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AT HARVARD COLLEGE.

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THE FOSSIL ELATERIDÆ OF FLORISSANT.

By H. F. WICKHAM.

WITH SEVEN PLATES.

CAMBRIDGE, MASS., U. S. A :
PRINTED FOR THE MUSEUM.
OCTOBER, 1916.



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No. 12.— *The Fossil Elateridae of Florissant.*

BY H. F. WICKHAM.

ELATERID beetles are fairly common as fossils. Some of the earliest Coleoptera known, occurring in the Triassic rocks, had the form of an *Elater* more or less sketched out but, according to Handlirsch, who has seen the specimens, none of them displayed characters which would allow them to be placed in the modern family with any certainty. Again, in the Liassic beds, the elateriform Coleoptera appeared, this time in rather greater abundance, but even yet they seem to present no evidence of belonging to the family in a proper sense. The lithographic chalk of Jurassic times has furnished insects which have even been referred to the recent genus *Elater* but here, as before, Handlirsch believes that the closeness of relationship has been overestimated, though he states that his Jurassic genus *Malmelater* belongs at any rate to the Elateridae. This seems to be the earliest well-supported record of the appearance of the family in geologic time.

Following the Jurassic, we have a period of immense duration in which no large deposits of Coleoptera were made or, if they exist, none have been discovered. No more Elateridae are recorded until after the opening of the Tertiary, when they begin to be at least moderately numerous. Menge is said to have had 130 specimens from the Amber fauna. In the later deposits of Oeningen and other European Miocene localities they seem to be quite abundant, Heer having described many, some in fine preservation. By this time they had become so much like our modern forms that generic identity frequently seems quite well established though one cannot feel sure that some important character may not have been carried away with a missing member. Tarsal lobes and claw-teeth scarcely ever remain intact, the mesosternum is often too distorted to study and in many instances it is impossible to make out the limits of the metacoxal plates which play so large a part in the classifications of systematists.

In the way of giving at a glance the published standing of Elateridae in Tertiary strata, the following outline, compiled mostly from Handlirsch and with his assignment of the age of each deposit, may be useful. The records are given by localities in preference to arrangement by generic sequence.

*Paludina Beds, England.**Lower Eocene.*

Elater sp.

*Baltic Amber.**Lower Oligocene.*

Eucnemidae, (many).

Elater, including Ampedus, (seven sp.).

Eucnemis sp.

Elater naumanni Giebel.

Microrhagus sp.

Agriotes sp.

Elateridae, (many).

Limonium, (two sp.).

Cardiophorus, (two ? sp.).

Athous sp.

Cryptohypnus, (two sp.).

*Aix.**Lower Oligocene.*

Elater, (two sp.).

*Siebengebirge.**Upper Oligocene.*

Silicernius spectabilis Heyd.

*Greith, Switzerland.**Upper Oligocene.*

Elaterites amissus Heer.

*Spitzbergen.**Lower Miocene.*

Elater holmgreni Heer.

Elater ehrenwardi Heer.

*Kutschlin, Bohemia.**Lower Miocene.*

Campososternus atavus Deichm.

Elaterites dicrepidoides Deichm.

*Oeningen.**Upper Miocene.*

Adelocera granulata Heer.

Ischnodes gracilis Heer.

Lacon primordialialis Heer.

Limonium optabilis Heer.

Alaus spectabilis Heer.

Corymbites sutor Heer.

Cardiophorus brauni Heer.

Elaterites lavateri Heer.

Cardiophorus sp. nov.

Elaterites obsoletus Heer.

Elater, (five sp.).

Elaterites, (five sp.).

Ampedus seyfriedi Heer.

*Myszyn, Galicia.**Upper Miocene.*

Elater wisniowskii Lomn.

From the above list, it will be seen that only eighteen species have been specifically characterized from the European Tertiaries, scarcely enough to make a comparison with the Florissant fauna of any value. It should be noted, however, that several of the principal genera are taken to be identical in the two areas. Too much confidence must not be given the determinations in any case. Outside of the Floris-

sant district, the only North American Tertiary Elateridae thus far made known are these:—

<i>Green River, Wyo.</i>	<i>Oligocene.</i>
Corymbites velatus Scudd.	
<i>White River, Colorado-Utah.</i>	<i>Oligocene.</i>
Epiphanis deletus Scudd.	
<i>Fossil, Wyo.</i>	<i>Oligocene.</i>
Adocetus buprestoides Scudd.	
<i>Similkameen River, B. C.</i>	<i>Miocene.</i>
Limonius impunctus Scudd.	Elaterites sp.
<i>Nicola River, B. C.</i>	<i>Miocene.</i>
Cryptohypnus (?) terrestris Scudd.	

These five records (since that of *Elaterites* cannot be considered as having any special value) are even less illuminating than those of Europe. Three of the genera are now recognized from Florissant.

Years ago, Scudder announced that he had about forty species of Florissant Elateridae but he never gave them detailed study and it is probable that the number was somewhat overestimated. At any rate, when I looked through his collections in 1912 I was unable to distinguish so many and of those in his cabinet a good proportion was too poor for identification. Later explorations have brought in about as many specimens as were known to Scudder and by a study of the material belonging to the Museum of Comparative Zoölogy, the United States National Museum, the Princeton University Geological Museum, the Museum of the University of Colorado and the Peabody Museum of Yale University, supplemented by a collection of my own, I have separated forty-three species with some degree of certainty as to their generic and specific affiliations. For convenience in making comparisons, this list is appended. Excepting four which I have described in earlier papers, all are new and are characterized in the body of this article.

Eucneminae.

<i>Eucnemis antiquatus.</i>	<i>Microrhagus miocenicus.</i>
<i>Deltometopus fossilis.</i>	<i>Microrhagus vulcanicus.</i>
<i>Fornax relictus.</i>	

Elaterinae.

Lacon exhumatus.	Limonius aboriginalis.
Cardiophorus lithographus.	Limonius florissantensis.
Cardiophorus florissantensis.	Limonius praeursor.
Cardiophorus cockerelli.	Limonius shoshonis.
Cardiophorus requiescens.	Limonius volans.
Cardiophorus (?) deprivatus.	Athous lethalis.
Horistonotus coloradensis.	Athous contusus.
Cryptohypnus exterminatus.	Athous fractus.
Cryptohypnus hesperus.	Paranomus exanimatus.
Anchastus eruptus.	Paranomus heeri.
Anchastus diluvialis.	Paranomus laevisimus.
Monocrepidius dubiosus.	Ludiophanes haydeni.
Elater rohweri.	Corymbites granulicollis.
Elater scudderi.	Corymbites primitivus.
Elater florissantensis.	Corymbites submersus.
Megapenthes primaevus.	Corymbites restructus.
Cryptagriotes minusculus.	Corymbites propheticus.
Agriotes comminutus.	Oxygonus primus.
Agriotes nearecticus.	Melanaectes cockerelli.

Assuming the above species to be correctly referred to their respective genera, analysis shows that five belong to the Eucneminae, the remaining thirty-eight to the Elaterinae. Of those in the second category, one belongs to the Agrypnini, the other thirty-seven to the Elaterini which holds today the great bulk of North American species of the subfamily. According to the classification adopted by LeConte, the Elaterini separates on the basis of the structure of the metacoxal plates into two subtribes, the Elaterini (*genuini*) and the Corymbitini, dividing the North American species between them almost exactly in the ratio of three to four. Of the fossils, fifteen are referred to the first subtribe, twenty-two to the second, giving a ratio rather startlingly similar. Of course the number of species involved is small enough to allow a considerable percentage of error to creep in, should the identifications turn out to be wrong in any case, but the conclusions must be held to have some weight. On the face of the matter, the figures would indicate that the relative percentages of Elaterini and Corymbitini were almost the same at Florissant during the Miocene as they are in North America in general today.

Making some comparisons with the recent Elateridae of Colorado, we find recorded in the catalogue of the beetles of that state about seventy-three species, three of which are Eucneminae, leaving seventy in the Elaterinae. Of these, three are Agrypnini, three Chalcolepidiini (a tribe not represented among our fossils and containing large species rather tropical than otherwise in their general range, though the Colorado representatives are of the genus *Alaus* which runs well to the north) while the rest, sixty-four in number, are Elaterini. These Elaterini are divided into twenty-nine which belong to the subtribe Elaterini proper and thirty-five to the Corymbitini, a moderate divergence from the ratio shown at Florissant in the Miocene. If we may depend upon these figures, the evidence indicates a rather remarkable similarity in conditions then and now.

Two or three items of generic comparison deserve notice. In looking over the fossils I was surprised to find such an apparent richness in *Cardiophorus*; but turning to the Colorado catalogue it will be noted that *Cardiophorus* now has no less than eight representatives in the state, against the five known as fossils. Here again, the two ratios are remarkable for their similarity. Of the genus *Corymbites*, we find sixteen recent Colorado species against five fossils — indicating that this genus, relatively to the other Corymbitini, was only half as numerously represented then as at present. Of the twenty-one genera included in the entire list of fossils, nine are not now known from Colorado; two of these are erected as new, four others are fairly distinctively northern and none of the three remaining can be considered southern types. In fact, there is nothing in the fossil Elateridae to indicate tropical or subtropical conditions or origin.

Something should be said regarding the facies of this collection of Elateridae. On looking through the list, one will be struck at once by the fact that it is made up, in the main, of species belonging to large and well-known genera, mostly those of wide distribution. Even if we allow that the preservation of fossil beetles is practically never good enough to permit absolute certainty in generic identification, it remains true that these Florissant Elateridae do not, even in a single instance, exhibit anything conspicuous or remarkable in size or form. This family, today, is by no means without peculiar and highly modified members, some of them reaching great size, others displaying oddities in outline or in the development of various portions of the body, as will be seen in glancing over the plates in the extensive monograph of Candèze. We are forced here, to the same conclusion as in so many of the other families — that the Florissant

fauna, outside of the rhynchophorous series, comprised a rather monotonous and little specialized lot of beetles.

This paper, with another now in press elsewhere, will bring the number of published Coleoptera from these shales up to about 566 species, and may be considered as very nearly ending the task of working up the available material. What remains consists of isolated species in various families so scattered through the whole order as not essentially to disturb the conclusions already reached in regard to the number and nature of the representation of each group. The richness of this fauna remains absolutely unapproached by that of any other known deposit, unless the many unworked collections of Amber insects may yield a similar wealth.

Citation of catalogue numbers follows the plan of Scudder, in joining by "and" those referring to the two halves of a single specimen with its counterpart. The drawings are made with the camera lucida and will show the outlines, though not the sculpture, the latter being carefully described in the specific diagnoses.

EUCNEMINAE.

EUCNEMIS ANTIQUATUS Wickham.

Described and figured in Bull. M. C. Z., 1914, 58, p. 437, pl. 2, fig. 9. No other specimens have been met with.

DELTOMETOPUS FOSSILIS, sp. nov.

Plate 1, fig. 1, 2.

