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R. Ellsworth Call.

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BULLETIN

OF THE

DES MOINES ACADEMY OF SCIENCE.

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THE UNIONIDÆ OF THE MISSISSIPPI
VALLEY.

PUBLISHED BY THE ACADEMY.

VOLUME I.

NUMBER I.

DES MOINES, IOWA,
MARCH, 1885.

BULLETIN
OF THE
Des Moines Academy of Science.

VOL. I.

MARCH, 1885.

No. I.

INTRODUCTORY.

THE DES MOINES ACADEMY OF SCIENCE, in presenting to the scientific public this, its first, contribution to the literature of science, hopes to initiate a series of publications which will ultimately cover, more or less completely, the natural history of the entire State. To this end a number of gentlemen, specialists in science, some of whom are residents of Iowa, have been invited to prepare papers on topics of general interest or value. Succeeding numbers of its BULLETIN will present the results of investigations conducted in other branches of science.

The immediate occasion for the publication of matter of this kind rests in the utter dearth of a natural history literature pertaining to Iowa. It is believed that many persons, intelligently interested in studies of this character, do not become actual students because there are no publications devoted to the natural history of the state. To all such it is hoped these Bulletins will commend themselves as intended to foster an intelligent observation of the unrecorded facts abounding on every hand. To facilitate the accomplishment of this purpose, objects of natural history, of whatsoever kind, are earnestly desired by the Academy. Collections of such a character will serve, first, to enable the institution of a well selected and carefully preserved museum, and second, to enable the placing of the objects collected in the hands of competent students for study and report.

The BULLETIN will be published at irregular intervals, and the time of its appearance will be governed by the amount and character of the material at hand. The greatest care will be exercised in determining what contributions are to be admitted to its pages, inasmuch as the information it may convey should be accurate and permanent in value

The Academy of Science is desirous of placing within the reach of its members, through its library, the results of investigations conducted by sister societies and published in their journals, and hence presents itself to their attention in the hope that an exchange of publications, subject to the usual conditions, may be made. There are now in preparation, papers upon the *Musci* and *Lichens*, and upon the Ornithology of the region about Des Moines. An extended paper upon the *Mites* will probably be the first contribution in the science of entomology, and others may be expected to follow as rapidly as the exigencies of publication will allow.

A GEOGRAPHIC CATALOGUE

—OF THE—

UNIONIDÆ OF THE MISSISSIPPI VALLEY.

BY R. ELLSWORTH CALL.

The incompleteness of this first attempt to succinctly present the geographic distribution of the *Unionidæ* of the drainage system of the Mississippi river will be conspicuous to those who may have given the subject any careful study. The causes of such incompleteness are to be referred to the dearth of a special literature and to the absence of complete collections made over all portions of the included area. For the same reason, there may be question whether the distribution of many of the species herein included shall not need future modification. The states west of the Mississippi river yet remain to be fully searched, and their molluscan fauna carefully studied. Aside from a fragmentary knowledge of the shells of Texas, Louisiana, Indian Territory, Kansas and Iowa, almost nothing is known of this area.

Then, again, the continually recurring problems in synonymy have necessarily modified the statement of the extremes of distribution. It has been difficult to decide just where any individual member of a widely spread group, for example, like that of *Unio rubiginosus*, ceased and another replaced it. In certain cases the intermingling of closely related forms appears to be indicative of identity rather than of specific distinctness, and it is often a question whether to state the limits of distribution of each form separately or to unite them and point out the

distribution of the combined forms as a unit. In this respect, the treatment of species has not been uniform. Where identities have appeared to be fairly well established, comparisons have been instituted and the results positively stated, though in the great majority of cases there has been no attempt to critically fix the species synonymy. The evidence—which is not inconsiderable—by which such treatment is justified will, it is hoped, appear in a future synonymic catalogue designed to cover the same area with this. It is proper to state, in this connection, that the extremes of distribution and such synonymy as is positively asserted, are based upon the private collections of the writer, except in those instances where shells are cited as occurring in British America. The statements of distribution in these few instances, are based upon material to be seen in the collections of the Smithsonian Institution.

In anticipation of the results of a further study of synonymy it is suggested that the elimination of a large number of forms, herein included as species, is probable. Many others, when studied in connection with the peculiar environments imposed by wide geographic range, will be found devoid of even a racial value, while still others will rank as mere varieties. In the case of several widely distributed groups it has been found that the extremes of differentiation are co-ordinate with the extremes of distribution, and that the differences become less appreciable as the various intervening localities furnish their quota to the geographic series. Such, notably, is the fact in connection with the pustulate group of *Uniones* in which the northern *Unio pustulosus* graduates insensibly into the southern *Unio asperatus*, *U. vallatus* and *U. sphaericus*. Bearing this fact in mind the co-ordination of species on the basis of resemblances rather than their specific separation on trivial variant characters, appears to be most useful as a preparation for a complete synonymy. Thus, in this paper, well known and common forms are taken as the types of groups in which are placed all those species which present close resemblances, and which are conceived to be—if good species—genetically related to the type. In general, the first described species of a natural group has been selected as the type, so that on the completion of the synonymy of any individual group the arrangement would be chronologic.

It has not appeared desirable to institute subgenera for the reception of such forms as approach closely to the type of any group. Several such attempts have been made, (1) but the limits imposed by these devices appear to be no more constant than the characters of the specimens themselves. It is believed that, for the North American *Unionidae* at least, no more characteristic grouping than that implied in the adoption of the genera *Anodonta*, *Margaritana* and *Unio* will be found really serviceable. Even in the adoption of certain typical groups,

(1) By Rafinesque, L. Agassiz, Swainson, Stimpson, Chenu, H. and A. Adams, and others.

as herein, the type does not always plainly suggest the affinities of certain forms grouped with it as subordinate members. Thus the pustulate group, typified by *Unto pustulosus*, contains species which, like *Unto houstonensis*, are non-pustulate. But, since there is an essential agreement in all other characters, and since individuals of usually pustulate forms are sometimes found free of pustules, no real violence is done any scientific principle of classification. Indeed, the presence or absence of pustules often appears to afford a no more reliable basis of classification or grouping than does color, which, as has long been recognized, is by no means a constant factor.

Collections from every sub-drainage area within the Mississippi valley are generally important in order to understand the geographic range of characteristic forms and as an aid in the determination of suspected synonymy, and particularly important in connection with the chronologic history of the family in these waters. The existence of various species of *Unionidæ* in the Laramie beds of Wyoming, probably genetically related to certain widely spread types in the Mississippi basin, as shown by White (2) point to regions adjacent to the great valley, as the locality of probable origin. When investigation of this phase of the subject is carried further, so that actual genetic relation be demonstrated, an important fundamental problem, that underlies the fact of synonymy, will be solved.

In brief, then, the intention of this tentative catalogue is to place within the reach of students, a convenient geographic *resume* of the *Unionidæ* of the Mississippi valley, and at the same time to prepare the way for an intelligent discussion of the biologic and geologic problems which their numbers and distribution suggest. The greater fullness of the notes which pertain to certain groups, is to be considered indicative of the opportunities the writer's private cabinet presents and the extent to which he has been aided by the generous help of a numerous list of correspondents, while the paucity of notes in certain other instances will serve to indicate those species—either good or nominal—concerning which information is most earnestly desired. A failure to point out the possible affinities of any form, is sometimes the result of positive ignorance of its true relations consequent upon inability to examine authentic specimens. The element of uncertainty which attaches to all mere descriptions and to most figures, is too great to warrant a suggestion of possible relationship. It could, at best, be no more than mere conjecture. Those suggestions which involve a probable synonymy are advanced with some degree of trepidation due both to the inherent difficulties of the subject and to its delicacy. But the desire, which every honest investigator has, to render strict justice to the work of his predecessors needs also to be judiciously

(2) Am. Jour. of Sci., Vol. XX, Pp. 44-49.

exercised in the interests of his special science lest a greater injustice be done the student who shall follow him.

Bibliographic matter would be inappropriate in a paper of this character, and but little such matter has been admitted. A simple reference to a figure of each form—where one is known to exist, in most cases the original—has been deemed useful. In general, descriptions will be found in connection with the plates indicated in the several references.

CATALOGUE.

FAMILY UNIONIDÆ.

(RIVER MUSSELS.)

GENUS ANODONTA.

Gills free; eggs received throughout the gill; anal opening not fringed.

Shell equivalve, ovate, usually thin, auriculate, inequilateral, closed; beaks small. Hinge without teeth, but furnished with a lamina; ligament external, linear. Pallial impression simple. (H. and A. Adams.)

† **Anodonta argentea**, Lea.

(Trans. Am. Phil. Soc., 2nd Ser., Vol. VIII, Pl. XIX, Fig. 41.)

This species was described from Stone's river, Tennessee, and has been reported from no other locality. It forms a member of the group of which *Anodonta ferussaciana*, Lea, is the type.

‡ **Anodonta arkansensis**, Lea.

(Trans. Am. Phil. Soc., 2nd Ser., Vol. X, Pl. XXIX, Fig. 56.)

Described from the Little Arkansas river. The most northerly locality reported is Mill Creek, near Alma, Kansas. The form is, perhaps, properly to be regarded as a synonym of *Anodonta edentula*, Say, which see.

‡ **Anodonta bealii**, Lea.

(Jour. Acad. Nat. Sci. Phila. 2nd Series, Vol. VI, Pl. IX, Fig. 25.)

Distributed from north-eastern Kansas to Texas. The original locality is in Leon county, Texas.

† **Anodonta buchanensis**, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIV, Fig. 43.)

Buck Creek and Grand river, Ohio. Not reported elsewhere. This species groups with *Anodonta ferussaciana*, Lea, and is suspiciously close to it.

† *Anodonta carinifera*, Conrad.

(Not figured.)

Nothing further is known of this species than that it came from Kentucky, and was described on the cover of No. 9, Conrad's *Monograph of Unionidæ*.

Anodonta corpulenta, Cooper.

(Not figured.)

"Upper Mississippi river and Lake of the Woods." Shells referable to this species have been supplied from Aledo, Illinois, and Muscatine, Iowa. It is doubtful whether it is more than a very obese variety of *Anodonta grandis*, Say.

† *Anodonta danielsii*, Lea.

(Jour. Acad. Nat. Sci., Phila., 2nd Series, Vol. IV, Pl. LXIII, Fig. 190.)

Described from Topeka, Kansas. Specimens have been taken in Dodge county, Nebraska, and Fremont county, Iowa. It belongs to the group of which *Anodonta grandis*, Say is the type.

* *Anodonta decora*, Lea.

(Trans. Am. P. fl. Soc., Vol. VI, Pl. XX, Fig. 63.)

Ranges from Western New York to Iowa. It belongs to the *grandis* group, between which, this form, and *Anodonta plana*, Lea, exists a relationship which must be regarded as genetic—unless they are positively identical.

† *Anodonta dejecta*, Lewis.

(Not figured.)

This species was described from imperfect specimens obtained by the U. S. Geog. and Geol. Survey W. of the 100th meridian, credited, by Dr. H. C. Yarrow, the collector, to "the Arkansas river or Tributaries west of the 100th meridian." Nothing further is known of its geographical distribution. (*Vide* U. S. Geog. Sur. W. of 100th Meridian, Vol. V, Pp. 952—953.

† *Anodonta denigrata*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XXV, Fig. 45.)

Described from Campbell county, Tennessee, the only locality yet reported. The species groups with *Anodonta ferussaciana*, Lea, which see.

* *Anodonta edentula*, Say.

(Nat. Hist. of New York, Zoology Vol. V, Pl. XVI, Fig. 231.)

Ottawa, Canada, south to Central New York, North Carolina and Tennessee; west to Iowa; north to Lake Winnipeg, British America. This is an exceed-

ingly variable form, and its synonymy is correspondingly large. A peculiar quadrate form from Michigan received, at the hands of Mr Anthony, the name of *Alasmodonta rhombica*. The figure to which reference is made does not well illustrate the species. It is believed the following will prove to be synonyms: *Anodonta arkansensis*, Lea, *A. ferruginea*, Lea, *A. tetragona*, Lea, and *A. shaffæriana*, Lea. The species is not far removed from *A. undulata*, Say—of the Atlantic drainage. Specimens are frequently found with a thickening on the dorsal margin which simulates the cardinal tooth of *Margaritana*. Mr. Anthony's specimens probably presented that feature.

† *Anodonta ferruginea*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XIX, Fig. 43.)

"Simon's Creek, Indiana." See under *A. edentula*.

* *Anodonta ferrussaciana*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. VI., Fig. 15.)

Ranges from Montreal, Canada, to Kansas; to Vermillion river, Dakota. The form has been erroneously attributed to Western New York. It is the type of a group of *Anodontæ* which includes *A. argentea*, *A. denigrata*, *A. buch-anensis*, and *A. oblita*, and which is not altogether free from synonymy.

† *Anodonta footiana*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol VIII, Pl. XX, Fig. 44.)

The only locality, within the Mississippi basin, in which this form is known to occur, is Chautauqua Lake, in Western New York. It abounds in very many of the small lakes in Wisconsin and Michigan, but, apparently, in those only which are tributary to the Great Lakes. The most northerly recorded range is Fort Winnebago, to Ottawa river, Canada.

Anodonta gigantea, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl I, Fig. 1.)

This species was described from a single valve obtained in the vicinity of Port Gibson, Mississippi. It is a member of the *grandis* group, to which it is very closely related.

* *Anodonta grandis*, Say.

(Not figured.)

Described from the "Upper Mississippi." Its range is very considerable—from Ohio to Texas; west to Nebraska and north to Minnesota. Throughout its range it exhibits a very considerable diversity of form which is to be regarded as

a biologic expression of differences in environment. The specific distinction between this and several other forms is not clearly established. It is the type of a group including *A. decora*, *A. virens*, *A. linnaana*, *A. corpulenta*, *A. harpethensis*, and *A. plana*, some of which are certainly synonymous. Lea's figure of *A. plana*, (which see) is a very good illustration of *grandis*.

† *Anodonta harpethensis*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XIX, Fig. 42.)

Harpeth river, Tennessee, the only locality yet reported. See under *grandis*.

* *Anodonta imbecillis*, Say.

(Trans. Am. Phil. Soc., Vol. V, Pl. VI, Fig. 6. Figured as *Anodonta incerta*, Lea.)

Ranges from Central New York to Georgia, to Texas, to Iowa. The great fragility of this species and its brilliant green epidermis will serve to readily distinguish it from all other *Anodontæ*.

† *Anodonta linnaana*, Lea

(Trans. Am. Phil. Soc. 2nd Series, Vol. X., Pl. XXVII, Fig. 51.)

"Lake Concordia, Louisiana." This species is a member of the *grandis* group. Its specific value is questionable.

† *Anodonta oblita*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. X, Pl. XXVIII, Fig. 52.)

Campbell county, Tennessee. This form, which is a member of the *ferrussaciana* group, is certainly synonymous with *A. denigrata*, Lea

† *Anodonta opaca*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. X., Pl. XXV, Fig. 46.)

Near New Orleans, Louisiana, and Little Rock, Arkansas. This and *A. stewartiana*, Lea, are synonymous.

† *Anodonta ovata*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. II, Fig. 2.)

Ranges from Ohio and Wisconsin to Jackson, Mississippi. Specimens doubtfully referred to this species have been taken in Lake Okoboji, northwestern Iowa. This form groups with *grandis*.

† *Anodonta pavonia*, Lea

(Trans. Am. Phil. Soc., Vol. VI Pl. XXI, Fig. 65.)

Ohio and Indiana. This species is a member of the *edentula* group, from

which it is not far removed, and synonymous with *A. wardiana*, Lea, which see.

† *Anodonta pepinianna*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XVI, Fig. 51.)

Lake Pepin, Ohio. No further information is accessible.

* *Anodonta plana*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. VII, Fig. 18.)

Montreal, Canada. From Ohio to Kansas and Indian Territory. The original locality was near Louisville, Kentucky. See *Ano. grandis*.

† *Anodonta plicata*, Haldeman.

(Figured?)

"Cumberland river, Kentucky." I know nothing more of the species.

† *Anodonta salmouia*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIV, Fig. 41.)

Ohio and Michigan to Illinois. Abundant in Winnebago county, in the last mentioned state, and near Indianapolis, Indiana.

† *Anodonta shaffneriana*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XXVI, Fig. 50.)

Horn Lake creek, Tennessee, and Flat Rock creek, Indiana. See *Ano. edentula*.

Anodonta stewartiana, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. VI, Fig. 17.)

Near New Orleans, Louisiana. This form and *Ano. opaca*, Lea, are undoubtedly synonymous. Both forms are very local in distribution and are from localities—if not the same—if not far removed.

* *Anodonta suborbiculata*, Say.

(Descriptions of the Shells of North America. Pl. XI)

Indiana, Illinois, Iowa, and Kansas. The species is considered somewhat rare, though it is abundant locally; near Springfield, Illinois, and Muscatine, Iowa. A single specimen has been submitted by the Natural History Survey of Kansas, taken near Neosho Falls, in that State.

† *Anodonta tetragona*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. VIII, Fig. 25.)

"Alexandria, Louisiana." A member of the group typified by *Ano. edentula*, Say, to which it is closely related.

† *Anodonta virens*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. XXVIII, Fig. 53.)

Red River, Louisiana, near Alexandria. Synonymous with *Ano. linneana*, Lea, which see.

† *Anodonta wardiana*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIV, Fig. 42.)

Scioto river, Ohio, and White river, Indianapolis, Indiana. Synonymous with *Ano. pavonia*, Lea, which consult.

GENUS MARGARITANA.

Gills generally free from the abdominal sac, and their posterior extremity not united to the mantle; anal opening not fringed, branchial mostly fringed.

Shell transverse, oblong, equivalve, covered with an olivaceous epidermis. Hinge with a single cardinal tooth in the right valve, broad, erect, and grooved at its apex; twin teeth of left valve strong, the hinder denticulated, the front narrower, entire, pointed; lateral teeth not developed. (H. & A. Adams.)

* *Margaritana calceola*, Lea.(Trans. Am. Phil. Soc., Vol. III, Pl. III, Fig. 1, as *Unio calceolus*.)

Ranges from Ohio to Iowa and north to Michigan. It varies but little throughout its limits of distribution. It is most abundant in creeks, rather than in rivers, in which respect it simulates the habit of *Marg. hildrethiana*, Lea. *Calceola* is the type of a group which includes *M. deltoidea*, *M. minor*, and *M. quadrata*, all of which are believed to be synonymous with it.

* *Margaritana complanata*, Barnes.

(Am. Jour. Sci. and Arts, 1st Series Vol. VI, Pl. XIII, Figs. 17a, 17b.)

Western New York to Alabama; to Kansas; north to Lake Winnepeg. It is usually an abundant species in the north and west central states and especially so in those contiguous to the Mississippi. This species is very readily recognized by its flattened and somewhat circular outline and alate dorsum. It is our largest *Margaritana*.

* *Margaritana confragosa*, Say.(Descriptions of the Shells of North America, Pl. XXI. As *Alasmodonta confragosa*.)

Western Indiana to Iowa. Specimens have also been received from Trinity river, Texas, but from no intermediate stations. It appears to be very abundant near Springfield, Illinois, but is elsewhere somewhat rare and local. Described from Fox river, a tributary to the Wabash.

† *Margaritana curreyana*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XIX, Fig. 41.)

Stone river, Tennessee, and Tennessee river in North Alabama. These are the only localities yet reported. Groups with and probably a synonym of *Marg. fabula*, Lea.

† *Margaritana dehiscens*, Say.(Descriptions of the Shells of North America, Pl. XXI, as *Unio dehiscens*.)

This species, which is rare and local, was described from the Ohio river from which it ranges to Illinois. Specimens have been received from the Holston river, in East Tennessee, taken by Mrs. Geo. Andrews.

* *Margaritana deltoidea*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIII, Fig. 38.)

This form has the same geographic distribution as *Marg. calceola* with which it is certainly synonymous. It is very abundant at numerous localities in Illinois and Indiana.

† *Margaritana fabula*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIII, Fig. 39.)

Described from the Cumberland river, Tennessee. See under *Marg. curreyana*.

* *Margaritana hildrethiana*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. III, Fig. 8, as *Unio hildrethiana*.)

Originally described from the Ohio river, near Cincinnati. Specimens have been taken in the Des Moines river, in Central Iowa, and at numerous intervening points. It is one of those forms which, like *Marg. calceola* and *Marg. holstonia*, abound in creeks. The localities of greatest abundance yet reported are near Iowa City, Iowa, and Indianapolis, Indiana. (Lehnert.) The species varies little throughout its range.

† *Margaritana holstonia*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIII, Fig. 37.)

Though credited to the Holston river, East Tennessee, and bearing the name of that stream, no authentic specimens are known from that location. It is, however, a form exceedingly abundant in creeks and brooks in East Tennessee that are tributary to the Holston. *Marg. georgiana*, Lea, similarly abundant in the streams of North Georgia, and *Marg. etowahensis*, Lea, from the Etowah river, also in northwest Georgia, are synonymous. The most southern limit thus far known is Coosa river, and Shoal Creek, Shelby county, Alabama.

‡ *Margaritana margaritifera*, Linnæus.

(Nat. Hist. of New York, Pt. I, Vol. V. Mollusca. Pl. XIV, Fig. 224, as *Alasmodonta arcuata*, Barnes.)

This species has a very eccentric distribution. A common form in the rivers of Europe, it also occurs in both eastern and western North America. In the northern states it abounds at some points in Vermont and Massachusetts, its western limit over this area being near central Pennsylvania, but still within the Atlantic drainage. In our area it occurs in the Gallatin river, and headwaters of the Missouri—but not east of these points—ranging westward to British Columbia and California. In portions of Nevada, Idaho and Utah, it is an exceedingly abundant species, and in parts of California is used to some extent for food purposes by the Indians. *Anodonta nuttalliana*, with a similar distribution, but limited eastward by the Wahsatch range, is the only other member of the *Unionidæ* which is now known to subserve a similar use.

* *Margaritana marginata*, Say.

(Nat. Hist. of New York, Pt. I, Vol. V, Mollusca. Pl. XIV, Fig. 225.)

Ranges from New Hampshire to Iowa and Kansas; to Georgia, in the Etowah river, at Rome; north into Canada in Rideau and Ottawa rivers. This species varies considerably at different points through its area of distribution, but is not easily confused with any other. The figure cited above is a very poor one.

† *Margaritana minor*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. VIII, Fig. 26.)

This is a Tennessee species, but is found also in North Alabama in streams tributary to the Tennessee river. It groups with *Marg. calceola* Lea, which see.

† *Margaritana monodonta*, Say.(Descriptions of the Shells of North America, Pl. VI as *Unio monodontus*.)

This species was described from the Wabash river. It ranges from Ohio to the Holston and Tennessee rivers, and west to the Mississippi, in Mercer county, Illinois. It is not a common species, and appears to occur locally and not generally between the limits here indicated. It is usually considered to be and distributed as a *Unio*.

† *Margaritana quadrata*, Lea.

(Jour. Phila. Acad. Nat. Sci., 2d Series, Vol. V, Pl. XXXII, Fig. 279.)

Credited only to east Tennessee. The form groups with *Marg. calceola*, which see.

† *Margaritana raveneliana*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. XVII, Fig. 50.)

This form has been credited only to the French Broad and "Swananoë" rivers, North Carolina. It appears to be rare and local. Its affinities are uncertain, unless it be related closely to *Marg. marginata*, which is suspected, though the only specimens seen were badly eroded and hence likely to mislead.

* *Margaritana rugosa*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XIII, Figs. 21a, 21b.)

Ranges from Rideau and Ottawa rivers, Canada, to Eastern New York; to Georgia and Alabama; to Neosho river, Kansas, and north to Wisconsin. Notwithstanding so wide a range the species is very constant in all its characters. It is usually a very abundant form, but west of the Mississippi much less so than eastward. The specimens from north Alabama, (at Tuscumbia) are the largest which have passed in review.

GENUS UNIO.

Outer gill united to the mantle as far as its extremity; inner gill not united to the foot.

Shell equivalve, inequilateral, variable in shape, covered with an olivaceous epidremis; beaks usually eroded (1). Hinge with primary teeth, and with elongated laterals; ligament external, more or less elongated. Pallial impression simple; muscular scars conspicuous. (H. and A. Adams.)

† **Unio abacus**, Haldeman.

(Figured ?)

“Tennessee. No further information is at present attainable.

‡ **Unio aberti**, Conrad.

(Figured ?)

Described from the “Verdigris river, Arkansas.”

† **Unio acuens**, Lea.

(Observations on the Genus Unio, Vol. XIII, Pl. VIII, Fig. 24.)

Holston and Clinch rivers, east Tennessee. This species groups with *Unio clavus*, Lam.

* **Unio æsopus**, Green.

(Figured ?)

Ohio to central Iowa and south to the Tennessee river in north Alabama. Holston river, east Tennessee, at Knoxville, is the most eastern locality reported. This is one of the few species the animals of which are rubiginose, or salmon colored.

† **Unio affinis**, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. XIX, Fig. 26.)

Described from the Red river, at Alexandria, Louisiana. This is the only information recorded concerning the distribution of the species.

(1) An *eroded beak* is certainly not a generic character, and it is not to be presumed the author so considered it. It is usually quite impractical to observe the character of the beaks, since they are eroded and this is probably the meaning intended. Completing this portion of the generic diagnosis it would stand “*beaks undulate concentrically or rugosely apiculate, sometimes smooth.*”

* *Unio alatus*, Say.

(Am. Jour. Sci. and Arts, 1st Series, Vol. XIV, Fig. 17a, 17b. Originally figured in Nicholson's Encyc., Vol. IV, Pl. IV, Fig. 2.)

Ranges from Ottawa river, Canada, to Central New York; to Michigan and St. Peter's (Minnesota) river, in Minnesota; to Big Sioux river, Nebraska; Kansas to east Tennessee, and North Alabama, at Tuscumbia. Very slight differences are presented by this species notwithstanding its wide distribution. It is the type of a group which includes *U. larvissimus*, and *U. gracilis*, all three forms being bialate, and wide in their distribution, but all are very distinct.

(A single valve is reported by Mr. T. H. Aldrich, to have been found at Troy, New York, but no living shells are known from that point.)

† *Unio amœnus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. X, Fig. 12.)

No information concerning this species is accessible beyond that contained in the original description, which locates it in the Holston river, east Tennessee.

† *Unio andersonensis*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. XII, Fig. 33.)

Holston and Clinch rivers, east Tennessee. This form is a member of the group of which *U. edgarianus*, Lea is the type.

* *Unio anodontoides*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. VIII, Fig. 11.)

Distributed commonly from western New York to Flint and Chattahoochee rivers, Georgia; to Trinity river, Texas; north to Kansas, Iowa and Michigan. This is one of the most beautiful *Uniones* in our waters. Its light straw colored, beautifully rayed epidermis serves to distinguish it from all others of similar form. I do not understand exactly how the specific name came to be applied. It resembles an *Anodon'ta* in no respect whatever.

* *Unio apiculatus*, Say.

(Descriptions of the Shells of North America, Plate LII.)

Bayou Teche, Louisiana: the original specimens were obtained from a large pile of the shells of *Gnathodon cuneatus* (*Rangia cyrenoides*) from Lake Ponchartrain. Specimens of the closely related *U. asper*, Lea, from Alabama, have been received bearing the name of this species. *U. speciosus* and *U. forsheyi* also group here. I am not sure that these are all specifically distinct.

† *Unio appressus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. III, Fig. 8.)

Tennessee and Holston rivers, at and above Tusculumbia, Alabama and east Tennessee.

† *Unio approximatus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. V, Fig. 13.)

Red River, Louisiana. This is a member of the *luteolus* group; it is very close to *U. hydianus*, Lea.

† *Unio areaformis*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVII, Fig. 44.)

Clinch, Holston and Cumberland rivers, Tennessee, the last named being the original locality.

† *Unio aretiar*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. IV, Fig. 10.)

Ohio and Coosa rivers. This so-called species is synonymous with *U. gibbosus*, Barnes, from the type of which it differs only in the white nacre.

† *Unio argenteus*, Lea

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XXV, Fig. 57.)

Holston river and Conasauga Creek, east Tennessee, and Armuchee and Swamp creeks, northwest Georgia. This species is a member of a very numerous group illustrated by *U. glandaceus*, *U. verus*, *U. instructus*, *U. oviformis*, *U. estabrookianus*, *U. troschelianus* and others. This, together with the *rubiginosus*, *clavus* and *novi-eboraci* groups, presents a very considerable portion of the synonymy of our *Uniones*.

† *Unio arkansensis*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2d Series, Vol. V., Pl. XXX, Fig. 275.)

"Hot Springs, Arkansas." This is the only information at present attainable regarding this species, which appears to be rare.

† *Unio arquatus*, Conrad.

(Figured ?)

"Wabash River, Indiana." No specimens have passed under notice.

* *Unio asperimus*, Lea,

(Trans. Am. Phil. Soc., Vol. IV., Pl. V. Fig. 3.)

Ranges from Ohio to the Big Sioux River, Nebraska, south to Trinity river, Texas. The form is synonymous with *U. lachrymosus*, which see.

