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, 11½ mm.; width of areola, 2½ mm.; width of rostrum between the eyes, 4 mm.; length of chela, 25 mm.; breadth of chela 11½ mm.; length of dactylus, 16½ 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 anme 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, 142, 154).

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*) *cunicularius* 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 hassleri 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.