

CAMBRIAN BRACHIOPODA: GENERA IPHIDEA AND  
YORKIA, WITH DESCRIPTIONS OF NEW SPECIES  
OF EACH, AND OF THE GENUS ACROTHELÆ.

By CHARLES D. WALCOTT,

Honorary Curator, Department of Invertebrate Palæontology.

THIS IS THE first of a proposed series of preliminary papers on the Cambrian Brachiopoda, to be published in advance of a memoir on the subject. Owing to administrative duties, only a small part of each year can be devoted by me to palæontologic studies. In the present paper the genera *Iphidea* and *Yorkia* are discussed. Succeeding papers will treat of other well-known genera.

IPHIDEA, Billings.

*Iphidea*, BILLINGS, 1872, Can. Nat., new ser., VI, p. 177, fig. 13.

*Micromitra*, MEEK, 1873, Sixth Ann. Rept. U. S. Geol. Surv. Terr., for 1872, p. 479.

*Iphidea*, BILLINGS, 1874, Pal. Foss., II, Pt. 1, p. 76.

*Iphidea*, LINNARSSON, 1876, Bihang Till K. Svenska Vet. Akad., Handlingar, No. 12, p. 26. Brachiopoda of the Paradoxides Beds of Sweden.

*Iphidea*, WALCOTT, 1886, Bull. U. S. Geol. Surv., No. 30, p. 100.

*Paterina*, BEECHER, 1891, Am. Jour. Sci., XLI, p. 345.

*Iphidea*, HALL and CLARKE, 1892, Pal. N. Y., VIII, Pt. 1, p. 97.

*Iphidea*, HALL and CLARKE, 1892, Eleventh Ann. Rept. State Geol. N. Y., p. 249.

*Paterina*, HALL and CLARKE, 1892, Eleventh Ann. Rept. State Geol. N. Y., p. 247.

The description of the genus *Iphidea* and that of the type species were combined. At the time of my study of *Kutorgina* and *Iphidea* I did not agree with Mr. Billings in his reference of *Obolus labradoricus* to *Kutorgina*,<sup>1</sup> overlooking the fact that he had referred *O. labradoricus* to *Iphidea*.<sup>2</sup> Since that time I have collected more material representing this group of shells, and from its study have come to the conclusion that Mr. Billings was correct in referring *O. labradoricus* to *Iphidea*. The ventral valve of *O. labradoricus* has a narrow false area of the same type as *Iphidea bella*, and the characteristic pseudodeltidium is clearly shown in a section, and it is known to occur in *I. sculptilis*, Meek, *I. ornatella*, Linnarsson, and *I. pannula*, White. The extreme development of the false area and pseudodeltidium is found in an undescribed

<sup>1</sup> Bull. U. S. Geol. Surv., No. 30, 1886, p. 100.

<sup>2</sup> Pal. Foss., II, Pt. 1, p. 76.

species of *Iphidea* (*I. superba*) from the Middle Cambrian Tonto sandstone of the Grand Canyon of the Colorado. In this form the ventral valve is broadly conical, and the large pseudodeltidium projects backward at an angle equal to that of the slope from the apex to the front. In *I. bella* the false area slopes more abruptly downward, and in *I. ornatella* it is nearly vertical, the pseudodeltidium being much shorter and projecting but a short distance beyond the area. The slope of the area of *I. ornatella* is essentially the same as that of *I. labradorica* var. *swantonensis*, which is the type of Mr. Beecher's genus *Paterina*. In some specimens of the latter species the beak projects so that the slope of the area carried it forward to a considerable distance under the beak. This is also true of *I. pannula*.

The presence of an apical foramen in *I. bella* and *I. ornatella* would separate the genus from *Paterina*, but, from a careful study of all the evidence attainable, I am led to question the presence of a true apical foramen in either species. Unless there are other characters than those shown by the false area and pseudodeltidium and the angle at which they slope, it will be impracticable to generically separate *I. bella* and *I. labradoricus* and the other species mentioned.

In his original description, Mr. Billings says:

In the specimen above figured there is an aperture in the beak, but in another there is no appearance whatever of a perforation.<sup>1</sup>

Professor Whiteaves writes me, under date of July 23, 1896, that there are no specimens or electrotypes of the types of *I. bella* in the collections of the Geological Survey of Canada, nor of the closely allied species of the same genus from Topsail Head, mentioned by Mr. Billings. Under the circumstances, nothing can be done but to decide from Mr. Billings's description and figure the characters of the genus and species, and refer to the species the form that can best be identified with the description and figure as the specific type of the genus. This appears to be the species from the York limestone of Pennsylvania.

