

became extinct at the end of the Permian Period some 200 million years ago. 18 species of crinoids are known from the Falls (see table 1).

Both crinoid and blastoid calices are very rare at the Falls. Less than a dozen of each have been observed in outcrops by interpretive staff. The muscles and ligaments holding the plates of a crinoid calyx together would rot soon after the animal's death. Unless it was buried within three weeks (or so), the calyx would disintegrate. The theca of the blastoid would usually be pulverized in strong ocean currents. Consequently, good crinoid calices and blastoids are highly sought after by fossil collectors. If you locate one in the park, please tell the interpretive staff and remember - *never* remove them from the Falls area.

Table 1 Crinoids and Blastoids from the Falls of the Ohio

Blastoids

- Eleacrinus greeni* (Miller & Gurley)
- Eleacrinus venustus* (Miller & Gurley)
- Eleacrinus verneuili* (Roemer)
- Eleutherocrinus casedayi* Shumard & Yandell
- Trionoblastus pyramidatus* (Shumard)

Crinoids

- Ancyrocrinus spinosus* Hall
- Comanthocrinus priscus* Springer
- Dolatocrinus exstans* Springer
- Dolatocrinus grandis* Miller & Gurley
- Dolatocrinus insuetus* Rowley
- Dolatocrinus lacus* Lyon
- Dolatocrinus major* Wachsmuth & Springer
- Dolatocrinus marshi* Lyon
- Dolatocrinus multibrachiatus* Rowley
- Dolatocrinus pyramidatus* Springer
- Dolatocrinus rotundus* Springer
- Dolatocrinus spinosus* Miller & Gurley
- Hadrocrinus discus* Lyon
- Himerocrinus plenissimus* (Lyon)
- Megistocrinus knappi* Lyon & Casseday
- Megistocrinus spinulosus* Lyon
- "Poteriocrinus" cylindricus* Lyon
- "Poteriocrinus" simplex* Lyon

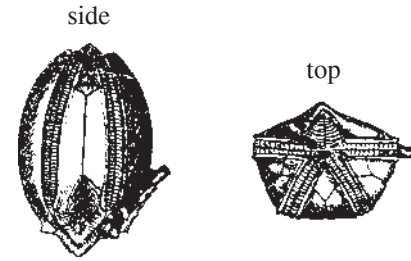
Suggested Reading

The Audubon Society Field Guide to North American Fossils, by I. Thompson. Published by Alfred A. Knopf.

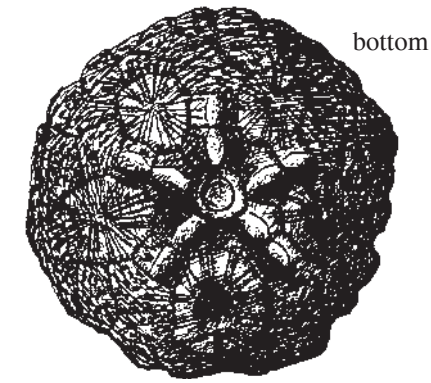
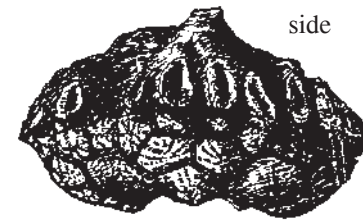
The Fossil Crinoid Genus Dolatocrinus and its Allies, by Frank Springer. Published by the U.S. National Museum, Bulletin 115, 1921. Out of print. May be available of university or college libraries.

Fossil Invertebrates, edited by R.S. Boardman, A.H. Cheetham, and A.J. Rowell. Published by Blackwell Scientific Publications, 1987. College level book.

Treatise on Invertebrate Paleontology, Part T, Echinodermata 1 (blastoids) and 2 (crinoids), edited by R.C. Moore (1) and R.C. Moore and C. Teichert (2). Published by the Geological Society of America and the University of Kansas. 1967 (1) and 1978 (2). Advanced level publications.

