Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. XL. No. 8.

NOTES ON THE CRAYFISHES

IN THE

UNITED STATES NATIONAL MUSEUM

AND THE

MUSEUM OF COMPARATIVE ZOÖLOGY

WITH DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES

TO WHICH IS APPENDED

A CATALOGUE OF THE KNOWN SPECIES AND SUBSPECIES.

BY

WALTER FAXON.

With Thirteen Plates.

CAMBRIDGE, U. S. A.:
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p. in 1914 paper

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PREFATORY NOTE.

The following notes on Crayfishes were made during an examination of all the Crayfishes that have been received at the United States National Museum and the Museum of Comparative Zoölogy since my last paper on these animals was published in the Proceedings of the United States National Museum, Feb. 7, 1898, 20, p. 643–694, pl. 62–70. I am deeply indebted to the authorities of the National Museum for sending to me the vast amount of material that has come to Washington since my last review of the subject. I am also indebted to Mr. W. P. Hay of Washington, Prof. S. E. Meek of the Field Museum of Natural History, Chicago, Ill., and Dr. A. E. Ortmann of the Carnegie Museum, Pittsburgh, Pa., for the loan of specimens.

NOTES ON THE CRAYFISHES.

Astacopsis australasiensis (Milne Edwards).

Astacus australasiensis M. Edw., Hist. Nat. Crustacés, 1837, **2**, p. 332, pl. 24, f. 1–5.

There are two cotypes of this species in the Museum of Natural History in Paris. One of these, a female, has been kindly loaned to me by Prof. E. L. Bouvier. The rostrum of this specimen is long-triangular, excavated, the acumen provided with an upturned, blunt, apical denticle and a similar denticle on each side; behind the lateral denticles the margins of the rostrum are obscurely crenate. The post-orbital ridges terminate anteriorly in a blunt tubercle; they are channelled throughout their length and are followed by two obsolescent tubercles at a little lower level on the gastric region; the hepatic area also is tuberculated and a few less prominent tubercles are visible on the posterior margin of the cervical groove on each side of the carapace. The areola is broad, narrowing from before backward, punctate. Branchial regions obsoletely squamose. Abdomen rather smooth, with a submarginal row of small tubercles on the pleura of the second somite; pleura rounded. Spine on dorsal face of inner branch of posterior abdominal appendages *submarginal*. Antennal scale of moderate width, flanked with a sharp denticle on the outer side at the base. Anterior process of the epistome triangular, with convex sides, ending anteriorly in an attenuated angle. Chelipeds nearly symmetrical, meros armed below with spines biserially disposed, upper margin thereof also furnished with a few (three or four) spinules; upper margin of carpus armed with two prominent spines, the distal the larger; outer face furrowed longitudinally, slightly tuberculate along the upper edge of the furrow; inner face of the carpus somewhat tuberculate and armed with one spine in the middle of the distal border. Propodite distinctly carinate on the upper border, less distinctly so on its lower border; the superior crest is cut into five teeth, the lower margin is denticulate; the outer face of the propodite is thickly covered with depressed tubercles. Dactylus furnished with one denticle near the proximal end of the upper border. Length, 63 mm.; length of carapace, 30.5 mm.; breadth of carapace, 13 mm.; length of areola, 9 mm.; breadth of areola at anterior end, 6 mm., at posterior end, 4.5 mm.; length of chela, 20 mm.; breadth of chela, 10 mm.; length of dactylus, 11.5 mm.

Bay of Sydney, Verreaux, No. 944, 1837.

I doubt if this is the specimen figured by Milne Edwards: he gives as the length of the body, two inches; the figure, which is said to be life size, is 56 mm. long.

Dr. Giuseppe Nobili [1] also has examined the same cotype belonging to the Paris Museum and is convinced that it belongs to the same species as a male specimen, 66 mm. long, in the Museum of Natural History of Genoa, said to have been collected by D'Albertis in 1872 on the little island of Sorong in the Strait of Galevo, northwestern coast of New Guinea. Perhaps a misplacement of labels has occurred in this case; the extraordinary distribution of this species implied by the nominal locality label accompanying the Genoa specimen, as well as the nature of the islet of Sorong, make it probable that the specimen was in reality secured at Sydney, Australia, where D'Albertis collected in 1873.

Astacopsis australasiensis may turn out to be nothing but an immature stage of *A. spinifera*.

Astaconephrops albertisii Nobili.

Astaconephrops albertisii Nobili, Annali Mus. Civ. Storia Nat. Genova, 1899, **40**, p. 244; Bolletino dei Musei di Zoologia ed Anatomia Comparata di Torino, June 9, 1903, **18**, p. 1.

The genus Astaconephrops, with its one species *albertisii*, based on a single female specimen in the Museum of Genoa which is said to have come from Katau on the southern coast of New Guinea, needs further elucidation. According to Nobili the margins of the rostrum (which in a general way resembles the rostrum of Paranephrops) are continued back, in the shape of two keels, over the carapace to the cervical groove; the abdominal segments are produced into points laterally; the inner branch of the last pair of abdominal appendages is furnished with a rib or keel on the dorsal face, terminating in a spine *near the centre* of the branch; the chelae are long and slender and on account of the elevation of the middle of the two faces appear subprismatical; the carpus is cylindrical, or rather depressed, and armed on the inner side with a sharp spine concealed in a large tuft of hairs; the inner margin of the palm is furnished with minute teeth, all the rest of the palm being smooth; the fingers are unarmed, but provided with hairs along their cutting edges.

From the description of this animal given by Nobili one would infer a combination of the characters of Nephrops, Paranephrops and Cheraps. The

[1] Contribuzioni alla Conoscenza della Fauna Carcinologica della Papuasia, delle Molluche e dell' Australia. Annali del Mus. Civ. Storia Nat. Genova, 1899, **40**, p. 246.

branchial formula is the same as in the genus Cheraps, and essentially the same as in Paranephrops; but according to Nobili the podobranchiae of the eighth and ninth somites are not furnished with an ala or lamina in the genus Astaconephrops, whereas in the genus Cheraps these podobranchiae are alate.

Parastacus araucanius, sp. nov.

Plate 4.

Male:— Cephalothorax shorter than the abdomen, strongly compressed laterally, mostly smooth, minutely granulated on the sides; areola broad (about two thirds as broad as long), minutely punctated; rostrum short, not reaching the distal end of the second antennulary segment, margins elevated, slightly convergent from base to near the tip, where they abruptly converge to form the abbreviated acumen; the infero-lateral edges of the rostrum are visible from above, forming the superior border of the orbit separated from the supero-lateral edge of the rostrum by a groove; distal half of the rostrum concave above; antero-lateral margins of the carapace produced into a prominent, rounded angle below the small eye which lies in a deep and uncommonly complete orbit. Post-orbital ridges, obsolete. The pleural angles of the abdomen are rounded, the telson long with a pair of lateral spines and a longitudinal median furrow on its upper face along its distal half; the median rib on the upper side of the inner branch of the last pair of abdominal appendages ends in a small spine situate a little distance from the margin. Antennal scale short and broad. The chelipeds are asymmetrical, the right one being the larger; the meros is tuberculated on its lower face, granulate on the superior margin, but destitute of spines; the surface of the carpus is lightly squamoso-granulate, the granulations becoming more pronounced on the supero-interior edge where they take the form of blunt tubercles; the chela, too, is lightly squamoso-granulate, without any prominent spine or tubercle, except one blunt tubercle or tooth near the base of the immovable finger; the superior and inferior borders are rounded.

Dimensions. Length, 42 mm.; length of cephalothorax, 19 mm.; length of areola, 6 mm., breadth of areola, 4 mm.; length of larger claw, 15.5 mm., breadth of do., 7 mm., length of dactylus, 8.5 mm.

Corral, Chile, Dec. 18, 1908, in a cascade stream. Thomas Barbour coll., M. C. Z., No. 7,355.

This species is related to *P. nicoleti* (Phil.) and *P. hassleri* Fax. Like these it has a strongly compressed cephalothorax, indicating a burrow-dwelling species.

It differs from both of these species in its short and broad areola. Compared with *P. nicoleti*, it differs in the lack of sculpture of the chela and carpus. Compared with *P. hassleri*, the rostrum is shorter, broader, and more abruptly truncate, the chela is rounded above and below and unprovided with the crest-like series of low, squamous tubercles.

Six species of Parastacus have been previously described from Chile, viz.:— *P. chilensis* (M. Edw.) in 1837, *P. spinifrons* (Philippi) in 1882, *P. nicoleti* (Philippi) in 1882, *P. bimaculatus* (Philippi) in 1894, *P. agassizii* Fax. in 1898, and *P. hassleri* Fax. in 1898. The type of *P. chilensis*, a single dry specimen, is in the Muséum d'Histoire Naturelle in Paris, and should be more fully described, since Milne Edwards's diagnosis (Hist. Nat. Crust., 1837, **2**, p. 333) is entirely insufficient. In 1849 (Gay's Hist. Chile, Zool., **3**, p. 211, Atlas, **2**, Crust. pl. 1, f. 4) Nicolet described and figured as *Astacus chilensis* M. Edw. a crayfish certainly different from Milne Edwards's species, and R. A. Philippi therefore gave Nicolet's species a new name, *Astacus nicoleti*, in a paper published in the Anales de la Universidad de Chile, 1882, **61**. In a paper published in 1898 when I was ignorant of Philippi's paper, I also gave a name to Nicolet's crayfish, fortunately the same name that had been already given it by Philippi. In the same paper Philippi describes and figures a new species, *Astacus spinifrons;* the diagnosis is as follows:— A. rostro elongato-triangulari ad basin utrinque spinula acuta; carpo extus profunde sulcato, margine superiore grosse tuberculato; mano crassa subtus rotundata; digitis haud lineato-sulcatis, intus basi longe barbato-ciliatis.

In 1894 Philippi[1] published a description of another new species of Parastacus from Chile under the name of *Astacus bimaculatus*. This is probably the species which I described later by the name of *Parastacus agassizii* (Proc. U. S. Nat. Mus., 1898, **20**, p. 690).

Parastacus spinifrons (Philippi).

Plate **9**, Fig. 1.

Astacus spinifrons Philippi, Anales Univers. Chile, 1882, **61**.

A male Parastacus in the Museum of Natural History, Paris, sent to me for identification by Prof. E. L. Bouvier, I think belongs to this species. It differs,

[1] Dos Palabras sobre la Sinonimia de los Crustáceos, Decápodos, Braquiuros o Jaivas de Chile. Anales Universidad Chile, 1894, **87**, p. 369–379. I have been unable to consult either of Philippi's memoirs directly. Miss Rathbun, however, has kindly furnished me with a transcript of the earlier one, copied from the volume of the Anales in the Library of Congress, Washington, and Dr. A. E. Ortmann has courteously lent me a MS. copy of the later paper, given to him by F. Philippi, son of the author, about 1900.

it is true, from Philippi's figures of *P. spinifrons*, at least from the copy of those figures in Dr. Ortmann's possession, in some respects, for instance the rostrum is shorter and broader and the immobile finger of the large claw is much longer. These discrepancies may be due to the inaccuracy of the original figures or of the copy of these figures which is all that I have before me. Philippi's diagnosis, moreover, takes no account of the pronounced asymmetry of the chelipeds, a marked feature of the specimen from the Paris Museum. I append a description of the latter; future explorations in Chile will determine whether it is the same species as Philippi's.

Cephalothorax subcylindrical, smooth, shorter than the abdomen; areola broad, considerably less than one half the length of the anterior section of the carapace; rostrum triangular, reaching to the distal end of the second antennulary segment, upper surface plane, with slightly elevated margins; post-orbital ridges obscurely marked except anteriorly where they form an elongate, low, tubercle without an acute spine; the antero-lateral angle of the carapace is produced to a prominent blunt angle below the orbit; there is no lateral or branchiostegian spine. The abdominal pleura are broad, with rounded angles. The antennal scales are broad, broadest in the middle; lower surface of the peduncle of the antenna hairy; epistoma triangular, anterior angle acute; third pair of maxillipeds clothed with dense hair below. Chelipeds unsymmetrical, the right one being much the larger, meros pretty smooth, except on its lower face which is provided with a row of small marginal tubercles and clothed with a heavy coat of hair; the superior margin of the meros is destitute of a spine; the carpus has a deep longitudinal groove along its external face; below this groove the surface is smooth, above it there are small squamous tubercles which on the superior border of the carpus assume the form of prominent tubercles, or blunt teeth, four or five in number; the infero-interior face of the carpus of the larger cheliped is likewise furnished with similar tubercles; the right (larger) claw is very thick, with rounded superior and inferior borders; the body of the claw is beset with flattened low tubercles which are most pronounced anteriorly, near the socket of the dactylopodite; the fingers gape, are pitted in place of being tuberculated, and there are about three blunt teeth on the cutting edge of each finger, one of which is especially prominent; both fingers are heavily bearded at the base, especially on the inner side; the left (smaller) claw is nearly smooth, with long and slender fingers that meet throughout their length, destitute of teeth but furnished with a beard at the base, like the larger claw. Inner branch of the last pair of abdominal appendages armed with a submarginal spinule at

the distal end of the median rib. Length, 90 mm., length of carapace, 41 mm., width of carapace, 20 mm., width of base of rostrum, 6.5 mm., length of rostrum, 9 mm., length of areola, 11.5 mm., breadth of areola, 7 mm., length of antennal scale, 7 mm., greatest breadth of do., 4 mm., length of larger claw, 31 mm., breadth of do., 17.5 mm., length of superior margin of hand, 10 mm., length of dactylus, 19 mm., length of smaller chela, 23 mm., breadth of do., 9 mm., length of dactylus, 16 mm.

There are four specimens of this species in the U. S. National Museum from the rivulets of MM. Bock and Jones, Lake Nahuel Huapi, on the eastern slope of the Cordilleras in Argentina. The chelipeds are preserved in three of these specimens; in two the larger claw is on the left side, in one it is the right, as in the Paris specimen.

The tip of the rostrum is setose in this species, and in most cases there are a pair of minute, horny, bead-like lateral teeth just back of the point of the rostrum. The rostrum is therefore essentially like that of *P. bimaculatus*. From the latter the present species differs in having much stouter, shorter-fingered, more heavily tuberculated claws, and a somewhat longer metathorax and narrower areola.

Parastacus agassizii (= *bimaculatus*) has been recorded from Lake Nahuel Huapi by Ortmann (Proc. Amer. Philos. Soc., **41**, p. 293). The specimens should be examined anew with reference to the possibility of their belonging to the present species, *P. spinifrons?*

Specimens from Puerto Montt, Lake Llanquihué, on the opposite slope of the Cordilleras, in Chile, are said by Doflein (Sitzungsber. Akad. Wissensch. München, 1900, **30**, p. 133) to agree wholly with my description of *P. agassizii*[1] (= *bimaculatus*).

Parastacus bimaculatus (Philippi).

Astacus bimaculatus R. A. Philippi, Anales Universidad Chile, 1894, **87**, p. 378 (Chile).

Parastacus agassizii Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 690, pl. 70, figs. 4, 5 (Talcahuano, Chile). Doflein, Sitzungsber. Akad. Wissensch. München, 1900, **30**, p. 132 (Puerto Montt, Lago Llanquihué, Chile). Lenz, Zool. Jahrb., Supp., May 2, 1902, **5**, p. 736 (Tumbes, Chile). Porter, Revista Chilena de Hist. Nat., Dec. 31, 1904, **8**, p. 258, Pl. 9 (Contulmo and Chillán, Chile).

[1] The error in the branchial formula of *P. agassizii* as it appears in my paper in the Proc. U. S. Nat. Mus., 1898, **20**, p. 692, has been pointed out by Doflein. This error was due to an unfortunate dislocation of the table in printing, as is evident on comparing the table of the branchial arrangement in the genus Parastacus on p. 683.

A single specimen of this species has been lately received at the Museum of Comparative Zoölogy from Valparaiso, Chile.

As noted above, *P. agassizii* has been recorded from Lake Nahuel Huapi in Argentina by Ortmann (Proc. Amer. Philos. Soc., **41**, p. 293). Specimens from this locality in the U. S. National Museum belong to a different although similar species, *P. spinifrons* (Phil.)? and Dr. Ortmann's determination should therefore be verified.

I think that my *P. agassizii* is the same species as the one previously described by R. A. Philippi in 1894 under the name of *Astacus bimaculatus*. Philippi's description is as follows:—

"Astacus bimaculatus Ph.

"A. cephalothorace utrinque macula magna triangulari, albida notato; rostro elongato, peracuto, utrinque ante apicem denticulo armato, unde lineae elevatae sensim divergentes nascuntur; chelis valde inaequalibus, sinistra majore; carpo ejus extus inflato, velut bullato, margine superiore unispinoso; digitis gracilibus, denticulatis. Longit. corporis 72 mm., chelae majoris 37 mm.

"El color del cuerpo es oscuro siendo una mezcla de negro verdoso i de pardo rojizo, como en las demas especies, i en cada lado se ve una gran mancha triangular blanquizca; su superficie es lisa, pero las patas anteriores están cubiertas de granulaciones bastante gruesas, que faltan solo en la parte inflada del carpo. El pico es casi tan largo como la escama situada en la base de las antenas esteriores; se adelgaza paulatinamente en una punta mui aguda e inclinada. De cada lado i mui cerca de la punta se notan dos dientecitos puntiagudos, de donde parten listones bastante elevados i agudos, qui diverjen paulatinamente. Un dientecito mui puntiagudo se observa tambien ante el borde de la órbita. Las patas anteriores son mui desiguales, la izquierda es mucho mas larga i sobre todo mas gruesa; por lo demas su hechura es la misma. En el borde superior del artículo tercero se nota una espina, i dos o tres en el borde inferior. El carpo muestra tambien una o dos espinas en su borde superior, i en su lado esterior una hinchazon casi semi-globosa, mui notable en el carpo izquierdo, menor pero bien aparente en el derecho. La mano es mucho mas angosta i estirada que en las otras tres especies chilenas, sobre todo los dedos, cuyo borde interior es finamente dentado. Las otras partes del cuerpo no ofrecen nada de particular."

This description agrees pretty well with the species which I described as *P. agassizii*, but I do not know what Philippi means by asserting that the figure of *Astacus fluviatilis* in the Régne Animal of Cuvier (Disciples' Ed., pl. 49, fig. 2) is an exact representation of his new Chilean species. The colour of the specimens from Talcahuano had long since vanished when I described them. Porter, however, has more recently described the living colours of *P. agassizii*, and they seem to conform in the main to the colour scheme of *P. bimaculatus* as described by Philippi:

"El color es en el dorso i flancos del cuerpo bruno-oliváceo, notándose en cada costado del cefalotórax, por detras del surco cervical, una gran mancha triangular de color amarillo limon cuyo vértice redondeado alcanza hasta la arcola, confundiéndose en esta rejion con la del lado opuesto en muchos ejemplares. A veces se vé ademas una mancha redondeada del mismo color a pocos milímetros del borde anterior del carapacho. Los tubereulillos escamiformes de las quelas lo mismo que las espinitas del rostro

son anaranjados, color que se observa en la parte inferior del cuerpo e inferior e interna de las patas. Estas últimas son de color bruno-oliváceo o bien oliváceo, especialmente en las quelas."[1]

With reference to the large triangular colour-patch on each side of the carapace of *P. bimaculatus* as described by Philippi and of *P. agassizii* as described by Porter, it should be observed that spots of the same shape and in the same place are often seen in crayfishes of divers kinds shortly after they are immersed in alcohol. These spots or blotches are the result of the quick action of the alcohol on the thinnest part of the branchiostegites, which are bathed in the fluid on both sides, within and without. At first red, these spots afterwards fade into yellowish white,— the colour which ultimately pervades the whole of the body in specimens preserved in spirits. One is almost inclined to suspect that the colour-pattern noted by Philippi and Porter was due to recent immersion of the specimens in alcohol.

Astacus leniusculus Dana.

A large number of specimens of this species were collected for the U. S. National Museum in Johnson Creek, Portland, Multnomah Co., Oregon, by Messrs. Lyon and Benedict in May, 1905. The largest of these are upwards of five and one half inches long and demonstrate the fact that this species has as full, obese a form as *A. trowbridgii*. There is considerable variation in relative width of the areola in these specimens. Of twenty-six specimens, eighteen (7 ♂, 11 ♀) have the right and left claws symmetrical, while in eight (5 ♂, 3 ♀) the claws are asymmetrical. In many of the asymmetrical individuals I think the smaller, slenderer claw, which may be either on the right or left side, is a new claw grown after the loss of the original one.

In a male specimen collected by Mr. S. E. Meek, in Ten-Mile Lake, Florence, Lane Co., Oregon, Oct. 17, 1896 (U. S. N. M. No. 23,121), the chelae have the form characteristic of *A. leniusculus*, and both pairs of post-orbital spines are developed as in that species, but in the shape of the rostrum and the proportions of the areola it agrees with *A. trowbridgii*. Another specimen in the U. S. National Museum from Astoria, Clatsop Co., Oregon, resembles *A. trowbridgii* in the breadth and inflation of the claws and the length of the posterior section of the carapace. Still another specimen in the same Museum (collected by Mr. Wm. Palmer) from the base of Mt. Tamalpais, Marin Co., Cal., taken altogether would be classed with *A. trowbridgii*; yet in the proportions of the posterior sec-

[1] Porter, op. cit., p. 258.

tion of the carapace and the areola it agrees rather with *A. leniusculus*. As these two species inhabit the same region it is possible that they interbreed and produce hybrids.

Astacus trowbridgii Stimpson.

Astacus trowbridgii stands midway between *A. leniusculus* and *A. klamathensis*. As it varies in one direction towards the former species, as has just been shown, so, on the other hand it passes through intermediate forms into the latter species. Such intermediate forms I have seen from Wilson Creek, Willapa, Pacific Co., and Littlerock, Thurston Co., Washington; and Sinslow River, Mapleton, Lane Co., and Wallowa Lake, Oregon. In dealing with small, immature individuals it is often difficult if not impossible to decide whether they should be assigned to *A. klamathensis* or to *A. trowbridgii*.

Astacus klamathensis Stimpson.

Plate 11, 12.

Astacus klamathensis has a wide distribution in British Columbia, and in the states of Idaho, Washington, Oregon, and northern California, in the vast area drained by the Columbia River and its tributaries as well as in the smaller streams that empty into the Pacific Ocean on the west side of the Cascade Range of mountains.

New localities:—Idaho: Indian Creek, Washington Co. Washington: Goldendale, Klickitat Co.; Granite Lake, Spokane Co.; Naches River, North Yakima, Yakima Co.; Crab Creek, [Douglas Co.?]; Creek near Hemp P. O.; Salmon River; Prairie Creek; North River; Willapa River, Holcomb, Nasel River, Nasel, Pacific Co. Oregon: Wallowa Lake, Wallowa Co.; Silver Creek, Harney Co.; Bear River, Medford, Jackson Co., Johnson Creek, Portland, Multnomah Co.; Nehalem River, Tillamvok Co. California: Shasta River, near Montague, Siskiyou Co.; Cottonwood Creek, near Hornbrook, Siskiyou Co.; Priceland and Garberville, Humboldt Co.

In a lot of two dozen or more specimens of this species from Portland, Oregon, in the U. S. National Museum, a slight variation from the typical form is apparent in the lengthening of the rostrum and antennal scale and the more pronounced granulation of the chelae. In these regards they show a slight approach towards *A. trowbridgii*. Many of these individuals have lost their

claws and grown them anew (see Plate 11, 12). It is interesting to note the restored claws never assume the normal form but are elongated and flattened. When both chelipeds have been lost and re-grown simultaneously, the result is an individual with perfectly symmetrical claws on the right and left sides, so different in shape from the normal claws that one might easily be led to believe that it is a distinct species. Such a specimen is shown in Plate 12, fig. 2. The restored claws in these cases assume an ancestral, less highly specialized from.

Astacus nigrescens fortis, subsp. nov.

Plate 7, Fig. 5, 9; Plate 9, Fig. 2.

Similar to *Astacus nigrescens*, from which it is distinguished by the following characters: — the sides of the rostrum converge more from the base to the tip; the areola of the carapace is narrower in proportion to its length; the chelae are shorter, broader, and more inflated.

Dimensions of a male:— length, 94 mm.; length of carapace, 49 mm.; width of carapace, 26 mm.; length of abdomen, 45 mm.; width of abdomen, 24 mm.; length of posterior section of carapace, 19 mm.; width of areola, 6 mm.; length of chela, 42 mm.; width of chela, 19 mm.; length of dactylus, 22 mm.

Types:— Fall River, Fall City Mills, Shasta Co., Cal., Aug. 29, 1898, Rutter and Chamberlain coll., U. S. N. M., No. 44,404, 2 ♂, 3 ♀, 1 juv.

Paratypes:— Hat Creek, Cassel, Shasta Co., Cal., Aug. 30, 1898, Rutter and Chamberlain coll., U. S. N. M., 3 ♀.

Astacus gambelii connectens, subsp. nov.

