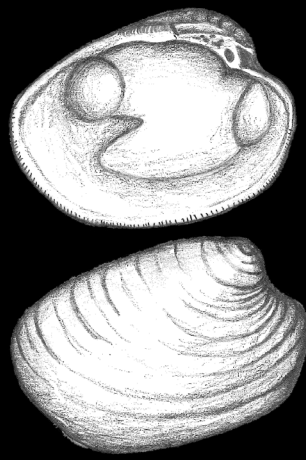
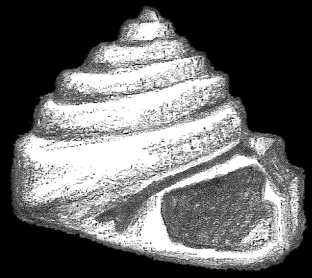
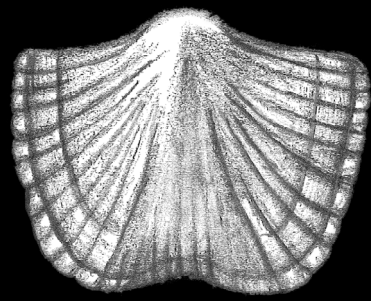
Identification Guide for Common Fossils of the Cincinnatian







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for information on how to use this guide

or

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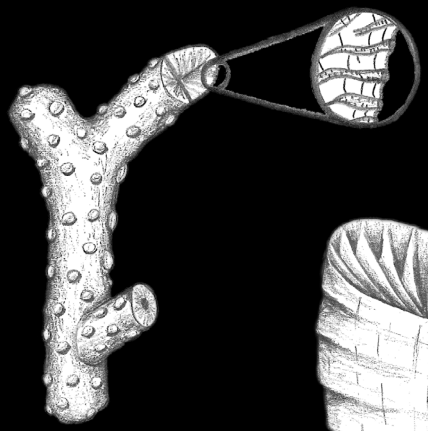

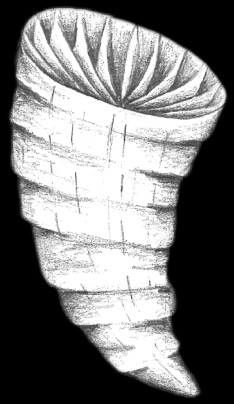

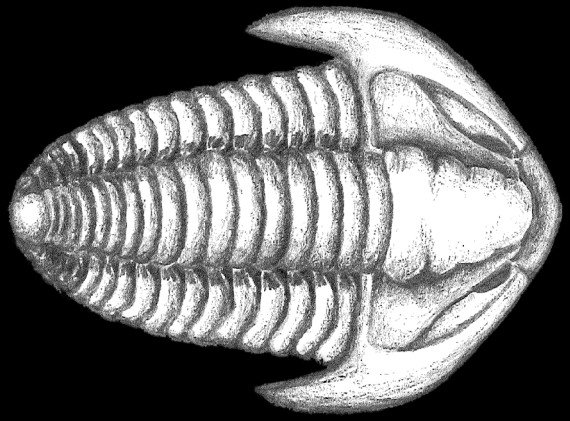

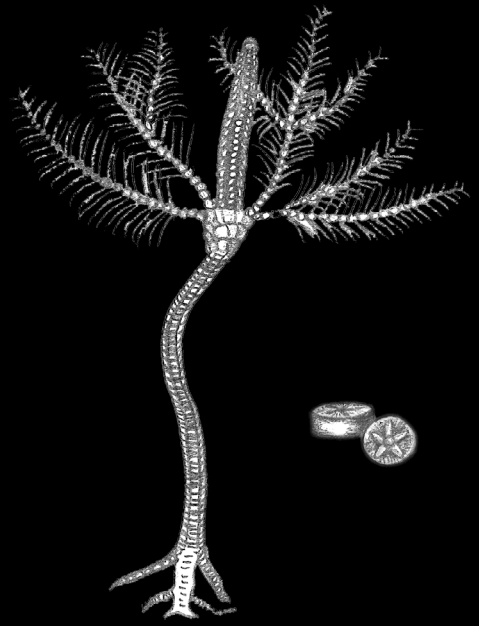

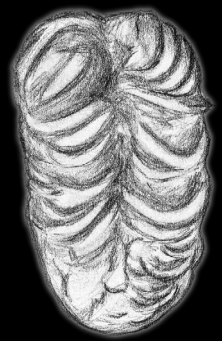

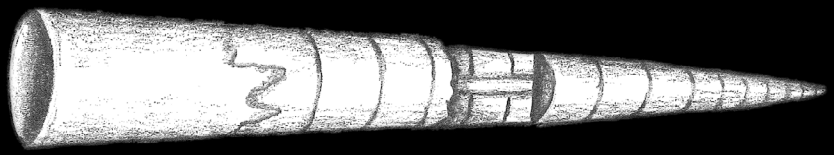

Instructions for use:

This is an interactive document. Hovering your cursor over pictures and certain text will turn your pointer into a little hand that looks like this:

If you click on any of these links, you will be taken right to the page with information about that fossil. You can always scroll through the pages too. We hope this identification guide is helpful to you!

Sincerely,

Cedarville University
Invertebrate Paleontology, 2013

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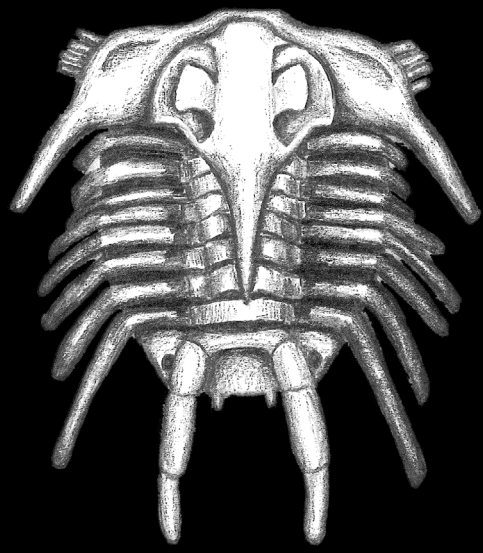
Note:
all photo scale bars are
one centimeter



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About the specimens:

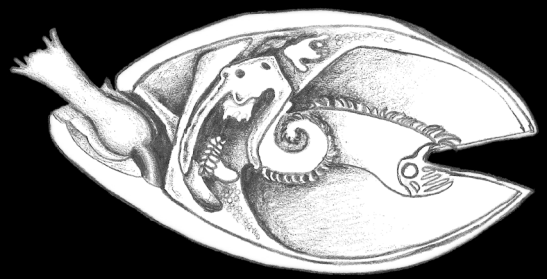
For more than thirty years, John Whitmore and his students have been collecting fossils from the Waynesville, Liberty, and Whitewater formations of the upper Ordovician. The fossils shown in this guide were primarily collected from outcrops in Camden and Waynesville, Ohio, and South Gate Hill, Indiana.

Calvin Anderson, Connor Smith (editors)

Brachiopods

Brachiopods are solitary marine organisms that live between two valves or "shells." They are very common in the Cincinnatian rocks of Ohio. They are externally different from the pelecypods (clams) in that the left and right halves of the brachiopod shells are usually mirror images of each other (see picture below). Internally, brachiopods are completely different from the pelecypods. Brachiopods feed with a special filtering organ called the lophophore which is located between the valves and attached to the brachial valve. The pedicle extends through a small opening or hole in the pedicle valve and is used as an anchoring device. The interior of the brachial valve is important in taxonomic differences between various species.

Brachiopod anatomy



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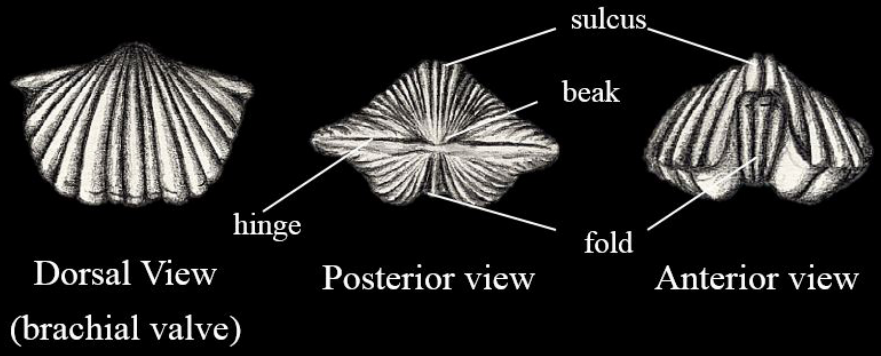
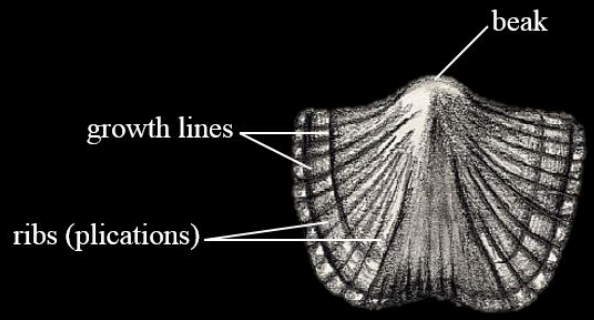
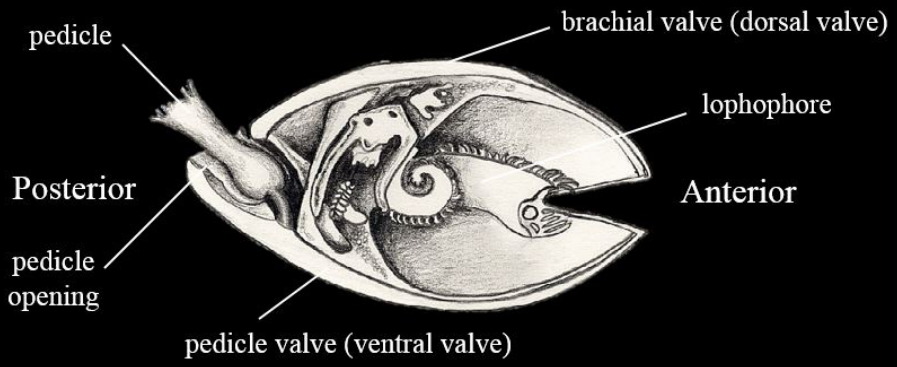
Dylan McKevitt, Matthew Cheney, Jorie Krob, Victoria Couser

Brachiopod Anatomy

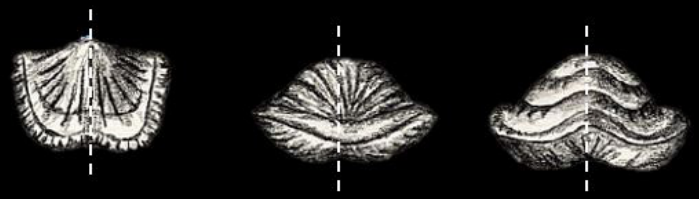






Brachiopod vs. Pelecypod Symmetry

The symmetry in brachiopod valves is usually perpendicular to the hinge line.



If pelecypod valves are symmetrical (and often they aren't), the symmetry is usually parallel to the hinge.

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Catazyga headi

This medium-sized (~2.0 cm wide) articulate brachiopod displays a smooth, rounded shell with faint striations. The pedicle valve has a minor sulcus. Note the unique pedicle opening on the pedicle valve.

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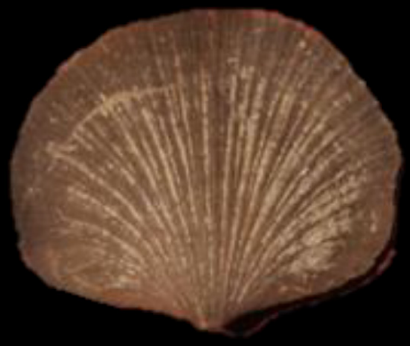
Cincinnetina

Cincinnetina meeki

Cincinnetina multisecta



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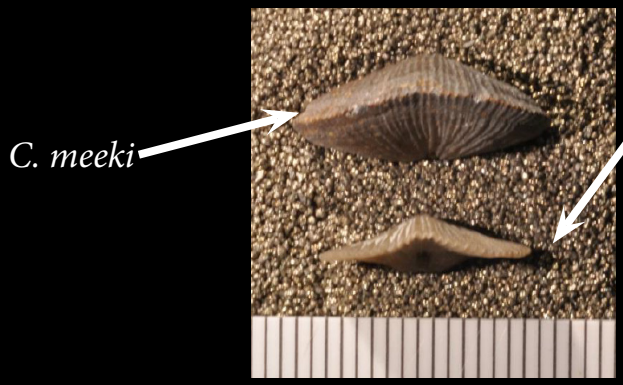
Cincinnetina meeki

Previously *Dalmanella meeki*, this small to medium sized (1.1-1.7 cm wide), gently biconvex brachiopod displays a shallow sulcus on the brachial valve, a mild fold on the pedicle valve, and a semicular to subquadrate outline. Sharp, fine, evenly-spaced and sometimes bifurcating striations sometimes intersect with growth lines to form a minor reticulate pattern. The hinge line is relatively short (about ⅔ of shell width). *C. meeki* is very similar to *C. multisecta*, but displays greater thickness, a more rectangular outline, a sharper sulcus, and larger average size.



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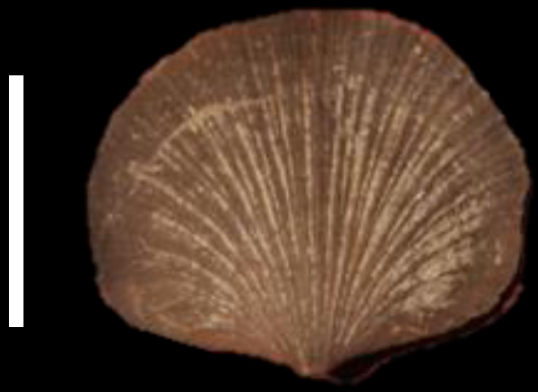
Cincinnetina multisecta

Previously *Dalmanella emacerata* or *multisecta*, this species displays very similar morphology to *C. meeki*. It differs in having a shallower sulcus, slightly smaller average size, and being less thick. Many specimens display caved-in dorsal valves, due to depositional conditions and the valve's thin wall.



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Glyptorthis insculpta

This medium sized (2.5 cm wide), biconvex brachiopod displays a more inflated, sulcus-bearing brachial valve. *G. insculpta* is similar to *Hebertella* and *Plaesiomys* in external morphology, but is distinguished by a rectangular outline and coarse, radiating ribs and concentric growth lines whose intersection produces a reticulate ornamentation on the exterior of both valves.

