fourth.....14. *Pachymerus.*
Second joint of antennæ much longer than either of the succeeding .....15. *Tiromerus.*
Larger species, usually more than 5mm (in one instance as little as 4.7mm) in length.
Antennæ nearly or quite half as long as the body, the last joint scarcely or not incrassated. 16. *Lithochromus.*
Antennæ not or scarcely longer than head and thorax together, the last joint usually a little incrassated.
Second joint of antennæ longest.
Thorax considerably less than twice as broad as long.....17. *Coptochromus.*
Thorax much more than twice as broad as long.....18. *Prolygæus.*
Last joint of antennæ longest.
Eyes at base of head; thorax punctate; sides of abdomen expanded, usually beyond the closed hemelytra.....19. *Neerochromus.*
Eyes in middle of head; thorax smooth; sides of abdomen not expanded laterally beyond the hemelytra.....20. *Exitelus.*
Eyes large, lenticular, half as long as the thorax; head considerably broader than the front of the thorax.....21. *Cryptochromus*

1. LIGYROCORIS Stål.

This American genus, best developed in Mexico and Central America, where seven species are recorded, and which also extends into the United States, where two species are known in the eastern portions, seems to be represented in the Florissant shales by one species, though the obscurity of the single specimen makes the reference somewhat doubtful. No extinct forms have before been recognized.

LIGYROCORIS EXSUCTUS.

Pl. 24, Fig. 5.

The single specimen that is referred here is very poorly preserved, but differs markedly from all other specimens; in general the aspect of the insect is that of a Ligyrocoris, and I have accordingly placed it in that genus. The head appears to be of the same width as the thorax, which is subquadrate, narrows very little forward, and is rather broader than long. The antennæ are slender, and if turned backward would reach about half-way to the tip of the closed hemelytra. The fore and middle femora are very similar in character, the middle pair slightly the longer, moderately stout, of nearly equal width throughout, the hind femora longer still and perhaps a little slenderer, reaching nearly to the tip of the abdomen. Hemelytra with the membrane reaching far beyond the tip of the abdomen, the veins dusky; the whole body is of a uniformly dark color.

Length of body, 5.25^{mm}; including the closed hemelytra, 7^{mm}; breadth of body, 1.6^{mm}; length of hind tibiæ and tarsi, 4^{mm}.

Florissant. One specimen, No. 12925.

2. STENOPAMERA gen. nov. (στενός, Pamera, nom. gen.).

A genus of Myodocharia in which the anterior lobe is not only several times longer than the posterior, but which by its bullate form is even wider than it, the posterior lobe being reduced to a mere narrow belt. The whole insect is of compact oval form, less than three times longer than broad. In the last respect it reminds one of Trapezus, but in its principal features it seems to be most nearly allied to Pamera. The antennæ are scarcely longer than the extreme width of the body and scarcely have the apical joint

incrassated; the first joint scarcely surpasses the head, the second is the longest, and the others successively shorter.

Two species may be separated among the fossils found at Florissant.

Table of the species of Stenopamera.

Corium of hemelytra dark with pallid subcostal streak and median patch.....1. *S. tenebrosa.*
Corium of hemelytra pale with darkened marginal stripe.....2. *S. subterrea.*

1. Stenopamera tenebrosa.

Pl. 23, Figs. 16, 24.

Head rounded subtriangular, of about equal length and breadth, less than half as broad as the thorax at its greatest; antennæ about as long as head and thorax combined. Thorax with the sides strongly convex and almost angulate in the middle, in front of which it narrows rapidly, the truncate anterior margin shorter than the length of the thorax and hardly more than half its greatest breadth; surface nearly smooth, transversely and finely pectinate. Hemelytra with the corium reaching rather beyond the middle of the abdomen, very dark, but not so dark as the thorax, with a distinctly and sharply pallid sutura clavi and pallid streaks, especially in the subcostal region and in the middle of the outer membranal margin, but also often extending from the base outward along the costal margin.

Length, 3.55^{mm}; breadth of thorax, 1.45^{mm}.

Florissant. Nine specimens, Nos. 1448, 4597, 5736, 6217, 6373, 7397, 7675, 11301, 12446.

2. Stenopamera subterrea.

Pl. 23, Fig. 7.

This species differs from the preceding in no conspicuous feature and agrees with it in size. The front margin of the thorax appears, however, to be a little and roundly emarginate and the sides slightly less prominent. The hemelytra are pallid with a pale testaceous thickening of the costal margin of the corium and a faint line of punctuation along the principal veins.

Length, 3.25^{mm}; breadth of thorax, 1.2^{mm}.

Florissant. Three specimens, Nos. 4887, 6140*a*, 7473.

3. CATOPAMERA gen. nov. (*κάτω*, Pamera, nom. gen.).

Head subtriangular, roundly angulated in front, slightly broader than long, with the eyes as broad as the apex of the thorax; eyes situated at the base, small, globular: antennæ slender, no longer than the head and thorax together; beyond the basal joint (which just surpasses the head) of almost exactly uniform width, the joints of very nearly equal length, each from four-fifths to five-sixths the length of the preceding. Thorax about half as broad again as long, considerably longer than the head, tapering from the posterior margin of the anterior lobe forward, the sides ampliated, base truncate, apex more or less but broadly emarginate. Legs moderately stout, the middle femora not more than two-thirds the width of the body at their insertion. Abdomen very full, well rounded.

Two species occur in the Florissant shales.

Table of the species of Catopamera.

Corium of hemelytra reaching the middle of the apical half of the abdomen .....1. *C. aughegi.*
Corium of hemelytra reaching scarcely beyond the middle of the abdomen .....2. *C. bradleyi.*

1. CATOPAMERA AUGHEYI.

Pl. 27, Fig. 7.

Whole body of a nearly uniform dark color; the antennæ a little paler. Head smooth or finely corrugated transversely. Thorax faintly punctate. Hemelytra just surpassing the extremity of the abdomen, the corium reaching the middle of its apical half, fusco-fuliginous, sparsely but distinctly punctate, the punctæ showing a tendency to a linear arrangement along the veins; membrane clear. Abdomen with the sides slightly paler than the middle.

Length of body, 5^{mm}; antennæ, 2.15^{mm}; breadth of thorax, 1.55^{mm}; abdomen, 2.05^{mm}.

Named in honor of Samuel Aughey, geologist of the Hayden Survey.

Florissant. Four specimens, Nos. 1716, 2042, 9590, 12033.

2. CATOPAMERA BRADLEYI.

Pl. 26, Fig. 12.

Whole body blackish brown, excepting the hemelytra. Antennæ rather stouter than in the preceding species and as dark as the body. Head uniform, smooth. Thorax very finely, faintly, and distantly punctate; the

scutellum more coarsely. Hemelytra reaching just about the tip of the abdomen, the corium not beyond its middle, testaceous, rather finely and very distantly and evenly punctate, the punctæ showing no disposition to longitudinal arrangement; membrane faintly infumated. Sides of abdomen as dark as the disk.

Length of body, not including the terminal extension of the abdomen, 4.65^{mm}; antennæ, 1.65^{mm}; breadth of body, 1.25^{mm}; abdomen, 1.75^{mm}.

Dedicated to Mr. Frank H. Bradley, geologist of the Hayden Survey.

Florissant. One specimen, No. 14236.

4. PHRUDOPAMERA gen. nov. (φρουδος, Pamera, nom. gen.).

Head rounded, of about equal length and breadth, rather broader than the apex of the thorax, more or less produced in front of the antennæ; eyes situated at the outermost limits of the head, a little in advance of the base, of moderate size, subglobular; antennæ as long as the head, thorax, and scutellum together, the basal joint barely or not surpassing the front of the head, the three succeeding joints subequal, the last incrassated so as to be half as broad again as the middle of the second joint. Thorax scarcely longer than the head, half as broad again as long, tapering forward from the posterior limit of the anterior lobe, the sides ampliated; posterior margin truncate or slightly convex, the anterior margin similarly concave. Legs moderately stout, the middle femora not more than two-thirds the width of the body at their insertion. Abdomen moderately full, well rounded.

Two species occur in the shales of Florissant.

Table of the species of Phrudopamera.

Front of head distinctly angulate.....1. *P. wilsoni.*
Front of head broadly rounded or subtruncate.....2. *P. chittendeni.*

1. PHRUDOPAMERA WILSONI.

Pl. 27, Figs. 9, 16.

Head smooth, the front rectangulate in advance of the antennæ; antennæ of uniform color. Thorax finely and evenly granulate; hemelytra rather heavily punctured in definite longitudinal lines following the course of the veins; these infuscated but the rest of the hemelytra scarcely infuscated; membrane clear. Abdomen oval, somewhat elongated.

Length of body, 5.45^{mm}; antennæ, 2.5^{mm}; breadth of thorax, 1.45^{mm}; abdomen, 2^{mm}.

This species is named for Mr. A. D. Wilson, the accomplished topographer of the Hayden Survey.

Florissant. Two specimens, Nos. 6931, 13315.

2. Phrudopamera chittendeni.

Pl. 26, Figs. 7, 9.

Head smooth or very finely and transversely corrugate, the front projecting forward between the antennæ, but subtruncate or broadly rounded; antennæ with the basal and apical joints darker than the rest. Thorax rather faintly and somewhat distinctly punctate, as well as transversely corrugated, especially in the middle. Hemelytra rather coarsely punctate in longitudinal lines, following the course of the veins, more or less infuscated; the membrane slightly infumated. Abdomen broad and very well rounded.

Length of body, 5.25^{mm}; antennæ, 2.5^{mm}; breadth of thorax, 1.65^{mm}; abdomen, 2.25^{mm}.

The name is given in honor of Mr. G. B. Chittenden, topographer of the Hayden Survey, engaged during its exploration of Colorado.

Florissant. Three specimens, Nos. 7037, 11229, 11232.

5. CHOLULA Distant.

A single species, represented by a single, imperfect, headless specimen from Green River, Wyoming, is referred here from its near resemblance to one of the species described by Distant. It differs, however, in several points: the basal margin of the thorax is hardly concave at the base of the scutellum, but straight, while elsewhere it is convex; there is but the faintest sign of any carination of the scutellum, and I can not see that either corium or clavus is punctured.

Cholula triguttata.

Pl. 7, Fig. 21.

Body slender with parallel sides, fully three times longer than broad. [Head wanting] Thorax rounded subquadrate, broader than long, the anterior a little shorter than the posterior lobe, and distinctly separated from it

by a transverse constriction, noticeable particularly by the deep lateral notch; anterior lobe rapidly narrowing with strongly oblique convex sides, two and a half times broader than long, the surface apparently smooth, light colored, with broad, marginal, dark bands, a faint dusky median stripe fading posteriorly, and three dark round spots, one in the middle of each lateral half posteriorly and one in the middle of the posterior margin, overlapping the posterior lobe; this last is broader than the anterior, with strongly convex sides, and is three times as broad as long, its posterior lateral angles not rounded; the posterior margin is transverse outwardly and next the base of the scutellum, a little oblique between; the surface is dark posteriorly, lighter anteriorly, the whole rather coarsely and faintly punctate. Corium of hemelytra clear and smooth, with distinct and straight subcostal vein and fuliginous outer angle (the other dark spots on the surface of the corium in the plate belong to the middle and hind femora); membrane clear.

Length (without head), 4.5^{mm}; probable complete length, 5^{mm}; breadth of thorax, 1.7^{mm}.

Green River, Wyoming. One specimen. No. 113 (Dr. A. S. Packard).

6. LITHOCORIS gen. nov. (λίθος, κόρις).

Head large, subrotund, slightly broader than long, with moderately large eyes, which are situated just behind the middle of the head, at its greatest lateral expansion as broad as the middle of the thorax; front rounded, angulate in advance of the base of the antennæ; antennæ more than half as long as the body, the basal joint pretty stout, surpassing a little the front of the head, the remaining joints subequal, the second the shortest, all very slender, but the last slightly incrassated to about the width of the basal joint. Thorax slightly longer than broad, divided into anterior and posterior lobes of equal length, both tapering from base to apex, the anterior more rapidly than the posterior and with perfectly straight oblique sides; the base fully twice as broad as the apex. Legs moderately slender, the middle femora fully three-fourths the width of the body at their insertion. Corium of hemelytra reaching the middle of the apical half of the abdomen, which is full, laterally ampliated, half as broad again as the base of the thorax.

A single species is known.

LITHOCORIS EVULSUS.

The single specimen known is rather faintly preserved upon the stone, but otherwise is in excellent condition. The head and thorax are dusky, the abdomen paler: the antennæ and legs are also pale obscure. Head rather densely and not very finely punctate. Thorax more coarsely and more distantly punctate, as is also the scutellum. Hemelytra with similar coarse punctæ arranged along the veins; membrane cloudy.

Length of body, 6.5^{mm}; antennæ, 4^{mm}; hind femora, 2.2^{mm}; tibiæ, 3.2^{mm}; tarsi, 1.5^{mm}; breadth of thorax, 2.2^{mm}; abdomen, 2.7^{mm}.

Florissant. One specimen, No. 4890.

7. COPHOCORIS gen. nov. (κωφός, κόρις).

Head rounded, a little broader than long, a little broader than the apex of the thorax but not nearly so broad as its middle; front roundly produced, almost angulate; antennæ only half as long as the body, the basal joints just surpassing the front of the head, the remaining joints slender, subequal, the last faintly incrassated. Thorax at least one-fourth broader than long, divided into anterior and posterior lobes of equal length, the posterior lobe with straight and nearly parallel sides, the anterior tapering forward, the sides oblique and straight. Legs apparently much as in the preceding genus, but perhaps slightly shorter. Abdomen well rounded, hardly ampliated laterally.

A single species occurs at Florissant

COPHOCORIS TENEBRICOSUS.

Whole body almost uniformly dark, the abdomen, antennæ, and legs much lighter. Head minutely punctate. Thorax distantly and rather coarsely punctate; scutellum the same. Corium of hemelytra reaching a little beyond the middle of the abdomen, infuscated, the veins finely punctate; membrane clear.

Length of body, 5^{mm}; antennæ, 2.4^{mm}; breadth of thorax, 1.6^{mm}; abdomen, 2^{mm}.

Florissant. One specimen, No. 9742.

8. EUCORITES gen. nov. (εὖ, κόρις).

Head well rounded, with a slightly triangular form, the apex forward, of about equal length and breadth, slightly broader than the apex of the thorax; the front gently and roundly produced in front of the antennæ; eyes situated in advance of the middle, transverse, reniform; antennæ slightly longer than the head and thorax together, the basal joint moderately stout, just surpassing the front of the head, the remaining joints subequal, the second slightly longer than the others, slender and equal, the third slightly shorter than the terminal, scarcely and gently enlarging in the apical half, the fourth incrassated so as to be almost throughout half as broad again as the middle of the second joint. Anterior lobe of the thorax trapezoidal, more than twice as broad as long, tapering regularly from base to apex, with oblique sides, both base and apex truncate; posterior lobe of unusual form, being twice as broad in the middle as at the sides, the posterior margin being strongly, broadly angulate, with rounded apex, simulating a broad and short scutellum. Middle femora much shorter than the breadth of the body at their insertion. Corium of hemelytra reaching the middle of the apical half of the abdomen. Abdomen moderately long ovate.

One species only is known.

EUCORITES SERESCENS.

Whole body black, the antennæ with the basal joint black, the apical joint and apical third of the penultimate joint blackish fuscous, the remainder testaceous. Head and thorax uniformly, coarsely, and rather distantly punctate. Corium of hemelytra coarsely punctate, mostly in longitudinal lines following the course of the veins, the punctæ infuscated and the whole corium more or less infuscated, but generally of a light color; membrane faintly infumated, reaching just to the tip of the abdomen.

Length of body, 5^{mm}; antennæ, 2.6^{mm}; breadth of thorax at the base, 2.25^{mm}; abdomen, 2.5^{mm}.

Florissant. One specimen, No. 860.

9. PROCORIS gen. nov. (πρό, κόρις).

Head rounded, slightly longer than broad, with the eyes a little but distinctly broader than the apex of the thorax, the front rounded, angulate

in advance of the antennæ; eyes moderately large, situated just in advance of the base; antennæ as long as the head and thorax together, the basal joint clearly surpassing the front, the subsequent joints subequal, the second not longer than the others, slender, the fourth incrassate throughout, but largest in the middle, where it is twice as broad as the middle of the second joint. Thorax longer than broad, the posterior about two-thirds as long as the anterior lobe, of equal length throughout, with straight and parallel sides, the anterior lobe tapering from base to apex with oblique straight sides; posterior margin of the thorax truncate, anterior scarcely emarginate. Legs moderately stout, middle femora not more than two-thirds as long as the breadth of the body at their insertion. Corium of hemelytra reaching nearly or quite to the middle of the apical half of the abdomen. Abdomen broad ovate.

Two species are known, both of which occur only at Florissant.

Table of the species of Procoris.

Third joint of antennæ of nearly equal width throughout; femora relatively slender. . . . . 1. *P. sanctæjohannis.*

Third joint of antennæ considerably enlarged apically; femora relatively stout . . . . . 2. *P. bechleri.*

1. Procoris sanctæjohannis.

Whole body uniform black or blackish fuscous; antennæ of the same color as the head or perhaps not so dark, but in any case much infuscated, the third joint of nearly equal width throughout, scarcely enlarged at the apex. Head smooth or perhaps faintly and very finely punctate. Thorax and scutellum coarsely and rather distantly punctate, the punctæ on the hemelytra arranged linearly along the course of the veins. Femora only moderately stout, fully three times as long as broad. Abdomen rather full, with ampliated sides.

Length, 6.1^{mm}; antennæ, 2.25^{mm}; breadth of thorax, 1.85^{mm}; abdomen, 2.5^{mm}.

The name of the species is given in honor of Mr. Orestes St. John, geologist of the Hayden Survey, a pioneer of much work in the West.

Florissant. Four specimens, Nos. 3556, 4808, 7688, 10560.

2. Procoris bechleri.

Pl. 27, Fig. 4.

Head faintly and rather coarsely punctate, and, like the whole body, black or blackish brown, the antennæ a little lighter colored, the third joint

enlarging regularly from base to apex, where it is nearly twice as large as at the base. Thorax very coarsely and not very distantly punctate, as is also the scutellum. Hemelytra fusco-fuliginous, coarsely punctate in serial rows along the course of the veins. The femora rather stout, the middle pair being but little more than twice as long as broad. Abdomen with the sides scarcely ampliated, and a premarginal pallid line.

Length, 6.15^{mm}: antennæ, 2.25^{mm}: breadth of thorax, 1.85^{mm}: middle of abdomen, 2.15^{mm}.

Named for Mr. G. R. Beehler, topographer of the Hayden Survey during its work in Colorado and elsewhere.

Florissant. One specimen, No. 13564.

10. CTEREACORIS gen. nov. (κτέρεα, κόρις).

Head broader than long, rounded subtriangular, with the moderately large eyes broader than the apex of the prothorax: the front prominent and rounded: antennæ considerably shorter than the head and thorax together, the basal joint stout, surpassing the front of the head, the second and third joints about equal in length, slender, less than half the width of the basal joint, the apical joint slightly the longest, incrassate to the stoutness of the basal joint. Thorax more than twice as broad as the head, the posterior decidedly shorter than the anterior lobe, with straight and parallel sides and truncate anterior and posterior margins: the anterior lobe tapering rapidly with straight oblique sides, the anterior margin gently emarginate, the whole nearly three times as broad as long. Middle femora very much shorter than the breadth of the body at their insertion. Corium of hemelytra barely surpassing the middle of the abdomen. Abdomen broad and rounded.

A single species is known.

CTEREACORIS PRIMIGENUS.

Head, thorax, scutellum, and corium of hemelytra black, antennæ blackish fuscous, abdomen dark fusco-fuliginous. Head smooth, the antennæ, especially the apical joint, a little roughened. Thorax and scutellum coarsely punctate. Corium of hemelytra the same, the punctæ following mostly the course of the veins; membrane clear. Abdomen obscurely and coarsely punctate.

Length, 5^{mm}; antennæ, 1.75^{mm}; breadth of head, .95^{mm}; base of thorax, 2.15^{mm}; abdomen, 2.75^{mm}.

Florissant. One specimen, No. 2022.

11. TRAPEZONOTUS Fieber.

This genus, abundantly represented in Europe, rather feebly in America, where it is found in the United States, and at high elevations in Central America, seems to have lived at Florissant, a couple of species, one of them tolerably common being found there; yet they certainly differ from modern types in the brevity of the antennæ and bluntness of the head, and are considerably slenderer than any American species known to me. They may be placed here at least provisionally.

Table of the species of Trapezonotus.

Smaller species, hardly exceeding three millimeters in length; thorax with no median sulcation; costal margin of corium dark ..... 1. *T. exterminatus.*
Larger species, considerably exceeding four millimeters in length; thorax with median sulcation; costal margin of corium light ..... 2. *T. stygialis.*

1. Trapezonotus exterminatus.

Pl. 22, Fig. 9; Pl. 23, Figs. 11, 22, 25.

Head triangular, rounded, slightly broader than long, the angulate front rounded; antennæ slender, subequal, a little longer than head and thorax together, the first joint barely surpassing the front of the head, the second joint longest, the succeeding joints successively shorter. Thorax with convex sides, the anterior about three-fourths the length of the posterior border, the former slightly concave, the latter as slightly convex, the surface faintly punctate, though this does not appear on all individuals. Hemelytra with the corium reaching the middle of the abdomen, strongly infuscated with pallid markings, consisting of a broad, pale subcostal stripe which does not reach the membranal suture, and a median triangular patch seated on the same suture, besides which a pale, slender stripe follows the sutura clavi. Abdomen full and rounded.

Length of body, 3.1^{mm}; breadth, 1.2^{mm}; length of antennæ, 1.4^{mm}.

Florissant. Eight specimens, Nos. 5801, 6366, 6550, 7609, 9674, 11757, 12060, 12459.

2. Trapezonotus stygialis.

Pl. 27, Fig. 11.

Head roundly triangular, its sides continuing the course of the oblique sides of the thorax, a little broader than long, the front well rounded; antennæ slender and equal, hardly so long as the head and thorax together, the first joint not surpassing the head. Thorax transverse, more than half as broad again as long, broadest in the middle of the posterior half, the sides strongly rounded, tapering forward so that the anterior margin is only two-thirds as long as the whole width of the thorax, the front margin slightly and roundly emarginate, the hind border gently convex. Hemelytra just reaching the end of the abdomen, the corium extending hardly past the middle of the same, this latter rather pale testaceous, with the whole costal region pallid, besides longitudinal pallid streaks toward the sutura clavi; membrane clear. Abdomen full and rounded.

Length of body, 4.3^{mm}; breadth, 1.8^{mm}; length of antennæ, 1.5^{mm}.

Florissant. One specimen, No. 9302.

12. LINNÆA gen. nov. (Linné).

A genus of Rhyparochromaria closely allied to Gonatas Distant, but from which it is readily distinguished by the smaller head and shorter antennæ, the first joint of which barely surpasses the head. The head is not more, often less, than half as broad as the thorax, nearly as long as broad, and scarcely angulated in front; the antennæ are only as long as the head and thorax together, the second joint the longest, scarcely increasing in size apically, the third and fourth successively though but slightly shorter, the third shaped like the second, the fourth not incrassated, all smooth. Thorax very broad, broadest posteriorly, the sides full. Hemelytra just surpassing the abdomen, the corium occupying about three-fifths of the whole. Legs, and especially the fore femora, stout.

Probably the use of Linnæa in botany has prevented its use in zoölogy, but the time is long past when such restrictions have any value. There is no conceivable way in which the use of the same term for a living Alpine flower and a Tertiary bug can cause confusion or be inconvenient.

Several species occur in the North American Tertiaries, but only at Florissant: while but for their much longer antennæ and slighter fore

femora I should be inclined to place here two of the fossil species found at Aix in Provence (Oligocene) and heretofore referred to Pachymerus, viz, P. fasciatus Heer and P. pulchellus Heer, which much resemble our first two species.

Table of the species of Linnæa.

Membrane of the hemelytra distinctly marked with broad, arcuate, longitudinal stripes.
- Thorax very rapidly narrowing in the anterior fourth ..... 1. *L. holmesii*
- Thorax narrowing only a little in the anterior fourth ..... 2. *L. putnami.*

Membrane of the hemelytra clear.
- Corium mostly obscure.
  - Anterior outer angles of the thorax so rounded that the curve of the anterior half of the thorax is almost uniform ..... 3. *L. abolita*
  - Anterior outer angles distinct though rounded ..... 4. *L. carcerata.*
- Corium mostly clear.
  - Costal margin distinctly though rather narrowly testaceous; rest of corium clear .5. *L. coluta.*
  - In addition to the thickening of the costal margin, testaceous blotches fringe the membranal suture and mark the outer tip of the corium ..... 6. *L. gravida.*

1. Linnæa holmesii.

Pl. 23, Fig. 10.

Head slightly broader than long, well rounded, the front entirely without angulation. Thorax half as broad again as long, the sides strongly arcuate, the anterior margin only about half as long as the posterior (in which point it is wrongly represented on the plate), which is slightly emarginate at the base of the scutellum, the surface smooth. Hemelytra with the corium very dark testaceous, deepening apically, with a pallid sutura clavi, and a subcostal streak, besides a small triangular spot on the membranal suture just without the sutura clavi; membrane with four pale testaceous, equidistant, slightly arcuate, longitudinal streaks, the outer occupying, respectively, the costal and inner margins, originating at a little space beyond the membranal suture and running to the outer margin, the interspaces perfectly clear.

Length of body, 3.35^{mm}; breadth, 1.15^{mm}; length of antennæ, 1.4^{mm}.

Named for Mr. W. H. Holmes, geologist, archeologist, and artist of the Hayden Survey.

Florissant. One specimen, No. 2320.

2. Linnæa putnami.

Pl. 23, Fig. 4

This species closely resembles the preceding in general appearance, but differs from it in important details in those parts which can be com-

pared. Unfortunately the head is not well preserved and the thorax is defective, but the latter can be seen to be nearly as broad in front as behind, with decided though rounded angles in front and with a faintly punctate surface. It is of a very dark color; the corium, which is scarcely less dark than the body, shows only a slender pallid line at the sutura clavi and along the principal vein, which passes down the middle and forks in the middle of the outer half of the corium, much fainter after forking. The membrane is marked as in L. holmesii, but the stripe on the inner margin is very faint.

Length of body, 3.35^{mm}; breadth, 1.25^{mm}.

Named for my fellow student in science, Prof. F. W. Putnam, of Cambridge.

Florissant. One specimen, No. 5873.

3. Linnæa abolita.

Head exceptionally small and rounded, not more than a third as broad as the thorax, the front in no way angulate. Thorax with the posterior lobe distinctly separated from the anterior and rather less than half as long as it; anterior lobe very rapidly narrowing with oblique but slightly arcuate sides, so that the front margin is scarcely more than a third as wide as the thorax, and the front half of the thorax has one nearly uniform curve; the posterior lobe again narrows or is slightly constricted; surface smooth. Hemelytra with the corium uniformly dark fuliginous, membrane clear. Abdomen very full and rounded.

Length, 3.75^{mm}; breadth, 1.4^{mm}.

Florissant. One specimen, No. 1918.

4. Linnæa carcerata.

Pl. 23, Fig. 2.

Head small, less than half as broad as the thorax, almost as long as broad, the front well rounded; antennæ shorter than the head and thorax. Thorax very broad, twice as broad as long, the sides very strongly rounded and full, the anterior hardly shorter than the posterior margin, with no distinct separation into anterior and posterior lobes, the surface smooth, with a slight median sulcation. Hemelytra pale testaceous, with large and irregular pallid blotches covering nearly half the corium but not invading the

apex; membrane clear. Abdomen narrower than the thorax, with parallel sides and broadly rounded apex, and half as long again as broad.

Length of body, 3.55^{mm}; breadth of thorax, 1.35^{mm}.

Florissant. Four specimens, Nos. 5793, 9692, 12096, 12464.

5. Linnæa evoluta.

Pl. 23, Fig. 21.

Head much broader than long, the front broadly angled; basal joint of antennæ not surpassing the head, the last joint two-thirds the length of the second; rostrum reaching the posterior extremity of the fore coxæ. Thorax transversely striate, the posterior half with parallel sides, continuous with the equally broad abdomen, the anterior half rapidly narrowing with oblique arcuate sides, so that the anterior border is about two-thirds as long as the posterior and as long as the length of the thorax. Hemelytra with the corium clear, except for a faint cloudiness which is a little intensified in a costal margin, the veins marked with serial punctures; membrane clear. Abdomen parallel sided, broadly rounded apically, about half as long again as broad.

Length, 3.6^{mm}; breadth, 1.4^{mm}.

Florissant. Two specimens, Nos. 5840, 7233.

6. Linnæa gravida.

Pl. 23, Fig. 19.

Head small, apparently rather less than half as broad as the thorax, shorter than broad, the front broadly angled; antennæ with the basal joint just attaining the front of the head, the whole scarcely longer than head and thorax. The latter smooth or scarcely punctate, half as broad again as long, the sides well rounded, tapering forward a little, the outer anterior angles well rounded off, the anterior margin about two-thirds the length of the posterior. Hemelytra with a pale testaceous costal stripe on the corium with the membranal edge marked irregularly with the same, as well as with a stripe following the outer side of the sutura clavi and another down the middle of the corium; membrane clear. Abdomen full, about half as long again as broad. This species is slightly larger than any of the others.

Length, 4.5^{mm}; breadth, 1.75^{mm}.

Florissant. Four specimens, Nos. 2966, 4994, 10410, 10882.

13. RHYPAROCHROMUS Curtis.

A single fossil was formerly referred to this genus by me, which seems rather to belong to the Acanthiidæ. But another from Florissant may more rightly claim a place here, and is the only fossil species known. The genus is now feebly represented in North America, a single species occurring in the United States and another in Guatemala, while a number are recorded from Europe.

RHYPAROCHROMUS VERRILLII.

Pl. 23, Figs. 15, 30.

Head narrower than the thorax, barely broader than long, rounded subtriangular; antennæ just about as long as head and thorax together. Thorax subquadrate, narrowing gently, the truncate anterior margin five-sixths the length of the posterior, the whole as long as its anterior breadth, the anterior lobe three times as long as the posterior, the sides full and rounded, very feebly separated from the posterior lobe, the surface faintly punctate. Hemelytra with the corium reaching the middle of the hinder half of the abdomen, heavily infuscated, but the sutura clavi always marked by a pallid line, and sometimes the corium marked with pallid after the style of Trapezonotus exterminatus of the same beds.

Length, 3.5^{mm}; breadth, 1.25^{mm}.

Named for the distinguished Yale zoologist, Prof. A. E. Verrill.

Florissant. Seven specimens, Nos. 1511, 2027, 2050, 3160, 5270, 9884, 11210.

14. PACHYMERUS St. Fargeau and Serville.

This group, as restricted by Stål, is composed wholly of Old World forms, and is closely related to Rhyparochromus. To it have been referred a considerable number of fossil Heteroptera, fifteen species in all,[1] but only two or three of them at the most can by any possibility be regarded as belonging to the genus in its now restricted form; these would be, besides the one given below, a single species each at Aix and Oeningen and in amber.

[1] In my Systematic review of fossil insects (Bull. U. S. Geol. Surv., No. 31, p. 63), I have said seventeen, having wrongly given credit to Radoboj and amber for one more species each than they have.

Pachymerus petrensis.

Pl. 5, Figs. 70, 71.

Pachymerus petrensis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 761 (1877).

A single specimen, of which most of the right half is destroyed, represents this species, which is placed here provisionally, principally because it appears to be closely related to fossil species put in this group by Heer. It seems to be a larva, and to belong to the Myodochina in the vicinity of Eremocoris. The outline of the head is vague and broken, but the front is apparently bent at a right angle. The antennæ are about half as long as the body, four-jointed; the basal joint only about half as long again as broad, the others subequal, very slightly smaller at the base than at the apex, but otherwise equal, the second a very little the longest, the last pointed at the tip. Thorax and abdomen of about equal length, the former equally broad throughout (or nearly so); the fore and middle femora short and stout, about as long as their separation from each other. Abdomen expanding suddenly at the base, so that the second segment is broadest and apparently half as broad again as the thorax, beyond tapering rather rapidly to a rounded tip.

Length of body, 3^{mm}; antennæ, 1.5^{mm}; fore femora, 0.35^{mm}.

Fossil Cañon, White River, Utah. One specimen (W. Denton).

15. TIROMERUS gen. nov. (*τείρω, μηρός*).

Head broadly triangular, as broad as front of thorax, the front angularly rounded, the eyes basal; antennæ much more than half as long as the body, the first joint distinctly surpassing the head, the second very slender and almost as long as the third and fourth together, these subequal, the last slightly incrassated. Thorax transverse, trapezoidal, tapering gently, the sides more or less but not much ampliated, with no distinct division into anterior and posterior lobes. Hemelytra with the corium barely reaching the middle of the abdomen.

The genus appears to be allied to Rhyparochromus, but the relative length of the second joint of the antennæ separates it from any existing genus with which it appears comparable. Two species are found at Florissant, which may perhaps be generically distinct, in which case T. torpefactus should be regarded as typical.

Table of the species of Tiromerus.

Thorax much less than twice as broad as long ..... 1. *T. torpefactus.*
Thorax fully twice as broad as long ..... 2. *T. tabiflnus.*

1. Tiromerus torpefactus.

Sides of body nearly straight and enlarging slightly from the head to the middle of the abdomen Head about twice as broad as long, the front roundly produced in front of the eyes. Antennæ very slender, extending, if stretched along the body, beyond the commissura. Rostrum extending to the middle coxæ. Thorax flat, gently tapering, with hardly any fullness, the length about two-thirds the breadth, its breadth at apex five-sixths that at base, the angles scarcely rounded, the front margin roundly, regularly, and slightly emarginate, the surface faintly wrinkled transversely. Hemelytra with the corium reaching the middle of the abdomen, apparently almost clear, but for a costal thickening of a testaceous color.

Length, 3^{mm}; breadth of base of thorax, 1.3^{mm}; length of antennæ, 2^{mm}.

Florissant. One specimen, No. 1214.

2. Tiromerus tabifluus.

Whole body of a very regular oval shape, the largest end posterior. Head about half as broad again as long, the front angularly produced but with the extreme front well rounded; rostrum reaching at least the fore coxæ, and apparently the middle pair; only the basal part of the antennæ preserved. Thorax almost flat, distinctly and considerably tapering, but short, with full sides, a little more than twice as broad as long, the apex about three-fourths the width of the base, the front margin roundly, regularly, and not slightly emarginate, the surface faintly and finely punctate Hemelytra with the corium not extending beyond the middle of the abdomen or hardly reaching it, the membranal suture transversely oblique, the corium apparently clear.

Length, 3.25^{mm}; breadth in middle of body, 1.5^{mm}.

Florissant. One specimen, No. 2475.

16. LITHOCHROMUS gen. nov. (λίθος, χρῶμα).

Head moderate, rounded subtriangular, of about equal length and breadth, the front distinctly angulate, the eyes small and globular, situated in the middle, away from the base; antennæ nearly or quite half as long as the body, the last joint scarcely or not incrassated; the first joint just or barely surpasses the front, the second is long and slender, and with the first

equal or almost equal to the last two together, these subequal. Thorax transverse, usually only half as broad again as long, broadest at the base or slightly before the base, narrowing in front so that the head is never more than half as broad as the thorax, often with a slight triangular depression at apex, with no distinct posterior lobe. Legs, especially the femora, moderately stout. Hemelytra with the corium reaching beyond the middle of the abdomen, but not far.

Four species have been distinguished in the Florissant shales.

Table of the species of Lithochromus.

Thorax broadest at base; first two joints of antennæ together as long as the last two.
- Thorax impunctate or scarcely punctate, longer than the width of the head; corium of hemelytra obscure ..... 1. *L. gardneri.*
- Thorax punctate, only as long as the width of the head, corium of hemelytra clear.
  - Thorax more than one-half as long again as the head ..... 2. *L. obstrictus.*
  - Thorax less than one-half as long again as the head ..... 3. *L. mortuarius.*

Thorax broadest before the base; first two joints of antennæ together slightly shorter than the last two ..... 4. *L. extraneus.*

1. Lithochromus gardneri.

Pl. 26, Fig. 10; Pl. 27, Fig. 8.

Antennæ as long as the head, thorax, and half of the scutellum. Thorax trapezoidal, longer than the width of the head, less than half as broad again as long, the sides scarcely convex, the apex nearly five-sixths the length of the base, the outer anterior angles a little rounded; the front transverse or slightly emarginate; a slight triangular depression broader than long occupies the whole front margin: surface impunctate or scarcely punctate, as is also the scutellum. Corium of the hemelytra obscure dark fuscous, with pallid longitudinal strigæ which scarcely affect the outer apex; membrane showing faint, longitudinal, pale testaceous strigæ.

Length, 5^{mm}; breadth, 2^{mm}.

Named for Mr. James T. Gardner, geographer of the Hayden Survey.

Florissant. Seven specimens, Nos. 1092, 2577, 3947, 4717, 9837, 10076, 14204.

2. Lithochromus obstrictus.

Thorax nearly twice as broad as long, only as long as the width of the head, more than half as long again as the head; the sides pretty strongly oblique and slightly convex; the apex about three-quarters the length of the base; front margin regularly, broadly, and considerably

emarginate; a slight median sulcation, but scarcely any sign of a depression at the apex. Surface nearly smooth, but coarsely, distantly, and faintly punctate. Corium of hemelytra clear.

Length, 5.25^{mm}; breadth, 2.1^{mm}.

Florissant. One specimen, No. 6390.

3. Lithochromus mortuarius.

Pl. 26, Fig. 2.

Antennæ slightly longer than head and thorax together. Thorax subquadrangular, less than half as broad again as long, less than half as long again as the head, and only as long as the width of the head, broadest before the base, with rather strongly convex sides, tapering only in the apical half, but rapidly; the apex three-fourths the length of the base; a distinct posterior lobe not one-fourth the length of the anterior; the front margin transverse or very slightly emarginate, with a distinct triangular anterior depression, twice as broad as long, the apex broadly rounded; surface indistinctly punctate. Corium of hemelytra blackish fuscous; membrane with slight marks of longitudinal infuscation.

Length, 4.6^{mm}; breadth of base of thorax, 1.85^{mm}; abdomen, 2.25^{mm}.

Florissant. Two specimens, Nos. 4644, 11220.

4. Lithochromus extraneus.

Pl. 26, Fig. 6.

The single specimen is preserved only upon a side view, and is on that account difficult to compare with the others absolutely. The head appears to be of unusual length, being apparently about five-sixths the length of the thorax, and is smooth; the antennæ are exceptionally stout and are somewhat longer than the head and thorax together; the first two joints together slightly shorter than the last two; the first and second joints increase very slightly in size next the apex, and are truncate at tip; the last joint scarcely enlarges toward the tip, which is rounded. Thorax apparently tapering from a little before the base, somewhat tumid, and punctate; corium of hemelytra clear, or very slightly obscured, punctate throughout, but more densely along the principal veins; membrane clear.

Length, 5.5^{mm}; of corium of hemelytra, 2.75^{mm}.

Florissant. One specimen, No. 13660.

17. COPTOCHROMUS gen. nov. (κοπτός, χρῶμα).

Head rounded triangular, fully as long as broad, as broad as the apex of the thorax; the eyes small, globular, median, the front between them advanced considerably, and roundly angulated; antennæ shorter than in the preceding genus, longer than in the succeeding genera, being longer than head and thorax together, but considerably less than half the length of the body; first joint distinctly, though not considerably, surpassing the front, the first and second together shorter than the remainder of the antennæ, the third and fourth subequal and not at all incrassated. Thorax transverse, considerably less than twice as broad as long, decidedly longer than the head, broadest at the base, the anterior lateral margins strongly rounded, the apex about three-fourths the width of the base; no noticeable posterior lobe. Legs and hemelytra as in the preceding genus.

A single species occurs at Florissant.

Coptochromus manium.

Antennæ of nearly uniform diameter throughout. Thorax trapezoidal with the outer anterior angles strongly rounded; the thorax tapering rapidly only at the extreme apex; front margin gently emarginate, a very broad, rounded, subtriangular, anterior depression three or four times as broad as long occupying the whole apex; a distinct median carina; surface smooth. Corium of hemelytra varying from pale testaceous to fuscous, more heavily marked along the costal margin; the whole surface faintly and uniformly punctate; membrane clear.

Length, 4.6^{mm}; breadth, 2^{mm}.

Florissant. Four specimens, Nos. 5248, 6270, 6449, 9046.

18. PROLYGÆUS gen. nov. (πρό, Lygæus, nom. gen.)

Body of a very regularly oval form less than twice as long as broad. Head rather small, with the eyes rather narrower than the reduced front of the thorax, as long as broad, the eyes situated in the middle of the head, and the front produced in advance of them as a broad quadrate mass; antennæ as long as the head and thorax, the first joint not surpassing, probably just reaching, the front, the last two longer than the first two joints, subequal and slightly incrassated. Thorax very transverse, nearly three

times as broad as long, the posterior lobe more than one-third of the whole, tapering pretty regularly and very considerably from base to apex, which is not more than two-thirds as long as the base. Femora stout and large. Hemelytra with the corium extending a little beyond the middle of the abdomen.

A single species is found at Florissant.

PROLYGÆUS INUNDATUS.

Pl. 27, Fig. 13.

Head very faintly and finely punctate, oblique sides of the thorax gently convex, front margin of thorax marginate and broadly and slightly emarginate; surface distinctly, rather distantly and uniformly punctate. Corium of hemelytra rather heavily punctate in series which are more or less longitudinal.

Length, 5.5^{mm}; breadth of thorax, 1.85^{mm}; abdomen, 2.6^{mm}.

Florissant. One specimen, No. 6299.

19. NECROCHROMUS gen. nov. (*νεκρὸς, χρῶμα*).

Body very regularly oval, the broader end posterior, the abdomen being very full, laterally expanded beyond the costal margins of the closed hemelytra, the whole body less than twice as long as broad. Head with the moderately large eyes just as broad as the apex of the thorax, almost as long as broad, being strongly and angularly produced in front of the eyes, which are situated at or close to the base. Ocelli small, situated close to the eyes on a line with their posterior margin; antennæ as long as head, thorax, and scutellum, the first joint not or but slightly surpassing the front, the other joints subequal, the fourth slightly the longest, the third shortest, the last two gently incrassated. Thorax transverse, broadest at base, tapering rather or very rapidly, scarcely longer than the head, the sides convex, the obscure posterior lobe rather less than one-fourth of the whole. Legs, or at least the femora, pretty stout. Hemelytra with the corium surpassing the middle of the abdomen to a greater or less degree.

Three species are known, all from Florissant.

Table of the species of Necrochromus.

Thorax about twice as broad as long.
Apex of thorax more than three-fourths as long as base; corium of hemelytra short.....1. *N. cockerelli.*
Apex of thorax hardly more than half as long as base; corium of hemelytra long.....2. *N. labatus.*
Thorax about half as broad again as long .....3. *N. saxificus.*

1. Necrochromus cockerelli.

Pl. 27, Fig. 10.

Head smooth. Thorax fully twice as broad as long, the apex more than three-quarters the length of the base, gently tapering with arcuate sides, the front margin gently and broadly emarginate with somewhat rounded lateral angles; sides marginate and on either side near the margin a gently arcuate sulcus subparallel to the margin; the posterior lobe separated only by a slight carination; whole surface uniformly and distinctly punctate. Corium of hemelytra relatively short, hardly surpassing the middle of the abdomen, clear, excepting a broad, fusco-fuliginous band along the membranal suture and the fuscous punctate veins; the whole of the corium is also distantly punctate; membrane clear, abdomen fusco-fuliginous with a broad, submarginal, distinctly bordered, clear band not clearly observable in all specimens.

Length, 6.15^{mm}; breadth of thorax, 2.15^{mm}; abdomen, 2.85^{mm}.

Named for Mr. T. D. A. Cockerell, the industrious entomologist of Colorado.

Florissant. Five specimens, Nos. 2229, 8139 and 8234, 9086. 10135, 11231.

2. Necrochromus labatus.

Pl. 27, Fig. 14.

Thorax nearly two and a half times as broad as long, only a little longer than the head; apex only three-fifths the breadth of the base, transverse, the sides oblique, gently arcuate, the outer anterior angles scarcely rounded; the surface uniform, heavily punctate. Corium of hemelytra relatively long, reaching the middle of the outer half of the abdomen, pale testaceous excepting rather large fuscous spots along the inner half of the membranal suture; the whole surface punctate; the veins infuscated; abdomen as in last species.

Length, 5^{mm}; breadth of thorax, 2.15^{mm}; abdomen, 2.8^{mm}.

Florissant. One specimen, No. 2871.

3. Necrochromus saxificus.

Antennæ as long as head, thorax, and scutellum, all but the apical joint dark; the latter clear except for some slight blotches. Thorax trapezoidal, hardly half as broad again as long, tapering gently and regularly except

for the slight arcuation of the sides from the extreme base; the apex fully three-fourths as long as base, the front margin gently emarginate, the outer angles hardly rounded; surface punctate. Corium of hemelytra reaching almost to the middle of the apical half of the abdomen, more or less obscure and punctate; abdomen uniformly dark fuscous, differing from the other species in its relative narrowness, so that it is apparently not expanded laterally beyond the margin of the hemelytra.

Length, 6mm; breadth of thorax, 1.8mm; abdomen, 2.5mm.

Florissant. One specimen, No. 8927.

20. EXITELUS gen. nov. (ἐξίτηλος).

The body is long oval, more than twice as long as broad. Head a little broader than long, as broad as the abruptly narrowed apex of the thorax, but hardly half so broad as the base of the thorax; eyes rather small, situated in the middle of the head, the front between them strongly and roundly produced, with no angulation; antennæ as long as head and thorax together, the first joint barely surpassing the front, the last a little incrassated and apparently the longest. Thorax trapezoidal, narrowing rapidly from base forward, abruptly at the very apex, not much more than half as broad again as long, the sides a little convex. Femora stout. Corium of hemelytra extending beyond the middle of the abdomen, which, though full, perhaps does not expand laterally beyond the closed hemelytra.

A single species is known.

Exitelus exsanguis.

Pl. 27, Fig. 2.

Head and thorax fusco-fuliginous, the latter with a median sulcation, both smooth, though the scutellum is faintly punctate; front margin of the thorax slightly emarginate. Corium of hemelytra reaching the middle of the apical half of the abdomen, fuliginous with a central faint pallid spot, faintly punctate; abdomen fusco-fuliginous with a premarginal, broad, clearly defined, pale belt which traverses the abdomen in equal breadth just beyond the scutellum.

Length, 4.85mm; breadth of thorax, 1.9mm; abdomen, 2mm.

Florissant. One specimen, No. 6656.

21. CRYPTOCHROMUS gen. nov. (*κρυπτός*, *χρῶμα*).

Body of an oval shape, a very little more than twice as long as broad. Head large, distinctly broader than the apex of the thorax, fully half as broad again as long, the front but slightly advanced before the eyes, very broadly angulate. Eyes very large, half as long as the thorax, hemispherical, occupying the entire narrowed side of the head. Antennæ as long as head and thorax, the first joint scarcely surpassing the head, the other joints subequal in length, the second very slender, the fourth distinctly incrassate. Thorax trapezoidal, a little more than twice as broad as long, flattened, broadest at base, narrowing gently in advance, the sides gently arcuate, the apex two-thirds as broad as the base. Corium of hemelytra reaching beyond the middle of the apical half of the abdomen.

One species only is known, from Florissant.

CRYPTOCHROMUS LETATUS.

Head, thorax, scutellum, and hemelytra, the latter perhaps to a less extent than the other parts, blackish fuscous, finely and uniformly punctate. Thorax about two and a quarter times as broad as long, the front margin roundly emarginate, the hind margin transverse, the posterior considerably longer than the anterior lobe; a slight median sulcation. Corium of hemelytra strongly infuscated, very long, reaching to the last abdominal joint, the membranal suture very oblique; abdomen fusco-fuliginous.

Length, 4.15^{mm}; breadth of thorax, 2^{mm}; abdomen, 2.15^{mm}.

Florissant. One specimen, Nos. 4487 and 11655.

Subfamily PYRRHOCORINA Stal.

This peculiar group, by many regarded as deserving family rank, has never before been found fossil. The Florissant beds, however, yield two species, which I have referred to Dysdercus.

DYSDERCUS Amyot and Serville.

To this genus, found all over the world, but not so rich in species with us as in the Old World, an inhabitant mostly of warm climates, and represented in the United States only in the southern portion, a couple of Florissant forms appear to belong. It has not before been recognized in a fossil

state, but it is quite possible that some of the undescribed species in the European Tertiaries referred to Lygæus may be found on examination to belong here or to other Pyrrhocorina, since the two species found at Florissant closely resemble the species of Lygæus from the same beds, and until their want of ocelli was noted were placed next to them.

Table of the species of Dysdercus.

Middle of body belted with a light band ..... 1. *D. cinctus.*
Body uniform in color ..... 2. *D. unicolor.*

1. Dysdercus cinctus.

Pl. 24, Figs. 11, 13, 14.

Head rounded, subtriangular, the front broadly rounded with a slight angulation (Fig. 13 is inaccurate, having been drawn before the stone was broken away from the head). Surface transversely and finely corrugated, otherwise smooth. Thorax coarsely, obscurely, and distantly punctate, as are also the femora. The scutellum appears to be nearly smooth. Hemelytra finely punctate along impressed lines following the course of the principal veins. Whole body dark, but transversely banded with lighter color in a rather broad belt, which crosses the posterior half of the thorax and more distinctly traverses the body and closed hemelytra at the tip of the scutellum.

Length of body, 8.65^{mm}; antennæ, 3.75^{mm}; breadth of body, 3.5^{mm}.

Florissant. Nine specimens, Nos. 1426, 1745, 3199, 4248, 5865, 7161, 9890, 10303, 13561. One of the specimens figured, No. 5865, was mislaid at the time of description of the species, but undoubtedly belongs here.

2. Dysdercus unicolor.

Body uniformly dark fuscous throughout, with no indication of any transverse lighter-colored bands. Head smooth, antennæ concolorous. Thorax and scutellum very coarsely and distantly punctate. The abdomen similarly but more obscurely and still more distantly punctate, the closed hemelytra slightly surpassing its extremity.

Length, including the closed hemelytra, 8.5^{mm}; antennæ, 3.5^{mm}; breadth, 3.5^{mm}.

Florissant. Two specimens, Nos. 3230, 10340.

Family COREIDÆ Stephens.

The members of this large family do not appear to have been recovered from the rocks in any great variety of forms, and from amber but a single species is known. The Coreina and Alydinæ appear to have been far the most abundant among the subfamilies, the former prevailing in Europe, the latter in America; in America much the greater number of all the species, and genera as well, belong to the Alydinæ, a somewhat remarkable fact in view of the relatively slight importance of this group to-day. The Corizida were next in importance, a few species being found both in Europe and America. The other subfamilies represented are the Pseudophlœina, which occurs only in America and in a single genus, which appears, however, to have been very common; and the Berytina, found only in Europe, and the only subfamily represented in amber. Excepting one Corizus, all the American species that have been found have occurred only at Florissant.

Subfamily COREINA Stål.

This subfamily is better represented in the European Tertiaries than in our own, where it has so far been detected only at Florissant. In Europe we find a dozen species of half as many genera, of which one, Palæocoris Heer, with a single species from Radoboj, is regarded as extinct, and another, Coreites, with three species from Oeningen and Radoboj, is used only as a magazine for imperfectly known forms. The other genera are Syromastes, with four species from Oeningen, Spartocera, with two from Radoboj, and single species of Hypselonotus at Oeningen, and Leptoscelis at Sieblos. Besides Serres states that two small species of Coreus (used in a general sense) occur at Aix.

None of these at all resemble in any particular manner the forms we find at Florissant, where all the species but one have to be referred to extinct genera, and the one exception may require a similar reference when better known. There are, however, but four genera with nine species. In two of them, one containing four species, it is difficult to determine in what relation they stand to existing types on account of the peculiarities of the neuration of the hemelytra. A third, Piezocoris, with three species, is remarkable for its large head, but otherwise does not greatly differ from

Anasa, to which the remaining species is referred. In all the antennæ are brief and have the joints beyond the basal of more than usual equality.

Table of the genera of Coreina.

Head not more than half as long as the thorax ..... 1. *Anasa.*
Head more than half as long as the thorax.
An oblique vein running from the upper apex of the central cell of the corium to the costa, inclosing a large rhomboidal cell at the apex of the corium.
Head and thorax of subequal length ..... 2. *Achrestocoris.*
Head much shorter than the thorax ..... 3. *Phthinocoris.*
No oblique vein nor rhomboidal cell at apex of corium ..... 4. *Piezocoris.*

1. ANASA Amyot and Serville.

This American genus, rich in species in tropical and subtropical regions and with at least twenty species in North America having a great variety of form and general appearance, is best known to the public by our common odoriferous "squash-bug." The genus has never before been found fossil, but occurs in a single instance at Florissant, the species being somewhat peculiar in the form of the anterior half of the thorax.

Anasa priscoputida.

Pl. 24, Fig. 4.

Head rounded triangular, together with the eyes rather more than half the width of the front lobe of the thorax, of about equal length and breadth, the front strongly protruded in advance of the eyes. Antennæ somewhat more than half as long as the body, the first joint but little stouter than the others, cylindrical, scarcely shorter than the head, the second and fourth subequal, the third smaller. Thorax fully double the length of the head, the anterior and posterior lobes very distinct in their form and structure, the posterior occupying two-thirds of the length with rounded alations, which increase its breadth nearly one-third; surface distantly and rather finely granulate, except along its anterior edge, where the granulations are larger and more crowded; except for the alations the sides are straight; anterior lobe very rapidly tapering in front, the sides strongly oblique and well rounded; the front margin gently and broadly emarginate; the surface smooth like the head, except for a few granulations along the anterior margin and lateral edges. Scutellum large, triangular, granulate like the posterior lobe of the thorax. Corium and clavus of the hemelytra distantly

punctate in linear rows. Legs slender, the anterior femora longer than the breadth of the body. Abdomen long and rather narrow with straight sides tapering apically.

Length of body, 7^{mm}; breadth of posterior lobe of thorax, 2.8^{mm}; abdomen, 2.25^{mm}; length of antennæ, 4^{mm}.

Florissant. One specimen, No. 13314.

2. ACHRESTOCORIS gen. nov. (ἄχρηστος, κόρις).

This genus and the following are remarkable for the neuration of the corium of the hemelytra, where an oblique vein runs from the upper apex of the central cell to the costa, in addition to the two other veins running from the extremity of the cell to the membrane, and so inclosing between itself and the upper of these two usual veins a large rhomboidal cell at the apex of the corium. In the present genus the thorax is exceptionally short, being no longer than, if as long as, the small head. The head is subquadrate, slightly longer than broad, less than half as wide as the base of the thorax, not much produced in front of the antennæ. Antennæ not preserved in any of the specimens. Eyes large and rather prominent, ocelli minute, circular, more than twice as near the eyes as each other, opposite the middle of the posterior half of the eyes. Thorax with truncate base, the sides tapering rapidly to the narrow apex, the apical margin gently, regularly, and roundly emarginate, the whole more than twice as long as broad. Scutellum very large, triangular, broader than long. Corium of hemelytra large, reaching nearly to the tip of the abdomen, which the membrane appears to surpass slightly. Membranal margin straight, very oblique. Abdomen large and rather full, half as long again as broad.

A single species is known.

Achrestocoris cinerarius.

Pl. 22, Fig. 1.

Body robust, but little more than twice as long as broad. Head very finely granulate, intraocular space about half as wide as the length of the head; the color black. Thorax blackish fuscous with coarse and faint punctæ, not very close together; sides with very slight ampliations; rest of the body black or blackish fuscous. Hemelytra fusco-fuliginous with dusky

veins; a broad band crossing the base of the abdomen and including the hemelytra of a reddish fuscous color.

Length of body, 8.5^{mm}; breadth of thorax, 3^{mm}; breadth of middle of abdomen, 3.6^{mm}.

Florissant. Four specimens, Nos. 4480, 11223, 11234, 12085.

3. PHTHINOCORIS gen. nov. (φθίνω, κόρις).

This genus agrees closely with the last except that the thorax is much longer, the head being distinctly shorter than it. It is of a similar robust form. The head is similarly shaped and well rounded; the eyes are large, the ocelli small and circular, as near together as to the eyes and opposite the middle of the same. The antennæ are scarcely half as long as the body, the basal joint moderately stout but short, not half so long as the head, the other joints subequal, but the fourth the smallest and scarcely incrassated. Thorax fully twice as broad as the head, tapering forward with rounded ampliated sides, more or less distinctly separated into an anterior and posterior lobe (the anterior very short) by a transverse slight sulcation, sometimes marked by a series of granules. Hemelytra with the same structure as to the venation as in Achrestocoris, the central cell remarkably short, its apex being scarcely beyond the center of the corium; membrane slightly exceeding the abdomen; this latter shaped as in Achrestocoris.

Four species are known.

Table of the species of Phthinocoris.

Head much shorter than thorax; species of medium size.
- Thorax almost twice as broad at base as long ..... 1. *P. colligatus.*
- Thorax much less than twice as broad at base as long ..... 2. *P. lethargicus.*

Head and thorax of subequal length.
- Species of small size (measuring about 6.5^{mm} in length); head not broader than long, delicately granulate ..... 3. *P. languidus.*
- Species of large size (measuring about 9.5^{mm} in length); head broader than long, coarsely and obscurely granulate ..... 4. *P. petræus.*

1. PHTHINOCORIS COLLIGATUS.

Pl. 22, Fig. 3.

Head imperfectly preserved but plainly triangular, the surface nearly smooth, but beset with a fine granulation. Thorax nearly twice as long as the head, not quite twice as broad as long, the sides nearly straight and

regularly tapering; the surface black or blackish fuscous and finely granulate, a row of granules marking the limitations of the two lobes. Scutellum finely granulate, black. Hemelytra fusco-fuliginous, the membrane fainter; the corium long, reaching almost to the extremity of the abdomen; the sutura clavi marked by a pallid line; the surface of the whole more or less finely punctate.

Length of body, 8^{mm}; breadth of thorax, 3^{mm}.

Florissant. One specimen, No. 6371.

2. Phthinocoris lethargicus.

Pl. 26, Fig. 17; Pl. 27, Fig. 17.

Head blackish fuscous, nearly smooth, but with fine transverse corrugations; the antennæ of the same color. Thorax reddish fuscous except along the posterior margin, which with the whole scutellum and the base of the hemelytra beside it is blackish, forming a broad, transverse belt across the body; the sides of the thorax full, ampliated, the thorax tapering much more rapidly in the anterior than in the posterior half, the separation of the anterior and posterior lobes marked by a fine row of granules; the surface otherwise nearly smooth but faintly and coarsely granulose. Scutellum finely corrugate. Hemelytra pale fusco-fuliginous, the membrane nearly pallid, the veins all marked with fuscous in series of punctures upon either side; corium rather shorter than in the preceding species.

Length of body, 8.65^{mm}; breadth of thorax, 2.5^{mm}; abdomen, 3.5^{mm}; length of antennæ, 3.5^{mm}.

Florissant. Three specimens, Nos. 6370, 8740, 9532.

3. Phthinocoris languidus.

Pl. 27, Fig. 6.

The smallest of the species. Head rounded, of about equal length and breadth, the eyes only moderately large, globular, the surface of the head finely granulate. Antennæ slender but short, not half the length of the body, black like the head; indeed the whole body is black. Thorax just about as long as the head, more coarsely granulate than it, more than twice as broad as long, the sides tapering but regularly rounded. Corium of

hemelytra rather heavily but not very deeply punctate, the punctæ distributed only in part in longitudinal series and not confined to the veins; the corium about as long as in the preceding species, or rather shorter; not so short as represented in the figure, but extending as far as the membrane is there represented. Legs short but slender.

Length of body, 6.65^{mm}; of antennæ, 2.25^{mm}; breadth of thorax, 2 25^{mm}

Florissant. Three specimens, Nos. 9451 and 10961, 10613, 12256.

4. Phthinocoris petræus.

This species is represented by specimens less well preserved than the others, but differs from them all in its much larger size and in the structure of the thorax. The head is distinctly broader than long, more than half as broad as the thorax, distantly and very finely granulate; the basal joint of the antennæ is pretty stout, but very short and but little surpasses the front of the head. The thorax is twice as broad as long, the sides tapering rapidly but full, the surface coarsely and very distantly granulate; the whole body is black or blackish fuscous with faint signs, in some instances at least, of a broad belt of lighter color across the body including in its anterior half the scutellum. Corium of hemelytra marked by coarse distant granulations following the veins; it extends to no great distance before the tip of the abdomen.

Length of body, 9.5^{mm}; breadth of thorax, 3.1^{mm}.

Florissant. Four specimens, Nos. 7769, 9999, 10366, 11766.

4. PIEZOCORIS, gen. nov. (πιέζω, κόρις).

A genus of Coreina peculiar for the large size of the head; this is fully one-half, sometimes two-thirds, the width of the thorax, subtriangular in form and well rounded, rather broader than long, the front rectangular, produced in front of the eyes; the latter are rounded, prominent, the intraocular space being as broad as half the length of the head. Antennæ much as in Phthinocoris, the basal joint moderately stout, cylindrical, less than one-half as long as the head, the remaining joints subequal, the second and third slender, about half as broad as the basal, the last incrassated, subfusiform, nearly as stout as the basal. Thorax fully as long as the head, tapering, the apical margin more than half as long as the basal. The hemelytra of the

ordinary structure. The legs rather short, slender, the hind femora scarcely so long as the width of the abdomen.

Three species are known.

Table of the species of Piezocoris.

No distinct dark spot near apex of corium; eyes large.
Apical margin of thorax more than half as long as the basal .....1. *P. peritus.*
Apical margin of thorax less than half as long as the basal .....2. *P. compactilis*
A distinct dark spot near the apex of corium; eyes small.....3. *P. peremptus.*

1. Piezocoris peritus.

Pl. 25, Fig. 15.

The whole body fusco-fuliginous, tinged more or less with blackish fuscous. Head faintly granulate, excepting next the base, where it is more distinct. Thorax very coarsely and very distantly granulate, the sides nearly straight, the apical margin faintly and roundly emarginate and nearly two-thirds as long as the basal; scutellum like the thorax. Corium of hemelytra very coarsely punctate, especially next the base, reaching very near the extremity of the abdomen, which the membrane considerably surpasses. Legs short, the femora subequal, faintly punctate.

Length of body, 7.5^{mm}; breadth of thorax, 2.8^{mm}; length of antennæ, 4^{mm}.

Florissant. One specimen, No. 10956.

2. Piezocoris compactilis.

Whole body black. Head apparently smooth. First joint of antennæ surpassing a little the front of the projecting snout; second and third joints of the antennæ a little pallid. Thorax coarsely but not prominently and rather distantly granulate, the apical margin broadly and roundly emarginate, a little more than half as long as the basal, the sides rapidly tapering with slight fullness. Abdomen rather slender and long.

Length of body, 7.5^{mm}; breadth of thorax, 2.75^{mm}; length of antennæ, 4^{mm}.

Florissant. One specimen, No. 5731.

3. Piezocoris? peremptus.

Pl. 26, Fig. 14.

Body blackish fuscous, mottled with pallid, especially upon the abdomen. Head smooth excepting on its posterior border, where it is coarsely

granulate; eyes very small, globular. Thorax very coarsely and distantly granulate, perhaps a little longer than the head and certainly broader than long. Hemelytra scarcely showing any veins in the corium, which is pale fuliginous, edged with dark fuscous, and with a large round fuscous spot just before the middle of the membranal margin; the membranal margin itself infuscated at its two extremities; membrane more deeply fuscous, especially toward the base and on either side, with numerous veins arising from a transverse vein following the membranal margin; the extremity of the corium is far before that of the abdomen, which is barely covered by the membrane.

Length of body, 9.65^{mm}; breadth, at least 3^{mm}.

This species, being preserved only upon a side view, can not be definitely referred to this genus; but as it agrees better with it than with any of the others and does not furnish characters sufficient for clear generic separation I have preferred to leave it in this place.

Florissant. One specimen, No. 5633.

Subfamily ALYDINÆ Distant.

Although when compared to the other Coreidæ, this subfamily is to-day but poorly represented in America, whether in temperate or tropical regions, this was not the case in Tertiary times, for it was fairly well furnished with genera and species, and as for numbers in individuals no group of Heteroptera could compare with it. Most of the eight genera are extinct types and belong to the division of Micrelytraria in the immediate vicinity of Protenor and Darmistus, with slender and unarmed hind femora, but also, as a general rule, with distinctly though delicately and profusely spined hind tibiæ. One genus, Rhepocoris, contains the bulk of all, and of the four or five species belonging to it nearly all the specimens obtained belong to two closely allied forms, possibly to be regarded as only one. In Europe but three fossil Alydinæ have been recognized, and these have all been referred to the division Alydaria. One from the brown coal of the Rhine is irrecognizable at present, but was referred by Germar to Alydus; a second from Oeningen is a true Alydus; and a third, also from Oeningen but undescribed, was compared by Heer to Alydus lateralis, now placed in the neighboring genus Camptopus.

Table of the genera of fossil Alydinæ.

Hind femora spined beneath ..... 1. *Cacalydus.*
Hind femora unarmed.
Posterior lateral angles of thorax produced as a spine ..... 2. *Cydamus.*
Posterior lateral angles of thorax not produced.
Thorax scarcely narrower at apex than at base ..... 3. *Parodarmistus.*
Thorax distinctly tapering from base to apex.
First joint of antennæ no longer than the head.
Head distinctly longer than the thorax; first joint of antennæ (at least in Protenor) as long as the head.
Body slender; thorax tapering gently, of about equal length and breadth. 1. *Protenor.*
Body robust; thorax tapering rapidly, twice as broad as long ..... 5. *Tenor.*
Head and thorax subequal in length; first joint of antennæ shorter than the head.
Second joint of antennæ much longer than either of the others ..... 6. *Etirocoris.*
Second, third, and fourth joints of antennæ subequal ..... 7. *Rhepocoris.*
First joint of antennæ much longer than the head ..... 8. *Orthriocorisa.*

1. CACALYDUS gen. nov. (κακός, Alydus, nom. gen.).

Nearly allied to Alydus but differing from it in the structure of the antennæ, which are distinctly shorter than the body; the first joint about as long as the head, the other three subequal, the terminal joint incrassated gently, but no longer or scarcely longer than the second and third. The head is more than half as broad as the thorax, subquadrate or subrotund, of about equal length and breadth; the eyes not very strongly prominent. The body is elongate, subequal, the thorax tapering forward to a greater or less degree. The legs moderately stout, the hind femora strongly incrassated, and on the outer half of their inferior surface armed more or less distinctly with spines. These, unfortunately, are not shown in the drawings of either of the species.

Table of the species of Cacalydus.

Species of large size (more than eleven millimeters long); head scarcely constricted behind the eyes. 1. *C. lapsus.*
Species of moderate size (less than nine millimeters long); head strongly constricted behind the eyes. 2. *C. exstirpatus.*

1. Cacalydus lapsus.

Pl. 25, Fig. 12.

A large species, of which unfortunately but a single specimen is at hand. Intraocular space of the head scarcely equaling one-half the width of the head, the surface rather coarsely, faintly, and transversely corrugate, not constricted in the least behind the eyes, so that there is no neck at the junction of the head and thorax. Thorax subquadrate, a little broader than long, tapering but gently, the surface nearly smooth. Fore

femora with a median longitudinal carina, not very prominent, middle and hind femora much enlarged, the hind pair with delicate spines on only the apical half of the inferior surface.

Length, 12.4^{mm}; breadth of thorax, 2.3^{mm}.

Florissant. One specimen, No. 1.508 of the Princeton Collection.

2. Cacalydus exstirpatus.

Pl. 25, Fig. 3.

Head subrotund, of about equal length and breadth, distinctly constricted behind the eyes so as to form with the rapidly tapering thorax a distinct neck; intraocular part of the head three-fourths the width of the whole; the surface coarsely granulate. Thorax trapezoidal, fully one-third as broad again at base as at apex, not very coarsely granulose. Legs rather slender, the middle femora agreeing better with the fore femora than with the hind; the hind femora much swollen, armed on the inferior surface at and a little beyond the middle with six or seven large, coarse, irregular, flattened, spinous denticulations; the basal third of the same femora lighter colored than the rest of the femur.

Length of body, 7.25^{mm}; breadth of thorax, 2^{mm}.

Florissant. Four specimens, Nos. 6628, 10709, 12102, 13311.

2. CYDAMUS Stål.

This genus comprises, as far as known, only four or five tropical and subtropical American species. The one which we here add from Florissant can be placed here only provisionally, as it does not agree in many striking features with the modern forms. In particular the body is more robust, not slender and elongate, as in the modern types. With this exception, it has never been recognized in a fossil state.

Cydamus robustus.

Pl. 26, Fig. 3.

Head and thorax similarly, delicately, and equably granulate, unless the granulations are coarser next the base of the thorax. Thorax a little shorter than broad, tapering rather rapidly to the apex, which is not so broad as the head, the eyes included, but broader than the intraocular part of the head; outer posterior angles produced to a long, tapering spine

directed equally backward and outward, not properly represented on the plate; the hinder margin slopes backward to aid in forming the spine, immediately the limits of the scutellum are past. On the scutellum the granulations become more or less transverse corrugations, especially toward the apex, but I can detect no scutellar spine. Hemelytra extending a little beyond the abdomen, with the corium and clavus dark brownish fuliginous, rather distantly punctate with white in linear rows; membrane very pale fuliginous, pallid next the apex of the corium.

Length of body, not including the hemelytra, 5.75^{mm}; hemelytra, 4.5^{mm}; breadth of thorax, 2.5^{mm}.

Florissant. One specimen, No. 7856.

3. PARODARMISTUS gen. nov. (*πάρος*, Darmistus, nom. gen.).

Related to Darmistus Stål, but differing from it in the length of the last antennal joint, which is no longer than either of the two preceding; the antennæ are scarcely more than half as long as the body; the basal joint is moderately stout, short, projecting but little beyond the front of the head, the remaining joints subequal, the last very gently and slightly incrassated, but not longer than the second, rarely longer than the third and then but slightly. Head and thorax of subequal length, the head rounded or subquadrate, of about equal length and breadth; the thorax subquadrate, scarcely narrower at apex than at base, yet never longer than broad. Hemelytra just reaching the end of the abdomen, the two principal veins of the membrane forming a median loop, its apex just before the center of the membrane, and from which radiate at tolerably regular distances six or seven equal or subequal forks. Hind femora slender and smooth, hind tibiæ delicately spinous.

Six species occur in the Tertiary shales of America, all from Florissant.

Table of the species of Parodarmistus.

Thorax about equally granulate throughout.
- Hind femora twice as long as the width of the thorax ..... 1. *P. abscissus.*
- Hind femora less than half as long again as the width of the thorax ..... 2. *P. caducus.*

Thorax with the posterior lobe very distinctly more coarsely granulate than the anterior.
- Thorax scarcely broader than long ..... 3. *P. collisus.*
- Thorax considerably broader than long.
  - Thorax about half as broad again as long.
    - Eyes of moderate size, not prominent; head and thorax subequal in length ..4. *P. defectus.*
    - Eyes very large and prominent; head considerably longer than the thorax. 5. *P. exanimatus.*
  - Thorax twice as broad again as long ..... 6. *P. inhibitus.*

1. Parodarmistus abscissus.

Body much elongated and slender. Head slightly longer than broad, broadest at the posterior margin of the eyes, behind which the head is somewhat strongly contracted; eyes pretty large, not very prominent. Antennæ a little more than half as long as the body, very slender; surface of head not very coarsely but very considerably granulate, with a tendency toward a transverse disposition of the granules. Thorax subquadrate, scarcely narrower apically than basally, at the apex as broad as the head, including the eyes; the lateral angles of the front somewhat rounded; surface like that of the head granulate, equally fine throughout, with no distinction between the anterior and posterior portions. Hind femora very long, gradually enlarging from base to apex, but scarcely stouter at the broadest than the middle femora, almost as long as the antennæ. Head and thorax piceous, legs dusky fuliginous.

Length of body, 7.25^{mm}; hind femora, 3.25^{mm}; breadth of thorax, 1.5^{mm}; abdomen, 2.2^{mm}.

Florissant. One specimen, No. 12100.

2. Parodarmistus caducus.

Body slender but not greatly elongated; head of about equal length and breadth, the front well rounded between the antennæ, constricted behind the eyes, which are moderately large, not very prominent. Antennæ about half as long as the body, or a little more than that, moderately slender, the second and third joints a little larger apically than at the base, the last joint gently incrassated and fusiform. Thorax subquadrate, a little broader than long, like the head granulate equally throughout, with no distinction between the anterior and posterior portions. All the femora subequal, the hind femora very much shorter than the antennæ. Head and thorax piceous, legs fusco-fuliginous.

Length of body, 6^{mm}; breadth of thorax, 1.6^{mm}; abdomen, 1.75^{mm}; length of hind femora, 2.5^{mm}.

Florissant. Two specimens, Nos. 1432, 3358.

3. Parodarmistus collisus.

Pl. 25, Fig. 13.

Head quadrate, the front transverse, scarcely advanced between the antennæ; of nearly equal breadth throughout, not constricted behind the

eyes, which are moderately large and very prominent; surface delicately granulate. Thorax scarcely broader than long, subquadrate, at the apex of the same width as the head, the lateral angles rectangular, the posterior lobe coarsely, the anterior lobe scarcely, granulate. Hemelytra reaching the extremity of the abdomen; corium and clavus blackish fuliginous, with the sutura clavi marked by a broad pallid stripe which broadens at the costal margin to a large triangular spot; membrane pale fuliginous, the veins infuscated, a moderately large, trapezoidal, pallid spot next the apex of the corium. Legs dark fuliginous, uniform.

Length of body, 7.5^{mm}; breadth of thorax, 1.8^{mm}; abdomen, 2.7^{mm}.

Florissant. One specimen, No. 12778.

4. Parodarmistus defectus.

Head subquadrangular, slightly longer than broad, about as long as the thorax, the sides straight, the front broadly angulate, surface delicately granulate, eyes rather small, not very prominent. Antennæ rather more than half as long as the body, slender, the last joint delicately incrassated and fusiform. Thorax trapezoidal, tapering slightly from base to apex, the apex being about two-thirds as long as the base, the whole about half as broad again as long, the apex about as broad as the intraocular part of the head, the apical margin slightly and gently emarginate; the surface of the anterior lobe nearly smooth, of the posterior coarsely granulate like the scutellum; veins of the corium of the hemelytra coarsely granulate. Head and thorax blackish fuscous, the anterior lobe of the thorax a little lighter; the legs fusco-fuliginous.

Length of body, 7.5^{mm}; breadth of thorax, 2^{mm}.

Florissant. Three specimens, Nos. 5121, 9428, 9941.

5. Parodarmistus exanimatus.

Head rounded, except for the eyes broadest at the posterior edge of the eyes, behind which it is somewhat constricted, rather longer than broad, longer than the thorax, considerably and roundly produced in front of the eyes; eyes large and prominent; surface granulate; antennæ considerably more than half as long as the body. Thorax about half as broad again as long, shorter than the head, coarsely granulate posteriorly, delicately granulate anteriorly, the sides somewhat full; scutellum coarsely granulate.

Corium of hemelytra distantly and coarsely punctate along the veins. Head and thorax blackish fuscous; the legs very dark testaceous.

Length of body, 5.7mm; breadth of thorax, 1.3mm.

Florissant. Four specimens, Nos. 772, 4639, 5114, and perhaps 7926.

6. Parodarmistus inhibitus.

Head very large, transverse, roundly angulate in front, but nevertheless distinctly longer than broad, not contracted behind the eyes, which are very large but not very prominent; surface granulate throughout; the antennæ considerably more than half as long as the body. Thorax quadrangular, transverse, about twice as long as broad, scarcely tapering anteriorly, both base and apex truncate, the whole surface granulate, but much more coarsely behind than in front. Head, thorax, and scutellum black; abdomen blackish fuscous, together with most of the corium of the hemelytra; the membrane fuliginous with a pallid area at the apex of the corium, the veins marked in fuscous; legs blackish fuscous.

Length of body, 6.3mm; breadth of thorax, 1.8mm.

Florissant. Two specimens, Nos. 5829, 8356.

4. PROTENOR Stål.

This genus, of which only two species are known, one from the central Western States, the other from Central America, is represented at Florissant by a single species, which seems to agree tolerably well generically with these. It is to be noticed, however, that, as frequently seems to be the case with fossil forms, the antennæ are distinctly shorter than in the existing types, and that the fossil species agrees better in the structure of the head and in general size with the Central American than with the Illinois species; it is much smaller and stouter than the Illinois species.

Protenor imbecillis.

Pl. 26, Fig. 8.

The head of the single specimen known is somewhat obscure, but is half as long again as broad, with straight and parallel sides and rather bluntly angulate front, the portion in front of the antennæ being equiangular; the whole considerably longer than the thorax, and not constricted

posteriorly, being as broad at the base as the apex of the thorax; antennæ distinctly shorter than the body, the first joint nearly as long as the head, and scarcely, if at all, shorter than the second or third joint, the fourth joint gently incrassated, but scarcely broader than the others and slightly the longest. Thorax trapezoidal, scarcely longer than broad, gently narrowing from base to apex, the apex being five-sixths the length of the base; surface coarsely granulate, especially posteriorly. Hemelytra faintly punctate in linear series. Legs long and very slender.

Length, 8.25^{mm}; breadth of base of thorax, 1.5^{mm}; length of hind femora, 3 5^{mm}.

Florissant. One specimen, No. 10391.

5. TENOR gen. nov. (τείνω).

Body robust; head subrotund, of about equal length and breadth, the eyes centrally situated, small, globular, the front between them broadly rounded but much advanced, behind the eyes constricted. Thorax several times broader than long, not more than half as long as the head, strongly tapering, the apex as broad as the intraocular part of the head. Abdomen tolerably full. Hind femora remarkably slender, scarcely longer than the width of the body.