Plate 7, Fig. 6, 10; Plate 10, Fig. 1.

Similar to *A. gambelii* (Girard), but different in these regards:— the rostrum is narrower and longer, with a longer acumen, and in correlation with this the antennal scales are much longer, their internal margin sloping gradually to the lengthened apical spine. The post-orbital ridges, though rudimentary, as in *A. gambelii*, develop a pair of prominent posterior spines as in *A. nigrescens*, while the anterior pair — the only post-orbital spines found in *A. gambelii* — are much more prominent than in that form. The chelae are longer and slenderer than in *A. gambelii*.

Types:— U. S. N. M. No. 23,096, Snake River at Upper Salmon Falls, Idaho, Oct. 3, 1894, Evermann and Seovill coll., 3 ♂, 1 ♀.

Paratype:— Silvies River, Burns, Harney Co., Oregon, July 27, 1904, J. O. Snyder coll., 1 ♀. U. S. N. M.

This form bears the same relation to *A. gambelii* as *A. leniusculus* does to *A. trowbridgii*. In the development of the posterior pair of post-orbital spines it shows an affinity to *A. nigrescens*. It appears to be connected with *A. gambelii* by intermediate forms. A large male upwards of $3\frac{1}{4}$ in. long in the U. S. National Museum, collected at the mouth of St. Joe River, Coeur d'Alene Lake, Idaho, has the long narrow rostrum and the elongated hand and fingers of *A. g. connectens*, but the posterior pair of post-orbital spines are wanting, and specimens (also in the U. S. National Museum) from Warm Springs, Harney Co., Oregon, in most respects like typical *A. gambelii*, show traces of the posterior post-orbital spines.

Dimensions of a male:— Length, 65 mm.; length of carapace, 34 mm.; length of abdomen, 31 mm.; length of posterior section of carapace, 11 mm.; width of areola, 5 mm.; length of chela, 31 mm.; breadth of chela, 7.5 mm.; length of dactylus, 18 mm.

Astacus leptodactylus Eschscholtz.

New locality:— Myslowitz, Germany, 1893, Coll. Hofer, (U. S. N. M., No. 43,317) 1 ♂.

Astacus pallipes italicus, subsp. nov.

Plate 8, Fig. 2.

In the Italian Crayfish as compared with the typical form of *A. pallipes* from France, the margins of the rostrum are less convergent from the base to the lateral pair of spines, so that the breadth of the rostrum between the lateral spines is greater; the rostral acumen, too, is longer. The sides of the abdominal segments end in a distinctly more acute angle. The chelae are more coarsely granulated, the granulations or small tubercles separated by wider intervals. The anterior process of the epistoma is more broadly triangular. The antennal scale is larger, longer, and terminates in a more prominent spine. The tip of the inner part of the gonopods of the male is produced beyond the tip of the external part, whereas in *A. pallipes* the tips of the two parts are subequal. The telson is relatively broader.

Types:— U. S. N. M., No. 28,638, River Sarno, Pompeii, Italy, June 10, 1900, Dana Coolidge coll. 11 ♂, 9 ♀.

Two specimens, 1 ♂, 1 ♀, in the U. S. N. M., No. 20,073, from Piobesi, near Turin, Italy, received from the Turin Zoölogical Museum agree in the essential characters with the Pompeiian specimens.

From these specimens I infer that the Cisalpine crayfishes constitute a marked geographical race, which in some respects (viz. the form of the rostrum, antennal scale, epistoma, and gonopods) shows an approach to *Astacus astacus*. It is not, however, liable to be confounded with that species, since the median carina of the rostrum is not denticulated, and the post-orbital ridges are entire, not broken up into an anterior and a posterior section as is the case with *Astacus astacus*. In the important matter of the branchial apparatus, moreover, *Astacus pallipes italicus* differs from *A. astacus* and agrees with *A. pallipes* in having but two rudimentary pleurobranchiae on each side of the body, upon the eleventh and twelfth body-segments.[1]

The crayfish found in the neighbourhood of Madrid, Spain, is in almost every respect like the typical French *Astacus pallipes*. It does, however, show an approach to the Italian examples in one regard, viz. an enlargement of the anterior process of the epistoma, and with this in a few specimens goes a tendency toward a broadening of the rostrum. It would nevertheless be an over-refinement to separate the Spanish crayfishes from *Astacus pallipes*.

Cambarus digueti Bouvier.

Cambarus digueti Bouv., Bull. Mus. d'Hist. Nat., Paris, 1897, **3**, p. 225.
Cambarus carinatus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 648.

New locality:— Ocotlan, State of Jalisco, Mexico (Field Mus. Nat. Hist.).

Cambarus pilosimanus Ortmann?

A young female crayfish, 35 mm. long (M. C. Z., No. 7,405) was collected by Mr. J. L. Peters at Camp Menzel, 36 miles from the mouth of the Hondo River, in the Territory of Quintana Roo, Mexico, March 27, 1912. It is closely affined to *C. pilosimanus* and *C. williamsoni* of Ortmann, if not identical with one of these. It presents certain features, however, that are not found in either of Ortmann's species; viz: — there are two well-marked spines, one above the

[1] This was determined by examination of the branchial apparatus of two examples from the type lot of *A. p. italicus* from the River Sarno. The rudimentary gills borne on the eleventh and twelfth somites have the form of reduced simple filaments representing the stem of the completely formed gill.

other, on each side of the latero-anterior margin of the carapace, above the well-developed branchiostegian spines. This is a feature that one would not suspect to be a juvenile mark, and it may denote specific diversity. There are, moreover, two sharp spines on the second segment of the antennae near the base of the antennal scales.

The chelae of the specimen collected by Mr. Peters are slender and nearly smooth, the fingers sparsely pilose, the spines of the carpus and merus well developed, as in young specimens of *C. pilosimanus* according to Ortmann. The anterior segment of the telson is three-spined on each side, the inner spine being very small; the median longitudinal rib on the dorsal face of the inner branch of the last abdominal appendages ends in a spine some distance from the posterior margin.

The type locality of *C. pilosimanus* is Coban, Guatemala. Dr. Ortmann also records one specimen, in the Museum of Natural History of Paris, from Belize, British Honduras, a locality not very remote from the place where Mr. Peters got his specimen. Mr. A. S. Pearse (13th Ann. Rep. Mich. Acad. Sci., 1911, p. 110) has more recently recorded it from Cuatotolapam, Canton of Acayucan, State of Vera Cruz, Mexico. The type locality of *C. williamsoni* is Los Amates, Province of Izabal, Guatemala.

Cambarus mexicanus Erichson.

New localities:— Mexico: Tuxtla Gutierrez, State of Chiapas (U. S. N. M., No. 30,580); Jalapa, State of Vera Cruz (Field Mus. Nat. Hist.).

Mr. A. S. Pearse [1] has recently redescribed this species under the name *Cambarus ruthveni*, sp. nov., from the hacienda of Cuatotolapam, Canton of Acayucan, State of Vera Cruz, Mexico, altitude, 15 metres.

Cambarus cubensis Erichson.

New localities:— Cuba: Almendares River, Calabazar, Province of Habana (U. S. N. M., No. 31,881); Unión de Reyes, Province of Matanzas (M. C. Z., No. 7,633); Ciego de Avila, Province of Camagüey (Coll. J. T. Nichols).

There is a small specimen, a male, only $\frac{3}{4}$ in. long, in the U. S. National Museum (No. 28,625), from Nueva Gerona, Isla de Pinos. It was collected by

[1] Report on the Crustacea collected by the University of Michigan — Walker Expedition in the State of Vera Cruz, Mexico. Thirteenth Ann. Rep. Mich. Acad. Sci., 1911, p. 110.

Messrs. Palmer and Riley, July 8, 1900. It may be an immature specimen of one of the races of *C. cubensis*, or possibly a nearly allied species.

Since the above paragraph was written, and the specimen returned to the United States National Museum, Dr. A. E. Ortmann [1] has described as a new species, *Cambarus* (*Procambarus*) *atkinsoni*, a crayfish collected by Dr. A. Atkinson in the tributaries of Rio de los Indios, Los Indios, Isle of Pines, May 25, 1910. It is closely related to *C. cubensis*, from which it differs principally in the much less dilated inner face of the copulatory organs of the male.

Cambarus cubensis consobrinus Saussure.

Cambarus consobrinus Sauss., Rev. et Mag. Zool., 1857, sér. 2, **9**, p. 101; Mém. Soc. Phys. Hist. Nat. Genève, 1858, **14**, p. 457, pl. 3, fig. 21.

Cambarus cubensis consobrinus Faxon, Bull. Mus. Comp. Zoöl., Oct. 1912, **54**, p. 458.

In this form of the Cuban Crayfish the rostrum is narrower than in the typical *C. cubensis*, more deeply concave above, its margins more distinctly raised and less convergent between the base and the pair of lateral spines near the distal end; these lateral rostral spines, moreover, are much better developed than in the typical form, and the rostral acumen is longer; the post-orbital ridge is more prominent, distinctly grooved along its outer face, and produced anteriorly into an acute spine much more strongly emphasized than in the typical *C. cubensis;* there is, too, an evident lateral spine on each side of the carapace, on the hind border of the cervical groove,— a spine which is not present in *C. cubensis cubensis*. The external sexual organs are alike in the two forms.

Nine specimens of this crayfish (5 ♂, 4 ♀), M. C. Z., No. 7,343, were secured by Dr. Thomas Barbour from lads who were using them for fish-bait, at San Antonio de los Baños, in the interior of the Province of Habana, Cuba, April, 1909.

Cotypes of Saussure's *Cambarus consobrinus* are now dispersed among the Museums of Geneva, Paris, Berlin, and Washington. It is very likely that Saussure's material included some of the typical form of *C. cubensis*; his description and figures, nevertheless, were grounded on the form with long rostral acumen, and distinct rostral and lateral thoracic spines; the type locality of *consobrinus*, moreover, as specified by Saussure, is the *central part* of the island.

In the cotype in the U. S. National Museum (No. 20,684, *ex Mus. Geneva*),

[1] A New Species of the Genus Cambarus from the Isle of Pines. Ann Carnegie Mus., May 5, 1913. **8**, p. 414–417.

a male, dried and transfixed with a pin, the rostrum is abnormal, the right margin thereof being pared away toward the tip, carrying with it the right marginal spine. This deformity was evidently present in the living specimen. On the left side the marginal rostral tooth or spine is well developed, as are also the spines at the anterior end of the post-ocular ridges. The lateral thoracic spines too are fairly well marked.

Cambarus cubensis rivalis Faxon.

Cambarus cubensis rivalis Fax., Bull. Mus. Comp. Zoöl., Oct., 1912, 54, p. 459.

Differs from typical *C. cubensis* (which lives in the low country, near the sea-level) in having a much shorter and broader areola, a shorter, broader, and more heavily granulated claw; the sides of the rostrum, furthermore, are more nearly parallel and they bear a pair of distinct lateral spines at the base of the acumen. In so far as the rostrum is concerned this subspecies resembles *C. c. consobrinus*, yet it differs from *consobrinus* by having a short and wide areola and by the absence of lateral thoracic spines. The sexual parts are like those of *C. cubensis*.

Length of an ovigerous female, 44 mm., length of carapace, 21 mm., length of areola, 6 mm., breadth of areola, 2 mm.

This form is an inhabitant of the mountain streams of western Cuba. The extent of its distribution remains to be determined by further exploration of the island. The type specimens (M. C. Z. No. 7,406), two males of the second form and three females, were caught by Dr. Thomas Barbour in a mountain stream near San Diego de los Baños, in the Province of Pinar del Rio, Feb., 1912. There are also specimens in the U. S. National Museum from the same place (Nos. 28,626, 28,627) and also from a mountain brook north of the town of Pinar del Rio (Nos. 23,656, 23,657).

Cambarus simulans Faxon.

New localities:— Texas: Sourlake, Hardin Co. (U. S. N. M.). Arkansas: Saline R., Benton, Saline Co. (U. S. N. M.). Oklahoma: Mount Scott, Comanche Co. (U. S. N. M.).

Under the name *Cambarus gallinus* this species has been recorded by Messrs. T. D. A. Cockerell and Wilmath Porter (Proc. Acad. Nat. Sci. Phila., 1900, p. 434–435) from the Gallinas River at Las Vegas, San Miguel Co., in lakes at Watrous, Mora Co., and from Roswell, Chaves Co., in the State of New Mexico.

Its range is now known to include the five states, Texas, Arkansas, New Mexico, Oklahoma, and Kansas.

Cambarus gracilis Bundy.

New localities:— Illinois: Abingdon, Knox Co. (U. S. N. M.); Oquawka, Henderson Co. (U. S. N. M.).

Cambarus hagenianus Faxon.

Plate 1; Plate 7, Fig. 1, 7.

Cambarus carolinus Hagen, nec Erichson.
Cambarus hagenianus Faxon, Proc. Amer. Acad., 1884, **20**, p. 14.

This species has been hitherto known only through the type specimen in the Museum of Comparative Zoölogy (No. 232), a male of the first form received early in the history of the Museum from Professor Lewis R. Gibbes of Charleston, S. C. The United States National Museum has recently received it in ample numbers from the Agricultural College, Oktibbeha Co., Miss., and also from Muldon, Monroe Co., Miss., and Farmdale, Ala. It is a pest to the cotton growers of these regions, riddling the fields with its burrows, and devouring the young plants; to a less degree it is destructive to young blades of maize or Indian corn.[1]

Hagen's Crayfish attains to a length of three inches. It is nearly related to *C. gracilis* Bundy, replacing that species in more southern localities. In *C. gracilis* the sides of the rostrum are more nearly parallel; the sub-orbital angle, which is pronounced in *C. gracilis*, is wanting in *C. hagenianus*. The branchio-cardiac lines, although contiguous in both *C. gracilis* and *C. hagenianus* for a considerable distance, obliterating the areola, are united for less distance in the former than in the latter; the abdomen is much broader in *C. gracilis*, and the longitudinal rib on the upper side of the inner branch of the last pair of abdominal appendages terminates in a spine which lies some distance from the posterior margin, while in *C. hagenianus* this rib extends clear to the margin, where the spine projects freely. The gonopods of the first form male are formed after a similar fashion in *C. hagenianus*, *C. gracilis*, and *C. simulans;* there are three terminal teeth (one of which is compressed or laminate) in *C. gracilis* and *C.*

[1] See U. S. Depart. Agric., Rept. Bureau Biol. Surv. for 1911, p. 9; and A. K. Fisher, Crawfish as Crop Destroyers, Yearbook U. S. Depart. Agric. for 1911, 1912, p. 319–324, pl. 22.

simulans, but the smallest of the three is smaller in *C. simulans* than in *C. gracilis* and lacks the horny texture; in *C. hagenianus* the truncate end of the gonopods bears but two teeth.

In the second form of the male the gonopods are less perfectly finished at the tips, the terminal teeth being blunter and membranous. The annulus ventralis of the female *C. hagenianus* is much like the annulus of *C. gracilis*, being produced on each side of the median line into a prominent tubercle, each tubercle tending to denticulation.

The specimens from Muldon, Miss., are peculiar in having a beard along the internal border of the upper face of the hand in the males, as in *Cambarus barbatus* and *Astacus gambelii*.

Colour of living specimens from Muldon, Miss.:—Male (Plate 1, fig. 2), metacarapace violet-gray with round greenish spots on the branchial regions; procarapace greenish, dashed with red anteriorly; abdomen light orange, with two longitudinal rows of irregular olive spots; chelae and carpus olive, the tubercles and granules green; fingers and antennae orange, beard whitish. Female (Plate 1, fig. 1), metacarapace bluish; procarapace, abdomen, and chelae tending to green at the expense of the orange tints.

Few cases of colour differences correlated with sex have been noted among Crustacea. See Andrews, Zool. Anz., Apr. 25, 1911, 37, p. 401.

Cambarus versutus Hagen.

New locality:— Auburn, Lee Co., Alabama (M. C. Z.).

Cambarus blandingii (Harlan).

New localities:— Virginia: Cape Henry, Princess Anne Co. (U. S. N. M.). North Carolina: Mattamuskeet Lake, Hyde Co. (U. S. N. M.); Reedy Fork, Cape Fear River, Greensboro, Guilford Co. South Carolina: Charleston Co. (U. S. N. M.).

Cambarus blandingii acutus (Girard).

New localities:— Illinois: Greathouse Creek, Wabash Co. (U. S. N. M.). Arkansas: Bruce Lake, Little Rock, Pulaski Co. (U. S. N. M.). Maryland: Fulton Co. (U. S. N. M.). Mississippi: Rosedale, Bolivar Co. (U. S. N. M.). Louisiana: Frierson, De Soto Co. (U. S. N. M.). Texas: Angelina River (U. S. N. M.).

A large male, form I., in the U. S. National Museum, collected in 1897 in the Mississippi River at New Orleans, La., measures $5\frac{3}{8}$ in. from the tip of the rostrum to the end of the telson, the chelipeds are $6\frac{7}{8}$ in. long, the chelae $3\frac{3}{4}$ in. long. The dimensions of a male of about the same size were given on page 23 of my Revision of the Astacidae. This specimen also came from New Orleans (M. C. Z., No. 3,327) and is the same one whose measure was given by Dr. Hagen on page 37 of his Monograph of the North American Astacidae with an errour of over an inch in the length.

Cambarus hayi Faxon.

New locality:— Agricultural College, Oktibbeha Co., Mississippi (U. S. N. M.).

Cambarus fallax Hagen.

New localities:— Florida: Auburndale, Polk Co.; Kissimmee River, between L. Hatch and Kissimmee, Osceola Co.; Lake Monroe, near Sanford, Orange Co.; St. Johns R., at Palatka, Putnam Co.; St. Johns River at Beecher Point.

Cambarus acherontis Lönnberg.

New locality:— Eustis, Lake Co., Florida, 2 ♂ f. II., 7 ♀, in U. S. N. M.

Cambarus clarkii Girard.

New localities:— Texas: Fort Clark, Kinney Co.; Seguin, Guadalupe Co.; San Marcos, Hays Co.; Houston, Harris Co.; Corpus Christi, Nueces Co.; Angelina River; Beaumont, Jefferson Co. Louisiana: Lake Lepourde, Morgan City, Saint Mary Co.; Melville, Saint Landry Co.; Frierson, De Soto Co. Arkansas: Little Rock, Pulaski Co., (1 ♀ coll. by O. P. Hay, U. S. N. M., No. 19,762). All of the above are in the U. S. National Museum.

This last reid. by Faxon, 19 ei bland. ae see card

As noted in my Revision of the Astacidae, p. 26, specimens of *C. clarkii* from New Orleans, La., differ slightly from the typical specimens from western Texas in having the branchio-cardiac lines in close apposition for a long distance through the procarapace, obliterating the areola and reducing the size of the anterior and posterior triangular fields. This is well shown in Roetter's beautiful drawing of a specimen from New Orleans in Hagen's Monograph of the North American Astacidae, Pl. 4.

Cambarus clarkii paeninsulanus, subsp. nov.

The examples of Clark's crayfish found in the peninsular portion of the State of Florida differ slightly, albeit constantly, from the typical Texas form in being smoother, in having a more tapering rostrum, and a shorter and broader antennal scale; there is moreover a slight difference in the shape of the tip of the male sexual appendages: the anterior terminal tooth being narrower and more acute than in the typical form in which this tooth is broader, more laminate and less acute at the tip; in the Floridan subspecies, too, the anterior half of the telson bears on each side from three to five spines, while in the typical *C. clarkii* there are but two spines on each side.

Type: M. C. Z., No. 3,530, 1 ♂ f. II. Three miles below Horse Landing, St. John's River, Florida, Feb. 9, 1869, J. A. Allen.

There are a good many specimens of this subspecies in the U. S. National Museum collected by W. C. Kendall at Beecher's Point, St. John's River, Fla., in February and March, 1897, Nos. 28,587, 28,589.

Cambarus wiegmanni Erichson.

This species is still imperfectly known; Erichson's type, which came from Mexico, is no longer extant; it was described as having hooks on both the third and fourth pairs of legs in the male. A female individual from Mexico, in the collection of the Academy of Natural Sciences of Philadelphia, was referred to this species by Dr. Hagen and myself, although with some doubt on account of the want of male specimens. In 1906 Dr. Ortmann (Proc. Washington Acad. Sci., 8, p. 15–19) described and assigned to this species a male belonging to the Philadelphia Academy, collected by Professor E. D. Cope in 1885 in Lake Xochimilco, south of the City of Mexico, in the Federal District; in this specimen the legs of the third pair are furnished with a very small tubercle only, while those of the fourth pair are armed with a strongly developed hook.

Four specimens, three male, one female, recently collected by Mr. W. M. Mann at San Miguel, State of Hidalgo, Mexico, and now in the Museum of Comparative Zoölogy, conform to Ortmann's description of the Cope specimens, barring the fact that there is no vestige of even a tubercle on the third pair of legs of the male, the fourth pair alone being provided with hooks; these specimens may represent an undescribed species, but on account of the sad dearth of requisite material and the loss of the type of *C. wiegmanni* the elucidation of this question must needs be deferred to a later time.

Cambarus viae-viridis, sp. nov.

Plate 5.

Male, form I: — Rostrum long, triangular, plane above, margins raised so as to form a sharp rim, destitute of lateral spines or angles; acumen strongly deflexed, not clearly defined; a shallow depression or foveola at the posterior end of the rostrum. Carapace punctate above, finely granulate on the sides; post-orbital ridges terminating bluntly before; cervical groove sinuate, interrupted on each side; no lateral spine, branchiostegian spine minute; areola narrow, equal in length to about one half the distance from the cervical groove to the tip of the rostrum. Abdomen punctate, pleural angles rounded off, hind border of anterior section of the telson bispinose on each side. Anterior process of the epistome triangular, with slightly convex sides. Antennal scale short and very broad, truncate at the anterior end. Chelipeds of moderate length; upper margin of the meros serrated, below there are two series of spines; carpus tuberculate and spinulose on the inner face; chela of moderate proportions, with slender fingers; superior margin of the hand spinulose, outer and inner faces spinuloso-tuberculate; dactylus spinulose through the proximal quarter of the superior border. Basal segment of last pair of thoracic appendages provided with a crest which is produced on the inner side into a projecting tooth. Third segment of third and fourth pairs of legs hooked. First pair of abdominal appendages rather short, tip truncate, outer part furnished with a prominent horny tooth and two minor denticles, inner part terminating in a straight spine, the end of which does not reach to end of the largest tooth of the outer part.

Length 45 mm., carapace 23 mm., areola 7.5 mm., width of areola 5 mm. Length of hand 17.5 mm. Length of palm 8 mm., width of palm 5.5 mm. Length of fingers 9.5 mm.

Annulus ventralis of the female transversely broad, with a deep sigmoid sulcus which is open in front.

St. Francis River, Greenway, Clay Co., Arkansas, Aug. 1894, S. E. Meek coll. M. C. Z., No. 7,336, 10 specimens, ♂ and ♀.

This species is allied to *Cambarus evermanni* Fax. from Pensacola, Fla. It differs in having the upper surface of the rostrum flatter, with depressed acumen, the areola narrower, the hand broader, and also by the different character of the tips of the male appendages. It falls into the group of species represented by *C. evermanni* Fax., *C. barbatus* Fax., *C. wiegmanni* Erichs., *C. hinei* Ortm., and *C. alleni* Fax.

Cambarus alleni Faxon.

New localities:—Florida: Fort Florida, Volusia Co. (M. C. Z.); ponds near Tampa, Hillsboro Co. (U. S. N. M.); Lake Butler, Tarpon Springs, Hillsboro Co. (U. S. N. M.); Lake Yohopekalize, Kissimmee, Osceola Co. (U. S. N. M.).

Cambarus shufeldtii Faxon.

There is a male of this species, 21 mm. long, in the U. S. National Museum, collected by Robert Kennicott at Cairo, Ill. It has been previously known only from the original type lot collected near New Orleans, La., by Dr. R. W. Shufeldt in 1883.

Cambarus montezumae Saussure.

New locality:—Acambaro, State of Guanahuato, Mexico (Field Mus. Nat. Hist.).

Cambarus montezumae dugesii Faxon.

New localities:—Mexico: Chalco, State of Mexico; Celaya, State of Guanahuato; Lake Quitzeo, Huingo, State of Michoacan; La Barca and Lagos, State of Jalisco; all of these are in the Field Museum of Natural History; they were collected by Prof. S. E. Meek in 1901.

Cambarus montezumae chapalanus Faxon.

New localities:—Patzcuaro and Zirahuen, State of Michoacan, Mexico (Field Mus. Nat. Hist.).

Cambarus montezumae occidentalis Faxon.

Two males, collected by Prof. S. E. Meek, in Lake Quitzeo, Huingo, State of Michoacan, Mexico, and now deposited in the Field Museum of Natural History, appear to belong to this subspecies. It has been already recorded from the same place by Dr. A. E. Ortmann (Proc. Washington Acad. Sci., 1906, 8, p. 20).