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Hebertella

Hebertella alvaeata

Hebertella occidentalis

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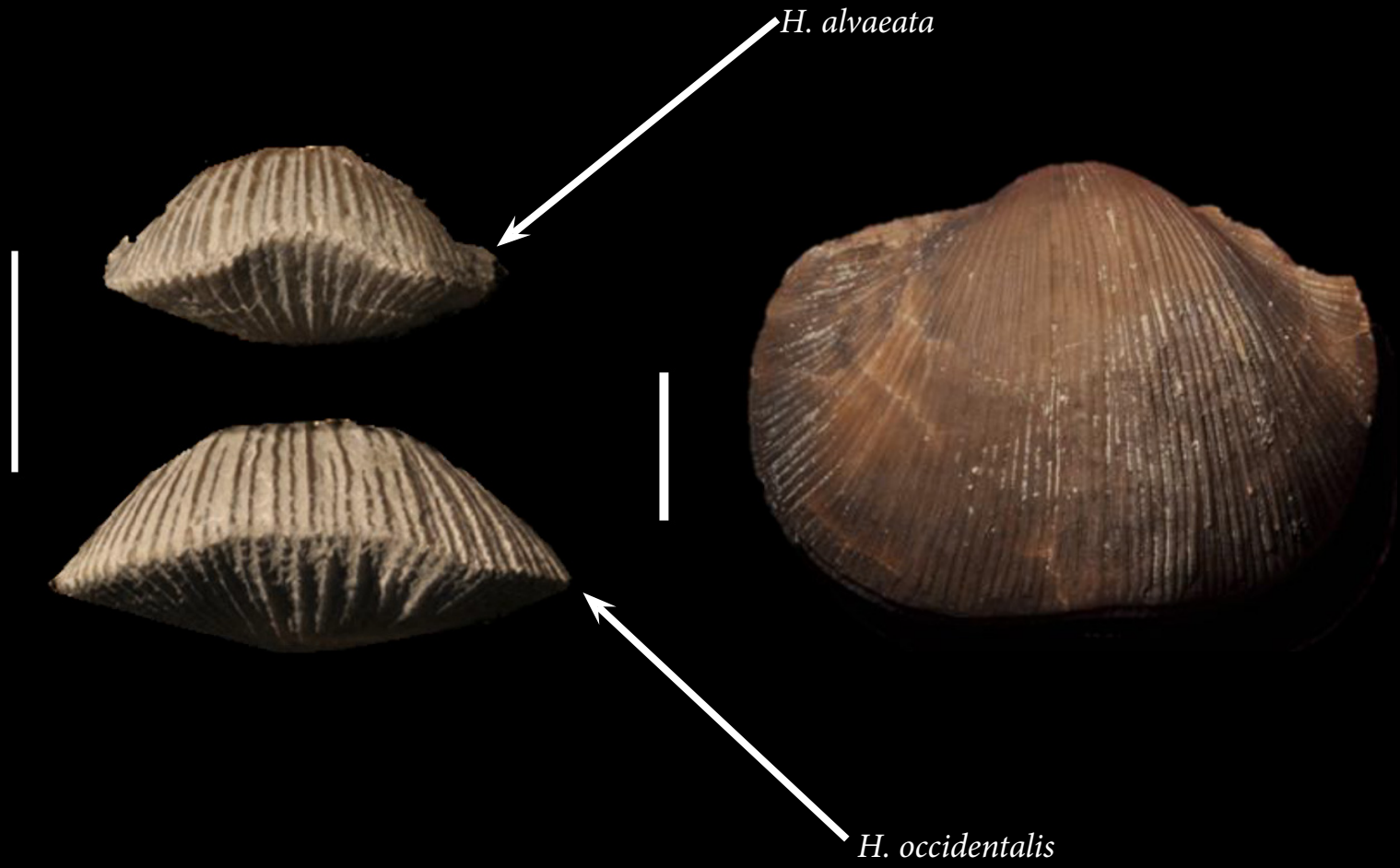
Hebertella alvaeata

Very similar to *Hebertella occidentalis*. A distinguishing characteristic of *H. alveata* is that the sulcus in its dorsal valve runs to the anterior margin.



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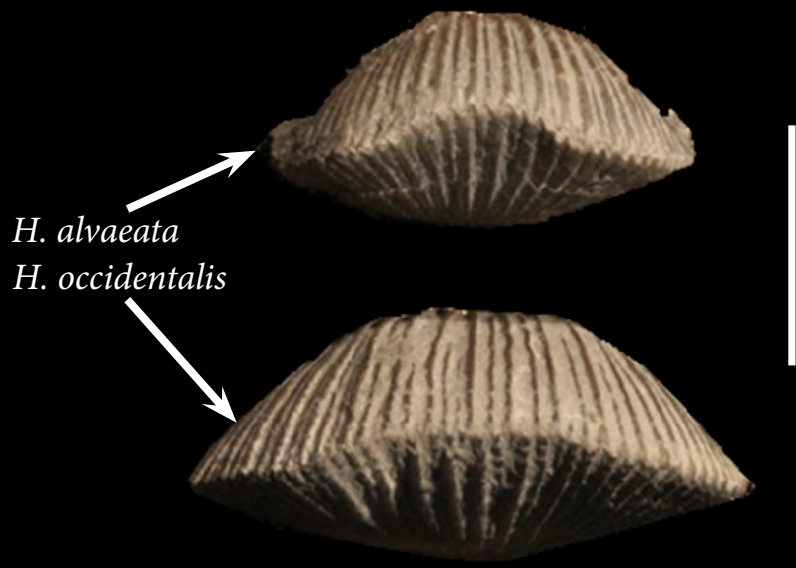
Hebertella occidentalis

Both valves on this brachiopod are globular with rays running straight to the margin. There is a beak on the margin of the shell. The radiating ornaments are stronger than the concentric ornaments. The shell of this brachiopod has more than 40 radiating ribs and includes both a fold and very shallow sinus. The shell is easily recognizable in that it is large (more than 2 cm wide) and very thick.



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Hiscobeccus capax

H. capax is a small (0.8-2.0 cm), biconvex brachiopod with smaller specimens appearing triangular in outline. It displays a rounded beak and three major plications in the sulcus (differing from *Rhynchotrema dentatum*). H. capax is very similar to *Lepidocyclus perlamellosus*, yet it tends to be smaller and has less distinct (but still noticeable) growth lines crossing the plications.

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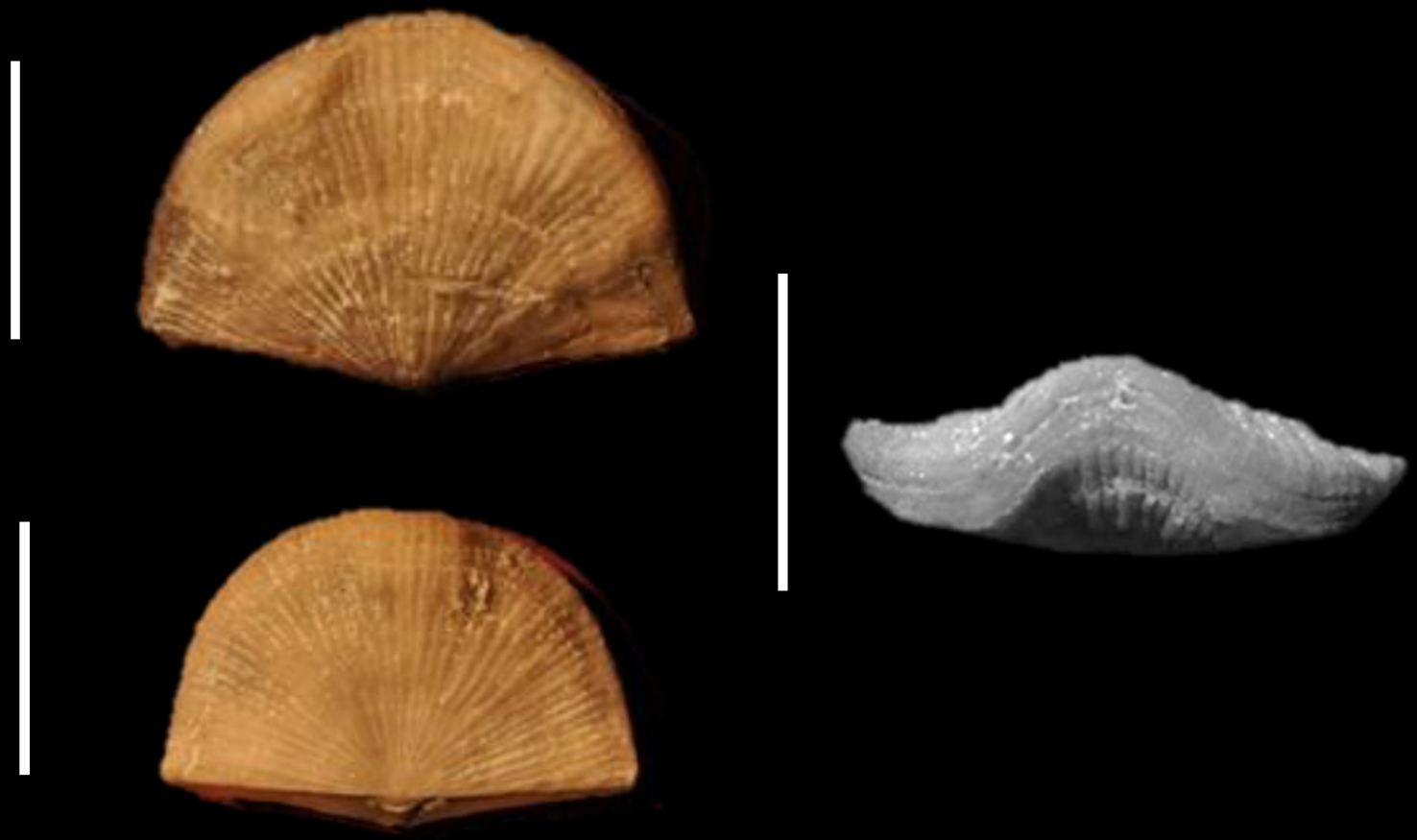
Holtedahlina sulcata

This small to medium sized (1.5-2.0 cm wide), slightly biconvex species has a semicircular outline. Coarse striations on both valves are often "wavy," and may intersect concentric growth lines. Some specimens display conspicuous thickening; others are nearly flat due to depositional processes. *H. sulcata's* defining characteristic is a deep sulcus in the pedicle valve.



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Lepidocyclus

Lepidocyclus capax

Lepidocyclus perlamellosus

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Lepidocyclus capax

L. capax is very similar to *L. perlamellosus*, but differs in being "thicker" and more rounded, with the sulcus not as deep and lateral "wings" not as apparent.

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Lepidocyclus perlamellosus

This medium-sized (2.0-2.5 cm), biconvex brachiopod has three plications in the sulcus (differing from *Rhynchotrema dentatum*). It is very similar to *Hiscobeccus capax* but is slightly larger and displays more distinct (very conspicuous) growth lines.

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Leptaena richmondensis

This small to medium (2-3 cm wide) concavo-convex brachiopod has fine radiating ribs and a semicircular to rectangular outline. Characteristic irregular, concentric wrinkles ornament the exteriors of both valves. The anterior margin sometimes displays significant thickening. A sharp flexure in the shell near the anterior margin is common.

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Petrocrania scabiosa

This small (averaging 1.0 cm wide) inarticulate brachiopod displays a thin, oval, white phosphatic shell. It commonly grows on *Rafinesquina ponderosa* valves (see arrow) sometimes so closely that the underlying host shell's striations show through.

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Philhedra laelia

This small (~0.5 cm) circular, unique inarticulate brachiopod displays prominent, coarse plications radiating outwards from a central "high." It commonly grows along with *Petrocrania scabiosa* on *Rafinesquina* valves (see arrow).

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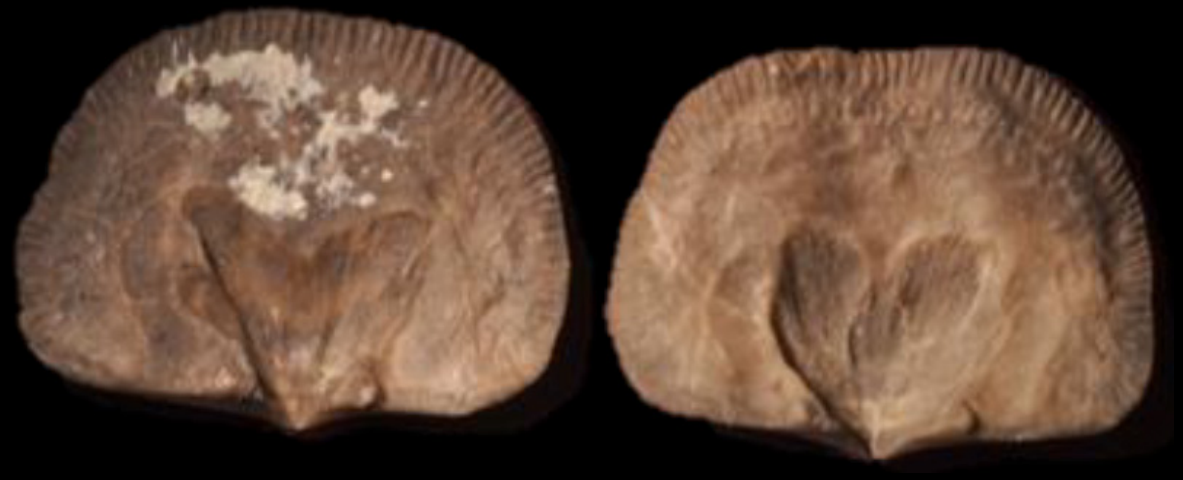
Plaesiomys subquadrata

This medium sized (2.5-3.5 cm wide) brachiopod displays a subquadrate (nearing circular) outline and fairly short, straight hinge line. It ranges in profile from convexi-concave to unequally biconvex. Coarse, irregularly bifurcating striations (ribs) curve near the shell margin. Similar to *Glyptorthis, P. subquadrata* lacks the reticulate pattern and has differently-shaped muscle impressions on the pedicle valve's interior.



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Platystrophia

Platystrophia acutilirata

Platystrophia clarksvillensis

Platystrophia cypha

Platystrophia hopensis

Platystrophia laticosta

Platystrophia moritura

Platystrophia ponderosa

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Platystrophia acutilirata

This brachiopod is large with a width that is greater than its length and contains strong radiating ribs. This brachiopod has three almost equally developed plications in the sulcus. There are ten or more plications on either side of the sulcus. The brachiopod contains a low, rounded fold.

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Platystrophia clarksvillensis

This brachiopod is both large and biconvex with a width that is greater than its length with strong radiating ribs. They have three almost equally strong plications in the median sinus. Both of the valves are convex almost to the outer edge. They have eight or nine plications on either side of the sulcus. Also, both valves are convex to the outer edge.

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Platystrophia cypha

This brachiopod is large and biconvex with a width that is greater than its length. These brachiopods have a very strong median plication in the sulcus. There are nine or more plications on either side of the fold. The sides of the pedicle valve are flattened and hollowed out.

