



**The New Hampshire Geological Survey,
in cooperation with The Old Man of the
Mountain Legacy Fund,**

invites you to explore ...



**The Old Man
of the Mountain
Legacy Fund**

The Geologic Story of the Old Man of the Mountain



Photo Credit: Am. Cole/AP

The geologic conditions that created the familiar profile that once crowned Cannon Mountain Cliffs in Franconia Notch also brought about his downfall. The story of the Old Man of the Mountain reminds us of the relentless power of water and ice and the unyielding force of gravity to shape the landscape around us.

Conway Granite: Pretty in Pink

The Old Man was made of a hard pinkish rock, called the Conway Granite, that today forms the steep walls of the Cannon Mountain Cliffs. No wonder that this unique natural sculpture was adopted as the iconic symbol of the Granite State. A large piece of that pink granite is on display below.



Photo Credit: Leo Wilder, New Hampshire Geological Survey

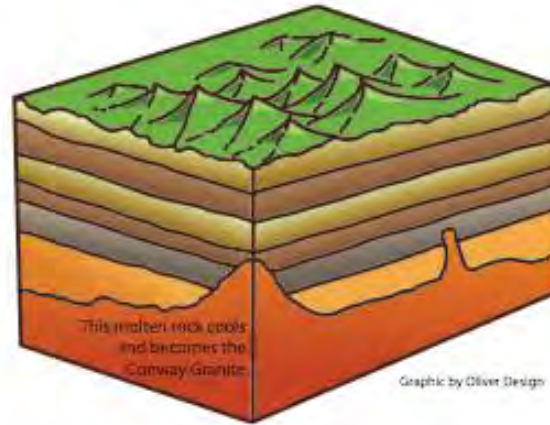


Photo Credit: Neil Olson, New Hampshire Geological Survey

The Conway Granite gets its pinkish color from the potash feldspar (orthoclase), one of the minerals that make up this igneous rock. The other minerals are clear dark gray smoky quartz and thin plates of black biotite mica.

Setting the Stage

The story begins millions of years ago when the Conway Granite was once molten rock that forced its way into older and colder rocks deep below the earth's surface. The tightly interlocking mineral grains of feldspar, quartz, and mica formed as the molten mass slowly cooled into solid rock.



Map adapted from Lyons et al. (1997). Cartography by Greg Barker, New Hampshire Geological Survey.

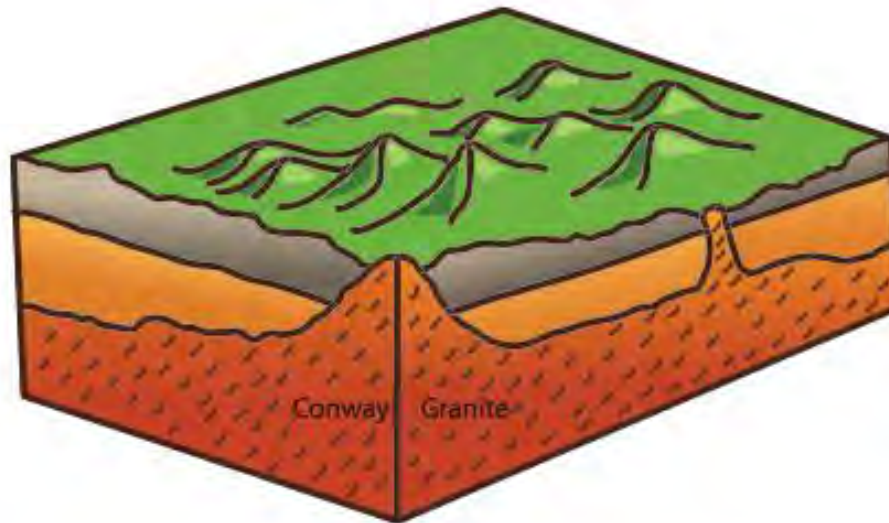
During what geologists call the Jurassic time period (also known as the age of the dinosaurs), about 180 million years ago, molten rock or magma intruded a large area of what is now north-central New Hampshire. The Conway Granite is one body of igneous rock (bedrock formation) that formed from this magma, underlying much of the White Mountains today.

Close inspection of the generalized geologic map of the Franconia Notch region reveals the other types of rock that occur in this area.

Can you name at least two other bedrock formations that are in contact with the Conway Granite? Are they older or younger than the Conway? [Answer on next panel]

Unearthing the Conway

Inch by inch, century after century for tens of millions of years, the enormous mass of rock above the Conway Granite was weathered and eroded away. Running water and ice, heat and cold, broke apart and disintegrated once solid rock near the land surface. Eventually, the Conway Granite emerged into the light of day.



Graphic by Silver Design

No one really knows exactly what the landscape looked like throughout this long interval of time because the evidence has largely been erased. One hypothesis holds that the ancestral Appalachian Mountains, including the White Mountains, were eroded to low hills with a scattering of remnant peaks by about 65 million years ago before intensified river down cutting produced topographic relief that is similar to what we see today. The exhumation history has recently been studied by looking in minute detail at the geochemistry of grains of the mineral zircon contained in the remaining rocks. Results estimate the average rate of erosion to have been approximately 490 feet per million years (less than 6 thousandths of an inch per year).

Answer: Kinsman Granodiorite, Rangley Formation, Mt. Osceola Granite, Granite Porphyry and Quartz Syenite. All of these are older than the Conway Granite.

Fast Forward: The Big Chill

About 2.6 million years ago, the climate began to cool. The New England landscape was covered by a massive ice sheet, not just once, but several times. As each ice sheet expanded and advanced southward over the White Mountains, faster moving, rock-laden ice at the base of the glacier streamed through Franconia Notch and scoured the valley to form its present "U-shape".