A single species is known.

Tenor speluncæ.

Head uniform and coarsely punctate. Thorax similar but even more coarse, uniform throughout; behind the prothorax the body is nearly twice as broad as the head; whole body blackish fuscous; the legs testaceous. Unfortunately the antennæ are not present, and the hemelytra are too obscure to say more than that the corium and clavus are rather finely punctate linearly.

Length of body, 7^{mm}; breadth of head, 1.5^{mm}; base of thorax, 2.6^{mm}; abdomen, 2.8^{mm}.

Florissant. One specimen, No. 10227.

6. ETIROCORIS gen. nov. (τείρω, κόρις).

Head narrow, long, and slender, the front between the antennæ greatly prolonged, so as to reach beyond the apex of the first antennal joint; the antennæ form the most remarkable feature; the first joint is moderately

stout, and does not attain the extremity of the head, but this is only on account of the great prolongation of the same; the second joint is of extraordinary length, being about two and a half times longer than the basal joint, half as long again as the elongated head, and slightly longer than the remaining joints together; these are subequal, and all the joints are moderately slender, the last slightly incrassated if at all, and bluntly rounded at the apex. Thorax shorter than the head and rapidly tapering, so that the apex is only half as long as the base. Abdomen rather stout with parallel sides. Legs unknown.

A single species is known.

ETIROCORIS INFERNALIS.

Pl. 26, Fig. 16.

The whole body blackish fuscous, including the antennæ; surface of the head punctate, like the thorax; these two parts about equal in length. Veins of the corium punctate.

Length of body, 7.25^{mm}; breadth of thorax, 3.1^{mm}; length of antennæ, 6.3^{mm}.

Florissant. One specimen, No. 9253.

7. RHEPOCORIS gen. nov. (ῥέπω, κόρις).

This is the commonest form of the Alydinæ in Florissant, and is a genus of the Micrelytraria, with unarmed thorax and scutellum and tapering thorax, but is remarkable for its spinous hind tibiæ, as well as for the characteristics of the antennæ, by which it is clearly separated from any modern types. The head is well rounded, of about equal length and breadth as viewed from above. The antennæ have a stout basal joint not half so long as the head, the three succeeding joints subequal, slender, the last gently incrassated and fusiform, corresponding in this respect with the bulk of fossil Alydinæ. The thorax is trapezoidal, perhaps a little longer than broad, and tapers with straight sides, not in the least full, to the head, forming a slight collar. The legs are moderately stout, the hind femora considerably longer than the others and scarcely stouter, the hind tibiæ delicately but profusely spined throughout.

Five species occur at Florissant.

Table of the species of Rhepocoris.

Head longer than broad; hind legs long and slender.
Larger and stouter species, more than 8mm long; thorax shorter than the head ....1. *R. prætectus.*
Smaller and slenderer species, less than 8mm long; thorax as long as the head....2. *R. macrescens.*
Head broader than long; hind legs less long.
Largest species, usually about 8mm long.....3. *R. prævalens.*
Medium sized species, usually about 6mm long.....4. *R. propinquans.*
Smallest species, usually about 4.5mm long.....5. *R. minima.*

1. Rhepocoris prætectus.

Head one-fourth longer than broad, hardly constricted behind the eyes; surface rather coarsely granulate with a tendency to a transverse arrangement. The thorax considerably shorter than the head and broader than long, the apical margin more than three-fourths as long as the basal margin; the surface coarsely granulate. Hind legs exceptionally long, the femora being nearly half as long as the body.

Length of body, 6 6mm; breadth of thorax, 1.4mm; length of hind femora, 3.2mm.

Florissant. Two specimens, Nos. 9756, 10645.

2. Rhepocoris macrescens.

Head subpentagonal, broadest in advance of the middle except for the eyes, from this point tapering gently backward; the front triangular, rounded; surface rather finely granulate, the antennæ scarcely more than half as long as the body. Thorax as long as the head and slightly broader than long, tapering regularly from base to apex, the apical margin being about two-thirds as long as the basal margin; the surface finely granulate in front, coarsely behind. Whole body blackish, hemelytra blackish fuscous, the membrane infumated with a large triangular pallid patch at the apex of the corium. Legs blackish fuliginous. The hind femora less than half as long as the body.

Length of body, 8.5mm; breadth of thorax, 2.5mm; length of hind femora, 3.4mm.

Florissant. One specimen, No. 2158.

3. Rhepocoris prævalens.

Pl. 25, Figs. 4, 6, 7, 9, 10, 11, 14, 16; Pl. 26, Fig. 11.

Head rounded, scarcely longer than broad, uniformly and rather finely granulate, the granulations on the under surface of the head showing a tend-

ency to a transverse arrangement into corrugations. Antennæ more than half as long as the body, slender, and pale, the whole body being black or blackish fuscous. Thorax trapezoidal, broader than long, as long as the head, tapering regularly and considerably in front, the apical margin being about three-fourths the length of the base; surface coarsely granulate. Hemelytra with the corium and clavus blackish fuliginous, the former just before the middle with a large triangular pallid spot on the costal margin sending from its apex a curved pallid shoot to the membranal margin; membrane pale fuliginous with a large trapezoidal pallid spot next the apex of the corium on the costal margin; veins marked in fuscous. Legs dark fuliginous, the hind pair very slender, the hind femora nearly as long as the abdomen, the hind tibiæ delicately and profusely spinous.

Length, 6.5–8.5^{mm}; average about 8^{mm}.

This is the commonest of the heteropterous insects of Florissant.

Florissant. About one hundred and fifty specimens, of which some of the best are Nos. 2431, 3257, 5669, 7102, 8374, 9045, 9170, 11211, 11217, 12081, 12087, and of the Princeton collection, 1.335 and 1.712.

4. Rhepocoris propinquans.

Pl. 25, Fig. 1; Pl. 26, Fig. 13.

In studying the species of Rhepocoris I discovered that they were naturally subdivided into three groups according to their size, and that it was not often that there was any doubt into which of the three groups any given individual would fall. I have accordingly separated the present species from those on either side of it, though I can give no characters at all except those of size. In a few instances there may be doubt into which of the two species, this and the preceding, any given individual may fall, inasmuch as the range of form comes close together, and it may be that these two should be considered as one and the same species. But I have thought it best under the circumstances, and in the hope of being able by more careful study to separate the forms on other characteristics than that of mere size, to keep the two apart, at least provisionally. In each of these two forms the individuals may be separated as slenderer and stouter, which I regard as probably the two sexes, as they seem to differ in no other constant character that can be seen in their state of preservation.

In the present species the length varies from 5.5 to 6.5^{mm}, the average being about 6^{mm}.

Florissant. About eighty specimens, of which some of the best preserved are Nos. 5002, 6652, 6980, 8467, 9276, 9585, 10033, 10263, 11015, 11212, 13307.

5. Rhepocoris minima.

See the preceeding species for some remarks on this. This small species appears to be also relatively rather stouter than the others, but otherwise it can hardly be said to differ in any characters which may be seized upon. It does not appear, however, that the hemelytra are so distinctly marked as appears to be ordinarily the case in the others, and this, when better specimens are found, may serve more readily to distinguish it from them.

Length, 4.5–5.5^{mm}; the breadth can not be readily given as all the specimens are preserved upon their side.

Florissant. Four specimens, Nos. 3854, 6029, 11755, 11763.

8. ORTHRIOCORISA gen. nov. (*ὄρθριος*, *κόρις*).

An elegant genus of Micrelytraria, not far removed from Darmistus Stål and apparently near Acestra Dall, from which it differs totally in the form of the front of the head. It is long and slender in form. Head well rounded, a little elongate, the front scarcely produced in advance of the antennæ, rounded, or perhaps a little angulate; eyes moderately small, seated in the middle of the sides of the head; antennæ very long and slender, the first much longer than the head, nearly or quite as long as the thorax, slender on the basal half, gently incrassate and subfusiform on the apical half; the second and third joints are exceedingly slender, the third as long as the first and slightly enlarged at the extreme truncate tip, the second a little shorter; unfortunately the fourth joint is not preserved; if as long as the third joint the whole would be still considerably shorter than the body and a little shorter than the hind femora and tibiæ together. Thorax considerably longer than the head, tapering toward the apex with no lateral spines. Legs long and very slender, the hind femora scarcely incrassated and both they and the tibiæ totally unarmed, the femora longer than the tibiæ, the latter about as long as head and thorax together; the length of the first tarsal joint about equals that of the other two together.

A single species is known.

Orthriocorisa longipes.

Pl. 26, Fig. 1.

A single remarkably well preserved specimen lies upon its side on a very fragile sheet of shale. The general color is a dark, sometimes, and especially on the less solid parts, a light, testaceous. The head seems to be smooth except for here and there a small granule; the rostrum shows only the central black needle which reaches the mesostethium. The thorax is rather heavily and pretty closely punctate, and the corium of the hemelytra similarly punctate in serial rows along the course of the veins. The state of preservation is poorer posteriorly, so that the length of the abdomen can not be accurately told, but it appears to extend beyond the reach of the hind femora.

Length of body (partly estimated), 11^{mm}; basal joint of antennæ, 2^{mm}; hind femora, 4.75^{mm}.

Florissant. One specimen, No. 8604.

Subfamily PSEUDOPHLŒINA Stål.

This rather limited subfamily is much better developed in the Old than the New World. In the United States but a couple of genera occur, each with a single species, and, in the Biologia Centrali Americana, Distant records but three genera, each with a single species. Yet, although never detected in the European rocks, Florissant yields an extinct genus allied to one found in Central America, and it is well represented there, as will be seen immediately below.

HEERIA gen. nov.

Allied to Arenocoris but with second and third antennal joints subequal. Of our native forms it approaches nearest to Scolopocerus Uhl., if the Mexican species described by Distant be included therein, but the structure of the antennæ again is different. The body is of a more or less oval shape, the broader end posterior. Head moderately small, rounded, of about equal length and breadth, the front between the antennæ never greatly, sometimes scarcely, advanced; antennæ not more than half as long as the body, the basal joint stout, cylindrical, about as long as the head, the second and third joints subequal, long, slender, and sometimes,

especially the third, enlarging apically where truncate; last joint long oval, scarcely more than one-third as long as the third, nearly or quite as stout as the basal. Thorax trapezoidal, the apical margin of the breadth of the head, the basal fully half as broad again, the sides more or less rounded. Hemelytra large, covering the abdomen, except possibly the sides in the broadest species, the corium reaching the middle of the apical half of the abdomen. All the species have heavily granulate thorax, the last joint of the antennæ more or less granulate, and the corium of hemelytra coarsely punctate.

The genus is named in memory of Oswald Heer, of Switzerland, the principal student of fossil insects in the last generation.

Three species are known, all from Florissant.

Table of the species of Heeria.

Head broadly rounded between the antennæ.
Body ample, much less than twice as long as broad ..... 1. *H. gulosa.*
Body less ample, twice as long as broad ..... 2. *H. lapidosa.*
Head angularly produced between the antennæ ..... 3. *H. fœda.*

1. Heeria gulosa.

Pl. 27, Figs. 5, 12, 18; Pl. 28, Fig. 17.

Whole body tolerably uniform blackish fuscous, the lateral incisures of the abdomen paler. Head, whole of first, apical extremity of second and third, and basal two-thirds of fourth joint of antennæ finely granulate, these parts in the antennæ blackish, the other parts of the middle joints of the antennæ pale testaceous and faintly granulate, the apical third of the fourth joint smooth and blackish fuliginous; front of head between the antennæ broadly rounded, scarcely advanced, not at all angulate. Thorax heavily granulate, almost twice as broad on the basal as on the apical margin, and fully twice as broad as long. Hemelytra with the corium heavily and irregularly punctate. Abdomen broad and full, about half as broad again as the base of the thorax.

Length of body, 9.15^{mm}; antennæ, 4.8^{mm}; breadth of base of thorax, 3.35^{mm}; middle of abdomen, 5^{mm}.

Florissant. Seven specimens, Nos. 789, 1977, 4269, 6151, 11773, and of the Princeton Collection, 1.560 and 1.802, 1.831.

2. Heeria lapidosa.

Pl. 27, Figs. 3, 19.

In color this species entirely resembles the preceding both as to body and antennæ. The head and first joint of antennæ are here as coarsely granulate as the thorax, while the other joints of the antennæ resemble those of the last species; the front of the head is as there. The thorax is perhaps a trifle longer than in H. gulosa and has straighter sides, but otherwise does not differ. The hemelytra are similarly punctate. The main difference is to be found in the abdomen, which, though full, is not nearly so full as in the preceding species, the breadth being scarcely half the length of the body.

Length of body, 8.5^{mm}; antennæ, 4.5^{mm}; breadth at base of thorax, 3.25^{mm}; at middle of abdomen, 4^{mm}.

Florissant. Eleven specimens, Nos. 1648, 1884, 3767, 4617, 5703, 5965, 8949, 12241, 14179 and 14197, and of the Princeton Collection, 1.804, 1.817.

3. Heeria fœda.

In color like the other species. Head scarcely granulate, the front between the antennæ advanced angularly by half the length of the first antennal joint to less than a right angle, the angle rounded. Antennæ throughout slenderer than in the other species, and shorter, scarcely in the least granulate anywhere. Thorax coarsely granulate, the base a third longer than the apex, less than twice as broad as long. Hemelytra rather distantly punctate. Abdomen much as in H. lapidosa.

Length of body, 8^{mm}; antennæ, 3.25^{mm}; breadth at base of thorax, 2.7^{mm}; at middle of abdomen, 4^{mm}.

Florissant. Three specimens, Nos. 3097, 7874, 7974.

Subfamily CORIZIDA Mayr.

A few fossil forms have been referred to this group, not very abundant in species at the present day. The most prolific genus in either Old or New World is Corizus, to which all the four species from the American Tertiaries described below are referred. The only described European form is one from Oeningen referred by Heer to an extinct genus, Harmostites; Corizus, however, is said to occur at Aix, but, as I shall point out below, its reference here is doubtful.

CORIZUS Fallén.

Two fossil species have already been referred to this genus, both from Aix. One, however, as shown by Heer, belongs rather with Pachymerus, and the other is merely indicated as being half the size of Therapha hyoscyami of Europe. In America the genus is best developed within the tropics, but has abundant representatives in the United States. Three of the Florissant Heteroptera appear to fall within its limits, and a Green River species, which I formerly took for a Reduvius, appears also to belong here.

Table of the species of Corizus.

Without an interrupted series of lateral spots.
- Smaller forms, not exceeding five millimeters in length ..... 1. *C. celatus.*
- Larger forms, exceeding six millimeters in length.
  - Body relatively stout, about three times as long as broad ..... 2. *C. abditivus.*
  - Body relatively slender, nearly four times as long as broad ..... 3. *C. somnurnus.*

An interrupted series of lateral spots ..... 4. *C. guttatus.*

1. Corizus celatus.

Pl. 27, Fig. 15.

Head a little broader than long, with the eyes a little broader than the apex of the thorax, subtriangular, the front angularly produced between the antennæ, the basal joint of which seems barely to surpass the apex of the front; the remaining joints slender. Thorax half as broad again as long, tapering forward with slightly ampliated sides, the front margin gently and broadly emarginate, scarcely more than half as long as the base, the surface densely and sharply punctate, and a faint sign of a median sulcation. Corium of hemelytra reaching a little beyond the middle of the abdomen, clear excepting along the finely punctate principal veins and near the outer apex, which is wholly clouded. Abdomen dark, with broad premarginal pale lateral bands.

Length, 5^{mm}; breadth of thorax, 1.9^{mm}.

Florissant. Three specimens, Nos. 1952, 6369, 14205.

2. Corizus abditivus.

Pl. 25, Fig. 5; Pl. 26, Fig. 4.

Body relatively stout, about three times as long as broad, the head rounded, hardly subtriangular, considerably broader than the apex of the thorax, the front roundly produced between the antennæ, the basal joint of

which considerably surpasses the apex of the front; the second and third joints of antennæ of equal diameter and very slender, the last joint a little incrassated; surface of head densely and finely punctate. Thorax trapezoidal, narrowing rapidly, punctate like the head. Hemelytra more coarsely punctate along the veins of the corium, which reaches barely beyond the middle of the abdomen and is infuscated, while the membrane is nearly clear. Abdomen oval, the sides slightly ampliated. The figure on Plate 26 poorly represents the species.

Length, 7.3^{mm}; antennæ, 4.1^{mm}; breadth of thorax, 2^{mm}; abdomen, 2.65^{mm}.

Florissant. Four specimens, Nos. 3247, 5715, 8544, 14207.

3. Corizus somnurnus.

Body very slender, being nearly four times as long as broad, the sides parallel. Head rounded, subtriangular, scarcely broader than the apex of the thorax, fully as long as broad, the surface punctate. The antennæ very long and slender, the first joint clearly surpassing the apex of the front. Thorax nearly twice as broad as long, tapering gently, with scarcely ampliated sides, the front margin broadly, roundly, and deeply emarginate, the apex fully two-thirds as long as the base; surface punctate. Hemelytra as in the preceding species, but the membrane distinctly infumated. Legs long and slender, the hind femora with a very slight posterior fringe of minute short denticulations, on which account one would be inclined to place it in Harmostes, but the denticulations do not take on the form of spines, but are more like serrations.

Length, including the closed hemelytra, 5.5^{mm}; antennæ, 4^{mm}; hind femora, 2.4^{mm}; breadth of body, 1.8^{mm}.

Florissant. One specimen, No. 14193.

4. Corizus guttatus.

Pl. 7, Fig. 11.

Redurius? guttatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 771 (1878).

Two specimens of this species have been found, one with reverse, by Mr. Richardson, the other by myself. Mr. Richardson's specimen is very obscure and distorted, and without the aid of the other could not have been determined. The insect probably belongs to Corizus, or at all events falls in its immediate vicinity. All parts are rather obscure, but the head evi-

dently tapers and is roundly pointed in front, the thorax narrows gently from behind forward, and is nearly as long as broad; the scutellum is rather small, triangular, the apex bent at a right angle and rounded. The abdomen is ovate, twice as long as broad. The species is marked with round, dark spots, about 0.2mm in diameter, on either side, one at the outer edge of the front of each abdominal segment, and one in the middle of either transverse half of the thorax, a little removed from the outer border; the anterior ones half-way between the border and the middle line. The whole surface appears to be very minutely granulated. The tegmina can not be seen.

Length of body, 5.5mm; breadth of thorax, 1.4mm; of abdomen, 1.65mm.

From its form I formerly referred the insect doubtfully to Reduvius, but its size alone would preclude such a reference.

Green River, Wyoming. Two specimens, Nos. 9a and 96b (F. C. A. Richardson), 4070 (S. H. Scudder).

Family PENTATOMIDÆ Stephens.

This family has always held the first place among Heteroptera in Tertiary deposits, but with the publication of this volume its place is disputed by the Lygæidæ. This is due not only, though principally, to the exceptional abundance of the Lygæidæ at Florissant, but also to the rather meager proportion of the Pentatomida, as will appear below. In European deposits only a single species is known from amber, while fifty have been exhumed from the rock deposits. They represent only four of the nine subfamilies, and the great majority belong to the two subfamilies Cydnida and Pentatomida, the former with sixteen species referred to four genera, the latter with twenty-five species referred to six genera The other subfamilies represented are the Scutellerina with five species of two genera, Pachycoris and Tetyra, both at Oeningen, and the Acanthosomina with four species of two genera, Acanthosoma and Phlœocoris, both at Radoboj. Besides these a Pentatoma is reported from Greenland and a Cydnus from New South Wales. The American forms here brought to notice represent only the subfamilies Cydnida and Pentatomida, but in reverse proportion to what appears in Europe, the Cydnida being very well represented by twenty-four species of six genera, nearly all of them by a number of individuals, and one by a great many, the Pentatomida on the contrary by only thirteen species of

ten genera, and of each of these species more than a single example has rarely been found. While therefore the prevalent subfamilies are the same on the two continents, one has scarcely half as many representatives in America as in Europe, while the other has half as many more.

A very striking peculiarity is found in the American Pentatomidæ as a whole, whether Cydnida or Pentatomida. In living forms the vast majority have a long scutellum reaching beyond the middle of the abdomen, and have the tip produced, forming a parallel-sided apical lobe. In the American Tertiary forms, so far as yet known, with only a single exception, no such apical lobe exists, but the scutellum ends with an angular apex, sometimes a little rounded, but the sides perfectly straight and confluent at least in the apical half; besides which, or perhaps partly as a consequence, the scutellum does not reach farther than, sometimes does not attain, the middle of the abdomen. It has seemed necessary therefore to establish a considerable number of new generic groups to embrace these remarkable forms. To judge from the illustrations given by Heer the same thing would seem to be true of at least a few of the European Tertiary Pentatomida, especially of those from Radoboj, and it would be very desirable to institute direct comparisons between specimens from the two continents.

In our general remarks in the introduction to the Heteroptera we called attention to the close relation which existed between the proportional abundance (in the number of specific forms) of the four principal families of Heteroptera in Tertiary times, and the same in the existing fauna of the self-same region. A further illustration, but even more exaggerated, appears by using the same guides in comparing the relative numbers of the Cydnida and Pentatomida, the only two subfamilies of Pentatomidæ known to exist in our Tertiary deposits and so capable of comparison. In Distant's work the Cydnida number about one-sixth of the total number of Cydnida and Pentatomida; in Uhler's general list, one-seventh; in his western list, one-fourth; the increasing number thus shown in the region where the fossils occur is vastly exaggerated in their relative representation in the rocks, this being two-thirds the whole.

Subfamily CYDNIDA Stål.

This subfamily is well represented in the European Tertiaries, and is indicated as occurring also in the Australian Tertiaries. All of the European species are from the rocks (none from amber), and most have been

referred to two distinct genera, Cydnopsis with eleven species from Oeningen, Radoboj, and Aix, and Neurocoris with two from Radoboj. Cydnus is represented by a species at Oeningen and another at Aix, and Brachypelta one at Krottensee. Neither of these extinct generic types occurs in our Tertiaries, where this subfamily is far more prolific than in Europe and far surpasses the Pentatomida. With the exception of a couple of forms, represented each by a single specimen, and which are referred to modern types, Cyrtomenus and Discostoma, all the others are remarkable for differing apparently from nearly all living types and also from the known fossils in the short and accurately triangular scutellum, agreeing in this respect with the Florissant Pentatomida, and, as there, necessitating the establishment of several new generic groups. These, however, are more prolific in species, and the species in individuals, than is the case with the Pentatomida.

Table of the genera of Cydnida.

Body less than 10 millimeters long.
  Scutellum triangular, not produced at the apex, as broad as long.
    Head deeply sunk in the thorax, the depth of the emargination of the thorax embracing it being nearly or quite half its width.
      Body more than twice as long as broad ..... 1. *Stenopelta.*
      Body less than twice as long as broad ..... 2. *Procydnus.*
    Head sunk but little in the thorax, almost wholly free.
      Anterior lateral angles of the thorax rounded, so that the head projects but little beyond the general curve of the body ..... 3. *Necrocydnus.*
      Anterior lateral angles of the thorax prominent, the head out of direct relation to the curve of the body ..... 4. *Thlibomenus.*
  Scutellum produced into a lobe at apex, distinctly longer than broad ..... 5. *Cyrtomenus.*
Body more than 15 millimeters long ..... 6. *Discostoma.*

1. STENOPELTA gen. nov. (στενός, πέλτη).

Body more than twice as long as broad, the sides nearly parallel, with broadly rounded ends, the anterior curve broken by the head, one-half of which is advanced beyond its outline, the other half sunken in the thorax, which is deeply emarginate to receive it; the eyes, which are moderately large, globular, and central, are thus brought to the edge of the thorax; in front of the eyes the head is rounded with a slight angulation, the whole nearly circular; the ocelli are large and situated behind and within the eyes. Thorax subquadrangular, about twice as broad as long, the anterior lateral angles prominent but rounded, the basal margin truncate. Scutellum moderate, triangular, with perfectly straight sides, nearly half as broad again as long, reaching less than a third way to the tip of the abdomen.

A single species is known, from Green River, formerly referred to Ethus.

STENOPELTA PUNCTULATA.

Pl. 7, Figs. 12, 13.

Ethus punctulatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 769-770 (1878).

I repeat here the original description, although it contains many generic details:

Body of nearly equal breadth throughout, the sides of the abdomen a little fuller. Head rounded, small, the part behind the eyes rounded, as deep as the portion in front of them; front as seen from above, well rounded, well advanced, subangulate; eyes moderately large; ocelli large, situated close to, a little behind, and within the eyes, and about one-third their diameter; surface of head minutely and obscurely granulate. Thorax nearly equal, slightly broadening posteriorly, the anterior angles well rounded, the front border very deeply and roundly excised, the hind border nearly straight; the whole fully twice as broad as the head and twice as broad as long. Scutellum obscure, but apparently of about equal length and breadth, and regularly triangular. Abdomen well rounded, half as long again as broad. Tegmina obscure or lost in all the specimens seen. Thorax and scutellum minutely granulate, like the head. Posterior half, at least, of the abdomen profusely covered with shallow punctures.

Length of body, 3.75^{mm}; of head, 0.6^{mm}; of middle of thorax, 0.75^{mm}; breadth of head, 0.8^{mm}; of thorax, 1.7^{mm}; of abdomen, 1.85^{mm}.

Green River, Wyoming. Five specimens, Nos. 19^{d}, 67^{c}, 74^{a}, 172 (F. C. A. Richardson), 4193 (S. H. Scudder).

2. PROCYDNUS gen. nov. (πρό, Cydnus, nom. gen.).

Body less than twice as long as broad, ovate, with extremities more or less tapering, especially in front, by the more rapid narrowing of the thorax, the head sometimes completely sunken in the thorax, at other times half projecting beyond the anterior curve of the body; it is always broader than long, though sometimes nearly circular; the eyes are moderately large, not very prominent, subcentral, the ocelli large and situated well behind the produced anterior curve of the thorax in the deep emargination for the reception of the head. Thorax subtrapezoidal, more than twice, sometimes thrice, its middle length, truncate at base, the sides more or less

oblique, and arcuate, the front lateral angles always rounded, sometimes so much as to disappear. Scutellum usually small, never large, triangular, with straight sides, of varying proportions but never longer than broad, reaching from less than a third to one-half way to the tip of the abdomen.

A large number of species occur in our Western Tertiaries, all found at Florissant and one also at Green River.

Table of the species of Procydnus.

Anterior half of thorax uniformly depressed.
- Head so sunken in the prothorax that its front margin forms a regular curve with that of the thorax ..... 1. *P. pronus.*
- Head sensibly projecting beyond front line of body.
  - Head only a fourth the width of the thorax ..... 2. *P. devictus.*
  - Head much less than half the width of the abdomen, at least a third the width of the thorax.
    - Thorax scarcely more than twice as broad as its middle length.
      - Larger species; emargination of apical margin of thorax relatively shallow. 3. *P. diversus.*
      - Smaller species; emargination of apical margin of thorax relatively deep and abrupt. 4. *P. quietus.*
    - Thorax nearly or quite three times as broad as its middle length.
      - Larger species; head more than one-third as wide as the body ..... 5. *P. reliquus.*
      - Smaller species; head less than one-third as wide as the body ..... 6. *P. vesperus.*
  - Head half the width of the abdomen ..... 7. *P. eatoni.*

Anterior half of thorax with lateral bosses ..... 8. *P. mamillanus.*

1. Procydnus pronus.

Pl. 28, Fig. 5.

Head rounded, broader than long, deeply sunken in the thorax, its broad anterior curve almost continuous with the rounded sloping lateral angles of the thorax, the eyes small and in advance of the middle. Thorax shaped much as in P. devictus, but with a broad and especially deep, rounded, almost angular emargination to receive the head, about a third the width of the thorax; its basal margin is not indicated on the plate, but should unite the extreme bases of the hemelytra in a straight line; the surface shows excessively shallow crowded punctuation. Scutellum very large, triangular, reaching half-way to the tip of the abdomen, broader than long. Hemelytra with the corium occupying the basal three-fifths, uniformly coriaceous, with punctuation like the thorax, and an excessively delicate impressed submarginal line. Hind tibiæ densely spined. Abdomen very broad and full, scarcely longer than broad. Whole body black, the corium of the hemelytra hardly less dark.

Length of body, 5^{mm}; breadth, 3.1^{mm}.

Florissant. One specimen, No. 14426.

2. Procydnus devictus.

Pl. 28, Fig. 4.

Head minute, subcircular, hardly a fourth as wide as the thorax, its posterior third sunken in the thorax, which is here narrowly but rather deeply emarginate to receive it. Thorax scarcely twice as broad as long, tapering from the base and with the sides strongly arcuate, so that the whole is nearly semicircular but for the narrow rounded emargination (not shown on the plate) for the head; basal margin truncate or scarcely convex; surface perfectly smooth and regular, with an anterior, transverse, arcuate, impressed line opening forward, half as broad as and one third the depth of the thorax. Scutellum large, triangular, smooth, the base fully three-fourths the width of the thorax, nearly three-fourths as long as broad, and reaching half-way to the tip of the abdomen. Hemelytra with the corium reaching half-way to the tip, uniformly coriaceous, testaceous, with faint and shallow equidistant and rather distant punctæ. Hind tibiæ densely spiny. Abdomen very broad and full, of nearly equal length and breadth.

Length of body, 5^{mm}; breadth, 3.1^{mm}.

Florissant. One specimen, No. 11225.

3. Procydnus divexus.

Head imperfectly preserved in both the specimens at hand. Thorax shaped much as in the species which have preceded this, twice as long as its middle length, with a very deep rounded emargination in front, less than a third the width of the thorax and three times as broad as deep, the lobes beside it well advanced, the surface finely and closely but not very deeply punctate. Scutellum with similar sculpture, the apex scarcely less than rectangular, the base about two-thirds as wide as the thorax. Hemelytra having the similarly punctate corium occupying fully the basal three-fifths, the full and well rounded abdomen of equal length and breadth and punctate. Hind tibiæ very slender and rather feebly spined. Whole body uniformly blackish brown.

Length, 4.7^{mm}; breadth, 3^{mm}.

Florissant. Two specimens, Nos. 2132, 13154.

4. Procydnus quietus.

Head nearly one-half as broad as the thorax, well rounded, half as broad again as long. Thorax subtrapezoidal, tapering from the base at first slightly, afterwards a little more rapidly, so that the sides are a little arcuate, and the rounded anterior lateral lobes rather prominent from the deep almost angular emargination of the front, which is hardly more than a third the width of thorax, and only a little more than twice as broad as deep; surface apparently smooth, punctate along the lateral margin. Scutellum nearly two-thirds as broad as the thorax, reaching less than half-way to the tip of the abdomen, the apex nearly rectangular, the surface punctate, somewhat shorter than broad. Hemelytra with the coriaceous corium hardly occupying more than half the wing, serially punctate, of a testaceous color, the membrane faintly infumated. Tibiæ densely spiny. Abdomen full, broadly rounded, a little longer than broad.

Length, 4.1–4.5^{mm}; breadth, 2.4–2.6^{mm}.

Florissant. Eight specimens, Nos. 2060, 6812, 7652, 10092, 10174, 10531, 12771, 14186.

5. Procydnus reliquus.

Head rounded, broader than long, nearly half as broad as the thorax. Thorax nearly three times as broad as its middle length, tapering from the base, the sides considerably arcuate, with scarcely any sign of an anterior lateral shoulder, the emargination of the anterior border half as broad as the base of the thorax, shallow and uniform, followed by a median arcuate sulcation half as broad as the emargination and equally deep: the surface is apparently quite smooth, but there are signs of punctuation at the extreme lateral margins. Form of the scutellum not evident, but apparently exactly as in the last species. Corium of hemelytra reaching considerably beyond the middle. Abdomen full but considerably longer than broad. Whole body uniformly dark, the corium of hemelytra dark testaceous.

Length, 5.5^{mm}; breadth, 3^{mm}.

Florissant. One specimen, No. 434.

6. Procydnus vesperus.

Pl. 28, Fig. 15.

Head tolerably large, rounded, broader than long, together with the projecting eyes more than a third the width of the thorax. Thorax almost or quite three times as broad as the middle length, the shape very much as in the preceding species, with an equally broad but much deeper emargination of the front, the surface very finely, faintly, and densely punctate. Scutellum less than two-thirds as broad as the thorax, considerably broader than long, the pointed angulate apex extending less than half-way to the tip of the abdomen. Hemelytra with a rather short punctate corium. Tibiæ heavily spined. Abdomen full and broadly rounded, scarcely longer than broad. Color of body blackish brown, the hemelytra with the corium blackish fuliginous, the membrane faintly infumated.

Length, 4.5^{mm}; breadth, 2.65.^{mm}.

Florissant. Four specimens, Nos. 70, 145, 2464, 5612.

7. Procydnus eatoni.

A poorly preserved specimen represents this species, remarkable for its very large and nearly circular head, which is half as wide as the abdomen and scarcely broader than long, and is deeply embedded in the thorax. The latter is shaped much as in the last two or three species, nearly two and a half times as broad as its median length, the front deeply and broadly emarginate to receive the head, the emargination very regular, considerably more than half as broad as the thorax, and a third as deep as broad. Scutellum broad and short, the angulate apex not at all less than a right angle, reaching much less than half-way to the tip of the abdomen. The only signs of punctuation, fine and dense, are on the broadly rounded abdomen, which is considerably longer than broad. Other parts not clear. The whole blackish brown.

Length, 6.75^{mm}; breadth, 3.6^{mm}.

Named for one of the pioneers in American geology, Amos Eaton.

Florissant. One specimen, No. 3153.

8. Procydnus mamillanus

Pl. 7, Fig. 19.

Cydnus? mamillanus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 770 (1878).

The body is broad and convex in front, with a rapidly tapering abdomen, scarcely at all rounded, even at the tip. The head, as seen from above, is nearly circular, shaped much as in Stenopelta punctulata from the same beds, but more broadly and regularly rounded in front, with the central lobe broad, and defined by rather strongly impressed furrows; the ocelli are large, situated just behind the anterior extension of the thoracic lobes; the surface of the head is rugulose. Thorax more than twice as broad as the head, and more than half as long again; the sides rounded, being broadest at the posterior border, narrowing in front and roundly excised at the anterior angles; front border very deeply hollowed behind the head, leaving prominent front lobes on either side, nearly as large as the head and strongly mamillate; hind border nearly straight The surface is minutely granulate, besides which there is a transverse belt of rather large and distant punctures midway between the mamillations and the hind border. The scutellum is very large, rounded-triangular, broader than long, and granulate like the thorax. Corium of tegmina, which occupies their greater portion, obscurely and distantly punctulate; abdomen triangular, the apex bluntly pointed.

Length of body, 4^{mm}; of head, 0.8^{mm}; of either lateral half of thorax, 1.35^{mm}; breadth of head, 1^{mm}; of thorax, 2.4^{mm}.

Green River, Wyoming. One specimen, No. 39 (F. C. A Richardson). Florissant, Colorado. Two specimens, Nos. 1925, 11760.

3. NECROCYDNUS gen. nov. (νεκρος, Cydnus, nom. gen.).

The species of this have the same oval form as those of the preceding genus, and differ from them in little but the relation between the head and thorax, the latter very broadly and shallowly emarginate in front, and the former consequently embraced by the thorax to a much smaller degree. The head is rounded, always broader, generally much broader, than long, the eyes and ocelli as in Procydnus; it is, however, sunken to some extent in the thorax, and its curves and those of the sides of the thorax are such as hardly to destroy the effect of a single parabolic curve to the front end of

the body. The thorax is generally only twice as broad as the median length, but sometimes considerably more than that, tapering in a very variable degree, sometimes rapidly and regularly, but always with a rounded curve, sometimes so slowly as to leave the lateral angles of the front very prominent, and making the thorax here twice as wide as the head; the basal margin is truncate. Scutellum rather large and especially broad, triangular, with straight sides, always shorter than broad, and yet generally reaching nearly half-way to the tip of the abdomen.

A large number of species are known, as many as in the preceding genus, all but one, which comes from Green River only, being found at Florissant, one of them very abundantly.

Table of the species of Necrocydnus.

Body more than half as long again as broad.
Thorax considerably more than twice as broad as the median length.
Body relatively slender; thorax tapering considerably, the breadth at the bottom of the apical emargination about three-fourths that of the basal margin .....1. *N. vulcanius.*
Body relatively stout; thorax tapering but little, the breadth, as above, about seven-eighths that of the basal margin .....2. *N. gosiutensis.*
Thorax only twice as broad as the median length.
Thorax tapering considerably, the lateral angles of front not prominent.
Head broad, nearly or quite a third as broad as base of thorax.
Smaller species; emargination of apical border of thorax deep, half as long as greatest breadth of thorax .....3. *N. torpens.*
Larger species; emargination of apical border of thorax shallow, considerably less than half as long as greatest breadth of thorax .....4. *N. stygius.*
Head relatively narrow, hardly more than a fourth the breadth of the base of the thorax. 5. *N. amyzonus.*
Thorax tapering but little, the lateral angles of front prominent.
Smaller species, hardly exceeding four millimeters in length, less than two-thirds as long again as broad; abdomen full and rounded .....6. *N. senior.*
Larger species, more than five millimeters long, and about three-fourths as long again as broad; abdomen tapering .....7. *N. solidatus.*
Body less than half as long again as broad .....8. *N. rerectus.*

1. Necrocydnus vulcanius.

Head rounded triangular, broader than long, with the large eyes nearly half as broad as the base of the thorax. Thorax considerably more than twice as broad as the median length, subtrapezoidal, the sides tapering so that the breadth near the front (at the bottom of the apical emargination) is about three-fourths that of the basal margin, the lateral angles rounded somewhat, the apical emargination half as broad as the thorax, and a third as deep as broad, very regular, the surface uneven from the elevation of the sides in front to irregular bosses, and rather coarsely, faintly, and sparsely punctate. Scutellum small, not more than half as long as broad, regularly

triangular, with straight sides, the apex scarcely reaching more than quarter way to the tip of the abdomen. Hemelytra with the corium reaching to the middle of the apical half of the abdomen, only the costal edge, but that broadly, coriaceous, the remainder semidiaphanous and faintly infumate like the membrane.

Length, 4.5^{mm}; breadth, 2.25^{mm}.

Florissant. One specimen, No. 7399.

2. Necrocydnus gosiutensis.

Pl. 7, Fig. 22.

Head broad, rounded, nearly twice as broad as long and with the rather large and prominent eyes fully half as broad as the thorax. Thorax more than three times as broad as the median length, subquadrangular, the sides tapering only a little, the anterior lateral angles well rounded, the breadth near the front (next the bottom of the apical emargination) seven-eighths that of the basal margin, the apical emargination broad and shallow, rather more than half as broad as the base of the thorax, and hardly a tenth as deep as broad, very regular; surface even, but for a rapid slope close to the sides, and apparently smooth. Scutellum very large from its breadth, much shorter than broad, reaching nearly half-way to the tip of the abdomen. Corium of hemelytra reaching the last abdominal segment, rather coarsely and very sparsely granulate.

Length, 4.65^{mm}; breadth, 2.5^{mm}.

Green River, Wyoming. One specimen, No. 13, Leslie A. Lee.

This is the only species of Necrocydnus yet found within the limits of the ancient Gosiute Lake.

3. Necrocydnus torpens.

Head large, well rounded, nearly twice as broad as long, and nearly two-fifths as broad as base of thorax; the antennæ about as long as the thorax. Thorax only twice as broad as the median length, tapering considerably, the lateral angles of the front not prominent, the emargination of the apical border half as long as the basal border, regular, and moderately deep; surface very finely punctate, even. Scutellum large, broader than long, the apex not extending half-way to the tip of the abdomen. Hemelytra with the corium serially punctate, reaching the penultimate abdominal

segment. Tibiæ heavily spined. Whole body brownish fuscous, the corium of hemelytra fusco-castaneous, the membrane scarcely infumated.

Length, 5.1^{mm}; breadth, 3^{mm}.

Florissant. Two specimens, Nos. 441, 12998.

4. Necrocydnus stygius.

Head twice as broad as long, well rounded, two-fifths as broad as the base of the thorax, the eyes large. Thorax only twice as broad as its median length, tapering considerably, the sides very regularly arcuate, the lateral angles of front not prominent, the emargination of the apical border somewhat less than half the length of the basal border, regular, and very shallow; surface even, a little roughened. Scutellum scarcely more than half as wide as the thorax, almost equiangular, the sides perfectly straight, reaching less than half-way to the apex of the abdomen, the surface apparently punctate, but obscure. Corium of hemelytra reaching the middle of the antepenultimate abdominal segment, punctate, the punctæ serial only near the sutura clavi. Tibiæ heavily spined. Abdomen a little produced, so that the posterior curve of the body is scarcely so broad as the anterior.

Length, 6^{mm}; breadth, 3.5^{mm}.

Florissant. Two specimens, Nos. 6654, 9947.

5. Necrocydnus amyzonus.

Pl. 28, Fig. 16.

Head rather small, rounded subtriangular, nearly or quite twice as broad as long, hardly more than a fourth as broad as the thorax. Thorax twice as broad as the median length, tapering considerably, with rather strongly arcuate oblique sides, the lateral angles of the front not prominent, the apical emargination regular, considerable, rather deep, and very broad, the surface of the thorax even and very finely and closely punctate. Scutellum nearly as long as broad, fully two-thirds as broad as the thorax, the apex reaching about half-way to the tip of the abdomen, the surface like the thorax. Hemelytra with the corium reaching the penultimate abdominal segment, feebly punctate. Legs densely spined. Abdomen broadly rounded. Whole body uniformly blackish fuscous, the corium of hemelytra dark castaneous, the membrane clear.

This is the commonest fossil cydnid known in the "Amyzon shales."

Length, 4.25–5.1^{mm}; breadth, 2.2–3.1^{mm}.

Florissant. Twenty-nine specimens, of which some of the best are Nos. 1919, 2100, 4565, 4663, 4851, 7543, 9583, 11226, 12068, 12987, 14221, 14224.

6. Necrocydnus senior.

Head well rounded, transversely ovate, nearly a third as broad as the thorax, half as broad again as long. Thorax only twice as broad as the median length, tapering but little, the lateral angles of the front prominent, the apical emargination considerably and tolerably deep, the surface apparently finely punctate, with two posteriorly converging shallow and faint sulcations crossing the disk longitudinally from the outer edges of the eyes backward. Scutellum moderate, more than half as broad as the thorax, broader than long, reaching less than half-way to the tip of the abdomen. Hemelytra with the corium punctate in serial rows, reaching the middle of the antepenultimate segment of the abdomen. Tibiæ heavily spined. Abdomen full and rounded, hardly so long as broad. Color blackish brown, the hemelytra with the corium dark testaceous, the membrane clear.

Length, 4^{mm}; breadth, 2.5^{mm}.

Florissant. Four specimens, Nos. 2732, 11566, 11793, 13155.

7. Necrocydnus solidatus.

Pl. 28, Fig. 13.

A stout species, fuller in front than behind. Head transversely ovate, about twice as broad as long and about one-third as broad as the thorax. Thorax hardly twice as broad as the median length, tapering but very little, the lateral angles of front very prominent, the apical emargination very broad and only moderately deep; surface even and distantly punctate. Scutellum similarly punctate, about two-thirds as broad as the thorax, broader than long, the angular apex not reaching half-way to the tip of the abdomen. Hemelytra with the corium apparently reaching the penultimate abdominal segment. Tibiæ very heavily and coarsely spined. Abdomen subconical, pointed.

Length, 5.6^{mm}; breadth, 3^{mm}.

Florissant. Two specimens, Nos. 6967, 8840.

8. Necrocydnus revectus.

A very broad, stout, and rounded species. Head rather small, well rounded, at least half as broad again as long and scarcely a fourth as wide as the thorax; the antennæ about as long as the thorax. Thorax about twice as broad as the median length, with strongly arcuate, somewhat oblique sides, which curve rapidly on the anterior half to the ends of the apical emargination, which is hardly one-third as long as the basal margin, moderately shallow and very regular; surface even, finely, uniformly, and densely punctate, as is every coriaceous part of the body. Scutellum nearly half as broad as the thorax, considerably broader than long, the scarcely less than rectangular apex not extending half-way to the apex of the abdomen. Hemelytra reaching as far as the tip of the abdomen, the membrane small. Abdomen very broadly rounded posteriorly, somewhat shorter than broad.

Length, 4.5^{mm}; breadth, 3.2^{mm}.

Florissant. Two specimens, Nos. 1581, 10844.

4. THLIBOMENUS gen. nov. (*θλιβόμενος*).

This genus is even more closely allied to Necrocydnus than the latter to Procydnus, and differs from it principally in the still greater prominence of the head, which is out of direct relation to the general anterior curve of the body, the anterior emargination of the thorax being slight or even absent. The head is nearly circular, generally a little, but only a little, broader than long, the eyes central, moderate in size and prominence, globular, the ocelli well behind them, pretty large, and as near each other as the neighboring eye. Thorax about twice as broad as long, subquadrate the sides very variable, but the tapering usually confined to the anterior half, or very much stronger here than posteriorly, the front margin but slightly emarginate, usually also very broadly rounded or subtruncate, with a strongly arcuate anterior sulcation terminating next the sides of the head; the basal margin truncate. Scutellum precisely as in Necrocydnus.

The species are pretty numerous, but are known only by one or two examples each. They are mostly of the smallest size, and all come from Florissant.

Table of the species of Thlibomenus.

Outer anterior angles of the thorax prominent, the length of the apical margin of the thorax not greatly less than that of the basal.

Thorax fully twice as broad as long ..... 1. *T. petrens.*

Thorax scarcely twice as broad as long ..... 2. *T. parrus.*

Outer anterior angles of the thorax well rounded, the sides considerably oblique, so that the apical is much shorter than the basal margin of the thorax.
Head broader than long.
Thorax less than twice as broad as long ..... 3. *T. perennatus.*
Thorax more than twice as broad as long ..... 4. *T. limosus.*
Head longer than broad ..... 5. *T. macer.*

1. Thlibomenus petreus.

Head moderately large, about a third as broad as the thorax. Thorax rather more than twice as broad as long, the length of the apical not greatly less than the basal margin, since the sides do not greatly taper and the outer anterior angles are prominent; apical margin with a very gentle and very broad emargination; the surface even and very finely punctate. Scutellum moderate, sharply and regularly triangular, about two-thirds as broad as the thorax, broader than long, extending much less than half-way to the tip of the abdomen. Hemelytra with the corium hardly reaching the middle of the apical half of the abdomen, heavily punctate in serial rows. Tibiæ strongly but not very densely spined. Abdomen very full and rounded, fully as broad as long. Color black, the corium of hemelytra very dark castaneous, the membrane infumated.

Length, 4^{mm}; breadth, 2.25^{mm}.

Florissant. Two specimens, Nos. 5557, 6613.

2. Thlibomenus parvus.

Pl. 19, Fig. 23.

Head small, hardly more than a fourth as wide as the large thorax. The latter scarcely twice as broad as long, with nearly straight, scarcely oblique sides and prominent outer anterior angles, so that the thorax tapers but little, the length of the apical being but little less than that of the basal margin. There is a slight and short rounded emargination on the anterior border, and the surface is even and very shallowly punctate. Scutellum similarly punctate, very short, not nearly reaching half-way to the tip of the abdomen, and hardly more than three-fifths as broad as the thorax. Hemelytra, with the corium, easily reaching the penultimate abdominal segment, more coarsely punctate. Abdomen very broad and rounded, not nearly so long as broad. Of a uniform, griseous color. The parts in front

of the head and following the corium of the hemelytra on the plate are foreign to the specimen, which is not well represented there.

Length, 3.25^{mm}; breadth, 2.25^{mm}.

Florissant. One specimen, No. 4552.

3. Thlibomenus perennatus.

Head very regularly rounded, considerably broader than long, about a third the width of the thorax. The latter is a little less than twice as broad as long, with tapering arcuate sides, the outer anterior angles well rounded but tolerably prominent, the apical border gently emarginate for a distance about equal to a third of the base of the thorax. Scutellum rather small, hardly more than half as broad as the thorax, and shorter than broad, extending not nearly half-way to the tip of the abdomen, the surface and that of the thorax even, with the faintest and shallowest possible punctuation. Corium of the hemelytra hardly reaching the middle of the apical half of the abdomen, very sparsely and rather faintly punctate. Abdomen broadly semiovate, of equal length and breadth. Color a uniform testaceous where the pigment is not removed.

Length, 4^{mm}; breadth, 2.25^{mm}.

Florissant. One specimen, No. 7841.

4. Thlibomenus limosus.

Pl. 28, Fig. 12.

Head precisely as in the last species. Thorax trapezoidal, a little more than twice as broad as long, with rather rapidly tapering sides, the apical about three-fourths the length of the basal margin, the former almost truncate, with the faintest possible arcuation throughout, the surface of the thorax even, faintly and finely rugulose. Scutellum obscure in the only specimens seen, but apparently large and triangular, and extending half-way to the tip of the abdomen. Corium occupying about three-fifths the hemelytra, serially and distinctly punctate. Abdomen well rounded, but distinctly longer than broad. Color blackish fuscous, the corium of hemelytra fusco-testaceous.

Length, 4.5^{mm}; breadth, 2.6^{mm}.

Florissant. Two specimens, Nos. 5723, 13583.

5. THLIBOMENUS MACER.

Head scarcely longer than broad, small, not a quarter the width of the thorax. Thorax several times broader than long, the sides very oblique, so that it tapers rapidly forward and has the front broadly rounded, with scarcely any sign of emargination opposite the head, the surface even and apparently very coarsely granular. Scutellum similar, triangular, more than two-thirds as broad as the thorax, and shorter than broad, but reaching about half-way to the tip of the abdomen. Hemelytra with the corium rather short, coarsely and obscurely punctate. Abdomen well rounded, scarcely longer than broad. Color of the body black, the corium fuscous, membrane infumated.

Length, 4^{mm}; breadth, 2.5^{mm}.

Florissant. One specimen, No. 2455.

5. CYRTOMENUS Amyot and Serville.

This tropical American type, with four or five species, one of them found in our Southern States, occurs also so far as the imperfect remains can determine in the Tertiary beds at Green River, where one species is found, remarkable for the great width of the head. It is the only fossil known.

CYRTOMENUS CONCINNUS.

Pl. 7, Fig. 14.

Cyrtomenus concinnus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 769 (1878).

This species is represented by a single specimen, a little smaller than C. mirabilis (Perty), but closely resembling it in general form. It is broadly ovate; the head large, prominent, well rounded, nearly half the eyes protruding beyond the margin, the ocelli nearly one-fourth the diameter of the eyes, and situated next the hind border, very nearly half-way between the inner margin of the eyes and the middle line of the head. Thorax twice as broad as the head exclusive of the projecting part of the eye, more than twice as broad as long, the front margin rather deeply and regularly concave, the sides considerably convex, especially on the front half, the hind margin very broadly convex. Scutellum longer than the thorax, scarcely less tapering on the apical than on the basal half, the apex rounded, half as broad as the base, the whole about as long as the breadth at base. Teg-

mina very faint, but the corium apparently terminating just before the tip of the scutellum. Extremity of the abdomen very broadly rounded. The whole surface of the head, thorax, scutellum, and probably of the corium uniformly, very profusely, and minutely punctulate, otherwise smooth, excepting that there are also faint traces of a slight, transverse, median depression, and a similar longitudinal median depression on the thorax.

Length of body, 5.25^{mm}; of head, 1.2^{mm}; of thorax, 1.3^{mm}; of scutellum, 1.65^{mm}; breadth of head, 2^{mm}; of thorax, 3.5^{mm}; diameter of eye, 0.25^{mm}.

Green River, Wyoming. One specimen, No. 4190.

6. DISCOSTOMA nom. nov. (*δίσκος, στόμα*).

This name is proposed for Lobostoma Am.-Serv., preoccupied in mammals. The genus is composed of only two or three species found in Central America and Guiana. It has never been recognized in a fossil state, and the specimen from Florissant is referred to it only tentatively until better material is at hand.

Discostoma ? sp.

Pl. 22, Fig. 6.

The ventral surface of an exceptionally large cydnid, showing the abdomen and a part of the legs and little more, is all that remains of the single specimen referred here. From its size one would naturally refer it to this genus or its neighbors, which contain the largest species of the group; and besides, the hind tibiæ are furnished exteriorly, as in existing species of Discostoma, with a single line of fine spinules, the only characteristic available: whether the tibiæ are cylindrical or flattened can not be told. The abdomen is dark griseous, with a pale rounded semicircular spot seated on the outer margins of each segment, separated from its neighbors by the darker incisures, besides which the apical margin of the first segment shows a narrow, blackish fuscous belt. Legs pale, the spines blackish: only the basal part of the hind tibiæ seen

Probable length of body, 18^{mm}; breadth of abdomen, 8^{mm}; length of hind femora, 5^{mm}.

Florissant. One specimen, No. 234.

Subfamily PENTATOMIDA Stal.

This group is one of the most prevalent of the subfamilies of Heteroptera in the European Tertiaries, twenty-six species being found there, which have been referred to six genera: Ælia, one species, Eurydema, one, Eusarcoris two, and Halys two, all from Oeningen, besides Pentatoma, which has been accredited to Radoboj, Aix, Salzhausen, and amber, but especially to Oeningen, where nine species have been recorded. Besides these a species of Pentatoma has been described from Greenland.

In our Western Tertiaries remarkably few examples of this group have been recovered, considering its abundance in the Old World, but nearly every specimen is generically distinct from every other, for we have but thirteen species, and in only two instances have these more than a single specimen each, yet so different are they that they must be separated into ten genera; only one of these, imperfectly known by a very remarkable head, can be referred to an existing genus, for in all the scutellum is remarkably triangular and equiangular and destitute of the apical extension common to living types. In this, as already stated, some of the European species appear to agree with them; it should, however, be noted that this agreement appears far more marked in Heer's direct illustrations of the fossils than in his restorations of the same species. Our species all come from Florissant, with a single exception.

Table of the genera of Pentatomida.

Intraocular part of head less than two and a half times as long as broad.
- Apex of scutellum reaching distinctly less than half-way to the tip of the abdomen.
  - Head in front of eyes quadrate, the tylus and juga of similar length ..... 1. *Teleoschistus.*
  - Head in front of eyes tapering, the tylus surpassing the juga ..... 2. *Thnetoschistus.*
- Apex of scutellum reaching half-way to the tip of the abdomen.
  - Thorax less than three times as broad as long.
    - Body regularly ovate throughout ..... 3. *Poteschistus.*
    - Body with parallel or nearly parallel sides.
      - Head shorter than middle of the thorax and more than half its width .. 4. *Cacoschistus.*
      - Head longer than the middle of the thorax and slightly less than half as wide as the thorax ..... 5. *Mataoschistus.*
  - Thorax three or more than three times as broad as long.
    - Body at least half as long again as the width of the abdomen.
      - Posterior lateral angles of thorax prominent.
        - Sides of thorax in front of lateral prominences concave ..... 6. *Polioschistus.*
        - Sides of thorax in front of lateral prominences convex ..... 7. *Pentatomites.*
      - Posterior lateral angles of thorax not prominent ..... 8. *Tiroschistus.*
    - Body less than half as long again as the width of the abdomen ..... 9. *Thlimmoschistus.*

Intraocular part of head two and a half times as long as broad ..... 10. *Mecocephala.*

1. TELEOSCHISTUS gen. nov. (τέλεος, σχιστός).

Head of moderate size, nearly half as broad as the thorax, and distinctly broader than long, scarcely longer than the intraocular width, the portion in front of the eyes subquadrate, with broadly rounded front, rounded angles, the tylum and juga of equal length. Rostrum reaching, as seen through the specimen, opposite a point a little beyond the base of the scutellum. The thorax is pentagonal, the base at least half as long again as the straight, oblique, posterior lateral margins, the nearly straight but slightly convex anterior lateral margins at right angles to the posterior and a little longer than they, the apical border emarginate for its whole length for the reception of the head, and less than half as long as the breadth of the widest part of the thorax and scarcely shorter than the middle length of the thorax. Scutellum triangular, vaulted, of nearly equal length and breadth, the tip angulate and not produced, reaching less than half-way to the tip of the abdomen. Mesosternum much longer than the metasternum, the coxal cavities of the two hinder pairs of legs contiguous, separated only by a common paries.

Three species are known, one of them from British Columbia, the others from Florissant.

Table of the species of Teleoschistus.

Scutellum reaching very nearly half-way to the tip of the abdomen.....1. *T. antiquus.*
Scutellum reaching barely two-fifths way to the tip of the abdomen.
  Punctuation of costal margin of corium clustered along the edge, leaving an open submarginal streak free of punctures .....2. *T. rigoratus.*
  Punctuation of costal margin of corium uniform .....3. *T. placatus.*

1. TELEOSCHISTUS ANTIQUUS.

Pl. 2, Figs. 17–19.

Euschistus antiquus Scudd., Rep. Progr. Geol. Surv. Can., 1876–1877, 459–461 (1878).

The principal specimen is unusually perfect, and appears to be a male. The head is slightly longer than broad, equal beyond the expanding base, broadly rounded and somewhat flattened in front; the slight carinæ marking the borders of the middle lobe are parallel throughout and extend to the front of the head. The thorax is so imperfectly preserved as to throw doubt upon the generic affinities of the insect, but it appears to have been more than twice as broad as long, with a median furrow, and its front margin very slightly concave behind the head; probably, also, it was considerably pro-

duced at the hinder lateral angles, and had its lateral margin slightly denticulate anteriorly. The scutellum is large, a little narrower than the breadth of the base of the abdomen, of nearly equal length and breadth, pretty regularly triangular, but with a slight emargination of the sides on their basal half; the tip bluntly pointed and rounded off, extending a little way upon the middle of the strongly advanced fourth abdominal segment. The surface of the head, prothorax, and scutellum is covered pretty uniformly and abundantly with distinct round punctures, which are, however, deepest, most sharply defined, and so abundant as nearly to occupy the entire surface, on the front half of the head and next the margins of the prothorax. The corium of the tegmina includes more than half the wing, and is covered with punctures, deeply impressed, and much minuter and more frequent than on the scutellum; there is also a distinct vein passing down the middle, a little to one side, and another separating the clavus from the corium, but distinct on the specimen only apically, where it is continuous with the inner margin of the membrane. The membrane is well rounded, but slightly produced at the outer angle, and the space is occupied by nine nearly longitudinal veins, distributed in three sets of three each: the first set is composed of three obscure veins, pretty close together next the inner edge, originating from the same point, equidistant from one another, the innermost hugging the inner margin; from apparently the same point originates the next cluster, starting in a single vein, which almost immediately forks, and sends its innermost branch parallel to those mentioned; the other branch diverges strongly from it and again forks, the two branches running parallel to the first; while from opposite the point of origin of the last fork the third cluster takes its rise, starting as a shouldered vein, which forks at its shoulder into two slightly divergent veins which run subparallel to the previous veins; but the innermost of these again forks beyond its middle, crowding the veins together at this point. There is also a short, tenth, independent vein close to the outer extremity of the produced coriaceous field. The outer margin of the wing is delicately wrinkled with a simulation of veinlets. The abdomen is ovate, somewhat regularly tapering at its outer half; the apex obscure but apparently regularly rounded; the pleuræ are punctured like the scutellum, while the dorsal surface is minutely and profusely but obscurely punctulate. Such portions of the chitine as remain are of an intense black. The specimen is apparently a male, but whether two small triangular pieces,

nearly equiangular, following the posterior edge of the sixth abdominal segment laterally, are to be considered the anal cerci is doubtful.

Directly beside this specimen, and, in fact, partly underlying it, are the abdomen and part of the sternum of another insect, which, although much smaller, should doubtless be regarded as the female of the same species. This abdomen represents an under surface; it is very rounded and ovate, the extremity well rounded, the sixth segment represented by a circular fissured plate. The sides of the abdomen are punctulate, as in the other specimen, but the punctulation dies out before reaching the middle of the abdomen. Little can be said of the other parts of the body, excepting that the rostrum appears to terminate at the front limit of the middle coxæ, and the sternal parts of the thorax are coarsely punctate as above and more particularly at the margins of the separate pieces.

Length of the male, 15^{mm}; of head, 2.9^{mm}; breadth of same beyond the base, 2.4^{mm}; length of thorax, 3.25^{mm}; of tegmina, 11^{mm}; breadth of same near tip, 4.35^{mm}; length of scutellum, 4.2^{mm}; breadth of same, 4.5^{mm}; greatest breadth of abdomen, 8^{mm}; breadth of its dorsal face at tip of scutellum, 6^{mm}. Length of abdomen of female, measured beneath, 4^{mm}; breadth of same, 5^{mm}; width of fissured plate, 1.25^{mm}.

Quesnel, British Columbia. One specimen, No. 38, Dr. G. M. Dawson.

2. Teleoschistus rigoratus.

Pl. 28, Fig. 14.

Head punctate, the punctæ moderately deep and rather sparse, absent from the extreme back of the head. Thorax irregularly punctate, at the sides very deep and sharp, on the disk shallow and half obscured, everywhere irregularly distributed and rather distant, showing, however, a tendency to run in lines in various directions but never crossing one another and generally transverse; a straight, transverse, slightly impressed, broad sulcation free of punctuation a little in advance of the middle of the apical half of the thorax. Scutellum much more coarsely and more bluntly punctate, reaching barely two-fifths way to the tip of the abdomen. Hemelytra with the corium punctate like the thorax, but distinct and sharp throughout, the punctæ along the costal margin clustered next the edge, leaving an open, narrow, submarginal space free of punctuation. Whole body uniform griseous.

Length, 15.75^{mm}; breadth across base of closed hemelytra, 7.5^{mm}.

Florissant. Two specimens, Nos. 8666, 12072.

3. Teleoschistus placatus.

Pl. 28, Fig. 3.

Head not preserved on the single specimen known. Thorax bluntly punctate throughout, mostly rather coarsely, besides which the surface is more or less roughened except just in advance of the scutellum, where it is smooth, and the punctæ rather fine and a little sharper. Scutellum reaching barely two-fifths way to the tip of the abdomen, uniformly punctate throughout like the greater part of the thorax. Corium of hemelytra rather sharply, deeply, very uniformly and not very sparsely punctate, the punctæ with a tendency to a longitudinal arrangement. Body griseous, corium of hemelytra griseo-castaneous, the clavus and costal field of corium darker, a pallid line following the sutura clavi, and, less distinctly, the lower edge of the principal costal vein and the outer margin of the broadly sinuous marginal suture; membrane slightly infumated with a small but distinct dark triangular coriaceous spot at extreme inner base.

Length (without head), 12.75^{mm}; breadth at base of hemelytra, 6.75^{mm}.

Florissant. One specimen, No. 5460.

2. THNETOSCHISTUS gen. nov. (*θνητός*, *σχιστός*).

Body moderately slender with nearly parallel sides. Head with prominent moderately large eyes, scarcely broader than long, less than half the width of the thorax, scarcely shorter than it, the portion in front of the eyes as long as the part behind them, tapering, subtriangular, bluntly pointed, the tylum distinctly surpassing the juga; antennæ with the basal joint not attaining the front of the head, the second apparently just longer than the thorax. Thorax two and a half times broader than long, apparently with a slight angulate prominence at the base of the sides, in front of which the sides taper very rapidly, forming one curve with the broadly rounded front, which has no emargination for the reception of the head. Scutellum triangular with straight sides and bluntly angulate, not produced apex, considerably longer than the thorax, but not reaching half-way to the apex of the rather elongated produced abdomen.

A single species is known.

THNETOSCHISTUS REVULSUS.

Pl. 28, Fig. 6.

Whole body griseous, the juga apparently lighter than the tylum, the membrane faintly infumated. Head faintly, shallowly, and coarsely punctate; thorax distinctly, rather sparsely, and coarsely punctate; scutellum still more coarsely punctate, but otherwise similar; corium of hemelytra punctate like the thorax, but less coarsely and less sparsely.

Length, 14.5^{mm}; breadth of base of thorax, 6.5^{mm}.

Florissant. One specimen, No. 1837, collected by the Princeton Expedition.

3. POTESCHISTUS gen. nov. (πότε, σχιστός).

Remarkable for the regularly ovate form of the body. [Head unfortunately wanting.] Thorax more or less broken and crushed, so as to render its precise form indeterminable, but apparently it was uniformly vaulted, nearly twice as broad as long, tapering from the very base with no lateral projections, the sides arcuate and tapering pretty regularly, the outer anterior angles well rounded, the apical margin less than half the width of the base, gently and regularly emarginate for the reception of the head. Scutellum triangular, as long as broad by reason of the arcuation at the base of the otherwise straight sides, the tip angulate, not in the least rounded or produced, reaching barely half-way to the tip of the somewhat conical abdomen, which the hemelytra surpass a little.

A single species is known.

POTESCHISTUS OBNUBILUS.

Pl. 28, Fig. 18.

The thorax is smooth except for an exceedingly sparse, low, and inconspicuous granulation. Scutellum, on the contrary, very coarsely granulate indeed and less sparsely; the hemelytra midway between the two and tolerably dense; membranal suture with a barely perceptible arcuation opening outward, and the otherwise clear but faintly veined membrane coriaceous at its extreme inner base, between the membranal suture and the end of the claval suture. Whole body brownish griseous, the scutellum lighter.

Length, excluding head, 13.75^{mm}; breadth, 7.5^{mm}.

Florissant. One specimen, No. 1472.

4. CACOSCHISTUS gen. nov. (*κακός*, *σχιστός*).

Closely related to Mataeoschistus, from which it differs mainly in the structure of the head, which is broader, with a less prominent front: it is more than half as broad as the thorax, the eyes very large, the portion in front of them scarcely tapering, not so long as the eyes, broadly rounded apically, the tylum and juga of equal length, the whole head but little longer than the intraocular space. Thorax in the middle considerably longer than the head, two and a half times as broad as its middle length, tapering from the very base, at first slightly, afterwards rapidly, with the outer anterior angles well rounded by the arcuation of the sides and not at all prominent, and posteriorly with no lateral projection whatever, the apical border rather deeply emarginate for the reception of the head, the middle half of the emargination hardly arcuate. Scutellum triangular, with straight sides and an angulate, in no way produced apex, which barely reaches halfway to the tip of the abdomen, which the hemelytra surpass. Body rather slender (for this group) with parallel sides.

A single species is known.

CACOSCHISTUS MACERIATUS.

Pl. 28, Fig. 2.

The head appears to be smooth; the thorax rather coarsely, very sparsely, and irregularly granulate; the scutellum and corium of hemelytra similarly but more closely and less irregularly granulate; corium of hemelytra long, the membrane hardly occupying more than the apical fourth. Whole body blackish griseous.

Length, including hemelytra, 14.75^{mm}; breadth, 6^{mm}.

Florissant. One specimen, Nos. 13318 and 13319.

5. MATÆOSCHISTUS gen. nov. (*μάταιος*, *σχιστός*).

Of the general form of Euschistus but far more elongate, with parallel sides, probably not far removed from Mecocephala. Head broad at base, the eyes being large; beyond tapering and prolonged, almost exactly as in the typical Mecocephala, the tip being, however, more broadly rounded, the whole head twice as long as its intraocular breadth; tylum apparently a little longer than the juga; first joint of antennæ not nearly attaining the

front of the head, the second slightly longer than the head. Thorax in middle a little shorter than the head, about two and a half times as broad as the middle length, the posterior half of equal width, in front tapering rapidly by the oblique straight sides, the apical nearly half as broad as the basal margin and roundly emarginate to receive the head. Scutellum triangular, with straight sides and angulated apex in no way produced, reaching halfway to the tip of the abdomen. Hemelytra considerably surpassing the abdomen.

A single species is known.

MATEOSCHISTUS LIMIGENUS.

The whole body with the antennæ and legs blackish or blackish griseous; the outer margins and sides of the head appear to be darker than the central portions, the corium of the hemelytra evidently testaceous and the membrane clear. The head appears to be smooth; the thorax is coarsely, and the scutellum very coarsely, granulate, and the corium of the hemelytra faintly granulate on the basal portions like the thorax.

Length, 14.5^{mm}; breadth of thorax, 6^{mm}.

Florissant. One specimen, No. 1.1095, obtained by the Princeton College Expedition.

6. POLIOSCHISTUS gen. nov. (*πολιὸς*, *σχιστός*).

Body with the general form of Euschistus. Head of moderate size, the part in front of the eyes subquadrate, a trifle broader than the intraocular space, the tylum and juga of equal length, the outer angles of the latter a little rounded. Thorax very short, nearly or quite four times as broad as the median length, the posterior part of the sides laterally produced to a blunt, stout knob, increasing the width of the thorax but little, the sides in front rapidly tapering with a concave curve. Scutellum large, broad, triangular, with an angulate and in no way produced apex, reaching halfway or a little more than half-way to the tip of the abdomen.

Two species are known, both from Florissant.

Table of the species of Polioschistus.

Punctuation of corium relatively delicate, the punctæ usually separated by much more than their own diameter; hemelytra less than half as long as scutellum ..... 1. *P. ligatus.*

Punctuation of corium relatively coarse, the punctæ usually separated by only so much as or very little more than their own diameter; hemelytra more than twice as long as scutellum..2. *P. lapidarius.*

1. Polioschistus ligatus.

Pl. 28, Fig. 7.

Head distinctly, rather densely, and not very coarsely punctate. Thorax much more coarsely granulate. Scutellum faintly and rather coarsely punctate. Hemelytra less than twice as long as the scutellum, the punctuation of the corium rather delicate, the punctæ being usually separated by much more than their own diameter. Whole body uniformly blackish griseous, the membrane of hemelytra infumated.

Length of body, 11^{mm}; hemelytra, 7.5^{mm}; scutellum, 4^{mm}; breadth of thorax at base, 5.25^{mm}; at prominences, 6.75^{mm}

Florissant. One specimen, No. 2856.

2. Polioschistus lapidarius.

Pl. 28, Fig. 10.

Of this species, evidently nearly related to the last, only the scutellum and one of the hemelytra are preserved. The scutellum is heavily and coarsely punctate, scarcely shorter than broad, apically angulate, with straight sides. The hemelytra are more than twice as long as the scutellum, the punctuation of the corium much less coarse but distinct and deep, the punctæ separated usually by only so much as or very little more than their own diameter. The scutellum is blackish griseous, the corium dark testaceous, the membrane distinctly infumated. It is a larger species than the last.

Length of hemelytra, 10^{mm}; scutellum, 4.6^{mm}.

Florissant. One specimen, No. 1112.

7. PENTATOMITES gen. nov. (Pentatoma nom. gen.).

This name is proposed for an obscure form of Pentatomidæ, which can not be placed with any of the others, and which is too incomplete to characterize accurately. The head is nearly half as broad as the base of the thorax, with prominent eyes, but the front too broken to determine anything about it. Thorax slightly more than half as long as the basal margin, the sides produced into broad rounded lobes, which increase the width of the thorax by fully one-half; in front of the widest expansion the sides are

arcuate, convex, merging into the broadly rounded apical margin, which is narrowly and slightly emarginate for the reception of the head. Scutellum equiangular, with straight (and not, as given on the plate, convex) sides, longer than the thorax, the apex bluntly angular and in no way produced, reaching less than half-way to the tip of the abdomen.

A single species is known.

Pentatomites foliarum.

Pl. 28, Fig. 1.

A single specimen with partly spread hemelytra, both extremities broken, is the only representative at hand of this species, which differs considerably from all others. The head is rather finely and very sparsely punctate. The thorax and scutellum, and especially the latter, are much more coarsely but quite as sparsely punctate, while the punctuation of the corium of the hemelytra is between the two but rather less sparse; the membranal suture of the hemelytra is rigidly straight and marked by a dark line. The body is blackish griseous, much more conspicuous on the scutellum and disk of thorax than elsewhere, the corium of hemelytra merely infuscated, the membrane faintly infumate.

Length of fragment, 15^{mm}; probably length of body, 16.5^{mm}; breadth of thorax, 9^{mm}; abdomen, 6.5^{mm}.

Florissant. One specimen, No. 7929

8. TIROSCHISTUS gen. nov. (τείρω, σχιστός).

Head rounded, broader than long, with remarkably little projection in advance of the eyes; antennæ about twice as long as the head and thorax together, the first joint short, barely surpassing, if surpassing, the head, the second longest and about as long as the width of the head, the third and fourth equal and each about three-fourths the length of the second, all slender beyond the basal joint, the fifth unknown. Thorax transverse and semilunar, only slightly broader in advance of, than at, the base at the lateral angulation, which is not at all prominent. Scutellum large, triangular, simple, slightly longer than broad, about as long as head and thorax together, but reaching only half-way to the tip of the abdomen.

A single species is known.

TIROSCHISTUS INDURESCENS.

Pl. 22, Fig. 4.

Head finely and densely granulate; antennæ very minutely punctulate, with an exceedingly fine median carina on the upper surface. Thorax and scutellum more coarsely, less distinctly, and more sparsely granulate, the corium of the hemelytra still more obscurely, so as not to be noticeable. Head, thorax, and scutellum blackish or black. Corium and clavus of hemelytra very light colored, almost colorless, with the base largely blackish fuscous and the apex occupied next the costal margin with a very large roundish fusco-castaneous spot, the sutura clavi infuscated and punctate, the membrane pallid at base but the whole apical two-fifths or more occupied by a fusco-castaneous cloud, densest basally, fading toward the edge.

Length, 10.75^{mm}; breadth of base of thorax, 4^{mm}.

Florissant. One specimen, No. 11784.

9. THLIMMOSCHISTUS gen. nov. (*θλίβω*, *σχιστός*).

Head moderately large, rounded, half as broad as the thorax, almost equally long and broad, the front rounded and not produced beyond the rounded curve of the whole head; antennæ with the basal joint distinctly surpassing the front, the remaining joints very slender, the second longest, the others subequal and each about two-thirds as long as the second, all together half as long as the body. Thorax fully three times as broad as the median length, yet tapering from the base with no lateral prominences, the sides very oblique and straight, the apical margin deeply emarginate to receive the head. Scutellum large (not shown on plate, being very obscure), reaching fully two-thirds way to the tip of the short abdomen, but triangular with straight sides and an angulate and in no way produced apex. Abdomen very broad and short, the extremity very broadly rounded, the whole body being less than half as long again as the width of the abdomen.

A single species is known.

THLIMMOSCHISTUS GRAVIDATUS.

Pl. 28, Figs. 11, 19.

Whole body uniformly rather obscurely and sparsely and not prominently granulate and blackish. Hemelytra the same but only pale and

more or less infumated, the costal margin of the corium infuscated, and at the apex of the same a large, round, blackish, cloudy spot; membrane infumated to the same degree as the corium, but the apical two-fifths overlain by a similar black cloud, which fades a little next the margins of the wing.

Length, 9mm; breadth of thorax, 5.5mm; abdomen, 6.25mm.

Florissant. Two specimens, Nos. 8471, 10405.

10. MECOCEPHALA Dallas.

To this genus belongs a single living insect from Uruguay. It is the only genus that seems to have been published in which the head is prolonged to an equal degree, which tapers throughout, and in which the middle lobe is not surpassed by the lateral lobes. Quite similar in this respect is a fragment from Florissant, which unfortunately consists of the head only.

Mecocephala sp.

Pl. 28, Fig. 8.

The base of the head, including the large eyes but not the parts behind, is a little more than twice as broad as long, but in front the head is prolonged, so that the postocular part is as long as the entire breadth of the head. This portion tapers, at first rapidly until it has reached the intraocular width, then gradually to the apex, which is scarcely more than a third the intraocular width; the tip is roundly truncate. At first appearance, and as given in the plate, the whole seems to be made up of the lateral lobes, the middle lobe being in fact very slender but enlarging a little at the apex. The whole is blackish fuscous and the surface of the base coarsely, of the frontal projection finely, and in both shallowly and obscurely, punctate.

Length of head, 5mm; breadth, including eyes, 3.5mm; tip of prolongation, 0.65mm.

Florissant. One specimen, No. 3007.

COLEOPTERA Linné.

In working out these fossil Coleoptera I have been greatly indebted to my friends, Dr. George H. Horn, the late Dr. John L. LeConte, and especially Mr. Samuel Henshaw, and have had free access to the collections of Mr. Henshaw, as well as to those of Mr. E. P. Austin while in Mr. Henshaw's keeping, and of the late Mr. George D. Smith, for all of which I wish to express my grateful thanks.

For the remainder of this volume no general comparisons are presented under the different groups, as, with rare exceptions, none of the Florissant species are described, and until they are, the American fauna can not be fairly discussed.

Family ANTHRIBIDÆ Waterhouse.

CHORAGUS Kirby.

Choragus fictilis.

Pl. 8, Fig. 9.

A single specimen, not very distinctly preserved, represents this species. It shows a partially dorsal and partially lateral aspect. The head is well rounded, the mouth parts triangularly produced, to a greater extent and more pointed than shown in the plate. The antennæ are apparently inserted upon the upper surface of the beak, and are more or less clubbed, which circumstances have made it seem probable that the insect belonged here. The antennæ, however, appear to become thickened into a club throughout all the distal half, and are thus different from Choragus; they can be seen to be jointed, but with such indistinctness that the number of joints involved in the club is uncertain. The thorax is quadrate and apparently half as long as broad, while the exceedingly obscure elytra are seen to be feebly striate; the

body is unfortunately broken across the elytra, which has given the drawing an anomalous appearance.

Length of body, 2.4^{mm}; of antennæ, 0.5^{mm}; breadth of body, 0.75^{mm}.

Green River, Wyoming. One specimen, No. 166 (Prof. L. A. Lee).

BRACHYTARSUS Schönherr.

Brachytarsus pristinus.

Pl. 7, Fig. 26.

Brachytarsus pristinus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 87 (1876).

The single specimen obtained is very poorly preserved and fragmentary. The head is roundish, with small circular eyes 0.08^{mm} in diameter. The prothorax is subquadrate, considerably larger than the head and nearly as broad as the body at the base of the elytra; the latter are broken.

