

RUSHMORE: *Carved in* Granite

BY AMY GRISAK

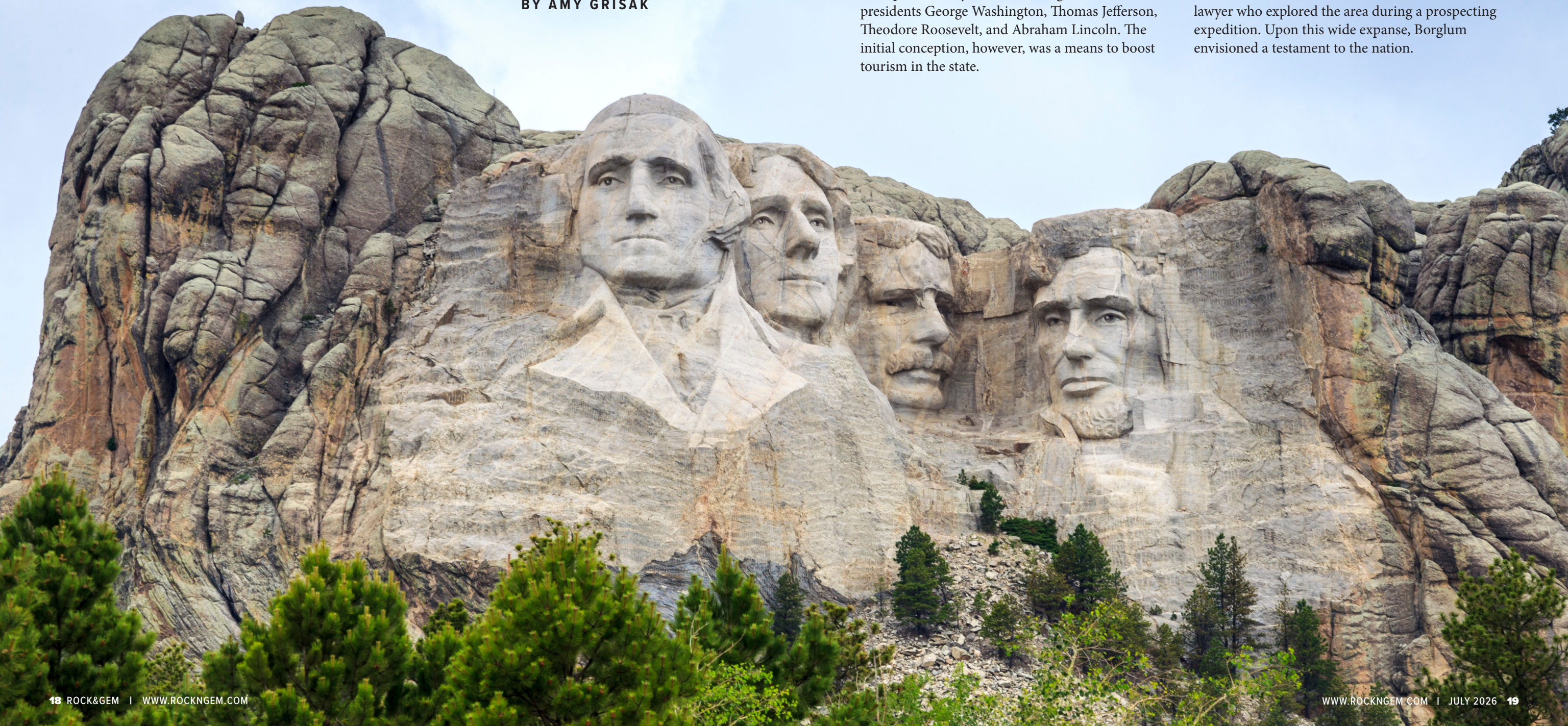
During America's 250th anniversary, the Mount Rushmore National Monument takes on a deeper significance, demonstrating the grit and gumption of four leaders in this country's history. Carved from Harney Peak granite, a coarse-grained, mineral-rich Precambrian granite that forms the Black Hills of South Dakota, this stable rock maintains their features for generations to come.

WHEN TOURISM MEETS HISTORY

For most visitors to the Rushmore Monument, it's a quick history lesson extolling the virtues of presidents George Washington, Thomas Jefferson, Theodore Roosevelt, and Abraham Lincoln. The initial conception, however, was a means to boost tourism in the state.

In 1924, state historian Jonah LeRoy "Doane" Robinson sought to create monuments to Western heroes, including Buffalo Bill Cody and Red Cloud, a much-respected Oglala Lakota leader, in the rock known as "The Needles," spire-like granite formations also found in the Black Hills.

When Robinson brought the sculptor, Gutzon Borglum, aboard, Borglum felt the Needles were too fragile to carve. He set his sights on a much grander palette. His focus was on the sacred peak of the Lakota Sioux, which they call "The Six Grandfathers." In the mid-1800s, it was dubbed Rushmore Peak, named for Charles Rushmore, an eastern lawyer who explored the area during a prospecting expedition. Upon this wide expanse, Borglum envisioned a testament to the nation.