* *Unio atrocostatus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X. Pl. II, Fig. 5.)

Alabama and Coosa rivers, Alabama, to Cherokee Nation, Indian Territory and Red river, at Alexandria, Louisiana—the last mentioned being the original locality. It groups with *U. undulatus* (the type of the group) *U. laticostatus*, *U. plicatus*, *U. perplicatus*, *U. hippopus*, and others, some of which are certainly synonymous.

† *Unio barnesianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. X., Fig. 26.)

Cumberland river, Tennessee. A species belonging in the group typified by *U. bigbyensis*.

† *Unio bellulus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. XVII, Fig. 48.)

Holston and Tennessee rivers, from Muscle Shoals upwards. Belongs to a group which includes *U. mundus* and similar closely related forms.

† *Unio biangulatus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. IX, Fig. 8.)

Caney Fork, Holston and Elk rivers, Tennessee. In the Holston the species is very abundant. It is a member of a very large group, of which *U. ligamentinus* may be considered the type.

† *Unio biemarginatus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. VI, Pl. XVI, Fig. 45.)

Tennessee river, at Florence, northwest Alabama, the only locality yet reported. The species is apparently synonymous with *U. perplexus*, Lea—the type of the group with which it belongs.

† *Unio bigbyensis*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. VIII, Pl. XXII, Fig. 51.)

Central (Maury county), and south (Elk river), Tennessee.

† *Unio bournianus*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. VIII., Pl. XV, Fig. 28.)

“Scioto river, Ohio.” This species belongs in the group typified by *U. edgarianus*, Lea.

† *Unio brevidens*, Lea.

(Trans. Am. Phil. Soc., Vol. IV. Pl. VI, Fig. 6.)

Clinch, Cumberland, Powell’s, Holston and Tennessee rivers, Tennessee. It is the type of a group including *U. compactus*, *U. penitus* and *U. lentior*, among others. Described from the Cumberland.

† *Unio brevis*, Lea.(Observations on the Genus *Unio*, Vol. XIII. Pl. XII, Fig. 32.)

Conasauga creek, east Tennessee, and Tennessee river, north Alabama. Groups with *U. argenteus*.

† *Unio celatus*, Conrad.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. XXV, Pl. I, Fig. 2.)

Powell’s, Clinch, Holston, Elk, and Tennessee rivers, Tennessee.

† *Unio caliginosus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. VII, Fig. 21.)

Red River, Louisiana—the original locality—: Arkansas to Devil’s river, Texas.

† *Unio callosus*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. VIII., Pl. XXIII, Fig. 54.)

Described from the Ohio canal, at Columbus. No other localities yet reported.

† *Unio camelopardilis*, Lea.

(Jour. Acad. Nat. Sci. Phila. Vol. IV, Pl. LIX, Fig. 180.)

Tennessee drainage of north Alabama. Rare and local.

† *Unio camelus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. XV, Fig. 45.)

Ohio to north Alabama. Probably synonymous with *U. phascolus*, which see.

* *Unio camptodon*, Say.

(Descriptions of the shells of North America, Pl. XLII.)

Ohio to Alabama; to Little Wachita river, Texas; north to Kansas. This species is not far from *U. manubius*, Gould, if indeed it be not indetical. It is the type of a group which includes *U. tetralasmus*, *U. symmetricus*, and *U. declivis*,—the first named being, probably, a synonym. Say's figure, to which reference is given above, does not well represent this species as it is usually found.

* *Unio capax*, Green.(Trans. Am. Phil. Soc., Vol. V, Pl. IV, Fig. 12, as *Symphynota globosa*, Lea.)

Ohio river, near Cincinnati, to eastern Iowa,—in the Mississippi river, at Muscatine. This form groups with *U. ventricosus*, Barnes, which see.

† *Unio caperatus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. V, Fig. 14.)

Powell's, Clinch and Holston rivers, Tennessee. It groups with *U. dromas*, Lea.

† *Unio capillaris*, Lea,

(Trans. Am. Phil. Soc., Vol. V, Pl. II, Fig. 2.)

"Ohio." No further information is attainable.

† *Unio capsaeformis*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. II, Fig. 4. The specimen figured is a male.)

Asheville, North Carolina; Holston, Clinch, Cumberland and Tennessee rivers, Tennessee. This form groups with *U. perplexus*, and is not far removed from it.

† *Unio chattanoogaensis*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series, Vol. IV, Pl. XXV, Fig. 10.)

Tennessee river, at Chattanooga; Etowah and Oostanaula rivers, at Rome, Georgia; Coosa, Cahawba, and Alabama rivers, Alabama. This is a member of the *clavus* group, the synonymy of which is very great. See under *Unio clavus*, Lea.

† *Unio cincinnatiensis*, Lea.

(Trans. Am. Phil. Soc. 2nd Ser., Vol. VIII. Pl. VIII. Fig. 4.)

This, a member of the group of *U. perplexus* with which it is probably synony-

mous, was described from the Ohio river, at Cincinnati. No other locality has been reported.

† *Unio circulus*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. IX, Fig. 14.)

Ritchie county, West Virginia, to Indiana; south to Tennessee, in the Holston at Knoxville. This species is the type of a group which includes *U. unicolor*, *U. castaneus*, and *U. lens*, all of which are believed to be synonymous.

† *Unio circumactus*, Lea.

(Observations on the Genus Unio, Vol. XIII, Pl. IV, Fig. 11.)

Tennessee and Holston rivers. A member of the *thorntonii* group of *Uniones*.

† *Unio clarkianus*, Lea.

(Trans. Am. Phil. Soc., 2nd Ser., Vol. X, Pl. XXI, Fig. 30.)

"William'sport, Tennessee," and in Chattooga river, north-west Georgia. *U. gerhardtii* is probably synonymous. The species is a member of the group of *U. ligamentinus*.

† *Unio clavus*, Lam.

(Trans. Am. Phil. Soc., Vol. III, Pl. XII, Fig. 23, as *U. patulus*, Lea.)

This species has a very wide distribution east of the Mississippi river, ranging from Illinois to western Pennsylvania, and south to Alabama and Tennessee. It is a very variable form and typifies a group which includes—some being synonymous—*U. decus*, *U. concolor*, *U. consanguineus*, *U. pallidofulvus*, *U. interventus*, *U. crebrivittatus*, *U. chattanoogaensis*, *U. anaticulus* and *U. curtus*. *Unio patulus*, Lea, is certainly synonymous, and reference has been given to Lea's figure of that species as a good illustration of *U. clavus* as usually received from correspondents.

† *Unio clinchensis*, Lea.

(Jour. Acad. Nat. Sci. 2nd Series Vol. VI, Pl. XXXVII, Fig. 91.)

Clinch, French Broad, Holston and Duck rivers, Tennessee. It forms a member of the *cuneolus* group.

† *Unio coccineus*, Hildreth.

(Trans. Am. Phil. Soc., Vol. VI, Pl. V, Fig. 12.)

Ranges from western New York to Kansas; south to the Holston river, Tennessee. It is frequently confused with flattened forms of *rubiginosus*, by collectors. A variety from the Ohio river was described as *U. gouldianus*, Ward.

† *Unio compressissimus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. VIII, Fig. 23.)

Holston river, Tennessee. Is this more than a variety of *Unio phaseolus*?† *Unio conasaugensis*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. X, Fig. 30.)Conasauga creek, in east Tennessee, and Swamp creek, Whitfield county, Georgia. Very close to *U. argenteus* Lea.† *Unio conradianus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. IX, Fig. 23.)

Southeastern Virginia; Asheville, North Carolina; Powell's and Holston rivers, Tennessee. This species belongs to the group of which *U. acutissimus* is the type. *U. penicillatus* and *U. rubellinus* also group with this species.The species was described and figured as *U. conradicus*.* *Unio cooperianus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. VIII, Fig. 21.)

Ohio river, near Cincinnati, to Mississippi river, near Muscatine, Iowa; south to the Holston and Tennessee rivers. This species belongs to the group typified by *U. pustulosus*, Lea.† *Unio copei*, Lea.

(Jour. Acad. Nat. Sci., Phila., 2nd Series, Vol. VI, Pl. XLVII, Fig. 120.)

"Holston river, Smyth county, Virginia," is the only locality reported. The species is very close to *U. pybasii*, grouping with it and *U. obscurus*.† *Unio cor*, Conrad.

(New Fresh Water Shells of the United States, Pl. III, Fig. 3.)

Elk and Flint rivers, Tennessee.

* *Unio cornutus*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. IV, Fig., 5a, 5b.)

Ohio to Etowah rivers, Georgia; Coosa river, Alabama, at Wetumpka; Alabama river, at Selma; to Trinity river, Texas; north to Kansas, Iowa, and Minnesota. This species constantly maintains its own well known characters throughout its wide distribution. There is no other form closely resembling it.

* *Unio crassidens*, Lamarck.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XVI, Fig. 34. This is Lea's *Unio incrassatus*, which is believed to be equivalent to the *crassidens* of Lamarck.)

Alleghany river, Pennsylvania, to Iowa; to Tennessee, in the Holston, at Knoxville; Etowah, Oostanaula and Chattahoochee rivers, Georgia; Alabama, Tennessee, Cahawba and Black Warrior rivers, Alabama. In the last named stream the species is very abundant at Tuscaloosa, and also at the Jefferson coal mines, in Jefferson county. The largest specimens seen came from the Alabama, at Selma, and the Ohio, at Cincinnati.

† *Unio creperus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. X, Fig. 28.)

"Tennessee." There is nothing further on record concerning this form.

† *Unio crudus*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. IV, Fig. 10.)

Clinch river, Tennessee, and Chattooga river, north Georgia. Groups with those forms which are typified by *U. argenteus*.

† *Unio cumberlandicus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. VII., Fig. 19.)

"Cumberland river, Tennessee." This species belongs to the group of *U. iris*, which see.

† *Unio cuneolus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. VII, Fig. 3.)

Powell's, Clinch and Holston rivers, Tennessee. Belongs to the group of *U. bigbyensis*.

* *Unio cylindricus*, Say.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. XIV, Pl. I, Figs. 13a, 13b.)

Ohio to Kansas; Tennessee, in the Holston; Alabama, in the Tennessee river, near Florence. This is a very persistent type of a group of curiously tuberculate *Uniones* which includes *U. metanevrus*, *U. wardii*, and *U. tuberosus*.

The species was originally figured in Nicholson's Encyc. American edition, Vol. IV, Pl. IV, Fig. 3. The figure given in Barnes' paper, and referred to above, is very characteristic of the form.

† *Unio cylindrellus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol VI, Pl. XLVIII, Fig. 121.)

Duck Creek, Tennessee, northwest Georgia, and north Alabama. This is a member of the group of *U. glans*, with which it is synonymous.

† *Unio daetylus*, Lea

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. IX, Fig. 7.)

"Caney fork, Tennessee?" Can add no further information.

* *Unio declivis*, Say.

(Descriptions of the Shells of North America, Pl. XXXV.)

Shoal creek, Alabama, to Bayou Teche, Louisiana. See under *U. campton*.

† *Unio depygis*, Conrad.

(Figured?)

"Harpeth river, Tennessee." Further information upon this species is very much desired.

† *Unio deviatius*, Anthony.

(Figured?)

"Tennessee." I can add no information concerning this species except that it belongs to the group of *perplexus*.

† *Unio difficilis*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series, Vol. VI, Pl. XLIX, Fig. 124.)

Headwaters of the Holston river, in Virginia.; and north Georgia.

† *Unio dispansus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. VI. Fig. 16.)

East Tennessee. Doubtfully attributed by Mr. Lea to the Holston river.

† *Unio dollabelloides*, Lea.

(Trans. Am. Phil. Soc., 2nd Series. Vol. VIII, Pl. XV, Fig. 31.)

"Holston river, Tennessee." This species is a member of the *cuneolus* group.

* *Unio donaciformis*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. IV, Fig. 3.)

Ranges from Ohio to Kansas, and north to Michigan and Wisconsin. This is

the type of a group which includes *U. zigzag* (its synonym,) *U. elegans*, and *U. lumarekianus*.

† *Unio dorfeuillianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XVII, Fig. 54.)

From the Ohio river to Kansas river, at Topeka; south to Trinity river, Texas. This species is a member of the *pustulosus* group of *Uniones* from the type of which it is not far removed.

† *Unio dromas*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. X, Fig. 29.)

Cumberland and Holston rivers, Tennessee. It is very close to *U. caperatus*, with which it groups.

* *Unio ebenus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. IX, Fig. 14.)

Ohio to Alabama river, at Selma; to Kansas; to Minnesota, Mississippi river. *U. globatus*, *U. subglobatus*, *U. lescuerianus*, and *U. subrotundus*, among others, group with this form, and of them some may prove to be synonymous.

† *Unio edgarianus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XV, Fig. 30.)

Clinch, Powell's and Holston rivers, Tennessee. This species may be considered the type of a rather large group which includes, with others, *U. obuncus*, *U. andersonensis*, *U. flavidus*, and *U. tuscumbiensis*. The group apparently offers some interesting synonymy.

* *Unio elegans*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. IX, Fig. 13.)

From western New York to Nebraska; to Neosho and Verdigris rivers, Kansas. It is a fairly common species at all points where it occurs. Some of the Kansas specimens are the largest and finest seen. Groups with *U. donaciformis*.

* *Unio ellipsis*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. IV, Fig. 4.)

Ottawa river, Canada; western New York; to Kansas; north to Minnesota. The original specimens, forming the basis of description, came from the Ohio river. *U. pealti* groups here, and is a synonym.

† *Unio estabrookianus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. VI, Fig. 17.)

Clinch, Holston, and Elk rivers, Tennessee. Groups with *U. argenteus*, which see.

† *Unio fabalis*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. X, Fig. 16.)

Ohio, Indiana, and Tennessee. Say's *U. lapillus* is synonymous with this species.

† *U. fascians*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series, Vol. VI, Pl. XLVII, Fig. 118.)

Holston river, Virginia and Tennessee; Chattooga river, north Georgia. This species is a member of that very extensive group typified by *U. argenteus*.

† *Unio fatuus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XI, Fig. 14.)

“Holston river, east Tennessee. Groups with *U. iris*, which see.

† *Unio flavidus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. 9, Fig. 25.)

Clinch, Holston and Tennessee rivers. This so-called species is very close to *U. tuscumbiensis* being a member of the same group. See under *U. edgarianus*, Lea.

† *Unio florentinus*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2d Series, Vol. V., Pl. V, Fig. 213.)

Tennessee river, Alabama, near Florence, probably Muscle Shoals. A female of this form, from the Cumberland river, Tennessee, bearing the identification of the author of the species, has passed in review. It groups with *U. perplexus*, Lea.

† *Unio foliatus*, Hild.

(Figured ?)

Described from the Ohio river. Specimens have been submitted from the Holston river, at Knoxville, Tennessee.

* *Unio forsheyi*, Lea.

(Jour. Phila. Acad. Nat. Sci., 2d Series, Vol. V. Pl. LX, Fig. 182.)

Indian Territory to Texas; east to Big Prairie creek, Alabama. See under *U. lachrymosus*, Lea, with which the species groups.

* *Unio fragosus*, Conrad.

(Mongraph of Unio, Pl. VI, Fig. 2.)

Ranges from the Ohio river to Fall river, Elk county, Kansas. The species is often received as *U. asperrimus*, Lea, to which it bears a close resemblance. It groups with *U. lachrymosus*, Lea.

† *Unio fucatus*, Lea.

(Jour. Acad. Nat. Sci. Phila., Pl. LIX, Fig. 178.)

"North Alabama," the original locality; Elk river, a tributary to the Tennessee, but whether in the Alabama portion of its course is not known. Belongs to the group of which *U. iris* is the type.

‡ *Unio fulgidus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. IV, Fig. 10.)

This species, a member of the *tumescens* group, was described from the Red river, at Alexandria, Louisiana, the only locality yet known.

† *Unio gibber*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. X, Fig. 30.)

Caney Fork, Tennessee, a tributary to the Cumberland. Is this more than a variety of *U. crassidens*, Lamarek?

* *Unio gibbosus*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XI, Fig. 12.)

Ottawa river, Canada; central New York, Mohawk river; south to Bluestone river, Virginia, and Tuscumbia, Alabama; Kansas; north to Minnesota. See under *U. arctior*, Lea. The species is frequently received bearing the name of *U. rectus*, Lamarek, from which it is readily to be distinguished by the coarse character of the undulations on the umbones.

† *Unio glaber*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. X., Fig. 29.)

This is a member of the *iris* group, was described from the Holston river, Tennessee, and has not been reported from elsewhere.

* *Unio glandaceus*, Lea.

(Jour. Acad. Nat. Sci. Phila. Vol. V, Pl. IX, Fig. 226.)

This species was described from the Cahawba river, Alabama. Specimens credited to Arkansas, by Dr. Lea, and collected by Prof. B. Powell, have passed in review. See under *U. argenteus*, Lea.

† *Unio glans*, Lea.

(Trans. Am. Phil. Soc., Vol. IV., Pl. VIII, Fig. 12.)

Ohio and Indiana, south to the Kentucky and Green Rivers, and Tennessee drainage system. *U. corrunculus*, Lea, of Alabama and Georgia, appears to be closely related to this species

† *Unio globatus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. I, Fig. 1.)

Credited to the Holston river, in east Tennessee and to the Etowah river, in north Georgia. See under *U. ebenus*, Lea.

* *Unio gracilis*, Barnes.

(Figured ?)

This species has a wide range from Ottawa river, Canada; to Central New York; Tuscumbia, Alabama, in the Tennessee river and Spring creek; to Michigan; Kansas; and south to Texas. It is one of the few alate species of *Unio*. See under *U. alatus*, Say.

‡ *Unio grandidens*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series Vol. V, Pl. XXX, Fig. 274.)

Hot Springs, Arkansas, the only reported locality. It belongs to the *pustulosus* group, and is not far removed from *U. cooperianus*, Lea.

* *Unio graniferus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIX, Fig. 60.)

Ohio to Iowa, Mississippi river. The species been often received under the name of *U. verrucosus*, Barnes, but is an entirely distinct form. Both are related to the *pustulosus* group, but distinguished readily by their purple nacre.

† *Unio habetatus*, Conrad.

(Figured ?)

“Missouri.” No further information is at present accessible.

* *Unio haleianus*, Lea.

(Trans. Am. Phil. Soc. 2d Series, Vol. VIII, Pl. XXVII, Fig. 63.)

Described from the Mississippi river, at New Orleans. Specimens have been received from Mr. Lea credited to the Indian Territory.

† *Unio haysianus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. III, Fig. 7.)

Described from the Cumberland river, Tennessee. It occurs also, in the Tennessee, Powell, Clinch, and Holston rivers. *U. sowerbyanus*, Lea, is probably synonymous.

† *Unio higginsii*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. V, Pl. XXIV, Fig. 258.)

Described from the Mississippi river, at Muscatine, Iowa, ranging thence to the Little Blue river in Kansas. If *U. orbiculatus*, Hildreth, and this form be identical, which is believed to be the case, then *higginsii* is a synonym, and the range of *orbiculatus* considerably increased. Say also described this form under the name of *U. abruptus*. See “Descriptions of the Shells of North America,” Pl. XVII.”

† *Unio holstonensis*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XV, Fig. 27.)

This form which groups with *U. cuneolus*, was described from the Holston river, in east Tennessee, and has been reported from no other locality.

† *Unio hydianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. VI, Fig. 14.)

This form, originally described from the Bayou Teche, Louisiana, ranges west to the Indian Territory and south to Trinity river, Texas. It is synonymous with *U. luteolus*, Lamarek, which see.

† *Unio intermedius*, Conrad.(Monograph of *Unio*, Pl. XXXV, Fig. 2.)

Described from the Nolachucky river, Tennessee. It occurs also in the Clinch

and Holston rivers, Tennessee, and in the Tennessee river, near Tuscumbia, north Alabama

† *Unio interruptus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. VI, Fig. 15.)

Harpeth river, Tennessee. This species is a member of the *ligamentinus* group.

† *Unio iris*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. IX, Fig. 18.)

This species ranges from western New York to Michigan; to Illinois; and south to Rock Castle creek, Kentucky. *U. novi-eboraci*, Lea, is probably a synonym, but not the sole one. The form may be considered the type of a considerable group which, among others, includes *U. novi-eboraci*, *U. muhlfieldianus*, *U. simus*, *U. zeiglerianus*, and *U. cumberlandianus*. The type came from the Ohio river, near Cincinnati.

† *Unio irroratus*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. V, Fig. 5.)

The type upon which this species is based came from the Ohio river, near Cincinnati. Thence it ranges to Illinois; south to Tuscumbia, Alabama, and Holston river, east Tennessee.

† *Unio jonesii*, Lea.

(Jour. Acad. Nat. Sci. Phil., Vol. IV, Pl. LIV, Fig. 164.)

The locality of the type of this species is Eularlee creek, Georgia. It occurs in Swamp creek, north Georgia; at Asheville, North Carolina; in creeks, Monroe county, Tennessee; and in the Elk river, north Alabama. It is a member of the *iris* group.

† *Unio kirtlandianus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. XIV, Fig. 41.)

The type of this species—which is closely related to *U. coccineus*, Hildreth—was derived from the Mahoning river, Ohio. Examples have been seen credited to Grand river, Michigan, and Waukesha, Wisconsin.

† *Unio lachrymosus*, Lea.

(Trans. Am. Phil. Soc., Vol. III Pl. VI, Fig. 8.)

Ohio river, near Cincinnati, to Kansas river, at Topeka. The most northerly

locality noted is the Red river of the North at Pembina. *U. asperrimus*, Lea, is a synonym. Here, also, group *U. fragosus*, *U. speciosus*, *U. forsheyi*, and *U. apiculatus*.

* *Unio laevisissimus*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. XIII, Fig. 23. As *Symphynota laevissima*.)

Ohio to Nebraska; Kansas; to Trinity river, Texas. See under *U. gracilis*, Barnes.

† *Unio lamareckianus*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. X., Pl. XVII, Fig. 20.)

Caddo and Washita rivers, Arkansas. Belongs in the group of *U. irroratus*.

† *Unio lawi*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. 2, Fig. 4.)

East Tennessee and North Alabama. This species is a member of the *clavus* group, and is confined to a comparatively small area in the Tennessee drainage system.

† *Unio lenior*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, P. XII, Fig. 18.)

This, a member of the *perplexus* group, was described from Stone river, Tennessee, and has not elsewhere been found.

† *Unio lens*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. V+II, Fig. 10)

Ohio and Indiana; Elk river, Tennessee. This form is a synonym of *U. circulus*, which see.

† *Unio lenticularis*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. IX, Fig. 27.)

Described from the Tellico river, east Tennessee. Specimens have been received from Coal creek, Anderson county, Tennessee. The species groups with *U. argenteus*.

† *Unio lesleyi*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. IV, Pl. LVIII, Fig. 177.)

Kentucky and Tennessee. Groups with *U. clavus*.

† *Unio leseuerianus*, Lea.

(Trans. Am. Phil. Soc., 2nd Ser., Vol. VIII, Pl. VIII, Fig. 6.)

The type of this species came from the Holston river, east Tennessee. It ranges from Asheville, North Carolina, to near Tusculumbia, Alabama. See under *U. ebenus*, Lea.

* *Unio ligamentinus*, Lamarek.(American Conchology, Pl. VIII, as *U. crassus*, Say. Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XI, Fig. 20 As *U. carinatus*, Barnes.)

This species has a wide distribution and is the type of a rather large group. The extremes of distribution, noted thus far, are western New York to North Alabama; to south-western Kansas; north to St. Paul, Minnesota. In almost every considerable stream throughout this vast range it is a very common shell. A very peculiar dwarfed form occurs abundantly in the Holston river, Tennessee, and in the Tennessee river, Muscle Shoals, Alabama. It is also extra-limital, being found at Racine, Wisconsin, in streams flowing into Lake Michigan, and hence in the Atlantic drainage. Among the forms belonging to the group of which this species is the type are *U. pictus*, *U. menkianus*, *U. lindsleyi*, *U. clarkianus*, *U. bilingulatus*, *U. punctatus*, *U. pulcher*, *U. interruptus*, *U. upsoni*, and *U. perdix*, some of which do not appear to be far enough removed from one another to take specific rank.

* *Unio lindsleyi*, Say.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. IV, Pl. LVIII, Fig. 176.)

"Tennessee." See under *U. ligamentinus*, Lamarek.

‡ *Unio linguæformis*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. IV, Pl. LVI, Fig. 170.)

French Broad river, Tennessee, and Chattahoochee river, Georgia. It is very close to *U. tener*, Lea, forming a member of the same group.

Unio lunulatus, Pratt.

(Proc. Davenport Acad. Nat. Sci., Vol. I, Pl. XXXI, Fig. 1.)

This form was described from the Mississippi river, at Davenport, Iowa. It groups with *U. lachrymosus*, and is, perhaps, synonymous.

* *Unio luteolus*, Lamarek.

(Nat. Hist. of New York, Vol. V, Part I, Mollusca. Pl. XX, Fig. 241. Also, in Am. Jour. of Sci. and Arts, 1st Series. Vol. VI, Pl. XIII, Fig. 15. As *U. stliquoides*, Barnes.)

This is probably the most widely distributed *Unio* in North America. The extreme northeastern stations, from which specimens have been seen, are the Rideau canal and Ottawa river, Canada, near Ottawa. It ranges thence to western and central New York, to West Virginia. The most southwestern localities reported are the San Antonio and San Saba rivers, in Texas. The most northern localities authenticated by specimens are the Red river of the North, at Pembina, Lake Winnipeg, and Moose river, near Hudson's Bay. A depauperate form was collected abundantly by Lieut. Beale, in Texas, which presents a greater degree of variation than exists between many other *Uniones* known under various specific names. A beautifully rayed variety, occurring in the Ohio, in northern Indiana and in the smaller lakes of Michigan and Wisconsin was made the subject of specific diagnosis by Mr. Anthony under the name of *Unio distans*. A more cylindrical and somewhat larger form, common in Ohio, Illinois, Iowa and Kansas, received from Mr. Barnes the name of *Unio siliquoides*. The range of variation which this species presents is more than paralleled by others which are types of groups of wide distribution—notably *U. pustulosus*, *U. rubiginosus*, *U. undulatus*, and *U. complanatus*. This last named form ranges from Nova Scotia to southeastern Alabama, is peculiar to the Atlantic drainage, and is known by some sixty names between these limits. It presents some of the most remarkable synonymy in the whole family. In this, more than in any other group of *Uniones*, perhaps, have species been multiplied by the exaggeration of superficial differences and by a failure to recognize the equally or more apparent important resemblances.

† *Unio lyonii*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XXXII, Fig. 74.)

This, a member of the *argenteus* group, has been reported only from east Tennessee.

† *Unio maculatus*, Conrad.

(New Fresh Water Shells of the United States, Pl. IV, Fig. 4.)

“Elk and Flint rivers, tributaries to the Tennessee.”

† *Unio mæstus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XXVI, Fig. 6a.)

“French Broad river, east Tennessee.”

† *Unio menkianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XIX, Fig. 5a.)

This species, which is a member of the *ligamentinus* group, was described

from the Harpeth river, Tennessee and no other localities have yet occurred. See under *Unio ligamentinus*, Lamarck.

† *Unio meredithii*, Lea.

(Observations on the Genus *Unio*, Vol. VIII, Pl. VI, Fig. 214.)

The original locality of this species was the Tennessee river, near Tuscumbia, Alabama. Specimens have been taken in Spring creek, at Tuscumbia. It belongs to the group of *argenteus*, and is rather close to *estabrookianus*.

* *Unio metanevrus*, Rafinesque.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. VI, Figs. 7a, 7b, as *Unio nodosus*, Barnes.)

The orthography of this word is unsettled, usage often sanctioning *metanevrus*. This shell is a member of the group which includes *U. tuberosus*, *U. wardii*, and *U. cylindricus*. Its range is from the Ohio south to the Coosa and Alabama rivers, Alabama; to Neosho and Elk rivers, Kansas; and north to Lake Pepin, Mississippi river.

* *Unio mississippiensis*, Conrad.

(Figured ?)

This form was described from the lower Mississippi. It is synonymous with *U. subrostratus*, Say, which see.

† *Unio monodontus*, Say.

See under *Margaritana monodonta*, Say.

† *Unio mooresianus*, Lea.

(Jou. Acad. Nat. Sci. Phila. Vol. VI, Pl. XIV, Fig. 37.)

Clinch, Holston and Tennessee rivers, above Tuscumbia, Alabama. This form belongs to the group represented by *U. thurtonii*, and is possibly synonymous with the type of the group.

† *Unio muhlfieldianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XII, Fig. 36.)

"Cumberland river, Tennessee." This is a member of the *iris* group, which see.

*** *Unio multiplicatus*, Lea.**

(Trans. Am. Phil. Soc. Vol. IV. Pl. IV, Fig. 2. Soft parts figured in Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. IV, Pl. XXX, Fig. 105.)