Length of fragment, 2.1^{mm}; breadth of same, 0.84^{mm}; length of head, 0.39^{mm}; breadth of same, 0.4^{mm}; of thorax, 0.64^{mm}.

Green River, Wyoming. One specimen, No. 15216 (F. C. A. Richardson).

CRATOPARIS Schönherr.

Cratoparis repertus.

Pl. 8, Fig. 4.

Cratoparis repertus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 768 (1878).

A single specimen shows the fragment of an elytron, which is referred to this genus from the character of the punctuation and the arrangement of the striæ. It closely resembles C. lunatus Fahr. in these points, but must have belonged to a slenderer insect, about as large as C. lugubris Fahr. There are eleven striæ or rows of pretty large, subconfluent, short, longitudinal dashes or oval punctures, deeply impressed, the outer of which follows the extreme margin, excepting apically; the inner stria also runs very near the border; the interspaces between the first and second and between the second and third striæ are equal and a little broader than the interspaces between the other striæ; the inner margin is delicately grooved next the base, as in C. confusus.

Length of fragment, 4.3mm; width of elytra, 1.6mm; width of interspace between second and third striæ, 0.21mm; between third and fourth striæ, 0.13mm.

Green River, Wyoming. One specimen, No. 4035.

Cratoparis ? elusus.

Pl. 8, Fig. 40.

Cratoparis ? elusus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 768–769 (1878).

To this I refer doubtfully two specimens, neither of them very perfect, which appear to belong together, and to represent an insect allied at least to Cratoparis and of about the size of C. lunatus Fahr. It appears to have a short rostrum, a moderately small but rather tumid head with circular eyes; thorax not greatly attenuated anteriorly, but profusely punctate, with moderately large and rather shallow punctures; elytra arched, nearly three times longer than the thorax when measured over the curved back, furnished with slight and faintly impunctured striæ; the surface between the striæ also punctured, but very faintly.

Length of body, 7.5mm; of thorax, 2.25mm; of elytra, 5.5mm.

Green River, Wyoming. Two specimens, Nos. 4012, 4060.

HORMISCUS Waterhouse.

Hormiscus partitus.

Pl. 8, Fig. 17.

A single specimen showing the upper surface of a minute beetle seems to fall in this immediate vicinity. Only a little of the head is shown, protruding as a rounded mass in front of the minutely punctate thorax, which is subquadrate with gently rounded sides, scarcely tapering anteriorly. The elytra at their base, as throughout their basal two-thirds, are together half as broad again as the thorax, and are marked by straight longitudinal rows, of which eight are visible on each elytron, of large round punctures, about as distant in each row as the rows are from one another.

Length, 2.75mm; of elytra, 1.8mm; breadth of thorax, 0.9mm; of tegmina, 1.4mm.

Green River, Wyoming. One specimen (Dr. A. S. Packard)

Family SCOLYTIDÆ Kirby.

HYLASTES Erichson.

HYLASTES ? SQUALIDENS.

Pl. 1, Figs. 23–25.

Scolytidæ sp. Scudd., Can. Ent., XVIII, 194–196 (1886).

Prof. G. J. Hinde sent me a branch of a conifer obtained by him from the interglacial clays near Toronto on account of its being scored with insect tracks. From an examination of the cell structure Dr. G. L. Goodale has determined it to be the branch of Juniperus communis. It is about 12.5^{cm} in length and 13 by 18^{mm} in thickness: the broader surface is shown of the natural size in Pl. 1, Fig. 23, and the scorings, which cover a considerable part of the surface, are made by several distinct tracks of a scolytid larva, which appears to be referable to Hylastes, Phlœosinus, or some near ally. There are parts of at least six different sets of tracks on this small fragment, portions of all of which may be seen in the figure, and are marked by the different letters at the sides. The whole of that seen at *d* is enlarged in Fig. 24, which shows a little more than can be seen in Fig. 23*d*.

The mating chamber is more or less triangular, resembling often a shark's tooth in form (whence the name) generally equiangular or tridentate, the apex upward (see especially *c*, *d*). Two of these chambers from which no main galleries take their rise occur on the stick; they may, however, have some other explanation, since they are much narrower and much more deeply excavated than the other mating chambers. Possibly they were unsatisfactory to the constructor and left unfinished.

From the mating chambers, which are not deep and are about 3^{mm} in diameter, pass the main galleries: these generally run obliquely, but more nearly transverse than longitudinal (as in Fig. 24), are subequal, and take their rise one on either side of the mating chamber at the lateral angles and run in exactly or almost exactly opposite directions. In one case, however (*d*), there is but one main gallery, and in another (*f*) they are at right angles to each other, one being longitudinal; but in this latter case the mating chamber is in the reverse of the usual position, the apex being downward. These main galleries vary from 1.5 to 8^{mm} in length, and are slightly more than a millimeter wide, with dentate edges, marking probably the sinuses where the eggs are laid by the parent.

At least this is the custom with the mining beetles; but here, as in some other rare cases, the young larvæ do not begin to mine at right angles to the main gallery, but all start from one spot, either the summit of the mating chamber or the extremity of one of the main galleries, and thence burrow in irregular and somewhat interlacing mines in a longitudinal direction (see Fig. 24), but nearly all apparently either upward or else downward, not, as usually, in the two directions almost equally. Apparently they may often turn upon their course again and again, or they may mine in an almost perfectly straight line or in a tortuous line for as much as 5^{cm}, in the whole of which distance the mine will scarcely have doubled in width; indeed, in many cases it is difficult to tell in which direction the larva has moved. The greatest width of these mines is scarcely more than half a millimeter and they vary greatly in depth. The depth of those at *a* may be seen in the enlarged drawing of this portion in Fig. 25.

The connection between the main gallery and the mines is often obscure, owing doubtless to the younger larvæ burrowing more in the bark than in the wood (the bark being here entirely lost). In one case (*c*) there is a mating chamber and a pair of short galleries, but nothing more; here apparently the mother fell a prey to some enemy before oviposition.

This mode of origin of the larval mines seems to be different from anything hitherto described, and it is therefore difficult to decide to what minor group of insects the creature constructing the mines belonged. In the Museum of Comparative Zoology at Cambridge is a mine of Scolytus rugulosus on cherry, which shows a somewhat similar distribution of the larval mines, emerging and diverging from one point of the mating chamber; but the main galleries are reduced to almost nothing, and the figures of the mines of this species given by Ratzeburg are altogether different.

This specimen is one of those branches "of some coniferous tree," which Mr. Hinde in his article on the glacial and interglacial strata of Scarboro Heights,[1] states to occur in the layers between the beds of clay and sand found between his "till No. 1" and "till No 2," and which are described as "flattened by pressure, their edges . . . worn as if they had been long macerated in water." This is exactly true of the present fragment.

[1] Can. Jour. Sc. Lit. Hist., XV, 388–413, plate, 1877.

DRYOCÆTES Eichhorn.

Dryocætes impressus.

Pl. 8, Fig. 28.

Trypodendron impressus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 83 (1876).
Dryocætes impressus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 767–768 (1878).

This species has the prothorax punctured as distinctly as the elytra, and the punctures on the elytra show but a slight tendency to a longitudinal arrangement. The punctures of the prothorax are longitudinally obovate, a very little more frequent than on the elytra, equally distributed throughout; on the elytra they are also equally distributed, but circular, about 0.04^{mm} in diameter, and average 0.1^{mm} in distance apart; they have but an obscure longitudinal arrangement into nineteen or twenty rows, and the successive punctures of each row are at about the same average distance apart as those of two contiguous rows. The species is of about the size of D. septentrionalis (Mann.), but has more of the markings of D. affaber (Mann.), although the punctuation of the elytra is not so distinctly separable into longitudinal series.

Length of prothorax, 1.28^{mm}; height of same, 1.44^{mm}; length of elytra, 2.8^{mm}; breadth of same, 1.24^{mm}.

Green River, Wyoming. Four specimens, Nos. 15218 (F. C. A. Richardson), 4009, 4048, 4091 (Bowditch and Scudder).

Dryocætes carbonarius.

Pl. 8, Fig. 6.

Dryocætes carbonarius Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 768 (1878).

Another species, not very closely allied to the last, is represented by a single, rather mutilated specimen, which is pitchy-black, and consists of part of the head, thorax, and elytra. The head is rather long, faintly and not very closely punctured, the eye moderately large and circular. The thorax is proportionally longer than in the preceding species; the front margin recedes a little on the sides, and the surface is subrugose by subconfluent punctures, the walls of which form wavy ridges having a longitudinal direction. The elytra are broken at the tip; their outer anterior angle is obliquely excised, and the outer margin behind it straight, not sinuate, as in the preceding species: the surface is rather coarsely, but very

faintly granulate, more distinctly next the base, but even here very vaguely; and there are faint indications of three or four distant, simple, longitudinal striæ.

Length of the fragment as curved, 4^{mm}; of head, 1.1^{mm}?; of thorax, 1.3^{mm}; probable length of elytra, 3.15^{mm}; width of same, 1.5^{mm}; diameter of eye, 0.35^{mm}.

Green River, Wyoming. One specimen, No. 3999.

Family CURCULIONIDÆ Leach.

CRYPTORHYNCHUS Illiger.

Cryptorhynchus annosus

Pl. 8, Fig. 3.

Cryptorhynchus annosus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 86–87 (1876).

The fragmentary specimen is exposed on a side view, with head, front of prothorax, and all the legs gone, and the elytra a little broken. The prothorax is profusely and uniformly pitted with moderately shallow pits, averaging .06^{mm} in diameter; the elytra are traversed by longitudinal costæ, five of which are much more prominent than the others, with sharp, unbroken edges and equidistant from one another, the outer ones in close proximity to the sutural and outer edges; the other costæ are obscure, slightly elevated, rounded, broken to a greater or less extent into raised points: midway between the first and second prominent costæ (counting from the outer margin) there is an exactly similar prominent costa on the basal third of the elytron; the prominent costæ are 0.2^{mm} apart.

Length of the prothorax, 0.88^{mm}; height of same, 1.04^{mm}; length of elytron, 1.96^{mm}; breadth of same, 1.08^{mm}.

Green River, Wyoming. One specimen, No. 15223 (F. C. A. Richardson).

GYMNETRON Schönherr.

Gymnetron lecontei.

Pl. 8, Fig. 26.

Gymnetron lecontei Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 767 (1878).

A single well preserved specimen, with its reverse, lies in such a position as to show a partly lateral and partly dorsal view; the legs are also pre-

served, so that it is one of the most perfect of the Green River Coleoptera. The small head, long and slender, straight, and drooping snout, the tapering thorax, broad and short striate elytra, thickened femora, and long and slender tibiæ leave little doubt that it should be referred to Gymnetron or to its immediate vicinity. It is very nearly as large as G. teter Schönh., with which it closely agrees in almost every part. The third tarsal joint is similarly expanded. The real length of the rostrum can not be determined from the position of the insect, but it is apparently as long as the head and thorax together, is very nearly straight, slender, scarcely enlarged, and obliquely docked at the tip; only a portion of the antennal scrobes can be seen; this is in the middle of the beak, where the groove is narrow, deep, sharply defined, and inclined slightly downward toward the base of the beak. The thorax is subrugulose, and the surface of the elytra smooth, with distinct, but not deeply impressed, very faintly punctured striæ. The whole specimen is piceous.

Length of body, 3.15^{mm}; of snout, 1^{mm} (?); of head and thorax, 0.9^{mm}; of thorax, 0.75^{mm}; of elytra, 2.25^{mm}; of hind tibiæ, 1.5^{mm}; distance apart of elytral striæ 0.1^{mm}.

Green River, Wyoming. One specimen, Nos. 4030 and 4047.

ANTHONOMUS Germar.

Anthonomus soporus.

Pl. 8, Fig. 16.

A single elytron is preserved, in excellent condition. It is, however, completely flattened, bringing the apex, which is scarcely angulate, in the middle. There are nine equidistant, rather coarse, not greatly elevated (perhaps partly flattened by pressure), coarsely beaded ridges (representing, by reversal, striæ) besides the sutural ridge, the third and fourth from the sutural being a little shorter than the others, which increase regularly in length from within outward. The smooth, flat interspaces are fully twice as broad as the striæ.

Length of elytron, 2^{mm}; breadth, 0.9^{mm}.

The elytron differs from that of A. defossus previously described from the Florissant Tertiaries in its greater size and apparently greater slender-

ness. The specimens of A. defossus examined give, however, a lateral view and render comparison somewhat difficult.

Green River, Wyoming. One specimen, No. 48 (Prof. L. A. Lee).

HYLOBIUS Germar.

Hylobius provectus.

Pl. 8, Figs. 37, 41.

Hylobius provectus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 86 (1876); IV, 767 (1878).

The single specimen first found is very poorly preserved, being not only fragmentary but faintly impressed; the rostrum is broken, so that its length can not be determined, but the general facies of the insect resembles that of H. picivorus Germ. so closely that it must be referred to the same genus. The rostrum is rather stout; the antennal scrobes are slender, and commence not far beyond the eyes; the eyes are very large, transverse obovate, with an interior clear space, as described in Epicærus saxatilis Scudd., with very small facets, scarcely 0.02^{mm} in diameter. The thorax is rather small, but apparently partially concealed by the way the specimen is crushed, not very tumid, and entirely smooth. The elytra are of much the same form as those of the species of Epicærus just mentioned, provided with slender, shallow, impressed lines, about 0.22^{mm} apart; the latter are rather delicately punctured, the punctures a little less distant from one another than are the rows; the number of rows can not be determined from this specimen.

Length, exclusive of rostrum, 5^{mm}; length of broken rostrum, 0.45^{mm}; of eyes, 0.9^{mm}; breadth of same, 0.44^{mm}; length of elytra, 4^{mm}.

Another specimen, taken by Mr. Bowditch at the same locality as the other, shows the character of the rostrum. The specimen is strangely preserved, as there appears to be a second rostrum, a perfect counterpart of the first, attached to it at the tip; perhaps this belongs to another individual, of which the rostrum only is preserved. The rostrum is about as long as the thorax, scarcely tapering as viewed laterally, gently curved, with a median, lateral, longitudinal groove, directed toward the middle of the eye, just as in H. confusus Kirb., besides the antennal scrobes, which are directed obliquely toward its base.

Green River, Wyoming. Two specimens, Nos. 4051 (F. C. Bowditch), 15215 (F. C. A. Richardson).

LISTRONOTUS Jekel.

Listronotus muratus.

Pl. 8, Fig. 23.

A small species, represented by a single specimen showing a lateral view. The beak is a little longer than the thorax, tolerably stout (not tapering, as the figure would seem to represent it), the antennal groove reaching nearly to the tip, the eye moderately large, round. The whole body is rather slender, the thorax tapering slightly forward from just beyond its base, faintly and sparsely punctulate; the fore femora increase pretty uniformly in size from the base to near the tip, where they are twice as broad as near the base. Elytra with distant thin striæ.

Length of body, not including rostrum, 4.75^{mm}; of head and rostrum combined, 1.75^{mm}; of pronotum, 1.2^{mm}; of elytra, 3.25^{mm}.

Green River, Wyoming. One specimen, No. 90 (Dr. A. S. Packard).

ENTIMUS Germar.

TIMUS PRIMORDIALIS

Pl. 5, Figs. 109, 109*a*.

Entimus primordialis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 81 (1876); in Zittel, Handb. d. Palæont., I, ii, 789, Fig. 1011 (1885).

Besides a crushed elytron there are only some indeterminate fragments of the neighboring parts of the body. The form and sculpturing of the elytron resemble those of the Brazilian diamond-beetle so closely that I place the species provisionally in the same genus, or until further remains are obtained. The insect must have been rather small for an Entimus, is of about the usual size of the species of Otiorhynchus, and it is not at all improbable that it should be referred to the latter genus, some species of which have elytra with similar sculpturing and approximately the same form. The elytron is traversed by ten similar, stout and coarse, longitudinal costæ, most of which are broken up by transverse depressions into bead-like hemispherical prominences; at the tip of the elytron, however, and on the apical half of the inner two costæ this irregularity is nearly or

quite lost sight of; the edges of the elytron for about the width of one of the costæ is also smooth and depressed; the front border is sinuous, and the sutural margin appears the same on the stone, from the compression the elytron has undergone, which was sufficient to split it down the middle through half its length.

Length of fragment, 8^{mm}; greatest breadth of unsplit portion, 4^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Family OTIORHYNCHIDÆ Shuckard.

EUDIAGOGUS Schönherr.

Eudiagogus terrosus.

Pl. 8, Fig. 29.

Eudiagogus terrosus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 766–767 (1878).

This species, which seems more properly referable to Eudiagogus than the others formerly so named by me, is represented by a single specimen and its reverse, preserved on a side view. The snout is short, as long as the eyes, scarcely so long as the head, and stout; the eyes transverse, rather large, subreniform. The thorax appears to be smooth, like the head, deep and short, its front border extending forward on the sides toward the lower part of the eye. The elytra, the lower surface of which does not appear to be in view, are broad and long, rectangular at tip, furnished with more than eight rows of frequent, rounded, moderately large and shallow punctures, and between each pair of rows a similar row with smaller punctures.

Length of body, 6^{mm}; of elytra, 4.55^{mm}; of eyes, 0.5^{mm}.

Green River, Wyoming. One specimen, Nos. 4024 and 4078.

TANYMECUS Germar.

Tanymecus seculorum.

Pl. 8, Fig. 22.

A single specimen preserved on a side view shows all the parts of the body tolerably well, but only a confused mass of appendages. Unfortunately the plate was engraved before the whole of the head, and especially the rostrum, was uncovered, and the eye-like spot there shown is wholly

accidental, no such protuberance existing. The general appearance is very similar to that of our common species of Tanymecus. The head and beak combined are a little shorter than the thorax, and the eye is circular, removed by less than half its diameter from the middle of the front border of the prothorax and but little narrower than the tip of the rostrum. The head and rostrum appear to be nearly smooth, the prothorax to be coarsely and somewhat transversely rugulose, and the striæ of the elytra to be coarse, with large and deep punctures, which grow smaller and shallower in the apical half. All this is shown only in reverse, the single specimen being a reverse.

Length, 6.5^{mm}; of head, including rostrum, 1.5^{mm}; of pronotum, 1.6^{mm}; of elytra, 4^{mm}; breadth of thorax, 2^{mm}.

Green River, Wyoming. One specimen, No. 91 (Dr. A. S. Packard).

OTIORHYNCHUS Germar.

Otiorhynchus perditus.

Pl. 8, Fig. 25.

Otiorhynchus perditus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 84 (1876); IV, 766 (1878).

A single specimen, showing a side aspect, differs from the living species of Otiorhynchus, with which I have compared it, in not having the prothorax conspicuously smaller than the body behind it. The head is withdrawn into the prothorax, almost to the hinder edge of the eyes; the snout is short, stout, slightly curved, bluntly rounded, and rather tapering than enlarged at the tip, not quite so long (measuring from the front edge of the eyes) as the length of the pronotum; the eyes are rounded, subtriangular, with a diameter equal to half the width of the snout, the central facets with a diameter of 0.027^{mm}; the antennal scrobes are twice as long as broad, commencing at the middle of the snout and extending two-thirds the distance thence to its tip. The prothorax is equal, nearly as long as high, not tumid, rugulose. The elytra, which are not elevated at base above the prothorax, are simple, not very tumid, provided with about eight longitudinal slender rows, 0.3^{mm} apart, of low, raised, rounded points, nearly as distant from one another as those of contiguous rows; midway between each of these rows is a very inconspicuous dull ridge. Fragments of the legs remain, which agree as far as they can be made out with the same parts in Otiorhynchus.

In the general sculpturing of the elytra this insect is not very unlike O. sulcatus (Fabr.).

Length, 8^{mm}; of snout beyond front of eyes, 1.23^{mm}; width of same, 0.75^{mm}; length of antennal scrobes, 0.32^{mm}; diameter of eyes, 0.46^{mm}; length of pronotum, 1.8^{mm}; height of same, 2.28^{mm}; length of elytra, 5.2^{mm}; width of same, 2.05^{mm}; length of fore femora, 1.8^{mm}.

Green River, Wyoming. Two specimens, Nos. 4021 (Scudder), 15213 (Richardson).

Otiorhynchus tumbæ.

Pl. 8, Fig. 13.

Otiorhynchus dubius Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 766 (1878).

A cast of an elytron resembles so closely the elytron of O perditus, excepting in size, that it is referred to the same genus. Only nine striæ can be counted, but all of those at the outer side may not be seen; the inner stria is very close to the margin, and indeed is lost in it both above and below, but this may be due simply to the preservation. The stone in which they are preserved is coarser than usual, coming from beds about thirty meters directly below the shales which have furnished the other insect remains, and has a greater admixture of sand; consequently the character of the surface of the elytra can not be determined, but the striæ are sharp and narrow, and filled with longitudinal punctures, which do not show in the engraving. With the exception of a couple of poor specimens of Epicærus effossus Scudd., this was the only recognizable insect found at this locality.

Length of elytron, 4^{mm}; breadth of same, 1.5^{mm}.

Dr. E. Bergroth having called my attention to the fact that there is a recent European species of Otiorhynchus bearing the specific name dubius, I have renamed the fossil as above.

Green River, Wyoming. One specimen, No. 4204.

OPHRYASTES Schönherr.

Ophryastes compactus.

Pl. 8, Fig. 39.

Ophryastes compactus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 765–766 (1878).

A single specimen, preserved so as to show a lateral view of the insect, appears to indicate an Otiorhynchid allied to Ophryastes. The form of the

elytra, indeed, does not well correspond, since, in place of their abrupt posterior descent, as seen in O. cinereus Schönh. from Mexico, with which it agrees best in general features as also in size, they slope very gradually, and appear to be tumid next the base. But the structure of the stout snout, enlarged apically, with very oblique descending antennal scrobes, the superior transverse furrow at its base giving an increased convexity to the vertex of the head, ally it closely to Ophryastes. The ovate eye is longitudinal, the front border of the pronotum nearly straight, with no advance of the sides, the prothorax itself faintly rugulose, the elytra coarsely striate, the striæ with feeble, rather distant punctures (the reverse is shown on the stone); the tips of the elytra are right-angled or slightly produced at the extremity, as in recent species.

Length of body, measured from base of rostrum, 7.5^{mm}; height of same, 3.5^{mm}; length of elytra, 5.5^{mm}; of rostrum beyond front of eyes, 1.2^{mm}; breadth of rostrum at base, 0.9^{mm}; where largest, 1.05^{mm}; length of eye, 0.5^{mm}; breadth of same, 0.3^{mm}; distance apart of the elytral striæ, 0.35^{mm}.

Green River, Wyoming. One specimen, No. 4210.

EPICÆRUS Schönherr.

Epicærus saxatilis.

Pl. 8, Figs. 33, 34, 36.

Eudiagogus saxatilis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 84–85 (1876).
Epicærus saxatilis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 765 (1878).

Twenty-seven specimens of this species have been found by Mr. Richardson, Mr. Bowditch, and myself. This and the two following species can not, as at first supposed, be referred to Eudiagogus on account of the length of the snout. Although very small for Epicæri (especially the present species), they agree so well with Epicærus griseus Schönh. from Mexico—one of the smallest of the group—that they would best be referred here, although they differ from this genus in the brevity and stoutness of the femora, all of which are swollen apically. It is possible that all three of the forms mentioned here should be referred to a single species, as there is certainly very little difference between them excepting in size; this is particularly the case with this and the next species. Together over one hundred

specimens of these species have been examined by me; they are therefore the most abundant fossils of the insect beds of the Green River shales.

In the present species the snout is shaped much as in Otiorhynchus perditus Scudd., being short, stout, and, especially anteriorly, arched, the front border being faintly angulate about the middle; the antennal scrobes can not be certainly defined; the eyes are pretty large, transversely ovate, and in most of the specimens are indicated on the stone by an annulus of dark color, containing an interior narrow ovate pale spot 0.22^{mm} long by 0.12^{mm} wide, while the eye itself is 0.4^{mm} in its longer, and 0.3^{mm} in its shorter, diameter; the facets of the interior portion are very minute, being scarcely .01^{mm} in diameter. The prothorax is somewhat tumid, rather higher than long, very profusely and delicately punctulate, the anterior and posterior walls between the pittings often less elevated than the lateral walls, so that the punctures often form broken longitudinal furrows; the punctures are nearly uniform in size over the whole prothorax and average about 0.04^{mm} in diameter. The elytra are simple, not tumid, sloping off gradually toward the tip, not elevated at base above the thorax, and provided with six equidistant, very slender and slight, raised ridges, faintly broken into dashes by a series of minute, moderately distant punctures along the inner border of each; these punctures are of the same size as those on the prothorax; the ridges are about 0.16^{mm} apart. The posterior coxæ have an inerassate posterior margin.

Length of body, 4^{mm}; of rostrum beyond the eye, 0.68^{mm}; width of same, 0.46^{mm}; length of prothorax, 1.2^{mm}; height of same, 1.3^{mm}; length of tegmina, 2.8^{mm}; width of same, 0.9^{mm}.

Green River, Wyoming. Numerous specimens.

Epicærus exanimis.

Pl. 7, Fig. 31; Pl. 8, Figs. 30, 31, 38, 42.

Eudiagogus exanimis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 58 (1876).
Epicærus exanimis Scudd., Bull. U. S. Geol. Geogr. Surv., Terr. IV, 765 (1878).

Thirty-one specimens of this species have been examined since the first. All those first obtained (by Mr. Richardson) were fragmentary, and most of them rather obscure; they consist mostly of side aspects of the creature, but several are single elytra. Still the characters drawn from them appear to be all that can be found in the more perfect examples since found. The

head is rather large at base, tapering with a short, broad snout, not so deep as broad, equal and at the tip broadly rounded, directed downward and forward, slightly bent along the front margin; the antennal scrobes extend from the front edge of the eye nearly to the end of the rostrum, and are broadest next the eye, where they are half as broad as the eye itself, tapering regularly throughout and shallow; the eyes are moderately large, broadly oval, transverse or a little oblique, the upper extremity thrown backward and the lower forward. The prothorax is short, only about half as long as deep, not tumid, rather cylindrical, its surface smooth. The elytra are not broader nor higher at their base than the surface of the pronotum, and they are simple and furnished with seven equidistant, equally and not deeply impressed, longitudinal striæ, 0.16^{mm} apart from one another, and the outer ones an equal distance from the adjacent border; these striæ are provided with slightly longitudinal punctures at regular intervals of about 0.1^{mm}, by which the striæ are carried to about double their usual depth Some of the specimens have lost the elytra, and on these the posterior edge of the hind coxæ have been impressed through the abdomen, giving the insects the appearance of being furnished with elytra which cover but half of the abdomen. The same thing may be noticed in other species.

Length of body exclusive of rostrum, 5.75^{mm}; of rostrum beyond the eye, 0.62^{mm}; breadth of same, 0.5^{mm}; depth of same, 0.44^{mm}; length of eye, 0.36^{mm}; width of same, 0.24^{mm}; length of prothorax, 0.72^{mm}; height of same, 1.3^{mm}; length of elytra, 3.05^{mm}; width of same, 1.2^{mm}; length of fore femora, 0.72^{mm}; width of same, 0.32^{mm}; length of middle femora, 0.8^{mm}; width of same, 0.32^{mm}; length of hind femora, 1.1^{mm}; width of same, 0.34^{mm}.

Green River, Wyoming. Numerous specimens.

Epicærus effossus.

Pl. 8, Figs. 7, 35.

Eudiagogus effossus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 85–86 (1876).
Epicærus effossus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 765 (1878).

Nearly fifty specimens of this species are at hand, all found in Richardson's shales by Mr. Richardson, Mr. Bowditch, and myself, besides two I found in beds at the same spot, but about thirty meters lower; these were the only Coleoptera found at the latter spot, excepting a single specimen of Otiorhynchus tumbæ Scudd., belonging to the same family. Most of the

specimens are composed of fragments of elytra, and the only specimens which are preserved entire are such as give a dorsal or ventral aspect. These, however, are enough to show that they belong to a species closely allied to but distinct from the preceding, differing principally in its smaller size, its slender and more tapering rostrum, the smaller circular eyes, and in the slightly more distant and rather more deeply impressed striæ of the elytra. The following measurements will give a better understanding of the degree of difference between them in certain points:

Length of body exclusive of rostrum, 5^{mm}; breadth of same, 2.1^{mm}; width of rostrum at base, 0.48^{mm}; diameter of eyes, 0.28^{mm}; distance apart of the elytral striæ, 0.18–0.20^{mm}; distance apart of punctures in the striæ. 0.11^{mm}.

Green River, Wyoming. Numerous specimens.

Family RHYNCHITIDÆ LeConte.

EUGNAMPTUS Schönherr.

EUGNAMPTUS GRANDÆVUS.

Pl. 8, Fig. 20.

Sitones grandævus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 83–84 (1876).

A single specimen, very poorly preserved, was found by Mr. Richardson on Green River, at the crossing of the Union Pacific Railroad, and at the first description of the species this was all that was at hand. Little could be seen in it except a vague outline of the form of the body, with a broken rostrum; the eye was large, obovate, longitudinally disposed, 0.42^{mm} long and 0.25^{mm} broad; the elytra were furnished with a number of slight, slender, raised ridges, 0.34^{mm} apart, probably the reverses of striæ.

Two more specimens obtained at the same spot by Profs. Packard and Lee, and in better condition, show that it probably belongs to Eugnamptus, though it differs from that genus in the extreme feebleness of the elytral striation which is barely perceptible; no punctures are discernible, but instead the elytra are sparsely clothed with exceedingly delicate short hairs. The beak is slender and from in front of the eye about as long as the thorax; it, as well as the rest of the head, faintly subscabrous, while the thorax is very delicately and shallowly punctulate, so as to appear almost smooth, with a short delicate hair from each depression.

The measurements of the best specimen are: Length of head and rostrum, 1.35^{mm}; of thorax, 0.9^{mm}; of elytra, 2.6^{mm}; breadth of thorax, 1^{mm}.

Green River, Wyoming. Three specimens, Nos. 15234 (F. C. A. Richardson), 101 (Prof. L. A. Lee), 76 (Dr. A. S. Packard).

Eugnamptus decemsatus.

Pl. 8, Fig. 12.

Eugnamptus decemsatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 764–765 (1878).

A single elytron with a broken base is all that remains of this species. But this is peculiar on account of the supplementary humeral stria, which seems to be common in the Rhynchitidæ, and at least very rare in the allogastral Rhyncophora, to which one would at first glance refer this fragment. So far as the material at hand permits determination it appears to agree best with the genus to which it is referred, on account of the disposition of the punctuation and the form of the tip of the elytron. It represents, however, a very large species, and one whose punctuation is very delicate. The elytron is long and rather narrow, indicating an elongated form for the body, as in this genus, with parallel sides and a bluntly rounded tip. There are ten complete equidistant rows of delicate, lightly impressed punctures, those of the same row less distant than the width of the interspaces; the outer row lies close to the outer border and is seated in an impressed stria, as also is the apical half of the inner row; but the other rows show no such connections between the punctures which compose them: at the base the rows curve very slightly outward to make place for a very short humeral row of punctures, parallel to the inner complete row, and composed of only three or four punctures on the part preserved; the interspaces are smooth.

Length of fragment, 4.5^{mm}; width of elytron, 1.5^{mm}.

Green River, Wyoming. One specimen, No. 4046.

Family RHIPIPHORIDÆ Gerstæcker.

RHIPIPHORUS Fabricius.

Rhipiphorus geikiei.

Pl. 27, Fig. 1.

A single specimen preserved upon a side view seems clearly referable to Rhipiphorus except for the well rounded tip of the elytra. The three lines

radiating from the head in the plate do not belong to the specimen but lie at a slightly higher level, except the proximal half of the one lying next the body, which is the basal joint of the antennæ, and which before careful study was taken for a beak, and the insect therefore placed among the Hemiptera. The head and thorax have the form and attitude of the Rhipiphoridæ; the eye is oval, twice as long as broad; the basal joint of the antennæ enlarges slightly from base to apex and is nearly as long as the head; an ineffectual attempt was made to uncover the parts beyond and reveal the structure of the remaining joints. The head and thorax are delicately scabrous rather than punctate, or punctate with the punctures run together transversely in an irregular manner. The elytra are almost as long as the body, three and a half times as long as their basal breadth, the sutural margin perfectly straight until the rounding of the extreme apex begins, the outer margin broadly sinuous, the elytra shortly beyond the base diminishing rather rapidly in width as far as the middle, then subequal to just before the tip, which is half as broad as the base, strongly rounded, almost equally on each side; the tip has been uncovered since the plate was made, and is in no sense pointed, but the inner side is subrectangular though rounded; the surface is punctured, not deeply, the punctures separated by considerably more than their own diameter; the outer border is finely marginate, at least in the basal half. The wings are ample, exceeding when closed the length of the abdomen, and when expanded surpassing by one-fifth the elytra; they show at least four principal veins radiating from the base, some of them distinctly forked, and none showing marks of a transverse fold.

Length of body, 9.75^{mm}; elytra, 6^{mm}.

Named for Dr. Archibald Geikie, Director of the Geological Survey of Great Britain.

Florissant. One specimen, No. 367.

Family TENEBRIONIDÆ Leach.

TENEBRIO Linné.

TENEBRIO PRIMIGENIUS.

Pl. 2, Fig. 32.

Tenebrio primigenius Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 183B, (1879).

A single, complete, and well-preserved elytron represents a species of Tenebrionidæ, a little larger than, and somewhat resembling, Tenebrio

molitor (Linn.), the beetle of the common meal-worm. It has been flattened by pressure, so as to show but little sign of having been arched, while at the same time the shape is fairly preserved. Wherever it differs in color from the stone it is piceous. The margins are very nearly parallel, approaching each other rather gradually and very regularly toward the tip; there are eight equidistant, pretty strongly impressed, rather coarse, longitudinal striæ, besides others next the outer margin, whose number can not be determined, and a short scutellar stria, about as long as in T. molitor, but quite as distinct as the others; the surface between the striæ appears to be very minutely subrugulose, and shows in favorable light a faint transverse corrugation.

Length of elytron, 11^{mm}; breadth, 4.4^{mm}.

Nine-mile Creek, British Columbia. One specimen, No. 63 (Dr. G. M. Dawson).

Family BRUCHIDÆ Leach.

BRUCHUS Geoffroy.

Bruchus anilis.

Pl. 5, Fig. 125.

Bruchus anilis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 82 (1876).

The single specimen consists of two elytra, in natural juxtaposition seen from above. They have a brown color, which is wanting in certain places, but in so irregular a manner that it is doubtless fortuitous; they are furnished with striæ, but these, as well as all color, are entirely obliterated in the middle of the wing; this again is doubtless a defect of preservation, since the sutural edges of the elytra are similarly affected; the striæ are deep, sharply cut, straight, subequidistant, eight in number, fading out at the apex of the elytra, the space between them smooth and arched.

Length of one elytron, 5^{mm}; breadth of same, 1.9^{mm}; distance of striæ apart, 0.45^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Family CHRYSOMELIDÆ Leach.

GALERUCELLA Crotch.

GALERUCELLA PICEA.

Pl. 2, Fig. 31.

Gallerucella picea Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 182–183B (1879).

A pair of rather poorly preserved elytra, parted at the tip, and showing between and through them the outlines of the abdominal segments represents a species of Chrysomelidæ, which appears to be most nearly allied to the genus in which I have placed it and to be about the form of, and a little smaller than, G. maritima LeC. The elytra are uniformly piceous throughout, showing no marks of lighter-colored borders; there are faint indications of one or two marginal impressed lines in their outer half, and the whole surface seems to have been very minutely punctate, more faintly and finely than in the existing species mentioned. The abdomen is very broadly and very regularly rounded, subovate, and at least five segments of similar length can be determined.

Breadth of the pair of elytra at base, 3.75^{mm}; length of elytra, 5.5^{mm}; breadth of abdomen, 3.25^{mm}; length of penultimate segment, 0.4^{mm}.

Nine-mile Creek, British Columbia. One specimen, No. 62 (Dr. G. M. Dawson).

CRYPTOCEPHALUS Geoffroy.

CRYPTOCEPHALUS VETUSTUS.

Pl. 7, Figs. 29, 37.

Cryptocephalus vetustus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 764 (1878).

This species is fairly represented by a pair of specimens with their reverses. One pair exhibits the front, and by the drooping of the abdomen the under surface of the insect with expanded elytra (one of them curiously foreshortened), the other the under surface only. The insect is broadly oval, and, except in being much stouter, closely resembles C. venustus Fabr., with which it agrees in size. The thorax, as seen on a front view, is arched, and the proportion of the head to the thorax is as in the recent species mentioned. The elytra, which are the parts best preserved,

are rounded at the extremity, and are furnished with ten slightly arcuate rows of gentle punctures, arranged inconspicuously in pairs, besides a sutural, slightly oblique row on the basal third of the elytra, terminating in the margin. This disposition of the punctures and the character of the head, sunken, as it were, into the thoracic mass, leave little doubt that the insect should be referred to Cryptocephalus. The elytra are of a uniform light horn color, but the body is darker. The body is more oval than in the parallel-sided C. venustus.

Length of body, 4–4.5^{mm}; breadth of same, 2.6–3.2^{mm}; length of elytra, 4^{mm}; breadth of one of them, 1.8^{mm}.

Green River, Wyoming. Two specimens, Nos. 4003 and 4004, 4039. and 4044.

DONACIA Fabricius.

Donacia stiria.

Pl. 1, Fig. 28.

This is represented by the mere fragment of an elytron, but with a distinct kind of sculpturing. It seems to come as near D. porosicollis Lac as any of our modern species I have seen. The tip is the part preserved; it is of a deep blue-black color, with an excessively fine, microscopic, transverse rugulation, delicately impressed narrow striæ, the striæ minutely punctulate, the first and last striæ moderately distant from the margins, deeply impressed, and less distinctly punctate. It is apparently a rather small species.

Length of fragment, 3 2^{mm}; breadth of same, 1.4^{mm}.

Interglacial clays of the neighborhood of Scarboro, Ontario. One specimen, No. 14558 (G. J. Hinde).

Donacia pompatica.

Pl. 1, Figs. 33, 34.

This species, of which there are several examples at hand, is most nearly allied to our living D. pubicollis Suffr., but is much smaller or about the size of D. emarginata Kirb. As to the sculpture of the surface of the elytra (the only part preserved in any specimen), it would be difficult to say in what respect it differed from the former species except in the obliteration of the

markings at the tip of the elytra, which seems to be characteristic of the fossil. In color it varies extremely; in one (No. 14582) it is bluish purple: in another (No. 14566) it is deep brilliant violet; still another (No. 14577) has it dark metallic green. In all, the colors are as fresh as if living. The punctured striæ are rather deep and the whole surface of the elytra transversely wrinkled at the punctures.

Length of elytron, 5^{mm}; breadth, 1.45^{mm}.

Interglacial clays of Scarboro, Ontario. Five specimens, Nos. 14566, 14573, 14577, 14581, 14582 (G. J. Hinde).

Family SCARABÆDIÆ Leach.

TROX Fabricius.

Trox oustaleti.

Pl. 2, Fig. 22.

Trox oustaleti Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 179–180B (1879).

A single elytron, well preserved, appears to represent a species of Trox of about the size of T. terrestris Say, but with rather slender elytra. The elytron is subequal, narrowing rapidly and regularly at the tip, well arched, and was apparently still more arched originally, the middle portion having a flattened appearance, as if from pressure, with a narrow flattened outer margin; the surface is completely and uniformly covered with thirteen or fourteen equal equidistant rows of frequent dull tubercles, as distant from one another in the rows as each row from its neighbor, and obsolescent toward the apex and the base, especially towards the former. In certain places there is a very slight appearance of greater prominence to every fourth row, which would hardly be noticed if its resemblance to modern species of Trox did not lead one to look for it; the extreme tip is broken. The color is dark-brown, approaching black, but the whole central portion of a faded brown, nearly resembling the natural color of the stone in which it is preserved.

Length of elytron, 4.25^{mm}; breadth, 1.85^{mm}.

Named after M. Emile Oustalet, of the Jardin des Plantes, whose researches on the Tertiary insects of Auvergne and Aix are well known.

Nine-Mile Creek, British Columbia. One specimen, No. 61 (Dr. G. M Dawson).

APHODIUS Illiger.

APHODIUS PRECURSOR.

Pl. 1, Fig. 11.

Aphodius precursor Horn, Trans. Amer. Ent. Soc., V, 245 (1876).

"Elytra smooth, shining, feebly striate, striæ shallow but rather wide; punctures distant, round near the apex, becoming transverse near the base, intervals flat, smooth.

"A species is indicated of the size and nearly of the sculpture of ruricola. The scutellum is short. Length of elytra, .10 inch.; 2.5mm." Horn, loc. cit.

Of this species three elytra lie side by side in the same mass; the middle one shows only the impression of the striæ, being the reverse of the left elytron, which has been removed from its original position; this and the right elytron are black, the striæ distinct and moderately deep, with punctures as described by Dr. Horn. The striæ are ten in number, and in the middle of the elytra are 0 17mm apart. The left elytron shows the upper, the others the under, surface. There must be some mistake in Dr. Horn's measurements; the best preserved elytron, the contours of which are perfectly preserved, is 3.5mm long and 1.65mm broad and the others agree perfectly with it in size.

Upon the same stone occur the remains of a pair of elytra (Pl. 1, Figs. 16, 17) not noticed by Dr. Horn in his paper, but considered by him as belonging to the same species. This view is tenable only on the supposition that the right elytron (in which the chitine is preserved and which shows the upper surface) is imperfect, for there are but eight striæ. When first examined by me both margins appeared perfect; but as they have since been damaged I refrain from further remark beyond the description of the fragments and the expression of my belief that they can not be referred to Aphodius. The elytra, which are shining black, appear to be considerably flattened, are consequently nearly as broad at base as in the middle, and have the apical half rounded rather rapidly and the apex nearly square; they possess eight distinct striæ, made more conspicuous by bearing frequent, moderately distinct, small, round, occasionally elongate punctures; the interspaces between the striæ are 0.15mm wide, flat and smooth; the eighth stria is confluent anteriorly, and perhaps posteriorly, with the margin; and the margin itself is not only slightly reflexed but forms by the reflection

a groove very similar to the striæ and bearing similar punctures; there is also a short and exceedingly slight and faint scutellar stria crowded against the scutellum.

Length of elytron, 3^{mm}; breadth, 1.3^{mm}.

Not improbably these should be looked upon as belonging to Carabidæ

Bone caves of Port Kennedy, Pennsylvania.

ÆGIALIA Latreille.

ÆGIALIA RUPTA.

Pl. 8, Fig. 19.

A single specimen and its reverse are preserved with partially expanded strongly arched elytra. Body elongated obovate, two and a half times longer than broad. Head small, broadly rounded in front, the eyes (not shown in the plate) moderately large, oval, less than half as large as one of the pair of oval distinct marks in the middle of the head posteriorly, which are either some parts beneath showing through, or ridges or the bases of horns on the upper surface. Prothorax about twice as broad as long, tapering anteriorly from the posterior edge and with rounded sides, the whole front border broadly emarginate, the hind margin scarcely convex, the surface indistinctly granulate. Elytra rather heavily striate, the striæ rather distantly punctate.

Length of body, 3.4^{mm}; of middle of prothorax, 0.5^{mm}; of elytra, 2^{mm}; breadth of prothorax in front, 0.7^{mm}; the same behind, 1.1^{mm}; of middle of body, 1.35^{mm}.

Green River, Wyoming. One specimen, Nos. 80 and 81 (Dr. A. S. Packard).

PHANÆUS MacLeay.

PHANÆUS ANTIQUUS.

Pl. 1, Figs. 12–14.

Phanæus antiquus Horn, Trans. Amer. Ent. Soc., V, 245 (1876).

"Elytra with feeble striæ, intervals moderately convex, surface slightly rugulose. Abdomen smooth. Length, .40 inch; 10^{mm}.

"A species is indicated somewhat larger than carnifex; the elytral sculpture is, however, more nearly that of pluto, inasmuch as the intervals

are regularly convex, and the striæ not suddenly impressed at base. The remains consist of an impression with a small portion of the substance of both elytra in position, slightly separated at base by pressure so that a deceptive appearance of an elongate scutellum is presented; also the impression of the abdominal segments with a small portion of chitinous substance.

"There is also the substance remaining of the greater portion of an elytron which probably belongs to the same species, in which the intervals are moderately convex and with traces of a few punctures, the striæ being moderately impressed and not punctured." Horn, loc. cit.

The elytra have seven feeble and dull striæ; the surface of the single elytron, which agrees altogether in size with the pair, is black and smooth, but faintly wrinkled transversely. Four segments of the abdomen are shown

Length of one of the pair of elytra, 11^{mm}; breadth of same, 5^{mm}.

Bone caves of Port Kennedy, Pennsylvania.

CHŒRIDIUM Lepelletier-Serville.

Chœridium? ebeninum.

Pl. 1, Figs. 18–22.

Chœridium? ebeninum Horn, Trans. Amer. Ent. Soc., V, 244–245 (1876).

"The remains for which the above name is suggested, consist of the greater portion of the thorax, the two elytra in a fair state of preservation and a portion of the abdominal segments. These may be described as follows:

"Thorax nearly twice as wide as long, sides feebly arcuate, gradually converging anteriorly, surface sparsely and finely punctate, pleuræ longitudinally finely strigose. Elytra rather wider, conjointly, than long, sides moderately arcuate and gradually narrowed to apex, disk with seven moderately impressed striæ, the outer rather distant from the margin; striæ entire and nearly parallel and equidistant. Intervals coarsely but sparsely punctured. Epipleuræ sparsely punctate. Abdomen with coarse punctures at the sides, smoother at middle.

"Length of thorax, .07 inch; 1.75^{mm}.

"Length of elytra, .14 inch; 3.5^{mm}.

"I have been really at a loss to know to what genus to refer these remains. They were at one time considered to be Saprinus, but the number of the striæ and their character forbid such a reference. The species seems to have been rather smaller than our Cheridium histeroides, but undoubtedly resembled it in form. I would have referred the remains to Canthon near perplexus, but the thorax is by no means that of the genus." Horn, loc cit.

The thorax of the specimen appears to have been broken off before reaching me, as the description given by Dr. Horn is inapplicable to any of the fragments before me.

The pleuræ are not only "longitudinally finely strigose," but also delicately striate in the same direction. Aside from the punctuation the upper surface of the thorax is smooth.

The outer discal stria of the elytra is very widely separated at base from the submarginal stria which runs closely parallel to the outer border.

Length of elytron, 3.6^{mm}; breadth of same, 2^{mm}.

Bone caves of Port Kennedy, Pennsylvania.

Family PTINIDÆ Leach.

ANOBIUM Fabricius.

ANOBIUM? OVALE.

Pl. 8, Fig. 1.

Anobium? ovale Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 762–763 (1878).

The insect evidently appertains to a distinct genus of Ptinidæ, in which the sides of the body are not parallel, but the body tapers posteriorly much, though not to the same extent, as anteriorly. It is, however, most nearly allied to Anobium, in which it is provisionally placed. It is about as large as Endecatomus rugosus LeC. The prothorax, viewed from above, is bluntly conical, tapering rapidly. The body is broadest just behind the base of the elytra, and tapers slightly at first, more rapidly afterward, and is rounded posteriorly; thus the whole body has an ovate outline. The pronotum is minutely and very profusely punctulate in black, the punctures being slightly elongated longitudinally, and appears to have been covered profusely with slight asperities or a coarse pile (much perhaps as in Endecatomus rugosus). The elytra, which are nearly three times as long as

broad and taper regularly from near the base to near the tip, show no mark of such asperities, but are profusely punctate in black, made up of scattered punctæ, about 0.03^{mm} in diameter, not altogether irregularly disposed, although at first sight having that appearance, but showing in many places, not uniformly, signs of a longitudinal distribution into from fourteen to sixteen rows. The elytra, indeed, resemble those of Bostrychus capucinus (Linn.), but I am not aware that similar markings occur on smaller Ptinidæ.

Length of body, 4.3^{mm}; breadth of same, 2^{mm}; length of elytra, 3.15^{mm}.

Green River, Wyoming. Two specimens, Nos. 97 (Dr. A. S. Packard) and 4038 (S. H. Scudder).

Anobium ? deceptum.

Pl. 8, Fig. 18.

Anobium deceptum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 763 (1878).

Another specimen, representing an elytron only, evidently belongs to the same genus as the last, and at first sight appeared to be of the same species, as it belongs to an insect of the same size, and the punctures on the elytra are similarly disposed; they are, however, if anything, more thickly crowded, so as to form about eighteen rows in the rather broader elytron; and not only is the elytron broader and shorter than in the preceding species, being less than two and a half times longer than broad, but it scarcely tapers at all in the basal three-fifths, and beyond that more rapidly than in the species last described.

Length of elytron, 3^{mm}; breadth of same, 1.25^{mm}.

Green River, Wyoming. One specimen, No. 4086.

Anobium lignitum.

Pl. 8, Fig. 24.

Anobium lignitum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 763 (1878).

A third species of this family, with irregularly punctate elytra, is represented by a single specimen, giving a dorsal view of pronotum and elytra. It differs generically from the two preceding species, and agrees better with Anobium proper in having a more gibbous and less conical prothorax, and in having the sides of the elytra parallel through most of their extent. It is considerably smaller than either of the preceding species. The prothorax

is one-third the length of the body, minutely punctate and scabrous, tapering only a little in its basal and considerably in its anterior half, the front well rounded. The elytra are about two and a half times longer than broad, equal on the basal two-thirds, and then rounding rapidly inward, so that the posterior outline of the body is more broadly rounded than the anterior outline; the elytra are profusely punctate with little pits, averaging scarcely more than 0.02^{mm} in diameter, distributed at pretty regular intervals, but not forming anything like longitudinal series, and so near together as to be equivalent to about fourteen rows. The whole body is uniformly black.

Length of body, 3.75^{mm}; of elytra, 2.5^{mm}; width of body, 1.9^{mm}.

Green River, Wyoming. One specimen, No. 4082.

SITODREPA Thomson.

Sitodrepa defuncta.

Sitodrepa defuncta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 82 (1876).

A single elytron, with its reverse, is very poorly preserved, more than twice and a half as long as broad, equal until near the tip, which is rounded off; it is traversed by eight or nine very slightly impressed and delicate punctate striæ 0.1^{mm} apart.

Length, 2.75^{mm}; breadth, 1.06^{mm}.

Green River, Wyoming. One specimen, Nos. 191 and 15206 (F. C. A. Richardson).

Family BUPRESTIDÆ Stephens.

BUPRESTIS Linné.

Buprestis tertiaria.

Pl. 2, Fig. 23.

Buprestis tertiaria Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 180–181B (1879).

Three specimens were obtained of this species, all of them elytra. One shows the two elytra crossed at the base, and a reverse of this shows the cast of the upper surface; the other two are single and perfect elytra, both exhibiting the upper surface, one in relief, the other as a cast, but they are not reverses. This and the two following species classed under

Buprestis agree closely together, but do not seem to be plainly referable to any recent American genus, although approaching nearest Buprestis or Ancylocheira. They seem to be nearly related also to the Tertiary species from Sieblos, described by Heyden under the name of B. senecta. For the present I place them in Buprestis.

The elytra are very long and slender, nearly four times as long as broad, equal throughout the basal two-thirds, then gradually and very regularly tapering by the sloping of the outer edge, the tip a little produced and rounded, and about one-fourth as broad as the middle of the elytron. The surface is ornamented by ten rows of very distinct striæ with rather deeply impressed punctæ; these striæ are a little sinuous near the base, and there is also a scutellar stria extending down nearly one-third of the elytron; the outer stria unites with the margin in the middle of the outer half of the elytron; the three inner and two other outer striæ extend to the apex, while the four interior striæ terminate: the inner pair a little beyond the termination of the outer stria, the outer pair still a little farther toward the apex, thus allowing for the narrowing of the elytra; the surface between the striæ is much broken by slight transverse corrugations, giving, with the punctate striæ, a rough appearance to the elytra. This species differs from the two following by the great slenderness of the elytra and the more delicate tapering of its tip.

Length of elytron, 6.5^{mm}; breadth, 1.7^{mm}.

Nicola River, below main coal seam, British Columbia. Three specimens, Nos. 48, 51 and 52, 54 (Dr. G. M. Dawson).

Buprestis saxigena.

Pl. 2, Figs. 24, 25.

Buprestis saxigena Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 181B (1879).

This species is represented by several elytra or fragments of elytra, sometimes preserved by pairs in natural connection. It is very closely allied to the last, but differs from it in having the elytra less slender, the breadth being contained about three and a half times in the length, and in the rather greater coarseness of the punctuation and transverse corrugation. The striæ are the same in number, but are, perhaps, a little more sinuous, and the scutellar stria is shorter, hardly extending so much as a quarter-way down the inner margin; the other striæ terminate in much the same way as

in B. tertiaria, but the seventh stria (from the suture) frequently runs to, or very nearly to, the tip; the extreme tip is formed precisely as in B. tertiaria, but the sides of the elytra, running parallel throughout three-quarters of their length, taper toward the apex more abruptly than in the preceding species, though with the same regularity. This species stands midway between the other two here described in the form of the apical third of the elytra.

Length, 6.2^{mm}; breadth, 1.7^{mm}.

Nicola River, below main coal seam, British Columbia. Five specimens, Nos. 47 and 54, 49, 50, 55, 56 (Dr. G. M. Dawson).

Buprestis sepulta.

Pl. 2, Fig. 26.

Buprestis sepulta Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 181B (1879).

A single specimen, showing the greater part of both elytra in natural conjunction, must be separated from the two preceding by its still broader elytra with more rapidly tapering apex. The elytra are slightly less than three and a half times longer than broad, with sides parallel throughout three-quarters of their length, then suddenly tapering, the extreme tip shaped as in the other species, only more produced, so as to form more distinctly a kind of lobe, the outer margin being very slightly and roundly excised just before the produced tip. The surface is perhaps even rougher than in the other species, but the striæ appear to be less sinuous; the scutellar stria is destroyed in both elytra of the single specimen before me; the outer stria terminates as in B. tertiaria, but the inner pair of the middle series of striæ is here the longer, extending barely to the tip of the outer stria, while the outer pair is a little shorter; the produced tip of the elytra is a little shorter than in the preceding species, but similarly rounded apically.

Length of elytron, 6.7^{mm}; breadth, 2^{mm}.

Nicola River, below main coal seam, British Columbia. One specimen, No. 53 (Dr. G. M. Dawson).

Family ELATERIDÆ Leach.

OXYGONUS LeConte.

OXYGONUS MORTUUS.

Pl. 5, Figs. 110, 111.

Oxygonus mortuus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 81 (1876).

The single elytron and its reverse obtained is slender, the humeral angle well rounded, the outer edge apparently a little marginate; it is almost equal until near the tip, when it tapers to a point. This peculiarity leads me to refer it to Oxygonus, although the apex is not produced so much as in recent species of that group. It is furnished with eight equidistant, rather strongly impressed, but delicate striæ, that nearest the suture almost incroaching upon the margin; these striæ are equidistant anteriorly and in the middle, but posteriorly they converge toward each other.

Length of elytron, 4.55^{mm}; breadth, 1.72^{mm}; distance of striæ apart, 0.2^{mm}.

Fossil Cañon, White River, Utah. One specimen (W. Denton).

CORYMBITES Latreille.

CORYMBITES VELATUS.

Corymbites velatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 81 (1876).

A single specimen, with its reverse, found. The head and prothorax are gone, but both upper and under surface of the rest of the body, including the elytra, may be seen in each impression with nearly equal distinctness. The insect appears to have been about the size of C. medianus (Germ.), but more closely allied in form to C. splendens (Ziegl.). The legs have been destroyed, but the middle and hind coxal cavities may be seen. The elytra are of the length of the abdomen, acutely angled, almost pointed at the tip, and furnished near the outer edge with a broad and shallow furrow, whose outer limit is abrupt and thus well marked. Besides this the elytra are faintly and distantly striate, with five or six rows of striæ, and the mesosternum and metasternum are very delicately granulate.

Length of fragment, 6^{mm}; breadth, 3^{mm}; distance between anterior edges of middle and hind coxæ, 1.75^{mm}.

Green River, Wyoming. One specimen, Nos. 137 and 15249 (F. C. A. Richardson).

CRYPTOHYPNUS Eschscholtz.

CRYPTOHYPNUS ? TERRESTRIS.

Pl. 2, Fig. 30.

Cryptohypnus? terrestris Scudd., Rep. Progr. Geol. Surv. Can., 1877-1878, 181-182B (1879).

A single, very nearly perfect, elytron, broken slightly at the base, which belongs, with little doubt, to the Elateridæ, is provisionally referred to this genus. The form of the elytron is as in C. planatus LeC., which is slightly larger than the fossil species. The surface is very minutely punctato-rugose, and the striæ are sharp and clearly defined. In nearly all Elateridæ the fourth stria from the suture unites with the third rather than with the fifth, although it often runs independently to the tip. In Cryptohypnus there appears to be more latitude, nearly any of the striæ uniting with either of their neighbors; and in this species the fourth unites with the fifth some distance before the tip, while the first three run to the extremity of the elytron, and the sixth, seventh, and eighth, following the curve of the outer margin, terminate near the tip of the third stria.

Length of elytron, 5.5^{mm}; breadth, 1.75^{mm}.

Nicola River, below main coal seam, British Columbia. One specimen, No. 59 (Dr. G. M. Dawson).

From the same locality were brought the remains of another insect, consisting of the metasternal plates, one side complete, the other broken, and plainly belonging to the Elateridæ. The perfect side agrees so well with the same part in Cryptohypnus planatus LeC. that I refer it to the fossil species above described, which its size renders entirely admissible. It is, however, relatively longer than in C. planatus, the perfect half being about a third longer than broad, not including, of course, the side pieces, which are not preserved. The surface is densely and rather heavily punctate, more densely and perhaps less deeply next the coxal cavities; the median line (separating the two lateral halves of the whole metasternum) is very deeply impressed, but the furrow dies out anteriorly in the projection between the coxæ.

Length of metasternum, 2.1^{mm}.

EPIPHANIS Eschscholtz.

Epiphanis deletus.

Pl. 5, Figs. 113, 114.

Epiphanis deletus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 80–81 (1876).

On account of the structure of the antennæ and general resemblance of this insect to Epiphanis cornutus Eschsch, I have placed it in the same genus; but the form of the prothorax differs somewhat in the two species. The head is moderately large, subquadrate, the antennæ moniliform, composed of twelve (preserved) equal joints. The thorax is nearly quadrate with straight sides, the front lateral angles rectangular, the front border straight or scarcely concave, the hind border slightly angulate; the elytra are slender and taper from the middle backward; they are too poorly preserved to show the markings.

Length, 5^{mm}; breadth, 1.52^{mm}; length of head, 0.94^{mm}; breadth of same, 0.96^{mm}; length of prothorax, 1.12^{mm}; breadth of same, 1.24^{mm}; length of elytra, 2.85^{mm}; breadth of same, 0.76^{mm}; length of antennæ, 1.6^{mm}; of sixth joint of same, 0.13^{mm}.

Fossil Cañon, White River, Utah. One specimen (W. Denton).

Elateridæ ? sp.

Pl. 2, Fig. 28.

Elateridæ? sp. Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 182B (1879).

In the Collection of the Geological Survey of Canada there is an elytron with the base nearly destroyed which resembles in striation the Hydrophilidæ, but is far too elongated to belong to that family, resembling rather the Elateridæ. It is so imperfectly preserved that, perhaps, a nearer determination is impossible at present. There are eight rather faintly impressed but distinct striæ, the outermost a little more distinct, especially toward the tip.

Width of elytron, 1.25^{mm}; its apparent length, 4.5^{mm}.

Nicola River, below main coal seam, British Columbia. One specimen, No. 60 (Dr. G. M. Dawson).

Family BYRRHIDÆ Leach.

NOSODENDRON Latreille.

NOSODENDRON TRITAVUM.

Pl. 7, Fig. 36.

A single specimen is preserved, a little larger and a little stouter than our N. unicolor, and which shows the under surface of the body with the head bent under and with the elytral markings showing through to a certain extent. The head appears to be smooth; four segments are shown behind the hind coxæ, occupying about one-third of the abdomen, and, excepting for the slightly longer posterior segment, of equal length and all uniformly, profusely, and minutely punctate. The elytra show here and there signs of faintly impressed distant striæ, which do not appear on the plate.

Length of body, 5^{mm}; breadth, 3.6^{mm}; distance apart of elytral striæ, 0.2^{mm}.

Green River, Wyoming. One specimen, No. 86 (Dr. A. S. Packard).

Family NITIDULIDÆ Leach.

PHENOLIA Erichson.

PHENOLIA INCAPAX.

Pl. 7, Fig. 23.

Phenolia incapax Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 80 (1876).

Represented only by a single specimen and its reverse, showing the under surface of the body, from which the appendages have been torn. It closely resembles in size, form, and the relation of the parts P. grossa (Fabr.), but differs from it in the character of the under surface of the body, which in the fossil species is very minutely and very faintly punctulate, and the posterior edges of the segments are not raised.

Length of fragment, 5.5^{mm}; of abdomen, 2.3^{mm}; breadth of same, 3^{mm}.

Green River, Wyoming. One specimen, Nos. 133 and 15201 (F. C. A. Richardson).

PROMETOPIA Erichson.

Prometopia depilis.

Pl. 2, Fig. 29.

Prometopia depilis Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 278–279 (French ed., 308–309) (1877).

This beetle appears to belong to the Nitidulidæ, but where it should be generically located is a matter of some doubt. It resembles most among our American forms the genus in which I have provisionally placed it, but so few really generic features remain that one can judge by little other than accessory characters. The head is wanting and the thorax is broken, and though exhibiting the under surface, the markings of the elytra can be readily seen, as is frequently the case in fossil beetles. The form of the elytra and scutellum is precisely that of Prometobia sexmaculata, excepting that the base ofthe elytra is more distinctly angulate; beneath, the elytra are expanded just as there, and punctured in much the same irregular and minute manner, but equally so at the extreme border beneath, instead of being furnished at this point with transverse rugæ; the punctures are 0.028^{mm} in diameter, and do not give origin to hairs; the elytra are dark castaneous, and have a dull ridge along the sutural margin. The thorax is black and proportionally shorter than in Prometopia, but otherwise it appears to have the same form, although the characteristic lateral projections of the front border are broken off, only the slightest indication of that on the left side appearing in a portion of the curve of the front border. The thorax is more minutely punctate than the elytra, and the punctæ are connected by the slightest possible impressed lines, giving it somewhat of a corrugated appearance: a few of the abdominal segments may be seen, the pygidium extending just beyond the elytra; all these joints are black, smooth, and shining, without trace of hairs or punctures.

Length of fragment, 5.5^{mm}; length of middle of thorax, 1.25^{mm}; breadth of same, 3.2^{mm}; length of elytra, 3.75^{mm}; breadth of united elytra, 3.35^{mm}.

Quesnel, British Columbia. One specimen, No. 24 (Dr. G. M. Dawson).

Family CRYPTOPHAGIDÆ Kirby.

ANTHEROPHAGUS Latreille.

Antherophagus priscus.

Pl. 7, Figs. 24, 35.

Antherophagus priscus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 79–80 (1876); in Zittel, Handb. d. Palæont., I, ii, 799, Fig. 1051 (1885).

Several specimens, representing either the upper or the under surface of the body, have been obtained. They resemble A. ochraceus Melsh. in general appearance. The head is nearly as broad as the thorax and well rounded; the eyes are about circular, 0.11^{mm} in diameter; the mandibles are stout, about twice as long as their breadth at base, tapering but slightly; the labium is narrow. The prothorax is about twice as broad as long, smooth, the front border slightly concave above, rather strongly concave below, the sides gently and regularly convex, the anterior angles rectangular, the posterior less prominent, the hind border broadly convex. The prosternum and the other sternal portions of the thorax seem to be delicately granulose; the middle coxæ are about equidistant from the others, or perhaps slightly closer to the hind pair, and the fore coxæ are more closely approximated to each other than the others, being separated by less than their own width. The scutellum is small, scarcely longer than broad. The elytra are smooth, equal, tapering only near the tip, the extremity of each independently and roundly pointed.

Length, 3.2^{mm}; breadth, 1.65^{mm}; breadth of head, 1.05^{mm}; of prothorax, 1.53^{mm}; length of same, 0.75^{mm}; of elytra, 2.1^{mm}; breadth of same, 0.9^{mm}.

Green River, Wyoming. Four specimens, Nos. 4191, 15152 and 15143, 15202, 15252 (Richardson, Bowditch, Scudder).

Family CUCUJIDÆ Stephens.

PARANDRITA LeConte.

Parandrita vestita.

Pl. 7, Fig. 41.

Body stout. Head quadrate, twice as broad as long, the posterior and lateral margins straight, the front margin between the bases of the antennæ

made of three nearly equal emarginations, one at the base of each mandible, and one, slightly broader, the emargination of the labrum. These scarcely show on the plate, where the anterior edge wrongly appears, especially on the left side, to be somewhat in advance of the front margin of the eyes. Mandibles large, stout, nearly as long as the head. Eyes small, circular, situated with the antennæ at the anterior angles of the head, as distant as possible from the prothorax. Prothorax slightly broader than the head and of the same shape, excepting that the posterior angles are broadly rounded and so not closely connected with the elytra, the humeral angles of which are also rounded. These are slightly broader than the prothorax, somewhat longer than the rest of the body, entire, with parallel sides They are weakly and distantly striate, the striæ marked by sparsely arranged erect setæ about as long as the interspaces. Similar setæ are scattered sparsely over the head and prothorax and even the base of the mandibles.

Length of body, 7^{mm}; of head and mandibles, 1.75^{mm}; of prothorax, 1.2^{mm}; of elytra, 4^{mm}; breadth of head, 2^{mm}; of prothorax, 2.35^{mm}; of elytra, 2.65^{mm}.

This species differs so much in its general aspect, and especially in its comparative breadth, the great breadth of the head, and the squareness of the prothorax, from P. cephalotes LeC., with which I have especially compared it, that I have hesitated somewhat to place it in the same genus. Casey does not recognize the generic distinction of Parandrita from Læmophlæus, but if this fossil be considered a member of the group there can be little doubt of its value.

Green River, Wyoming. Four specimens, Nos. 87 (Dr. A. S. Packard); 83, 85, 95 (Prof. L. A. Lee).

Family EROTYLIDÆ Leach.

MYCOTRETUS Chevrolat.

MYCOTRETUS BINOTATUS.

Pl. 7, Fig. 30.

Mycotretus binotata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 763–764 (1878); in Zittel, Handb. d. Paleont., I, ii, 800, Fig. 1053 (1885).

A single specimen with its reverse represent the dorsal aspect of this species, which closely resembles M. sanguinipennis Lac. in shape. It is,

however, a little smaller, the thorax tapers less rapidly, and the elytra are not striate. The head is badly preserved, being crowded under the thorax; it appears, however, to be very small, about half as broad as the thorax, with a broadly rounded front, large eyes, and a dark color. The thorax is about two and a half times broader than long, with slightly convex sides, regularly tapering toward the apex, but not so rapidly as would seem to be required for so proportionally narrow a head; the front border broadly concave, the hind border very obtusely angulate, scarcely produced as a broad triangle in the middle; the surface is of a light color, very minutely and profusely punctulate, the hind borders faintly marginate, the margin black and punctate. The elytra are more elongate than, and do not taper so rapidly as, in M. sanguinipennis; they are of the color of the thorax, even more delicately punctulate than it, with two small, short, black, longitudinal, impressed dashes just outside the middle, and just before the end of the basal third; the basal edge of the elytra is marked in black, much as the posterior border of the pronotum; and the scutellum is small, owing to the encroachment of the median prolongation of the prothorax.

Total length, 3.5^{mm}; length of thorax, 0.6^{mm}; of elytra, 2.5^{mm}; breadth of head, 0.75^{mm}; of thorax in front, 1.2^{mm}; behind, 1.45^{mm}; of elytra at the spots, 2.1^{mm}.

Green River, Wyoming. One specimen, Nos. 3990 and 4015.

Family STAPHYLINIDÆ Leach.

OXYTELUS Gravenhorst.

Oxytelus pristinus.

Pl. 5, Figs. 118–120.

Oxytelus pristinus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 79 (1876).

A single fairly preserved specimen, but of which none of the appendages excepting the elytra are visible. Apart from the labral prolongation, which is as in other species of Oxytelus, the head is subquadrate, slightly broader than long, the eyes occupying the whole lateral outline and but little convex; the sutural divisions of the under surface show through upon the upper surface (which is exposed to view), obscuring somewhat the parts above. The prothorax is somewhat injured, but was evidently subquadrate, a little broader than the head, nearly a third broader than long, the front

border slightly concave, the outer margin a little convex, the posterior angles and posterior border exactly as in Oxytelus rugosus (Grav.); the surface is delicately punctulate as in the species named, and there is a very slight, shallow, and broad median longitudinal sulcation, whose walls, however, are not elevated into ridges, as usual in the species of Oxytelus. The right elytron is expanded, and is therefore in the most favorable position for examination; it is more than half as long again as broad, the humeral angle well rounded off, the outer margin very gently convex, the apex squarely truncate but slightly convex; the surface is covered rather profusely and uniformly with shallow circular punctures resembling those of the prothorax, and averaging about 0.04^{mm} in diameter. The abdomen is much as usual in Oxytelus, the sides slightly convex, and the tip of the abdomen bluntly and rather regularly rounded; it was evidently furnished rather abundantly with very fine, short hairs.

Length of body, 4.2^{mm}; of head, 0.78^{mm}; breadth of same, 8^{mm}; length of eyes, 0.54^{mm}; breadth of same, 0.18^{mm}; length of prothorax, 0.72^{mm}; breadth of same, 0.9^{mm}; length of elytra, 1.22^{mm}; breadth of same, 0.75^{mm}; breadth of abdomen, 1.16^{mm}.

Chagrin Valley, White River, Colorado. W. Denton.

BLEDIUS Leach.

Bledius adamus.

Pl. 8, Fig. 10.

Bledius adamus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 762 (1878).

A rather poorly preserved specimen shows the dorsal view of the body without the legs or antennæ. It is of about the size of B. annularis LeC., and resembles it in general appearance, but seems to have shorter tegmina, although these are obscure; it is also a rather slenderer species. The head is large, as broad as the thorax, with rather large eyes. The thorax is quadrate, and the elytra together quadrate, and of the same size as the thorax. The abdomen beyond the elytra is as long as the rest of the body; apically it expands somewhat, and the extremity is shaped as in the species mentioned.

Length of body, 4.4^{mm}; breadth of thorax, 0.75^{mm}.

Green River, Wyoming. One specimen, No. 4081.

Bledius glaciatus.

Pl. 1, Fig. 35.

Allied to B. brevidens LeC. A single elytron, about twice as long as broad, the sides almost parallel and straight, slightly broader than elsewhere just before the tip, the apical margin straight, not inclined, the outer posterior angle gently rounded, the outer border slightly, the inner scarcely, margined, the deflexed portion of the outer margin narrow, equal, terminating at the middle of the outer half. Texture delicate, the surface slightly, irregularly, and not very closely punctate. A very small and rather broad scutellum is indicated by the shape of the inner basal angle, which is not quite accurately given on the plate.

Length of elytron, 1.9mm; breadth, 1.1mm.

Interglacial clays of the neighborhood of Scarboro, Ontario. One specimen, No. 14540 (G. J. Hinde.)

OXYPORUS Fabricius.

Oxyporus stiriacus.

Pl. 1, Fig. 36.

A single elytron, less than twice as long as broad, somewhat broken at the base, with very straight and almost parallel sides, enlarging to the least possible degree apically. It is a rather small species, of delicate texture, with smooth, unsculptured surface, except for the slightly impressed lines which follow the sutural and outer margins, giving a thickened appearance to either edge. The outer margin is gently and regularly convex, the outer posterior angle gently rounded, and the deflexed portion of the outer margin very narrow, equal, and reaching as far as the rounded apical part.

Length of elytron, 1.8mm; breadth, 1.12mm.

Interglacial clays of Scarboro, Ontario. One specimen, No. 14552 (G. J. Hinde.)

LATHROBIUM Gravenhorst.

Lathrobium abscessum.

Pl. 8, Figs. 15, 21.

Lathrobium abscessum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 791 (1876).

Two fragmentary specimens were taken by Mr. Richardson near Green River Crossing, Wyoming. The head is smooth, subquadrate, broader

than long, with slightly convex sides and hind border, the eyes of medium size, obovate, a little in advance of the middle of the head. The prothorax is smooth, as broad as the head, shaped quite as in L. elongatum (Linn.), the sides straight, the anterior angles rounded off, the whole posterior border well rounded. The abdomen is also as in the species mentioned, with rounded, tapering tip, but the elytra are shorter, being barely as long as the prothorax, with rounded apices.

Length of body, 6.25^{mm}; of head, 0.96^{mm}; of eyes, 0.25^{mm}; breadth of head, 1.02^{mm}; length of prothorax, 1.16^{mm}; of elytra, 1.05^{mm}; breadth of abdomen, 1.2^{mm}.

The above is the original description of the species. Since then other specimens have been found by Dr. Packard and myself, some of which are better preserved. These show that the head is of about equal length and breadth, well rounded, and with the surface slightly granular, as is also the prothorax; the last is of a very short oval shape, with regularly rounded sides, scarcely more prominent anteriorly than posteriorly.

Green River, Wyoming. Seven specimens, Nos. 5, 155^{b} (F. C. A. Richardson); 84, 94 (Dr. A. S. Packard); 3987, 4049, 4088 (S. H. Scudder).

Latirobium interglaciale.

Pl. 1, Fig. 38.

A single elytron indicates a species nearly as large as L. grande LeC., but with coarser sculpturing than is common in this genus and more as in Cryptobium; but in the latter genus the posterior margin is outwardly produced. The inner basal angle indicates a pretty large scutellum. The elytron is of nearly uniform width, with a nearly straight outer margin but gently rounded, the greatest width close to the tip; the posterior outer angle is rounded off and the posterior margin straight. The deflexed portion of the outer margin is narrow, subequal, rapidly tapering just before its termination, extending just beyond the middle of the apical half of the elytron; inner margin simple. Texture dense, the surface of elytron coarsely, rather shallowly, and not very closely, irregularly punctate, and marked besides by four or five short, shallow, irregular, longitudinal grooves just within and before the middle.

Length of elytron, 2.5^{mm}; width of upper surface, 1.25^{mm}.

Interglacial clays near Scarboro, Ontario. One specimen, No. 14555 (G. J. Hinde).

LEISTOTROPHUS Perty.

Leistotrophus patriarchicus.

Pl. 5, Fig. 112.

Leistotrophus patriarchicus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 78–79 (1876).

A single greatly crushed and ill defined specimen. Above, the head is broader than long, the front very broadly and regularly rounded, the jaws projecting triangularly beyond it; the eyes are large, nearly as long as the head and just as long as the width of the space between them; the whole head is minutely and uniformly granulate. The collar, which is not granulate, is of the same width as the part of the head between the eyes, and about half as long as the head; on one side of and in direct connection with this are some crushed fragments, apparently of one of the fore coxæ and femora, which distort its appearance. The prothorax is of about the size of the head, quadrate, with rounded corners and a slight elevated rim, without punctures or granulations. The elytra are very short, broader than long, quadrate, squarely truncate at the tip, leaving no signs of an exposed scutellum, faintly and distantly punctulate. The outline of the middle coxæ is impressed through the remains of the insect, showing them to be shaped as in Creophilus and Leistotrophus. The abdomen is as broad as the thorax, not much longer than broad, broadly rounded apically, furnished with hairs on the upper surface and apical tufts as in Creophilus villosus (Grav.); there are, however, no signs of punctulation.

Length of fragment, 12^{mm}; of head, 2.5^{mm}; breadth of same, 3.75^{mm}; length of eyes, 2^{mm}; breadth of same (as seen from above), 0.88^{mm}; length of tegmina, 1.75^{mm}; breadth of same, 2^{mm}; breadth of abdomen, 3.8^{mm}; length of middle femora, 2.3^{mm}; breadth of same, 0.65^{mm}; length of middle coxæ, 2.5^{mm}; breadth of same, 1.1^{mm}; length of hind femora, 2^{mm}; of hind tibiæ, 2.5^{mm}.

White River, near the Colorado-Utah boundary. One specimen (W. Denton).

QUEDIUS Stephens.

The two species described here from Florissant differ considerably from each other in general appearance, but appear to be structurally similar. They differ, one more markedly than the other, from modern species

of the genus in the great brevity of the antennæ and of their separate joints, as well as, so far as can be seen, in the shortness and stoutness of the legs.

Quedius chamberlini.

Pl. 16, Fig. 8.

Head moderately large, ovate, with a slightly constricted neck. Antennæ considerably longer than the head, reaching about to the middle of the thorax, the third joint a little longer than the second, scarcely increasing in breadth apically, the last joint no broader than the penultimate and scarcely, if at all, longer than broad. Prothorax fully as long as the head and narrower than long, subequal, smooth, and black. Legs shorter and stouter than in our smaller species of Quedius, but otherwise similar. Elytra longer than the prothorax, of the same color and densely, finely, and briefly pilose. Abdomen black, narrowing posteriorly, the part beyond the elytra longer than the rest of the body.

Although longer than in the other species of Quedius here described, the antennæ are still markedly shorter than in our living forms.

Length, 7.25^{mm}; breadth, 1.5^{mm}.

The species was described from other specimens than the one figured. It is named for the distinguished geologist, President Chamberlin, of the University of Wisconsin.

Florissant. Four specimens, Nos. 1478, 6615 and 7083, 10627, 12057 and 12483.

Quedius breweri.

Pl. 16, Fig. 4.

