ADIRONDACK GEOLOGY
HOW THE LAND CAME TO BE
The Grenville Orogeny

The rocks that form the Adirondacks were created 1.1 to 1.3 billion years ago when ancient continents collided to form Rodinia, a super continent. When the collision occurred, it created the Grenville Orogeny, a large mountain range. This mountain range is similar to today’s Himalayan Mountain Range. During this collision, heat and pressure changed the ancient Adirondack coast’s sediments into crystalline metamorphic rocks. Sandstone, limestone, and shale are all examples of rocks that changed composition due to the heat and pressure.
Metamorphic Rocks

**Metamorphic rocks** are rocks that are formed when existing rocks are subjected to intense heat and pressure.

- Limestone and calcium carbonate muds were metamorphosed into marble. Marble can be found on display in the Naturalist Cabinet from the Cascade Lakes.

- Mud and shale was often metamorphosed into feldspar gneiss and mineral garnet. Large garnet crystals from mines near North Creek and Gore Mountain are on display in the Naturalist Cabinet.

- Sandstones were metamorphosed into quartzite.

- Occasionally, even chunks of the ancient seafloor bedrock (basalt) were metamorphosed into uncommon rock forms such as Charnockite.

![Marble](image1.png)  
![Charnockite](image2.png)  
![Garnet](image3.png)
**Igneous Rocks**

**Igneous Rock** comes from molten rock, formed deep within the crust or mantle of the earth. It cools and crystallizes miles below the surface. Rock that is completely melted becomes remixed with other minerals and elements forming igneous rock when the magma cools.

- Granite is one of the most common igneous rocks and was formed when the Rodinia continent was formed. This rock was cooled under the earth’s surface which is why it has large crystal structures. Minerals commonly found in granite include feldspar, quartz and mica. Granite was metamorphosed further and became Granite Gneiss which is one of the most common rocks in the Adirondack Park. Granite Gneiss can be found in the rock display by otter falls.

- Anorthosite is another igneous rock found in the Adirondacks. This rock is rare on earth but common on the moon. This type of rock is formed in the same way that granite is but it has more calcium, magnesium and other minerals. Anorthosite is very resistant to erosion and is one of the main rock types found in the High Peaks of the Adirondacks. In fact, all 46 High Pecks of the Adirondacks have Anorthosite bedrock. Anorthosite can be found in the rock display near otter falls.
Breaking Up

Rodinia started to break apart between 800 and 850 million years ago. A large rift opened up and the continent is believed to have split in three directions. The Reelfoot Rift which extends from the Gulf of Mexico to parts of Illinois is thought to be one of these breaking points. These rifts filled with water creating new oceans. As the splitting occurred, other smaller rifts known as faults were created.

The fault valleys that Lake George and Schroon now lie in were created during this period by a type of fault called a graben. A graben occurs when bedrock splits apart and a slice of the bedrock breaks off and drops down forming a deep trench.

Most of the faults in the northern and central Adirondacks broke in a NE-SW angled direction, parallel to the angel the continent probably broke up at.
Iapetus Ocean: An Ancient Sea

The Iapetus Ocean was a tropical sea which formed after the Rodinia continent broke up, around 550 million years ago. This ocean covered what we now know as the Adirondack Region.

- Thick deposits of sand were deposited on the floor of this sea and with pressure they turned into the Potsdam Sandstone 520 million years ago. An example of Potsdam Sandstone can be found in the Naturalist Cabinet. If you look closely at the rock, you can see ripple marks created by water.

- Calcium Carbonate deposits from the shells and skeletons of sea creatures and coral reefs formed over the bottom sands, eventually solidifying into Limestone about 490 million years ago.

- Fossils of stromatolites have been found in similar limestone right outside the park in Saratoga Spring and within the park. Stromatolites are considered one of the first living organisms on Earth. A fossil of stromatolites from Arizona can be found near the bog exhibit.
A Huge Dome

Although the rock had been around for over a billion years, the Adirondacks were flat until a hot spot formed 10 million years ago. A hot spot is a large area of molten rock under the earth’s crust that usually forms volcanoes.

The magma from this hotspot heated the rock above it and caused the crust of the earth to expand and rise. The expanding crust weakened and fractured the Potsdam sandstones and limestones near the surface. The rising crust formed a domelike topography.

Over time the sandstones and limestones on this dome were weakened and eroded away by the forces of water from streams and rivers.

The ancient metamorphic rock from Rodinia was now exposed again for the first time in millions of years. On the perimeters of the Adirondack dome, the sandstones and limestones are still intact and the billion year old Rodinia rocks are still thousands of feet below the surface.

The Adirondacks are still rising slowly today! Thus the Adirondacks are the youngest mountains in the northeastern U.S. while they are composed of some of the oldest rock in the northeast.
The round dome shape of the Adirondacks causes the major rivers of the park to flow east, west, south, and north from the high central plateau of the Adirondacks, centered roughly around Blue Mountain Lake. This is called a radial drainage pattern.

The faults that were apart of the Rodinia bedrock were now close to the surface again. The Adirondack river systems took advantage of the weaker and fractured rock in these old faults to carve valleys and ravines out of the fault zones.

The old faults were aligned toward the northeast which explains why most of the valleys and corresponding ridges in the park all have the same northeast facing alignment. Some good examples of this are Indian Lake, Long Lake, Lake Placid, Thirteenth Lake, Upper Saranac Lake, Avalanche Lake and Pass, Indian Pass, Wilmington Notch, Johns Brook Valley, and the Upper and Lower Ausable Lakes.

Waterways also took advantage of the differences in rock composition and hardness to form their valleys. Weaker rocks such as marble often form valleys, while harder rocks like granitic gneiss and Anorthosite form ridges.
The Age of Ice

Starting about 1.6 million years ago and ending roughly 10,000 years ago, successive ice ages overtook the northern United States including the Adirondack region. The ice deepened many pre-existing valleys as the ice gouged out the bedrock and soil and steepened the south slope of many ridges as it overrode them.

As the ice started to retreat around 10,000 years ago, most of the famous Adirondack Lake country came into being. Many lakes were formed when the ice dammed up water to the north, while deposits of glacial debris called moraines dammed up water to the south. Many big Adirondack lakes such as Lake George were formed in this way.

The Glaciers left behind a thick covering of unsorted clay, sand, silt, gravel, rock, and boulders called glacial till. The large boulders in the parking lot were deposited by glaciers! They were uncovered during the excavation of the parking lot. Till covers most of the areas outside of the major river valleys in the park up to an elevation of around 3,000 feet.
The Age of Ice Continued

Most of the wide, flat sections of the major river valleys and lake plains in the park are covered with *glacial outwash*. As the glaciers melted, their were tremendous floods of water which washed away all the tiny clay particles in the bottom of the ice, leaving behind the course sandy soils we find in the outwash plains of the park today such as the *Moose River Plains* and *Saint Regis Canoe Area Wilderness*.

Many small lakes were formed in these outwash plains by chunks of ice that were buried under outwash sands and eventually melted, forming *kettle hole ponds* in their depressions. Most of the tons of small lakes and ponds in the Saint Regis Canoe Area nearby are kettle ponds.

The erosion of the Adirondacks continues to this day due to the erosive power of running water.