Beautiful light on the monument.
Travel South Dakota/
Chad Coppess

THE CREATION OF THE HARNEY PEAK GRANITE

Rushmore Peak was also more practical from a geological aspect, which began billions of years before the first chisel touched the stone. The Black Hills are a geological island made up of some of the oldest rock on the continent.

“The Black Hills are an elongate dome cored by rocks of the Precambrian age,” explains Dr. Edward Duke, professor and manager of analytical services at South Dakota School of Mines in nearby Rapid City. “Those rocks are 2.5 to 1.7 billion years old and only exposed in the Black Hills (in

this region). To see rocks of similar age, you’d have to go all the way up into northern Manitoba.”

“Most of the Precambrian rock now exposed was deposited as mud and sand in an ancient ocean basin between 2.5 and 1.9 billion years ago,” he says. “Subsequently, between about 1.9 and 1.8 billion years ago, the continental plates bordering the ocean basin began to converge, much the way the Indian and Asian plates are converging today. It is believed that an alpine-type mountain chain, similar in scope to the Himalayas, stretched from the site of the Black Hills north into Manitoba and east across Hudson’s Bay. Eventually, as these mountains eroded, some of the deeper rocks were exposed to the surface. And that’s essentially what we’re seeing in the Black Hills today.”

During the mountain-building event, the sedimentary deposits were subducted and pushed down beneath the continental masses and the growing mountain range. Throughout this process, which forces the sedimentary masses to depths up to 15 km, they were subsequently deformed and heated.

Duke says that at this depth, the rock is subjected to extreme pressure and temperatures around 600-700°C. “At those temperatures, the rocks begin to melt, and



those melts typically are of the composition of what we call granite.”

HARNEY PEAK GRANITE

Harney Peak granite, as implied by the definition of granite, contains a considerable amount of quartz, as well as both potassium feldspar and sodium feldspar. Yet, this unique granite also holds a lot of very coarse muscovite mica. While many other granites have grains of these minerals that might be only a few millimeters in size, many crystals within the Harney Peak granite are the size of a fist, and the rock shines with inch-long mica flecks glistening in the sunshine.

“This is fairly unusual in terms of granite worldwide, and probably has something to do with the rocks which melted to form the granite magma. For some reason, the magma may have had a higher content of things like water, which can be dissolved in magma,” says Duke. “It may have had a higher content of certain elements such as fluorine and boron, which are minor constituents in all granites, but they seem to be especially abundant in the Harney Peak for reasons we don’t really understand.”

“There are also a lot of pegmatites associated with Harney Peak,” he explains. “Pegmatite simply means an igneous rock with very coarse crystals.”



Left: Gutzon Borglum suspended on the boson seat inspecting the work on Lincoln’s face.
U.S. National Park Service.

Right: Charges of dynamite being prepared by powder man, John Johnson, with a cast of Washington’s face behind him.
U.S. National Park Service.

IMPRESSIVE CRYSTALS

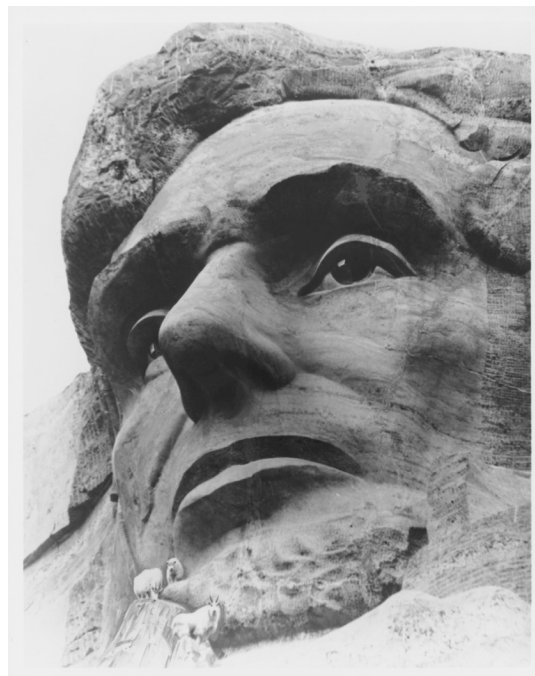
The crystals in the Black Hills are known to grow to impressive sizes. Duke points out that there have been feldspar crystals larger than a person, and one of the longest crystals in the world was a spodumene crystal, a lithium-bearing mineral found within pegmatites, which was over 45 feet long. This was found near the small town of Keystone, within sight of Mount Rushmore.

“Rushmore itself is part of the Harney Peak granite. If you just saw a geologic map, it’s really just along the edge of the main part of the granite. The main granite would include areas like Harney Peak itself or Black Elk Peak,” Duke says. “On the other side of the Black Hills, the Crazy Horse Memorial is also carved from Harney Peak granite.”