Head large, ovate, apparently smooth, with distant punctures, the neck slightly constricted; mandibles stout and not very long; antennæ but little longer than the head, increasing very slightly in size apically, the third joint a little shorter than the second, the last subpyriform, a little longer than broad, while the penultimate is broader than long. Prothorax smooth like the head, not at all explanate, apparently of about equal length and breadth, narrowing a little anteriorly, furnished with a few distant, scattered, erect bristles. Legs apparently much as in Q. molochinus (Grav.), to which it appears to be most nearly allied, though a slenderer insect. Elytra rather shorter and scarcely broader than the prothorax,

thinly clad with rather long hairs, which are darker than the also sparse hairs of the abdomen; abdomen with parallel sides and rounded tip.

The species is remarkable for its slenderness, the brevity of the antennæ, and the stoutness of the mandibles.

Length, 8.5^{mm}; breadth, 1.5^{mm}.

The species was described from other specimens than the one figured. It is named after the Western explorer and botanist, Prof. W. H. Brewer, of Yale College.

Florissant. Five specimens, Nos. 3863, 5800, 8259, 13635 and 14161, besides 1.381 from the Princeton Collection.

GYROPHÆNA Mannerheim.

Gyrophæna saxicola.

Pl. 5, Figs. 123, 124.

Gyrophæna saxicola Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 78 (1876).

A single specimen of a species allied to G. vinula Er. has the head well rounded, with large round eyes and a rounded labrum. The prothorax is but vaguely defined on the stone, and is apparently of about equal breadth with the head, and shorter than broad. The elytra are of equal length and breadth, each with a pair of longitudinal, straight, delicate, raised lines. There is no sculpturing of the surface; no wings can be seen, nor legs, and the indistinctly preserved abdomen is shaped as in G. vinula.

Length of body, 1.84^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

HOMALOTA Mannerheim.

Homalota recisa.

Pl. 8, Fig. 14.

The head is tolerably large, produced and tapering anteriorly but well rounded at tip; eyes globular, moderately large. Thorax a little broader than the head, subquadrate, broader than long (but this feature exaggerated in the figure), with gently rounded sides and profusely and rather delicately punctate surface. Elytra together considerably broader than the thorax, about as long as their united breadth, with scattered short hairs apparently

arising from shallow punctæ. Abdomen beyond the elytra of the width of the thorax, and retaining that width for four segments; the four segments beyond that, and especially the longer penultimate and antepenultimate segments, tapering considerably, the last segment bluntly pointed, triangular. From indications in the clearer parts the abdomen would appear to have been faintly and rather distantly punctate.

Length of body, 4.5^{mm}; width at elytra, 1.1^{mm}.

Green River, Wyoming. Two specimens, No. 78 (Dr. A. S. Packard), No. 3996 (S. H. Scudder).

STAPHYLINITES gen. nov. (Staphylinus, nom. gen.).

Staphylinites obsoletum.

Pl. 8, Fig. 32.

Staphylinites obsoletum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 78 (1876).

The single specimen obtained is too poorly preserved to determine until further material is obtained to what genus of Staphylinidæ it should be referred. Following, therefore, the lead of Prof. Oswald Heer in similar cases, it is referred to a provisional genus Staphylinites. The head, thorax, and abdomen are of equal breadth; the eyes are round and rather large; the posterior border of the pronotum is well rounded; the elytra are simple, about twice as long as broad, truncate, and very broadly rounded, with a large, roundish, very dark spot occupying the whole of the tip.

Length of fragment, 3.25^{mm}; breadth of same, 1.25^{mm}; diameter of eyes, 0.45^{mm}; length of elytra, 1.25^{mm}.

Green River, Wyoming. One specimen, No. 15200 (Mr. F. C. A. Richardson).

Family HYDROPHILIDÆ Leach.

CERCYON Leach.

Cercyon ? terrigena.

Pl. 2, Fig. 21.

Cercyon ? terrigena Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 179B (1879).

A single elytron with the base broken off appears to represent a species of Hydrophilidæ, and perhaps is most nearly related to Cercyon, but of this

there is much doubt. The elytron is pretty well arched, equal nearly to the tip, then rapidly rounded off, indicating an ovate beetle with the shape of a Hydrobius or a shorter insect, and of about the size of Helophorus lineatus Say. Eight faintly impressed unimpunctured striæ are visible, the outer one, and to some extent the one next it, deeper; these two unite close to the tip, curving strongly apically; the next two curve slightly near their extremity, but are much shorter, not reaching the fourth stria from the suture, which, like the remaining three, pursues a straight course to the seventh stria. The surface between the striæ is nearly smooth, piceous.

Length of fragment, 2.4^{mm}; breadth of elytron, 1.35^{mm}; distance apart of the striæ, 0.15^{mm}.

Nicola River, below main coal seam, British Columbia. One specimen, No. 57 (Dr. G. M. Dawson).

HYDROBIUS Leach.

Hydrobius decineratus.

Pl. 8, Fig. 27.

Hydrobius decineratus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 761 (1878).

A single specimen exhibits the dorsal surface, but with part of the thorax gone. It represents a species a very little larger than H. fuscipes Curt. of California, and is apparently allied to it, though slenderer; the head and eyes are as in that species; the thorax shorter and the elytra longer and more tapering at the tips, the extremities of which, however, are not preserved; they are furnished with eight delicate striæ, in which the punctures are scarcely perceptible even when magnified; the surface otherwise appears to be smooth, but is not well preserved. The scutellum is as in the recent species mentioned.

Length of body, 7.5^{mm}; of elytra, 4.75^{mm}; breadth of body, 3.6^{mm}.

Green River, Wyoming. One specimen, No. 4007.

Hydrobius confixus.

Pl. 7, Fig. 25.

A single elytron has been found, perfectly flat, with nearly parallel sides and a bluntly pointed apex. It shows place for a minute scutellum, the surface is smooth, but marked by nine parallel, equidistant, slightly

incised striæ, which are apparently accompanied (not shown in the plate) by very faint and rather infrequent punctures; all the striæ can be traced almost to the very tip of the elytron, some of them uniting, or almost uniting, as shown in the plate. The outer edge is not very well preserved, and doubtless a tenth stria is concealed there.

Length, 4^{mm}; breadth, 1.7^{mm}.

Green River, Wyoming. One specimen, No. 79 (Dr. A. S. Packard).

PHILHYDRUS Solier.

PHILHYDRUS PRIMÆVUS.

Pl. 8, Fig. 5.

Philhydrus primævus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 78 (1876).

A single specimen, wanting head, thorax, and legs, but exhibiting at once the upper and under surface of the body (like specimens mounted after a potash bath), represents this species, which is poorly drawn on the plate, the striæ being too far apart and only a portion of them shown. The elytra taper on the apical third, following the narrowing form of the abdomen, and are delicately pointed; they are furnished each with six straight, equidistant rows of distinct, longitudinal, punctate striæ, 0.19^{mm} distant from one another.

Length of elytra, 3.8^{mm}; breadth of same, 1.35^{mm}.

Green River, Wyoming. One specimen, No 15199 (F. C. A. Richardson).

PHILHYDRUS spp.

Two specimens (Nos. 4033, 4042) of species of Philhydrus were found by Mr. F. C. Bowditch and myself at the same Green River locality, but neither of them is very perfect, representing little else than elytra, and these rather obscurely preserved. The larger species has smooth elytra; the elytra of the other have eight delicate striæ, which apparently are not punctured. Possibly one or both should be referred to Hydrobius.

Length of elytra of larger species (No. 4033), 4^{mm}; breadth of body, 3.2^{mm}.

Length of elytra of smaller species (No. 4042), 3.75^{mm}; breadth of body, 3^{mm}.

Mention of these was made by me in the Bull. U. S. Geol. Geogr. Surv. Terr., IV, 761 (1878).

LACCOBIUS Erichson.

Laccobius elongatus.

Pl. 7, Figs. 27, 28.

Laccobius elongatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 761 (1878).

A single specimen and its reverse exhibit the elytron of a slender species of Laccobius. It is more than two and a half times longer than broad, and is furnished with thirteen equidistant, delicately punctured, faintly impressed striæ, the punctures of which are more apparent on the basal than on the apical half; the inner stria is as distant from the sutural border as from the neighboring stria, while the outer is scarcely separate from the outer margin. The species is very large, and also very slender, for a Laccobius, in which genus, however, I am inclined to place it, from the large number of punctured striæ. The elytron has much the general appearance of that of a Lebia, but the number of striæ, of course, forbids such a reference.

Length of elytron, 2.9^{mm}; breadth, 1.1^{mm}.

Green River, Wyoming. One specimen, No. 81^{a} and 136^{g} (Mr. F. C. A. Richardson).

BEROSUS Leach.

Berosus sexstriatus.

Pl. 7, Fig. 40.

Berosus sexstriatus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 760–761 (1878).

A single well preserved elytron represents a species scarcely smaller than B. punctipennis Chevr. (undescr.[1]) from Mexico, with the elytra of which it also agrees in the character of the tip and in the shape of the whole, unless in the fossil it tapers more toward the base: the latter is also remarkable for the absence of the two lateral striæ, the others retaining their normal position; and for the delicacy of the striæ themselves, which are even more faintly impressed than in B. cuspidatus Chevr., and, unlike all Berosi I have seen, are nearly devoid of any sign of punctuation; faint traces only can be seen when magnified twenty-five diameters. As not unfrequently happens in Hydrophilidæ, although I have not noticed it in Berosus, a

[1]Seen in the collection of the late Mr. George D. Smith.

short supplementary stria originates near the base of the second stria, pushing it a little to one side, and runs into the first stria a short distance from the base of the elytra. Length of elytron, 4.5mm; breadth, 1.4mm.

Green River, Wyoming. One specimen, No. 4079.

Berosus tenuis.

Pl. 8, Fig. 8.

Berosus tenuis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 760 (1878).

The single specimen representing this species is preserved on a dorsal view, and is unusually slender for a Berosus, but seems to fall here rather than in any other of the hydrophilid genera. It is of about the size of B. cuspidatus Chevr. from Mexico, and agrees generally in appearance with it, but is slenderer, and the tip of the elytra is simple; the punctured striæ are exactly as in that species, as far as they can be made out. The head is large and well rounded, with large round eyes. The pronotum, the posterior edge of which is partly concealed by the overlapping base of the elytra, pushed a little out of place, is shorter than in B. cuspidatus, with rounded sides, broadly and shallowly concave front, and apparently smooth surface. The elytra are long and slender, with entire, bluntly pointed tips, and very delicate, finely impunctured striæ. The whole body is regularly obovate, broadest in the middle.

Length of body, 5.65mm; of elytra, 4.15mm; breadth of body, 2.75mm.

Green River, Wyoming. One specimen, No. 4002.

TROPISTERNUS Solier.

Tropisternus sculptilis.

Tropisternus sculptilis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 760 (1878).

In a specimen and its reverse, of which only the abdomen and elytra are preserved, we have a well marked species of Tropisternus of about the size and shape of T. mexicanus Castln., but with rather frequent striæ, more distinct than in that species, and composed, not, as there, of rows of impressed points, but of continuous, faintly impressed lines; the lines are apparently eight in number and uniform in delicacy and distance apart; the base of the elytra, however, is poorly preserved; the elytra are rather slenderer than in the recent species mentioned, and the extreme tip is

rounded and not acutely pointed. Distinct striation of the elytra is rare in Tropisternus, but it scarcely seems possible to refer this species elsewhere.

Length of elytra, 6.5mm; breadth of combined elytra, 5mm.

Green River, Wyoming. One specimen, Nos. 3989 and 4084.

Tropisternus saxialis.

Pl. 8, Fig. 2.

Tropisternus saxialis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 759–760 (1878).

One specimen and its reverse, found by me in the Green River shales, represents a species of Tropisternus nearly as large as T. binotatus Walk. from Mexico. The large size of the head and the shortness of the prothorax are doubtless due to the mode of preservation, the whole of the head, deflected in life, being shown, while the thorax is in some way foreshortened. In all other respects it agrees with the Hydrophilidæ, and especially with Tropisternus, having the form of the species mentioned. The head is broad and well rounded, with small, lateral, posterior eyes. The thorax is much broader and much more than twice as broad as long, with rounded sides, tapering anteriorly, the front margin broadly and rather deeply concave, the hind border gently convex; the scutellum is large, triangular, a little longer than broad. The surface of the thorax and elytra is apparently smooth; at least no markings are discoverable, excepting the line of the inner edge of the inferior margination of the sides of the elytra, which appears through the latter, as do also the abdominal incisures and the hind femora and tibiæ. These legs are longer and slenderer than in T. binotatus, the femora extending beyond the sides of the abdomen, and the tibiæ are armed beneath at tip with a pair of slender spines, which together with the tibiæ are about as long as the femora.

Length of body, 6.65mm; of elytra, 4.45mm; breadth of middle of body, 3.25mm; length of hind femora, 2mm; of hind tibiæ, 1.25mm.

Green River, Wyoming. One specimen, Nos. 4023 and 4027.

HYDROCHUS Germar.

Hydrochus amictus.

Pl. 1, Fig. 47.

A single fragmentary elytron indicates a species of about the size of H. subcupreus Rand., and in general resembling it. The figure does not

properly represent the prominent rounded humeral angle. It differs from the modern species mentioned in wanting the special prominence of the third and fifth interspaces over the intermediate ones, though the seventh and eighth are elevated: the punctures are also a little less pronounced, and so the interspaces wider; whence doubtless it happens that the minute hairs which are confined to a single pretty regular row in the interspaces of the living species are scattered, irregular, and more numerous in the fossil.

Length of fragment, 2.6^{mm}; probable length of elytron, 2.8^{mm}: its breadth, 1^{mm}.

Interglacial clay beds of Scarboro, Ontario. One specimen, No. 14504 (G. J. Hinde).

Hydrochus relictus.

Pl. 8, Fig. 11.

Head rather large, rounded, subtriangular, broader than long but prominent; eyes moderately large, globular, somewhat projecting. Thorax cylindrical, broader than long, a little broader than the head, broadest in the middle and narrowing a little both in front and behind, the sides slightly and rather regularly rounded, front and hind border nearly straight, the surface apparently a little roughened and with very short, moderately stout, scattered hairs, or perhaps only the latter. Elytra together much broader than the thorax, with well rounded humeral angles and with ten longitudinal punctate striæ (the innermost and outermost not shown in the plate) marked by short, moderately stout, scattered hairs, about half as long as the width of the interspaces.

Length of body, 3^{mm}; of thorax, 0.6^{mm}; of elytra, 2^{mm}; breadth of thorax, 0.9^{mm}; of elytra, 1.3^{mm}. The specimen is seen from above but with a partially lateral view; if it were wholly dorsal the width of the elytra would probably be 1.7^{mm}.

Green River beds, Wyoming. One specimen, No. 88 (Dr. A. S. Packard).

HELOPHORUS Illiger.

Helophorus rigescens.

Pl. 1, Fig. 53.

A single elytron with a broken tip represents this species, which does not seem to agree closely with any modern form, having less heavily punctate

striæ and flatter interspaces than any known to me. In general, in color and in texture, excepting in the very interruptedly elevated and gibbous interspaces, which are the chief characteristic of the elytra of H. tuberculatus Gyll., it might be compared to that species, but it agrees better in size with H. scaber LeC. The prominent humeral angle is not properly shown in the plate, and the breadth is made to appear too great from the spreading of the declivous margin

Length of fragment, 2.1[mm]; probable length of elytron, 2.25[mm]; breadth in natural position, 0.7[mm].

Interglacial clays of Scarboro, Ontario. One specimen, No. 14505 (G. J. Hinde).

Family DYTISCIDÆ MacLeay.

LACCOPHILUS Leach.

Laccophilus sp.

Pl. 5, Figs. 116, 117.

Laccophilus sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 78 (1876), III, 759 (1877).

A fragment of a leg found by Mr. Denton in Fossil Cañon, White River, Utah, must be referred to this genus. It represents the hind femur and tibia of a species allied to L. maculosus Germ, but is so uncharacteristic a fragment that it is not worthy of further mention.

Family CARABIDÆ Leach.

CHLÆNIUS Bonelli.

Chlænius punctulatus.

Pl. 1, Fig. 7.

Chlænius punctulatus Horn, Trans. Amer. Ent. Soc., V, 244 (1876).

"One elytron of the size and very similar to that of C. laticollis, from which it differs in having the striæ more finely impressed and the punctures rather closer, while those of the intervals are coarser and less numerous. Length, .40 inch; 10[mm].

"There can be no doubt that the generic determination is correct in this instance." Horn, loc. cit.

Besides a short humeral stria there are nine others, finely but sharply impressed, with frequent punctures at irregular distances as if they were only a part of those which cover profusely the whole surface. The interspaces are 0.375[mm] broad in the middle of the elytra, nearly flat, and besides the abundant punctuation are very delicately and sharply rugulose, much as in Cymindis aurora from the same beds.

Bone caves of Port Kennedy, Pennsylvania.

CYMINDIS Latreille.

Cymindis aurora.

Pl. 1, Fig. 6.

Cymindis aurora Horn, Trans. Amer. Ent. Soc., V, 243 (1876).

"Elytra Striæ moderately deep, indistinctly punctured, intervals irregularly, biseriately punctulate, and very finely alutaceous. Length, .30 inch; 7.5[mm].

"The greater portion of both elytra remain, somewhat distorted by pressure and retaining much of the chitinous substance A species is indicated closely related to C americana, but somewhat larger. The punctuation of the intervals and the arrangement of the striæ near the tip, resemble so closely those of Cymindis, that I place the species in that genus." Horn, loc. cit.

The striæ, although very distinct, are really shallow, and are very indistinctly and somewhat irregularly punctured; the interspaces are 0.25[mm] broad in the middle of the elytra, and the surface is very regularly and most delicately and sharply rugulose and furnished abundantly with irregularly scattered, somewhat faint, circular punctures, which can scarcely be said to be arranged biseriately, although they are more frequent along lines which are slightly nearer the striæ than the middle of the interspaces, and also to a less extent along the middle line of the interspaces. The length of the chitinous portion of the fragment is 6.5[mm]. The breadth of the elytron and the number of striæ can not be determined.

Bone caves of Port Kennedy, Pennsylvania.

PLATYNUS Bonelli.

The several species of Platynus here described from the interglacial clay beds belong to one type, somewhat distantly represented to-day by

P. crenistriatus LeC. and P. rubripes Zimm., in which the striæ are coarse and punctured, the sutural stria insignificant or obsolescent, and the surface texture a very delicate transverse ribbing nowhere broken up into a reticulation.

Platynus senex.

Pl. 7, Fig. 38.

Platynus senex Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 759, (1878.)

This species is represented by a single specimen and its reverse. The upper surface is shown with none of the slenderer appendages. The true form of the head can not be determined, as the edges are not preserved. The prothorax is unusually square for a carabid, resembling only certain forms of Bembidium and Platynus, and especially P. variolatus LeC. It is, however, still more quadrate than in that species, and differs from it in shape, being a little broader than long, broadest just behind the middle, tapering but little anteriorly, and scarcely more rapidly at the extreme apex; the elytra are together only about half as broad again at base as the thorax, and are furnished with eight very faint and feeble striæ, apparently unpunctured, the one next the margin interrupted by four or five foveæ on the posterior half of the elytra; the humeral region is too poorly preserved to determine the striæ at that point; the form of the elytra is as in P. variolatus.

Length of body, 6.1^{mm}; breadth of thorax, 1.5^{mm}; of base of elytra together, 2.3^{mm}; length of elytra, 4.1^{mm}.

Green River, Wyoming. One specimen, Nos. 3998 and 3992.

Platynus casus.

Pl. 1, Fig. 42.

A single elytron is preserved in the beds which have yielded so many Platyni, which seems to be better comparable with P. rubripes Zimm. than with any other living form, but better still with the fossil forms from the same beds, with which it agrees also better in size, though it is a trifle broader, with a considerably more rounded humeral angle, a more rounded outer margin, and the first stria closely approximated to the suture. Except in these particulars it agrees best with P. halli; but, somewhat as in P. rubripes though with less regularity in size and distribution, the interspaces

are filled with irregular shallow punctures, which run more or less together so as to form interrupted, longitudinal, adventitious series between the striæ. The intimate texture of the surface is much as in P. halli, the fifth and sixth striæ meet at a distance from the tip and the sut .ral stria is obsolescent and brief.

Length, 4 7^{mm}; breadth, 1.6^{mm}.

Interglacial clay beds, Scarboro, Ontario. One specimen, No. 14523, (G. J. Hinde).

Platynus hindei.

Pl. 1, Fig. 54.

A number of fragments occur of a species which seems to be allied to P. rubripes Zimm., but is much smaller than it and differs from it considerably. The shape of the elytron is much the same as there, but the humeral angle is more pronounced, the striæ are rather coarser and perhaps a little more heavily punctate, while the interspaces, instead of being faintly and shallowly punctate, are not only very faintly and irregularly transversely corrugate, but the fine sharp reticulation of the living species seen under strong magnifying power is entirely absent from the piceous surface of the fossil, being replaced by a scarcely perceptible dull transverse ribbing. The fifth and sixth striæ are also united only a little beyond the middle of the outer half of the elytron, and the sutural stria is very short indeed and generally inconspicuous.

Length, 4.65^{mm}; breadth, 1.5^{mm}.

Clay beds of interglacial deposits, Scarboro, Ontario. Nine specimens, Nos. 14512, 14514, 14518, 14528, 14533, 14544, 14546, 14554, 14562 (G. J. Hinde).

I take pleasure in dedicating this species to Dr. G. J. Hinde, to whose industry and zeal we are indebted for the interesting series of interglacial Coleoptera shown on Plate 1.

Platynus halli.

Pl. 1, Fig. 41.

Another species of Platynus, allied to P. crenistriatus LeC., is still more nearly related to P. hindei just described, and is of the same size, and therefore considerably smaller than the living species, to which it bears the

nearest resemblance. Its relations to P. hindei are very much the same as those of P rubripes to P. crenistriatus, the striæ being deeper and coarser than in P. hindei and the punctures larger and heavier. Though the humeral angle is scarcely so prominent as in P. hindei, the texture of the surface is scarcely different, unless in being slightly more marked, while in P. crenistriatus there is no reticulation or cross ribbing whatever. The early union of the fifth and sixth striæ again marks its affinity with P. hindei, and the sutural stria is of much the same character, though slightly variable.

Length, 4.65^{mm}; breadth, 1.5^{mm}.

Clay beds of interglacial age, Scarboro, Ontario. Three specimens, Nos. 14520, 14524, 14525 (G. J. Hinde).

Named in honor of the veteran New York paleontologist, Prof. James Hall.

Platynus dissipatus.

Pl. 1, Fig. 37.

This species, which is of the same size as P. halli and agrees with it in its general features and in the minute texture of the surface, is separated from it solely on account of the grosser sculpture of the elytra, since the striæ, which are equally broad, are much shallower—a characteristic which applies as well to the punctures—and are less distinct on the sides than on the interior half. Neither of the fragments is perfect, though one has all but a little of the tip and permits us to see that the fifth and sixth striæ would unite early, as in those species, did they not fade out altogether before uniting. There is at least one puncture in the third interspace as far from the base as the width of the elytron.

Breadth of elytron, 1.5^{mm}.

Interglacial clay beds of Scarboro, Ontario. Two specimens, Nos. 14515, 14563 (G. J. Hinde).

Platynus desuetus.

Pl. 1, Figs. 43, 51, 58.

This, the largest of the species from the clay beds of the Canadian border, is more nearly allied to P. crenistriatus LeC. than to any other liv-

ing species, agreeing with it also in size, which none of the other fossils do; but in other particulars, including the intimate texture of the surface, it agrees better with its contemporaries. It is nearest perhaps to P. halli, but the striæ and punctures are a little less pronounced, the insect is much larger, and the fifth and sixth striæ meet at no great distance from the tip of the elytron, as in the modern species mentioned. There appear to be three punctures in the third interspace.

Length of elytron, 5^{mm}; breadth, 2^{mm}.

Clay beds of interglacial times, Scarboro, Ontario. Six specimens, Nos. 14477, 14478, 14486, 14516, 14526, 14538 (G. J. Hinde).

Platynus harttii.

Pl. 1, Fig. 31.

This species, represented by a couple of specimens only, is the smallest of those found in the interglacial deposits, and in its peculiarities, especially in the distant union of the fifth and sixth striæ, is most nearly allied to the largest. Its outer margin is well rounded, scarcely marginate, the humeral angle tolerably prominent but well rounded; the striæ are coarse and deep, with rather heavy but not very distinct punctures, scarcely broadening the striæ, while the piceous surface is delicately and rather faintly cross-ribbed. The marginal stria is obsolescent. There are apparently two or three interspacial punctures. It is very small for a Platynus.

Length of elytron, 3.6^{mm}; width of one, 1.35^{mm}.

Interglacial clays of Scarboro, Ontario. Two specimens, Nos. 14475, 14480 (G. J. Hinde).

Named in memory of my fellow-student, Prof. C. F. Hartt, formerly director of the Geological Survey of Brazil.

Platynus cæsus.

Pl. 7, Fig. 34.

This species is represented by a couple of specimens, one showing the closed elytra, the other the whole body proper and the fragment of a leg. It appears to be a true Platynus. The head is obscure, but apparently longer than broad, with medium-sized circular eyes. The pronotum is broad sublyriform, the front margin scarcely concave, the anterior angles a

little more than rectangular and well defined, the sides convex, the posterior angles very much rounded off, the hind margin otherwise gently convex; it is broadest slightly behind the middle, strongly margined at the sides, followed by a distinct neck, which is half the width of the pronotum. The elytra are oval, strongly margined, the humeral angles almost as strongly rounded as the hinder margin, the striæ coarse, with no indication of punctures.

Length of body, 6^{mm}; of pronotum, 1.4^{mm}; of elytra, 3.25^{mm}; second specimen, 3.5^{mm}; width of pronotum, $1\ 75^{mm}$; of elytra, $2.2\ (2.25)^{mm}$.

Green River, Wyoming. Two specimens, Nos. 83, 85 (Dr. A. S. Packard).

DIPLOCHILA Brullé.

In this genus I place provisionally a fine but headless specimen from Florissant, rather imperfectly preserved as regards the elytra, and which was accidentally placed with the Heteroptera from appearing to have a large scutellum, due to the impress of underlying parts. There seems to be nothing nearer among our native Coleoptera. No fossil form has previously been recognized in this genus, which is a widely distributed one in various parts of the globe.

Diplochila ? henshawi.

Pl. 28, Fig. 9.

A species is indicated of the size and general appearance of D. major, but it differs so much that it is very doubtful if it belongs to the genus. The finding of fresh material will probably determine this. The head is packing. The form of the thorax is somewhat similar so far as can be told; much has been worked out from the stone since the drawing was made, but the front part is imperfect by the removal of an angular fragment following an angulate sulcation not uncommon in Carabidæ, but here excessively deep; the thorax narrows more rapidly and considerably than in D. major, with angulate rather than sinuate sides, so that the thorax is one-half wider at base and two-thirds wider at the widest than at apex. The ovate form of the abdomen with the closed elytra is rather more like that of Carabus than of Diplochila, the elytra apparently furnished with distant slightly impunctate striæ. The legs are constructed on the carabid type; the middle and hind

femora are of equal size, the hind tibiæ considerably longer than the femora, furnished with a superior sharp carination; they expand slightly at the tip, and are armed with a pair of long, unequal spurs; hind tarsi a little longer than the tibiæ, the first two joints are subequal, very long, each almost as long as the third to the fifth together; these subequal, the last apically subbullate and armed with a pair of rather short claws. Apparently the whole body was uniformly black.

Length of fragment, 14^{mm}; breadth across middle of thorax, 6.5^{mm}; across closed elytra, 9.2^{mm}; length of hind tibia, 6.4^{mm}; tarsus, 7.1^{mm}; first tarsal joint, 2.75^{mm}.

Named for my excellent friend, the well known American entomologist, Mr. Samuel Henshaw, of Cambridge.

Florissant. One specimen, No. 8201.

DICÆLUS Bonelli.

Dicælus alutaceus.

Pl. 1, Figs. 8–10.

Dicælus alutaceus Horn, Trans. Amer. Ent. Soc., V, 244 (1876).

"Two elytra much flattened, retaining their proper position in relation to each other, remain, with but little of their actual substance enough however to indicate the surface sculpture.

"A species is indicated bearing a close relationship to dilatatus, but with the intervals somewhat more convex and the surface more distinctly alutaceous. The humeral carina appears to have been extremely fine and rather less elevated than in dilatatus.

"Elytra.—Length, .70 inch, 17.5^{mm}. Width, .40 inch, 10^{mm}.

"The measurement includes also the portion of the elytra covered by the base of the thorax. With proper allowance being made for flattening a species is indicated of as large size as our largest purpuratus but relatively narrower." Horn, loc. cit.

The striæ are seven in number, besides the humeral stria, and are 0.65^{mm} apart in the middle of the elytra. The length of the largest fragment is 17^{mm}; the breadth of one elytron, 4.9^{mm}.

Bone caves of Port Kennedy, Pennsylvania.

Dicælus sp.

Pl. 1, Fig. 15.

Dicælus sp. Horn, Trans. Amer. Ent. Soc., V, 244 (1876).

"Another species of much smaller size than the preceding [D. alutaceus Horn] is indicated by an impression of the greater part of both elytra and a very small fragment of one elytron, resembling D. elongatus. The carina appears to be of similar length and the intervals moderately convex, equal and smooth.

"No measurements can be given as I have not sufficient material on which to base them and I must also leave the species nameless." Horn, loc cit.

I have seen only the specimen figured. The surface sculpturing is the same as in D. alutaceus, but the species being smaller the striæ are of course closer; but in addition to this there are more of them, as there are nine in all; their average distance apart in the middle of the elytron is 0.4^{mm}. The width of the two elytra together is 7^{mm}.

The fragment is too imperfect to require a name at present.

Bone caves of Port Kennedy, Pennsylvania.

PTEROSTICHUS Bonelli.

Pterostichus abrogatus.

Pl. 1, Fig. 39.

A fragment of an elytron indicates a species closely allied to P. herculaneus Mann. in elytral structure and of probably about the same size. The sutural stria is similar; there are the same broad and deep, simple striæ, only they are, if anything, broader and deeper in the fossil. The interspaces are, however, flatter than in the recent species, and the intimate texture of the surface, instead of showing a very distinct reticulation of minute imbricated cells with sharply defined walls, is almost entirely smooth, the faintest sign only of such tracery being visible with strong magnification. The first stria is also at an unusual distance from the margin. The color is piceous.

Length of fragment, 5^{mm}; width of same, 2^{mm}; presumed length of elytron, 7.5^{mm}.

Interglacial clays of Scarboro, Ontario. One specimen, No. 14560, (G. J. Hinde).

Pterostichus dormitans.

Pl. 1, Figs. 49, 55.

This species, represented by two opposite ends of elytra, is very close indeed in size and general character to P. laetulus LeC. It may be slightly smaller, but not enough to be worth specifying. The color is different, being testaceous instead of a dull metallic green. There are the same delicately traced, indistinctly, distantly, and delicately punctate striæ; a sutural stria of the same character, and similarly flattened interspaces. The intimate surface structure of the interspaces is similar, but the cells of the present species are a little smaller than in P. laetulus, with coarser and less prominent walls, and therefore giving a much less delicate reticulation. The third interspace is not well enough preserved to tell anything about the punctures.

Length of largest fragment, 4.5^{mm}; breadth of elytron, 2^{mm}.

Interglacial clays of Scarboro, Ontario. Two specimens, Nos. 14503, 14508 (G. J. Hinde).

Pterostichus destitutus.

Pl. 1, Fig. 44.

This species is represented by a single elytron of a mahogany color, which seems to be nearly related to P. sayi Brullé and of the same shape, though a considerably smaller species. The character of the striæ in depth and punctuation is quite as in P sayi, but the interspaces are flatter, and the delicate transverse reticulate striation, finely traced in P. sayi, is here inconspicuous and dull and more irregular. The present species has a similar sutural stria, but apparently no puncta in the third or any other interspace, though it is possible that one exists in the place occupied by the posterior one in P. sayi. One peculiarity of the present species is the early union of the fifth and sixth striæ, well in advance of the interruption of the marginal curve.

Length of elytron, 6^{mm}; breadth, 2.5^{mm}.

Interglacial clay beds of Scarboro, Ontario. One specimen, No. 14522, (G. J. Hinde).

Pterostichus fractus.

Pl. 1, Figs. 29, 30.

Closely allied to P. destitutus, with the same early union of the fifth and sixth striæ, not shown in the figure, but still smaller and with less distinct strial punctuation, this being indeed very inconspicuous. A single elytron is preserved, with the extreme apex broken. There is a distinct punctum in the third interspace opposite the union of the fifth and sixth striæ, which is just before the break. The interspaces are flattened, as in P. destitutus, and the intimate structure of their surface is exactly as there, except in showing scarcely any sign of reticulation.

Length of fragment, 4.5^{mm}; breadth, 2^{mm}.

Interglacial clays of Scarboro, Ontario. One specimen, No. 14532 (G. J. Hinde).

Pterostichus destructus.

Pl. 1, Fig. 46.

A couple of elytra, from each of which the entire apex is broken, closely resemble P. patruelis Dej in shape and sculpture, but represent a species a little larger than it. The sutural stria is exactly as in that species, and the striæ are finely impressed and without punctures; the interspaces would appear to be flatter than in P. patruelis, and the third interspace does not appear to have the three punctures found in that species, but only the central one. The color is blackish castaneous.

Length of one fragment, 3.5^{mm}; probable length of elytron, 4.75^{mm}; width of same, 1.5^{mm}. Length of another fragment, 3.8^{mm}; width, 1.45^{mm}.

Interglacial clays of Scarboro, Ontario. Two specimens, Nos. 14519, 14549 (G. J. Hinde).

Pterostichus gelidus.

Pl. 1, Figs. 52, 59–61.

Loxandrus gelidus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 763–764 (1877).

The following fragments of this species have been examined: A very nearly perfect elytron, but badly cracked and pressed apart; the greater part of another; parts of three united segments of the abdomen; the prothorax slightly cracked; and a portion of one of the mandibles. A species

is indicated of about the same size as P. hudsonicus LeC. and closely resembling it. The elytra are piceous, with a metallic-blue reflection; there are nine distinctly and rather deeply and equally impressed striæ, rather faintly and not very profusely punctate; the interspaces appear as if minutely cracked, and with a simulation of excessively faint and small foveæ throughout, while the third has a more distinct, though still rather shallow and rather large fovea considerably behind the middle of the apical half of the elytra; a second fovea appears in the third interspace, as far from the apical fovea as that is from the apex, but it is situated laterally, encroaching on the stria next its inner side. It is perhaps due only to an excess of the simulating foveæ that there is apparently a row of approximated punctures, quite like those of the neighboring striæ, for a very short distance between the base of the sixth and seventh striæ. The first stria turns outward next the base, to make room for a scutellar stria. The obliquely cut marginal foveæ agree with those of P. hudsonicus. The prothorax is quadrate, the front margin very slightly angled, the sides broadly rounded, fullest anteriorly, with an exceedingly slight median sulcus (indicated by a slender crack), and more distinct posterior sublateral sulci (indicated by wider cracks), and between which the hind border is scarcely convex. The surface of the prothorax is smooth; the abdomen is also smooth. The part of the mandible remaining is only the basal "molar" portion, armed with six or seven mammilate conical teeth, or rather transverse ridges.

Length of elytron, 5.75^{mm}; breadth, 2^{mm}; length of prothorax, 2.25^{mm}; breadth, 3.5^{mm}; breadth of abdomen, 2.25^{mm}.

The species differs from P. hudsonicus in the shape of the prothorax (if that belongs here), broader striæ, and less convex elytra.

Interglacial clays of Scarboro Heights, near Toronto, Canada. Several specimens, among others Nos. 14521, 16418 (G. J. Hinde).

Pterostichus lævigatus.

Pl. 1, Figs. 3, 4.

Pterostichus lævigatus Horn, ined.
Pterostichus sp. Horn, Trans. Amer. Ent. Soc., V, 243 (1876).

"Fragments of two elytra. Elytra striate, striæ impunctured, intervals moderately convex, smooth.

"A species apparently of the size of coracinus or stygicus is indicated,

but without more material it seems unnecessary to name it, or guess as to its affinities." Horn, loc. cit.

Besides the two elytra referred to above Dr. Horn has sent me attached to the same card another elytron, better preserved, but with the apex lacking: the chitinous portions of the other fragments perfectly resemble this, and there can scarcely be any doubt that they belong together. This new fragment is of a piceous color. There are nine striæ, counting the one next the outer edge; the interspaces are 0.5^{mm} broad, moderately convex, smooth, but with transverse impressed lines at very irregular and rather infrequent intervals, which can hardly be due altogether to preservation, as they seldom or never cross continuously two contiguous interspaces; the striæ are deep, faintly margined at the bottom, but in none of them, nor in any of those in the specimens described by Dr. Horn, can I discover the slightest sign of punctures.

Length of this elytron (fragmentary), 6.5^{mm}; breadth of same (complete), 2.5^{mm}; width of the two contiguous elytra, 5.5^{mm}.

With this additional knowledge it seems worth while to restore the name Dr. Horn once thought of employing.

Bone caves of Port Kennedy, Pennsylvania.

PTEROSTICHUS? sp.

Pl. 1, Fig. 5.

Pterostichus? sp. Horn, Trans. Amer. Ent. Soc., V, 243 (1876).

"The greater portion of two elytra with the basal and apical ends wanting, indicate a form of larger size than any of our eastern species of Pterostichus. The elytral substance is in extremely bad state, being wrinkled and cracked in such a manner as to render a description of its surface impossible. It may be a Lophoglossus." Horn, loc. cit.

There are eight striæ besides that at the outer edge; the interspaces are 0.42^{mm} in width, more flattened than in P. lævigatus, broken into innumerable fragments, like sun-dried mud, resulting in a dead-black color, but with no indications that the surface was otherwise than quite smooth. The length of one of the elytra (the base broken) is 10^{mm}; its width (complete) 3.25^{mm}

Bone caves of Port Kennedy, Pennsylvania.

PATROBUS Megerle.

Patrobus gelatus.

Pl. 1, Fig. 48.

Of this species the only remains are a single prothoracic shield perfectly preserved. It is piceous, posteriorly truncate, its angles rectangular and as broad as the length; in advance of the hinder fourth expanding to nearly one-fourth greater width in the middle of the anterior half, and then again narrowing to the declivous front angles; the disk convex with a uniformly and rather deeply incised median line, each lateral half thus divided marked posteriorly by an abrupt flat and punctate depression, with well marked rounded outline, distinctly separated from the median incision on one side or the very narrow, marginate, lateral border on the other, and separated from the latter also by a longitudinal furrow not figured in the plate; otherwise the surface is smooth. It is undoubtedly related very closely to P. septentrionis Dej., differing principally in the sharp and sudden depression of the fossæ in the hind angles and their separation from the lateral border by a distinct incised longitudinal furrow.

Length of prothorax, 2.1^{mm}; greatest breadth, 2.75^{mm}.

Interglacial clays of Scarboro, Ontario. One specimen, No. 14586 (G. J. Hinde).

BEMBIDIUM Latreille.

Bembidium exoletum.

Pl. 5, Figs. 121, 122.

Bembidium exoletum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., II, 77–78 (1876).

A single, rather well preserved specimen, exhibiting the upper surface and impressions of parts of the legs. It is of about the size of B. inæquale (Say). The head is too poorly preserved to present any characters; the pronotum is of equal width anteriorly and posteriorly, its sides regularly and considerably convex, the posterior angles well defined, the hind margin slightly convex; its surface appears to be very faintly punctulate, at least posteriorly, and there is a slightly impressed median line. The elytra are shaped as in B. inæquale, and are provided with seven or eight very delicately impressed longitudinal striæ, made up apparently of a series of ad-

jacent punctures; the sutural edge is delicately marginate. The fragments of legs show simply that they are of the form usual in Bembidium.

Length of insect, 4.75mm; of pronotum, 0.88mm; width of same in the middle, 1.2mm; of same at the posterior border, 1mm; of the body at the humeral portion of the elytra, 1.6mm; of same at the middle of the elytra, 2.06mm; length of the elytra, 2.8mm; of fore femora, 0.96mm; breadth of same, 0.24mm; length of hind femora (?) 0.92mm; breadth of same, 0.36mm; distance apart of the elytral striæ, 0.11mm.

White River, near the Colorado-Utah boundary. One specimen, No. 34 (W. Denton).

Bembidium glaciatum.

Pl. 1, Fig. 40.

A couple of elytra represent this species, which seems to be nearly allied to the scarcely smaller B. longulum LeC. The humeral angle is not quite so prominent, and the striæ and punctures are more heavily marked. The striæ are indeed rather deeply impressed and equally so over the whole width of the elytron, but all become less pronounced and even obsolescent apically; the same is true of the punctures which on the basal half of the elytra are very heavy, making transverse creases in the neighboring interspaces, so that they are rather transverse than longitudinal or even circular. The sutural stria is as in B. longulum, and the texture of the surface of the interspaces, instead of being as in the modern species almost structureless, is marked with a fine but decided cross-ribbing, verging upon reticulation. The color is a rich carbonaceous with a purplish tinge.

Length of elytron, 3.2mm; width, 1.35mm.

Interglacial clays of Scarboro, Ontario. Two specimens, Nos. 14536, 14541 (G. J. Hinde).

Bembidium fragmentum.

Pl. 1, Fig. 45.

Another species of Bembidium from the glacial clays is represented by a single elytron with the tip broken off, differing from the preceding by its much less heavy markings and agreeing better among modern types with B. constrictum Say, which is of about the same size. The elytron is black, with a remarkably little developed humeral angle (though this is exagger-

ated in the plate by an unfortunate twist in the specimen) and with striæ almost wholly made up of tolerably heavy circular punctures, which fade out on the apical half of the elytron and are obsolescent on the sides. It is about as heavily marked as B constrictum.

Length of fragment, 3.6mm; probable length of elytron, 4mm; its breadth, 1.45mm.

Interglacial clays of Scarboro, Ontario. One specimen, No. 14509 (G. J. Hinde).

NEBRIA Latreille.

Nebria paleomelas.

Pl. 2, Fig. 20.

Nebria paleomelas Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 179B (1879).

A nearly perfect elytron with the humeral angle broken off represents a carabid, probably related to Nebria. A species is indicated which is of about the size of N. sahlbergi Fisch. The elytron is about two and a half times longer than broad: the surface is nearly smooth, piceous, with nine striæ, which are rather deeply impressed, and a scutellar stria, which unites with the first longitudinal stria at about one-sixth the distance from the base, in such a way as to make it appear equally forked in passing toward the base, its outer fork striking close to the base of the second longitudinal stria: the fifth and sixth striæ are united to each other and to the united third and fourth striæ, near the apex, by a wavy continuation of the sixth, after it has bent toward the fifth in running parallel to the seventh, as it curves toward and runs to the tip of the elytron: the ninth stria, which forms the edge of the elytron as it is preserved, shows no appearance whatever of ocellate punctures, although under the microscope some of the central striæ show slight signs of faintly indicated punctures near the middle of the elytron.

Length of elytron, 5.2mm; breadth, 1.8mm.

Nicola River, below main coal seam, British Columbia. One specimen, No. 58 (Dr. G. M. Dawson, Canadian Geological Survey).

LORICERA Latreille.

Loricera glacialis.

Pl. 1, Figs. 50, 57.

Loricera glacialis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 763 (1877).

Of this species a pair of elytra are preserved nearly complete, but cracked and flattened somewhat out of shape. It is allied to L. cærulescens L., but differs from it and from all other American species of Loricera in the much greater depth of the striæ and in the presence of distinct submarginal foveæ. The elytra are of a glistening, somewhat blue-black color. The striæ are strongly impressed, faintly though rather coarsely and profusely punctulate, the third interspace with three small, distinctly but not deeply impressed foveæ, arranged as in L. cærulescens, two near each other just above the middle of the elytra, and one behind the middle of the apical half; fifth interspace sometimes furnished with a pair of very faint foveæ near the middle of the elytra, much as in L. decempunctata Esch., about as far from each other as from the sutural border; and finally the ninth interspace, different from all the species of Loricera I have been able to examine, has eight or more small but distinct and deep foveæ, mostly situated in the apical half of the elytra, sometimes connected by oblique ridges with the next stria within. The interspaces are crossed by very fine wrinkles, scarcely visible with a simple lens. Seen on the under surface each of the punctures of the striæ are surrounded by a circle reaching to the circles around the adjoining punctures, reminding one somewhat of the upper surface of Elaphrus. The elytra are shaped as in L. decempunctata, particularly at the apex.

Length of elytron, 4.4^{mm}; breadth, 1.6^{mm}.

Interglacial clays, Scarboro Heights, near Toronto, Canada. Two specimens, Nos. 16416, 16417 (G. J. Hinde).

Loricera ? lutosa.

Pl. 1, Fig. 32.

A single elytron in a perfect state of preservation. It is almost two and a half times longer than broad, scarcely broader in the middle than at the base, the humeral angle roundly angulated. There are ten series of very coarsely punctured striæ, the four inner running almost to the apical

margin, the others, however, curving inward to abut against them, the outermost meeting the innermost at the apex; the elevated narrow interspaces smooth and shining; the whole piceous.

This can hardly be referred to Loricera, but I can find no other genus with which it better agrees. I am inclined to the belief that it will be found to belong to an extinct type of Loricerini. There seems to be, as there, a faint internal plica, but the specimen is broken only at just this point.

Length of elytron, 3.3mm; breadth, 1.4mm.

Clay beds of Scarboro, Ontario, Canada. One specimen, No. 14559 (G. J. Hinde.)

ELAPHRUS Fabricius.

Elaphrus irregularis.

Pl. 1, Fig. 56.

An elytron only is preserved, which by its surface sculpture appears to resemble E. viridis, of California (which I have not seen), more than any other, though in size it agrees better with E. riparius and E. ruscarius, the nearest allied of the species I have examined. The elytron is distinctly slenderer than in these latter species, with the middle scarcely, if at all, wider than the base, but with entirely similar apex. Surface uniformly punctured, the punctures coarser than in E. riparius, with ill-defined obscure foveæ, the basal one of the second series from the suture being the only one as distinct as in E. riparius; spaces between the foveæ remarkably elevated, forming longitudinal, more or less tortuous ridges which are highest (and rarely polished) in longitudinal dashes as long as the diameter of the foveæ and in the same lines with them, i. e., between foveæ of the same longitudinal series and not in the interspaces between the series. It is in these elevated spaces that its relationship to E. viridis especially appears, and their irregularity, through their more or less tortuous connecting, less elevated ridges, which has suggested the name. Color dull piceous, with faint dark metallic green reflection, which is quite distinct on the inflected margin.

Length of elytron, 4.5mm; breadth, 1.5mm.

Clay beds of Scarboro, Ontario. One specimen, No. 14527 (G. J. Hinde).

NEOTHANES gen. nov. (*νέος*, *θνήσκω*).

Allied to Carabus, and belonging to the same tribe, Carabini. It differs from it in some marked features of the head, but agrees better with it than with the Cychrini, in which it was formerly placed. The head is unusually broad and short, the width between the base of the not very prominent round eyes being nearly twice as great as the length from the center of the eyes to the margin of the labrum, while the burial of the head in the prothorax up to the base of the eyes renders the brevity more apparent; the labrum is entire, its base just in front of the insertion of the antennæ; mandibles shorter and stouter than in Carabus and Calosoma, arcuate, untoothed; tip of maxillæ just as stout as (though probably thinner than) the apex of the mandibles. The head does not appear to be constricted behind the eyes, though but little of that portion can be seen in the single specimen which preserves this part. Prothorax and elytra as in Carabus, excepting that the latter have no foveæ whatever, and the very numerous striæ are straight and the interspaces smooth and unbroken.

NEOTHANES TESTEUS.

Pl. 7, Figs. 32, 39.

Cychrus testeus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 758-759 (1878).

This species was first described from the less perfect and more obscure specimen of the two now before me. The better preservation of the second, with its thorax and other parts, shows that the species should be placed in the Carabini rather than in the Cychrini. The stout and untoothed mandibles leave no doubt on this point.

The pronotum is broadest somewhat in advance of the middle and tapers with about equal rapidity toward the front and toward the base, so that the base is somewhat narrower than the front, the external angles well rounded; the front margin is nearly, the hind margin quite, straight, the former scarcely angulate in the middle, the lateral angles slightly produced anteriorly; there is a faint median carina, more pronounced in the middle, but otherwise the thorax appears to be tolerably smooth, though laterally the head is longitudinally subrugulose. The elytra have the humeral angle well rounded off and the tip angulate; the striæ are close and crowded to the number of about twenty-five on each elytron, sharp and clean, but

rather shallow, and with scarcely the slightest sign of any uncertainty of direction or waviness of course such as is common in the Carabini; nor do they combine and divide, but are equidistant and parallel throughout, the interspaces smooth and not imbricated.

Length of body to tip of mandibles, 11[mm]; length of head from posterior edge of eyes to front of clypeus, 1.25[mm]; of prothorax, 2.15[mm]; of elytra, 7[mm]; width of head between the eyes, 1.7[mm]; of prothorax in front, 2.75[mm]; at widest, 3.5[mm]; at base, 2.5[mm]; of elytra, 4.8[mm].

Green River, Wyoming. Two specimens, Nos. 24 (L. A. Lee), 4059 and 4100 (S. H. Scudder).

CYCHRUS Fabricius.

Cychrus wheatleyi.

Pl. 1, Fig. 1.

Cychrus wheatleyi Horn, Trans. Amer. Ent. Soc., V, 242 (1876).

"Of this species I have before me a flattened thorax, all the actual substance of the upper surface being present in moderately good preservation, and the large portion of a left elytron of which but a small portion of the substance remains.

"The thorax although flattened bears evidence of having the disk moderately convex, the median line distinct, the transverse basal impression rather deep and the lateral margins broad, wider at base and reflexed. The hind angles are obtuse and not prolonged, the base being moderately emarginate. The sides are moderately arcuate and gradually narrowed toward the base, the widest portion of the thorax being slightly in front of the middle. A species is thus indicated resembling viduus but smaller, not exceeding in size the average specimens of andrewsii.

"The elytra are finely striate, the intervals moderately convex and apparently smooth, the striæ with moderate punctures not as closely placed as in any species on this side of the continent. The striæ are as numerous as in viduus or andrewsii.

"Thorax.—Width, .24 inch, .6[mm]; length, .16 inch; 4[mm].

"Elytra (restored).—Width, .48 inch; 12[mm]. Length, .66 inch; 16.5[mm].

Bone caves of Port Kennedy, Pennsylvania.

"I think there is very little doubt of the distinctness of this species

from any at present existing, but it may be inferred that it is the species to which our viduus must look for its ancestry.

"I have named the species in honor of Mr. Charles M. Wheatley, of Phœnixville, to whom we are indebted for the exploration of the locality in which the fossil insects were discovered." Horn, loc. cit.

Including the striæ next the margins of the elytra there appear to be fourteen in all; the two outer ones are obscure and those upon the disk are at an average distance apart of 0.375^{mm}; the striæ appear to be faintly punctured and the punctures as distant as the striæ; the intervals between the striæ are broken by irregular impressed lines producing a tuberculate appearance but otherwise smooth. The disk of the prothorax is considerably more quadrate and proportionally broader than in the species of Cychrus with which Dr. Horn compares it. Indeed, I was at first inclined to believe that the lateral lamellate rim was narrow and equal throughout, and therefore to place the insect in Calosoma (in the neighborhood of the species sometimes referred to Callisthenes); but a renewed study in company with Dr. Horn shows that this is a mistake, and that the rim broadens greatly behind, leaving a somewhat shield-shaped disk as in Cychrus viduus.

Length of thorax, 3.6^{mm}; breadth of same, 6^{mm}; breadth of elytron, 6^{mm}; length of fragment preserved, 12.75^{mm}.

Bone caves of Port Kennedy, Pennsylvania.

Cychrus minor.

Pl. 1, Fig. 2.

Cychrus (*minor*) Horn, Trans. Amer. Ent. Soc., V, 243 (1876).

"Two fragmentary elytra of smaller size than the preceding [C wheatleyi] afford the only groundwork for the name above suggested. The striæ are fine and with fine punctures, the intervals feebly convex, evidently slightly rugulose, and probably, also sparsely punctulate An impression of the scutellum remains which is broadly triangular, and not different in form from that of andrewsii.

"Elytra (restored). Length, .54 inch; 13.5^{mm}. Width (actual), .15 inch; 3.75^{mm}.

"The form is therefore almost exactly that of andrewsii." Horn, loc. cit.

There is a slight bluish cast to the black chitinous parts of the elytra

I have examined; the punctures of the striæ are about as far apart as two-thirds the width of the interspaces; the latter are 0.25^{mm} wide and are barely convex, slightly rugulose, and so far as I can determine not at all punctulate: the length of the fragment of one elytron is 10.5^{mm}, the width of the same elytron, 4.25^{mm}.

Bone caves of Port Kennedy, Pennsylvania.

DIPTERA Linné.

Baron R. von Osten Sacken and Mr. Edward Burgess have given me much assistance in perplexing points while studying the Diptera here recorded.

DIPTERA CYCLORHAPHA Brauer.

Family LONCHÆIDÆ Loew.

LONCHÆA Fallén.

LONCHÆA SENESCENS.

Pl. 3, Fig. 18.

Lonchæa senescens Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 277–278 (1877).

A portion of the body (excluding the head) too fragmentary to be of any value and a pair of expanded wings faintly impressed on the stone compose the remains of the single individual of this species. The wings are rather slender, obovate and well rounded, with the neuration of Lonchæa vaginalis Fall., as given by Westwood in Walker's "Diptera Britannica," excepting that the basal cells do not appear to be quite so large in the fossil species, and the fourth longitudinal vein is slightly more arched beyond the larger transverse vein; the costal vein is bristly; the wing appears to be hyaline, but there is an indication of a slight infumation along the larger transverse vein; it is covered with excessively fine microscopic hairs, which also cover all the veins with a delicate pubescence; with this exception the first longitudinal vein is bare; the larger transverse vein is slightly oblique, and but little larger than the portion of the third longitudinal vein lying between the two transverse veins.

Length of wing, 4.6^{mm}; breadth of same, 1.8^{mm}.

Quesnel, British Columbia. One specimen, No. 17, Dr. G. M. Dawson, Geological Survey of Canada.

PALLOPTERA Fallén.

Palloptera morticina.

Pl. 3, Fig. 15.

Palloptera morticina Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 278 (1877).

An indistinguishable crushed mass of chitine and the basal half or more of a single wing are all that remain of this creature. The wing is small and probably was not over three millimeters long; hyaline, with a slight infumated spot of considerable size in the middle of the wing between the two transverse veins; the basal cells are small; the auxiliary vein is very slight, and throughout very closely approximated to the first longitudinal vein; the latter appears to be short and nearly straight, bare of bristles, but pubescent like the rest of the wing; the costal vein is bristly, but like all the others is pale testaceous; the small transverse vein lies within the tip of the first longitudinal vein; the large transverse vein is straight and perpendicular to the costa, removed from the small transverse vein by double its own length.

Length of fragment of wing, 2.15^{mm}.

Quesnel, British Columbia. One specimen, No. 20 (Dr. G. M. Dawson, Geological Survey of Canada).

Family ORTALIDÆ Fallén.

LITHORTALIS Scudder.

Lithortalis Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 276–277 (1877).

This ortalid can certainly not be referred to any of the American genera mentioned by Loew. It is most closely allied to Ceroxys, but besides a different distribution of the spots the neuration of the wing varies so much from that of Ceroxys as to render it certain that it should be separated from it. The shape of the wing is much as in Ceroxys, especially as in C. canus Loew, to which it is also most nearly allied in markings; the first longitudinal vein has bristles upon its end only, and even here they are few and small; the fourth longitudinal vein is curved backward a little, and the posterior angle of the third basal cell is not at all produced; the third and fourth longitudinal veins diverge at their tips, while the second and third converge. In Ceroxys the auxiliary runs beside the first longitudinal vein

for some distance and then suddenly curves, almost bends upward. In Lithortalis the separation is gradual and not abrupt. In Ceroxys the small transverse vein lies below or outside the tip of the first longitudinal vein; in Lithortalis it lies within it. In the pattern of the markings also it differs from Ceroxys in that there are no spots whatever before the larger transverse vein, excepting that the stigma, or the space lying between the auxiliary and first longitudinal veins, is testaceous.

Lithortalis picta.

Pl. 3, Figs. 10, 16.

Lithortalis picta Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 277 (1877).

The thorax, part of the abdomen, and both wings of the single specimen preserved show the upper surface of the body with expanded wings. The abdomen is without markings. The wings are very well preserved, the apex slightly angulated between the third and fourth longitudinal veins; the costa nearly straight on its basal half, strongly convex beyond; the stigma occupies the entire space between the auxiliary and first longitudinal veins and is dark castaneous, deepening toward the costa to blackish fuscous; the costal vein is blackish fuscous; the other veins are luteo-testaceous, deepening to blackish fuliginous next or in the spots; the other spots are dark fuliginous, deepening toward the veins or the margin, and consist of a narrow belt following the larger transverse vein and of confluent spots at the tips of the second, third, and fourth longitudinal veins, forming a narrow marginal belt from just below the tip of the fourth longitudinal vein to half-way between the tips of the first and third longitudinal veins, broadening slightly at the extremities of the veins in rapidly narrowing shoots, which follow the veins a short distance.

Length of thorax and fragment of abdomen, 3^{mm}; breadth of thorax, 1.25^{mm}; breadth of abdomen, 1.5^{mm}; length of wing, 5^{mm}; breadth of same, 1.75^{mm}.

Quesnel, British Columbia. One specimen, No. 5 (Dr. G. M. Dawson, Geological Survey of Canada).

Family SCIOMYZIDÆ Fallén.

SCIOMYZA Fallén.

Sciomyza revelata.

Pl. 3, Figs. 3–6.

Sciomyza revelata Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 275–276 (1877); 1876–1877, 458–459 (1878).

Three specimens are to be referred to this species. Although each of them is rather imperfect, the collocation of the fragments enables us to reconstruct all parts of the wing. The head was about one-fifth the size of the thorax; the thorax broadly vaulted, abruptly arched in front, somewhat depressed above; the wings were a little more than twice as long as broad with the costal border gently arched, the apex slightly angulated and the lower margin pretty regularly convex, bent but rounded at the axillary angle; the membrane and the castaneous veins as well are covered not very profusely with delicate microscopic hairs, distributed with great regularity and about 0.02^{mm} apart; the costal vein is setose throughout the upper margin, and extends to the fourth longitudinal vein, although it is but faint at the extreme tip or on the lower third of the space between the third and fourth longitudinal veins; the auxiliary vein is weak, but distinctly separated from the first longitudinal vein from its very base, terminating at the middle of the basal half of the costa; the transverse shoulder vein is exactly transverse, very faint, and lies a little beyond the base of the basal cells; the first longitudinal vein is bare save the pubescence, and apparently terminates just within the small transverse vein; the latter lies as far before as the large transverse vein lies beyond the middle of the wing and is midway between the basal cells and the large transverse vein; the second and third longitudinal veins are nearly straight, slightly sinuous and subparallel throughout, but at their tips diverge from each other; the third longitudinal vein is regularly though but slightly arched beyond the small transverse vein, and strikes the very apex of the wing; the fourth longitudinal vein is made up of three perfectly straight subequal parts, slightly bent at the transverse veins; the larger transverse vein is straight, nearly perpendicular to the costa; it is about half the length of the middle portion of the fourth longitudinal vein, and its lower extremity is nearer the margin of the wing (following the course of the fifth longitudinal vein) than its own

length; the fifth longitudinal vein is lost just before reaching the margin and the sixth runs half-way to it; the second and third longitudinal veins separate just over the extremities of the small basal cells, and originate from a transverse vein which unites the first and fourth longitudinal veins before the middle of the basal cells.

Length of the wing, 4.5^{mm}; breadth, 2^{mm}.

Quesnel, British Columbia. Three specimens, Nos. 2, 42, 43 (Dr. G. M. Dawson, Geological Survey of Canada).

SCIOMYZA? MANCA.

Pl. 4, Fig. 9; Pl. 9, Figs. 1–6, 15, 16, 18, 20, 23, 24, 28, 29.

Sciomyza? manca Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 756–758 (1878).

This fly, extremely abundant in the Green River shales—in fact outnumbering all the other Diptera together—is temporarily placed in this genus, because its characters seem to agree better with those of the family Sciomyzidæ than of any other; yet it can not properly be placed in any of the genera known to me. I should be inclined to place it near Blepharoptera in the Helomyzidæ, but all the tibiæ are bristled throughout. Its general appearance is that of the Ephydrinidæ, but the bristly surface of the middle tibiæ would allow us to place it only in the Notiphilina, from which it is excluded by the want of pectinations on the upper side of the antennal bristle. The want of complete neuration prevents me from designating it at present by a new generic name, which it can hardly fail to require as soon as that is known; only two or three of the three-score specimens before me have any important part of the wings, and this constant fragmentary condition of the fossils has suggested the specific name. The genus in which it would fall may be partially characterized as follows: Body compact, stout; the head comparatively small, perhaps one-third the bulk of the thorax, about three-fourths its width, with large, naked eyes, the front between them nearly equal and pretty broad, obliquely sloped, and slightly tumid on a side view, so as to project considerably below; a few curved bristles project from its summit. Antennæ with the flagellum subglobose, scarcely longer than broad, much larger than the joints of the scape, and above bearing at its tip a curved, rather short, naked, tapering style, scarcely longer than the flagellum proper and bluntly pointed; in several specimens in which this part is pretty well preserved this is inva

riably its character, and no terminal thread can be seen in any of them, nor any indication of joints in the style; this brevity of the style seems to be peculiar. As far as the neuration of the wing can be made out (there must remain some doubt upon this point until better examples are discovered) the course of the auxiliary vein can not be determined; the first longitudinal vein appears to end before the middle of the costal border; the second originates abruptly from the middle of the first longitudinal vein, and terminates (certainly) only a little way before the tip of the wing; the third runs very nearly parallel to the second longitudinal vein, terminates at the tip of the wing, and is perhaps connected by a cross-vein with the fourth longitudinal vein scarcely within the extremity of the first longitudinal vein; the fourth longitudinal vein originates from the fifth or sixth a little before the origin of the second longitudinal vein, diverges rapidly from the third beyond this connection, and is arcuate, curving upward again before reaching the posterior border and running outward to the outer border; the fifth longitudinal vein curves still more strongly from the fourth, until it reaches the middle of the posterior border, to which it suddenly drops, and scarcely above which it is united with the fourth longitudinal vein by a long, oblique cross-vein. The femora are stout, the front pair largest at the base and tapering, the other pairs subequal throughout, all armed externally above and below with a row of very delicate, nearly straight spines, the upper row perhaps wanting on the middle femora, and the lower row developing into longer and stiffer bristles on the apical half of the fore femora. The tibiæ are equal, a little longer than the femora, considerably slenderer but still rather stout, furnished alike with several straight, longitudinal rows of minute spines, and on the outer side with three or four distant, moderately stout, longer spines (less prominent on the fore tibiæ than on the other legs), and at the tip with a cluster or several similar spines or spurs. The tarsi are very much slenderer than the tibiæ, longer than they, the other joints slenderer than the metatarsus, all profusely armed with exceedingly delicate spines or spinous hairs, arranged regularly in longitudinal rows: at tip is a pair of very slender, pretty long, strongly curved claws, and apparently a pretty large pulvillus.

The brevity of the antennal style, the length of the first longitudinal vein of the wing, the approximation of the middle transverse vein to the base, the strong arcuation of the fourth longitudinal vein, the obliquity of

the posterior, large, transverse vein, and its approach to the posterior margin, the bristly nature of the legs, and the length and comparative slenderness of the tarsi—all, excepting parts of the neuration, characters open to little question—render this fly peculiar and its exact location somewhat dubious. When, however, the neuration of the wing is sufficiently well known to enable us to understand more definitely the character of the basal cells and other parts of the base of the wing, the relation of the auxiliary to the first longitudinal vein, and to map unquestionably the whole course of the fourth longitudinal vein, we shall probably be able to arrive at very precise conclusions.

In addition to the features above mentioned, it may be added that the thorax is subquadrate, scarcely longer than broad, furnished with distant, long, curving bristles disposed in rows, but in no individual well enough preserved to give further details of distribution. The abdomen is composed of five visible, subequal joints; its mass compact, scarcely constricted at the base, regularly and pretty strongly arched on a side view, tapering rapidly on the apical half to a bluntly rounded apex, the surface abundantly clothed with rather delicate spinous hairs, those at the posterior edge of the segments longer, and forming a regular transverse row. The metatarsus of the middle leg is proportionally longer than in the others, where it is about half as long as the other joints combined

Measurement of average individuals: Length of body as curved, 4.25^{mm}; of head, 0.65^{mm}; of thorax, 1.7^{mm}; of abdomen, 2.2^{mm}; breadth of head, 0.85^{mm}; of thorax, 1.25^{mm}; of abdomen, 1.4^{mm}; length of flagellum of antennæ, 0.16^{mm}; of style, 0.19^{mm}; of wing, 3.4^{mm}?; breadth of same, 1.2^{mm}; length of femora, 0.75^{mm}; of tibiæ, 0.95^{mm}; of fore tarsi, 0.85^{mm}; of middle tarsi, 1.5^{mm}; of hind tarsi, 1.6^{mm}; of fore metatarsi, 0.4^{mm}; of middle metatarsi, 0.64^{mm}; of hind metatarsi, 0.48^{mm}; breadth of femora, 0.28^{mm}; of tibiæ, 0.12^{mm}; of metatarsus, 0.08^{mm}; of tip of tarsi, 0.05^{mm}; length of claws, 0.09^{mm}

Green River, Wyoming. Numerous specimens, collected by Mr. F. C. A. Richardson, Dr. A. S. Packard, Prof. L. A. Lee, Messrs. F. C. Bowditch, and S. H. Scudder. Station 16 on the White River in western Colorado (Dr. C. A. White)

Sciomyza? disjecta.

Pl. 9, Figs. 7, 22, 25, 30, 32, 33.

Sciomyza? disjecta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 758 (1878).

A second species, apparently of the same genus as the last mentioned, but smaller, is found in considerable numbers in the same Green River beds, although in far less abundance than the last. The wings appear to be proportionally shorter than in the last species, with a rather broader space between the veins in the upper half of the wing, indicating perhaps a broader wing. The legs are slenderer, the disparity in the stoutness of the tibiæ and tarsi is not so great, and the tarsi are proportionally shorter; the legs are also as densely, though less coarsely, spined, and a similar delicacy is observable in the hairiness of the body. All the specimens are preserved on a side view, and like the last species are in a fragmentary condition.

Length of body of an average individual, 3.2^{mm}; of head, 0.55^{mm}; of thorax, 1.2^{mm}; of abdomen, 1.8^{mm}; of wing, 2.4^{mm}?; of hind femora, 1.2^{mm}; of hind tibiæ, 1.4^{mm}; of middle and hind tarsi, 1^{mm}.

Green River, Wyoming. Numerous specimens by the same as the last species.

Sciomyza? sp.

Pl. 10, Fig. 5.

Another species of Sciomyza, or perhaps of the same genus as the last-mentioned species (for several of its features are certainly repeated here), seems to be represented by the insect figured in Pl. 10, Fig. 5, which is of about the size of S. manca, but is more delicate. It is however so imperfect as far as the head and wings are concerned that one can not characterize it satisfactorily without better material.

Green River, Wyoming. One specimen, No. 18 (Dr. A. S. Packard).

Family HELOMYZIDÆ Westwood.

HETEROMYZA Fallén.

Heteromyza senilis.

Pl. 3, Figs. 1, 2.

Heteromyza senilis Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 275 (1877).

In this case we have but a fragment of one wing, but one which exhibits most of the peculiarities of neuration, and, so far as it goes, very well preserved. The wing is slightly discolored, but was apparently hyaline in life, covered rather profusely with exceedingly delicate microscopic hairs which cover veins as well as membrane: the veins, excepting the costal, are testaceous; the costal vein is blackish fuscous, covered with short bristles, and extends beyond the third longitudinal vein, where the wing is broken; the auxiliary vein strikes the costa at about the end of the first quarter, and the nearly straight first longitudinal vein before the middle of the wing; this latter vein is bare or only feebly pubescent; the slightly sinuous, toward the extremity slightly upturned, second longitudinal vein divides about equally the space between the costa and the third longitudinal vein; the latter is almost straight, scarcely bending to receive the small transverse vein at about the end of its basal third, and terminates at the broadly rounded tip of the wing; the small transverse vein lies just before the tip of the first longitudinal vein; the fourth longitudinal vein is nearly straight, only bent next the transverse veins; before the small transverse vein it is parallel and rather closely approximated to the third longitudinal vein; beyond, it diverges slightly and regularly from it, and beyond the large transverse vein again becomes parallel to it; only the basal portions of the fifth and sixth longitudinal veins are present, and the extreme base of the wing is lost; but the basal cells are evidently small, and their extremities lie just beneath the union of the second and third longitudinal veins; the wing is broad, ovate, and well rounded; the costa pretty strongly arched.

Length of fragment, 4^{mm}; probable length of wing, 4.5^{mm}; probable breadth of same, 2^{mm}.

Quesnel, British Columbia. One specimen, No. 1 (Dr. G. M. Dawson, Geological Survey of Canada).

Heteromyza detecta.

Pl. 5, Fig. 76.

Heteromyza detecta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 758–759 (1877).

A single specimen and a very poor reverse of it occur on the same stone with Spiladomyia simplex. Both wings and the thorax are preserved, with short fragments of moderately stout hairy legs. The venation is obscure, and the species referred provisionally to Heteromyza until better specimens decide more certainly to which of the groups of Muscidæ it belongs. So far as it can be determined the venation is very similar to that of the preceding species, but the wing is much smaller, and there is a peculiarity about it which is not quite clear: at the bend of the costa, indicating the termination of the auxiliary vein, there is a short, distinct, oblique cross-vein nearly in continuation of the base of the costa, but bent slightly downward, which reaches the first longitudinal vein; the latter runs close to the costa and strikes it about midway between the tip of the auxiliary vein and the tip of the wing; the costa apparently runs exactly to the tip of the second longitudinal vein; the third and fourth longitudinal veins run parallel to each other to a very little way beyond the extremity of the auxiliary vein, where they are united by a short cross-vein, beyond which they both diverge from each other in opposing curves, equally turned aside from their former course; the third longitudinal vein runs to the tip of the wing: the fourth is united half-way to the border of the wing by a long oblique cross-vein, running at right angles to the fifth longitudinal vein. The extremity of the basal cells apparently lies about half-way from the base of the wing to the tip of the auxiliary vein, but this point is very obscure.

Length of wing, 1.65^{mm}; breadth of same, 0.95^{mm}; length of thorax, 0.75^{mm}; breadth of same, 0.55^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Family ANTHOMYIDÆ Robineau-Desvoidy.

ANTHOMYIA Meigen.

Anthomyia inanimata.

Pl. 3, Fig. 19.

Anthomyia inanimata Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 273–274 (1877).

This species is pretty well represented by a single individual and its reverse, showing the superior view of the insect with the wings (excepting

the extreme base), most of the abdomen, and parts of the head, thorax, and legs. The wings are rather narrow and regularly rounded; the bristly costal vein extends to the tip of the fourth longitudinal vein; the first longitudinal vein terminates before the middle of the costal border, just above the small transverse vein; the auxiliary vein is distinct throughout and remains in close contiguity with the first longitudinal vein, curving first downward and then upward, and diverging from it only near the tip, and then but little, being separated from it at its tip by scarcely more than the thickness of the costal vein; the transverse shoulder vein is slightly oblique; the third longitudinal vein strikes the tip of the wing, and the second divides the space between this and the costa, running for the greater part of its length parallel to the latter, turning slightly upward at the tip; the third and fourth longitudinal veins are pretty closely approximated, and parallel as far as the transverse vein in the middle of the wing; from this to the large transverse vein they diverge gently, and are again parallel beyond; the small transverse vein is placed a very little before the middle of the wing; the large transverse vein is straight, nearly perpendicular to the costa, its lower extremity distant from the margin by about half its own length, its upper extremity dividing, just before the middle, the part of the fourth longitudinal vein lying beyond the transverse vein; the fifth longitudinal vein vanishes just before reaching the border; the two small basal cells are nearly equal in size, in length about midway between the lengths of the two transverse veins. The wing is covered pretty abundantly, veins and membrane, with delicate microscopic hairs, and appears to be uniformly hyaline, though a little fuscous on the stone. The specimen appears to be a male, and the tegulæ are distinctly marked, leaving no doubt that it belongs to this group of Muscidæ.

Probable length of body, 6^{mm}; length of wing, 6.2^{mm}; breadth of same, 2.25^{mm}; length of hind tibia, 1.45^{mm}.

Quesnel, British Columbia. One specimen, Nos. 30 and 32 (Dr. G. M. Dawson, Geological Survey of Canada).

Anthomyia burgessi.

Pl. 3, Fig. 34.

Anthomyia burgessi Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 271–275 (1877).

The single specimen of this species shows an upper view of the whole body in a somewhat fragmentary condition. The broad and rounded

abdomen indicates that it is a female. The wings are uniformly faint fuliginous, but probably hyaline in life, covered with microscopic hairs over both membrane and veins; they are short and broad and well rounded; the veins in the upper half of the wing are rather darker than those in the lower; the costal vein is bristly and extends to the tip of the fourth longitudinal vein: the stout first longitudinal vein strikes the costal at the middle of the front margin; the auxiliary vein appears to be confluent with the first longitudinal vein half-way from the base of the wing to the tip of the former; then, rapidly curving forward, diverges from it, and at its tip is as distant from the first longitudinal vein as the second longitudinal is from the third above the short transverse vein; the transverse shoulder vein is slightly curved and a little oblique and lies directly above the base of the small basal cells: the direction and relation of the longitudinal veins is the same as in A. inanimata, but the small transverse vein lies slightly beyond the middle of the wing, so that the divergence or parallelism of the veins is more marked than there; the large transverse vein is bent slightly inward in the middle, and its general direction is about midway between perpendicular to the costa and parallel to the neighboring border; its lower extremity is but half as far from the margin of the wing as its own length; its upper divides, a little before the middle, the portion of the fourth longitudinal vein which lies beyond the small transverse vein, but instead of being only half as long as the portion of the fourth longitudinal vein lying between the two transverse veins, as in A. inanimata, it is very nearly as long; the fifth longitudinal vein just fails of reaching the border, while the sixth only runs about two-thirds the distance to the border; the basal cells are moderately large, much as in the preceding species. On one side there are apparently remains of tegulæ, showing that the insect should be referred to this group of Muscidæ. The apical third of the hind tibia is furnished abundantly with not very long hairs, while the remainder of the tibia is bare.

Length of body, 4.75^{mm}; length of wing, 4.75^{mm}; breadth of same, 2^{mm}; length of hind tibiæ, 1.15^{mm}; length of hind tarsi, 1.25^{mm}.

Named for my friend Mr. Edward Burgess, whose critical knowledge of Diptera, before he turned his attention exclusively to naval architecture, was of the greatest service to me.

Quesnel, British Columbia. One specimen, No. 29 (Dr. G. M. Dawson, Geological Survey of Canada).

Family MUSCIDÆ Leach.

MUSCA Linné.

Under this head I have temporarily placed five species of dipterous larvæ which appear to belong to this family.

Nearly all of them, however, and especially Musca ascarides, so closely resemble the larvæ of bot-flies that I could scarcely persuade myself that they did not belong to the Œstridæ. The appendages of the skin, however, are much more delicate than is usual in Œstridæ, and are uniformly distributed over the surface or are altogether absent. The empty skins, too, have every appearance of belonging to the same insects as the complete bodies, and, although these are not cast skins (in which case they would be proved natural inhabitants of the water), for they still contain the harder parts of the internal organs in many cases, but rather remains of partially decomposed larvæ, it would seem improbable that so large a number of œstrid larvæ could be found, when the only way in which they could have reached their present condition would be through the droppings of animals affected by the bots standing in the water. Of course the reference I have given them is only provisional.

Musca ascarides.

Pl. 5, Figs. 74, 75, 79, 82–87, 98, 101.

Musca ascarides Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 756–757 (1877).

First there is a species to which a considerable number of specimens belong, which may take the name here given. Some of the specimens are complete; others consist of emptied skins only. When contracted the body is thick, especially on the anterior half, and about twice as long as broad, closely resembling the larva of a bot-fly. Both extremities are rounded, the anterior very broadly, while the posterior half tapers very regularly. In one specimen, which is not so much shrunken, the body is fusiform, and about three and a half times longer than broad, the head and hinder extremity tapering in a nearly equal degree. In the emptied skins, as in the others, it may be seen that the normal form is a blunt, squarely rounded head, behind which the body is nearly equal, and then tapers toward the tail. At the anterior extremity may be nearly always seen a portion of the mandibles, consisting of a pair of very slender rods or

blades converging anteriorly and terminating in two attingent rounded lobes attached to the inner edge of the blades. The anterior spiracles are seen in a single specimen as a simple, rounded, dark spot just outside the middle of either lateral half; the two lateral tracheal vessels may be seen in nearly all the specimens, and especially at the hinder extremity, and fragments of them are frequently scattered about on the stones; they are very large. The integument is generally rather dark and more or less blotched, and covered profusely and almost uniformly with backward-directed hairs; these are short, tapering, and moderately stout, though minute.

Length of contracted bodies, 11.5^{mm}; breadth of same, 6.25^{mm}; length of bodies not contracted, 17.5^{mm}; breadth of same, 5.75^{mm}; length of skins, 25^{mm}; breadth of same, 7.25^{mm}; length of blades of mandibles, 3.25^{mm}; diameter of tracheæ, 0.6^{mm}; of anterior spiracles, 0.4^{mm}; distance of latter apart, 2.75^{mm}.

Chagrin Valley, White River, Colorado. Several specimens (W. Denton).

Musca bibosa.

Pl. 5, Fig. 73.

Musca bibosa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 757 (1877).

