

The Moon House dwelling is perched in a canyon in Cedar Mesa, at an elevation of 5,700 feet (1,740 meters) in a relatively arid region of southeastern Utah.

Is the MOON HOUSE an AMERICAN STONEHENGE?

This ancient Puebloan structure, now a historical landmark, may have been inspired by a pair of eclipses.

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Imagine that you live in isolation on a beautiful mesa with a small band of subsistence farmers. Your territory is rugged and difficult to traverse, with steep slopes, deep canyons, and sandstone cliffs, and is strewn with boulders, hoodoos, balanced rocks, and other obstacles. Even the flat places are uneven and covered with piñon, cedar, shrub oak, yucca, cactus, and scrubby desert plants.

The key to your survival is your ability to grow, store, and defend your food. You must cultivate it where you live, because

transporting it over long distances would be impossible. You have no government or societal safety net. Your survival is up to you, and you are acutely aware that plants require sunlight, warmth, and water.

You have no written language, books, television, computer, phone, internet, or recorded music. All you have is your intellect, your community, your family, and your civilization. You've identified items you can make without much technology, like rock art, baskets, stone tools, and clothing. When darkness falls, you have sky, fire, voices, faces, drums,

flutes, food, sex, and dreams. That's pretty much it.

Such was life for the ancestral Puebloan people, often called the Anasazi, who inhabited southeastern Utah. Their cliff-dwelling stage lasted between 1150 and 1300. During this span, they built and decorated a complex some 6,500 feet (1,980 meters) above sea level on a plateau called Cedar Mesa. In the 1960s, archaeologist Bill Lipe of Washington State University dubbed it the "Moon House." The name stuck.

The Moon House divides into three sections: a living area with about half a dozen households, a



Above: The outer wall of the Moon House stands beneath an overhanging cliff that has helped to protect the interior from wind and rain. **Left:** Getting to the Moon House isn't easy. As you approach it, you'll see old wooden support beams spanning the gaps between rocks.

storage area, and a large room reserved for religious or social meetings. Throughout the structure, its walls carry decorations that may indicate that those who lived there carefully watched the sky.

Life as they knew it

The people who built the Moon House had a lot of time for observing. They certainly kept an eye on the weather: how clouds form, how storms move, and how and when rain, virga, and snow falls. When the sky was cloud free, they observed how the Sun, Moon, stars, and planets track across it. Their understanding of natural cycles was handed down by their elders and reinforced by observations and personal

experience. And because those cycles were the keys to their survival, they paid attention to the slightest detail and any variation in the pattern.

Every once in a while, something out of the ordinary would happen. A brilliant light streaks across the clear sky, lighting up the entire mesa and causing hoodoos to cast moving shadows in the night. A fuzzy patch appears, grows a tail, and moves through the constellations like a fast planet. A bright star that never existed before appears and then fades out. Many stars fall at once, like snowflakes. The Full Moon is swallowed up and glows a dim blood red. In their world, these were the dramatic, emotional, and terrifying external events that everyone would talk about, tell their grandchildren, and record.

Their lives and everything they knew and cared about depended on the seasonal cycle, which happened the same way every

year. Where the Sun came up and where it set told them when to plant, because the sky was their calendar as well as their clock. After the harvest, the days got short and cold, and the nights got long. But even before they witnessed them, they knew from their elders that unexpected and unpredictable things could happen, so surely they wondered if it was also possible that dependable and regular things could stop happening.

Endless routine?

It took faith to believe that the Sun would come back and that it would ever be warm enough to grow food again. The Puebloans watched as the Sun set earlier and farther to the south on the horizon at the fall of night — each night longer and colder than the one before. Everyone expected and hoped the rate would slow, and eventually stop, because it always had.



Top: The Moon House is larger than it appears when you view it from the outside. The interior has areas for living, storage, and meetings. **Above:** Visitors can see many colorful vistas from inside the Moon House, and the closer you get to the entrance, the more the sky comes into view.

And then one evening, the glowing orb stopped moving south. Across the mesas, that last beam of sunlight shone through a natural V in the rock, lighting up a spot on a nearby wall. Somebody pecked a spiral into the desert varnish as a reminder of where the beam would be on this day of celebration of the return of the Sun — the winter solstice.

A half-year later, the opposite happened. Unlike winter, this was a joyful time of year with long, hot days and short nights. The crops would be growing fast, nourished by the Sun's heat and light. Now the Puebloans watched as the Sun rose further to the north on the horizon every day, and another marker that told them when the longest day — the summer solstice — would arrive. On that day of celebration, they watched as the Sun rose nearly to the zenith (the overhead point) at midday. Its brilliant light bathed the canyons, and they welcomed it.