Cambarus sloanii Bundy.

Four specimens, males of the second form, collected by Mr. W. P. Hay between Paoli and Wyandotte, Ind. (U. S. N. M., No. 19,776), and determined by Mr. Hay as *C. sloanii*, differ in some important regards from the types of *C. sloanii* from New Albany, Ind.: The tip of the inner ramus of the gonopods is not deflected inward so strongly, the rostrum is longer, with a longer acumen, the large claws are distinctly narrower, with relatively longer fingers, and the outer row of spines on the lower face of the merus of the cheliped is reduced to a single terminal spine. These specimens perhaps represent a new species or subspecies, but in the absence of the first form of the male and the female I refrain from naming it.

Cambarus affinis (Say).

New localities:—Maryland: Sam's Creek, Frederick Co. (U. S. N. M.); Little Pipe Creek at Union Bridge and near New Windsor, Carroll Co. (U. S. N. M.); Northwest Branch near Hyattsville, Prince Georges Co. (U. S. N. M.). Virginia: Orkney Springs, Shenandoah Co. (U. S. N. M.). Massachusetts: Bancroft's Pond, Brown's Pond and Spring Pond, Peabody, Essex Co. (M. C. Z.); Mansfield Pond, Great Barrington, Berkshire Co. (M. C. Z.);

This species, whose real home is in the rivers that flow into the Atlantic in New Jersey, Pennsylvania, Maryland and Virginia, is now well established in the town of Peabody, Essex Co., Mass. How or when it got there I do not know. The first report of it came to me in 1901 when the late J. H. Sears brought me a specimen 90 mm. long, which he had caught in Bancroft's Pond, Peabody, on the 4th of August of that year. In Sept., 1911, Dr. John C. Phillips secured a good many (43) specimens from Spring Pond, Brown's Pond and Bancroft's Pond in Peabody, some of them attaining a length of 98 mm.[1] Dr. Phillips's collector searched for crayfishes in the following ponds in Essex County with negative results:— Hood's, Stephens, Four-Mile, Stiles's, Spofford's and Perley Pond in Boxford, and Chebacco, Beck's, Round and Gravelly Ponds in Hamilton.

On the 14th of June, 1912, I captured a female *C. affinis*, with young under her abdomen, in Mansfield Pond, Great Barrington, Berkshire Co., Mass.

[1] The largest specimen of *C. affinis* in the Museum of Comparative Zoölogy, a female from Havre de Grace, Md., No. 180, collected in 1854, measures 124 mm. from the tip of the rostrum to the end of the telson. This is the individual figured, slightly lengthened, on Plate 5 of Hagen's Monograph of the North American Astacidae.

I was told in Great Barrington that these animals were introduced 10–15 years ago into Lake Buel, on the borders of the neighboring towns of Monterey and New Marlborough, by anglers who were using them as fish-bait, that they are now exceedingly numerous in Lake Buel and have been probably transferred thence to neighboring ponds by boys.

C. affinis has been introduced into Europe as a piscicultural experiment in acclimatization at the Station Agricole at Fécamp, France,[1] and elsewhere.

This species has also been found of late in Central Park Lake, New York City, and in Prospect Park Lake, Brooklyn; it has also been reported as introduced into a lake in East Hampton, Middlesex Co., Conn. (Bull. N. Y. Zoöl. Soc., Nov. 1912, 16, p. 924).

Cambarus propinquus Girard.

New localities:— New York: Munnsville, Madison Co.; Glenmark Creek, North Rose, Wayne Co.; Chaumont River, Batavia, Genesee Co.; Seneca Lake; Mud Creek and Saint Lawrence River, Cape Vincent, Jefferson Co.; Griffin's Creek, Chaumont, Jefferson Co.; Stony Island, Jefferson Co.; Stony Creek, Henderson Harbor, Jefferson Co.; Sandy Creek, North Hamlin, Monroe Co.; Nine-Mile Point, Webster, Monroe Co.; Selkirk, Oswego Co.; Marsh Creek, Point Breeze, Orleans Co.; Tonawanda Creek; Canada Way Creek, Dunkirk, Chautauqua Co.; Van Buren Point, Chautauqua Co.; Silver Creek, Chautauqua Co.; Cattaraugus Creek. Ohio: Cowles Creek, Geneva, Ashtabula Co.; Conneaut Creek, Kingsville, Ashtabula Co.; Rocky River, Olmsted Falls, Cuyahoga Co.; Port Clinton, Ottawa Co.; Catawba Island, Ottawa Co.; Lakeside, Ottawa Co. Indiana: Tippecanoe River, Delong, Fulton Co.; Sims, Grant Co.; Winona Lake, Kosciusko Co.; Eagle Lake, Warsaw, Kosciusko Co.; Evansville, Vanderburg Co.; Eel River and Blue River, Columbia City, Whitley Co. Illinois: Wabash R., Hutsonville, Crawford Co. (Mus. Comp. Zoöl.); Kankakee River, Momence, Kankakee Co.; Illinois River, Havana, Mason Co. Michigan: Raisin River, Monroe, Monroe Co.; Black Creek, Lexington, Sanilac Co.; Port Sanilac, Sanilac Co.; Grand River below Lansing, Ingham Co.; Wolf Lake, Jackson Co.; Long Lake, 8 miles north of Alpena, Alpena Co.; Tawas City, Iosco Co.; Au Sable River, Au Sable, Iosco Co.; mouth of Carp River, 12 miles from Straits of Mackinac; Mullet Lake, Cheboygan Co. (U. S. N. M.). Mexico: Jimenez, State of Chihuahua (Field Mus. Nat. Hist.).

The locality Jimenez, Mexico, is such an extraordinary one for this species

[1] Acclimatation des Écrevisses Américaines. Revue Scientifique, Jan. 9, 1897, ser. 4, 7, p. 56.

that one might well suspect some error if the origin of the specimens were not so well attested. Seven specimens, males of the first form, now in the Field Museum of Natural History, were collected by Mr. S. E. Meek, together with four female *C. virilis*, June 9, 1901, in the drainage of the Rio de los Conchos, one of the southern tributaries of the Rio Grande. They were picked out from among the fishes which were the chief object of Mr. Meek's exploration of Mexico and sent to me for determination in January, 1902.

The conditions obtaining at the time and place of their capture are thus described by Mr. Meek in his account of the fishes secured during his Mexican explorations of 1901:[1]

"At Jimenez the Rio Conchos was nearly dry. Our collections were made from a few deep holes about two miles below the city. These contained a large amount of aquatic vegetation, which made collecting difficult and unsatisfactory. The water was very clear, and in the deeper places were seen many large suckers which we were unable to capture. Sunfishes were very abundant. All of these streams become large and deep in the rainy season, at which time the Rio Conchos at Jiminez becomes two hundred or more feet in width and as much as fifteen feet in depth."

Cambarus propinquus sanbornii Faxon.

New localities:— Ohio: Black River, Elyria, Lorain Co.; Hudson, Summit Co.; Vermilion River; Cuyahoga River, Kent, Portage Co.; Dover Creek, Dover, Cuyahoga Co. West Virginia: Horse Creek (U. S. N. M.).

Cambarus obscurus Hagen.

New localities:— New York: Cattaraugus Creek. West Virginia: Cassity, Randolph Co.; Cheat River, Ises Ferry, Sand Run, Childer's Run, and Trubie's Run, near Buckhannon, Upshur Co.; Queens, Upshur Co.; Weston, Lewis Co.; Hacker's Creek, near Janelew, Lewis Co.; Ten-Mile Creek at Lumberport, Harrison Co.; Decker's Creek above Morgantown, Monongalia Co. (U. S. N. M.).

Cambarus obscurus is an abundant river species in the Upper Ohio River Basin in northern West Virginia, and western Pennyslvania. It is also found in the Lake Erie and Lake Ontario drainage in the states of Pennsylvania and western New York, and in Wills Creek, an affluent of the Potomac River, at Hyndman, Bedford Co., Pa., and Ellerslie, Allegany Co., Md.[2] In the U. S.

[1] A Contribution to the Ichthyology of Mexico. Field Columbian Museum, Publ. 65, Zoöl. Ser., May, 1902, **3**, p. 65.

[2] Ortmann, Mem. Carnegie Mus., 1906, **2**, p. 445.

National Museum there is a female crayfish (No. 22,518) collected by D. S. Jordan in northern Wisconsin which looks like this species, but the locality is an extraordinary one for this species and should not be accepted as authentic until confirmed by securing more material.

Cambarus rusticus Girard.

New localities:— Iowa: West Fork of Des Moines River, Spring Vale, Humboldt Co. (M. C. Z.). Ohio: Sandusky River, Fremont, Sandusky Co.; Presque Isle, Perrysburg, Wood Co. Indiana: Moot's Creek, White Co.; Salmonie River, Mount Etna, Huntington Co. Kentucky: Salt River. Tennessee: Richland Creek, Nashville, Davidson Co. (U. S. N. M.).

Cambarus neglectus Faxon.

New localities:— Missouri: Indian Creek, McDonald Co. (U. S. N. M.). Colorado: Republican River, Wray, Yuma Co. (M. C. Z.).

Cambarus spinosus gulielmi, subsp. nov.

Cambarus spinosus Hay, Proc. U. S. Nat. Mus., 1902, **25**, p. 439 (*nec* Bundy).

Cephalothorax shorter than the abdomen, densely punctate above, granulate on the sides, the granules largest on the hepatic region where they assume the form of small tubercles; the whole surface, but more particularly the sides, is clothed with fine setae arising as pencils from the pits of the dorsal surface and the granules of the sides; the rostrum is deeply excavated above, its sides parallel from the base to the lateral pair of teeth at the base of the moderately long, triangular apex; the post-orbital ridges are prominent and provided with a small tooth at the anterior end; the sub-orbital angle is obliterated, but there is a well-developed branchiostegian spine, as well as a lateral spine on the cervical groove; the section of the carapace behind the cervical groove in the median dorsal line is a little less than one half the distance from the cervical groove to the tip of the rostrum. Areola of moderate width. The anterior segment of the telson bears two spines on each side. The anterior process of the epistome is moderately broad, its sides convex, its anterior angle rounded off. The antennal flagella are long and slender,— longer than the body; the scale or scaphocerite is of moderate width, widest at a point a little anterior to the middle. The chelae, like the carapace, bear numerous setae springing from the pits and

tubercles on its surface; the inner border of the hand is furnished with squamoid tubercles disposed for the most in two longitudinal rows; along the distal half of the outer border of the hand there runs a low, but well-marked, carina; the dactylus is tuberculate on its free border, blunt-toothed (like the immobile finger) along its prehensile edge and ridged longitudinally along its outer face; the carpus is armed with an acute spine on the middle of its internal border, and with a small tubercle at each end of the same border; below, the median carpal spine is well pronounced and there is a small acute spine at the inferior point of articulation with the propodus; the two customary spines are present near the anterior end of the upper margin of the merus; the outer of the two rows of spines on the lower face of the merus is reduced to two at the distal end. The dorsal carina of the inner branch of the last abdominal appendages terminates in a tooth a little distance within the hind margin.

The gonopods, in the second form of the male, are long and straight, reaching forward, when the abdomen is flexed, as far as the basal segments of the second pair of legs; their rami are rather thick, blunt at the tip, and the outer one is but a trifle longer than the inner one; when viewed from the inner side the two rami are fused up to within a short distance of the end of the organ.

The annulus ventralis of the female is bituberculate in front, unituberculate behind, the anterior and posterior walls being separated by a transverse fossa which is divided longitudinally by the sigmoid fissure.

Dimensions of a female:— length, 73 mm., length of carapace, 37 mm., length of rostrum from tip to a level with the post-orbital spines, 11 mm., width of rostrum at base, 5 mm., length of areola, 12 mm., width of areola, 2 mm., length of cheliped, 54.5 mm., length of chela, 27.5 mm., breadth of chela, 12 mm., length of dactylus, 16 mm.

This crayfish is closely related to the *Cambarus spinosus* of Bundy, but is different in the following respects:— the body is more villous, the metacarapace longer in proportion to the procarapace, the anterior process of the epistome is much narrower than in the types of Bundy's species and (what has most weight in regarding it as a subspecies) the external sexual organs are clearly different. The gonopods in *C. s. gulielmi* being shorter, the rami thicker, blunter, nearly equal in length, and separate for but a short distance from the tip, while in *C. spinosus* the rami are slender, pointed, the outer one exceeding the inner by a great distance and the split between the two parts involving a large part of the length of the organ. The annulus ventralis of the female, though of the same type as that of the typical *C. spinosus*, differs slightly in having a more open transverse fossa.

The villosity may be an evanescent character, as it is a condition often apparent in individuals that have recently undergone a moult; at a later period the setae are apt to disappear by attrition.

U. S. National Museum, Nos. 26,379, 12 ♂ f. II., 14 ♀. From a small stream flowing from a pond fed by the cave stream known as John Ross Spring, near Rossville, Walker Co., Georgia, Aug. 23, 1901, William Perry Hay coll.

Cambarus putnami Faxon.

Upward of one hundred specimens of a crayfish closely resembling *C. putnami* were collected by Mr. W. P. Hay in southwestern West Virginia in the summer of 1900. They were found in the shallower parts of streams, usually under flat stones,— in Barrenshe Creek, near Perryville, U. S. N. M., No. 25,018, 28,613, and Horsepen Creek, (U. S. N. M. No. 28,612) and War Creek (U. S. N. M. No. 28,614). In these specimens the rami of the gonopods are a trifle longer than in the types of *C. putnami* from Kentucky, the rostrum, moreover, shows a pretty constant faint carina on its upper surface, near the tip, and the anterior angle of the epistome is truncate. These peculiarities do not seem to me important enough to separate this form nominally from *C. putnami*.

According to Mr. Hay's notes their colour when alive was olive-green on the dorsal surface of the body and chelipeds, changing to vinaceous on the sides, under parts and other appendages; the tips of the fingers were horn-yellow and preceded by a rather broad band of dark orange-red.

Cambarus longidigitus Faxon.

New locality:— James River, Springfield, Green Co., Missouri (U. S. N. M. No. 20,856).

James River, Missouri, without further specification of locality, is the type locality of *Cambarus whitmani* Steele,[1] which as far as can be seen from the description is the same as *C. longidigitus*.

Cambarus virilis Hagen.

New localities:— Indiana: Prairie Creek, Scotland, Green Co. Illinois: Henderson Co.; Kankakee River, Momence, Kankakee Co. Michigan: Belle Isle, Detroit, Wayne Co.; Pigeon River, Caseville, Huron Co.; Bird Creek, Port

[1] Univ. Cincinnati Bull. No. 10, 1902, p. 24.

Austin, Huron Co.; Sand Beach, Huron Co.; Pinnebog River, Port Crescent, Huron Co.; Mud Creek, Bay Port, Huron Co.; Black River, near Port Huron, Saint Clair Co.; Pine River, West Harrisville, Alcona Co.; Au Sable River, Au Sable, Iosco Co.; Rabbit's Back Creek, 5 miles above Saint Ignace, Mackinac Co.; 12 miles from Straits of Mackinac. MINNESOTA: Deer River, Itasca Co.; Lake of the Woods. NORTH DAKOTA: Borit's Ford, Cheyenne River. NEBRASKA: Lincoln Creek, York, York Co. MISSOURI: Clinton, Henry Co. (U. S. N. M.). COLORADO: Republican River, Wray, Yuma Co. (M. C. Z.). MEXICO: Jimenez, State of Chihuahua (Field Mus. Nat. Hist.).

The Mexican specimens (four females) were collected by Mr. S. E. Meek from deep holes, Rio de los Conchos, about two miles below Jimenez, June 9, 1901. For the circumstances of their capture, see under *Cambarus propinquus*, page 373, 374.

CAMBARUS IMMUNIS Hagen.

Plate 2, 6.

New localities:— NEBRASKA: Norfolk, Madison Co. (U. S. N. M.); Elkhorn River, Fremont, Dodge Co. (U. S. N. M.); Omaha, Douglas Co. (M. C. Z.). MISSOURI: Lake City, Jackson Co. (M. C. Z.). IOWA: West Fork of Des Moines River, Spring Vale, Humboldt Co. (M. C. Z.). MICHIGAN: Pine River near West Harrisville, Alcona Co. (U. S. N. M.); Caseville, Huron Co. (U. S. N. M.); mouth of Bunce River, south of Port Huron, St. Clair Co. (U. S. N. M.). ILLINOIS: Wabash Co. (U. S. N. M.); Indian Creek, Abingdon, Knox Co. (U. S. N. M.); Illinois River, Havana, Mason Co. (U. S. N. M.). OHIO: Cedar Point, and Presque Isle, Toledo, Lucas Co. (U. S. N. M.); Toussaint River, ten miles below Port Clinton, Ottawa Co. (U. S. N. M.). NEW YORK: Pond near the mouth of Cattaraugus Creek, Chautauqua Co. (U. S. N. M.); Silver Creek, Chautauqua Co. (U. S. N. M.); Fish Creek, Buffalo, Erie Co. (U. S. N. M.); Stony Island, Jefferson Co. (U. S. N. M.). MASSACHUSETTS: Pontoosuc Lake, Lanesborough, Berkshire Co. (M. C. Z.); Onota Lake, Goodrich Pond and Housatonic River, Pittsfield, Berkshire Co. (M. C. Z.); East Washacum Pond, Sterling, Worcester Co. (M. C. Z.); Blackstone River, Uxbridge, Worcester Co. (M. C. Z.); Lake Boone, Stow, Middlesex Co. (Boston Soc. Nat. Hist.); Walden Pond, Concord, Middlesex Co. (M. C. Z.). NEW HAMPSHIRE: Lake Winnepesaukee (U. S. N. M.).

Cambarus immunis, taken as a whole, has an enormous range, as a common species, through the western states, from northern Ohio, through Indiana,

Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas and Nebraska, into Colorado and Wyoming.[1] To the eastward of Lorain County, Ohio, it has hitherto been recorded from only two localities, both in the state of New York: in 1891 Mr. Gerrit Smith Miller, Jr., brought me three specimens which he found in July of that year in a small stream flowing into Oneida Lake; these were recorded by me in 1898 (Proc. U. S. Nat. Mus., **20**, p. 654); in 1906 Dr. Ortmann (Mem. Carnegie Mus., **2**, p. 467) called attention to specimens in the New York State Museum which had been taken by Mr. F. C. Paulmier in Rensselaer Lake, Rensselaer Co., N. Y. I can now add to the New York stations for this species the following:— pond near the mouth of Cattaraugus Creek, and Silver Creek, Chautauqua Co. (U. S. N. M. Nos. 22,417, 22,408); Fish Creek, Buffalo, Erie Co. (U. S. N. M. No. 22,418); and Stony Island, at the eastern end of Lake Ontario, Jefferson Co. (U. S. N. M. No. 22,409).

My first knowledge of this species as an inhabitant of Massachusetts was obtained when I was walking across the mud-flats at the upper end of Pontoosuc Lake on the 11th of November, 1899. The numerous mud-towers or "chimneys" here rising above the level of the flat at once betrayed the abode of some kind of burrowing crayfish. Although the soil was then frozen so as to make exploration difficult, I satisfied myself that the builders of the little mud-towers had withdrawn to their brumal retreats in the deeper waters of the Lake, leaving behind them only one dead companion, a first-form male *C. immunis spinirostris* (M. C. Z. No. 6,687). Here the matter rested until, during a visit to Berkshire in 1911, I ascertained that this crayfish was abundant on the 12th of August among the water-weeds at the head of Pontoosuc Lake. Two days later I searched for it at the northern end of Onota Lake in Pittsfield and again found it in altogether similar surroundings, albeit in much smaller numbers than in the neighbouring Pontoosuc or Lanesborough Pond.

On the 15th of June, 1912, I again collected this crayfish at the outlet of Goodrich's Pond and in the Housatonic River just above Pomeroy's Mills, in Pittsfield.

These specimens from Berkshire Co., Mass., agree in most respects with the types of *C. immunis spinirostris*, which were collected in Obion County, Tennessee. The rostrum in the Massachusetts examples tapers a little more between the base and the ante-apical teeth and, the antennal scales are a little shorter in proportion to the length of the rostrum. Compared with the typical

[1] There are two specimens of *C. immunis*, ♂ f. II. and ♀, in the U. S. National Museum, No. 3,257, labelled as coming from Orizaba, Mexico, through Professor Sumichrast. F.E. (Acc. 1806, Mar. 30, 1870).

form of *C. immunis* from Illinois, *C. immunis spinirostris* differs in having a distinct spine or tooth on each side of the rostrum near the tip, more prominent post-orbital and branchiostegian spines and a shorter posterior section of the carapace in relation to the section in front of the cervical groove (the proportion being 1:2 or even less in *C. i. spinirostris*); the claw, too is narrower, with proportionally longer and slenderer fingers.

In full-grown living specimens from Pontoosuc Lake (Plate 2, fig. 2) the dominant colour of the carapace is a rich Vandyke brown shading into tawny olive on the sides; the cardiac area is conspicuously marked off by being a much lighter colour,— tawny olive; the abdomen is beautifully mottled above with darker and lighter shades of tawny olive; the legs are olive-coloured.

In the young, 27 mm. long, from the same locality (Plate 2, fig. 1), the brown of the adult is replaced by an olive-green which pervades the whole dorsal side of the creature and is delicately varied by mottling of olive-buff; the cardiac area is of the latter hue and is continued backward, through the whole length of the abdomen, as a broad median band; the appendages are delicate olive-green, changing to a pinkish tint at the tips of the claws.

C. i. spinirostris was first described from Obion County, Tennessee; it has also been recorded from Omaha, Nebraska (Pearse), Shawnee County, Kansas (Faxon), Douglas County, Kansas (Harris), Vigo County, Indiana (W. P. Hay), Ottawa Co., Ohio (Pearse), and Long Point Creek, Canada (Pearse). As a matter of fact, specimens of *C. immunis* agreeing more or less closely with the form which I described as var. *spinirostris* are to be found pretty much throughout the range of the species. I have seen such among material collected in Nebraska, Kansas, Missouri, Michigan, Illinois, Indiana, Ohio, and New York. I am therefore disposed to regard it as a variety rather than a true geographical race or subspecies, although it is true that all of the Massachusetts specimens possess the characters of *spinirostris*.

When *Cambarus immunis* was first discovered in Berkshire County, Mass., it had been recorded from only one place (Oneida Lake, N. Y.) east of Lorain County, Ohio, and in the State of Ohio it had been recorded from but three localities — Huron River at Huron, Erie County (Osburn and Williamson, 6th Ann. Rept. Ohio State Acad., 1898, p. 11), Sandusky, Erie County (Faxon, Proc. U. S. Nat. Mus., 1898, 20, p. 654), and Lake Erie, Lorain Co. (Osburn and Williamson, *l. c.*). I was therefore formerly inclined to think that its presence in Berkshire County, Mass., was due to artificial introduction, like the *Cambarus affinis* in the ponds of Essex County, Mass.; but I have now before me specimens from

along the Ohio shore of Lake Erie from Lucas County, through Ottawa County, to Erie and Lorain Counties, from the New York borders of the same Lake in Chautauqua and Erie Counties, from the eastern end of Lake Ontario and from Lake Oneida; while Ortmann's discovery of the specimens in the Albany Museum from Renssalaer County, N. Y., extends the eastward distribution of this crayfish up to Berkshire County, Mass. In the light of all the evidence now collected it seems to me possible, if not probable, that Berkshire County is the eastern limit of the natural distribution of this species and that the discontinuity results from imperfect exploration of the waters of New York State. It should be noted however, for what it is worth, that the Berkshire countrymen whom I have questioned believe the crayfishes are a comparatively late addition to the fauna of the Lakes.

However this may be, there can be no reasonable doubt that the presence of this crayfish in Worcester and Middlesex Counties, Mass., and in Lake Winnepesaukee, N. H., is the result of artificial transference at a comparatively recent date. The first time this animal was found in Walden Pond, Concord, Middlesex County, Mass., so far as I can learn, was in the summer of 1909, when two or more were captured, as I am told by Mr. Reginald Heber Howe, Jr., of the Middlesex School, Concord. In 1910 Mr. Howe sent me a fine specimen, a male about $3\frac{3}{8}$ inches long, which had been taken in the Pond, and in early October, 1911, the Rev. Smith Owen Dexter and Mr. H. Richardson of Concord secured two specimens by a long search under the stones on the edge of Walden. Mr. Dexter's specimen, taken from the Pond the 9th of October, when about $1\frac{1}{2}$ inches long, lived in my aquarium until April 6, 1912, casting its shell twice, on February 20 and March 19, and attaining a length of $1\frac{3}{4}$ inches. On the 14th of June, 1912, Mr. Dexter collected four specimens, ranging from $2\frac{1}{2}$ to $4\frac{1}{2}$ inches in length, from the borders of the Pond, and still more during the following month. On the 24th of July, 1912, Mr. W. F. Clapp and I got six specimens there.