Ohio river to Alabama river, at Selma; to Trinity river, Texas; to Neosho, river, Kansas; to Mississippi river, at Davenport, Iowa. This is the type of a group which includes, among others, *U. eightsii* and *U. boykinianus*, both of which should be considered synonymous with it. Indeed, it is a matter of doubt whether all of the plicate forms should not group under *plicatus* as the type of the group. See under *U. plicatus*.

† *Unio multiradiatus*, Lea.

(Trans. Am. Phil. Soc., Vol. III. Pl. IX, Fig. 15.)

Ranges from Ohio to Michigan and Illinois; south to Green river, Kentucky and Duck river, Tennessee. In east Tennessee, at Asheville, North Carolina, and at Tuscumbia, Alabama, occurs a form, probably synonymous, which has received the name of *U. perradiatus*, Lea.

† *Unio mundus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XIV, Fig. 38.)

Tuscumbia, Alabama, in Tennessee river. See under *U. clavus*, Lamarek, with which it groups.

*** *Unio mytiloides*, Rafinesque.**

(Am. Jour. of Sci. and Arts, 1st Series, Vol. XXV, Pl. I, Fig. 7.)

Ohio river at Marietta, to the Mississippi river, at Muscatine, Iowa. This is a member of a group of wide distribution embracing *U. plenus*, *U. pyramidatus*, *U. obliquus*, and *U. solidus*.

*** *Unio nashvillensis*, Lea.**

(Trans. Am. Phil. Soc. Vol. VI., Pl. XIV, Fig. 43.)

Described from the Cumberland river, at Nashville, Tennessee. It is synonymous with *U. subrostratus*, Say, which see.

† *Unio neglectus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. IX, Pl. XLII, Fig. 10.)

“North Alabama.” No other information has been attainable.

* *Unio nigerrimus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XVIII, Fig. 23.)

Described from the Red river, at Alexandria, Louisiana. See *U. subrostratus*, Say.

† *Unio nitens*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XII, Fig. 19.)

“Long creek, Cocke county, Tennessee.” This form appears to group with *U. obscurus* and *U. pybasii*.

† *Unio notatus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. VIII, Fig. 22.)

This species—a member of the *iris* group—was described from the Cumberland river, Tennessee, and has not yet been found elsewhere.

† *Unio novi-eboraci*, Lea.

(Trans. Am. Phil. Soc., Vol. VI Pl. XXIV, Fig. 114. Also Natural History of New York, Part I, Vol. V, Mollusca, Pl. XX, Fig. 240.)

Ranges from central New York to Michigan, Wisconsin, and Illinois. See under *U. iris*, Lea.

* *Unio obliquus*, Lamarek.

(Figured ?)

This form is the type of a group of *Uniones*, which includes *U. mytiloides* and the other species named in connection therewith. It is rather commonly distributed from the Alleghany river to Tusculumbia, Alabama, Muscatine, Iowa, and St. Peter's river, Minnesota.

† *Unio obscurus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. III, Fig. 7.)

Cumberland river, at Nashville, Tennessee. Groups with *U. nitens*, Lea, and *U. pybasii*, Lea.

† *Unio obuncus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. II, Fig. 5.)

The distribution of this form, which is a member of the *edgarianus* group, is quite local and confined to the drainage of the Tennessee at and below Knoxville to Muscle Shoals.

* *Unio occidentens*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. X, Fig. 16.)

This species has a very wide range, is common wherever it occurs, and is a member of the large group typified by *U. ovatus*, Say. It ranges from Ottawa river, Canada, to Western New York, Pennsylvania and Ohio; southwest to Indian Territory and north to Nebraska and Minnesota. In the belief that this form is synonymous with *U. ventricosus* Barnes, that name has been affixed to all specimens distributed by the reporter. Say evidently so regarded it inasmuch as his figure of *ventricosus* (Descriptions of the shells of North America, Pl. XXXII.) appears to be identical with Lea's figure of *occidens*. The beautifully rayed specimens, such as served for the illustrations of both Say and Lea, are exceptionally rare, and do not represent the form as commonly found. With this form group *U. capax* and *U. canadensis*.

† *Unio occidentalis*, Conrad.(Monograph of *Unio*, Pl. XXXVI, Fig. 1.)

“Currant river, Arkansas.”

* *Unio orbiculatus*, Hildreth.(For illustration reference see *U. higginsii*, Lea.)

Ranges southwest from the Ohio to the Cumberland, west to Davenport, Iowa, and Blue river, Kansas. See under *U. higginsii*, Lea. *U. pinguis* groups here, and is probably synonymous.

† *Unio ovatus*, Say.(Am. Jour. of Sci. and Arts, 1st Series, Vol. XIV, Pl. I, Figs., 21a, 21b. Also well figured by Lea as *U. excavatus*.)

This is the type of a very large group of widely distributed *Uniones*. It ranges from the Alleghany river to Central New York and south to the Tennessee and Holston rivers. In the Black Warrior, Alabama, Cahawba and Coosa rivers, Alabama, is a very closely related form, which passes under the name of *U. excavatus*.

† *Unio oviformis*, Conrad.

(New Fresh Water Shells of the United States, Pl. III, Fig. 6.)

Clinch river, Tennessee. It belongs to the group of *argenteus*.

* *Unio parvus*, Barnes.

(Jour. Acad. Nat. Sci. Phil., Vol. IV., Pl. XXIX, Figs. 102, 102a; soft parts here figured.)

Western New York to Tusculum, Alabama; to Jackson, Mississippi; to Indian Territory and Kansas; to Lake Pepin, Mississippi river. This species is the type of a group, two members of which are *U. cromicellii*, and *U. paulus*.

† *Unio patulus*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. XII, Fig. 20.)

Alleghany, Ohio and Scioto rivers; Holston river, Tennessee. This form is identical with *U. clavus*, Lamarek, which see for further synonymy.

† *Unio pattinoides*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. VIII, Fig. 23.)

Clinch and Holston rivers, east Tennessee. This form is a member of the *clavus* group, and is close to *U. mundus*, Lea.

‡ *Unio pealii*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. VIII, Fig. 23.)

Kansas river, at Topeka. Belongs with *U. ellipsis*, from which it is quite clearly not distinct.

† *Unio pectorosus*, Conrad.

(New Fresh Water Shells of the United States, Pl. VI, Fig. 19.)

A species of the *ovatus* group, from the Elk and Tennessee rivers, Tennessee.

† *Unio perdis*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. XI, Fig. 31.)

Harpeth and Elk rivers, Tennessee. This *Unio* is a member of the *ligamentinus* group, and is very close to *U. pictus* and *U. mentanus*, which see.

Unio pernodosus, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. III, Fig. 8.)

From western North Carolina. This shell groups with *U. pustulosus*, and has many points of resemblance to *U. cooperianus*, Lea.

† *Unio perplexus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVII, Fig. 42.)

Ohio and Indiana to the Clinch, Holston and Tennessee rivers. This is the type of a considerable group, most forms of which are probably synonymous, in-

cluding *U. capsæformis*, *U. turgidulus*, *U. rangianus*, *U. sampsonii*, *U. stewardsonii* and others.

† *Unio perpictus*, Lea.

(Jour. Acad. Nat. Sci. Phil., Vol. IV, Pl. LVIII, Fig. 175.)

Holston and Bull rivers, Tennessee. This is a member of the *iris* group, and appears to be synonymous with its type.

* *Unio perplicatus*, Conrad.

(Figured ?)

This form, which ranges from Jackson, Mississippi, to the Red river, in Arkansas, is a member of the *undulatus* group, which see.

† *Unio perpurpureus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. VI, Pl. XVI, Fig. 44.)

"Tennessee." No other information is available.

† *Unio perradiatus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. V, Pl. VI, Fig. 215.)

French Broad river, North Carolina, Holston and Tennessee rivers, Tennessee, and Tennessee river, near Tusculumbia, Alabama. See under *U. multiradiatus*, Lea.

† *Unio personatus*, Say.

(Figured ?)

"Wabash river, Indiana." A member of the *perplexus* group.

‡ *Unio petrinus*. Gould.

(Figured ?)

Southeast Kansas to Trinity and Brazos rivers, Texas.

* *Unio phaseolus*, Hildreth.

(Trans. Am. Phil. Soc., Vol. III, Pl. IX, Fig. 13, as *U. planiatus*, Lea; also Descriptions of the Shells of North America, Say, Pl. XXII.)

Western New York to North Carolina, in the French Broad river; Tennessee and Alabama, in the Elk, Clinch, Holston and Tennessee rivers; Indian Territory, Kansas, Minnesota, Michigan, and intervening states. The Clinch river form is Lea's *U. camelus*, which see. This species is the type of a group which includes *U. camelus*, *U. trinacris*, *U. woodwardianus*, and *U. formanianus*.

The specimens seen from Indian Territory and Kansas are beautifully ornamented with numerous green capillary rays. The soft parts of *phaseolus* are finely figured in Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. IV, Pl. XXIX, Fig. 101.

† *Unio phillipsii*, Conrad.

(Monograph of *Unio*, Pl. V, Fig. 1.)

"Ohio river." Belongs to the group of *U. metanever*?

† *Unio pictus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. XI, Fig. 32.)

Harpeth river, Tennessee. See under *U. ligamentinus*, Lamarek.

† *Unio pilaris*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XIV, Fig. 24.)

French Broad river, North Carolina, and Holston river, Tennessee. See under *U. ebenus*, Lea.

† *Unio pileus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVIII, Fig. 47.)

Ohio river, Cincinnati, Ohio.

* *Unio pinguis*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series, Vol. IV, Pl. XV, Fig. 58.)

St. Peter's (Minnesota) river, Minnesota, and, doubtfully, Ohio river at Cincinnati. Groups with *U. orbiculatus*, Hildreth.

† *Unio planicostatus*, Lea.

(Jour. Acad. Nat. Sci. Phil., 2nd Series, Vol. IV, Pl. LIX, Fig. 179.)

Clinch river, Tennessee, and in Tennessee river, near Tusculumbia, north Alabama.

† *Unio planior*, Lea.

(Jour. Acad. Nat. Sci. Phila. 2nd Series Vol. VI, Pl. L, Fig. 129.)

South-west Virginia and east Tennessee, in the headwaters of the Holston river. The species belongs with the *argenteus* group.

† *Unio plenus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. XIV, Fig. 16.)

Ohio river to Holston. Tennessee and Alabama rivers. See under *U. mytiloides*, Rafinesque.

* *Unio plicatus*, Le Sueur.

(Figured?)

This is a widely distributed form belonging to the group of which *U. undulatus*, Barnes, is the type. It ranges from the Ohio to the Cumberland, to Kansas, to the Red river of the North, at Pembina. *U. pauciplicatus*, Lea, from Texas, groups here, and is a closely related form.

† *Unio popenoi*, Call.

(Bull. of the Washburn Coll. Laboratory of Nat. Hist. No. II, Pl. II, Figs. 1-4.)

Fall and Verdigris rivers, southeast Kansas. A member of the *irroratus* group.

† *Unio powellii*, Lea.

(Trans. Am. Phil. Soc. 2d Series, Vol. X, Pl. XIX, Fig. 25.)

This species, a member of the *tutcolus* group, has been reported only from the original locality—the Saline river, Arkansas.

* *Unio pressus*, Lea.(Trans. Am. Phil. Soc., 2d Series, Vol. III, Pl. XII, Fig. 22, as *Symphynota compressa*, Lea.)

Rideau river, Canada, to central New York, to Nemaha river, Nebraska, to Wisconsin and Michigan.

† *Unio propinquus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. V, Pl. V, Fig. 212.)

Clinch, Holston and Tennessee rivers, to Tusculum, Alabama. This is a member of the *perplexus* group, from some forms of which it may not prove specifically distinct.

† *Unio pudicus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. IV, Pl. LVI, Fig. 171.)

Elk River, Tennessee and north Alabama. Very close to *highyensis*, which see.

† *Unio pulcher*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. III, Fig. 6.)

Nashville, Tennessee, in the Cumberland river. Groups with *flamentinus*, Lamarek.

† *Unio pulvinulus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. VIII, Fig. 24.)

Murray county, Tennessee. This appears, from the description and figure, to be synonymous with *U. circulus*, Lea.

† *Unio punctatus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. VI, Pl. XXXII, Fig. 76.)

Elk and Caney-fork rivers, Tennessee, and near Tusculum, Alabama. Groups with *U. ligamentinus*, Lamarek.

† *Unio puniceus*, Haldeman.

(Figured ?)

Holston river, Tennessee.

* *Unio purpuratus*, Lamarek.

(Trans. Am. Phil. Soc., Vol. III, Pl. VII, Fig. 9, as *U. ater*, Lea. Also Descriptions of the Shells of North America, Pl. XLIII, as *U. lugubris*, Say.)

This is a fine robust *Unio*, often attaining a great size, and the typical species of a restricted group so far as regards the number of species included. It ranges from the Kansas and Verdigris rivers, Kansas; to the Colorado river Texas, to the Black Warrior, Cahawba, Coosa and Alabama rivers, Alabama, and the Etowah river, northwest Georgia.

* *Unio pustulatus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. VII, Fig. 9.)

Ranges from western New York to Kansas. It has been frequently received under the name of *U. pustulosus*, Lea—with which it groups and from which it is readily distinguished by the larger and less frequent pustules.

* *Unio pustulosus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. VII, Fig. 6.)

Ohio to Tusculum, Alabama; to Trinity river, Texas; to Kansas; Minnesota and Michigan. A very peculiar variety of this species occurs in the Holston river, at Knoxville, Tennessee, the umbones of which are retuse and not nearly central as in the forms found farther north. A very thick and solid variety, occurring in the Black Warrior, Cahawba, Alabama and Coosa rivers, Alabama, and the Oostanaula and Etowah rivers, in Georgia, has received the name of *Unio depressus*, Lea. A less rotund form of the same species, from the Cahawba, has passed under the name of *U. cahabensis*, Lea. Other local varie-

ties have been severally called *U. sphericus*, *U. houstonensis*, *U. schoolcraftii*, *U. prasinus* and *U. vallatus*, all of which group in a natural assemblage with the early described *U. pustulosus* as the type.

† *Unio pybasii*, Lea.

(Jour. Acad. Nat. Sci. Phila., Vol. V, Pl. VI, Fig. 216.)

East Tennessee and North Alabama. Groups with *U. obscurus*, and *U. tener*.

* *Unio pyramidatus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVI, Fig. 39.)

Ohio to the Alabama river, at Selma; to Kansas; to Rock river, Wisconsin. See under *U. obliquus*, Lamarck.

† *Unio radiosus*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. III, Fig. 9.)

Holston river, Tennessee, and Tennessee river, north Alabama.

† *Unio rangianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. XVIII, Fig. 56.)

Ohio, Indiana, Illinois, and Michigan. Belongs to the group of *perplexus*, which see.

† *Unio raveneliana*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. III, Fig. 5.)

Asheville, North Carolina, and Black Warrior river, Jefferson county, Alabama.

* *Unio rectus*, Lamarck.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XIII, Fig. 11, as *Unio praelongus*, Barnes.)

This is one of the most widely distributed species in the United States. It ranges from the Rideau and Ottawa rivers, Canada, to western New York; Alabama river, at Selma; to Texas; to Kansas and north to the Red river, at Pembina. Its characters remain quite constant over all this vast area. It appears to group with *Unio anodontoides*, though totally different in color and ornamentation. It is often confounded with *U. gibbosus*, but the latter has less frequent and much coarser undulations on the umbones, and much heavier lateral teeth. The species, as it usually occurs, has an iridescent, deep purple nacre, but individuals entirely or partially white, in respect to the nacre, occur abundantly.

† *Unio recurvatus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. II, Fig. 6.)

Tennessee and Holston rivers, above Tusculumbia, Alabama. This is a member of the *ebenus* group, and probably synonymous with *U. globatus* and *U. subglobatus*, which see.

‡ *Unio reevianus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. XX, Fig. 28.)

Red river, at Alexandria, Louisiana. A member of the *luteolus* group.

† *Unio regularis*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XXV, Fig. 29.)

"French Broad river, east Tennessee."

† *Unio retusus*, Lamarck.

(Figured ?)

Ohio to Illinois in the Mississippi river; south to the Holston river, Tennessee.

‡ *Unio rotundatus*, Lamarck.

(Figured ?)

The only specimens which have come under notice were from Louisiana. No authentic record of this form, *vero*, is known outside that state, though Lea credits it to the Ohio river. (Synopsis of the Family Unionidae, 4th Ed. P. 100.) While this is a true *Unio* it has a greater resemblance to a very large *Cyrena* than to any other familiar shell. The epidermis is velvety and jet black. Conchologists appear to have confounded oval forms of *U. ebenus*, of the Ohio drainage with Lamarck's species, which is unique among American *Unionidae*.

* *Unio rubiginosus*, Lea.

(Trans. Am. Phil. Soc., Vol. III, Pl. VIII, Fig. 10.)

Ranges from central New York, in the Erie Canal at Mohawk, to Jackson, Mississippi; to Trinity river, Texas; north to Indian Territory, Kansas; Nebraska; to Minnesota and Wisconsin. There is a very instructive synonymy in the group which this species typifies embracing, among others, *U. rubidus*, *U. negatus*, *U. chunii*, *U. riddellii* and *U. chitkasawensis*. This species is a very variable one due probably to the diverse physical conditions imposed by its extensive distribution. It is usually a very abundant species.

† *Unio sampsonii*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. V, Pl. XXV, Fig. 261.)

Wabash river, Indiana. This is a synonym of *U. perplexus*, which see.† *Unio satur*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XVII, Fig. 19.)

Alexandria, Louisiana, in the Red river. A single specimen labelled "Gaines Creek, New Mexico," has passed under review. This is a member of the *ventricosus* group, and very close to the female of *U. occidentis*.

* *Unio schoolcraftii*, Lea.(Trans. Am. Phil. Soc., Vol. V, Pl. III, Fig. 3, as *U. schoolcraftensis*.)

Ohio to the Des Moines river, Iowa; to Wisconsin and Michigan. See under *U. pustulosus*, Lea. This is Conrad's *U. prasinus*.

† *Unio scitulus*, Lea.

(Jour. Acad. Nat. Sci. Phila., Vol. IV, Pl. IV, Fig. 167.)

"Tuscumbia, Alabama." Groups with an assemblage of small and beautiful *Uniones* of which *U. radians* and *U. planus* are typical.

* *Unio securis*, Lea.(Trans. Am. Phil. Soc., Vol. III, Pl. XI, Fig. 17. And Say's "Descriptions of the Shells of North America, Pl. XLVIII, as *U. lineolatus*, Rafinesque.)

Ohio to Kansas, in the Neosho river; to Georgia, in the Etowah river; to Alabama, in the Coosa, Black Warrior, and Alabama rivers; to Iowa and Wisconsin.

† *Unio sinus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. VIII, Fig. 20.)

Cumberland river, Tennessee, and Swamp Creek, Whitfield county, Georgia. Groups with *U. iris*, Lea.

* *Unio solidus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. V, Fig. 13.)

Ohio to Kansas. Groups with *U. obliquus*, Lamarck, which see.

† *Unio sowerbianus*, Lea.

(Trans. Am. Phil. Soc., Vol. V, Pl. X, Fig. 28.)

Elk and Powell's rivers, Tennessee, and Tennessee river, north Alabama.

† *Unio sparsus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. VIII, Pl. XXV, Fig. 58.)

“Holston river, Tennessee.”

† *Unio sparus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XLVII, Fig. 119.)

Kentucky, east Tennessee, and northwest Georgia, in Whitfield county, Swamp creek—the last named being the locality of the original specimens.

* *Unio spatulatus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. VIII, Fig. 22.)

Western New York to central Iowa; to Wisconsin, Minnesota and Michigan. This species usually occurs abundantly.

* *Unio sphaericus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. LI, Fig. 132.)

Alabama and Cahawba rivers, Alabama, to Indian Territory and south to Trinity river, Texas. See under *U. pustulosus*, Lea.

† *Unio stewardsonii*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XXIII, Fig. 36.)

“Chattanooga,” Cumberland, and Holston rivers, Tennessee, and Tennessee river, north Alabama. This is a member of the group of *perplexus*, which see.

† *Unio stonensis*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. VIII, Fig. 5.)

“Stone’s river, Tennessee;”—a tributary to the Cumberland.

† *Unio subroceus*, Conrad.

(Figured ?)

“Canadian river, Arkansas.” No further information has been accessible.

† *Unio subglobatus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. I, Fig. 3.)

Central and east Tennessee, and north Alabama. This is a member of the *ebenus* group, and synonymous with *U. globatus*, which see.

† *Unio subovatus*, Say.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVIII, Fig. 46.)

This form was described from the Ohio river, whence it ranges west to the Mississippi and north to the Rideau Canal, Ottawa, Canada. See under *U. occidens*, Lea.

* *Unio subrostratus*, Say. [1](Figured as *U. topekaensis*, *U. nashvillensis*, and *U. rutersvillensis*, which see.)

The occurrence of this species in Kansas was originally reported, in the publication below referred to in Bull. No. II, under the name of *U. topekaensis*, Lea. It is without doubt that species, but it is equally certain that it has been recognized elsewhere under at least four other names. Some time since, in collecting the material for a careful study of certain groups of *Uniones*, questions of synonymy presented themselves on every hand. The group to which this form belonged was in a most unsatisfactory condition and one of its elements was wanting. The collections submitted for study by the Washburn College Survey have supplied some of the missing data and a review of all the material, the comparison of descriptions and plates and the certainty attaching to *authentic specimens* have led to the following conclusions:

The shell was first described as *Unio subrostratus* by Thomas Say in 1831. Three years subsequently Mr. Lea obtained specimens from near Nashville, Tennessee, in the Cumberland river, and described them specifically as *U. nashvillensis* (originally *U. nashvillianus*.) The species is figured in Trans. Am. Phil. Soc. Vol. V, Pl. XIV, Fig. 43, and appears to have been a male of *U. subrostratus*, Say. Mr. T. A. Conrad, in Vol. I, Jour. Acad. Nat. Sci. 1850, described, from the "lower Mississippi" this same species as *U. mississippiensis*. Later, in 1852, Mr. Lea again described specimens sent to him from Alexandria, Louisiana, under the name of *U. nigerrimus*, and figured it in Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XVIII, Fig. 23. Again, in 1859, he obtained other representatives from near Ruttersville, Texas, and described and figured it as *U. rutersvillensis*, in Jour. Acad. Nat. Sci. Phila. 2nd Series, Vol. IV, Pl. LX, Fig. 181. Once again did this widely distributed form occur in collections submitted from Kansas, and was re-described and figured in the Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI. Pl. XLIX, Fig. 126, as *U. topekaensis*. Three

[1] The remarks herein presented concerning this form were originally printed in a paper by the author, which appeared in the *Bulletin of the Washburn College Laboratory of Natural History*, No. III, March, 1885. It is proper to add here, that the major portion of the references to distribution in Kansas was rendered possible by the collections made under the auspices of the Biologic Survey of Kansas, conducted by that institution.

times have the sharp posteriorly pointed males received a specific name, and to an equal number of specific diagnoses have the more swollen and posteriorly emarginate females been subjected. I cannot see that the shell varies considerably from the original description of Say—who did not, as many appear to have surmised, have before him the male of *U. nasutus*, a trans-Alleghany species—though occurring occasionally in the northern portion of Ohio in rivers which discharge into Lake Erie. The synonymy of this species will therefore stand as follows:

- Unio subrostratus*, Say, [1831.]
Unio nashvillensis, Lea, [1834.]
Unio mississippiensis, Con., [1850.]
Unio nigerrimus, Lea, [1852.]
Unio rutersvillensis, Lea, [1859.]
Unio topekaensis, Lea, [1868.]

† *Unio subrotundus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XV III, Fig. 45.)

Ohio to Illinois. Specimens have been received under the name of *U. politus*, Say. See under *U. ebenus*, with which it groups.

† *Unio subtentus*, Say.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. XXV, Pl. I, Fig. 3.)

Green and Salt rivers, Kentucky, and Elk, Clinch and Holston rivers, Tennessee.

† *Unio sulcatus*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. III, Pl. VIII, Fig. 12.)

Ohio and Indiana south to Tennessee. Described originally from the Ohio river.

† *Unio symmetricus*, Lea.

(Trans. Am. Phil. Soc., 2d Series, Vol. X, Pl. IV, Fig. 11.)

This species, which was described from the Red river, Louisiana, belongs to the group of which *U. camptodon*, Say, is the type. No other localities have been reported.

† *Unio tellicoensis*, Lea.

(Observations on the Genus *Unio*, Vol. XIII, Pl. X, Fig. 28.)

“Tellico river, east Tennessee.”

† *Unio tener*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. VIII, Pl. X, Fig. 10.)

Pigeon river, Tennessee. This form groups with *U. pybasii* and *U. obscurus*.† *Unio tennesseensis*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. VIII, Pl. X, Fig. 11.)

Stone river, Tennessee—a tributary to the Cumberland.

* *Unio tenuissimus*, Lea.(Trans. Am. Phil. Soc., Vol. III, Pl. XI, Fig. 21, as *Symphynota tenuissima*, Lea.)

Ranges from the Ohio to the Tennessee river, in north Alabama, and west to the Neosho river, Kansas.

† *Unio tesserulæ*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XV, Fig. 39.)

Nolachucky river, Tennessee. This form is very close to *U. acuens*, Lea.* *Unio tetralasmus*, Say.

(Descriptions of the Shells of North America, Pl. XXIII.)

Louisiana, Mississippi, and Alabama. Probably synonymous with *U. camp-todon*, which see.† *Unio texasensis*, Lea.

(Jour. Acad. Nat. Sci. Phil., Vol. IV, Pl. LXI, Fig. 184.)

Indian Territory, Red river drainage, to Dewitt county, Texas. This is a member of the *parvus* group, together with *U. bealii* and *U. bairdianus* with both of which it appears to be identical.† *Unio thorntonii*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XIV, Fig. 33.)

Tennessee river, near Tusculumbia, Alabama, and Clinch river, Anderson county, Tennessee. See under *U. mooresianus*, Lea.† *Unio topekaensis*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. VI, Pl. XLIX, Fig. 126.)

See under *U. subrostratus*, Say, with which this form is synonymous. Originally described from the Kansas river, at Topeka.

* *Unio trapezoides*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. III, Fig. 1.)

Alabama and Coosa rivers, Alabama; lower Mississippi river to Trinity river, Texas. *U. sloottianus*, of the Chattahoochee river, Georgia, is very close to this form.

* *Unio triangularis*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XIII, Figs. 17a, 17b.)

Western New York to Michigan and Iowa; south to Tennessee river, in north Alabama.

* *Unio trigonus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XVI, Fig. 40.)

This species ranges from western New York to Minnesota and Iowa. It is a member of the group typified by *U. rubiginosus*, which see. Very turgid specimens of the latter have been occasionally received as *trigonus*.

† *Unio troostii*, Lea.

(Trans. Am. Phil. Soc., Vol V, Pl. X, Fig. 30, as *U. troostensis*.)

Rock Castle river, Kentucky, and Cumberland, Clinch and Powell's rivers, Tennessee.

* *Unio tuberculatus*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. VII, Figs., 8a, 8b. Also finely figured in Poulsen's translation of Rafinesque's "Bivalve Shells of the river Ohio," in frontispiece, as *U. verrucosa*.)

Ohio to Etowah rivers, Georgia; Coosa, Alabama, Cahawba and Black Warrior rivers, Alabama; to Minnesota and Kansas; south to Trinity river, Texas. Notwithstanding the wide distribution of this well-known species it presents little variation. The specimens from the Alabama streams are largely characterized by a purple nacre—while the more northern forms are usually white.

† *Unio tuberosus*, Lea.

(Trans. Am. Phil. Soc. 2nd Series, Vol. VIII, Pl. XIV, Fig. 25.)

Caney Fork and Cumberland rivers, Tennessee, and Tennessee river, north Alabama. Groups with *U. metanervus*, Rafinesque.

* *Unio tumescens*, Lea.

(Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. III, Fig. 7.)

Described from Alexandria, Louisiana, whence it ranges to the Tennessee river, in north Alabama, and to the Clinch river, east Tennessee.

† *Unio turgidulus*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2nd Series, Vol. V, Pl. V, Fig. 211.)

Cumberland and Duck rivers, Tennessee. Groups with *U. perplexus*, Lea.

‡ *Unio turgidus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. V, Fig. 11.)

This form, which groups with *U. pustulosus*, ranges from Louisiana, near New Orleans, to Choctaw Nation, Indian Territory.

† *Unio tuscumbiensis*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. III, Fig. 7.)

Tennessee and Holston rivers, Alabama and Tennessee, and Poplar Creek, Roane county, Tennessee. Groups with *U. edgarianus*, Lea.

* *Unio undulatus*, Barnes.

(Am. Jour. Sci. and Arts, 1st Series, Vol. VI, Pl. II, Fig. 2a, 2b.)

This form has a wide range, throughout which it presents many local varieties. It occurs, usually as a very common species, from Western New York to Tennessee river, Alabama; to Michigan and Kansas; to San Saba river, Texas. It is the type of a rather large group embracing *U. latecostatus*, *U. atrocostatus*, *U. pauciplicatus*, *U. neislerii*, *U. hippoparvus*, *U. plicatus*, *U. perplicatus* and *U. elliottii*. It is doubtful whether these forms should not be included in the group of *U. multiplicatus*.

