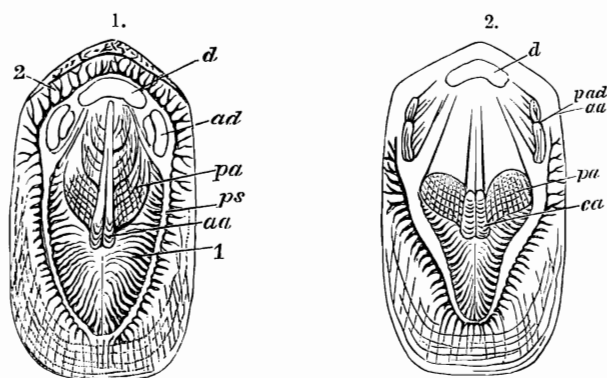


ART. LXIV.—*On the occurrence of true Lingula in the Trenton Limestones*; by R. P. WHITFIELD.

It has been supposed by many that the Brachiopodous genus, *Lingula*, as represented by *Lingula anatina* Lamarck, a living species, was not represented among the fossil Lingulidæ of the older Paleozoic rock formations, if anywhere in rocks of Paleozoic age; and there has been a growing tendency to class all the Linguloid shells of these formations under other generic names. There is no question but that many of the forms represented in the Paleozoic rocks are really generically distinct from the living types; but I think we have proof in a species from the Trenton limestones of Wisconsin and Minnesota, that the true Lingulæ were represented by at least one species at that period. Several years ago I received from Dr. Aaron Elder, formerly of New York city, who had been spending a summer near Rochester, Minn., some internal casts of an undescribed *Lingula*. On examining them and finding the markings of the muscular scars and vascular lines very strong, I urged Dr. Elder to obtain more of the casts, at his next visit to that place, calling his attention particularly to these markings. During the following autumn I received other specimens, from some of which the accompanying figures and description of parts are taken. The species I propose to name *Lingula*

*Elderi*, after the discoverer, and a full description will be given, with figures, in the forthcoming Paleontological Report of the Geological Survey of Wisconsin.

The casts represent a species of moderate size, the average being about seven-eighths of an inch in length; the general outline is somewhat quadrate, the lateral margins being subparallel and a little convex, the upper end very obtusely angular or pointed, and the base rounded; the valves are convex, but the dorsal the most strongly so. The shell, when preserved, is smooth with very fine concentric lines, but presenting a polished appearance. The peculiar features are found in the preservation of the imprints left by the muscular and vascular scars on the shell, as copied on these internal casts, thus affording means of comparison with the corresponding organs of the living forms of the genus. These markings correspond more nearly to those of *L. anatina* Lam. than do those of any other



Silurian or Devonian species which I have ever examined, and although they do not exactly correspond still are as similar as one could expect in widely separated species. The variations consist in the position of the various muscular scars, and also somewhat in the lines of the pallial sinuses and in the ramifications of their branches. Nearly all the muscular areas have been identified on several individuals, and the anterior portion of the pallial sinuses with their interior ramifications, and the outer ones to a slight distance from the main trunks on most of them; while the ramifications of the posterior prolongations have been detected on two of the dorsal valves. I have not been able to trace all the elements of the muscular system, nor to detect the divisions between those forming the larger scars; some of which, in the recent forms, are seen to be composed of three or four elements; but where they are impressed so lightly on the shell and yet leave the trace of their advance over its

surface by the growth of the animal to interfere with their distinctness, this would scarcely be looked for in a fossil species.

On the cast of the dorsal valve (fig. 1) the impressions of the pallial sinuses (*ps*) are deeply marked and are widely separated, leaving the area within them very considerable; the central or inner ramifications (1) are very distinct, and the outer ones also for a short distance from the main branches; while the posterior branches (2) show the lateral ramifications only on the outer side. The divaricator muscular scar of the dorsal valve (*d*) is very large and curved forward at the sides, being situated well back near the apex of the valve. It has not been satisfactorily observed on the ventral side, as every specimen yet obtained has been more or less imperfect at this point, but it should be situated directly opposite that of the dorsal. The anterior adductor scars (*aa*) are small and situated near the center of the valve, while the posterior adductors (*pa*) are large and situated outside of, and posterior to them; so as to inclose their posterior ends. The scars of the adjustor muscles are distant from each other, and placed just within the posterior third of the length of the shell. Two elements can be detected in each scar on some individuals, but they are usually obscure.

In the ventral valve (fig. 2) the lines of the pallial sinuses are nearer together on the anterior half of the cast than on the other valve, which feature is remarkably similar to these lines as shown in *L. anatina*, but spread out rapidly toward the middle and on the posterior half occupy nearly the same relative position as on the dorsal side. Near the center of the valve are seen a pair of large scars which have progressed from behind, their track forming a strong feature on the cast, as it originates just in front of the divaricator muscle scar (*d*) and gradually widens as it advances until it occupies fully one-half the width of the cast near the middle of its length. In the central line of this track there is an elevated ridge which terminates in a slightly prolonged tongue and seems to represent the central adjustors (*ca*) and their track of advance. The large scars outside of these are probably the posterior adductors and external adjustors combined (*pa*), each scar being formed of two elements. Posterior to these and distant from the median line are other scars which are long and narrow, their length being parallel to the margin of the valve. These also have left their track of advance, having started from a point just in advance of the anterior margin of the divaricator muscle. Two elements are recognized on each side and represent the posterior adjustors and probably the anterior adductors combined (*pa* and *aa*.) Between the lines formed by the advance of the adjustor muscles and those occupying the central area, on each

valve are narrow, smooth, impressed spaces which unite with the lines of the pallial sinuses at the junction of the anterior and posterior branches, and extend to the position of the divaricator muscle scar. They are seen on all the specimens but I have not been able to identify them with any organs, and it is probable they are only the spaces of unoccupied shell between the scars of the adjacent muscles and their tracks of advance, as they are within the area of the muscles and consequently within the perivisceral chamber. The area of attachment of the posterior muscular walls of the perivisceral chamber have not been detected, unless they have occupied a portion of the area assigned to the posterior branches of the pallial sinuses as seen on the dorsal valve. In which case there could have been only external ramifications from this portion of those organs, instead of both external and internal, as in *L. anatina*.

In making these comparisons and in identifying the several muscles and other organs as represented on the casts, I have made use of the very excellent memoir "On the organization of the Brachiopoda," by Albany Hancock, Esq., published in the Trans. Phil. Soc. of England in 1858, a comparison with which cannot fail to convince any one of their intimate generic relations with *L. anatina*.