I have been told by citizens of Concord that two men who fished in Walden Pond about ten years ago (*c.* 1903), using crayfishes for bait, threw their surplus bait into the Pond and thus unwittingly stocked it with these creatures.

Walden Pond is apparently a most uncongenial abode for *Cambarus immunis*, being clear as a well and almost destitute of vegetable growth. The favourite haunts of this species are rather muddy waters stocked with a rank growth of pond weeds.

In 1913 specimens of this crayfish were collected in Boone Pond, Stow,

Middlesex County, Mass., by Professor G. H. Barton. Boone Pond drains into the Assabet River. Walden Pond has no visible inlet or outlet.

Dr. D. L. Belding, of the Mass. Fish Commission, collected several specimens in East Washacum Pond, Sterling, Worcester Co., Mass. (Nashua River drainage), Oct. 10, 1912; Mr. W. F. Clapp found many in the Blackstone River, at Uxbridge, Worcester County, Mass., Sept. 29, 1913, and there is a specimen in the United States National Museum collected in 1913 in Lake Winnepesaukee, N. H.

In colour as well as in all other characters the Walden Pond and Blackstone River specimens agree perfectly with those from Berkshire County. Those from Boone Pond, Sterling, and Lake Winnepesaukee I have seen only after they had been immersed in alcohol and lost their colour; in other respects they too are conformable to the Berkshire County variety, *i. e.*, *C. i. spinirostris.*

Cambarus validus, sp., nov.

Plate 7, Fig. 3, 4, 8; Plate 13, Fig. 1.

Male, form I.— Similar to *C. immunis* Hag., but differs as follows:— the rostrum is relatively narrower, less tapering from the base to the lateral angles at the proximal end of the acumen, its margins are more distinctly raised so that the upper surface of the rostrum appears to be more deeply hollowed out. The foveola at the base of the rostrum in *C. immunis* is scarcely evident in *C. validus.* The chela is very much larger, more powerful and of a different form from that of *C. immunis;* the immovable finger is curved strongly outward at the base, giving a convex outline to the external margin of the hand; the movable finger is furnished with a double row of tubercles running along its external margin, while the inner margin is not excised at the base and is armed with a row of eight or nine round bead-like tubercles; the chela is as long as the carapace, and broad and inflated. The lower face of the carpus is furnished with only a rudimentary, blunt, median spine or tubercle. The sub-orbital angle is less prominent, the posterior wall of the orbit forming a perpendicular straight line. The anterior process of the epistome is much broader, with the anterior end truncated but not notched. In other regards, including the form of the sexual appendages it agrees with *C. immunis.* The rostrum is devoid of lateral teeth or spines, like the typical form of *C. immunis.*

Length, 68 mm.; length of carapace, 33.5 mm.; length from tip of rostrum

to cervical groove, 22 mm.; length of chela, 35 mm.; breadth of chela, 15 mm.; length of dactylus, 21.5 mm.

Huntsville, Madison Co., Alabama. One male, form I. M. C. Z., No. 301.

This specimen was considered to be *C. immunis* by Hagen, is mentioned by him on page 72 of his Monograph, and its chela is probably the one figured by him on Pl. VIII, fig. b. Compare my "Revision of the Astacidae," p. 100.

Six specimens in the U. S. National Museum, three of which are males of the second form, and three females (No. 23,092) collected by Mr. J. E. Benedict at Nashville, Tennessee, in May, 1897, without much doubt are conspecific with the type specimen of *C. validus*. As they are younger than the type specimen, and as the first form of the male is not represented among them, the peculiarities of the species are not so well pronounced. The chelae are proportionally smaller and the curve of the immobile finger is less. This finger, as in the type specimen and in *C. immunis*, is heavily bearded within at the base. The gonopods of the males are similar to those of second-form males of *C. immunis*, but less strongly curved; indeed the curve of the stem of the organ is no greater than it is in *C. virilis*, but the blunt recurved tips are subequal as in *C. immunis;* in other words the shape of the second form male organ is the same as in *C. alabamensis*. The annulus ventralis of the female is virtually the same as in *C. immunis*.

Cambarus mississippiensis Faxon.

New locality:— Agricultural College, Oktibbeha Co., Mississippi (U. S. N. M.).

Cambarus lancifer Hagen.

A female specimen, collected by Robert Kennicott at Cairo, Ill., is in the U. S. National Museum. The few specimens heretofore known have come from Root Pond, Miss., Vicksburg, Miss., and the St. Francis River at Greenway and Big Bay, Clay Co., Ark.

Cambarus bartonii (Fabricius).

New localities:— Maine: Little Madawoska River, a tributary of Aroostook River at New Sweden, Aroostook Co. (M. C. Z.); brook tributary to Aroostook River at Caribou, Aroostook Co. (Coll. W. P. Hay). New York: Schoharie Creek, Catskill Mts., Green Co. alt. 2,000 ft. (U. S. N. M.); Little

Simonds's Pond, Franklin Co. (M. C. Z.); Three-Mile Creek, Oswego, Oswego Co. (U. S. N. M.). VIRGINIA: Broad Run and Gap Run, Fauquier Co. (U. S. N. M.); Orkney Springs, Shenandoah Co. (U. S. N. M.); Stony Man Mt., 3000 ft., Madison Co. (U. S. N. M.); Peaks of Otter, 2600 ft., Bedford Co. (U. S. N. M.). WEST VIRGINIA: West Branch of Potomac River, 5 miles west of Circleville, Pendleton Co. (U. S. N. M.); Rich Creek, Spanishburg, Mercer Co. (U. S. N. M.); Trubie's Run, 7 miles above Buckhannon, Upshur Co. (U. S. N. M.). NORTH CAROLINA: Looking-Glass Creek, Transylvania Co., 3300 ft. (U. S. N. M.); near Montreat, Buncombe Co. (U. S. N. M.). TENNESSEE: 7 miles northwest of Chattanooga, Hamilton Co. (U. S. N. M.); Little River, a tributary of the Tennessee River at Cade's Cave (U. S. N. M.).

The Barton's Crayfish of Aroostook County in Northern Maine (of which there is a large collection in the United States National Museum from the Allegash River a little below Chamberlain Lake, Churchill Lake, Eagle or Heron Lake, Crosslake Throughfare, and Bean Lake, St. Francis River) is a small, clean form that in these clear, cool, northern waters shows a slight differentiation from the typical *C. bartonii* from the Middle States. The rostrum is more strongly decurved and the fingers are narrower and more cylindrical and gape widely at the base. The differences between this form and the type nevertheless do not seem to be great enough or constant enough to warrant a subspecific separation.

CAMBARUS BARTONII CARINIROSTRIS Hay MS., subsp. nov.

"Rostrum of medium length, very broad, nearly plane or slightly excavated above and with a more or less distinct, median, longitudinal carina; acumen short, broad, with concave sides, its tip strongly upturned. Carapace with a spinulose angle below the eye; branchiostegian spine obsolescent; areola of moderate width. Telson bi- or tri-spinose on each side. Antennae, when extended backward, reaching beyond the middle of the abdomen. Chelipeds stout and heavy, chelae broad and strong, heavily punctate above and below; inner margin of hand obscurely serrato-denticulate; fingers usually gaping at the base, strong down curved, pitted in lines, upper surface heavily ribbed. Otherwise essentially the same as typical *C. bartonii*.

"This form, which I regard as a well-marked subspecies, is in typical examples very like *C. bartonii* in general, but different in the following regards:—the carapace is a little more cylindrical, the rostrum broader and flatter, and

always furnished near the tip with a median longitudinal carina. This carina is usually well defined and extends from near the acumen backward to about the middle of the broad flat surface of the rostrum; it is generally followed by an ill-defined and very shallow foveola. In less typical specimens the carina is reduced to a very low, rounded, almost invisible elevation just between the lateral angles of the rostrum, or in some cases is wanting altogether; in such specimens the other characters,— cylindrical carapace and broad, flat rostrum,— will hardly be sufficient to separate them from other closely related subspecies.

"Type, U. S. Nat. Mus. No. 23,962. Gandy Creek, Osceola, Randolph Co., W. Va. W. P. Hay coll., July 12, 1899. Mas, forma secunda.

"This crayfish is abundant in the main stream as well as in the tributaries of the Tygart's Valley and Cheat Rivers in Randolph County, West Virginia. I have collected typical examples from the Tygart's Valley River at Beverly and near Elkins. It is most abundant, however, further east in the Cheat River basin, and Osceola may be regarded as approximately the centre of its distribution."— W. P. Hay MS.

C. b. carinirostris Hay is a slightly differentiated local form of *C. bartonii* found chiefly in the mountain streams of Randolph Co., W. Va., the Cheat and Tygart's Valley Rivers and their tributaries. Outside of Randolph County, Mr. Hay secured a few specimens at Albright, Preston Co., at Queens, Upshur Co., in the above-named river-basins. It is also probably to be found in the upper waters of the Kanawha River basin further to the south, since there are a few specimens in the U. S. National Museum (Nos. 23,975, 28,605) from the West Fork of the Greenbrier River, near Durbin, Pocahontas Co., and from Laurel Creek, in second Water Cave, near Greenville, Monroe Co., that are pretty characteristic examples of this race.

The median carina on the upper surface of the rostrum is a rather elusive character, in many individuals it is scarcely if at all apparent. Such specimens retain, nevertheless the peculiar quadrangular outline of the rostrum, which is often a trifle broader at the base of the acumen than it is in the middle. The areola is of moderate width and not so thickly pitted as it is in *C. b. montanus*.

The dimensions of Mr. Hay's type are as follows:—

Length, 63 mm.; length of carapace, 32 mm.; length of areola, $11\frac{1}{2}$ mm.; width of areola, $2\frac{1}{2}$ mm.; width of rostrum between the eyes, 4 mm.; length of chela, 25 mm.; breadth of chela $11\frac{1}{2}$ mm.; length of dactylus, $16\frac{1}{2}$ mm.

Cambarus bartonii montanus (Girard).

In looking over any extensive collection of *Cambarus bartonii* from the Alleghany Mountain region of Virginia and West Virginia one is struck by the tendency of the material before him to fall into two sets of forms, one characterized by a rather narrow areola, sparsely sown with impressed points or dots which incline to a serial arrangement in three or four longitudinal rows; while in the other set the areola is shorter and proportionally broader, and its field is thickly strewn with innumerable dots. On further examination it will be seen that the narrower areola usually goes with a shorter and broader rostrum, a more depressed and oval carapace and a narrower antennal scale. These two forms are often found in the same locality and with these alone in view one might be justified in deeming them two well-differentiated species, but it soon becomes clear that in other places specimens are found that combine in a most perplexing fashion the features of our two supposed species.

The second of the two forms above noticed, the one with the shorter and broader and more thickly punctate areola and longer rostrum is the one too curtly diagnosed by Girard under the name of *Cambarus montanus*.

Girard's description of *C. montanus* is as follows:— "Antennæ more elongated and more filiform than in *C. Bartonii*. Rostrum intermediate in shape between the latter and *C. carolinus*, being proportionally longer than in *C. Bartonii* and shorter and less tapering than in *C. carolinus*. Dorsal sutures of the carapace more apart than in both of the latter species.

"*Localities.*— Within the Alleghany ranges in Virginia and Maryland: tributaries of James River in Rockbridge Co. (Va.); Shenandoah River in Clarke Co. (Va.), and Cumberland (Md.) of the hydrographical basin of the Potomac; Sulphur Spring, Greenbrier River, an affluent of the Kenhawa River (Va.) [now W. Va.] of the Ohio basin."

When Dr. Hagen was preparing his Monograph of the North American Astacidae in 1868, he had the opportunity to examine one of Girard's types of *C. montanus* from Greenbrier River, W. Va., sent to him by Wm. Stimpson who then had the types from the Smithsonian Institute in Chicago, where in 1871 they were most unfortunately destroyed by the disastrous conflagration of that year.

Sixteen years later, while I was revising the Astacidae, I had the advantage of close personal intercourse with Dr. Hagen and free use of his notes and memoranda. The identity of Girard's *Cambarus montanus* is thus assured by an unbroken tradition. Neither Dr. Hagen nor myself in my earlier publications esteemed this form worthy of even a subspecific name, although its characters

were pointed out in my Revision, p. 64. It may be well in our present more advanced knowledge of the *C. bartonii* group to recognize *C. montanus* as a geographical race or subspecies of *C. bartonii*.

In the collection of the Academy of Natural Sciences of Philadelphia there is a young male, labelled "James River, Va., *C. montanus?*" which is very probably a cotype or paratype of Girard's *Cambarus montanus*. With regard to this and other *quasi* types of Girard's species in the Philadelphia Academy, the reader is referred to Hagen's Monograph, p. 7, and my Revision, p. 11.

I have examined specimens of *C. bartonii montanus*, nearly or quite typical, from the following localities:—Virginia: Wytheville, Wythe Co. (U. S. N. M., No. 13,966, M. C. Z., No. 3,838); Rocky Gap, Bland Co. (U. S. N. M., No. 28,568.) West Virginia: Horsepen Creek, [Mingo Co.?] (U. S. N. M. No. 28,555); Madam Creek, tributary of New River, opposite Hinton, Summers Co. (U. S. N. M., No. 28,556, M. C. Z., No. 7,398); Bergen's Springs, 12 miles above Hinton (U. S. N. M., No. 28,566); Delashmeet Creek, Kegley, Mercer Co. (U. S. N. M., No. 28,610); Bluestone River, just above its mouth, Mercer Co. (U. S. N. M., No. 28,570); mouth of Delashmeet Creek, Bluestone River, Mercer Co. (U. S. N. M., No. 28,565); Bluestone River, Abb's Valley (U. S. N. M., No. 28,569); East River, Mercer Co. (U. S. N. M.); Rich Creek, Spanishburg, Mercer Co. (U. S. N. M.); Barrenche Creek, Perrysville, McDowell Co. (U. S. N. M., No. 28,573); War Creek, McDowell Co. (U. S. N. M., Nos. 28,564, 28,580); Guyandotte River, Baileysville, Wyoming Co. (U. S. N. M., Nos. 28,562, 28,578, 28 ♂).

Isolated localities from which I have seen specimens of *C. bartonii* very closely resembling the form *montanus* in the breadth and punctation of the areola are: Alum Creek, Franklin Co., Ohio, R. C. Osburn and E. B. Williamson (U. S. N. M., No. 22,351), Cincinnati, Ohio (M. C. Z., No. 288), creek at Knoxville, Tenn., Walter Faxon (M. C. Z., No. 3,477). From Cogar's Mill, Elk River, Kanawha Co., W. Va., I have seen an interesting lot of specimens that combine the characters of *C. b. montanus* and *C. b. longulus*, the rostrum and chela of *montanus* going with the reduced sub-orbital angle of *longulus*. These specimens are in the U. S. National Museum, No. 23,990, and in the Museum of Comparative Zoölogy, No. 7,401.

Cambarus bartonii robustus (Girard).

Plate 3.

From *Cambarus bartonii montanus* the passage is easy to *C. b. robustus*, in which form the rostrum is longer and more tapering, the areola rather longer and narrower and the outer margin of the hand more costate, an emphatic de-

pression running along the upper and lower faces of the immobile finger. In the United States National Museum there are many specimens from West Fork of Greenbrier River, W. Va. (No. 23,977, 23,978) and from Crane Creek, W. Va., which are very nearly typical examples of *C. b. robustus*. They differ slightly, it is true, from more northern specimens in having a little broader areola and less pronounced impressions upon the immobile finger. In these regards they show an approach to *C. b. montanus*, from which the form *robustus* is probably derived.

Specimens collected at Wytheville, Wythe Co., Va. (U. S. N. M., No. 13,966, M. C. Z., No. 3,838) which were referred to *C. b. robustus* by me in 1890 (Proc. U. S. Nat. Mus., 12, 622) are in reality *C. b. montanus*.

Examples from Fredericksburg, Spotsylvania Co., Va., were formerly referred to *C. robustus* by Hagen in his Monograph, p. 80, and by myself in my Revision, p. 61, 67, but they are not typical examples of *C. robustus*. These specimens (M. C. Z., Nos. 3,615, 3,797) are in many ways like to *C. acuminatus* in the rostrum which is longer and more tapering than in *robustus*, in the relatively short posterior section of the carapace, greater width of the areola, and the highly developed spines at the base of the antennal scales, on the carpus, and on the merus. The lateral spine of the carapace is distinctly developed on almost all of the Fredericksburg specimens. A similar form is found at Raleigh, N. C. (U. S. N. M. No. 22,355).

After eliminating the specimens which have been wrongly identified with *C. robustus*, the distribution of the latter race, in its true form, is restricted, as far as known, to the following regions:—Ontario: Toronto, Weston. Michigan: Wayne, Washtenaw, Oakland, Sanilac, Huron, Oscoda, Crawford, Alcona and Ionia Counties. Ohio: Knox, Lorain, Cuyahoga, and Ashtabula Counties. New York: Chautauqua, Genesee, Allegany, Monroe, Wayne, Tompkins, Oswego, Madison, Jefferson, St. Lawrence, Herkimer and Hamilton Counties. Pennsylvania: Erie, Crawford, Warren, McKean, and Allegheny Counties (St. Lawrence and Upper Ohio drainage). West Virginia: West Fork of Greenbrier River and Crane Creek.

Cambarus bartonii robustus is a sombre-coloured crayfish in life (Plate 3), the dominant color of the upper surface being a dusky olive tone, nearly uniform and little relieved by the inconspicuously red-tipped fingers of the large claw. The ambulatory appendages have a somewhat bluish cast, and the ventral surface of the creature tends to a dull whitish tint. After the animal is placed in alcohol, a large, bright red, quadrangular patch presently appears on the branchiostegites behind the cervical groove, denoting that part of the shell which

is most susceptible to the action of the liquid. After some hours the red colour extends over the whole branchial region and for a time is sharply defined from the median areola and the other parts of the body, which still retain the dusky colour of the living animal. These striking colour-patterns resulting from recent immersion in alcohol might easily be mistaken for natural life colours by one who had not witnessed the change, and it suggests the probability that some writers have been misled into describing such colours as those of the living animal. Randall, for instance, in the Journal of the Academy of Natural Sciences of Philadelphia, 8, p. 138, Pl. 7, describes and figures *Astacus oreganus* (= *A. leniusculus* Dana?) as having a red spot on each side of the carapace, quite similar to the red spot which temporarily shows in *Cambarus b. robustus* recently immersed in alcohol. So, too, the whitish or lemon-yellow spot on the branchiostegites of *Parastacus bimaculatus* Philippi (Anales Universidad Chile, 87, p. 378), which is probably the same species that I described under the name *Parastacus agassizii* (*cf.* the colour description of this species by Prof. Carlos E. Porter in Revista Chilena de Historia Natural, 8, p. 258, pl. 9, fig. b) may possibly be the result of the action of alcohol on freshly killed specimens.

Cambarus bartonii longulus (Girard).

New localities:— West Virginia: West Fork of Greenbrier River, near Durbin, Pocahontas Co. (U. S. N. M., No. 23,992); Bluestone River, Abb's Valley (U. S. N. M., No. 28,618).

In normal specimens of this subspecies the sub-orbital angle is hardly if at all prominent. The individuals which I mentioned in Proc. U. S. N. M., 12, p. 623, as having the orbit sharply defined below by a prominent angle may prove to be, I suspect, *C. bartonii longirostris*. This form is not very well known as yet, and I have reason to think that it acquires with maturity a claw very much like that of *C. bartonii longulus*. The character of the sub-orbital margin of the carapace seems to be very constant within the limits of a good subspecies, and it may prove to be the really diagnostic feature for separating *C. b. longulus* and *C. b. longirostris*.

Cambarus bartonii veteranus, subsp. nov.

Plate 13, Fig. 2.

Rostrum long, without lateral teeth, margins elevated, strongly convergent, acumen triangular, terminating in an upturned corneous tooth. Antero-lateral

margins of the carapace destitute of any marked angle below the eye. A small spine on each side of the carapace on the posterior edge of the cervical groove. Areola long and broad, $\frac{1}{4}$ as broad as long, thickly strewn with impressed dots. Anterior process of the epistome triangular, truncated anteriorly in old individuals. Chelae large, flattened, internal border furnished with a row of low tubercles, with another row of obsolescent ones running along beside them. The outer margin of the chela is ridged, on account of a marked longitudinal depression which runs along the distal part of the palm and the proximal part of the immobile finger. The fingers are long, heavily pitted, meeting only at their tips, leaving a wide gape between them. The carpus is armed with an internal median spine, and a very small internal posterior spine; below it is furnished with the usual anterior median spine and a minute spinous tubercle between it and the internal median spine. The lower face of the merus is armed with a row of spines along its internal margin and an incomplete row on its external margin made up of about three at the distal end of the joint.

Length of a ♂ form I., 93 mm.; length of carapace 49 mm.; length of areola, 17 mm.; width of areola, 4 mm.; length of chela, 67 mm.; width of chela, $26\frac{1}{2}$ mm.; length of dactylus, 45 mm.

Type locality, Indian Creek, Baileysville, Wyoming Co., W. Va.

Two males of the first form, sixteen males of the second form and seven females were collected by Mr. W. P. Hay at this place on the 16th of August, 1900. They are in the collection of the U. S. National Museum, Nos. 25,020, 28,609, 44,712 (type).

There are also in the National Museum one male of the second form and two females (No. 28,619) from Crane Creek, W. Va., collected together with *C. b. robustus* on the 8th of August, 1900, and one male of the first form from the Elk River, Cogar's Mills, W. Va.

This peculiar form of *C. bartonii* resembles *C. b. longulus* in the form of the rostrum, the wide gape of the fingers of the large claw, and in the absence of a sub-orbital angle. In other respects it is very different from *longulus*, especially in the shape of the chela which is strongly depressed, with deep longitudinal furrows at the base of the immovable finger, both above and below, as in *C. b. robustus*, while in *C. b. longulus* the fingers are cylindrical and bearded within at the base. The characteristic gape of the fingers is not present in regenerated claws, which are furnished with very long straight fingers whose cutting edges are straight and meet together throughout their whole length.

Cambarus bartonii asperimanus, subsp. nov.

Even as these pages are going to press, two specimens of a peculiar, new race of *C. bartonii* are sent to me from the U. S. National Museum,— males of the first form, collected by Messrs. P. C. Standley and H. C. Bolman in Flat Creek, near Montreat, Buncombe Co., N. C., Sept. 1, 1913. *C. bartonii bartonii* was also collected at the same time and place. The new form is conspicuously different from any previously known race of *C. bartonii* in having scattered coarse setae upon the chelae, which are moreover deeply and coarsely pitted, with a tendency toward corrugation: the inner border of the propodus is furnished with a cristiform row of from five to seven teeth; the dorsal face of the carapace is extremely smooth and shows hardly a trace of the customary pits or impressed dots except a row along the margin of the rostrum; even on the areola the dots are scarcely visible without high magnification; finally, the anterior process of the epistoma is broadly truncate in front.

Such are the diagnostic characters of this sub-species, which in other regards agrees pretty closely with typical *C. bartonii*. The hooks of the third segment of the third pair of legs are acute and attenuated at the tip.

Length, 54 mm., carapace, 27 mm.; chela, 19 mm. Type, U. S. N. M., No. 47,375.

Cambarus bartonii acuminatus Faxon.

Cambarus acuminatus Faxon, Proc. Amer. Acad., 1884, **20**, p. 113.

New localities:— Maryland: Northwest Branch, Hyattsville, Prince George's Co. (U. S. N. M.); Indian Creek, Beltsville Prince George's Co. (U. S. N. M.); North Carolina: Halifax, Halifax Co. (U. S. N. M.).

As noted above under *Cambarus bartonii robustus*, specimens from Fredericksburg, Va. (M. C. Z., Nos. 3,615, 3,797) approach closely to the form *acuminatus* and seem to exemplify a transition from *robustus* to *acuminatus*.

Cambarus bartonii laevis, subsp. nov.

This form of *C. bartonii* differs from the typical race in having the carapace smoother and less conspicuously punctated, the posterior section proportionately longer, being equal in length to the distance from the cervical groove to the root of the eye-stalks; this lengthening of the hind section of the carapace involves a long areola which is also not merely relatively but also absolutely

narrower than in the typical *C. bartonii;* the areola is so narrow as to allow barely room for two closely approximated longitudinal rows of dots; the rostrum is a little longer than in *C. bartonii*, with more convergent margins and a longer acumen; the upper or superior border of the hand and movable finger are more distinctly tuberculate; the fingers are shorter, stronger, and more heavily ribbed, and the outer border of the immobile one is more heavily and coarsely punctate. The posterior internal spine of the carpus is obsolete; the anterior process of the epistoma is more broadly triangular.

Type specimen, M. C. Z., No. 3,812, W. S. Blatchley, Bloomington, Ind. ♂, form II. Measurements:— Length, 67 mm., length of carapace, 33 mm., length of areola, 14 mm., breadth of areola at middle, 1 mm., length of right chela, 24 mm., length of right dactylus, 16 mm.

