ORIGINAL ARTICLES.

I.—*BUNAIA* WOODWARD, A NEW MEROSTOME FROM THE SILURIAN WATERLIMES OF NEW YORK.

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(PLATE XIV.)

Prefatory remark by author.—Dr. Henry Woodward has asked me to prepare for the GEOLOGICAL MAGAZINE a brief sketch of this new fossil. It seems to me most appropriate that the Magazine, the sturdy child of this eminent and venerable palæontologist, and the expositor of so many of his own observations on Palæozoic Crustacea, should carry the first printed account of this discovery, which I have taken pleasure in dedicating to Dr. Woodward, my colleague and friend of many years.

THE hydraulic limestone series which cap the Silurian rocks of the New York sections, and are commonly embraced under the name “Salina Group”, are probably the richest known depository of remains of the Merostome Crustacea. During the past fifteen years we have been engaged upon the study of this fauna, and the results at which we arrived in our memoir on the Eurypterida of New York¹ could not have been safely attained without the previous labours of Dr. Woodward and the late Professor Rupert Jones, of Huxley, and Hugh Miller for the British species; of Friedrich Schmidt, Nieszkowski, and Holm for the species of the Baltic basin.

We now recognize in the Salina basin of New York over sixty species of the Eurypterida (*Eurypterus*, *Pterygotus*, *Dolichopterus*, *Stylonurus*, etc.), and to this large number are to be added two species of the rare genus *Pseudoniscus*, which had heretofore been found only in the Baltic beds. In the North European development of this shallow-water coastal bay fauna there are three genera of Merostomes which the New York deposits have never revealed; *Hemiaspis* and *Neolimulus*, from the Scottish Silurian, and *Bunodes* from the Island of Oesel. What we are now designating by the name *Bunaia* may be regarded as an alternative expression of *Bunodes*, which according to the descriptions by Eichwald, Schmidt, Nieszkowski, and more recently by Patten (*The Vertebrates and their Kin*) is a creature 2–3 inches long, with short semicircular head, a broad mesosoma of six segments, followed by three narrow segments of the post-abdomen and a long single telson-spine. The head is marked by five curved radial furrows diverging on each side from the central subtriangular glabellar elevation; and these divide the surface into corresponding radial ridges. Dr. Patten has called attention to the retention of this primitive structure in the *Limulus* embryo, a fact which certainly seems to bespeak the direct descent of the latter from this ancient primitive merostome.

The New York fossil is like *Bunodes* in these cephalic structures. Though of very much smaller size, the carapace shows on the upper surface the same arrangement of parts, and on the underside this

¹ Clarke & Ruedemann, Mem. 14, pts. 1, 2, N.Y. State Museum, 1912.

pentamerous division is clearly accompanied by remains of the five pairs of legs, the mouth orifice, and, as it seems, the chelate first legs folded down close alongside the mouth.

We illustrate here in connexion with these features a head of *Bunodes lunula*, the Oesel species, showing a similar arrangement of the five pairs of legs and, in addition, what appear to be the lateral thickenings of the glabellar ridges. This is a specimen from which the very thin epidermal film has been removed. Further, the head-shield of *Bunaia* displays more than that of *Bunodes* in its thickened margins and extended cheek-spines. Patten believed that antennæ were present in *Bunodes*, and so restored it, but we find no evidence of these structures in *Bunaia*.

In our specimens the chief difference of *Bunaia* from *Bunodes* is in the structure of the abdomen. In the latter there are six broad segments followed behind by three narrow ones. In *Bunaia* this structure appears to be somewhat different. The cephalon or head-shield is followed behind by narrow segments of which seven or eight can be counted, with possibly one missing. These seem to be of somewhat unequal length and to be longitudinally ridged, but without lateral flanges. Our knowledge of this structure is restricted to a single example and is subject to modification. In one of the three specimens there is a broad detached smooth spine lying alongside the head, which may have been the telson, though apparently pretty large for the species.

The measurements are as follows: width of carapace, 8 mm.; estimated total length of animal, inclusive of telson, 23 mm.

The specimens of *Bunaia Woodwardi* are from the Bertie Waterlime of the Salina Group at East Buffalo, N.Y.

EXPLANATION OF PLATE XIV.

BUNAIA WOODWARDI, sp. nov., J. M. Clarke.

- FIG. 1.—A weathered exterior of a head-shield showing the triangular central area or "glabella" and the five pairs of lateral lobes crenulating the surface and corresponding to the legs beneath. $\times 8$.
 FIG. 2.—The interior of a head-shield with five pairs of radial appendages and evidently a sixth pair at the central mouth. The light-coloured lines on the right-hand radial areas are elevated linear ridges which appear to be parts of the appendages themselves, and it is thought that the broad dark areas may include both legs and gills. $\times 8$.
 FIG. 3.—A crushed and defaced head-shield with a postabdomen of ridged segments. $\times 8$.
 FIG. 4.—A telson spine which lies close to the specimen Fig. 1 and, it is thought, may belong to this species. $\times 8$.

All the foregoing are from the Bertie Waterlime (Silurian) at the East Buffalo, N.Y., quarries.

BUNODES LUNULA, Eichwald.¹

- FIG. 5.—An exfoliated carapace from the Silurian of the Island of Oesel, showing the broad dark bands left by the six pairs of cephalic appendages and also the central divergent ridges which seem to be the interior projections of the ridges of the "glabella". $\times 3$.

¹ Dr. d'Eichwald, Archiv für die Naturk. Liv.-Ehst.- und Kurlands, erste Serie, vol. ii, pl. ii, figs. 12-13, 15, pp. 378-82, Dorpat, 1859, 8vo.

FIGS. 1-4. *BUNAFIA WOODWARDI*, *sp. nov.*, J. M. CLARKE.
FIG. 5. *BUNODES LUNULA*, EICHWALD, 1859.