Another species is represented by a single body and one skin and its reverse, which seem to belong to the same. It is closely allied to M. ascarides, but differs from it in some essential features. When contracted the body does not taper regularly from the middle of the front half to the tail, but the whole hinder half is much slenderer than the front and toward the tip has nearly parallel sides, so that the body is flask-shaped and about twice as long as broad. A similar, though not so abrupt, change of contour is seen in the skin. The structure of the mandibles and of the tracheæ may be seen to be the same as in the preceding species, but the integument is naked, being entirely destitute of any of the hairs which roughen the skin of M. ascarides.

Length of contracted body, 14^{mm}; breadth of same in front, 7.5^{mm}; behind, 3.75^{mm}; length of skin (a small one), 16^{mm}; greatest breadth of same, 5.25^{mm}; length of mandible blade, 2.75^{mm}; diameter of tracheæ, 0.75^{mm}.

Chagrin Valley, White River, Colorado. Two specimens (W. Denton).

Musca sp.

Pl. 5, Figs. 106, 108.

Musca sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 757 (1877).

A third species is represented by three or four contracted skins, which are too uncharacteristic to name, though it may be seen that they are distinct from the others. As preserved they are almost black; the skin is much wrinkled and smooth; the body pretty regularly and bluntly obovate, nearly twice as long as broad; at the end of one, two colorless oval patches lie united, side by side, pressed against the extremity, and doubtless represent the head, and prove it to be different from the other species; it is, however, impossible to say what its affinities may be

Length of body, 8.5^{mm}; breadth, 4^{mm}.

Chagrin Valley, White River, Colorado. (W. Denton).

Musca hydropica.

Pl. 5, Figs. 72, 92, 93, 107.

Musca hydropica Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 757–758 (1877).

A fourth species is represented by two bodies and a skin, which present an entirely different appearance from the preceding three species, but which may temporarily be given the same broad generic name. In this species the form, even when contracted, is far more elongated than in the others; the body is nearly five times as long as broad, is broadest just behind the roundly pointed head, tapers rapidly toward it, but gently posteriorly to the middle, behind which it is equal. In the skin the part of the body preserved is equal and very broad, excepting toward the head, where it rapidly narrows, the head being well rounded or slightly produced; the mouth parts, instead of being withdrawn a little from the front extremity of the body, as in the species already described, lie at its very boundary, and the blades are parallel instead of posteriorly divergent. The integument is covered rather profusely with very short, conical, tapering hairs, scarcely more than twice as long as their breadth at base. The larva is very distinctly banded with darker and lighter colors, as the empty skin shows, the posterior third of each segment being occupied by a very dark band, darkest on the dorsal surface, while a faint pale transverse line breaks the anterior portion into two equal halves of the same width as the blackish band.

Length of body, 23[mm]; greatest breadth of same, 5[mm]; breadth posteriorly, 3[mm]; breadth of skin, 9.5[mm]; length of segments on same, 4[mm]; length of mandible blades, 3.5[mm].

Chagrin Valley, White River, Colorado. Three specimens (W. Denton).

Musca vinculata.

Pl. 5, Fig. 77.

Musca vinculata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 758 (1877).

There is still another species allied to the last mentioned which may bear the name here proposed. It is represented only by parts of emptied skins, all lying on the same stone, and which differ from the preceding species in being absolutely devoid of any hairs and in having different and much fainter markings. The general color of the best preserved specimen is a pale brown, and the markings are scarcely darker transverse bands, narrowing on the sides, but occupying nearly the entire length of a segment dorsally, and broken into equal parts by two transverse rows of very faint and minute pale dots. No specimen is sufficiently perfect to show the shape or the length, but the shape appears to be similar to that of M. hydropica, and the insect much smaller than it, for the breadth is 4.5[mm], and the length of one segment, 2[mm].

Chagrin Valley, White River, Colorado. Several specimens (W. Denton).

Musca spp.

Pl. 5, Figs. 80, 81, 99, 100.

A wholly different form of larva is represented in Pl. 5, Figs. 80, 81, and on one of the stones are found the mouth parts of another, Pl. 5, Figs. 99, 100, which are quite different from those of Musca ascarides.

Chagrin Valley, White River, Colorado (W. Denton).

Family TACHINIDÆ Loew.

TACHINA Meigen.

Tachina sp.

Tachina sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 756 (1878).

To this genus is referred provisionally a small but stout and densely hairy fly, with thick, slightly tapering abdomen, broadly rounded at the tip,

long wings with heavily ciliated costal margin, the auxiliary vein terminating just before the middle, and the first longitudinal vein not very far before the tip; the other veins of the wing can not be determined. The legs are pretty stout and densely haired. About the fly are scattered many arcuate, tapering, spinous hairs 0.7^{mm} long, evidently the clothing of the thorax.

Length of body, 4^{mm}; breadth of thorax, 1.25^{mm}; length of wings, 4^{mm}(?); of hind femora, 0.6^{mm}; hind tibiæ, 1.25^{mm}; hind tarsi, 1.25^{mm} (?).

Green River, Wyoming. One specimen, No. 48^{b} (F. C. A. Richardson).

Family PLATYPEZIDÆ Loew.

CALLOMYIA Meigen.

Callomyia torporata.

Pl. 9, Fig. 11.

A single specimen is preserved showing a dorsal view of the body but with no distinct appendages excepting one wing which is imperfectly figured on the plate. The thorax is broad oval, and the abdomen oval, as long as the head and thorax together, narrower than the thorax, tapering from in front of the middle backward, and rounded at the tip. The wing is as long as the thorax and abdomen together. The third longitudinal vein terminates at the tip of the wing, the first in the middle of the outer half of the wing, and the second midway between them; the basal cells are about one-third the length of the wing (indicated in the plate by the angle in the fifth longitudinal vein), and the oblique posterior transverse vein is situated at its upper extremity, about midway between the middle basal cell and the apex of the wing. The exact length of the lower basal cell can not be determined.

Length of body, 3^{mm}; of wing, 2.7^{mm}; breadth of same, 1.1^{mm}.

Green River, Wyoming. One specimen, No. 71 (Prof. Leslie A. Lee).

Family CONOPIDÆ Leach.

POLIOMYIA Scudder (*πολιός*, *μυῖα*).

Poliomyia Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 754–755 (1878).

This genus of Conopidæ, most nearly allied to Myopa, appears in the neuration of the wings to resemble closely some genera of Syrphidæ, especially Xylota and Milesia, but it altogether lacks the spurious longitudinal

vein, and the third, fourth, and fifth longitudinal veins are not united at their extremities by marginal veins; indeed, they run without swerving and subparallel to one another to the margin. In this respect the genus differs also from other Conopidæ, as it does also in the extreme length of the third basal cell, which is as long as in Syrphidæ. In these points of neuration it would seem to agree better with the Pipunculidæ, which family, however, is entirely composed of very small flies, so that it seems better with our imperfect knowledge of the fossil to refer it to the Conopidæ. The body resembles that of Syrphus in general form The wings are as long as the body and slender, with very straight veins; the auxiliary and first to fourth longitudinal veins are almost perfectly straight, the third originating from the second longitudinal vein at some distance before the middle of the wing; the auxiliary vein terminates beyond the middle of the costal margin; directly beneath its extremity is the small transverse vein, and about midway between the latter and the margin the large transverse vein uniting the fourth and fifth veins; the extremity of the second basal cell is farther from the base than the origin of the third longitudinal vein, and the third basal cell reaches very acutely almost to the margin of the wing.

Poliomyia recta.

Pl. 9, Figs. 19, 21.

Poliomyia recta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 755 (1878); in Zittel, Handb. d. Palæont., I, ii, 807, Fig. 1072 (1885).

The single specimen referable to this species was obtained at the "Petrified Fish Cut," and represents a dorsal view of the insect with the wings partly overlapping on the back. It is the smaller fly referred to in Dr. Hayden's Sun Pictures of Rocky Mountain Scenery, page 98. The head is broken; the thorax is stout, rounded ovate, and blackish; the scutellum large, semi-lunar, and nearly twice as broad as long, with long black bristles along either lateral edge and along the sides of the thorax posteriorly. The wings are long and narrow; the auxiliary vein runs into the margin just beyond the middle of the wing; the first longitudinal vein runs into the margin at about two-thirds the distance from the tip of the auxiliary vein to that of the second longitudinal vein, and scarcely turns upward even at the tip; the straight second and third longitudinal veins diverge from each other at the extreme tip after running almost parallel

throughout the length of the latter, which originates from the second some distance before the middle of the wing; the small transverse vein between the third and fourth longitudinal veins lies just beyond the middle of the wing and perpendicular to the costal border, while the large transverse vein between the fourth and fifth longitudinal veins is perpendicular to the latter and renders the discal and second posterior cells of about equal length. The abdomen is apparently lighter colored than the thorax, regularly obovate, as broad as the thorax, and longer than it, its terminal (fifth) segment small, the others large and subequal.

Length of thorax and scutellum, 4^{mm}; breadth of same, 2.75^{mm}; length of abdomen, 4.5^{mm}; breadth of same, 2.75^{mm}; length of wing, 6.5^{mm}; breadth of same, 2.25^{mm}.

I am indebted to Mr. Edward Burgess for some critical remarks upon the affinities of this fly, and for a careful sketch of the neuration, which is very difficult to trace in certain places.

Green River, Wyoming. One specimen, No. 14696 (Dr. F. V. Hayden).

Family SYRPHIDÆ Leach.

MILESIA Latreille.

Milesia quadrata.

Pl. 9, Fig. 13.

Milesia quadrata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 752–753 (1878); Willist., Syn. N. A. Syrph, 281, 283 (1886).

A specimen in a fine state of preservation, although not perfect, and with most of the neuration of the wing concealed under hard flakes of stone which can not be wholly removed, was found by Dr. Hayden at the "Petrified Fish Cut," Green River. It is the larger fly alluded to in Dr. Hayden's Sun Pictures of Rocky Mountain Scenery, page 98. The head and thorax are black, the head large, nearly as broad as the thorax, the eyes large, globose, as broad as the summit of the head between them, the front very large, prominent, half as broad as the head, and half as long as broad. Thorax globose, a little longer than broad, largest in the middle. Wings surpassing slightly the abdomen; the third longitudinal vein originates from the second in the middle of the wing, is very gently arcuate (the convexity backward) in its outer half, and appears to terminate just above

the tip of the wing; the fourth longitudinal vein is united by an oblique cross-vein to the third very near the origin of the latter, and the spurious longitudinal vein can not be made out, from poor preservation; the marginal vein between these two appears to be very simple, the fourth longitudinal vein bending downward at its tip to meet it. The abdomen is as broad as the thorax, fully as long as the rest of the body, broad ovate, tapering slightly at the base and rapidly beyond the middle, broadest at the second segment; the first segment is longest and half as long as broad, the second and third slightly shorter, the fourth still shorter, and the fifth minute; the abdomen is light-colored, probably yellow in life, and the first three segments are rather narrowly margined posteriorly with black; the first segment is also similarly margined in front, and besides has a median black stripe of similar width, which divides the segments into equal lateral quadrate halves, whence the specific name; the whole abdomen is rather profusely covered with very brief, black, microscopic hairs, which are thickest in the black bands bordering the segments, and next the hind edge of the fourth and fifth segments, producing a dusky posterior margin, similar to but narrower than the dark belts of the preceding segments, and of course very inconspicuous.

Length of body, 18^{mm}; of head, 2.85^{mm}; of thorax, 5.65^{mm}; of abdomen, 9.5^{mm}; breadth of front, 2.4^{mm}; of head, 4.5^{mm}; of thorax, 6^{mm}; of abdomen, 6^{mm}; probable length of wing, 14.5^{mm}; length of hairs on abdomen, 0.04^{mm}; width of dark abdominal bands, 0.5^{mm}.

Dr. Williston thinks it can not be a Milesia, but that its affinities are rather with Syrphus.

Green River, Wyoming. One specimen, No. 14691 (Dr. F. V. Hayden).

ERISTALIS Latreille.

Eristalis lapideus.

Pl. 5, Figs. 48, 49.

Eristalis lapideus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 756 (1877); Willist., Syn. N. A. Syrph., 281, 283 (1886).

A poorly preserved specimen, showing little that is characteristic, but which belongs near Eristalis or Helophilus. The body is preserved on a dorsal aspect, with wings partially expanded; the head is nearly wanting, the thorax without markings. The wings are distinct only on the basal

half, and even here show no neuration at all beyond the general course of the principal veins at the very base; the alulæ, however, are very distinct, very large, their breadth (along the wing) fully equal to half the breadth of the thorax, dark, with obliquely transverse dark ridges, indicating that they were wrinkled in nature, much as in Volucella or Œstrus. Abdomen long, broadest in the middle of the basal half, beyond tapering considerably, the tip roundly pointed; apical half of basal joint black, forming a distinct transverse straight band; the number of abdominal joints appears to be five.

Length of thorax, 3.5^{mm}; breadth of same, 3.25^{mm}; length of abdomen, 6.5^{mm}; wings, 12^{mm}; breadth of same, 3.5^{mm}.

Dr. Williston thinks it can not be an Eristalis.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

SYRPHUS Fabricius.

Syrphus sp.

Syrphus sp. Scudd., Bull U. S. Geol. Geogr. Surv. Terr., IV, 755 (1878).

A species of this family, and in size second only to the Milesia from the same beds, is represented by reverse and obverse of a single specimen, which is too imperfect for description, only the body being preserved; the form and size of this agree best with the genus Syrphus.

The length of the body is 10^{mm}.

Green River, Wyoming. One specimen, Nos. 4110 and 4132 (S. H. Scudder).

CHILOSIA Meigen.

Chilosia ampla.

Pl. 9, Figs. 14, 27.

Cheilosia ampla Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 753–754 (1878).

This species is primarily founded on a single specimen which Mr. Bowditch and I found in the shales at Green River, and which preserves nearly all parts of the insect. There is also a specimen with its reverse which we obtained at the same place, and another which Mr. Richardson sent me from these beds, agreeing with the first-mentioned specimen, but a little larger. As only the bodies are preserved, they are temporarily placed

in this connection until other material is at hand, while the species is described wholly from the more perfect individual. This has a body more nearly of the shape of an Orthoneura, the abdomen being broader and stouter than is usual in Chilosia, but the wings are much longer than in the species of Orthoneura I have seen, and both the shape of the wing and its neuration agree well with Chilosia. The head is round and moderately large, the thorax stout and rounded ovate, the scutellum large, semi-lunar, twice as broad as long; all these parts are dark brown. The wings are very long and narrow, extending much beyond the tip of the abdomen, the costal edge very straight until shortly before the tip, where it curves rapidly; all the veins are very straight, especially those of the upper half of the wing; the auxiliary vein terminates in the middle of the costal border, the first longitudinal at the extremity of the straight part of the costa, beyond the middle of the outer half of the wing, the third at the tip of the wing, and the second midway between the first and third; the third is united to the fourth by a straight cross-vein in the middle of the wing, directly beneath the tip of the auxiliary vein, and about its own length beyond the extremity of the long second basal cell; the extremity of the third basal cell is very oblique and reaches the tip of the lower branch of the fifth longitudinal vein; the marginal vein, uniting the third and fourth veins, strikes the former just before the tip, while that uniting the fourth and fifth, toward which the fourth bends to receive it, is removed farther from the margin by about half the width of the first posterior cell. The legs are slender, scantily clothed with short, fine hairs. The abdomen is broad, oblong ovate, fully as broad as the thorax, broadly rounded at the apex, no longer than the rest of the body, of a light color, with darker incisures, and scantily covered with delicate hairs; it is composed of five segments, of which the second, third, and fourth are of equal length, the first shorter and suddenly contracted, the apical minute.

Length of body, 7^{mm}; diameter of head, 1.35^{mm}; length of thorax, 2.5^{mm}; breadth of same, 2^{mm}; length of abdomen, 3.5^{mm}; breadth of same, $2\ 2^{mm}$; length of wing, 6.4^{mm}; breadth of same, 1.8^{mm}; length of hind femora, 1.25^{mm}; of hind tibiæ, 1.25^{mm}; of hind tarsi, 1.25^{mm}.

Green River, Wyoming. Three specimens, Nos. 4112, 4135 and 4141 (F. C. Bowditch and S. H. Scudder), 40 (F. C. A. Richardson).

Chilosia ? sp.

Pl. 9, Fig. 26.

Another species resembling the last, but too large to be referred to it and too imperfect to be sufficient for characterization, occurs in the same beds. It is pretty plainly one of the Syrphidæ from its general appearance and from such remains of the neuration as are preserved. The abdomen is almost round, considerably surpassed by the wings, and consists of four visible segments, of which the second is conspicuous for its ornamentation, the margins being dark and joined by a blackish mesial longitudinal stripe, next which, on either side, the surface is much paler than elsewhere.

The length of the body is 7.1^{mm}; the apparent length of the wings, 6.75^{mm}; the breadth of the abdomen, 3^{mm}.

Green River, Wyoming. One specimen, No. 17 (Dr. A. S. Packard).

Chilosia sp.

Pl. 9, Fig. 8.

Cheilosia sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 754 (1878).

Two specimens of a smaller species of Syrphidæ, preserving the bodies, agree so completely with C. ampla, excepting in their much smaller size, that they are referred to the same genus; but as the wings are almost entirely lost the reference is made only to indicate the approximate place of the species, which need not be described until better material is at hand.

The length of the body is 4.25^{mm}.

Green River, Wyoming. Two specimens, Nos. 4113, 4150 (S. H. Scudder).

PSILOTA Meigen.

Psilota tabidosa.

Pl. 9, Fig. 9.

A headless body of a testaceous color with a nearly complete wing represents this species. Unfortunately it is not accurately drawn on the plate, the nearly invisible veins connecting the third and fourth longitudinal veins at their tips and closing the discal cell being omitted and the cross-vein being placed much too near the base. In reality it should lie scarcely within the middle of the discal cell, and the fourth longitudinal

vein should curve, brace-like ~~ to meet it, while the third longitudinal vein, from which the cross-vein parts at a right angle, runs in a straight course, as represented. The brace-like direction of the fourth longitudinal vein causes the discal cell to be of equal breadth in the distal half and about twice as broad as the proximal half, the whole cell being unusually long and narrow or fully five times as long as its greatest breadth. The first longitudinal vein reaches the margin nearer the tip of the second longitudinal than the auxiliary vein.

Length of headless body, 5^{mm}; of wing, 4^{mm}.

Green River, Wyoming. One specimen, No. 59 (Prof. Leslie A. Lee).

Syrphidæ sp.

Pl. 10, Fig. 9.

Another species of Syrphidæ appears to be represented in Pl. 10, Fig. 9, but it is too obscure for determination and is incompletely drawn on the plate. It is in any case a very small species. The basal cells appear to be long, extending nearly to the middle of the wing; the third longitudinal vein is certainly simple, and there are no intercalaries.

Green River, Wyoming. One specimen, No. 98 (Prof. L. A. Lee).

DIPTERA ORTHORHAPHA Brauer.

BRACHYCERA Zetterstedt.

Family DOLICHOPODIDÆ Loew.

DOLICHOPUS Latreille.

Dolichopus sp.

Dolichopus sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 756 (1878).

A specimen and its reverse are to be referred to this family by the structure of the abdomen and by the general aspect. The wings and head, however, are lacking. The thorax is globose, well arched, and, like the abdomen, of a light brown color, and ornamented with scattered, bristly, black hairs. The tip of the abdomen is recurved beneath.

The length of the fragment is 3.65^{mm}.

Green River, Wyoming. One specimen, Nos. 4124 and 4148 (S. H. Scudder).

Family CYRTIDÆ Loew.

ACROCERA Meigen.

ACROCERA HIRSUTA.

Pl. 5, Fig. 5.

Acrocera hirsuta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 755 (1877).

A single very fragmentary specimen appears to belong in the neighborhood of Acrocera, but is too imperfect to mention with any certainty. The size of the insect, the small head, robust and coarsely haired thorax, stout and abbreviated abdomen, indicate a form resembling that of Acrocera, and the tibiæ appear to be destitute of spurs; but the legs are not very slender and the neuration of the fragment of the wing does not agree well with Westwood's figure of A. globulus Panz. in Walker's Diptera Britannica. There are, however, only a few longitudinal veins next the base, disconnected and faint, so that they afford very slight indication of the real character of the wings, and the transverse veins being obliterated nothing can be said of the basal cells. Thorax and abdomen of about equal size.

Length of body, 4.5^{mm}; head, 0.6^{mm}; height of same, 1.3^{mm}.

Fossil Cañon, White River, Utah. One specimen (W. Denton).

Family ASILIDÆ Leach.

STENOCINCLIS Scudder (στενὸς, κιγκλίς).

Stenocinclis Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 751 (1878).

This genus of Asilidæ is founded wholly upon characters drawn from the neuration of the wing, the only portion of the insect preserved. It falls into the group of Dasypogonina, in which the second longitudinal vein terminates on the margin apart from the first longitudinal vein, instead of uniting with it just before the margin. It is not very far removed from Dioctria, but differs from it and from all Asilidæ I have examined in that the third longitudinal vein arises from the first before the middle of the wing, instead of from the second longitudinal vein after its emission from the first; the first longitudinal vein has therefore two inferior shoots, giving the wing a very peculiar aspect, and causing it to differ radically from all other Asilidæ; indeed, it would be hard to know where to look for a similar feature among allied Diptera, unless it be in the anomalous group of

Cyrtidæ. The wing is very slender and all the cells unusually elongated, which also gives it a unique appearance.

Stenocinclis anomala.

Pl. 9, Fig. 10.

Stenocinclis anomala Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 751–752 (1878).

This species is represented by a single fragment of a wing, which I found in the Green River shales. Nearly all the neuration is preserved; but the posterior margin is absent and the length of the cells which border upon it can not be accurately determined. The insect was evidently small, with a long and slender wing. The auxiliary vein terminates slightly beyond the middle of the costal margin; the first longitudinal vein runs up toward the margin where the auxiliary vein terminates, and follows along next the edge far toward the tip, as usual in this group; the second longitudinal vein originates from the first a little way before the middle of the wing, and with an exceedingly gentle sinuous curve, turning upward apically, terminates a little way beyond the first longitudinal vein; the third longitudinal vein originates from the first as far before the origin of the second longitudinal vein as the distance apart of the tips of the first and second longitudinal veins, and, running at first parallel and almost as close to it as the first longitudinal vein to the apical half of the costal margin, but distinctly separate throughout, it diverges slightly from it in the middle of the wing and terminates at the lower part of the apex of the wing, curving downward more strongly toward the margin; at the middle of the divergent part of its course, which is very regular, it emits abruptly a superior branch, which afterward curves outward and runs in a very slightly sinuous course to the margin, curving upward as it approaches it. The fourth longitudinal vein is seen to start from the root of the wing, and runs in a straight course until it reaches a point just below the origin of the second longitudinal vein, where it is connected with the vein below by the anterior basal transverse vein, and then bends a little downward, running nearly parallel to the third longitudinal vein, but continuing in a straighter course terminates on the margin at nearly the same point; these two veins are connected by the small transverse vein midway between the anterior basal transverse vein and the forking of the third longitudinal vein; the fourth longitudinal vein is connected by the posterior transverse vein

(which is scarcely as long as the small transverse vein) with the upper apical branch of the fifth longitudinal vein just beyond its forking, or opposite the forking of the third longitudinal vein; the fifth longitudinal vein forks previously to this, emitting a branch barely before the point where the anterior basal transverse vein strikes it, so that the branch almost appears to be a continuation of the transverse vein; and previous to this it has a distinct angle, where another vein is thrown off at right angles, directly opposite the upper extremity of the anterior basal transverse vein, and beyond the origin of the third longitudinal vein; the basal half only of the sixth longitudinal vein can be seen, but its direction shows that it unites with the lowest branch of the fifth at its apex, as in Dasypogon. All the cells throughout the wing are exceedingly narrow.

Length of wing, 6.75^{mm}; probable breadth, 1.6^{mm}.

Green River, Wyoming. One specimen, No. 4143 (S. H. Scudder).

Stenocinclis sp.

Pl. 10, Fig. 15.

Certainly to this family, not improbably to this genus, and perhaps to the single species described above, belongs the body of a fly figured on Pl. 10, Fig. 15. It is a male. The thorax is very stout, naked, and devoid of bristles. The femora stout, inflated, naked, and spineless; the tibiæ not one-third so stout, cylindrical, hairy, and apparently spinous, not so long as the femora; the tarsi densely hairy and spinous, the claws stout, strongly curved. The thorax and abdomen, the former more distinctly, show a microscopic longitudinal wavy carding of the integument, which is also faintly seen on the naked femora.

Length of body, 9.5^{mm}; of femora, 2^{mm}; breadth of latter, 0.7^{mm}.

Green River, Wyoming. One specimen, No. 45 (Prof. L. A. Lee).

Asilidæ sp.

A fly, apparently of this family, but in too imperfect a state for any reasonable identification at present, was found by Dr. G. M. Dawson three miles up the North Fork of the Similkameen River, British Columbia, and numbered by him 67 and 68.

Family STRATIOMYIDÆ Leach.

LITHOPHYSA gen. nov. (λίθος, φῦσα).

This genus, of the section Beridina, is peculiar for the plump, ovate abdomen, somewhat as in Diphysa, for having no lower intercalary vein, for the distance at which the lower branch of the fourth longitudinal vein arises from the apex of the discoidal cell and for the presence of six spines on the metanotum.

The head is large and nearly as broad as the stout oval thorax, the eyes occupying above all but a narrow mesial belt about a fifth the width of the head: the antennæ apparently as in Xenomorpha, short and tapering regularly apically. The metanotum has six coarse, equidistant, and not very long spines, the middle pair a little stouter than the lateral. The auxiliary vein terminates a little beyond the middle of the wing, and a little beyond, like the first and second longitudinal, it curves upward rather strongly at the extremity. The third longitudinal vein is forked. The basal cells are of equal length and half as long as the wing; the discoidal cell about twice as long as broad, two branches issuing from the two outer angles and the third branch from the lower border close to the second basal cell. Abdomen regularly ovate, broader than the thorax, composed of six visible segments, besides, probably, a basal segment, which the preservation of the fossil does not permit to be seen.

LITHOPHYSA TUMULTA.

Pl. 9, Fig. 31.

This species is represented by a single specimen which is tolerably well preserved. The thorax is darker than the head and abdomen, and the obscurity of the base of the latter leads to the presumption that it was pale in life; the hinder edges of the abdominal segments are a little darker than the rest of the abdomen. The wings are clear excepting the fuliginous stigma which embraces the interspaces on either side of the second longitudinal vein from where it parts from the third vein to its tip. The discoidal cell is almost regularly pentagonal, and would be quite so were the lower branch of the fourth longitudinal vein to arise a short distance farther toward the base; the base is outward, and the outer, upper, and lower sides are longer than the inner; it is situated about midway between the costal and

lower margins of the wing, and the auxiliary and first longitudinal veins, though closely approximate, are pretty distant from and parallel to the margin through most of their course.

Length of body, 5^{mm}; of wing, 4.5^{mm}; breadth of thorax, 1.5^{mm}; of abdomen, 1.9^{mm}; of wing, 1.75^{mm}.

Green River, Wyoming. One specimen, No. 4 (Dr. A. S. Packard).

ASARCOMYIA gen. nov. (α-, σάρξ, μυῖα).

This genus, also belonging to the section Beridina, is distantly related to Chiromyza Wied. Head slightly narrower than the globular thorax. Abdomen long, composed of seven joints, with nearly parallel sides, broader than the thorax. Antennæ with short basal, long and equal second, joint. Legs long and very slender, the tibiæ with a short row of spines near the tip, the apical ones no longer than the others. Wings with the third longitudinal vein simple, the first longer than the second basal cell, the discoidal cell emitting three long and nearly straight veins to the border, all arising apically, a fourth vein arising from the second basal cell; fifth and sixth longitudinal veins uniting close to the margin.

The simple third longitudinal vein, the unequally long basal cells, and the fourth branch of the fourth longitudinal vein with its origin from the second basal cell apart from the others, are characteristics which do not seem to be combined in any other genus. The discoidal cell is small, longitudinal, arched, situated a little above the middle of the wing.

Asarcomyia cadaver.

Pl. 9, Fig. 17.

Whole body and wings of a nearly uniform testaceous color, the thorax, legs, and principal veins of the wings a little darker. Metanotum with two large approximated basal bristles. The wings are tolerably broad, the costal margin nearly straight most of the way to the tip, the auxiliary vein reaching to a little beyond the middle of the wing, the second longitudinal arising from the third a little sooner, or at about the middle, and ending after a gently sinuous course considerably less than midway from the tip of the auxiliary to the tip of the arcuate third longitudinal vein. First basal cell closed scarcely beyond the tip of the auxiliary, at the middle of the discoidal cell. (In the figure the cross-vein before this is an accidental mark

on the stone.) Discoidal cell about three times as long as broad; second basal cell about half as long as the wing. Legs very slender, the tarsi longer than the tibiæ, and the hind tibiæ at least with an outer row of short spines on the apical third; all the legs sparsely covered with not very long hairs. Abdomen very thinly clothed with distant, moderately long, slender hairs.

Length of body, 4.5^{mm}; of wing, 3.5^{mm}; of hind leg, 4.2^{mm}; of hind tibiæ, 1.3^{mm}; of hind tarsi, 1.6^{mm}.

Green River, Wyoming. One specimen, No. 12 (Dr. A. S. Packard).

NEMATOCERA Latreille.

Family TIPULIDÆ Leach.

DICRANOMYIA Stephens.

Dicranomyia stigmosa.

Pl. 5, Figs. 16, 17, 25–27, 42, 43, 68, 69.

Dicranomyia stigmosa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 746–748 (1877).

The neuration and the presence of a stigma in a fine, nearly perfect specimen of this species indicate a form closely allied to D. pubipennis O. S., but the absence of any pubescence at the tip of the wing at once distinguishes it from the recent species. At first I supposed that it differed from other species of Dicranomyia in the absence of the auxiliary vein; but after careful study a faint trace of its apical portion was found in the same position relative to the origin of the second longitudinal vein as in D. pubipennis; as there also, the first longitudinal vein curves downward to, and terminates on, the second longitudinal vein, directly opposite the cross-vein uniting the discal cell with the third longitudinal vein, instead of on the costa; the subcostal cross-vein arises before the deflection of the first longitudinal, runs parallel with it until it curves, when it turns in the opposite direction to the costa. The discal cell is closed, but the cross-vein separating it from the second posterior cell is very faint, in which respect it agrees better with other Dicranomyiæ than with D. pubipennis. The stigma is confined to that part of the space between the first and second longitudinal veins which lies beyond the origin of the third longitudinal vein, but it also extends upward to the costa; it is nearly circular and faintly fuliginous.

An oblique supernumerary vein runs to the center of the stigma from a point in the first longitudinal vein directly above the origin of the third; that is, from the inner edge of the stigma. The outer and posterior margins of the wing are profusely fringed with very delicate hairs, longer than the thickness of the stout costal vein. The antennæ are fourteen-jointed, about twice as long as the head, the basal joints of the flagellum subglobular, the others obovate, the apical one more than twice as long as broad; they are delicately verticillate, the hairs being but half as long as the width of the joints. The male anal lobes are broadly obovate, deeply and abruptly excised externally at the base, so as to leave a sharp right angle outwardly and a narrow peduncle on the inner side. Together the lobes are broader than the tip of the abdomen, and each is about half as long again as broad.

Length of body, including the lobes, 6.5^{mm}; antennæ, 1.2^{mm}; wings, 7.5^{mm}; anal lobes of male, 0.55^{mm}.

Fossil Cañon, White River, Utah (W. Denton.)

A second specimen of what is apparently the same species, judging from the anal lobes, is somewhat stouter, but is destitute of all other appendages, excepting indeterminate fragments of the rostrum, so that no further knowledge of the species can be gained from it. The rostrum, however, would seem to be scarcely longer than the head.

Chagrin Valley, White River, Colorado (W. Denton)

In another specimen, also a male, the body, one of the wings, and part of the legs of one side are preserved; the whole is much fainter than in the other specimens, but the auxiliary vein can be traced midway between the costal and first longitudinal veins throughout nearly its whole length. What is apparently the rostrum is a very little longer than the basal joint of the antennæ and a very little shorter than the head. The character of the male appendages adds to the proof that this belongs to the same species as those previously mentioned, but the stigma of the wing is lost by the incompleteness of the preservation. The legs are very slender and delicately hairy throughout, with no sign of spurs, although it should be remarked that the extremities of the tibiæ are not well preserved.

Length of middle femora, 5.25^{mm}; middle tibiæ, 4.5^{mm}; hind femora, 5.75^{mm}; hind tibiæ, 5.5^{mm}.

Chagrin Valley, White River, Colorado (W. Denton.)

Another specimen is a female, with remnants of wings, having most of the veins scarcely traceable; enough of the right wing remains to be sure that it is this species, with which the size agrees.

Fossil Cañon, White River, Utah (W. Denton.)

Still another is similarly preserved; but on account of the partial folding of the wing no stigma can be seen, and the first longitudinal vein seems to unite, or almost unite, with the second so far from the branching of the latter that I was at first inclined to separate it; but the difference proves to be very slight. The antennæ of this specimen are pretty well preserved, but so bent as not to allow of direct measurement; the size agrees well with other specimens, although it is slightly smaller than the second specimen mentioned, which, however, is rather larger than the average. The specimen is a female.

Fossil Cañon, White River, Utah (W. Denton).

A head preserved on the same stone as the last specimen probably also belongs to this species.

In the last specimen to be mentioned we have the upper surface of an abdomen of a male Dicranomyia, apparently of this species, twisted so as to present a lateral view of the tip, showing the structure of the under surface of the appendages. The under inner edge is evidently thickened, and a slight hook projects a little beyond the broad lobe; as the lobe itself is preserved in a different view from what holds in the other specimens, and therefore has a slightly different contour, the specimen is judged to belong to this species only from the size of the abdomen and of its anal lobes.

Chagrin Valley, White River, Colorado (W. Denton).

Dicranomyia primitiva.

Pl. 5, Figs. 20, 21, 65–67.

Dicranomyia primitiva Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 748 (1877).

Two specimens, a little smaller than D. stigmosa, but still more closely resembling D. pubipennis, together with a third, which is simply a body, to which is attached the costal outline of a wing, and near which lies a leg, represent the female of this species. The two first mentioned are rather faintly preserved, but permit the venation to be traced with certainty, though with difficulty, and with one of them a portion of a detached (middle or hind) leg may be seen. The neuration of the wing differs from that

of D. stigmosa in the shape of the discal cell, the inner border of which is straight, and strikes the incomplete fifth longitudinal vein exactly where the lower cross-vein strikes it, so that the two are continuous and produce no break of direction in the fifth longitudinal vein. The auxiliary vein is not preserved, and there is no adventitious vein in the stigma, which otherwise is as in that species. The wing is not so slender as in D. stigmosa.

Length of body, 5.5^{mm}; wing, 5.5–6^{mm}; femur, 5^{mm}; tibia, 5.75^{mm}; first two joints of tarsi, 3.5^{mm}. The measurements of the leg are doubtful.

Fossil Cañon, White River, Utah. (W. Denton.)

Another poorly preserved specimen which by the structure of the male forceps is plainly to be referred to this genus is judged merely from its size to belong to this species, none of the characteristic parts of the neuration being preserved. The body is a very little smaller than in the females of this species, and the male forceps are ovate and rather large.

Length of body without forceps, 4.5^{mm}; forceps, 0.35^{mm}; breadth of one of them, 0.2^{mm}.

On the same stone with this is a leg which probably belonged to it, though some distance from it; the length of the femur is 5^{mm}; tibia, 4.5^{mm}; the tarsi are broken.

Same locality.

A single wingless male, taken by Mr. Richardson at Green River, Wyoming, can be referred doubtfully to this species.

About fifteen other specimens of Tipulidæ were collected by Mr. Richardson, Mr. Bowditch, and myself at Green River; but unfortunately not one of them presents the vestige of a wing and seldom anything more than the body. Probably some of them also belong to this species; others may with more doubt be referred to D. stigmosa but all are valueless for any precise determination, and, indeed, may not belong to Dicranomyia at all.

Dicranomyia rostrata.

Pl. 5, Figs. 40, 41, 63, 64.

Dicranomyia rostrata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 719 (1877).

A single specimen larger than the other species of Dicranomyia and about the size of Tipula decrepita Scudd. is provisionally referred to this genus. The head is very small, the thorax rather robust and very strongly

arched, and the abdomen shows it to be a female. The antennal joints are fifteen in number, the basal one stout, the apical slender obovate, the others globular; the palpi are four-jointed, the last three joints equal, and together as long as the first, the whole rather longer than the head, and therefore rather long for a Dicranomyia. The legs are lacking, the single wing detached, broken at the base, and longitudinally folded. Such of the neuration as can be disentangled agrees wholly with the peculiarities of this genus.

Length of fragment of body without head, 6^{mm}; breadth of head, 0.5^{mm}; length of antennæ, 2^{mm}; palpi, 0.9^{mm}.

Fossil Cañon, White River, Utah. (W. Denton.)

A second specimen is referred to this species, but with some doubt, as it consists of only a trunkwith no appendages excepting the male forceps. The specimen is slightly smaller than the female, as we should expect, and the plates at the extremity of the body differ from those of the other fossil species described in being of a regular, short, obovate form.

Length of body without forceps, 6.25^{mm}; of forceps, 0.6^{mm}; width of same, 0.28^{mm}.

Same locality.

SPILADOMYIA Scudder (σπιλάς, μυῖα).

Spiladomyia Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 749 (1877).

This genus is founded upon a peculiar form of fly allied to Dicranomyia. The palpi are no longer than the head; the thorax is comparatively slender, the legs very long and slender, and the wings shaped much as in Dicranomyia, with a peculiar neuration. The auxiliary vein terminates some way beyond the middle of the costal border; the first longitudinal vein terminates in the second, close to the tip of the wing; the second originates from the first beyond the middle of the wing, but some distance before the tip of the auxiliary vein; the third longitudinal vein originates from the second, near the middle of its course, beyond the tip of the auxiliary vein; a little distance beyond its origin, but much nearer the tip of the wing than usual, it is connected by a cross-vein with the fourth longitudinal vein; the first and second posterior cells are therefore very short; there is, then, but a single submarginal cell, three, or, if a very slight fork at the apex of the posterior branch of the fourth longitudinal vein be counted, four posterior cells, and no discal cell.

SPILADOMYIA SIMPLEX.

Pl. 5, Fig. 37, 38.

Spiladomyia simplex Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 750 (1877).

A single specimen and its reverse show nearly all the parts of the body, but all are faintly preserved, so as to be very difficult of study. The specimen is a female; nearly all the legs are preserved, and all but the base of the wings; the latter, however, trail along the abdomen, so that parts are obscured and the neuration is exceedingly faint. The head is small, the eyes almost exactly circular, the palpi a little shorter than the head, the antennæ composed of cylindrical joints, a little longer than broad, the legs slender, with femora, tibiæ, and tarsi of nearly equal length, and the wings as long as the body. The anterior branch of the fourth longitudinal vein is abruptly bent at its base, so as nearly to connect with the cross-vein uniting it with the third longitudinal vein, and the first and second posterior cells are scarcely more than three times as long as broad. The third posterior cell is but very insignificant, as the posterior branch of the fourth longitudinal vein forks but slightly and near its tip. The neuration of the lower part of the wing is uncertain.

Length of body, 7.5^{mm}; palpi, 0.35^{mm}; fore femora, 4.5^{mm}; middle femora, 4.5^{mm}; hind femora, 4.5^{mm}; fore tibiæ, 4.65^{mm}; middle tibiæ, 4.5^{mm}; hind tibiæ, 4.5^{mm}; fore tarsi, 4^{mm}; middle (or hind) tarsi, 4.5^{mm}. Measurements of tarsi uncertain.

Chagrin Valley, White River, Colorado. (W. Denton.)

PRONOPHLEBIA Scudder (*πρωΐν*, *φλέβιον*).

Pronophlebia Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 750 (1877).

This genus differs from all Tipulidæ known to me in the early origin of the third longitudinal vein, which springs from the second almost immediately after its own separation from the first longitudinal vein and some way before the tip of the auxiliary vein; the second longitudinal vein arises near the middle of the wing and branches, the inner branch apparently forking near its tip. These characteristics readily serve to distinguish it from other Tipulidæ. The head is small, the antennæ long, very slender, and more than thirteen-jointed. They are too imperfect in the specimen studied to allow of any further statement. The palpi are not preserved, but

the thorax is strongly arched and the neuration indicates that the genus belongs to the Tipulidæ brevipalpi, and with other signs that it is probably one of the Limnophilina, although the auxiliary cross-vein appears to be exactly opposite the origin of the second longitudinal vein. It is perhaps most nearly allied to Trichocera.

Pronophlebia rediviva.

Pl. 5, Fig. 39.

Pronophlebia redivira Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 750–751 (1877).

The single specimen of this species is spread at full length, but the stone containing it is broken. The specimen is a male. The antennæ are considerably longer than the head and thorax together, and the joints are shaped and ornamented as shown in the figure of Dolichopeza in Walker's Diptera Britannica. The head is small and the eyes so well preserved that they can be seen as in a living creature. The wings are very long and slender; the auxiliary vein terminates some distance beyond the middle of the wing; the first longitudinal vein about midway between that and the tip; the second longitudinal vein arises just within the middle of the wing, and the third longitudinal vein less than half the distance from that to the tip of the auxiliary vein; the second longitudinal vein forks just beneath the tip of the auxiliary vein, its upper branch bends just beneath the tip of the first longitudinal, and its lower branch appears to fork just beyond the middle of its course. Cross-veins appear to divide the interspace between the second and third longitudinal veins (the second submarginal cell) into three equal parts, and there is certainly a cross-vein in the interspace between the fourth and fifth longitudinal veins (the second basal cell) directly opposite the origin of the third longitudinal vein.

Length of body, 9.25^{mm}; antennæ, 2.6^{mm}; wings, 9.25^{mm}.

White River, near the Colorado-Utah boundary (W. Denton).

CYTTAROMYIA Scudder (*κύτταρος*, *μυια*).

Cyttaromyia Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 751 (1877).

This genus of Tipulidæ differs somewhat remarkably from any known to me. It appears to belong among the Tipulidæ brevipalpi, the first longitudinal vein terminating in the second much in the manner of Dicranomyia, with which, however, this genus seems to have little else in common.

Although the first longitudinal vein terminates in this way, no trapezoidal cell is formed near its extremity after the manner of the Tipulidæ longipalpi, but this portion is quite as in Dicranomyia. The position of the auxiliary vein is indeterminable from the fragment I have seen; but the "posterior intercalary vein" of Loew issues from the lower outer angle of the discal cell at a long distance from the great cross-vein, and in direct continuation of the fourth longitudinal vein. All these characteristics place it with the Tipulidæ brevipalpi; but the points wherein it differs from them, as indeed from all other Tipulidæ, are not a little extraordinary. Apparently it has certain relations with the Amalopina, and has some resemblance to Symplecta, but it may be questioned whether it should not form a section by itself in the neighborhood of the Ptychopterina.

The first longitudinal vein terminates in the upper branch of the second at no great distance from the tip of the wing; at the same point it is connected with the costa by an oblique cross-vein running in continuity with its terminal portion. *There are three submarginal cells and a secondary discal cell.* The large number of submarginal cells is due to the forking of the posterior branch of the second longitudinal vein, just as two submarginal cells are formed in Anisomera by the forking of the anterior branch of the same vein. The secondary discal cell is formed by the division of the third submarginal cell by a cross-vein, which unites with the elbow of the basal portion of the lower branchlet of the fork of the second submarginal vein, and leaves two cells beyond the supplementary discal cell, just as there are two cells (the first and second posterior) beyond the true discal cell; the latter lies directly below the secondary discal cell, but is twice as large as it. This is an anomaly quite unique, so far as I am aware, among the Tipulidæ.

Cyttaromyia fenestrata.

Pl. 5, Fig. 78.

Cyttaromyia fenestrata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 751–752 (1877).

This species is represented by the portion of a wing and its reverse, containing a little more than the distal portion with nearly all the important part of the neuration. The striking peculiarities of this have been pointed out in the description of the genus; but a few minor points, probably of specific value, may be added. The second longitudinal vein originates far

back toward (perhaps before) the middle of the wing, and half-way to the tip forks abruptly, the anterior branch immediately arching over and running to a point just above the extreme tip of the wing; the space between this portion of its course and the first vein is infuscated, forming a stigma; the posterior branch forks half-way toward the tip, the upper branchlet being in almost direct continuity with the main branch, while the lower diverges suddenly from it and unites with the cross-vein from the third longitudinal vein, after which it runs parallel to the other branchlet; the third longitudinal vein springs from the posterior branch of the second directly after its origin. The first and second posterior cells are of the same length as the lower two submarginal cells, and the discal cell is of a similar length. The lower part of the wing is confused from folding, but there is a cross-vein uniting the fourth and fifth longitudinal veins next the inner extremity of the discal cell; the discal cell extends farther by its own width toward the base of the wing than the secondary discal cell, and there is a slight appearance on the stone, as if the middle of the cross-vein forming the inner limit of the discal cell were united by a cross-vein to the second longitudinal vein shortly before it branches, thus forming a prediscal cell of irregular shape and about as long as broad.

Length of fragment, 5.5^{mm}; width of middle of wing, 2^{mm}.

Fossil Cañon, White River, Utah. (W. Denton.)

TIPULA Linné.

Tipula decrepita.

Pl. 5, Figs. 56, 57.

Tipula decrepita Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 752 (1877).

A single specimen, poorly preserved, is to be referred to the genus Tipula (s. str.). The head is small, the antennal joints very slender, obovate, between two and three times as long as broad, the thorax well arched, and the abdomen indicating a female; the legs are lacking; both the wings are present, but poorly preserved, and one of them imperfect; even the perfect one is badly folded longitudinally, but the costal border is nearly uninjured, and indicates the generic affinities, from the peculiar nature of the venation toward the apex; instead of forming toward the termination of the first longitudinal vein a large stigma-like cell, the second longitudinal vein appears to form, with a slight vein springing from below, a long and

exceedingly slender cell, above and outside of which the wing is slightly clouded.

Length of body without head, 6mm; diameter of head, 0.6mm; length of wings, 8.5mm.

White River. (W. Denton.)

Tipula tecta.

Pl. 5, Figs. 46, 47.

Tipula tecta Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 752–753 (1877).

A single specimen preserved on a dorsal aspect is of a larger size than the other Tipulidæ from this locality; its precise relationship can not be determined until other specimens are discovered, as it has no head nor legs, except a very slender fragment of a tibia; and the wings, being longitudinally folded and partially concealed by the body, along which they lie, show only that the neuration is not discordant with that of the crane-flies, with which its other features agree. The specimen is a female, with a slight, not greatly arched, thorax, and full and plump, though still slender, abdomen nearly as broad in the middle as the thorax.

Length of thorax, 1.4mm; breadth of same, 1.25mm; length of abdomen, 4.75mm; breadth of same, 1.15mm; length of wings, 7mm

Fossil Cañon, White River, Utah (W. Denton).

Tipula spoliata.

Pl. 10, Fig. 4.

Fragments of wings only are preserved in two of the specimens referred here; but a third, in which the wings uniform in tint with dusky veins are thrown up parallel to each other in front of the head, shows also the body and part of the antennæ, which are equal and sparsely covered with very short hairs. There is no trace of a stigma on any of the wings, and the cell at the place of the stigma is subfusiform in shape and nearly six times as long as broad, the third longitudinal vein arising only a little before the end of the great cross-vein. The discal cell is rather less than half as long again as broad, its lower inner angle is scarcely more than a right angle, and the fifth longitudinal vein is bent at a considerable angle at the

great cross-vein, so that its apical portion and the sixth longitudinal vein converge rapidly. The tip of the wing is decidedly below the middle.

Length of body, 12.75^{mm}; of wing, 14.5^{mm}; breadth of same, 3.5^{mm}.

Green River, Wyoming, Three specimens, Nos. 15 and 74, 42, 43 and 44 (Dr. A. S. Packard).

Tipula sepulchri.

Pl. 10, Fig. 1.

A single specimen is preserved, showing a nearly complete wing (imperfect at the base), parts of the body, with the head and palpi and parts of the antennæ. The antennæ are similar to those of T. spoliata, and the palpi of similar form and clothing but slenderer. The wing is slightly larger than in T. spoliata, with a distinct subtriangular stigma, but with no other marking about the dusky veins. The stigmatal cell has its lower bordering vein bent some way beyond the middle, and the cell is long and slender, fully eight times longer than broad, the third longitudinal vein arising from the second much earlier than in T. spoliata, considerably before the lower end of the great cross-vein. The discal cell is about half as long again as broad, its lower inner angle much more than a right angle; the fifth longitudinal vein is scarcely bent where it strikes the great cross-vein, and its apical portion therefore scarcely converges with the sixth longitudinal vein. The tip of the wing is only a little below the middle of the wing.

Length of wing, 15^{mm}; breadth, 3.75^{mm}.

Green River, Wyoming. One specimen, No. 9 (Dr. A. S. Packard).

Family CHIRONOMIDÆ Westwood.

CHIRONOMUS Meigen.

Chironomus septus.

Pl. 10, Fig. 8.

A single specimen in which the wings are imperfectly preserved, being obscured by the abdomen, over which they are folded The antennæ are hidden. The body is preserved on a partially lateral view and has an S-shaped form, the head being closely appressed to the lower front of the thorax, which is elevated behind the middle, and the abdomen curved

upward, its tip rather indicating the specimen to be a male. The legs are well preserved, and the wings so far as their venation can be made out indicate a Chironomus. One antenna is preserved and is very slender indeed, about a third or a quarter the width of the front tibia and about as long as the eye; it is not shown on the plate and is obscure from its crossing the front tibia; its basal joint is rounded ovate, twice as stout as the stem, which is equal, with a blunt tip; no hairs can be detected except some excessively delicate ones close to the base, the only portion excepting the tip which is not obscured by the tibia; all the joints of the stem appear to be cylindrical and in no way moniliform. The legs are of nearly equal length. The tibiæ are slightly longer than the femora and of the length of the thorax; the first joint of the tarsi is less than half as long as the tibia, and the remainder of the tarsus a little more than half as long again as the first joint. The femora and tibiæ are sparsely clothed with very short delicate hairs, and the tibiæ and tarsi, and especially the latter, have in addition a few inferior rows of distant short delicate spines, a pair of which, as short as the others, are apical in the tibiæ, and perhaps also in the tarsal joints. The whole body is uniformly testaceous, slightly infuscated by the sparse clothing of short fine hairs.

Length of body, 3^{mm}; of thorax, 1.2^{mm}; of legs, about 3.5^{mm}.

Green River, Wyoming One specimen, No. 10 (Dr. A. S. Packard).

Chironomus depletus.

Pl. 5, Fig. 62.

Chironomus depletus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 744 (1877).

A single mutilated specimen of this insect remains, and is doubtfully referred to Chironomus. The thorax is moderately robust and the abdomen rather plump for a Chironomus. The antennæ are broken, and only the costal border of one of the fore wings can be seen; this shows that the second longitudinal vein terminates in the middle of the apical, and the first longitudinal apparently in the middle of the basal, half of the wing. The legs are moderately long, slender, the tibiæ finely spined, the spines arranged on the middle legs in a somewhat verticillate manner, and terminating with two or three long spurs; the femora are rather short, the tibiæ considerably longer, but not so long as the tarsi.

Length of body, 3^{mm}; of wing, 2.3^{mm}; of fore femora, 0.68^{mm}; of fore tibiæ, 0.6^{mm}; of fore tarsi, 1^{mm}; of middle tibiæ, 1^{mm}; of middle tarsi, 1.25^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Chironomus patens.

Pl. 5, Figs. 18, 19, 28.

Chironomus patens Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 744–745 (1877).

A single specimen, very well preserved, represents a species which is provisionally referred to Chironomus. Nearly all the parts are present, and the neuration of one of the wings is nearly perfect, showing the structure of Chironomidæ, but differing apparently from any genus yet characterized. The antennæ are parted and bent, but apparently perfect; they seem to be fifteen-jointed, the joints square, the apical no larger than the others, and all apparently furnished (as indicated at one point only) with a fringe of profuse, exceedingly delicate hairs, as long as the joints. The body is slender and the wings three times as long as broad; the costal vein runs only to the tip of the wing, and the margin beyond it is very faint; the first longitudinal vein runs uninterruptedly to the middle of the apical fourth of the wing; the second longitudinal nearly to the tip; the third longitudinal vein takes its rise from the second in the middle of the basal half of the wing, and parts widely from the second, leaving an unusual space devoid of neuration next the apex of the wing; the fourth arises from the third rather abruptly a little beyond its base, and has close beneath it the remnant of a vein or a fold in the wing; the next vein forks just beneath the origin of the fourth longitudinal vein, and leaves beneath it, next the posterior margin, a broad space without veins; the two basal cells are very short, and there appear to be no other transverse veins in the whole wing; all the veins are hirsute. The legs are long and slender, and covered with spinous hairs arranged in exact longitudinal rows, giving the legs a striped appearance under the microscope; the femora are rather short, and the tibiæ and tarsi of very unequal length excepting on the hind legs; the tibiæ and all the joints of the tarsi are furnished apically with small spurs.

Length of body, 3^{mm}; antennæ, 1^{mm}; wings, 2.1^{mm}; fore femora, 0.5(?)^{mm}; middle femora, 0.6^{mm}; hind femora, 0.8^{mm}; fore tibiæ, 0.8^{mm};

middle tibiæ, 0.9^{mm}; hind tibiæ, 1.4^{mm}; fore tarsi, 1.8^{mm}; middle tarsi, 2.3^{mm}; hind tarsi, 2.1^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Chironomus sp.

Chironomus sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 749 (1878).

A minute specimen apparently of this family. Unfortunately it has no wings, and little can be said of it more than to record its occurrence; it is 3^{mm} long, has large eyes, a stout thorax, and altogether resembles a Chironomus: it is however distinct from any found in the White River shales.

Green River, Wyoming. One specimen, No. 141 (F. C. A Richardson).

Chironomidæ sp.

Pl. 5, Figs. 32, 33.

An indeterminate species of this family, whose generic affinities can not be discovered from the entire absence of neuration in the wings and the loss of every other characteristic feature, presents a side view of the body with fragments of legs. The insect is minute, measuring but 2.75^{mm} long. It may possibly belong to the Cecidomyidæ.

Chagrin Valley, White River, Colorado (W. Denton).

Chironomidæ sp.

Pl. 5, Fig. 24.

Another similar specimen, but distinct from the above, exhibits a dorsal aspect, and little besides the trunk is left. The thorax is comparatively stout, the head nearly as broad as the thorax, and the abdomen very slender and equal. The body is 3.25^{mm} long.

Chagrin Valley, White River, Colorado (W. Denton).

Chironomidæ sp.

A third indeterminate species probably belongs to this group, but the specimen is too indistinct to be of much value. It is a female. The antennæ are a little longer than the head, the head a little narrower than the abdomen, the latter tapering to a point. The costa of one wing is present and the rather short and moderately stout legs of the opposite side.

Length of body, 1.8^{mm}; of middle femur 0.8^{mm}; of same tibiæ, 0.5^{mm}.

Fossil Cañon, White River, Utah (W. Denton).

Family CULICIDÆ Stephens.

CULEX Linné.

CULEX DAMNATORUM.

Pl. 10, Fig. 14 ♀.

None of the specimens referred here show much of the neuration of the wings excepting parts of longitudinal veins, but the other characteristics are unmistakable. The eyes are surrounded by a fringe of curved lashes as long as the width of the eye. The antennæ (all the specimens are females) are fully as long as the thorax, slender, tapering, the joints almost three times as long as broad, cylindrical, clothed sparsely with excessively short hairs, and showing signs here and there of a thin whorl of fine hairs at the base of the joints a little longer than the joints themselves. Palpi about as long as the head, more than twice as stout as the basal portion of the antennæ, the last joint almost obpyriform, bluntly terminated, about three times as long as broad, and briefly hairy. Proboscis as stout as the palpi, stouter than the fore tibiæ, nearly or quite as long as the thorax. Legs long and slender, clothed sparsely with fine short spinous hairs, and the tibiæ with inferior rows of more distant, longer, but still brief spines, and the first joint of the tarsi with inferior rows of short, close set spines. Hind tarsi nearly as long as the abdomen.

Length of body, 6^{mm}; of thorax, 1.8^{mm}; of antennæ, 2^{mm}; of proboscis, 1.9^{mm}; of fore legs beyond coxæ, 5.6^{mm}; of fore femora, 1.6^{mm}; fore tibiæ, 1.8^{mm}; fore tarsi, 2.2^{mm}; hind femora, 2.5^{mm}; hind tibiæ, 2^{mm}; hind tarsi (broken just short of extremity), 3^{mm}. Measurements from specimen figured.

Green River, Wyoming. Three specimens, Nos. 16, 38, 39 (Dr. A. S. Packard).

CULEX PROAVITUS.

Pl. 5, Figs. 8, 9.

Culex proavitus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 744 (1877).

A poorly preserved specimen in which only fragments of the legs can be seen, and the wings are so crumpled and folded as to prevent tracing the neuration. What can be seen resembles the neuration of the Culicidæ, and the veins and borders are heavily fringed with long hairs. The body is

slender and the insect minute; the proboscis is about as long as the head and thorax combined, and the last joint of the equally long palpi is cuneate, the base rounded.

Length of body, 2.2^{mm}; of proboscis, 0.9^{mm}.

Fossil Cañon, White River, Utah (W. Denton).

CORETHRA Meigen.

Corethra exita.

Pl. 5, Figs. 22, 23.

Corethra exita Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 744 (1877).

A specimen, viewed from above, with expanded wings, and destitute of legs, palpi, and all but the basal joints of the antennæ. The broad head, stout basal joint of antennæ, general form and size, with such of the neuration of one wing as can be determined, indicate the genus; seven of the abdominal segments are very clearly marked, and the specimen appears to be a male. The body is slender; the head, thorax, and abdomen of equal width; the wings slender and of about equal length with the body. The fourth longitudinal vein runs in a nearly straight line over the basal half of its course, but is gently arched beyond; the fifth originates from the fourth in the middle of its straight portion, runs nearly parallel with it so long as it continues straight, and afterward diverges considerably; the first longitudinal vein appears to run to the tip of the wing.

Length of body, 4.25^{mm}; of wing, 4.25^{LIM}; breadth of latter, 0.8^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

Family BIBIONIDÆ Westwood.

PLECIA Wiedemann.

Plecia similkameena.

Pl. 3, Figs. 20–22.

Penthetria similkameena Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 177–179B (1879).
Plecia similkameena Scudd., Zittel, Handb. d. Palæont., I, ii, 811, Fig. 1086 (1885).

Five specimens, three of them with their reverses, represent very fairly a species of Plecia, one of them certainly a male, and remarkably perfect. The body of this male is of nearly equal size throughout, scarcely thickened

at the thorax. The male antennæ consist of ten joints, and they are moniliform, very gently and slightly decreasing in size to the tip, the apical joint smallest, all together a little longer than the height of the head. Legs of the male long and slender, all the femora of equal length (the middle pair perhaps a little shorter than the others), slightly thickened, especially on the apical half. All the tibiæ are very long, slender, equal, covered below with a dense clothing of very delicate and short hairs, and furnished above with a row (?) of very short, delicate, minute, recumbent spines, the apex devoid of spurs; the first pair is about as long as the fore femora; the second is considerably shorter than the middle femora, while the third pair is longer than the hind femora. The tarsi are scarcely shorter than their respective tibiæ; the first joint is nearly as long as the rest of the tarsus, excepting on the middle legs, where it only equals the two succeeding joints taken together; the remaining joints are subequal in length (on the middle legs the second and third joints are longer than the fourth and fifth), and the last is armed with a delicate pair of divergent claws. The whole body and the appendages are black. The wings are fuliginous, deepening in tone toward the front margin; they are nearly as long as the body and about three times as long as broad. The first and second longitudinal veins are straight and approximate to the front margin, the latter striking it scarcely beyond the middle of the apical half of the wing, the former at about the middle of the third quarter; the third longitudinal vein diverges from the second at some distance before the middle of the wing, is connected by the middle transverse vein a little beyond the middle of the wing to the fourth longitudinal vein, and forks either at a little more (♂) or at a little less (♀) than one-third the distance from the cross-vein to the apex of the wing,[1] the lower branch striking the tip, while the other, strongly curved, strikes the margin at about one-third (♂), or a little more than one-third (♀), the distance from the apex of the second to that of the lower branch of the third longitudinal vein; the fourth longitudinal vein is very nearly straight until it forks, considerably (♂) or a little (♀) nearer the middle transverse vein than the origin of the fork of the vein above; the branches part widely at base, the upper more arcuate than the lower; the fifth longitudinal vein forks as far from the base of the wing as the divergence of the second and third longitudinal

[1] The sexes in this genus differ in neuration, and, as the wing attached to the body of the male differs from the other wings in the particular above mentioned, I look upon the others as belonging to females of the same species, and describe them accordingly.

veins, the upper branch being connected just beyond its origin with the fourth longitudinal vein, which is of the same length as the middle transverse vein, and lies as far within as that without the middle of the wing. In none of the specimens (owing to imperfect preservation) can the sixth longitudinal vein be traced beyond the basal transverse vein.

Length of body, 11^{mm}; breadth of thorax, 1.75^{mm}; of abdomen, 1.2^{mm}; length of femora: fore 3.5^{mm}, middle 3.5 (?)^{mm}, hind 3.5^{mm}; of tibiæ: fore 3.65^{mm}, middle 3.25^{mm}, hind 4^{mm}; of tarsi: fore 3^{mm}, middle 2.75^{mm}, hind 3.5^{mm}; of first joint of tarsi: fore 1.4^{mm}, middle 1^{mm}, hind 1.5^{mm}; length of wing, 10^{mm}; breadth of same, 3.5^{mm}. All the measurements are taken from the male.

Similkameen River, British Columbia. Five specimens, Nos. 76, 79–83 (Dr. G. M. Dawson, Geological Survey of Canada).

Plecia pealei.

Pl. 4, Figs. 2, 3, 10, 11, 12.

This species differs from P. similkameena mainly in a single point, the earlier forking of the fourth longitudinal vein, the stalk of which is as short as or shorter than the middle transverse vein, while in the British Columbia species it is about twice as long. The superior fork of the third longitudinal vein is also a trifle shorter, although it does not appear to arise any earlier. The cross-vein uniting the fourth longitudinal vein with the branch of the fifth (next its base) is not shown in the figures, and the neuration is imperfect in Figs. 2 and 3 at several points. The species is of the same size as P. similkameena, but a couple of specimens, thought at first to be distinct from apparent differences in their obscure neuration, but which turned out to be identical on closer inspection, are somewhat smaller than the average. The species must have been exceedingly common in the beds at Twin Creek, Wyoming, for out of more than fifty specimens of fossil insects obtained for me by the brothers Bell at their coal bed all but one or two belong to this species. They are preserved in a whitish fetid shale. They are mostly in a very poor state of preservation, the best of them being shown in Figs. 2, 3, and 11, the last showing the average size. Much better specimens, however, were obtained by Dr. A. C. Peale in October, 1877, in beds on the same creek, about thirty-five to forty miles northeast of Randolph, on a darker shale, where the specimens were equally abundant

and excellently preserved, as see Figs. 10 and 12. Dr. Peale brought home nine slabs, numbered 1 to 6, containing ten specimens, with reverses of four of them. Three or four good specimens were also sent me from Twin Creek by Prof. J. S. Newberry, and were then taken for the preceding species.

Named for the geologist Dr. A. C. Peale, who has been quick in the discovery of insect-bearing shales in the West.

Plecia dejecta.

Pl. 10, Fig. 17.

This species is in most respects nearer P. similkameena than P. pealei from the neighboring region to the north, but it is considerably smaller than the former and than most specimens of the latter; a single well preserved and nearly perfect specimen has been found, in marked contrast to the abundance of P. pealei to the north. As in P. pealei the superior branch of the third superior vein is no longer, or scarcely longer, than the distance from the median transverse vein to the origin of the branch, while, on the other hand, it resembles P. similkameena in that the length of the median transverse vein is double that of the distance from it to the fork of the fourth longitudinal vein, represented a trifle too short on the plate. The legs are as in the other species as far as noted.

Length of wing, 7.5^{mm}; breadth of same, 3^{mm}.

Green River, Wyoming One specimen, No 8 (Dr. A. S. Packard).

Family MYCETOPHILIDÆ Westwood.

SCIARA Meigen.

Sciara deperdita.

Pl. 3, Fig. 17.

Sciara deperdita Scudd., Rep. Progr. Geol. Surv. Can., 1876–1877, 457–458 (1878).

The remains of this species consist of a single perfect wing and the fragments of an eye whose facets are 0.0165^{mm} in diameter. The wing is oval and regularly rounded, with a somewhat abrupt inner angle, the surface covered with microscopic hairs. Judging from Winnertz's descriptions this insect must be more nearly allied to S. ungulata Winn. than to any

other of the numerous species mentioned in his monograph of the group. The costal and first and second longitudinal veins, together with the cross-veins uniting the two latter, are much heavier and darker than the other veins of the wing; the veins near the center of the wing and from there toward the base are more delicate and fainter than elsewhere; but this perhaps is due to their indifferent preservation; the costal vein, which scarcely fails of reaching the tip of the wing, is covered with fine and short spinous hairs. The first longitudinal vein strikes the middle of the costal margin, and the cross-vein below unites it at the middle with the second longitudinal vein; the auxiliary vein is very obscure though broad and scarcely extends more than half-way to the cross-vein, in close juxtaposition to the first longitudinal vein; the transverse shoulder vein is equally faint, oblique, uniting the middle of the auxiliary vein with the costal margin. The second longitudinal vein is strongly bowed and extends nearly to the tip of the costal vein. The basal undivided part of the third longitudinal vein is straight, originates from the second barely beyond the tip of the auxiliary vein, and forks somewhat abruptly at the middle of its course and just beyond the extremity of the first longitudinal vein; shortly beyond their origin the forks are very nearly straight and quite parallel to the tip, the upper fork striking exactly the tip of the wing; the tips of the two forks and of the second longitudinal vein are equidistant, and the costal vein terminates midway between the extremity of the second and of the upper fork of the third longitudinal vein; the tip of the fourth is slightly farther from that of the lower fork of the third longitudinal vein than the separation of the two forks. The fourth and fifth longitudinal veins are straight and subparallel at base, beginning to diverge where they bend downward, just beyond the middle, the tip of the fourth lying about midway between that of the fifth and the lower fork of the third longitudinal vein. The sixth longitudinal vein is rudimentary and very indistinct, extending less than a quarter-way toward the margin.

Length of wing, 2.75^{mm}; breadth, 1.25^{mm}.

Quesnel, British Columbia. One specimen, No. 44 (Dr. G. M. Dawson, Geological Survey of Canada).

Sciara scopuli.

Pl. 10, Fig. 16.

A little slab brought home by Dr. Packard has two flies upon it in close proximity, one preserved on a dorsal, the other on a lateral aspect. The venation in both is obscure, but they apparently belong to the Sciarina at least. The head is rather small, the antennæ are rather coarse, cylindrical, equal, shorter than the thorax. Legs very long, exceedingly slender, the tibiæ without apical thorns, or rather without conspicuous thorns, all the legs covered with excessively delicate aculiform hairs. Wings with only two distinct veins, which run nearly parallel, not far from the front border, and the second of which terminates a little above the middle of the tip, and below it a deeply forked vein, apparently much as in Sciara proper.

Length of body, 3.25^{mm}; of antennæ, 1^{mm}; of legs, 4.25^{mm}; of wings, 3^{mm}.

Green River, Wyoming. One specimen, No. 2. (Dr. A. S. Packard)

MYCETOPHILA Meigen.

Mycetophila occultata.

Pl. 5, Figs. 44, 45, 54, 55.

Mycetophila occultata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 753 (1877).

A single poorly preserved specimen and its reverse present an upper view of the insect, with the wings folded over the back, the legs crowded together, and the antennæ lying beside the body. The antennæ are about as long as the head and thorax, the joints scarcely longer than broad, nearly cylindrical, scarcely at all moniliform. The legs are comparatively slender, hairy, and unarmed, not very long. The character of the venation shows the insect to belong to the Mycetophilidæ, but what genus is represented is somewhat obscure through doubt of the exact location of some of the veins; neither the auxiliary vein nor any of the basal veins above it can be seen, nor can the axillary be traced; judging from the other veins, it is probably allied to Mycetophila, although, in the possible presence of a second cross-vein uniting the cubital vein with the extremity of the radial, it should be referred to a distinct genus, probably allied to Empheria and

Tetragoneura. The presence of a such a vein being doubtful, we have preferred to point out its affinity to Mycetophila. The radial vein ends in the middle of the outer two-thirds of the costa, and at its tip a distinct stigma, nearly three times as long as broad, occupies the space between the radial and costal veins. The tip of the wing is broken on one specimen and obscured on the other, so that the length of the costal vein can not be determined, although it appears to extend slightly beyond the tip of the cubital vein; the cubital is connected by the cross-vein to the radial but a short distance from its origin, and bends but little upward from the median vein to reach it; the middle discal vein, on the contrary, bends downward considerably, and forks at a distance from the base, less than half-way from the median cross-vein to the tip of the radial vein, and an unusually broad space is left between its upper branch and the cubital vein, while the fork of the hind vein is nearer the base than the separation of the cubital from the median vein.

Length of body, 3.5^{mm}; antennæ, 1.1^{mm}; wings, 3.5^{mm}; tibiæ (of fore legs?), 0.75^{mm}; tarsi (of same legs), 0.4^{mm}.

Chagrin Valley, White River, Colorado. One specimen. (W. Denton.)

ANATELLA Winnertz.

Anatella tacita.

Pl. 10, Fig. 13.

A single specimen with damaged wings is referred here. The antennæ are as long as the thorax, slender, equal, covered with fine short hairs The legs are long and slender, the tarsi apparently longer than the tibiæ, the latter armed apically with a pair of exceedingly long unequal spines, and all the legs thickly clothed with rather coarse spinous hairs. Wings dusky, the venation obscure, but apparently as in Anatella, there being no sign of any auxiliary vein beyond the base, the stalk of the upper discoidal vein apparently short and the fork of the lower a little further out than that of the upper discoidal vein.

Length of body, 4^{mm}; of antennæ, 1.5^{mm}; of tarsi, 1.75^{mm}; of wing (estimated), 3.2^{mm}.

Green River, Wyoming. One specimen, No. 14. (Dr. A. S. Packard.)

TRICHONTA Winnertz.

Trichonta dawsoni.

Pl. 3, Figs. 12, 13.

Trichonta dawsoni Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 272 (1877).

A very well preserved though fragmentary specimen must unquestionably be referred to this genus, and is named for its discoverer. The greater part of one wing, the basal half of the other, including between them all the characteristic parts of the neuration, with crushed fragments of the thorax and abdomen, make up the remains of the creature. The veins of the wing are black, especially the upper ones, which are heavily marked: the wing is covered with microscopic hairs, and slightly infuscated throughout, but on the apical quarter becomes dark fuliginous. The neuration agrees in every particular, to the minutest degree, with the figure of Trichonta given by Winnertz, excepting that the fifth longitudinal vein forks considerably nearer the base, and the sixth longitudinal vein extends farther into the middle of the wing.

Estimated length of wing, 4.75^{mm}; breadth of same, 1.85^{mm}.

Quesnel, British Columbia. One specimen, No. 6 (Dr. G. M. Dawson, Geological Survey of Canada).

RYMOSIA Winnertz.

Rymosia strangulata.

Pl. 10, Fig. 2.

A single specimen in which most of the legs and one wing, of which the apex is lost, is all that remains of this species. Unfortunately the drawing is incorrect in two particulars: the transverse median vein which is at about the middle of the fragment, and is very obscurely preserved, is not given; and the stalk of the upper discoidal vein is scarcely half so long as represented, although the fork of the lower discoidal vein is still nearer the base. The cubital vein, which must terminate rather far above the apex of the wing, is not in the least bent at the transverse median vein. The legs are hairy and tolerably well though delicately spined.

Probable length of wing, 3^{mm}.

Green River, Wyoming. One specimen, No. 11 (Dr. A. S. Packard).

BRACHYPEZA Winnertz.

Brachypeza abita.

Pl. 3, Figs. 7, 8.

Brachypeza abita Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 271–272 (1877).

This species is represented by a single specimen and its reverse in which the wings and an obscure and detached fragment of the abdomen are present. The wing appears to be devoid of markings. The auxiliary vein does not fairly impinge upon the first longitudinal vein, but bends toward it and then vanishes: in other respects the neuration of the base of the wing is precisely as figured by Winnertz for Brachypeza; so, too, are the origin, course, and position of all the principal veins and the cross-vein, but the branches of the fifth longitudinal vein unite perhaps a little farther from the base, viz: scarcely nearer the base than the point of separation of the united third and fourth longitudinal veins from the second; the sixth longitudinal vein is perfectly straight, and terminates quite as far from the base of the wing as the small transverse vein: the anal vein is regularly curved, about as long as the sixth longitudinal vein, runs parallel to the border beside it, and terminates on the lower margin.

Length of wing, 4^{mm}; breadth of same, 1.35^{mm}.

Quesnel, British Columbia. One specimen, Nos. 3 and 16 (Dr. G. M. Dawson, Geological Survey of Canada).

Brachypeza procera.

Pl. 3, Fig. 14.

Brachypeza procera Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 272 (1877).

The single specimen of this species is in a very fair state of preservation, almost the entire neuration of the wings being preserved, as well as fragments of the body and other appendages. The wings are fuliginous, more deeply next the costal border. The neuration of the extreme base is lost, and the remainder differs from that of B. abita only in the lower half of the wing; the branches of the fifth longitudinal vein unite nearer the base than in that species, resembling, in this respect, the illustration of Brachypeza given by Winnertz; the lower branch curves strongly toward the tip, diverging unusually from the upper branch; the sixth longitudinal vein is straight,

and runs far past the forking of the fifth vein, fully two-thirds the way to the margin of the wing; the anal vein curves but gently, and appears to vanish before reaching the margin of the wing.

Length of wing, 3.5^{mm}; breadth of same, 1.5^{mm}.

Quesnel, British Columbia. One specimen, No. 4 (Dr. G. M. Dawson, Geological Survey of Canada).

GNORISTE Meigen.

Gnoriste dentoni.

Pl. 5, Figs. 6, 7.

Gnoriste dentoni Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 755 (1877).

A single specimen, a little broken, but otherwise in good preservation. The head and thorax are nearly black, the abdomen dark fusco-castaneous. Legs and base of antennæ fuscous. Wings rather narrower at tip than in the European G. apicalis Hoffm., hyaline, covered with microscopic hairs, with a very slight and increasing infuscation toward the apex, the veins testaceous, the costal and second and third longitudinal veins much heavier than the others, and the fifth longitudinal vein with its lower fork scarcely heavier than the veins about it. The extreme tip of both wings is broken, so that the extent of the costal vein can not be seen; but, in the approach of the proximal end of the fork of the fifth longitudinal vein to the root of the wing, the species agrees with the American G. megarhina O. S. more than with the European species mentioned, for it lies scarcely farther from the base than the transverse vein connecting the first and second longitudinal veins, and slightly nearer than the separation of the third and fourth longitudinal veins Only the basal four joints of the antennæ are preserved; the basal joint is obconic, broadly rounded at the apex, nearly twice as long as broad, the other three cylindrical, the second nearly half as long again as broad, the third and fourth less than a third longer than broad. The legs are profusely covered with hairs, but the hinder pair appear to be spineless, except at the apex of the tibia and of each tarsal joint, where there are three or four slender and rather short spines; the claws are very small and delicate, strongly curved and delicately pointed; the short tibiæ of the front legs, however, have at least a single row of fine, distant spines on the upper (?) edge.

Length of body, 4.4^{mm}; first joint of antennæ, 0.2^{mm}; second joint, 0.125^{mm}; third and fourth joints each, 0.11^{mm}; wings, 4.5^{mm}; middle (?) tarsi, 2.2^{mm}; first joint of same, 1.1^{mm}; second, 0.45^{mm}; third, 0.28^{mm}; fourth, 0.2^{mm}; fifth, 0.17^{mm}; claws, 0.038^{mm}.

Fossil Cañon, White River, Utah. One specimen (W. Denton).

BOLETINA Stäger.

Boletina sepulta.

Pl. 3, Fig. 9.

Boletina sepulta Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 271 (1877).

A fragment of a single wing and a portion of the abdomen represent this species. It is accompanied by Pimpla decessa. The wing is moderately broad, and faintly fuliginous; the costal, auxiliary, and first and second longitudinal veins are heavily impressed, broad, black, and devoid of the microscopic hairs which uniformly cover the membrane of the wing and the other veins; these latter are faintly impressed, slender, and testaceous. The costal vein is bristly; the base of the wing is broken, so that only the tip of the auxiliary vein can be seen, which terminates on the costal margin scarcely before the small transverse vein; the latter is conspicuously oblique, directed from above, downward and outward; the first and second longitudinal veins are pretty strongly curved downward at tip; the veins below these fork a little farther out than in the scheme of Boletina, as figured by Winnertz, and the sixth longitudinal vein terminates just beyond the junction of the fourth and fifth longitudinal veins.

Length of fragment, 3.75^{mm}; estimated length of wing, 6^{mm}; breadth of wing, 2.15^{mm}.

Quesnel, British Columbia. One specimen, No. 9^{b} (Dr. G. M. Dawson, Geological Survey of Canada).

Boletina umbratica.

Pl. 10, Fig. 3.

From the size of the abdomen, the single specimen known seems to be a female. A fragment of one antenna is preserved together with parts of the legs, especially of the tibiæ, which are very delicately spined, though no apical spurs are seen. The hind tarsi of one side are also preserved

and are equal in length to the tarsi. The wings show most of the neuration. The auxiliary vein terminates on the costa before the middle of the wing opposite the transverse median vein. The radius terminates some distance and the cubitus slightly before the tip of the wing. The upper discoidal vein forks about one-quarter way to the margin, and the lower discoidal before the origin of the upper discoidal vein.

Length of body, 3.5^{mm}; of wings, 2.5^{mm}; breadth of same, 1.1^{mm}; length of hind tibiæ, 1.5^{mm}.

