





# Welcome

Welcome to the Glacial Grooves Geological Preserve. This preserve, consisting of three and one-half acres on Kelleys Island, has been administered by the Ohio History Connection since 1932 and is managed locally by Kelleys Island State Park, Ohio Department of Natural Resources.

Due to their large size and ease of accessibility, these are the most famous glacial grooves in the world. Designated as a National Natural Landmark in 1967, the grooves have been an object of fascination for students, vacationers, and scientists alike.

Beginning about 2.1 million years ago, long cycles of climate change from warm to cold allowed several massive glaciers to form and flow from Canada into Ohio. By about 14,000 years ago, the last ice sheet to cover northern Ohio was gone. This island retained a spectacular reminder of the glacier's presence here—these huge glacial grooves that had been carved in the limestone bedrock by the actions of advancing ice and meltwater.

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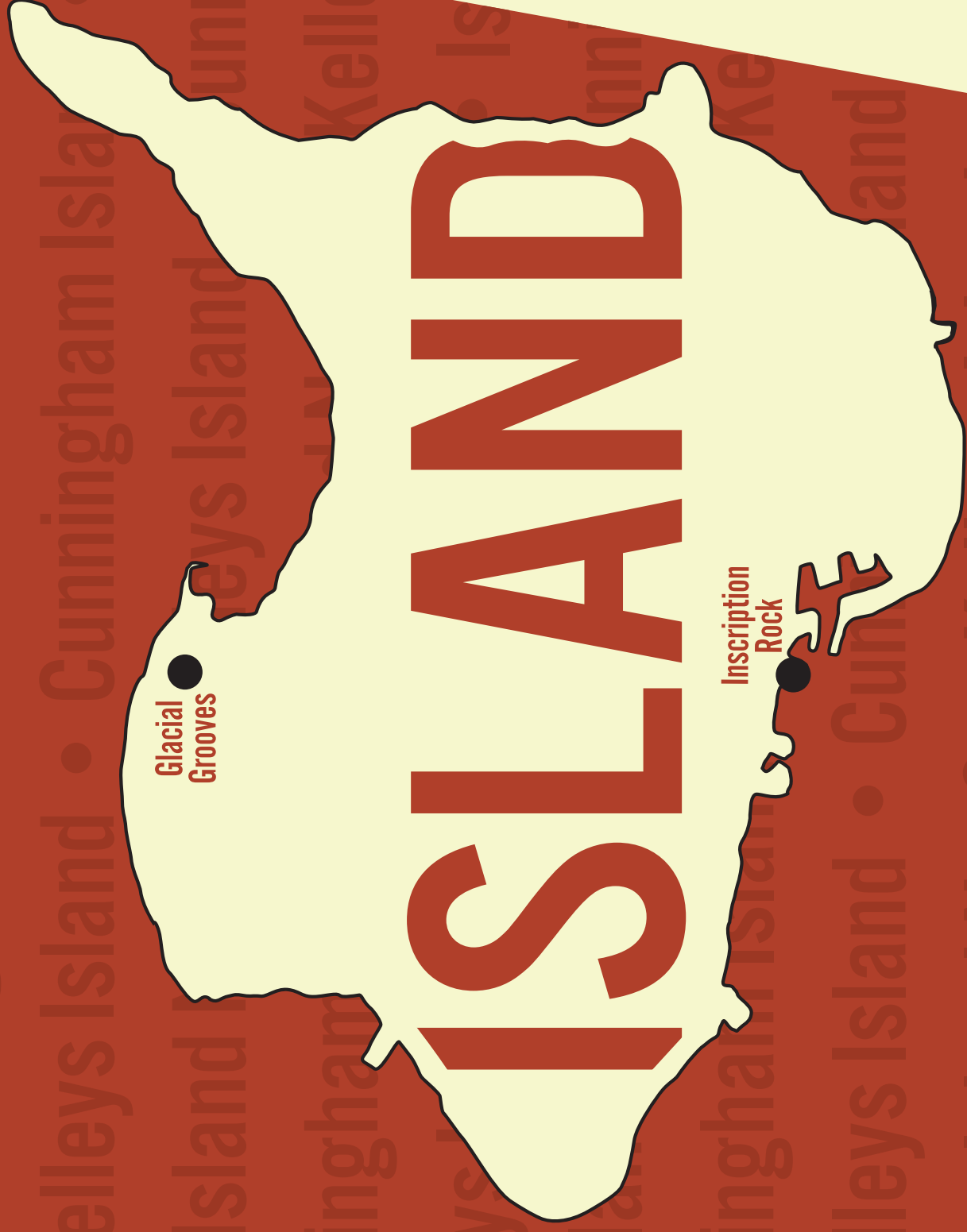
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National Natural Landmark

# Glacial Grooves Geological Preserve



Charles E. Frohman Collection, 1910-1918

Waiting for the Ferry, 1910-1918

# HISTORY

As evidenced by Inscription Rock and other archaeological sites around the island, Kelleys Island was home to American Indians for many centuries. By the time of European contact, Kelleys Island was on the frontier between lands under the influence of the Ottawas and Wyandots.

