Interactive 3D model recreates Old Man of the Mountain

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Screenshot of the interactive 3D model with the Old Man of the Mountain back on Cannon Cliff. Credit: Matthew Maclay.

Twenty years after the Old Man of the Mountain collapsed, audiences around the world will now be able to explore the iconic symbol of New Hampshire through an online interactive 3D model created by Matthew Maclay, a graduate student in earth sciences at Dartmouth's Guarini

School of Graduate and Advanced Studies.

The face-shaped granite formation on the northeast side of Cannon Cliff in Franconia Notch State Park fell off the cliff on May 3, 2003, drawing international attention and dismay in New Hampshire itself.

"People continue to have a very emotional connection to the Old Man of the Mountain—the state emblem of New Hampshire, so I am really excited that this 3D model will provide the public with an opportunity to learn more about this natural wonder and the weathering processes affecting the underlying geological structure of the area," says Maclay.

As part of the research project, Maclay and collaborators Jesse Casana and Carolin Ferwerda at Dartmouth's Spatial Archaeometry Lab performed aerial surveys of Cannon Cliff using a drone. They then reconstructed the now lost profile using original film negatives taken between 1958 and 1976 that documented the Old Man of the Mountain and surrounding area during maintenance conducted by the profile's caretakers.

Maclay processed the imagery in the Planetary Surface Processes Computing Lab led by Marisa Palucis, an assistant professor of earth sciences at Dartmouth. By applying photogrammetry, a technique akin to the way that eyes provide depth perception, Maclay was able to create a 3D model of Cannon Cliff with and without the Old Man of the Mountain.

"As a New Hampshire native, I visited the Old Man many times as a child and like so many other state residents I felt a real sense of loss when it finally collapsed," says collaborator Jesse Casana, a professor of anthropology and director of the Spatial Archaeometry Lab at Dartmouth. "I'm really happy to be part of this project helping to digitally bring the Old Man back to life."

Through the modern 3D model, viewers can zoom around Cannon Cliff, which is approximately one mile across and 1,000 feet tall in size and see where the Old Man used to be located.

"Cannon Cliff is one of the largest cliffs in the eastern United States and it looms over a massive pile of rocky debris ranging in size from sand to boulders larger than cars," says Maclay. "It's an enormous slope of loose rocks, which serves as evidence of the efficient bedrock weathering and rockfall that has been taking place since the last ice sheet retreated, around 12,000 years ago."

In his research, Maclay is studying how climate-based processes break down bedrock physically and chemically in place, which in turn loosens and frees up the bedrock for rockfall.

"Understanding which areas of Cannon Cliff may be especially susceptible to rockfall is important given the popularity of the area as a year-round climbing and tourist destination," he says.

"The bedrock weathering processes are also significant because they are breaking down rocks on the slope into sediment, which is how soil is made," says Maclay.

Prior research has found that the cold, harsh winters and warm, wet summers in the White Mountains create conditions for efficient soil production, which may be affected by a warming climate.

As part of the ongoing project, the researchers installed 24 sensors that record the bedrock temperature at Cannon Cliff. They will also be conducting laboratory analyses of rock samples from the area to investigate chemical changes in minerals due to mildy acidic rainwater and snowmelt.

Through the model, Maclay was able to estimate the volume and mass of rock that was lost when the Old Man of the Mountain fell, which couldn't be calculated until now. According to his measurements, around 750 cubic meters of granite fell, so he says it would have been tremendously heavy.

"The Old Man of the Mountain may have weighed nearly 2,000 tons, when it collapsed," says Maclay. "While 3-inch turn buckles had been bolted into the Old Man to try and prevent it from falling, the actual strength of the granite was degraded over centuries and that's probably why it collapsed."

He says the same forces that shaped the Old Man of the Mountain are still active on Cannon Cliff today.

"The Old Man's face is no longer perched on that rocky outcrop, but he wasn't the first rockfall and he's not the last. There are still rockfalls happening at Cannon Cliff, as it's one of the most dynamic places in the White Mountains."

The debut of the 3D model coincides with a virtual event on Wednesday, May 3 at 11 a.m. commemorating the 20th anniversary of the collapse. The online event will feature a historical perspective from the Museum of the White Mountains in Plymouth, N.H., on how the Old Man shaped New Hampshire's identity from its first recorded discovery in the early 19th century until today.

It will also include an introduction to the ongoing geological research of the Old Man and the Cannon Cliff by Maclay and a medley of personal stories and poems from local public school students in Franconia, N.H. and Lincoln, N.H.

The event will also feature the release of a new song, Great Stone Face,

by New Hampshire songwriter Rick Lang.

"This model has for the first time enabled a precise determination of how much rock fell from Cannon Cliff when the Old Man collapsed," says Brian K. Fowler, president of the Old Man of the Mountain Legacy Fund, a longtime scholar of the White Mountains and engineering geologist, who conducted the geological survey in 1976 prior to the construction of Interstate 93 through Franconia Notch.

"For years, Brian Fowler has studied Cannon Cliff to understand the geology and stability of the Old Man of the Mountain, and well before that, there were efforts to preserve the delicate formation," says Maclay. "One of the most rewarding aspects of this project has been collaborating with Brian and meeting so many people who care about the cliff."

"I hope that our research will get people excited about visiting Franconia Notch State Park, where they can look at the stunning Cannon Cliff from some of the many nearby hiking trails and see 'geology in action,' as we like to call it," says Maclay.

More information: For more details about the virtual event and other anniversary-related events, visit: oldmannh.org. (Registration is required for the online event on May 3).

Provided by Dartmouth College