

PALLIAL SINUSES OF *COMPOSITA ARGENTIA**

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The mantle or pallium which completely lines the internal surface of each valve of a brachiopod shell is composed, beyond the body of the animal, of two epithelial membranes which are firmly united by a uniform layer of cartilaginous connective tissue except along certain lines which are occupied by the pallial sinuses. These are tubes which open into the main body cavity or coelom and whose numerous ramifications extend to the border of the mantle. They are an important part of the circulatory system and in most brachiopods the genital organs extend into them.

In both mantles of a brachiopod the pallial sinuses issue in more or less diverging trunk lines which branch to a greater or lesser extent as the margin is approached. The patterns thus formed differ considerably in the various observed species and Thompson considers their disposition probably to be of at least superfamily value in classification.¹

In most brachiopods the pallial sinuses have left no traces on the internal surfaces of the valves, but in others their pattern is preserved as a system of shallow grooves which on internal casts are shown by low rounded ridges. Although some species appear to retain traces of the pallial sinuses more commonly than others, specimens exhibiting these characters are quite rare and no traces of them have been observed among the abundant specimens of many very common species that have been collected.

Composita argentia (Shepard) is probably the most common Pennsylvanian fossil in America. It has been reported throughout a range extending from California to Maryland and from British Columbia to Brazil, and more than fifty descriptions and illustrations of this species have been published. In all these notices of the species there are only three references to the pallial sinuses. Herrick casually mentions "radiating lines on the dorsal valves . . . impressed upon the shell by

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¹ Thompson, J. A., Brachiopod morphology and genera (Recent and Tertiary), New Zealand Board of Science and Art, Manual No. 7, p. 11, 1927.

the viscera,"² but he neither describes nor figures these markings. On the other hand, internal casts showing traces of the pallial sinuses have been illustrated by Whitfield³ and by Hall and Clarke⁴ but not described. It is of considerable interest, therefore, that a small collection from the Vanport limestone in the NE. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 25, T. 5 N., R. 18 W., Jackson County, Ohio,⁵ contains a number of specimens in which the positions of these sinuses are clearly indicated. This collection was obtained from the dump of an old entry into the Clarion coal that was formerly worked in connection with the operations of the Diamond Brick Company. The Vanport limestone at this locality contains beds of massive, locally fossiliferous chert in which *Composita argentia* is

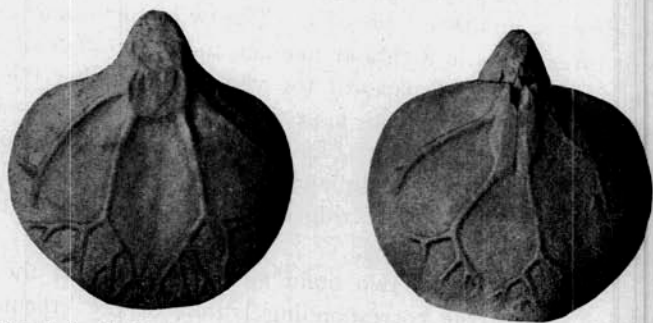


FIG. 1 and 2. Pedicle and brachial views of an internal cast of *Composita argentia* showing pattern of pallial sinuses. Enlarged 3 diameters.

especially common. The calcareous shells have been leached out and the fossils are preserved as external moulds which faithfully record delicate surface markings and as complete internal casts which may be easily obtained by simply breaking up the rock.

The accompanying figures are reproduced from enlarged photographs of the specimen which shows the pattern of the pallial sinuses in greatest detail. This specimen is slightly distorted as it probably was in life and consequently the sinuses are somewhat unsymmetrical.

The pallial sinuses appear to have been more deeply impressed in the pedicle than in the brachial valve and in almost all specimens only the positions of the two main anterior trunks are shown. These originate at the border of the muscle scar, represented on the internal casts

² Herrick, C. L., A sketch of the geological history of Licking County, accompanying an illustrated catalogue of Carboniferous fossils from Flint Ridge, Ohio, Bull. Sci. Lab. Denison Univ., Vol. 2, p. 44, 1887.

³ Whitfield, R. P., Contributions to invertebrate paleontology, Ann. N. Y. Acad. Sci., Vol. 5, Pl. 16, Figs. 7 and 8, 1891; reprinted in Report Geol. Surv. Ohio, Vol. 7, Pl. 12, Figs. 7 and 8, 1895.

⁴ Hall, James, and Clarke, J. M., An introduction to the study of the genera of Paleozoic Brachiopoda, Paleol. of N. Y., Vol. 8, pt. 2, Pl. 47, Figs. 27 and 28, 1894.