Form fairly stout. Head rounded in front, surface finely, not very deeply and moderately closely punctate, bearing a scant covering of dark hairs. Antennae practically complete on one side, in life evidently reaching the prothoracic hind angles, first joint large, second short, third not in good condition but apparently rather long, fourth and following subequal, weakly serrate. Prothorax only a little broader than long, (as preserved), the sides nearly straight and, judging from the margins, about perfect, only a little sinuate in front of the base, hind angles (only one of which remains), scarcely diver-

gent and but shortly if at all carinate, entire thoracic surface hairy like the head, minutely and sparsely punctured. Elytra not tapering until well behind the middle, striae very fine, their punctures separated in general by considerably more than their own long diameters, interspaces broad, flat, finely, sparsely punctured, each puncture bearing a hair. Length, from front of head to elytral apex, 5.90 mm.; of elytron, 3.75 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by S. A. Rohwer.

The generic reference is made with a good deal of doubt, but the form, sculpture, and vestiture point, in general, to the Eucneminae and the antennae and size are not unlike *Deltometopus*.

FORNAX RELICTUS, sp. nov.

Plate 1, fig. 3.

Outline rather fusiform. Head of moderate size. Antennae not preserved except the basal portion of one which is in too poor condition to be described. Prothorax beneath with wide marginal groove, prosternum not very well shown in front, but the lobe was evidently short, sutures grooved and quite broad, probably nearly straight although one of them is thrown out of line by pressure, spine not long, pointed, its margin with a fine but distinct bead. The hind angle, shown on one side only, is well developed, not strongly divergent, front angles not completely preserved, sides, as far as shown, evidently convergent anteriorly and slightly arcuate. Punctuation of the entire underside obscure, apparently minute, with marks of a covering of fine hairs. Elytra with striato-punctate sculpture showing through. Length, from front of head to abdominal apex, exclusive of sex organ, 6.85 mm.

Described from one specimen.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

In form and size, this beetle is not unlike the fossil *Microrhagus vulcanicus*, described herein, but has stronger elytral sculpture. The wide marginal prothoracic grooves and the type of the prosternal sutures are much like those of the recent *Fornax hornii* of our eastern states, which is said to be the female of *F. calceatus*. In general, the form and size are also similar to that species.

MICRORHAGUS VULCANICUS, sp. nov.

Plate 1, fig. 5.

Form moderately stout. Head finely but closely and rather deeply punctured. Antennae not well preserved, about eight joints remaining which are scarcely serrate and indicate that if entire the antennal apex would pass well beyond the prothoracic hind angles. Prothorax finely, sparsely punctate and strongly hairy, apex much narrowed, sides rather pronouncedly arcuate, hind angles divergent. Scutellum injured so that the exact shape is not definable. Elytra a little arcuate at sides and conjointly rounded at apex, hairy, slightly striate near the base, the remainder of the surface finely punctulate. Length, from front of head to elytral apex, 7.40 mm.; of elytron, 4.85 mm.

Described from one specimen.

Type.—No. 2,775 M. C. Z. Florissant, Colo. (No. 13,034 S. H. Scudder Coll.).

This insect has a type of sculpture and vestiture common in the Eucneminae, and if assigned to that subfamily would go in *Microrhagus* by the form of the coxal plates and the apparent structure of the basal antennal joints. Compared with the recent *M. triangularis*, the present species has finer sculpture throughout and is of larger size.

MICRORHAGUS MIOCENICUS, sp. nov.

Plate 1, fig. 4.

Form fairly stout. Head quite large, strongly transverse, anterior margin arcuate, surface obscurely but closely and rather coarsely punctured on the front, less strongly on the vertex, which becomes nearly smooth posteriorly. Antennae poorly preserved, not strongly serrate, reaching to or behind the prothoracic hind angles. Prothorax about one fourth broader than long, apex narrower than the base, front angles not well marked, sides regularly and moderately arcuate, base nearly truncate, hind angles, (only one of which is preserved), acute, slightly divergent and distinctly carinate. The surface is finely, very obscurely and not closely punctate, with a thin clothing of moderately long dark hairs. Elytra broad at humeri, sinuately tapering behind them, hardly striate and with faint rows of punctures, the vestiture like that of the prothoracic disk. Underside

not shown. Length, from front of head to elytral apex, 5.60 mm.; of elytron, 3.60 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected by Mrs. W. P. Cockerell at Station 14, Florissant, Colo.

In general, this beetle is a good deal like the preceding, but is smaller and has very differently shaped elytra.

ELATERINAE.

LACON EXHUMATUS, sp. nov.

Plate 1, fig. 6, 7.

Form stout. As the specimen shows the underside only, no details of the sculpture of the upper surface can be given. Antennae with only the middle portion well preserved, joints stout, moderately serrate. Prothorax beneath punctured on the flanks but not very closely nor strongly, prosternum somewhat smoother, lobe short, blunt, sutures curved, excavate, more deeply in front. Elytra, as shown from below, merely indicating that they were marked with rows of coarse punctures. Abdominal punctuation obscure. Length, from front of head to elytral apex, 7.75 mm.; of elytron, about 5.00 mm., the base being too obscure to locate exactly.

Described from one specimen.

Type.— No. 2,776 M. C. Z. Florissant, Colo. (No. 4,456 S. H. Scudder Coll.)⁶

This insect has the look of *Lacon* and agrees in the structure of the underside of the prothorax, the short antennae and the elytral sculpture. It is smaller than the average recent *L. rectangularis*, widespread in North America, but is just the same size as some southern specimens in my collection.

CARDIOPHORUS LITHOGRAPHUS, sp. nov.

Plate 2, fig. 1-3.

Form moderately stout. Head not well preserved, very minutely punctulate. Prothorax nearly equal in length and breadth, apex narrower than base, sides rather faintly arcuate, hind angles acute

and only a little divergent. Surface polished, with sparse, fine punctuation and signs of delicate pubescence. Scutellum cordiform, impunctate. Elytra finely, regularly striate, the stria punctures deep but not coarse, rounded or very slightly oblong, ordinarily separated in each stria by about their own diameters or sometimes a little less. Interstitial spaces flat, extremely minutely punctulate and with fine pubescence. Underside almost perfectly smooth. Length, 8.25 mm.; of elytron, 5.25 mm.

Described from one specimen, with counterpart.

Type.— In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it are associated four others in my collection; two in the collection of the U. S. National Museum; one in the Museum of the University of Colorado, found by Professor Cockerell's party at Station 14; and No. 2,777-2,784 M. C. Z. (No. 4,746, 6,007, 7,650, 8,731, 11,174, 11,782, 12,423, 14,329, S. H. Scudder Coll.).

The generic reference is based on the form of the metacoxal plates, the truncate prosternal spine, the cordiform scutellum and the cariniform mark on the underside of the prothoracic flanks. The sculpture is entirely that of *Cardiophorus* and the present species is not unlike the common recent North American *C. convexus* in most of its characters.

CARDIOPHORUS FLORISSANTENSIS, sp. nov.

Plate 2, fig. 4, 5.

Form stout. Head minutely, closely punctulate and pubescent. Antenna not complete, but in life evidently not quite reaching the prothoracic basal angles, the articulations too obscure to allow of comparisons of their lengths. Prothorax one fifth broader than long, narrower apically, sides regularly arcuate to near the hind angles which are acute and somewhat divergent, base sinuate each side, rather prominent at middle, surface very minutely punctulate and finely, not closely, pubescent. Scutellum cordiform. Elytra finely striate, the striae with rounded or slightly elongate punctures which are separated usually by less than their own diameters, interstitial spaces broad, flat, not visibly punctured, pubescent. Underside nearly smooth. Length, from front of head to elytral apex, 10.70 mm.; of elytron, 6.60 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado, collected

by G. N. Rohwer at Station 13, Florissant, Colo.; with it are associated a specimen, with counterpart, found by S. A. Rohwer and one found by Mrs. W. P. Cockerell at the same place; five examples in the collection of the U. S. National Museum; and No. 2,771-2,774 M. C. Z. (No. 84, 2,094, 12,421, 12,425 S. H. Scudder Coll.).

Larger than *C. lithographus* (p. 501), but otherwise similar. I do not think there is any doubt of the specific distinctness of the two. The coxal plates, as shown, look quite different but I am afraid to depend entirely upon these as the edges may become broken and change the apparent form.

CARDIOPHORUS COCKERELI, sp. nov.

Plate 2, fig. 6.

Form stout. Head minutely, obscurely punctured, antennae wanting. Prothorax nearly one and one third times as broad as long, not much narrowed anteriorly, sides strongly rounded, hind angles short but prominent, carinate, basal sinuations pronounced, surface rather densely and more strongly and coarsely punctured than the head. Scutellum apparently imperfect, pointed behind. Elytra short, broad, somewhat obtusely conjointly rounded apically, surface striate, the striae moderately deep, their punctures strong, rounded or a little elongate, close-set, separated ordinarily by less than their own diameters, interspaces broad, flat, roughened somewhat but not distinctly punctured. The entire upper surface of the prothorax and elytra shows signs of rather fine pubescence. Length, from front of head to elytral apex, 6.20 mm.; of elytron, 3.85 mm.

Described from one specimen.

Type.—No. 2,765 M. C. Z. Florissant, Colo. (No. 1,916 S. H. Scudder Coll.). With it are associated No. 2,766-2,767 M. C. Z. (No. 6,379, 10,639 S. H. Scudder Coll.); and three specimens, two with counterparts, in the Museum of the University of Colorado, all from Station 14, bearing the numbers 151, 178 and 179, 209 and 258. No. 2,768-2,770 M. C. Z. (No. 7,476, 9,160, 12,041 S. H. Scudder Coll.) probably belong here.

The underside is not shown in the type, but the specimen No. 2,767 M. C. Z. (No. 10,639 S. H. Scudder Coll.), displays it well, exhibiting moderately curved prosternal sutures, truncate spine and nearly smooth surface. This beetle is similar to the recent North American

C. cardisce, but seems to be a little more coarsely punctured on the prothorax. It is smaller than the Florissant species *C. lithographus* and *C. florissantensis*, and much less coarsely punctured than the fossil *Horistonotus coloradensis* from the same shales.

CARDIOPHORUS REQUIESCENS, sp. nov.

Plate 2, fig. 7, 8.

Form fairly elongate. Head minutely and closely punctulate. Antennae wanting. Prothorax too badly damaged for description of the form, punctuation sparse and fine. Scutellum cordiform. Elytral striae extremely fine, the punctures shallow, somewhat elongate and, in general, separated by several times their own diameters. Underside nearly smooth, the visible punctures being sparse and small. Length, from front of head to elytral apex, 6.65 mm.; of elytron, 4.15 mm.

Described from one specimen.

Type.—In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This seems to separate easily from the other Florissant fossil Cardiophori by the finer sculpture and especially in the distant striae punctures. The generic reference is plainly indicated by the form of the prosternal spine and of the scutellum.

CARDIOPHORUS (?) DEPRIVATUS, sp. nov.

Plate 2, fig. 9, 10.