In a fine series of *Iphidea bella* from the Lower Cambrian, south of Emigsville, York County, Pennsylvania, the characteristics of the genus and species are strikingly well shown. In none of the specimens is there in the ventral valve an indication of an apical pedicle opening. The dorsal valve is slightly elevated, and in the half dozen well-preserved specimens no trace has been observed of any false area or pseudodeltidium; but in *I. pannula* the false area is even more clearly defined than in the ventral valve, and the pseudodeltidium is present as a depressed concave covering of more than one-half of the triangular space inside the narrow area on each side. The area on the dorsal valve has also been observed in *I. ornatella* and *I. labradorica*.

Doctor Linnarsson, in describing *I. ornatella*, speaks of the presence of a minute foramen; but, after the study of several finely preserved

<sup>1</sup> Pal. Foss., 11, Pt. 1, p. 76.

ventral valves from the Paradoxides beds of Andrarum, Sweden. I am led to believe that what he considered to be an apical foramen is a depression in the apex of the shell in front of the incurved beak, which represents a foramen which was present in one of the embryonic (nepionic) stages, and was subsequently lost. This would involve the crowding out, as it were, of the pedicle posteriorly, the only evidence of its presence in the adult being the narrow, slightly depressed slit at the apex of the valve in some specimens. The pedicle in the adult shell is protruded between the two valves and separated from the embryonic pedicle opening by the growth of a pseudodeltidium.

The examination of the somewhat closely allied form, *I. pannula*, shows the presence in some specimens of the apical depression and its absence in others. In an undescribed species, *I. superba*, still more closely approaching the type *I. bella* in external appearance, there is no trace of an apical slit or foramen. In another species associated with *I. superba* (*I. crenistria*) the apex is rounded, while in a somewhat similar but distinct form (*I. pedlei*), from the Gallatin River valley of Montana, the apical slit is as clearly shown as in *I. ornatella*, but not any apical foramen.

Messrs. Hall and Clarke illustrate a specimen of *I. bella* showing an apical foramen, but in the description of the figure the statement is made that the foramen is not altogether distinct in the specimen.<sup>1</sup>

The systematic position of the genus *Iphidea* appears to be in the Neotremata of Beecher,<sup>2</sup> possibly with characters that nearly place it in the Protremata. If the pedicle was apical in its early stages and inclosed by shell growth, and subsequently was crowded back of a pseudodeltidium, it passed through the Neotrematic stage to the Protrematic. The presence of an obscure listrium in front of the apex of *I. bella*, *I. ornatella*, and some specimens of *I. pedlei*, tends to support this view. We also have to consider the area of the dorsal valve as shown in *I. pannula*. In this species there is a rather deep, convex pseudodeltidium in the ventral valve, and a clearly defined, depressed pseudodeltidium on the dorsal valve between the narrow false areas. There is also present a narrow median groove extending from beneath the apex of the valve to the posterior margin of the pseudodeltidium. It is similar in appearance to the pedicle groove of the ventral valve of *Obolus* and *Rhinobolus*. This suggests that it may be the pedicle valve; but the presence of the listrium or embryo pedicle scar on the conical valve is opposed to the interpretation.

It may be urged that *Iphidea* is a true Atrematic genus, the pedicle never having been inclosed and the slit on the ventral valve being only a depression without special significance. This may be so, but the impression it conveys to me is that the slit indicates a pedicle opening near the apex of the ventral valve, at an early stage in its growth,

<sup>1</sup> Pal. N. Y., VIII, Pt. 1, description of pl. IV, fig. 8.

<sup>2</sup> Amer. Jour. Sci., XLI, 1891, pp. 354, 355.

which was subsequently closed, the pedicle then protruding between the valves.

The only interior of any specimen of the genus thus far discovered that shows a trace of muscular scars or vascular markings is the interior of the dorsal valve of *I. pannula*, from near Rome, Georgia. All that is discernible in this is a slight depression in the east of the interior, about one-third the distance from the beak to the front. A rather strong vascular trunk arches forward on each side of it, nearly to the center of the valve.

*Stratigraphic distribution.*—The genus ranges from the lowest known Lower Cambrian horizon to the upper portion of the Middle Cambrian. The species thus far referred to the genus are as follows:

Lower Cambrian:

*Iphidea bella*, Billings.

*labradorica*, Billings.

var. *swantonensis*, Walcott.

*pannula*, White.

*prospectensis*, Walcott.

Middle Cambrian:

*Iphidea crenistria*, new species.

*alabamaensis*, new species.

*logani*, new species.

*ornatella*, Linnarsson.

*pannula*, White.