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Platystrophia hopensis

This brachiopod is small with coarse plications. There is a fold in the brachial valve and a sulcus in the pedicle valve.

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Platystrophia laticosta

This brachiopod is medium sized and has a width that is greater than its length with strong radiating ribs. They have seven ribs on either side of the sulcus and fold and three plications in the sinus. The medial plications should be the strongest. These brachiopods are also exactly like *Platystrophia hopensis* except that it is larger. It also appears sharper with a higher fold.

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Platystrophia moritura

This is a medium sized brachiopod whose width is greater the its length. It also has strong radiating ribs. These brachiopods have three equally developed plications in the sulcus with greater than ten plications on each side of the fold. Their pedicle valve is convex to the outer edge and is not flattened.

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Platystrophia ponderosa

This brachiopod is known for its large size and thick shell with strong ribs. It also is globular in shape. There are three costa in the pedicle valve and three costa in the brachial fold. There are two subspecies.

Platystrophia ponderosa aubernensis

Platystrophia ponderosa

Platystrophia ponderosa ponderosa

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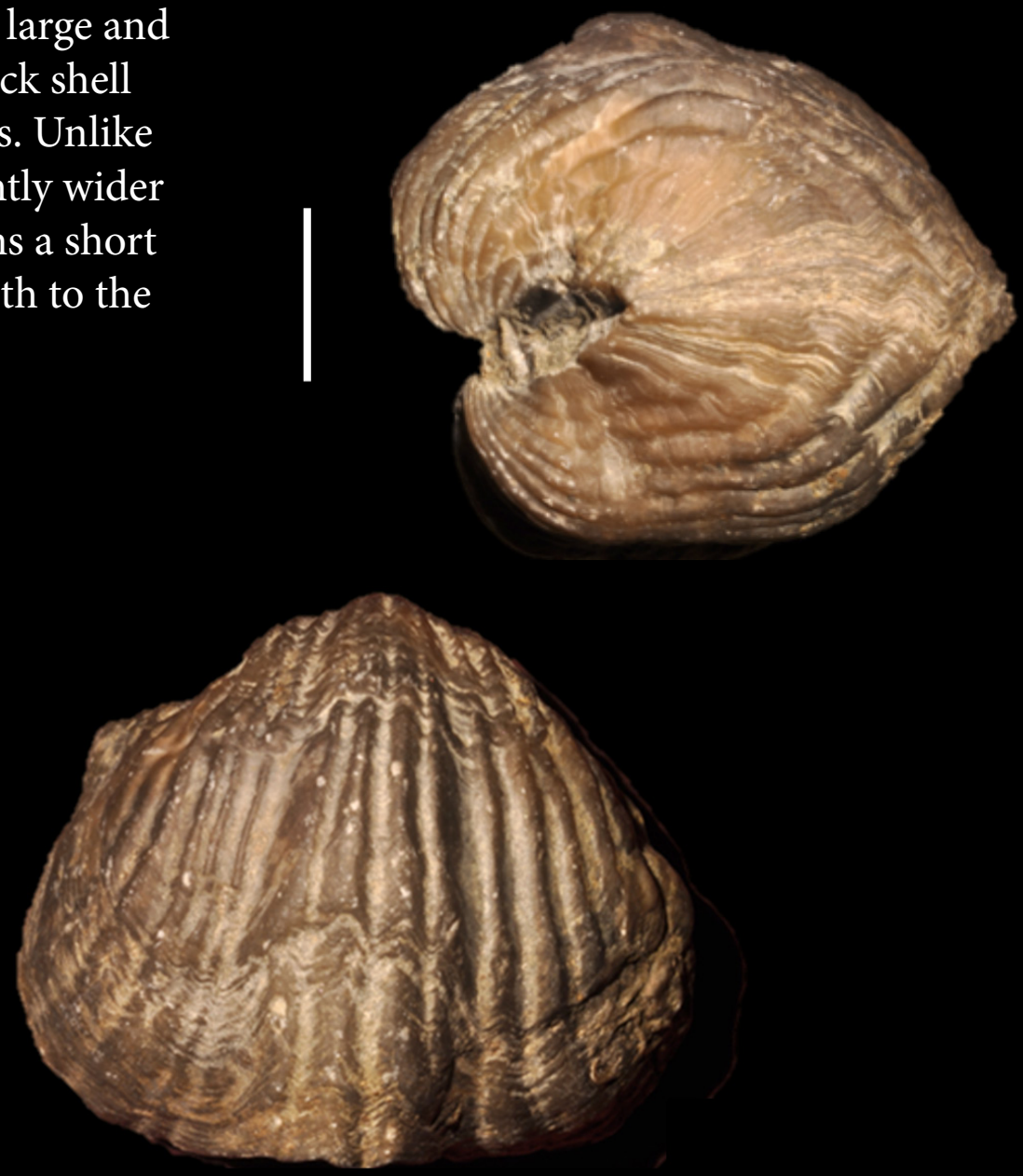
Platystrophia ponderosa aubernensis

This brachiopod is both large and biconvex with a very thick shell and strong radiating ribs. Unlike the others it is only slightly wider than it is long. It contains a short hinge line and great depth to the shell.



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Platystrophia ponderosa ponderosa

This brachiopod is known for its larger size and its very thick shell with strong radiating ribs. Unlike the others it is only slightly wider than long. Also, most have a triangular pedicle opening.

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Plectorthis

Plectorthis fissicosta

Plectorthis plicatella

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Plectorthis fissicosta

A small (1.2-1.8 cm wide), biconvex brachiopod with a rectangular outline. Similar to *Plectorthis plicatella*, it differs by having more numerous and often splitting plications, a generally larger size, and a slight sulcus and fold.

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Plectorthis plicatella

A small (0.8-1.1 cm wide), biconvex brachiopod lacking a sulcus and fold. It differs from *Plectorthis fissicosta* with a generally smaller size and plications that are less numerous and non-splitting.

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Pseudolingula sp.

This unique inarticulate brachiopod has a triangular to oblong outline and small size (1.5-2.0 cm long). It displays concentric growth lines and white, phosphatic shell material.

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Rafinisquina

Rafinesquina fracta

Rafinesquina nasuta

Rafinesquina ponderosa

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Rafinesquina fracta

R. fracta is very similar to *R. ponderosa*. It differs in being very thin (almost flat) and tending to be longer than wide.

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Rafinesquina nasuta

R. nasuta is very similar to *R. ponderosa* but displays a characteristic anterior extension that may even take the shape of a minor fold, giving the shell a more triangular outline.

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Rafinesquina ponderosa

R. ponderosa has a semicircular outline, straight hinge line, numerous fine radiating ribs on both valves, and a large size (4.0-5.0 cm), with length and width approximately equal. It often displays significant anterior-margin thickening, and the pedicle valve is generally more convex than other *Rafinesquina* species.

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Rhynchotrema dentatum

This biconvex brachiopod is similar to *Lepidocyclus* and *Hiscobeccus*, but can easily be differentiated by its more pointed beak, smaller size (1.0-1.5 cm wide), and single fold in the sulcus.

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Sowerbyella

Sowerbyella rugosa

Sowerbyella sp.

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Sowerbyella rugosa

S. rugosa displays a semi-circular outline, concavo-convex profile, and small size (~1.5 cm wide). It also has a wide, straight hinge line and numerous, very fine ribs. It differs from *S. sp.* (or *Thaerodonta clarksvillensis*) by having concentric wrinkles along the front margin and a smaller size.

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Sowerbyella sp.

This species is very similar to *S. rugosa*, but is distinguished by a smooth exterior, sometimes visible hinge-line denticulations, and generally larger size with somewhat smaller width relative to length. It also displays septa (plate-like structures) in the brachial valve. Limited and overlapping literature makes confident identification of the exact species difficult.

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Strophomena

Strophomena concordensis

Strophomena nutans

Strophomena planoconvexa

Strophomena planumbona

Strophomena vetusta

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Strophomena concordensis

S. concordensis displays delicate striations and the absence of a sulcus and fold. It lacks conspicuous thickening of the anterior margin. It differs from similar species by having a relatively large size (2.0-4.0 cm wide), triangular outline, and the interior muscle area is not strongly fan-shaped nor ornamented with radial ridges.

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Strophomena nutans

Like *S. concordensis*, *S. nutans* displays a triangular outline, delicate striations, and the absence of a sulcus and fold. However, *S. nutans* has a smaller size (1.5-2.5 cm wide), a small and deep muscle impression inside the pedicle valve, and a noticeably thickened anterior margin.

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Strophomena planoconvexa

This species displays a characteristic muscle scar, medium size (2.5-3.0 cm), semicircular outline and a relatively straight hinge line. Irregular, coarse striations differentiate it from similar *Strophomena* species.

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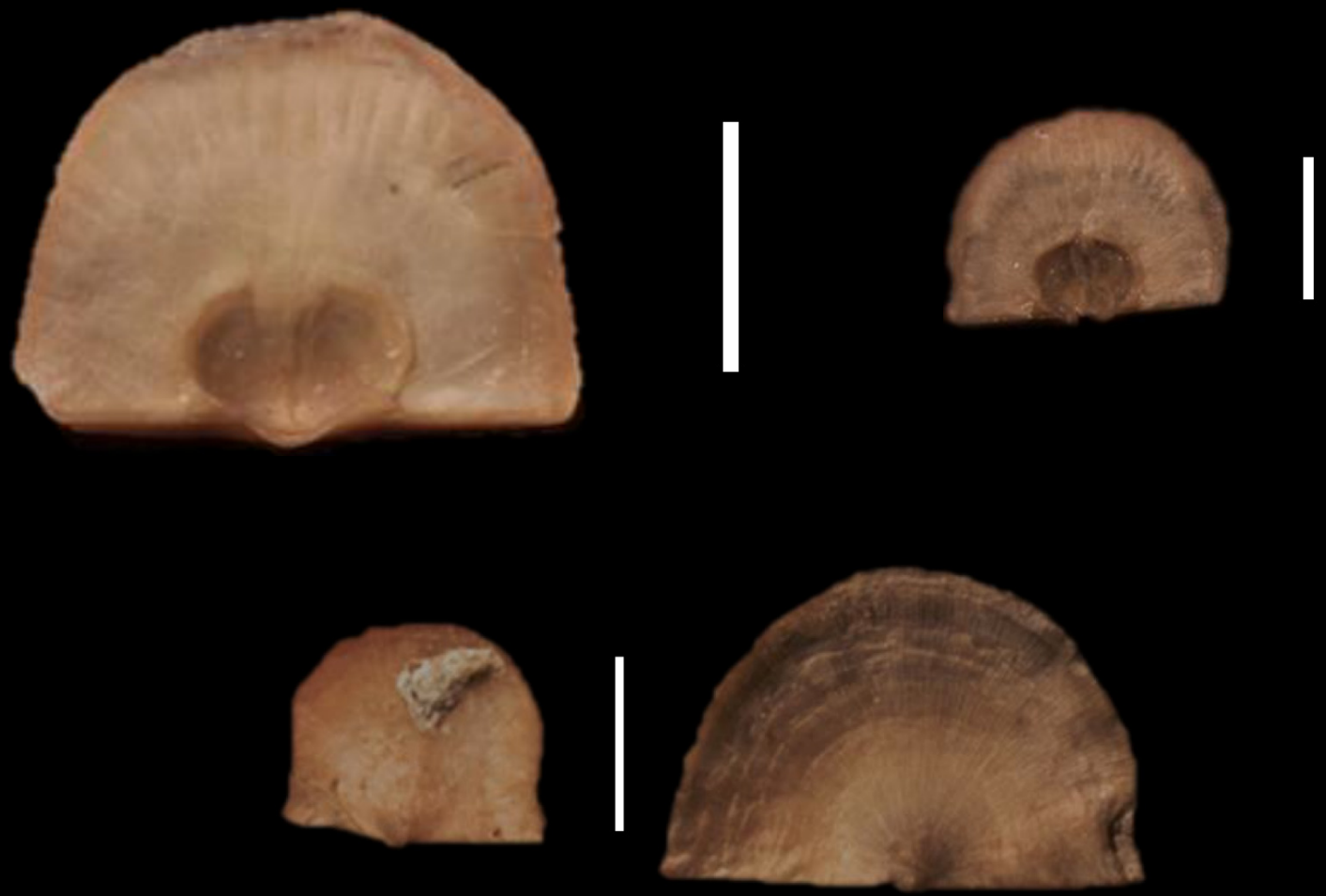
Strophomena planumbona

S. planumbona displays fine striations and a rectangular outline. It differs from similar species by having a relatively small size (1.5-3.0 cm wide).



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Strophomena vetusta

S. vetusta is similar to other Strophomena species in outline, size, and striations. However, a set of four parallel ridges on the interior of the brachial valve and wrinkles along the shell's edge near the hinge line set it apart.

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Tetraphalerella neglecta

This medium to large (2.5-3.0 cm wide) concavo-convex brachiopod has fine striations, a semicircular outline, and lacks a well-defined sulcus and fold. It is very similar to *Strophomena* but lacks a strongly triangular outline and displays characteristic muscle impressions inside the pedicle valve that are fan-shaped with radial ridges.

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Trematis millepunctata

This small (1.3-1.8 cm wide) inarticulate brachiopod displays a low, convex pedicle valve with a lenticular pedicle opening. Its brachial valve is less convex than the pedicle valve. Characteristic pitting covers the shell in diagonal rows. It may be found grown onto or encrusted by bryozoans (note the two prints of bryozoan-encrusted shells).

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Zygospira modesta

This biconvex brachiopod is easily identified by its very small size (3-7 mm wide), circular to sub-circular outline displaying nearly equal width and length, and coarse plications.

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Unidentified

This small (0.4 cm wide) brachiopod appears to have grown onto the valve of a *Cincinnetina meeki* (note the valve margin of unidentified brachiopod grown down between the striations of the host shell). It displays coarse striations, a triangular outline, and differs from *Philhedra laelia* by having a raised "beak." It resembles the pedicle valve of *Zygospira modesta*.

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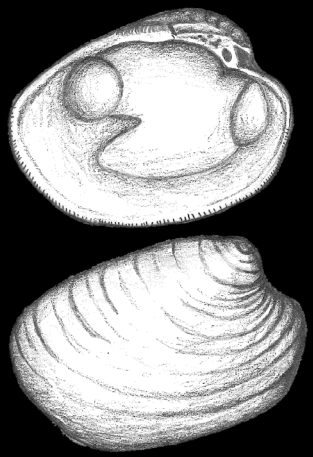
Pelecypods

Pelecypoda, now known as Bivalvia, contains mollusks such as mussels, oysters, clams, and scallops. The pelecypods are composed of a right and left valve which is joined in the middle by a hinge. Generally the valves are of equal size, with a few exceptions and are composed of calcite. Large muscles known as adductors hold the valves together and can demonstrate muscle scars within fossilized specimens. The plane of symmetry is parallel to the hinge line. Most pelecypod fossil specimens are preserved as internal molds. The pelecypods originated in the Ordovician and have only slightly declined up to the present.