† *Unio upsoni*, Marsh, (Mss.)

(Not figured.)

This form was described by Mr. Marsh in a paper read before the Mercer county, Illinois, Historical Society. The types came from the Mississippi river, on the western border of Mercer county. A careful examination of the types in the cabinet of the author of the species leads to the conclusion that it is not a good species, but will fall under the synonymy of *U. ligamentinus*. It appears to be a depauperate form of that species. The four specimens examined do not present constant characters.

† *Unio validus*, Lea.(Observations on the Genus *Unio*, Vol. XIII, Pl. I, Fig. 2.)

Duck river, Tennessee. Nothing more is recorded of this species, which appears to be close to *U. bigbyensis*, Lea.

† *Unio vanuxemii*, Lea.(Trans. Am. Phil. Soc., Vol. VI, Pl. XI, Fig. 31, as *U. vanuxemensis*.)

Cumberland river, Tennessee.

† *Unio varicosus*, Lea.

(Trans. Am. Phil. Soc., Vol. IV, Pl. XI, Fig. 20.)

Ohio river, Cincinnati, Ohio. Local, and rather rare.

* *Unio ventricosus*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. XIII, Fig. 14.)

Seneca river, New York, to Kansas river, at Topeka; north to Wisconsin and Michigan. The species has been doubtfully credited to Lake Champlain. See under *U. occidentis*, Lea.

‡ *Unio venustus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. II, Fig. 4.)

"Potosi, Missouri," in a tributary to the Mississippi. Very closely resembles the young of *U. ligamentinus*, Lamarek.

* *Unio verrucosus*, Barnes.

(Am. Jour. of Sci. and Arts, 1st Series, Vol. VI, Pl. V, Figs. 6a, 6b.)

New river, Virginia, to Tuscumbia, Alabama; to Iowa; to Michigan. Frequently confounded by collectors with *U. graniferus*, but from which it is entirely distinct, though grouping with it.

† *Unio virescens*, Lea.

(Jour. Acad. Nat. Sci. Phila. Vol. IV, Pl. LV, Fig. 166.)

Spring creek and Tennessee river, north Alabama. A member of the group of *ventricosus*.

* *Unio wardii*, Lea.

(Jour. Acad. Nat. Sci. Phila., 2d Series, Vol. V, Pl. XXIV, Fig. 257.)

Ranges from West Virginia to central Iowa. The species is close to *U. metanervus*, into which it appears to graduate. It groups with *U. cylindricus*, Say.

† *Unio zeiglerianus*, Lea.

(Trans. Am. Phil. Soc., Vol. VI, Pl. X, Fig. 27.)

Cumberland river, Tennessee. See under *U. iris*, with which it groups.* *Unio zigzag*, Lea.

(Trans. Am. Phil. Soc., Vol. III., Pl. XII, Fig. 19.)

Ohio to Coosa river, Alabama; to Indian Territory and Kansas; to Minnesota and Wisconsin. Synonymous with *U. donaciformis*, which see. Groups with *U. elegans*, Lea.

The following species have been erroneously cited, by various authors, as occurring within the Mississippi drainage area:

Unio complanatus, Solander, *Unio nasutus*, Say,*Unio ochraceus*, Say, *Unio cariosus*, Say.*Unio radiatus*, Lamarek, *Unio uharensis*, Lea.

The first and last of these belong to a group which is not represented at all in western waters. Two others—*U. cariosus* and *U. ochraceus* belong in the *luteolus* group; possibly, also, will so group *U. radiatus*. The western analogue of *U. nasutus* is the *U. subrostratus*, Say, which is mentioned at length above. These species are all, so far as authentic information goes, confined to the Atlantic drainage. The presence of certain western forms in the Erie canal and Mohawk river, in central New York, on the Atlantic slope, and in waters directly connected with the western drainage system presents an explanation of their occurrence that is not paralleled by the possible presence of the eastern forms in western waters. The western species thus far recognized east of the Atlantic divide in the state of New York are the following:

Unio rubiginosus, Lea. *Unio gibbosus*, Barnes,*Unio luteolus*, Lamarek, *Unio pressus*, Lea.

All four are forms of wide distribution, but in the case of the species erroneously cited as occurring west of the Appalachian system and in waters belonging to the Mississippi drainage area, all save one—*U. complanatus*—are comparatively limited in their geographic areas. The extent to which these propositions will be modified can be determined only when very full and complete collections shall be made in all streams, flowing in either direction, which rise in the Appalachians.

In the preceding catalogue those forms which are common to both sides of the Mississippi are indicated by an asterisk [*], those found on the east side alone, by a dagger [†], and those known only from the streams to the westward are indicated by a double dagger [‡]. The results of this study of geographic distribution may be seen in the following recapitulation:

CATALOGUE 48.

SUMMARY.

GENERA.	Number of Species.	Common to both sides of the Mississippi river.	Occurring only east of the Mississippi.	Occurring only west of the Mississippi.	Extra-limital. (1)	Foreign.	Indefinite. (2)
ANODONTA.	33	7	14	9	4	0	3
MARGARITANA.	16	7	8	1	6	1	0
UNIO.	248	69	152	25	53	0	1
TOTAL.	287	83	174	35	63	1	4

(1) By this term are designated those species which also occur in waters without the drainage area of the Mississippi river system.

(2) This term will serve to indicate those species which are described from Louisiana without explicit local reference and concerning which, in the absence of local specimens, it is impossible to decide as to their occurrence east or west of the Mississippi.

VOL. I.

PRICE, 20 CENTS.

2
No. 4.

BULLETIN

OF THE

WASHBURN COLLEGE

LABORATORY OF NATURAL HISTORY.

EDITED BY

Francis M. Cragin,

PROFESSOR OF NATURAL HISTORY IN WASHBURN COLLEGE.

TOPEKA, KANSAS:

R. E. MARTIN & Co., PRINTERS AND BINDERS,
OCTOBER, 1885.

BULLETIN
OF THE
WASHBURN COLLEGE LABORATORY
OF
NATURAL HISTORY

Published by Washburn College.]

[Edited by F. W. Cragin.

VOL. 1.

TOPEKA, KANSAS, OCTOBER, 1885.

NO. 4.

FOURTH REPORT ON THE PROGRESS OF THE WASHBURN
COLLEGE BIOLOGICAL SURVEY OF KANSAS.*

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
October 18, 1885. }

To the Board of Trustees of Washburn College:

Hereby introduced, to be printed and distributed within the present month, and at the same time submitted for your approval, is the Fourth Report of Progress of the Washburn College Biological Survey of Kansas; in submitting which, I am

Very respectfully yours,

F. W. CRAGIN,

In charge of the Survey.

* We occupy this entire number of the *Bulletin* with the current Report of the Washburn Biological Survey.—[EDITOR].

Third Contribution to the Knowledge of Kansas Mosses.

BY EUGENE A. RAU.

The mosses herewith reported have been contributed to the Washburn Biological Survey, in the main from nearly extreme northeastern and northwestern portions of the State; the Labette Co. specimens having been collected about Oswego, and those from Brown Co. near Netawaka.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Fissidens osmundioides, Hedw.—Brown Co.; collected for the Survey by Miss Mara Becker.

Dicranum scoparium, Hedw.—Labette Co.; collected for the Survey by Dr. W. S. Newlon.

Webera albicans, (Wahl.) Schimp.—Brown Co.; collected by Miss Becker.

Bryum bimum, Schreb.—Topeka, growing in the south side of a well; collected by Prof. F. W. Cragin.

Bartramia pomiformis, Hedw.—Labette Co. (Dr. Newlon).

Hypnum (Eurhynchium) strigosum, Hoffm.—Wabaunsee Co., December; from Mr. S. A. Baldwin.

Hypnum (Amblystegium) riparium, Linn.—Brown Co. (Miss Becker).

Hypnum (Campylium) chrysophyllum, Brid.—Labette Co. (Dr. Newlon).

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Physcomitrium pyriforme, Brid.—Brown Co. (Miss Becker), Labette Co. (Dr. Newlon).

Barbula unguiculata, Hedw.—Brown Co. (Miss Becker).

Funaria hygrometrica, Hedw.—Labette Co. (Dr. Newlon).

Atrichum angustatum, Brid.—Male plants,—in fruit also,—Labette Co. (Dr. Newlon).

Mnium cuspidatum, Hedw.—Wabaunsee Co., December (S. A. Baldwin), and Brown Co. (Miss Becker).

Thelia asprella, (Schimp.) Sull.—Brown Co. (Miss Becker).

Leskea polycarpa, Ehrh.—Brown Co. (Miss Becker).

Anomodon obtusifolius, Br. Eu.—Brown Co. (Miss Becker).

Cylindrothecium sedutrix, (Hedw.) Br. Eu.—Brown Co. (Miss Becker).

Hypnum (Brachythecium) lætum, Brid.—Wabaunsee Co., December (S. A. Baldwin), and Labette Co. (Dr. Newlon).

Hypnum (Brachythecium) acuminatum, Beauv.—Brown Co. (Miss Becker).

Hypnum (Rhynchostegium) serrulatum, Hedw.—Wabaunsee Co., December (S. A. Baldwin).

Hypnum (Amblystegium) serpens, L., var.—Brown Co. (Miss Becker).

Hypnum (Campylium) hispidulum, Brid.—Brown Co. (Miss Becker).

Contributions to a Knowledge of the Fresh-water Mollusca of Kansas.—IV.

(Constituting the Fourth Report of Progress of the Washburn College Biological Survey of Kansas in the department of Fresh-water Mollusks.)

By R. ELLSWORTH CALL.

In this contribution there are added to those already enumerated two genera—*Pisidium* and *Ancylus*—and twelve species. Three species whose names were previously given with doubt are now for the first time positively recorded from Kansas. Some of the new forms occur abundantly, as is indicated by the numbers submitted. The discovery of *Unio pustulatus* in the Verdigris River places this species far to the westward of any hitherto recorded locality—Davenport, Iowa, being the most western station known hitherto. The minute corbiculid genus, *Pisidium*, also occurs for the first time in the Survey collections, but is represented by few individuals of the species *abditum*. The curious limnæid genus *Ancylus* has also appeared, and may be expected to occur in not inconsiderable numbers when proper search is instituted.

All portions of the State do not appear to be equally favorable to either the development or the maintenance of molluscan life. In notes accompanying several parcels from south-central Kansas, Prof. Cragin mentions certain features of a geologic character which the field conchologist always recognizes as inimical to the development of the objects of his search. Of Barber Co., he remarks as follows: "I found shells very scarce. The tributaries of the Medicine River from the north have few shells, except in the headwaters. Most of the tributary streams on the south side seem to be entirely destitute of bivalves." It appears, from the notes submitted by him, that the country is largely of a sandy and clayey formation, and that limestone is absent almost totally, except in the form of the sulphate—*i. e.*, gypsum. In Barber and Harper counties the streams have a similar bed of sand, with the addition of considerable quantities of iron, probably in the form of the sesquioxide. Where either iron or gypsum occurs in some abundance, experience has demonstrated that shell-life is reduced to a minimum. It is highly desirable that such notes as these should accompany all collections, together with some statements as to the nature of the bed where mollusks occur either abundantly or sparingly. Studies of this sort are of inestimable value from a biologic standpoint, and by too many students are utterly neglected. It is important, too, to observe carefully the conditions of springs in which mollusks occur. But few observations of this character are on record; yet many chalybeate, saline and sulphuretted springs contain mollusks, and these always in number or in size showing the biologic effects of the station.

In this place only the usual record of species will now be made. Some considerations on geographic distribution and synonymy have been included, but full discussion of these questions must await returns from all portions of the State, and receive proper treatment in a final report.

A.—SPECIES NOT PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

Family UNIONIDÆ.

Genus UNIO.

Unio asperimus, Lea.—Verdigris River at Coffeyville (Snow);* Mill Creek, Wabaunsee Co., and Soldier Creek, Shawnee Co. (Quintard).

This form and *U. lachrymosus*, Lea, are probably synonymous. A closely related form is *U. fragosus*, Con., also of nearly the same geographic distribution. The largest and finest specimens the reporter has ever seen are those from near Wichita, collected by Mr. J. R. Mead, and reported under the name of *U. lachrymosus*, which see.

Unio plenus, Lea.—Verdigris River (Snow).

Unio pustulatus, Lea.—Verdigris River at Coffeyville (Snow).

This form is a member of the *pustulosus* group, and was described from the Ohio River in the vicinity of Cincinnati. It is readily distinguished from its near relative—in the group as well as by name,—*U. pustulosus*, Lea, by its much less numerous but larger pustules, arranged in two diverging series from umbones to margin. In this respect it differs materially from *pustulosus*, which has smaller pustules generally distributed over the whole disk but most numerous on the posterior half. In the details of the hinge-teeth and adductor cicatrices they also present differences. *Pustulatus* ranges from New York to Kansas, but is nowhere abundant, though formerly common in the vicinity of Cincinnati.

Genus ANODONTA.

Anodonta edentulata, Lea.—Soldier Creek, Shawnee Co. (Quintard). See under *A. arkansensis*, p. 122.

Anodonta imbecillis, Say.—Verdigris River at Coffeyville (Snow); Little Arkansas River at Wichita (Mead).

It is not difficult to distinguish this *Anodonta* from all others of the genus by its brilliant green epidermis, the small but beautifully undulate umbones, and its exceedingly fragile shell. In geographical distribution it rivals the range of all other forms, extending from Canada to Kansas; to Texas; to Georgia; to New England.

CORBICULIDÆ.

Genus SPHÆRIUM.

Sphærium partumeium, Say.—Cedar Creek, Mt. Ida (Snow); brook

*The courtesy of Prof. F. H. Snow, of the Kansas State University, has allowed the use of the collections contained in that institution. These are credited above under his name. They were all collected by Mr. E. P. West, and have been of great use in helping to understand the nature of the shell life of southeastern Kansas. To Mr. J. B. Quintard and to Mr. J. R. Mead, the Survey is also indebted for numerous examples of some very fine *Unionidæ*, all of which are credited above. Others who contributed largely to the material embraced in preceding contributions were prevented from doing much work in this department during the past summer by the unusually high water that has prevailed in the rivers of southern Kansas.—R. E. C.

in Silver Lake township, Shawnee Co. (Quintard); western Barber Co. (Cragin); Oswego (Dr. Newlon).

This species is now reported for the first time from Kansas, and appears to occur not uncommonly. It is readily distinguished from the very abundant *Sphærium striatinum*, Lam., by the absence of striation and greater fragility. It has nowhere occurred abundantly.

Sphærium stamineum, Conrad.—Elm Creek, Barber Co. (Cragin); Kansas River, at Topeka (Quintard).

This very beautiful shell is of rather rare occurrence, and does not appear to be generally distributed geographically. Its globose or obese appearance, dark epidermis with fine striæ, light straw-colored ventral margins, and smooth beaks, will serve to distinguish it from other forms reported hitherto.

Genus PISIDIUM.

Pisidium abditum, Haldeman.—Wabaunsee Co. (Miss Lillian A. Baldwin).

These minute bivalves--the smallest genus represented in American waters, are now first reported from Kansas. They are easily distinguished from young *Sphæria* by the position of the beaks, which are in *Sphærium* nearly or quite central, while in *Pisidium* they are prominently inclined anteriorly, and are entirely forward of a line drawn from the hinge to the ventral margin. At least one other species of this genus may be expected to yet occur in the collections which are to be carefully made the coming summer.

It may not be out of place to suggest, at this point, that these minute shells, and others of the minute gasteropods, *Amnicola*, *Somatogyrrus*, and the like, should be sought by scraping the muddy banks of streams or the surface of muddy submerged bars. The mud, and whatever material it may contain, should be carefully sifted, using a fine flour sieve, and shaking it gently to and fro under the water. The shells may be assorted at the leisure of the collector. In this manner a thorough examination may be made, and, when a favorable locality is found, large quantities may be taken in a comparatively brief time. These small forms should always be thrown into alcohol for a day or two and then dried. They may be cleaned by shaking in a test-tube with sand and water.

GASTEROPODA.

RISSOIDÆ.

Genus AMNICOLA.

Amnicola cincinnatiensis, Anthony.—Vesser Creek, Shawnee Co. (Quintard); a small creek near Wabaunsee (Miss Lillian A. Baldwin).

Two species have been contributed by Miss Baldwin, both from the same locality. The second of these species was reported under the name of *Amnicola limosa*, Say, in the second of these contributions. It is a somewhat globose and short form, differing very greatly in this particular from the species here catalogued for the first time. *A. cincinnatiensis* is the largest species of the genus, and has probably the widest range. Speci-

mens are before the writer from Albany, New York, San Antonio, Texas, Salt Lake City, Utah, (quaternary fossils), Des Moines, Iowa, and over thirty intermediate localities. The species is a remarkably constant one, and the easiest to determine of any of the group.

***Amnicola porata*, Say.**—Cross Creek, Jackson Co. (Quintard), a small creek near Wabaunsee (Miss Baldwin).

This form and the preceding are nearly co-equal in geographic distribution. It is quite readily distinguished from the preceding by its proportionately larger body-whorl, shorter spire, and less number of whorls. It appears to be more abundant than *Amnicola cincinnatiensis*.

LIMNÆIDÆ.

Genus LIMNOPHYSA.

***Limnophysa bulimoides*, Lea.**—Marshy draws, Belle Meade, Ford Co. (Cragin).

The specimens submitted, twenty-two in all, are enough to settle any doubt which may arise as to the validity of the determination. In appearance, size, and all characteristic markings, they agree almost perfectly with specimens of Lea's *L. bulimoides*, received from Oregon, and also with specimens personally collected in northwestern Nevada in 1883. Binney, in Smithsonian Miscellaneous Collections, No. 143, page 56, figures a form from Grindstone Creek which not only resembles *L. bulimoides* but is also our shell. If found away from the water or draws, it is quite likely that many collectors would imagine they had happened upon a new *Bulimus*, so closely does it resemble that genus. In the reference to Mr. Binney's figure only the first and last—the two smaller—of the four figures are indicated as probably new, and as being examples of this form. There is no tendency whatever to malleation, a feature rarely wanting in *L. catascopium*. There is no other known American *Limnophysa* with which it is at all comparable. The shell is perfectly smooth, with bright, shining epidermis.

***Limnophysa caperata*, Say.**—Elm Creek, Barber Co. (Cragin).

This species was originally described from Indiana. Its range is very great, from Massachusetts and Rhode Island to Hudson's Bay, and west to Utah. In some portions of Iowa and Illinois it is very abundant and attains a great degree of perfection.

***Limnophysa desidiosa*, Say.**—Silver Lake, Shawnee Co. (Quintard).

Mr. Quintard has submitted a number of very fine examples of this species from the locality named. It is usually an abundant shell, and ranges throughout the whole of the United States, and northwest into the British Possessions. It is, in habit, quite similar to *L. humilis*, Say, before reported.

Genus ANCYLUS.

***Ancylus rivularis*, Say.**—On inner surface of valves of dead *Anodonta grandis*, in tributary to Soldier Creek, Silver Lake Township, Shawnee Co. (Quintard); Cedar Creek, Mt. Ida (Snow), discovered in same situation.

One specimen of this form was found, accidentally, while examining the

Unionidæ submitted by Prof. Snow. It was subsequently lost. In a later consignment of shells, from Mr. Quintard, there were included a number of examples of this interesting limnæid, all but two being immature. Careful search upon submerged sticks, leaves, stones, bark, and *especially* dead bivalves, will no doubt bring to light abundant specimens. This species forms one of a group of univalve mollusks concerning which—at least so of American forms—little satisfactory information can be given. In Proc. Phila. Acad. Nat. Sci. for 1883, pp. 214–240 and plate X, Dr. Benj. Sharp has done for certain European forms* a work which is urgently needed for our own. If Kansas collectors will collect, in alcohol, some of these mollusks, a beginning may be made.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

Family UNIONIDÆ.

Genus UNIO.

Unio alatus, Say.—Marais des Cygnes River at Malvern (Snow).

Unio anodontoides, Lea.—Verdigris River at Coffeyville (Snow); small stream at Wellington (Snow); Marais des Cygnes River, Chippewa Hills, Indian Reservation (Snow); Elk River at Howard (Snow); White-water River (Mead); Cowskin Creek (Mead); Little Arkansas River near Wichita (Mead); Soldier Creek, Shawnee Co. (Quintard).

From these data it will be seen that this form is probably of general distribution throughout the State. It is one of the most widely distributed forms of the eastern United States, ranging from New York to Georgia, to Texas, to Michigan. It is also the least variable of the *Uniones*.

Unio camptodon, Say.—Lake Thayer, and Mumm's Creek, Thayer (Snow); in a tributary to Soldier Creek, Shawnee Co. (Quintard); Cowskin Creek (Mead), and Turkey Creek, Barber Co. (Cragin).

The examples of this form which have been seen are not numerous, but the species is probably quite generally distributed in the eastern and southern portions of the State. It is known from Ohio under the name of *U. sayii*, Ward, and from the southern States as *U. declivis*, Say, and *U. manubius*, Gould. It is remarkably constant in its characteristics when its wide distribution is considered.

Unio coccineus, Hildreth.—Verdigris River at Coffeyville, and Spring River at Baxter Springs (Snow).

This form has proven to be of somewhat rare occurrence within the limits of Kansas. It is generally abundantly distributed throughout the Mississippi Valley.

Unio cornutus, Barnes.—Mill Creek, Wabaunsee Co. (Quintard).

Unio cylindricus, Say.—Neosho River (Dr. Newlon); Spring River, Baxter Springs (Snow).

One entire shell and two odd valves are all that have been hitherto submitted by the Survey. It ought to be found, not uncommonly, on gravel

**Ancylus fluviatilis*, Muel., and *Ancylus lacustris*, Geof.

beds; for it usually occurs abundantly in such situations when found at all. The finest and largest examples of this remarkably beautiful *Unio* come from the Cumberland River, Tennessee.

***Unio ebenus*, Lea.**—Neosho River at Burlington (Snow).

***Unio elegans*, Lea.**—Spring River, Baxter Springs, and Prairie Creek, Jefferson Co. (Snow); Whitewater River (Mead).

***Unio fragosus*, Conrad.**—Neosho River at Burlington (Snow); Whitewater River in Butler Co. (Mead).

This form is a member of a small group which is typified by *Unio asperrimus*, Lea. It often attains a great size—larger, far, than that reached by any other member of the group.

***Unio gibbosus*, Barnes.**—Ottawa Creek at Garnett, Marais des Cygnes River at Malvern, and Spring River at Baxter Springs (Snow).

***Unio gracilis*, Barnes.**—Verdigris River at Coffeyville (Snow); Little Arkansas River near Wichita (Mead).

This form is very abundant and attains a high degree of perfection in the last-named locality.

***Unio lachrymosus*, Lea.**—Prairie Creek, Jefferson Co. (Snow); Cow-skin Creek and Little and Big Arkansas Rivers, near Wichita (Mead).

***Unio laevis*, Lea.**—Silver Lake, Shawnee Co. (Quintard); Little Arkansas River near Wichita (Mead).

This, one of the alate *Uniones*, is distributed from New York to Texas. It appears to be generally distributed throughout Kansas, but is of somewhat rare occurrence.

***Unio ligamentinus*, Lamarek.**—Spring River at Baxter Springs (Snow); Neosho River (Dr. Newlon).

This form is often confounded with the following, from which, however, it is very distinct. The character of the umbonal undulations, the heavier cardinal and lateral teeth, tendency to pink color of nacre, and generally more numerous green rays will serve to distinguish it from Lamarek's other species. It is not so widely distributed as the next species.

***Unio luteolus*, Lamarek.**—Marais des Cygnes river, creek at Moline, Ottawa Creek at Garnett, Elk River at Howard (all Snow); Soldier Creek, Shawnee Co. (Quintard).

This is probably the most widely distributed *Unio* in North America. It is also exceedingly variable. Various forms have been described under the names of *U. siliquoides*, Barnes, *U. hydianus*, Lea, and *U. distans*, Anthony.

***Unio metanevrus*, Rafinesque.**—Spring River, Baxter Springs (Snow).

***Unio occidentalis*, Lea.**—Verdigris River at Coffeyville, Marais des Cygnes River at Malvern, Spring River at Baxter Springs (Snow); Mill Creek, Wabaunsee Co., and Soldier Creek, Shawnee Co. (Quintard); Whitewater River, near Towanda, Butler Co. (Mead).

This form is properly a synonym of *Unio ventricosus*, Barnes, under which name it is usually known to collectors.

***Unio parvus*, Barnes.**—Canal at Hutchinson, and Turkey Creek, Barber Co. (Cragin); Ellis (Dr. Watson).

This form typifies a group which numbers among its members some of the smallest species of the genus. It does not appear to be abundant in the State, though it will probably be found more commonly, if sought along the muddy banks of deep streams.

Unio petrinus, Gould.—Mill Creek, Wabaunsee Co. (Quintard); Cow-skin Creek and Little Arkansas River, near Wichita (Mead).

In Contribution Number III this *Unio* was listed with a mark of doubt. Further specimens have been received from the above localities, and there is no longer doubt but that the form is true *petrinus*. The specimens observed place the species in the group of *Unio pustulosus*, Lea, though non-pustulate usually. Two of the specimens now in the cabinet of the reporter show an occasional pustule, though in all other respects there is a most accurate agreement with Gould's description. The species has never been figured.

Unio phaseolus, Hildreth.—Spring River, Baxter Springs (Snow).

The soft parts of this species are well figured in Jour. Phila. Acad. Nat. Sci., Vol. IV, 2d Series, pl. 29, fig. 101. The species has a rather large synonymy.

Unio plicatus, Le Sueur.—Neosho River near Burlington, Ottawa Creek at Garnett, and Verdigris River at Coffeyville (Snow); Whitewater River near Towanda (Mead).

Another undulate *Unio*, but much flatter, with plications much less oblique, more numerous and generally distributed over the major portion of the valves, is often confounded with this species. They *do not*, as some collectors appear to have imagined, grade each into the other, when numerous specimens of each, *of all ages*, are examined. The related *Unio* indicated, *U. undulatus*, is more widely distributed than this form, and attains, in the Cumberland and Duck Rivers, Tennessee, its maximum size. While members of the same group, these forms nevertheless should be held as quite distinct.

Unio purpuratus, Lamarek.—Kansas River at Topeka (Cragin); Verdigris River at Coffeyville, and Spring River at Baxter Springs (Snow); Whitewater River near Towanda, Cowskin Creek and Little Arkansas River, near Wichita (Mead); Neosho River (Newlon).

Unio purpuratus is of quite general occurrence in all parts of Kansas yet explored, which are favorable to *Uniones*. Mr. Mead has contributed some of the largest and finest specimens and in the greatest numbers from the Little Arkansas at Wichita. These specimens further contribute additional data to the synonymy of this genus in that some of the larger Kansas specimens grade into almost or quite typical forms of *Unio coloradoensis*, Lea, from Texas. The facts all seem to make necessary this disposition of the last-named *Unio*. *U. ater* is also a synonymy.

Unio pustulosus, Lea.—Verdigris River at Coffeyville, Marais des Cygnes near Malvern, and Spring River at Baxter Springs (Snow).

A *Unio* which is generally distributed, under various names, from New York to Texas, and northward to Minnesota and Wisconsin. It is the type of an extensive group affording a most fruitful and instructive synonymy.

Unio rectus, Lamarek.—Cow Creek, Hutchinson, Verdigris River at Coffeyville, Solomon River, and Spring River at Baxter Springs (Snow).

Unio rubiginosus, Lea.—Marais des Cygnes River, and Ottawa Creek at Garnett (Snow).

Unio subrostratus, Say.—Ellis (Watson); Soldier Creek, Silver Lake township (Quintard); Little Arkansas River near Wichita (Mead); Mumm's Creek, Elk Creek and Lake Thayer, Thayer, Cedar Creek at Mt. Ida, creek at Moline, Marais des Cygnes River at Malvern, and Ottawa Creek at Garnett (Snow).

This name will include, also, those specimens which appear in the Survey's and State University's collections under the name of *Unio topekaensis*, Lea. See Contributions to a Knowledge of Kansas Mollusca, No. III. It will be seen from these localities that this species is probably found in all parts of the State.

Unio tuberculatus, Barnes.—Whitewater River at Towanda (Mead); Verdigris River at Coffeyville (Snow).

Unio undulatus, Barnes.—Neosho River (Newlon); Mission Creek, Shawnee Co. (Quintard); Cowskin Creek (Mead); the following localities are all certified by material in the Snow collection: Deer Creek, Lawrence; Walnut Creek, El Dorado; Cedar Creek, Mt. Ida; Marais des Cygnes River at Malvern; Elk River at Howard; Verdigris River at Coffeyville, and Spring River at Baxter Springs.

A very common, usually abundant form, often confounded with *U. plasticus*, which see.

Genus MARGARITANA.

Margaritana complanata, Barnes.—Soldier Creek and Silver Lake, Shawnee Co. (Quintard); Neosho River (Newlon); Cowskin Creek and Little Arkansas River at Wichita (Mead).