*pealei*, new species.

*pusilla*, Linnarsson.

*sculptilis*, Meek.

*stissingensis*, Dwight.

*superba*, new species.

*Ornamentation of the surface.*—One of the most noticeable characters is the surface ornamentation. In the type *I. bella* it is formed of simple concentric striae and lines of growth. This may be called type A, and to it may be referred:

<i>Iphidea bella</i> .....	Lower Cambrian.
<i>labradorica</i> .....	Lower Cambrian.
var. <i>swantonensis</i> .....	Lower Cambrian.
<i>prospectensis</i> .....	Lower Cambrian.
<i>alabamaensis</i> .....	Middle Cambrian.
<i>logani</i> .....	Middle Cambrian.
<i>pusilla</i> .....	Middle Cambrian.
<i>superba</i> .....	Middle Cambrian.
<i>stissingensis</i> .....	Middle Cambrian.
<i>crenistria</i> .....	Middle Cambrian.
<i>pealei</i> .....	Middle Cambrian.

The second type (B) is represented by *I. sculptilis*, in which the striae are more crenulated than in *I. crenistria*, but not sufficiently so to give a diamond-shaped interspace.

Type C is a beautiful surface, formed by the union of the crenulated striae so as to make a fine network of raised, obliquely arranged lines



that divide the surface into minute pits that give the impression of finely woven cloth. *I. ornatella* and *I. pannula* represent this type. Among other genera it may be found in *Trematis*; and the second type of surface, as shown by *I. sculptilis*, is frequently seen on *Lingulella*.

IPHIDEA SUPERBA, new species.

(Plate LIX, figs. 1, 1a-c.)

*Iphidea* cf. ? *ornatella*, 1892. HALL and CLARKE, Pal. N. Y., VIII, Pt. 1, pl. IV, figs. 6, 7.

Ventral (pedicle) valve subconical, with a minute beak incurving over the pseudodeltidium. Cardinal slope slightly flattened, so as to merely indicate an imperfectly defined, rather narrow area. In some specimens the curvature of the shell is practically continuous to the base of the pseudodeltidium. Pseudodeltidium broad, convex, with its lower margin broadly arched, so as to leave a considerable space between it and the line of the general plane of the shell.

Dorsal (brachial) valve slightly convex; most elevated a little in front of the small beak which projects slightly over the broad open (?) delthyrium. No traces of a false area or a pseudodeltidium have been observed.

Surface with rather strong concentric striae, and a few somewhat obscure lines of growth. On the ventral valve the striae extend around to and cross the pseudodeltidium. Shell substance corneous.

This is one of the larger species of the genus, being surpassed in size only by *I. labradorica*. It is clearly distinguishable from *I. bella* by its larger size, more depressed ventral valve, and the form of the pseudodeltidium. The dorsal valves of the two species are quite similar. It differs from *I. pealei* in its broad pseudodeltidium, false area, and surface markings.

One specimen has a length of 9 mm. and a little greater width. The area is vertical, the pseudodeltidium being broken away.

*Formation and locality*.—Middle Cambrian, Tonto Terrane, Chuar and Nunkoweap valleys, Grand Canyon of the Colorado. (No. 26429, U.S.N.M.)

IPHIDEA LOGANI, new species.

(Plate LIX, figs. 2, 2a, 2b.)

Ventral (pedicle) valve conical, transverse in outline at base, almost semicircular. Beak minute, incurving over the pseudodeltidium. Cardinal slopes rounded and flattened so as to form a fairly well defined false area that is broken by a very wide triangular space. Pseudodeltidium arched upward, forming a narrow, sloping shelf beneath the beak, the angle of slope from the summit of the shell over the beak and pseudodeltidium being nearly the same as that of the slope from the summit to the front.

Surface marked by very fine concentric striae and somewhat coarser lines of growth. Under a high power slight traces of radiating striae

may be observed. The concentric striae pass around over the false area and cross the pseudodeltidium. Shell substance corneous.

This specimen was received from Professor J. F. Whiteaves as one of the types of *I. bella*. It differs, however, so materially from the description of that species and the figure illustrating it that I found it necessary to give it a distinct specific designation, and I take pleasure in naming it after Sir William E. Logan.

The specimen bears the label "Trois Pistoles, 1868, T. C. Weston." It was collected from a bowlder in the conglomerate at that locality. It is probably of Middle Cambrian age, but this can not be stated with certainty, as there are no associated fossils. Mr. Billings speaks of the occurrence of fragments of trilobites in the bowlder containing this type of *I. bella*. He does not mention the genera or species.