Other localities:— Fall Creek, Indianapolis, Ind. (M. C. Z., No. 3,796), New Albany, Ind. (M. C. Z., No. 3,618), Irvington, Ind. (U. S. N. M., Nos. 19,738, 22,204), May's Cave, Monroe Co., Ind. (U. S. N. M., No. 19,740).

The peculiarities of this crayfish, which appears to be a common form in the State of Indiana, were first pointed out in my Notes on North American Crayfishes, Proc. U. S. Nat. Mus., 1890, 12, p. 622. It has been described and figured, as *C. bartonii*, by Mr. W. P. Hay in the Twentieth Ann. Rep. of the Department of Geology and Natural Resources of Indiana, 1896, p. 437–489. The features which distinguish it from the typical form of *C. bartonii* are so pronounced as to render it necessary to mark it as a subspecies of *C. bartonii* if not as a valid species. In the great relative length of the posterior section of the carapace it resembles *C. bartonii tenebrosus* Hay from the Mammoth Cave of Kentucky.

According to letters which I received from Dr. John Sloan of New Albany, Ind., in the year 1883, this crayfish was always found by him in that region to be a denizen of standing ponds and still water, being replaced by *C. sloanii* in the running streams. On the contrary, both Mr. W. P. Hay (*l. c.*, p. 489) and Mr. A. M. Banta (The Fauna of Mayfield's Cave, Carnegie Inst. of Washington, Publ. No. 67, Sept. 1907, p. 73–75) aver that it is most commonly found in springs and small streams of clear running water where it seeks concealment under stones or in shallow burrows.

Messrs. Hay and Banta have found this form a frequent inhabitant of the caves of southern Indiana in company with the blind species, *C. pellucidus*. Those that dwell in the caves appear to attain a greater size than those in the surface waters, specimens in the Mitchell Caves, Lawrence Co., often exceeding

100 mm. in length according to Banta, while those from the outside do not exceed 84 mm. A series of fifty-eight specimens from the outside waters compared with a series of six specimens from Mayfield's Cave, Monroe Co., by Mr. Banta revealed the fact that the antennae of the cave specimens averaged 11.89 p. c. longer than the antennae of specimens taken outside the caves in the immediate vicinity. The cave series was also lighter-coloured than the series from above ground.

Cambarus graysoni, sp. nov.

Cephalothorax robust, posterior section high, flattened on the back and compressed laterally so that the sides are nearly vertical, giving to the whole section a subquadrangular aspect; shell densely punctated on the dorsal face, granulated on the lateral surfaces; distance from the tip of the rostrum to the cervical groove one and one half times the length from the cervical groove to the posterior end of the carapace; there are no lateral spines upon the carapace and only the rudiments of the branchiostegal spines; the areola is narrow (1.5 mm. broad at the middle in a specimen measuring 21 mm. from the cervical groove to the posterior border of the carapace) with but two rows of dots along the narrow part of its course; rostrum short, margins slightly convergent, middle excavated, acumen short, upturned at the tip, without lateral spines or teeth; post-orbital ridges low, without spines; sub-orbital angles well marked but blunt.

Abdomen as long as the cephalothorax, smooth, pleural angles rounded.

Chelipeds short in proportion to the body; merus short, with low tubercles near the distal end of the superior margin and spines biserially arranged on the lower face; carpus deeply furrowed along the upper face, armed with a prominent median internal acute thorn or spine, one or two small tubercles in place of a median posterior spine; an inferior median spine, with sometimes a small tubercle between it and the interior median spine completes the armature of the carpus; the chela is short, broad and triangular, articulated with the carpus in such a way as to assume a vertical position when flexed and to form with its fellow a shield or operculum appressed to the front of the body; this conformation of the chelae is a sure token of the burrowing habits of this species; the inner (or superior) margin of the palm, is very short, with a marginal row of five or six low tubercles; immediately within this row (which forms a serrate edge to the hand) is another row of similar though smaller tubercles, with vestiges of a few more irregularly disposed near the articulation of the dactylus; the fingers

are rather short, strongly curved downward or inward, not conspicuously ribbed, their prehensile margins armed with rounded teeth, the free edge of the dactylus furnished with low, ciliated, squamous tubercles.

Antennal scale small, narrow. Anterior process of the epistome broad, truncate, anterior border concave, with a median tooth. Sexual organs of male and female similar to those of *C. bartonii*.

Dimensions of a female specimen:— length, 113 mm. length of cephalothorax, 54 mm., breadth, 29 mm., height of do., 21 mm.; length of areola, 21 mm., breadth of areola, 1.5 mm.; length of cheliped, 75 mm.; merus, 21 mm.; length of chela, 39 mm.; breadth of chela, 19 mm.; length of dactylus, 24 mm.

Bear Creek, a tributary of Green River, Grayson Springs, Grayson Co., Ky., Oct. 24, 1874, F. W. Putnam coll. 1 male of the second form, 3 females. M. C. Z., No. 3,593.

This species is nearly related to *C. ortmanni*. Its form, like that of *C. ortmanni*, denotes a species of fossorial habits, but not so preëminently addicted to subterranean life as the species of the *C. diogenes* group, in which the cephalothorax suffers a greater lateral compression. Compared with *C. ortmanni*, *C. graysoni* is more depressed dorsally, more heavily punctated, the areola is broader (as broad as in the typical form of *C. latimanus*) the metathorax somewhat shorter in proportion to the prothorax, the suborbital angle is much more salient, the anterior process of the epistoma is deeply emarginate in front, with a prominent spine at the bottom of the emargination, the internal carpal spine is acute even in old and large examples, and the tubercles of the inner (superior) margin of the hand are stronger and biserially disposed.

The specimens which form the types of *C. graysoni* were referred to *C. bartonii* in my Revision of the Astacidae, p. 61, 159, 169. The peculiarities of the chelipeds, however, show that they belong to a distinct species, allied to *C. ortmanni* and *C. latimanus* and forming together with these species a group connecting *C. bartonii* and its near allies with *C. diogenes* and the nearly related preeminently burrowing forms.

Cambarus ortmanni Williamson.

Cambarus ortmanni Williamson, 31st Ann. Rept. Department Geol. Indiana, 1906, 1907, p. 754–760, pl. 35.

Cambarus ortmanni, a burrowing species, was described by Mr. E. B. Williamson from specimens captured in Wells Co., Ind., in the Wabash River drainage near Bluffton. There has been a single female specimen from Cincinnati, O.,

however, in the Museum of Comparative Zoölogy since the early days of the Museum. This specimen, No. 243, was referred to *C. bartonii* by Dr. Hagen in his Monograph and entered into his computation of the variability of the width of the areola of that species, on p. 78. In my subsequent Revision of the Astacidae, in 1885, p. 64, I referred to this individual as possibly a peculiar species related to *C. latimanus*.

In the shape of the body and the narrow areola *C. ortmanni* bears a close resemblance to *C. latimanus striatus*, but in the outline of the rostrum and the sculpture of the claws it betrays a closer resemblance to *C. bartonii*. It is without doubt an immediate offshoot of the latter, modified by fossorial habits; the narrow areola, broad, conical claws, small antennal scale, long, narrow and quadrangular epistome, all denote this. It forms a passage from *C. bartonii* to *C. latimanus* on the one hand and on the other to the more eminently fossorial forms, *C. carolinus*, *C. diogenes*, etc.

Cambarus latimanus (Le Conte).

There is a cotype, a dried male, in the Museum of Comparative Zoölogy, No. 3,378, acquired by exchange of types with the Smithsonian Institution in 1861; another cotype, a dried female, is preserved in the collection of the Academy of Natural Sciences of Philadelphia. There are also in the Museum of Comparative Zoölogy, No. 236, preserved in alcohol, 3 males of the first form, 6 males of the second form, 3 females, and 7 young, collected in Athens, Ga., and sent to Professor Agassiz by LeConte in the 50's. These are essentially paratypes, and are of interest as fixing the type locality, Athens, Ga., which was not specified in Le Conte's original description of the species nor on the labels accompanying the type specimens in Cambridge and Philadelphia.

Two males, dried, M. C. Z., No. 3,366, sent by Prof. Lewis R. Gibbes from South Carolina as *C. bartonii*, without precise locality, are the only specimens reported from South Carolina so far as I know.

A small young female from Milledgeville, Ga. (M. C. Z., No. 3,365) and another from Roswell, Ga. (M. C. Z., No. 3,502) probably belong to this species.

Specimens from Blount Spring and Cullman, Ala. (U. S. N. M., No. 4,953, M. C. Z., No. 3,639) differ from the typical form in having a narrower rostrum, and in specimens from Bridgeport, Ala., and Nickajack Cave, Ashland City, and Nashville, Tenn., the divergence from the type is so pronounced that Mr. W. P. Hay has described them as a subspecies, *C. latimanus striatus* (Proc. U. S. Nat. Mus., 1902, **25**, p. 437; type locality, Nashville, Tenn.).

Mr. C. F. Baker has sent me a fine lot of *C. latimanus* from Auburn, Ala., among them specimens that have attained a length of four inches.

Cambarus carolinus Erichson.

This species was described in 1846 (Arch. Naturgesch., **12**, 1, p. 96). Erichson's type, a male of the first form, is preserved in the Berlin Museum. It was collected by Dr. Cabanis, who assured Dr. Hagen that all the crayfishes that he collected in the United States came from a rivulet in a plantation called Tiger Hall, near Greenville, S. C.[1] In 1902 Mr. W. P. Hay procured from Dr. Johann Thiele of Berlin a photograph of the type specimen together with drawings of the right claw and first and second abdominal appendages. By means of this photograph and the drawings Mr. Hay identified the species with the crayfish which I described in 1884, from Cranberry Summit (now Terra Alta), Preston Co., W. Va., under the name of *Cambarus dubius* (see Hay, Proc. Biol. Soc. Washington, **15**, March 5, 1902, p. 38.

By the courtesy of Mr. Hay I have before me Dr. Thiele's photograph and drawings of Erichson's type, and find that, although it nearly resembles *C. dubius*, yet it presents some different characters. The carpus is armed on its inner margin with two prominent, acute spines; of these the larger, anterior one is the so-called internal median carpal spine; on the left cheliped the photograph reveals a tubercle just behind, and at a lower level than, the median spine. In *C. dubius* there is but one carpal spine, the internal median. Furthermore, the outer margin of the hand of *C. carolinus*, as shown in Dr. Thiele's drawing, is rounded off and lacks the subserrate ridge characteristic of *C. dubius;* in this regard the hand of *C. carolinus* appears to be like that of *C. monongalensis* Ortm.

No. 14,314, U. S. N. M., male, form I., "among the Cherokees, James Mooney," agrees closely with the pictures of Erichson's type, and may be considered a typical *C. carolinus*. In a notice of this specimen as *C. dubius* in 1890 (Proc. U. S. Nat. Mus., **12**, p. 624), I erred in ascribing it to the Indian Territory. I am advised by Mr. Mooney that it was in reality obtained in Swain Co. or in Jackson Co., N. C., among the *Eastern* Cherokees,— a remnant of the Nation which eluded deportation in 1838 and still clings to the old home in western North

[1] Mr. W. P. Hay (Proc. Biol. Soc. Washington, **15**, p. 38, 1902) has unfortunately given this locality as *western North Carolina*, and has been followed in this error by Mr. J. A. Harris (Kansas Univ. Sci. Bull., 1903, **2**, p. 81, 112, 151).

Carolina.[1] It thus appears that Mr. Mooney's crayfish came from a region not far remote from the type locality of *C. carolinus*.

In this specimen (U. S. N. M., No. 14,314), which displays the normal features of *C. carolinus*, as I believe, the rostrum is narrower than in *C. dubius* and less quadrangular in outline; the anterior process of the epistoma is much broader and more triangular in outline, the sides converging much more between the base and the truncated anterior angle; the carpus is armed with a prominent, acute, internal median spine, immediately behind which and at a little lower level lies a very small spiny tubercle; posteriorly to this, not far from the inner articulation with the merus, lies another distinct spine, smaller than the internal median spine; the lower face of the carpus bears one tubercle about half-way between the internal median spine and the outer articulation with the propodus; the lower face of the merus shows the biserial arrangement of spines as in *C. dubius*, as many as five or six spines adorning the external edge of the segment; the distal segment of the outer branch of the last pair of abdominal appendages is shorter and broader (less oval in contour) than in *C. dubius*. The living color of this specimen, as is shown by a MS. note accompanying the specimen, was red, the color of *C. dubius* also.

A large number of specimens in the U. S. National Museum collected at various places in the southwestern part of West Virginia (Nos. 28,591–28,596, 28,598–28,600, Horsepen Creek, War Creek, Baileysville, Lashmeet, Barranche Creek), agreeing in most respects with the typical *C. dubius* from northern West Virginia and Pennsylvania tend to develop the accessory carpal spines and tubercles of *C. carolinus*.

Three specimens (male, form I.) in the U. S. National Museum, No. 22,386, from a tributary of Stone River twenty miles from Columbia in central Tennessee are interesting. They agree in most respects with *C. c. dubius*, but the rostrum is a little narrower, with more convergent margins, the rostral acumen is less abrupt, and the outer border of the hand is rounded off without much indication of serrature. In these regards the specimens agree with the typical *carolinus;* the carpus, however, is very smooth, bearing no spines except the internal median, as in *C. c. dubius*. The outer inferior row of spines on the merus is present, though slightly developed. The branchio-cardiac lines are in closer contact than in any other specimens of this species that I have seen, reducing the areola to a narrow line.

[1] See Myths of the Cherokee, by James Mooney, Nineteenth Ann. Rept. Bureau Amer. Ethnol. 1897–98, 1900, p. 308.

The closely related Blue or Monongahela Crayfish was first discovered at Pittsburgh, Pa., in 1898, by Mr. E. B. Williamson. Specimens were sent to me in the month of August of that year, which appeared to me to be a local form of *C. dubius*, and they were recorded as such by Mr. Williamson in a paper on the Crayfish of Allegheny County, Pennsylvania (Ann. Carnegie Mus., 1901, 1, p. 11). Compared with the type of *C. dubius* these specimens showed a narrower rostrum with less pronounced angles at the base of the acumen; the outer border of the hand was evenly rounded, not ridged, and destitute of the imperfect serrature seen in *C. dubius*, where this feature results from the regular row of transversely elongated marginal punctations giving to the margin a milled appearance; further, the carpus of the Pittsburgh form was armed with several accessory spines and tubercles, besides the prominent internal median spine which is all the armature of the carpus in *C. dubius*.

In a paper on the Crawfishes of western Pennsylvania published in 1905 (Ann. Carnegie Mus., 3, No. 2) and in a more elaborate memoir which appeared at the close of the following year (The Crawfishes of the State of Pennsylvania, Mem. Carnegie Mus., 2, No. 10), Dr. A. E. Ortmann showed that the Blue Crayfish and *C. dubius* both lived in western Pennsylvania, that they occupied different areas separated by the Chestnut Ridge, a range of hills on the west of the Allegheny Mountains, the Blue Crayfish (to which he gave the name *Cambarus monongalensis*) being found on the hills lying on the west of this range while *C. dubius* lived in the mountain region to the east of Chestnut Ridge, between it and the principal range of the Allegheny Mountains. Dr. Ortmann also brought out clearly, as a result of extensive field study, the color-difference between the two forms, the dominant color of *C. dubius* being red, of *C. monongalensis* blue. The range of the latter form appears to be rather narrow, being restricted, as far as is shown by Dr. Ortmann's most interesting investigations, to Westmoreland, Allegheny, Beaver, Washington, Fayette and Green Counties, Pa., and Hancock, Brooke, Ohio, Marshall and Monongalia Counties, W. Va., at altitudes ranging from 800 feet to 1200 feet above the sea-level.

Dr. Ortmann compared his specimens of *C. monongalensis* with the northern race of *C. carolinus, i. e., C. dubius* Fax., and came to the conclusion that they represented a distinct species. But as appears from what has been said above, three of the characters which Ortmann thought were peculiar to *C. monongalensis* are also present in the southern, typical form of *C. carolinus*, viz., the narrower rostrum, non-serrated outer margin of the hand, and the presence of more than one spine on the inner side of the carpus. There are thus left but two features

to separate *C. monongalensis* from *C. carolinus*, viz., the uniserial disposition of the spines on the lower face of the merus of the cheliped, and the colour.

So, with a broader overlook of the geographical variations of these interesting forms it would seem to be more logical to consider *C. carolinus* Erichs., *C. dubius* Fax. and *C. monongalensis* Ortm. as three geographical races, or subspecies of one species. The three subspecies may be distinguished by means of the subjoined key:—

Lower face of merus with only one row of spines developed. Colour, blue . . . . . *C. carolinus monongalensis* (Ortm.)

Lower face of merus with two rows of spines developed. Colour, red.

- Margins of rostrum distinctly convergent; outer margin of hand rounded, not serrated; more than one spine on inner margin of the hand . . . . . *C. carolinus carolinus* Erichs.
- Rostrum broader with nearly parallel margins; outer margin of hand subserrate; only one spine on inner margin of the hand . . *C. carolinus dubius* Fax.

The geographical range of *C. c. monongalensis*, so far as it has been worked out by Dr. Ortmann, has been given above. More exploration is needed to elucidate the dispersal of the typical *C. carolinus*. The type locality is near Greenville, Greenville Co., S. C. The specimen in the U. S. National Museum, collected by James Mooney and described above, came from Swain or Jackson Co., western North Carolina. Ortmann (Mem. Carnegie Mus., 2, p. 397) mentions some specimens in the Academy of Natural Sciences of Philadelphia, collected by Prof. J. P. Moore at Blowing Rock, Watauga Co., N. C., which have a narrower rostrum than *C. c. dubius*, and are therefore probably *C. c. carolinus*.

Specimens collected by Mr. H. G. Hubbard at Pennington's Gap, Lee Co., Va. (M. C. Z., No. 3,489) and by myself at Cumberland Gap, at the junction of the three states of Virginia, Kentucky and Tennessee (M. C. Z., No. 3,594) are too young to determine subspecifically with assurance, but they appear to be *C. c. dubius*. The form spread over the southwestern parts of West Virginia, as has been pointed out (p. 397) is more or less intermediate between *carolinus* and *dubius*, while the pure *C. c. dubius* has been reported from Westmoreland, Fayette, and Somerset Cos., Pa., Garrett Co., Md., and Preston, Tucker, and Mineral Cos., W. Va.

Cambarus diogenes Girard.

New localities:— Maryland: Laurel, Prince Georges Co. (U. S. N. M.). Virginia: Dismal Swamp (U. S. N. M.). North Carolina: Near Beaufort, Carteret Co. (Coll. W. P. Hay). Alabama: Auburn, Lee Co. (M. C. Z.). Mississippi: Muldon, Monroe Co. (U. S. N. M.); Agricultural College, Oktibbeha Co. (U. S. N. M.). Ohio: Toledo, Lucas Co. (U. S. N. M.). Indiana: Near Milltown, Crawford Co. (U. S. N. M.); Lake Maxinkuckee, Marshall Co. (U. S. N. M.); White Co. (U. S. N. M.). Illinois: Wabash Co. (U. S. N. M.); Henderson Co. (U. S. N. M.); near Olney, Richland Co. (U. S. N. M.). Iowa: Burlington, Des Moines Co. (U. S. N. M.). Michigan: Raisin River, Monroe, Monroe Co. (U. S. N. M.). Nebraska: Omaha, Douglas Co. (M. C. Z.); Creighton Creek, south of Niobrara, Knox Co. (U. S. N. M). Colorado: Fort Collins, Lorimer Co. (M. C. Z.).

Knox Co., Indiana, given as a station for *C. diogenes* in my Revision of the Astacidae, page 71, should be transferred to *C. argillicola*, p. 77.

Cambarus diogenes ludovicianus Faxon.

New localities:— Frierson, De Soto Co., La.; Rosedale, Bolivar Co., Miss.; U. S. N. M.).

Cambarus argillicola Faxon.

New localities:— Olney, Richland Co., Ill. (U. S. N. M.); Frierson, De Soto Co., La., in burrows 18 inches deep, surmounted by low mud "chimneys" (U. S. N. M.).

Cambarus uhleri Faxon.

Mr. W. P. Hay captured one specimen of this species near Beaufort, N. C., Aug. 17, 1912. This specimen, a female, was taken from a hole in the bank of a pond on the south side of Adley's Creek, about fourteen miles north of Beaufort. On the other side of the same creek, about a mile away, Mr. Hay collected three specimens of *C. diogenes* (also females) in holes on the edge of a swamp. The specimen of *C. uhleri* differs from the type specimens from Maryland but very slightly, the rostrum being a trifle more concave above, and the foveola at the base of the rostrum rather more pronounced.

Uhler's Crayfish has heretofore been known only from the tidewater Ocean and Bay counties of eastern Maryland.

Cambarus clypeatus Hay.

Proc. U. S. Nat. Mus., Oct. 11, 1899, **22**, p. 122, fig. 2.

The type specimen of this species, a female, U. S. Nat. Mus., No. 17,277, is the only one known. It was found by Mr. G. A. Coleman, of the U. S. Biological Survey, in April, 1892, in a skiff at Bay St. Louis, Miss. Mr. Hay surmises that it belongs in the neighbourhood of *C. cubensis;* I should incline rather, on account of the structure of the annulus ventralis and the shape of the body, to place it in *C. bartonii* group.

LIST OF THE DESCRIBED SPECIES OF CRAYFISHES (PARASTACIDAE AND ASTACIDAE).

PARASTACIDAE.

Astacopsis Huxley.

Astacopsis Huxley, Proc. Zoöl. Soc. London, 1878, p. 764.

1. Astacopsis franklinii.

Astacus franklinii Gray, Eyre's Journals of Expeditions of Discovery into Central Australia, 1845, **1**, p. 409.

Type locality:— Tasmania.

2. Astacopsis nobilis.

Astacoïdes nobilis Dana, Crustacea U. S. Expl. Exped., 1852, **1**, p. 526.

Type locality:— New South Wales?

3. Astacopsis spinifera.

Cancer serratus Shaw, Zoölogy of New Holland, 1794, pl. 8, (nec *Cancer serratus* Forskål, 1775).

?Astacus australasiensis Milne Edwards, Hist. Nat. Crustacés, 1837, **2**, p. 332. *Type locality:*— Sydney, Australia. *Two cotypes*, Paris Mus.

?Astacus australiensis Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 94 (*nom. emend.*).

Astacoïdes spinifer Heller, Reise der Novara, Zool. Th., **2**, pt. 3, Crust., 1865, p. 102.

Astacus armatus Martens, Ann. Mag. Nat. Hist., 1866, ser. 3, **17**, p. 359. *Type locality:*— Murray River, Australia. *Type*, Berlin Mus.

?Astacopsis paramattensis Bate, Rept. Challenger, **24**, Crust. Macrura, 1888, p. 202. *Type locality:*— Paramatta River, Sydney, Australia. *Type*, Brit. Mus., 1 ♀.

?Astacopsis sydneyensis Bate, Rept. Challenger, **24**, Crust. Macrura, 1888, p. 204. *Type locality:*— Sydney, Australia. *Type*, Brit. Mus., 1 ♀.

Type locality:— Australia.

Incertae Sedis.

1. Astacopsis ? tasmanicus.

Astacus tasmanicus Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 94.

Type locality:— Tasmania. *Type*, Berlin Mus., No. 1,579, ♀.

CHERAPS Erichson.

CHERAPS Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 101.

1. CHERAPS PREISSII.

Astacus (*Cheraps*) *preissii* Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 101.

?Astacoïdes plebejus Hess, Arch. Naturgesch., 1865, **31**, 1, p. 164. *Type locality:*— Sydney, Australia. *Type*, Göttingen Mus.

Type locality:— Southwestern Australia.

2. CHERAPS BICARINATUS.

Astacus bicarinatus Gray, Eyre's Journals of Expeditions of Discovery into Central Australia, 1845, **1**, p. 410.

Type locality:— Port Essington, North Australia.

3. CHERAPS QUADRICARINATUS.

Astacus quadricarinatus Martens, Monatsber. Akad. Wissensch. Berlin, 1868, p. 617.

Type locality:— Cape York, Australia. *Type*, Berlin Mus., No. 2972.

4. CHERAPS QUINQUECARINATUS.

Astacus quinquecarinatus Gray, Eyre's Journals of Expeditions of Discovery into Central Australia, 1845, **1**, p. 410.

Type locality:— Western Australia, near Swan River.

ENGAEUS Erichson.

ENGAEUS Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 102.

1. ENGAEUS FOSSOR.

Astacus (*Engaeus*) *fossor* Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 102.

Type locality:— Tasmania. *Types*, Berlin Mus., Nos. 1123, 1124.

2. ENGAEUS CUNICULARIUS.

Astacus (*Engaeus*) *cuniculariu*s Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 102.

Engaeus cunicularis Haswell, Cat. Australian Stalk- and Sessile-eyed Crustacea, 1882, p. 179. (*Err. typograph.?*)

Type locality:— Tasmania. *Type*, Berlin Mus., No. 1122.