Form stout. Head not visibly punctured. Antennae apparently with the second joint hardly shortened, the third a trifle shorter than the fourth, the following, up to and including the tenth, subequal and only faintly serrate. Prothorax scarcely at all punctulate, about one third wider than long, sides regularly and not strongly arcuate, the angles not prominent. Scutellum a little elongate, pointed at tip but not strictly cordiform. Elytra hardly three and one third times as long as wide, rather strongly tapering, apices conjointly rounding, surface without sculpture. Underside practically smooth throughout, prosternal sutures curved, convex inwards, metacoxal plates suddenly narrowed externally. Length, from front of head to elytral apex, 5.15 mm.; of one elytron, 3.50 mm.

Described from one specimen with its counterpart.

Type.— In the Museum of the University of Colorado. It was collected at Station 13, Florissant, Colo., by Professor Cockerell's expedition of 1906. The obverse bears his number 99, the reverse, 127.

Unfortunately the prosternal spine is damaged so that its form is not shown and while the beetle is perhaps not a true *Cardiophorus*, because of the form of the scutellum, it seems best to place it provisionally in that genus on account of its general similarity to some of the recent species with faint sculpture.

HORISTONOTUS COLORADENSIS, sp. nov.

Plate 2, fig. 11, 12.

Form fairly stout. As the specimen shows from the underside, the sculpture of the head is not visible. Prothorax, beneath, with the flanks and prosternum distinctly but rather finely and only moderately closely punctate, the punctures ordinarily separated by their own diameters or a little less, not very regularly spaced. Metasternum a little more finely punctured. Abdomen punctured in general, like the prothorax, the proximal segments somewhat more finely and sparsely than the distal, the terminal one with the punctures crowded laterally. Scutellum not visible. Elytra displayed in reverse, the punctuation showing through. It is arranged in striae, the punctures coarse, rounded, deep, mostly separated by less than their own diameters, those near the elytral apices nearly touching. Length, 6.60 mm.; of elytron, 4.10 mm.

Described from one specimen.

Type.— In the collection of H. F. Wickham. Florissant, Colo. Possibly No. 2,763-2,764 M. C. Z. (No. 815, 6,384 S. H. Scudder Coll.) may also belong here.

In this case, the generic reference is not made with much confidence. However, the size, the truncate prosternal spine and the form of the coxal plates point to the *Cardiophori*. The punctuation of the underside is coarser than usual in *Cardiophorus* but is quite similar in disposition to that of the recent *Horistonotus simplex* from the southwestern United States.

CRYPTOHYPNUS EXTERMINATUS, sp. nov.

Plate 1, fig. 8, 9.

Form short, broad, and stout. Surface hardly visibly punctate anywhere, but this may possibly be due to the rather coarse texture of the stone in which the specimen is preserved. Head rather large. Antennae with the first joint long and thick, the second and third scarcely shorter than those succeeding, none of which are much produced at the angles so that the organ is only weakly serrate. Prothorax a little distorted, a trifle more than one third wider than long, apex feebly emarginate, front angles pointed but obtuse, width greatest in front of the middle, sides moderately strongly arcuate to a point near the acute hind angles, slightly divergent and carinate, base sinuate each side. Scutellum suborbicular. Elytra a little more than twice the length of the prothoracic median line, pointed at apex. Length, 4.55 mm.

Described from one specimen.

Type.—No. 2,762 M. C. Z. Florissant, Colo. (No. 11,280 S. H. Scudder Coll.).

The form and antennal structure are those of *Cryptohypnus*. In size, it approximates the recent *C. nocturnus* of Canada and our northern states, but the sculpture, if properly shown on the stone, is more like that of the much smaller *C. pectoralis*. This last species, in its varieties, has a wide distribution in North America today.

CRYPTOHYPNUS HESPERUS, sp. nov.

Plate 3, fig. 1.

Form fairly slender for this genus. Sculpture of head not definable. Antennae not well shown, but one side is well enough preserved to indicate that they reached at any rate to the hind angles of the prothorax. Prothoracic width about one fourth greater than the length, surface sculpture obscurely preserved, base not much broader than the apex, sides rather strongly rounding, hind angles short, not divergent, base deeply sinuate each side. Scutellum rounded or oblong. Elytra tapering, arcuate at sides, apices conjointly rounded, sculpture not well defined, showing only traces of faint striae. Length, from front of head to abdominal apex, 4.30 mm.; of elytron, 2.60 mm.

Described from one specimen.

Type.—No. 2,761 M. C. Z. Florissant, Colo. (No. 5,294 S. H. Scudder Coll.).

This has the size and general appearance of *Cryptohypnus* and, as far as shown, the sculpture seems to be like that of the recent *C. pectoralis*. In form, the present insect differs widely from the Florissant fossil *C. exterminatus*.

ANCHASTUS ERUPTUS, sp. nov.

Plate 3, fig. 2, 3.

Form moderately stout. Sculpture of head not definable. Antennae long, that on the right side, (as preserved), showing nine joints, the terminal one of which, in life, would have reached well behind the prothoracic basal angles, so it is likely that if complete the antennae would have extended nearly to the elytral middle. The first joint is large, the second small, third much larger than the second but a little shorter than the fourth, fifth not in good condition, sixth and following longer than the fourth, serrations, in general, well pronounced. Prothorax with strongly curved prosternal sutures, lobe short, spine stout and short, punctuation of flanks and sternum minute and inconspicuous. Elytra conjointly rounded apically, sculpture not showing through. Abdominal sculpture very fine. Length, from front of head to elytral apex, 4.80 mm.; of elytron, about 3.00 mm.

Described from one specimen.

Type.—No. 2,760 M. C. Z. Florissant, Colo. (No. 11,281 S. H. Scudder Coll.).

The coxal plates do not show up well, but seem to be very narrow externally and broad internally, as in *Anchastus*. This genus has similar antennal and prosternal characters, also.

ANCHASTUS DILUVIALIS, sp. nov.

Plate 3, fig. 4.

Form moderately elongate. Head not visibly punctured beneath. Antennae poorly defined. Prothorax closely, distinctly, and regularly but finely punctate on the flanks and sternum, the grooves strongly double, curved. The prothoracic outline is obscured to some extent

by flattening, but as preserved the apex is very nearly as wide as the base, the sides little curved, none of the angles plainly shown. Elytra long, tapering, coarsely punctatostriate, the punctures separated by about their own diameters, interstitial areas not wide nor visibly punctured. Length, from front of head to elytral apex, 5.50 mm.; of elytron, about 3.60 mm.

Described from one specimen.

Type.—No. 2,759 M. C. Z. Florissant, Colo. (No. 11,277 S. H. Scudder Coll.).

The generic reference is not certain, being based upon the sternal grooves, the size, sculpture, and general form. This species easily separates from the preceding by being much more coarsely sculptured. Both are represented by undersides only.

MONOCREPIDIUS DUBIOSUS, sp. nov.

Plate 4, fig. 1.

Form only moderately elongate. Head finely, sparsely, and indistinctly punctate. Prothorax about one fourth broader than long, base and apex subequal, none of the angles very prominent, side margin nearly regularly but not strongly arcuate, base broadly emarginate in front of the scutellum, sinuate each side, surface not well preserved but showing a few fine punctures. Scutellum subquadrate. Elytra nearly three times the length of the prothoracic median line, conjointly rounded at apex, surface finely and not deeply striate, the striae with small, slightly elongate punctures, separated in each row by approximately their own diameters, interstitial spaces flat and not visibly punctured. Underside finely and feebly punctulate or nearly smooth. Length. 4.50 mm.; of elytron, 2.65 mm.

Described from one specimen, with counterpart.

Type.—In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This specimen is not especially well preserved nor does it offer any striking characters. The underside shows the prosternal sutures to be double, nearly straight, somewhat excavated anteriorly, the prosternum rather narrow, the spine acuminate at tip. The hind coxal plates are not well defined, but I think they are suddenly dilated internally. Both legs and antennae are too poor for description. No more suitable generic position can be suggested at present, though

all of the species of *Monocrepidius* that I know are more strongly striate and somewhat differently proportioned.

ELATER ROHWERI, sp. nov.

Plate 3, fig. 5, 6.

Form moderately elongate. Head rather short, distinctly but finely punctured, somewhat sparsely on the sides and still more finely and sparsely on the vertex, minutely hairy. Antennae quite slender, scarcely at all serrate, not reaching the tips of the prothoracic hind angles, basal joint large, second and third not well defined, the remainder subequal, all finely hairy. Prothorax strongly narrowed anteriorly, front margin arcuately emarginate, anterior angles not very prominent, sides moderately arcuate, hind angles long, sharp, a little divergent with distinct discal carina and possibly with an external marginal one as well. The base is a little emarginate in front of the scutellum. Thoracic disk with a well-impressed, smooth median line on basal one fifth, the middle area finely and sparsely, sides more strongly and closely punctate, entire surface hairy. Scutellum oblong, punctured and hairy. Elytra bluntly pointed, tapering, striae not deep, with rows of slightly elongate, rather fine punctures separated in general by about their own long diameters, interstitial spaces broad, flat, hairy, but not punctured excepting the small depressions from which the hairs arise. Legs of moderate length, finely hairy. Underside of body with most of the details not well defined, but the prothoracic side-pieces are fairly strongly though not densely nor coarsely punctured, the prosternum more finely. The spine is pointed, the lobe broken at tip but apparently not long, the sutures double, excavated, the metacoxal plates broad internally, the abdomen finely hairy, scarcely punctulate. Length, from front of head to elytral apex, 7.60 mm.; of elytron, 5.00 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. Florissant, Colo., collected at Station 14 by Professor Cockerell and bearing his numbers 192 and 211.

The general features of this beetle point to *Elater* as a fairly exact reference. It is most like some of the less strongly sculptured modern North American species, such as *E. sanguinipennis* or *E. behrensi*, but is rather smaller. Compared with the fossil *E. scudderi*, the

present species may easily be distinguished by the distinctly striatopunctate elytra, while *E. florissantensis*, from these shales, is larger and has a differently formed prothorax.

The specific name is given for Mr. S. A. Rohwer, a member of Professor Cockerell's expeditions and now of the U. S. National Museum staff.

ELATER FLORISSANTENSIS, sp. nov.

Plate 3, fig. 9.

Form moderately elongate. Head large, closely and rather strongly but finely punctured. Antennae poorly defined. Prothorax about one seventh broader than long, wider near the apex than at base, finely, deeply, and closely punctured, sides regularly and somewhat faintly arcuate anteriorly, nearly straight posteriorly, front angles obtuse, hind angles long, a little divergent and apparently bicarinate. Scutellum oval. Elytra rather strongly tapering, apices conjointly a little rounded, surface clothed with rather long but not close hairs of a darker color, striae fairly coarse, their punctures of moderate size, usually a little elongate and separated by less than their own long diameters, interstitial spaces flat, scarcely visibly punctulate. Length, from front of head to elytral apex, 8.25 mm.; of elytron, 5.40 mm.; of prothorax, along median line, 2.00 mm.

Described from one specimen.

Type.—No. 2,752 M. C. Z. Florissant, Colo. (No. 8,034 S. H. Scudder Coll.). With it are associated No. 2,753–2,758 M. C. Z. (No. 79 and 103, 6,869, 8,891, 9,200 and 11,732 S. H. Scudder Coll.).