Pelecypod Anatomy

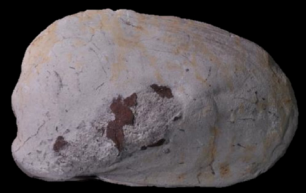


Ambonychia robusta

Anomalodonta gigantean

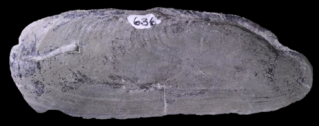
Caritodens demissa

Crytodontula umbonata



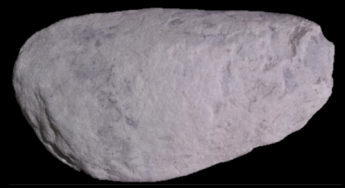
Cycloconcha milleri

Cymatonota typicalis



Ischyrodonta elongata

Modiolopsis



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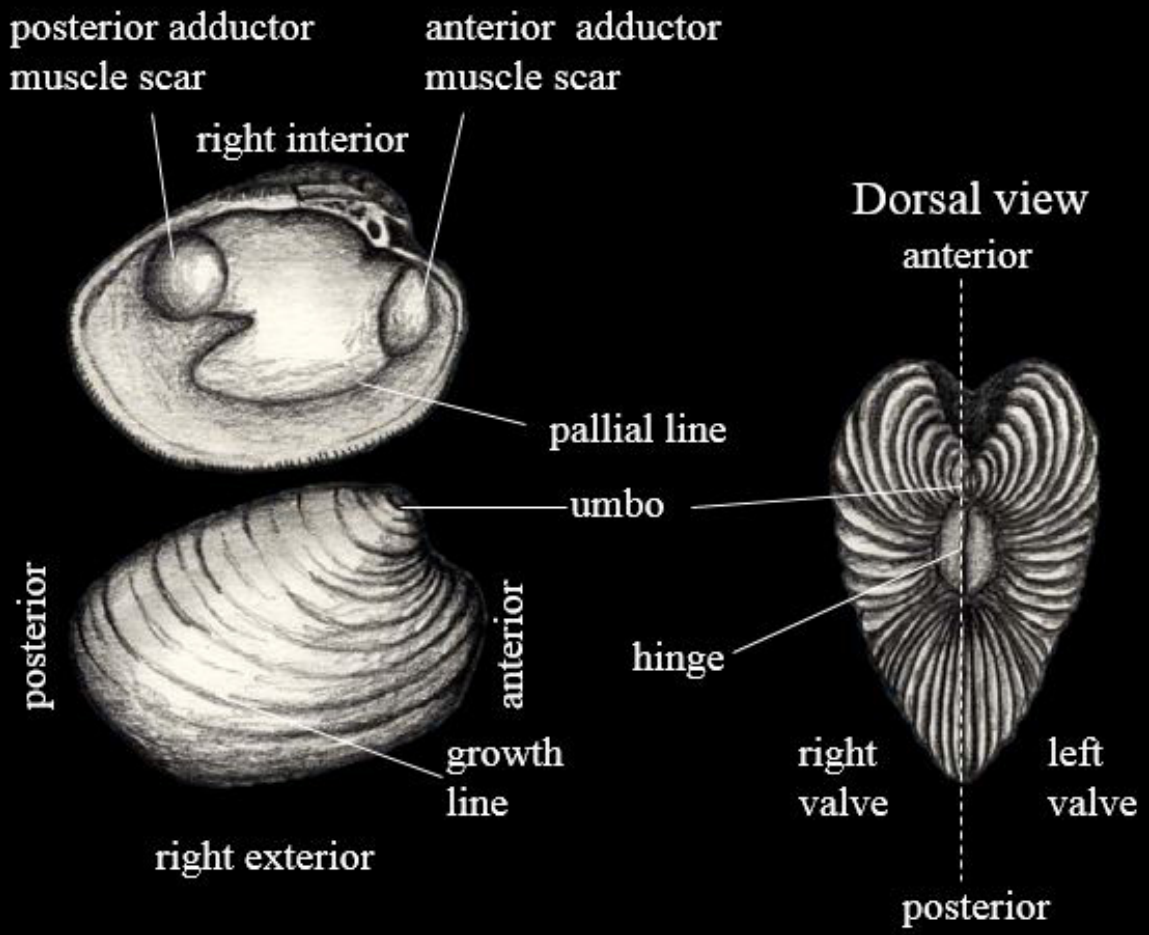
Dylan McKevitt, Matthew Cheney, Jorie Krob, Victoria Couser

Pelecypod Anatomy



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Ambonychia robusta

One of the most common pelecypods in the Cincinnatian demonstrates very fine radiating rib structure and a terminal beak. Average length ranges from 2-7cm, prominent beak structure on both sides of hinge line escutcheon. The finer radiating rib (costae) structure distinguishes this specimen from other pelecypods.

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Anomalodonta gigantean

One of the largest Cincinnatian pelecypods, it can reach 9cm in length. The dominating characteristic is broad, coarse radiating ribs. A small number of concentric growth lines can be seen as well, along with a prominent beak.

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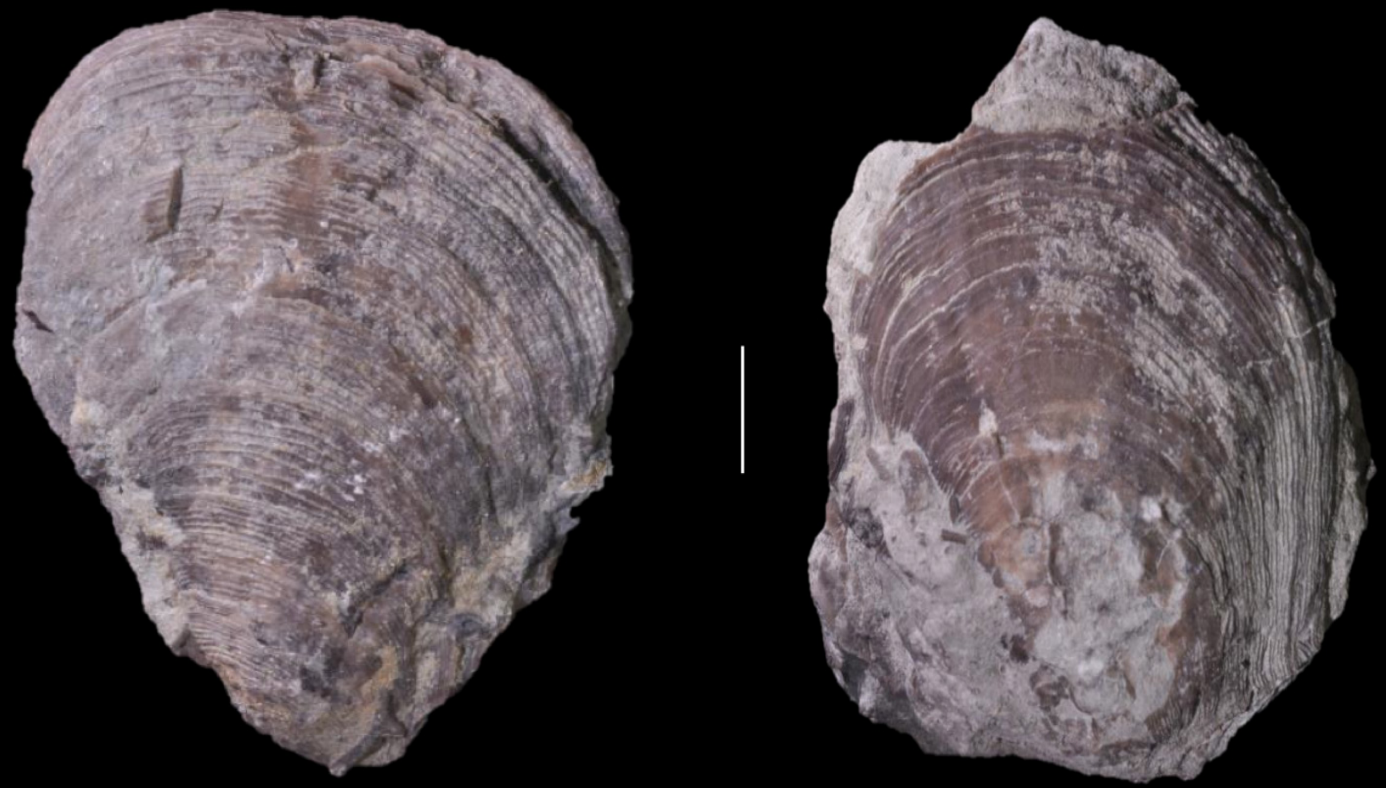
Caritodens demissa

This common pelecypod specimen demonstrates very fine concentric growth lines which are in close proximity to one another. The hinge line separates the wing features of this fossilized pelecypod with the beak slightly off center. Size can reach 7cm in length.



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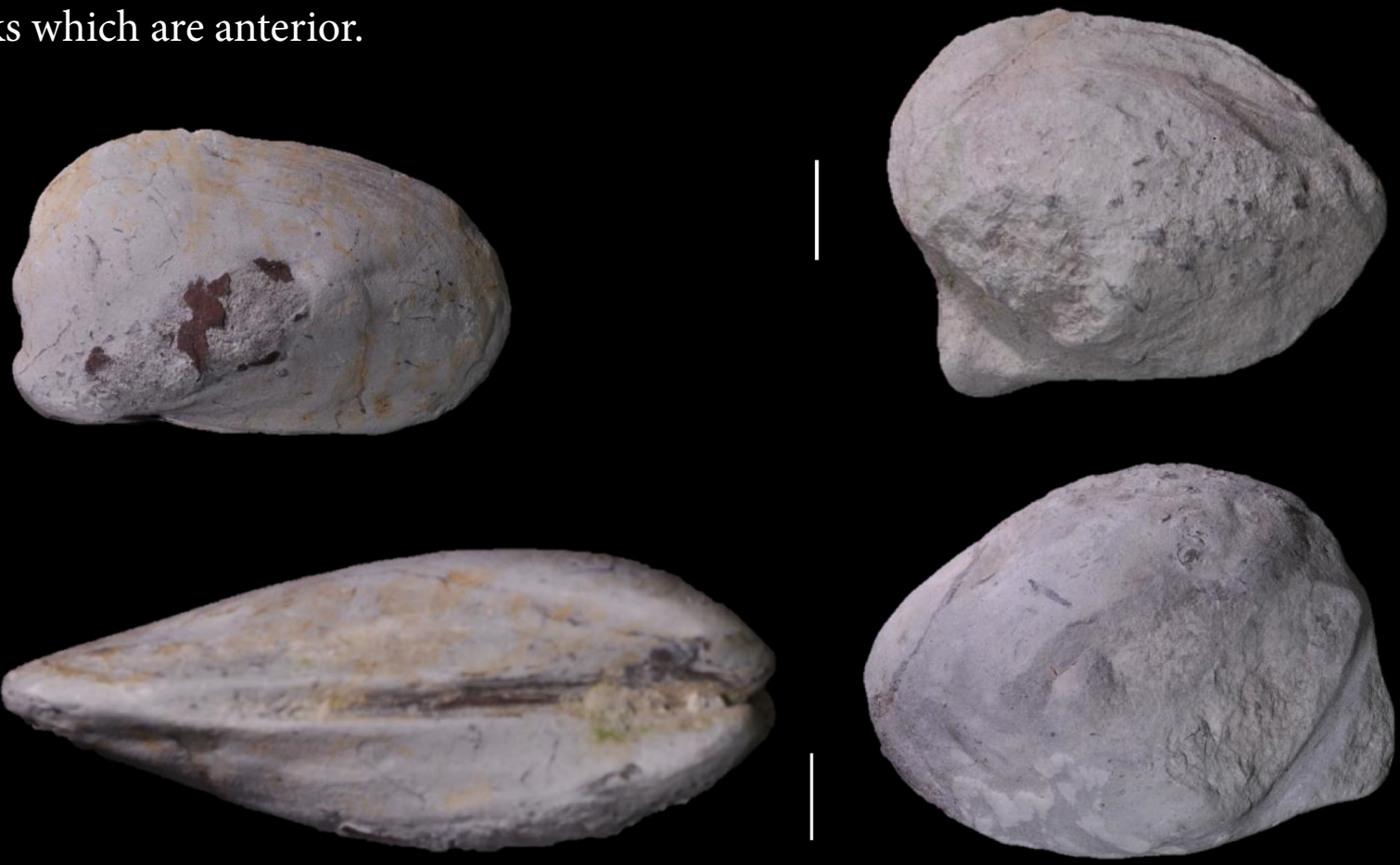
Crytodontula umbonata

This specimen is characterized by its large thickness when compared to other pelecypod species. The length ranges in size from 3-7cm and beaks are prominent, parallel to the hinge line. Another distinguishing characteristic is the position of the beaks which are anterior.



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Cycloconcha milleri

Smallest of the pelecypod specimens, ranging in size from 0.5-1cm in length. This specimen demonstrates anterior beak position which is still distinguishable regardless of the small size of this fossil.

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Cymatonota typicalis

This pelecypod specimen demonstrates an elongate shell, with its length being at least three times its height, on average 9cm in length. The beaks are difficult to identify, while the uniform hinge line demonstrates a prominent internal ridge, running the length of the fossil. Concentric growth lines and muscle impressions are almost nonexistent.

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Ischyrodonta elongata

This specimen can be distinguished from other fossils, specifically Modiolopsis, due to an internal diagonal ridge that runs from the beak to the lower margin of the organism. This ridge separates the right and left valve parallel with the hinge line. In some examples concentric rib structure can be seen, specimens are within the 3-6cm range and beaks are appear inconspicuous.

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Modiolopsis

The lack of an internal diagonal ridge separates this fossil pelecypod from other examples, specifically *Ischyrodonta elongate*. The narrowest region of the pelecypod is near the beak. The length, averaging 5cm, always exceeds the height in this specimen.

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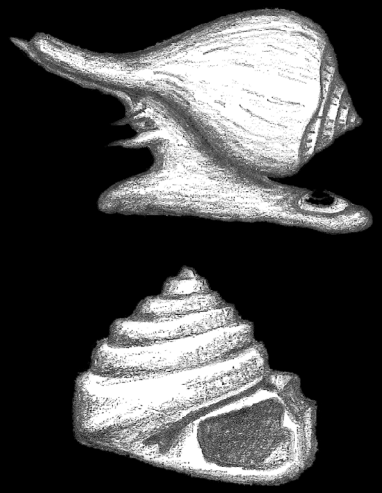
Gastropods

The gastropods, or snails, are extremely diverse inhabiting marine, fresh water and terrestrial environments. Their shell can coil in a conical (conispiral) or in in single plane (planispiral).

