BIHANG

TILL

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR.

TJUGONDE BANDET.

AFDELNING IV.

ZOOLOGI, OMFATTANDE BÅDE LEFVANDE OCH FOSSILA FORMER.

STOCKHOLM 1895. P. A. NORSTEDT & SÖNER.

BIHANG TILL K. SVENSKA VET.-AKAD. HANDLINGAR. Band 20. Afd. **IV.** N:o 1.

CAMBARIDS FROM FLORIDA.

A NEW BLIND SPECIES, CAMBARUS ACHERONTIS MIHI.

BY

EINAR LÖNNBERG.

WITH ONE PLATE.

PRESENTED 1894, MARCH 14. REVISED BY G. LINDSTRÖM AND HJ. THEEL.

STOCKHOLM 1894.
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER.

During a sojourn in Florida in the years 1892—93 I collected cray-fishes from different parts of the country. Since, on coming home and with the help of the literature classifying my specimens, I found three different species in my collection. Two of these were normal-eyed forms which have been described before and are well known. They lived in creeks, small lakes and ponds, very often hiding in the rich vegetation there or under logs, boards and so on. Sometimes I found them digging holes on the shore, at low water, and then those holes often went down to such a depth that the water came up into them.

These normal-eyed forms were the following. *Cambarus fallax* Hagen and *Cambarus Alleni* Faxon. As both of them have been well described before, I have not much information to add, except to mention the localities where I have found them.

Cambarus fallax Hagen.

Of this I collected specimens in the sulphursprings at Lake Jessup and in St. John's river, in Lake Eola, in Fern-creek at Orlando Orange Co.

All my specimens except one have the posterior part of the carapax shortened so that the distance from the hinder edge to the cervical groove is a little less than half the distance from that groove to the tip of the rostrum, sometimes very little less though, and never less than $^3/_7$.

Cambarus Alleni Faxon.

This seems to be a form largely distributed in South Florida. I have specimens from Hillsborough, Orange and De Soto Counties. The specimens from Hillsborough County were caught in a little creek and the males all belonged to the »second form»; this was in October. When living they had a

dorsal yellow stripe on carapax. In Orange Co. I found this species in small lakes round Apopka and several other places.

I made my collections in De Soto Co. from ditches and small ponds at Arcadia.

There are two species of Cambarus besides these two found in Florida, viz. Cambarus Clarkii and C. versutus, but as they have been collected particularly in the northwestern portion[1] of the country and both are found in Alabama too, I think they more properly belong to the fauna of that state. Cambarus Clarkii is even found so far west as in Texas and in the states between. Cambarus fallax and C. Alleni are characteristic for Florida.

At the beginning of the year 1893 Mr. SJÖBLOM of Lake Brantley, Orange County wanted to dig a well near his house. It was on the top of a sandy hill, and he first went through about 11 feet of sand, then he struck clay and had to dig through that to a distance of about 22 feet from the surface. Under the clay there was sand again and then a layer of 5 feet which consisted of phosphate rock, bones and teeth of sharks. After that had been removed, he struck a very hard limestone extremely rich in fossils of marine mollusca. When he with much difficulty had worked through a little of that, he came suddenly on water, a subterranean rivulet about 42 feet from the surface. When this water was brought up, white, colourless crayfishes were found from time to time in it. At first they were fairly numerous, but later on, when I had heard about it and tried to obtain some specimens, I could only procure two males. They were, however, sufficient to show that it was a modified form with rudimentary eyes and blind, an *Orconectes* if this COPE's genus can be maintained. In Florida there was heretofore no blind crayfish known, but from other parts of the United States three different species are described viz. *Cambarus hamulatus* COPE & PACKARD from the Nickajack cave in Tennessee, *Cambarus pellucidus* TELLKAMPF from the Mammoth-cave in Kentucky and Bradford, Wyandotte, and other caves in Indiana, and *Cambarus setosus* from Missouri. From the Wyandotte cave COPE received a specimen somewhat aberrant, which he called *Orconectes inermis*

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[1] Cambarus Clarkii is also found in St. John's river.

