# Guide to the Geology Trail

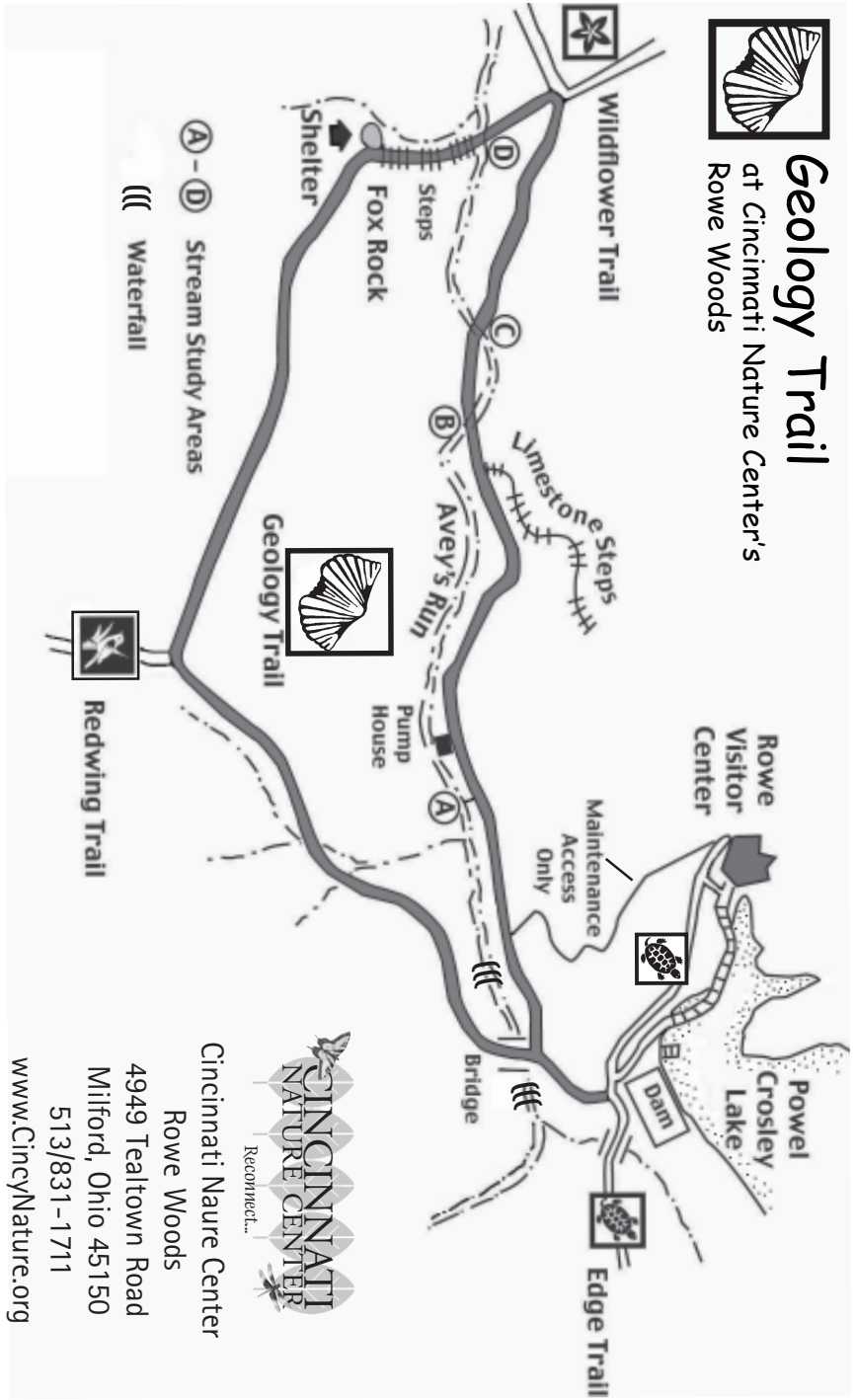
## at Cincinnati Nature Center's Rowe Woods

*Everything flows and nothing abides;*
*everything gives way and*
*nothing stays fixed.*
Heraclites of Ephesus (ca. BC 540-480)

Welcome to the Geology Trail at Cincinnati Nature Center's Rowe Woods! This brochure will guide you through the fascinating geology of this landscape. The story begins 450 million years ago as ancient Ordovician seas deposited the bedrock. Numerous glacial advances and thaws followed, and finally, recent human activity has yet again altered the landscape. Try to envision the dynamic landscape during each of these eras. Follow along with a Rowe Woods Trail Map, or use the map on the back of this guide. Enjoy your journey back through time!