Surprise!

And then, one day, something odd began to happen, something they had never witnessed before. In the middle of the day, the light started to fade and it got a little cooler. It was almost imperceptible at first, but then it became obvious. Something was wrong with the Sun. Imagine the emotions people felt as they saw the golden orb, bit by bit, disappear.

To scientists, total solar eclipses are fascinating, but they are also gut wrenching and emotional to experience. We now know what causes them, and we have the technology to precisely predict their timing and tracks, but they are still adrenaline- and tear-inducing events as best described by Annie Dillard in her essay, "Total Eclipse." One paragraph captures the terror, but I highly recommend that you read the whole thing:

BEARS EARS: AMERICA'S NEWEST NATIONAL MONUMENT

One of President Barack Obama's final acts while in office was to issue a Presidential Proclamation on December 28, 2016, to establish Bears Ears National Monument. The proclamation reads:

"Rising from the center of the south-eastern Utah landscape and visible from every direction are twin buttes so distinctive that in each of the native languages of the region their name is the same ... 'Bears Ears.' For hundreds of generations, native peoples lived in the surrounding deep sandstone canyons, desert mesas, and meadow mountaintops, which constitute one of the densest and most significant cultural landscapes in the United States. Abundant rock art, ancient cliff dwellings, ceremonial sites, and countless other artifacts provide an extraordinary archaeological and cultural record that is important to us all, but most notably the land is profoundly sacred to many Native American tribes. ... Resources such as the Doll House Ruin in Dark Canyon Wilderness Area and the Moon House Ruin on Cedar Mesa allow visitors to marvel at artistry and architecture that have withstood thousands of seasons in this harsh climate."

With the stroke of his pen, President Obama preserved this vast treasure of geological, ecological, archaeological, historical, cultural, and astronomical heritage. These lands are withdrawn from any new mineral exploration or development, and the same dark skies that 13th-century ancestral Puebloan inhabitants once enjoyed will forever remain available for stargazing and tranquil contemplation by future visitors. — M. B.

"From all the hills came screams. A piece of sky beside the crescent Sun was detaching. It was a loosened circle of evening sky, suddenly lighted from the back. It was an abrupt black body out of nowhere; it was a flat disk; it was almost over the Sun. That is when there were screams. At once this disk of sky slid over the Sun like a lid. The sky snapped over the Sun like a lens cover. The hatch in the brain slammed. Abruptly it was dark night, on the land and in the sky. In the night sky was a tiny ring of light. The hole where the Sun belongs is very small. A thin ring of light marked its place. There was no sound. The eyes dried, the arteries drained, the lungs hushed. There was no world. We were the world's dead people rotating and orbiting



The ancestral Puebloans decorated the walls of one of the inner rooms with evenly spaced dots. At each end is a shape (not pictured) that could depict a crescent Moon or partially eclipsed Sun.

HOW TO GET TO THE MOON HOUSE

For our trip, we made arrangements by calling the Bureau of Land Management's Kane Gulch Ranger Station at 435-587-1500. The permit fee cost \$2 per person, and groups of up to 12 were allowed. Reservations are required during the spring and fall high seasons when Kane Gulch Ranger Station is open (March 1 to June 15 and September 1 to October 31). The number of visitors is limited each day to provide a quality experience.

The closest accommodations are in Blanding, Utah, about 45 minutes away. We stayed at the Stone Lizard Lodge, which serves breakfast and has knowledgeable staff. Its phone number is 435-678-3323. The closest major airports are in Albuquerque, New Mexico, and Salt Lake City. The drive from either city is about the same: a bit more than 300 miles (480 kilometers) that takes a bit over five hours. — M. B.

around and around, embedded in the planet's crust, while the Earth rolled down. Our minds were light-years distant, forgetful of almost everything. Only an extraordinary act of will could recall to us our former, living selves and our contexts in matter and time. We had, it seems, loved the planet and loved our lives, but could no longer remember the way of them. We got the light wrong. In the sky was something that should not be there. In the black sky was a ring of light. It was a thin ring, an old, thin silver wedding band, an old, worn ring. It was an old wedding band in the sky, or a morsel of bone. There were stars. It was all over."