The generic reference is only fairly exact. In thoracic outline the fossil more nearly resembles our recent *E. areolatus* than any other North American species known to me. The sculpture and vestiture of the elytra is something of the type seen in the living *E. cordatus* from our Pacific coast. Unfortunately the outlines of the metacoxal plates cannot be distinguished.

ELATER SCUDDERI, sp. nov.

Plate 3, fig. 7, 8.

Form rather elongate. Head quite closely and coarsely punctured. Antennae incomplete, but when entire probably not reaching the prothoracic hind angles. Prothorax very little wider than long,

sides, (judging by the better preserved one), gently and regularly rounding, base and apex subequal or the latter a little narrower, front angles obtuse, not at all prominent, hind angles moderately acute, a little divergent and distinctly carinate. Thoracic punctuation rather shallow and obscure, close and only fairly fine, surface strongly hairy. Scutellum pointed at apex. Elytra moderately tapering to apex, not striate and very obscurely punctate but hairy like the thorax. Length, from front of head to elytral tip, 7.10 mm.; of elytron, 4.75 mm.

Described from one specimen.

Type.—No. 2,751 M. C. Z. Florissant, Colo. (No. 12,485 S. H. Scudder Coll.).

Looks a good deal like *E. florissantensis* but is smaller and has non-striate elytra. Probably it does not belong to *Elater* in the modern sense.

MEGAPENTHES PRIMAEVUS, sp. nov.

Plate 4, fig. 2.

Form rather elongate. Head finely but extremely densely and quite deeply punctured, somewhat less strongly upon the vertex than upon the front. Antennae reaching well beyond the base of the prothorax, heavier than in most of the fossil Elateridae but not very strongly serrate, only the middle joints well defined. Prothorax narrower at apex than at base, approximately equal in length and breadth, surface finely and closely punctured though not quite so strongly as the head, sides but little arcuate, front angles short, hind ones not very long, a little divergent and distinctly carinate. Scutellum oblong. Elytra conjointly rounded apically, finely striate, striae punctures rounded, mostly separated by about their own diameters or a little more, interspaces flat, wide, finely and not very closely punctate, the punctures distinctly smaller than those of the striae. Underside not shown. Length, 8.90 mm.; of elytron, 5.60 mm.; of prothorax, 2.35 mm.

Described from one specimen.

Type.—No. 2,750 M. C. Z. Florissant, Colo. (No. 10,859 S. H. Scudder Coll.). With it are associated two others, in the Museum of the University of Colorado, one with counterpart (No. 226 and 249). The only one with definite record is from Station 13B, collected by S. A. Rohwer.

As seen under magnification, the general effect is much like that of

the recent *M. aterrimus* of the Pacific states. I am not sure of the antennal structure, but it looks as if the second and third joints are very short and what can dimly be seen of the hind coxal plate on one side has the appearance of being broad internally and much narrowed to the outer edge. Of course the generic reference is subject to correction in the event of more material coming to hand.

CRYPTAGRIOTES, gen. nov.

Body form almost like that of *Cryptohypnus*. Coxal plates nearly linear, scarcely narrowed externally, obtusely lobed over the thighs. Prosternum short with a small, subtruncate lobe, sutures nearly straight, apparently excavate anteriorly.

Type.—*C. minusculus*, sp. nov.

CRYPTAGRIOTES MINUSCULUS, sp. nov.

Plate 4, fig. 3.

Form moderately stout. Head large. Antennae not well preserved, slender, reaching beyond the prothoracic hind angles. Prothorax probably somewhat distorted, but, as preserved, wider in front of the middle where the width is a little greater than the length. Sides very gently arcuate, angles not well shown. Prosternal sutures nearly straight, lobe rather short, entire under surface of the prothorax finely punctulate and pubescent. Elytra two and one fourth times the prothoracic length, conjointly rounded apically, the sides somewhat arcuate, sculpture not showing through. Abdomen very finely punctulate and pubescent. Length, from front of head to elytral apex, 4.00 mm.; of elytron, about 2.30 mm.

Described from one specimen.

Type.—No. 2,749 M. C. Z. Florissant, Colo. (No. 8,653 S. H. Scudder Coll.).

(Judging from the form of the coxal plates, this little beetle should go into the *Corymbitini*, possibly near *Agriotes*, but it does not agree with any genus known to me.

AGRIOTES NEARCTICUS, sp. nov.

Plate 4, fig. 6.

Form elongate. Head minutely but very closely and distinctly punctured. Antennae poorly preserved, but what remains of one of them indicates that they were short and slender, scarcely serrate. Prothorax broken along the side margins, obscuring the shape, punctuation almost exactly like that of the head, the punctures finely mamillate, nearly touching, even on the middle of the disk. Elytra relatively rather elongate as compared with their width, striae apparently very shallow but their rows of punctures are fairly deep and strong, each puncture somewhat elongate, those in each series separated by a little more or less than their own long diameters. Interstitial spaces scarcely perceptibly punctulate, but with marks of a fine, moderately short pubescence. Length, from front of head to elytral apex, 8.00 mm.; of elytron, 5.50 mm.

Described from one specimen.

Type.—No. 2,748 M. C. Z. Florissant, Colo. (No. 6,653 S. H. Scudder Coll.).

While resembling the Florissant fossils, *Limonius florissantensis* and *L. praecursor*, this insect is more elongate and more delicately punctured than the former and differs from the second in the closer punctuation of the head and prothorax as well as the almost complete lack of it in the elytral interspaces. The coxal plates are not very clearly shown, but I think they are correctly exhibited in the drawing. The front seems to be higher than the labrum, as indicated by the distinct line of demarcation in the fossil, and the slender antennae are like those of *Agriotes*.

AGRIOTES COMMINUTUS, sp. nov.

Plate 4, fig. 4, 5.

Form rather elongate. Head coarsely, closely but not very deeply punctured. Eyes and antennae not defined. Prothorax with the margins badly broken, so that the exact shape is not discernible, but it was evidently only a little wider than long, with a large discal dark spot, similar to that of the recent North American *A. fucosus*, surface sculpture obscure, the prosternal sutures, which show through,

nearly straight and apparently excavate anteriorly. Elytra not less than two and one half times the prothoracic length, apices broken, surface finely striate, the striae with distinctly elongate, well-impressed punctures which are separated in each row by approximately their own long diameters, interstitial spaces flat, broad, apparently punctate. Abdominal dorsal sculpture, on the portion exposed by the spreading of the elytra, obscure. Length, from front of head to abdominal apex, 6.70 mm.; of portion of elytron as preserved, 3.60 mm.

Described from one specimen.

Type.—No. 2,747 M. C. Z. Florissant, Colo. (No. 11,800 S. H. Scudder Coll.).

Since the general preservation of this beetle is poor, I should not have ventured to describe it, had not the coxal plate been well shown on one side. Taken into account with the form of the prosternal sutures, the sculpture and the coloration, this seems to indicate a probable affinity with *Agriotes*.

LIMONIUS ABORIGINALIS, sp. nov.

Plate 5, fig. 1-4.

Form stout for the genus. Head practically smooth. Antennae just about reaching the hind prothoracic angles, moderately serrate, second and third joints subequal, their united length about the same as that of the fourth which, however, is broader and begins the serration. Eyes normal. Prothorax about one fourth broader than long, not visibly sculptured above, apex scarcely emarginate, narrower than the base, sides arcuately broadening to about the middle thence slightly sinuately narrowing posteriorly, hind angles well defined, acute but not divergent. Scutellum oblong oval. Elytra with sides less parallel than in most modern species of *Limonius*, apices conjointly rounded, surface rather finely but quite distinctly and regularly striate, striae punctures becoming less distinct posteriorly, rounded or slightly oblong, separated by about their own diameters, interstitial areas with signs of fine pubescence. Underside almost smooth, only a few small, scattering punctures being visible. Legs not displayed. Length, from front of head to elytral apex, 6.65 mm.

Described from one specimen, with counterpart.

Type.—In the collection of H. F. Wickham. Wilson Ranch,

Florissant, Colo. With it are associated No. 2,737-2,738 M. C. Z., (No. 7,971 and 10,952 S. H. Scudder Coll.). Most likely No. 2,739-2,746 M. C. Z. (No. 2,870, 8,345, 8,549, 8,753, 12,766, 8,226, 8,842 and 11,788 S. H. Scudder Coll.), belong to the same species. There are also three additional specimens in my collection.

While shorter and broader than most recent species of *Limonius*, the essential characters, as shown by the coxal plates (which are narrow and but little dilated internally, only moderately prominent over the insertion of the thighs), the prosternal sutures, (double, little curved), the short prosternal lobe and the blunt scutellum correspond very well with this genus. The basal antennal structure is similar to what we see in the recent *L. crotchii* of the western United States, but the general aspect is more that of *L. nitidulus* from the same district.

LIMONIUS FLORISSANTENSIS, sp. nov.

Plate 5, fig. 5-7.

Form moderately elongate. Head rather finely and extremely closely and deeply but regularly punctured. Antennae about reaching the prothoracic base, faintly serrate. Prothorax approximately one seventh broader than long, apex and base subequal, surface quite evenly punctate, about as coarsely as the head but more sparsely, apex nearly truncate, front angles obtuse, sides regularly arcuate to about the middle, which is the broadest part, thence narrowing to near the base, hind angles acute, carinate, but hardly divergent. Scutellum oblong oval. Elytra about two and two thirds times the length of the prothoracic median line, finely, sharply striate, striae punctures fine, somewhat elongate, separated by approximately their own long diameters, interstitial spaces flat, broad, confusedly and sparsely punctate, the punctures of varying sizes, the largest distinctly smaller than those of the striae. Underside punctured throughout, rather coarsely and closely on the prosternum and flanks, more finely on the meso- and metasternal sclerites, the abdomen finely punctate except on the last segment and along the sides, where the sculpture is coarser. Length, 8.40 mm.; of elytron, 5.50 mm.

Described from two specimens, one with counterpart.

Type.—In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it are associated another specimen, with counterpart, in my own collection; two from Station 14 in the Mu-

seum of the University of Colorado; No. 6,572 of the Princeton collection; and No. 2,734 M. C. Z. (No. 11,664 S. H. Scudder Coll.). It is possible that No. 2,735, 2,736 M. C. Z. (No. 8,340, 10,492 S. H. Scudder Coll.), represent the same species.

Characters pointing to *Limonius* are seen in the coxal plates, hind tarsi, prosternal sutures, and antennae. The short prosternal lobe is more like *Nothodes*. Compared with *L. aboriginalis*, the present species is much more roughly sculptured.

LIMONIUS PRAECURSOR, sp. nov.

Plate 5, fig. 8, 9.

Form elongate, slender. Head finely but very regularly and distinctly punctured, the punctures separated by their own diameters or less. Antennae short, showing only a few of the joints well enough for description, but these are about one half longer than wide and weakly serrate. Prothorax punctured similarly to the head but a little more finely, the sides not in very good condition but evidently subparallel, length and width subequal. Scutellum obscure. Elytra about two and two fifths times the prothoracic length, subparallel, finely but very distinctly striate, the striae with decidedly elongate punctures which are separated in each row by their own diameters, a little more or less, interstitial spaces broad and flat, very minutely punctulate. Underside of prothorax finely but clearly punctured, rather closely on the flanks, less so on the prosternum, sutures double, a little curved in front, nearly straight behind, broader anteriorly, lobe moderate. Length, from front of head to elytral apex, 8.50 mm.; of elytron, 5.75 mm.

