

## ON EUCRANGONYX MUCRONATUS FORBES.

A subterranean blind shrimp; in this paper reported for the first time from Ohio, with a discussion of the relation of the animal to the glacial period.

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*Eucrangonyx* is an amphipod genus with a number of species, all of which, as far as I know, are found in cool fresh water. *Eucrangonyx gracilis* has been dredged from Lake Superior. This genus is to be separated from the other genera of the amphipods by the possession of a secondary flagellum on the first antenna, a reduced endopod on the third pleopod, and a telson notched at the distal end.

Professor Forbes reported this crustacean in 1876 from wells and springs of McLean County and of Champaign County, Illinois. O. P. Hay found it in 1879 in an old well in Marion County, Indiana, and in 1931 it was pumped from a well on the Francis farm in Butler County, Ohio.

By inspection of the glacial maps these localities are all within and close to the boundary of the Wisconsin or last glaciation. According to the monographs by Leverett, the Bloomington and Champaign localities in Illinois and the Butler County locality are early Wisconsin, while Irvington, Indiana, is late Wisconsin glaciation.

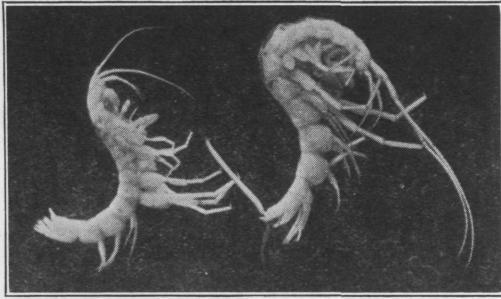
Wyandot Cave, Indiana, as reported by Banta, outside the glaciated area, has many *Eucrangonyx gracilis* but no *Eucrangonyx mucronatus*.

### DESCRIPTION OF THE OHIO LOCALITY.

Ross Township is in the southern tier of townships of Butler County. The road from Ross (Venice) to Shandon starts in the wide first terrace or bottom of the pre-glacial Ohio Valley, now occupied by the Great Miami. It rises sharply to the second terrace or bottom and after some distance on this terrace it leaves it and curves upward around a high hill to descend into the valley of the Paddy's Run, a small tributary of the Miami. On the west slope of this hill and extending southward through the second bottom as far as the north line of Hamilton County lies the Francis farm. The never failing well at the west side of the house, dating from 1858, has furnished a number of specimens of the blind shrimp *Eucrangonyx mucronatus*, the subject of this paper, and many specimens of a Cyclops with eyes, *Cyclops bicuspidatus* Claus,

(kindly identified for me by Dr. Lela Ewers). On this slope of the hill the glacial deposit could never have been very thick. Most of the present day gullies show stratified limestone. There are several springs in the neighborhood, both above and below the level of this well which is 33 feet deep. A small stream from one of these springs runs westward parallel to the road about 250 feet north of the house. Its bed at this point as ascertained by Locke level is 25 feet below the well curb.

The surface of the ground at the barn well south of the house is ten feet below the house well curb. This barn well was formerly about 20 feet deep and would go dry in the summers. Some years ago it was deepened. After passing through a heavy layer of limestone just beneath the old bottom they found an abundant supply of water and the well is now permanent.



*Eucrangonyx mucronatus* Forbes. Female on left; male on right.

The house stands on an outlier from the higher hill to the northeast and I am assuming that there has been in the country limestone, both before and since the glacial withdrawal, a connecting series of solution channels spreading under the ground like a spider's web at a level of about thirty feet below the curb of the house well. The entrance to this network may have been through the spring to the northeast or through the bed of the stream flowing from it and by some such pathway the *Eucrangonyx* may have followed the ice cooled waters into the passages and by these the eyed Cyclops may return again to open water whenever it finds the way. *Eucrangonyx*, being already adapted to darkness, would only need to escape if driven by a scarcity of food. Forbes' paper states that in very wet weather the *Eucrangonyx* makes its appearance at the mouths of the drains.

As long as the forest covered the hills the surface erosion would be slight and the subterranean solution channels would very gradually increase in size and area, thereby increasing the range for these animals. When the forest was cut away the level of the ground water was lowered abruptly and the available area of these solution channels was probably reduced. This would kill off the animals in all unfavorable situations and permit them to persist only where a concentration of water, as in a well like this one, would tide them over the drier parts of the year.

As a matter of fact the drier time of the year is when more shrimps are taken from the well. It formerly was an open well operated by a windlass and buckets and shrimps were rarely seen, if ever. Now that there is a pump and the top is covered over perhaps the creatures swim up into the tube as a hiding place. More than a dozen specimens were taken during last September and October, while only one has been collected since. This may indicate that when the ground water is higher and the area available for occupation is greater the animals do not stay in the well. Since the summer temperature of the well water is 60° F. and the winter 58° F. the temperature would not be a deciding factor.