PARANEPHROPS White.

PARANEPHROPS White, Gray's Zoöl. Miscell., June, 1842, p. 79.

1. PARANEPHROPS PLANIFRONS.

Paranephrops planifrons White, Gray's Zoöl. Miscell., June, 1842, p. 79.

?Paranephrops tenuicornis Dana, Crustacea U. S. Explor. Exped., 1852, **1**, p. 527. *Type locality:* — Fresh-water streams about the Bay of Islands, North Island, New Zealand.

Type locality: — River Thames, North Island, New Zealand. *Types*, Brit. Mus.

2. Paranephrops zealandicus.

Astacus zealandicus White, Proc. Zoöl. Soc. London, 1847, part 15, p. 123.

Paranephrops neo-zelanicus Chilton (in part), Trans. and Proc. New Zealand Inst., 1888, **21**, p. 249 (*nom. emend.*).

Type locality: — New Zealand. *Types*, Brit. Mus.

3. Paranephrops setosus.

Paranephrops setosus Hutton (in part), Ann. Mag. Nat. Hist., Nov. 1873, ser. 4, **12**, p. 402.

Paranephrops horridus "S[emper?] MS.," Miers, Cat. Stalk and Sessile-eyed Crust. New Zealand, 1876, p. 73. (*nom. nudum*). Brit. Mus.

?Astacoïdes tridentatus Wood-Mason, Proc. Asiatic Soc. Bengal, 1876, p. 4. *Type locality:* — New Zealand.

Type locality: — River Avon, near Christchurch, South Island, New Zealand.

Astaconephrops Nobili.

Astaconephrops Nobili, Annali del Mus. Civ. Storia Nat. Genova, 1899, **40**, p. 244.

1. Astaconephrops albertisii.

Astaconephrops albertisii Nobili, Annali del Mus. Civ. Storia Nat. Genova, 1899, **40**, p. 244.

Type locality: — Katau, southern New Guinea. *Type*, Genova Mus., 1 ♀.

Astacoïdes Guérin.

Astacoïdes Guérin, Revue Zoologique, 1839, **2**, p. 109.

1. Astacoïdes madagascariensis.

Astacus madagascariensis Aud. et M. Edw., Journ. de l'Institut, 1839, p. 152.

Astacoïdes goudotii Guérin, Revue Zoologique, 1839, **2**, p. 109. *Type locality:*— Madagascar. *Type*, Acad. Nat. Sci. Philad., Guérin Coll., No. 290.

Astacus caldwelli Bate, Proc. Zoöl. Soc. London, 1865, p. 469. *Type locality:*— Near Antananarivo, Madagascar.

Type locality: — Madagascar.

Parastacus Huxley.

Parastacus Huxley, Proc. Zoöl. Soc. London, 1878, p. 771.

1. Parastacus pilimanus.

Astacus pilimanus Martens, Arch. Naturgesch., 1869, **35**, 1, p. 15.

Type locality: — Porto Alegre, Brazil. *Types*, Berlin Mus., Nos. 3,323, 3,447.

2. Parastacus brasiliensis.

Astacus brasiliensis Martens, Arch. Naturgesch., 1869, **35**, 1, p. 16.

Type locality: — Porto Alegre, Brazil. *Types*, Berlin Mus., Nos. 3,322, 3,448.

3. Parastacus defossus.

Parastacus defossus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 686.

Type locality: — Montevideo, Uruguay. *Types*, U. S. N. M., No. 19,647; *paratype*, M. C. Z., No. 4,776.

4. Parastacus saffordi.

Parastacus saffordi Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 683.

Type locality: — Montevideo, Uruguay. *Types*, U. S. N. M., No. 12,581; *paratype*, M. C. Z., No. 4,775.

5. Parastacus varicosus.

Parastacus varicosus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 685.

Type locality: — Colima, Mexico (by error?). *Type*, U. S. N. M., No. 4,133.

6. Parastacus chilensis.

Astacus chilensis M. Edw., Hist. Nat. des Crustacés, 1837, **2**, p. 333.

Type locality: — Coasts of Chile. *Type*, Mus. Hist. Nat. Paris.

7. Parastacus bimaculatus.

Astacus bimaculatus Philippi, Anales Universidad Chile, 1894, **87**, p. 378.

Parastacus agassizii Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 690. *Type locality:* — Talcahuano, Chile. *Types*, M. C. Z., No. 3,400; *paratypes*, U. S. N. M., No. 12,045.

Type locality: — Chile.

8. Parastacus spinifrons.

Astacus spinifrons Philippi, Anales Universidad Chile, 1882, **61**.

Type locality: — Chile.

9. Parastacus nicoleti.

Astacus chilensis Nicolet (nec M. Edw.), Gay's Hist. Chile, Zool., 1849, **3**, p. 211. *Type locality:* — Chile.

Astacus nicoleti Philippi, Anales Universidad Chile, 1882, **61**.

Type locality: — Chile.

10. Parastacus hassleri.

Parastacus hasslcri Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 687.

Type locality: — Talcahuano, Chile. *Types*, M. C. Z., No. 3,401; *paratypes*, U. S. N. M., No. 19,689.

11. Parastacus araucanius.

Parastacus araucanius Faxon, supra, p. 353.

Type locality: — Corral, Chile. *Type*, M. C. Z., No. 7,355.

Astacus Fabricius.

Astacus Fabricius, Syst. Entomol., 1775, p. 413.

1. Astacus colchicus.

Astacus colchicus Kessler, Bull. Soc. Imp. Moscou, 1876, **50**, p. 2.

Type locality: — Upper Rion River and tributaries, Transcaucasia.

2. Astacus pachypus.

Astacus pachypus Rathke, Mém. Acad. Imp. St. Pétersbourg, 1836, **3**, p. 365.

Astacus caspius Eichwald, Bull. Soc. Imp. Moscou, 1838, p. 149. *Type locality:* — Caspian Sea, near Baku.

Type locality: — Neighborhood of Nikolaiev, Boug River, Russia.

3. Astacus leptodactylus.

Astacus leptodactylus Eschscholtz, Mém. Soc. Imp. Moscou, 1823, **6**, p. 109.

Astacus leptodactylus salinus Nordmann, Observations sur la Faune Pontique, in Demidoff's Voyage dans la Russie Méridionale et la Crimée, Atlas, Crustacea, 1842, Tab. 1. *Type locality:* — Black Sea.

Type locality: — Government of Taurida, Russia.

3a. Astacus leptodactylus caspius.

Astacus leptodactylus, var. *caspia* Eichwald, Bull. Soc. Imp. Moscou, 1838, p. 148.

Type locality: — Caspian Sea, near Lenkoran.

3b. Astacus leptodactylus angulosus.

Astacus angulosus Rathke, Mém. Acad. Imp. St. Pétersbourg, 1836, 3, p. 364.

Type locality: — Crimea, Russia.

4. Astacus kessleri.

Astacus kessleri Schimkewitsch, Bull. Soc. Imp. Amis Hist. Nat. Moscou, 1886, 50 (Proc. Zool. Sect., 1, pt. 1, p. 20).

Type locality: — Near the town of Turkestan, Government of Syr-Darya, Asiatic Russia.

5. Astacus astacus.

Cancer astacus Linné, Syst. Nat., Ed. 10, 1758, 1, p. 631.

Astacus fluviatilis Fabr., Syst. Entomol., 1775, p. 413. *Type locality:* — Europe.

Cancer nobilis Schrank, Fauna Boica, 1803, 3, 1 Abth., p. 246. *Type locality:* — Bavaria.

Astacus fluviatilis communis Gerstfeldt, Mém. Acad. Imp. St. Pétersbourg, 1859, 9, p. 554. *Type locality:* — Europe.

Type locality: — Europe.

6. Astacus pallipes.

Astacus pallipes Lereboullet, Mém. Soc. Sci. Nat. Strasbourg, 1858, 5, p. 7.

Astacus fontinalis Carbonnier, L'Écrevisse, 1869, p. 8. *Type locality:* — France.

Type locality: — In canals and ditches, Strasbourg, Alsace.

6a. Astacus pallipes fulcisianus.

Astacus pallipes, var. *fulcisiana* Ninni, Atti Soc. Ital. Sci. Nat. Milano, 1886, 29, p. 326.

Type locality: — Province of Belluno, Italy.

6b. Astacus pallipes italicus.

Astacus pallipes italicus Faxon, supra, p. 361.

Type locality: — River Sarno, Pompeii, Italy. *Types*, U. S. N. M., No. 28,638; *paratypes*, M. C. Z., No. 7,409.

7. Astacus torrentium.

Cancer torrentium Schrank, Fauna Boica, 1803, 3, 1 Abth., p. 247.

Astacus saxatilis Koch, Deutschlands Crustaceen, Myriapoden und Araehniden, 1835?, 7, No. 1 (Panzer and Herrieh-Schäffer's Deutschlands Inseeten, 140, No. 1). *Type locality:* — Bavaria, in mountain brooks of the Oberpfalz and also in the Danube under stones.

Astacus tristis Koch, Deutschlands Crustaceen, Myriapoden und Arach niden, 1835?, 7, No. 2 (Panzer and Herrieh-Schäffer's Deutschlands Inseeten, 140, No. 2). *Type Locality:* — Bavaria, in a mountain brook at Bodenstein, Regen River system.

Astacus longicornis Lereboullet, Mém. Soc. Sei. Nat. Strasbourg, 1858, 5, p. 2. *Type locality:* — Ill and Bruehe Rivers, Alsace.

Type locality: — Bavaria, in stony streams and also in lakes, e. g. Würm-See.

8. Astacus gambelii.

Cambarus gambelii Girard, Proc. Aead. Nat. Sei. Philad., 1852, 6, p. 90.

Type locality: — "California." *Types*, Aead. Nat. Sci. Philad.

8a. Astacus gambelii connectens.

Astacus gambelii connectens Faxon, supra, p. 360.

Type locality: —Snake River, Upper Salmon Falls, Idaho. *Type*, U. S. N. M. No. 23,096; *paratype*, M. C. Z., No. 7,385.

9. Astacus nigrescens.

Astacus nigrescens Stimpson, Proc. Boston Soc. Nat. Hist., Feb., 1857, 6, p. 87.

Type locality: — Neighborhood of San Franeisco, Cal. *Types* probably destroyed in the Chieago fire in 1871.

9a. Astacus nigrescens fortis.

Astacus nigrescens fortis Faxon, supra, p. 360.

Type locality: — Fall River, Fall City Mills, Shasta Co., Cal. *Type*, U. S. N. M., No. 44,404; *paratypes*, M. C. Z., No. 7,383.

10. Astacus trowbridgii.

Astacus trowbridgii Stimpson, Proc. Boston Soc. Nat. Hist., Feb., 1857, 6, p. 87.

Type locality: — Columbia River above Astoria, Oregon. *Cotypes*, U. S. N. M., No. 2,080; M. C. Z., No. 3,510; Bost. Soc. Nat. Hist.; Peabody Mus. Yale Univ.

11. Astacus leniusculus.

Astacus leniusculus Dana, Crustacea U. S. Expl. Exped., 1852, **1**, p. 524.

?Astacus oreganus Randall, Journ. Acad. Nat. Sci. Philad., 1840, **8**, p. 138.

Type locality: — Columbia River. *Type* destroyed.

Type locality: — Columbia River and Puget's Sound. *Cotype*, U. S. N. M., No. 2,019, and probably No. 2,161.

12. Astacus klamathensis.

Astacus klamathensis Stimpson, Proc. Boston Soc. Nat. Hist., Feb., 1857, **6**, p. 87.

Type locality: — Klamath Lake, Oregon. *Type* probably destroyed in the Chicago fire in 1871.

CAMBAROÏDES Faxon.

Cambaroïdes Faxon, Proc. Amer. Acad., 1884, **20**, p. 150.

1. Cambaroïdes japonicus.

Astacus japonicus De Haan, Crustacea of Siebold's Fauna Japonica, 1842, p. 164.

Type locality: — Japan.

2. Cambaroïdes similis.

Astacus (Cambaroïdes) similis Koelbel, Anz. Akad. Wissensch. Wien, math.-nat. Classe, 1892, **29**, p. 176; Sitzungsber., 1892, **101**, pt. 1, p. 650.

Type locality: — Province of Kjöng-Kur-do, Korea.

3. Cambaroïdes dauuricus.

Astacus dauuricus Pallas, Spicilegia Zoologica, 1772, Fasc. 9, p. 81.

Astacus leptorrhinus Fischer, Bull. Soc. Imp. Moscou, 1836, **9**, p. 467.

Type locality: — Dauria. *Types*, St. Petersburg Mus.[1]

4. Cambaroïdes schrenckii.

Astacus schrenckii Kessler, Bull. Soc. Imp. Moscou, 1874, **48**, p. 361.

Type locality: — Lower Amur River Basin.

[1] *I. e.*, were there when the species was described.

CAMBARUS Erichson.

CAMBARUS Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 88.

§ I. Third segment of the third pair of legs of the male furnished with hooks. First pair of abdominal appendages of the male stout, inner and outer parts closely appressed, laterally compressed, with a horny (in the first form) spine at the tip; anterior margin with a prominent shoulder near the distal end. (Subgenus PROCAMBARUS of Ortmann.)

1. CAMBARUS DIGUETI.

Cambarus digueti Bouvier, Bull. Mus. Hist. Nat. Paris, 1897, **3**, p. 225.

Cambarus carinatus Faxon, Proc. U. S. N. M., Feb. 17, 1898, **20**, p. 648. *Type locality:* — Guadalajara, Mexico. *Type*, U. S. N. M., No. 17,699, 1 ♂ f. I; *paratypes*, U. S. N. M., No. 16,085 (Ameca, State of Jalisco, Mex.), 17,707 (Hacienda de Villachuato, State of Michoacan, Mex.); M. C. Z., No. 4,338 (Ameca, Mex.).

Type locality: — Affluents of River Santiago, State of Jalisco, Mexico. *Cotypes*, Mus. Hist. Nat. Paris; U. S. N. M., No. 30,579; Carnegie Mus. Pittsburgh.

2. CAMBARUS WILLIAMSONI.

Cambarus (*Procambarus*) *williamsoni* Ortmann, Annals Carnegie Mus., 1905, **3**, p. 439.

Type locality: — Los Amates, Province of Izabal, Guatemala. *Types*, Carnegie Mus. Pittsburgh.

3. CAMBARUS PILOSIMANUS.

Cambarus (*Procambarus*) *pilosimanus* Ortmann, Proc. Washington Acad. Sci., May 3, 1906, **8**, p. 6.

Type locality: — Coche, near Coban, Guatemala. *Types*, Mus. Hist. Nat. Paris; *paratypes*, Carnegie Mus. Pittsburgh (1 ♂ f. I., 1 ♀).

4. CAMBARUS MEXICANUS.

Astacus (*Cambarus*) *mexicanus* Erichson, Arch. Naturgesch., 1846, **12**, 1, p. 99.

Cambarus aztecus Saussure, Rev. et Mag. Zool., 1857, ser. 2, **9**, p. 503. *Type locality:* — Tomatlan [State of Vera Cruz?] Mexico. *Cotypes*, Geneva Mus.; U. S. N. M., No. 20,682 (1 ♂ ex Geneva Mus.).

Cambarus ruthveni Pearse, 13th Rept. Mich. Acad. Sci., 1911, p. 110. *Type locality:* — Cuatotolapam, Canton of Acayucan, State of Vera Cruz, Mexico. *Types*, Mus. Univ. Michigan, No. 41,704, 41,705, 1 ♂, 1 ♀.

Type locality: — Mexico. *Type* seemingly lost from the Berlin Mus.

5. Cambarus cubensis.

Astacus (*Cambarus*) *cubensis* Erichson, Arch. Naturgesch., 1846, 12, 1, p. 100.

Type locality: — Cuba. *Type*, Berlin Mus.

5a. Cambarus cubensis consobrinus.

Cambarus cubensis consobrinus Saussure, Rev. et. Mag. Zool., 1857, ser. 2, 9, p. 101.

Type locality: — Ponds in the central part of Cuba. *Cotypes*, Geneva Mus. (2 ♂); Mus. Hist. Nat. Paris (1 ♂); Berlin Mus. (2 ♀); U. S. N. M., No. 20,684 (1 ♂ ex Geneva Mus.).

5b. Cambarus cubensis rivalis.

Cambarus cubensis rivalis Faxon, Bull. M. C. Z., October, 1912, 54, p. 459.

Type locality: — San Diego de los Baños, Province of Pinar del Rio, Cuba. *Type*, M. C. Z., No. 7,406.

6. Cambarus atkinsoni.

Cambarus (*Procambarus*) *atkinsoni* Ortmann, Annals Carnegie Mus., May 5, 1913, 8, p. 414.

Type locality: — Tributaries of Rio de los Indios, Los Indios, Isle of Pines. *Types*, Carnegie Mus. Pittsburgh, No. 74,924.

§ II. Third segment of third pair of legs of the male provided with hooks. First pair of abdominal legs of the male truncate, outer part closely applied to the inner and armed at the tip with from one to three horny, recurved teeth; inner part ending in a sharp spine generally directed outward. (Subgenus Cambarus of Ortmann, in part.)

7. Cambarus bouvieri.

Cambarus (*Cambarus*) *bouvieri* Ortmann, Ann. Sci. Nat., 1909, sér. 9, 7, p. 159.

Type locality: — Uruapan, Michoacan, Mexico. *Cotypes*, Mus. Hist. Nat. Paris (2 ♂ f. I., 1 ♀); Carnegie Mus. Pittsburgh (1 ♂ f. I.).

8. Cambarus simulans.

Cambarus simulans Faxon, Proc. Amer. Acad., 1884, 20, p. 112.

Cambarus gallinus Cockerell and Porter, Proc. Acad. Nat. Sci. Philad., 1900,

p. 434. *Type locality:* — Gallinas River at Las Vegas, N. Mex. *Types*, U. S. N. M., No. 23,916; *paratypes*, M. C. Z., No. 7,342; Acad. Nat. Sci. Philad.

Type locality: — Dallas, Texas. *Types*, M. C. Z., No. 3,646; *paratypes*, M. C. Z., No. 3,647; U. S. N. M., No. 4,150; St. Petersburg Mus.

9. Cambarus gracilis.

Cambarus gracilis Bundy, Bull. Illinois State Lab. Nat. Hist., Dec. 1876, **1**, p. 5.

Type locality: — Normal, McLean Co., Ill., and Racine, Racine Co., Wisconsin. *Cotypes*, Ill. State Lab. Nat. Hist., Urbana, Ill.; M. C. Z., No. 3,794 (Normal, Ill.), No. 3,454 (Racine, Wis.).

10. Cambarus hagenianus.

Cambarus hagenianus Faxon, Proc. Amer. Acad., 1884, **20**, p. 141.

Type locality: — Charleston, S. C. *Type*, M. C. Z., No. 232 (1 ♂ f. I.).

11. Cambarus advena.

Cambarus advena LeConte, Proc. Acad. Nat. Sci. Philad., 1855, **7**, p. 402.

Type locality: — Lower Georgia. *Cotypes*, M. C. Z., No. 3,379; Acad. Nat. Sci. Philad.

§ III. Third segment of third and fourth pairs of legs of the male furnished with a hook. First pair of abdominal appendages of male truncate, outer part closely applied to inner part and armed at the end with from one to three horny recurved teeth; inner part ending in a sharp spine which is often directed outward. (Subgen. Cambarus of Ortmann in part.)

12. Cambarus spiculifer.

Astacus spiculifer Le Conte, Proc. Acad. Nat. Sci. Philad., 1855, **7**, p. 401.

Type locality: — Athens, Clarke Co., Georgia. *Cotypes*, M. C. Z., No. 3,376 (1 ♂ f. I.); Acad. Nat. Sci. Philad. (1 ♂ f. II); *paratypes*, M. C. Z., No. 172 (11); U. S. N. M., No. 4,962 (1 ♂); Mus. Hist. Nat. Paris (2).

13. Cambarus versutus.

Cambarus versutus Hagen, Mem. M. C. Z., 1870, **2**, p. 51.

Type locality: — Spring Hill, Mobile Co., Ala. *Types*, M. C. Z., No. 190; *paratypes*, U. S. N. M., No. 4,963, (1 ♂); Mus. Hist. Nat. Paris (2); Australian Mus., Sydney.

14. Cambarus pubescens.

Cambarus pubescens Faxon, Proc. Amer. Acad., 1884, **20**, p. 109.

Type locality: — MeBean Creek, Augusta, Georgia. *Types*, U. S. N. M., No. 3,181 (1 ♂ f. II., 1 ♀); *paratypes*, M. C. Z., No. 3,551 (2 ♀).

15. Cambarus angustatus.

Cambarus angustatus LeConte, Proc. Acad. Nat. Sci. Philad., 1855, 7, p. 401.

Type locality: — Lower Georgia, in streams of clear water, between sand-hills. *Type*, Acad. Nat. Sci. Philad. (1 ♂ f. I.).

16. Cambarus lecontei.

Cambarus lecontei Hagen, Mem. M. C. Z., 1870, 2, p. 47.

Type locality: — Mobile, Ala. *Types*, M. C. Z., No. 217; *paratypes*, U. S. N. M., No. 4,958; Mus. Hist. Nat. Paris (2); Mus. Würzburg (2); Mus. St. Petersburg (2); Australian Mus., Sydney.

17. Cambarus blandingii.

Astacus blandingii Harlan, Trans. Amer. Philos. Soc., 1830, 3, p. 464.

Type locality: — Marshes and rivulets, Southern United States [Camden, Kershaw Co., S. C.?]. *Type*, Acad. Nat. Sci. Philad. (1 ♂).

17a. Cambarus blandingii acutus.

Cambarus acutus Girard, Proc. Acad. Nat. Sci. Philad., 1852, 6, p. 91.

Cambarus acutissimus Girard, Proc. Acad. Nat. Sci. Philad., 1852, 6, p. 91. *Type locality:* — Affluent of Mobile River, Kemper Co., Miss. *Type* probably destroyed in the Chicago fire in 1871; *paratypes* (?), Acad. Nat. Sci. Philad. (2).

Type locality: — Affluent of Mobile River, Kemper Co., Miss. *Type* probably destroyed in the Chicago fire in 1871.

18. Cambarus hayi.

Cambarus hayi Faxon, Proc. Amer. Acad., 1884, 20, p. 108.

Type locality: — Maeon, Noxubee Co., Miss. *Type*, M. C. Z., No. 3,533; *paratypes*, U. S. N. M., No. 19,752, 21,850.

19. Cambarus fallax.

Cambarus fallax Hagen, Mem. M. C. Z., 1870, 2, p. 45.

Type locality: — Florida. *Cotypes*, Boston Soc. Nat. Hist. (1 ♂ f. II., 1 ♀); M. C. Z., No. 3526 (1 ♂ f. I., 1 ♂ f. II.).

20. Cambarus acherontis.

Cambarus acherontis Lönnberg, Bihang K. Svenska Vet.-Akad. Handl., 1894, 20, af. 4, no. 1, p. 6.

Type locality: — Subterranean rivulet about 42 feet from surface, Lake Brantley, Orange Co., Fla.

21. Cambarus clarkii.

Cambarus clarkii Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 91.

Type locality: — Between San Antonio and El Paso del Norte, Texas. *Types* probably destroyed in the Chicago fire in 1871.

21a. Cambarus clarkii paeninsulanus.

Cambarus clarkii paeninsulanus Faxon, supra, p. 369.

Type locality: — Three miles below Horse Landing, St. John's River, Florida. *Type*, M. C. Z., No. 3,530 (1 ♂, f. II.); *paratypes*, U. S. N. M., No. 28,587, 28,589; M. C. Z., No. 7,370 (Beecher Point, St. John's River, Fla.).

22. Cambarus troglodytes.

Astacus troglodytes LeConte, Proc. Acad. Nat. Sci. Philad., 1855, **7**, p. 400.

Astacus fossarum LeConte, Proc. Acad. Nat. Sci. Philad., 1855, **7**, pl. 401. *Type locality:* — Ditches, Lower Georgia. *Cotypes*, M. C. Z., No. 3377; Acad. Nat. Sci. Philad.

Type locality: — Rice-fields, Georgia. *Cotypes*, M. C. Z., No. 3,375 (♂, f. I.); Acad. Nat. Sci. Phila. (♂ f. I.).

23. Cambarus evermanni.

Cambarus evermanni Faxon, Proc. U. S. Nat. Mus., May 22, 1890, **12**, p. 620.

Type locality: — Escambia River, at Flomaton, Escambia Co., Ala. *Type*, M. C. Z., No. 3,834 (1 ♂ f. I.).

24. Cambarus viae-viridis.

Cambarus viae-viridis Faxon, supra, p. 370.

Type locality: — St. Francis River, Greenway, Clay Co., Arkansas. *Type*, M. C. Z., No. 7,336.

