water currents to flow through. These microscopic animals fed on plankton. Perhaps because they shared an ecological niche similar to corals, bryozoans were not abundant while the coral patch reef was living.

Trilobites were mobile scavengers, crawling around the sea bottom, much like lobsters today. Trilobites shed their skin as they grew by molting. Most fossil finds are of these molts. Three species are depicted in the center section of the diorama.

Shelly animals in the diorama include snails big and small, brachiopods and clams.. Brachiopods are not clams, their internal anatomy and shell symmetry is different. These were stationary creatures, like barnacles are today. The shelly animals were much more abundant after the coral patch reef had been buried by sediment. Clams lived buried in the sediment and were usually found on the sea floor as empty shells. Coiled and straight cone-like cephalopods swam in the Devonian sea, preying upon soft-bodied animals.

Stalked echinoderms were more common after the corals had perished. Large flower like crinoids and nut-like blastoids fed on plankton, elevated above the sea floor into nutrient-rich currents. Mobile echinoderms like star fish and echinoids (urchins) existed, but are never found intact as fossils at the Falls.

Devonian is sometimes called the “Age of Fishes” because they became abundant at that time. Locally, they are rarely preserved, except as teeth and scales. The armored fish in the diorama is a distant relative to the giant arthrodire in the lobby exhibit. Cartilaginous fish like sharks, and bony fish like coelacanths (lobe finned fish) developed in the Middle Devonian, therefore well-preserved remains are scarce. The needle-like teeth of one coelacanth can be found in the some layers of the Jeffersonville Limestone.

The North Vernon Limestone section of the diorama represents a rock formation that is found on the far end of Goose Island, near the upper gates of the dam. The best exposures of this rock lie to the northeast of the Falls near Charlestown and Sellersburg, Indiana. This formation has a different variety of fossils compared to the underlying Jeffersonville Limestone. Crinoids are more abundant and diverse. Corals are still common, but less diverse. Mollusks, especially snails and clams, are more common.

Echinoderms in the diorama include the crinoids and blastoids. Note the crinoid stalk with the spine-like flanges. The small purplish crinoid is best known from the grappling hook-like holdfast, which kept it from being swept away by currents. Most other crinoids and blastoids had “rootlets” (called cirri) radiating away from the base (as shown in fossil case below).

Mollusks in the diorama include snails and clams. A scallop is attached to a branching coral. Most clams are not visible in the living position because they lived buried in the sediment, with only their siphons sticking out. Their empty shells littered the sea floor, just as they do today.

Brachiopods are among the most abundant animals in the North Vernon Limestone. A type called “spiriferids” are exquisitely preserved in some layers, and some show rare internal structure.

One trilobite, called *Phacops*, is common in this formation. It can found flat or enrolled. Trilobites enrolled when they sensed danger. A storm or a shift in sea floor sediment might bury them. Most Devonian trilobites have multi-faceted eyes similar to an insect’s. These creatures may have been the first organisms to see the world around them clearly and in color.

The large fish in the background is *Cladoselache*, a primitive shark. The Beechwood Limestone contains arthrodire (armored) fish plates, exceeding 6” across. The fossil fish bone fragments are black, but turn blue upon exposure to sunlight. They are most common where limestone rock changes to black shale. The thin layer is called a “bone bed.”

By exploring the fossil beds below the Interpretive Center and examining the diorama inside, it is possible to appreciate the wonders of fossils and the difficultly of interpreting their remains.

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

Falls of the Ohio State Park
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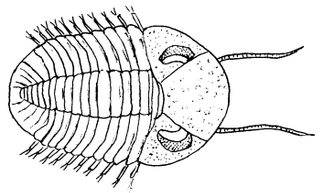
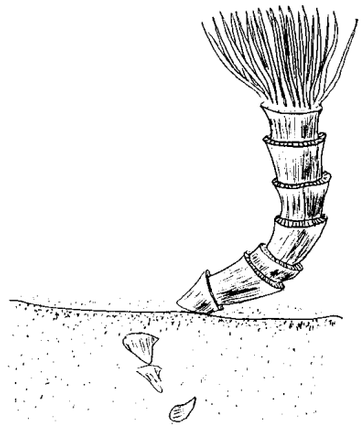
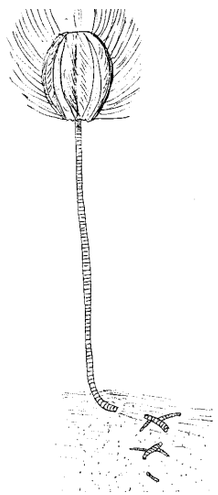


Trilobite *Phacops* illustrated as living.