The species approaches most nearly *I. crenistria* in its short pseudodeltidium and finely striated surface. It differs, however, in the character of the surface striae, the form of the false area, and the pseudodeltidium.

*Formation and locality.*—Conglomerates at Trois Pistoles on the St. Lawrence, Province of Quebec. The conglomerates of this formation, according to Sir William E. Logan, form nine separate layers, from 2 to 16 feet thick, bedded in gray, calcareous sandstone. The geologic age of the deposit containing the matrix is supposed to be Upper Cambrian or Lower Ordovician. The age of the bowlders can be determined only by the fossils found in each.

#### IPHIDEA PEALEI, new species.

(Plate LIX, figs. 3, 3a-3c.)

Ventral (pedicle) valve subconical, beak slightly incurving over the pseudodeltidium. Cardinal slope flattened to form a narrow false area, which is clearly defined from the curvature of the shell by slightly elevated thread-like ridges. Pseudodeltidium comparatively narrow, strongly convex, and arched below. The striae of growth cross the false area and arch over the delthyrium.

Dorsal (brachial) valve moderately convex, and without any special characteristics to distinguish it from the same valve in *I. bella*, *I. superba*, and *I. labradorica*.

Surface marked by fine concentric striae and lines of growth that are usually plain, but in some examples are slightly crenulated. In such instances fine radiating lines or striae are also shown. Shell substance corneous.

In the most perfectly preserved specimens there is a slight slit or depression near the apex of the ventral valve, but there is no trace of a perforation or apical opening.

This species approaches *I. sculptilis* in some examples of the ventral valve. It differs mainly in the narrow pseudodeltidium and the character of the surface markings. It might be considered as a form intermediate between *I. bella* and *I. sculptilis*.

Specific name in honor of Doctor A. C. Peale, who collected the type specimen.

*Formation and locality.*—Middle Cambrian, Flathead Terrane. North of East Gallatin River, north of Hillsdale, Montana. Also, on the east side of Gallatin River above Gallatin City. (No. 26430, U.S.N.M.)

IPHIDEA CRENISTRIA, new species.

(Plate LIX, figs. 4, 4a, 4b.)

Pedicle valve subconical, beak nearly apical, curving slightly over to the pseudodeltidium. False area very narrow, separated from the curvature of the shell by being turned somewhat abruptly backward. Pseudodeltidium comparatively broad, but decidedly short as compared with that of *I. bella* or *I. superba*. It is more of the type of *I. labradorica*. It is strongly arched, leaving a broad, high space between it and the plane of the shell.

Dorsal (brachial) valve unknown. Surface of ventral (pedicle) valve marked by very fine, slightly crenulated striae that are so crowded on the false area that they are nearly lost, and only one or two varices of growth and a few striae are shown on the pseudodeltidium. No traces of an embryonic foramen are seen, save the slight slit at the apex of the shell.

This species is clearly distinguishable from other described forms of the genus by its highly arched pseudodeltidium and crenulated surface striae.

*Formation and locality.*—Middle Cambrian, Tonto Terrane. In thin intercalated limestone layers near head of Nunkoweap Valley, Grand Canyon of the Colorado. (No. 26431, U.S.N.M.)

IPHIDEA ALABAMAENSIS, new species.

(Plate LIX, figs. 5, 5a.)

In following the Lower Cambrian rocks southward from Vermont, the first type of *Iphidea* met with is *I. stissingensis*, which occurs in the Middle Cambrian of Dutchess County, New York. This is fairly well distinguished by its surface characters from *I. labradorica* and its variety *swantonensis*, but at the next locality to the south, in eastern Tennessee, four miles north of Rogersville, in the Rogersville shale of the Middle Cambrian, was found a form that is practically identical with the northern species or its variety, as far as it is possible to compare specimens preserved in limestone with those preserved in shale. The same form also occurs in the Middle Cambrian shales of the Cowan Creek section, Cherokee County, Alabama. There is, however, a difference in the surface striae that distinguishes it from *I. labradorica* and its variety and *I. stissingensis*. It is the tendency to crenulation of the striae in nearly all the specimens that have been examined. Thus in extreme cases goes so far as to approach the surface, so characteristic of *I. pannula*.

The form can not well be identified with the closely related *I. labradorica* or its variety *sicantonensis*, or *I. stissingensis*, on account of these peculiar surface characters, and the name *I. alabamaensis* is proposed for it.

In general form of the valves this species is the same as *I. labradorica* and *I. stissingensis*. The specific difference from them, as far as known, is in the surface character. The convexity of the valves is unknown, owing to the compression of the shells in the shale, and we have no information of the area or the pseudodeltidium. It may be that with the obtaining of better material, especially from the limestone, this species will be referred to as a variety of *I. stissingensis*. Shell substance corneous.

