

ART. XV.—*Restoration of Stylonurus Lacoanus, a Giant Arthropod from the Upper Devonian of the United States*; by CHARLES E. BEECHER. (With Plate I.)

IN the animal kingdom, the attribute of bigness has come to be regarded as one of the prerogatives of the vertebrates. On this account, invertebrates seldom receive credit for having a size of more than a fraction of a cubit, and are looked upon as objects to be held in the hand or viewed under a lens. As a matter of common experience, and probably also of congratulation, large invertebrates *are* rare, and some whole classes cannot furnish a single individual measuring more than a few inches in greatest diameter.

In a list of arthropod giants, the subject of the present note must be included, and will take equal rank with the Giant Spider-Crab of Japan (*Macrocheira Kaempferi*) and the great "Seraphim" of the Scotch quarrymen (*Pterygotus anglicus*). The former can safely claim to be the largest representative of the Brachyurans that has ever existed, and to the latter may be accorded the same distinction among the Merostomes.

The living species of the Merostomata comprise only the American and Moluccan Horse-Shoe Crabs, *Limulus polyphemus* and *L. moluccanus*. The latter sometimes attains a length of three feet, and measures eighteen inches across the carapace. To find other species in this order worthy of comparison with the huge Brachyuran of Japan, it is necessary to go back to the Paleozoic forms, and among these the larger species of *Pterygotus*, and the *Stylonurus* here noticed, fill all the requirements. It should be borne in mind, however, that these statements are based upon comparative lengths and breadths. If bulk alone were considered, the common lobster (*Homarus americanus* and *H. vulgaris*) should be mentioned, though in length and extent of limbs it would be considerably smaller.

Concerning the size of the Scotch "Seraphim," Dr. Henry Woodward<sup>10</sup> states that "From our present knowledge of the almost perfect remains of *Pterygotus anglicus*, and on the evidence of the numerous detached portions of this extinct genus, we are justified in concluding that it attained a length of six feet, and a breadth of nearly two feet at the widest part of its body." This huge Merostome has been found in the Lower Old Red Sandstone of Scotland, at a horizon nearly equivalent to the one furnishing the remains of *Stylonurus* in America. Thus what seem to be the two largest species of this class were contemporaries, though not associates.

*Historical.*

The first specimen found in America that can be referred to the genus *Stylonurus* was collected by the writer about 1870, and loaned to Professor James Hall. It remained in his hands unnoticed until 1884, when he described it as *Eurypterus Beecheri*.<sup>4</sup> The specimen preserves the abdomen and portions of two of the large posterior limbs. No species of *Eurypterus* known possessed such greatly elongated limb joints, and there seems to be no good reason for not referring it to *Stylonurus*, in which this is a normal character. The specimen of *Stylonurus Beecheri* is uncompressed, and apparently retains the proportions of form and convexity as in life. On this account, it was of considerable importance in the restoration of the larger species.

In 1882, Hall was furnished with a plaster cast of the carapace of a large arthropod, by Dr. Cook, then State Geologist of New Jersey. The original specimen was from the Catskill group at Andes, Delaware County, New York, and had been sent to the museum at Rutgers College, New Brunswick, New Jersey. Prof. D. S. Martin<sup>5</sup> made the first reference to this species in some remarks on "A New Eurypterid from the Catskill Group," before the New York Academy of Sciences, October 16, 1882, an abstract of this note appearing in the transactions of the same society some time after June, 1883. In this abstract, the species is neither described nor figured, and Hall is not mentioned in any connection. Martin states that he saw the specimen (=cast sent to Hall) in the State Museum at Albany, and it bore the name *Stylomaurus excelsior* (evidently a misprint for *Stylonurus*).

The next reference to this form in point of time, and the first publication of a generic and specific name accompanied with a description and accurate illustration, was given by E. W. Claypole,<sup>1</sup> in a paper read before the American Philosophical Society, September 21, 1883, under the title "Note on a large Crustacean from the Catskill Group of Pennsylvania." It is stated on the signature containing this paper that it was printed November 2, 1883. Claypole's description was based upon a second specimen found in Wyoming County, Pennsylvania, which preserves about three-fourths of the cephalothorax, and belonged to the collection of R. D. Lacoë of Pittston. This was given the name *Dolichocephala Lacoëana*, and rightly classified with the Merostomata. It therefore appears that, up to this time, the name *Stylonurus excelsior* was simply *nomen nudum*, and as such cannot be recognized as valid.

In 1884, Hall<sup>3</sup> published his description and figure of the

New York specimen, in the thirty-sixth Annual Report of the New York State Museum, in a paper entitled "Description of a New Species of *Stylonurus* from the Catskill Group." It is here that the New York specimen was first figured and a description given, and the date of publication of this paper is the one to be considered in deciding the claims of *Stylonurus excelsior* as Hall's species.