(4), but it proved afterwards to be only a variety of *Cambarus pellucidus* with fewer and smaller spines. Can now the specimens from Florida be identified with any of the hitherto known species of blind Cambarus from North America? I think not, and what follows plainly shows why. *Cambarus hamulatus* (6) belongs to a group of species with the third segment of only third pair of legs hooked; the first pair of the abdominal appendages of the male thick, the inner and outer parts each terminating in a short recurved tooth.[1] The Florida-form on the other hand belongs to the first group (according to FAXON [6]) with the third segment of third and fourth pairs of the legs of the male hooked; the first pair of the abdominal appendages of the male with the outer part truncated at the tip, with one to three recurved teeth; the inner part terminated by a short acute spine etc. That is in itself enough to show the difference, but there are other characteristics too, for instance the rostrum is of quite a different shape in the two forms, and of the strong, sharp spines at the base of the antennæ and of the spines just behind the cervical groove on each branchial region of C. hamulatus there is no trace in the Florida-form. *Cambarus setosus* belongs to the same group as C. hamulatus, and is thus both by the characteristics of the group and by its hairy appearance, the strength of the chelæ etc. easily distinguished from the Florida-form. This is rather more related to *Cambarus pellucidus* and belongs in fact to the same group of species. But they are fully distinguished from each other nevertheless, as is plainly seen on comparison. The rostrum of *C. pellucidus* is longer (even in forma inermis) and is always sharply pointed, and the lateral teeth are prominent, long in the typical form, shorter in the inermis. The rostrum of the form from Florida is shorter, broader, more excavated and it ends very blunt at the tip; the lateral teeth are less developed and do not form spines as in *C. pellucidus*. The antennal lamellæ are broader in the Florida-form, but have smaller, hardly conspicuous spines. In his »*Orconectes inermis*» too COPE (4) describes and draws spines on both sides of the carapax which are still more developed on the typical *C. pellucidus* at different points of the carapax, but of those there are no traces in the Florida-

[1] FAXON: Revision of the Astacidæ, Mem. Mus. Comp. Zool., Harvard College, Cambridge Mass. 1885.

form. But *C. pellucidus* has a smooth carapax except for these spines or only »lateribus subgranulosis» (HAGEN [2]). In this respect the Florida-form is quite different, as the sides of the head and the branchial region are both densely covered with large granules or small tubercles only leaving the areola and rostrum smooth. The distal segment of telson has quite a different form too, as it is in the Florida-form much shorter and broader, nearly twice as broad as long, and not so rounded, but more square. I need not say more; it can not be disputed that the Cambarus from Lake Brantley is a well distinguished species, and I consequently propose the name *Cambarus acherontis*. A diagnose of this new species then will be as follows.

Cambarus acherontis LÖNNBERG (belonging to the first group according to FAXON: type C. Blandingii).

Male form I: Rostrum broad, smooth, very excavated above, margin raised into sharp crests, gradually converging towards the tip, but they do not come together there to form the point, but end in the angles which correspond with the lateral teeth of other species. In this way the rostral groove remains open in the distal end. At the end of rostrum there is a short and blunt tooth, the base of which extends into the foremost part of the rostral groove as a slight ridge. Any real »lateral teeth» do not exist, but are only represented as the ends of the marginal crests, which form obtuse angles. Postorbital ridges not strongly developed, with a small anterior spine. Carapax broader than abdomen, smooth above on the areola and on the top of the head, on the sides of the head and on the branchial region strongly granulated or covered with small tubercles, but no spines at all. A row of the granules behind the cervical groove is a little but only *very* little larger than the other ones, the same is the case with some of them on the sides of the head. The distance from the hind margin of the carapax to the cervical groove is a little more than or just about two thirds of that from the cervical groove to the tip of the rostrum. Areola narrow. Abdomen smooth, narrower than carapax and short (much shorter comparatively than in C. pellucidus), the distance from distal end of telson to hind-margin of carapax of the same length as from the hindmargin of carapax and to the tip of rostrum. The lateral outlines of the abdominal segments nearly elliptical with an angulation at the end. Only one short and blunt spine on each side of