Green River, Wyoming. One specimen, No. 37 (Prof. L. A. Lee).

Boletina paludivaga.

Pl. 10, Fig. 7.

The venation is not correctly drawn, the auxiliary vein which reaches nearly to the middle of the wing not being shown; the radius should curve upward at the middle of the wing and be connected with the cubital just previous to this curve; the stalk of the upper discoidal vein is short. The legs are moderately stout but long, densely clothed with delicate hairs, the tibiæ with long apical thorns.

Length of body, 2.5^{mm}; of wings, 2.25^{mm}; of tarsi, 1.35^{mm}.

Green River, Wyoming. Two specimens, Nos. 5, 40 (Dr. A. S. Packard).

SACKENIA Scudder.

Sackenia Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 753–754 (1877).

Body shaped much as in Boletina. Antennæ longer than the thorax, one-fourth slenderer at the apex than near the base, gently curved, 2+14-jointed. Legs very long and slender; femora and tibiæ of about equal length; tarsi a little longer than the tibiæ; the hind tibiæ and tarsi together a little longer than the abdomen; the tibiæ with one or two apical spurs beneath and spined throughout. Wings rather broad ovate; the smaller veins at the extreme base obliterated in the specimen examined; auxiliary vein terminating on the costa beyond the end of the basal third, the first longitudinal vein in the middle of the outer half; the second longitudinal vein is unusually curved downward at the tip, so as almost to reach the apex of the wing; the united third and fourth longitudinal veins part from the second very near the base of the wing or within the small transverse vein;

they divide near the center of the wing, and the fifth and sixth longitudinal as near the base as the third and fourth; the sixth longitudinal vein is straight, and appears to reach the margin of the wing.

The genus resembles Boletina more than any of the genera figured by Winnertz, but differs strikingly from it in the approximation to the base of the forking of the third and fourth, and of the fifth and sixth longitudinal veins. In this particular it closely resembles the Sciarina, but on the other hand differs from them to a greater degree in the length of the auxiliary and first longitudinal veins, and in that the former reaches the costa. The costal vein does not appear to pass beyond the tip of the second longitudinal vein, but this point is obscure.

I have dedicated this genus to the distinguished dipterologist, Baron Osten Sacken, to whom I am indebted for many suggestions in the determination of these fossils.

Sackenia arcuata.

Pl. 5, Figs. 3, 4, 12, 13.

Sackenia arcuata Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 754–755 (1877); in Zittel, Handb. d. Palæont., I, ii, 811, Fig. 1088 (1885).

This species is represented in part by a female specimen, more than usually well preserved. The body is pale testaceous; the wings wholly hyaline, but the veins faint testaceous; the antennæ are a little longer than the head and thorax together, very slender, of the color of the thorax; the basal joints are subglobular, slightly broader than long, the remainder twice as long as broad, and beyond the middle of the antennæ slightly moniliform. In the wings, the base of the hinder cell, using Winnertz's terminology, lies within the base of the upper discal cell, both being nearer the base of the wing than the middle transverse vein, while the base of the middle discal cell is far outside of either of these, near the center of the wing. The costal vein appears to terminate where the cubital reaches the margin, and the axillary vein nearly or quite reaches the border. The legs are partly detached, and the basal portion of the front pair obscure, but it looks as though the front tarsi were about three times as long as the front tibiæ, which is hardly probable.

Length of body, 5.65^{mm}; antennæ, 2^{mm}; wings, 4.25^{mm}; hind femora, 3^{mm}; hind tibiæ, 2^{mm}; hind tarsi, 2.4^{mm}; fore tarsi, 2^{mm}.

A second specimen of the same species is similarly preserved, but lacks the wings. The legs, however, are better preserved, and show a pair of apical spurs to the tibiæ. The antennæ are imperfect, but the proboscis is seen. The length of the curved body is a little more than 5.5^{mm}. The legs are detached and confused, so that it is impossible to separate the middle and hind legs; one leg (a front leg, to judge from its length) has the following measurements: femur 1.2^{mm}, tibia, 1.4^{mm}, tarsi 1.7^{mm}; another (probably a hind leg): femur 2.1 (!)^{mm}, tibia 2.25^{mm}, tarsi 1.75^{mm}; another (probably the opposite of the same): tibia 2.25^{mm}, tarsi 1.75^{mm}. Apparently, all the tarsi are broken. The tibial spines, both in this and the first-mentioned specimen are delicate, and a little more than half as long as the thickness of the tibiæ.

Chagrin Valley, White River, Colorado. Two specimens. (W. Denton.)

Sackenia ? sp.

Pl. 5, Fig. 50.

Another and far smaller species of Sackenia seems to be indicated by the imperfect fragment of a wing and an obscure body. The third longitudinal vein is wrongly drawn as if united to the second instead of to the fourth. The common stem of the latter is joined to the second very shortly before their union, this being effected nearer the base of the wing than in S. arcuata.

Length of body, 2^{mm}; probable length of wing, 1.6^{mm}.

Fossil Cañon, White River, Utah. One specimen, No. 33^{e} (W. Denton).

Sackenia sp.

Sackenia sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 750 (1878).

A specimen of Mr. Richardson's collection represents a species of Mycetophilidæ apparently belonging to this genus, so far as can be determined. It closely resembles Sackenia arcuata from the White River shales, but differs from it in its smaller size and in possessing a proportionally larger and more arched thorax; the legs also appear to be shorter. Besides the body and (indistinctly) the antennæ and legs, only the upper portions of the wings remain, consisting of the costal margin and first and second longi-

tudinal veins, with the cross-vein uniting them; these wholly agree with the same features in S. arcuata, excepting that the second longitudinal vein terminates a little higher up.

Length of body, 3.75mm; of wings, 2.9mm.

Green River, Wyoming. One specimen, No. 7 (F. C. A. Richardson).

ANACLINIA Winnertz.

Anaclinia? sp.

Pl. 9, Fig. 12.

Another specimen undoubtedly to be referred to the Mycetophilidæ is figured in Pl. 9, Fig. 12, but the fragment of the wing preserved is so obscured by the overlying legs that a nearer determination is impossible. It seems, however, to fall in the neighborhood of Anaclinia or Gnoriste, but the weaker parts of the neuration and the origin of the veins are so obscure that no closer determination can be made. The first longitudinal vein is longer than usual, reaching to beyond the tip of the wing, and the termination of the second is about midway between that of the first and that of the third. The antennæ are moderately slender, about as long as the thorax with cylindrical joints about twice as long as broad.

Length of body, 2.6mm; wing, 2.1mm.

Green River, Wyoming. One specimen, No. 66 (Prof. Leslie A. Lee).

SCIOPHILA Meigen.

Sciophila hyattii.

Pl. 10, Fig. 6.

Some fragments of legs and one wing are all that remain of the single specimen of this species. Most of the neuration of the wing, and especially of the more important portions, can be made out, but an error occurs in the drawing, in the omission of the brachial vein, characteristic of this group of Mycetophilidæ. The species is peculiar in that the auxiliary vein bends downward and terminates on the radius above the middle cell, showing no branch to the costa. The radius terminates far out toward the tip of the wing. The middle cell is more than twice as long as broad. The cubitus terminates at the extreme wing-tip; the stalk of the upper discoidal vein is

short, not more than half as long as the middle cell (here again the plate is inaccurate), and the lower discoidal vein forks, apparently, before the base of the upper discoidal stalk, but this point is obscure; the brevity of the latter is remarkable for a Sciophila.

Length of wing (estimated), 5.5^{mm}; breadth, 2^{mm}.

Named for my learned friend and comrade, Prof. Alpheus Hyatt, of Cambridge.

Green River, Wyoming. One specimen, No. 99 (Prof. L. A. Lee).

DIADOCIDIA Ruthé.

Diadocidia? terricola.

Pl. 10, Figs. 10, 11.

Diadocidia? terricola Scudd., Bull. U. S. Geol. Geogr. Surv. Terr. IV, 750 (1878).

This species is founded upon a single wing found by Mr. Richardson, differing to such a degree from Diadocidia that I place it here only because the only other reasonable course would be to refer it to a new genus, which would necessarily be conjectural, from the imperfection of the fragment. If a transverse vein exists in the middle of the wing, it must unite the fourth longitudinal vein with the second, and not, as in Diadocidia, with the third. The wing itself is shaped much as in Diadocidia, and, at least near its costal border, is covered with fine hairs arranged in rows parallel to the course of the neighboring veins; one of these rows in the costal cell is so distinct as to appear like a vein parallel to and lying within the auxiliary vein. The auxiliary vein terminates in the costal margin far beyond the middle of the wing, a feature apparently unknown in Mycetophilidæ; the first longitudinal vein terminates only a little farther beyond, and as in Diadocidia there is no transverse vein connecting them; the second longitudinal vein terminates a little above the apex of the wing, curving downward at its extremity and apparently surpassed a little by the marginal vein; the third longitudinal vein originates from the second at only a short distance before the middle of the wing, and soon forks, or at about the middle of the wing; the fourth longitudinal vein is perhaps connected with the second at the point where it parts with the first by a cross-vein perpendicular to the costal margin; at least, it is elbowed at this point, its basal portion running parallel to the costal margin to the fifth longitudinal vein,

which, beyond this point, has a gentle sinuous course, and diverges rather strongly from the fourth; the sixth vein can not be traced, although the axillary field is broad, very much as in Diadocidia, and the inner margin distinct

Probable length of wing, 3.6mm; its breadth, 1.45mm.

Green River, Wyoming. One specimen, No. 125 (F. C. A. Richardson).

Mycetophilidæ spp.

Pl. 10, Fig. 12.

Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 750–751 (1878).

Three other species of Mycetophilidæ occur among the specimens collected by Mr. Bowditch and myself at Green River, Wyoming, but they are indeterminable from their fragmentary condition. One of them, No 4134 (Pl. 10, Fig. 12), has indeed the remnant of a wing, but the portion of the venation preserved is only sufficiently characteristic to enable us to judge that it belongs in this family The thorax is strongly arched, and the full and tapering abdomen indicates a female. The head is gone.

The thorax and abdomen are 3.5mm long, and the wing probably 3mm long.

Another of them, from the same place, No. 4114, has a portion of the base of a wing in which the forking of the fifth and sixth longitudinal veins is very close to the base, as in Sackenia, but nothing more can be said concerning it; the thorax is very globular and the abdomen short.

Length of thorax and abdomen, 3.65mm.

The third species is represented by two specimens on one stone (No. 4205) which came from the high buttes opposite Green River Station, and is the only fly which had the slightest value found in four days' search at that spot. One of the specimens is a pupa and the other an imago, apparently of the same species and distinct from either of the preceding, with a longer thorax and slenderer abdomen, provided with large ovate anal lobes.

Length of thorax and abdomen, 5mm.

Family CECIDOMYIDÆ Westwood.

LASIOPTERA Meigen.

Lasioptera recessa.

Pl. 5, Figs. 29–31.

Lasioptera recessa Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 745–746 (1877).

A single specimen of a minute fly, with the antennæ perfect, the body preserved on a side view, with parts of the legs and the wings folded together over the back, raised from the body. The head is moderately large and appears to be a little narrower than the thorax. The antennæ show fourteen joints, without counting the basal joint, and perhaps one or two more next the base, where the antennæ are parted; the joints are submoniliform, slightly broader than long, subequal; the last joint subconical, twice as long as broad. The wings show a principal vein, which strikes the costa about the middle, and apparently another, striking the costa halfway between this and the tip, a feature which does not accord with the structure of the Cecidomyidæ generally; but the wing at this point is very obscure, so that the appearance may be accidental. The legs are apparently about as long as the body and rather slender.

Length of body, 1.4^{mm}; of antennæ, 0.6^{mm}; wings, 1^{mm}.

White River, near the Colorado-Utah boundary. One specimen. (W. Denton.)

LITHOMYZA Scudder (λίθος, μύζω).

Lithomyza Scudd., Bull. U. S. Geol. Geogr Surv. Terr., III, 746 (1877).

Ocelli present. Antennæ nine-jointed, scarcely longer than the thorax, the first joint cylindrical, the remainder submoniliform, ovate, about twice as long as broad, minutely and sparsely pubescent. Wings resembling those of Anarete in neuration, but differing considerably in shape, being broadest beyond the middle and tapering toward the base. The first longitudinal vein extends beyond the middle of the wing; the auxiliary vein runs close beside the first longitudinal vein, but only half as far, terminating independently; the second longitudinal vein extends to the tip of the wing, curving downward in the distal part of its course; the third longitudinal vein forks as in Anarete, but the independent or fourth longitudinal vein

beneath it in Anarete is absent from Lithomyza. The tibiæ are destitute of spurs, but furnished with a posterior row of slight, recumbent spines.

Lithomyza condita.

Pl. 5, Figs. 34–36.

Lithomyza condita Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 746 (1877); in Zittel, Handb. d. Paleont. I, ii, 812, Fig. 1089 (1885).

Represented by a single specimen in an unusually perfect condition, although somewhat indistinct. The joints of the antennæ are difficult to determine, but with little doubt are nine in number; although short, they are not so abbreviated as in Anarete, the joints being twice as long as broad; toward the tip, they grow smaller. The legs are long and bristly. The fork of the third longitudinal vein is at the center of the wing, and nearer the base than the extremity of the first longitudinal vein. There is a faint indication of a transverse vein between the first and second longitudinal veins, about midway between the fork of the third longitudinal vein and its separation from the second. There is also a faint and very doubtful indication of an oblique cross-vein just beyond the transverse vein mentioned, running from the first longitudinal vein to the costa.

Length of body, 2.7^{mm}; of antennæ, 0.75^{mm}; of wings, 2^{mm}; fore legs, 0.7(?)^{mm}; middle legs, 2^{mm}; hind legs, 2.4^{mm}; hind tibiæ, 0.56^{mm}; hind tarsi, 1.28^{mm}.

Chagrin Valley, White River, Colorado. One specimen. (W. Denton.)

LEPIDOPTERA Linné.

No Lepidoptera have as yet been found in the American Tertiaries, excepting at Florissant. The butterflies have been described in the Eighth Annual Report of the U. S. Geological Survey and the heterocerous members will be discussed at another time. Here there is place only for the single species accidentally figured with the Trichoptera.

Family TINEIDÆ Leach.

Tineidæ are not rare in amber, Menge having in his collection sixty-nine specimens, of which one was a caterpillar and two were pupæ, but they have not been studied. Gravenhorst also mentions a Tinea in amber, and Presl describes one species. Germar long ago figured a large Ypsolophus from the Rhenish brown coal, and Heyden from the same beds figures the larval mine of a Nepticula. Finally, Kawall described a Tineites from "Bergkrystall" at Ufalei in Siberia. The single species here found may be referred, at least provisionally, to Psecadia, and though smaller than Germar's Ypsolophus, is a large insect (for this family), resembles it not a little, belongs to the same group, and is remarkably preserved.

PSECADIA Hübner.

To this group I temporarily refer a remarkably well preserved moth, which may very properly be better relegated to a distinct genus, on account, in part, of the brevity of the first antennal joint. Its close relationship to Psecadia and Depressaria can hardly be contested, though the neuration can not be traced. It is a large tineid, like those of these two groups, and it is tolerably plain that Germar's Ypsolophus insignis is nearly related; an interesting fact, since the single fossil species of Tineidæ fairly known in Europe is thus found to be closely related to the single species known in America.

Psecadia mortuella.

Pl. 15, Figs. 12, 17.

A single specimen has been found with its reverse. The insect is preserved lying upon its side, and though the neuration can not be seen from the wing having been heavily scaled, the whole of the antennæ and most of the palpi, tongue, and legs are well preserved. The palpi are closely recurved over the head, the middle joint apparently of about the same length as the apical joint, compact but heavily clothed, appressed to the front, reaching the summit of the eye, the apical joint very slender and pointed, directed at last backward, reaching the back of the head Antennæ fully two-thirds as long as the wings, slender, naked, gently tapering, the basal joint stout, rounded apically, not over twice as long as broad, the succeeding joints uniformly cylindrical, about twice as long as broad, transversely sulcate in the middle, as if made of two subjoints, relatively a little longer near the middle of the antennæ than at the two extremities, the second joint three-fourths the diameter of the first and only as long as broad. Tongue at least as long as the middle femora, with no sign of squamation at the base anteriorly. Wings fully three times as long as broad, the apex roundly but acutely angulate, all heavily squamate. It is difficult to make out what the markings may have been, but it would appear that the wings were grizzly with an interrupted series of small darker spots along the proximal half of the costa, and another series down the middle of the wing on its distal half. The legs are not very long, the fore legs somewhat shorter than the middle pair and much slenderer, the tarsi considerably shorter than the femora, and fully as much longer than the short tibia. The middle legs are very much shorter than the hind pair, the tibia and tarsi of equal length and each about three-fourths as long as the broad femur; the tibia armed apically with a pair of excessively long spurs. The hind legs can not be fully determined, but the tarsi are about twice as long as the middle tarsi, and the double series of tibial spurs as long as those of the intermediate tibiæ.

Length of body, 12.5^{mm}; wings, 10.2^{mm}; probable spread of wings, 25^{mm}; length of antennæ, 8^{mm}; fore femora, 2^{mm}; tibiæ, 1.3^{mm}; tarsi, 1.7^{mm}; middle femora, 2.3^{mm}; tibiæ, 1.75^{mm}; tarsi, 1.75^{mm}; hind tarsi, 3.5^{mm}.

Florissant. One specimen, Nos. 8460 and 9630.

HYMENOPTERA Linné.

Tribe TEREBRANTIA Latreille.

Family TENTHREDINIDÆ Leach.

TAXONUS Dahlbom.

TAXONUS NORTONI.

Pl. 10, Figs. 26, 27.

A fairly preserved specimen and its reverse, showing a dorsal view with most of a front wing, but neither legs nor antennæ. The head and thorax are dark, unusually dark for specimens on this stone, but the abdomen is much lighter, almost uniformly so, but showing the sides a little duskier. The veins of the wings and the stigma are uniformly dusky. The first discoidal cell is almost uniformly rhombic, the cross-vein separating it from the second discoidal cell being unusually long. The first inner apical nervure falls exactly below the middle of the first discoidal cell and the lanceolate cell has a strongly oblique cross nervure terminating opposite the inner end of the same discoidal cell.

Length of body, 7.5^{mm}; breadth of thorax, 2.5^{mm}; length of wing, 7^{mm}.

Green River, Wyoming. One specimen, Nos. 22 and 140 (Prof. L. A. Lee).

Family CHALCIDIDÆ Walker.

DECATOMA Spinola.

DECATOMA ANTIQUA.

Pl. 10, Figs. 20?, 31.

Decatoma antiqua Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 749 (1878).

On the same stone as Lystra richardsoni, but at a slightly higher level, is a minute chalcid fly. The wings are lacking, but the whole of the body is preserved, together with the antennæ. The head is large, arched, and

otherwise well rounded, the face tapering below, the eyes large, deep, with their inner borders nearly parallel, leaving an equal front; the base of the antennæ can not be made out, but beyond the long basal joint are six nearly equal quadrate joints, increasing very slightly indeed in size away from the head, scarcely so long as broad, the spiral joint subconical, scarcely longer than the penultimate. Thorax compact, globose, minutely granulated like the head; the abdomen also compact, arched, the tip rounded; beyond it the ovipositor extends very slightly, apparently by pressure.

On another stone, collected by Mr. Richardson, is pretty certainly another specimen of this species, in which the abdomen is distorted by pressure; the abdomen shows this by the rupture of the integument, and the result is an apparently slenderer abdomen; it is also a female, with exactly the same parts preserved, with the addition of the other antenna; but both antennæ are more obscure than in the other specimen, especially at the apex; they appear, however, to enlarge more rapidly and may be clavate at the tip, in which case the insect can not be the same.

Length of body, (of No. 4076), 1.85^{mm}; of abdomen, 0.95^{mm}; of antennæ beyond basal joint, 0.4^{mm}; width of penultimate antennal joint, 0.045^{mm}.

Green River, Wyoming. Two specimens, Nos. 4076 (S. H. Scudder), 86 (F. C. A. Richardson).

Family BRACONIDÆ Haliday.

CALYPTITES Scudder.

Calyptites Scudd., Rep. Progr. Geol. Surv. Can., 1876–1877, 270 (1878).

This name is proposed for a genus of fossil Braconidæ, which seems to be distinct from any described living forms. It is related to Calyptus, but differs from it in the neuration of the front wings, mainly in the shortness of the first submedian cell, the division between which and the second submedian cell lies much before the lower extremity of the first median cell; and still more in the shape and position of the first subcostal and second median cells; the vein which separates them is in straight continuity with that separating the second subcostal and third median cells, so that the subcostal cells and the median cells lie in parallel lines along the longer diam-

eter of the wing; the second median cell is scarcely more than half as large as the first subcostal cell, subquadrate, broadest below; the first subcostal cell is angulate, but broadly oval, its larger diameter along the wing almost twice as long as broad.

Calyptites antediluvianum.

Pl. 3, Fig. 32.

Calyptites antediluvianum Scudd., Rep. Progr. Geol. Surv. Can., 1876–1877, 270 (1878); in Zittel, Handb. d. Paläont, I, ii, 816, Fig. 1100 (1885).

Represented by a single fore-wing in perfect preservation. It is uniformly and scarcely infumated, the anal cell decidedly fuliginous, the stigma also fuliginous and centrally infuscated; as preserved on the stone the veins are pale and delicately edged with black and accompanied by a very narrow and delicate infumated margin, especially in the basal and lower halves of the wing; the median vein does not reach the margin of the wing next the anal excision, but bends and runs in a straight course to the outer border; the second median cell has numerous brief shoots from the nervures along its lower and outer margins, and one is found at the middle of the upper margin of the second subcostal cell, and another below the middle of the vein separating the first and second subcostal cells.

Length of wing, 6^{mm}; breadth of the same beyond the costa, 2.1^{mm}.

Quesnel, British Columbia. One specimen, No. 7 (Dr. G. M. Dawson, Geological Survey of Canada).

BRACON Fabricius.

Bracon laminarum.

Pl. 10, Fig. 29.

Bracon laminarum Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 748 (1878).

A single specimen and its reverse show a body without wings or other appendages. The head is quadrate, broader than long, and nearly as broad as the thorax. The thorax is subquadrate, either extremity rounded, about half as long again as broad, the sides nearly parallel, and the surface, like that of the head, minutely granulated; abdomen fusiform, very regular, in the middle as broad as the thorax, as long as the head and thorax together, tapering apically to a point, and composed apparently of six segments.

Length of body, 2.8^{mm}; of head, 0.6^{mm}; of thorax, 0.85^{mm}; of abdomen, 1.35^{mm}; breadth of head, 1.1^{mm}; of thorax, 1.2^{mm}.

Green River, Wyoming. One specimen, Nos. 4196 and 4197 (S. H. Scudder).

Bracon sp.

Pl. 3, Fig. 33.

Bracon sp. Scudd., Rep. Progr. Geol. Surv. Can., 1877–1878, 177B (1879).

An insect apparently belonging to Bracon or a closely allied genus is so imperfectly preserved as not to allow of description; both the front wings are very imperfect; the whole of the body and fragments of the legs are preserved.

The insect was 4^{mm} long, and the length of the front wing about 2.85^{mm}.

Similkameen River, British Columbia. One specimen, Nos. 69 and 78 (Dr. G. M. Dawson, Geological Survey of Canada).

Braconidæ sp.

Pl. 10, Fig. 18.

Probably belonging to this family is the insect figured on Pl. 10, Fig. 18, which represents a minute species preserved on a partially lateral, partially dorsal view. Unfortunately the wings are nearly obliterated, and though the general appearance of the insect is gained, it is impossible to determine its place. Its size and general appearance would seem to indicate that it belongs here rather than in the Ichneumonidæ, and it perhaps falls in the vicinity of Laccophrys Först. and of Macrocentrus Cress.

Length of body, 3^{mm}; of antennæ as far as preserved, 2^{mm}; of ovipositor, 1.5^{mm}.

Green River, Wyoming. One specimen, No. 130 (Dr. A. S. Packard)

Braconidæ sp.

Pl. 10, Fig. 28.

To this family rather than to the Ichneumonidæ also probably belongs the specimen figured in Pl. 10, Fig. 28, but of which, the antennæ and ovipositor being the only well preserved parts, not enough remains to indicate any affinities with certainty. Perhaps it may fall near Meteorus.

Length of body, 4.5^{mm}; of (broken) antennæ, 3^{mm}; of ovipositor (base wanting), 2.5^{mm}.

Green River, Wyoming. One specimen, No. 133 (Dr. A. S. Packard).

Family ICHNEUMONIDÆ Leach.

ICHNEUMON Linné.

Ichneumon petrinus.

Pl. 5, Figs. 14, 15.

Ichneumon petrinus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 743 (1877).

A fragmentary specimen, preserved on a dorsal aspect: parts of the front wings, the thorax, and basal half of the abdomen are preserved. The body is blackish and the wing-veins testaceous; the wing, excepting the fusco-testaceous stigma, is hyaline, covered sparsely with very delicate and moderately long hairs; the stigma is long and slender, the heaver main portion about two and a half times longer than broad, the slender basal extension as long again. Unfortunately, the wing is preserved only as far as, but not including, the areola, so that many characteristic parts are lacking; the second median and first subcostal cells are united, the vein separating them being present only below, where it is directed parallel to the principal longitudinal veins; the vein from which it springs is bent at an angle of about 70°, so that the part representing the first subcostal cell tapers rather rapidly in its apical half, while its basal half (if the cross-vein were continued) would be of the same size and shape as the second median cell, or a parallelogram nearly twice as long as broad; the vein separating the first and second median cells is continued in a nearly direct line below; the third median cell is long and rather slender, with somewhat produced angles basally. The first segment of the depressed abdomen is fully half as long again as broad, increases a little and regularly in size toward the extremity, at its base is about half as broad as the extremity of the thorax, and at its tip less than half as broad as the broadest part of the thorax; the second segment is considerably larger, and also enlarges apically, but its length is indeterminate.

Length of thorax, 2.6^{mm}; breadth of same, 1.5^{mm}; length of wing to tip of stigma, 4.25^{mm}; breadth of base of abdomen, 0.5^{mm}.

Chagrin Valley, White River, Colorado. One specimen (W. Denton).

LITHOTORUS gen. nov. (*λίθος*, *τόρος*).

This genus of Ichneumonidæ is undoubtedly allied to Exyston, but differs from it, as it does from all members of the family known to me, by the separation of the first from the second cubital cell by a weak nervure, not shown in the plate, which extends entirely across the space usually left open in this family, though almost always closed in the Braconidæ. It is also remarkable for the flaring of the apical cubital cell. The antennæ are shorter than the body and the abdomen has the basal joint comparatively stout, considerably enlarging, and the subapical joints more than twice as broad as long.

LITHOTORUS CRESSONI.

Pl. 10, Fig. 21.

The single specimen is preserved on a side view in which all the parts but the legs are preserved, but the wings are somewhat obscured by overlapping. Apparently, the areola is not closed externally, and the outer cubital cell is opened unusually wide, while the radial cell is exceptionally deep for its length; the parts below the areola are obscure. The antennæ are moderately stout, reaching to the middle of the abdomen, the joints scarcely moniliform, twice as long as broad. The thorax is compact oval. The abdomen beyond the basal joint is as long as the head and thorax together; the basal joint is more than twice as broad apically as at the base and less than twice its greatest breadth. The whole body, but especially the thorax, is dark colored.

Length of body, 4^{mm}; of antennæ, 3^{mm}; of wing, 3^{mm}.

Green River, Wyoming. One specimen, No. 131 (Dr. A. S. Packard).

RHYSSA Gravenhorst.

RHYSSA JUVENIS.

Pl. 10, Fig. 19.

Although smaller than any species I have noted, and much smaller than most known to me, I can find no characters in this single specimen which do not occur in Rhyssa, except in the relative proportions of the thorax and abdomen. The specimen is preserved on a side view and in a gen-

eral way shows everything except the legs; but the basal parts of the wings are obscured on account of their overlying the body, and give the remainder a foreshortened look. The antennæ are tolerably stout, a portion longer than the large thorax being preserved, with joints a little more than twice as long again as broad. The thorax is large, massive, arched, twice as high as the head, regularly ovate, and half as long again as high. The wings are tolerably broad, and the neuration is obscured by the overlying of the wings and the crumpling of some of them; it shows, however, a long first cubital cell separated from the second by a minute triangular areola attached by its apex directly to the radius, with no intervening pedicel, and containing a brief, outward directed, recurrent nervule emitted from the cubital vein slightly nearer the areola than the outer discoidal cell. The abdomen is very obscure, but is certainly very short—no longer than head and abdomen together—and appears not to be broadest apically, but only a little beyond the middle; but this can not be stated positively. The ovipositor is considerably longer than the body, stout and straight; it is densely clothed with fine, short, recumbent hairs to its very tip.

Length of body, 8^{mm}; of thorax, 3.3^{mm}; of abdomen, 4^{mm}; height of thorax, 2.1^{mm}; length of wing, 6.25^{mm}; breadth of same, 2.25^{mm}; length of ovipositor, 9^{mm}; breadth of same, 0.25^{mm}.

Green River, Wyoming. One specimen, No. 129 (Dr. A. S. Packard).

PIMPLA Fabricius.

Pimpla saxea.

Pl. 3, Fig. 23.

Pimpla saxea Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 268 (1877).

This species is represented by a single specimen presenting a shattered thorax, the first four abdominal segments viewed from above, and the front wing. These abdominal segments are pretty uniform and regular, rather strongly convex, pale testaceous, with a broad, blackish fuscous, basal, transverse band, occupying fully one-third of each segment; the segments are quadrate, broader than long, and smooth. The metathorax is pale testaceous, and very delicately scabrous. The wing is uniformly hyaline, or shows the slightest trace of infumation, especially at the extreme tip, and is uniformly and rather sparsely covered with microscopic hairs, averaging

0.04mm in length in the third median cell, seated upon little chitinous annuli 0.008mm in diameter; the veins are black, and the basal part of the stigma black, but beyond it is dark fusco-castaneous; the castaneous portion (lying beyond the tip of the first median cell) is three times as long as broad, extending half-way down the upper border of the first subcostal cell; the third costal cell is comparatively narrow at tip, and the tip of the wing is somewhat pointed; the vein separating the areola or second subcostal cell from the third costal cell is partially obliterated, and the areola is rather small, subquadrate, broadest at the open side; there is the slightest possible trace of the lower extremity of the vein separating the united first subcostal and second median cells, but the vein bordering the upper side of the third median cell is perfect throughout; the vein separating the third and fourth median cells is gently curved, subsinuate and partially obliterated in the middle.

Length of fragment of body, 5.5mm; length of wing, 8.75mm; breadth of wing beyond stigma, 2.9mm; greatest width of third costal cell, 0.35mm.

Quesnel, British Columbia. One specimen, No. 31 (Dr. G. M. Dawson, Geological Survey of Canada).

Pimpla senecta.

Pl. 3, Figs. 29–31.

Pimpla senecta Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 267–269 (1877).

A single specimen and its reverse show little besides the greater part of the front wing and the tip of the hind wing; crushed chitinous masses represent parts of the abdomen, and perhaps of the thorax; the wing is uniformly hyaline, with the slightest possible trace of infumation next the base, and is profusely covered with tapering microscopic hairs, averaging 0.065mm in length in the third median cell, seated upon minute chitinous annuli 0.01mm in diameter; the veins are black, or toward the tip and on the hind wing castaneous, and the stigma is dark testaceous; most of the stigma is broken, but enough remains to show that it is apparently not so broad as in the other species here described, and it extends less than half-way down the upper border of the first subcostal cell; apically the third costal cell is comparatively broad, and the tip well rounded; the vein separating the areola from the third costal cell is nearly obliterated, and the areola is rather small, and shaped as in P. saxea; there is no trace whatever of the vein separating the united

first subcostal and second median cells, although the vein above the third median cell is bent where it should join it, as in the preceding species; the same vein is partially obliterated in the middle of the portion below the first subcostal cell; the vein separating the third and fourth median cells is strongly curved, subsinuate and distinct throughout.

Length of wing, 8.4^{mm}; breadth beyond the stigma, 2.4^{mm}; greatest width of the third costal cell, 0.4^{mm}. Formica arcana lies on the same stone.

Quesnel, British Columbia. One specimen, Nos. 10^{b} and 12 (Dr. G. M. Dawson, Geological Survey of Canada).

Pimpla decessa.

Pl. 3, Fig. 27.

Pimpla decessa Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 269 (1877).

The remains of this insect consist of crushed thorax and abdomen, and the two wings of one side of the body, superimposed; upon the same stone, at a slightly higher level, is the specimen of Boletina sepulta. The thorax and abdomen are entirely crushed and black, but the last segment of the latter bears the closest possible resemblance to the abdomen of the male of Pimpla instigator Fabr. The wing is uniformly infumated, and the margins of the anal excision infuscated; it is covered very profusely with short microscopic tapering hairs, more irregularly distributed than in the other two species described, averaging in the third median cell 0.03^{mm} in length, and seated on chitinous annuli varying in size, some being but half as large as others, the larger ones measuring about 0.007^{mm} in diameter; the veins are black and the large triangular stigma almost as dark, a little paler toward either extremity; the stigma is about twice as long as broad, and extends more than half-way down the upper border of the first subcostal cell, the vein being partially obliterated beyond it; the third costal cell is rather narrow apically, although the tip of the wing is pretty well rounded. The species may readily be distinguished from those described above by the shape of the areola, which is pretty regularly quadrate, twice as long as broad, and has the vein next the third costal cell obliterated only at the ends; there is no trace of the vein separating the united first subcostal and second median cells, and the vein separating these cells from the third median cell is bent in the middle, and nearly obliterated in the middle half;

the vein separating the third and fourth median cells is strongly curved, not at all sinuate, and slightly indistinct at its upper extremity.

Length of fragment of body, 8.5^{mm}; length of wing, 7.7^{mm}; breadth of same beyond the stigma, 2.6^{mm}; greatest width of third costal cell, 0.27^{mm}.

Quesnel, British Columbia. One specimen, No. 9^{a} (Dr. G. M. Dawson, Geological Survey of Canada).

GLYPTA Gravenhorst.

Glypta transversalis.

Pl. 10, Fig. 25.

The single specimen is preserved on a dorsal view, with the upper right wing turned forward and reversed. The flaking of the stone in front has destroyed the antennæ, no legs are preserved, and the apical portion of the abdomen is altogether obscure; no ovipositor can be seen. The general disposition of the neuration is altogether as in all the figures of Glypta I have seen, but there are several points in it wherein it differs from all of them. The basal cubital cell is much less elongated than usual by the comparatively slight extension of the apical portion of the cell beneath the stigma, consequent upon the brevity of the basal portion of the radius; the basal discoidal cell is also unusually short and the cross-vein separating the middle and apical discoidal cells straight and not zigzag. The eyes are large and prominent, and by the preservation of the specimen it is evident that they shared in the considerable variegation of the body by being of a light color with a basal dark annulus, next which the head was again light, with a dark central portion relieved by a posterior transverse light belt. The thorax was similarly ornamented, the mesothorax having dark sides and a broad mesial light band enlarging posteriorly and anteriorly, but divided by a middle dark line which expands in front and behind to a stripe. The metathorax is mostly light with a mesial dark stripe. The abdomen is light, but with the lateral prominences at the base of the earlier joints peculiar to Glypta (here transverse instead of obliquely longitudinal) of a dark color; these prominences are largest on the first and second segments, where they nearly touch in the middle, and especially on the second segment, where they are twice as broad as on the others, slightly oblique, but directed

inward and backward (not forward) and reticulated as if more or less punctate in life. The head, thorax, and abdomen are of about equal width.

Length of wing, 4.5mm.

Green River, Wyoming. One specimen, No. 76 (Prof. L. A. Lee).

ECLYTUS Holmgren.

Eclytus lutatus.

Pl. 10, Fig. 24.

The single specimen is preserved on a side view, with one wing drooping. A portion of the moderately stout antennæ is preserved, showing them to be at least nearly as long as the body, and the middle joints to be rather more than twice as long as broad. The neuration of the wing is obscure about and below the region of the areola, which appears to be lacking, the direction of the cubital vein from its extremity backward being toward the angle of the radius beyond the stigma; before this junction the cubitus is more curved than represented on the plate; the obscurity prevailing in that region does not permit one to see the cross-vein below the position of the areola with clearness, but there is a faint indication of a straight vein depending from that point; the separation of the second discoidal and humeral cells is by a straight, scarcely oblique cross-vein in direct continuation of the vein above and not shown on the plate. The neuration of the hind wing is exactly as in all species of Eclytus. The abdomen is evidently compressed laterally, pedicelled by the apically enlarging long first segment, the remainder oblong ovate on a side view, most expanded beyond the middle, a little more than twice as long as high; ovipositor scarcely so long as the extreme height of the abdomen.

Length of body, 3.5mm; of wing, 2.65mm; of ovipositor, 0.65mm.

The species apparently differs from those figured by Snellen van Vollenhoven in his Pinacographia in that the cubital vein meets the radius by a union of similar but reversed angles.

Green River, Wyoming. One specimen, No. 36 (Prof. L. A. Lee).

Tribe ACULEATA Latreille.

Family MYRMICIDÆ Lepelletier.

APHÆNOGASTER Mayr.

APHÆNOGASTER LONGÆVA.

Pl. 3, Fig. 28.

Aphænogaster longæva Scudd., Rep. Progr. Geol. Geogr. Surv. Can., 1875–1876, 267 (1877).

A single very obscure and fragmentary specimen, and its still more obscure reverse, are the sole representatives of this species; they exhibit a crushed and confused mass of head, thorax, legs, and antennæ, and the larger part of a single front wing, apparently of a male. The wing is faintly infumated, especially beyond the stigma, and the stigma itself is only a little deeper in tint; the wing is also covered very sparsely with excessively delicate and very short microscopic hairs. The cubital vein forks beyond the discoidal cell by only one-third the width of the latter, and both the veins run to the tip of the wing, although very faintly. This cell is shaped exactly as in A. berendti Mayr, found in amber, and is distant from the scapular vein by only half its width; the costal margin of the wing is more convex beyond the stigma than in the amber species mentioned.

The base of the wing is lost, but its probable length is 7^{mm}, and its greatest breadth is 2.3^{mm}; length of stigma, 0.8^{mm}.

Quesnel, British Columbia. One specimen, No. 33 (Dr. G. M. Dawson, Geological Survey of Canada).

MYRMICA Latreille.

MYRMICA sp.

Pl. 10, Fig. 22.

Myrmica sp. Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 748 (1878).

A species of this family was found at Green River, but a specific name is withheld in the hope of finding better material on which to base it. The head is rather small, circular; the thorax very regularly ovate and nearly twice as long as broad; the peduncle small and composed of two adjoining

circular masses, the hinder slightly the larger; the abdomen is much broken, but evidently larger than the thorax and pretty plump; no appendages are preserved.

Length of body, 3.3^{mm}; diameter of head, 0.4^{mm}; length of thorax, 1.2^{mm}; width of same, 0.75^{mm}; length of peduncle, 0.25^{mm}; diameter of anterior joint of same, 0.1^{mm}; width of abdomen, 0.85^{mm}; its probable length, 1.8^{mm}.

Green River, Wyoming. One specimen, No. 53 (F. C. A. Richardson).

Family FORMICIDÆ Stephens.

HYPOCLINEA Mayr.

Hypoclinea obliterata.

Pl. 3, Figs. 25, 26.

Hypoclinea obliterata Scudd., Rep. Progr. Geol. Geogr. Surv. Can., 1875–1876, 267 (1877).

There are two specimens to be referred to Hypoclinia, and both are very fragmentary. One (No. 8) consists of the partial remains of the wings of one side overlapping; the other (No. 14) of similar remains, but so faintly impressed on the stone that some of the veins can not be traced at all, and since in all essential features it agrees with the more distinct fragments, I have considered it as belonging to the same species, although it is of slightly greater size.

The essential portions of the fore wing remain, showing the neuration to be that of Hypoclinia; the second cubital cell is triangular, and the vein which marks its outer limit arises from the upper branch of the cubital vein a little beyond the cross-vein depending from the stigma; the discoidal cell is of about the same size as the second cubital cell, and is subquadrate, the vein marking its outer margin a little curved, and the apex of the cell itself separated by but a short space from the base of the second cubital cell. The scapular vein is more darkly colored than the others, and a faint fuliginous cloud appears to surround the rather dark stigma.

Length of fragment of wing, 5^{mm}; distance from base of wing to tip of stigma, 4^{mm}.

Quesnel, British Columbia. Two specimens, Nos. 8, 14 (Dr. G. M. Dawson, Geological Survey of Canada).

LIOMETOPUM Mayr.

LIOMETOPUM PINGUE.

Pl. 5, Fig. 10.

Liometopum pingue Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 742–743 (1877).

The single specimen representing this species is a male, as the number of abdominal segments show; but the wings are lacking. The insect is viewed from above. The head and thorax are slightly darker than the abdomen, but otherwise the whole body is uniformly fuscous, somewhat darker than the stone. The head is very small, subquadrate, slightly broader behind, and the posterior angles nearly rectangular: the anterior margin of the head is broadly and pretty regularly rounded, and the whole head is of about equal length and breadth. The thorax is very regularly ovate, broadest next the insertion of the front wings (traces of the origin of which can be seen), nearly twice as long as broad, rapidly tapering on the metathorax. The peduncle, as seen from above, is square, half as broad as the head, the hinder edge showing by its thickening that it was probably elevated at this point. The abdomen is plump, rounded ovate, scarcely less rounded posteriorly than in front, only one quarter longer than broad, broader than the thorax, composed of six segments, of which the first, third, and fourth are about equal in length, and the second half as long again.

Length of whole body, 7.5^{mm}; of thorax, 3^{mm}; breadth of same, 1.8^{mm}; of peduncle, 0.9^{mm}; of abdomen, 2.3^{mm}; length of hind femora, 4.3^{mm}; breadth of same, 0.36^{mm}.

On account of the smallness of the head, I venture to place this insect in the genus Liometopum. It has the aspect of a Hypoclinea, but the head is only half as broad as the thorax.

Fossil Cañon, White River, Utah. One specimen. (W. Denton.)

A specimen from Green River, of precisely the same size and general appearance and pretty certainly belonging to the same species, is also wingless and has no legs preserved, but the thorax is rather profusely clothed with exceedingly delicate very short hairs.

Green River, Wyoming. One specimen, No. 262 (Dr. A. S. Packard).

FORMICA Linné.

Formica arcana.

Pl. 3, Fig. 24.

Formica arcana Scudd., Rep. Progr. Geol. Surv. Can., 1875–1876, 266–267 (1877).

A single fragment of a wing, exhibiting, however, all the important parts of the neuration, is to be referred to the genus Formica (s. str.) Pimpla senecta lies on the same stone. The discoidal cell is of medium size, subquadrate, a little broader below than above; the single closed cubital cell is about three times as long as the discoidal cell, being a little produced (to considerably less than a right angle) at the tip, where the transverse vein, coming obliquely from the stigma, strikes the cubital vein exactly where it branches, forming a minute stigma, from which four veins radiate almost symmetrically: the wing is of a uniform, faint fuliginous color, the stigma of medium size, darkest along its lowest border, and all the veins dark, the scapular vein even black, and margined on its apical half with testaceous.

The wing is 3^{mm} in width, from the anal emargination to the base of the stigma, and the tip of the basal internomedian cell is 4.25^{mm} distant from the apex of the closed cubital cell, making it probable that the entire length of the wing was nearly 12^{mm}.

Quesnel, British Columbia. One specimen, No. 10^{a} (Dr. G. M. Dawson, Geological Survey of Canada).

LASIUS Fabricius.

Lasius terreus.

Pl. 10, Fig. 23.

Lasius terreus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., IV, 747–748 (1878).

A single specimen obtained by Dr. Hayden at the "Petrified Fish Cut," Green River (alluded to in his Sun Pictures of Rocky Mountain Scenery, page 98), is probably to be referred to this genus, but is in rather a poor state of preservation. The head is small and rounded, with antennæ shaped as in Lasius, but of which the number and relative length of the joints can not be determined from their obscurity; the long basal joint, however, appears to be comparatively short and uniform in size, being not quite so long as the width of the head, while the rest of the antennæ is more than half as

long as the basal joint, and thickens very slightly toward the apex. The thorax, preserved so as to show more of a dorsal than a lateral view, is compact, oval, less than twice as long as broad, with no deep separation visible between the meso- and metathorax, tapering a little posteriorly. The peduncle, as preserved, is a minute circular joint, but from its discoloration appears to have had a regular, rounded, posterior eminence. The abdomen consists of five joints, is very short oval, very compact and regular, and of about the size of the thorax, although rounder. The legs are long and slender, the femora of equal size throughout, and all the pairs similar. There is no sign of wings, and the specimen is probably a neuter.

Length of body, 7.5^{mm}; of head, 1.4^{mm}; of thorax, 3.2^{mm}; of abdomen, 2.9^{mm}; breadth of head, 1.1^{mm}; of thorax, 1.9^{mm}; of abdomen, 2.2^{mm}; diameter of peduncle, 0.55^{mm}; length of first joint of antennæ, 1^{mm}; of rest of antennæ, 1.65^{mm} ?.

Green River, Wyoming. One specimen, No. 14692 (Dr. F. V. Hayden).

CAMPONOTUS Mayr.

Camponotus vetus.

Pl. 5, Figs. 1, 2.

Camponotus vetus Scudd., Bull. U. S. Geol. Geogr. Surv. Terr., III, 742 (1877).

A single specimen, very fairly preserved, lying upon the side; a remnant of one wing is left, and a faint indication of the antennæ, but the legs are wanting. The head has a flat summit, the upper half of the sides roundly protuberant, the lower half rather broad, and tapering but little; the thorax is long and moderately slender, compacted into a single mass, with a low arch, more than twice as long as high. The first segment of the abdomen increases rapidly in size posteriorly, and has a rounded knob above at its hinder end; the abdomen is long and slender, composed of five joints, the second the largest, gradually tapering to the pointed tip. It seems to agree better with Camponotus than with any other genus, but has a differently shaped head and first abdominal joint, and is smaller than the species of that genus, so that it is only placed here provisionally until other and better specimens are obtained.

Length of body, 3.75^{mm}; of thorax, 1.15^{mm}; of abdomen, 2^{mm}.

White River, near the Colorado-Utah boundary. One specimen (W. Denton).

Family SPHEGIDÆ Westwood.

DIDINEIS Wesmael.

DIDINEIS SOLIDESCENS.

Pl. 10, Fig. 30.

The body of the single specimen known is preserved on a side view but partially dorsal, and though the antennæ and legs are destroyed, the wings are tolerably well preserved. There is, however, no sign of any spine on the sides of the metanotum, the thorax here appearing to be well rounded; nor would the abdomen appear to be so closely narrowed at the base as in Didineis. The neuration of the wings agrees very closely with that of Didineis lunicornis Fabr. sp., except in the very much larger size and subtriangular shape of the marginal cell, the width of which is nearly one-third that of the wing. The middle discoidal cell also is remarkable for its extreme length, being at least three times as long as its basal breadth. The body is not very darkly colored on the stone, being of a rather pale testaceous tint, but the apical half or less of the abdominal segments are paler than the rest.

Length of body, 7^{mm}; of wing, 5.25^{mm}.

Green River, Wyoming. One specimen, Nos. 132 and 263 (Dr. A. S. Packard).

LIST OF SPECIES.

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, WITH REFERENCE TO THE PLACES WHERE THEY ARE DESCRIBED AND FIGURED AND THE LOCALITIES AND HORIZONS AT WHICH THEY ARE FOUND.

The following abbreviations are used in the last two columns of localities: Q. = Quesnel; S. = Similkameen River; M. = Nine-Mile Creek; N = Nicola; C. C. = Crow Creek, Colo.; H. C. = Horse Creek, Wyo.; T. C. = Twin Creek, Wyo.; S. O. = Scarboro, Ontario; P. K. = Port Kennedy, Pa.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	MYRIAPODA.								
1	Iulus telluster	44	6: 15		×				Oligocene
	ARACHNIDES.								
	ACARINA.								
2	Ixodes tertiarius	47	6: 12		×				Oligocene
	ARANEIDES.								
	SALTIGRADÆ.								
	Attides.								
3	Parattus resurrectus	53	11: 26	×					Oligocene
4	Parattus evocatus	54		×					do
5	Parattus latitatus	55		×					do
	LATERIGRADÆ.								
	Thomisides.								
6	Thomisus resutus	57	11: 13	×					Oligocene
7	Thomisus disjunctus	58	11: 9	×					do
8	Thomisus defossus	59	11: 23	×					do
	TUBITELARIÆ.								
	Dysderides.								
9	Segestria secessa	61	11: 28	×					Oligocene
	Drassides.								
10	Clubiona eversa	63	11: 22	×					Oligocene
11	Clubiona arcana	64	11: 4	×					do
12	Clubiona latebrosa	65	11: 18	×					do
13	Clubiona ostentata	65	11: 24	×					do
14	Anyphæna interita	67	11: 5	×					do
	Agalenides.								
15	Titanœca ingenua	69	11: 29, 32	×					Oligocene
16	Titanœca hesterna	69		×					do
	RETITELARIÆ.								
	Theridides.								
17	Aranea columbiæ	71	2: 1, 2	×	×		Q.		Oligocene
18	Theridium opertaneum	73	11: 3	×					do
19	Theridium seclusum	74	11: 20	×					do
20	Linyphia retensa	75	11: 25, 27	×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED.

In the columns giving Degree of Relationship the following marks are used: !! = very close; ! = close; = general; † = distant; ? = possible.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living	
....	.....	.....	.....	....	.....	.....	1
....	.....	.....	.....	....	.....	.....	2
....	.....	.....	.....	....	.....	.....	3
....	.....	.....	.....	....	.....	.....	4
....	.....	.....	.....	....	.....	.....	5
....	.....	.....	.....	....	.....	.....	6
....	.....	.....	.....	....	.....	.....	7
....	.....	.....	.....	....	.....	.....	8
....	.....	.....	.....	-	S. senoculata (Linn.)	Europe.....	9
=	C. tomentosa K. & B...	Baltic amber.	Ligurian..	....	.....	.....	10
=	C. sericea, C. lanata K.-B.	....do	....do	....	.....	.....	11
=	C. attenuata K. & B...	....do	....do	....	.....	.....	12
†	C. microphthalma K.-B.	....do	....do	....	.....	.....	13
....	.....	.....	.....	....	.....	.....	14
....	.....	.....	.....	†	T. quadriguttata (H.)	Europe	15
....	.....	.....	.....	†	....do	....do	16
....	.....	.....	.....	....	.....	.....	17
?	T. granulatum K. & B...	Baltic amber.	Ligurian ..	....	.....	.....	18
?	T. hirtum K. & B.....	....do	....do	....	.....	.....	19
†	L. cheiracantha K. & B.	....do	....do	....	.....	.....	20

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.		Localities where found.							
	Groups, genera, and species.	Page.	Plate and figure	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	ORBITELARIÆ.								
	Epeirides.								
1	Tetragnatha tertiaria	77	11: 11	×					Oligocene
2	Tethneus guyoti	78	11: 8, 10	×					do
3	Tethneus obduratus	79	11: 31	×					do
4	Tethneus hentzii	80	11: 14	×					do
5	Tethneus provectus	81	11: 21	×					do
6	Epeira meekii	83	11: 2, 17	×					do
7	Epeira abscondita	84	11: 7	×					do
8	Epeira delita	85	11: 6	×					do
9	Epeira cinefacta	85	11: 16	×					do
10	Epeira vulcanalis	86		×					do
11	Epeira emertoni	87	11: 15, 19	×					do
12	Epeira sp	88	11: 1	×					do
13	Epeira sp	89			×				do
14	Epeira sp	89			×				do
15	Nephila pennatipes	89	11: 12	×					do
	NEUROPTERA.								
	THYSANURA.								
	BALLOSTOMA.								
16	Planocephalus aselloides	94	Figs. in text	×					Oligocene
	LEPISMATIDÆ.								
17	Lepisma platymera	102	12: 18	×					Oligocene
	TERMITINA.								
18	Parotermes insignis	108	12: 13, 14	×					Oligocene
19	Parotermes hageni	110	12: 2	×					do
20	Parotermes fodinæ	112	12: 3, 22	×					do
21	Hodotermes coloradensis	113	12: 6	×					do
22	Entermes fossarum	115	12: 20	×					do
23	Entermes meadii	115	12: 12, 17	×					do
	PSOCINA.								
24	Paropsocus disjunctus	118	5: 51			×			Oligocene (?).
	EPHEMERIDÆ.								
25	Ephemera tabifica	120		×					Oligocene
26	Ephemera immobilis	121	12: 5	×					do
27	Ephemera macilenta	122	12: 4, 10	×					do
28	Ephemera pumicosa	122	12: 7, 15, 16	×					do
29	Ephemera interempta	123		×					do
30	Ephemera exsucca	124	12: 9	×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
....	.....	.....	.....	†	T. grallator Hentz.	East. U. S.	1
....	.....	.....	.....	....	.....	.....	2
....	.....	.....	.....	....	.....	.....	3
....	.....	.....	.....	....	.....	.....	4
....	.....	.....	.....	....	.....	.....	5
?	E. troschelii Bertk	Rott	Aquitanian.	....	.....	.....	6
....	.....	.....	.....	....	.....	.....	7
....	.....	.....	.....	....	.....	.....	8
....	.....	.....	.....	....	.....	.....	9
....	.....	.....	.....	....	.....	.....	10
....	.....	.....	.....	....	.....	.....	11
....	.....	.....	.....	....	.....	.....	12
....	.....	.....	.....	....	.....	.....	13
....	.....	.....	.....	....	.....	.....	14
....	.....	.....	.....	?	N. plumipes Koch..	South. U. S.	15
....	.....	.....	.....	....	.....	.....	16
....	.....	.....	.....	....	.....	.....	17
....	.....	.....	.....	....	.....	.....	18
....	.....	.....	.....	....	.....	.....	19
....	.....	.....	.....	....	.....	.....	20
?	H. insignis, spectabilis.	Oeningen....	Tortonian	....	.....	.....	21
....	.....	.....	.....	....	.....	.....	22
....	.....	.....	.....	....	.....	.....	23
....	.....	.....	.....	....	.....	.....	24
....	.....	.....	.....	....	.....	.....	25
....	.....	.....	.....	....	.....	.....	26
....	.....	.....	.....	....	.....	.....	27
....	.....	.....	.....	....	.....	.....	28
....	.....	.....	.....	....	.....	.....	29
....	.....	.....	.....	....	.....	.....	30

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River,	British Columbia.	Other localities.	Geological horizon.
	ODONATA.								
	AGRIONINA.								
1	Dysagrion fredericii	130	6: 2, 5, 6, 9, 10, 14, 17		×				Oligocene
2	Dysagrion lakesii	132			×				do
3	Dysagrion packardii	132	6: 1, 3, 11		×				do
4	Podagrion abortivum	134	6: 7, 8		×				do
5	Lithagrion hyalinum	135	13: 4	×					do
6	Lithagrion umbratum	136	13: 12, 14	×					do
7	Agrion mascescens	138	13: 8, 9	×					do
8	Agrion exsularis	139	13: 6	×					do
9	Agrion telluris	140	13: 10	×					do
	ÆSCHNINA.								
10	Æschna solida	143	13: 1	×					Oligocene
11	Æschna separata	144	13: 15	×					do
12	Æschna larvata	145	13: 11	×					do
	LIBELLULINA.								
13	Libellula sp	146	6: 4, 16		×				Oligocene
	PLANIPENNIA.								
	SIALINA.								
14	Corydalites fecundum	149	14: 5-7, 13 16, 18 21, 23					C. C.	Laramie
15	Raphidia tranquilla	154	14: 2	×					Oligocene
16	Inocellia veterana	156	14: 1	×					do
17	Inocellia somnolenta	157	14: 12	×					do
18	Inocellia tumulata	158	14: 15	×					do
19	Inocellia eventa	160		×					do
	HEMEROBINA.								
20	Osmylus requietus	162	14: 3, 8	×					Oligocene
21	Bothromicromus lachlani	164	2: 7–10				Q.		
22	Palæochrysa stricta	166	14: 13, 14	×					do
23	Tribochrysa vetusula	170	14: 9	×					do
24	Tribochrysa inequalis	170		×					do
25	Tribochrysa firmata	172	14: 6, 7, 10, 11	×					do
	PANORPIDÆ.								
26	Holcorpa maculosa	174	14: 4, 5	×					Oligocene
27	Panorpa rigida	176		×					do
	TRICHOPTERA.								
	HYDROPSYCHIDÆ.								
28	Hydropsyche operta	180	5: 52, 53			×			Oligocene
29	Hydropsyche marcens	180	15: 7	×					Oligocene
30	Polycentropus exesus	181		×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

	Fossil species.				Existing species.		
	Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.
1							
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4						P. macropus Selys.	Venezuela
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8							
9							
10					??	E. constricta Say	Northern U. S.
11					??	E. janata Say	New England
12							
13							
14					†	Corydalus cornutus.	Northern U. S.
15							
16							
17							
18							
19							
20	?	O. pictus Hagen	Baltic amber.	Ligurian			
21							
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	HYDROPSYCHIDÆ—C'n'd.								
1	Polycentropus eviratus	182	13: 7	×					Oligocene
2	Derobrochus abstractus	183		×					do
3	Derobrochus cænulentus	183		×					do
4	Derobrochus æternus	184		×					do
5	Derobrochus commoratus	184		×					do
6	Derobrochus marcidus	185	15: 2	×					do
7	Derobrochus frigescens	185	15: 6, 16	×					do
8	Derobrochus cratera	186	13: 13; 15: 4	×					do
9	Litobrochus externatus	186	15: 10	×					do
10	Leptobrochus luteus	187	15: 1, 3	×					do
11	Mesobrochus lethæus	188	15: 11	×					do
12	Mesobrochus imbecillus	189	15: 13	×					do
13	Paladicella eruptionis	189	15: 14	×					do
14	Tinodes paludigena	190	15: 9	×					do
	LEPTOCERIDÆ.								
15	Setodes portionalis	191	15: 15	×					Oligocene
16	Setodes abbreviata	192		×					do
	LIMNOPHILIDÆ.								
17	Limnophilus soporatus	193	15: 5	×					Oligocene
18	Indusia calculosa	194	4: 4					H. C.	
	PHRYGANIDÆ.								
19	Neuronia evanescens	196	13: 3	×					Oligocene
20	Phryganea labefacta	197	13: 5	×					do
21	Limnopsyche dispersa	199	13: 2	×					do
	ORTHOPTERA.								
	FORFICULARIÆ.								
22	Labidiuromma avia	205	16: 3, 5, 11, 22, 23	×					Oligocene
23	Labidiuromma bormansi	206	16: 1	×					do
24	Labidiuromma mortale	207	16: 2, 6, 20	×					do
25	Labidiuromma commixtum	208	16: 10, 17	×					do
26	Labidiuromma tertiarium	209	16: 15, 18, 21	×					do
27	Labidiuromma gilberti	211	16: 14	×					do
28	Labidiuromma exsulatum	212	16: 12	×					do
29	Labidiuromma lithophilum	213	16: 19	×					do
30	Labiduromma sp	214	16: 24	×					do
31	Labidiuromma infernum	214	16: 7	×					do
32	Labidiuromma labens	214	16: 9, 13, 16	×					do
	BLATTARIÆ.								
33	Paralatindia saussurei	216	6: 25		×				Oligocene

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	BLATTARIÆ—Continued.								
1	Zetobora brunneri	217	17: 12	×					Oligocene
2	Homœogamia ventriosa	218	17: 8	×					do
	PHASMIDA.								
3	Agathemera reclusa	219	17: 11	×					Oligocene
	ACRIDII.								
	Truxalidæ.								
4	Tyrbula multispinosa	221	17: 13	×	×				Oligocene
5	Tyrbula russelli	222	17: 1–4	×					do
6	Gomphocerus abstrusus	223	17: 6	×					do
	Œdipodidæ.								
7	Nanthacia torpida	224		×					Oligocene
8	Œdipoda præfocata	225	17: 5	×					do
9	Taphaeris reliquata	226	12: 8, 19	×					do
	LOCUSTARIÆ.								
	Phyllophoridæ.								
10	Lithymnetes guttatus	229	17: 14, 15	×					Oligocene
	Pseudophyllidæ.								
11	Cymatomera maculata	230	17: 7	×					Oligocene
	Conocephalidæ.								
12	Orchelimum placidum	231	17: 16, 18, 19	×					Oligocene
13	Locusta silens	232	17: 9, 10	×					do
	Gryllacrididæ.								
14	Gryllacris cineris	233	17: 17	×					Oligocene
15	Locustariæ sp.	234			×				do
	GRYLLIDES.								
16	Pronemobius indnratus	235	6: 18		×				Oligocene
17	Pronemobius tertiarius	235	6: 13, 21, 23		×				do
18	Pronemobius smithii	236	6: 22		×				do
	HEMIPTERA.								
	HOMOPTERA.								
	COCCIDÆ.								
19	Monophlebus simplex	242		×					Oligocene
	APHIDES.								
	Aphidinæ.								
20	Catanenra absens	245		×					Oligocene
21	Catanenra rileyi	245		×					do
22	Archilachnus pennatus	247	18: 1, 15–17	×					do
23	Archilachnus mudgei	247		×					do
24	Gerancon davisii	248		×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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				†	O.concinnum Sendd	Northern U. S ..	12
				†	L.occidentalis Thom	California.....	13
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○	M. pennatus G. & B ..	Baltic amber.	Ligurian ..	†			19
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Aphidina—Cont'd.								
1	Geraneon petrorum	249	2: 6	....	....	....	Q	.....	.....
2	Sbenaphis quesneli	250	2: 4,5;18:12	×	....	....	Q	.....	.....
3	Sbenaphis uhleri	252	.....	×	....	....	.....	.....	Oligocene....
4	Sbenaphis lassa	253	.....	×	....	....	.....	.....	....do.....
5	Aphantaphis exsuca	254	.....	×	....	....	.....	.....	....do.....
6	Siphonophoroides antiqua	255	18: 3,5,7,10	×	....	....	.....	.....	....do.....
7	Siphonophoroides rafinesquei	256	.....	×	....	....	.....	.....	....do.....
8	Siphonophorondes propinqua	257	.....	×	....	....	.....	.....	....do.....
9	Lithaphis diruta	258	.....	×	×?	....	.....	.....	....do.....
10	Tephraphis simplex	259	18: 4	×	....	....	.....	.....	....do.....
11	Tephraphis walshii	260	18: 19	×	....	....	.....	.....	....do.....
12	Aphidopsis subterna	261	.....	×	....	....	.....	.....	....do.....
13	Aphidopsis hargeri	262	.....	×	....	....	.....	.....	....do.....
14	Aphidopsis lutaria	263	.....	×	....	....	.....	.....	....do.....
15	Aphidopsis margarum	264	18: 8	×	....	....	.....	.....	....do.....
16	Aphidopsis dalli	264	.....	×	....	....	.....	.....	....do.....
17	Aphidopsis emaciata	265	.....	×	....	....	.....	.....	....do.....
18	Aphidopsis sp.	266	18: 11	×	..	...	.....	.....	....do.....
19	Oryctaphis recondita	266	18: 14	×	....	....	.....	.....	....do.....
20	Oryctaphis lesneurii	267	.....	×	....	....	.....	.....	....do.....
21	Sychnobrochus revivescens	268	18: 6	×	....	....	.....	.....	....do.....
	Schizoneurina.								
22	Schizoneuroides sendderi	269	18: 2	×	....	....	.....	.....	Oligocene....
23	Am dancon lutosus	270	18: 13	×	....	....	.....	.....	....do.....
24	Anconatus dorsnosus	272	18: 9	×	....	....	.....	.....	....do.....
25	Anconatus bucktoni	272	.....	×	....	....	.....	.....	....do.....
26	Pterostigma recurvum	274	18: 18	×	....	....	.....	.....	....do.....
27	Pterostigma nigrum	275	.....	×	....	....	.....	.....	....do.....
	PSYLLIDÆ.								
28	Necropsylla rigida	276	12: 11,21	×	....	....	.....	.....	Oligocene....
29	Catopsylla prima	277	.....	×	....	....	.....	.....	....do.....
	FULGORINA.								
	Fulgorida.								
30	Nyctophylax uhleri	279	19: 11	×	....	....	.....	.....	Oligocene....
31	Nyctophylax vigil	280	19: 8	×	....	....	.....	.....	....do.....
32	Aphana atava	281	5: 96,97	....	....	×	.....	.....	Oligocene (?).
33	Aphana rotundipennis	282	6: 27	....	×	....	.....	.....	Oligocene....
34	Lystra richardsoni	283	6 24, 30, 31, 7: 1, 3	....	×	....	.....	.....	....do.....
35	Lystra leei	283	7: 2	....	×	....	.....	.....	....do.....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Fulgorida—Cont'd.								
1	Fulgora granulosa	284	6: 35	....	×	....	.....	.....	Oligocene....
2	Fulgora populata	284	7: 16	....	×	....	.....	.....	....do .....
3	Fulgora obticescens	285	19: 1	×	....	....	.....	.....	....do .....
	Dictyopharida.								
4	Dictyophara honvei	286	21: 16	×	....	....	.....	.....	Oligocene....
	Cixiida.								
5	Cixius hesperidum	287	6: 19	....	×	....	.....	.....	Oligocene....
6	Cixius proavus	287	19: 14	×	....	....	.....	.....	....do .....
7	Oliarus lutensis	288	7: 18	....	×	....	.....	.....	....do .....
8	Diaplegma haldemani	289	.....	×	....	....	.....	.....	....do .....
9	Diaplegma veterascens	290	.....	×	....	....	.....	.....	....do .....
10	Diaplegma abductum	290	15: 8	×	....	....	.....	.....	....do .....
11	Diaplegma venerabile	291	.....	×	....	....	.....	.....	....do .....
12	Diaplegma occultorum	291	.....	×	....	....	.....	.....	....do .....
13	Diaplegma ruinosum	292	.....	×	....	....	.....	.....	....do .....
14	Diaplegma obdormitum	292	.....	....	×	....	.....	.....	....do .....
15	Oliarites terrentula	293	7: 17	....	×	....	.....	.....	....do .....
16	Florissantia elegans	294	19: 12	×	....	....	.....	.....	....do .....
	Delphacida.								
17	Delphax senilis	295	5: 95	....	....	×	.....	.....	Oligocene? ..
18	Planophlebia gigantea	296	2: 16	....	....	....	S	.....	.....
	Achilida.								
19	Elidiptera regularis	297	19: 13	×	....	....	.....	.....	Oligocene....
	Ricaniida.								
20	Hammapteryx reticulata	298	6: 34	....	×	....	.....	.....	Oligocene....
	Flatida.								
21	Lithopsis fimbriata	300	6: 36, 37	....	×	....	.....	.....	Oligocene....
22	Lithopsis elongata	301	6: 28	....	×	....	.....	.....	....do .....
23	Ficarasites stigmaticum	301	6: 20	....	×	....	.....	.....	....do .....
	JASSIDES.								
24	Tettigonia priscomarginata	302	7: 4	....	×	....	.....	.....	Oligocene...
25	Tettigonia priscotincta	303	19: 9	×	....	....	.....	.....	....do .....
26	Tettigonia priscovariegata	303	.....	....	×	....	.....	.....	....do .....
27	Tettigonia obtecta	304	5: 58, 59	....	....	×	.....	.....	Oligocene? ..
28	Bythoscopus lapidescens	305	5: 94	....	....	×	.....	.....	Oligocene? .
29	Agallia lewisii	305	19: 7, 21	×	....	....	.....	.....	Oligocene....
30	Agallia flaccida	306	19: 18	×	....	....	.....	.....	....do .....
31	Agallia instabilis	306	21: 1	×	....	....	.....	.....	....do .....
32	Agallia abstructa	307	19: 5	×	....	....	.....	.....	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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				○	Aul. irroratus (F.)	United States	24
				†	Tett. bella Walk.	Silhet	25
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	JASSIDES—Continued.								
1	Gypona cinereia	308	19: 4	×					Oligocene
2	Jassus latebræ	308	20: 19	×					do
3	Thamnotettix mutilata	309	7: 6		×				do
4	Thamnotettix gannetti	309	6: 33; 7: 5		×				do
5	Thamnotettix fundi	310	19: 20	×					do
6	Cicadula saxosa	310	6: 26		×				do
7	Acocephalus adæ	311	6: 29		×				do
8	Acocephalus callosus	311	19: 15	×					do
9	Jassopsis evidens	312	19: 16	×					do
10	Cœlidia columbiana	313	2: 13				S.		
11	Cœlidia wyomingensis	313	4: 8					T. C.	Oligocene?
12	Docinus psylloides	314	19: 6, 17	×					Oligocene
	CERCOPIDÆ.								
	Cercopida.								
13	Cercopites umbratilis	316	7: 9		×				Oligocene
14	Cercopites calliscens	317	6: 32		×				do
15	Cercopis selwyni	318	2: 14, 15				M.		
16	Cercopis astricta	318	7: 15		×				Oligocene
17	Cercopis suffocata	319	19: 2, 3	×					do
18	Petrolystra gigantea	321	20: 5–7	×					do
19	Petrolystra heros	322	20: 8	×					do
20	Locrites copei	323	21: 19	×					do
21	Locrites whitei	324	21: 17	×					do
22	Paleephora maculata	326	20: 10, 17	×					do
23	Paleephora patefacta	327	7: 7		×				do
24	Paleephora marvinei	327	20: 11-13, 21: 9, 12	×					do
25	Paleephora communis	328	20: 3, 20, 21	×					do
26	Paleephora prævalens	329	20: 1; 21: 2	×					do
27	Paleephora inornata	329	20: 15	×					do
28	Lithecphora setigera	330	20: 22	×					do
29	Lithecphora diaphana	330	21: 13	×					do
30	Lithecphora unicolor	331	21: 4, 5, 11, 11	×					do
31	Lithecphora murata	331	21: 3, 8	×					do
32	Prinecphora balteata	332	20: 14	×					do
	Aphrophorida.								
33	Palaphrodes cincta	334	20: 16; 21: 15	×					Oligocene
34	Palaphrodes obscura	335	21: 18	×					do
35	Palaphrodes irregularis	335	20: 2, 18; 21: 6, 7	×					do
36	Palaphrodes obliqua	336	21: 10	×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Aphrophorida—Con.								
1	Palaphrodes transversa	336		×					Oligocene
2	Aphrophora sp.	337	19: 10	×					do
3	Clastoptera comstocki	338	19: 22	×					do
	HETEROPTERA.								
	CORIXIDÆ.								
4	Prosigara flabellum	344	22: 12	×					Oligocene
5	Corixa vanduzeei	344	22: 17	×					do
6	Corixa immersa	345	22: 16	×					do
	NOTONECTIDÆ.								
7	Notonecta emersoni	346	22: 11	×					Oligocene
	GALGULIDÆ.								
8	Necygonus rotundatus	348	7: 8		×				Oligocene
	VELIIDÆ.								
9	Palæovelia spinosa	349	22: 13	×					Oligocene
10	Stenovelia nigra	350	22: 8, 14	×					do
	HYDROBATIDÆ.								
11	Telmatrechus stali	351	2: 11, 12				8		
12	Telmatrechus parallelus	353	4: 1					T. C.	Oligocene ?
13	Metrobates æternalis	353	22: 15	×					do
	REDUVIIDÆ.								
14	Eothes elegans	355	26: 5	×					Oligocene
15	Tagalodes inermis	357	26: 15	×					do
	TINGIDIDÆ.								
16	Piesma rotunda	358	23: 6	×					Oligocene
17	Monanthia veterna	359	23: 5, 9	×					do
18	Eotingis antennata	360	23: 1, 3	×					do
	ACANTHIIDÆ.								
19	Lyctocoris terreus	361	7: 20		×				Oligocene
	CAPSIDÆ.								
20	Closterocoris elegans	363	24: 7	×					Oligocene
21	Carmelus gravatus	364	24: 10	×					do
22	Carmelus sepositus	364	24: 6	×					do
23	Fuscus fœcatus	365	22: 5	×					do
24	Pœcilocapsus fremontii	365	24: 3	×					do
25	Pœcilocapsus veterandus	366	24: 9	×					do
26	Pœcilocapsus veternosus	367		×					do
27	Pœcilocapsus tabidus	367	24: 8	×					do
28	Pœcilocapsus ostentus	368	24: 2	×					do
29	Capsus obsolefactus	368	23: 13	×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
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					C. interrupta Say	United States	4
					C. hellensii Sahlb	Europe	5
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				†	Hyg. remigis (Say.)	Atlantic States.	11
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	Phyt. involutus Germ	Baltic amber.	Ligurian		C. parvus Dist	Cen. America	21
	do	do	do		do	do	22
							23
					P. ornatulus (Stal.)	Mexico	24
							25
†	P. fremontii Scudd	Florissant	Oligocene				26
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	CAPSIDÆ—Continued.								
1	Capsus lacus	369	22: 2	×	....	....	.....	.....	Oligocene ...
2	Aporema præstrictum	370	20: 4	×	....	..	.....	.....	....do .....
3	Hadronema cinerescens	370	24: 12	×	....	....	.....	.....	....do .....
	PHYSAPODES.								
4	Melanothrips extincta	371	5: 90, 91	...	....	×	.....	.....	Oligocene ?..
5	Lithadothrips vetusta	372	5: 88, 89, 102, 103	....	....	×	.....	.....	Oligocene ?..
6	Palæothrips fossilis	373	5: 104, 105, 115	....	....	×	.....	.....	Oligocene ?..
	LYGÆIDÆ.								
	Lygæina.								
7	Lygæus stabilitus	376	22: 10; 24: 16	×	....	....	.....	.....	Oligocene ...
8	Lygæus obsolescens	377	24: 15	×	....	....	.....	.....	....do .....
9	Lygæus faeculentus	377	.....	×	....	....	.....	.....	....do .....
10	Nysius vinctus	378	.....	×	....	....	.....	.....	....do .....
11	Nysius vecula	378	22: 7	×	....	....	.....	.....	....do .....
12	Nysius tritus	379	23: 20	×	....	....	.....	.....	....do .....
13	Nysius terræ	379	23: 31	×	....	....	.....	.....	....do .....
14	Nysius stratus	380	23: 14, 27; 25: 2, 8	×	....	....	.....	.....	....do .....
	Geocorina.								
15	Geocoris infernorum	381	23: 17, 26	×	....	....	.....	.....	Oligocene ...
	Oxycarenina.								
16	Procrophius communis	382	23: 12, 18, 28, 29; 24: 1	×	....	....	.....	.....	Oligocene ...
17	Procrophius costalis	382	23: 8	×	....	....	.....	.....	....do .....
18	Procrophius languens	383	23: 23	×	....	....	.....	.....	....do .....
	Myodochina.								
19	Ligyrocoris exsuctus	385	24: 5	×	....	....	.....	.....	Oligocene ...
20	Stenopamera tenebrosa	386	23: 16, 24	×	....	....	.....	.....	....do .....
21	Stenopamera subterrea	386	23: 7	×	....	....	.....	.....	....do .....
22	Catopamera augheyi	387	27: 7	×	....	....	.....	.....	....do .....
23	Catopamera bradleyi	387	26: 12	×	....	....	.....	.....	....do .....
24	Phrudopamera wilsoni	388	27: 9, 16	×	....	....	.....	.....	....do .....
25	Phrudopamera chittendeni	389	26: 7, 9	×	....	....	.....	.....	....do .....
26	Cholula triguttata	389	7: 21	....	×	....	.....	.....	....do .....
27	Lithocoris evulsus	391	.....	×	....	...	.....	.....	....do .....
28	Cophocoris tenebricosus	391	.....	×	....	....	.....	.....	....do .....
29	Eucorites serescens	392	.....	×	....	....	.....	.....	....do .....
30	Procoris sanctæjohannis	393	.....	×	...	....	.....	.....	....do .....
31	Procoris bechleri	393	27: 4	×	...	...	.....	.....	....do .....
32	Ctenacoris primigenus	394	.....	×	....	....	.....	.....	....do .....
33	Trapezonotus exterminatus	395	22: 9, 23: 11, 22, 25	×	....	....	.....	.....	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
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					H. militaris Uhl..	Western U. S ..	3
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Myodochina—Cont'd.								
1	Trapezonotus stygialis	396	27 : 11	×	....	....	.....	.....	Oligocene ...
2	Liunæa holmesii	397	23 : 10	×	....	....	.....	.....	....do .....
3	Linnæa putnami	397	23 : 4	×	....	....	.....	.....	....do .....
4	Liunæa abolita	398	.....	×	....	....	.....	.....	....do .....
5	Liunæa carcerata	398	23 : 2	×	....	....	.....	.....	....do .....
6	Linnæa evoluta	399	23 : 21	×	....	....	.....	.....	....do .....
7	Linnæa gravida	399	23 : 19	×	....	....	.....	.....	....do .....
8	Rhyparochromus verrillii	400	23: 15, 30	×	....	....	.....	.....	....do .....
9	Pachymerus petrensis	401	5: 70, 71	....	....	×	.....	.....	Oligocene? ..
10	Tiromerus torpefactus	402	.....	×	....	....	.....	.....	Oligocene ...
11	Tiromerus tabifluus	402	.....	×	....	....	.....	.....	....do .....
12	Lithochromus gardueri	403	26: 10; 27: 8	×	....	....	.....	.....	....do .....
13	Lithochromus obstrictus	403	.....	×	....	....	.....	....	....do .....
14	Lithochromus mortuarius	404	26: 2	×	....	....	.....	.....	....do .....
15	Lithochromus extraneus	404	26: 6	×	....	....	.....	.....	....do .....
16	Coptochromus manium	405	.....	×	....	....	.....	.....	....do .....
17	Prolygæus mundatus	406	27 : 13	×	....	....	.....	.....	....do .....
18	Necrochromus cockerelli	407	27 : 10	×	....	....	.....	.....	....do .....
19	Necrochromus labatus	407	27 : 14	×	....	....	.....	.....	....do .....
20	Necrochromus saxificus	407	.....	×	....	....	.....	.....	....do .....
21	Exitelus exsanguis	408	27 : 2	×	....	....	.....	.....	....do .....
22	Cryptochromus letatus	409	.....	×	....	....	.....	.....	....do .....
	Pyrrhocorina.								
23	Dysdercus cinctus	410	24: 11, 13, 14	×	....	....	.....	.....	Oligocene ...
24	Dysdercus unicolor	410	.....	×	....	....	.....	.....	....do .....
	COREIDÆ.								
	Coreina.								
25	Anasa priscoputida	412	24: 4	×	....	....	.....	.....	Oligocene ..
26	Achrestocoris cinerarius	413	22: 1	×	....	....	.....	.....	....do .....
27	Phthinocoris colligatus	414	22: 3	×	....	....	.....	.....	....do .....
28	Phthinocoris lethargicus	415	26: 17; 27: 17	×	....	....	.....	....	....do .....
29	Phthinocoris languidus	415	27: 6	×	....	....	.....	.....	....do .....
30	Phthinocoris petræus	416	.....	×	....	....	.....	....	....do .....
31	Piezocoris peritus	417	25: 15	×	....	....	.....	.....	....do .....
32	Piezocoris compactilis	417	.....	×	....	....	.....	.....	....do .....
33	Piezocoris peremptus	417	26: 14	×	....	....	.....	.....	....do .....
	Alydina.								
34	Cacalydus lapsus	419	25: 12	×	....	....	.....	.....	Oligocene ..
35	Cacalydus exstirpatus	420	25: 3	×	....	....	.....	.....	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
=	Pach. fasciatus Heer	Aix	Ligurian				2
=	Pach. pulchellus Heer	do	do				3
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Aldyina—Cont'd.								
1	Cydamus robustus	420	26: 3	×					Oligocene
2	Parodarmistus abscissus	422		×					do
3	Parodarmistus caducus	422		×					do
4	Parodarmistus collisus	422	25: 13	×					do
5	Parodarmistus defectus	423		×					do
6	Parodarmistus exanimatus	423		×					do
7	Parodarmistus inhibitus	424		×					do
8	Protenor imbecillis	424	26: 8	×					do
9	Tenor speluncæ	425		×					do
10	Etirocoris infernalis	426	26: 16	×					do
11	Rhepocoris prætectus	427		×					do
12	Rhepocoris macrescens	427		×					do
13	Rhepocoris prævalens	427	{25: 4, 6, 7, 9-11, 14, 16, 26; 11}	×					do
14	Rhepocoris propinquans	428	25: 1; 26: 13	×					do
15	Rhepocoris minima	429		×					do
16	Orthriocorisa longipes	430	26: 1	×					do
	Pseudophlæina.								
17	Heeria gulosa	431	27: 5, 12, 13, 28, 17	×					Oligocene
18	Heeria lapidosa	432	27: 3, 19	×					do
19	Heeria foeda	432		×					do
	Corizida.								
20	Corizus celatus	433	27: 15	×					Oligocene
21	Corizus abditivus	433	25: 5; 26: 4	×					do
22	Corizus sommurnus	434		×					do
23	Corizus guttatus	434	7: 21		×				do
	PENTATOMIDÆ.								
	Cydnida.								
24	Stenopelta punctulata	438	7: 12, 13		×				Oligocene
25	Procydnus pronus	439	28: 5	×					do
26	Procydnus devictus	440	28: 4	×					do
27	Procydnus divexus	440		×					do
28	Procydnus quietus	441		×					do
29	Procydnus reliquus	441		×					do
30	Procydnus vesperus	442	28: 15	×					do
31	Procydnus catoni	442		×					do
32	Procydnus mamillanus	443	7: 19	×	×				do
33	Necrocydnus vulcanius	444		×					do
34	Necrocydnus gosutensis	445	7: 22		×				do
35	Necrocydnus torpens	445		×					do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Cydnida—Cont'd.								
1	Necrocydnus stygius	446		×					Oligocene
2	Necrocydnus amyzonus	446	28: 16	×					do
3	Necrocydnus senior	447		×					do
4	Necrocydnus solidatus	447	28: 13	×					do
5	Necrocydnus revectus	448		×					do
6	Thlibomenus petrens	449		×					do
7	Thlibomenus parvus	449	19: 23	×					do
8	Thlibomenus perennatus	450		×					do
9	Thlibomenus limosus	450	28: 12	×					do
10	Thlibomenus macer	451		×					do
11	Cyrtomenus concinnus	451	7: 14		×				do
12	Discostoma sp	452	22: 6	×					do
	Pentatomida.								
13	Teleoschistus antiquus	454	2: 17–19				Q.		
14	Teleoschistus rigoratus	456	28: 14	×					Oligocene
15	Teleoschistus placatus	457	28: 3	×					do
16	Thnetoschistus revulsus	458	28: 6	×					do
17	Poteschistus obnubilus	458	28: 18	×					do
18	Cacoschistus maceriatus	459	28: 2	×					do
19	Mataeoschistus limigenus	460		×					do
20	Polioschistus ligatus	461	28: 7	×					do
21	Poltoschistus lapidarius	461	28: 10	×					do
22	Pentatomites foliarum	462	28: 1	×					do
23	Tiroschistus indurescens	463	22: 4	×					do
24	Thlimmoschistus gravidatus	463	28: 11, 19	×					do
25	Mecocephala sp	464	28: 8	×					do
	COLEOPTERA.								
	RHYNCHOPHORA.								
	ANTHRIBIDÆ.								
26	Choragus fictilis	465	8: 9		×				Oligocene
27	Brachytarsus pristinus	466	7: 26		×				do
28	Cratoparis repertus	466	8: 4		×				do
29	Cratoparis elusus	467	8: 40		×				do
30	Hormiscus partitus	467	8: 17		×				do
	SCOLYTIDÆ.								
31	Hylastes squalideus	468	1: 23–25					S. O.	Pleistocene
32	Dryocætes impressus	470	8: 28		×				Oligocene
33	Dryocætes carbonarius	470	8: 6		×				do

