

Sandia Cave Restoration: National Historic Landmark

Sandra Arazi-Coombs-USFS and Carrin Rich-Sandia Grotto



Spiral stairs leading to the mouth of Sandia Cave, viewed from the half-mile trail from the parking lot. Photo by Pete Lindsley.

Sandia Cave (formerly as Sandia Man Cave), high in the walls of Las Huertas Canyon in northern New Mexico, holds cultural and spiritual significance for several of the surrounding tribes. Lying within the Madera limestone formation dated to the Pennsylvanian Age, Sandia Cave has a verified Folsom component and evidence of human use for as many as 10,000 years. As such, the site is a National Historic Landmark that has played an important role in the history of archaeological thought about the Paleoindian period and Southwestern archaeology.

The cave is also a popular tourist destination and has been open to the public for many decades. A 466.4-foot horizontal solution cavity proximate to the city of Albuquerque, New Mexico, Sandia Cave is navigable by explorers of all experience levels. The site is accessible by car and appears on many maps and navigation apps.

The site features a half-mile access trail with spectacular views and a thrilling 20-foot spiral staircase to the cave mouth. Unfortunately, the same ease of access that allows visitors to experience the historic and natural richness of Sandia Cave also leaves the site vulnerable to vandalism.

SANDIA CAVE ARCHEOLOGICAL CONTROVERSY

Much of Sandia Cave's notoriety in the twentieth century derived from the contro-

versial work of Frank Cummings Hibben (1910-2002), professor of Anthropology at the University of New Mexico, and his search for evidence of pre-Folsom culture in North America. Hibben conducted excavations in Sandia Cave from 1936 through 1941, and attempted to associate prehistoric human material with extinct Pleistocene fauna, including mammoth, mastodon, horse, and camel.

Because his excavations were conducted prior to acceptance of radiocarbon dating in the 1950s, his interpretation was based on the stratigraphy of the cave. Hibben purported that below a Folsom Age stratigraphic layer that contained several fluted projectile points was a layer of material where Pleistocene fauna were found in association with a distinct type of stone projectile point.

This type of point, dubbed "Sandia points" by Hibben, had a single-shouldered side reminiscent of Solutrean points found in northwest Europe (22,000 – 17,000 B.P.) The find was significant, as it suggested that human use of Sandia Cave represented the earliest known occupation in North America, predating the Folsom period, which was the oldest established period at that time.

Controversy erupted regarding the true age of the points, as other archaeologists questioned the cave's actual stratigraphy and whether Hibben himself had planted the artifacts. Hibben's contemporaries questioned whether the stratigraphy of the cave was intact and if layers had been mixed by rodent activity, artificially integrating later-period

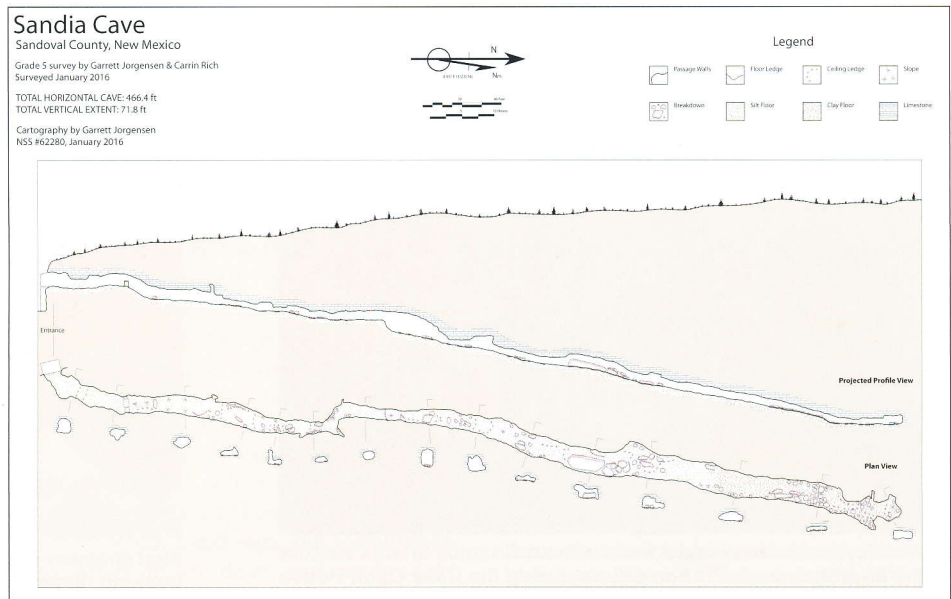
artifacts into earlier layers. Following a series of published academic articles questioning the veracity of the finds at Sandia Cave, Hibben's work was largely discredited.