the posterior border of the basal segment of telson. The distal lamella of telson not quite but nearly twice as broad as long and with rather square outer margin, but well rounded on the sides. Anterior process of epistoma subtriangular with rounded angles. Basal segments of the antennæ provided with hairs on the inner sides but no spines. The length of the antennæ equals that of the body from rostrum to telson. Antennal scales shorter than the peduncle, about equal to rostrum, very broad, broadest a little above middle, narrowed to the base. The exterior margin nearly straight, the anterior rounded and fringed, the interior converging to the exterior towards the base, nearly straight and fringed. The exterior margin ends in a short tooth. Third pair of maxillipeds hairy within. Chelipeds slender, chelæ subcylindrical, strongly granulated or covered with small tubercles and with a few fine hairs upon it. Fingers about as long as the hand, granulated and hairy, more hairs at the tips and on the insides or opposed margins. Opposed margins of fingers straight, provided with one tooth each, that of the movable finger situated nearer the hand, but even the one on the immovable finger situated on the proximal half of the same. Carpus granulated, with two stronger spines below. Brachium granulated with three or occasionally two anteapical spines on the inner side below and one on the outer; two rows of smaller spines along the brachium beneath. The hooks on the third segment of third and fourth pair of legs not very strong. On the basal segment of fourth pair of legs there is a rather large interior tubercle. On the basal joint of the fifth too there is a little tubercle, but it is much smaller than the corresponding one of C. Alleni for instance which species has no tubercle on the basal joint of the fourth. First pair of abdominal legs moderate, not bifid or provided with large teeth at the tip, twisted so that on the anterior part the inner side is better developed, in the posterior part the outer. The margins are sparsedly fringed with fine, small hairs. Eyes and eyestalks rudimentary forming together short blunt cones. Here are the dimensions of two individuals:

Total length . . .	55	mm.
	50	»
Length of carapax	27	»
	25	»

Length of rostrum {6 mm. / 5 »

Basal width of rostrum {4 mm. / 4 »

Distance from tip of rostrum to cervical groove {16 mm. / 15 »

» » cervical groove to hind margin of carapax {11½ mm. / 10 »

Width of areola {1½ mm. / 1 »

Length of chelæ {19 mm. / 18 »

Width » » {5 mm. / 4 »

From the above it is plain that *Cambarus acherontis* is a well-defined species, that does not show any likeness to any of the blind Cambari hitherto known. Two questions may now be asked which are not either so easily answered. How great is the geological or phylogenetic age of this blind form and which are its normal-eyed ancestors? To answer the first question about the age we have to try to find out how old the subterranean water is in which it exists. The little rivulet and its cavern can not have been formed before the land had been raised above the level of the sea, and even supposing it had been previously upheaved and covered by the sea again, the maximum age of the crayfish must in any case be reckoned from the last time it was covered by the sea. For even if in a foregoing period the cave had been formed, the crayfish could not have lived below the sea. Thus the uppermost marine layer will give us the maximum age of the little cavern and the Cambarus. The phosphatelayer in which were found sharks-teeth is the uppermost layer containing fossils, and it is of course marine. Its age? It is certainly tertiary and probably pliocene. But the sand and clay deposited on the top of the phosphate layer have probably also a marine origin, but this question does not seem to be fully solved yet. Angelo Heilprin says in his (9) »Explorations on the Westcoast of Florida» (Wagner free Inst. of Science, Philadelphia 1887) p. 66: »Freshwaterstreams, and consequently dry land existed in the more southern part of Florida during the Pliocene period» — — — But it can not

at that time have been much elevated »as is proved by the interassociation of marine and fluviatile mollusks in the deposits of the Caloosahatchee». From this it is evident that it could not have been then a very favorable time for the forming of a subterranean rivulet. Thus I do not think that we shall be far wrong, if we suppose the maximum age of the cavern to be postpliocene or still younger. The other caves, in which blind Cambari have been discovered, seem to be comparatively much older. The Mammoth-cave in Kentucky for instance is excavated in a subcarboniferous limestone forming a more or less elevated plateau. The caves in Indiana have a roof of Upper Silurian limestone and are excavated in the Lower. Thus the material in which these are dug out is much older and as they are situated on an old continent, which has been upheaved above the sea much earlier than Florida, it is more than probable that they have been formed long before the comparatively small subterranean rivulet in Florida. The size of these other caves indicates also a very much higher age. Thus there is a *possibility* that they have been inhabited by blind forms in a much earlier period and at the same time it is very likely that in them existed blind crayfishes long before there were any in Florida.

But on the other hand it is possible that all animal life in them was extinguished[1] by the glaciers or by the proximity to them at least in Indiana. The caves all lie however south of the great endmoraine, so it is not quite certain. The presence of a species of Cambarus in Alaska shows that they sometimes can stand a rather rough climate. I think therefore that it is at least a possibility that Cambarus pellucidus and hamulatus are older than C. acherontis from Florida. The species of Cambarus from the caves of Carniola ought to be rather old too as the caves themselves are very old and the other species of Cambarus are now all extinct in Europe where there are to be found, with the exception of this one, only representatives of the related genus Astacus.