Described from one specimen, with counterpart.

Type.—No. 2,730 and 2,731 M. C. Z. Florissant, Colo. (No. 9,417 and 10,558 S. H. Scudder Coll.). With it is doubtfully associated another specimen, also with counterpart, No. 2,732 and 2,733 M. C. Z. (No. 12,049 and 12,762 S. H. Scudder Coll.).

In general form and sculpture, this approaches closely to *L. florissantensis*. However, the present insect has relatively shorter elytra, with markedly finer and sparser cephalic and prothoracic punctuation.

LIMONIUS SHOSHONIS, sp. nov.

Plate 5, fig. 10.

Form fairly elongate. Head finely and rather vaguely punctate. Antennae lacking. Prothorax almost exactly equal in length and breadth, surface finely, not deeply, but fairly closely punctate, apex not much narrower than the base, sides feebly arcuate, front angles nearly rectangular, hind angles carinate, sharp, only a little divergent. Scutellum nearly triangular. Elytra moderately tapering, finely striate, striae punctures a little elongate, quite fine, not very deep and separated from each other in the same row by approximately their own diameters, interstitial spaces flat, wide, scarcely visibly punctulate, finely hairy. Length, from front of head to elytral apex, 7.25 mm.; of elytron, 4.35 mm.

Described from one specimen.

Type.—In the Museum of the University of Colorado. It was collected by Professor Cockerell at Station 14, Florissant, Colo., in 1906 and bears his number 58.

The beetle is provisionally placed in *Limonius* chiefly on account of its form and sculpture. It is smoother than the other Florissant species referred to this genus.

LIMONIUS VOLANS, sp. nov.

Plate 5, fig. 11.

Form rather elongate. Head deeply punctured, closely and relatively coarsely on the front, more finely and sparsely on the vertex. Antennae wanting. Prothorax a trifle broader than long, more finely and much more sparsely punctured than the head except near the side margins where the sculpture is much coarser and closer than on the disk. Base somewhat broader than the apex, sides very little arcuate, front angles short, hind ones of moderate length and but slightly divergent. Elytra two and three fourths times the prothoracic length, conjointly rounded at apex, finely striate, the striae punctures not very close nor well defined, interstitial spaces flat, with strong, fairly sparse punctures, more pronounced, though probably not larger, than those of the striae. Length, from front of head to elytral apex, 9.00 mm.; of elytron, 5.60 mm.

Described from one specimen.

Type.—In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by G. N. Rohwer, while a member of one of Professor Cockerell's parties.

Separates from *L. florissantensis*, with which it agrees in the relatively coarse interstitial punctuation, by having a much finer and sparser sculpture of the head and particularly of the thorax. The generic reference is provisional, being based mostly on facies.

ATHOUS LETHALIS, sp. nov.

Plate 6, fig. 1, 2.

Form elongate, parallel. Head finely and extremely densely punctured and with a short pubescence. Antennae long, slender, faintly serrate, apparently not entire but reaching far beyond the prothoracic hind angles, basal joints too poor to allow of their definition. Prothorax punctured similarly to the head but a trifle more coarsely and less deeply, length and breadth equal, front angles slightly prominent, sides nearly straight to the hind angles which are acute and a little divergent, base sinuate each side. Scutellum oblong oval. Elytra a little over three times the length of the prothoracic median line, apices conjointly rounded, finely striate and pubescent, the striae with small, deep, nearly circular or slightly elongate punctures which are separated in the series by their own diameters or something more. Underside of prosternum closely and finely punctured, the prothoracic flanks less strongly, sculpture of the remainder of the thoracic sclerites and abdomen very obscure. Length, from front margin of prothorax to elytral tip, 8.40 mm.; of elytron, 5.50 mm.

Described from one specimen, with counterpart.

Type.—No. 2,728 and 2,729 M. C. Z. Florissant, Colo. (No. 8,464 and 8,713 S. H. Scudder Coll.).

The prothorax is ornamented with a broad brown stripe, about one third of the discal width, occupying the median area from base to apex, similar to that seen in the recent *A. excavatus*, from California. The latter insect, however, is much more coarsely sculptured. The coxal plates are not well displayed in the fossil, but the prosternal lobe and sutures, as well as the general form, correspond well with the genus in which I have placed it.

ATHOUS CONTUSUS, sp. nov.

Plate 6, fig. 3, 4. •

Form very elongate, subparallel. Head moderately coarsely and fairly closely punctured. Antennae slender, and, when complete, probably reaching or passing the prothoracic hind angles. Only a few of the joints are well defined and these are scarcely serrate. Prothorax long, narrow, the sides not in good condition, apparently wider at base than at apex, hind angles only moderately pronounced, flanks rather closely but not coarsely punctured, prosternum more strongly. Elytra long, conjointly rounded at apex, strongly sculptured, the punctures of the striae rounded, separated longitudinally by their own diameters or a little more. Abdominal punctuation fine, moderately close. Length, from front of head to elytral apex, 11.15 mm.; of elytron, 7.65 mm.

Described from one specimen.

Type.—No. 2,727 M. C. Z. Florissant, Colo. (No. 8,346 S. H. Scudder Coll.).

The specimen is preserved in such a way as to show the upper side of the head and elytra and the details of the underside of the prothorax, due to the manner of splitting the stone. It retains a portion of the raised frontal margin and the aspect is quite that of *Athous*.

ATHOUS FRACTUS, sp. nov.

Plate 6, fig. 5.

Form elongate. Head with a rather well-pronounced frontal margin, surface finely punctate and pubescent. Antennae weakly serrate, slender, the basal and apical joints poorly defined, but in life the antennal tip evidently attained or passed the prothoracic hind angles. Prothorax very little broader than long, surface finely, not closely punctate and pubescent. Sides very little arcuate, angles small, the hind ones not in good preservation but evidently carinate and at least moderately prominent. The notch in front of the angle, as shown on the figure, is perhaps adventitious. Scutellum oblong. Elytra broken at tip but apparently, if complete, not much, if any, less than three times as long as the prothorax, finely striate, the striae with irregularly spaced, round, or often elongate or elliptical, punctures

separated by more or less than their own long diameters. Interstitial spaces flat, broad, pubescent but scarcely visibly punctulate. Only one leg shows, which is of moderate size. Length of fragment, 13.40 mm.; of prothorax, along median line, 3.50 mm.

Described from one specimen.

Type.—In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by S. A. Rohwer.

Placed in *Athous* because of the form, the coxal plates (only indistinctly seen), the frontal margin and the very long prosternal lobe which shows through as indicated, Plate 6, fig. 5. In this figure, the dotted lines will show the courses of the elytral striae, but the punctures are actually somewhat smaller and more numerous than the dots which might be taken to represent them. It seems smoother than the recent North American species known to me.

PARANOMUS EXANIMATUS, sp. nov.

Plate 6, fig. 6, 7.

Form only moderately elongate. Head practically smooth. Antennae not well enough preserved to show the relative sizes of most of the joints, but they are quite weakly or scarcely serrate, reaching, in life, beyond the prothoracic hind angles. Prothorax in poor condition and probably somewhat distorted, but as shown it is a little more than one fifth broader than long, wider in front of the middle, front angles a little acute, sides moderately arcuate in anterior three fourths, thence sinuate, in reverse curve, to the hind angles which are sharp and slightly divergent, base broadly emarginate in front of the scutellum, sinuate each side, surface minutely, sparsely punctured. Scutellum suborbicular. Elytra three times the length of the prothoracic median line, conjointly rounded apically, not striate nor visibly punctured but finely pubescent. Underside nearly smooth. Length, 7.00 mm.; of elytron, 4.30 mm.

Described from one specimen, with counterpart.

Type.—In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo. With it is associated, somewhat doubtfully, another from the same source.

Most probably a *Paranomus*, but more finely sculptured than *P. costalis* or *P. estriatus*, the only recent species known to me. The prosternal sutures are moderately curved, the hind coxal

plates but slightly dilated externally and without a distinct tooth over the thighs. The beetle differs from *P. laevis* in the proportions of the elytra and prothorax, as well as in some minor details which may be gathered from the descriptions.

PARANOMUS LAEVISSIMUS, sp. nov.

Plate 6, fig. 10.

Form fairly stout. Head very finely punctulate, a little more coarsely anteriorly. Antennae poorly preserved, slender, scarcely at all serrate. Prothorax almost absolutely smooth, neither side completely preserved but from a combination of the two it is evident that the base and apex were subequal, the width about one third greater than the length, sides arcuate, sinuate in front of the hind angles which are somewhat divergent, acute and carinate, basal margin strongly sinuate each side. Scutellum obscure, apparently oblong. Elytra two and three fifths times the length of the prothoracic median line, without sculpture except two lines of faint elongate punctures near the outer edges and some still weaker ones on the disk, no visible hair marks. Underside almost perfectly smooth. Length, from front of head to elytral apex, 8.10 mm.; of elytron, 4.75 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado, collected at Station 14, Florissant, Colo., by Mrs. W. P. Cockerell.

Perhaps the most striking characteristic of this beetle is the almost total lack of sculpture. The form is like that of *Cardiophorus* and the curved prosternal sutures are similar to those found in that genus, but the spine is not truncate nor is the scutellum cordiform. The nature of the prosternal sutures forbids reference to *Cryptohypnus*, and while the coxal plates are not distinctly shown I think they are gradually smaller externally as in the *Corymbitini*. The practical lack of elytral striation leads me to refer the insect to *Paranomus*.

PARANOMUS HEERI, sp. nov.

Plate 6, fig. 8, 9.

Form only fairly elongate. Head minutely, sparsely punctulate on the vertex, more closely at front and sides. Antennae bent under

the body, lying along the breast near the prosternal sutures, not well enough defined for description. Prothorax punctulate, finely and sparsely, the outline incomplete on one side but evidently the width is about one half greater than the median length, base and apex subequal, front angles obtuse, sides regularly rounding to the hind angles which are obscure and probably short. Scutellum oval. Elytra a little over three times the prothoracic length, apices conjointly rounding, surface distinctly and rather deeply but finely and sparsely punctured without any definite stria arrangement. Under-side obscurely, finely punctate. Length, from front of head to elytral apex, 4.65 mm.; of elytron, 3.25 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. It was collected at Station 14, Florissant, Colo., by Dr. W. M. Wheeler, while a member of one of Professor Cockerell's expeditions.

Probably not a true *Paranomus*, but I can find no better place for it and the assemblage of visible characters points in that direction. The metacoxal plates are not suddenly dilated, the prosternal lobe is moderate, the sutures nearly straight, apparently slightly excavate anteriorly, the elytra not striate. The size is somewhat less than that of the recent *P. estriatus*, from Mt. Washington.

LUDIOPHANES, gen. nov.

Form of *Ludius*. Elytra confusedly punctate, not striate. Coxal plates gradually narrowed externally and not toothed over the insertion of the thighs. Scutellum ogival.

Type.— *L. haydeni*, sp. nov.