Gastropod Anatomy



Clathrospira

Cyclonema

Cyrtolites

Liospira

Loxoplocus

Salpingostoma

Sinuites

Tropidodiscus

Euryzone or Tetranota

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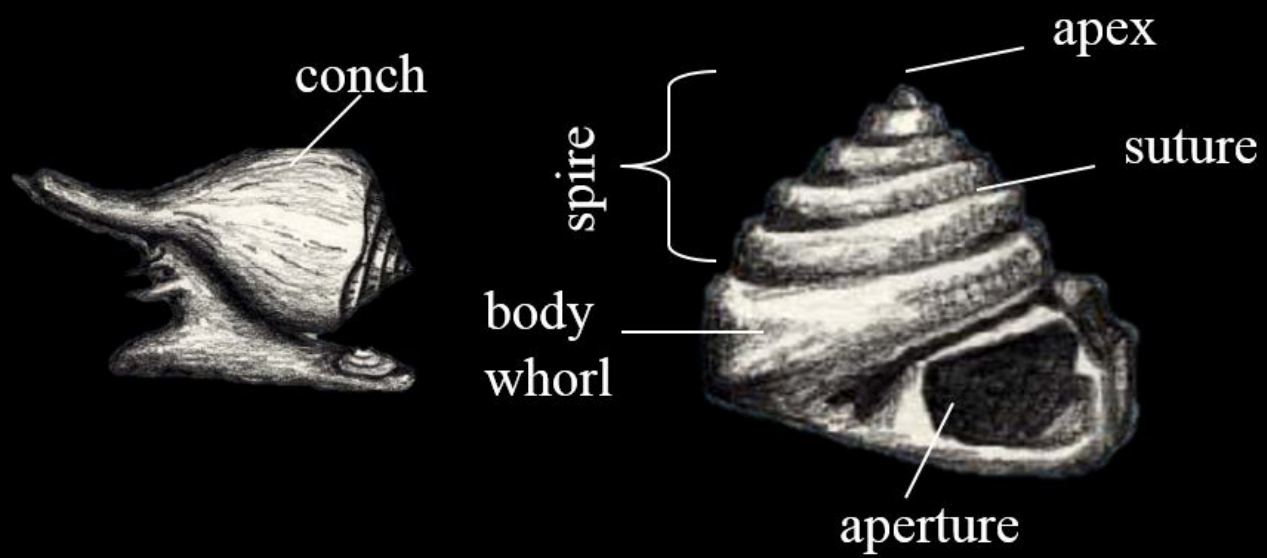
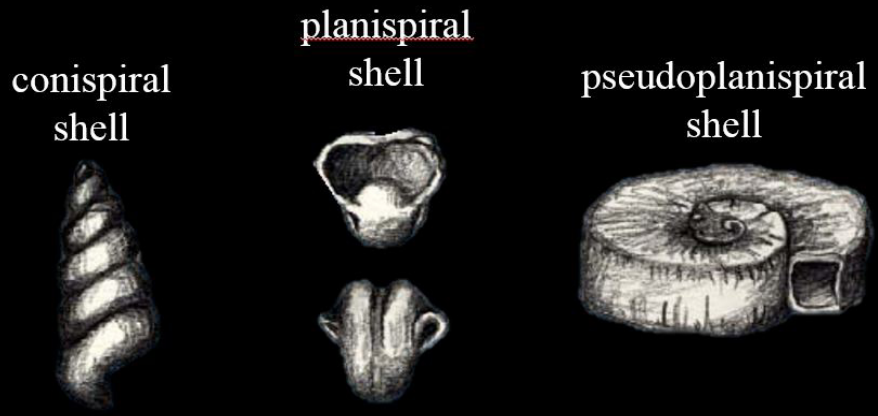
April Menendez

Gastropod Anatomy





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Clathrospira subconica

Medium sized and broadly turreted. The largest specimens illustrated here is about 3 cm in width. Conispirally coiled.

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Cyclonema

Cyclonema

Cyclonema bilix lata

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Cyclonema

A gastropod characterized by its fine costae that coil around the shell. 0.5 to 2.5 cm in width. 1 to 2.5 cm in height. Conispirally coiled.

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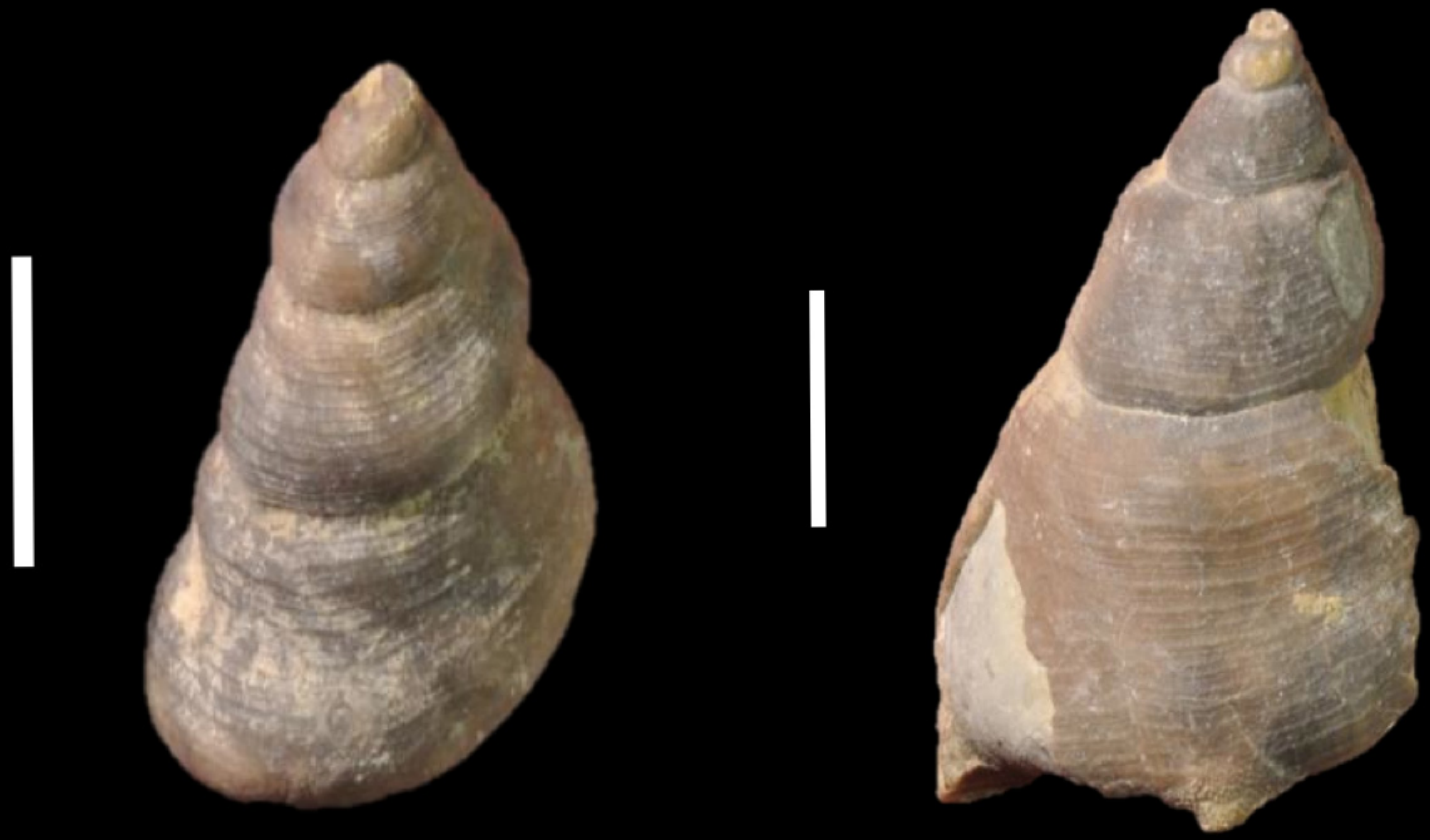
Cyclonema bilix lata

This can be distinguished from other species of *Cyclonema* by its large size, height, and additional whorls. It also has a medial groove in the largest whorl. Conispirally coiled.



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Cyrtolites ornatus

This species may belong to the Monoplacophoran class of mollusks instead of the Gastropoda. *Cyrtolites* is characterized by its large size, and distinct shell ornamentation. Planispirally coiled.

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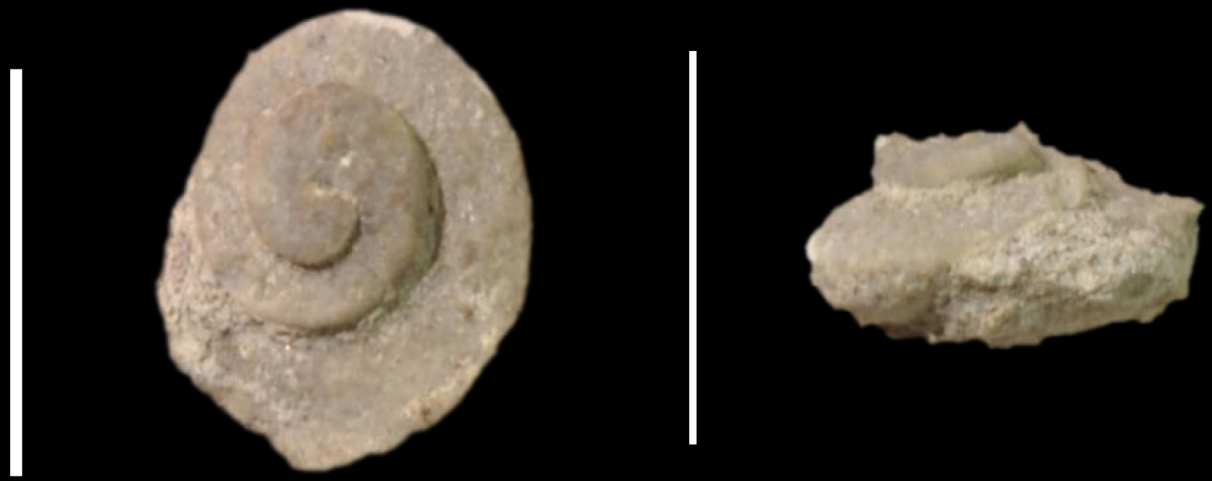
Liospira vitruvia

A small gastropod, about 1 cm in diameter and 0.3 cm in height. Conispirally coiled, but not in a tall cone.



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Loxoplocus bowdeni

Medium sized, high turreted form with a keel running around the shell. The internal molds of this species is common and usually do not show the keel. Conispirally coiled.

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Salpingostoma

A large gastropod that is planispirally coiled. Specimens are about 3-4 cm in diameter.

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Sinuites cancellatus

A planispiral gastropod 1-4 cm in diameter. This species may belong to the class Monoplacophora instead of Gastropoda.

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Tropidodiscus magnus?

A small pseudoplanispiral gastropod
with distinct ornamentation on its shell.

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Euryzone arata or Tetranota bidorsata?

A medium sized gastropod with a flat and rounded form. Sizes from 2 to 1 cm in diameter. Planispirally coiled.

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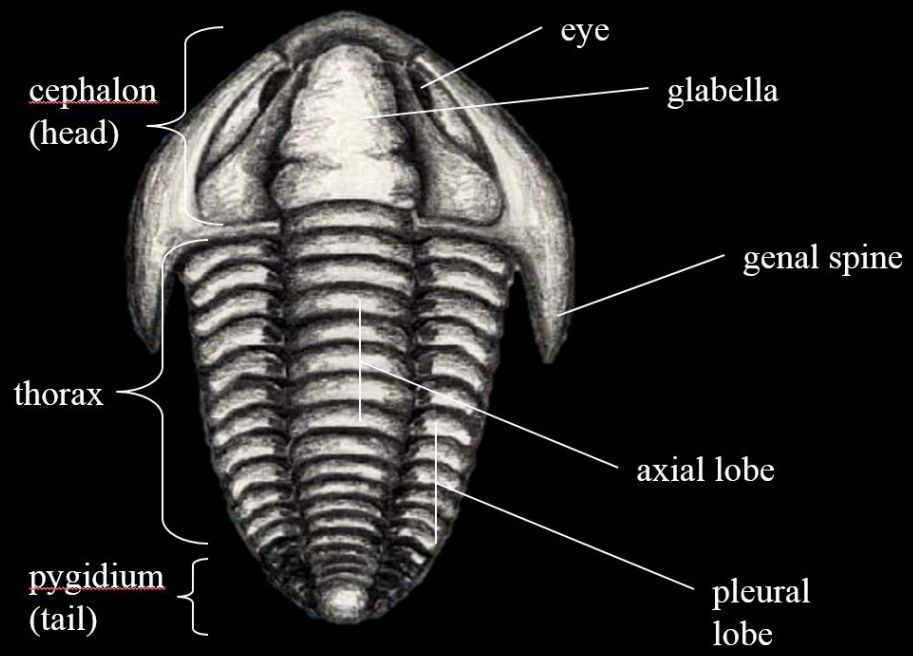
Trilobites

Trilobites were a bottom dwelling marine arthropod (like crabs), only known from fossils. They often molted as they grew, so their heads and "tails" are often found preserved rather than their entire body.

Trilobite Anatomy



Acidaspis

Ceraurinus

Tricopelta

Isotelus maximus

Isotelus gigas

Flexicalymene granulosa

Flexicalymene meeki

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Chris Griffin

Acidaspis cincinnatiensis

The pygidium, or tail lobe, has smaller spines between a pair of larger spines (see picture). Large genal spines (cheek spines) protrude from the cranidium (main head segment). The thorax (body lobe) is made of ten segments.

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Ceraurinus Icarus

Very rare trilobite. The cephalon (head) is rounded, and the thorax (body lobe) consists of eleven segments. The pygidium (tail lobe) is small and has three pairs of spines, the largest blunt, the smaller two ending in a sharper point (see pictures).

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Flexicalymene granulosa

Can be differentiated from *Flexicalymene meeki* by its smaller size and a less sharp anterior border of the glabella (central part of head). Covered with small bumps.

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Flexicalymene meeki

Most common trilobite in the Cincinnatian, and are often found whole, rolled up into a protective ball. Thorax (body lobe) has 13 segments, and the glabella (central part of head) is sub-triangular in shape, with three furrows on either side. The genal spines, or cheek spines, are small and rounded/ blunt.

Click here for a high resolution image of *Flexicalymene meeki*

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Flexicalymene
meeki

Isotelus maximus

A common and often large trilobite; specimens can exceed 50 cm in length, and it is the Ohio state fossil. The cephalon and pygidium (head and tail lobes) are sub-triangular, flat, and shallow, appearing to be covered by a "shield," and lacks spines on the pygidium. One of the most common fragments found are the large, long genal spines (cheek spines). Often large hypostomes (mouthparts) may be found (see picture).