Although very little is known about the subterranean watersystem of Florida, I think it must be of a considerable extent. I judge so from the numerous sinkholes I have seen

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[1] COPE, PACKARD and other american authors are of the opinion that probably the »true subterranean fauna does not date farther back than the beginning of Quaternary or Postpliocene period.»

and from the mighty springs that suddenly come to the surface at different places. It is thus possible that in the future there will be found a richer cave fauna in that State. I dare not say anything about the length of the subterranean rivulet at Lake Brantley in which Cambarus acherontis is found, but I remember having seen a white specimen of crayfish in »Clay Spring», a large sulphurspring about three miles northwest of Lake Brantley. I could not, however, procure that specimen and thus can not be sure, if it was the same species or only an albino of some other kind. I do not, however, think it impossible that the above-mentioned spring is fed from this and other subterranean rivulets all belonging to one system.

If now *Cambarus acherontis* is a rather young species, it would be of interest to know its ancestors. As it seems to be a rather recent form, it is reasonable to take into consideration the normal-eyed forms of Cambarus still existing in Florida first, the more so as they belong to the same group. There is, however, not much similarity between them. *Cambarus fallax* HAGEN has quite a different shape of the rostrum with strong lateral teeth, the antennæ are shorter than the body and the antennal scale provided with a strong spine at the tip. The carapax is not granulated as in C. acherontis, but has a spine behind the cervical groove and another one at the base of the antennæ. The posterior portion of the carapax is comparatively much shorter. The abdomen is longer and the basal segment of the telson has three spines on each side. The tuberculated chelæ are much larger etc. *Cambarus Alleni* FAXON is more similar to *C. acherontis*, as far as concerns the shape of the broad rostrum, but there are many great differences in other respects. For instance on *C. Alleni* the posterior portion of the carapax behind the cervical groove is only a little longer than half the distance from the cervical groove to the tip of rostrum. The shape of the carapax is different as it is compressed on *C. Alleni* and only punctuate on the surface. The abdomen is by comparison longer than in *C. acherontis* and the telson is narrower and the lateral outlines of the abdominal segments more square or shortly rounded. There is no tubercle on the basal segment of the fourth pair of the legs etc. Thus there is no very close relationship between these forms. Let us now make a comparison

Florida. They have thus probably become differentiated as species in that country and their existence can not therefore extend farther back than to about the Pliocene. For this reason they can not be much older than the possible maximum age of Cambarus acherontis.

The ancestors of this species may either have forced their way from the exterior mouth of the subterranean water or, which is more probable, accidentally fallen down when one or another of the many sinkholes originated. When they once had come down, they had to adapt themselves to the new life. But thus the mode in which Cambarus acherontis has originated is somewhat different from that of other blind species which live in large open caves with easier entrance.

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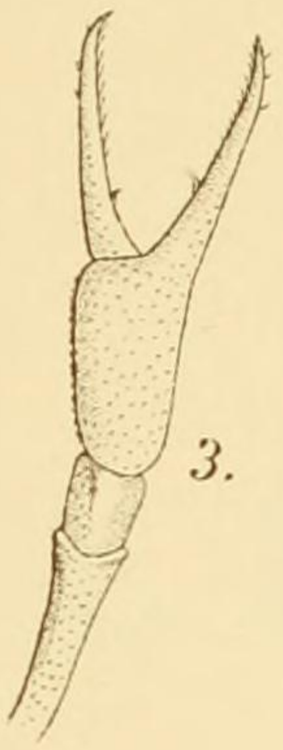
Explanation of figures.

Fig. 1. Cambarus acherontis n. sp., nat. size.
Fig. 2. » » » » rostrum of an other specimen, magnified.
Fig. 3. » » » » chela, magnified.
Fig. 4. » » » » side of abdomen magnified.
Fig. 5 a. » » » » first abdominal male appendage from below or behind.
Fig. 5 b. » » » » the same from the side.



