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Y E L L O W S T O N E

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# DISCOVERY

A QUARTERLY PUBLICATION OF THE YELLOWSTONE ASSOCIATION



Meltwater from the Absarokas flowed down into Hayden Lake during the Pinedale glaciation, creating the smooth terrain of today's Hayden Valley. Photo: Shirley Cope

By Beth Pratt  
Yellowstone Association

## Introduction

*"The Age of Volcanism ended with an icy breath."*

**W**hen driving the Grand Loop Road to Tower Falls from Mammoth Hot Springs, most visitors delight in the sweeping views of the Yellowstone River Canyon or stop to photograph the frequent wildlife sightings in the area. In the midst of experiencing this abundance of scenic wonders, most would not remember encountering a small, rough patch of road during the trip; at best they may have simply commented

on the bumpy ride and forgotten about the incident. Millions of park visitors pass over this bump each year, unaware of its significance. The uneven patch hides one of the last known remnants of Yellowstone's ice age: a glacial deposit from 1.3 million years ago.

In 1931 when work commenced on the Grand Loop Road, a surprised construction crew discovered a large block of blue-gray ice when cutting the grade with a bulldozer. After examining the find, park officials decided to pave over the ice mass instead of relocating the road. Since then, the ancient piece of what was once a massive glacier has been melting slowly and quietly under the road. The only evidence of its presence is the perpetual rough patch, which has to be continually repaved as the road sinks from the gradual melting of the ice.

This lonely piece of ice used to be a part of a kingdom of glaciers that ruled Yellowstone for major periods over the last 2 million years. Today an empire of volcanic fire controls the park, and not one active glacier remains in Yellowstone. With the steaming geysers and scalding hot springs now dominating the landscape,

## What's Inside...

- OVER \$1.6 MILLION DEDICATED TO CURRENT PROJECTS IN YELLOWSTONE
- NEW GROUP LEARNING VACATIONS ANNOUNCED
- CAMPAIGN FOR NEW EDUCATIONAL FACILITY NEEDS YOUR HELP!



This 500 ton piece of granite was carried 40 miles by the Pinedale glacier. Photo: Jim Peaco

it's easy to forget that ice once reigned supreme in Yellowstone—and that the park owes much of its current form to the legacy of the lost glacial realm.

What can conquer a mountain? Silence Old Faithful? Bring spring wildflowers to

Hayden Valley? Carry house-sized boulders for miles? Create lakes and ponds? Or effortlessly carve out a river canyon? The youthful and energetic fire has decorated the park with geothermal wonders, but the glacial elders with their patient handiwork left a mighty inheritance. Evidence of their

reign still abounds in Yellowstone; indeed, these kingly glaciers influenced the modern landscape considerably.

## The Ice Age and Glaciers

*“But how to imagine that transformation... from lava to icicles, from suffocation to freezing? The burning sea gave way to a frozen waste, but the transformation required millions of years.”*

The historical reign of ice was not unique to Yellowstone. During the most recent ice age—the Pleistocene—a series of glacial periods left more than 30 percent of the earth's landmass, or up to 10 million square miles, under ice at times. Throughout intervals spanning the Pleistocene epoch, which began approximately 1.6 million years ago and ended about 10,000 years ago, continental ice sheets thousands of feet in thickness covered almost all of Canada, the northern United States, most of Alaska, and the majority of northern Europe. Not surprisingly, the average global temperature of 50°F was cooler than today's 58°F. So pervasive was this reign of glaciers on our planet that they controlled sea levels, influenced local and global climate, changed weather systems, and radically shaped the landscape. As Scott Elias observes in *The Ice-Age History of National Parks in the Rocky Mountains*:

*“The last Pleistocene glaciation in North America, the Wisconsin Glaciation, was probably the most important force affecting the development of our modern ecosystems; it had an effect on every part of the continent, even if it did not cover the whole continent with ice.”*

Glaciers form when snow accumulates and survives over a multitude of summers without melting. As the weight of the snow pile becomes heavier and heavier, the layers at the bottom compress into a dense ice. When the ice layers reach a certain thickness—usually about 200 feet—the ice begins to slowly move from its own weight or through gravity. Once on the move, a glacier becomes a force—albeit a slow one—to be reckoned with. As ice is a million, million times stiffer than water, glaciers possess an enormous power to shape the landscape, whether through carving out rock and soil, grinding the

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## YELLOWSTONE ASSOCIATION

### THE MISSION OF THE YELLOWSTONE ASSOCIATION

The Yellowstone Association, in partnership with the National Park Service, fosters the public's understanding, appreciation and enjoyment of Yellowstone National Park and its surrounding ecosystem by funding and providing educational products and services.

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surface of the land, or depositing materials from place to place.

Ranging in size and shape considerably, from the small cirque glaciers, (usually remnants of larger glaciers) to the sizeable valley or alpine glaciers, to the vast continental ice sheets, glaciers both assume and enhance the character of the land they inhabit. Even a temperate climate can give birth to these icy children as glacial formation is not limited to ice ages nor does their growth necessarily indicate an ice age. Some glaciers can form in periods of climatic warming if the right conditions produce more snow in the region but still allow for the “hoarding” of snow from winter to winter.

Individual glacial formation is well understood, but no widely accepted theory exists for the conditions that produce global ice ages. Some hypotheses include fluctuations in the earth’s motion or orbit, changes in concentrations of atmospheric gases, large volcanic eruptions, variations in ocean currents, or tectonic drift. However ice ages originated, geologists agree that for the last 2 million years in earth history, glaciers have largely been king.

## Yellowstone’s Glacial History

*“Even when sullen clouds hang low over Yellowstone, we find it hard to believe that ice ever buried these green meadows and dense forests. Heavy though these skies are, how could they ever have let snow fall in such quantities as to give birth to a sea of glaciers?”*

## Yellowstone’s Recent Glacial History

- **1.3 million years ago:** Oldest dated glaciation in Yellowstone
- **150,000 years ago:** Bull Lake Glacier extends west of West Yellowstone
- **70,000 years ago:** Pinedale glaciation begins
- **25,000 years ago:** Pinedale glaciation reaches maximum
- **15,000 years ago:** Pinedale glacial retreat
- **1,250-1,900 AD:** Little Ice Age

From *Interpreting the Landscape* by John Good and Ken Pierce.

During the Pleistocene, regional ice caps and large glaciers covered Yellowstone up to a dozen times, with the oldest dated glaciation in the park being 1.3 million years ago. Since the more recent glaciations destroyed most of the evidence for the older periods, the last glaciation is the most studied and well understood in Yellowstone. Some scientific evidence also survived from the Bull Lake glaciation (150,000 years ago) as well. Overall, Yellowstone and Grand Teton national parks for the majority of the last 100,000 years have lain under the mighty weight of glaciers and shivered in a climate up to 20 degrees cooler than today.

Although the continental ice sheets did not reach Yellowstone (they stopped about 150 miles to the north), the regional ice produced during the Pinedale and Bull Lake glaciations was massive—more than 120 miles in length and up to 4000 feet deep in some places. Since a single cubic yard of ice weighs nearly a ton, the weight of these ice fields exerted enormous pressure on the land.

During the height of the Pinedale glaciation, ice stretched from the Snake River Overlook in the Grand Tetons to Chico Hot Springs outside the northern

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Hot water melted stagnant ice carrying gravel, creating mounds called thermal kames. Photo: Jo Suderman