ART. XXVIII.—*The Appendages of the Pygidium of Triarthrus*; by CHARLES E. BEECHER. (With Plate VII.)

SINCE the previous publications in this Journal, on the antennæ and thoracic legs of *Triarthrus Becki*,* additional features have been worked out from the material in the Yale Museum, and it is now proposed to give the main characters of the appendages attached to the pygidium, or caudal shield. The structure of the under side of the head will next be de-

* Antennæ and other Appendages of *Triarthrus Beckii*; by W. D. Matthew. This Journal, August, 1893. On the Thoracic Legs of *Triarthrus*; by C. E. Beecher. This Journal, December, 1893.

scribed, after which it will be possible to review the present knowledge of *Triarthrus*, together with its bearings on the position and affinities of the Trilobita.

Walcott first determined the presence of pygidial legs, and in a restoration of the ventral surface of *Calymene senaria*, one pair is represented to each annulation of the axis.* Matthew (l. c.) figured and described an imperfect and poorly preserved specimen of *Triarthrus*, which obscurely showed two flaps or fin like extensions, beyond the lower edge of the pygidium. These he considered as possibly anchylosed pygidial limbs.

The specimens here described leave little to be desired in the way of perfect preservation. The lower side of a number of individuals has been exposed, showing the ventral membrane with the appendages attached. The dorsal shield has also been removed from other specimens, and the appendages exposed from that side, so that a very complete idea may be had of the character of the limbs, with many of the finer details of structure. The small size of the pygidium of *Triarthrus*, and the great number of elements in the appendages, however, render it difficult to remove the shaly matrix completely. Moreover, the overlapping and crowded arrangement of the limbs make the structure of the pygidial region seem quite complicated.

In *Calymene*, as worked out by Walcott, these appendages, of which the endopodites alone are shown, are weak and slender, and appear to show important differences from those of *Triarthrus*.

In *Triarthrus*, the thoracic legs near the head are composed of comparatively long joints, the proximal ones only of both endopodite and exopodite being somewhat flattened and expanded (figure 1). The functions of these two branches are clearly indicated, the endopodite being adapted for crawling and the exopodite for swimming. From the anterior region of the thorax, there is a gradual and progressive change in both branches of the legs increasing their functional powers as swimming organs. When the pygidium is reached, the endopodites preserve their slender, jointed distal portion, but the proximal part

FIGURE 1 — *Triarthrus Becki* Green; dorsal view of right legs of second and third free thoracic segments. $\times 12$.

* The Trilobite: new and old evidence relating to its organization. Bulletin of the Museum of Comparative Zoology, vol. viii, No. 10, 1881.

is composed of segments which are considerably expanded transversely, thus making a paddle-like organ, the anterior edge of which is straight, while the posterior one is serrated by the projecting points of the expanded segments. These points bear small bundles of setæ (Plate VII, figure 2).

The extreme posterior endopodites are made up of endites having a width two or three times greater than the length. A young individual (Plate VII, figure 3) presents pygidial endopodites, having this character while the lower thoracic segments (not represented in the figure) bear endopodites similar in form to a^v , in figure 2. As these phyllopodiform appendages are the youngest and most immature on an adult *Triarthrus*, and are the prevailing form on the pygidium of an adolescent specimen, they probably indicate some primitive feature or simple type of trilobite leg. Their resemblance to the endopodites of *Apus*, figure 4, or to a typical phyllopod limb is very marked.

There is little apparent change in the structure of the exopodites from the anterior thoracic segments to the pygidium, as throughout this length they retain the large basal joint with a slender many jointed end carrying a long fringe of closely arranged setæ. As shown in figure 1, these fimbriæ overlap, and project behind the pygidium, forming with the endopodites a fin-like expansion on each side, especially well adapted to propel and guide the animal in swimming. They may have served also as egg carriers. As far as known, there was but a single pair of biramous limbs to each annulation, or potential segment, of the pygidium.

Yale Museum. New Haven, Conn., March 9th. 1894.

EXPLANATION OF PLATE.

Triarthrus Becki Green.

FIGURE 1.—Dorsal side of pygidium, showing fringes of exopodites (*b*) and ends of endopodites (*a*). The last free thoracic segment is represented in outline. Taken from an entire individual. $\times 16$.

FIGURE 2.—Ventral view of pygidium with appendages well preserved on one side, showing expanded setiferous endites of endopodial limbs (a^1 , a^v , etc) and exopodites (*b*). The last free thoracic segment is represented in outline. Taken from an entire individual. $\times 16$.

FIGURE 3.—The endopodites (somewhat displaced) from right side of pygidium of small specimen. The two end segments of upper limb are restored. The lower limbs are minute and rudimentary. $\times 60$.
Utica Slate. Near Rome, N. Y.

FIGURE 4.—Endopodites from right side of fourth larval stage of *Apus*, enlarged.
(After Claus)