Glacier National Park
National Park Service
U.S. Department of the Interior

Rocks and Glaciers

AUDIO

Glacier National Park
A Story of Sedimentation, Uplift, and Glaciation

Most rocks in Glacier are about 1.2 billion years to 800 million years old. They were formed when this area was repeatedly covered and uncovered by the sea. During this time, thousands of feet of mud and sand deposited and compressed into rock. These rocks were lifted upwards around 70 million years ago and form the park's mountains.

Several small glaciers, like Grinnell Glacier seen here, still dot the landscape. Although smaller than the large Ice Age glaciers of the past, they still continue to shape the landscape.

Over millions of years, running water, and the passage of large Ice Age glaciers, carved the rugged peaks and deep valleys of Glacier National Park. This is one of the most spectacular landscapes in the world.

One of the oldest layers is a band of limestone called the Altyn (all' tin) Formation. Limestone is usually formed from shells and skeletons of dead sea animals that settle to the ocean bottom. The Altyn Formation formed about 1.2 billion years ago, long before such life forms existed. It is layer after layer of mud and sand held together by calcium carbonate, the same chemical as chalk.

On top of the Altyn Formation is a broad band of greenish-gray rock, 2500 to 3500 feet thick, called the Appekunny (ap a koon' e) Formation. It consists of deposits of silts and mud hardened into a rock known as mudstone, as well as sand layers that became a hard rock called quartzite.

Atop the Appekuny lies another layer of thick red mudstone called the Grinnell (grin el') Formation. The red and green colors are caused by small amounts of iron. The difference in color depends on whether the rocks were formed in the presence of oxygen or not. Without oxygen the rocks turned a greenish color, and in the presence of oxygen the rocks turned red. The Appekuny and Grinnell Formations have well-preserved mud cracks and ripple marks indicating shallow water at the time of deposition.

The Siyeh (sy ee') Formation forms many of the bold cliffs and mountain tops seen in the park. Fossilized blue-green algae colonies, known as stromatolites are abundant throughout this layer. This indicates the area was covered by shallow warm waters when this layer was deposited slightly less than a billion years ago.

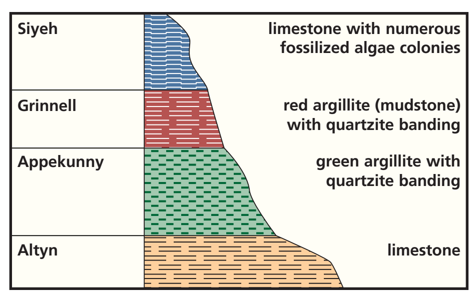
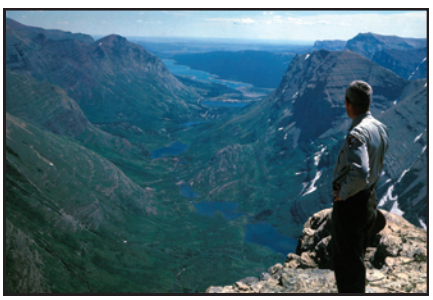
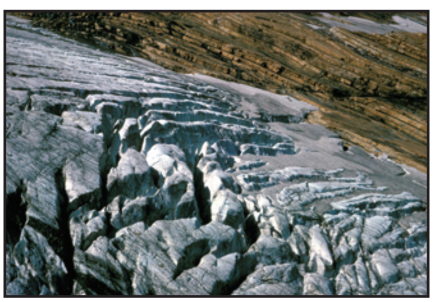


Chart showing the major rock layers in the park.

Forming the Mountains

The youngest rocks in Glacier are found along the eastern edge of the park. Some of these sedimentary rocks are only 70 million years old, just yesterday in geologic terms.




Usually the younger layers lie on top of the older layers. Along the east and south side of Glacier National Park, very old Altyn limestone are found on top of the youngest rocks. How can this be?

About 70 million years ago, movement of the earth's tectonic plates built up pressures along the western edge of the North American continent. These pressures pushed the land up and created the Rocky Mountains. Locally, a section of rock over 50 miles wide, 300 miles long and up to 4 miles thick broke under this pressure and slid over the layers to the east. This movement known as the Lewis Overthrust Fault, pushed rocks in some places as much as 50 to 60 miles from west to east. The old rocks ended up on top of much younger rocks.

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Carving the Mountains

A glacier forms when more snow falls each winter than melts the next summer. The weight of snow above presses down on the layers below, and compacts them into ice. The ice needs to be about 100 feet thick for a glacier to form.

Ice near the surface of the glacier is often hard and brittle, but due to the pressure of ice above, the ice near the bottom of the glacier becomes flexible. This flexible layer allows the ice to move. Depending on the amount of ice, the angle of the mountainside, and the pull of gravity, the ice may start to move downhill. Once the ice begins to move, it is called a glacier.

Photographs from top to bottom
mud cracks & ripple marks, Mt. Reynolds, U-shaped valley and glacial lakes, Blackfoot glacier with crevasses, glacier carved landscape

As the ice moves, it plucks rock from the sides and bottom of the valleys. Rocks falling on the glacier from above mix with the glacial ice as well. Over long periods of time the sandpaper-like quality of the moving ice scours and reshapes the land into broad U-shaped valleys, sharp peaks, and lake-filled basins.

At the start of the Ice Age, about 2 million years ago, the climate became cooler and/or wetter. Huge glaciers formed and filled the valleys with thousands of feet of ice. Imagine the valleys of the park filled with ice and just the tops of the highest peaks sticking out. These giant rivers of ice carved the mountains and valleys into their present appearance.

A 2003 count for glaciers found 26 glaciers in the park. Recent surveys and data from 2005 suggests that the number is declining. They are not the remains of Ice Age glaciers. The glaciers in Glacier National Park are all geologically new, having formed in the last 6,000 to 7,000 years. However, they work in the same way as the larger glaciers of the past, and teach us about Glacier's geologic history.

A Changing Climate

Presently, all the glaciers in the park are shrinking. More snow melts each summer than accumulates each winter. Research in Glacier National Park, and worldwide, shows that the earth is warming. If present climate trends continue, the glaciers and snowfields that embrace Glacier's lofty peaks may once again melt away completely, possibly by the year 2030 or sooner. Many species of the park's plants, animals, and fish may be particularly sensitive to this climate change. Thus, the park will likely continue to be an important site for global climate change research in the future.