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
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				○	C. mirabilis Perty	Brazil	11
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				!	C. lunatus (Fabr.)	Eastern U. S.	28
							29
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				○	D. affaber (Mann.)	Boreal America.	32
							33

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	CURCULIONIDÆ.								
1	Cryptorhynchus amnosus	471	8: 3	....	×	....	.....	.....	Oligocene....
2	Gymnetron lecontei	471	8: 26	....	×	....	.....	.....	....do.....
3	Anthonomus soporus	472	8: 16	...	×	...	.....	.....	....do.....
4	Hylobius provectus	473	8: 37, 41	....	×	....	.....	....	....do.....
5	Listronotus muratus	474	8: 23	....	×	....	.....	.....	....do.....
6	Entimus primordialis	474	5: 109, 109a	....	....	×	.....	.....	Oligocene?...
	OTIORHYNCHIDÆ.								
7	Endhagogus teriosus	475	8: 29	....	×	....	.....	.....	Oligocene ...
8	Tanymecus seculorum	475	8: 22	....	×	....	.....	.....	....do .....
9	Otiorhynchus perditus	476	8: 25	....	×	....	.....	.....	....do .....
10	Otiorhynchus tumbæ	477	8: 13	....	×	....	.....	.....	....do .....
11	Ophryastes compactus	477	8: 39	...	×	....	.....	.....	....do .....
12	Epicærus saxatilis	478	8: 33,34,36	...	×	....	.....	.....	...do .....
13	Epicærus examinis	479	37: 31, 8, 30, 31, 38, 42	....	×	....	.....	.....	....do .....
14	Epicærus effossus	480	8: 7, 35	....	×	....	.....	.....	....do .....
	RHYNCHITIDÆ.								
15	Eugnamptus grandævus	481	8: 20	....	×	....	.....	.....	Oligocene ...
16	Eugnamptus decemsatus	482	8: 12	...	×	....	.....	.....	....do .....
	HETEROMERA.								
	RHIPIPHORIDÆ.								
17	Rhipiphorus geikiei	482	27: 1	×	...	....	.....	.....	Oligocene ...
	TENEBRIONIDÆ.								
18	Tenebrio primigenius	483	2: 32	...	...	....	M.	.....	.....
19	Bruchus anilis	484	5: 125	...	...	×	.....	.....	Oligocene? ..
	PHYTOPHAGA.								
	CHRYSOMELIDÆ.								
20	Galerucella picea	485	2: 31	...	...	....	M.	.....	.....
21	Cryptocephalus vetustus	485	7: 29, 37	....	×	...	.....	.....	Oligocene ...
22	Donacia stria	486	1: 28	....	....	....	.....	S. O.	Pleistocene ..
23	Donacia pompatica	486	1: 33, 34	....	....	....	.....	S. O.	....do .....
	LAMELLICORNIA								
	SCARABÆIDÆ.								
24	Trox onstaleti	487	2: 22	....	....	....	M.	.....	.....
25	Aphodius precursor	488	1: 11	....	...	...	....	P. K.	Pleistocene ..
26	Ægialia rupta	489	8: 19	....	×	....	....	.....	Oligocene ...
27	Phanæus antiquus	489	1: 12-14	....	...	....	....	P. K.	Pleistocene ..
28	Cœridium ebeninum	490	1: 18-22	....	....	...	.....	P. K.	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.		
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	!	G. teter Schönh ...	Atlantic States ....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	°	H. picivorus Germ.	Eastern U. S .....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	°	O. sulcatus (Fabr.).	Eastern N. A .....
....	.....	.....	.....	..	.....	.....
....	.....	.....	.....		O. cinereus Schönh.	Mexico .....
....	.....	.....	.....	°	E. griseus Schönh ..	....do .....
....	.....	.....	.....	..	.....	.....
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....	.....	.....	.....	°	T. molitor (Linn.)..	Europe, N. Amer...
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	°	G. maritima Le C...	Atlantic States ....
....	.....	.....	.....	!	C. venustus Fabr...	Eastern U. S .....
....	.....	.....	.....	°	D. porosicollis Lec..	Lake Sup., N. Engl.
....	.....	.....	.....	!	D. pubicollis Suffr..	Illinois .....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	°	A. ruricola Melsh...	Anticosti to La ....
....	.....	.....	.....	....	.....	.....
....	.....	.....	.....	°	P. pinto Harold	Arizona, Mexico ...
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	SERRICORNIA.								
	PTINIDÆ.								
1	Anobium ovale	491	8: 1	....	×	....	.....	.....	Oligocene....
2	Anobium deceptum	492	8: 18	....	×	....	.....	.....	....do.....
3	Anobium lignitum	492	8: 24	....	×	....	.....	.....	....do.....
4	Sitodrepa defuncta	493	.....	....	×	....	.....	.....	....do.....
	BUPRESTIDÆ.								
5	Buprestis tertiaria	493	2: 23	....	....	....	N.	.....	.....
6	Buprestis saxigena	494	2: 24, 25	....	....	....	N.	.....	.....
7	Buprestis sepulta	495	2: 26	....	....	....	N.	.....	.....
	ELATERIDÆ.								
8	Oxygonus mortuus	496	5: 110, 111	....	....	×	.....	.....	Oligocene?..
9	Corymbites velatus	496	.....	....	×	....	.....	.....	Oligocene ...
10	Cryptohypnus terrestris	497	2: 30	....	....	....	N.	.....	.....
11	Epiphanis deletus	498	5: 113, 114	....	....	×	.....	.....	Oligocene?..
12	Elateridæ sp	498	2: 28	....	....	....	N.	.....	.....
	CLAVICORNIA.								
	BYRRHIDÆ.								
13	Nosodendron tritavum	499	7: 36	....	×	....	.....	.....	Oligocene ...
	NITIDULIDÆ.								
14	Phenolia incapax	499	7: 23	....	×	....	.....	.....	Oligocene ...
15	Prometopia depilis	500	2: 29	....	....	....	Q.	.....	....do.....
	CRYPTOPHAGIDÆ.								
16	Antherophagus priscus	501	7: 24, 35	....	×	....	.....	.....	Oligocene ...
	CUCUJIDÆ.								
17	Parandrita vestita	501	7: 41	....	×	....	.....	.....	Oligocene ...
	EROTYLIDÆ.								
18	Mycotretus binotatus	502	7: 30	....	×	....	.....	.....	Oligocene ..
	STAPHYLINIDÆ.								
	Oxytelini.								
19	Oxytelus pristinus	503	5: 118–120	....	....	×	.....	.....	Oligocene?...
20	Bledius adamus	504	8: 10	....	×	....	.....	.....	Oligocene ...
21	Bledius glaciatus	505	1: 35	....	....	....	.....	S. O.	Pleistocene..
22	Oxyporus stiriacus	505	1: 36	....	....	....	.....	S. O.	....do.....
	Paederini.								
23	Lathrobium abscessum	505	8: 15, 21	....	×	....	.....	.....	Oligocene ...
24	Lathrobium interglaciale	506	1: 38	....	....	....	.....	S. O.	Pleistocene..
	Staphylinini.								
25	Leistotrophus patriarchicus	507	5: 112	....	....	×	.....	.....	Oligocene?..
26	Quedius chamberlini	508	16: 8	×	....	....	.....	.....	Oligocene ...

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.		
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.
...	.....	.....	.....	....	.....	 1
....	.....	.....	.....	....	.....	 2
...	.....	.....	.....	...	.....	 3
....	.....	.....	.....	....	.....	 4
!	B. senecta Heyd...	Sieblos	Aquitanian?	....	.....	 5
!	....do	....do	....do	....	.....	 6
!	....do	....do	....do	...	.....	 7
...	.....	.....	.....	....	.....	 8
....	.....	.....	.....	○	C. splendens Ziegl .	Lake Sup., N. Engl. 9
....	.....	.....	.....	○	C. planatus LeC....	Atlantic States 10
....	.....	.....	.....	-	E. cornutus Eschsch	Boreal America 11
....	.....	.....	.....	....	.....	 12
....	.....	.....	.....	○	N. unicolor Say	Penn. & southward. 13
....	.....	.....	.....	!!	P. grossa (Fabr.) ..	North.U.S.; Canada. 14
....	.....	.....	.....		P. sexmaculata S .	Central U. S 15
....	.....	.....	.....	○	A. ochraceus Melsh	Northern U. S..... 16
....	.....	.....	.....	†	P. cephalotes LeC	Arizona 17
....	.....	.....	.....	○	M. sanguinipennis L	Eastern U. S 18
....	.....	.....	.....	!	O. rugosus (Grav) .	Atlan. States; Eur. 19
....	.....	.....	.....	'	B. annularis LeC	North America 20
...	.....	.....	.....	!	B. brevidens LeC	New York 21
....	.....	.....	.....	....	.....	 22
....	.....	.....	.....		L. elongatum (L.) .	Europe..... 23
...	.....	.....	.....		L. grande LeC.....	Lake Sup. to N. C . 24
....	.....	.....	.....	....	.....	 25
..	.....	.....	.....	....	.....	 26

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Staphylinini—Cont'd.								
1	Quedius breweri	508	16: 4	×					Oligocene
	Aleocharini.								
2	Gyrophæna saxicola	509	5: 123, 124			×			Oligocene?
3	Homalota recisa	509	8: 14		×				Oligocene
4	Staphylinites obsoletum	510	8: 32		×				Oligocene
	HYDROPHILIDÆ.								
	Sphæridiini.								
5	Cercyon terrigena	510	2: 21				N.		
	Hydrobiini.								
6	Hydrobius decineratus	511	8: 27		×				Oligocene
7	Hydrobius confixus	511	7: 25		×				....do
8	Philhydrus primævus	512	8: 5		×				....do
9	Philhydrus spp	512			×				....do
10	Laccobius elongatus	513	7: 27, 28		×				....do
11	Berosus sexstriatus	513	7: 40		×				....do
12	Berosus tenuis	514	8: 8		×				....do
	Hydrophilini.								
13	Tropisternus sculptilis	514			×				Oligocene
14	Tropisternus saxialis	515	8: 2		×				....do
	Helophorini.								
15	Hydrochus amictus	515	1: 47					S. O.	Pleistocene
16	Hydrochus relictus	516	8: 11		×				Oligocene
17	Helophorus rigescens	516	1: 53					S. O.	Pleistocene
	DYTISCIDÆ.								
	Laccophilini.								
18	Laccophilus sp.	517	5: 116, 117			×			Oligocene?
	CARABIDÆ.								
	Chlæniini.								
19	Chlænius punctulatus	517	1: 7					P. K.	Pleistocene
	Lebiini.								
20	Cymindis aurora	518	1: 6					P. K.	Pleistocene
	Platynini.								
21	Platynus senex	519	7: 38		×				Oligocene
22	Platynus casus	519	1: 42					S. O.	Pleistocene
23	Platynus hindei	520	1: 54					S. O.	....do
24	Platynus halli	520	1: 41					S. O.	....do
25	Platynus dissipatus	521	1: 37					S. O.	....do
26	Platynus desuetus	521	1: 43, 51, 58					S. O.	....do
27	Platynus harttii	522	1: 31					S. O.	....do
28	Platynus cæsus	522	7: 34		×				Oligocene

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
					Q. molochinus Grav.	U. S.; Europe	1
					G. vinula Erichs.	Pennsylvania	2
							3
							4
							5
					H. fuscipes Curt	Cosmopolitan	6
							7
							8
							9
							10
					B. punctipennis Ch.	Mexico,?	11
					B. cuspidatus Chevr	Mexico	12
					T. mexicanus Cast.	Mexico	13
					T. binotatus Walk	Vancouver Isl	14
					H. subcuprens Rand.	Lake Sup. southwd.	15
							16
					H. tuberculatus G.	Nor. U. S. ; Scand'va.	17
					L. maculosus Germ.	Lake Sup. to Ga	18
				?	C. laticollis Say	N. Y. to Fla., Ariz	19
				?	C. americana Dej.	New York	20
					P. variolatus Le C.	California	21
	P. halli	Scarboro	Pleistocene		P. rubripes Zimm.	Mid. States to Kans.	22
					Do.	do	23
!	P. hindei	Scarboro	Pleistocene		P. crenistriatus Le C.	Western States	24
=	P. halli	do	do				25
!	do	do	do	!	do	do	26
							27
							28

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	Licinini.								
1	Diplochila henshawi	523	28: 9	×	....	....	.....	.....	Oligocene
2	Dicælus abstaceus	524	1: 8–10	.....	.....	....	.....	P.K	Pleistocene
3	Dicælus sp.	525	1: 15	.....	....	....	.....	P.K.	...do
	Pterostichini.								
4	Pterostichus abrogatus	525	1: 39	.....	.....	....	.....	S. O.	Pleistocene
5	Pterostichus dormitans	526	1: 49, 55	....	....	...	.....	S. O.	...do
6	Pterostichus destitutus	526	1: 41	....	....	....	.....	S. O.	...do
7	Pterostichus fractus	527	1: 29, 30	....	....	....	.....	S. O.	....do
8	Pterostichus destructus	527	1: 46	....	....	....	.....	S. O.	....do
9	Pterostichus gelidus	527	1: 52, 59–61	....	....	....	.....	S. O.	....do
10	Pterostichus lævigatus	528	1: 3, 4	....	....	....	.....	P.K.	....do
11	Pterostichus sp	529	1: 5	....	....	....	.....	P.K.	....do
	Pogonini.								
12	Patrobus gelatus	530	1: 48	....	....	....	.....	S. O.	Pleistocene
	Bembidiini.								
13	Bembidium exoletum	530	5: 121, 122	....	...	×	.....	....	Oligocene?
14	Bembidium glaciatum	531	1: 40	....	....	....	.....	S. O.	Pleistocene
15	Bembidium fragmentum	531	1: 45	....	...	....	.....	S. O.	....do
	Nebriini.								
16	Nebria paleomelas	532	2: 20	....	....	...	N.	.....	.....
	Loricerini.								
17	Loricera glacialis	533	1: 50, 57	....	....	....	.....	S. O.	Pleistocene
18	Loricera lutosa	533	1: 32	....	...	....	.....	S. O.	....do
	Elaphrini.								
19	Elaphrus irregularis	534	1: 56	....	....	....	.....	S. O.	Pleistocene
	Carabini.								
20	Neothanes testens	535	7: 32, 39	....	×	....	.....	.....	Oligocene
	Cychrini.								
21	Cychrus wheatleyi	536	1: 1	....	....	...	.....	P.K.	Pleistocene
22	Cychrus minor	537	1: 2	....	....	....	.....	P.K.	....do
	DIPTERA.								
	CYCLORHAPHA.								
	LONCHŒIDÆ.								
23	Lonchæa senescens	539	3: 18	....	....	....	Q.	.....	.....
24	Palloptera morticina	540	3: 15	....	....	....	Q.	.....	.....
	OTALIDÆ.								
25	Lithortalis picta	541	3: 10, 16	....	....	....	Q.	.....	.....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.		
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
....	.....	.....	.....		D. major Le C.....	Southern U. S	1
..	.....	.....	.....	?	D. dilatatus Say...	U. S. east of Gt. Pls ...	2
....	.....	.....	.....		D. elongatus Bon..	....do	3
....	.....	.....	.....	?	P. herculanens Mann	Pac. coast, Br. Am	4
. .	.....	.....	.....	??	P. lætulus Le C....	Cal	5
....	.....	.....	.....	?	P. sayi Brullé.....	Atl. and West. States ..	6
!	P. destitutus .	Scarboro	Pleistocene.	..	....	.....	7
....	.....	.....	.....	??	P. patrnelis Dej....	N. Y., Mid. States	8
....	.....	.....	.....	?	P. hudsonicus Le C	Hudson Bay	9
....	.....	.....	.....	....	.....	....	10
..	.....	.....	.....	....	.....	.....	11
..	.....	.....	.....	??	P. septentrionis Dej.	Nor. Eur.; Arctic Am ..	12
....	.....	.....	.....		B. inæquale Say....	Northern U. S	13
..	.....	.....	.....	?	B. longulum Le C..	Lake Superior; N. Y....	14
....	.....	.....	.....	?	B. constrictum Say.	New England	15
....	.....	.....	.....	....	.....	.....	16
...	.....	.....	.....		L. cærulescens Linn.	Bor. Am. & Eur.; Siberia.	17
...	.....	.....	.....	....	.....	.....	18
...	.....	.....	.....	?	L. viridis Horn....	California.	19
...	.....	.....	.....	....	.....	.....	20
...	.....	.....	.....		C. vidnus Dej.....	Pennsylvania.....	21
...	.....	.....	.....		C. andrewsii Harr .	Central Atlantic States.	22
...	.....	.....	.....	....	.....	.....	23
..	.....	.....	.....	...	.....	.....	24
....	.....	.....	.....	....	.....	.....	25

SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

Systematic list of species.			Localities where found.					
Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
SCIOMYZIDÆ.								
1 Sciomyza revelata	542	3: 3–6	....	...	...	Q.	.....	....
2 Sciomyza manca	543	♂ 4, ♀ 9, 11, 14, 15, 16, 18, 20, 23, 24, 27, 28, 29	....	×	×	.....	.....	Oligocene....
3 Sciomyza disjecta	546	♀ 7, 22, 25, 30, 32, 33	..	×	...	.....	.....	....do .....
4 Sciomyza sp	546	10: 5	....	×	....	.....	.....	....do .....
HELOMYZIDÆ.								
5 Heteromyza senilis	547	3: 1, 2	....	..	....	Q.	....	....
6 Heteromyza detecta	548	5: 76	....	....	×	.....	.....	Oligocene ? ..
ANTHOMYIDÆ.								
7 Anthomyia inanimata	548	3: 19	....	....	....	Q.	.....	....
8 Anthomyia burgessi	549	3: 34	....	....	....	Q.	.....	....
MUSCIDÆ.								
9 Musca ascaridoides	551	♀ 5, 74, 75, 79, 82–87, 98, 104	....	....	×	.....	....	Oligocene ? ..
10 Musca bibosa	552	5: 73	....	....	×	....	.....	Oligocene ?
11 Musca sp	553	5: 106, 108	....	...	×	....	....	Oligocene ? ..
12 Musca hydropica	553	♀ 72, 92, 93, 107	....	...	×	.....	....	Oligocene ? ..
13 Musca vinculata	554	5: 77	....	....	×	. ..	.....	Oligocene ? ..
14 Musca spp	554	♂ 80, 81, 90, 100	....	....	×	.....	.....	Oligocene ? ..
TACHINIDÆ.		100						
15 Tachina sp	554	.....	....	×	..	.....	.....	Oligocene....
PLATYPEZIDÆ.								
16 Callomyia torporata	555	9: 11	....	×	....	.....	.....	Oligocene....
CONOPIDÆ.								
17 Poliomyia recta	556	9: 19, 21	....	×	....	.....	.....	Oligocene....
SYRPHIDÆ.								
18 Milesia quadrata	557	9: 13	....	×.	....	.....	.....	Oligocene....
19 Eristalis lapideus	558	5: 48, 49	....	..	×	.....	.....	Oligocene ? ..
20 Syrphus sp	559	.....	...	×	....	.....	....	Oligocene....
21 Chilosia ampla	559	9: 14, 27	...	×	....	.....	....	...do .....
22 Chilosia sp	561	9: 26	....	×	....	.....	...	...do .....
23 Chilosia sp	561	9: 8	....	×	....	.....	.....	...do .....
24 Psilota tabidosa	561	9: 9	....	×	....	.....	....	....do .....
25 Syrphidæ sp	562	10: 9	....	×	....	.....	.....	....do .....
ORTHORHAPHA.								
DOLICHOPODIDÆ.								
26 Dolichopus sp	562	.....	....	×	....	.....	.....	Oligocene....
CYRTIDÆ.								
27 Acrocera hirsuta	563	5: 5	....	....	×	.....	.....	Oligocene ? ..
ASILIDÆ.								
28 Stenocinclis anomala	564	9: 10	....	×	....	.....	.....	Oligocene....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.		
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.		Localities where found.						
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	ASILIDÆ—Continued.								
1	Stenocnemis sp	565	10: 15	....	×	....	.....	.....	....do .....
2	Asilidæ sp	565	.....	....	....	....	S.	.....	....
	STRATIOMYIDÆ.								
3	Lithophysa tumulta	566	9: 31	....	×	....	.....	.....	Oligocene....
4	Asarcomyia cadaver	567	9: 17	....	×	....	.....	.....	....do .....
	TIPULIDÆ.								
5	Dicranomyia stigmosa	568	♂ 5: 16, 17, 25, 27; ♀ 42, 43, 68, 69	....	....	×	.....	.....	Oligocene? ..
6	Dicranomyia primitiva	570	5: 20, 21, 65–67	....	×	×	.....	.....	Oligocene....
7	Dicranomyia rostrata	571	40, 41, 63, 64	....	..	×	.....	.....	Oligocene? ..
8	Spiladomyia simplex	573	5: 37, 38	....	....	×	.....	.....	Oligocene? ..
9	Pronophlebia rediviva	574	5: 39	..	..	×	.....	.....	Oligocene? ..
10	Cyttaromyia fenestrata	575	5: 78	....	....	×	.....	.....	Oligocene? ..
11	Tipula decrepita	576	5: 56, 57	....	....	×	.....	.....	Oligocene? ..
12	Tipula tecta	577	5: 46, 47	....	....	×	.....	.....	Oligocene? ..
13	Tipula spoliata	577	10: 4	....	×	....	.....	.....	Oligocene....
14	Tipula sepulchri	578	10: 1	....	×	....	.....	.....	....do .....
	CHIRONOMIDÆ.								
15	Chironomus septus	578	10: 8	....	×	....	.....	.....	Oligocene....
16	Chironomus depletus	579	5: 62	....	....	×	.....	....	Oligocene? ..
17	Chironomus patens	580	5: 18, 19, 28	....	....	×	.....	.....	Oligocene? ..
18	Chironomus sp	581	.....	....	×	....	.....	.....	Oligocene....
19	Chironomidæ sp	581	5: 32, 33	....	....	×	.....	.....	Oligocene? ..
20	Chironomidæ sp	581	5: 24	....	....	×	.....	.....	Oligocene? ..
21	Chironomidæ sp	581	.....	....	....	×	.....	.....	Oligocene? ..
	CULICIDÆ.								
22	Culex damnatorum	582	10: 14	....	×	....	.....	.....	Oligocene....
23	Culex proavitus	582	5: 8, 9	....	....	×	.....	.....	Oligocene? ..
24	Corethra exita	583	5: 22, 23	....	....	×	.....	.....	Oligocene? ..
	BIBIONIDÆ.								
25	Plecia similkameena	583	3: 20–22	....	....	....	S.	.....	....
26	Plecia pealei	585	4: 2, 3, 10–12	....	....	....	.....	T. C.	Oligocene? ..
27	Plecia dejecta	586	10: 17	....	×	....	.....	.....	Oligocene....
	MYCETOPHILIDÆ.								
28	Sciara deperdita	586	3: 17	....	....	....	Q.	.....	....
29	Sciara scopuli	588	10: 16	....	×	....	.....	.....	Oligocene....
30	Mycetophila occultata	588	5: 44, 45, 54, 55	....	....	×	.....	.....	Oligocene? ..
31	Anatella tacita	589	10: 13	....	×	....	.....	.....	Oligocene....
32	Trichonta dawsoni	590	3: 12, 13	....	....	....	Q.	.....	....
33	Rymosia strangulata	590	10: 2	....	×	....	.....	.....	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

	Fossil species.				Existing species.		
	Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.
1							
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27							
28						Scimgulata Winn	Europe
29							
30							
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.		Localities where found.						
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	MYCETOPHILIDÆ—Cont.								
1	Brachypeza abita	591	3: 7, 8	....	....	....	Q.	.....	....
2	Brachypeza procera	591	3: 14	....	....	....	Q.	.....	....
3	Gnoriste dentoni	592	5: 6, 7	...	...	×	.....	.....	Oligocene? ..
4	Boletina sepulta	593	3: 9	...	....	...	Q.	.....	....
5	Boletina umbratica	593	10: 3	....	×	...	.....	.....	Oligocene....
6	Boletina paludivaga	594	10: 7	....	×	...	.....	.....	....do .....
7	Sackenia arcuata	595	5: 3, 4, 12, 13	....	....	×	.....	.....	Oligocene? ..
8	Sackenia sp	596	5: 50	....	....	×	.....	.....	Oligocene? ..
9	Sackenia sp	596	.....	....	×	..	.....	.....	Oligocene....
10	Anaclinia sp	597	9: 12	...	×	...	.....	.....	....do .....
11	Sciophila hyattii	597	10: 6	....	×	...	.....	.....	....do .....
12	Diadocidia terricola	598	10: 10, 11	....	×	....	.....	.....	....do .....
13	Mycetophilidæ spp	599	10: 12	...	×	...	.....	.....	....do .....
	CECIDOMYIDÆ.								
14	Lasioptera recessa	600	5: 29–31	....	...	×	.....	.....	Oligocene? ..
15	Lithomyza condita	601	5: 34–36	....	....	×	.....	.....	Oligocene? ..
	LEPIDOPTERA.								
	TINEIDÆ.								
16	Psecadia mortuella	603	15: 12, 17	×	....	....	.....	.....	Oligocene....
	HYMENOPTERA.								
	TEREBRANTIA.								
	TENTHREDINIDÆ.								
17	Taxonus nortoni	604	10: 26, 27	....	×	....	.....	.....	Oligocene....
	CHALCIDIDÆ.								
18	Decatoma antiqua	604	10: 20, 31	....	×	....	.....	.....	Oligocene....
	BRACONIDÆ.								
19	Calyptites antediluvianum	606	3: 32	....	....	....	Q.		
20	Bracon laminarum	606	10: 29	....	×	...	.....	.....	Oligocene....
21	Bracon sp	607	3: 33	....	....	....	S.	.....	....
22	Braconidæ sp	607	10: 18	....	×	....	.....	.....	Oligocene....
23	Braconidæ sp	607	10: 28	....	×	...	.....	.....	.. .do .....
	ICHNEUMONIDÆ.								
24	Ichneumon petrinus	608	5: 14, 15	....	...	×	.....	.....	Oligocene? ..
25	Lithotorus cressoni	609	10: 21	....	×	....	.....	.....	Oligocene....
26	Rhyssa juvenis	609	10: 19	....	×	....	.....	.....	....do .....
27	Pimpla saxea	610	3: 23	....	....	....	Q.	.....	....
28	Pimpla senecta	611	3: 29–31	....	....	....	Q.	.....	....
29	Pimpla decessa	612	3: 27	....	....	....	Q.	.....	....
30	Glypta transversalis	613	10: 25	....	×	....	.....	.....	Oligocene....
31	Eclytus lutatus	614	10: 24	....	×	....	.....	.....	....do .....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
							1
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				○	P. instigator Fabr	Germany	29
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SYSTEMATIC LIST OF THE SPECIES DESCRIBED IN THE PRESENT WORK, ETC.—Continued.

	Systematic list of species.			Localities where found.					
	Groups, genera, and species.	Page.	Plate and figure.	Florissant, Colo.	Green River, Wyo.	White River.	British Columbia.	Other localities.	Geological horizon.
	ACULEATA.								
	MYRMICIDÆ.								
1	Aphænogaster longæva	615	3: 28	....	....	....	Q.	.....	.....
2	Myrmica sp	615	10: 22	....	×	....	.....	.....	Oligocene....
	FORMICIDÆ.								
3	Hypoclinea obliterata	616	3: 25, 26	..	....	....	Q.	.....	.....
4	Liometopum pingue	617	5: 10	....	×	×	.....	.....	Oligocene....
5	Formica arcana	618	3: 24	....	....	....	Q.	.....	.....
6	Lasius terrens	618	10: 23	....	×	....	.....	.....	Oligocene....
7	Camponotus vetus	619	5: 1, 2	....	....	×	.....	.....	Oligocene? ..
	SPHEGIDÆ.								
8	Didineis solidescens	620	10: 30	....	×	....	.....	.....	Oligocene....

DISTRIBUTION OF THE SPECIES WITH WHICH THEY ARE COMPARED—Continued.

Fossil species.				Existing species.			
Degree of relationship.	Name of species.	Where found.	Horizon.	Degree of relationship.	Name of species.	Where living.	
!	A. berendti Mayr	Baltic amber.	Ligurian				1
							2
							3
							4
							5
							6
							7
				!	D. lunicornis Fabr.	Europe	8

PLATES.

PLATE I.

EXPLANATION OF PLATE I.

All the drawings were made by J. Henry Blake.

Fig. 1. ($\frac{8}{1}$) Cychrus wheatleyi Horn.
2. ($\frac{4}{1}$) Cychrus minor Horn.
3. ($\frac{4}{1}$) Pterostichus lævigatus Horn.
4. ($\frac{4}{1}$) Pterostichus lævigatus Horn.
5. ($\frac{4}{1}$) Pterostichus? sp.
6. ($\frac{5}{1}$) Cymindis aurora Horn.
7. ($\frac{4}{1}$) Chlænius punctulatus Horn.
8. ($\frac{3}{1}$) Dicælus alutaceus Horn.
9. ($\frac{3}{1}$) Dicælus alutaceus Horn.
10. ($\frac{3}{1}$) Dicælus alutaceus Horn.
11. ($\frac{5}{1}$) Aphodius precursor Horn; *a*, upper surface; *b*, cast of *a*; *c*, under surface.
12. ($\frac{4}{1}$) Phanæus antiquus Horn.
13. ($\frac{4}{1}$) Phanæus antiquus Horn.
14. ($\frac{4}{1}$) Phanæus antiquus Horn.
15. ($\frac{4}{1}$) Dicælus sp.
16. ($\frac{5}{1}$) With Aphodius precursor Horn. See under that species, p. 488.
17. ($\frac{1.0}{1}$) With Aphodius precursor Horn. See under that species, p. 488.
18. ($\frac{5}{1}$) Chœridium ebeninum Horn.
19. ($\frac{5}{1}$) Chœridium ebeninum Horn.
20. ($\frac{8}{1}$) Chœridium ebeninum Horn.
21. ($\frac{5}{1}$) Chœridium ebeninum Horn.
22. ($\frac{5}{1}$) Chœridium ebeninum Horn.
23. ($\frac{4}{1}$) Hylastes? squalidens. The letters represent the work of distinct individuals.
24. ($\frac{5}{1}$) = 23 d. Hylastes? squalidens.
25. ($\frac{5}{1}$) = 23 a. Hylastes? squalidens
26. (14535) ($\frac{1.2}{1}$) A fragment of vegetable tissue, put on the plate by mistake.
27. (14535) ($\frac{5}{1}$) A fragment of vegetable tissue, put on the plate by mistake.

Fig. 28. (14558) ($\frac{1.0}{1}$) Donacia stiria.
29. (14532) ($\frac{6}{1}$) Pterostichus fractus.
30. (14532) ($\frac{6}{1}$) Pterostichus fractus.
31. (14475) ($\frac{8}{1}$) Platynus harttii.
32. (14559) ($\frac{1.0}{1}$) Loricera? lutosa.
33. (14566) ($\frac{8}{1}$) Donacia pompatica.
34. (14582) ($\frac{8}{1}$) Donacia pompatica.
35. (14540) ($\frac{1.0}{1}$) Bledius glaciatus.
36. (14552) ($\frac{1.5}{1}$) Oxyporus stiriacus.
37. (14563) ($\frac{5}{1}$) Platynus dissipatus.
38. (14555) ($\frac{1.0}{1}$) Lathrobium interglaciale.
39. (14560) ($\frac{6}{1}$) Pterostichus abrogatus.
40. (14536) ($\frac{1.0}{1}$) Bembidium glaciatum.
41. (14525) ($\frac{8}{1}$) Platynus halli.
42. (14523) ($\frac{8}{1}$) Platynus casus.
43. (14486) ($\frac{8}{1}$) Platynus desuetus.
44. (14522) ($\frac{6}{1}$) Pterostichus destitutus.
45. (14509) ($\frac{8}{1}$) Bembidium fragmentum.
46. (14549) ($\frac{8}{1}$) Pterostichus destructus.
47. (14504) ($\frac{1.0}{1}$) Hydrochus amictus.
48. (14586) ($\frac{5}{1}$) Patrobus gelatus.
49. (14508) ($\frac{1.0}{1}$) Pterostichus dormitans.
50. ($\frac{1.0}{1}$) Loricera glacialis.
51. (14478) ($\frac{6}{1}$) Platynus desuetus.
52. ($\frac{5}{1}$) Pterostichus gelidus.
53. (14505) ($\frac{1.0}{1}$) Helophorus rigescens.
54. (14533) ($\frac{6}{1}$) Platynus hindei.
55. (14503) ($\frac{1.0}{1}$) Pterostichus dormitans.
56. (14527) ($\frac{1.0}{1}$) Elaphrus irregularis.
57. (16416) ($\frac{1.0}{1}$) Loricera glacialis.
58. (14477) ($\frac{6}{1}$) Platynus desuetus.
59. ($\frac{8}{1}$) Pterostichus gelidus.
60. (16415) ($\frac{8}{1}$) Pterostichus gelidus.
61. ($\frac{1.4}{1}$) Pterostichus gelidus.

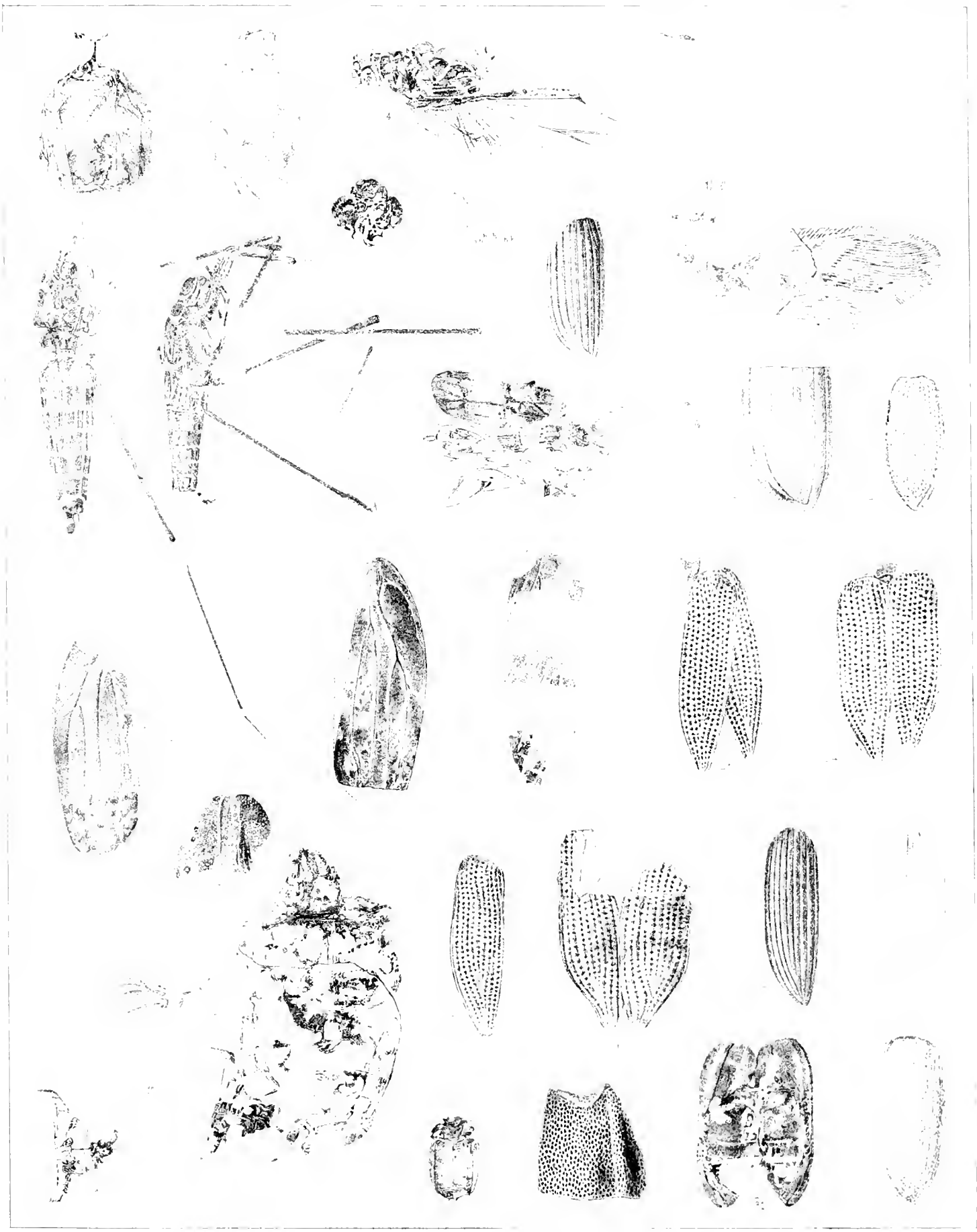
QUARTERNARY BONE CAVES AND CLAY BEDS

PLATE II.

EXPLANATION OF PLATE II.

All the drawings were made by J. Henry Blake, excepting Fig. 5, which is by S. H. Scudder.

Fig. 1. (40*b*D) ($\frac{6}{1}$) Aranea columbiæ.
2. (40*a*D) ($\frac{6}{1}$) Aranea columbiæ.
3. (28D) ($\frac{3}{1}$) Head of a libelluline odonate.
4. (34*a*D) ($\frac{7}{1}$) Sbenaphis quesneli.
5. (34*a*D) ($\frac{7}{1}$) Sbenaphis quesneli. Part of the neuration, the veins of the two overlapping wings distinguished by being drawn, one with solid, the other with broken lines.
6. (19D) ($\frac{2}{1}$) Geranœon petrorum.
7. (1466S) ($\frac{5}{1}$) Bothromicromus lachlani.
8. (36D) ($\frac{5}{1}$) Bothromicromus lachlani.
9. (36D) ($\frac{10}{1}$) Bothromicromus lachlani. Eye and head appendages.
10. (36D) ($\frac{30}{1}$) Bothromicromus lachlani. Maxillary palpus.
11. (15066) ($\frac{3}{1}$) Telmatrechus stali.
12. (73D) ($\frac{3}{1}$) Telmatrechus stali.
13. (75D) ($\frac{3}{1}$) Cœlidia columbiana.
14. (65D) ($\frac{3}{1}$) Cercopis selwyni.
15. (15072) ($\frac{3}{1}$) Cercopis selwyni.
16. (77D) ($\frac{2}{1}$) Planophlebia gigantea.
17. (14669) ($\frac{10}{1}$) Teleoschistus antiquus.
18. (14669) ($\frac{4}{1}$) Teleoschistus antiquus.
19. (38D) ($\frac{4}{1}$) Teleoschistus antiquus.
20. (58D) ($\frac{6}{1}$) Nebria paleomelas.
21. (57D) ($\frac{7}{1}$) Cercyon? terrigena.
22. (61D) ($\frac{6}{1}$) Trox onstaleti.
23. (51D) ($\frac{6}{1}$) Buprestis tertiaria.
24. (49D) ($\frac{6}{1}$) Buprestis saxigena.
25. (15073) ($\frac{6}{1}$) Buprestis saxigena.
26. (53D) ($\frac{6}{1}$) Buprestis sepulta.
27. (59D) ($\frac{6}{1}$) Cryptohypnus? terrestris.
28. (60D) ($\frac{7}{1}$) Elateridæ? sp. See p. 498.
29. (24D) ($\frac{3}{1}$) Prometopia depilis.
30. (15075) ($\frac{12}{1}$) Cryptohypnus? terrestris.
31. (62D) ($\frac{6}{1}$) Galerucella picea.
32. (63D) ($\frac{3}{1}$) Tenebrio primigenius.



TERTIARIES OF QUESNEL, NICOLA AND SIMILKAMEEN

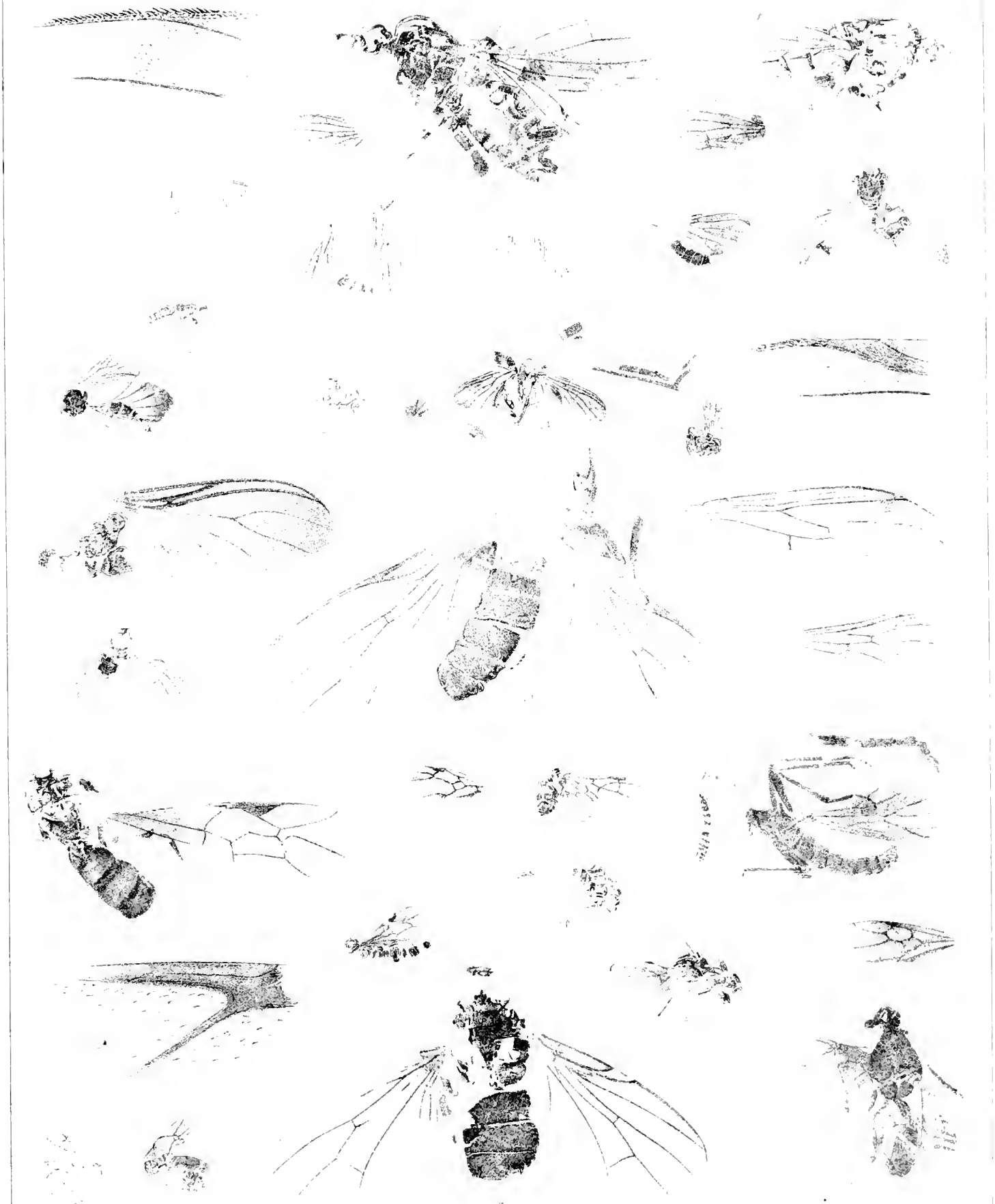
HEMIPTERA, COLEOPTERA, ETC.

PLATE III.

EXPLANATION OF PLATE III.

All the drawings were made by J. Henry Blake, excepting Fig. 6, which is by S. H. Scudder.

Fig. 1. (11D) ($\frac{4.0}{1}$) Heteromyza senilis.
2. (11D) ($\frac{4}{1}$) Heteromyza senilis.
3. (42D) ($\frac{1.0}{1}$) Sciomyza revelata.
4. (14671)·($\frac{3}{1}$) Sciomyza revelata.
5. (2D) ($\frac{4}{1}$) Sciomyza revelata.
6. ($\frac{3}{1}$) Sciomyza revelata. Restored.
7. (3D) ($\frac{4}{1}$) Brachypeza abita.
8. (14655) ($\frac{3}{1}$) Brachypeza abita.
9. (9D) ($\frac{3}{1}$) Boletina sepulta.
10. (5D) ($\frac{4}{1}$) Lithortalis picta.
11. (14651) ($\frac{4}{1}$) Dolichopus sp.
12. (6D) ($\frac{4}{1}$) Trichonta dawsoni.
13. (14649) ($\frac{4}{1}$) Trichonta dawsoni.
14. (4D) ($\frac{4}{1}$) Brachypeza procera ; *a*, ($\frac{1.5}{1}$) hind tibia.
15. (20D) ($\frac{3}{1}$) Palloptera morticina.
16. (5D) ($\frac{2.5}{1}$) Lithortalis picta.
17. (44D) ($\frac{1.5}{1}$) Sciara deperdita.
18. (17D) ($\frac{3}{1}$) Lonchæa senescens.
19. (32D) ($\frac{1.0}{1}$) Anthomyia inanimata
20. (15069) ($\frac{5}{1}$) Plecia similkameena.
21. (15068) ($\frac{3}{1}$) Plecia similkameena.
22. (82D) ($\frac{3}{1}$) Plecia similkameena. (Copied by Zittel, Handb. d palæont., Fig. 1086.) *a*, ($\frac{1.0}{1}$) antennæ ; *b*, ($\frac{1.0}{1}$) tibia and tarsi of hind leg.
23. (31D) ($\frac{5}{1}$) Pimpla saxea.
24. (10D) (–) Formica arcana.
25. (8D) ($\frac{3}{1}$) Hypoclinia obliterata.
26. (14653) ($\frac{3}{1}$) Hypoclinia obliterata.
27. (9D) ($\frac{3}{1}$) Pimpla decessa.
28. (33D) ($\frac{2}{1}$) Aphænogaster longævа.
29. (10*b*D) ($\frac{3.0}{1}$) Pimpla senecta.
30. (14650) ($\frac{2}{1}$) Pimpla senecta.
31. (10D) ($\frac{2}{1}$) Pimpla senecta.
32. (7D) ($\frac{4}{1}$) Calyptites antediluvianus. (Copied by Zittel, l. c., Fig. 1100.)
33. (78D) ($\frac{8}{1}$) Bracon sp.
34. (29D) ($\frac{1.0}{1}$) Anthomyia burgessi.



TERTIARIES OF QUESNEL, NICOLA AND SIMILKAMEEN

DIPTERA HYMENOPTERA

PLATE IV.

EXPLANATION OF PLATE IV.

All the drawings were made by J. Henry Blake.

Fig. 1. (14601) ($\frac{3}{1}$) Telmatrechus parallelus.
2. (14600) ($\frac{3}{1}$) Plecia pealei.
3. (14594) ($\frac{3}{1}$) Plecia pealei.
4. ($\frac{1}{1}$) Indusia calculosa. (Copied by Zittel, Handb. d. palæont., Fig. 985.)
5. ($\frac{3}{1}^{3}$) Corydalites fecundum. Summit of egg from above.
6. ($\frac{3}{1}^{2}$) Corydalites fecundum. Summit of egg from side.
7. ($\frac{3}{1}^{a}$) Corydalites fecundum. Base of egg inclosed in its cell.
8. (6*b*) ($\frac{6}{1}$) Cœlidia wyomingensis.
9. (St. 16) ($\frac{1}{1}^{0}$) Sciomyza manca ?.
10. (14613) ($\frac{3}{1}$) Plecia pealei.
11. (14596) ($\frac{3}{1}$) Plecia pealei.
12. (4*a*) ($\frac{3}{1}$) Plecia pealei.
13. ($\frac{3}{1}$) Corydalites fecundum. The right hand portion of Fig. 14 enlarged.
14. ($\frac{1}{1}$) Corydalites fecundum. Side view of one-half of egg-mass, broken longitudinally in the middle.
15. Corydalites fecundum. Schematic figure, cross-section.
16. ($\frac{1}{1}$) Corydalites fecundum. Side view of egg-mass. (Copied by Zittel, l. c., Fig. 981*a*.
17. ($\frac{1}{1}^{2}$) Corydalis cornutus (recent). Side view of egg.
18. ($\frac{1}{1}^{3,b}$) Corydalites fecundum. Crateriform micropylic prominence of summit of egg.
19. ($\frac{1}{1}$) Corydalites fecundum. Sawn cross-section of egg-mass.
20. ($\frac{1}{1}$) Corydalites fecundum. Rock fragment, showing two egg masses embedded in it, with fresh-water gastropods beside them.
21. ($\frac{1}{1}^{2}$) Corydalites fecundum. Side view of egg. (Copied by Zittel, l. c., Fig. 981*b*.)
22. ($\frac{3}{1}^{2}$) Corydalus cornutus (recent). Side view of summit of egg.
23. ($\frac{1}{1}$) Corydalites fecundum. Broken cross-section of egg-mass.

Tertiary Insects of North America

Miscellaneous

PLATE V.

EXPLANATION OF PLATE V.

Figs. 1, 2, 5, 10, 11, 14, 15, 25–27, 29–31, 37–39, 42–51, 54, 55, 58–61, 66–72, 74–76, 79–87, 90–92, 95, 98–105, 110–124 were drawn by J. Henry Blake; Figs. 3, 4, 6–9, 12, 13, 16, 17, 22–24, 32–35, 40, 41, 52, 53, 65, 88, 89, 96, 97, 109, 109*a* by A. Assmann; Figs. 20, 21, 73, 77, 106–108, 125 by J. H. Emerton; Figs. 18, 19, 56, 57, 62–64 by P. Roetter, and Figs. 28, 36, 78, 93, 94 by S. H. Scudder. The original drawings of Figs. 6, 13, 23, 57, 64 were also altered by S. H. Scudder, and Figs. 104 and 115 were after his camera lucida sketches.

Fig. 1. (15054) ($\frac{1}{1}$) Camponotus vetus.
2. (15054) ($\frac{1}{1}$) Camponotus vetus
3. (15057) ($\frac{1}{1}$) Sackenia arcuata.
4. (15057) ($\frac{1}{1}$) Sackenia arcuata
5. (21*b*) ($\frac{1}{1}$) Acrocera bisulta.
6. (1*a*) ($\frac{2}{1}$) Gnoriste dentoni.
7. (1*a*) ($\frac{1}{1}$) Gnoriste dentoni.
8. (16*a*) ($\frac{1}{1}$) Culex proavitus.
9. (16*a*) ($\frac{1}{1}$) Culex proavitus.
10. (15058) ($\frac{1}{1}$) Liometopum pingue.
11. (61*b*) Head of a hymenopterous insect.
12. (2) ($\frac{1}{1}$) Sackenia arcuata.
13. (2) ($\frac{1}{1}$) Sackenia arcuata (Copied by Zittel, Handb. d. palæont., Fig. 1088.)
14. (78*a*) ($\frac{1}{1}$) Ichneumon petrinus.
15. (78*a*) ($\frac{1}{1}$) Ichneumon petrinus
16. (4*b*) ($\frac{2}{1}$) Dicranomyia stigmosa.
17. (4*b*) ($\frac{1}{1}$) Dicranomyia stigmosa.
18. (54) ($\frac{1}{1}$) Chironomus patens.
19. (54) ($\frac{1}{1}$) Chironomus patens.
20. (57*a*) ($\frac{2}{1}$) Dicranomyia primitiva.
21. (57*a*) ($\frac{1}{1}$) Dicranomyia primitiva.
22. (7*a*) ($\frac{1}{1}$) Corethra exita.
23. (7*a*) ($\frac{1}{1}$) Corethra exita
24. (71*c*) ($\frac{1}{1}$) Chironomidæ sp.
25. (62*b*) ($\frac{2}{1}$) Dicranomyia stigmosa.
26. (62*b*) ($\frac{1}{1}$) Dicranomyia stigmosa.
27. (1*b*) ($\frac{1}{1}$) Dicranomyia stigmosa.
28. (54) ($\frac{1}{1}$) Chironomus patens.
29. (70*b*) ($\frac{1}{1}$) Lasioptera recessa.
30. (70*b*) ($\frac{1}{1}$) Lasioptera recessa.
31. (70*b*) ($\frac{1}{1}$) Lasioptera recessa
32. (71*d*) ($\frac{1}{1}$) Chironomidæ sp.
33. (71*d*) ($\frac{1}{1}$) Chironomidæ sp.
34. (15059) ($\frac{2}{1}$) Lithomyza condita. (Copied by Zittel, l. c., Fig. 1089.)
35. (15059) ($\frac{1}{1}$) Lithomyza condita.
36. (15059) ($\frac{1}{1}$) Lithomyza condita.
37. (77*a*) ($\frac{1}{1}$) Spiladomyia simplex.
38. (77*a*) ($\frac{1}{1}$) Spiladomyia simplex.
39. (15061) ($\frac{1}{1}$) Promophlebia rediviva
40. (8) ($\frac{2}{1}$) Dicranomyia rostrata.
41. (8) ($\frac{1}{1}$) Dicranomyia rostrata.
42. (53) ($\frac{1}{1}$) Dicranomyia stigmosa.
43. (53) ($\frac{1}{1}$) Dicranomyia stigmosa.
44. (58*c*) ($\frac{1}{1}$) Mycetophila occultata.
45. (58*c*) ($\frac{1}{1}$) Mycetophila occultata.
46. (60*b*) ($\frac{1}{1}$) Tipula tecta.
47. (60*b*) ($\frac{1}{1}$) Tipula tecta.
48. (46*b*) ($\frac{1}{1}$) Eristalis lapideus.
49. (46*b*) ($\frac{1}{1}$) Eristalis lapideus.
50. (33*c*) ($\frac{1}{1}$) Sackenia? sp.
51. (33*c*) ($\frac{1}{1}$) Paropsœus disjunctus.
52. (15064) ($\frac{1}{1}$) Hydropsyche operta.
53. (15064) ($\frac{1}{1}$) Hydropsyche operta.
54. (15060) ($\frac{1}{1}$) Mycetophila occultata.
55. (15060) ($\frac{1}{1}$) Mycetophila occultata.
56. (70*a*) ($\frac{1}{1}$) Tipula decrepita.
57. (70*a*) ($\frac{1}{1}$) Tipula decrepita.
58. (43) ($\frac{1}{1}$) Tettigonia obtecta
59. (43) ($\frac{1}{1}$) Tettigonia obtecta.
60. (57*c*) ($\frac{1}{1}$) (A small species of Muscidæ.)
61. (57*c*) ($\frac{1}{1}$) (A small species of Muscidæ.)
62. (45*a*) ($\frac{1}{1}$) Chironomus depletus.
63. (30) ($\frac{1}{1}$) Dicranomyia rostrata.
64. (30) ($\frac{2}{1}$) Dicranomyia rostrata.
65. (6*a*) ($\frac{2}{1}$) Dicranomyia primitiva.
66. (6*b*) ($\frac{2}{1}$) Dicranomyia primitiva.
67. (6*b*) ($\frac{1}{1}$) Dicranomyia primitiva.
68. (41*b*) ($\frac{2}{1}$) Dicranomyia stigmosa.
69. (41*b*) ($\frac{1}{1}$) Dicranomyia stigmosa.
70. (33) ($\frac{2}{1}$) Pachymerus petrensis.
71. (33) ($\frac{1}{1}$) Pachymerus petrensis.
72. (50) ($\frac{1}{1}$) Musca hydropica.
73. (71*b*) ($\frac{1}{1}$) Musca bibosa.
74. (59) ($\frac{1}{1}$) Musca ascarides?
75. (63*a*) ($\frac{1}{1}$) Musca ascarides?
76. (15063) ($\frac{10}{1}$) Heteromyza detecta.
77. (18) ($\frac{1}{1}$) Musca vinculata.
78. (15062) ($\frac{1}{1}$) Cyttaromyia fenestrata.
79. (17*b*) ($\frac{1}{1}$) Musca ascarides.
80. (78*b*) ($\frac{1}{1}$) Musca sp.
81. (78*b*) ($\frac{1}{1}$) Musca sp.
82. (52*c*) ($\frac{1}{1}$) Musca ascarides.
83. (52*c*) ($\frac{1}{1}$) Musca ascarides.
84. (52*c*) ($\frac{1}{1}$) Musca ascarides.
85. (15053) ($\frac{1}{1}$) Musca ascarides.
86. (17*c*) ($\frac{1}{1}$) Musca ascarides.
87. (63*b*) ($\frac{1}{1}$) Musca ascarides.
88. (29) ($\frac{1}{1}$) Lithadothrips vetusta.
89. (29) ($\frac{2}{1}$) Lithadothrips vetusta.
90. (45*b*) ($\frac{1}{1}$) Melanothrips extincta.
91. (45*b*) ($\frac{1}{1}$) Melanothrips extincta.
92. (15055) ($\frac{1}{1}$) Musca hydropica.
93. (15055) ($\frac{1}{1}$) Musca hydropica.
94. (44*b*) ($\frac{10}{1}$) Bythoscopus lapidescens.
95. (4*c*) ($\frac{1}{1}$) Delphax senilis.
96. (22) ($\frac{2}{1}$) Aphana atava.
97. (22) ($\frac{1}{1}$) Aphana atava.
98. (53*b*) ($\frac{1}{1}$) Musca ascarides.
99. (53*c*) ($\frac{2}{1}$) Musca sp.
100. (53*c*) ($\frac{1}{1}$) Musca sp.
101. (19*b*) ($\frac{1}{1}$) Musca ascarides.
102. (42) ($\frac{2}{1}$) Lithadothrips vetusta.
103. (42) ($\frac{1}{1}$) Lithadothrips vetusta.
104. ($\frac{10}{1}$) Palæothrips fossilis.
105. ($\frac{10}{1}$) Palæothrips fossilis.
106. (44*a*) ($\frac{1}{1}$) Musca? sp.
107. (20) ($\frac{1}{1}$) Musca hydropica.
108. (73*a*) ($\frac{2}{1}$) Musca? sp.
109. (10) ($\frac{2}{1}$) Entimus primordialis. (Copied by Zittel, l. c., Fig. 1011.)
109*a* (10) ($\frac{1}{1}$) Entimus primordialis.
110. (15062) ($\frac{1}{1}$) Oxygonus mortuus.
111. (15062) ($\frac{10}{1}$) Oxygonus mortuus.
112. (48) ($\frac{1}{1}$) Leistotrophus patriarchicus.
113. (36) ($\frac{2}{1}$) Epiphanis deletus.
114. (36) ($\frac{1}{1}$) Epiphanis deletus.
115. ($\frac{2}{1}$) Palæothrips fossilis. (Copied by Zittel, l. c., Fig. 999.)
116. (67) ($\frac{1}{1}$) Laccophilus sp.
117. (67) ($\frac{1}{1}$) Laccophilus sp.
118. (63*a*) ($\frac{2}{1}$) Oxytelus pristinus.
119. (63*a*) ($\frac{1}{1}$) Oxytelus pristinus.
120. (63*a*) ($\frac{5}{1}$) Oxytelus pristinus.
121. (34) ($\frac{1}{1}$) Bembidium exoletum.
122. (34) ($\frac{1}{1}$) Bembidium exoletum.
123. (77*b*) ($\frac{1}{1}$) Gyrophæna saxicola.
124. (77*b*) ($\frac{5}{1}$) Gyrophæna saxicola.
125. (46*a*) ($\frac{1}{1}$) Bruchus anilis.

WHITE RIVER BEDS, WESTERN COLORADO

PLATE VI.

EXPLANATION OF PLATE VI.

All the drawings were made by J. Henry Blake.

Fig. 1. (147P) ($\frac{2}{3}$) Dysagrion packardii: body only.

2. (4153) ($\frac{2}{3}$) Dysagrion fredericii: head and base of wing.

3. (146P) ($\frac{1}{1}$) Dysagrion packardii: fore wing. (Copied by Zittel, Handb. d. palæont. Fig. 979.)

4. (4175) ($\frac{2}{3}$) Libellula sp.: reverse of Fig. 16; part of abdomen.

5. 4178) (×) Dysagrion fredericii: part of abdomen.

6. 4170) (×) Dysagrion fredericii: terminal joints of abdomen.

7. (4169) ($\frac{4}{1}$) Podagrion abortivum: tip of fore wing next pterostigma.

8. (4169) ($\frac{2}{1}$) Podagrion abortivum: fore wing.

9. (4167–4168) ($\frac{2}{3}$) Dysagrion fredericii: fore wing.

10. (4179) ($\frac{4}{1}$) Dysagrion fredericii: head.

11. (147P) ($\frac{4}{1}$) Dysagrion packardii: abdominal appendages.

12. 258P) ($\frac{2}{1}$) Ixodes tertiarius.

13. (4188 ($\frac{4}{1}$) Pronemobius tertiarius: fore wing.

14. 4165–4166) (×) Dysagrion fredericii?: fore wing.

15. 154R ($\frac{2}{1}$) Iulus tellusterus.

Fig. 16. (4176) ($\frac{2}{3}$) Libellula sp.: reverse of Fig. 4; part of abdomen.

17. (4173) ($\frac{2}{3}$) Dysagrion fredericii; abdomen: accidentally placed on the plate upside down.

18. (112P) ($\frac{4}{1}$) Pronemobius induratus: part of wing.

19. (38R) ($\frac{2}{1}$) Cixius hesperidum.

20. (144L) ($\frac{4}{1}$) Ficarasites stigmaticum.

21. ($\frac{4}{1}$) Pronemobius tertiarius.

22. ($\frac{6}{1}$) Pronemobius smithii.

23. (18R) ($\frac{4}{1}$) Pronemobius tertiarius; hind leg.

24. (4076) ($\frac{1}{1}$) Lystra richardsoni.

25. (137P ($\frac{4}{1}$) Paralatindia saussurei.

26. (144P) ($\frac{4}{1}$) Cicadula saxosa.

27. (175R) ($\frac{4}{1}$) Aphana rotundipennis.

28. (90L) ($\frac{4}{1}$) Lithopsis elongata; fore wing.

29. (100R) ($\frac{4}{1}$) Acocephalus adæ.

30. (4217) ($\frac{2}{1}$) Lystra richardsoni.

31. (4207–4208) ($\frac{2}{1}$) Lystra richardsoni.

32. (115P) ($\frac{4}{1}$) Cercopites calliscens.

33. (116P) ($\frac{4}{1}$) Thamnotettix gannetti.

34. (117P) ($\frac{4}{1}$) Hammapteryx reticulata; parts of two fore wings.

35. (49R) ($\frac{2}{1}$) Fulgora granulosa.

36. (118P) ($\frac{4}{1}$) Lithopsis fimbriata; fore wing.

37. (4155) ($\frac{4}{1}$) Lithopsis fimbriata. (Copied by Zittel, l. c., Fig. 989.)

GREEN RIVER BEDS. WYOMING TERR

NEUROPTERA ORTHOPTERA HEMIPTERA

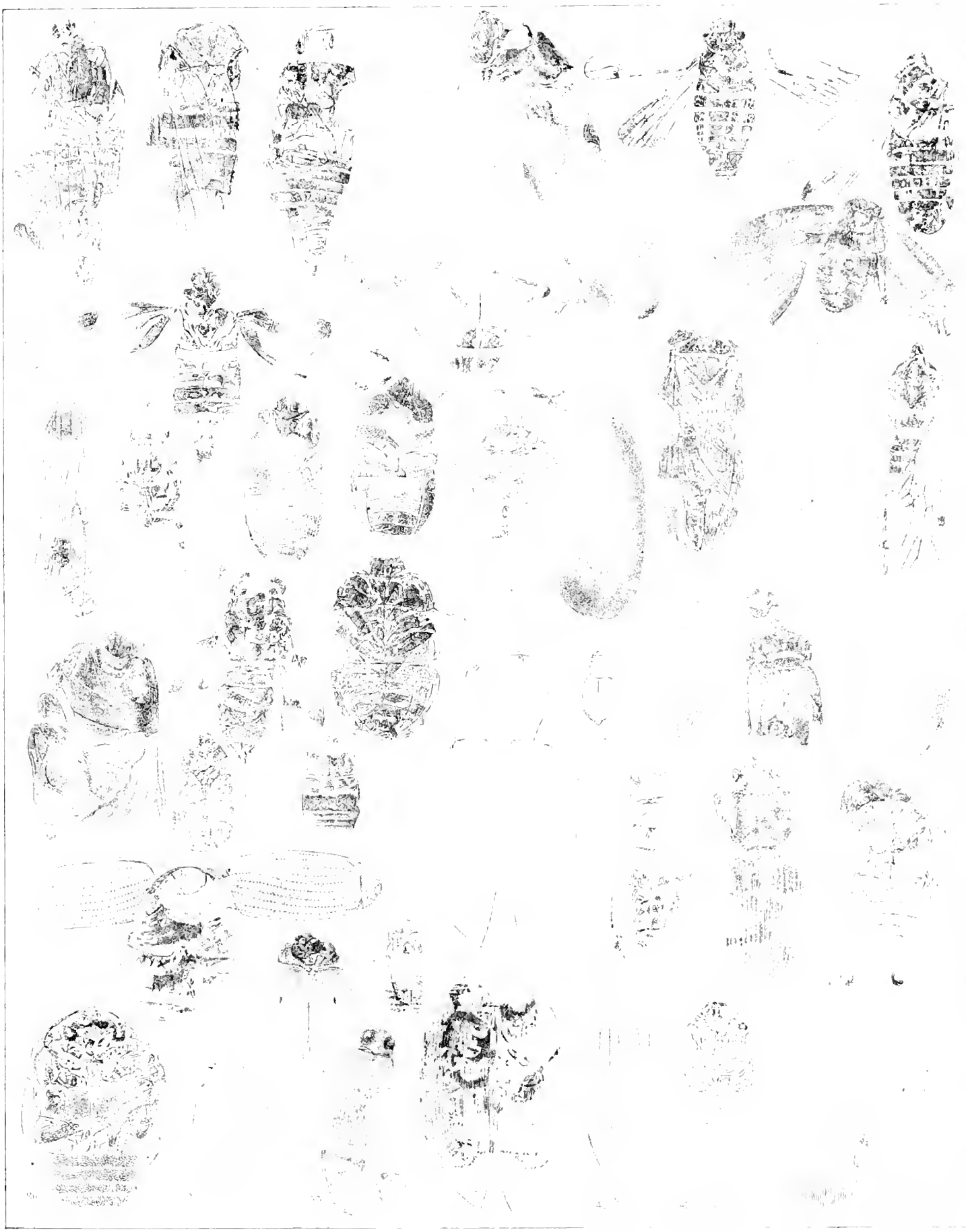
PLATE VII.

EXPLANATION OF PLATE VII.

All the drawings were made by J. Henry Blake, except Fig. 24, which is by Paul Roetter.

Fig. 1. (119R) ($\frac{4}{1}$) Lystra richardsoni.
2. (119P) ($\frac{4}{1}$) Lystra leci.
3. (4212) ($\frac{3}{1}$) Lystra richardsoni.
4. (34L) ($\frac{5}{1}$) Tettigonia priscomarginata.
5. (120P) ($\frac{5}{1}$) Thamnotettix gannetti.
6. (73L) ($\frac{5}{1}$) Thamnotettix mutilata.
7. (1L) ($\frac{4}{1}$) Paleephora patefacta.
8. (107P) ($\frac{4}{1}$) Necygonus rotundatus.
9. (108P) ($\frac{5}{1}$) Cercopites umbratilis.
10. (109P) ($\frac{5}{1}$) A pair of overlapping wings, apparently the tegmina of some homopterous insect, but which I am as yet unable to place more exactly; its resemblance to Oliarus lutensis, Fig. 18, is manifest.
11. (4070) ($\frac{5}{1}$) Corizus guttatus.
12. (1524S) ($\frac{10}{1}$) Stenopelta punctulata, and a portion more highly magnified.
13. (172R) ($\frac{10}{1}$) Stenopelta punctulata.
14. (4190) ($\frac{5}{1}$) Cyrtomenus concinnus.
15. (110P) ($\frac{5}{1}$) Cercopis astricta.
16. (111P) ($\frac{5}{1}$) Fulgora populata.
17. (31*d*R) ($\frac{5}{1}$) Oliarites terrentula.
18. (112P) ($\frac{5}{1}$) Oliarus ? lutensis.
19. (39R) ($\frac{10}{1}$) Procydnus mamillanus.
20. (4192) ($\frac{5}{1}$) Lyctocoris terreus.
21. (113P) ($\frac{5}{1}$) Cholula triguttata.

Fig. 22. (131L) ($\frac{5}{1}$) Necrocydnus gosiutensis.
23. (132R) ($\frac{4}{1}$) Phenolia incapax.
24. (153*a*R) ($\frac{5}{1}$) Antherophagus prisc u s. (Copied by Zittel, Handb. d. palæont., Fig. 1051.)
25. (79P) ($\frac{5}{1}$) Hydrobius confixus.
26. (23R) ($\frac{10}{1}$) Brachytarsus pristinus.
27. (81*a*R) ($\frac{5}{1}$) Laccobius elongatus; reverse of next.
28. (136*g*R) ($\frac{5}{1}$) Laccobius elongatus.
29. (4003–4004) ($\frac{5}{1}$) Cryptocephalus vetustus.
30. (4015, 3990) ($\frac{8}{1}$) Mycotretus binotatus.
31. (12R) ($\frac{5}{1}$) Epicærus exanimis.
32. (24L) ($\frac{5}{1}$) Neothanes testeus.
33. (4084) ($\frac{4}{1}$) Tropisternus sculptilis.
34. (83P) ($\frac{5}{1}$) Platynus cæsus.
35. (4191) ($\frac{15}{1}$) Antherophagus priscus.
36. (86P) ($\frac{8}{1}$) Nosodendron tritavum.
37. (4039) ($\frac{5}{1}$) Cryptocephalus vetustus.
38. (3998) ($\frac{5}{1}$) Platynus senex.
39. (4059) ($\frac{5}{1}$) Neothanes testeus.
40. (1079) ($\frac{10}{1}$) Berosus sexstriatus.
41. (87P) ($\frac{5}{1}$) Parandrita vestita.
42. (3989) ($\frac{10}{1}$) This is a mistake and should not have been engraved. It is made up of parts of two insects at different levels on the slab.



GREEN RIVER BEDS, WYOMING TERR
HEMIPTERA COLEOPTERA

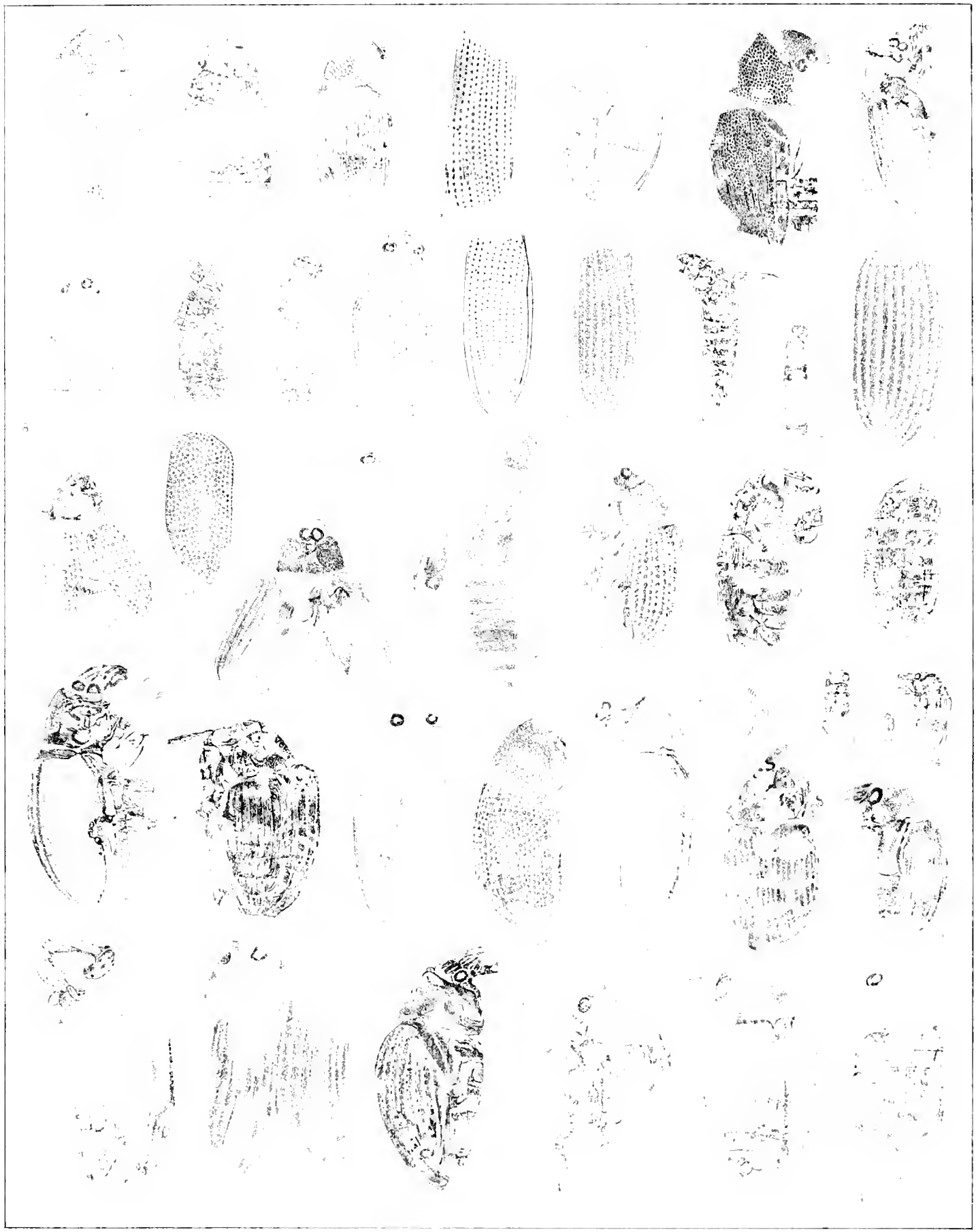
PLATE VIII.