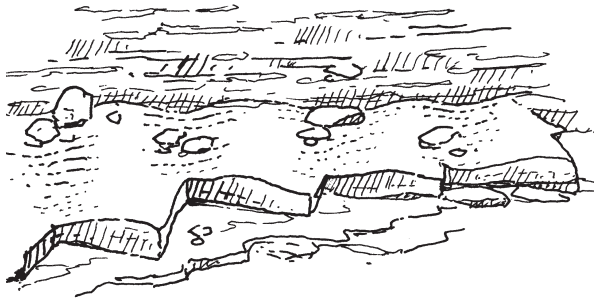
**1.** From the Rowe Visitor Center, take the Edge Trail past the boardwalk to the Geology Trail. The trail descends to Avey's Run and the first waterfall along the stream. At the split-rail fence you will have a good view of the waterfall. The lip of the waterfall is composed of a limestone layer supported underneath by softer, darker layers of shale. As water erodes the shale and carries it away, the unsupported limestone layer breaks off in blocks, causing the waterfall to continue its migration upstream.

Layers of limestone and shale comprise the bedrock of the Cincinnati region. This bedrock, about 450 million years old, started out as layers of bottom sediment in a sea that covered the area during the Cincinnatian Epoch of the Ordovician Period. Since that time, the land of the region has risen and the sea has retreated. Hundreds of millions of years of weathering have removed the sediments that accumulated on this landscape following the Ordovician Period.



2. At the trail marker, turn right (don't cross the bridge). Follow Avey's Run to the second waterfall that also is slowly moving upstream. Since the stream is steadily carving downward into the bedrock, the layers of limestone and shale exposed here are several thousands of years older than the layers exposed at the first waterfall.

Shale, which was formed from mud or silt on the bottom of the Ordovician sea, feels smooth and splits into thin layers when touched. Limestone, on the other hand, was formed from calcareous skeletons of organisms such as corals and shells that settled to the bottom of the sea.



3. Trimmed limestone blocks were used to build the pump house, a structure that once housed a water pump for the Krippendorf estate that preceded the nature center.

4. Below the crossing at Stream Study Area B, the banks contain limestone blocks deposited when the Avey's Run channel was located either to the right or left of its present course. The meandering of a stream causes the widening of its valley.



10. From the shelter on top of Fox Rock, follow the Geology Trail along the ridge to the next trail marker and keep left. As the trail turns downhill, you will feel a pull forward. This same force, gravity, pulls on the surrounding soil and rocks. In order to move downhill, these solid materials are loosened by worms, roots of trees, freezing and thawing, and wetting and drying. The resultant downslope movement of the land is known as creep. Over time, the creep of land causes a slope to become less steep.