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Isotelus gigas

Extremely similar to *Isotelus maximus*. I. gigas can be distinguished by a lack of genal spines (or possibly very short genal spines) and more triangular margins of the cephalon and pygidium (head and tail lobes).

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Tricopelta breviceps

Small trilobite with relatively large eyes and a glabella (central part of head) covered with bumps, and small genal spines (cheek spines) are present. The thorax (body lobe) has 11 segments, and the pygidium (tail lobe) is moderately large and subtriangular, with no spines.

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Cephalopods

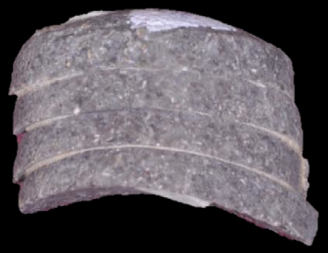
Cephalopods are members of the phylum Mollusca and include squid, octopi and the pearly nautilus. Cincinnatian cephalopods were straight shelled squids. The siphuncle connects the cameras (chambers) together. The squid could pass air to the chambers via the siphuncle to make it float higher in the water or sink as it swam.

A living shelled cephalopod. Modern cephalopods, with the exception of one species lack shells.

siphuncle

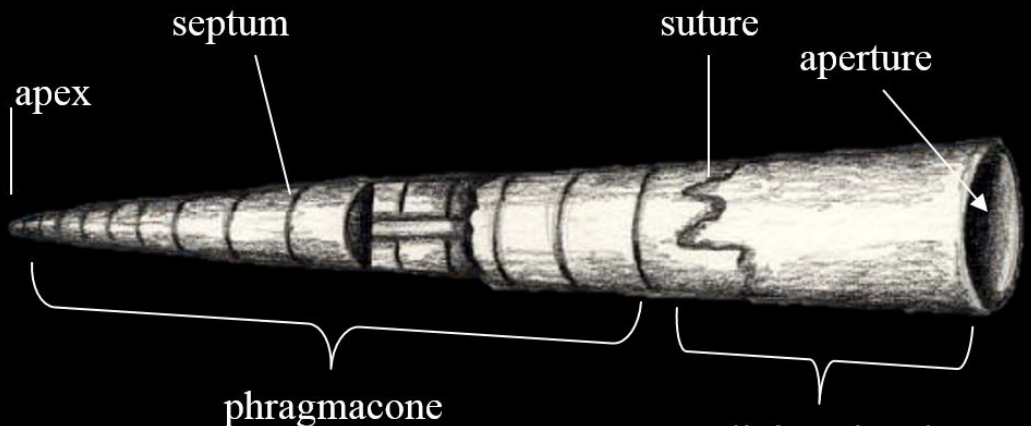
camera (chamber), often containing cameral deposits

Cameroceras



Stenodomatoceras

Treptoceras



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Nolan Shula

Cameroceras inaequabile

This is the largest known orthoconic cephalopod in Ohio. Individuals can grow up to 210 cm long and have diameters of up to 20 cm. The siphuncle is rather large, and is situated near the ventral shell wall. If the siphuncle is not preserved during fossilization, the shell can compress, giving the shell a flattened or "D" shaped appearance.

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Treptoceras duceri

These orthoconic cephalopods can grow up to 60 cm in length and are the most common cephalopod in the Cincinnatian. The shell is very cylindrical, much more so than Cameroceras inaequabile. Also, the siphuncle is much smaller than that in Cameroceras inaequabile and forms small beads when fossilized.

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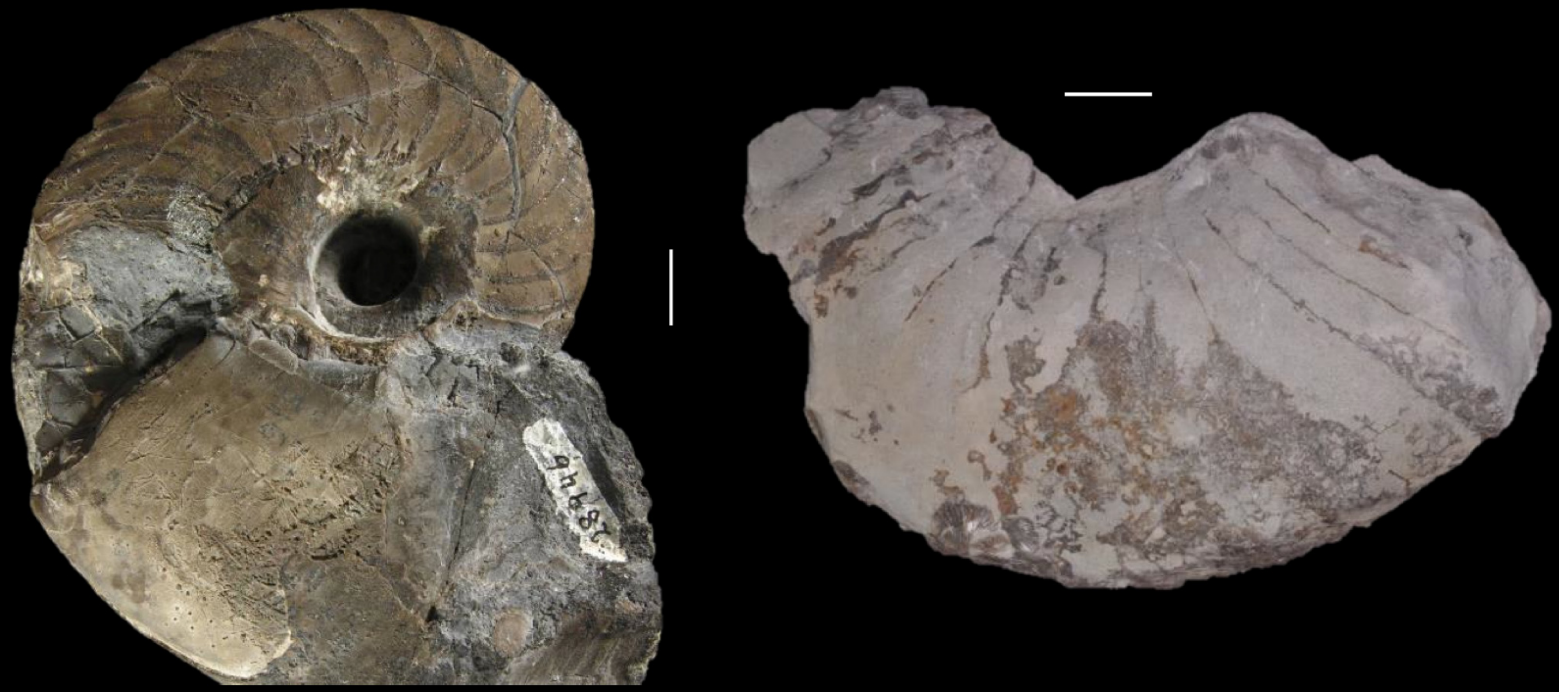
Stenodomatoceras gardi

This nautiloid cephalopod is curved in the typical nautilicone fashion. It is coiled planispirally. Individuals can grow larger than 11 cm long, 6 to 8 cm wide, and roughly 5 cm deep. This species is also common in the Pennsylvanian.



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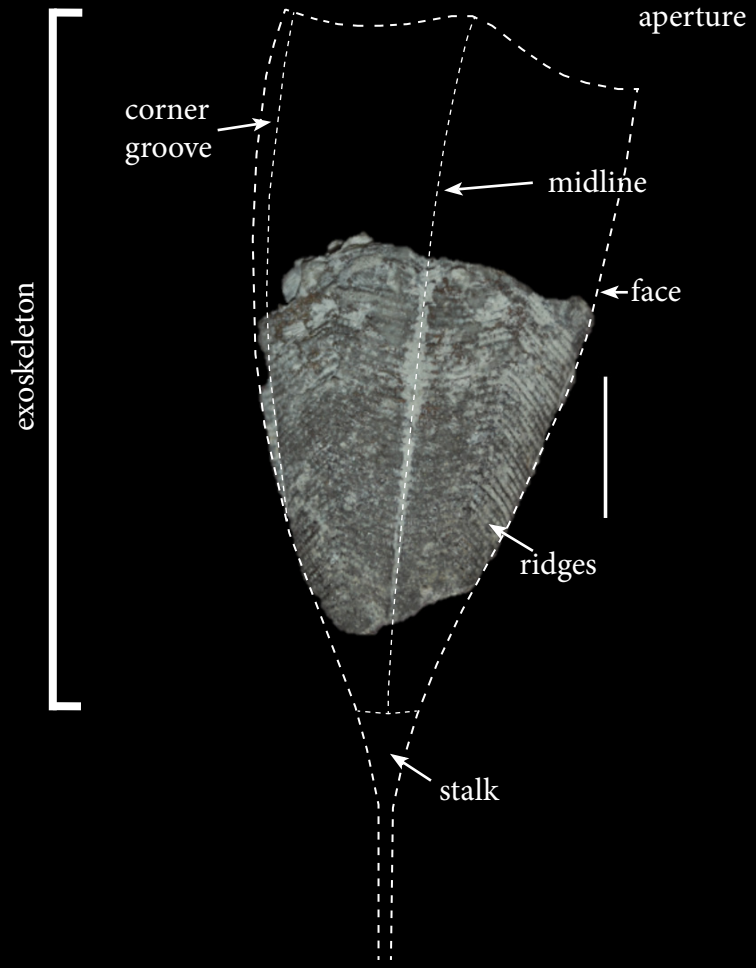
Conulariids

Conulariids have a four sided, pyramidal exoskeleton that has an aperture at the wide end and a closed apex at the other end. They have bilateral symmetry, with two major faces that are wider and two minor faces that are narrower. The curved ridges are formed by a thickening of the exoskeleton, called a rod, which gives the exoskeleton extra support. C. formosa average a length of 2 to 3 cm in length, with the aperture end measuring 1 cm or slightly more and the apex end measuring roughly ¾ cm.



Conularia formosa

Nolan Shula

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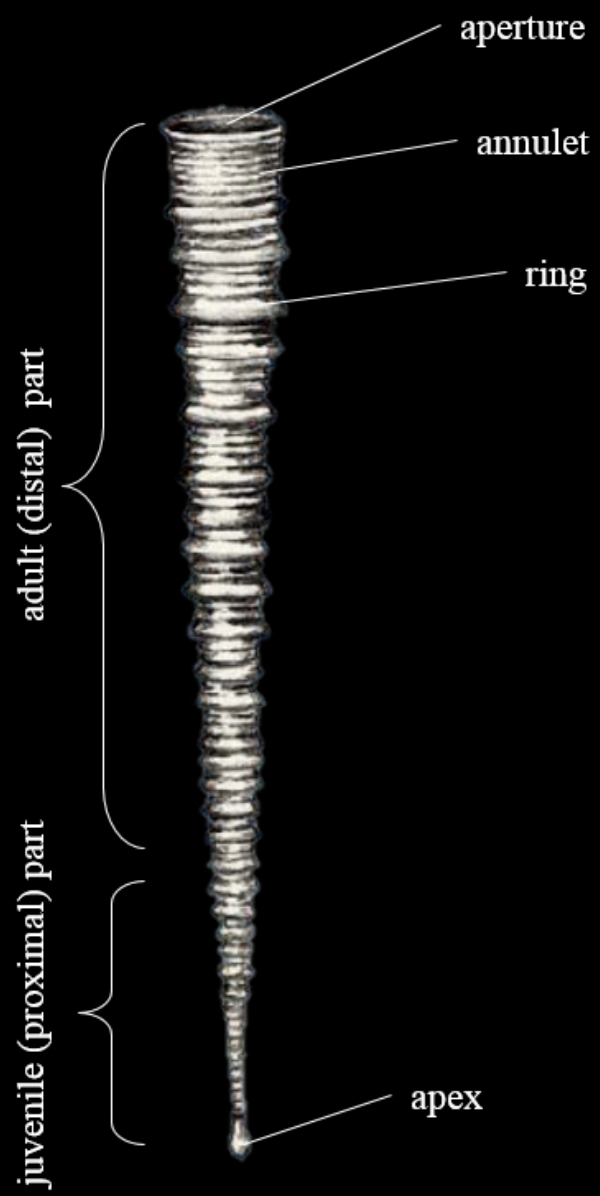
Tentaculitids

Tentaculitids are a group of extinct marine invertebrates whose taxonomic affinity is uncertain. They are usually small, and conical shaped. Sometimes their shells disarticulate and are found as small rings. Sometimes numerous shells can be found on the same bedding plane, suggesting mass mortalities of the animals. Tenticulitoida is a subclass of phylum Mollusca, and individuals have calcium carbonate shells.

T. richmondensis

T. sterlingensis



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Nolan Shula

Tentaculites richmondensis

Shells are straight or slightly curved and run 25 to 30 mm long and 2 to 3 mm wide at the aperture. There is a gradual increase in ring size from the proximal to the distal end, with 20 to 30 rings in all. Also, rings are not nearly as distinct as those in *Tentaculites sterlingensis*.

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Tentaculites stirlingensis

Specimens of *Tentaculites sterlingensis* have shells 10 to 15 mm long and 1 to 1.5 mm wide at the aperture. There are roughly 20 to 25 rings for each 10 mm, and specimens at times can have almost 40 rings.