In the first decade of the 19th century, European traders lived on the island. One of the traders was a Mr. Cunningham, and until 1834 the island was commonly known by his name. Some sources called it Island No. 6. During the War of 1812 the island was abandoned, but General William Henry Harrison did station a watch post on the island to keep track of British ships.

In the 1830s, brothers Datus and Irad Kelley began buying up land on the island. The Kelley family grew grapes and other fruit. Later, they used the grapes to produce wine. They started quarrying operations to take advantage of the outcroppings of limestone. The red cedar forest was useful for logging and the surrounding waters were rich with fish.

Beginning in the mid-19th century and taking off after the Civil War, Kelleys Island became a vacation spot. Urban families came to the island to escape the heat, congestion, and grime of city life.



*Charles E. Prohman Collection*

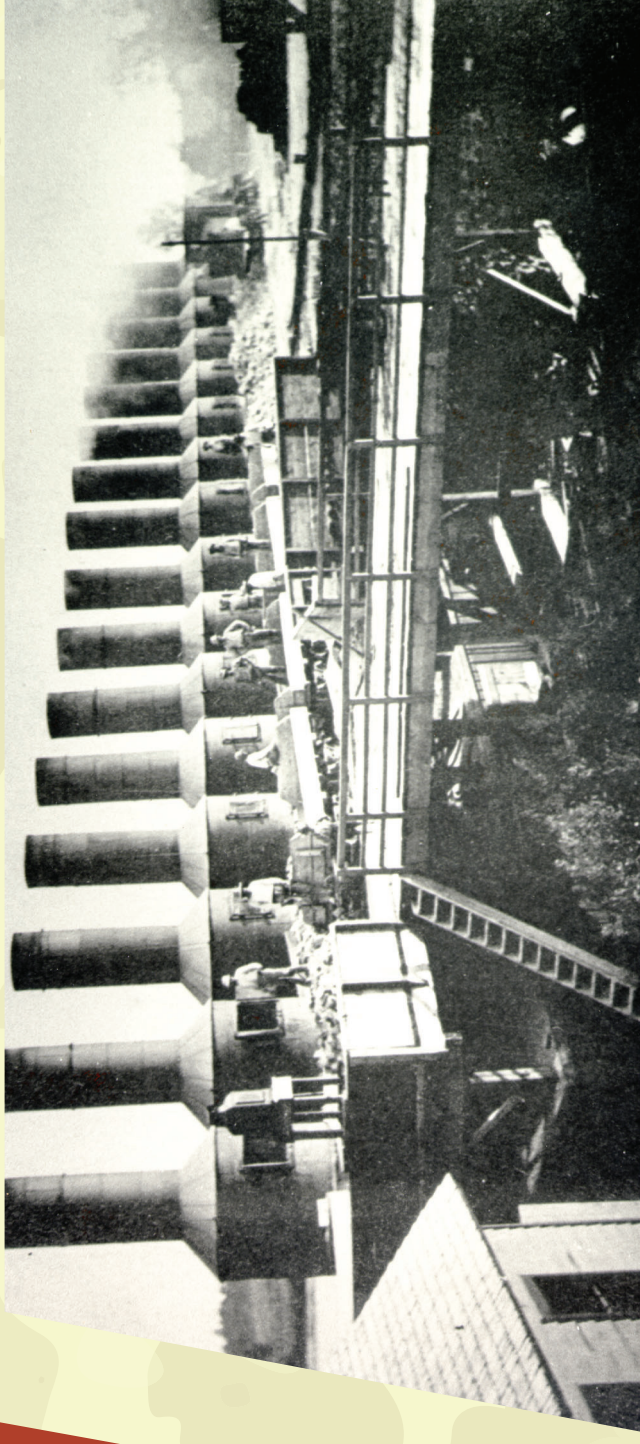
Removing limestone from the quarry.

# QUARRY

The abandoned quarry next to Glacial Grooves is one of several on Kelleys Island. Quarrying was once a major industry on the island. The fine quality limestone found here was highly valued for its many uses. It was cut to shape for buildings, removed in large blocks for the construction of piers and breakwaters, burned to make lime, and crushed for use as flux in the production of steel.