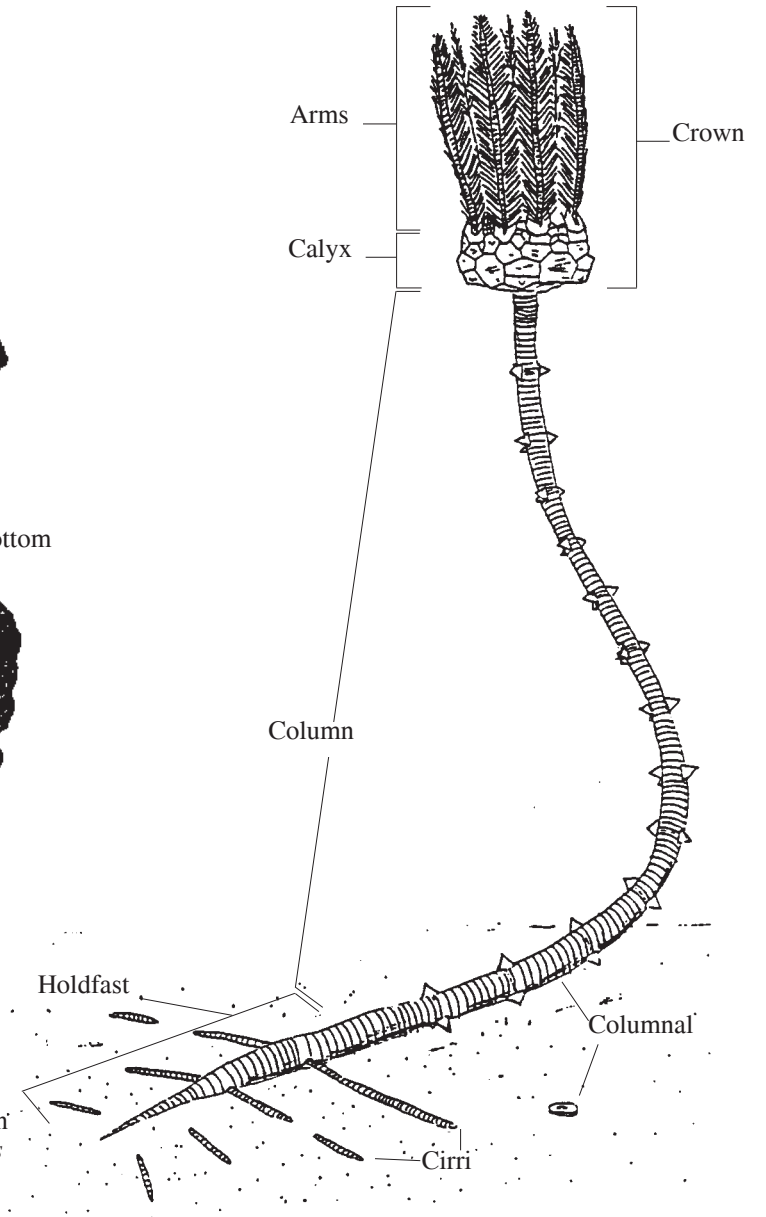


Blastoid
Eleutherocrinus casedayi



Crinoid
Dolatocrinus spinosus

Crinoids and Blastoids at the Falls of the Ohio State Park



A reconstruction of the Devonian crinoid *Deolatocrinus pyramidatus* as it may have looked. Anatomical features are labeled.



Falls of the Ohio State Park
201 W. Riverside Drive
Clarksville, Indiana 47129
(812) 682-4821



Indiana Department of Natural Resources
Division of State Parks and Reservoirs
Interpretive Services

Crinoids and blastoids are two kinds of fossils that may be observed at the fossil beds at the Falls of the Ohio. These fossils belong to the phylum **Echinodermata**. Starfish, sand dollars and sea urchins are echinoderms that are commonly observed along the sea shore today. Echinoderm means “spiny skin.” If you have felt a starfish or sand dollar, you are probably familiar with their scratchy texture. They lack an outer skin like we have. Crinoids are still living today, but usually occur in water a thousand feet (300 meters) or greater. One important characteristic of living (and most fossil) echinoderms is their **pentamerall symmetry**. That means their body is organized in multiples of five. We have bilateral symmetry (a left and a right side).