*Formation and locality.*—Middle Cambrian, Coosa Valley shale, Cowan Creek section, Cherokee County, Alabama; also in Rogersville shale, 4 miles northeast of Rogersville, Tennessee, back of Big Creek, southeast of Harlans Knob. (No. 26432, U.S.N.M.)

YORKIA, new genus.

Shell inarticulate, subcircular to suborbicular in outline. Apex of ventral (pedicle) valve perforate, marginal, with a false area and a pseudodeltidium. The cast of the interior of the valve shows a foramen which penetrated obliquely upward and backward through the thick umbonal portion of the shell. Two narrow furrows converge from the side of the foraminal opening toward the longitudinal mesial depression and then diverge toward the antero-lateral portions of the shell.

The dorsal (brachial) valve has a well-defined area and an obscure pseudodeltidium. The interior of this valve has a pair of broad, diverging, shear-shaped furrows passing directly forward from the beak for a short distance and then diverging to the outer margin, but not sufficiently to affect the outward curve of the inner margin.

Shell substance probably calcareous. External surface marked with more or less prominent concentric striae and lines of growth.

*Type.*—*Yorkia wameri*.

The area and pseudodeltidium of the ventral valve resemble the same parts in *Trematobolus insignis*, Matthew,<sup>1</sup> but the foramen is quite different, and generally the interior of the dorsal valve also serves to distinguish the forms. To *Discinopsis*, Matthew,<sup>2</sup> there is a resemblance in the markings of the interior of the dorsal valve. *Discinopsis*, however, is founded upon a small, apparently corneous shell, which so far as known, has no area or pseudodeltidium, and it is closely related to *Aerothele*. *Yorkia* differs from *Aerothele* in its pronounced area, substance of shell, and place of origin of vascular trunks. I do not know of any other genus of the *Siphonotretidae* with which it can be compared.

<sup>1</sup> Can. Rec. of Sci., V, 1893, p. 277.

<sup>2</sup> Pal. N. Y., VIII, Pt. 1, 1892, p. 105.



## YORKIA WANNERI, new species.

(Plate LX, figs. 1, 1a-1c.)

Shell subcircular to suborbicular in outline, moderately convex, with the apices of the valves marginal. Ventral (pedicle) valve highest at the beak, which is truncated by a circular foraminal opening; cardinal slope angular and slightly incurved, so as to form a narrow false area on each side of the slightly convex, rather broad pseudodeltidium. Numerous casts show the pseudodeltidium, false area, and a large filling or cast of the foramen which extended obliquely backward through the thickened umbonal portion of the shell to the apex. On a cast of the interior of the valve there are two elongated muscular or vascular (probably the latter) impressions that extend from the anterolateral base of the foraminal opening inward to nearly the median line, and then diagonally outward toward the anterior lateral margin of the shell. There is also a slight median longitudinal ridge that corresponds to a depression in the interior of the shell. (Plate LX, figs. 1b, 1c.) In other casts striae or lines only are shown radiating outward from the base of the foramen. Fine transverse striae cross the narrow area and then incurve and cross the pseudodeltidium.

The dorsal (brachial) valve has a well-defined area, with an obscure pseudodeltidium parting it midway. The cast of the interior of the valve shows two broad, shear-shaped diverging ridges that extend from near the apex to the center of the shell. Numerous vascular markings extend outward from the ridges. These ridges may indicate the muscular scars or merely the main trunks of the vascular depressions. The surface of the area is marked by fine transverse striae that abruptly incurve toward the front of the area, so as to follow along its anterior margin to the pseudodeltidium.

The surfaces of both valves, as shown in the casts, are smooth, except where marked by concentric lines of growth.

Shell substance unknown, but probably calcareous. It is dissolved away in all the specimens in the collection, only the impression of the shell remaining in the decomposed arenaceous limestone.

This species occurs in abundance, associated with *Billingsella festinata*, *Hyolithes americanus*, *Salterella conica*, new species, and fragments of *Olenellus*.

*Formation and locality.*—Lower Cambrian, York Terrane, on left bank of Codorus Creek, one-eighth of a mile below Meyer's Mill, near Emigsville, 4 miles north of York, Pennsylvania. (No. 26433, U.S.N.M.)

## YORKIA? WASHINGTONENSIS, new species.

(Plate LX, fig. 3.)