The long vertical marks on the quarry walls were made by the drills used in quarrying operations. Before the use of machine drills and explosives, the holes were hand-drilled and pieces of dry wood were packed into the holes. Water was then poured into the holes and as the wood absorbed the water and expanded, the resulting pressure caused large sections of the rock to be broken loose from the quarry wall.

# Limekilns



Lime kilns, circa 1902

*Sandusky Library/Follett House Museum*

Kilns and crushers were built on the island in the early 1900s and the industry reached its peak in 1918. At this time the Kelleys Island Lime & Transport Company owned most of the quarries, but by 1941 most had closed because Michigan quarries could supply limestone less expensively. One unfortunate aspect of the old quarrying industry was the destruction of many very spectacular grooves, some of which were more impressive than the ones exposed here today.

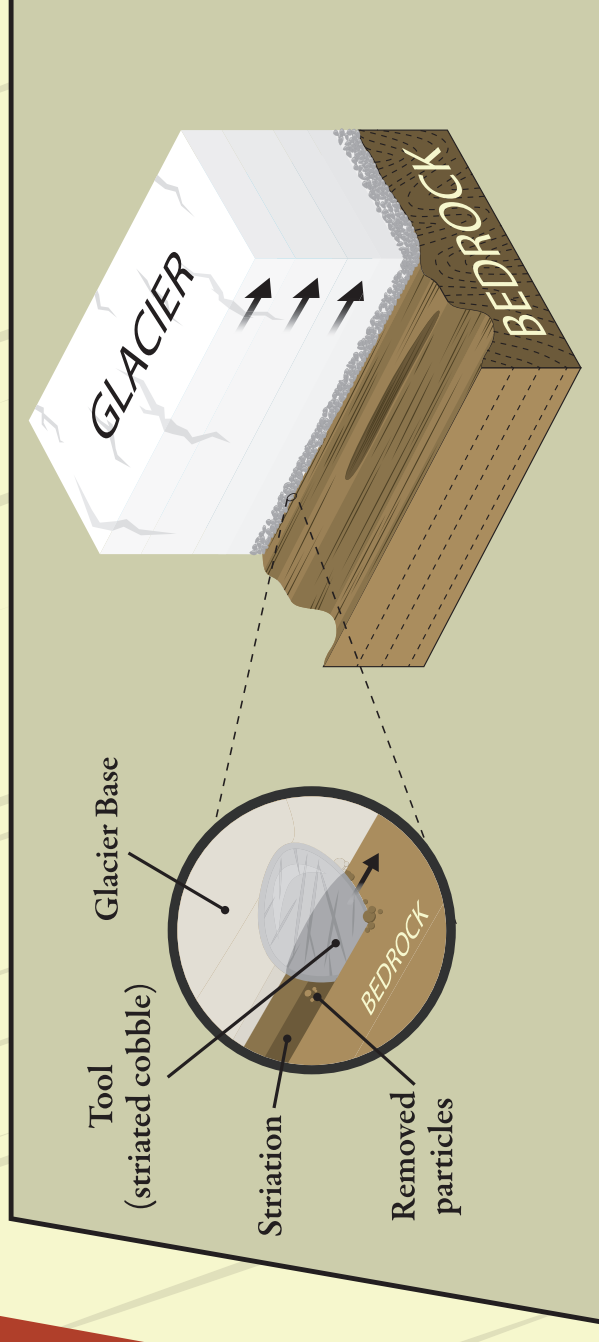
# THE WISCONSINAN GLACIER

The glacier probably most responsible for the sculpting of these grooves began forming in central Canada about 70,000 years ago, when the climate was cooler and wetter than today. The large quantity of snow that fell during the winters did not all melt during the short, mild summers. As the snow piled up year after year, the weight of the snow mass increased and the great pressure exerted on the deepest, oldest snow slowly converted it to ice. The thick ice under heavy pressure began to flow and ooze over the land surface like sticky pancake batter. Such movement was very slow, perhaps at a rate of only inches per day.

It may have taken about 45,000 years for the glacier, which advanced in a southwesterly direction, to finally make its way to this area of Ohio. By the time the sculpting of the grooves reached its most recent climax, the glacier was more than a mile thick here and it covered many thousands of square miles of land surface.



Southernmost boundary of eastern portion of the Wisconsinan glacier



Under great pressure from the ice above and from forward motion, a rock embedded in the glacier's base scratches the bedrock surface.