LUDIOPHANES HAYDENI, sp. nov.

Plate 4, fig. 7-9.

Form moderately elongate, tapering a little to both ends. Head short, closely, deeply, and coarsely punctured, except on the extreme frontal region where the sculpture is more shallow. Antennae very slightly longer than the prothoracic median line but not reaching the tips of the hind angles, eleven jointed, feebly serrate, first joint large, second shorter than the third, third and fourth subequal in length,

eleventh much longer than the tenth. Eyes not strongly convex. Prothorax a little broader than long, slightly narrower at apex than at base, front angles acute, sides gently and almost regularly arcuate, faintly sinuate in front of the hind angles which are acute and feebly divergent. The thoracic apex seems hardly emarginate, the base is notched in front of the scutellum and sinuate each side. Punctuation of pronotum close, deep, and rather coarse over the entire surface, the punctures everywhere separated by much less than their own diameters and but slightly less crowded along the median line than at sides, each with a central mark which looks as if it may have been the point of insertion of a hair or scale. Scutellum oval, much longer than wide, coarsely punctured. Elytra moderately tapering, not pointed at apices, confusedly but in general evenly punctured except that the punctures become somewhat more sparse posteriorly where they are separated by spaces about equal to or a little more than their own diameters. Each puncture carried a moderately long, curved dark hair, giving a somewhat shaggy appearance to the surface. Underside of body well preserved, showing the following features:—prothoracic flanks finely and densely punctured, prosternum, including the spine, more coarsely and deeply; lobe strong, rounded; sutures double, nearly straight, excavate anteriorly; meso- and metasternal areas similarly but in general less closely punctate, coxal plates narrow, little dilated externally, with a rounded lobe over the insertion of the thighs; abdominal punctuation rather fine but deep, closer externally but everywhere well separated. Legs not well displayed. Length, from front of head to tip of abdomen, excluding sex organ, 14.25 mm.; of prothorax, along median line, 3.35 mm.; of elytron, 9.00 mm.; of antenna, 3.65 mm.; width of prothorax, 3.75 mm.

Described from one specimen, with counterpart.

Type.—In the collection of H. F. Wickham. Wilson Ranch, Florissant, Colo.

This is probably the finest and best preserved specimen I have seen among the Elateridae of the Florissant shales. The aspect is much like that of a *Ludius* or of a *Megapenthes*, like the recent western North American *M. aterrimus*, but the form of the coxal plates indicates a position with the *Corymbitini*. The punctuation does not agree with that of any species of the group known to me and serves at once to differentiate it from all the Florissant fossil Elateridae of similar size. The antenna and sex organ are omitted (Plate 4, fig. 7) but the former is shown (Plate 4, fig. 8).

CORYMBITES PRIMITIVUS Wickham.

Described in American journal of science, 1908, ser. 4, 26, p. 77, fig. 2. It is a large species, about 22 mm. in length, and seems not to have been particularly rare. The type is in the Peabody Museum of Yale University and was found at Station 14, Florissant, Colo., by G. N. Rohwer. None are in the collections of the Museum of Comparative Zoölogy, but I have a good example, with counterpart, and the prothorax of another from the Wilson Ranch.

CORYMBITES GRANULICOLLIS Wickham.

This was described in the same article as the preceding. It is still larger, 24 mm. long, and is the most striking of all the Florissant Elateridae as far as size is concerned. The type is with the Peabody Museum, at Yale University. I have a very good specimen obtained at Florissant from a local collector who claimed to have found it in the railroad cut that runs through the Corixa bed. I doubt the accuracy of his statement. The original locality was Station 14, which has yielded many beautiful insects of various families.

CORYMBITES SUBMERSUS, sp. nov.

Plate 7, fig. 1-3.

Form fairly elongate. Head moderately coarsely punctured on the front, vertex becoming only faintly sculptured. Antennae broken, but enough remains to show that the second joint is shorter than the third and, judging from the portions preserved, the organ, when complete, reached slightly beyond the points of the prothoracic hind angles. The antennal serrations are faint. Mandibles a little prominent. Prothorax short, narrow anteriorly, broadest across the base, the sides arcuate near the front angles, which are obtuse, but becoming nearly straight to the hind angles which are long, sharp, divergent, and carinate. The sculpture of the pronotum consists of an extremely fine punctuation, with rather sparse pubescence. There is a fine lateral marginal bead the full length of each side. Scutellum oblong. Elytra striate, the striae with fine, deep, rounded or somewhat elon-

gate punctures separated in the series by something more or less than their own diameters. Underside showing that the prosternum is strongly, closely and rather coarsely punctured around the anterior portion of the lobe, nearly smooth at middle, side pieces vaguely punctate, abdomen thinly pubescent, the punctuation fine, shallow and sparse. Legs poorly preserved, of moderate size. Length, from front of head to abdominal apex, 13.50 mm.; of elytron, 9.45 mm.; of prothorax, along median line, 2.45 mm.; width of prothorax across base, just in front of hind angles, 3.35 mm.

Described from one specimen, with counterpart.

Type.— In the Museum of the University of Colorado. It was collected by G. N. Rohwer, at Station 14, Florissant, Colo.

Easily distinguished from the other Florissant fossil Corymbites by the short prothorax and widely divergent hind angles which give the appearance of the recent *C. appressus* from the northern United States and Canada. That species, however, has the prosternum and elytra differently sculptured. The prosternal, coxal, and antennal characters of the fossil all agree well with the genus in which it is placed.

CORYMBITES RESTRUCTUS, sp. nov.

Plate 7, fig. 4.

Form fairly elongate, tapering to the ends as in the recent *C. hieroglyphicus*. Since the specimen is exposed in ventral view, no description of the upper surface can be given. Head poorly preserved, antennae not shown. Prothorax rather closely and fairly coarsely punctured beneath, more deeply and strongly on the prosternum, spine margined at sides, lobe much rounded, hind angles long and acute, slightly diverging. Metasternal and abdominal punctuation much shallower and more vague than that of the prothorax. Hind leg moderately long, the first tarsal joint not much lengthened, the fourth and fifth obscured. Elytra pointed at apex, sides rather strongly rounding. Length, from front of head to abdominal apex, but without extruded sex organ, 16.30 mm.

Described from one specimen.

Type.— In the Museum of the University of Colorado. It was collected by Mrs. W. P. Cockerell at Station 14, Florissant, Colo.

Undoubtedly a Corymbites and easily distinguished from *C. primitivus* or *C. granulicollis* by its smaller size and more fusiform outline.

CORYMBITES PROPHETICUS, sp. nov.

Plate 7, fig. 5.

Form stout. Head in very poor preservation, finely, regularly, and closely punctate. Antennae wanting. Prothorax at sides punctured almost exactly like the head, a little more finely and sparsely on the disk, about one fourth broader than long, sides nearly regularly arcuate, somewhat more suddenly in front, anterior angles slightly acute, hind ones quite strongly so, feebly divergent and carinate. Scutellum oblong. Elytra quite strongly arcuate at sides, apices conjointly rounded, finely striate, striae with distinct but not coarse punctures which are circular or slightly elongate and separated in each series by their own diameters or less. Interspaces broad, flattened or nearly so, finely punctulate and distinctly pubescent. Legs wanting. Length, from front of head to elytral tip, 10.90 mm.; of elytron, 6.55 mm.; of prothorax along median line, 3.00 mm.

Described from one specimen.

Type.—No. 2,724 M. C. Z. Florissant, Colo. (No. 13,657 S. H. Scudder Coll.). With it is associated, somewhat doubtfully, No. 2,275 M. C. Z. (No. 11,282 S. H. Scudder Coll.). Two poor specimens from Station 13 and 13B are in the Museum of the University of Colorado.

This is quite surely a *Corymbites* and is of the same general form as the recent *C. aereipennis*, common in the northern and mountain regions of this continent. The sculpture seems not to have been very different. The size and outline will distinguish it from all the other fossil Florissant species.

OXYGONUS PRIMUS, sp. nov.

Plate 7, fig. 6.

Form fairly stout. Head not well preserved, showing no sculpture. Antennae moderately long but the individual joints are not definable. Prothorax stout, suborbicular, the sides strongly rounded, apex and base subequal, prosternal grooves double, somewhat curved, lobe long, front edge quite arcuate and strongly advanced, sculpture fine or nearly wanting. Elytron about four times as long as wide, moder-

ately pointed apically, punctatostriate, the punctures rounded or somewhat elongate and separated in each row by more than their own diameters. Abdomen and legs wanting. Length, from front of head to elytral apex, 6.00 mm.; of elytron, 3.85 mm.

Described from one specimen.

Type.— No. 2,726 M. C. Z. Florissant, Colo. (No. 6,381 S. H. Scudder Coll.).

A small species, about the size of the recent Californian *O. ater*. The form of the prothorax will separate it at once from all the other fossil Florissant Elateridae.

MELANACTES COCKERELLI Wickham.

Originally described in the American journal of science, 1908, ser. 4, 26, p. 77, fig. 3. The type is in the Peabody Museum of Yale University and was collected at Station 14, Florissant, Colo. No other specimens have come to light. It is a large insect, 23.50 mm. in length and similar in general appearance to the Florissant fossil *Corymbites granulicollis*.

PLATE 1.

PLATE 1.

- Fig. 1. *Deltometopus fossilis*.
2. *Deltometopus fossilis*, antenna.
3. *Fornax relictus*.
4. *Microrhagus miocenicus*.
5. *Microrhagus vulcanicus*.
6. *Lacon exhumatus*.
7. *Lacon exhumatus*, antenna.
8. *Cryptohypnus exterminatus*.
9. *Cryptohypnus exterminatus*, antenna.