At the Philadelphia meeting of the American Association for the Advancement of Science, September, 1884 (Proc. A. A. S., vol. xxxiii, published 1885), Hall<sup>6</sup> presented a note on *Stylonurus excelsior*, merely referring to its occurrence, and citing Martin's abstract with page and month of publication. This citation is repeated by Hall in each of his notices of this species, for only by thus establishing the species could he have any claim to priority. As already mentioned, Martin's paper does not attempt any description of this form, and Hall is not mentioned. Hall further says: "The carapace is described and figured in the 36th Report of the N. Y. State Museum of Natural History," without reference to plate, page, or year, and it is therefore quite possible that this description was not published until after the meeting of the Association. In any case, it appeared some months later than Claypole's paper, and the name *Dolichocephala Lacoana* has priority over *Stylonurus excelsior*, and must be recognized.

Claypole failed to point out the affinities of this form with *Stylonurus*, and proposed a new generic term for his species. Although there are differences that may prove of generic value when more complete specimens of the American species have been studied, yet at the present time there seem to be no strong reasons why the specimen in question should not be considered as belonging to *Stylonurus*, and it is upon this ground that the present restoration is attempted.

#### *Material available for a Restoration.*

Restorations of extinct organisms are largely exhibits of mental architecture, based upon the personal interpretation of a certain number of real things. Some statement, therefore, should be given of the character and amount of the material that has been collated to furnish a restoration of *Stylonurus Lacoanus*.

(1) The specimen of the cephalothorax described by Hall shows the complete outline and upper surface of this part, and a cast from the original was taken to represent this portion in the restoration. (2) The type of *S. Lacoanus* Claypole includes a large part of the cephalothorax of an individual nearly the same in size as the preceding. (3) Dr. J. M. Clarke

discovered that this specimen also preserved considerable evidence as to the nature of the appendages, and he succeeded in developing what appear to be the chelate antennæ, the first pair of gnathopods, and the mandibular bases of at least three others. (4) The length and number of joints in the limbs are taken from the English species *S. Logani* and *S. Powriei*, of which quite complete, though smaller, individuals have been described by Woodward.<sup>10</sup> (5) The outline and proportions of the abdomen follow closely those of the English forms and of *S. Beecheri*, the latter giving the natural convexity. (6) A portion of a large abdominal segment found by the writer in the Chemung group at Warren, Pennsylvania, and apparently belonging to a nearly related species, has an ornamentation closely approaching that on the cephalothorax of the type, and was used to elaborate the sculpture over the abdomen of the restoration. (7) The form and character of the telson spine correspond to *S. Logani* and also to some large fragments found by F. A. Randall at Warren and Ackley, Pennsylvania, in the Chemung group, and probably belonging with the abdominal somite already mentioned.

With the data furnished by the foregoing material, the restoration was undertaken. The first model in relief was constructed in clay, and from it a plaster mold was taken. A number of casts have been made since, and a photograph of one of them is represented in the accompanying plate (Plate I).

In this connection, it may be suggested that the type specimen of *Stylonurus* (?) (*Echinocaris*?) *Wrightianus* (Dawson sp.) represents two proximal joints of one of the large crawling feet of a form related to *Stylonurus*, and not two somites of the abdomen as indicated by Hall.<sup>6</sup> Any reference is at present somewhat uncertain, owing to lack of positive knowledge, and the fact that the specimen in question was first described as a plant (*Equisetides*<sup>2</sup>), then referred to the Phyllocarida (*Echinocaris*<sup>8</sup>), and lastly appeared as a possible Merosotome, shows how this form may be interpreted by different observers. No one can doubt its arthropod nature, on account of the characteristic surface markings. Its elliptical or ovoid section without any flattening of the epimera, the very considerable overlapping of the joints, and the configuration of the suture, are more strongly indicative of the nature and requirements of a limb than of abdominal segments.

#### *The Relief Model.*

In this restoration, the animal is represented as lying on a slab, with the entire dorsal surface exposed. The cephalothorax has an axial length of 25<sup>cm</sup> and a width of 22<sup>cm</sup>.

The chelate antennæ were doubtless carried in a folded position, as in most related genera, and seldom were visible from the dorsal side. They are, therefore, not shown. The three pairs of short gnathopods, serving partly as swimming organs, are seen extending outward from the antero-lateral margins of the cephalothorax. Several of their distal joints are each provided with a pair of flat, ridged, spinous processes, and a similar spine at the termination of the limb.

The two pairs of great crawling feet extend outward and backward from the postero-lateral margins of the cephalothorax. The anterior pair expose 109<sup>cm</sup> of length, and the posterior pair about 108<sup>cm</sup>. The elements of the limbs are represented as grooved, as this character seems necessary to give the needed strength to long slender joints, and also because a similar conformation is present in *S. Beecheri*.

The abdomen measures 30<sup>cm</sup> in greatest width at the fifth segment, and 66<sup>cm</sup> in length exclusive of the telson. The posterior abdominal segments are represented without detachable epimera, as this feature is not as yet known to be constant for the genus, although present in some species.