Ranges from Lake Winnipeg to New York, to Texas, and Kansas. This is the only symphynote or alate form in the genus, and is readily distinguished by this character.

Genus ANODONTA.

Anodonta arkansensis, Lea.—Ottawa Creek at Garnett; Ninnescah River at Reno (Platt and O'Hara); Whitewater River at Towanda, and Little Arkansas River at Wichita (Mead).

This species is a member of the group typified by *Anodonta edentula*, Lea, from which it is certainly not specifically distinct. It is described and figured in Vol. X, 2d Series, Trans. Am. Phil. Soc., pl. IX, fig. 56. The specimens contributed by Mr. Mead are from near the typical locality,—“the Little Arkansas, where the road to Santa Fe crosses it.”

Anodonta beallii, Lea.—Little Arkansas River at Wichita, and Cowskin Creek (Mead).

The southernmost known range of this shell is central Texas, where it was originally collected. It groups in that extensive natural series which may be headed by *Ano. grandis*, Say, and is close to certain forms of *Ano. plana* and *Ano. opaca*. The succeeding form is a member of the same group, and offers, in some Kansas specimens, so close resemblance to many forms of *Ano. beallii* as to make specific identity questionable.

Anodonta danielsii, Lea.—Elk Creek, Thayer, and Marais des Cygnes

River at Malvern (Snow); Smoky Hill River at Wallace (Col. N. S. Goss); Ellis (Watson); Turkey Creek, Barber Co. (Cragin).

This shell originally came from a point near Topeka. See the preceding species.

Anodonta grandis, Say.—Verdigris River at Coffeyville and creek at Moline (Snow); Cowskin Creek and Little Arkansas River near Wichita (Mead).

A full discussion of this extensively distributed form, the type of a large group of ponderous *Anodontæ*, is reserved for a separate paper. It can now be stated that very many so-called species must fall under *grandis* as synonyms. It ranges from Lake of the Woods to Texas, and east to New York. *Anodonta plana*, Lea, is plainly a highly colored or ornamented variety.

Anodonta ovata, Lea.—Lake Thayer at Thayer (Snow).

These specimens settle plainly the identity of this variety, and permit its appearance in this Contribution without the mark of doubt that has accompanied it heretofore.

Anodonta plana, Lea.—Cedar Creek, Mt. Ida, and Elk River at Howard (Snow); in tributary to Soldier Creek, Shawnee Co. (Quintard).

See preceding note under *Ano. grandis*.

Anodonta suborbiculata, Say.—Silver Lake, Shawnee Co. (Quintard).

Mr. Quintard has supplemented the single valve submitted by Col. Goss, from Neosho River, by a single specimen from the above locality. The form is everywhere considered a rare one, and does not generally appear in collections. It is, however, abundant near Muscatine, Iowa, and at Springfield, Illinois.

CORBICULIDÆ.

Genus SPHÆRIUM.

Sphærium striatinum, Lamarek.—Brook in Silver Lake township, Shawnee Co. (Quintard); Neosho River (Newlon); Little Arkansas River near Wichita (Mead); Wabaunsee Co. (Miss Lillian A. Baldwin); and the following localities certified by material contributed by Prof. Snow: Munn's Creek, Thayer; Cedar Creek, Mt. Ida; Elk Creek, Thayer; Verdigris River at Coffeyville.

GASTEROPODA.

LIMNÆIDÆ.

Genus HELISOMA.

Helisoma bicarinata, Say.—Cedar Creek, Mt. Ida (Snow); Barber Co. (Cragin); McDowell Creek, Riley Co. (Cragin); drift-wood on shore of Kansas River (Quintard).

From the amount of material submitted, this does not appear to be a very common form. It will doubtless be found in all portions of the State.

Helisoma trivolvis, Say.—Silver Lake, Shawnee Co. (Quintard); Sedgwick Co. near Wichita (Mead); Cedar Creek, Mt. Ida (Snow).

Genus PLANORBIS.

Planorbis lentus, Say.—Labette Co. (Newlon); Barber Co. (Cragin).

In Contribution II, this species was doubtfully recorded under *Helisoma*, which is usually considered as a subgenus of *Planorbis*. It is a matter of grave doubt whether such a division of American forms has any substantial basis of fact. The specimens submitted and herein reported upon allow the species to stand without mark of doubt.

Genus LIMNOPHYSA.

Limnophysa catascopium, Say.—Oswego (Newlon).

Limnophysa reflexa, Say.—Arkansas Valley at Wichita (Mead).

These were very poor specimens, but the largest yet received from any portion of the State.

Genus PHYSA.

Physa anatina, Lea.—Wabaunsee Co. (Miss L. A. Baldwin); Reno Centre, (D. H. Platt and L. A. O'Hara); Kansas River and Silver Lake (Quintard).

P. anatina was originally collected by Maj. F. Hawm, in a "northern tributary of the Arkansas River," and described by Dr. Lea in Proc. Acad. Nat. Sci., Phila., 1864, p. 115; also in Jour. Acad. Nat. Sci., Phila., 2d Series, Vol. VI, p. 171, pl. XXIV, fig. 94. It is very close to *Physa hawnii*, Lea, which was collected by the same gentleman in the Verdigris River, Kansas. A critical revision of the American forms is needed, when, as the facts seem to indicate, both these forms will fall into the synonymy of the ubiquitous and exceedingly-variable *Physa heterostropha*, Say.

Physa gyrina, Say.—Cedar Creek, Mt. Ida (Snow); Ellis (Watson); Barber Co. (Cragin); Labette Co. at Oswego (Newlon); Wichita (Mead).

From the last locality came specimens of the var. *hildrethiana*, which was raised to specific rank by Dr. Lea. No sufficient data have been observed to justify the retention of the latter as a species, and it is here ranked as a variety under the species *gyrina*. This and *P. heterostropha* will include most of the American so-called species.

Physa hawnii, Lea.—Cedar Creek at Mt. Ida (Snow); Labette Co. at Oswego (Newlon); a pool at Arkansas City (Cragin); Shawnee Co. (Quintard).

The reader is referred to the preceding remarks, under *Physa anatina*. This form was described as a preliminary description, in Proc. Acad. Nat. Sci., Phila., 1864, p. 115, and finally, with figure, in Jour. Phila. Acad. Nat. Sci., 2d Series, Vol. VI, p. 165, pl. 24, fig. 84. It is often difficult, even impossible, to separate this form from *anatina* on the one hand and *heterostropha* on the other. In the Arkansas City locality the specimens were found in midwinter—not an unusual but by no means a common occurrence.

Physa heterostropha, Say.—Silver Lake, Shawnee Co. (Quintard). See remarks under this species in Contribution II.

First Contribution to a Knowledge of the Orthoptera of Kansas.

BY LAWRENCE BRUNER.

[The subjoined paper constitutes the first report of the Washburn College Biological Survey of Kansas, on the order *Orthoptera*. It is based upon the material collected by the Survey, and also partly upon material collected by the undersigned before the Survey was organized. It makes no pretense to completeness, as it is the policy of the Survey to publish from time to time such partial reports as shall best represent its progress, the fuller and more general results to be reserved for a final report to be drawn up whenever the same seems warranted by the completeness of the work.

The present report includes eighty-eight species, many of which have never been previously recorded from this State, and several of which are new to science. Of some of these our reporter will have more to say in a future paper.

Upwards of seventy species, not thus far included in the Survey's collections, have been recorded in Kansas by eastern and European authors; but we omit here any enumeration of these species, as we expect ultimately to record them in such a way as to throw much more light upon their distribution and abundance in Kansas than could be given by collating the existing references.

The Orthopteran fauna of Kansas doubtless includes upwards of two hundred species.—F. W. CRAGIN, *Director of the Survey*.]

BLATTIDÆ.

1. *Periplaneta orientalis* L.—A single specimen received from Labette Co. (Dr. W. S. Newlon).

2. *Ischnoptera pennsylvanica* De Geer.—Topeka; found in woods under logs and the loose bark of trees (Prof. F. W. Cragin).

MANTIDÆ.

3. *Phasmomantis carolina* L.—There are specimens of this Mantid from Labette Co. (Newlon); Topeka (Miss Mara Becker, Mrs. J. K. Pitts, Mr. R. T. McKinney, and Mr. O. H. Bilger,), and Medicine Lodge, Barber Co. (Dr. E. H. Lockwood).

PHASMIDÆ.

4. *Diapheromera femorata* Say.—Several immature specimens from Barber Co. (Cragin); Ellis (Dr. Louis Watson).

GRYLLIDÆ.

5. *Gryllotalpa columbia* Scudd.—Labette Co. (Newlon).

This is the species first described as *G. longipennis* by Mr. Scudder, who afterwards changed it to the above because the name *longipennis* had already been used in the genus for an East Indian species.

6. *Gryllotalpa ponderosa* n. sp. (?)—There is a single specimen of a second species of mole cricket contained in the collection, from the same gentleman. This insect is greatly damaged, having the entire head and part of the front edge of the pronotum missing. It is the largest specimen of the genus that has ever come under my notice, and may prove to be new. I have labeled it *Gryllotalpa ponderosa*. Its distinguishing characteristics, so far as can be seen, are its great size, length of tegmina and wings, the venation of the former, and the evenness of the dactyls or claws of the front legs. Length of body still remaining, 40 mm.; of tegmina, 21 mm.; of wings, 41 mm.; of pronotum, $12\frac{1}{2}$ mm.; width of pronotum, 8 mm.

7. *Gryllus luctuosus* Serv.—Several specimens of immature insects from Barber and Shawnee counties (Cragin).

8. *Gryllus neglectus*? Scudd.—Several specimens from Topeka (Cragin) and McPherson Co. (Dr. John Rundstrom) are referred here with some doubt.

Most of our so-called North American species of this genus appear to run together, the only characters upon which some of the species are established being the variation in the length of the ovipositor in the females, and a few other such unreliable characters.

9. *Gryllus personatus* Uhler.—A few immature specimens collected in McPherson Co. (Rundstrom) are referred to this species.

Mr. Saussure, in his great work on the *Gryllidæ*, says this insect is probably a variety of the *Gryllus domesticus* of Europe.

10. *Nemobius vittatus* Harr.—Topeka (Miss Mara Becker, Cragin.); McPherson Co. (Rundstrom); Barber Co. (Cragin).

The genus *Nemobius*, like *Gryllus*, is composed of insects so closely related that it is with the greatest difficulty the species are separated from one another.

11. *Nemobius* ——— sp.—Topeka (Cragin).

There is a single specimen of a second species of *Nemobius* among some recently received material. This cricket is much smaller and lighter colored than *N. vittatus*, and is also somewhat irregularly mottled with very dark brown or black. It occurs in the woods among fallen leaves and other debris, and is very active. This may be one of Mr. Scudder's species, but I will reserve decision upon it for a future report.

12. *Æcanthus niveus* Serv.—This species, which is one of the commonest of Gryllids, in Kansas, is represented by but a few specimens from Topeka, Great Bend, and the Gypsum Hills, Barber Co. (Cragin).

The genus *Æcanthus* is also one in which the species are very variable, and pass into one another almost imperceptibly.

LOCUSTIDÆ.

13. *Ceuthophilus maculatus* Say.—Represented by a pair of defective specimens from McPherson Co. (Rundstrom).

14. *Ceuthophilus pallidus* Thos.—A single male from Topeka (Cragin) is referred here.

15. *Ceuthophilus* ——— sp.—Topeka (Cragin).

There are eight specimens of a third species of these "stone crickets" which I am unable to refer to any of the described North American forms. It may be that they are new, and if this be the case, I will give them the name of *Ceuthophilus silvestris*, or *Ceuthophilus* of the forest or woods. The specimens before me are very small—not more than 7.45 mm. in length, but appear to be fully matured, for the females have well developed ovipositors. Professor Cragin writes me that they were obtained under logs in the woods.

This insect belongs to the same group with *C. maculatus*, but differs from that species in the arrangement of the markings. The general color is a dull light-brown, with all the segments above bordered posteriorly rather broadly with piceous; posterior tibiae armed with four pairs of rather long divergent spines.

16. *Udeopsylla robusta* Hald.—A single female specimen from the Gypsum Hills of Barber Co. (Cragin).

17. *Daikinia gigantea* n. sp.—The collection contains a single male specimen of a species belonging to the genus *Daikinia* which may be new. I label it *D. gigantea*, but will not describe it fully until I have had an opportunity to compare it with the types of *D. brevipes* of Haldeman, which latter species also occurs in Kansas. The specimen before me is of a very dark mahogany-brown color, with an interrupted dorsal line of a somewhat lighter shade. There are a few irregular mottlings of the same color along the sides of the pronotum and other lobes of the body. Posterior femora very heavy and clumsy, furnished beneath with a row (9) of short spines. Posterior tibiae more bowed than in *brevipes*, and furnished with four alternating spines upon each of the two upper edges; lower edge also spined on the apical half. Length of body, 29 mm.; of posterior femora, 24.5 mm.; of posterior tibiae, 25 mm. Labette Co. (Dr. Newlon).

18. *Microcentrum laurifolium* L.—Topeka (Cragin); Labette Co. (Newlon); Reno Co. (L. A. O'Hara).

19. *Arethaea gracillipes* Thos.—Barber Co. (Cragin).

This is one of the few southern species that extends northward into Kansas and Colorado in its distribution.

20. *Scudderella curvicauda* De Geer.—Barber Co. (Cragin); McPherson Co. (Rundstrom).

21. *Scudderella furcata*? Brunner.—Barber Co. (Cragin); Labette Co. (Newlon).

Until quite recently (1878) it was supposed that we had but a single species of this group in this country, hence it has become a matter of great difficulty to decide just what insect is meant when we see an account of, or reference to, *Phaneroptera curvicauda*. Harris described a second species (*Phaneroptera angustifolia*) in his "Report on Insects Injurious to Vegetation"; but this was also afterwards placed as a synonym of *curvicauda* by Dr. Scudder. There have been six species described thus far and I have a seventh from California; and when the country of the interior shall have been carefully gone over, and everything in this group brought together, I am confident there will be still others.

22. *Conocephalus crepitans* Scudd.—Reno Co. (L. A. O'Hara); Barber Co. and Garden City (Cragin); Ellis (Watson); Labette Co. (Newlon).

This large conocephalid appears to be quite abundant throughout the valleys of the Arkansas and Kansas rivers. Like several other species of the genus inhabiting the central and eastern portions of the United States, it occurs in two colors; viz., bright grass-green and dull straw-yellow. It approaches more closely *C. robustus* than any other of our species, and is to be distinguished from that insect by its somewhat shorter fastigium, or cone between the eyes, which is devoid of all black marks on the under surface.

23. *Xiphidium strictum* Scudd.—Reno Co. (L. A. and H. P. O'Hara); Barber Co., Great Bend, and Topeka (Cragin); McPherson Co. (Rundstrom); Topeka (C. W. Lane).

This is our largest very short-winged species, and occurs throughout the entire eastern and central portions of the United States. In Texas the specimens are somewhat larger and have longer ovipositors than they do as far north as West Point, Neb., the northernmost point at which I have taken them.

24. *Xiphidium saltans* Scudd.—Topeka and Barber Co. (Cragin); McPherson Co. (Rundstrom).

The collection contains several specimens of what I take to be this species, although Mr. Scudder in his description states that its wings are much shorter than those of *X. brevipennis*. In the present specimens the females possess wings fully 18 mm. in length, but aside from this they agree with Mr. Scudder's description in every particular.

25. *Xiphidium fasciatum* De Geer.—Topeka (Cragin and Lane).

This species occurs very numerously along the margins of streams and ponds, among the rank grasses, in the stems of which its eggs are deposited.

26. *Orchelimum glaberrimum* Burm.—Topeka (Cragin).

I have never determined this species to my own satisfaction, and am of the opinion that a great many references to it are erroneous. There are at least three or four of the *Orchelimums* to be found at almost every locality in the United States, and any of which might be taken for *glaberrimum* or either of the other species. The characters by which they are separated are not always constant, and in some of their variations become difficult to recognize. *Orchelimum nigripes*, as the name implies, has black feet; but this characteristic sometimes becomes erased to a considerable extent, while occasionally specimens of one or two other species are found that also show dark feet and tibiae. *O. longipennis* has very long wings, while in *O. vulgare*, which is a rather clumsy insect, the wings are quite short and of equal length with the elytra. Again, *O. glaberrimum* is distinguished from *vulgare* by having the dorsal band of the pronotum edged with black, as is the outer edge of the sonorous apparatus of the male; the antennae in both sexes are very long, and the ovipositor slightly expanded in the middle. Again, *O. agile*, an insect resembling the last two in form, is to be distinguished from them in having "a very narrow dark median streak down the face"; and its pronotum is shorter than in *vulgare*.

I have given the above notes in order that every student who does not happen to have access to the works containing the original descriptions may determine these different species for himself.

27. *Orchelimum nigripes* Scudd.—Topeka (Cragin); Wakarusa (Washburn Senior Nat. Hist. Excursion, Class of 1882).

28. *Orchelimum longipennis* Scudd.—Barber Co. (Cragin).

The collection contains a single male of this species—the first specimen that I have ever seen.

29. *Orchelimum vulgare* Harr.—Shawnee Co. (Cragin).

There are three specimens in the collection which I place here.

30. *Orchelimum agile* De Geer.—Topeka (Cragin).

I also find a single male among the others that comes very close to the characters given for this species.

31. *Thyreonotus Cragini* n. sp.—The collection contains a single specimen (female) of an insect that is evidently undescribed, and which falls in the group of *Decticides* in which the prosternum is armed with two spines. In this group are contained the following two genera, to either of which the insect in question might belong: *Pterolepis* and *Thyreonotus*. Not having seen typical specimens of either of these genera, it is difficult for me to decide in which, if either, of these genera it belongs, without further study and a careful comparison of the descriptions of all the described species of our North American Decticids that have appeared from time to time, and are scattered throughout various Government reports and proceedings of scientific societies. These described species—twenty-two in all—are sadly in need of a thorough revision, and until this is accomplished, but little additional work can be done that will stand the test of time. In order to do this, a large amount of material from all parts of the country is absolutely necessary; and that is what I do not possess in my limited collection. Until I have had time for further study and comparison, I will label this specimen *Thyreonotus Cragini*. It can be known by the following characters which are quite striking: Pronotum large and wide, broadest in front and below, rounded above, without carinae, slightly flattened back of the middle, with the posterior margin evenly rounded. Abdomen rather slender, gradually tapering posteriorly, with a slight carina or ridge along the dorsum. Posterior femora nearly as long as the entire body, without spines and considerably enlarged on their basal half; tibiae as long as femora, thickly crowded along both edges on their apical three-fifths with spines; also a few minute spines along their lower side. The general color is dirty yellowish-green, with two rather broad stripes of brown along the top of the pronotum. These bands become almost black upon the posterior margin where they follow down the sides, as a sort of border to the lower angle. Length of body, 34 mm.; of pronotum, 11.5 mm.; of posterior femora, 31 mm.; of tibiae, 31 mm.; of ovipositor, 31 mm. Barber Co. (Cragin).

32. *Thyreonotus Scudderi* n. sp.—There are also two males and two females of a second and smaller species, which also appears to be new. I will call it *Thyreonotus Scudderi* in honor of Prof. S. H. Scudder, who

has done more toward describing and systematizing our North American *Orthoptera* than any other individual.

This species is a much smaller and slenderer insect than the preceding. The vertex of the head is also much more rounded and more produced in front of the eyes, which latter are fully as large as they are in that species. The pronotum is not so swollen, nor has it the sides of the dorsum flattened here as there; posterior margin nearly straight. Abdomen as in *T. Cragini*, but more plainly carinated. Ovipositor rather short, curved upward and tapering to a fine point. Posterior femora and tibiæ as in the preceding species. Cerci of the male forked, the inner finger slightly the shortest. Purplish-brown above, mottled and banded with ochraceous; brownish-yellow below. Face yellow with a dark-brown streak commencing at the base of each antenna and curving outward and downward upon the cheeks. Pronotum with the front edge and sides bordered rather widely with yellow. Posterior femora with a dark-brown streak along the upper edge of the basal half in some specimens, absent in others. Length of body—male, 18 mm., female, 24 mm.; of pronotum—male, 5.65 mm., female, 8 mm.; of posterior femora—male 19 mm., female, 22 mm.; of ovipositor, 15 mm. Barber Co. and Great Salt Well, Crooked Creek Valley, Ford Co. (Cragin).

33. *Anabrus coloradus* Thos. (?)—Garden City (Cragin).

There are two larvæ of what I make out to be this insect, but which may belong to some allied species, several of which occur in the same vicinity.

The foregoing families have been but sparingly studied in this country. as will be seen by a comparison of the number of species in each, as found here and in Europe. Of the *Decticinae*—the group comprising the large wingless Locustians that live above ground upon plants—we have but twenty described species, while in Europe there are upwards of eighty. Other groups show equally great contrasts. Therefore it should be the aim of collectors to work with a view of remedying this deficiency in particular directions.

ACRIDIDÆ.

34. *Oxyecoryphus obscurus* Thos.—Several specimens from Shawnee and Barber Cos. (Cragin).

This locust usually occurs where the grasses are short and the climate arid, and as a consequence, is to be met with most frequently upon the plains, where the grasses are of the genus *Bouteloua* and allied forms.

35. *Mermiria neo-mexicana* Thos.—The collection contains specimens from Barber Co. (Cragin); McPherson Co. (Rundstrom); and Shawnee Co. (H. J. Adams and R. E. McCampbell).

This locust frequents high hills and other localities where vegetation is scattered.

36. *Mermiria bivittata* Serv.—A pair from Sun City, Barber Co., at which locality a great many specimens of the locusts herein mentioned were taken by Prof. Cragin.

37. *Syrbula leucocerca* Stael.—Barber Co. and Topeka (Cragin); McPherson Co. (Rundstrom).

This is probably but a variety of the next species from which it differs only in color. The males of both species are indistinguishable, and there are intermediate specimens to be found, in which the colors are not those of typical specimens of either species. Saussure has described a third species—*Oxycoryphus montezuma*—from Mexico (Rev. et Mag. Zool., Vol. XIII (1861), p. 316) which Dr. Stael says also belongs to this genus. From the description, I should judge that this species may also be but a variety of *admirabilis*, or rather the reverse, since Saussure's description has priority.

38. *Syrbula admirabilis* Uhler.—This locust is represented by specimens from Barber Co. (Cragin); Topeka (Mrs. Cragin); McPherson Co. (Rundstrom), and Labette Co. (Newlon).

Dr. Newlon's specimen was incorrectly labeled *Tragocephala viridifasciata*. This latter insect belongs to the *Ædipodini*—the subfamily or group to which the colored winged locusts belong, while *Syrbula admirabilis* is a member of the *Truxolini* group, or those with cone-like heads.

39. *Chrysochraon viridis* Scudd.—Topeka (Mrs. Cragin); Barber Co. (Cragin).

Both the brown and green varieties are represented in the collection.

40. *Stenobothrus coloradus* Thos.—The collection contains but a single specimen, a female, from Barber Co. (Cragin).

This species does not properly belong in this genus, but has been placed there by Dr. Thomas, and has remained there ever since. It was first described (Geol. Survey Terr., 1871, p. 465) as *St. bicolor*, a name which was already used in the genus, and was accordingly changed to the present name.

41. *Stenobothrus æqualis* Scudd.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Mrs. Cragin, Prof. Cragin); Labette Co. (Newlon); Shawnee Co. (Cragin); Reno Co. (L. A. and H. P. O'Hara); Barber Co. (Cragin).

Dr. Newlon's specimen was labeled *Chloealtis conspersa*. As will be noticed by reference to the specimens, this species occurs in two colors, and is also very variable in size and general appearance.

42. *Stenobothrus maculipennis* Scudd.—Barber Co. (Cragin).

43. *Arphia tenebrosa* Scudd.—There are several larvæ of this species in the material collected in Barber Co. (Cragin).

44. *Arphia carinata* Scudd.—Topeka (Miss Becker, Mrs. Cragin); Shawnee Co., Barber Co. (Cragin); McPherson Co. (Rundstrom).

45. *Arphia simplex* Scudd.—Labette Co. (Newlon); Topeka (Cragin).

46. *Chimarocephala viridifasciata* De Geer.—The collection contains specimens of this much described locust, from Labette Co. (Newlon), and from Topeka (Cragin).

There are examples of variety *virginiana* and also of *infuscata*, both of which occur throughout its entire range, which extends from Manitoba to Central America. The farther northward we go, the fewer mottlings do

we find upon the specimens taken of either variety, these being often either plain green or dull brown throughout. Even in central Nebraska, specimens of the typical *virginianus* are of rare occurrence, while in the southern part of the State it is by far the commonest form. I have noticed that the form *infusca* is generally found early in spring while the green ones are more common later in the year. This I can only account for by the larvæ wintering over and imitating the color of the dead leaves, etc., among which they conceal themselves—a trait very common among different members of the order *Orthoptera*.

Dr. Saussure, in his recent work on the *Ædipodini* of the world, has erected a new genus for this and two allied species, which he calls *Chortophaga*. I see no need for this, as it was separated from the balance of the *Ædipodæ* by Mr. Scudder, and made the type of the genus *Tragocephala*, which last name, being preoccupied in the *Coleoptera*, was replaced by the present.

47. *Encoptolophus sordidus* Burm.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Mrs. Cragin, Prof. Cragin).

48. *Hippiscus rugosus* Scudd.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Prof. Cragin); Labette Co. (Newlon); Finney and Barber Cos. (Cragin).

49. *Hippiscus discoideus* Serv.—Several specimens of this species are in the collection from Topeka (Cragin).

Dr. Saussure, in his late work on the *Ædipodini*, places this species as a synonym of the *H. phœnicopterus* of Burmeister, and makes the insect which we always have relegated to the last name, *H. tuberculatus* Pal. de Beauv. In this he may be correct, as he has the facilities for examining the types of these various authors; and if this be true, hereafter we shall be obliged to drop Serville's name for that of Burmeister, which has priority.

Hippiscus discoideus and *H. phœnicopterus* have always been considered as separate species by me. I also have specimens of what I take to be *H. tuberculatus* in my collection. These latter are from Florida, while my supposed *discoideus* and *phœnicopterus* both occur here, and belong to the same subgenus with a fourth species that I have taken in the Big Horn Mountains of Wyoming. This last species has been referred to Prof. Thomas' *Ædipoda paradoxa*, and if I am correct in this determination, will hereafter be known as *Hippiscus paradoxus* Thos. With us in central Nebraska, *discoideus* and *phœnicopterus* winter in the larval state in a similar manner with *Tragocephala viridifasciata* and several of the *Arphias*. *H. phœnicopterus* always has the disc of the wings red, while in *discoideus* there are occasional specimens with yellow wings; there is also more of a contrast in the sizes of the sexes in the latter than in the former species, where there is but little difference.

I think there will be no harm, while speaking of the species belonging to this particular group, to say a few words in reference to Dr. Saussure's arrangement of all the large mottled *Ædipodini* native to this continent. He divides them as follows:

HIPPISCUS.—Antennæ thread-like, but little compressed or flattened in the male, of medium length.

XANTHIPPIUS.—Antennæ graceful in the female; in the male somewhat flattened, with the apex curved outward and pointed, quite long.

LEPRUS.—Antennæ slender; posterior femora remarkably broad; posterior tibiæ cærulean.

PYCNODICTYA.—Antennæ as in *Hippiscus*; lateral lobes of the pronotum narrow, parallel above as in *Hadrotettix*.

The last named genus he does not include in the North American fauna, but I add it here to receive the large and beautiful *Ædipoda Wheeleri* of Thomas, which occurs in the mountain regions of Colorado. Prof. Thomas himself states (Wheeler Geog. and Geol. Surv. W. 100 Merid.) that this locust agrees with the description of the genus *Pycnodictya*, and that he has a notion to place it there at once, "otherwise a new genus will necessarily have to be formed for its reception." Saussure includes *Ædipoda neglecta* Thos. in his genus *Xanthippus*, which I think is an error on his part, since the locust in question does not agree with the characters upon which he founds his genus. It is distinct from all other North American species with which I am acquainted, save one from California, in its general appearance, and in my opinion should be referred to a new genus, and be placed near *Arphia*.

50. Dissosteira carolina L.—Topeka (Cragin); Labette Co. (Newlon); McPherson Co. (Rundstrom).

This is the common species of our roadsides, with yellow-bordered black wings. It is one of the most widely distributed species in America, and occurs throughout all of the United States, Canada, British Columbia, Central America, and the West India Islands. It also occurs as far northward along the Pacific coast as southern Alaska.

51. Dissosteira longipennis Thos.—Barber Co. (Cragin).

This locust, which resembles no other species in this country, differs in its habits from its congener, *D. carolina*, which rather prefers to hang around cities, farm-yards, and dusty roadsides, to going off into the interior, away from the habitations and works of man. It is met with only in waste places where the soil is clayey and stony, and when disturbed takes rather long flights, being very difficult to capture. *Ædipoda nebrascensis* Bruner, is a synonym, and was described from a stray specimen found at West Point, Nebraska, whither it must have drifted with the winds from Kansas with *Melanoplus spretus*, which was flying at that time.