Horn coral *Tabulophyllum* reconstructed as a living organism.



Blastoid *Eleacrinus* reconstructed as living.

What is a Patch Reef?

Interpreting the origin of the fossil beds at the Falls of the Ohio

The fossil beds at the Falls of the Ohio are often said to be a fossil coral reef. Is this true? A “typical” coral reef consists of hundreds or thousands of intergrown coral colonies. Each coral colony consists of thousands or millions of soft polyp animals. There are a variety of different types of reefs. Reefs are formed in shallow marine (salt water) environments. The reef ecosystem has never existed in fresh water. They are built upon the skeletal remains of earlier organisms. Reefs need not be made up of corals at all. In the past some reefs were made from echinoderms (like crinoids), clams, sponges, brachiopods and other skeleton- producing animals.

The most well-known type of reef is a barrier reef. Barrier reefs can be enormous. They form parallel to coast lines. Australia’s Great Barrier Reef is more than 2,000 miles (3,200 km) long. Other types include atolls, apron reefs and patch reefs. Atolls fringe submerged volcanoes. Apron reefs form on shallow undersea slopes, away from land masses. A patch reef (or bioherm) forms mounds of isolated coral colonies (see figure 1). ***The coral bed at the Falls is a patch reef.*** It stretched some 1,000 miles (1,600 km) in length, was probably hundreds of miles wide (see figure 2) and can be found in similar rocks in Columbus, Ohio, near Buffalo, New York and in southern Ontario. A diorama was created to bring this ancient ecosystem “to life.”

Within the Interpretive Center exhibit gallery, the marine diorama can be found. It reconstructs, in detail, undersea life that existed here 425, 387, and 380 million years ago, respectively. From left to right, the diorama covers the Middle Silurian (Louisville Limestone), lower Middle Devonian (coral zone of the Jeffersonville Limestone) and upper Middle Devonian (North Vernon Limestone).

The diorama was laid out to allow one scene to merge into the next. The span of time represented in the diorama is an amazing 50 million years!

Tropical reef environments have always shared similar characteristics, including warm water, high angle of solar radiation and similar meteorological conditions. Coral reefs are only found between 27 degrees north and south of the equator (roughly between the Tropic of Cancer and the Tropic of Capricorn). Coral does not grow well in cool water and therefore does not form reefs outside of the tropics.

Looking at the diorama, corals dominate the Louisville and Jeffersonville Limestone scenes, but are less important in the North Vernon Limestone where brachiopods and crinoids are more numerous. The Silurian rocks are characterized by over 150 fossil species. The Devonian (both Jeffersonville and North Vernon Limestone) contain over 450 species. The diorama recreates nearly 200 species of fossils. This is a small representation of the living ecosystem, where only a minute number of organisms were actually preserved. Scientists estimate only one percent of the *species* of plants and animals are preserved as fossils.

The diorama revealed...

The Silurian diorama (on left) is dominated by the chain coral called *Halysites*. A replica can be examined more closely on the wall directly across from the diorama. Individuals forming the colony are linked together like a chain, hence its nickname. Other colonial corals, horn corals and sponges (the biggest are called stromatoporoids) make up this coral / stromatoporoid bioherm (patch reef).

A variety of other animals may be found in the Silurian rocks, recreated in the diorama. The tall stalked “flower-like” creatures in the background are echinoderms called cystoids. They are similar to crinoids in the Devonian diorama, but have fewer arms. Unlike corals, the arms are not soft, consisting of hard skeletal plates.

The somewhat ornate cephalopod on the chain coral is an ancestor to the both the modern chambered nautilus and the cephalopod in the adjacent diorama scene. The appearance of the animal, with its tentacles is a “best guess.” Some 300 million year old cephalopods have been found with the animal preserved. Tentacles show hooks, not suction disks, on their arms.