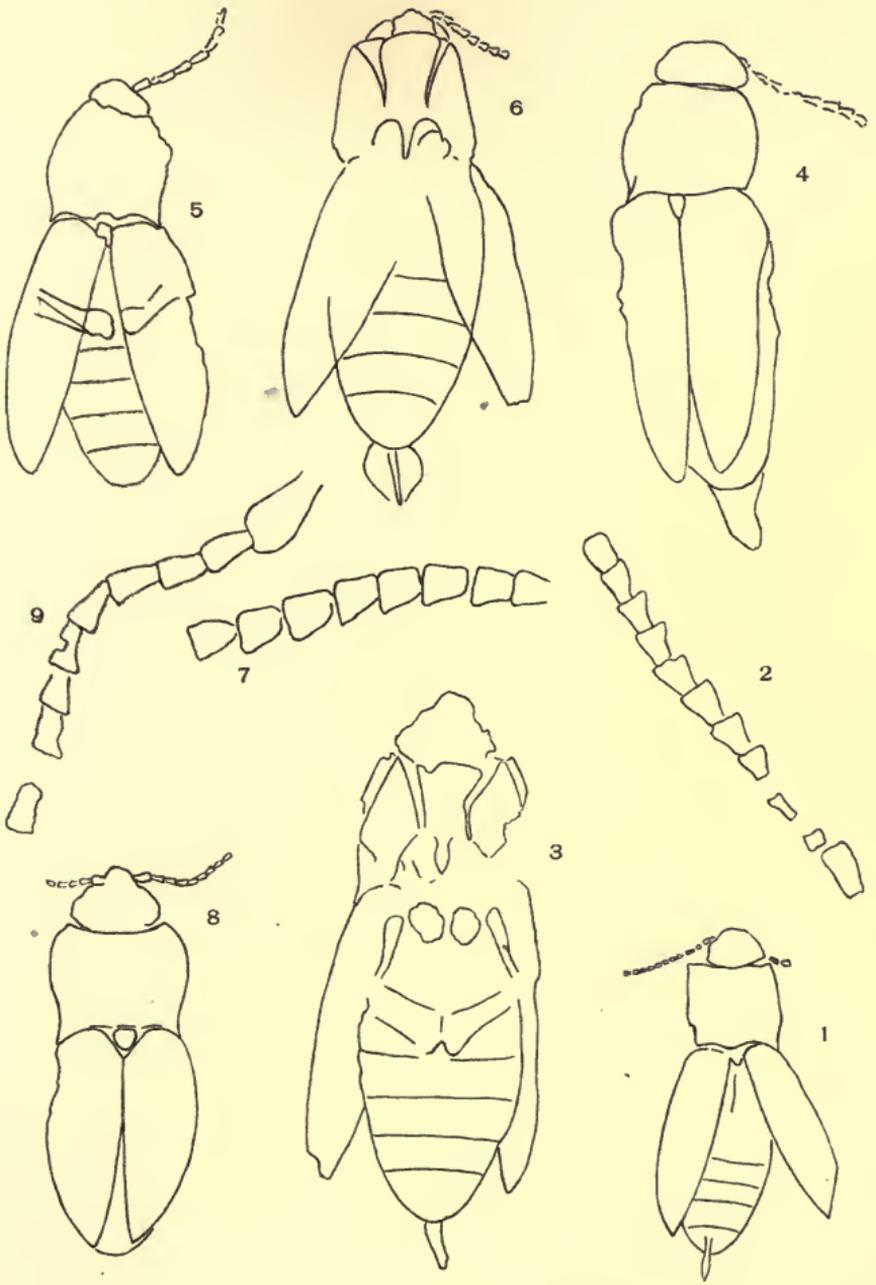


PLATE 2.

PLATE 2.

- Fig. 1. *Cardiophorus lithographus*.
2. *Cardiophorus lithographus*, underside of prothorax.
3. *Cardiophorus lithographus*, hind coxal plate.
4. *Cardiophorus florissantensis*.
5. *Cardiophorus florissantensis*, hind coxal plate.
6. *Cardiophorus cockerelli*.
7. *Cardiophorus requiescens*.
8. *Cardiophorus requiescens*, prosternal spine.
9. *Cardiophorus* (?) *deprivatus*.
10. *Cardiophorus* (?) *deprivatus*, antenna.
11. *Horistonotus coloradensis*.
12. *Horistonotus coloradensis*, hind coxal plate.

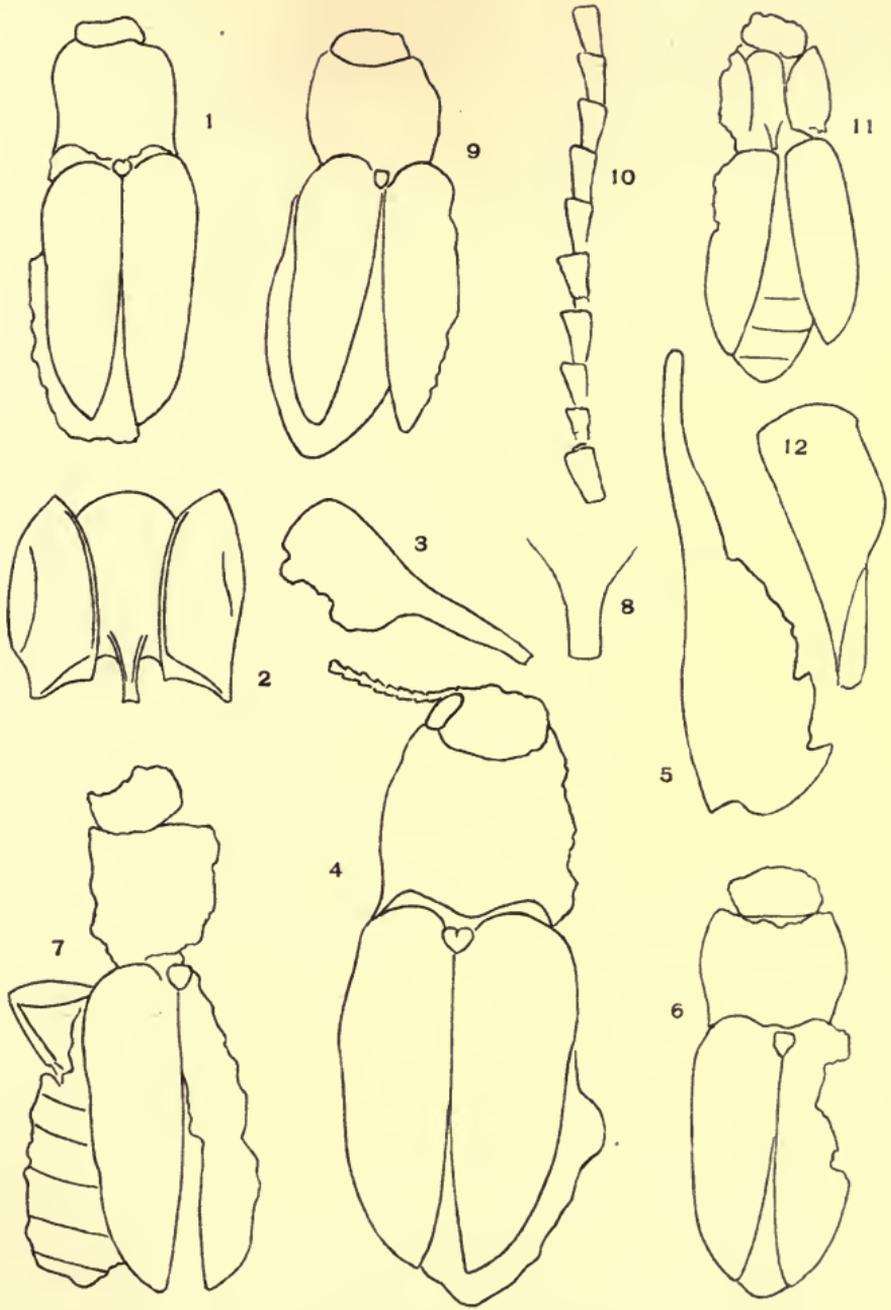


PLATE 3.

PLATE 3.

- Fig. 1. *Cryptohypnus hesperus*.
2. *Anchastus eruptus*.
3. *Anchastus eruptus*, antenna.
4. *Anchastus diluvialis*.
5. *Elater rohweri*.
6. *Elater rohweri*, underside of prothorax.
7. *Elater scudderi*.
8. *Elater scudderi*, antenna.
9. *Elater florissantensis*.

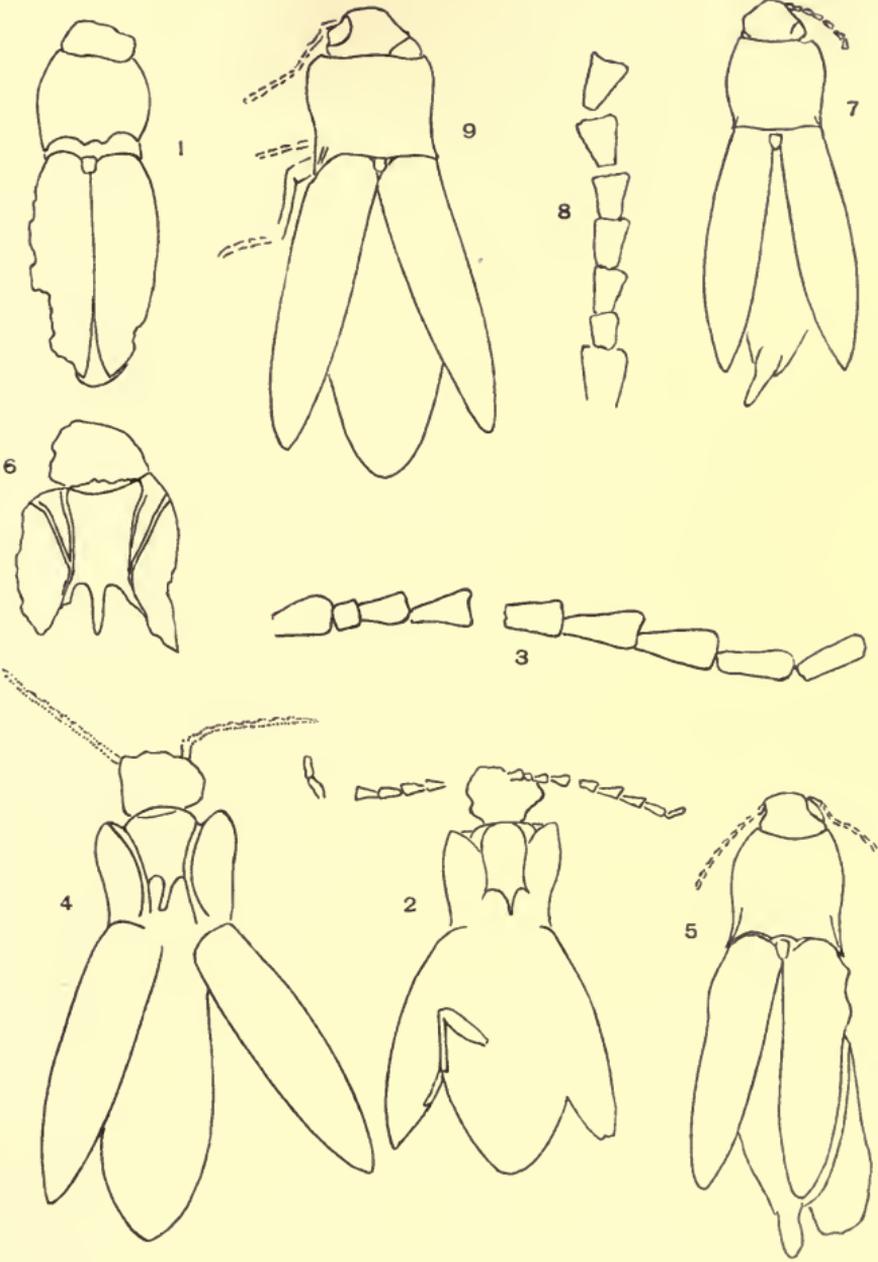


PLATE 4.

PLATE 4.

- Fig. 1. *Monocrepidius dubiosus*.
2. *Megapenthes primaevus*.
3. *Cryptagriotes minusculus*.
4. *Agriotes comminutus*.
5. *Agriotes comminutus*, hind coxal plate.
6. *Agriotes nearcticus*.
7. *Ludiophanes haydeni*.
8. *Ludiophanes haydeni*, antenna.
9. *Ludiophanes haydeni*, hind coxal plate.