52. Spharagemon balteatum Scudd.—Barber Co. (Cragin); Labette Co. (Newlon).

Dr. Newlon's specimen was labeled *Ædipoda xanthoptera*, an error on his part, as that insect belongs to the genus *Arphia* as now limited. Dr. Saussure now includes all the species of this genus in *Dissosteira* as a subgenus. This I hardly think proper, when he has gone to the trouble of subdividing some of the other genera in which, according to my notion, there is less difference among the members than there is here. He also removes Scudder's *Trimerotropis picta* to this genus under the subgenus *Scirtetica* on the same footing with *Ædipoda marmorata* Uhler, a second species of the same group.

53. Spharagemon aequale Say.—Barber Co. (Cragin).

These specimens are rather more ferruginous in color than the species

usually is; but this is easily to be accounted for when we take into consideration the character of the soil upon which they lived and were taken. In fact, generally, species collected upon the "red soil of the Gypsum Hills" of Barber Co. show a tendency to ferruginous hues even in insects that it would be supposed never occur in that color. I have often noticed, while collecting insects at various localities in the Rocky Mountain region, that where the soil was light colored, the insects were also light colored, and where the soil was dark, the prevailing hues of the insects found in the locality were likewise dark.

This species is an aberrant form, when compared with the other species of the genus to which it belongs, and resembles the members of the genus *Trimerotropis* to a great extent.

54. *Trimerotropis vinculata* Scudd.—A single specimen from Barber Co. (Cragin) is referred to this species.

The species appears to be very common wherever found, and I have received specimens from various portions of Texas, New Mexico, Arizona and California. I have never collected it myself, but from its appearance, I should say that it frequents localities where vegetation is somewhat scattered and dwarfed, and the soil alkaline.

55. *Mestobregma plattei* Thos.—Barber Co. (Cragin).

Saussure suppresses the genus *Mestobregma* of Scudder, of which this species is the type, and includes all of its species in the genus *Psinidia*. This he has evidently done on the authority of Dr. Sael, who describes several closely allied forms from Texas, under the generic name *Psinidia*.

56. *Mestobregma cincta* Thos.—Topeka, Shawnee Co., (Cragin).

This species is somewhat more slender, and has much narrower elytra than the preceding. It is somewhat closely related to *M. Kiowa* Thos., from which it can readily be distinguished by colored wings with a fuscous band, while in *Kiowa* the wings are perfectly hyaline throughout. A fourth species occurs in Montana, which is confined to *Eurotia lanata* as a food plant. This latter species I call *Mestobregma pulchella*, from its beautiful colors.

57. *Hadrotettix trifasciata* Say.—Ford Co.; Sun City, Barber Co., and Garden City (Cragin).

This locust is a very variable one indeed, and it is a great wonder that it has not been described oftener than it has. I have specimens from as far north as Ft. McLeod, on the South Saskatchewan, where I collected quite a large series of locusts of different species. It also occurs in Texas, where it is much larger than in the north. *Edipoda pruinosa* and *Æ. Hoffmani* are synonymous of this species.

58. *Brachystola magna* Girard.—Barber Co. (Cragin); Reno Co. (H. P. O'Hara).

This is one of the most clumsy insects that I know, and occurs throughout the great plains, from the Mississippi River westward to the Rocky Mountains, where it is popularly known as the "lubber grasshopper," the "buffalo hopper" and by several other equally appropriate names. However clumsy and dull it may appear, it seems to know enough to keep in the shade during the heat of the day, and at such times can be found com-

fortably settled in the shadows cast by weeds, etc., but never so comfortably but that it follows the shadow as the latter shifts.

59. *Boopedor nubilum* Say.—Barber Co. (Cragin).

This very variable insect is found throughout the entire country, from the British line southward to Texas, and from the eastern portion of Nebraska and Kansas, westward to the Rocky Mountains. It seldom occurs in numbers, and as a rule, is rather rare than otherwise. During the past summer, however, while I was passing through the valley of the Lower Yellowstone in Montana, I was surprised to find it by the hundreds upon the bench lands a few miles back from the River. It was represented in all shades, from deep, shining black, to pale yellowish brown, and also varied greatly in size. It appeared to be feeding upon sunflowers and several other weeds that had been left almost untouched by the various other species of locusts that were swarming throughout the immediate neighborhood.

60. *Anlocara Elliottii* Thos.—Garden City, (Cragin).

This species was first described by Prof. Cyrus Thomas as *Stauronotus Elliottii*, and afterwards by Scudder as *Aulocara cœruleipes*. It does not belong to the genus *Stauronotus*, and therefore must be placed in the new one created for the reception of it and a closely allied species.

61. *Anlocara* ? ——— sp.—Barber Co. (Cragin).

The survey collection contains specimens of a locust which I have never been able to place satisfactorily to myself, but which is so common throughout the central portion of the United States that there can be no doubt of its having been described. In its general appearance it comes close to the genus *Aulocara* as limited by Scudder, but also differs from that genus in several important characters. It also approaches the genera *Stenobothrus* and *Gomphocerus*, and appears to connect the two groups. I will send specimens of it to Prof. Scudder for determination, and will report the result in a future paper.

62. *Phlibostroma* ? *quadrimaculata* Thos.—Garden City (Cragin).

I place this insect in the above named genus with some hesitation, because I have only glanced at the types of *P. picta*, the insect upon which the genus was founded, and that at a time when I had no specimens of my own with me to label. The members of this genus also resemble the *Stenobothri* in their general appearance, and, if I am correct in my present determination, several species that belong here have been placed in the genus *Stenobothrus* by both Thomas and Uhler.

63. *Aceridium frontalis* Thos.—Garden City and Barber Co. (Cragin); Shawnee Co. (H. J. Adams and R. E. McCampbell).

This is the *Pezotettix speciosa* of Scudder (U. S. Geol. Surv. Neb., 1872, p. 250).

64. *Aceridium rubiginosum* Harr.—Labette Co. (Newlon).

This and the following species generally occur in regions where oak abounds, and in such localities can be found very early in spring as larvæ and pupæ. Especially is this true of the present species. In the vicinity of Washington. D. C., I have taken it throughout the entire winter in company with *Chimarocephla viridifasciata* and *Hippiscus discoideus*.

65. *Acridium alutaceum* Harr.—Labette Co. (Newlon).

The specimens of this species in the present collection vary slightly from the typical eastern form in the presence of a pretty well defined dorsal stripe. This, however, is a characteristic mark belonging to the genus, and is present to a greater or less degree in all the species with which I am acquainted.

66. *Acridium obscurum* Burm.—McPherson Co. (Rundstrom); Barber Co. (Cragin).

67. *Schistocerca americana* Drury.—Labette Co. (Newlon).

This large and beautiful insect is very closely related to the Egyptian locust, *Schistocerca peregriua*, that often appears as a plague; and it too, frequently becomes quite numerous at various points in the south, when it also shows a tendency to migrate and does injury to vegetation. In Yucatan and the neighboring portions of Central America and Mexico, as well as portions of South America and the West India Islands, either this or a closely allied species does much injury to crops, and at times becomes a plague.

68. *Pezotettix acutipennis* Scudd.—McPherson Co. (Rundstrom); Labette Co. (Newlon); Topeka and Barber Co. (Cragin).

69. *Pezotettix lakinus* Scudd.—Garden City (Cragin).

Mr. Scudder described the species from specimens taken at Lakin, Kas., on Sept. 1; and at Pueblo, Colorado. It was also collected by H. K. Morrison in some part of Colorado east of the mountains at an elevation of 5,500 feet above sea level. Aside from these references, I know of no other record of its occurrence. It must therefore be rather limited in its distribution, and if the matter were carefully investigated, I think it would be found partial to some special food-plant that occurs in this limited area only.

70. *Pezotettix albus* Dodge.—Topeka (Cragin).

This species, as the name indicates, is white, or whitish green, in imitation of the plant upon which it feeds (the common Cudweed, or White Sage of our meadows). I have never found this locust upon any other plant, and have met with it wherever I have found the plant. There are specimens in my collection and that of the Department of Agriculture at Washington, D. C., from Wyoming, Montana, Dakota and Minnesota, and I am also aware of its occurrence in Manitoba. Here in Nebraska it is one of our commonest species when one knows where to look for it.

71. *Pezotettix Scudderi* Uhler.—Labette Co. (Newlon).

The collection contains a single specimen which I refer to this species with some doubt, as it appears to vary somewhat from typical specimens taken in the vicinity of Washington, D. C.

72. *Pezotettix unicolor* Thos.—Topeka (Mrs. Cragin).

Among the material collected at Topeka I find a single female which evidently belongs to this species. I have always thought that *unicolor* is but a variety of *P. Scudderi*; but, perhaps, if a male specimen of the former could be examined, the two would prove to be distinct.

73. *Pezotettix nebrascensis* Thos.—Topeka (Cragin).

The collection contains a specimen of this species which differs so much

from all our other North American *Pezotettigi* that I am of the opinion it should be separated from them and placed in a genus by itself. It has been described by Dodge as *Pez. autumnalis* and also as *Caloptenus volucris*. The latter name was given to a long-winged variety that occurs at various points in Nebraska, but especially along the valleys of the Platte and its tributaries.

This peculiarity of variation in length of wing is not confined to this species alone, but belongs to quite a number of other grasshoppers or locusts, both in this country and in Europe. In most instances where this variation occurs, the species have been described under several names, and not unfrequently are the two forms of the same species placed in different genera, as for example the present species. The form of the male cerci and that of the spine on the prosternum, as a rule, will indicate the relationship of the two forms, even if all the other members have become so differentiated, through either lack of use or new uses, as not to be recognized.

74. *Dactylotum pictum* Thos.—Barber Co. and Great Salt Well of Crooked Creek Valley, forty miles southwest of Dodge City (Cragin).

This is our most beautifully colored locust, and can well be styled the "Union or Patriotic Grasshopper" since it wears the stripes, if not the stars, of the most glorious flag that floats. It occurs at various localities in Dakota, Nebraska, Colorado, and Kansas, but usually prefers the slopes of rather high hills somewhat devoid of vegetation. I found it by far the most numerous at Golden, Colorado, at an altitude of about 7,000 feet above sea level.

75. *Hesperotettix viridis* Thos.—Barber Co. (Cragin).

This insect is common throughout the region known as the plains, and appears to prefer certain plants upon which to rest and feed. Among these I have noticed more particularly a small composite flower near the *Bigelovia graveolens* or Rabbit Bush. This locust also occurs as far eastward as Iowa, and westward to the Salt Lake Valley, where it is replaced by another species that is undescribed.

76. *Melanoplus femur-rubrum* De Geer.—Reno Co. (L. A. and H. P. O'Hara); McPherson Co. (Rundstrom); Topeka (Cragin).

This is one of our most widely distributed locusts, and wherever found appears to be rather common—at times even numerous.* It has been recorded as occurring in Mexico, Florida, Canada, British Columbia, California, and all intermediate points. It also occurs at Great Bear Lake, British America. Nowhere are there specimens to be found with other than red tibiae.

77. *Melanoplus atlantis* Riley.—Labette Co. (Newlon); Topeka (Cragin)

This is the lesser migratory locust of the United States and adjoining portions of British America. It, like *femur-rubrum*, is very widely distributed over North America, specimens occurring as far southward as the Gulf of Mexico and northward to Alaska, and from ocean to ocean. Unlike the preceding, it is not everywhere present, but appears to occur in

*It is, this season at least, our most common species at Topeka.—[F. W. CRAGIN,

isolated areas over which it is common. These localities are more frequent in mountainous and hilly regions than in open country. *Atlanis* is the species that often occurs in hurtful numbers throughout the New England States, and also at various other localities throughout the interior. In general appearance and habits, *atlanis* approaches *spretus* more closely than it does *femur-rubrum* or any of our other North American *Melanopli*, of which there are upward of fifty described species.

78. *Melanoplus spretus* Thos.—McPherson Co. (Rundstrom).

There is but a single specimen of the much dreaded Rocky Mountain Locust contained in the collection before me, which would indicate an unusual freedom from its presence throughout the State at this time. At any rate, this is true in reference to the localities from which the various portions of the collection came. As there has so full a history of this locust been written at various times in the past, and it is familiar to every one, I will not say anything further of it here. Should anyone wish to read what has already been said on the subject, I would refer him to the three reports of the U. S. Entomological Commission relating to this and several other injurious insects that have attracted general attention on account of their great destructiveness.

79. *Melanoplus devastator* Scudd.—Garden City (Cragin).

There is contained in the material from the above-named locality a single pupa of a locust that I refer to this species, although the insect in question has not heretofore been recorded from that immediate locality, but has been taken at Morrison, Col. This is the locust which does much injury to crops in California and adjoining portions of Oregon. It also occurs throughout Montana and in northern Dakota, and I have taken it in Idaho and northwestern Wyoming.

80. *Melanoplus luridus* Dodge.—Reno Co. (L. A. and H. P. O'Hara); Barber Co. (Cragin).

This species belongs to one of the groups in which the cerci of the males are forked, *M. collinus*, *M. tenebrosus*, *M. nigre-cens* and *M. deletor* being the other species of the present group. It was first described from Dodge Co., Nebraska, but occurs on uplands throughout all of eastern Kansas and Nebraska, as well as in Iowa and Missouri, with perhaps a more extended range.

81. *Melanoplus angustipennis* Dodge.—Barber Co. and Topeka (Cragin).

This species belongs near *M. cinereus* Scudd., a species found throughout the Sage-brush regions of the West and Northwest, where it (*M. cinereus*) feeds upon and lives among the foliage of the different species of *Artemisia*. *M. angustipennis*, likewise, has the habit of hanging about plants of a similar nature and, like that species, this is more "arboreal" than otherwise, preferring to jump from plant to plant rather than to alight upon the ground. I have the species from as far south as Dimmit Co., Texas, and from Ft. Buford, Dakota. It also occurs at Anaheim, California.

82. *Melanoplus flavidus* Scudd.—Barber Co. (Cragin).

These are the first specimens of the species that I have seen. It was described from specimens taken at Morrison, Col., and is evidently restricted in its distribution to the plains of Colorado and Kansas.

83. *Melanoplus packardii* Scudd.—Barber Co. and Garden City (Cragin).

This is the locust which was described as *Caloptenus fasciatus*, Scudd., but afterwards changed to the above name by the same author to avoid conflicting with the *Cal. fasciatus* of Walker, a species found at St. Martin's Falls, Hudson Bay. This is an upland insect and may be met with throughout the western half of the United States and British America at all suitable localities. It bears some resemblance to *M. bivittatus* Say, but never leaves the open country for timbered or low localities where the vegetation is rank, as does this and several of our larger species of this genus.

84. *Melanoplus bivittatus* Say.—Labette Co. (Newlon); Topeka, Garden City and Barber Co. (Cragin).

This is the common two-striped locust of our meadows and fields, and usually occurs where vegetation is rankest. It is found from ocean to ocean, and from the Gulf of Mexico northward to the Saskatchewan River in the British possessions. Mr. Scudder says that the variety with red posterior tibiæ is the *Caloptenus femoratus* of Burmeister, and considers it a distinct species.

85. *Melanoplus differentialis* Thos.—Labette Co. (Newlon); Topeka, Garden City and Barber Co. (Cragin.)

This is our largest species of the genus and occurs in suitable localities throughout the central and eastern portions of the United States, where it also frequents low grounds among the rankest of vegetation. *M. robustus* and *M. ponderosus* are allied species which occur in Texas.

86. *Melanoplus turnbullii* Thos.—Garden City (Cragin).

This species is one of the few that is partial to some particular food-plant or set of food-plants, and in this instance it is the members of the *Chenopodiaceæ*, and especially the different kinds of pigweeds. It occurs at various points throughout Arizona, New Mexico, Colorado, Kansas, Wyoming and Montana. Scudder's *Pezotettix plagosus* is a synonym of this insect, at least this is what Mr. Scudder himself states.

87. *Tettix granulata* Say.—Topeka (Cragin).

The small Grouse Locusts, of which there are quite a number of species in the United States, are very difficult to identify, and appear to vary so much that I have never done much toward trying to separate the material in my collection. They all winter over as larvæ, pupæ or mature insects, and are to be found on sunny hill slopes throughout winter. Their favorite haunts are the edges of groves and the margins of streams. Closely browsed pastures are also frequented by them during the warm days of late fall and early spring, where they appear to congregate for sunning themselves. They never become so numerous as to injure crops, and but seldom enter cultivated grounds, except where these are low and damp, or lie alongside of meadows or groves near streams.

88. *Tettigidea polymorpha* Burm.—Barber Co. (Cragin).

The members of this genus, like those of the preceding and also those of *Batrachidea*, are found in like localities with them, and are also similar in general appearance and habits.

Preliminary Catalogue of the Crayfishes of Kansas.

BY WALTER FAXON, A. B., Sc. D.

1. *Cambarus simulans* Faxon.—Proc. Amer. Acad. Arts and Sci., XX, 112, 1884.—Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 48, Pl. I., fig. 12; Pl. VIII., figs. 3, 3', 3a, 3a', 1885.

Tributary of Medicine River, Barber Co. Messrs. Williams and Cragin. Fort Hays (Coll. Mus. Comp. Zool.).

2. *Cambarus gracilis* Bundy.—Bull. Ill. Mus. Nat. Hist., No. I., p. 5, 1876.—Trans. Wis. Acad. Sci., V. 182, 1882.—Geol. Wis., Surv. of 1873–79, I. 403, 1883. Faxon, Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 56, Pl. VIII., figs. 4, 4', 4'', 1885.

Labette Co. W. S. Newlon.

3. *Cambarus Diogenes* Girard.—Proc. Acad. Nat. Sci. Phila., VI. 88, 1852. *Cambarus obesus* Hagen, Ill. Cat. Mus. Comp. Zool., No. III., p. 81, Pl. I., figs. 39–42; Pl. III., fig. 163; Pl. IX., 1870.

Leavenworth (Coll. Mus. Comp. Zool.).

4. *Cambarus immunis* Hagen.—Ill. Cat. Mus. Comp. Zool., No. III., p. 71, figs. 101, 102; Pl. III., fig. 160; Pl. VII., fig. 6, 1870. *Cambarus signifer* Herrick, Tenth Ann. Rep. Geol. Nat. Hist. Surv. Minn. for 1881, p. 253, 1882.

Leavenworth (Coll. Acad. Nat. Sci. Phila.). Ellis (Coll. C. H. Gilbert).

4a. *Cambarus immunis* Hagen, var. *spinirostris* Faxon.—Proc. Amer. Acad. Arts and Sci., XX. 146, 1884.—Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 100, Pl. I., fig. 5, 1885.

Ward's Creek, Shawnee Co.; F. W. Cragin and J. B. Fields. When I described this variety in 1884, I had not seen the first form of the male, which is included among the specimens collected by Messrs. Cragin and Fields. The lateral spines of the rostrum are distinct as in the second-form male and in the female; the setæ on the second pair of legs are well developed; the first abdominal appendages are shaped exactly as in the first-form male of the typical *C. immunis*.

5. *Cambarus Nais*, sp. nov.—Male, form I.—Rostrum long, concave above, lateral margins converging from the base to the lateral spines, which are small but distinct; acumen of moderate length, acute. Post-orbital ridges provided with a minute anterior spine. Carapace smooth and lightly punctate above, granulate on the sides; lateral spine small, acute; cervical groove sinuate, ending anteriorly in a small branchiostegian spine; sub-orbital angle not prominent; areola very narrow, punctate, the margins parallel from the anterior to the posterior triangular fields; the length of the areola is equal to one-half the distance from the tip of the rostrum to the cervical groove. Abdomen as long as the cephalothorax. Proximal segment of the telson, bispinose on each side, distal segment shorter than the proximal. Antennæ longer than the body; laminae a little longer

than the rostrum, broad, broadest at the middle, subtruncate at the end, with an external apical spine. Third maxillipeds densely setose within and below. Anterior process of the epistoma with very convex sides. Chela broad, flattened above, punctate, external border marginate; inner margin of the hand short, with a double row of dentiform tubercles; fingers long, movable one tuberculate on the external border, toothed on the internal border; external finger flat above, internal margin toothed, and bearded at the base. Carpus armed with a row of small tubercles on the upper side, with a strong and acute internal median spine and a small one at the base; on the lower side the carpus is provided with a prominent median spine and an external one at the point of articulation with the chela; in some specimens there is a small spine on the lower face of the carpus, between the median spine and the large one on the internal margin. Third pair of legs armed with a hooped tubercle on the inner margin of the third segment. First pair of abdominal appendages of moderate length, twisted, deeply bifid, very broad in the middle; rami slender, styliform, strongly recurved, the inner one a little shorter and more curved than the outer one, the outer one corneous. Length from tip of the rostrum to the end of the telson, 61 mm. Length of antennæ, 67 mm.

The second form of the male differs from the first form in having smaller chelæ, the tubercles on the third pair of legs less developed, the first abdominal appendages less deeply cleft, the rami stouter, blunter, and not corneous.

In the female the chela is similar to that of the second form of the male, the sternum between the fourth pair of legs is smooth, the annulus ventralis triangular with a median longitudinal fissure.

Labette Co.; W. S. Newlon. 5 males form I., 5 males form II., 7 females.

This species much resembles *C. virilis*, especially the form called *variety A* by Dr. Hagen. It differs in the shape of the first abdominal appendages of the male. In *C. Nais* the rami of these appendages are shorter and more strongly curved than in *C. virilis*, but not so much recurved as in *C. immunitis*. The areola is narrower than in *C. virilis*. The first abdominal appendages are very like those of *C. Palmeri*, as far as can be seen by a comparison of the second-form males alone; but the areola is not obliterated in any part of its course in *C. Nais* and the rostrum is more tapering than in *C. Palmeri*.

6. *Cambarus virilis* Hagen.—Ill. Cat. Mus. Comp. Zool., No. III. p. 63, Pl. I. figs. 23–28, Pl. II. figs. 128–132, Pl. III. fig. 155, Pl. VIII., 1870. *Cambarus debilis* Bundy, Bull. Ill. Mus. Nat. Hist. No. I. p. 24, 1876.—Trans. Wis. Acad. Sci. V. 181, 1882.—Geol. Wis. Surv. 1873–79, I. 403, 1883. *Cambarus couesi* Streets, Bull. U. S. Geol. Geogr. Surv. Terr., III. 803, 1877.

Tributary of Kansas River, Shawnee Co. F. W. Cragin. Ward's Creek, Shawnee Co. J. B. Fields and F. W. Cragin. Wabaunsee Co. J. B. Fields. Garden City, F. W. Cragin. Leavenworth (Coll. Acad. Nat. Sci. Phila.) Manhattan, (Coll. Acad. Nat. Sci. Phila.) Republican River, northwest of Fort Riley (Coll. Acad. Nat. Sci. Phila.) Ellis, (Coll. Peabody Acad. Sci. Salem.)*

7. *Cambarus neglectus* sp. nov.—Male, form I.—Rostrum broad, sub-excavated, with a median longitudinal carina; sides nearly parallel from the base to the lateral spines, which are very small, brown, and horny; acumen of moderate length. Post-orbital ridges with very small anterior spines, or none. Carapace oval, flattened above, punctate, lightly granulate on the sides, lateral spine obsolete, antero-lateral border angulated below the eye; areola of moderate width, dilated anteriorly and posteriorly. Abdomen equal to the cephalothorax in length; basal segment of the telson two-spined on each side. Antennæ shorter than the body; lamina as long as the rostrum, broadest toward the distal end, apical spine of moderate length. Anterior process of the epistoma long, subtruncate. Third pair of maxillipeds hairy within, naked below. Chelipeds short; chela broad, punctate above and below, inner margin furnished with a double row of depressed squamous tubercles; fingers of moderate length, more or less gaping at the base, with a row of round tubercles on their opposed edges, outer margin of the movable finger furnished with low tubercles. Carpus broad, punctate above, with a strong median spine on the internal border and a small one near the base; there are no spines below. Superior border of meros armed with two obliquely-placed ante-apical spines; the lower face of the meros presents two rows of spines. Third segment of the third pair of legs hooped. First pair of abdominal appendages nearly straight, terminating in two long, slender, pointed, horny styles; the anterior style (outer part of the appendage) a little longer than the posterior and slightly recurved.

In the second form of the male the first abdominal appendages are cleft but a short distance. The terminal part of the appendages is stouter and not corneous, and the tips of the rami are rather blunt.

In the female the annulus ventralis presents a deep transverse fossa, bounded on all sides by a prominent wall, which is bituberculate in front.

Length of a male, form II., 74 mm. Length of areola 13 mm. Breadth of areola in the middle, 3 mm.

Mill Creek, Wabaunsee Co.; F. W. Cragin and J. B. Fields. 2 males f. I., 1 female.

This is the species mentioned, but not named, in my Revision of the Astacidae, page 94, under *C. propinquus*. When that work was written I had seen but three specimens of this crayfish, all of them second-form males, without locality. I then forbore to present a complete description of it. The collection of Messrs Cragin and Fields supplies the first-form male and the female. In general appearance this species nearly resembles *C. propinquus*, but the sexual appendages are quite different, resembling those of *C. rusticus*, var. *placidus*.

The tips of the fingers are orange-colored, preceded by a dark-colored annular band.

*The Peabody Academy specimens from Ellis were collected some years ago by Dr. L. Watson.

First Contribution to a Knowledge of the Myriopoda of Kansas.

BY F. W. CRAGIN, SC. B.

The present Contribution does not cover a moiety of the *Myriopoda* of Kansas, nor does it even embrace all of the genera contained in the collections of the Survey. It will be followed shortly by supplementary Contributions.

CERMATIDÆ.

Cermatia forceps, Raf.—This lively "wall-sweeper" is certainly distributed throughout the State. I have met with it frequently in Shawnee and Barber counties, and have received several Labette Co. specimens from Dr. W. S. Newlon. Its abundance, in connection with its *bizarre* appearance and "promptness" of action, make it an object of popular observation and dread. It seems to feel equally at home in houses, in woods, and in shady ravines.

LITHOBIIDÆ.

Neolithobius mordax, L. Koch.—Six specimens from the bluffs of Mulberry Creek, near Sun City, and one from a high hill about ten miles southwest of Medicine Lodge; all found under stones.

SCOLOPENDRIDÆ.

Scolopendra heros, Grd.—A specimen of this large centipede, taken several years since in Turkey Creek valley, in the northeastern part of Barber county, and measuring 7.25 inches in length, has been presented to the Survey by Mr. C. H. Douglass. A specimen 8 inches in length, loaned the Survey by Dr. S. M. Kessler, was taken in the Indian Territory not far south of the Kansas line.

From all the testimony that I have been able to gather, it seems that the bite of this centipede is sometimes fatal, but that its more common effect is a bad sore, resulting in a sloughing of the flesh from the affected part and leaving a more or less cavernous scar. It was a large centipede, and probably a specimen of this species, whose bite resulted in the death of Mr. Crouch, south of Dodge City two or three years since. The circumstances, which were as follows, are vouched for by various residents of southwestern Kansas: Mr. Crouch was one of a party in pursuit of a criminal. Sitting down to rest in the shade, and being somewhat warm, he had taken off his hat, when a centipede dropped upon and bit the top of his head, causing his death within less than an hour.

This seems to be an exceptional case, as it is not a very unusual thing in the southwestern territories to meet with a man who bears a great hollow scar which he asserts is the relic of a centipede's bite.

Fortunately *L. heros* is not of general distribution in Kansas, and apparently finds its northern limit in our south-central and southwestern counties. Old settlers of Barber county say that large centipedes are less

common to-day in that region than formerly. They are reported as rather common in the Cimarron valley; and thence through the southwestern territory and Mexico, they are a characteristic feature of the fauna, a constant bugbear to the inhabitants of adobes and dug-outs.

The species is extremely variable.

***Scolopendra heros*, Grd., var. *castaneiceps*, Wood.**—This beautiful variety of *heros*, deep-shining green with orange-colored head, is not uncommon in Barber Co., where I obtained several specimens from beneath blocks of gypsum. I have seen a single specimen over six inches in length.

***Scolopendra heros*, Grd., var. nov. *prismatica*.**—Under this name may be recorded an interesting variety of this species from the vicinity of Medicine Lodge, contributed to the survey by Mr. G. L. Johnston. It is remarkable for its strongly bicarinate scuta. The superior surface of each scutum, except the first and last, may be said to be bounded by three planes, one horizontal and two sloping from either side of the same and making with it a clearly-cut angle, giving the appearance of a double bevel. The general color of the specimen in alcohol is deep purplish-black, in sharp contrast with the bright orange-brown of the head and first body segment; feet greenish-yellow, the last pair concolorous with the body, and a little stouter than in the typical species.

***Scolopendra polymorpha*, Wood.**—Rice, Finney, and Barber Cos.,—in the last named county, common in the debris of the gypsum rock. Mrs. J. K. Pitts has contributed a specimen whose exact locality is now lost, but was probably in the vicinity of Topeka.

This is the common *Scolopendra* of Kansas. The largest specimens exceed four inches in length. One specimen has the joints of the antennæ 30, 29; another, 30, 28 in number.