House of the Moon

Because we now have tools for precise astronomical calculations, we know that

there was a total eclipse of the Sun about 10 minutes after local noon on Cedar Mesa on the summer solstice in the year 1257. Given Dillard's description of the reaction to an expected eclipse, imagine what it must have felt like to a 13th-century ancestral Puebloan cliff dweller.

I learned about this eclipse and its significance from Don Simonis, a recently retired Bureau of Land Management archaeologist who is an expert on the Moon House. I was attending the 2015 Pecos Conference at a campground in Mancos, Colorado, near Mesa Verde National Park.

Simonis became aware of the event a couple of years earlier from Ron Barber, a Los Alamos National Laboratory engineer. Barber has become obsessed with the



On June 20, 1257 (by our modern calendar), the inhabitants of the Moon House would have witnessed a total solar eclipse with totality lasting an amazing 5 minutes 55 seconds. Two years later, on October 24, 1259, another total solar eclipse occurred within the region; totality lasted 1 minute 11 seconds.



Sunlight beams through small openings in the wall of the Moon House. Although they don't correspond to obvious lineups or markings, the sunbeams lend a touch of mystery to an already enigmatic site.

presence of ancient stone glyphs that align with unique shadows and sunbeams on special astronomical dates across the southwest and beyond. His Stone Calendar Project is an effort to combine advanced surveying techniques and 3-D modeling along with field observations to discover, document, and understand petroglyphs, pictographs, and other markers that indicate important dates and events such as solstices, equinoxes, and the four cross-quarter days each year, which lie midway between solstices and equinoxes.

Barber had given a lecture on archaeoastronomy that included maps of the paths of total solar eclipses across the area in 1257 and 1259. The intersection of the zones of totality formed a large parallelogram across southwestern Colorado and southeastern Utah, including Mesa Verde and Cedar Mesa. Amazingly, the indigenous people who occupied those places witnessed two total eclipses of the Sun in just 28 months.

Connections

Simonis knew something that Barber didn't, because he was aware of the Moon House. He had spent the previous several years working with the National Park Service to have it listed on the National Register of Historic Places.

The Moon House is unusual for many reasons. It is well preserved, partly because



How would you interpret this piece of rock art? Is it a snake? A flowing stream? Lightning during a storm? Your interpretation may be wrong and lead nowhere, or it could be the key to unlocking the secrets of the site.

unlike most sizable cliff dwellings, it was not rediscovered until the 20th century. Its architecture is unique and fascinating, with an outer wall underneath a cliff overhang, and a set of protected rooms inside. The Sun passes over the outer wall and through peepholes into the alleyway between it and the rooms, where it is easy to imagine ceremonies taking place on special days.

In one of the inner rooms, the walls are decorated with evenly spaced white dots. At one end is a large circle, and the opposite end has a crescent. One must be careful when interpreting ancient rock art. For example, is a zigzag meant to be a snake? A waterway? Lightning? A circle can be just about anything round, including the Sun or the Moon. But not too many things form



crescents. Other than the Moon, only melon slices and fingernails come to my mind.

Simonis also knew that the Moon House was one of the best dated archaeological sites in southwestern Utah. Because its construction contained a lot of wood, researchers could count tree rings. When he saw the maps of the 1257 and 1259 eclipses, he thought of the Moon House because it contained wood that was harvested from trees between 1250 and 1268. It was apparently built during the time of these eclipses, so the builders must have witnessed them.

After I returned from the Pecos Conference, I immediately went onto the NASA eclipse website and learned that the Moon House was just west of the path of totality in 1259. It was a late October

eclipse, at midafternoon, when the Sun stood in the southwestern sky. At maximum obscuration, the Moon covered 99.99 percent of the Sun's disk. Our star would have appeared as a thin crescent with horns pointing to the left, just like the pictograph of the west wall of the Moon Room.

Keep calm and science on

At this point, it's easy to get carried away with speculation. Was the Moon House really a Sun House? Was it a shrine to commemorate the great eclipses of the 13th century? Was it a solar observatory? Perhaps fancy 3-D models and observations will help answer these questions.

On the weekend of October 22 last year, I went with a group of friends on a reconnaissance trip to the site to commemorate the 757th anniversary of the second eclipse. I also wanted to watch the Sun track across the sky to see if there were any sunbeam or shadow markers. Despite the lack of any obvious scientific evidence, it was a moving experience and one that I will always remember. At about the time that the eclipse would have reached the diamond ring phase, I proposed to my sweetheart in the Moon House. She said yes. ☽

Mark Boslough is a physicist who is active in defending science and evidence-informed decision making.