#### CHARACTERS CORRELATED WITH CAVE LIFE.

The specific character in this *Eucrangonyx* is the extension of the telson of the adult male into an elongate clublike structure. This gives the specific name *mucronatus*. The antennae and legs are longer in proportion than the same structures in *Gammarus*.

Ross, in the Proceedings of the Iowa Academy of Science, states that the young *Eucrangonyx* has a few slightly pigmented hypodermal cells representing a rudimentary eye, but he reports that according to Packard the adult brain has the optic lobes still but no optic nerve or eye.

#### THEORETICAL CONSIDERATIONS.

Graeter "Die Copepoden der Unterirdischen Gewaesser" states that there are two types of cave dwelling animals.

1. The changeable type which have wandered into caves in recent times and have adapted themselves to the environment.

2. The conservative type. These, in spite of long cave dwelling, remain unchanged keeping their superfluous eyes.

Banta reports *Cyclops bicuspidatus* with normal eyes from the darkness of Mayfield's Cave. It is the most abundant Cyclops in the plankton of Echo River, water temperature 55° F., Mammoth Cave. Kofoid considered this an adventitious and temporary member of the cave fauna since it can escape in any high water period. This same Cyclops appears in the Illinois River and in the Great Lakes in the cooler part of the year. Strangely enough the specimens from Echo River have antennae and furcae shorter than do the species from the Great Lakes.

To these two types I would add a third. Also a conservative type which was already blind as a surface form.

These entering cave conditions would survive because already adapted.

As examples I would cite:

1. The blind isopod, *Cecidotea stygia*, which is found in caveless regions as well as in caves.

2. The European cave shrimp *Niphargus*, both pale and blind, which is not uncommonly found in cold surface waters.

3. Dr. Menzel reports blind *Canthocamptus typhlops* in mossy bogs as well as in caves. The swamps furnished conditions under the vegetation much like those in caves.

Many cave dwellers are originally microcavernicolous forms. After a certain proportional dimension is reached, any size of cleft or cavern would be infinite in size for a small enough animal.

The possible plant food in solution channels would be bacteria, fungi and rootlets of higher plants, but of course no green plants. As a result the larger animals would need to be carnivorous. One *Niphargus* is reported to have eaten meat equal to his body weight in twenty-four hours.

At the first glance shrimps would appear to belong to Graeter's first class above because of the many forms adapted to subterranean waters. A large proportion are blind, some having lost the optic lobes, others with optic lobes having lost the cornea and pigmented cells, the visual elements, and others still which have functional eyes but reduced in size.

To quote Miss Weckel (Ward and Whipple, *Freshwater Biology*, p. 838), "Of the twenty species (of amphipods) known, ten or eleven seem to be inhabitants of caves, wells or springs. Not all have their eyes reduced, but the species of the genera *Crangonyx*, *Stygonectes*, and *Apocrangonyx* are actually blind and there is a blind species in each of the genera *Eucrangonyx* and *Gammarus* while the other species of these two genera show all transitional stages from well developed eyes to eyes more or less reduced. The correlation between subterranean life and reduction of the eyes is very evident in this family." Or as I should prefer to state—The correlation between reduction of the eyes and subterranean life is very evident in this family. Are they eyeless because subterranean or subterranean because eyeless? It seems to me that in this specific case they are subterranean because they are eyeless.

It can hardly be possible that near the close of the Wisconsin glaciation twenty-five to fifty thousand years ago an eyed

shrimp could have entered the ground at Bloomington and Champaign, Illinois, Irvington, Indiana, and Shandon, Ohio, and in these separate places have modified in exactly the same way to become blind and mucronate. It is, however, very reasonable to suppose that a blind and mucronate shrimp, living in the deeper portions of the flood waters below the glaciers could be left in favorable situations along the morainic edges where the glacier remained long enough to allow it to establish itself and persist to the present time.

Favorable situations for the preservation of these creatures would not be common, either at the edges of the ice fields or back of the moraines in the thinner till, so the main body of these animals would have gone north with the cold water and the ice. If these shrimps are still in existence in their primitive cold surface water habitat anywhere it should be far north in Canada where the water is now as cool as it was at the former glacier's edge in Illinois, Indiana, and Ohio.

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#### Human Physiology.

An eminent Danish physiologist has revised his text for translation into English, the translation being made by Dr. Drinker of Harvard. The result is a rather stilted compendium of facts, with no attempt at arousing the student's interest or thought. The book might do for high school students, or even as a reference work in a college library, but for modern university students of physiology, who demand up-to-the-minute methods of presentation and critical discussions of the most recent facts, the book falls far short of the mark.

A **Text-book of Human Physiology**, by August Krogh and Katherine R. Drinker. v + 233 pp., 108 engravings. Philadelphia, Lea and Febiger, 1932. \$2.75.