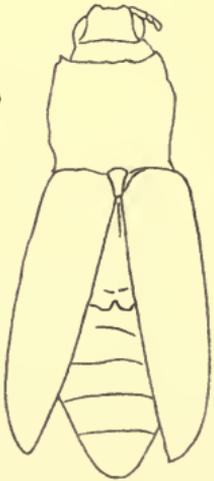
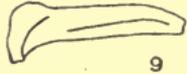
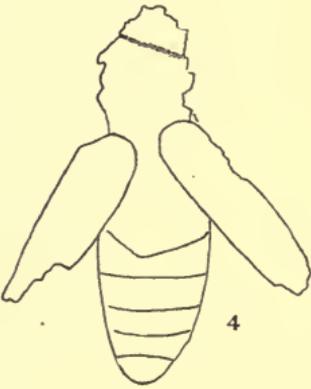
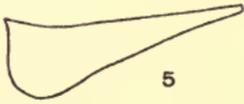
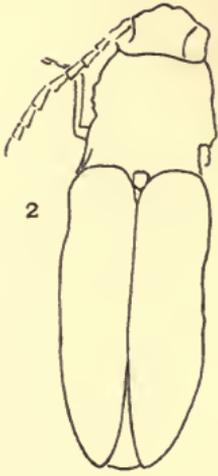


PLATE 5.

PLATE 5.

- Fig. 1. *Limonius aboriginalis*.
2. *Limonius aboriginalis*, underside of prothorax.
3. *Limonius aboriginalis*, hind coxal plate.
4. *Limonius aboriginalis*, antenna.
5. *Limonius florissantensis*.
6. *Limonius florissantensis*, hind coxal plate.
7. *Limonius florissantensis*, hind tarsus.
8. *Limonius praeursor*.
9. *Limonius praeursor*, antenna.
10. *Limonius shoshonis*.
11. *Limonius volans*.

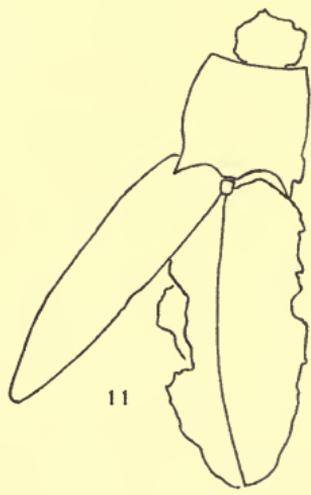
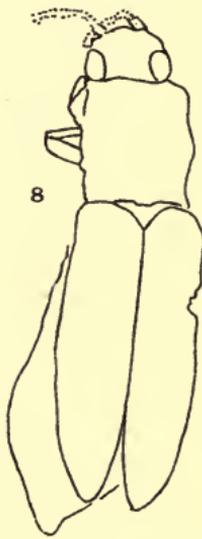
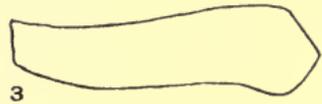
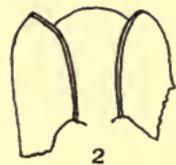
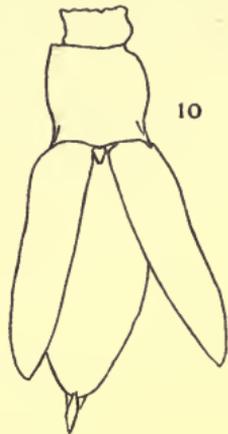
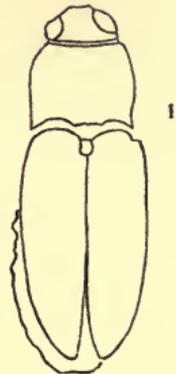
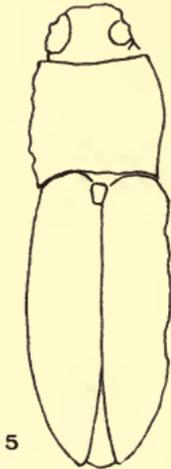


PLATE 6.

PLATE 6.

- Fig. 1. *Athous lethalis*.
2. *Athous lethalis*, underside of prothorax.
3. *Athous contusus*.
4. *Athous contusus*, antenna.
5. *Athous fractus*.
6. *Paranomus exanimatus*.
7. *Paranomus exanimatus*, hind coxal plate.
8. *Paranomus heeri*.
9. *Paranomus heeri*, hind coxal plate.
10. *Paranomus laevissimus*.

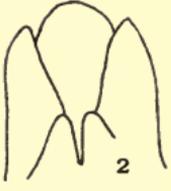
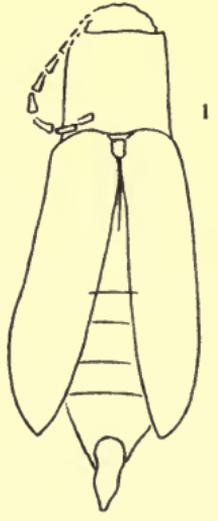
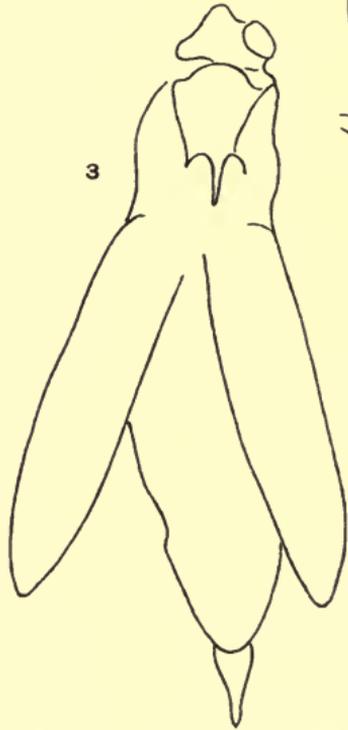
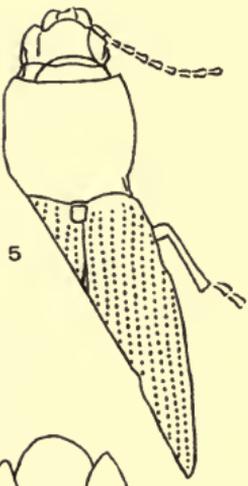
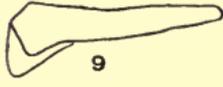
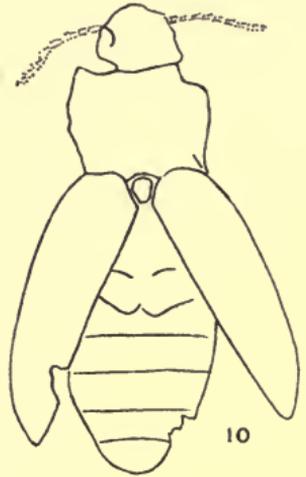
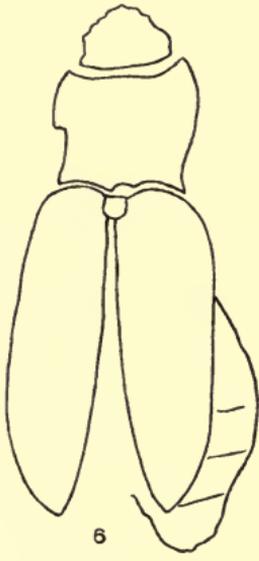
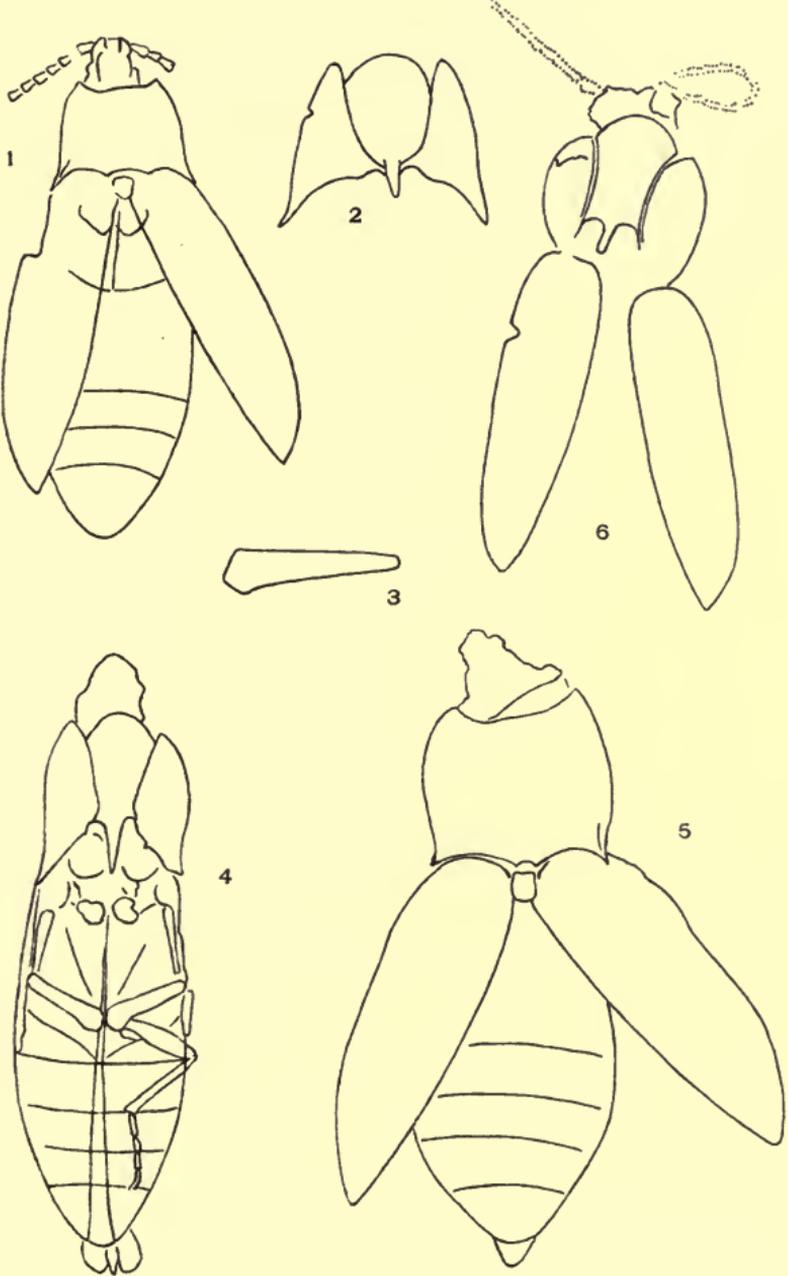


PLATE 7.

PLATE 7.

- Fig. 1. *Corymbites submersus*.
2. *Corymbites submersus*, underside of prothorax.
3. *Corymbites submersus*, hind coxal plate.
4. *Corymbites restructus*.
5. *Corymbites propheticus*.
6. *Oxygonus primus*.



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Report on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieut. Commander Z. L. Tanner, U. S. N.; Commanding, to cruise of Alexander Agassiz.

Report on the Scientific Results of the Expedition to the Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moses, U. S. N., Commanding.

Report on the Scientific Results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from October, 1904, to April, 1905, Lieut. Commander L. M. Garrett, U. S. N., Commanding.

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Contributions from the Zoological Laboratory, Professor R. A. Daly, in charge.

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