“If you picture the actual carvings at Rushmore, along the base of the carvings, you can see the rock that it intruded into. So, you see this kind of banded, dark rock. Those are the metamorphosed, sedimentary rocks that pre-existed the granite,” he says. This rock is possibly a billion years older than the granite, but pushed upwards and is exposed within the granite formations.

SHAPING THE VISION

Upon this broad, granite face, Borglum envisioned four presidents who represented



Left: Mountain goats on Lincoln’s collar.
U.S. National Park Service.

Right: Gutzon Borglum in a boson’s chair inspecting the work on the monument.
U.S. National Park Service.



Left: Profile image of Washington.
Travel South Dakota/
Chad Coppess

Right: Lincoln up close.
Travel South Dakota/
Chad Coppess



There were hidden fractures and rock that was weaker than anticipated. **After 18 months of working on Jefferson's face, workers had to blast away the progress because it was too unstable to continue.**

pivotal phases in the United States: George Washington (founding), Thomas Jefferson (expansion), Abraham Lincoln (preservation) and Theodore Roosevelt (development). He wanted an American vision, not a regional one, a wise move, particularly because he understood that federal funding would be integral to the project.

Borglum's original concept was to show the presidents from the waist up, creating more statue-like figures rather than simply portraits. Using the natural shape of the granite, he wanted to place Washington in the center with Jefferson to his right (or, for those looking at the monument, to the left of Washington's face). But the rock and world events had other plans.

When work began in 1927, Borglum was full steam ahead on the torso concept. By the time workers completed Washington's portrait in the early 1930s, it became obvious the plan was overly ambitious. There were hidden frac-

tures and rock that was weaker than anticipated. After 18 months of working on Jefferson's face, workers had to blast away the progress because it was too unstable to continue.

In some areas, fragile rock had to be removed to expose the harder Harney Peak granite. This unique rock made the monument possible, but even so, workers had to test and adapt to the realities within it.

The actual work was arduous, dangerous, and noisy, with dynamite doing the bulk of the rock removal. Because the project relied heavily on mining techniques, many of the workers were miners, intimately familiar with drilling and blasting, along with carpenters and mechanics, rather than a handful of trained sculptors.

Instead of building scaffolding, workers sat in bosun chairs, suspended seats held by cables, and lowered them to the section of the face where they were working. Dangling over one hundred feet above the ground,

they drilled and inserted charges before clearing the area to blast away sections of rock. Other times, they held heavy pneumatic drills to refine the features, all the while being exposed to the natural elements.

During each season, approximately 30 to 40 workers made progress from May to October in eight-hour shifts. By the time it was finished, over 400 workers played a part in the effort. Standard pay averaged between \$.55 and \$.75 an hour, with more experienced drillers and sculptors earning a dollar an hour. These were welcome wages during the Great Depression when most of the work was completed.

It took over seven years of hands-on work to carve the monument. It's surprising what didn't go wrong. Despite the grueling conditions and dangerous nature, no one was killed throughout the entire project. It seems a miracle that they never blasted out too much rock. Hitting a fracture or a weak spot in the rock could've been catastrophic, but every blast hit the mark.

Roosevelt's glasses also proved tough as carving them realistically would have left them vulnerable, and most likely not durable enough to last for centuries. Instead, Borglum created an illusion of lenses by carving thick ridges of granite.

HALL OF RECORDS

Borglum's vision went beyond the visible monuments. He wanted to create an 80-by-100-foot hall, accessible by an 800-foot granite stairway, leading to the room carved into the back of the monument. Glass and bronze cabinets would store important documents related to the country's history, including the Declaration of Independence and the Constitution.

Work began on the hall in 1938 with workers blasting a 70-foot-long tunnel into the mountain behind Lincoln, but progress ceased when Congress instructed them to focus on the faces. And with Borglum's death in 1941, even though his son Lincoln took the reins, work ceased on October 31, 1941.

In 1998, the National Park Service established a repository of records containing

sixteen porcelain tablets that explain the history of the country and the Mount Rushmore monument. These are kept within a teak box placed inside a titanium vault on the floor of the hall. A granite capstone covers it all and is engraved with these words of Borglum:

"...let us place there, carved high, as close to heaven as we can, the words of our leaders, their faces, to show posterity what manner of men they were. Then breathe a prayer that these records will endure until the wind and rain alone shall wear them away."

During this 250th anniversary of the United States, the Mount Rushmore National Monument is an example of the creativity, ingenuity, and sheer toughness of Americans, and of the pride we take in carving inspirational figures into stone to inspire future generations. 💎

Amy Grisak calls the "Treasure State" of Montana home, the ideal location for her fascination with rocks, gems and fossils. She is the author of the Nature Guide to Glacier and Waterton Lakes National Parks and Found Photos of Yellowstone, and readers can follow her adventures at amygrisak.com.



Sculpture maintenance on Lincoln's face.
U.S. National Park Service.

Closer shots of Rushmore showing Washington and Lincoln.
Travel South Dakota/Tim Schoon