⁵ This collection was obtained incidentally during the course of field studies of the Pennsylvanian system made possible by a Grant-in-Aid of the National Research Council.

by a raised area, and extend forward at the top of the slopes which form the sinus of the pedicle valve. At positions about half way between the edge of the muscle scar and the margin of the valves the two main pallial sinuses branch for the first time. (Because of curvature of the shell and fore-shortening in the figures the position of the first division of these sinuses appears to be farther forward than it actually is.) The branching of the pallial sinuses takes place in a fairly regular dichotomous manner. The branches decrease in size with each division and finally disappear along a fairly regular line about two-thirds of a millimeter from the margin of the shell. At the first division of the two main trunks the inner branches descend into the sinus of the valve and their offshoots approach the margin of the shell at rather regular intervals across this depression. The two outer branches bifurcate two or three times in a similar manner and their offshoots spread out on the adjacent lateral parts of the valve. Altogether the ramifications of the two main trunks approach almost the whole anterior half of the periphery of the valve. In the case of the figured specimen the left trunk gave rise to eight and the right one to twelve small branches represented by minute ridges, and further division that has left no traces probably occurred.

The description of the two main anterior trunks of the pedicle valve applies also to the corresponding trunks of the brachial valve but in this valve the trunks are situated at the bases of the slopes which form the fold. The impressions of the pallial sinuses of the brachial valve, however, are not as plainly marked and all traces of them disappear at a greater distance from the margin of the shell.

A pair of lateral pallial sinuses was present in each mantle of the figured specimen although they are not as well shown on the cast as are the two anterior pairs. The lateral trunks originate near the areas of the muscle scars some distance behind the points of origin of the anterior trunks. On the brachial side they begin about one-half and on the pedicle less than one-third of the way from the forward edge of the scar to the cardinal margin. The lateral trunks extend forward and outward. Both of those on the pedicle side and the left one of the brachial remain unbranched to positions $\frac{2}{3}$ or $\frac{3}{4}$ of the distance to the margins, but the right trunk of the brachial valve divides at a point about half way to the margin. All of the lateral trunks divide dichotomously two or three times and give rise to from four to six slender branches similar in size and spacing to those of the anterior trunks.

There appear to have been two pairs of posterior sinuses in each mantle. Their traces are very obscure on the figured specimen and

are better shown on another internal cast from the same locality. Like the anterior and lateral trunks these also originate near the borders of the muscle scars. The first pair of each mantle was directed laterally and the second pair extended outward and backward. It is probable that each of these sinuses branched once or twice although no traces of such branches are shown on the specimens.

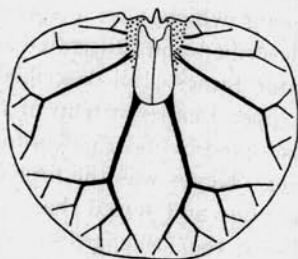


FIG. 3. A generalized restoration of an internal cast of the brachial valve of *Composita argenticia* showing the arrangement of the pallial sinuses and the location of the ovarian areas. This pattern differs considerably from those preserved on specimens figured by Whitfield and by Hall and Clarke.

The surface of one or two of the larger internal casts is slightly raised and covered with small tubercles in two restricted areas upon either side and back of the raised area of the muscle scars on the brachial valve. These areas represent the ovarian impressions and indicate the position of the dorsal pair of genital glands. No trace of the ventral pair has been observed on any of the specimens; possibly these were contained to a greater extent in the pallial sinuses of the ventral mantle which may account for the plainer impressions of the pallial sinuses in the pedicle valve.

A number of specimens in this same collection have been broken and show the character and position of the brachidia which consist of two large, laterally directed spires, each composed of seven or eight loops. They were attached by short, delicate crura which in almost all specimens have broken, thus freeing the brachidia which now occur in various irregular positions. Beede considered similar irregularity in the position of the spires in *Composita argenticia* from the Western Interior basin to be the result of individual variation.⁶ None of his specimens, however, show the crura and there can be little doubt that the irregular positions of the spires in his specimens also resulted from the detachment of the brachidia from the crura after the death of the animals and their displacement before fossilization occurred.

⁶ Beede, J. W., Variations of the spiralia in *Seminula argenticia* (Shepard) Hall, Kan. Univ. Sci. Bull., Vol. 1, pp. 155-157, Pl. 6, 1902.