Photo Credit: Neil Dixon, New Hampshire Geological Survey

Earth's most recent ice age is known as the Pleistocene Epoch, a period of multiple continental scale glaciations in both hemispheres. The last episode of continental glaciation in New England is known as the Wisconsinan Stage of the Laurentide Ice Sheet. Moving glacial ice carries enormous quantities of rocky material which has been eroded and picked up from the underlying land surface. Armed with these tools and driven by the shear weight of ice, glaciers are effective at scouring the bottom and sides of any valley to create a rounded U-shape... a classic glacial valley.

Valleys formed primarily by the action of running water have a distinctly different shape. What letter would you choose to best describe them? [Answer on next panel]



Photo Credit: Neil Dixon, New Hampshire Geological Survey

Ice Free At Last

As the last ice sheet melted from the notch around 14,000 years ago, the freshly exposed valley walls were attacked by the weather. Water seeping into cracks in the rock repeatedly froze and then thawed, continuously wedging and breaking pieces off the steep rock walls and top of the Cannon Mountain Cliffs.



Sequence Photo Credit: Robert Baker

Falling blocks of rock tumble to the bottom of the cliff, breaking into smaller pieces in the process. The apron of weathered rock debris that accumulates is known as a talus slope or pile. Patches of talus without vegetation highlight areas of most recent rockfalls.

Note the series of sheeting fractures parallel to the cliff face above the top edge of the talus pile in the close-up view.

Answer: V-shaped.



Photo Credit: Rick Charnane, New Hampshire Geological Survey

The Old Man Emerges

Sometime between the disappearance of the glacial ice and the first documented sighting of the Old Man by a party of surveyors in 1805, just the right combination of rock pieces were removed and preserved on the cliff face to form this world famous profile.



Photo Credit: New Hampshire Historical Society



Image from
Charles Sawyer

The bad news is that the pink potash feldspar in the Conway Granite is readily susceptible to being chemically altered to soft clay minerals by interaction with water. As the pink feldspar breaks down, the other mineral grains in the rock are loosened, leaving a crumbly mass of granite called "rotten stone". To make matters worse, the granite is not a solid mass but contains numerous cracks or fractures (the result of differential stresses acting on the rock over long periods of time) which intersect each other and the land surface at various angles. While these fractures undoubtedly helped to "sculpt" the Old Man, they also provided an easy point of attack for water and ice.

Before the Fall

Even as word of this remarkable natural feature spread and increasing numbers of tourists came to marvel at the Old Man, the forces of weathering and erosion were hard at work. The dedicated efforts of numerous "caretakers," beginning early in the 1900's, attempted to defy gravity, and fend off the relentless assault by wind and rain, snow and ice.



Photo Credit: Littleton Historical Society

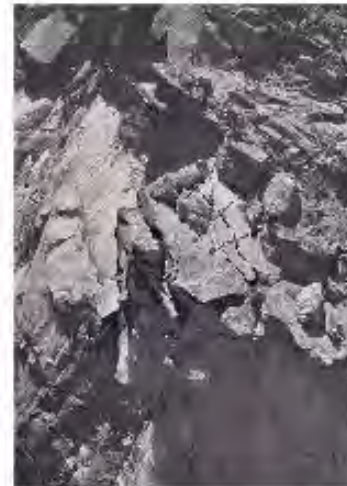


Photo Credit: Littleton Historical Society

On the other side of the chin block (not seen from this view) an open cavity (fracture) existed. This opening allowed the rain and snow to get in behind that lower block of rock and gradually weaken the shelf of cliff rock upon which all the above blocks rested.

How many parallel layers of blocks appear to make up the profile? [Answer on next panel]

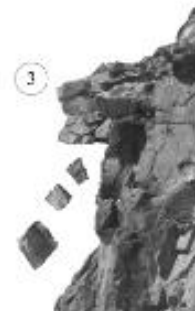
A DELICATE BALANCE

Geologists believe the Old Man of The Mountain, formed as weathering and frost action made blocks of rock fall from the Cannon Cliffs after the last Ice Age. On May 3, 2003, the delicate mechanism that had held the "Great Stone Face" in place abruptly failed.

The Old Man was made up of two blocks of Devon County Granite that had been stacked atop one another. As seen in this drawing of the profile, each block hid its front view. There was a narrow crevice about 4 feet wide behind the Old Man's chin (Block B). About 80% of the thin block was cantilevered out over the cliff by front of the crevice, wedged against the main block by the weight of the blocks above. This delicate wedging allowed the entire Old Man to rest on its side when it was formed.



Water and frost were having their year so damaged the small block that it could no longer support the weight from above, and it collapsed causing the main block and the block above Block A to topple forward and down the cliff.



Within seconds, the weight of the remaining blocks, no longer supported from below, quickly followed.



Almost simultaneously, the remaining block (Block B), now completely unsupported quickly fell forward and the Old Man was gone.

Approximately 600 tons of the Old Man's granite pieces were seen to tumble by New York State and Maine's State Police and geologists. The fall was captured on video by a group of geologists who collected the 80% of the original mass of the Old Man's granite. The fall was captured on video by a group of geologists who collected the 80% of the original mass of the Old Man's granite.



A close-up shows clearly after the Old Man's disappearance granite's deep cracks that were a sign to the geologists through the years that it would break and topple rather than tumble. What appears to be a crack in granite that was formed by water. The rock granite is broken into the smallest pieces (chips) which is particularly sensitive with water.