Fossils of these animals might be mistaken for plants, since both had a long, narrow “stem.” Superficially, the column may be compared to a stalk, and the “head” (which is actually the body) is often compared to a flower. These animals did not carry out photosynthesis. They did eat microscopic plankton. Crinoids and blastoids had a gut, muscles, nerves, a reproductive system and other features of animals. Oxygen is distributed to tissue through a **water vascular system**. Their “blood” is sea water! As adults, most of these Devonian echinoderms did not have the ability to move. Their relatives - starfish, echinoids and sea cucumbers - could. If a storm buried a starfish, it could wiggle out and crawl away. Immobile crinoids and blastoids would be buried, and quite possibly become preserved as a fossil.

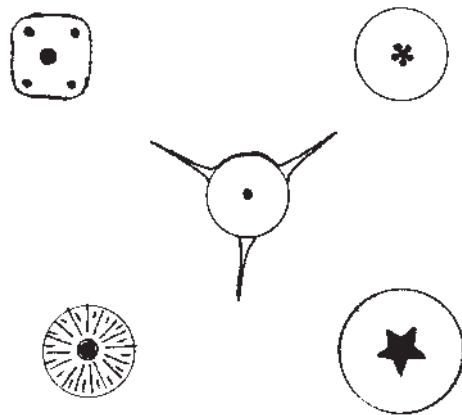
Comparing Crinoids and Blastoids

Refer to the illustrations to identify important characteristics.

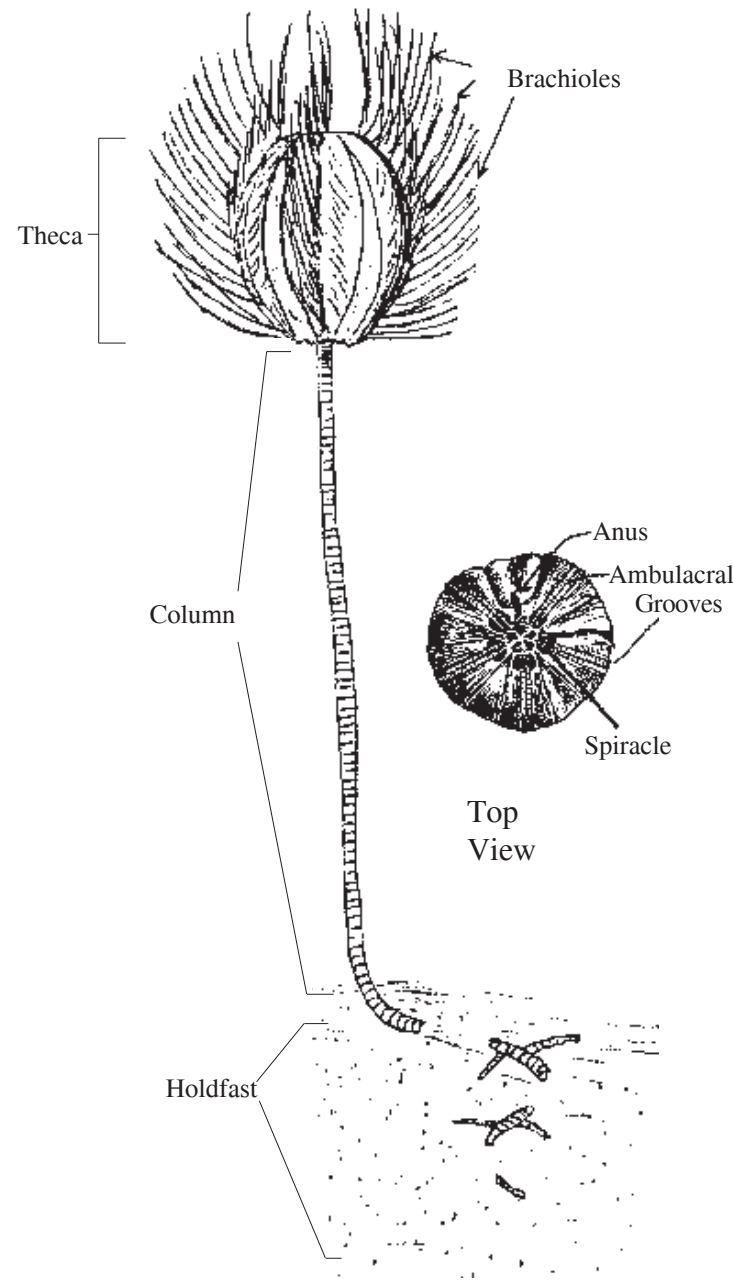
Crinoids and blastoids share some common characteristics. There are some important differences leading to placing them in separate classes (Class Crinoidea and Class Blastoidea). Perhaps the most important relates to the body (“head”) of the animal. Echinoderm skeletal material consists of **plates** or **ossicles**. With crinoids, these plates are held together with muscle and ligaments. Upon death, the tissue which held the skeletal material decayed within several weeks and the plates became disarticulated. Blastoids had fused plates which usually held together after