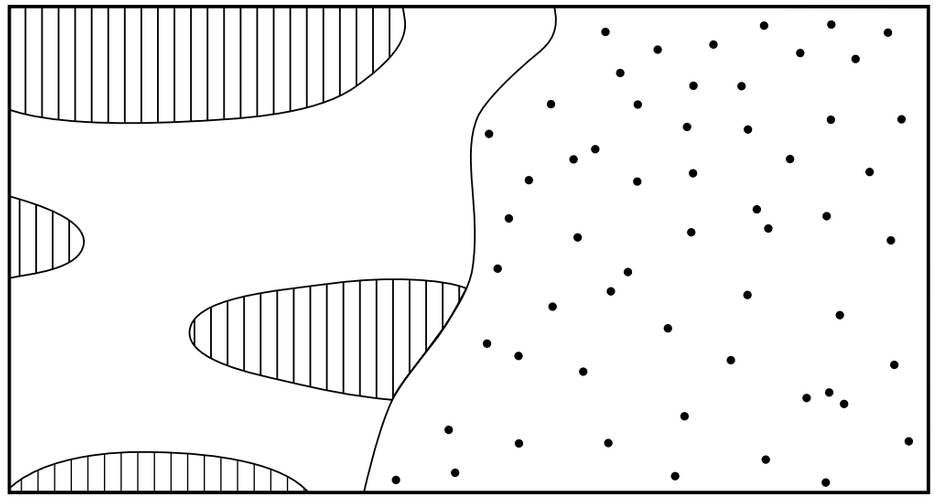


Figure 1

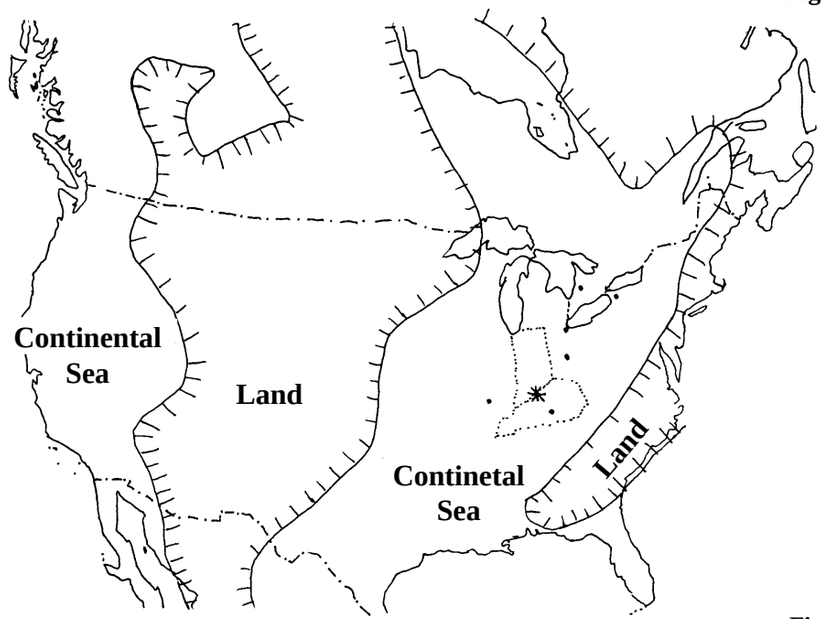


Figure 2

Dots mark Devonian coral-bearing exposures. The asterisk marks the Falls of the Ohio.

The small jawless fish in the foreground is an ancestor to lamprey. Fish are not preserved in local rocks, but no doubt swam in the ancient tropical seas. (Animals that swim are more rarely preserved as fossils compared to animals that were fixed or crawled on the sea floor.) Fish developed nearly 120 million years earlier, but did not reach abundance until the Devonian period.

The Jeffersonville Limestone diorama (center) is dominated by corals. This is a true patch reef. Large individual corals are scattered across the sea floor. Between them are smaller colonial or solitary corals and other organisms. Preserved fish, like the small armored fish in the foreground are almost unheard of in the Jeffersonville Limestone. Reef environments are dynamic - soft body parts are almost always devoured by scavengers and bacteria. Quick burial and a quiet environment are essential to preserve delicate organisms like fish. The Jeffersonville sea was most likely shallow, from less than three feet (one meter) to perhaps 30 feet (10 meters) deep. Scattered islands dotted the region. The evidence of these islands is very small (literally), the freshwater charophyte algae eggs found in rock layers are about 0.5 mm across. Today, charophyte algae can be found in quarry ponds and other bodies of water where calcium is dissolved. During the Devonian, islands with freshwater ponds must have been common, allowing billions of algae eggs to get washed into the sea.

The largest horn coral is called *Siphonophretis elongata*. It was the first fossil from the Falls of the Ohio described in scientific literature (in 1820). This was the largest horn coral that ever lived. It is generally thought to lie prostrate on the sea floor, (less erect than shown in the diorama) curving upward to catch plankton with its stinging tentacles. To reach lengths of up to five feet (1.6 meters), meant it had a long life span.

Other contributors of mass to the reef include stromatoporoid sponges, some forming bumpy mounds, others short and grasslike. The latter stromatoporoid is a “best guess” reconstruction, because it is always found as a tangled mass (like spaghetti) and its true growth habit is unknown.

Lacy bryozoans - moss animals - are found on the right side of the center of the diorama. Some forms had sieve-like colonies, which allowed