***Scolopendra morsitans*, Linn., var. nov. *cœrulescens*.**—A centipede with antennæ 20-jointed, I refer here provisionally, though it differs in some respects from the characters given by Newport and Wood for this species, and though the latter author has expressed his belief that *S. morsitans* is not an inhabitant of the United States. The color is a uniform light blue, or greenish blue, pale, almost to translucence, the legs being nearly colorless and transparent. The mandibles are dark green, in sharp contrast with the light-bluish hue of the other mouth-parts, which are concolorous with the head and body. The entire animal is of a more delicate structure than is usually seen even in small specimens of the genus. The reflexed antennæ cover about four segments of the body. The length is a little over an inch. These characters will suffice to distinguish this variety of *morsitans*, if I am right in referring it to that species; but I shall elsewhere give the details of its form and armature.

Newport states that the range of *S. morsitans* includes the tropical and subtropical portions of the New World, and an unknown portion of China. In view of the many subtropical features in the fauna of southern Kansas that have already come to light, the discovery of this species in that region need be hardly a matter of surprise. Our specimen was found under a stone on the summit of a high hill in Barber Co., about 500 feet above the Medicine River at Medicine Lodge.

GEOPHILIDÆ.

Geophilus bipuncticeps, Wood.—Two specimens of this distinctly marked species were recently collected by the writer in Jefferson Co. One of these specimens has sixty-five pairs of legs.

IULIDÆ.

Iulus ———, —.—Specimens of *Iulus* are abundant in Shawnee Co., but I shall not be able to report upon any of them in the present Contribution.

Spirobolus uncigerus, Wood (?)—A specimen of this genus from Topeka I refer to *uncigerus*, as it agrees better with that species than with any other. It seems to present important differences, however; and I will withhold final decision upon it for a later paper.

POLYDESMIDÆ.

Polydesmus Virginiensis, (Drury) Wood.—Two specimens from the Kansas Valley woods, Shawnee Co., are both clearly referable to this species, as is shown by the very characteristic genitalia. One of them agrees in full with Wood's description; the other differs considerably in color, but chiefly in its much paler and less distinct color-pattern.

Polydesmus floridus, Wood.—Two specimens, collected near Thompsonville, Jefferson Co., by the writer. A third from near the same locality is contributed by Miss Daisy McCampbell. I think that I have taken the same species in Shawnee Co., but have none in hand from this county at the present writing.

First Contribution to a Knowledge of the Arachnida of Kansas.

BY F. W. CRAGIN, Sc. B.

This short list is but a precursory fragment of a series of observations which the Survey is making upon the spiders of Kansas.

The distribution and abundance of the species herein given will be more fully stated in later Contributions.

Mygale Hentzii, Grd.: TRAP-DOOR SPIDER.—Barber Co. (A. J. McCabe); Chautauqua Co. (C. H. Hosford).

This spider is known in southern Kansas as "Tarantula" and "Bird Spider;" but the name, "Tarantula," is more properly applied to species of the genus *Lycosa*, and the true Bird Spider is a much larger species, *M. avicularia*, confined to the American tropics. The females of *M. Hentzii* are probably the largest specimens of genuine "Jayhawker" spiders extant. Both sexes are represented in these specimens.

Since the above specimens of *Hentzii* were recorded in our list, numerous specimens have been seen by the writer, and several collected; chiefly from Barber Co. and westward. It varies in color from reddish-brown to black.

Lycosa fatifera, Hentz.: TARANTULA.—Three specimens from Shawnee Co., June to September, and one from Brown Co. They present the following characters not mentioned by Hentz: Cephalothorax with an incomplete dorsal stripe of pale red; sides and ventral surface of abdomen light reddish-brown, speckled with black; legs reddish-brown and fuscous in subdued contrast. The color of the body above is dark blue-brown. The phase thus characterized may be provisionally designated as var. *centralis*, its exact relation to *fatifera* being as yet uncertain.

The Topeka specimens were collected by Messrs. L. T. Matthews and A. Tucker, and the writer; that from Brown Co. by Miss Mara Becker. A specimen has been recently contributed from Reno Co. by Mr. L. A. O'Hara.

Lycosa pilosa, Grd.—One male taken in Shawnee Co., in September, by the writer. The general grey color has a pinkish shade. The specimen differs from Girard's description only in having a subrectangular area of black, not sharply defined upon the upper surface of the abdomen anteriorly. The black dentoid processes on the distal end of the chelicera are, on its upper (anterior) margin one, and on its lower margin three in number, and nearly equal. The fourth leg is about 1.55' in length, the others averaging about .1' successively shorter in the order peculiar to the genus. Cephalothorax .44' in length by .31' in breadth.

Lycosa riparia, Hz.—Shawnee Co., August; entering an outbuilding. Though the single specimen which I refer to this species was not taken near water, it differs in no important respect from Hentz's description and figure. It has, however, the two rows of dots on the abdomen yellow instead of white. The two black spots and line, often present in this species at the base of the abdomen inferiorly, is in this instance lacking.

Agelena nœvia, Bosc.—Shawnee Co. As elsewhere in the United States, the commonest of spiders, building its geometric web in corners of houses and outbuildings, and less commonly in the lee of bushes.

Epeira domicilliorum, Hz. (?)—Topeka, cellars and dark rooms.

Epeira diadema, Hz.—Shunganunga and Wakarusa valleys.

Epeira riparia, Hz.—Shawnee and Barber Cos., frequent. Apparently not partial to margins of waters in Kansas, nor even to bottom-lands, but commonly stretching its web in gardens and beside bushes or weeds in shady places. It is perhaps more generally distributed in this (1885) than in dryer seasons.

Specimens have been contributed to the Survey from Labette Co. by Dr. W. S. Newlon, and from Reno Co. by L. A. O'Hara.

Epeira fasciata, Hz.—I have taken this species only in the valleys of the Medicine River and Turkey Creek, Barber Co. It is doubtless also common in eastern Kansas.

Epeira septima, Hz.—A single female specimen taken in Shawnee Co. in August, descending from the top of a door.

Miscellaneous Notes.

While collecting for the Survey in McPherson county, in the summer of 1884, the director found the curious and interesting *Azolla Americana* growing abundantly upon the shallow water and mud at the margin of Lake Inman. It seems not to have been hitherto recorded from Kansas. Later it has been sent to us from Neosho River at Oswego by Dr. W. S. Newlon.

Buthus Carolinianus appears to be generally distributed in Kansas, but is evidently not common in our northern and eastern counties. I have found it abundant in stony places on the Gypsum Hills of Barber county. A specimen from south of Emporia has been contributed by Mr. Frank Kizer, and a number of young from McPherson Co., by Dr. John Rundstrom. Scorpions (which are probably of this species) are reported as occurring commonly in the vicinity of Wallace, in the northwestern part of the State, and, less commonly, as far northeast as Douglas county.

A specimen taken near the fire, in a house in Medicine Lodge, in cold weather, has been contributed by Mr. G. L. Johnston.

Dr. H. C. Wood first recorded this species from Kansas, and appears to have been also the first to recognize the peculiar subtropical affinities of the fauna of Kansas. (See his monograph of the North American *Pedipulpi*, under *B. Caroliniana*.)

Elevation above sea-level having a marked influence upon the distribution of insects, it may be interesting to note, in connection with Mr. Bruner's report on *Orthoptera*, the elevations of the respective localities which furnished the specimens. They are as follows, the numbers usually referring to the elevation at the depot grounds of the A. T. & S. F., U. P., and S. K. railroads:

Town.	County.	Elevation.
Ellis.....	Ellis (western).....	2,117
Garden City.....	Finney (formerly Sequoyah).....	2,827
Great Bend.....	Barton.....	1,841
Lindsborg.....	McPherson	1,332
Medicine Lodge.....	Barber.....	1,449
Oswego.....	Labette.....	895
Reno Center.....	Reno.....	1,525-1,550
Sun City.....	Barber.....	(?) 1,750
Topeka.....	Shawnee.....	884

Many of the Barber Co. specimens were collected on the Gypsum Hills, 200-500 feet above the valley elevation above given for Medicine Lodge.

Prof. E. D. Cope, of paleontological and herpetological fame, has twice paused in his passage across the continent to note the progress of our work and bestow a word of cheer. In one of these brief visits, he discovered among some unstudied material recently collected by the director of the Survey in Barber county, a specimen of *Rhinocheilus LeContei*, B. and G., which shows some remarkable variations from the typical species. A brief note upon this specimen will appear from the pen of the Professor in our next Report.

The specimen was brought, living, to the director of the Survey, by Mr. Chaney Smith of Medicine Lodge, who captured it in a garden in that

town. It has previously been reported from southern Texas and California only, and it is therefore needless to say that the discovery of this rare and beautifully colored serpent in southern Kansas greatly extends its known range and adds yet one more emphatic link to the already strong chain of evidence which asserts that the fauna of southern Kansas has many features usually regarded as sub-tropical.

The genus *Pinus* has never appeared on any of the local lists relating to the flora of Kansas.

Dr. J. H. Oyster, of Paola, who recently passed through Topeka, and stopped long enough to glance at the Wasburn cabinet and the work of the Biological Survey, called our attention to the fact that a species of *Pinus* has been ascribed to Kansas by Prof. Sargent in his "Report on the Forest Trees of North America." On referring to that work, we find (p. 200) *Pinus mitis*, Mich., the Short-leaved Yellow Pine, given as native to southeastern Kansas. It is certainly not common, even in that favored section of the State.

During a brief trip to Cherokee county, Dr. Oyster learned that large pines had been felled in that county by the settlers, but could learn of none still standing, save a few saplings, the locality of which he was unable to visit. He was, however, informed by reliable parties that there exists a small group of pines at a point almost exactly on the line between Kansas and Indian Territory, while a considerable grove of the same exists but a very few miles further south.

We would gladly record any more definite observations as to the past or present occurrence of *Pinus* in Kansas; and those able to furnish such are respectfully requested to communicate with the director of the Survey.

The expense of publishing the first two *Bulletins* having, for various unforeseen reasons, proved relatively greater than it will henceforth be, the occasion for issuing *Bulletin* 3 arrived and found the funds available for that purpose temporarily exhausted. To avoid an interruption which would have been in many ways detrimental to the work of the Survey, we issued a call to various friends of the Survey for aid. The following responded and became the *Patrons of Bulletin* 3, by contributing sums of one to five dollars, thus enabling us to keep the publication abreast of the work:

George J. Angell, Esq.,
S. A. Baldwin, Esq.,
Miss Mara A. Becker.
George Brinkman, Esq.,
Jerry M. Fields, Esq.,
L. L. Jewell, Esq.,
Lucius T. Matthews, Esq.,
Ralph E. McCampbell, Esq.,
Angus McMillan, Esq.,

J. R. Mead, Esq.,
W. S. Newlon, M. D.
Andrew Sabine, M. D.
B. B. Smyth, Esq.,
William Tweeddale, Esq.,
Louis Watson, M. D.,
And three friends of the Survey, whose names are withheld.

We take this opportunity to return our sincere thanks to these kind friends for their prompt assistance, and we trust that we shall have no need of making any further call for aid, other than such as they are now giving by way of specimens and observations.

3.

Reprint from
Proceedings Davenport Academy of Natural Sciences,
Volume V.

ON CERTAIN RECENT, QUATERNARY,
AND NEW
FRESH-WATER MOLLUSCA.

BY R. ELLSWORTH CALL.

Read before the Davenport Academy of Natural Sciences, February 26th, 1886.

THE area which has contributed most of these forms is little known conchologically. All the knowledge gathered concerning its molluscan fauna is fragmentary, and, for the most part, scattered through many publications, rendering a collation of their information an imperative need. Such a collation has been for some time in progress, and the present writer hopes soon to present a summary of the results.

Of the six species herein described, four have hitherto been characterized by me, two of which were, in deference to authority, given only varietal rank. It is now proposed to recognize the varietal names as of specific value, and to republish the original descriptions as applicable to the specific name. This disposition is made in the light of continued and careful study of these forms in conjunction with well-preserved specimens of the species of which they were formerly regarded as varieties.

RISSOIDÆ.

Genus AMNICOLA Gould & Haldeman (1841).*Amnicola dalli*, sp. nov.

(Plate I., Figs. 4-6.)

Amnicola dalli, Call.—Bull. U. S. Geol. Sur., No. 11, p. 45, Plate VI., Figs. 4-6 (1884).

Shell narrowly umbilicate, obtusely conical, shining, slightly striated, brown or greenish horn color; whorls four, convex, gradually increasing in size; suture regularly impressed, somewhat deep; aperture rounded before, somewhat angular behind, bluish white within; lip simple, sharp, margins joined by a thick callus, columella rather reflexed.

Length, 3.50^{mm}; breadth, 2.30^{mm}.

Habitat and Station.—Mountain streams tributary to Pyramid Lake, North-west Nevada.

For the diagnosis of the lingual dentition I am indebted to Mr. Charles E. Beecher, who has prepared the following description and illustrations:

“Jaw thin, membranaceous.

“Odontophore 1.10^{mm} long, .13^{mm} wide. In a full-grown example the odontophore has 94 transverse rows of teeth, with the formula 3—1—3.

“Rhachidian tooth short and broad, with the inferior lateral angles produced. Cusp with seven denticles, of which the central one is the largest. The anterior lateral faces are each furnished with a short, strong, conical denticle, and the adjacent lateral margin of the tooth is thickened and slightly produced. Formula for rhachidian tooth:

$$\frac{3+1+3}{1+1}$$

“Body of intermediate tooth quadrate; infero-interior angle somewhat produced; furnished with a large bullation, into which the infero-interior angle of the succeeding tooth appears to fit as if for articulation. Peduncle long and straight. Cusp with seven strong angular denticles, arranged according to the formula 2+1+4.

“Body of the first lateral tooth elongate-triangular, oblique to the direction of the broad peduncle. Cusp inflected, and carrying twenty-three slender denticles.

“Outer lateral tooth hamate, with no marked distinction between the body and peduncle. Free extremity incurved and bearing thirty-four minute denticles. The denticle formula is, therefore,

$$34-23-7-\frac{3+1+3}{1+1}-7-23-34.$$

"The apparent articulation of the intermediate teeth, as described above, was observed in a fragment of an odontophore which presented a lateral aspect under the microscope. It is not known that this feature has ever been noted in any other species, although it very probably occurs in many which have foraminated or bullate teeth. This disposition of the teeth would allow great flexion of the odontophore without their displacement."

FIG. 1.—Lingual dentition of *Amnicola dalli*, Call $\times 400$.—Beecher.

a.—Two of the transverse rows of the odontophore, showing the normal position of the teeth. The teeth are considered as opaque.

Analysis: *b.*—Outer laterals. *c.*—First laterals. *d.*—Intermediate teeth. *e.*—Rachidian teeth.

FIG. 2.—Intermediate teeth ($\times 400$), showing mode of articulation.—Beecher.

This quite distinct form was collected in considerable numbers at Symon's Stage Station, near the foot of Pyramid Lake, Nevada. Its nearest congener is *A. porata* Say, from which it differs in elevation, sculpturing, and dentition. Since this last character is the one of chief importance, the description of the dentition is here given. Comparing the denticle formulæ of the two forms, thus:

A. porata.

$$30-18-5-\frac{3+1+3}{4+4}-5-18-30,*$$

A. dalli.

$$34-23-7-\frac{3+1+3}{1+1}-7-23-34,$$

the dissimilarity is strongly marked. Specimens may be seen in numerous private collections, and in the cabinets of the Smithsonian Institution, the New York State Museum of Natural History, and the Davenport Academy of Natural Sciences.

VALVATIDÆ.

Genus VALVATA Müller (1774).

***Valvata utahensis*, sp. nov.**

(Plate I., Figs. 1-3.)

Valvata sincera, var. *utahensis*, Call.—Bull. U. S. Geol. Sur., No. 11, p. 44, Plate VI., Figs. 1-3 (1884).

Shell operculate, narrowly umbilicate, conical, with minute transverse striæ, shining, somewhat pellucid, yellowish horn color at apex, white below; spire obtusely elevated, flattened at tip; suture well impressed; whorls four, convex, regularly increasing, the uppermost ones with a single well-marked carina, which becomes obsolete on the last whorl; last whorl equals one-half the whole length of the shell; aperture circular, slightly angled posteriorly; peristome simple, continuous, joined to the next whorl above by a very slight calcareous deposit; within white.

Operculum light horn color, corneous, spirally multivolute, slightly produced posteriorly to conform to the shape of the aperture. Dentition unpublished.

Length, 4.80^{mm}; breadth, 3.20^{mm}.

Habitat.—Lake Utah, Utah.

* After Stimpson, Smithsonian Misc. Coll., No. 201, p. 14, Fig. 6; also *ibid.*, No. 144, p. 80, Fig. 158.

This form was dredged by the writer, in August, 1883, in great numbers in Utah Lake, near Lehi, not far from the head of the River Jordan. It is intermediate between *Valvata sincera* Say and *V. virens* Tryon. From the first it differs in the unicarinate upper whorls, in being more elevated, in possessing a very much smaller umbilicus, and in its greater size. From the second it differs in color, size, carination, and form of aperture. It resembles, in some respects, *V. unicarinata* De Kay (= *V. tricarinata* Say), but differs in size, ornamentation, and form of aperture. Specimens may be seen in the Smithsonian Institution, in the New York State Museum of Natural History, in the Davenport Academy of Natural Sciences, and in the private collections of Beecher, Stearns, Dall, Aldrich, and the writer.

LIMNÆIDÆ.

Genus RADIX Montfort (1810).

Radix utahensis, sp. nov.

(Plate I., Figs. 7-9.)

Radix ampla, var. *utahensis*, Call.—Bull. U. S. Geol. Sur., No. 11, p. 47, Plate VI., Figs. 7-9 (1884).

Shell globose, somewhat umbilicated, irregularly costate, light horn color, nearly pellucid; spire rather small, conical; whorls four to four and one-half, convex, somewhat flattened above, giving rather a shouldered appearance to the whorls, rapidly increasing in size, the last whorl being inflated, with numerous rather marked transverse costæ, minutely wrinkled; suture somewhat deep, regularly impressed; aperture elongately ovate, effuse, approaching patulous, pearly white within; outer lip simple, the margin connected by a slight calcareous deposit; columella somewhat twisted, but straight in front. Dentition unpublished. Length of largest specimen, 16.82^{mm}; breadth, 8.88^{mm}. The average of nine specimens gave a length of 13.40^{mm}, breadth 7.10^{mm}, with about the same ratio for corresponding measurements of aperture.

Length, 13.40^{mm}; breadth, 7.10^{mm}.

Length of aperture, 9.00^{mm}; breadth of aperture, 5.90^{mm}.

Habitat and Station.—Lake Utah, Lehi, Utah.

This is a rare form in Utah Lake, its only locality so far as known. Its nearest affinity is *Radix ampla* Mighels. In the preceding reference its relation to *Polyrhytis kingii* Meek has been noted. It was associated with abundant specimens of the *Valvata* herein described, and with *Fluminicola fusca* Haldeman and *Sphærium dentatum* Haldeman. Specimens may be seen as above.

Genus LIMNOPHYSA Fitzinger (1833).***Limnophysa bonnevillensis*, sp. nov.**

(Plate I., Figs. 10-13.)

Limnophysa bonnevillensis, Call.—Bull. U. S. Geol. Sur., No. 11, p. 48, Plate VI., Figs. 10-13 (1884).

Shell umbilicated, elongate, ventricose or bullate, somewhat solid, faintly striate and very minutely reticulated below the suture, the last whorl bearing faint longitudinal ridges or costæ; spire elevated, acute; suture deeply impressed; whorls 4 to $4\frac{1}{2}$, very much rounded, sometimes tending to geniculation above, the last whorl equal to three-fourths the whole length of the shell, rapidly increasing in size, much swollen, somewhat expanded at base; columella somewhat plicate, slightly callous, regularly arcuate; columella and peristome continuous; peristome simple, margins joined by a heavy callus, which is continuous and so reflexed as to partially close the umbilicus; aperture broadly ovate, often patulous, equal to one-half the entire length of the shell, oblique, angled slightly behind.

Fossil, Quaternary. Bonneville Lake beds, Kelton, Utah.

The four largest specimens of the many in the collections give the following dimensions:

SPECIMEN.	LENGTH.	BREADTH.
	mm.	mm.
1.....	15.00	7.80
2.....	11.00	5.80
3.....	9.40	5.20
4.....	18.50	6.00

STREPOMATIDÆ.

Genus GONIOBASIS Lea (1862).***Goniobasis stearnsiana*, sp. nov.**

FIG. 3.
GON. STEARNSIANA. $\times \frac{3}{2}$

Shell globose, not very elongate, excavated in umbilical region, but not umbilicated, usually coarsely and obliquely costate on upper whorls; spire conical, not much elevated; whorls $5\frac{1}{2}$ – $6\frac{1}{2}$, scarcely convex, appressed at the suture, body-whorl very large, more than equalling one-half the entire length, often angulate at periph-

ery, above which it is flattened, many-banded and smooth, or bandless and coarsely multistriate, the striae cord-like and variable in number, coarsely and obliquely wrinkled by the well-marked lines of growth; suture well but irregularly impressed; aperture oblique, trapezoidal, twice as long as broad, effuse, white or creamy-white within, often banded with broad purple bands, slightly retuse at columellar region; peristome simple, sigmoid, a little thickened, somewhat reflexed at base of columella; columella thickened, always white, twisted; parietal wall usually with a thick deposit of callus, which is sensibly thickened near the posterior angle of aperture.

Operculum black, otherwise as usual in the genus.

Habitat and Station.—This shell occurred only in a limited area in Dyke's Creek, a clear and cold mountain stream tributary to the Etowah River, Floyd County, Georgia. Associated with it were numerous specimens of *Margaritana georgiana* Lea, two species of undetermined *Unio*, *Goniobasis vittata* Anthony, and *Goniobasis bella* Conrad. It has the habit of *Anculosa*, and is to be sought only in the most swiftly flowing and deepest portions of the stream, on rocks. It is not abundant, the most painstaking examination revealing some two hundred individuals.

The characters given are those which appear to be most constant, though some of these are variable. The variations, as usual in this family, range through wide limits. Thus, occasional specimens of the smooth and banded type depart so far from the figure that the whorls are loosely coiled and very much rounded; this does not appear to be of varietal value, but is pathologic. The color, again, ranges from light yellow to dark olive, and the peripheral angle becomes almost a carina. The average dimensions of seventeen individuals are, for length, 21.14^{mm}; for breadth, 12.02^{mm}. The largest specimen has a length of 26.08^{mm} and a diameter of 14.00^{mm}.

Specimens may be seen in the United States National Museum, Cornell University, New York State Museum of Natural History, Amherst College, Davenport Academy of Natural Sciences, and in the private collections of C. E. Beecher, T. H. Aldrich, and the writer. The species is named in honor of Dr. R. E. C. Stearns, so well known for his researches on the Pacific Coast mollusca.

CORBICULIDÆ.

Genus SPHÆRIUM Scopoli (1777).**Sphærium uintaense**, sp. nov.

FIG. 4.
SPHÆRIUM UINTAENSE.
× 5

Shell thin, small, globose, ventricose, slightly inequilateral, posterior and anterior margins well rounded, very slightly produced posteriorly; umbones large, subcalyculate, full, rounded, dark, retaining embryonic shell, approximate; basal margin rounded, thus giving a circular outline to shell; epidermis shining, dark straw or olive colored, substrate, light yellowish on basal margin; cardinal teeth microscopic, slightly in advance of the middle region of the umbones, not widely separating; lateral teeth small, short, somewhat upcurved.

Viewed in profile from in front, the point of junction of lower portion of valves with the embryonic shell appears as a well-marked obtuse angle.

Length, 4.76^{mm}; diameter, 4.02^{mm}; number of specimens, eight.

Habitat and Station.—A lake in the Uinta Mountains, Utah, at an elevation of 10,500 feet. The specimens were communicated by Prof. Orson Howard, of Salt Lake City, and were collected by him in August, 1885.

This species is remarkable for its small size, all the specimens seen being mature, and one with fry, and for the great elevation at which it occurred. This is by far the greatest hypsometric range recorded for any lamellibranch. The lake is snow-fed, and therefore its normal temperature must be far below that of waters in which the *Corbiculidæ* usually occur. Its extreme fragility and small size, it is believed, must be coördinated with these features of its environment. Specimens are in the collection of Prof. O. Howard and of the writer.

It may not be altogether improper, in this connection, to advert to the lax usage of naturalists in connection with the terms *habitat* and *station*. They are used as though strictly synonymic, while possessed of a definite and precise meaning. It is proposed, therefore, that the term *habitat* be used in the sense of geographic distribution, while *station* should be used always and alone to indicate the immediate physical environment of the form considered. Such is the sense herein contemplated.

PLATE I.

FIGS. 1-3—*Valvata utahensis*.

4-6—*Amnicola dalli*.

7-9—*Radix utahensis*.

10-13—*Limnophysa bonnevillensis*.

PLATE I.

(From Proceedings Davenport Academy of Natural Sciences, Vol. V.)

ON PYRGULOPSIS, A NEW GENUS OF RISSOID MOLLUSK, WITH DESCRIPTIONS OF TWO NEW FORMS.

BY R. ELLSWORTH CALL AND HARRY A. PILSBRY.

Read before the Academy, February 26th, 1886.

IN September, 1883, Mr. R. E. C. Stearns described a rissoïd mollusk from Pyramid Lake, Nevada, under the name of *Pyrgula nevadensis*. His description was based, in part, upon material furnished by one of the present writers, which was, at that time, inconsiderable in amount. In the following year the form was collected in almost incredible numbers in the original locality, and studied by Messrs. Call and Beecher in as complete a manner as rather unfavorable circumstances would admit. At that time the generic reference of the species appeared to be unquestionable, and, in the absence of specimens of European *Pyrgula* for comparison, was agreed upon as probably correct. Since this later study of the Nevada form, in which the dentition was illustrated and found to be rissoïd, additional data have accumulated, which appear to render impossible the original generic reference. These data consist, in the main, of a careful study of the original bibliographic matter concerning the institution of *Pyrgula* as a genus, of the discovery of at least two additional forms which seem to be congeneric with *Pyrgula nevadensis*, neither of which agree with typical *Pyrgula*, either in station or understood hypsometric range, and of certain conchologic features that appear in the following diagnosis. In the further absence of any generic group which will include these shells, it has seemed proper to institute for their reception a genus that would do no violence to their conchologic affinities or to their geographic distribution. We therefore propose the name of *Pyrgulopsis* for these forms, and define the genus as follows:

PYRGULOPSIS, *gen. nov.*

(Etymology: *Pyrgula*, and *opsis* = aspect of.)

Type, *Pyrgulopsis nevadensis* Stearns.

Pyrgula nevadensis Stearns.—Proc. Phila. Acad. Nat. Sci., 1883.

Generic characters: Shell minute, conically turreted, somewhat elongated, imperforate, unicarinate; apex acute; aperture ovate; peristreme continuous.

Operculum ovate, thin, corneous, spiral, with polar point well forward and approximating the columella.

Jaw thin, membranaceous.

Odontophore with teeth arranged in transverse rows, according to the formula $3+1+3$. Formula for denticles of rhachidian:

$$\frac{4+1+4}{1+1.}$$

Distribution: Western and South-western United States, in fresh or brackish water.

So far as known to us, the typical European *Pyrgulae* are bicarinate or multicarinate. The type of the genus is the species described by Michelin* as *Melania helvetica*. The founders of the genus, Christoforo and Jan, described the same form as *Pyrgula annulata*, from a locality in Switzerland. Figures 11 and 12 of Plate II. are drawn from Switzerland specimens of this form.

As above defined, this genus will include the form described by Mr. John Wolf as *Pyrgula scalariformis*.† Although the first described species, it was not considered advisable to constitute this form the type of the genus. Being a post-pliocene fossil, it was impossible to indicate those characters in the animal itself which are desirable in framing an intelligible diagnosis. These have, so far as the operculum and dentition go, been studied in the Nevada form only. The remaining species to be included are, besides the type, *P. mississippiensis*, sp. nov., and *P. spinosus*, sp. nov.

DESCRIPTIONS OF THE SPECIES OF PYRGULOPSIS.

Pyrgulopsis nevadensis Stearns.

(Plate II., Figs. 1-10.)

Pyrgula nevadensis Stearns. — Proc. Phila. Acad. Nat. Sci., p. 173, figure (1883). — Call and Beecher, Am. Nat., Sept. 1884, Vol. XVIII., pp. 851-855; from this paper the present account of the dentition is copied. — Call, Bull. U. S. Geol. Survey, No. 11, 1884.

Shell small, somewhat elongated, variable, turreted, imperforate; whorls $4\frac{1}{2}$ - $5\frac{1}{2}$, strongly unicarinate on periphery, otherwise smooth; epidermis shining, light straw color or whitish, white at suture; suture deeply and regularly impressed, made conspicuous by the approximating carina; aperture very oblique, roundly ovate, with an angle on outer edge corresponding to the excavated carina, posteriorly sharply

* Magasin de Zoologie, p. 37, Plate xxxvii. (1831.)