death, although they may have been shattered by hitting rocks or crushed upon burial.

Crinoids and blastoids have a stem, called a **column**. It consisted of hundreds or thousands of disk-like columnals. The small disk or wheel-like **columnals** are very common fossils and can be found abundantly on the upper fossil beds at the Falls. Like any growing organism, the stem would start small (both in diameter and length) and increase in size as the crinoid or blastoid grew. Crinoid stems can get very thick (over one inch / 2.5 cm) in diameter. They are usually thickest towards the end buried in the sea floor sediment. Close scrutiny will reveal that crinoid columnals are usually ridged. This allowed adjacent columnals to interlock securely. Not all columnals are round. *Dolatocrinus* has “flanges” positioned at 120 degree angles and *Himerocrinus* columnals resemble cogwheels. The central **axial canal** or **lumen** contained a fluid-filled sac and nerve that extended the length of the column. A circular cross-section is most common. Star, four or five-leaf clover-shaped lumens are not unusual. Two and five holes may be observed. (The columnal with five lumens is usually square, not round!) Columns must be buried within a matter of weeks after the animal’s death, or the individual columnals would fall away and become mixed with the surrounding sediment on the sea floor.



Different types of crinoid columnals that can be seen at the Falls. Note the varied shapes of the lumen or central axis of the disk.



The Devonian blastoid *Eleacrinus verneulli* as it probably looked living on the sea floor 386 million years ago. Anatomical features are labeled.

Crinoids were known to use a variety of methods to anchor them in place. Blastoids are only known to use one. The most common means of “staying put” is to develop “roots” called cirri. Cirri radiate from the column and were imbedded into the soft sediment, much like the trees on the edge of the Ohio River. Blastoids used this technique exclusively (as far as the fossil record shows us). One Devonian crinoid called *Ancyrocrinus* developed a unique grappling hook. It could have swiveled on the open sea floor or get hooked on coral or other debris to keep it from being swept away when ocean currents were swift. This form can be seen in the Interpretive Center exhibits. A third type of holdfast, was a button-like disk that was cemented to a hard surface. These interesting holdfasts may be found attached to corals.

Crinoids and blastoids differ markedly with the nature of their body. The character of the plates have already been described. The blastoid “head” resembles a flower bud and is called a **theca** it contains the vital organs. Five petal-like **ambulacral grooves** moved food to the blastoid’s mouth at the top. There are five to six openings at the top of a blastoid. The mouth is at the apex and is usually indistinct. There are four spiracles and an anus. The tentacles, made of skeletal ossicles, are called **brachioles**. They probably contained tube feet to move the captured plankton down to the mouth. Six species of blastoids have been described from the Falls area (see table 1).

The “head” of the crinoid also contains the vital organs and is called the **calyx**. Attached to the calyx is a set of arms. The calyx + arms together are called the **crown**. The tentacle-like arms of crinoids were composed of skeletal plates. Each arm contained rows of smaller tentacle-like **pin-nules**. Combined, an individual arm resembles a moving feather. Food is captured by tube feet and transported down the ambulacral groove on the side of the arm to the mouth. Crinoid arms are in multiples of five. A simple crinoid may have only five arms. One species at the Falls, *Himerocrinus*, has 80 arms! Whereas the blastoid’s anus were adjacent to the mouth, most crinoids had theirs in an elevated position. Crinoids were more efficient at feeding than blastoids. Over 650 species of crinoids inhabit the world’s oceans. Blastoids