Ventral (pedicle) valve longitudinally ovate, depressed, convex. Area and pseudodeltidium invisible, but, from the character of the foramen and its resemblance to the foramen of *Y. wanneri*, it is probable

that the area was somewhat similar to the area of that species. The east of the interior of the ventral valve shows a rather long, large foramen, in advance of which two ridges (vascular trunks) diverge somewhat, as in the ventral valve of *Y. wanneri*. There is also present a short longitudinal depression in the east, which indicates a corresponding mesial ridge just in advance of the foramen. The surface of the interior of the shell is marked by fine concentric lines and very fine interior ridges. Shell substance apparently corneous.

This species is founded upon two semicasts of the ventral valve, preserved in compact gray limestone. The shell appears to be very thin over the outer portions and thick over the umbonal region.

The generic reference is somewhat doubtful, owing to the close generic relations of *Yorkia*, *Acrothele*, and *Discinopsis*. The foramen and form of the vascular trunks suggest *Yorkia*, while the shell substance and surface characters are more those of *Acrothele*.

*Formation and locality*.—Lower Cambrian, one-fourth mile east of Salem, Washington County, New York. (No. 26434, U.S.N.M.)

ACROTHELE DECIPIENS, new species.

(Plate LX, fig. 2.)

General form of the ventral (pedicle) valve nearly circular, the length and breadth being nearly the same; moderately convex, most elevated at the apex, which is truncated by a rather large foraminal opening. Cardinal slopes rounded, forming an obscure false area on each side of the flattened pseudodeltidium, which appears to have a slight groove down its center. Surface marked by fine concentric striae and lines of growth, which pass around back over the area and pseudodeltidium. Shell substance corneous, or it may be phosphatic. The shell has the same appearance as *Acrothele* and *Linnarssonina*.

Only one specimen of this shell was found associated with *Linnarssonina* and fragments of *Olenellus*, in a fine gray limestone interbedded in the Lower Cambrian shale. It resembles quite strongly the ventral valve of *Discinopsis gulelmi*, Matthew, illustrated by Hall and Clarke.<sup>1</sup> It differs, however, in the presence of an obscure pseudodeltidium, and for the present I prefer to place it with *Acrothele* until more is known of the genus *Discinopsis*.

*Formation and locality*.—Lower Cambrian, York Terrane, 1½ miles north of Stoner's Station, York and Wrightsville Railroad, York County, Pennsylvania. (No. 26435, U.S.N.M.)

ACROTHELE BELLULA, new species.

(Plate LX, figs. 4, 4a-4c.)

General form of valves subcircular, moderately convex. Ventral (pedicle) valve highest at the apex and perforated by a circular foramen, in front of which there are two small, short, sharp spines. The

<sup>1</sup> Pal. N. Y., VIII, Pt. 1, 1892, pl. III, fig. 20.

cardinal slope forms a narrow, rounded, obscure false area on each side of a small, low, slightly convex pseudodeltidium. Both the area and the pseudodeltidium are scarcely observable in most specimens. On casts of the interior the pseudodeltidium is more plainly shown (Fig. 4e), but the general surface of the exterior of the shell rounds into the false area, with scarcely any line of demarcation. A section of the cast of the ventral valve indicates that it was thin at the margin, increasing in thickness toward the apex, where it was as thick in proportion as in the ventral valve of the *Yorkia wanneri*. The cast Fig. 4e shows that on the interior of the shell there is the opening of a large foramen which tapers to a small apex, and that just in advance of the foramen a short median depression occurs, on each side of which a slight elongated tubercle arose. Outside of the tubercle a small, elongated, depressed muscle scar is seen, which was separated from a deep, strongly marked vascular sinus by a very narrow, sharp ridge. The vascular trunks start on the sides of the pseudodeltidium, just back of the foraminal opening, curving around it to the central muscle scars and then extending forward to the center of the shell. Small, round, lateral scars appear to be indicated back of a sharp ridge that bounds the postero-lateral margin of the vascular trunks.

Dorsal (brachial) valve with a nearly transverse hinge line that is considerably narrower than the greatest width of the shell. The cardinal slope forms a rather narrow area, which is broken midway by a low, slightly convex pseudodeltidium. The cast of the interior shows that there was present in the interior of the shell a median ridge that extended from under the beak forward beyond the center of the shell; on each side of the median ridge, beneath the umbonal portion of the shell, a hollow occurs between the ridge and what appears to be a slightly depressed path of advance of a muscle scar. The features described occur upon a siliceous cast preserving the natural convexity of the shell. In a compressed specimen in the shales in which the siliceous nodules occur, the median ridge is well shown, and extends to the center of the shell, where a pair of small anterior muscle scars rest against it. In front of the scars the ridge sends off a number of fine lines or striae toward the front of the shell; the antero-lateral scars occur on each side of the ridge, about one-half the distance from the beak to the front margin of the shell. The postero-lateral scars are also indicated toward the postero-lateral margin.