Chinquapin Oak

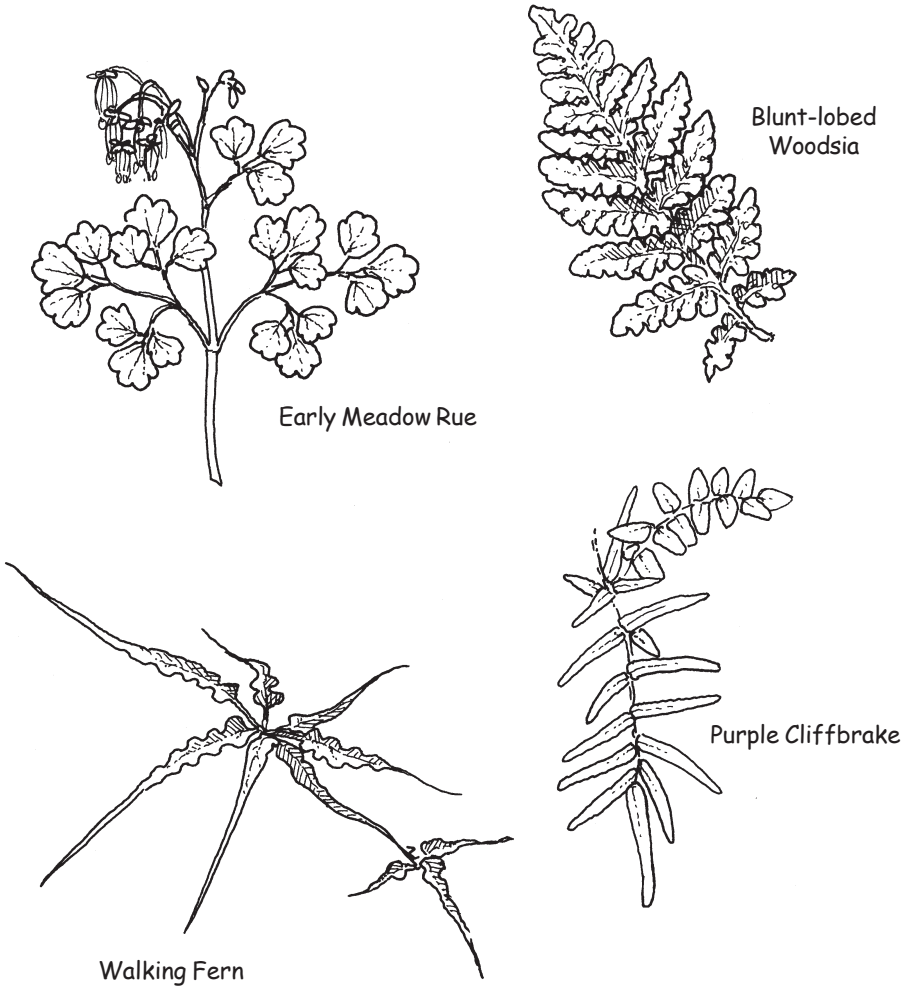
The trail follows a small stream valley down to Avey's Run. Observe the trees, shrubs and herbaceous vegetation along the trail. These species indicate that the soil here is neutral, neither acidic nor alkaline. Its lack of acidity is a result of the buffering effect of the calcium carbonate (lime) derived from the glacier-crushed limestone debris. The neutral soil's lack of alkalinity is due to the fact that much of the alkaline calcium carbonate has been washed (leached) away by stormwater percolating through the soil since the retreat of the Illinoian Glacier.

11. Cross the bridge. From the waterfall, retrace your steps up to the start of the Geology Trail. As you near the top of the stairs, note that you are paralleling the valley of a small stream leading down to Avey's Run. At the top of the steps note that the stream's valley has been filled by a rock and dirt dam, near the bottom of which is a trail crossing the valley. The human-constructed dam has caused the upper basin of the stream to be filled by the waters of Powel Crosley Lake. Human activities such as damming streams, mining minerals, and landfilling garbage now rival geological forces in their ability to alter the landscape.

12. Follow the Edge Trail back to the Rowe Visitor Center where you can find books in The Nature Shop about rocks, fossils and Ohio geology.

Special thanks to Professor Stanley Hedeen, Xavier University, and Ms. Bozana Lazic, 2005 CNC education intern, for preparing this guide.

9. Walk down the short set of steps to the viewing deck for a close-up look at the cliff face. You will notice many plants growing on the rock surface. Some of these rock-loving plants include liverworts (*Conocephalum* sp.), Walking Fern (*Camptosorus rhizophyllus*), Blunt-lobed Woodsia (*Woodsia obtusa*), Purple Cliffbrake (*Pellaea atropurpurea*), Wild Hydrangea (*Hydrangea arborescens*), Miterwort (*Mitella diphylla*), Early Meadow Rue *(Thalictrum dioicum),* Wild Columbine *(Aquilegia cana densis)* and Stonecrop *(Sedum ternatum).* Several of these species grow nowhere else at Rowe Woods.



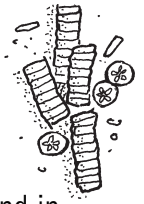



5. At the next stream crossing, Stream Study Area C, a close inspection of many rocks will reveal the fossilized hard parts of Ordovician marine animals, including bryozoans, brachiopods, crinoids, and cephalopods. Feel free to search for fossils but leave all of them behind for other visitors.