SPORADIC HUMAN USE CONFIRMED

Recent reanalysis of faunal material from the Hibben excavations has provided adequate closure to the debate surrounding prehistoric human use of Sandia Cave. In a 2008 analysis of patterns of bone fragmentation, researchers concluded that carnivores introduced most of the bones recovered from the cave, including those from extinct Pleistocene species.

Human use of the cave appears to be sporadic, and only two percent of the bones analyzed in the study displayed evidence of possible human modification, in the form of cut and percussion marks, charring, and bone tool manufacture. Subsequent studies where modified bone material was subjected to radiocarbon dating indicate that there is no evidence for human use of the cave prior to the Folsom period.

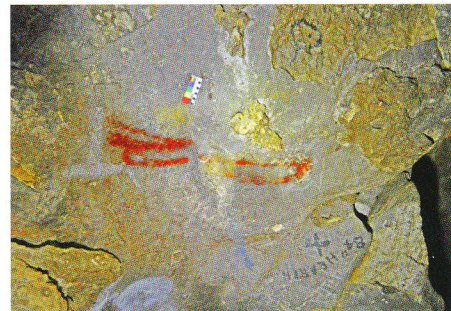
Despite the controversy surrounding Hibben's excavation results, the debate that ensued over Sandia Cave continues to be taught in the history of Paleoindian and Southwestern archaeology. Popular and professional articles revisiting the site and discussing the Hibben controversy continue to be published into the 21st century and suggest that Sandia Cave has significance because of its persistent use from the Paleoindian period to the present.





A group of archaeology students who assisted in the first year of Hibben excavations and survey, circa 1936, with a fresh survey mark on the left wall and a K&E transit on a wooden tripod. (photo credit unknown; property of the Maxwell Museum).

Right: Red ochre lines (enhanced with PhotoShop) on the cave ceiling that Loubser considers to be “of considerable antiquity,” as they underlie the yellow ochre handprints. Also visible here are historic markings from the Hibben excavations. (photo by Jannie Loubser)



In January 2015 UNM Public Archaeology graduate student Katherine Shaum collaborated with Sandia Grotto and USFS to submit a grant to New Mexico Historic Preservation Division to fund the restoration. The grant was awarded and provided \$16,777 toward the project. Rock Art Restoration Specialist Jannie Loubser of Stratum Unlimited in Alpharetta, Georgia [www.stratumunlimited.com] was contracted to lead the restoration. Dr. Loubser’s experience with restoring other natural and cultural sites throughout the American West and his sensitivity to art forms that are all but obscured by graffiti placed him in a unique position to lead the restoration effort at Sandia.

CULTURAL/SPIRITUAL SITE MARRED BY VANDALISM

Even while this site holds contemporary cultural and spiritual significance to many surrounding Native American communities, the integrity of Sandia Cave diminished extensively throughout the 1990s and early 2000s. The mouth of the cave, its first two chambers, and the metal infrastructure by which the cave is accessed were heavily and repeatedly vandalized with spray paint, marker, nail polish, and etching.