Surface of both valves marked by very fine concentric striae and extremely fine radiating lines of growth. Substance of shell corneous. It is not preserved in the siliceous nodules, but is shown as a black, almost phosphatic shell in the shales.

*Formation and locality.*—Middle Cambrian, Coosa shales, Cowans Creek, Cherokee County, Alabama. (No. 26436, U.S.N.M.)

## DESCRIPTION OF PLATES.

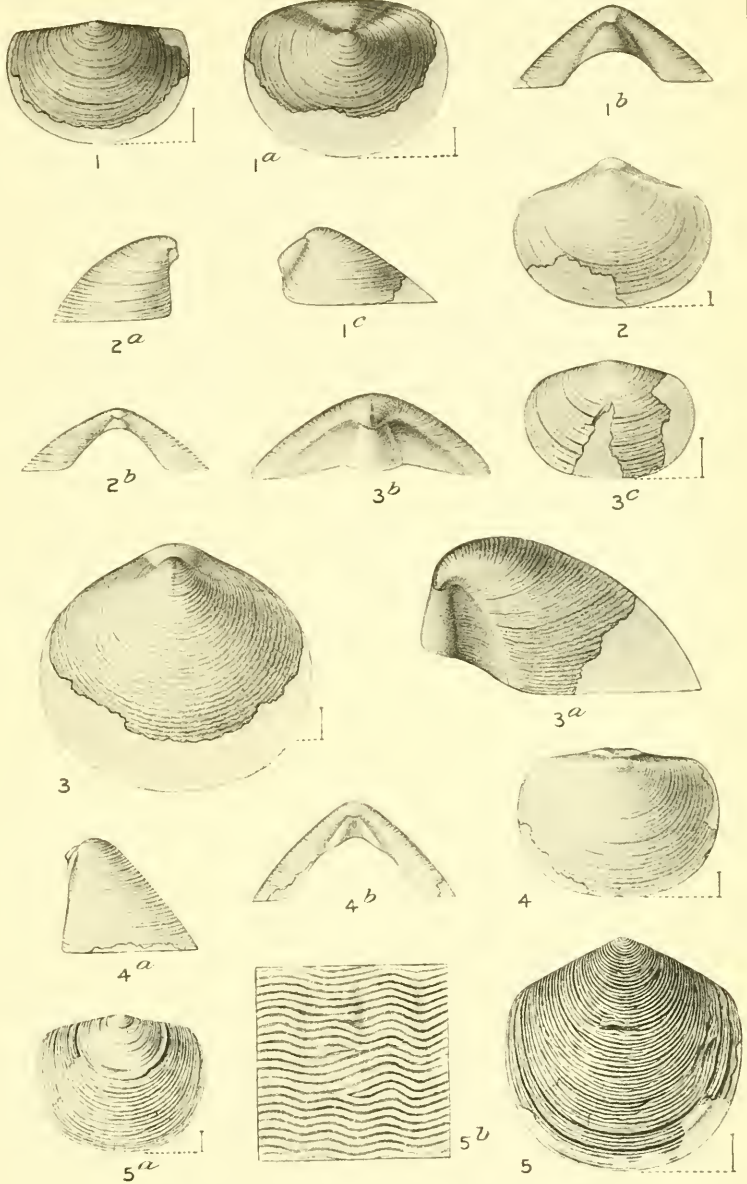
## PLATE LIX.

	Page.
Fig. 1. <i>Iphidea superba</i> .....	711
1. Dorsal valve. x 3.	
1 a. Summit view of ventral valve. x 6.	
1 b. Posterior view of ventral valve. x 6.	
1 c. Side view of ventral valve. x 6.	
2. <i>Iphidea logani</i> .....	711
2. Summit view of ventral valve. x 8.	
2 a. Side view of ventral valve. x 8.	
2 b. Posterior view of ventral valve. x 8.	
3. <i>Iphidea pealci</i> .....	712
3. Summit view of ventral valve. x 6.	
3 a. Side view of ventral valve. x 6.	
4. <i>Iphidea erenistria</i> .....	713
4. Summit view of ventral valve. x 6.	
4 a. Side view of ventral valve. x 6.	
4 b. Posterior view of ventral valve. x 6.	
5. <i>Iphidea alabamaensis</i> .....	713
5. Summit view of a compressed ventral valve. x 6.	
5 a. A small compressed dorsal valve. x 6.	
5 b. Enlargement of the surface side of a portion of the surface of fig. 5.	

