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William Harmon Norton

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VARIATION IN THE POSITION OF THE NODES ON  
THE AXIAL SEGMENTS OF PYGIDIUM OF  
A SPECIES OF ENCRINURUS.

BY WILLIAM HARMON NORTON.

In defining the different species of the genus encrinurus (Emmrich) use has frequently been made of the disposition of nodes on the rings of the mid-lobe of the tail-shield. It is largely by this diagnostic that Foerste, for example, distinguishes *E. thresheri* from *E. ornatus*. Hall and Whitfield\* and the latter authors again, use the same criterion in separating *E. ornatus* from the European species figured in Murchison's Siluria. †

This has been the perhaps unavoidable result of the scarcity of materials at hand. Several species of this genus have been described, each from a single pygidium. The specific importance of this feature having thus been exaggerated, any variation in it is of paleontological as well as evolutionary interest, and will be of value in the long-needed revision of the genus.

The specimens which afford the facts I am about to present were taken some years since by Prof. A. Collins, Sc.P., of Cornell College, and the author, from a single stratum near the top of Platner & Kirby's quarry, Mount Vernon, Iowa. They were associated with a rich fauna, but unfortunately the fossiliferous area was so limited that, though the quarry has been largely extended, scarcely a fossil has since rewarded the search of the collector. The investigation is therefore simplified by the absence of such factors as would obtain if the specimens had been taken from widely separated localities, or from a considerable vertical range.

Coming from a station near the summit of the Anamosa beds, which lie above the Le Claire, the position of the species is perhaps higher than that of any other American Encrinurus.

\* The Clinton Group of Ohio, Part II, pp. 101, 102, A. E. Foerste. Bulletin of The Laboratories of Denison University, II.

† Report Geological Survey of Ohio. Vol. II, pp. 155, 156.

The species in question which is of the general type of *Encrinurus punctatus* Wahlenburg, is well represented in the collections by two perfect, or nearly perfect, specimens and by scores of cephelons, moveable cheeks and pygidia, occurring both as external moulds and internal casts.

The nearness of the fossiliferous stratum to the top of the quarry brought it well within the zone of weathering. The laminae of the rock were parted and the fossils thus disengaged with a single stroke of the hammer, and without any picking and cleaning that might mingle artificial with the delicate natural markings. The latter are exceptionally well preserved. To speak of the pygidia only, the caudal spine is shown in several specimens, the ninth pair of pleural are usually distinct, and even a tenth pair may sometimes be seen as minute ridges nearly aligned with the axial lobe and ending upon it in a tubercle. Of the segmental lines on the mid-lobe as many as thirty-one have been counted with the aid of a magnifying glass, and in seven specimens over twenty-five are thus visible, and in several specimens eight and even nine axial nodes have been observed.

The investigation has thus been specially favored in the number and perfection of the specimens at hand. The prominence also of the large rounded anterior tubercle affords a sure ground which would be lacking if the investigation were carried over to the less distinct tubercles on the broad pleural annulations. In the same way the size of the specimens is of advantage. The largest twenty-three mm. in length and width, slightly exceeds in these dimensions the largest *Encrinurus* the author has seen figured or described. From this size the specimens range to a minimum of eight mm. in length and breadth. In several of the smaller pygidia, the axial lobe is slightly more convex and the central longitudinal space between the discontinuous segments is more or less obscure. The first nine segments in especial, are plainly continuous. While it is not thought that these are specifically distinct, they are separated in the following table by being marked with a star. Excluding these and considering the remainder whose specific identity can not be questioned, the following variation is observed:

No. of Nodes.	AXIAL SEGMENTS OCCUPIED.									
1.	1st.	2d.	(?)	3d.						
2.		3d.	4th.	5th.	6th.					
3.			7th.	8th.	9th.	10th.				
4.				10th.	11th.	12th.	13th.	14th.		
5.					14th.	15th.	16th.	17th.	18th.	(?) 19th.

The following table sets forth the facts observed graphically and in detail. It will be noted that not a single segmental line of the first twenty-three is unoccupied by a tubercle. No law obtains as to the successive number of the intervening segments. For comparison the sequences of nodes on two described species are inserted. Of the distinct trends observable in the grouping of the nodes that toward the formula of *E. ornatus* is most largely represented in the specimens at hand.

Geological Laboratory, Cornell College, December 31, 1895.

NUMBER OF AXIAL ANNULATIONS.

NO. OF SPECIMEN.	NUMBER OF AXIAL ANNULATIONS.																									
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.	15th.	16th.	17th.	18th.	19th.	20th.	21st.	22d.	23d.	24th.	25th.	
1.....	0				0				0				0				0									
2.....	0	0			0				0				0				0			0						
3.....	0	0			0				0				0				0			0						
4.....	0	0			0				0	0			0				0			0				0		
5.....	0	0			0				0				0				0			0						
6.....	0	0			0				0				0				0			0						
7.....	0	0			0				0				0				0			0						
8.....	0	0			0				0			0					0			0						
9.....	0	0			0				0				0				0			0						
10.....	0	0			0				0				0				0			0						
11.....	0	0			0				0				0				0			0						
12.....	0	0			0				0				0				0			0						
13.....	0	0			0			0					0				0			0						
14.....	0	0			0			0			0			0			0			0						
15.....	0	0			0			0			0			0			0			0						
16.....	0	0			0			0			0			0			0			0						
*17.....	0	0			0			0			0			0			0			0						
18.....	0	0			0			0			0			0			0			0						
19.....	0	0			0			0			0			0			0			0						
20.....	0	0			0			0			0			0			0			0				0		
21.....	0	0			0			0			0			0			0			0				0		
22.....	0	0			0			0			0			0			0			0						
23.....	0	0			0			0			0			0			0			0						
24.....	0	0			0			0			0			0			0			0						
25.....	0	0			0			0			0			0			0			0						
†26.....	0	0			0			0			0			0			0			0						
27.....	0	0			0			0			0			0			0			0						
28.....	0	0			0			0			0			0			0			0						
29.....	0	0			0			0			0			0			0			0	0					
30.....	0	0			0			0			0			0			0			0						
‡31.....	0	0			0			0			0			0			0			0						
32.....	0	0			0			0			0			0			0			0				0		
33.....	0	0			0			0			0			0			0			0						
34.....	0	0			0			0			0			0			0			0						
35.....	?	0			0			0			0			0			0			0						
36.....	0	0			0			0			0			0			0			0						
37.....	0	0			0			0			0			0			0			0						
38.....	0	0			0			0			0			0			0			0						
39.....	0	0			0			0			0			0			0			0				0		
40.....	0	0			0			0			0			0			0			0						
41.....	0	0			0			0			0			0			0			0						
42.....	0	0			0			0			0			0			0			0						
43.....	0	0			0			0			0			0			0			0						

\*No. 17. *E. ornatus*, H. & W. †No. 26. *E. punctatus*, Murch. S. Luria. Pl. III, fig. 6

‡No. 31. *E. thresheri*, Foerste.