25. Cambarus barbatus.

Astacus penicillotus LeConte (nec Olivier, 1791), Proc. Acad. Nat. Sci. Philad., 1855, **7**, p. 401. *Type locality:* — Lower Georgia.

Cambarus barbatus Faxon, Proc. U. S. Nat. Mus., May 22, 1890, **12**, p. 621. *Type locality:* — Georgia. *Type*, M. C. Z., No. 279 (1 ♂ f. I.); *paratypes*, M. C. Z., No. 3,845, Escambia River, Flomaton, Alabama.

26. Cambarus wiegmanni.

Astacus (Cambarus) wiegmanni Erichson, Archiv Naturgesch., 1846, 12, 1, p. 99.

Type locality: — Mexico. *Type* apparently lost from the Berlin Mus.

27. Cambarus hinei.

Cambarus (Cambarus) hinei Ortmann, Ohio Naturalist, Dec. 1905, 6, p. 401.

Type locality: — Near Cameron, Cameron Co., La.

28. Cambarus alleni.

Cambarus alleni Faxon, Proc. Amer. Acad., 1884, 20, p. 110.

Type locality: — St. John's River, Hawkinsville, Orange Co., Fla. *Type*, M. C. Z., No. 3,531 (1 ♂ f. I.).

29. Cambarus pellucidus.

Astacus pellucidus Tellkampf, Arch. Anat. Physiol. wiss. Med., 1844, p. 383.

Oreonectes inermis Cope, Amer. Nat., July, 1872, 6, p. 419; 3d and 4th Ann. Rept. Geol. Surv. Indiana, 1872, p. 173. *Type locality:* — Wyandotte Cave, Indiana.

Type locality: — Mammoth Cave, Kentucky. *Type*, Berlin Mus.

29a. Cambarus pellucidus testii.

Cambarus pellucidus, var. *testii* Hay, Proc. Indiana Acad. Sci., 1891, p. 148; Proc. U. S. Nat. Mus., Sept. 28, 1893, 16, p. 285.

Type locality: — Mayfield's Cave, Monroe Co., Ind. *Types*, U. S. N. M., No. 17,702; *paratypes*, U. S. N. M., No. 19,765, 19,766, 22,431; M. C. Z., No. 7,431.

§ IV. Third segment of fourth pair of legs of male hooked. Inner and outer parts of the first pair of abdominal appendages of male closely appressed, outer part terminating in a recurved horny (in form I.) tooth; the inner part giving off a long horny (in form I.) spine at an acute angle with the axis of the limb. (Subgen. Paracambarus of Ortmann.)

30. Cambarus paradoxus.

Cambarus (Paracambarus) paradoxus Ortmann, Proc. Washington Acad. Sci., May 3, 1906, 8, p. 3.

Type locality: — Sierra de Zacapoaxtla, State of Puebla, Mexico ("ruisseaux torrentueux des montagnes, a le cañada de Tetela de Oeampo"). *Types*,

Mus. Hist. Nat. Paris (1 ♂ f. I., 1 ♂ f. II., 1 ♀); *paratypes*, Carnegie Mus. Pittsburgh; M. C. Z., No. 6,955 (1 ♂ f. I., 1 ♂ f. II., 1 ♀).

§ V. Third segment of second and third pairs of legs of male hooked. First pair of abdominal appendages of male not truncate, inner and outer parts separate and divergent for some distance from the tip; outer branch cleft into two slender teeth at the end; inner branch either acute or spatulate at the tip. (Subg. CAMBARELLUS of Ortmann.)

31. CAMBARUS SHUFELDTII.

Cambarus shufeldtii Faxon, Proc. Amer. Acad., 1884, **20**, p. 134.

Type locality: — Near New Orleans, La. *Cotypes*, U. S. N. M., No. 4,860; M. C. Z., No. 3,684.

32. CAMBARUS MONTEZUMAE.

Cambarus montezumae Saussure, Rev. et Mag. Zool., 1857, sér. 2, **9**, p. 102.

Type locality: — Swamps of the Valley of Mexico; specifically, ponds in the park of Chapultepec, Mexico. *Cotypes*, Geneva Mus.; Berlin Mus.; U. S. N. M., No. 20,683 (ex Geneva Mus.).

32a. CAMBARUS MONTEZUMAE DUGESII.

Cambarus montezumae dugesii Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 660.

Type locality: — State of Guanajuato, Mexico. *Types*, U. S. N. M., No. 16,087; *paratypes*, M. C. Z., No. 4,339.

32b. CAMBARUS MONTEZUMAE AREOLATUS.

Cambarus montezumae, var. *areolata* Faxon, Mem. M. C. Z., 1885, **10**, p. 123.

Type locality: — Near Parras, Cohahuila, Mexico. *Type*, M. C. Z., No. 3,650.

32c. CAMBARUS MONTEZUMAE CHAPALANUS.

Cambarus chapalanus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 661.

Type locality: — Lake Chapala, State of Jalisco, Mexico. *Type*, U. S. N. M., No. 17,698 (1 ♂); *paratypes*, U. S. N. M., No. 16,294 (2 ♂); M. C. Z., No. 4,777 (1 ♂).

32d. CAMBARUS MONTEZUMAE OCCIDENTALIS.

Cambarus montezumae occidentalis Faxon, Proc. U. S. N. M., Feb. 17, 1898, **20**, p. 661.

Type locality: — Mazatlan, State of Cinaloa, Mexico. *Types*, M. C. Z., No. 3,652.

§ VI. Third segment of third pair of legs of male hooked. First pair of abdominal appendages of male (usually elongate) split into two rami, straight or somewhat recurved, and acute at the tips. (Subg. FAXONIUS of Ortmann.)

33. CAMBARUS HARRISONII.

Cambarus harrisonii Faxon, Proc. Amer. Acad., 1884, **20**, p. 130.

Type locality: — Irondale, Washington Co., Mo. *Types*, M. C. Z., No. 3,586; *paratypes*, U. S. N. M., No. 25,826.

34. CAMBARUS SLOANII.

Cambarus sloanii Bundy, Bull. Illinois State Lab. Nat. Hist., Dec., 1876, **1**, p. 24.

Type locality: — New Albany, Floyd Co., Ind. *Types*, M. C. Z., No. 3,806 (1 ♂ f. I., 1 ♀).

35. CAMBARUS INDIANENSIS.

Cambarus indianensis Hay, 20th Ann. Rept. Depart. Geol. & Nat. Resources Indiana, 1896, p. 494.

Type locality: — Patoka River at Patoka, Gibson Co., Ind. *Types*, U. S. N. M., No. 14,624, 2 ♂ f. I., 2 ♀; *paratypes*, M. C. Z., No. 3,859, 2 ♂ f. I., 2 ♀.

36. CAMBARUS AFFINIS.

?Cambarus limosus Rafinesque, Amer. Monthly Mag. & Crit. Rev., Nov. 1817, **2**, p. 42. *Type locality:* — In the muddy banks of the Delaware River, near Philadelphia, Pa. (Indeterminable from the description; types not extant.)

Cambarus affinis Say, Journ. Acad. Nat. Sci. Philad., 1817, **1**, p. 168.

Cambarus pealei Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 87. *Type locality:* — Potomac River at Washington, D. C. *Type*, U. S. N. M., No. 2,081 (2 ♂, 2 ♀).

Type locality: — Delaware River.

37. CAMBARUS PROPINQUUS.

Cambarus propinquus Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 88.

Type locality: — Garrison Creek, Sacket Harbor, Jefferson Co., N. Y., Four-mile Creek, Oswego, Oswego Co., N. Y. *Types* probably destroyed in the Chicago fire in 1871; *paratype* (?), Acad. Nat. Sci. Philad. (1 ♂).

37a. CAMBARUS PROPINQUUS SANBORNII.

Cambarus sanbornii Faxon, Proc. Amer. Acad., 1884, **20**, p. 128.

Type locality: — Oberlin, Lorain Co., Ohio. *Types*, M. C. Z., No. 3,692; *paratypes*, M. C. Z., No. 3,587 (Smoky Creek, Carter Co., Ky.).

38. Cambarus obscurus.

Cambarus obscurus Hagen, Mem. M. C. Z., 1870, **2**, p. 69.

Type locality: — Genesee River, Rochester, Monroe Co., N. Y. *Cotypes*, M. C. Z., No. 181, 3,353, 3,354; U. S. N. M., No. 4,971; Mus. Hist. Nat. Paris; Würzburg Mus.; Australian Mus., Sydney.

39. Cambarus erichsonianus.

Cambarus erichsonianus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 659.

Type locality: — Rip Roaring Fork, five miles northwest of Greeneville, Greene Co., Tenn. *Cotypes*, U. S. N. M., No. 20,787; M. C. Z., No. 4,347.

40. Cambarus rusticus.

Cambarus rusticus Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 88.

Cambarus placidus Hagen, Mem. M. C. Z., 1870, **2**, p. 65. *Type locality:* — Lebanon, Wilson Co., Tenn.; Quincy, Adams Co., Ill.; Texas. *Cotypes*, M. C. Z., No. 289, 296, 170; U. S. N. M., No. 4,966; Mus. Hist. Nat. Paris; Würzburg Mus.; Australian Mus., Sydney.

Cambarus juvenilis Hagen, Mem. M. C. Z., 1870, **2**, p. 66. *Type locality:* — Little Hickman, Jessamine Co., Ky. *Cotypes*, M. C. Z., No. 213, 3,347; U. S. N. M., No. 4,967; Mus. Hist. Nat. Paris; Würzburg Mus.; Australian Mus.

Cambarus wisconsinensis Bundy, Bull. Ill. State Lab. Nat. Hist., Dec., 1876, **1**, p. 4. *Type locality:* — Racine, Racine Co., Wisconsin. *Type*, M. C. Z., No. 3,448 (1 ♂ f. II).

Type locality: — Ohio River, at Cincinnati, Ohio. *Types* probably destroyed in the Chicago fire in 1871; *paratype* (?), Acad. Nat. Sci. Philad.

41. Cambarus forceps.

Cambarus forceps Faxon, Proc. Amer. Acad., 1884, **20**, p. 133.

Type locality: — Cypress Creek, Lauderdale Co., Ala. *Cotypes*, U. S. N. M., No. 4,880; M. C. Z., No. 3,582.

42. Cambarus neglectus.

Cambarus neglectus Faxon, Bull. Washburn College Lab. Nat. Hist., Oct. 31, 1885, **1**, p. 142.

Type locality: — Mill Creek, Wabaunsee Co., Kansas. *Cotypes*, M. C. Z., No. 3,757; Mus. Washburn College, Topeka, Kans.

43. Cambarus spinosus.

Cambarus spinosus Bundy, Proc. Acad. Nat. Sci. Philad., 1877, p. 173.

Type locality: — Etowah, Oostanaula, and Coosa Rivers, near Rome, Floyd Co., Georgia. *Cotypes*, M. C. Z., No. 3,540, 3,541 (4 ♂ f. II., 3 ♀); U. S. N. M., No. 19,779 (3 ♂ f. II., 2 ♀).

43a. Cambarus spinosus gulielmi.

Cambarus spinosus gulielmi Faxon, supra p. 375.

Type locality: — Near Rossville, Walker Co., Georgia. *Types*, U. S. N. M., No. 26,379; *paratypes*, M. C. Z., No. 7,448 (1 ♂ f. II., 1 ♀).

44. Cambarus putnami.

Cambarus putnami Faxon, Proc. Amer. Acad., 1884, **20**, p. 131.

Type locality: — Bear Creek, a tributary of Green River, Grayson Springs, Grayson Co., Ky. *Types*, M. C. Z., No. 3,568; *paratypes*, M. C. Z., No. 3,569 (Green River, near Mammoth Cave, Ky.), No. 3,570 (Rocky Creek, near Grayson Springs, Ky., 1 ♂); U. S. N. M., No. 10,130 (Grayson Springs, Ky.); St. Petersburg Mus. (Green River, Ky., 1 ♂, 2 ♀).

45. Cambarus hylas.

Cambarus hylas Faxon, Proc. U. S. Nat. Mus., May 22, 1890, **12**, p. 632.

Type locality: — West Fork of Black River, Reynolds Co., Mo. *Types*, M. C. Z., No. 3,858; *paratypes*, U. S. N. M., No. 25,827 (1 ♂, 1 ♀).

46. Cambarus medius.

Cambarus medius Faxon, Proc. Amer. Acad., 1884, **20**, p. 121.

Type locality: — Irondale, Washington Co., Mo. *Types*, M. C. Z., No. 3,585 (1 ♂ f. I., 1 ♀).

47. Cambarus compressus.

Cambarus compressus Faxon, Proc. Amer. Acad., 1884, **20**, p. 127.

Type locality: — Second Creek, Waterloo, Lauderdale Co., Ala. *Cotypes*, U. S. N. M., No. 4,878; M. C. Z., No. 3,583.

48. Cambarus meeki.

Cambarus meeki Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 657.

Type locality: — Walnut Fork of Big Piney Creek, Swain, Newton Co., Ark. *Types*, M. C. Z., No. 4,363; *paratypes*, U. S. N. M., No. 19,680; Mus. Zool. Torino.

49. Cambarus longidigitus.

Cambarus longidigitus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 653.

Cambarus whitmani Steele, Univ. Cincinnati Bull., 1902, no. 10, p. 24. *Type locality:* — James River, Mo.

Type locality: — Oxford Bend, White River, [Izard Co.?], Ark. *Types*, M. C. Z., No. 4,364; *paratypes*, U. S. N. M., No. 19,683.

50. Cambarus virilis.

Cambarus virilis Hagen, Mem. M. C. Z., 1870, **2**, p. 63.

Cambarus debilis Bundy, Bull. Illinois State Lab. Nat. Hist., Dec., 1876, **1**, p. 24. *Type locality:* — Baraboo River, Ironton, Sauk Co., Wis. *Cotype*, M. C. Z., No. 3,449 (1 ♂ f. II.).

Cambarus couesi Streets, Bull. U. S. Geol. Surv. Terr., 1877, **3**, p. 803. *Type locality:* — Red River of the North, near Pembina, Pembina Co., N. Dakota. *Cotypes*, U. S. N. M., No. 3,154; M. C. Z., No. 3,545.

Cambarus viridis Moenkhaus, Proc. Indiana Acad. Sci. for 1902, 1903, p. 111 (*per errorem vice "virilis"*).

Type locality: — Lake Superior. *Types*, M. C. Z., No. 1,151; *paratypes*, M. C. Z., No. 194, 203 (Lake Superior), No. 196 (Quincy, Ill.), No. 3,342 (Lake Winnipeg), No. 3,343 (Red River of the North), No. 3,344 (Saskatchewan River); Mus. Hist. Nat. Paris (Lake Superior); Würzburg Mus. (Lake Superior); Australian Mus., Sydney.

51. Cambarus pilosus.

Cambarus pilosus Hay, Proc. U. S. Nat. Mus., Oct. 11, 1899, **22**, p. 121.

Type locality: — Beloit, Mitchell Co., Kansas. *Cotypes*, U. S. N. M., No. 19,761 (6 ♂ f. II.); M. C. Z., No. 7,389 (1 ♂ f. II.).

52. Cambarus alabamensis.

Cambarus alabamensis Faxon, Proc. Amer. Acad., 1884, **20**, p. 125.

Type locality: — Second Creek, Waterloo, Lauderdale Co., Ala. *Cotypes*, U. S. N. M., No. 4,876; M. C. Z., No. 3,565.

53. Cambarus nais.

Cambarus nais Faxon, Bull. Washburn College Lab. Nat. Hist., 1885, **1**, p. 140.

Type locality: — Labette Co., Kansas. *Cotypes*, Mus. Washburn College, Topeka, Kan.; M. C. Z., No. 3,755.

54. Cambarus immunis.

Cambarus immunis Hagen, Mem. M. C. Z., 1870, **2**, p. 71.

Cambarus signifer Herrick, 10th Ann. Rept. Geol. Surv. Minn., 1882, p. 253.

Type locality: — Grass Lake, Richfield, Hennepin Co., Minn. *Cotype,* M. C. Z., No. 3,515, (2 ♂ f. I., 1 ♀).

Type locality: — Lawn Ridge, Ill. *Types,* M. C. Z., No. 188; *paratypes,* M. C. Z., No. 3,355 (Belleville, Saint Clair Co., Ill.); Mus. Hist. Nat. Paris (Lawn Ridge, Ill., 1 ♂).

54a. Cambarus immunis spinirostris.

Cambarus immunis spinirostris Faxon, Proc. Amer. Acad., 1884, **20**, p. 146.

Type locality: — Creek running into the east side of Redfoot Lake, near Idlewild Hotel, Obion Co., Tennessee. *Cotypes,* U. S. N. M., No. 4,655; M. C. Z., No. 3,562.

55. Cambarus validus.

Cambarus validus Faxon, supra, p. 382.

Type locality: — Huntsville, Madison Co., Ala. *Type,* M. C. Z., No. 301 (1 ♂ f. I.).

56. Cambarus palmeri.

Cambarus palmeri Faxon, Proc. Acad., 1884, **20**, p. 124.

Type locality: — Creek running into the east side of Redfoot Lake, near Idlewild Hotel, Obion Co., Tenn. *Cotypes,* U. S. N. M., No. 4,872; M. C. Z., No. 3,564.

56a. Cambarus palmeri longimanus.

Cambarus palmeri longimanus Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 655.

Type locality: — Red River, Arthur City, Lamar Co., Texas. *Types,* M. C. Z., No. 7,390; *paratypes,* M. C. Z., No. 4,361, 4,362, (Goodland, and Kiamichi, Indian Terr. [now Oklahoma]); U. S. N. M., No. 19,684 (Arthur, Tex., Indian Terr.); Mus. Zool. Torino.

57. Cambarus difficilis.

Cambarus difficilis Faxon, Proc. U. S. Nat. Mus., Feb. 17, 1898, **20**, p. 656.

Type locality: — Creek tributary to a southern branch of the Canadian River, McAlester, Pittsburg Co., Oklahoma. *Types,* M. C. Z., No. 4,359; *paratypes,* U. S. N. M., No. 19,687; Mus. Zool. Torino.

58. Cambarus mississippiensis.

Cambarus mississippiensis Faxon, Proc. Amer. Acad., 1884, **20**, p. 123.

Type locality: — Macon, Noxubee Co., Miss. *Types*, Coll. O. P. Hay; *paratype*, M. C. Z., No. 3,563 (1 ♀).

59. Cambarus lancifer.

Cambarus lancifer Hagen, Mem. M. C. Z., 1870, **2**, p. 59.

Cambarus faxonii Meek, Amer. Nat., Dec. 1894, **28**, p. 1042. *Type locality:* St. Francis River at Greenway and Big Bay, Arkansas. *Cotypes*, U. S. N. M., No. 19,331; M. C. Z., No. 4,220; Mus. Zool. Torino.

Type locality: — Root Pond, Miss. *Type*, M. C. Z., No. 306 (1 ♂ f. I.).

§ VII. Third segment of third pair of legs of male hooked. First pair of abdominal appendages of male short and thick, terminating in two large recurved tooth-like processes, the larger formed by the outer part of the appendage, the smaller by the inner. (Subgen. Bartonius of Ortmann.)

60. Cambarus hamulatus.

Orconectes hamulatus Cope and Packard, Amer. Nat., Nov. 1881, **15**, p. 881.

Type locality: — Nickajack Cave, Tennessee. *Cotypes*, M. C. Z., No. 3,678 (1 ♂ f. II., 1 ♀).

61. Cambarus setosus.

Cambarus setosus Faxon, Bull. M. C. Z., Dec. 1889, **17**, p. 237.

Type locality: — Wilson's Cave, Jasper Co., Missouri. *Types*, M. C. Z., No. 4,200; *paratypes*, M. C. Z., No. 4,201, 4,202; U. S. N. M., No. 25,828.

62. Cambarus ayersii.

Cambarus ayersii Steele, Univ. Cincinnati Bull., 1902, No. 10, p. 18.

Type locality: — Fisher's Cave, near Springfield, Greene Co., Missouri.

63. Cambarus extraneus.

Cambarus extraneus Hagen, Mem. M. C. Z., 1870, **2**, p. 73.

Type locality: — Tennessee River, Tenn., near the boundary of Georgia. *Types*, M. C. Z., No. 175; *paratype*, U. S. N. M., No. 4,957.

63a. Cambarus extraneus girardianus.

Cambarus girardianus Faxon, Proc. Amer. Acad., 1884, **20**, p. 117.

Type locality: — Cypress Creek, Lauderdale Co., Ala. *Cotypes*, U. S. N. M., No. 4,882; M. C. Z., No. 3,560.

64. Cambarus jordani.

Cambarus jordani Faxon, Proc. Amer. Acad., 1884, **20**, p. 119.

Type locality: — Etowah River, near Rome, Floyd Co., Georgia. *Type*, M. C. Z., No. 3,561 (1 ♂ f. II.).

65. Cambarus cornutus.

Cambarus cornutus Faxon, Proc. Amer. Acad., 1884, **20**, p. 120.

Type locality: — Green River near Mammoth Cave, Kentucky. *Type*, M. C. Z., No. 3,566 (1 ♂ f. I.).

66. Cambarus bartonii.

Astacus bartonii Fabricius, Suppl. Entomol. Syst., 1798, p. 407.

Astacus ciliaris Rafinesque, Amer. Monthly Mag. and Crit. Rev., Nov. 1817, **2**, p. 42. *Type locality:* — Brooks near Fishkill, Dutchess Co., and Newburgh, Orange Co., New York.

Astacus pusillus Rafinesque, Amer. Monthly Mag. and Crit. Rev., Nov. 1817, **2**, p. 42. *Type locality:* — Brooks near Saratoga Springs, Saratoga Co., N. Y.; Lake George, N. Y.; Lake Champlain; Utica, Oneida Co., N. Y.; Oswego, Oswego Co., N. Y.

Type locality:— North America [probably neighborhood of Philadelphia, Pa.]. *Type* (fragment only), Kiel Museum.

66a. Cambarus bartonii carinirostris.

Cambarus bartonii carinirostris Hay, supra, p. 384.

Type locality: — Gandy Creek, Osceola, Randolph Co., West Virginia. *Type*, U. S. N. M., No. 23,962; *paratypes*, M. C. Z., No. 7,399.

66b. Cambarus bartonii montanus.

Cambarus montanus Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 88.

Type locality: — Within the Alleghany ranges in Virginia, West Virginia, and Maryland; tributaries of James River, Rockbridge Co., Va.; Shenandoah River, Clarke Co., Va.; Cumberland, Allegany Co., Md.; Sulphur Spring, Greenbrier River, W. Va. *Types* probably destroyed in the Chicago fire in 1871; *paratype* (?), Acad. Nat. Sci. Philad. (1 ♂ juv., James River, Va.).

66c. Cambarus bartonii robustus.

Cambarus robustus Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 90.

Type locality: — Humber River, near Toronto, Canada. *Type* probably destroyed in the Chicago fire in 1871; *paratype* (?), Acad. Nat. Sci. Philad. (1 ♂).

66d. Cambarus bartonii longirostris.

Cambarus bartonii, var. *longirostris* Faxon, Mem. M. C. Z., Oct. 1885, **10**, p. 64.

Cambarus bartonii spinirostris Faxon, Proc. U. S. Nat. Mus., May 22, 1890, **12**, p. 623 (*lapsu calami pro "longirostris"*).

Type locality: — Near the boundary between western North Carolina and eastern Tennessee. *Type*, M. C. Z., No. 3,629 (1 ♂ f. II.).

66e. Cambarus bartonii longulus.

Cambarus longulus Girard, Proc. Acad. Nat. Sci., Philad., 1852, **6**, p. 90.

Type locality: — Unknown; "its range however, is within the Middle States of the Union." *Type* probably destroyed in the Chicago fire in 1871.

66f. Cambarus bartonii veteranus.

Cambarus bartonii veteranus Faxon, supra, p. 389.

Type locality: — Indian Creek, Baileysville, Wyoming Co., West Virginia. *Type*, U. S. N. M., No. 44,712; *paratypes*, U. S. N. M., No. 25,020; M. C. Z., No. 7,402.

66g. Cambarus bartonii asperimanus.

Cambarus bartonii asperimanus Faxon, supra, p. 391.

Type locality: — Flat Creek, near Montreat, Buncombe Co., N. C. *Types*, U. S. N. M., No. 47,375 (2 ♂ f. I.).

66h. Cambarus bartonii acuminatus.

Cambarus acuminatus Faxon, Proc. Amer. Acad., 1884, **20**, p. 113.

Type locality: — Saluda River at Farr's Mills, west of Greenville, Greenville Co., South Carolina. *Cotypes*, Butler Univ., Irvington, Ind. (1 ♂ f. II., 1 ♀); M. C. Z., No. 3,624 (1 ♀).

66i. Cambarus bartonii laevis.

Cambarus bartonii laevis Faxon, supra, p. 391.

Type locality: — Bloomington, Monroe Co., Indiana. *Types*, M. C. Z., No. 3,812.

66j. Cambarus bartonii tenebrosus.