# GLACIAL TOOLS

As the glacier advanced slowly over the land surface, many changes occurred. Forests were toppled, rivers were forced to change course, and soil was stripped away. But most importantly in the case of the glacial grooves, soil, clay, and many kinds and sizes of rocks were picked up and carried by the glacier.

Some of the rocks embedded in the base of the glacier, like granite, were very hard compared to the softer limestone bedrock of Kelleys Island. Known as tools, these rocks scratched, striated, polished, and ground away at the limestone. Each groove represents the work of not one, but hundreds of small tools, as evidenced by many small scratches in each of the large grooves. It is now believed that the grooves were formed by a complex process involving gouging glacial tools and sediment-laden meltwater rushing at high pressure under the enormous weight of the ice.

In the process of eroding the limestone, the tools themselves were abraded. Many smoothed and scratched rocks found in the area helped carve these glacial grooves thousands of years ago.



# GREAT GROOVES

Gary Meszaros, Photography

The large grooves, which for the most part are straight, are marked in many places with intricate and convoluted features. The most noticeable is the tortuous winding of some of the smaller grooves, probably due to sand-charged water running under high pressure beneath the ice. These twisting features were also seen in some of the photographs of the “Great Grooves,” which were destroyed many years ago during quarrying.

There are sections where the rock is undercut. These were probably formed by meltwater flowing through the grooves previously cut by rocks embedded in the base of the ice. Also visible are places where the rock formations indicate that the ice flowed around large melon-shaped knobs, possibly due to some local area of harder bedrock. In many places you may notice small grooves super-imposed on larger grooves. It is common to see very fine scratches or striations on the limestone, probably caused by the scraping of pebbles and sand particles in the glacier’s base.

# BEDROCK FRACTURES OR JOINTS

The straight cracks running across the grooves are called fractures or joints. Fractures form in sedimentary rocks, such as this limestone, as a result of the application or release of pressure on the bedrock. It is not known how these fractures were formed, but pressure changes caused by overriding glaciers probably contributed to their formation.



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Fractures in the bedrock

# OTHER GROOVES

Have you noticed any other glacial grooves on Kelleys Island? There are still more grooves, smaller than those featured here, to be found throughout the island and on the mainland. Several examples of grooves, striations, and planed surfaces may be found in Kelleys Island State Park along the north shore of the island, just north of Glacial Grooves Geological Preserve.

Some very spectacular grooves destroyed during quarrying operations on the island were called the “Great Grooves.” These grooves extended for at least 2,000 feet with a depth estimated at 15 feet and a width up to 30 feet.



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Grooves exposed in the late 1880s but later destroyed by quarry operations.

# THE EXCAVATION

These grooves are the finest example of glacial scouring in North America. Originally they were covered by a hard, dense glacial till (debris scoured, moved and deposited by the glacier), soil, and dump material from the quarry. For many years only about 35 feet of the grooves were exposed. Because this exposed section was suspected to continue under the high earth cover that abutted it, excavation operations were begun in 1971 to uncover the hidden grooves. The major excavation work was done by backhoe, but shovels, picks, air spades, and even brooms were used for the more delicate work. The total exposure now measures 396 feet in length, with a maximum depth of about 15 feet, and a width up to 34 feet.



Removal of material to expose the grooves in the early 1970s.

*Ohio History Connection*



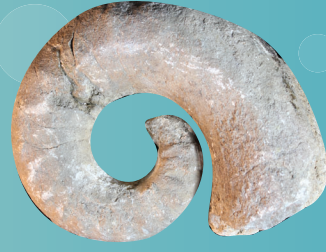
*Carnegie Museum of Natural History Paleozoic Hall*

Some of the Devonian marine animals now fossilized in the limestone on Kelleys Island.

# FOSSI LS

The fossils found in the bedrock of Kelleys Island are the remains of plants and animals that lived in Ohio millions of years before the glaciers when the area was covered by a shallow, subtropical sea. When these marine organisms died, they as well as other sediments in the sea water, settled to the bottom. Later, as these hardened into limestone bedrock, the little-altered remains of the organisms were preserved in place. The bedrock on Kelleys Island is known as Columbus Limestone, deposited during the Devonian Period (from about 419 – 359 million years ago). Fossils of many kinds are abundant in the limestone of Kelleys Island and can be seen almost everywhere if you look closely.

Fossils are very useful to scientists in the study of early life forms, environment, climate, evolution, and the relative ages of different rock layers.



**Cephalopod**

*Orton Geological Museum,  
The Ohio State University*



**Horn Coral**

*Orton Geological Museum,  
The Ohio State University*



**Bachiopod**

*Ohio History Connection*



**Crinoid Stem**

*Orton Geological Museum,  
The Ohio State University*