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# Thousands of Years in the Making: Insights into the Frozen Past Behind the Great Lakes

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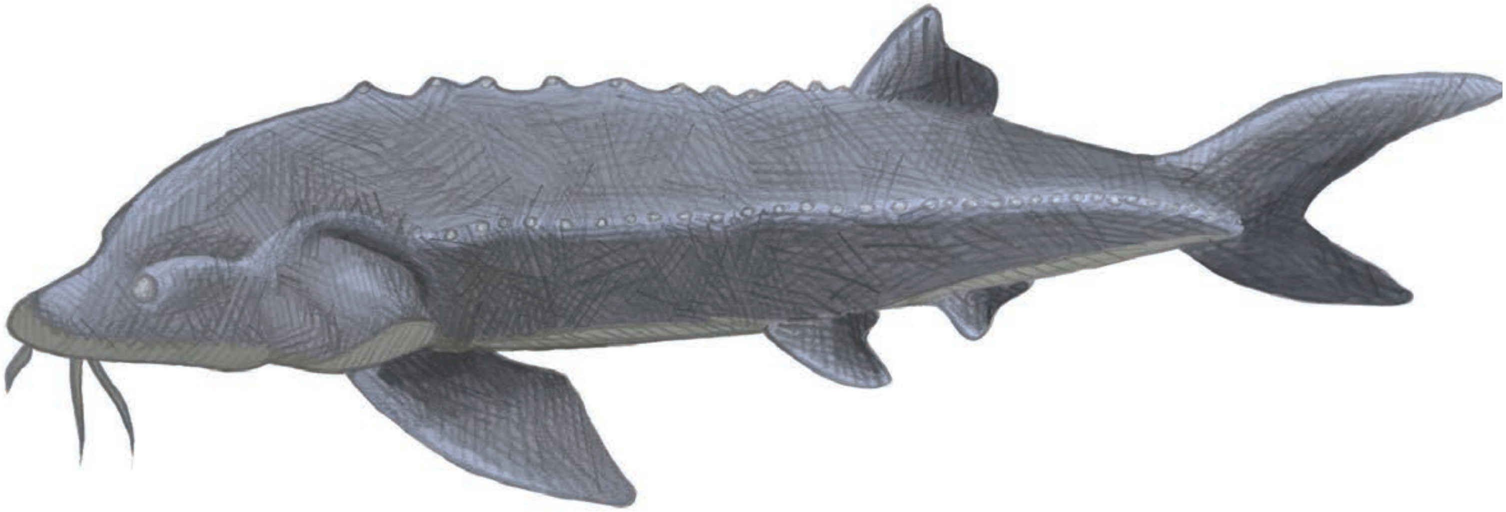

# Thousands of Years in the Making

*Insights into the Frozen Past Behind the Great Lakes*

**Written by Monica Dix**
**Illustrated by Emily Herrold**

Picture a vast freshwater sea covering the entire continental United States. You may think that this water does not exist, but that is simply not true. All of that water, which amounts to 20% of the world's available surface freshwater, resides in the Great Lakes — a chain of five lakes that define the northern border of the United States and provide drinking water to nearly 40 million people.

How did they get there? The simple answer would be to say they are a product of glacial advance and retreat over thousands of years — but that doesn't do them justice.

The Great Lakes began to form as a product of constant advance and retreat during the Pleistocene Epoch, during which the earth experienced its last ice age. What we now consider the northeastern United States was covered in the Laurentide Ice Sheet. This massive ice sheet formed as small ice caps thickened and grew under snow as the temperature dropped. They eventually reached a thickness of three miles, inching centimeters further south each year under the force of their own weight.

This ice sheet underwent at least four major glacial advances and retreats, spanning from Cape Cod to Minnesota and along the entire modern-day US/Canada border. At its lowest, the Laurentide Ice Sheet even moved into Southern Ohio. Over this series of advances the glacier slowly worked away at the bedrock, leveling mountains and moving sediment across the Northeast.

As geologists know, despite the fact that this glacier was moving across continental crust, not all crust acts the same, as not all bedrock near the surface is the same. These differences caused weaker or softer bedrock to give way more quickly, and the glacier dug deeper into these areas, causing major depressions in the continental crust. What we know now as the Great Lakes began as depressed weaknesses in the continental crust.

These formations were reinforced over the course of the advances and retreats, but as the earth began to warm, the glaciers made one final retreat. In their place they left a variety of landforms. Geologists can determine a glaciated landscape by looking for several features, all seen as the Laurentide retreated into Canada. The power of the glaciers can be seen on our landscapes today — a good example is Kelley's Island in Lake Erie, where dramatic lateral grooves can be seen in the bedrock. These were caused by the sheer force of glacial rocks and ice.

Another dramatic example of a formation made during glacial retreat is Long Island on the eastern coast of the United States. These features were produced initially as a terminal moraine, a large lateral deposit made of all the sediment that the glacier had been pushing in front of itself as it moved southward found at the end of the glacier. The glacier then melted for a while without retreating, continually depositing more and more sediment onto what is now present-day Long Island, Cape Cod, and Nantucket. These deposits were all made with rocks called 'glacial till'. This term is used for the deposits that a glacier makes, which are mixed in grain size — the size of the rocks and sediments — and also their type.