EXPLANATION OF PLATE VIII.

All the drawings were made by J. Henry Blake, excepting Figs. 5, 30, 31, 33, 34, which are by P. Roetter.

Fig. 1. (4038) ($\frac{1}{1}^{0}$) Anobium ovale.
2. (4023, 4027) ($\frac{?}{1}$) Tropisternus saxialis.
3. (15223) ($\frac{1}{1}^{2}$) Cryptorhynchus annosus.
4. (4035) ($\frac{8}{1}$) Cratoparis repertus.
5. (15199) ($\frac{?}{1}$) Philhydrus primævus.
6. (3999) ($\frac{1}{1}^{0}$) Dryocœtes carbonarius.
7. (4104) ($\frac{?}{1}$) Epicærus effossus.
8. (4002) ($\frac{6}{1}$) Berosus tennis.
9. (106L) ($\frac{1}{1}^{2}$) Choragus fictilis.
10. (4081) ($\frac{?}{1}$) Bledius adamus.
11. ($\frac{1}{1}^{2}$) Hydrochus relictus.
12. (4046) ($\frac{?}{1}$) Eugnamptus decemsatus.
13. (4204) ($\frac{?}{1}$) Otiorhynchus tumbæ.
14. ($\frac{?}{1}$) Homalota recisa.
15. (15204) ($\frac{4}{1}$) Lathrobium abscessum.
16. (48L) ($\frac{2}{1}^{0}$) Anthonomus soporus.
17. ($\frac{1}{1}^{2}$) Hormiscus partitus.
18. (4086) ($\frac{1}{1}^{0}$) Anobium deceptum.
19. ($\frac{1}{1}^{2}$) Ægialia rupta.
20. (15234) ($\frac{?}{1}$) Eugnamptus grandævus.
21. (84P) ($\frac{8}{1}$) Lathrobium abscessum.
22. ($\frac{?}{1}$) Tanymecus seculorum. The rostrum is lacking, not having been exposed when the plate was made.

Fig. 23. ($\frac{?}{1}$) Listronotus muratus.
24. (4082) ($\frac{?}{1}$) Anobium lignitum.
25. (15213) ($\frac{?}{1}$) Otiorhynchus perditus.
26. (4047) ($\frac{1}{1}^{2}$) Gymnetron lecontei.
27. (4007) ($\frac{6}{1}$) Hydrobius decineratus.
28. (15218) ($\frac{1}{1}^{0}$) Dryocœtes impressus.
29. (4078) ($\frac{?}{1}$) Endiagogus terrosus.
30. (15239) ($\frac{1}{1}$) Epicærus exanimis.
31. (15239) ($\frac{1}{1}$) Epicærus exanimis.
32. (15200) ($\frac{1}{1}$) Staphylinites obsoletum.
33. (15207) ($\frac{1}{1}$) Epicærus saxatilis.
34. (15207) ($\frac{1}{1}$) Epicærus saxatilis.
35. ($\frac{8}{1}$) Epicærus effossus.
36. (15208) ($\frac{8}{1}$) Epicærus saxatilis.
37. (4051) ($\frac{8}{1}$) Hylobius provectus.
38. (4014) ($\frac{1}{1}^{0}$) Epicærus exanimis.
39. (4210) ($\frac{6}{1}$) Ophryastes compactus.
40. (4012) ($\frac{6}{1}$) Cratoparis? elusus.
41. (15215) ($\frac{8}{1}$) Hylobius provectus.
42. (3991) ($\frac{8}{1}$) Epicærus exanimis.



GREEN RIVER BEDS WYOMING TERR.

COLEOPTERA

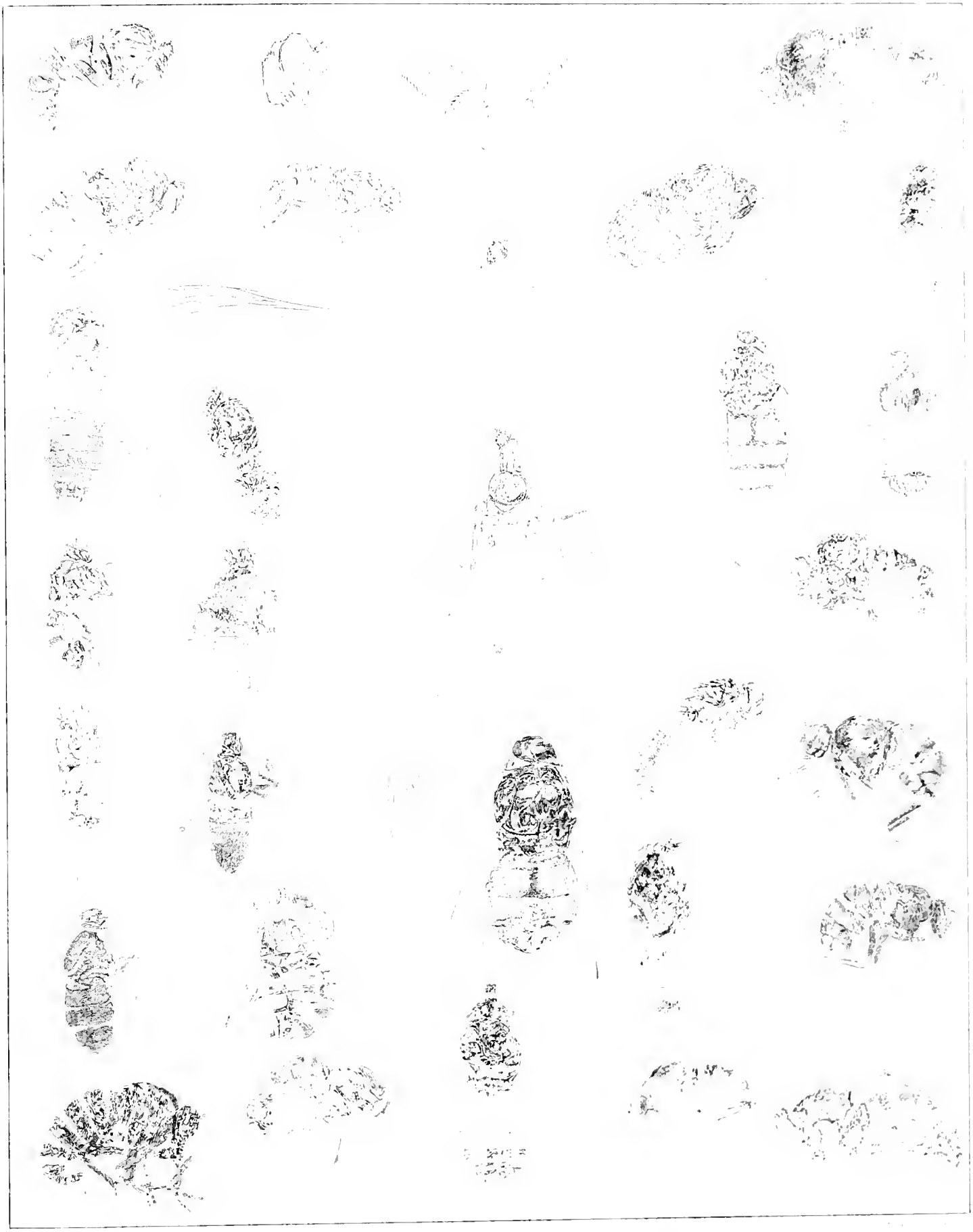
PLATE IX.

EXPLANATION OF PLATE IX.

All the drawings were made by J. Henry Blake, excepting Fig. 21, which is by Edward Burgess.

Fig. 1. (15192) ($\frac{8}{1}$) Sciomyza manca.
2. (15186) ($\frac{1.6}{1}$) Sciomyza manca.
3. (15187) ($\frac{1.2}{1}$) Sciomyza manca.
4. (4125) ($\frac{5}{1}$) Sciomyza manca.
5. (15193) ($\frac{8}{1}$) Sciomyza manca
6. (15186) ($\frac{6}{1}$) Sciomyza manca.
7. ($\frac{1.0}{1}$) Sciomyza disjecta.
8. (4113) ($\frac{7}{1}$) Chilosia sp.
9. (59L) ($\frac{5}{1}$) Psilota tabidosa.
10. (4143) ($\frac{6}{1}$) Stenocinclis anomala.
11. (71L) ($\frac{1.0}{1}$) Callomyia forporata.
12. (66L) ($\frac{1.2}{1}$) Anaclinia ? sp.
13. (14691) ($\frac{8}{1}$) Milesia quadrata.
14. (15184) ($\frac{4}{1}$) Chilosia ampla (?).
15. (15191) ($\frac{6}{1}$) Sciomyza manca.
16. (15196) ($\frac{8}{1}$) Sciomyza manca.
17. ($\frac{1.0}{1}$) Asarcomyia cadaver.

Fig. 18. (15188) ($\frac{7}{1}$) Sciomyza manca.
19. (14696) ($\frac{3}{1}$) Poliomyia recta.
20. (4121) ($\frac{7}{1}$) Sciomyza manca.
21. (14696) ($\frac{3}{1}$) Poliomyia recta.
22. (2L) ($\frac{8}{1}$) Sciomyza disjecta.
23. (15195) ($\frac{8}{1}$) Sciomyza manca.
24. (15189) ($\frac{7}{1}$) Sciomyza manca.
25. (4149) ($\frac{1.2}{1}$) Sciomyza disjecta.
26. ($\frac{6}{1}$) Chilosia ? sp.
27. (4112) ($\frac{6}{1}$) Chilosia ampla.
28. (15191) ($\frac{7}{1}$) Sciomyza manca.
29. ($\frac{8}{1}$) Sciomyza manca.
30. (15237) ($\frac{1.0}{1}$) Sciomyza disjecta.
31. ($\frac{8}{1}$) Lithophysa tumulta.
32. (15197) ($\frac{8}{1}$) Sciomyza disjecta.
33. (4131) ($\frac{1.2}{1}$) Sciomyza disjecta.



GREEN RIVER BEDS. WYOMING TERR

DIPTERA

PLATE X.

EXPLANATION OF PLATE X.

All the drawings were made by J. Henry Blake.

Fig. 1. (9P) ($\frac{4}{1}$) Tipula sepulchri.
2. (11P) ($\frac{8}{1}$) Rymosia strangulata.
3. (37L) ($\frac{8}{1}$) Boletina umbratica.
4. ($\frac{3}{1}$) Tipula spoliata.
5. (18P, reversed) ($\frac{5}{1}$) Sciomyza? sp.
6. (99L) ($\frac{9}{1}$) Sciophila hyattii.
7. ($\frac{15}{1}$) Boletina paludivaga.
8. (10P) ($\frac{10}{1}$) Chironomus septus.
9. (98L) ($\frac{5}{1}$) Syrphidæ? sp.
10. (15182) ($\frac{18}{1}$) Diadocidia terricola.
11. (15182) ($\frac{5}{1}$) Diadocidia terricola.
12. (4134) ($\frac{18}{1}$) Mycetophilidæ sp.
13. (14P) ($\frac{40}{1}$) Anatella tacita.
14. ($\frac{10}{1}$) Culex dammatorum.
15. (5L) ($\frac{5}{1}$) Stenocinclis? sp.
16. (2P) ($\frac{10}{1}$) Sciara scopuli.
17. (8P) ($\frac{5}{1}$) Plecia dejecta.
18. (130P) ($\frac{9}{1}$) Braconidæ sp.
19. (129P) ($\frac{9}{1}$) Rhyssa juvenis.
20. (15178) ($\frac{20}{1}$) Decatoma antiqua?
21. (131P) ($\frac{10}{1}$) Lithotorus cressoni.
22. (15177) ($\frac{12}{1}$) Myrmica sp.
23. (14692) ($\frac{3}{1}$) Lasius terreus.
24. (36L) ($\frac{5}{1}$) Eclytus lutatus.
25. (76L) ($\frac{8}{1}$) Glypta transversalis.
26. (22L) ($\frac{9}{1}$) Taxonus nortoni.
27. (22L) ($\frac{9}{1}$) Taxonus nortoni.
28. (133P) ($\frac{8}{1}$) Braconidæ sp.
29. (4196) ($\frac{12}{1}$) Bracon laminarum.
30. (132P) ($\frac{9}{1}$) Didineis solidescens.
31. (4076) ($\frac{8}{1}$) Decatoma antiqua.

GREEN RIVER BEDS. WYOMING TERR.

DIPTERA HYMENOPTERA

PLATE XI.

EXPLANATION OF PLATE XI.

All the drawings were made by J. Henry Blake.

Fig. 1. (9285) ($\frac{4}{1}$) Epeira sp.
2. (3204) ($\frac{2}{1}$) Epeira meekii ♀.
3. (13521) ($\frac{3}{1}$) Theridium opertaneum ♀.
4. (2831) ($\frac{3}{1}$) Clubiona arcana ♂.
5. (8269) ($\frac{3}{1}$) Anyphaena interita ♀.
6. (13523) ($\frac{3}{1}$) Epeira delita (♂?).
7. (7583) ($\frac{3}{1}$) Epeira abscondita ♂.
8. (8265) ($\frac{2}{1}$) Tethneus guyoti ♂.
9. (9677) ($\frac{4}{1}$) Thomisus disjunctus.
10. (320) ($\frac{3}{1}$) Tethneus guyoti ♀.
11. (5000) ($\frac{2}{1}$) Tetragnatha tertiaria ♂.
12. (11651) ($\frac{2}{1}$) Nephila pennatipes ♀.
13. (5502) ($\frac{4}{1}$) Thomisus resutus. The tibiæ should be slenderer at the base.
14. (8689) ($\frac{2}{1}$) Tethneus hentzii ♂.
15. (8777) ($\frac{4}{1}$) Epeira emertoni ♂.
16. (8576) ($\frac{4}{1}$) Epeira cinefacta ♂.
17. (9211) ($\frac{2}{1}$) Epeira meekii ♂.

Fig. 18. (6492) ($\frac{3}{1}$) Clubiona latebrosa ♂.
19. (5117) ($\frac{4}{1}$) Epeira emertoni ♀.
20. (9026) ($\frac{3}{1}$) Theridium seclusum ♂.
21. (13522) ($\frac{2}{1}$) Tethneus provectus ♀.
22. (5944) ($\frac{3}{1}$) Clubiona eversa ♂.
23. (4712) ($\frac{4}{1}$) Thomisus defossus ♂.
24. (199) ($\frac{3}{1}$) Clubiona ostentata ♂.
25. (14032) ($\frac{3}{1}$) Linyphia retensa ♂. Reverse of Fig. 27, lower part.
26. (8459) ($\frac{3}{1}$) Parattus resurrectus (♀?).
27. (12976) ($\frac{2}{1}$) Linyphia retensa ♂. (See Fig. 25.)
28. (205) ($\frac{3}{1}$) Segestria secessa ♀.
29. (13520) ($\frac{3}{1}$) Titanœca ingenua ♀.
30. (4921) ($\frac{4}{1}$) An ant, introduced by accident.
31. (7177) ($\frac{3}{1}$) Tethneus obduratus ♀.
32. (11203) ($\frac{3}{1}$) Titanœca ingenua ♀.

THE FLORISSANT BASIN

ARACHNIDA

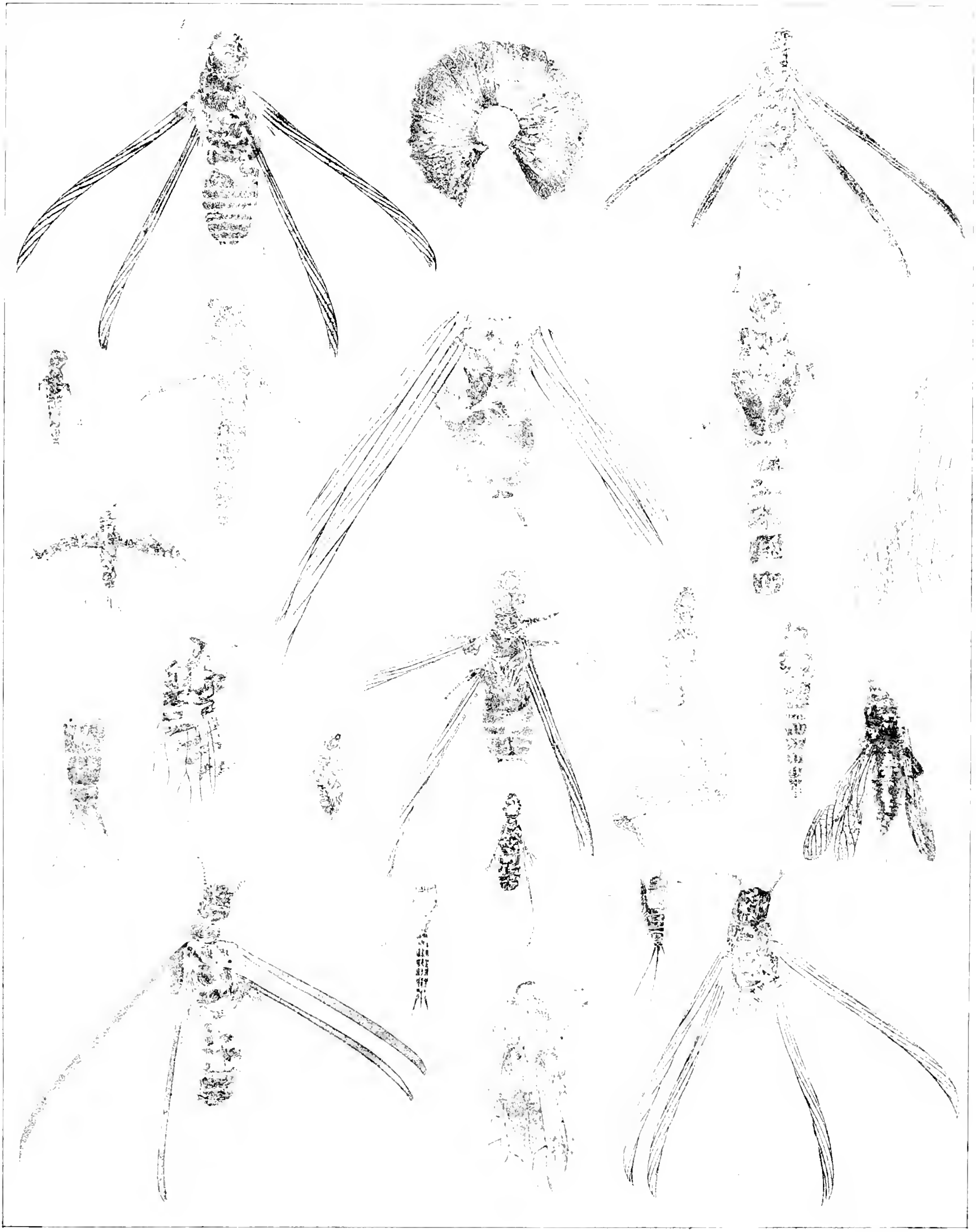
PLATE XII.

EXPLANATION OF PLATE XII.

All the drawings were made by J. Henry Blake.

Fig. 1. (399) ($\frac{3}{1}$) Cone of Sequoia, seen in cross-section; supposed when the plate was engraved to be a coiled myriapod.
2. (8616) ($\frac{4}{1}$) Parotermes hagenii.
3. (1247) ($\frac{4}{1}$) Parotermes fodinæ.
4. (13526) ($\frac{1}{1}$) Ephemera macilenta, larva.
5. (8824) ($\frac{2}{1}$) Ephemera immobilis, larva.
6. (6010) ($\frac{1}{1}$) Hodotermes ? coloradensis.
7. (10660) ($\frac{4}{1}$) Ephemera pumicosa, pupa.
8. (4643) ($\frac{3}{1}$) Taphacris reliquata.
9. (5587) ($\frac{2}{1}$) Ephemera exsucca.
10. (13526) ($\frac{4}{1}$) Ephemera macilenta, larva.
11. (349) ($\frac{4.2}{1}$) Necropsylla rigida.

Fig. 12. (19M) ($\frac{3}{1}$) Entermes meadii.
13. (9041) ($\frac{3}{1}$) Parotermes insignis.
14. (400) ($\frac{2}{1}$) Parotermes insignis.
15. (1516) ($\frac{3}{1}$) Ephemera pumicosa, larva.
16. (233) ($\frac{1}{1}$) Ephemera pumicosa, larva.
17. (31) ($\frac{3}{1}$) Entermes meadii.
18. (1693) ($\frac{3}{1}$) Lepisma platymera. Some of the abdominal joints are not indicated.
19. (4643) ($\frac{1}{1}$) Taphacris reliquata.
20. (6049) ($\frac{9}{1}$) Entermes fossarum.
21. (310) ($\frac{1.5}{1}$) Necropsylla rigida.
22. (11190) ($\frac{4}{1}$) Parotermes fodinæ.



J. Sinclair & Son Lith. Phila.

THE FLORISSANT BASIN

MYRIAPODA NEUROPTERA

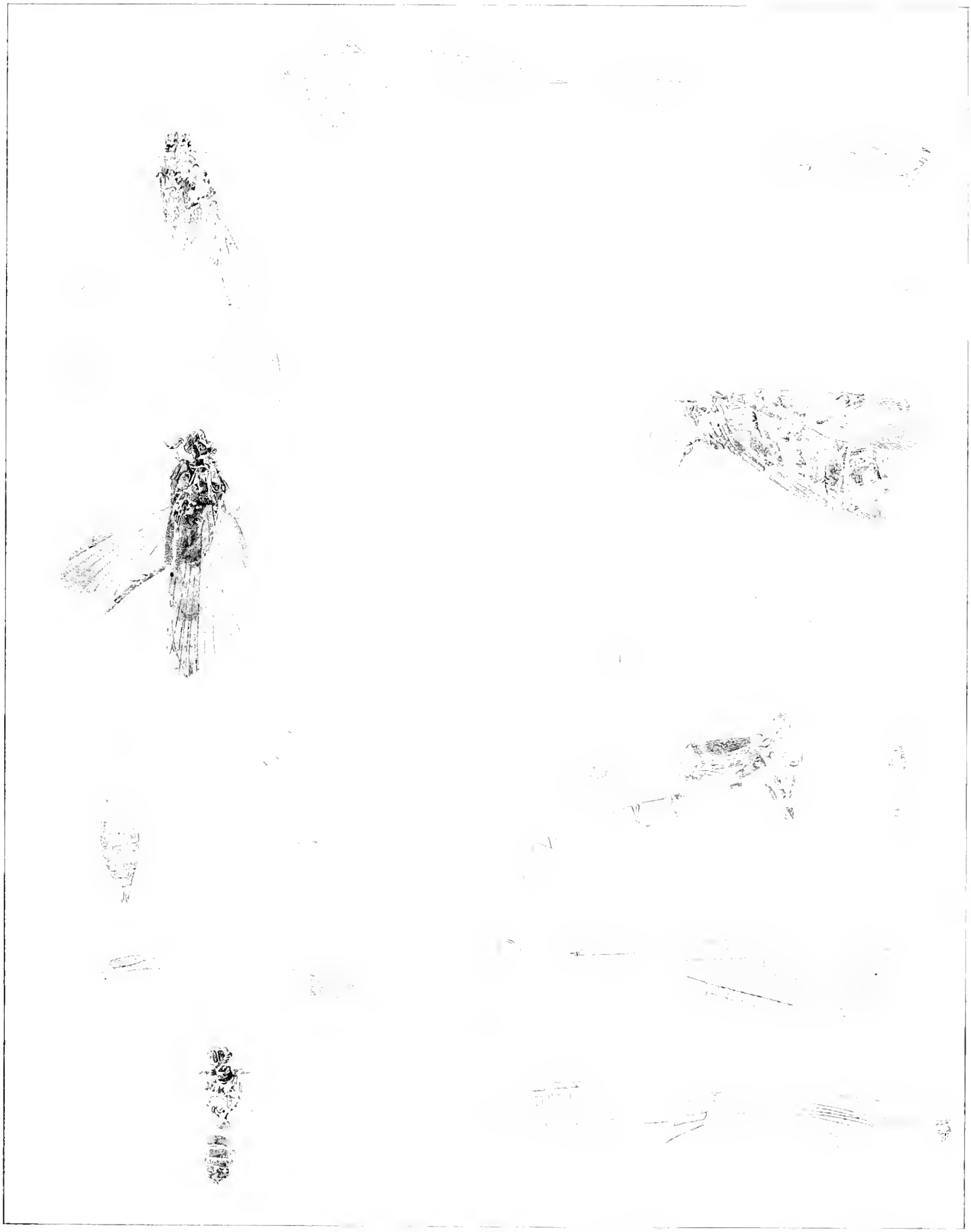
PLATE XIII.

EXPLANATION OF PLATE XIII.

All the drawings were made by J. Henry Blake.

Fig. 1. (8347) (♀) Æschna (Æschna) solida.
2. (8995) (♀) Limnopsyche dispersa.
3. (7728) (♀) Neuronia evanescens.
4. (8619) (♀) Lithagrion hyalinum.
5. (407) (♀) Phryganea labefacta.
6. (8046) (♀) Agrion exsularis.
7. (12239) (♀) Polycentropus ? eviratus.
8. (6824) (♀) Agrion mascescens.

Fig. 9. (6824) (♀) Agrion mascescens.
10. (13525) (♀) Agrion telluris.
11. (1816) (♀) Æschna larvata.
12. (6927) (♂) Lithagrion umbratum.
13. (2514) (♀) Derobrochus crateræ.
14. (8163) (♂) Lithagrion umbratum.
15. (11693) (♂) Æschna (Basiæschna) separata.



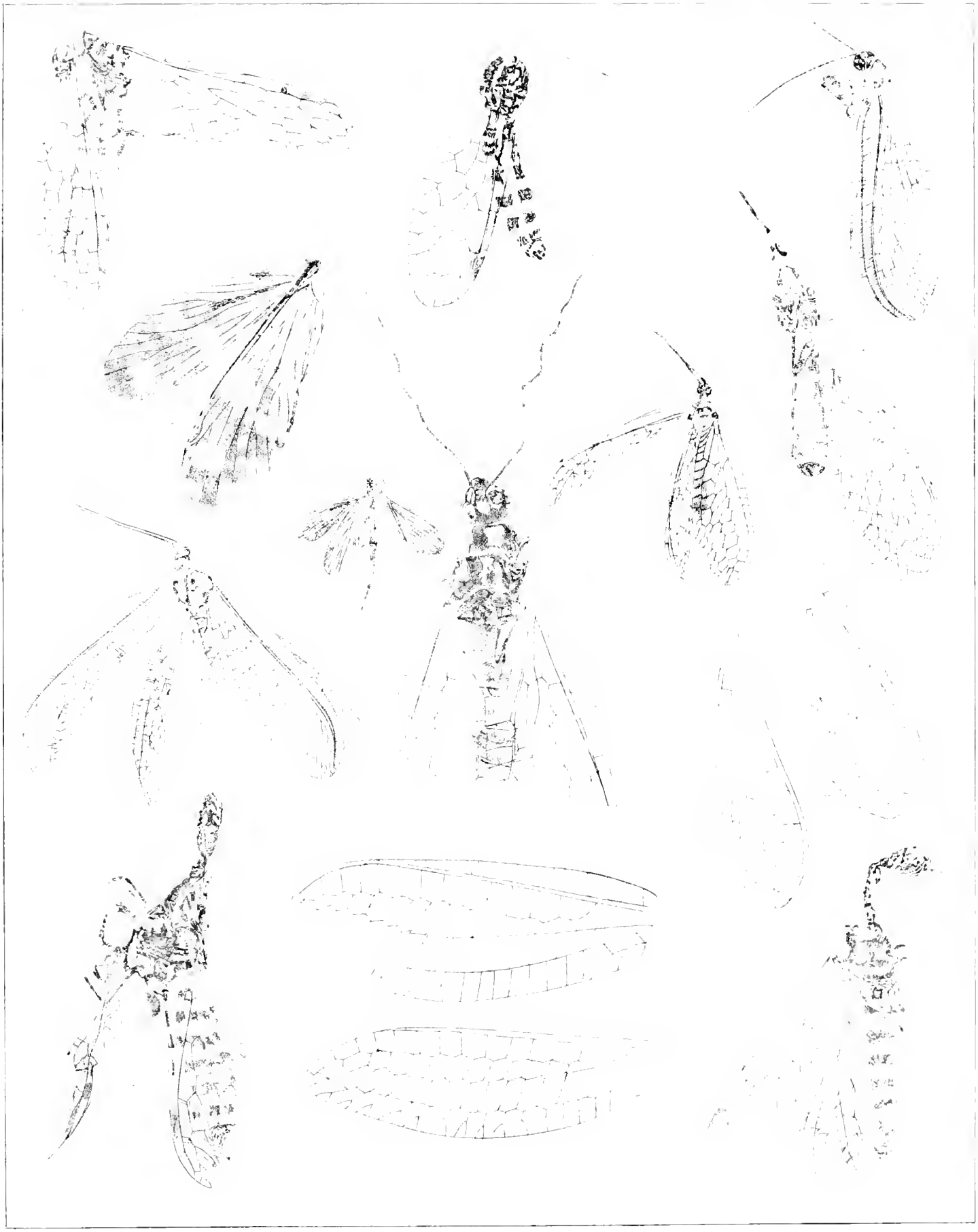
THE FLORISSANT BASIN
NEUROPTERA

PLATE XIV.

EXPLANATION OF PLATE XIV.

All the drawings were made by J. Henry Blake, excepting Figs. 13 and 14, which were traced by S. H. Scudder from a microphotograph, taken by Samuel Wells, Esq.

Fig. 1. (1385) ($\frac{6}{1}$) Inocellia veterana. The vein representing a bent costal vein of the right wing does not exist.
2. (4383) ($\frac{6}{1}$) Rhaphidia ? tranquilla ♂.
3. (13537) ($\frac{3}{1}$) Osmylus requietus.
4. (63) ($\frac{3}{1}$) Holcorpa maculosa.
5. (63) ($\frac{4}{1}$) Holcorpa maculosa.
6. (670) ($\frac{3}{1}$) Tribochrysa firmata.
7. (8792) ($\frac{6}{1}$) Tribochrysa firmata.
8. (14168) ($\frac{3}{1}$) Osmylus requietus.
9. (11204) ($\frac{6}{1}$) Tribochrysa vetuscula.
10. (8792) ($\frac{5}{1}$) Tribochrysa firmata; hind wing.
11. (8792) ($\frac{6}{1}$) Tribochrysa firmata; fore wing.
12. (9373) ($\frac{6}{1}$) Inocellia somnolenta ♀.
13. (7340) ($\frac{5}{1}$) Palæochrysa stricta; front wing; the basal half of the upper cubital vein should not be straight but zigzag like the apical half: the basal portion of the intercubital area is also wrongly given.
14. (7340) ($\frac{5}{1}$) Palæochrysa stricta; hind wing; the cross veins of the costal area are not shown.
15. (956) ($\frac{5}{1}$) Inocellia tumulata ♂.



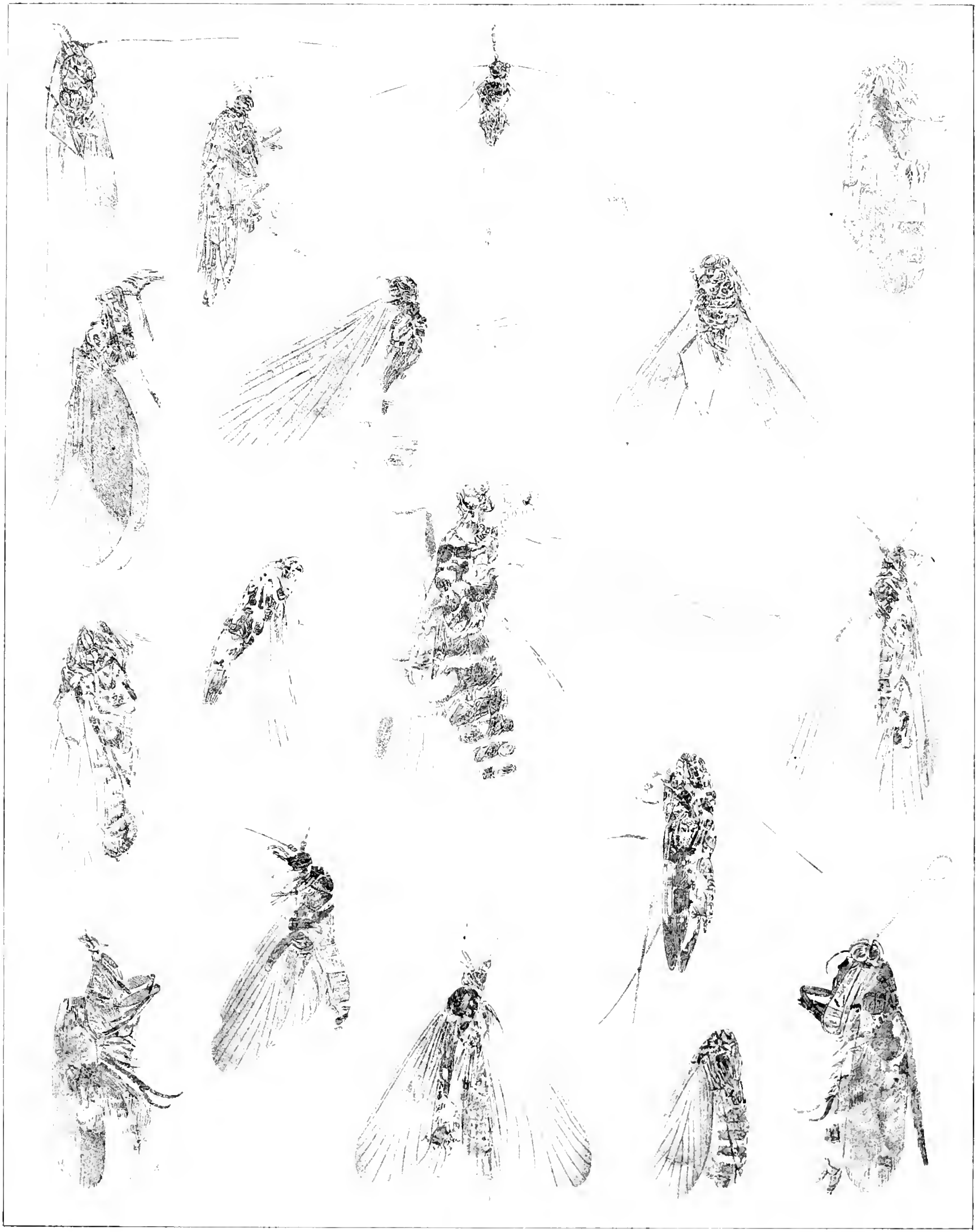
THE FLORISSANT BASIN
NEUROPTERA (PLANIPENNIA)

PLATE XV.

EXPLANATION OF PLATE XV.

All the drawings were made by J. Henry Blake.

Fig. 1. (8065) ($\frac{4}{1}$) Leptobrochus lutens.
2. (9416) ($\frac{4}{1}$) Derobrochus marcidus.
3. (8857) ($\frac{4}{1}$) Leptobrochus lutens.
4. (1.947) ($\frac{6}{1}$) Derobrochus craterae.
5. (1441) ($\frac{4}{1}$) Limnophilus soporatus.
6. (5433) ($\frac{6}{1}$) Derobrochus frigescens.
7. (11205) ($\frac{4}{1}$) Hydropsyche marcens.
8. (319) ($\frac{1.0}{1}$) Diaplegma abductum.
9. (13137) ($\frac{6}{1}$) Tinodes paludigena.
10. (14210) ($\frac{5}{1}$) Litobrochus externatus.
11. (6881) ($\frac{6}{1}$) Mesobrochus lethaeus.
12. (9630) ($\frac{4}{1}$) Psecadia mortuella. Reverse of Fig. 17.
13. (4123) ($\frac{6}{1}$) Mesobrochus imbecillus.
14. (8422) ($\frac{4}{1}$) Paladicella eruptionis.
15. (11754) ($\frac{6}{1}$) Setodes portionalis.
16. (2677) ($\frac{4}{1}$) Derobrochus frigescens.
17. (8460) ($\frac{4}{1}$) Psecadia mortuella. Reverse of Fig. 12.



THE FLORISSANT BASIN

NEUROPTERA (PHRYGANIDAE.)

PLATE XVI.

EXPLANATION OF PLATE XVI.

All the drawings were made by J. Henry Blake, excepting Fig. 18, which is by S. H. Scudder.

Fig. 1. (1.603) ($\frac{2}{1}$) Labidromma bormansi ♂.
2. (395) ($\frac{2}{1}$) Labidromma mortale ♂.
3. (3832) ($\frac{2}{1}$) Labidromma avia ♀.
4. (1.381) ($\frac{1}{1}$) Quedius breweri.
5. (13544) ($\frac{2}{1}$) Labidromma avia ♂.
6. (3705) ($\frac{2}{1}$) Labidromma mortale ♂.
7. (2604) ($\frac{2}{1}$) Labidromma infernum ♂.
8. (10627) ($\frac{1}{1}$) Quedius chamberlini.
9. (5004) ($\frac{8}{1}$) Labidromma labens (young).
10. (11208) ($\frac{2}{1}$) Labidromma commixtum ♀.
11. (11209) ($\frac{2}{1}$) Labidromma avia ♀.
12. (13546) ($\frac{2}{1}$) Labidromma exsulatum ♀. (Copied by Zittel, Handb. d. palæont., Fig. 959.)
13. (14471) ($\frac{1}{1}$) Labidromma labens ♂.
14. (4736) ($\frac{2}{1}$) Labidromma gilberti ♂.
15. (8334) ($\frac{2}{1}$) Labidromma tertiarium ♀.
16. (7118) ($\frac{3}{1}$) Labidromma labens ♂.
17. (1832) ($\frac{2}{1}$) Labidromma commixtum ♀.
18. (14688) ($\frac{1}{1}$) Labidromma tertiarium ♂.
19. (316) ($\frac{2}{1}$) Labidromma lithophilum ♀.
20. (13001) ($\frac{2}{1}$) Labidromma mortale ♀.
21. (4925) ($\frac{2}{1}$) Labidromma tertiarium ♂.
22. (11740) ($\frac{2}{1}$) Labidromma avia ♂.
23. (8022) ($\frac{2}{1}$) Labidromma avia ♀.
24. (5278) ($\frac{1}{1}$) Labidromma sp.

THE FLORISSANT BASIN
ORTHOPTERA (FORFICULARIAE)

PLATE XVII.

EXPLANATION OF PLATE XVII.

All the drawings were made by J. Henry Blake, excepting Fig. 8, which is by S. H. Scudder.

Fig. 1. ($\frac{3}{1}\frac{0}{0}$) Tyrbula russelli. One of the joints of the antennal club.
2. ($\frac{2}{1}$) Tyrbula russelli. Antennæ.
3. ($\frac{3}{1}$) Tyrbula russelli. (Copied by Zittel, Handb. d. palæont., Fig. 965.)
4. ($\frac{6}{1}$) Tyrbula russelli. Tibial spines.
5. (7389) ($\frac{2}{1}$) Œdipoda præfocata.
6. (635) ($\frac{2}{1}$) Gomphocerus abstrusus.
7. (1724) ($\frac{2}{1}$) Cymatomera maculata.
8. (8M) ($\frac{1}{1}$) Homœogamia ventriosa.
9. (7544) ($\frac{4}{1}$) Locusta silens. A portion of the leg, showing spines.
10. (7544) ($\frac{2}{1}$) Locusta silens.
11. (5817) ($\frac{1}{1}$) Agathemera reclusa.
12. (5122) ($\frac{3}{1}$) Zetobora brunneri.
13. (14720) ($\frac{3}{1}$) Tyrbula multispinosa.
14. (11557) ($\frac{1}{1}$) Lithymnetes guttatus ♀. (Copied by Zittel, l. c., Fig. 969.)
15. (11557) ($\frac{3}{1}$) Lithymnetes guttatus ♀. Showing the cellular spotting.
16. (13 50) ($\frac{1}{1}$) Orchelimum placidum ♀.
17. (4642) ($\frac{2}{1}$) Gryllacris cineris.
18. (13551) ($\frac{2}{1}$) Orchelimum placidum ♂. Fore leg.
19. (13551) ($\frac{1}{1}$) Orchelimum placidum ♂.

THE FLORISSANT BASIN

ORTHOPTERA

PLATE XVIII.

EXPLANATION OF PLATE XVIII.

All the drawings are by J. Henry Blake.

Fig. 1. (9221) (♀) Archilachnus pennatus. (Copied by Buckton, Monogr. Brit. Aphides, Pl. 133, Fig. 3.

2. (315) ($\frac{1}{1}^{8}$) Schizoneuroides s c u d d e r i. (Copied by Buckton, l. c., Pl. 133, Fig. 5. Copied by Zittel, Handb. d. palaeont., Fig. 988.)

3. (10205) (♀) Siphonophoroides antiqua.

4. (670) ($\frac{4.0}{1}$) Tephraphis simplex. (Copied by Buckton, l. c., Pl. 133, Fig. 2.)

5. (14450) (♀) Siphonophoroides antiqua.

6. (314) ($\frac{1.5}{1}$) Sychnobrochus reviviscens.

7. (13562) (♀) Siphonophoroides antiqua.

8. (5380) (♀) Aphidopsis margarum.

Fig. 9. (4827) (♀) Anconatus dorsuosus. (Copied by Buckton, l. c., Pl. 133, Fig. 4.)

10. (8889) (♀) Siphonophoroides antiqua. (Copied by Buckton, l. c., Pl. 133, Fig. 1.)

11. (1044) (♀) Aphidopsis sp. (immature).

12. (3577) (♀) Sbenaphis quesneli.

13. (340) (♀) Amalancon lutosus.

14. (4475) (♀) Oryctaphis recondita.

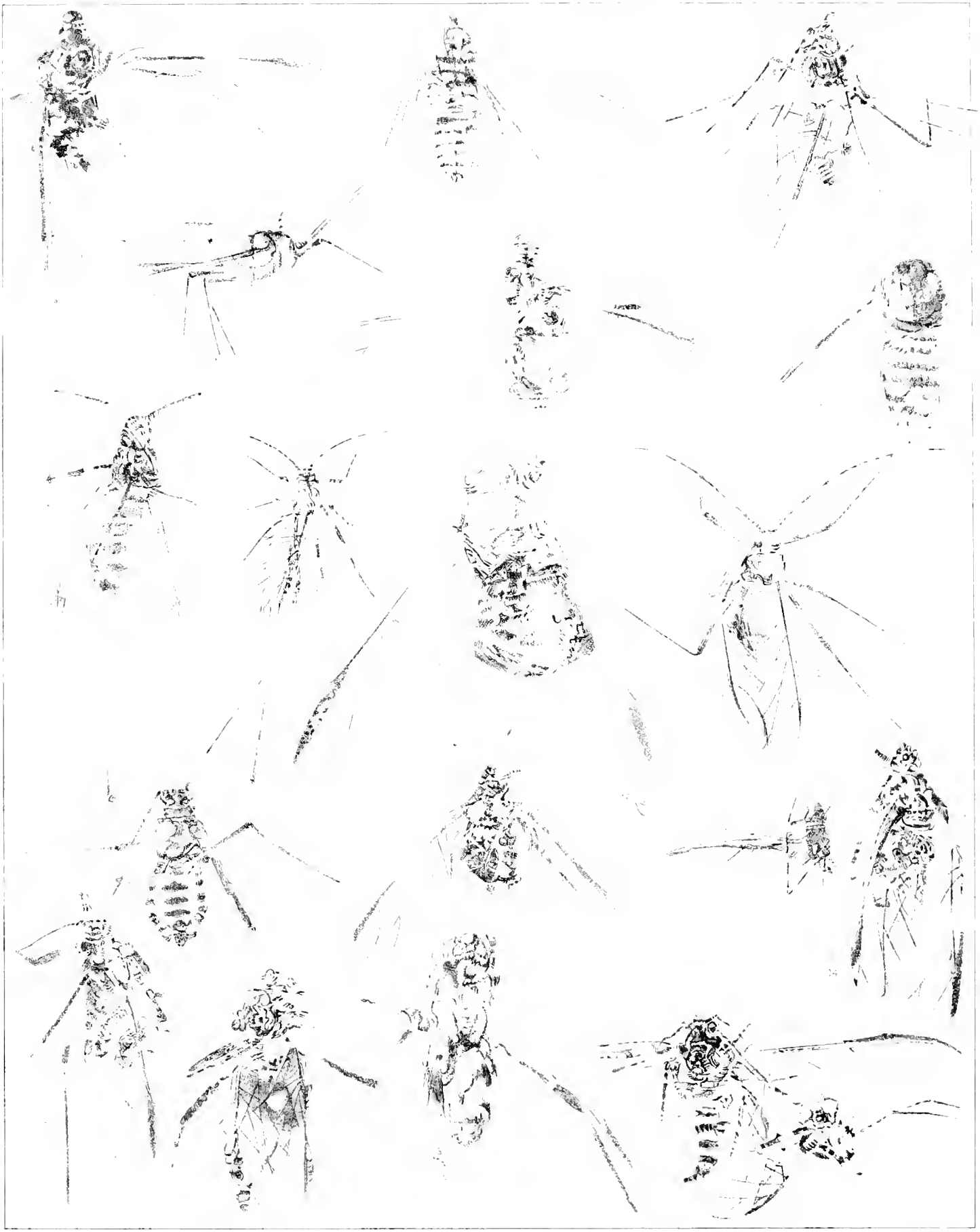
15. (6993) (♀) Archilachnus pennatus.

16. (4615) (♀) Archilachnus pennatus.

17. (177) ($\frac{1.0}{1}$) Archilachnus pennatus.

18. (8085) (♀) Pterostigma recurvum. (Copied by Buckton, l. c., Pl. 133, Fig. 6.)

19. (8085) (♀) Tephraphis walshii.



THE FLORISSANT BASIN
HEMIPTERA (HOMOPTERA: APHIDAE)

PLATE XIX.

EXPLANATION OF PLATE XIX.

All the drawings were made by J. Henry Blake.

Fig. 1. (12069) ($\frac{1}{1}^{2}$) Fulgora obtiecscens.
2. (262) ($\frac{1}{1}^{0}$) Cercopis suffocata. A portion showing the surface structure.
3. (262) ($\frac{3}{1}$) Cercopis suffocata.
4. (14229) ($\frac{6}{1}$) Gypona cinerea.
5. (2658) ($\frac{6}{1}$) Agallia abstructa.
6. (10479) ($\frac{7}{1}$) Docimus psylloides.
7. (307) ($\frac{5}{1}$) Agallia lewisii.
8. (12088) ($\frac{3}{1}$) Nyctophylax vigil.
9. (7628) ($\frac{6}{1}$) Tettigonia priscotincta.
10. (4379) ($\frac{6}{1}$) Aphrophora sp.
11. (11771) ($\frac{3}{1}$) Nyctophylax uhleri.
12. (1.789) ($\frac{4}{1}$) Florissantia elegans.
13. (12785) ($\frac{1}{1}^{3}$) Elidiptera regularis.
14. (1.705) ($\frac{4}{1}$) Cixius? proavus.

Fig. 15. (11307) ($\frac{8}{1}$) Acocephalus callosus.
16. (5188) ($\frac{1}{1}^{3}$) Jassopsis evidens.
17. (9299) ($\frac{7}{1}$) Docimus psyiloides.
18. (10158) ($\frac{7}{1}$) Agallia flaccida.
19. (10672) ($\frac{9}{1}$) This specimen was accidentally overlooked in working up the fauna. It is evidently the anterior half of one of the Cercopida and apparently a species of Locrites, but does not agree with the other species known.
20. (3412) ($\frac{1}{1}^{3}$) Thamnotettix fundi.
21. (1.805) ($\frac{9}{1}$) Agallia lewisii.
22. (6655) ($\frac{1}{1}^{2}$) Clastoptera comstocki.
23. (4552) ($\frac{1}{1}^{2}$) Thlibomenus parvus.

THE FLORISSANT BASIN
HEMIPTERA. (HOMOPTERA.)

PLATE XX.

EXPLANATION OF PLATE XX.

All the drawings were made by J. Henry Blake.

Fig. 1. (6050) (4) Palecphora prævalens.
2. (5058) (4) Palaphrodes irregularis.
3. (13584) (4) Palecphora communis.
4. (9900) (1) Aporema præstrictum.
5. (62) (1) Petrolystra gigantea ?.
6. (411) (1) Petrolystra gigantea. (Copied by Zittel, Handb. d. palæont., Fig. 992.)
7. (412) (1) Petrolystra gigantea.
8. (11829) (1) Petrolystra heros.
9. (11237) (4) A small fly, found on the same stone with the next, perhaps belonging to the Tachydromidæ, but whose precise affinities it is perhaps impossible to trace.
Fig. 10. (11237) (4) Palecphora maculata.
11. (6484) (1) Palecphora marvinei.
12. (6484) (4) Palecphora marvinei.
13. (6484) (4) Palecphora marvinei.
14. (11774) (1) Princephora balteata.
15. (609) (1) Palecphora inornata.
16. (582) (1) Palaphrodes cincta.
17. (3534) (4) Palecphora maculata.
18. (43) (1) Palaphrodes irregularis.
19. (6639) (1) Jassus ? latebræ.
20. (13570) (4) Palecphora communis.
21. (159) (1) Palecphora communis.
22. (1.121) (1) Lithecphora setigera.

THE FLORISSANT BASIN
HEMIPTERA (HOMOPTERA)

PLATE XXI.

EXPLANATION OF PLATE XXI.

All the drawings were made by J. Henry Blake.

Fig. 1. (78) ($\frac{6}{1}$) Agallia instabilis.
2. (8081) ($\frac{4}{1}$) Palecphora prævalens.
3. (12776) ($\frac{6}{1}$) Lithecphora murata.
4. (12447) ($\frac{6}{1}$) Lithecphora unicolor.
5. (13337) ($\frac{6}{1}$) Lithecphora unicolor.
6. (3864) ($\frac{4}{1}$) Palaphrodes irregularis.
7. (8536) ($\frac{4}{1}$) Palaphrodes irregularis.
8. (912) ($\frac{6}{1}$) Lithecphora murata.
9. (3801) ($\frac{4}{1}$) Palecphora marvinei.
10. (8887) ($\frac{4}{1}$) Palaphrodes obliqua.
11. (14178) ($\frac{6}{1}$) Lithecphora unicolor.
12. (9158) ($\frac{4}{1}$) Palecphora marvinei.
13. (30) ($\frac{5}{1}$) Lithecphora diaphana.
14. (11103) ($\frac{6}{1}$) Lithecphora unicolor.
15. (208) ($\frac{4}{1}$) Palaphrodes cincta.
16. (126) ($\frac{3}{1}$) Dictyophara bonvei.
17. (8313) ($\frac{4}{1}$) Locrites whitei.
18. (4287) ($\frac{4}{1}$) Palaphrodes obscura.
19. (9374) ($\frac{3}{1}$) Locrites copei.

THE FLORISSANT BASIN

HEMIPTERA (HOMOPTERA

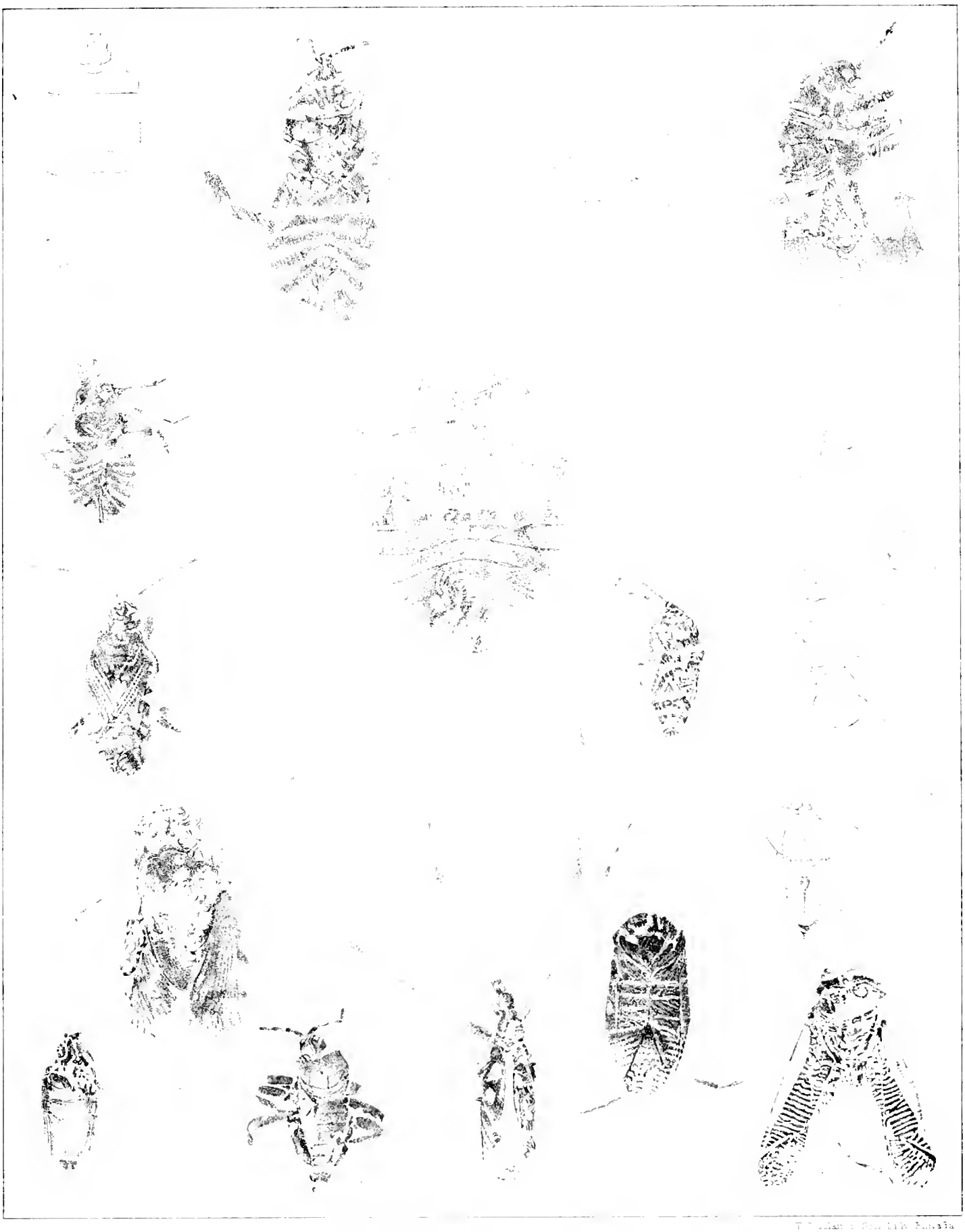
PLATE XXII.

EXPLANATION OF PLATE XXII.

All the drawings were made by J. Henry Blake.

Fig. 1. (4480) (♀) Achrestocoris cinerarius.
2. (128) (♂) Capsus laeus.
3. (6371) (♀) Phthinocoris colligatus.
4. (12784) (♂) Tiroschistus indurescens.
5. (4563) (♀) Fuscus fœcatus.
6. (234) (♂) Discostoma ? sp.
7. (1.828) (♀) Nysius vecula.
8. (14981) (♂) Stenovelia nigra.
9. (7609) (♂) Trapezonotus exterminatus.

Fig. 10. (1.821) (♀) Lygæus stabilitus.
11. (10729) (♀) Notonecta emersoni.
12. (1097) (♂) Prosigara flabellum.
13. (13325) (♀) Palæovelia spinosa.
14. (3268) (♂) Stenovelia nigra.
15. (12782) (♀) Metrobates æternalis. The figure is upside down.
16. (2238) (♀) Corixa immersa.
17. (7269) (♀) Corixa vanduzeei.



T. Sinclair & Son, Lith. Philada.

THE FLORISSANT BASIN

HEMIPTERA HETEROPTERA: REDUVIIDAE, IMMAIDAE.

PLATE XXIII.

EXPLANATION OF PLATE XXIII.

All the drawings were made by J. Henry Blake

Fig. 1. (5596) (♀) Eotingis antennata.
2. (12096) (♀) Linnæa carcerata.
3. (4365) (♀) Eotingis antennata.
4. (5873) (♀) Linnæa putnami.
5. (9672) (♀) Monanthia veterna.
6. (7617) (♀) Piesma ? rotunda.
7. (7473) (♀) Stenopamera subterrea.
8. (9937) (♀) Procrophius costalis.
9. (2349) (♀) Monanthia veterna.
10. (2321) (♀) Linnæa holmesii.
11. (9674) (♀) Trapezonotus exterminatus.
12. (11652) (♀) Procrophius communis.
13. (4560) (♀) Capsus obsolefactus.
14. (6365) (♂) Nysius stratus.
15. (9884) (♀) Rhyparochromus verrillii.
16. (5736) (♀) Stenopamera tenebrosa.

Fig. 17. (5864) (♀) Geocoris infernorum.
18. (11184) (♂) Procrophius communis.
19. (4994) (♀) Linnæa gravida.
20. (12465) (♂) Nysius tritus.
21. (7233) (♀) Linnæa evoluta.
22. (11757) (♀) Trapezonotus exterminatus.
23. (6239) (♀) Procrophius languens.
24. (11301) (♀) Stenopamera tenebrosa.
25. (6550) (♂) Trapezonotus exterminatus.
26. (6483) (♀) Geocoris infernorum.
27. (11164) (♀) Nysius stratus.
28. (11222) (♂) Procrophius communis.
29. (1209) (♀) Procrophius communis.
30. (11210) (♂) Rhyparochromus verrillii.
31. (7064) (♂) Nysius terræ.

THE FLORISSANT BASIN

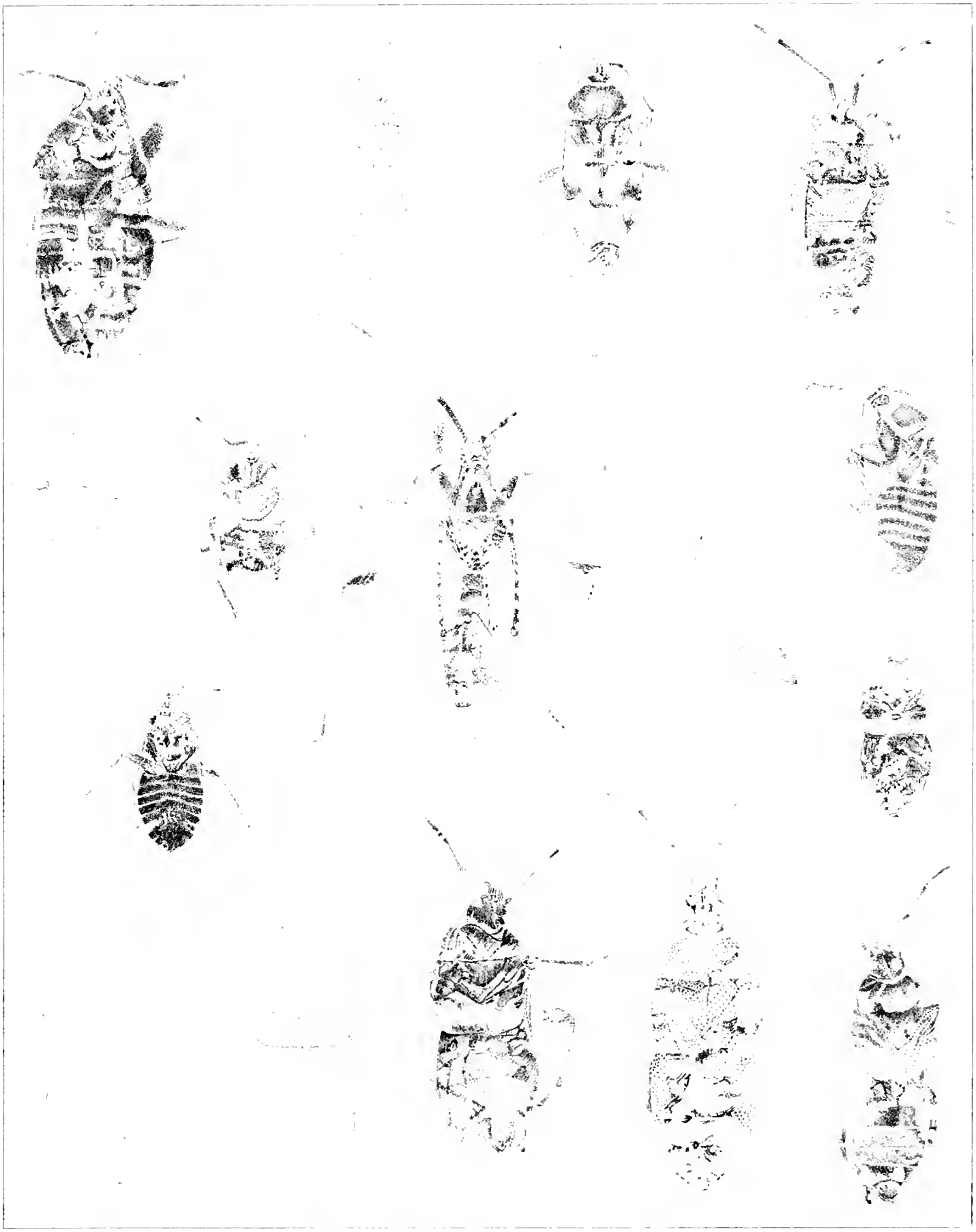
HEMIPTERA HETEROPTERA LYGAEIDAE

PLATE XXIV.

EXPLANATION OF PLATE XXIV.

All the drawings were made by J. Henry Blake.

Fig. 1. (193) ($\frac{1.5}{1}$) Procrophius communis.
2. (13560) ($\frac{5}{1}$) Pœcilocapsus ostentus.
3. (13554) ($\frac{5}{1}$) Pœcilocapsus fremontii.
4. (13314) ($\frac{5}{1}$) Anasa priscoputida.
5. (12925) ($\frac{5}{1}$) Ligyrocoris exsuctus.
6. (13558) ($\frac{5}{1}$) Carmelus sepositus.
7. (4369) ($\frac{5}{1}$) Closterocoris elegans.
8. (6968) ($\frac{5}{1}$) Pœcilocapsus tabidus.
9. (12076) ($\frac{5}{1}$) Pœcilocapsus veterandus.
10. (12457) ($\frac{5}{1}$) Carmelus gravatus.
11. (5865) ($\frac{4}{1}$) Dysdercus cinctus.
12. (13559) ($\frac{5}{1}$) Hadronema cinerescens.
13. (1426) ($\frac{6}{1}$) Dysdercus cinctus.
14. (13561) ($\frac{5}{1}$) Dysdercus cinctus.
15. (11218) ($\frac{5}{1}$) Lygæus obsolescens.
16. (11219) ($\frac{5}{1}$) Lygæus stabilitus.



THE FLORISSANT BASIN
HEMIPTERA HETEROPTERA LYGAEIDAE

PLATE XXV.

EXPLANATION OF PLATE XXV.

All the drawings were made by J. Henry Blake.

Fig. 1. (318*b*) ($\frac{6}{1}$) Rhepocoris propinquans.
2. (10381) ($\frac{?}{?}$) Nysius stratus.
3. (12102) ($\frac{5}{1}$) Cacalydus exstirpatus.
4. (12081) ($\frac{5}{1}$) Rhepocoris prævalens.
5. (3247) ($\frac{6}{1}$) Corizus abditivus.
6. (318*a*) ($\frac{5}{1}$) Rhepocoris prævalens.
7. (1761) ($\frac{5}{1}$) Rhepocoris prævalens.
8. (11140) ($\frac{8}{1}$) Nysius stratus.
9. (5669) ($\frac{6}{1}$) Rhepocoris prævalens.
10. (12087) ($\frac{5}{1}$) Rhepocoris prævalens.
11. (9128) ($\frac{5}{1}$) Rhepocoris prævalens.
12. (1.508) ($\frac{6}{1}$) Cacalydus lapsus.
13. (12778) ($\frac{6}{1}$) Parodarmistus collisus.
14. (1.803) ($\frac{6}{1}$) Rhepocoris prævalens.
15. (10956) ($\frac{8}{1}$) Piezocoris peritus.
16. (9) ($\frac{8}{1}$) Rhepocoris prævalens.

THE FLORISSANT BASIN
HEMIPTERA HETEROPTERA—COREIDAE

PLATE XXVI.

EXPLANATION OF PLATE XXVI.

All the drawings were made by J. Henry Blake.

Fig. 1. (8604) (♀) Orthriocorisa longipes.
2. (4644) (♀) Lithochromus mortuarius.
3. (7856) (♀) Cydamus robustus.
4. (14207) (♀) Corizus abditivus.
5. (12469) (♀) Eothes elegans.
6. (13660) (♀) Lithochromus extraneus.
7. (7037) (♀) Phrudopamera chittendeni.
8. (10391) (♀) Protenor imbecillis.
9. (11232) (♂) Phrudopamera chittendeni.
10. (9837) (♀) Lithochromus gardneri.
11. (2431) (♀) Rhepocoris prævalens.
12. (14236) (♀) Catopamera bradleyi.
13. (8467) (♀) Rhepocoris propinquans.
14. (5633) (♀) Piezocoris? peremptus.
15. (2696) (♂) Tagalodes inermis.
16. (9253) (♀) Etirocoris infernalis.
17. (6370) (♀) Phthinocoris lethargicus.

T. Sinclair & Son Lith. Phila.

THE FLORISSANT BASIN

HEMIPTERA HETEROPTERA COREIDAE

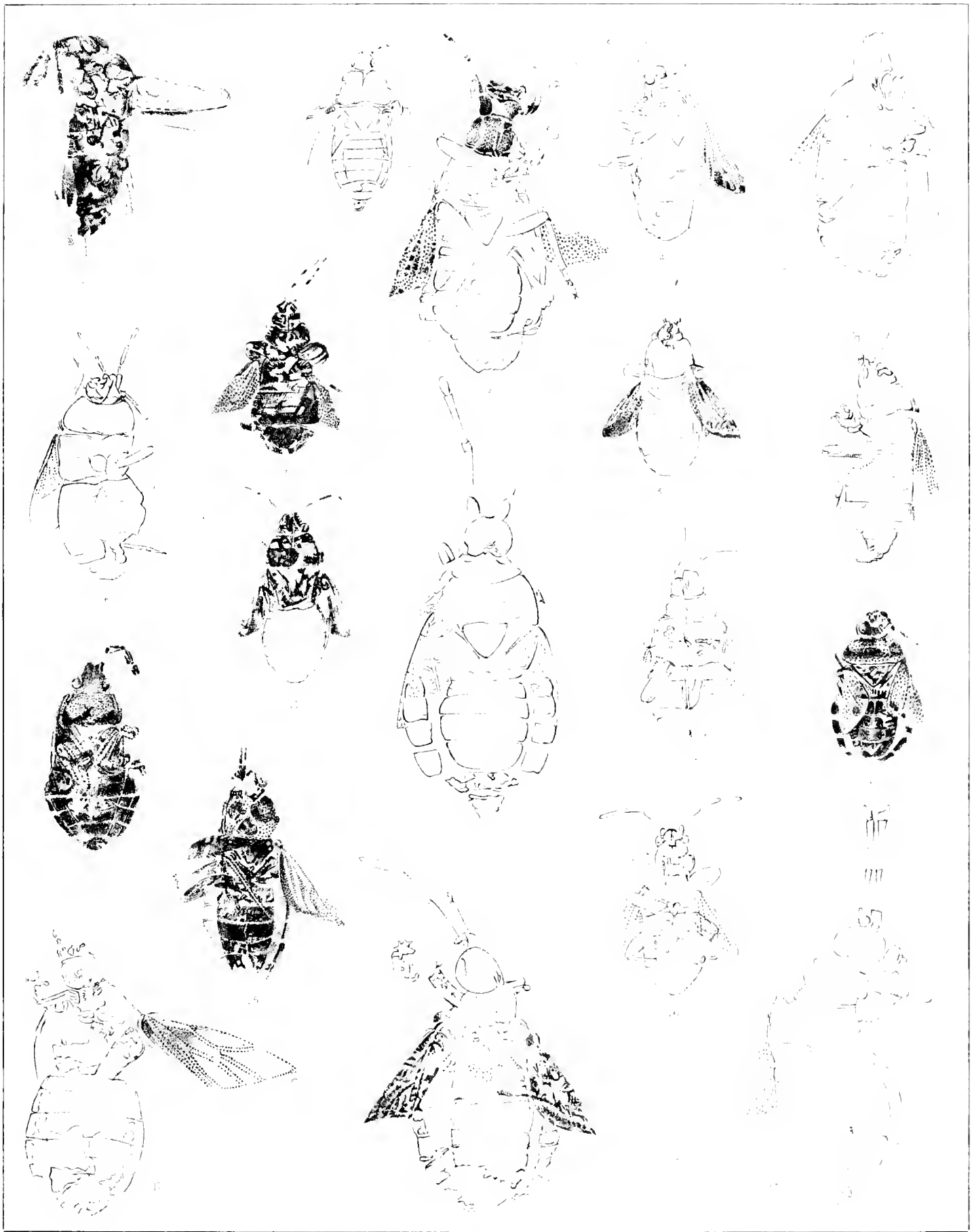
PLATE XXVII.

EXPLANATION OF PLATE XXVII.

All the drawings were made by J. Henry Blake.

Fig. 1. (367) ($\frac{4}{1}$) Rhipiphorus geikiei.
2. (6656) ($\frac{9}{1}$) Exitelus exsanguis.
3. (5703) ($\frac{6}{1}$) Heeria lapidosa.
4. (13564) ($\frac{9}{1}$) Procoris bechleri.
5. (1.831) ($\frac{9}{1}$) Heeria gulosa.
6. (12256) ($\frac{9}{1}$) Phthinocoris languidus.
7. (9590) ($\frac{9}{1}$) Catopamera angheyi.
8. (2577) ($\frac{9}{1}$) Lithochromus gardneri.
9. (6931) ($\frac{9}{1}$) Phrudopamera wilsoni.
10. (9086) ($\frac{9}{1}$) Necrochromus cockerelli.

Fig. 11. (9302) ($\frac{8}{1}$) Trapezonotus stygialis.
12. (11773) ($\frac{9}{1}$) Heeria gulosa.
13. (6299) ($\frac{9}{1}$) Prolygæus inundatus.
14. (2871) ($\frac{9}{1}$) Necrochromus labatus.
15. (6369) ($\frac{8}{1}$) Corizus celatus.
16. (13315) ($\frac{9}{1}$) Phrudopamera wilsoni.
17. (8740) ($\frac{9}{1}$) Phthinocoris lethargicus.
18. (4269) ($\frac{9}{1}$) Heeria gulosa.
19. (14197) ($\frac{9}{1}$) Heeria lapidosa.



THE FLORISSANT BASIN

HEMIPTERA (HETEROPTERA COREIDAE.)

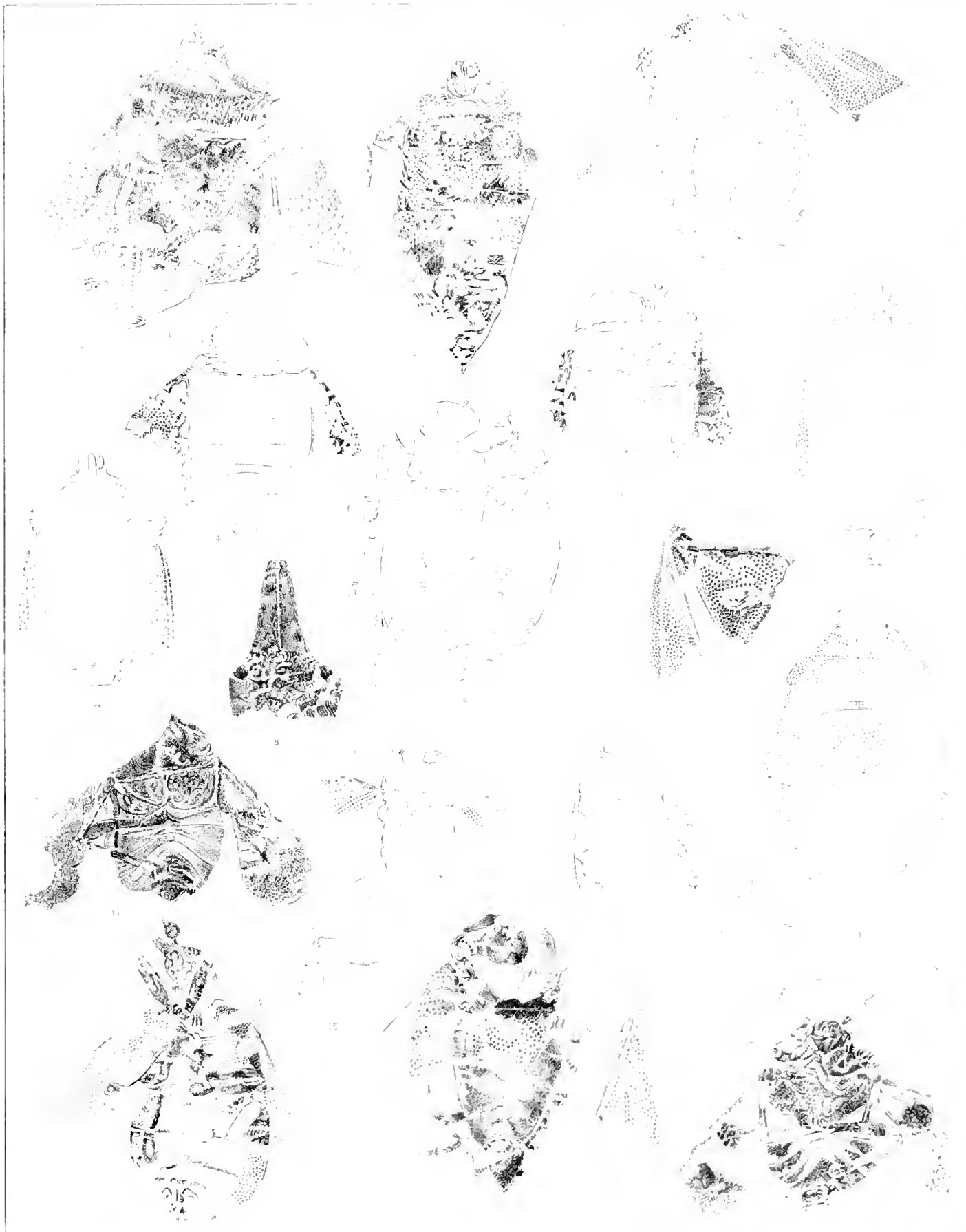
PLATE XXVIII.

EXPLANATION OF PLATE XXVIII.

All the drawings were made by J. Henry Blake.

Fig. 1. (7929) ($\frac{4}{1}$) Pentatomites foliarum.
2. (13318) ($\frac{4}{1}$) Cacoschistus macerratus.
3. (5460) ($\frac{4}{1}$) Teleoschistus placatus.
4. (11225) ($\frac{5}{1}$) Procydnus devictus.
5. (14426) ($\frac{5}{1}$) Procydnus promus.
6. (1837) ($\frac{4}{1}$) Thnetoschistus revulsus.
7. (2856) ($\frac{4}{1}$) Polioschistus ligatus.
8. (3007) ($\frac{5}{1}$) Mecocephala sp.
9. (8201) ($\frac{4}{1}$) Diplochila? henshawi.
10. (1112) ($\frac{4}{1}$) Polioschistus lapidarius.

Fig. 11. (8471) ($\frac{4}{1}$) Thlimmoschistus gravidatus.
12. (13583) ($\frac{5}{1}$) Thlibomenus limosus.
13. (8840) ($\frac{5}{1}$) Necrocydnus solidatus.
14. (8656) ($\frac{4}{1}$) Teleoschistus rigoratus.
15. (2464) ($\frac{5}{1}$) Procydnus vesperus.
16. (4851) ($\frac{5}{1}$) Necrocydnus amyzonus.
17. (1977) ($\frac{5}{1}$) Heeria gulosa.
18. (1472) ($\frac{4}{1}$) Poteschistus obnubilus.
19. (10405) ($\frac{4}{1}$) Thlimmoschistus gravidatus.



THE FLORISSANT BASIN

HEMIPTERA (HETEROPTERA PENTATOMIDAE CORIMALAENIDAE)

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