The telson spine agrees proportionally in length with the same member in *S. Logani* and *S. Powriei* as described by Woodward,<sup>10</sup> and was given a slight upward curvature as in *Limulus*. It measures 54<sup>cm</sup> in length and 7.5<sup>cm</sup> across at the proximal end.

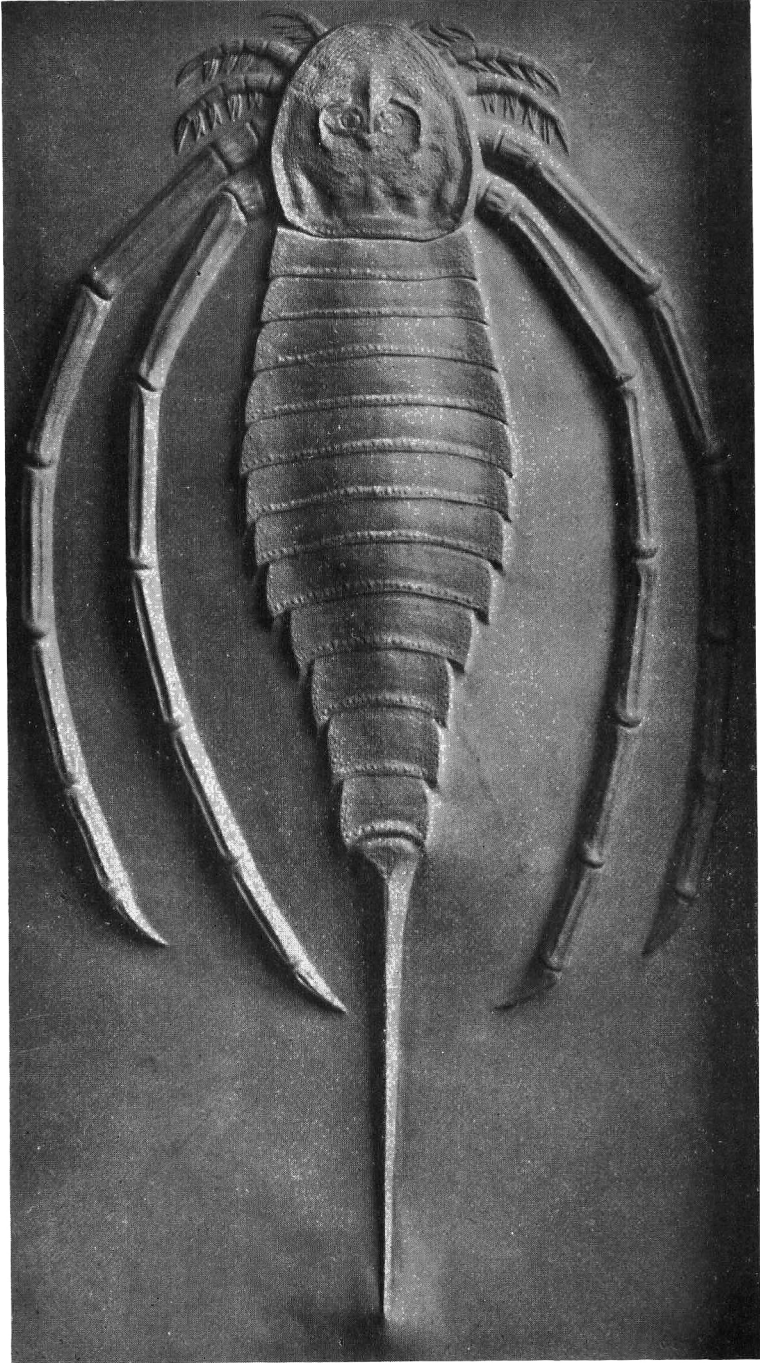
Altogether the animal as restored has a length of nearly five feet (147<sup>cm</sup>), and with the legs extended it would measure about eight feet (242<sup>cm</sup>) across.

It is not intended to claim any high degree of accuracy for this restoration, but merely to represent in some graphic form an animal approximating in size and character an individual of the species *Stylonurus Lacoanus*. Its size alone was the chief incentive for attempting a reconstruction, and some sacrifice of exact detail may well be allowed, in order to make any presentation of this magnificent arthropod.

Yale University Museum, New Haven, Conn., September 5, 1899.

#### References.

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2. Dawson, J. W.—Notes on New Erian (Devonian) Plants. Quar. Jour. Geol. Soc., London, vol. xxxvii, 1881.
3. Hall, J.—Description of a New Species of *Stylonurus* from the Catskill Group. Thirty-sixth Ann. Rept. N. Y. State Mus. Nat. Hist., 1884.
4. Hall, J.—Note on the Eurypteridæ of the Devonian and Carboniferous Formations of Pennsylvania. Second Geol. Surv. Penn., PPP, 1884.
5. Hall, J.—Note to Explanation of Plate 15 of paper on Geology of Yates County, N. Y., by B. H. Wright. Thirty-fifth Ann. Rept. N. Y. State Mus. Nat. Hist., published 1884.



STYLONURUS (length nearly five feet).