Cambarus bartonii tenebrosus Hay, Proc. U. S. Nat. Mus., Sept. 12, 1902, **25**, p. 232.

Type locality: — Mammoth Cave, Kentucky. *Types*, U. S. N. M., No. 22,346.

66k. Cambarus bartonii cavatus.

Cambarus bartonii cavatus Hay, Proc. U. S. Nat. Mus., Sept. 23, 1902, **25**, p. 435.

Type locality: — Powell River at Tazewell, Claiborne Co., Tennessee. *Types*, U. S. N. M., No. 25,017.

67. Cambarus latimanus.

Astacus latimanus LeConte, Proc. Acad. Nat. Sci. Philad., 1855, **7**, p. 402.

Type locality: — Athens, Clarke Co., Georgia. *Cotypes*, M. C. Z., No. 3,378 (1 ♂ f. I); Acad. Nat. Sci. Philad. (1 ♀); *paratypes*, M. C. Z., No. 236.

67a. Cambarus latimanus striatus.

Cambarus latimanus striatus Hay, Proc. U. S. Nat. Mus., Sept. 23, 1902, **25**, p. 437.

Type locality: — Nashville, Tenn. *Type*, U. S. N. M., No. 25,019; *paratype*, M. C. Z., No. 7,348.

68. Cambarus graysoni.

Cambarus graysoni Faxon, supra, p. 393.

Type locality: — Bear Creek, Grayson Springs, Grayson Co., Kentucky. *Types*, M. C. Z., No. 3,593.

69. Cambarus ortmanni.

Cambarus ortmanni Williamson, 31st Ann. Rept. Dept. Geol. Indiana, 1907, p. 754.

Type locality: — Six-Mile Creek and Craven Ditch, tributary to Wabash River, above Bluffton, Wells Co., Indiana. *Types*, Carnegie Mus., Pittsburgh; *paratypes*, Coll. W. P. Hay; M. C. Z., No. 7,587 (1 ♀).

70. Cambarus carolinus.

Astacus (*Cambarus*) *carolinus* Erichson, Arch. Naturgesch., 1846, **12**, p. 96.

Type locality: — Farm called "Tiger Hall," near Greenville, Greenville Co., S. C. *Type*, Berlin Mus. (1 ♂).

70a. Cambarus carolinus dubius.

Cambarus dubius Faxon, Proc. Amer. Acad., 1884, **20**, p. 114.

Type locality: — Cranberry Summit [now Terra Alta], Preston Co., West Virginia. *Type*, M. C. Z., No. 3,631.

70b. Cambarus carolinus monongalensis.

Cambarus monongalensis Ortmann, Annals Carnegie Mus., 1905, **3**, p. 395.

Type locality: — Head of Gordon's Valley, Edgewood Park, Allegheny Co., Pa. *Types,* Carnegie Mus.; *paratypes,* M. C. Z., No. 6,953; U. S. N. M., No. 30,613.

71. Cambarus diogenes.

Cambarus diogenes Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 88.

?Cambarus nebrascensis Girard, Proc. Acad. Nat. Sci. Philad., 1852, **6**, p. 91. *Type locality:* — Fort Pierre, Nebraska [now in Stanley Co., South Dakota].

Cambarus obesus Hagen, Mem. M. C. Z., 1870, **2**, p. 81. *Type locality:* — Lawn Ridge, Illinois. *Types,* M. C. Z., No. 195; *paratypes,* M. C. Z., No. 165 (Belleville, Saint Clair Co., Ill.), No. 336 (Evanston, Cook Co., Ill.), No. 229 (Arkansas), No. 3,363 (Petersburg, Dinwiddie Co., Va.); Mus. Hist. Nat. Paris (Lawn Ridge, Ill., Belleville, Ill.); St. Petersburg Mus. (Belleville, Ill.).

Type locality: — Near Washington, D. C. *Paratype* (?), Acad. Nat. Sci. Philad.

71a. Cambarus diogenes ludovicianus.

Cambarus diogenes, var. *ludoviciana* Faxon, Proc. Amer. Acad., 1884, **20**, p. 144.

Type locality: — New Orleans, La. *Cotypes,* U. S. N. M., No. 5,625; M. C. Z., No. 3,617.

72. Cambarus argillicola.

Cambarus argillicola Faxon, Proc. Amer. Acad., 1884, **20**, p. 115.

Type locality: — Detroit, Mich. *Types,* M. C. Z., No. 3,459.

73. Cambarus uhleri.

Cambarus uhleri Faxon, Proc. Amer. Acad., 1884, **20**, p. 116.

Type locality: — Swamp on Eastern Road near Felsburg, Somerset Co., Maryland. *Type* M. C. Z., No. 3,634 (1 ♂ f. I.); *paratypes,* M. C. Z., No. 3,633, 3,635, 3,636 (Dorchester, Somerset, and Worcester Cos., Md.).

74. Cambarus clypeatus.[1]

Cambarus clypeatus Hay, Proc. U. S. Nat. Mus., Oct. 11, 1899, **22**, p. 122.

Type locality: — Bay Saint Louis, Hancock Co., Miss. (found in a skiff). *Type,* U. S. N. M., No. 22,778 (♀).

[1] The position of this species is doubtful, as only the female is known.

DOUBTFUL SPECIES, NOT INCLUDED IN THE PRECEDING LIST.

1. CAMBARUS MANICULATUS.

Astacus maniculatus LeConte, Proc. Acad. Nat. Sci. Philad., 1855, 7, p. 401.

Type locality: — In ditches, Lower Georgia.

2. CAMBARUS STYGIUS.

Cambarus stygius Bundy, Bull. Illinois State Lab. Nat. Hist., 1876, 1, p. 3.

Type locality: — Lake Michigan at Racine, Racine Co., Wisconsin (washed up during a violent storm).

3. CAMBARUS TYPHLOBIUS.

Cambarus typhlobius Joseph, 57th Jahresber. Schlesischen Gesellsch. vaterl. Cult., 1879, 1880, p. 202.

Cambarus coecus Joseph, Berl. Entomol. Zeitschr., Dec. 1881, 25, p. 237.

Cambarus stygius Joseph, Berl. Entomol. Zeitschr., April, 1882, 26, p. 12 (nec Bundy, 1876).

Type locality: — Recca River, Grotto of St. Kanzian at Metaûn, near Divazza, Carniola (doubtless an error).

EXPLANATION OF PLATES.

Note.— Plates 1–3 are after colour-drawings of living specimens, by E. N. Fischer. Plates 4–8 are from India-ink drawings by E. N. Fischer. Plates 9–13 are from photographs by George Nelson.

PLATE 1.

PLATE 1.

Fig. 1.— *Cambarus hagenianus* Faxon. ♀. Muldon, Miss. M. C. Z., No. 7,425. × 1.
Fig. 2.— *Cambarus hagenianus* Faxon. ♂. Muldon, Miss. M. C. Z., No. 7,425. × 1.

PLATE 2.

PLATE 2.

Fig. 1.— *Cambarus immunis spinirostris* Faxon. Young ♀. Pontoosuc Lake, Lanesboro, Mass., Aug. 12, 1911. M. C. Z., No. 7,364. × 3.

Fig. 2.— *Cambarus immunis spinirostris* Faxon. ♂, form I. Pontoosuc Lake, Lanesboro, Mass., Aug. 12, 1911. M. C. Z., No. 7,363. × 1.

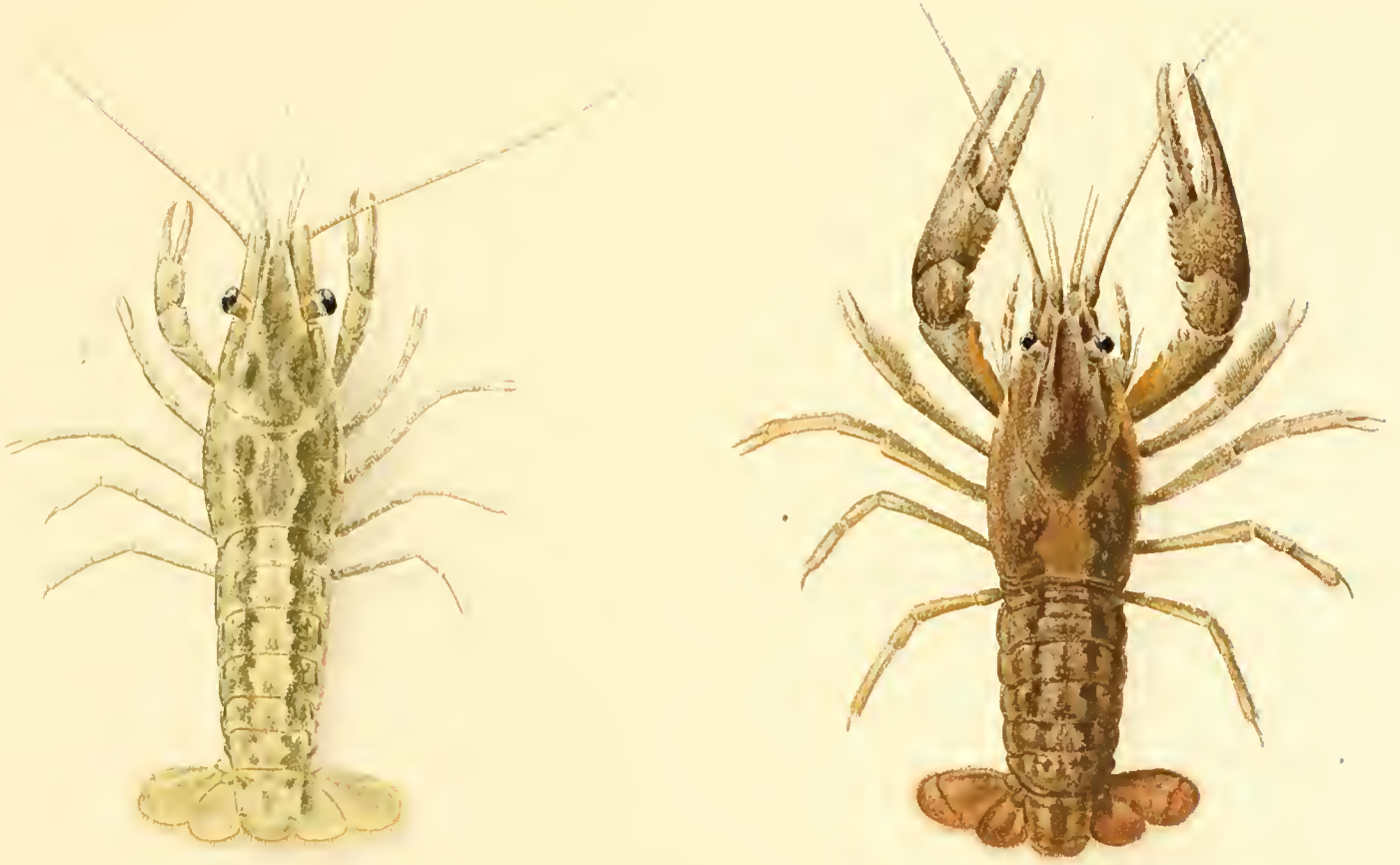


PLATE 3.

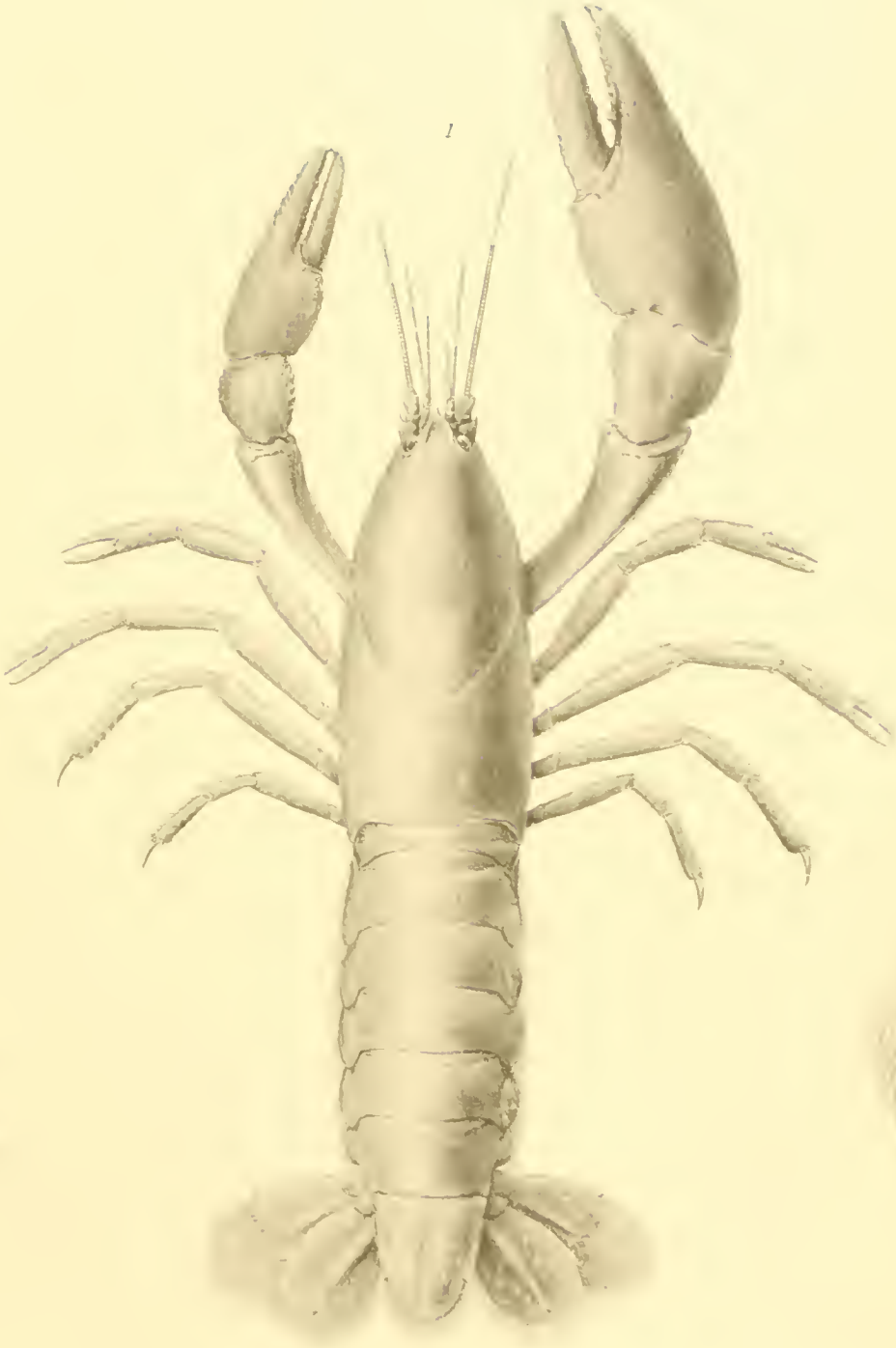
PLATE 3.

Cambarus bartonii robustus (Girard). Bog River, St. Lawrence Co., N. Y., July, 1912. M. C. Z., No. 7,440. × 1½.

PLATE 4.

PLATE 4.

Fig. 1.— *Parastacus araucanius* Faxon. ♂. Corral, Chile, Dec. 18, 1908. Type. M. C. Z., No. 7,355.
Fig. 2.— Epistoma of the same.
Fig. 3.— Antennal scale from the right antenna, upper face.



2

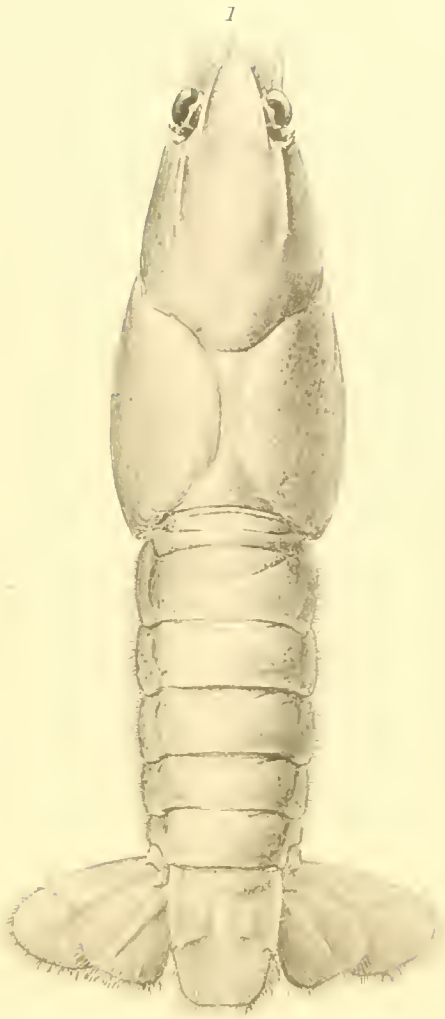
3

PARASTACUS ARAUCANUS (MOLINA).

PLATE 5.

PLATE 5.

Fig. 1.— *Cambarus viae-viridis* Faxon. ♂, form I. St. Francis R., Greenway, Ark., Aug., 1894. Type. M. C. Z., No. 7,336.
Fig. 2.— Epistoma of the same.
Fig. 3.— Antennal scale of the same.
Fig. 4.— Gonopod of the same, inner side.
Fig. 4*a*.— Gonopod of the same, outer side.
Fig. 5.— Right cheliped of the same.
Fig. 6.— Annulus ventralis of the female *Cambarus viae-viridis*.


1


2


3


4

4a


6


5

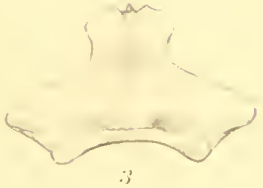
PLATE 6.

PLATE 6.

Fig. 1.— *Cambarus immunis spinirostris* Faxon. Pontoosuc Lake, Lanesboro, Mass., Aug. 12, 1911. M. C. Z., No. 7,363. Gonopod of the ♂, form I. 1*a*, outside, 1*b*, front, 1*c*, inside.
Fig. 2.— Gonopod of the ♂, form II. of the same, 2*a*, outside, 2*b*, front, 2*c*, inside.
Fig. 3.— Epistoma of the same.
Fig. 4.— Antennal scale of the same.
Fig. 5.— Annulus ventralis of the ♀ of the same.
Fig. 6.— Chela of the ♂, form I. of the same.

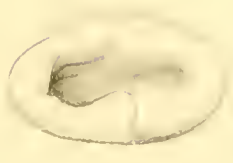
1a 1b 1c

2a 2b 2c



3

4



5

6

CAMBARUS IMMUNIS SPINIROSTRIS FAXON

PLATE 7.

PLATE 7.

Fig. 1.— *Cambarus hagenianus* Faxon. Muldon, Miss. Gonopod of ♂, form I. 1*a*, outer side, 1*b*, inner side, 1*c*, front.

Fig. 2.— *Cambarus pellucidus* (Tellkampf). Mammoth Cave, Ky. Gonopod of ♂, form I. 2*a*, outer side, 2*b*, inner side, 2*c*, front.

Fig. 3.— *Cambarus validus* Faxon. Huntsville, Ala. Type. M. C. Z., No. 301. Gonopod (♂ form I.). 3*a*, outer side, 3*b*, inner side, 3*c*, front.

Fig. 4.— *Cambarus validus* Faxon. Type. Antennal scale.

Fig. 5.— *Astacus nigrescens fortis* Faxon. ♂. Fall R., Fall City Mills, Cal. Type. U. S. N. M. Antennal scale.

Fig. 6.— *Astacus gambeli connectens* Faxon. ♂. Snake R., Upper Salmon Falls, Idaho. Type. U. S. N. M., No. 23,096. Antennal scale.

Fig. 7.— *Cambarus hagenianus* Faxon. ♀. Muldon, Miss. Annulus ventralis.

Fig. 8.— *Cambarus validus* Faxon. ♂. Type. Epistoma.

Fig. 9.— *Astacus nigrescens fortis* Faxon. ♂. Type. Epistoma.

Fig. 10.— *Astacus gambelii connectens* Faxon. ♂. Type. Epistoma.

1a

1b

1c

2a

2b

2c

3a

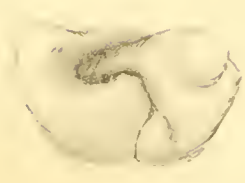
3b

3c

4

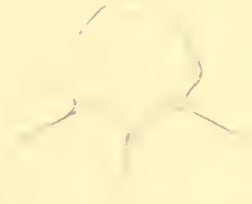
5

6



7

8



9

10

PLATE 8.

PLATE 8.

Fig. 1.— *Astacus astacus* (Linné). ♂. Leipzig, Germany. M. C. Z., No. 3403.
Fig. 1*a*.— Gonopod of the same.
Fig. 1*b*.— Chela of the same.
Fig. 1*c*.— Antennal scale of the same.
Fig. 1*d*.— Anterior process of the epistoma of the same.
Fig. 1*e*.— Profile of anterior end of rostrum of the same.
Fig. 1*f*.— Pleura of the second and third abdominal segments of the same.
Fig. 2.— *Astacus pallipes italicus* Faxon. ♂. Sarno R., Pompeii, Italy, June 10, 1900. Type. U. S. N. M., No. 28,638.
Fig. 2*a*.— Gonopod of the same.
Fig. 2*b*.— Chela of the same.
Fig. 2*c*.— Antennal scale of the same.
Fig. 2*d*.— Anterior process of the epistoma of the same.
Fig. 2*e*.— Profile of anterior end of rostrum of the same.
Fig. 2*f*.— Pleura of the second and third abdominal segments of the same.
Fig. 3.— *Astacus pallipes* Lereboullet. ♂. Saone R., Lyons, France. M. C. Z., No. 3,372.
Fig. 3*a*.— Gonopod of the same.
Fig. 3*b*.— Chela of the same.
Fig. 3*c*.— Antennal scale of the same.
Fig. 3*d*.— Anterior process of the epistoma of the same.
Fig. 3*e*.— Profile of anterior end of rostrum of the same.
Fig. 3*f*.— Pleura of the second and third abdominal segments of the same.

1b

2b

3b

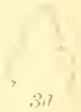
1c

2c

3c

1d

2d



3d

1

2

3

1a

2a

3a

1f

2f

3f

Fig. 1. ASTACUS ASTACUS LINNÉ. FIG. 2. ASTACUS FLUVIATILIS TAUSCHER. FIG. 3. ASTACUS [illegible]

PLATE 9.

PLATE 9.

Fig. 1.— *Parastacus spinifrons* (Philippi)? Mus. d'Hist. Nat., Paris. × 1.
Fig. 2.— *Astacus nigrescens fortis* Faxon. ♂. Type. Fall R., Fall City Mills, Cal., Aug. 29, 1898. U. S. N. M. Slightly enlarged.

FIG. 1. PARASTACUS SPINIFRONS, PHILIPPI ?

FIG. 2. ASTACUS NIGRESCENS FORTIS FAXON.

PLATE 10.

PLATE 10.

Fig. 1.— *Astacus gambelii connectens* Faxon. ♂. Type. Snake R., Upper Salmon Falls, Idaho, Oct. 3, 1894. U. S. N. M., No. 23,096. Enlarged.

Fig. 2.— *Astacus gambelii* with most of the characters of *A. g. connectens*. ♂. Mouth of St. Joe R., Coeur d'Alene Lake, Idaho. U. S. N. M. × 1.

FIG. 1. ASTACUS GAMBELII CONNECTENS FAXON

FIG. 2. ASTACUS GAMBELII CONNECTENS FAXON

PLATE 11.

PLATE 11.

Fig. 1.— *Astacus klamathensis* Stimpson. ♂. Portland, Or. U. S. N. M., slightly enlarged. Showing the chelipeds of normal shape.

Fig. 2.— *Astacus klamathensis* Stimpson. ♂. Portland, Or. U. S. N. M., slightly reduced. Showing the abnormal, atavistic form of the regenerated claw of the left side.

FIG. 1. ASTACUS KLAMATHENSIS STIMPSON

FIG. 2. ASTACUS KLAMATHENSIS STIMPSON

PLATE 12.

PLATE 12.

Fig.— *Astacus klamathensis* Stimpson. ♂. Portland, Or. U. S. N. M. × 1. Both of the chelipeds are second growths, the left the older.

Fig. 2.— *Astacus klamathensis* Stimpson. ♂. Portland, Or. U. S. N. M. Slightly reduced. Showing both claws regenerated, of full size, and nearly symmetrical; yet very different in shape from the normal claw as seen in Plate 11, Fig. 1.

FIG. 1. A. TALUS KLAMATHENSIS SUMICH.

FIG. 2. A. TALUS KLAMATHENSIS SUMICH.

PLATE 13.

PLATE 13.

Fig. 1.— *Cambarus validus* Faxon. ♂, form I. Type. Huntsville, Ala. M. C. Z., No. 301. × 1½.
Fig. 2.— *Cambarus bartonii veteranus* Faxon. ♂, form I. Type. Indian Creek, Baileysville, W. Va. Aug. 16, 1900. U. S. N. M., No. 25,020. Reduced.

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