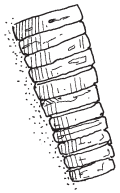
## Ordovician Fossils

Bryozoans resemble small twig- or bone-like structures but actually are colonies of tiny animals. Each animal in a colony secreted an armor of calcium around its soft body, giving the overall fossil its porous appearance. Each animal had retractable tentacles that moved food into its mouth. Bryozoans still exist in aquatic environments.

Brachiopods or lamp shells were filter feeders that attached to the sea bottom by a fleshy stalk called a pedicle. Abundant in the Ordovician seas, they are less common today, with about 1,000 surviving species.



Crinoid fossils appear as a stack of small disks that formed the stalk of the sea lily, named for the flower-like appearance of the animal. The stalk attached to the sea bottom and supported the body or calyx. Arms surrounding the calyx channeled food to the mouth at its center. Crinoids are still found in oceans today.

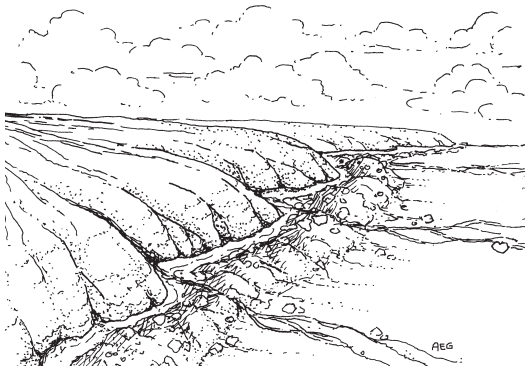


Cephalopods typically had a straight conical shell with the head and tentacles extending from the circular opening. The long shell was divided into chambers with a living cord of tissue, the siphuncle, extending its length. Cephalopods were likely the largest and most numerous predators in the ancient seas. Exclusively marine, living relatives include squid, octopus and chambered nautilus.

## The Ice Age in Cincinnati

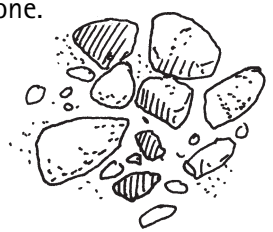
The Ice Age (the Pleistocene Epoch of the Quaternary Period) began approximately two and a half million years ago and lasted until about ten thousand years ago. In the Ice Age, continental ice sheets appeared during periods of global cooling. In each period an enormous amount of snow built up on northern North America as more snow fell in winter than melted in summer. The accumulating snow's tremendous weight compressed into glacial ice, which then spread outward at the ice sheet's margin. A continental ice sheet retreated and finally disappeared as warmer global temperatures returned.

Cincinnati Nature Center's Rowe Woods was covered by a pre-Illinoian glacier about a million years ago and by the Illinoian Glacier (so named because the first evidence of the continental glacier's existence was found in Illinois) about a quarter million years ago. Based on measurements of the current Greenland and Antarctic ice sheets, the Ice Age's continental glaciers were nearly a mile in thickness. As they ground south toward Cincinnati, the glaciers scraped rock off landscapes over which they moved. The rock fragments were deposited here as the glaciers receded due to melting, and rock debris (erratics) carried by the ice settled onto the ground.






**6.** At the meadow where the path divides into four, take the left-hand path leading back to Stream Study Area D. Not all of the rocks in the stream channel are composed of limestone. Some are different colors and shapes. Each foreign rock is known as an erratic since its mineral composition is markedly different from rocks of local origin. Ice Age glaciers carried these erratics into the area from Labrador, Quebec and Ontario, as well as from northern and central Ohio.



**7.** Cross the stream and climb the steps. Halfway up, stop at the bench and turn around. Avey's Run has carved this stream valley during the long span of time since the retreat of the Illinoian Glacier. As the stream formed the valley, its waters carried away most of the clay, silt, gravel and stones that were left by the retreating ice. However, at the top of these stairs there remains a large cliff comprised of glacial debris. This geologic structure is known as Fox Rock, originally named for a family of foxes that excavated their den in the cliff.

**8.** Upon reaching Fox Rock you may use the many steps and trails to explore the conglomerate outcropping. This glacial feature originated when a meltwater stream from the Illinoian Glacier deposited stone and gravel at this location. Over the next several thousand years, water draining through nearby, glacier-crushed limestone debris picked up calcium carbonate (lime) and spread it as cement in this glacial outwash deposit. The resulting cemented rock sediment, known as conglomerate, has been exposed by Avey's Run as the stream cut its valley into the local landscape.