Click here for a high resolution image of this slab

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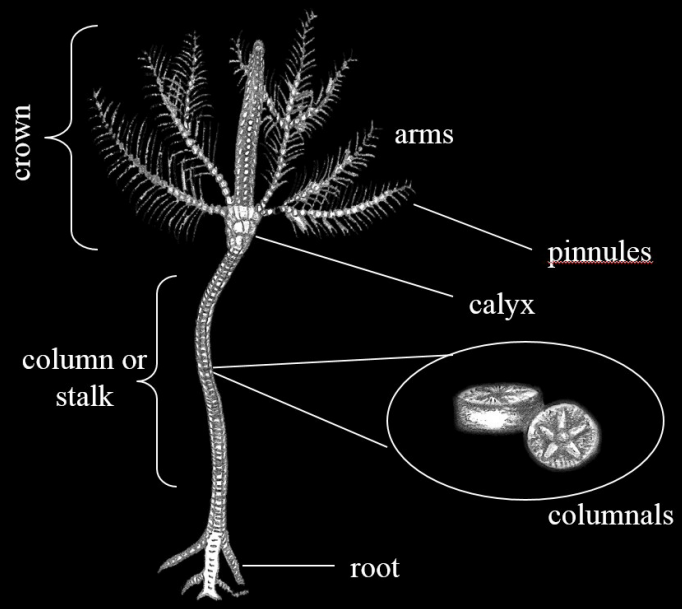
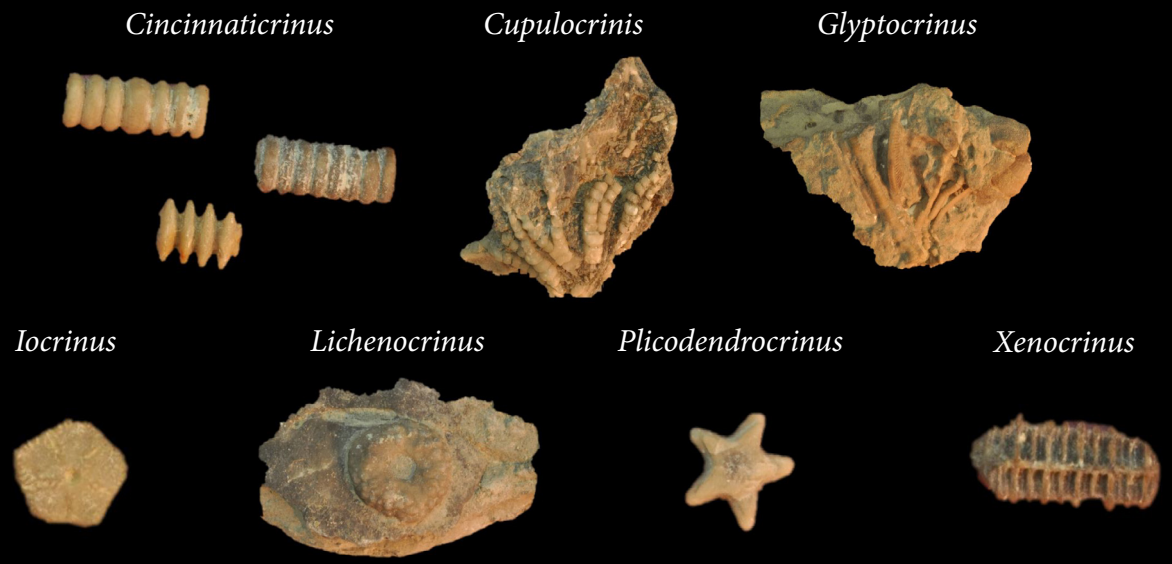
Crinoids

Crinoids are echinoderms that live on a long stalk, or column. Their crown is similar to an upside down starfish. Cross sections of the column usually have a tiny star within them. Columns and columnals are the most common parts found, although occasionally a crown or calyx can be found. It is rare to find the entire crinoid preserved. Crinoids are classified taxonomically by the characteristics of their crown, which makes identification of individual columns and columnals difficult unless the crown is attached.





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Nolan Shula

Cincinnaticrinus

The columns are circular and have highly rounded edges. The holdfast is distinguished by the coiled appearance of the stem.

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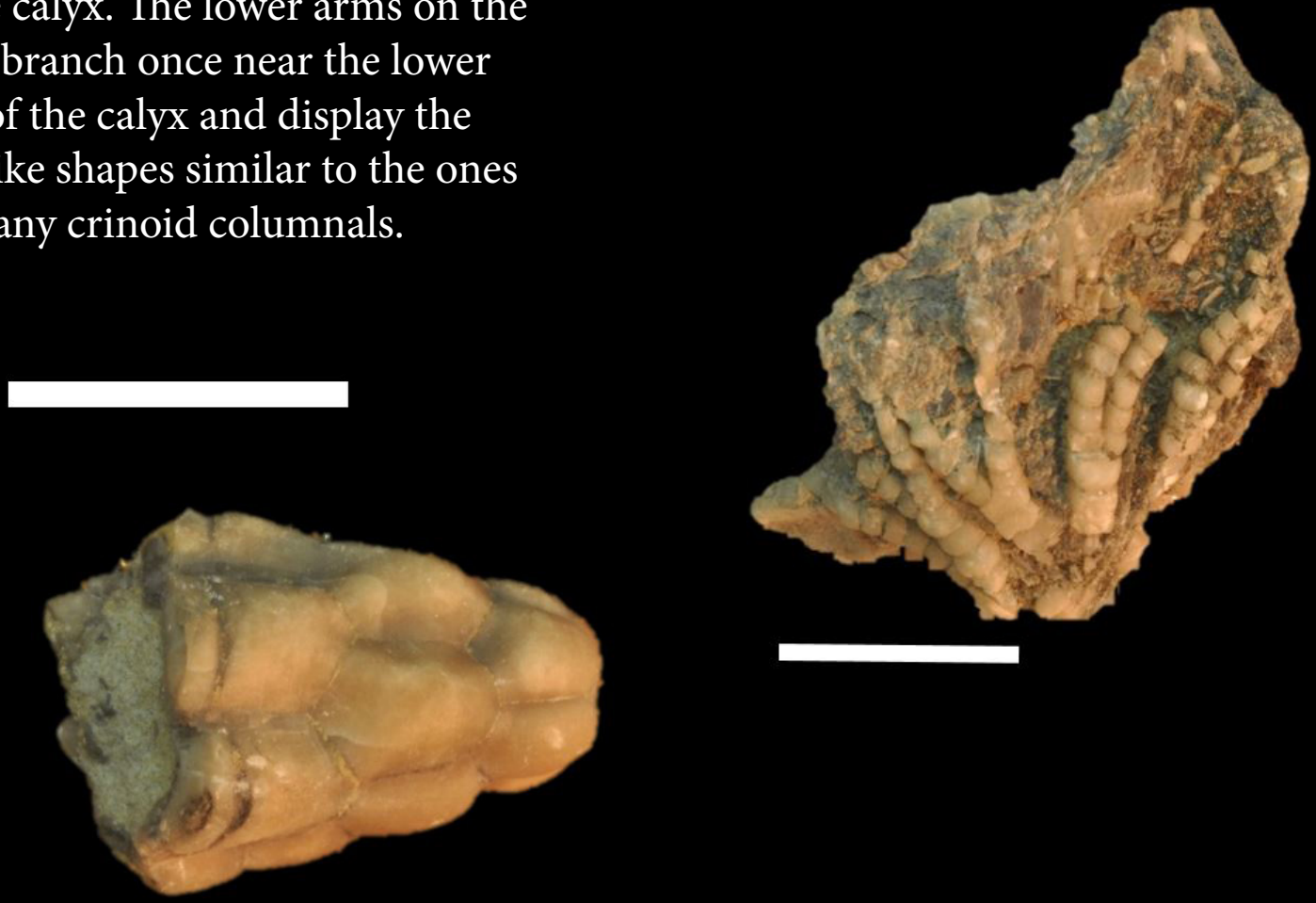
Cupulocrinis polydactylus

The calyx is distinguishable by the rounded plates on the lower part of the calyx. The lower arms on the calyx branch once near the lower part of the calyx and display the disc like shapes similar to the ones on many crinoid columnals.



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Glyptocrinus

Glyptocrinus is mainly characterize by the pattern of the branching on the arms. *Glyprocrinus* arms branch a single time close to the calyx. The calyx displays a distinctive start pattern.

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Iocrinus Subcrassus

The column is characterized by pentalobate (five lobed) shape.

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Lichenocrinus

The holdfast has a distinguishable shape that is reminiscent of a donut covered with sprinkles.

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Plicodendrocrinus casei

The characterizing feature on *Plicodendrocrinus casei* is the star shape features on the calyx. The columnal is distinguishable by its obvious star shape.

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Xenocrinus baeri

The columnal is characterized by a very angular pentagon shape, unlike many Cincinnatian crinoid columnals that are rounded.

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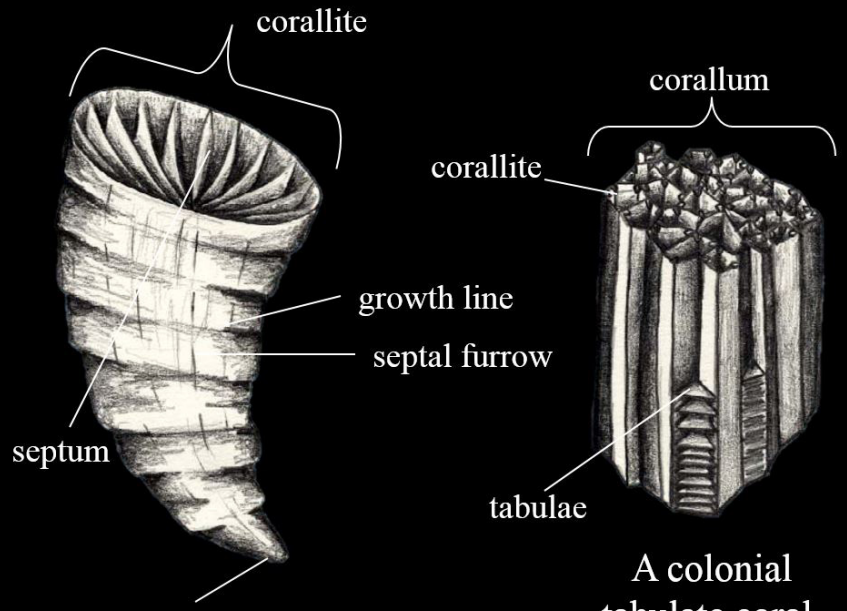
Corals

Phylum Cnidaria contains the corals, jellyfish, and anemones. Corals can be solitary or colonial. Corals have a rich fossil record because they excreted a hard calcium carbonate exoskeleton that preserves well. The Cincinnatian solitary corals are quite large, and are "horn" or "tooth" shaped. Individuals in the colonial corals are usually quite small, coralites being 1-3 mm in diameter.



A solitary horn coral.

A colonial tabulate coral.

Grewinkia

Favistina

Protaraea

Tetradium

Aulocystis

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Nolan Shula

Grewinkia canadensis

A solitary rugose coral with an elongate, curved corallum. Septa are numerous and vary in length. Individuals can grow up to 13 cm in length.

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Favistina stellate

A colonial rugose coral with hemispherical or glubose form. Individual corallites are polygonal or honeycomb shaped, and each corralite contains 12-15 septa. Colonies can grow up to 10 cm in length.

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Protaraea richmondensis

This is a colonial tabulate coral. Colonies encrust other organisms, such as gastropods and other mollusks. Individual corallites are anywhere from less than 1 mm to 2 mm wide.

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Tetradium approximatum

This is a large colonial tabulate coral that can range in size. Individuals can grow up to 20 or 30 cm wide and over 10 cm thick. Individual corralites are less than 1mm thick, and typically have four septa that are not well-developed.

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Aulocystis flabellate

This colonial tabulate coral is also an encrusting coral, as can be seen by the brachiopods that the individuals cover. Individuals normally grow between 10 and 15 mm long and 3 or 8 mm wide at the feeding end and less than 1 mm at the basal or attachment end.

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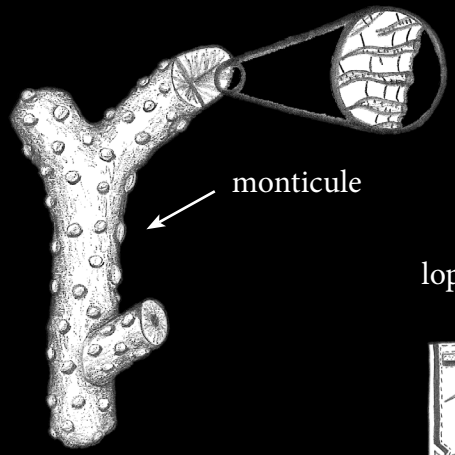
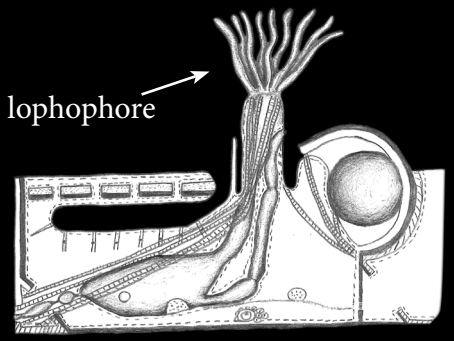
Bryozoans

Bryozoans are tiny colonial organisms, often mistaken for corals. The individual bryozoan is usually less than 1 mm in size. Bryozoan colonies can be branching, twig-like, fan-like, or encrusting. The entire colony is referred to as a zoarium. Some bryozoan colonies are smooth and others have monticules or bumps covering them. Each small opening or aperture was the home for an individual bryozoan or zooecium. The small animal seals the hole with a "door" or vestibule. They are difficult to identify without microscopic study. Sometimes the pattern of the apertures, size, or shape is characteristic and can be used for generic identification.





Constellaria

Homotrypella

Peronopora

Dekayia

Bythopora

Spatiopora

Batostoma

Prasopora

Parvohallopora

Escharopora

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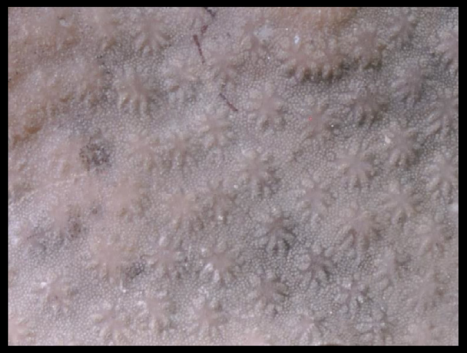
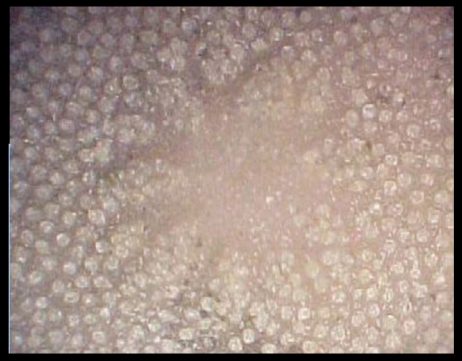
Ethan Shula

Constellaria

Characteristically forms branching or fan-like colonies. Monticules are present and have a unique star-shape. The monticules are 2-3 mm in diameter and give the species a distinct appearance. Apertures are circular in shape.





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Homotrypella

Characteristically forms hemispherical gum-drop and pyramid shaped colonies. Apertures are circular in form. Are often found growing or encrusted on a broken brachiopod shell. Sizes range from 5 mm to 1.5 cm in height and length.

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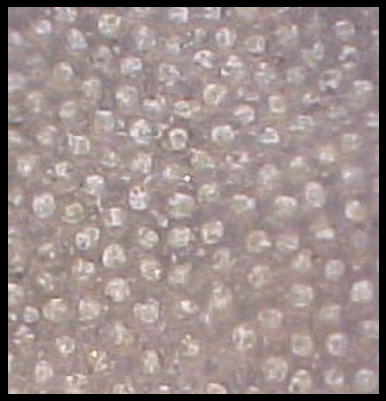
Peronopora

Characteristically forms colonies of flat, bifoliate sheets. Zooecial apertures are rounded/circular in shape. Monticules are prominent and have a smooth, rounded appearance.