In 1837 Dr. Charles Upham Shepard, Professor of Chemistry in the Medical College of the state of South Carolina, traveled by stage from Chicago to the village of Rockwell (situated just east of the present site of the city of LaSalle) where he remained for a short time. The following year he published a paper which was the first contribution to the geology of Illinois of any scientific importance.⁷ In this paper were presented the first illustrations and descriptions of fossils collected in Illinois, among which was a species named *Terebratula argenticola*, inadequately described and illustrated by two very poor wood cuts. Fourteen years later James Hall described and figured *Terebratula subtilita* from the Upper Pennsylvanian of northwestern Missouri⁸ and this name has been adopted by most paleontologists for the common Pennsylvanian *Composita*. Keyes was the first writer to consider these two names to be synonymous and stated that *Athyris argenticola* is "one of the commonest fossils of the (Shepard's) well known locality..."⁹ Writing on this same subject later, Girty concluded that Keyes' statement that "*Seminula subtilita* is the commonest species at the locality where *T. argenticola* was first found" is a "circumstance of importance, but scarcely . . . sufficiently conclusive to warrant the replacement of Hall's name, which has a definite meaning, for one whose significance is still vague and uncertain."¹⁰

Shepard's type specimen of *Terebratula argenticola* is probably no longer in existence but his statement that it was obtained from "The limestone of the western bluff of the Little Vermilion" makes it possible to determine with reasonable certainty what species he actually had. The LaSalle limestone is extensively exposed and forms a conspicuous bluff along this stream and there can be little doubt, therefore, that Shepard's specimens were obtained from this horizon, although several other fossiliferous horizons of the Pennsylvanian outcrop at a few places nearby. In the fauna of the LaSalle limestone, or of the entire Pennsylvanian for that matter, there are only two species to which *T. argenticola* possibly can be referred. These are, first, the form commonly cited as *Composita subtilita* and second, the one now known as *Squamularia perplexa*. It is true, as Girty has pointed out,¹¹ that Shepard's figures suggest the latter more than the former. All collections from the LaSalle limestone of this region, however, show

⁷ Shepard, C. U., *Geology of Upper Illinois*, Amer. Jour. Sci., ser. 1, Vol. 34, pp. 134-161, 1838.

⁸ Hall, James, Appendix E, *Geology and Paleontology*, in Stansbury, Howard, *An expedition to the valley of the Great Salt Lake of Utah*, p. 409, Pl. 4, figs. 1a-b, 2a-c, 1852.

⁹ Keyes, C. R., *Paleontology of Missouri*, part 2, Mo. Geol. Surv., ser. 2, Vol. 5, pp. 93-94, 1894.

¹⁰ Girty, G. H., *The Carboniferous formations and faunas of Colorado*, U. S. Geol. Survey, Prof. Paper 16, p. 406, 1903.

¹¹ Op. cit.

Composita to be much more abundant than *Squamularia*. A collection made at the quarry of the Alpha Portland Cement Company on the east side of Little Vermilion River only a few hundred yards from the place where Shepard's fossils were obtained contains 620 specimens of *Composita* and only 19 of *Squamularia*. Moreover, this and other collections from the LaSalle limestone reveal that specimens of *Squamularia* from this horizon are usually small and rarely attain a size equal to that of Shepard's figured specimen. On the other hand, *Composita* is commonly robustly developed, and numerous immature specimens equal in size to Shepard's type have not yet developed a conspicuous fold and sinus and cannot be certainly determined as *Composita* except by the absence of an open delthyrium and the presence of a foramen. Furthermore Shepard was a geologist of no little experience and his naming another species from LaSalle *Producta semipunctata* is evidence that he was familiar with paleontological literature which was not abundant at that time. Therefore his reference of the species *argentina* to the genus *Terebratula* rather than *Spirifer* is strong evidence that his specimen possessed a foramen and not an open delthyrium.

Hall's figures of *T. subtilita* are good and quite characteristic of certain types which are included within the common and variable Pennsylvanian species of *Composita*. However, Hall's designation of the type locality as "Missouri River, near Weston" is inadequate both as to horizon and precise locality and makes it impossible to obtain authentic toptype material which sometime may be desired to aid in a detailed stratigraphic study of these fossils. On the other hand the exact locality and precise horizon of Shepard's *T. argentina* are known and a large amount of authentic material may be collected from the extensive natural exposures and several large quarries which occur nearby.

In view of the above considerations it appears to be reasonably certain that *T. argentina* and *T. subtilita* are synonymous designations of the common Pennsylvanian *Composita* and as Shepard's name has priority this species should henceforth be known as *Composita argentina* (Shepard). Because of Shepard's poor illustrations and description and the loss of his type, some doubt must forever remain but Shepard may justly be given the benefit of this doubt in honor of his paper which was the first scientific contribution to the geology and paleontology of Illinois.