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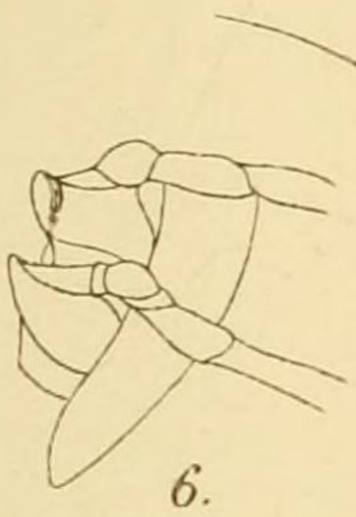

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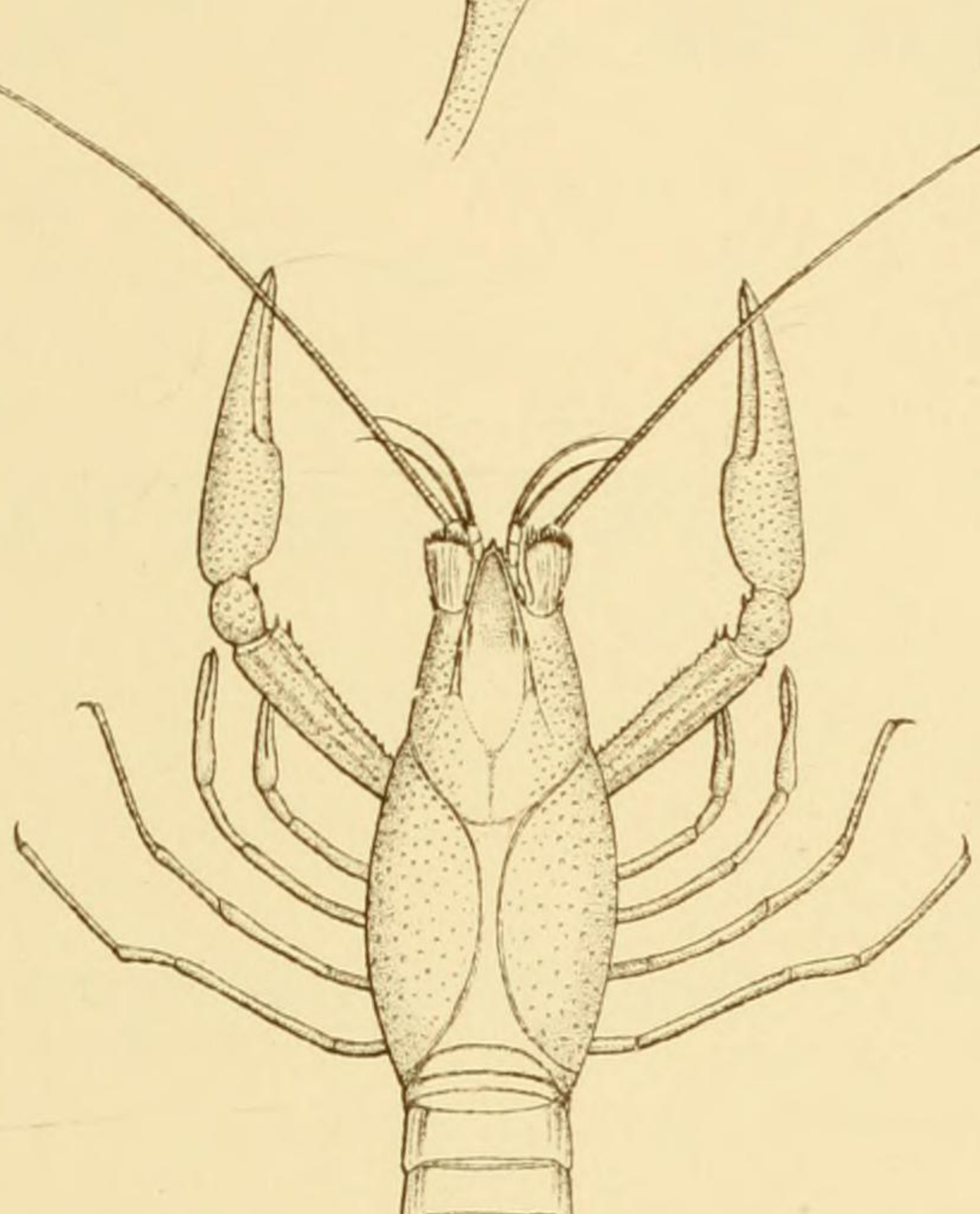

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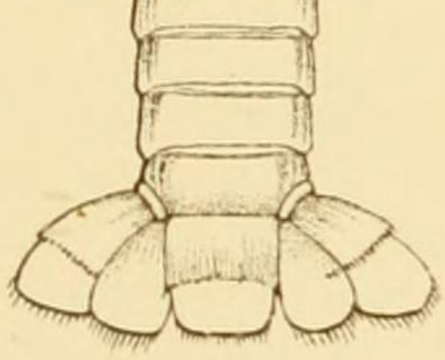

1.

5b.

4.

Del. & Lith. L. Ljunggren Ups.