† Vide American Journal of Conchology, Vol. V., 1869, p. 198, Plate xvii., Fig. 3.

angled, well rounded before; peritreme continuous, almost rimate, closely appressed to parietal wall.

Operculum light corneous, spiral, closely fitting the aperture.

The following account and illustration of the dentition is by Mr. Charles E. Beecher, who has devoted much attention to the dentition of this group:

"Jaw thin, membranaceous.

"Odontophore .62^{mm} in length, and .15^{mm} in width. There are usually fifty-five transverse rows of teeth, arranged according to the formula 3 — 1 — 3, which is common to the family *Rissoiidae*.

"Rhachis distinct, occupying one-fourth the width of the ribbon. Rhachidian tooth (Fig. 1) short and broad, with the infero-lateral angles produced and slightly arcuate. On each side of the anterior face is a strong, short, conical process or basal tooth projecting outward and somewhat downward. Basal margin trilobate; central lobe truncate. Cusp curved forward, and extended into a strong denticle with four smaller ones on each side. The formula of the denticles for this tooth would, therefore, be:

$$\frac{4+1+4}{1+1}$$

"Body of intermediate tooth* subrhomboidal, with the infero-interior angle slightly produced and with an angulation in the margin above. From this point there is a thickening or ridge extending toward the fixed end. Peduncle longer than the body of the tooth. Upper margin abruptly curved forward and marked by seven denticles, of which the third inner one is usually the largest; the formula for this tooth may be written 2+1+4.

"Inner lateral tooth (Fig. 3) spoon-shaped, with the infero-interior margin angular. Upper anterior margin marked with a fringe of about twenty-four denticles, decreasing in length from the interior extremity. Peduncle straight, wider than the body.

"Outer lateral tooth (Fig. 4) falciform, straight along the peduncle. Anterior margin and extremity denticulated with thirty minute denticles, usually decreasing in length toward the distal extremity, but subject to some variation. The denticulate margin extends more than one-third the length of the tooth. Peduncles slender and nearly straight.

"The formula for the denticles is:

$$30 - 24 - 7 - \frac{4+1+4}{1+1} - 7 - 24 - 30.$$

"There is a marked variation in the character of the denticles on the intermediate and lateral teeth. On the intermediate they are large,

*It is proposed by Mr. Beecher and the senior writer to give to this tooth the name of *admedian*. In a forthcoming monograph of the *Rissoiidae* that name will be constantly so employed.

angular, and somewhat irregular. The lateral teeth are uniformly marked by a regular fringe of slender denticles, which are much smaller on the outer lateral.

"Some portions of the membrane and different specimens show considerable variation in the length and strength of the denticles on the lateral teeth, and sometimes their number seems subject to some mutation. The numbers given in the formulæ were averaged from several enumerations, and represent the comparative denticulation of the teeth."

DESCRIPTIONS OF FIGURES.

(All figures enlarged to 500 diameters.)

FIG. 1.—Rhachidian teeth.

" 2.—Intermediate teeth.

" 3.—Inner laterals.

" 4.—Outer laterals.

" 5.—A portion of the odontophore, representing the teeth in their natural position.

This species has a limited distribution, occurring only, so far as present information goes, in North-western Nevada, in Walker and Pyramid Lakes. Living forms have been collected only in the last-named locality.

The description of Dr. Stearns has been amended to form a diagnosis as complete as very extensive series would permit. The shell is exceedingly variable, ranging from short and stout to long and slender, and from strongly carinate to entirely smooth. Figures 6, 7, and 8 of Plate II. show the smooth forms and the variations to which they are inclined.

Pyrgulopsis mississippiensis, sp. nov.

(Plate II., Figs. 14-16.)

Pyrgula scalariformis, var. *mississippiensis* Pilsbry.—Am. Nat., Jan. 1886, p. 75. No description.

Shell minute, pupiform, elevated, imperforate; whorls $5\frac{1}{2}$ –6, flattened, with a well-marked carina on lower third, which becomes central on periphery of last whorl, body-whorl equal to one-half entire length of shell and bluntly angulated at position of carina; epidermis —; suture distinct, deeply impressed only at commencement of last whorl and below, above last whorl covered by carina; aperture narrowly ovate, broadly rounded before and narrowly rounded behind, very oblique; peritreme continuous, almost rimate, slightly reflected over the parietal wall; lip simple, sharp.

Animal unknown.

This form has hitherto occurred only in the Mississippi River, near the mouth of Rock River, on the Illinois side — Rock Island County, Illinois. Many dead specimens have been taken, but, as yet, no living ones. It differs in important particulars from the *P. scalariformis*, Wolf, which is "carinate its entire length," has a different aperture, and is markedly different in the character of the sutures. Our species is ecarinate on all whorls above the body-whorl, the carina being depressed and filling entirely the suture. The outlines of the apical whorls are wholly unlike the figured type of Wolf's species. The average measurements of the four specimens upon which the preceding description is based are, for length, 4.66^{mm}; for breadth, 1.61^{mm}. The proportions of length and breadth, while variable, do not vary within so wide limits as the *P. nevadensis*. The individual measurements are as follows:

<i>Specimen</i>	1.—	Length,	3.58 ^{mm} ;	breadth,	1.60 ^{mm} .
"	2.—	"	3.38 ^{mm} ;	"	1.56 ^{mm} .
"	3.—	"	3.50 ^{mm} ;	"	1.64 ^{mm} .
"	4.—	"	3.40 ^{mm} ;	"	1.64 ^{mm} .

Pyrgulopsis spinosus, sp. nov.

(Plate II., Figs. 17-19.)

Shell minute, imperforate, turreted, unicarinate, carina modified into spinous processes on last three whorls, darker colored than balance of shell; whorls 5-5½, first two rounded, destitute of spines or carina, the last three somewhat geniculate, angled at location of carina, body-whorl large, sometimes with an occasional spine below the carina; epidermis light horn color, nearly white at apex, with microscopic longitudinal revolving striæ, shining; aperture roundly ovate, slightly longer than broad, rounded anteriorly; peristome not continuous, sharp, simple, slightly reflected near the columella, suggesting a faint umbilicus; suture slightly impressed.

Operculum spiral, reddish horn color.

Specimen 1.—Length, 3.86^{mm}; breadth, 2.34^{mm}.

“ 2.— “ 3.00^{mm}; “ 1.88^{mm}.

“ 3.— “ 3.06^{mm}; “ 1.52^{mm}.

Habitat.—Comal Creek, a clear stream at New Braunfels, Texas, on rocky bottoms. It was associated with numerous specimens of *Goniobasis pleuristriata* Say, *Amnicola* (species undetermined), and *Bythinella* (species undetermined).

In some particulars this form may be compared with Stimpson's genus *Potamopyrgus*. It differs radically, however, in the character of the spinous processes, which in that type are epidermal, while in our form they are true testaceous products. It is the only spinous rissoid described from the United States.

Pyrgulopsis scalariformis Wolf.

(Plate II., Fig. 13.)

Pyrgula scalariformis Wolf.—Am. Jour. Conch., Vol. V., p. 198, Plate xvii., Fig. 3 (1869).

“Shell turreted, slender; whorls 6, chalky white; suture deeply impressed; carinate its entire length on the lower edge of the whorls; mouth small, ovate, but slightly connected with the last whorl. Length, one-half inch.

“Post-pliocene; abundant on the Tazewell shore of the Illinois River.” (Wolf.)

No other locality has been recorded, and no living specimens have ever been taken. The figure is a copy of the original, and has been the main reliance in referring the species to this genus. We have not been able to procure from the author either the types or authentic specimens for examination.

PLATE II.

All original figures except 14 *b*, 14 *c*, and 17 *a* are enlarged three diameters.

FIGS. 1-6—*P. nevadensis*, carinate forms.

7-8— “ smooth var.

9— “ operculum.

10— “ Outline of Stearns' figure
in Proc. Phila. Ac. Nat. Sci., p. 173,
(1883).

11-12—*Pyrgula helvetica* Mich.

13—*P. scalariformis*—Copy of Wolf's figure
in Am. Jour. Conch., Vol. V., pl. xvii.,
fig. 3.

14-16—*P. mississippiensis*.

17-19—*P. spinosus*.

All figures except 10 and 13 are drawn from specimens in the authors' cabinets.

PROCEEDINGS DAVENPORT ACADEMY OF NATURAL SCIENCES—VOL. V.
 PLATE II.

ries edged with the color of the back, the throat pale ochraceous, and the breast and upper belly narrowly streaked with ochraceous.

3. *Dendrocincla minor* PELZ.

Dendrocincla minor Pelz., Orn. Bras., 1871, 42, 60 (S. Vicente, Brazil).

"*D. supra-olivaceo brunnea*, pileo nuchaque striis scapalibus angustis ochraceis, stria ab oculo versus nucham ducta ferruginea valde distincta, uropygio et tectricibus caudæ superioribus parum rufescentibus, tectricibus, alarum superioribus et remigum limbo angustissimo dorso concoloribus, remigibus cinnamomeo rufis, majoribus apicibus brunneis, tectricibus alarum inferioribus pallide ferrugineis, cauda cinnamomeo rufa, gula et capitis lateribus pallide griseis, scapis plumarum ochrascentibus, gastræ reliquo colori dorsi, plumarum pectoris scapis ochraceo, rostro corneo-nigro, pedibus corneis. Longit. $7\frac{1}{2}$ ", alæ 3" 8"', rostri a fronte 9"', a rictu 14"', caudæ 3" 3"', tars. 9'''.

"The only specimen of this species, an old female, was shot in the woods at St. Vicente in December by Mr. H. Sochor.

"It is similar to *D. meruloides* LAFR., but is smaller than both of the species with which *D. meruloides* (of which no measurements have been published) has been compared. The yellow streak behind the eye is also very prominent, as in *D. fumigata*.

"*D. olivacea* Lawr.....from New Granada seems to be larger; it shows a blackish line from the upper mandible to the eye and an oblong spot of the same color beneath the eye; the lower mandible is whitish."* (*Translation.*)

This species is also unknown to me.

* This is an error, only a streak on the gonys being whitish. The supposed blackish streaks also have no existence in fact, although mentioned both by Mr. Lawrence, in his original description, and in remarks quoted by him from Dr. Selater. They apparently consist of mere *shadows*, caused by the feathers standing on end, thus giving the appearance of dark markings unless carefully examined.

Proc. N. M. 87—32

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5
DESCRIPTIONS OF TWO NEW SPECIES OF THE GENUS UNIO,
FROM THE OZARK REGION OF MISSOURI.

By R. ELLSWORTH CALL.

(Plates XXVII, XXVIII.)

The collections in which these forms occurred were made in July, 1886. The associated species were *Unio iris* Lea, *Margaritana deltoidea* Lea, and abundant, though as yet undetermined *Strepomatida*, of the genus *Gonio-basis*. The streams were characteristic of mountain areas, being shallow, swift, and limpid, with rocky bottoms. In occasional ponds, occupying depressions which were filled at seasons of floods, were found numerous examples of *Unio subrostratus* Say, and *Anodonta grandis* Say, both of which were remarkable for their large size and perfect condition. It should be further noted that the streams from which these shells came, form a portion of the southern drainage of the Ozarks.

Unio ozarkensis, sp. nov. (Plate xxvii, Figs. 1-3 ♂, 4 ♀).

Shell smooth, elliptical, somewhat compressed laterally, inequilateral, thick, but thickest anteriorly; epidermis thin, striate towards the margins, yellowish-brown or olivaceous, marked with numerous obscure narrow green rays disposed regularly over the central portion of the disk; lines of growth rather numerous, dark, well marked; dorso-posterior margin curved; posterior umbonal slopes always eradiate, more or less biangulate, which angulations continued posteriorly mark the siphonal area and render the posterior margin biangular; umbones small, triangular, scarcely prominent, approximating, marked—in non-eroded specimens—by two or three rather coarse undulations; ligament short, thick, light brown; cardinal teeth disposed to be double in both valves, short, oblique, thick, unequally bifid, striated, the posterior division generally thickest and heaviest; lateral teeth rather short, slender, slightly curved, crenulate at extremities, in general direction forming nearly a right angle with a line drawn through the tip of the umbo and the anterior division of the cardinal tooth; anterior cicatrices deep, pit-like, striate, confluent, though in occasional specimens the *protractor-pedis* impression is distinct from the adductors and deep; posterior cicatrices distinct, that of the *adductor* muscle being usually well impressed, that of the *retractor-pedis* muscle circular, pit-like, impressed at extreme end of lateral tooth; pallial cicatrix well impressed throughout, but especially marked anteriorly; dorsal cicatrices irregularly crowded and placed near the inferior edge of the plate which connects the lateral and cardinal teeth; nacre usually silvery white, occasionally salmon or warm pink, iridescent posteriorly. Length 54.50^{mm}; breadth 15.28^{mm}; height 32.76^{mm}.

Common in Currant river, Shannon county, Mo., and in Jack's fork and Big creek, tributaries to it.

In general form this shell resembles *Unio lenticularis*, Lea, and *Unio connasaugensis*, Lea, from Tennessee, with which species it groups. Owing to the degeneration of the alcohol in which a number of specimens were collected it is impossible to give any account of the soft parts, which were destroyed. My note-book, however, shows that the ova are pinkish, and that the general characters of the ctenidia are similar to those exhibited by *Unio rubiginosus*, Lea, which species this shell in no other particulars at all resembles.

A single individual among the hundred or more found exhibited the cardinal teeth normally disposed, but the lateral teeth were reversed; *i. e.*, single in the left and double in the right valve. Instances of a similar partial reversion are not uncommon, while complete reversion, though rare, is exemplified in a number of common species.

Unio breviculus, sp. nov. (Plate xxviii, Figs 1, 1a, 1b male; 2, 2a, 2b female).

Shell smooth, ovate elliptical, inequilateral, subinflated, biangular posteriorly, circularly rounded before, somewhat incrassate; umbones slightly elevated, so much eroded that minute characters are indeterminate; ligament large, thick, black, or dark brown; epidermis yellowish horn-color, smooth, polished, rayed with dark green over the whole disk, the rays often interrupted by the lines of growth, which are numerous, but somewhat indistinct; umbonal slope rounded, depressed in the male, slightly elevated in the female; posterior outline emarginate in the female ventral of the siphonal area, dorsal outline rounded; cardinal teeth double in the left and single in the right valve, short, erect, triangular, solid, smooth, or scarcely crenulate; plate connecting laterals with cardinal teeth thick, somewhat arched; lateral teeth rather short, thick, slightly curved, smooth; anterior cicatrices distinct, large, deeply impressed; posterior cicatrices confluent, well impressed, that of the *retractor pedis* muscle at tip of base of lateral tooth but not on it; dorsal cicatrices numerous and deeply impressed in the cavity of the umbones; nacre salmon colored, occasionally white. Length 71.00^{mm}; breadth 27.20^{mm}; height 45.50^{mm}.

Animal dirty yellowish white; labial palps short, ovately triangular, adherent at base, laterally united so as to form an oval groove, midway from the extremities of which is placed the mouth. In the specimens examined only the anterior one-third of the external branchiæ contained ova. This portion was characterized by the heavy deposit of pigmentary matter at the apex of the chambers, while the remaining margins of the branchiæ were uniform in coloration with the mass of the animal. The posterior borders of the mantle were, as usual, differentiated into a series of tentacular folds; those surrounding the incurrent and excurrent orifices were yellow and brown—the remainder were black.

There is no well-known *Unio* with which this form is comparable.

While the males sustain a general resemblance to *Unio clarkianus*, Lea, and *Unio gerhardtii* Lea, the emarginate character of the female form is utterly unlike anything exhibited by the females of Lea's types.

This form occurs abundantly in the same streams as the preceding, outnumbering the other forms found combined. The specimens figured, while not the largest, are of average dimensions. Specimens of both species may be seen in the United States National Museum.

DES MOINES, IOWA, *October 12, 1887.*

Unio ozarkensis, sp. nov. Figs. 1-3, male; 4, female. (p. 498.)

Unio breviculus, sp. nov. Figs. 1, 1a, 1b, male; 2, 2a, 2b, female: (p. 499.)

6.

On the Gross Anatomy of Campeloma.

By R. ELLSWORTH CALL.*

[From the June number of the AMERICAN NATURALIST.]

On the Gross Anatomy of Campeloma.

BY R. ELLSWORTH CALL.

[From the June number of the AMERICAN NATURALIST.]

ON THE GROSS ANATOMY OF CAMPELOMA.

BY R. ELLSWORTH CALL.

THE collection of a large number of specimens of *Campelema subsolidum* Anthony, in the Des Moines river, Iowa, in early August, presented opportunities to somewhat carefully study the coarser anatomy of the genus as exhibited in this species. The results of this study are herein given. It may be noted, as introductory, that an unexpected closeness of structure to that of the foreign genus *Paludina* was developed, and, further, that the general diagnosis given by Dr. Stimpson¹ will need some slight emendation, particularly in respect to certain external characters, and in respect to the lingual teeth and the branchial laminae.

External Characters.—In the living and recently dead animal the color of the foot-mass is light lead or bluish white. Viewed from above, the cervical lappets, foot, operculigerous lobe, tentacles and proboscis are further enlivened by irregularly scattered bright orange-yellow dots. These dots are, on the tentacles and proboscis, arranged in somewhat regular transverse rows, giving a barred appearance to each. These last-named organs are, moreover, marked by an abundant deposition of black pigment immediately under the cuticular membrane. The under surface of the foot, the crawling disk, shows, in living specimens, the large longitudinal pedal muscles. When these muscles contract, in the act of withdrawal into the shell, the anterior margin of the disk is reflected upwards and backwards over the proboscis and tentacles. This reflected portion is, as a whole, then bent backwards and downwards to be finally covered by the posterior portion of the foot, the upper surface of which carries the operculum. The whole mass is then withdrawn into the shell. During the period of reproduction, when the organs devoted to that function are in a condition of marked activity and distension, the animal, especially of the female, cannot be wholly retracted. In this respect it resembles most of our large *Helices*.

Sexual Features.—The sexes are readily distinguished, in life, by means of the right tentacle, which, in the male, is very much larger than its fellow and rather more curved outwards (Plate VII., Fig. 2,

¹ Smithsonian Misc. Coll., No. 144, p. 35, 1865.

and VII. of Fig. 1, in the text). Again, as appears below, the shells differ in certain particulars of corresponding dimensions.

The male seminal duct is displayed throughout nearly its whole length by clipping the mantle along the extreme left of the branchial chamber. The *vas deferens superior* (IV., Fig. 1) arises from a point on the anterior left third of the testis (II., Fig. 1). This

Fig. 1.

latter organ is placed immediately under the right duodenal fold of the intestine (I., Fig. 1). It is about three times longer than wide, and whitish in color. The *vas deferens superior* after passing anteriorly to a point near the anal extremity of the intestine is suddenly bent obliquely backwards and traverses the floor of the branchial chamber for a short distance, but soon turns forward again at a somewhat acute angle. At this point (III., Fig. 1) is the prostate. The *vas deferens inferior* (V., Fig. 1) is rather long, narrow, and nearly straight, and is continued along the floor of the right

tentacle to the verge (VI., Fig. 1). The right tentacle thus becomes an intromittent organ in the process of copulation. This tentacle is somewhat flattened above, presenting, in cross section, an elongated ellipse. It is somewhat less in length than its left fellow, and is rather more curved outwards.

In the gravid female the gestatory sac (Plate VII., Fig. 5, c) occupies the greater portion of the body whorl on the right side. It is readily distinguished in the living specimen by the greater deposit of black pigmentary matter in its thin outer walls. Anteriorly the sac opens into a rather small duct, the mouth of which is prolonged into the branchial chamber about 2 to 2.5 millimetres (b, Plate VII., Fig. 5). This duct is guarded at each extremity by rather powerful sphincter muscles. Anteriorly the walls of the gestatory sac are slightly thicker and are modified into longitudinal folds or rugæ leading towards the duct. These possibly are of use in guiding the extrusion of the young.

During the summer and fall months, and often also in hibernating specimens, the gestatory sac is crowded to distension with young, in various stages of development (Plate VII., Fig. 5, c). Those most anterior are, in early August, nearly or quite through their prenatal growth, and are less closely crowded upon one another

than are those in the rear portion of the sac. All the young in the anterior portion possess shells. The shell of the young at

FIG. 2.

this stage is devoid of *colored* epidermis, is crystalline white, and possesses from 2 to $2\frac{1}{2}$ complete whorls. The apex is very short and blunt, the first whorl being nearly uniform in diameter throughout its length, while the body whorl is very large, comprising fully nine-tenths the entire bulk of the shell. The darker tentacles and the black eyes at their outer base are readily seen through the substance of the shell. The average dimensions of a dozen or more young examined were, for length 3.5 mm., for diameter 2.96 mm. The embryonic whorls never, so far as experience goes with mature specimens with completely preserved apices, acquire the characteristic green epidermal coloring.

The number of young is variable, the large mature specimens containing, as might be expected, the greater number of young shells. Twenty specimens were carefully examined with a view to this feature, with the following result:—

Specimen.	Young.	Specimen.	Young.	Specimen.	Young.	Specimen.	Young.
1	36	6	59	11	29	16	47
2	42	7	52	12	25	17	42
3	51	8	32	13	49	18	64
4	35	9	32	14	58	19	63
5	41	10	38	15	34	20	50

These twenty individuals, therefore, present an average of forty-three young.

Aside from the tentacular differences which exist between the male and female, both tentacles of the latter being uniformly subulate, a further sexual difference appears in the greater size and somewhat more globose character of the female shell. Coördinated with this difference in dimensions is the more shouldered character of the whorls in the female specimen, a difference connected with the position and necessarily large size of the gestatory sac. The males are more regularly conical, with rather less oblique aperture, and are of considerably less globose appearance than are the females. This difference was supposed to be of value in determining the sex when only the shell was at hand. To test it as a sexual differential character, thirty-six of the largest males and an equal number of the largest females were selected from a finding of more than a gallon of *C. subsolidum*, taken on August 6, 1887, and were carefully measured. The results appear in the following:—

TABLE OF DIMENSIONS. MALES.

No.	I.	II.	No.	I.	II.	No.	I.	II.
	mm.	mm.		mm.	mm.		mm.	mm.
1	25.88	12.80	13	24.94	12.92	25	24.22	12.36
2	26.00	13.00	14	24.52	12.38	26	25.14	13.00
3	27.25	13.32	15	26.10	13.51	27	23.90	12.70
4	26.06	13.31	16	30.76	15.00	28	26.62	13.12
5	27.22	12.90	17	27.34	14.00	29	23.94	12.86
6	26.80	13.14	18	24.95	13.36	30	25.84	12.92
7	27.47	15.08	19	27.32	13.04	31	26.16	13.29
8	25.50	12.66	20	26.86	14.20	32	25.16	12.92
9	24.48	12.54	21	25.76	13.62	33	25.50	13.60
10	25.54	12.90	22	25.20	13.61	34	23.36	12.24
11	26.28	13.40	23	24.82	13.50	35	24.95	12.88
12	24.14	12.50	24	28.32	15.22	36	24.00	12.64

I — length in mm. II — diameter in mm.

TABLE OF DIMENSIONS. FEMALES.

No.	I.	II.	No.	I.	II.	No.	I.	II.
	mm.	mm.		mm.	mm.		mm.	mm.
1	36.44	18.40	13	35.50	17.72	25	29.20	16.22
2	30.00	15.68	14	30.30	16.29	26	29.10	15.80
3	29.80	15.16	15	32.37	16.40	27	32.88	16.34
4	32.12	16.00	16	30.50	15.56	28	30.24	16.60
5	32.92	16.88	17	28.50	15.68	29	23.94	12.86
6	30.26	16.21	18	33.14	16.80	30	25.84	12.92
7	30.44	15.50	19	29.49	17.32	31	26.16	13.29
8	33.62	18.62	20	30.00	15.50	32	25.16	12.92
9	35.28	17.62	21	31.64	17.36	33	25.50	13.60
10	29.88	15.72	22	33.14	16.16	34	23.36	12.24
11	33.50	16.60	23	35.40	17.32	35	24.95	12.88
12	32.50	17.00	24	30.42	16.56	36	24.00	12.64

I. = length in mm. II. = diameter in mm.

A comparison of ratios shows the numerical values of differences, as follows: Length of male to its diameter, $\frac{25}{13} \frac{789}{234}$; length of female to its diameter, $\frac{31}{16} \frac{35}{127}$; length of female to length of male, $\frac{31}{25} \frac{35}{789}$; diameter of female to diameter of male, $\frac{16}{13} \frac{127}{234}$. The differences of lengths is 5.561 and of diameters 2.893. It would appear, then, that this degree of difference may be of diagnostic value in the matter of sex. The diagram, Fig. 3, is designed to present this sexual peculiarity in a graphic form. The marginal numbers represent millimetres. The ordinates represent the lengths, and the abscissas, which have the same scale, represent diameters. The circular conventional sign represents the male and the triangular character the female specimen. The average dimensions of each group are represented by the open conventional sign with its distinguishing sex mark conjoined. It will be seen that while the dots fall into two pretty well-defined groups, the range of greatest variation follows the ordinates, and that this range is comparatively greater for the female than for the male form. In other words, the males are more constant in lengths and vary less in diameter, while, for the female form, differences in length are measurably compensated by corresponding increase in diameter.

Fig. 3

In connection with this character it may not be altogether amiss to call attention to certain so-called species which have been based upon the males of *C. subsolidum*. They are *Campeloma milesii* Lea,

C. coarctatum Lea and *C. exilis* Anthony. The same unfortunate cause of synonymy has led, in the genus *Unio*, to the erection of more than a hundred spurious species, in certain cases the females serving as a basis for not less than five specific names. The *form* of a shell in so extremely variable a group is certainly a very misleading character.

Digestive Organs.—The buccal cavity opens on the middle side of the rather short proboscis near its base. Near the œsophagus (III., Fig. 3) and upon the floor of the buccal mass lies the radula. This is a small, narrow, chitinous organ, beset with numerous transverse rows of teeth, arranged according to the formula 3.1.3 (Fig. 3, Plate VII., and Fig. 4). The dentition is therefore tænioglossate. On either side, near the posterior end of the buccal cavity, open the ducts of the salivary glands (II., Fig. 3). These are small racemose paired glands, dirty white in color, and lie close upon the œsophagus. Including their ducts, they are about 1.5 mm. in length, and nearly or quite .25 mm. in width. The œsophagus is long, irregularly winding, placed upon the floor of the branchial cavity, and opens, into a somewhat capacious stomach (IV., Fig. 3), near the middle of the whorl next the body-whorl. The intestine is of nearly the same size as the œsophagus, and does not enlarge until the opening of the biliary duct is passed (V. and VII., Fig. 3). At this point it is coiled upon itself to the left, forming what may be called the right duodenal fold, immediately under which lies the testis, as stated above. Turning again to the right, it is there directed forward, becomes slightly enlarged, forming the rectal portion of the intestinal canal (VIII., Fig. 3), which opens into the branchial cavity near the margin of the mantle on the right side (IX., Fig. 3). The liver (VI., Fig. 3) is a very large glandular body, completely filling the first two and a half to three whorls of the shell. Its contents are discharged into the duodenal portion of the intestine near the position of the heart. In color it is orange-red, and is somewhat larger and darker in the male than in the female form. This organ, like all other portions of the animal which lie next the shell, is inversed by a thin membrane, containing pigmentary matter, the membrane itself being a continuation of the mantle.

Respiratory Apparatus.—The branchial cavity is large, extending backwards throughout nearly the whole length of the body-whorl. It opens towards the right side, its left margin being just

above the base of the left tentacle. The chamber is somewhat less in size in the gravid female than in the male, a fact the explanation of which probably lies in the distension of the gestatory sac and its consequent encroachment upon the branchial space. The chamber narrows rapidly posteriorly, and becomes laterally constricted. From its upper and left side walls is pendant the ctenidium (Plate ? Fig. 5, Br). This organ consists of a single row, containing a great number of thin elongately triangular plates, connected above with the branchial vein. The right edge and lower extremity of each plate is free, and each is constantly bathed with water. The plates become smaller as the rear end of the chamber is reached; they are yellowish white in color, and are furnished with abundant cilia. The blood, which is aerated in these plates, is white.

The attention of students with proper appliances at command is directed to these molluscs in respect to their embryology, nervous system, minute anatomy of the reproductive organs, myology and circulatory system. Only the crudest observations on these points were possible under the conditions which were presented to me, and such facts as were ascertained are repressed in the hope that some other one will be able to complete the work here outlined.

Explanation of the Plate.— $\times \frac{4}{3}$. All the figures, save Fig. 2, are drawn from the female. The mantle is clipped along the left margin of the branchial cavity.

Fig. 1. Female, Fig. 2, male individual.

Fig. 3. A single transverse row of teeth.

Fig. 4. Odontophore, natural size and very greatly enlarged.

Fig. 5. Anatomy of the branchial cavity with related organs.

a. Rectum and anus.

b. The opening of the gestatory sac, c.

br. The ctenidium.

The figures on the plate were drawn by Mr. H. A. Pilsbry from dissections made by him. Those in the text are drawn, some what diagrammatically, by the author, from nature.

PLATE VII.

Sporadic papers

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