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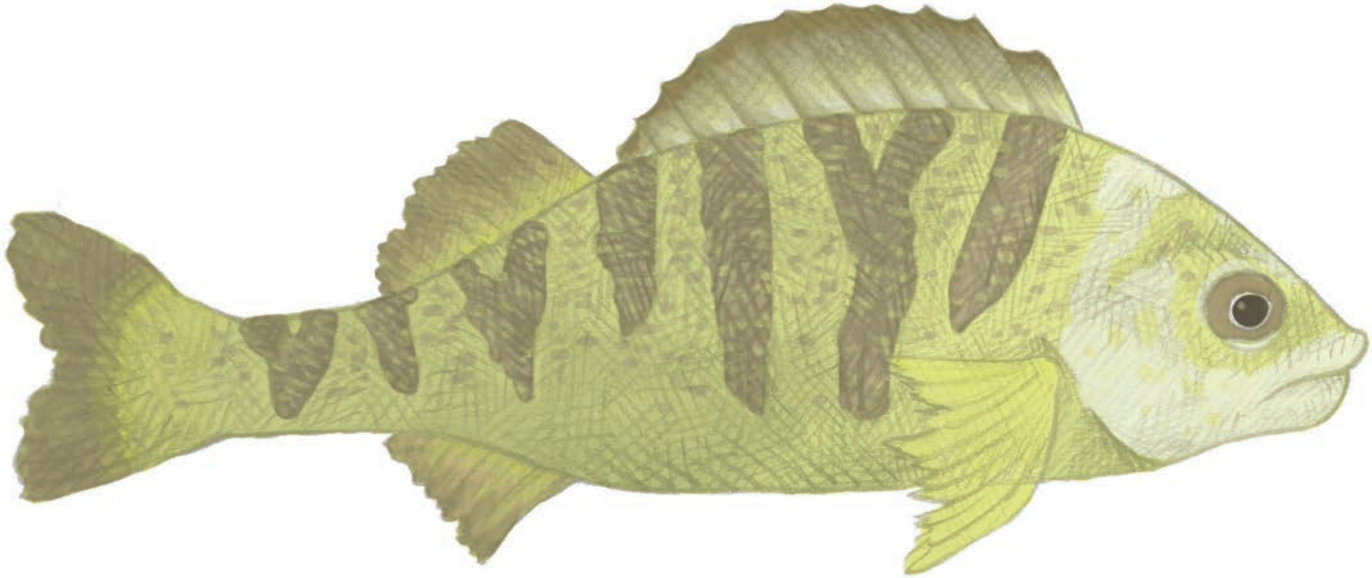
Other, more subtle examples are numerous across Michigan and Wisconsin, called kettle lakes and moraines. While kettle lakes are also caused by glaciers, they are much smaller, formed as a block of ice left by the glacier depresses and then melts in the landscape. The ice creates a depression for itself to fill as it melts, creating a small, very circular lake. Moraines are another formation, essentially the same as terminal moraines, but more general and smaller. They are ridges caused by lateral glacial deposits, usually by a stream running through the bottom of a glacier, and are often found in junction with kettle lakes.

A more common yet much less subtle example of evidence of glaciation is found in the glacial erratic. True to its name, the erratic is a



large rock which often appears out of place with its landscape. These are large rocks that were carried by the glacier but dropped out as it melted away. They are often incredibly dissimilar to the landscape in which they have been placed and can be as heavy as 16,500 tons, although they are typically more boulder-sized.

The Great Lakes were another piece of this puzzle, and their ground-out basins filled slowly with glacial meltwater as the glacier retreated across them. These basins overflowed onto the depressed land and spread gradually into the Great Lakes we know today. Their network of channels formed soon after, as the water in the lakes tried to find paths to reach the oceanic base level, initially traveling north and then traveling south.

This whole process took nearly 6,000 years, starting at the final retreat of the glaciers about 10,000 years ago and finishing up around 4,000 years ago.

However, like all geological systems, the process will continue to change. The continental crust on which the glaciers used to stand is still rising up in a process called isostatic rebound. This process operates on the premise that the crust compressed by the weight of the glaciers is now responding to the lack of weight by slowly rising up to its initial height, currently at a rate of eight inches every century. Isostatic rebound is actively changing the coasts of the Great Lakes, which are preventing uplift because they have replaced the weight of the glacier on the continental crust. This tension between the lifting land and the stationary lakebottom causes the incision of rivers, which can be seen across northeastern Ohio. This means that rivers are digging further and further into the crust as the crust rises, forming deeply cut valleys as the water travels towards the lake.

The Great Lakes are an essential resource to the people they support, providing flood control, natural water filtration and nutrient cycling, not to mention the water they supply to feed industry and agriculture across their coasts. While their system's geological changes cannot be seen on our human timescale, the evidence of glaciation reminds us of their long history and the need to protect them so they can continue to evolve into the future.