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Dekayia

Characteristically forms very large ramose colonies. Individual branch diameters range from 5 mm up to 1 cm. Apertures are sub-polygonal in shape. Monticules are not prominent.

Click here for a high resolution image of *Dekayia*

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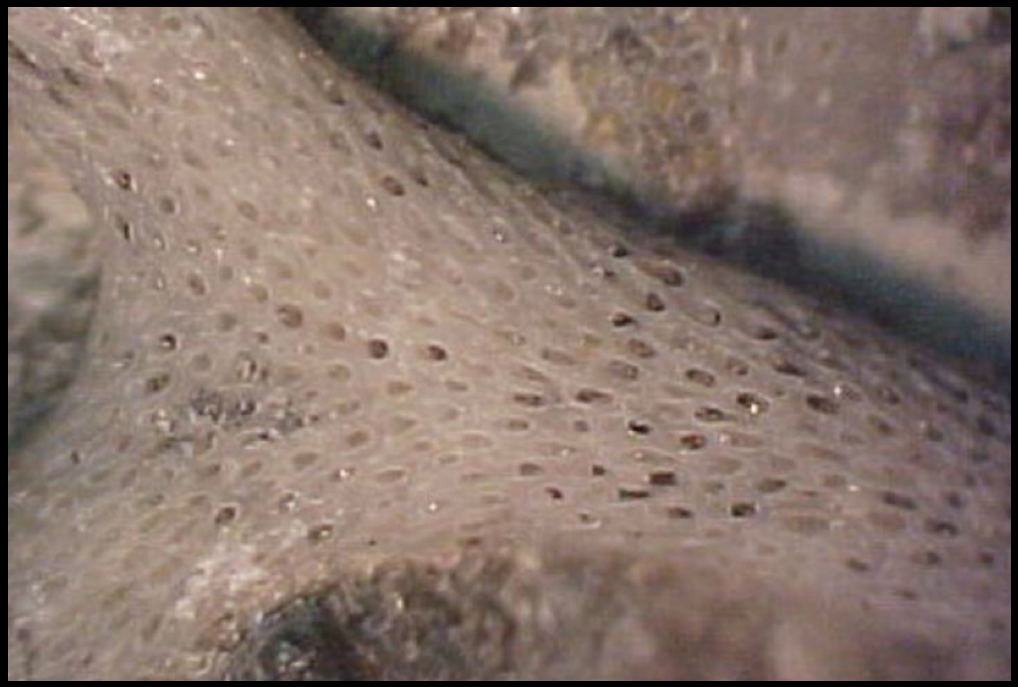
Waynesville
Road cut
3-2006

Bythopora

Characteristically forms ramose colonies comprised of very thin stick-like branches. Apertures are extremely elongated and ovular in shape. Branches range from 1-2 mm in diameter.



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Spatiopora

Characteristically forms flat, encrusting colonies often associated with cephalopods. Monticules are elongated and aligned with one another along the elongated axis of the cephalopod. Alignment and elongation are oriented in the direction of propagation of the cephalopods as they moved through the water column. Apertures are rounded/sub-polygonal in shape.

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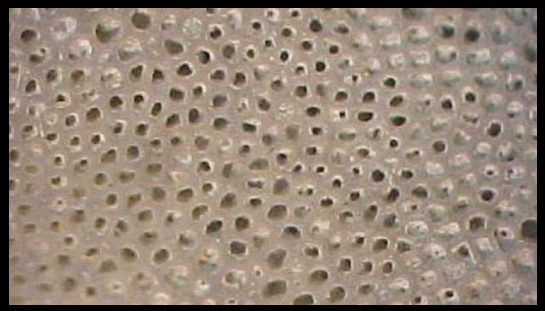
Batostoma

Characteristically forms branched, ramose, colonies. Apertures are predominately elongate and irregularly shaped, although circular and ovular apertures do exist. Minimal, if any, monticules are present and when they occur, are not uniformly spaced. Individual diameters range from 2 to 5 mm.



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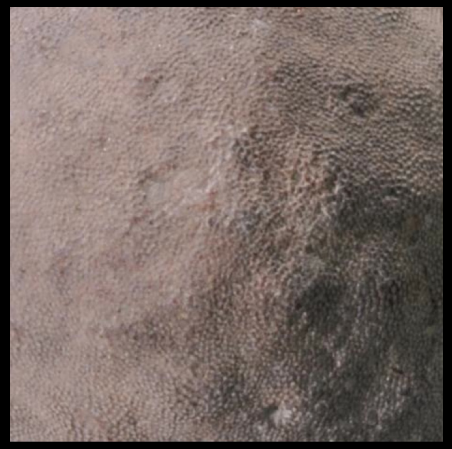
Prasopora

Characteristically forms hemispherical dome-shaped colonies. Monticules are prominent and have a smooth, rounded appearance. Apertures are subpolygonal in shape. Differs from *Homotrypella* which has a gumdrop/pyramid appearance.



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Parvohallopora

Parvohallopora ramosa

Parvohallopora subnodosa

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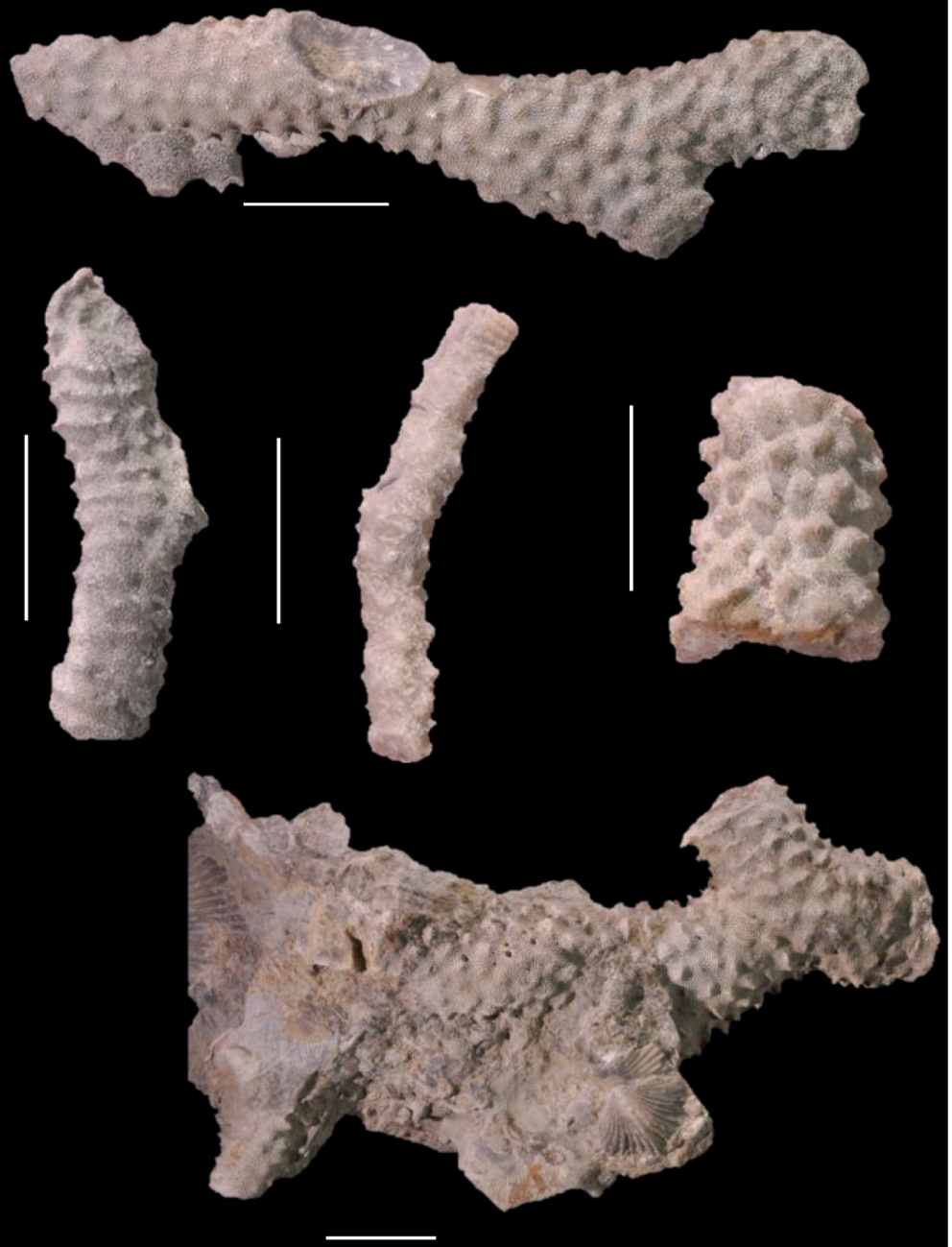
Parvohallopora ramosa

Characteristically forms ramose colonies with prominent, regularly spaced and sharp monticules. Monticules range in shape from circular and pointed to ridge-like features that conform to the circumference of the branch. Specimen diameters are 5 mm to 1.5 cm. Apertures are ovular/circular, regularly spaced, and uniformly shaped. This species differs from *P. subnodosa* by having sharp monticules instead of rounded protrusions.



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Parvohallopora subnodosa

Characteristically forms ramose colonies with prominent, regularly spaced and rounded monticules. Specimen diameters are 5 mm to 1.0 cm. Apertures are ovular/circular, regularly spaced, and uniformly shaped. This species differs from P. ramosa by having rounded monticules instead of sharp protrusions.

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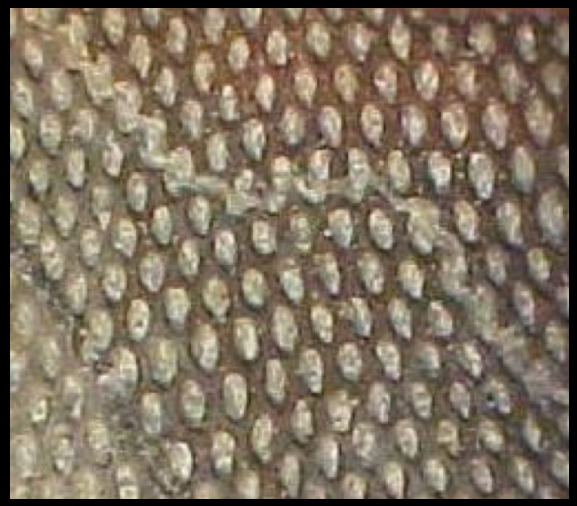
Escharopora

Characteristically forms blade shaped, bifoliate sheets that taper to a point at one end of the specimen. Apertures are diamond shaped. Sizes range from 2cm to 6cm in length.



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Stromatolites

Stromatolites are microbial colonies that grow in mound-shapes, usually in large numbers. They are formed when bacteria grow as a thin film on a certain object, die, and then a new generation of microbes grows on top of the old layer. These layers are called laminae and can range from 1 to several millimeters thick. Individuals can range from several centimeters to tens of centimeters across. They are rare in the Cincinnatian.

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Nolan Shula

Trace Fossils

Trace fossils, or ichnofossils, are marks or "traces" left behind by animals. The most familiar examples of trace fossils are footprints. However, since this is the Ordovician, all of these trace fossils were formed underwater. Underwater trace fossils occur in the form of burrows, with the animals digging into the mud or other animals. Imprints of animals do not count as trace fossils, because the animal did not actively make the fossil during its life.

Chondrites

Petroxestes

Planolites

Rusophycus

Tricophycus

Trypanites

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Sean O'Donnell

Chondrites

Chondrites are long, branching burrows that resemble the structure of plant roots and are horizontal to the bedding place. They are the most common trace fossil, having been found all the way back to the Cambrian and going all the way up to present day. However, their origin is unknown. Even in present *Chondrites*, no animal has ever been found inside of them. It is speculated that they are formed by some sort of worm or nematode, but it is not known for sure. Their length can be about a centimeter long to more than 20 cm long. Shaft widths vary from 0.1 mm to 10 mm.

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Petroxestes

Petroxestes is a shallow boring usually made in carbonate rock. They are small, with the largest being about 10 mm in length, and none go more than a few millimeters deep. They are first found in the Ordovician, and have been found all the way up into the Miocene. These borings are known to be created by the bivalve *Corallidomus*. This bivalve has actually been found inside of the boring, in which it was in feeding position.

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Planolites

Planolites is a fossil burrow that ranges from about 1-5 mm in size. It is not branched, not lines, and forms tube-shaped burrows with fill that differs from the host rock, unlike *Chondrites* which has no fill whatsoever. The burrows are horizontal to the bedding plane, and many times cross over each other. It is among the oldest known trace fossils, having been found all the way back in the Pre-Cambrian. The origin of *Planolites* is unknown, but the organism that made those burrows could have been feeding at the time of creation.

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Rusophycus

Rusophycus trace fossils are made by trilobites. The trilobite dug into the mud and formed this "burrow" of a sort. It then left and moved on to somewhere else. Occasionally, a trilobite might be found inside of a *Rusophycus* fossil, fossilized inside its own burrow. *Rusophycus* fossils can range in size as much as trilobites can, meaning quite small to quite large.

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Trichophycus

A cylindrical burrow ranging 15-20 cm long and 1-3 cm wide. It lined with fine striae that either radiate from a midline running the length of the fossil. Or, the striae radiate up from a button-like depression. These striae indicate lateral movement of animals through the sediment, possibly made by small trilobites. *Trichophycus* first appears in the Cambrian in some locations around the world while first appearing in the Ordovician in other locations.

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Trypanites

Trypanites is a fossil boring that goes down into rock or even into shells, vertical to the bedding plane. It is small, with a diameter usually less than a millimeter. It was first found in the Cambrian, and goes all the way up to present day. *Trypanites* is usually found in calcareous substrates, most likely because the organism that creates it uses acid, which dissolves calcite. The organism that creates *Trypanites* is not known.

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John Whitmore	Supervision
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Matthew Cheney	Brachipods
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Victoria Couser	Brachiopods
Mitchel Goodling	Pelecypods
Chris Griffin	Trilobites
Ryan Gustafson	Crinoids
Jorian Krob	Brachiopods
Dylan McKevitt	Brachiopods
April Menendez	Gastropods
Sean O'Donnell	Trace Fossils
Ethan Shula	Bryozoans
Nolan Shula	Cephalopods
	Conulariids
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	Corals
	Tentaculitids
Connor Smith	Editor

Drawings (except *Rusophycus*) by Allison Warren
Rusophycus drawing by Renae Chrystal

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About the specimens:

For more than thirty years, John Whitmore and his students have been collecting fossils from the Waynesville, Liberty, and Whitewater formations of the upper Ordovician. The fossils shown in this guide were primarily collected from outcrops in Camden and Waynesville, Ohio, and South Gate Hill, Indiana.

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Cedarville University
Department of Science and
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