## PLATE LX.

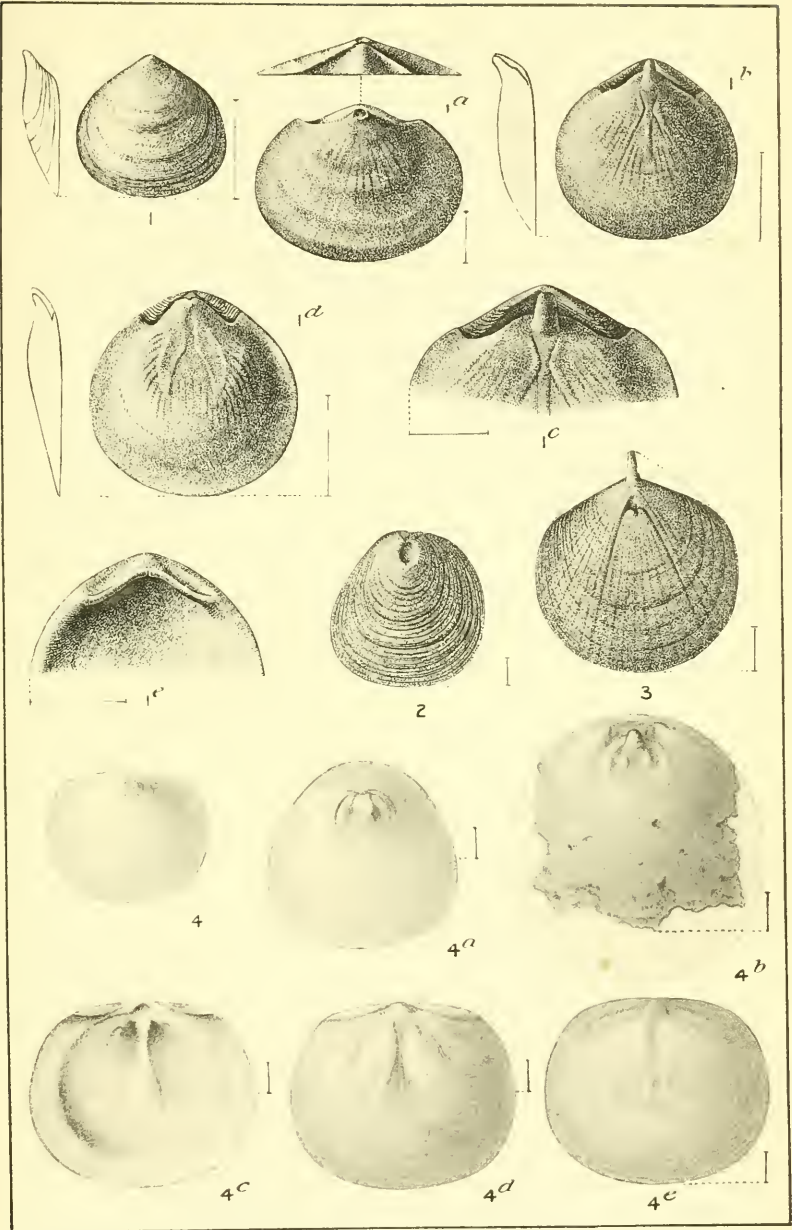
Fig. 1. <i>Yorkia wanneri</i> , new species .....	715
1. Exterior of ventral valve, with side outline. x $\frac{1}{2}$ . From east taken in natural matrix.	
1 a. Natural east of a ventral valve, with posterior view of area. x 3.	
1 b. Cast of interior of a ventral valve, with side outline. x 2.	
1 c. Enlargement of posterior half of fig. 1 b.	
1 d. Cast of interior of a dorsal valve, with side outline. x 2.	
1 e. Enlargement of the area and posterior portion of the interior of a dorsal valve. From a cast taken in a natural matrix.	
2. <i>Aerothole decipiens</i> , new species .....	716
2. Exterior of a ventral valve. x 6.	
3. <i>Yorkia? washingtonensis</i> , new species .....	715
3. Natural semecast of the interior of a ventral valve. x 4.	
4. <i>Aerothole bellula</i> , new species .....	716
4. Exterior of a ventral valve. x 6. Taken from east in a natural matrix in a siliceous nodule.	
4 a. Compressed ventral valve in shale. x 6.	
4 b. Natural east of the interior of a ventral valve. x 8.	
4 c. Interior of dorsal valve. Taken from a natural east of the interior occurring in a siliceous nodule. x 6.	
4 d. Natural east of an interior of a dorsal valve. x 6.	
4 e. Cast of the interior of a dorsal valve occurring in shale. x 6.	





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