The cave walls were severely sooted and blackened by fires illegally lit in its interior, and large amounts of graffiti and litter appeared along the trail from the parking area. USFS archaeologists concerned with Sandia Cave (as well as NSS cave restoration specialists Val Hildreth-Werker and Jim Werker) believed that the heavy graffiti at the site potentially obscured valuable historic and prehistoric markings on the rock surface of the cave.

PARTNERS IN APPROPRIATE RESTORATION STRATEGY

In fall 2013 the Cibola National Forest and National Grasslands paired with Sandia Grotto to address the possibility of restoring Sandia Cave to a more natural-looking state. Developing an action plan to mitigate degradation at Sandia posed special challenges due to the multitude of agencies and groups that are concerned with the cave, have ancestral ties to that land, or are involved in its ongoing management.

Discussion of restoration strategies was conducted over a two-year period and involved extensive outreach and collaboration with Pueblo tribal members, state and federal governments, and specialists in graffiti removal, archaeology, and cave science. Once a proposal was developed, it had to be reviewed internally by USFS, the National Park Service, New Mexico Department of Cultural Affairs, affiliated tribal members, and experts from the National Speleological Society (NSS), the NSS Southwestern Region (SWR), and Sandia Grotto.

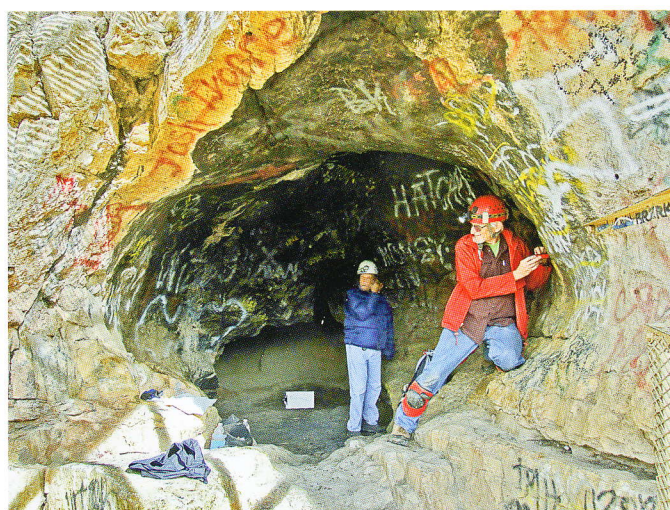
COMPLEX OVERLAYS REQUIRED SPECIAL EXPERTISE

Mounting a wide-scale restoration at Sandia Cave was complex for a number of reasons. The graffiti covering the site had accumulated over a number of decades and existed in layers and in multiple varying media. Restoration techniques that might work on one layer wouldn’t necessarily work on the next layer.

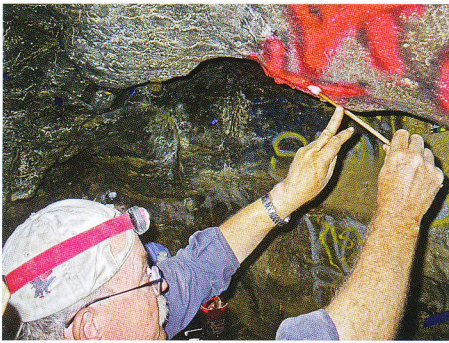
Likewise, the rock surface of the cave and trail varies in its composition, so removal techniques that worked on one instance of graffiti wouldn’t necessarily be effective on



Forest Service Archaeologist Sandra Arazi-Coombs orients visitors to the in-progress restoration efforts during the Cave Open House public day. Photo by Pete Lindsley.



First chamber pre-restoration; Pete Lindsley uses a Disto to measure opening dimensions. Photo by Val Hildreth-Werker.



Jannie Loubser applies potassium hydroxide with a rolling poultice to remove spray paint from the ceiling of the first chamber.

a neighboring instance, even if only a foot away.

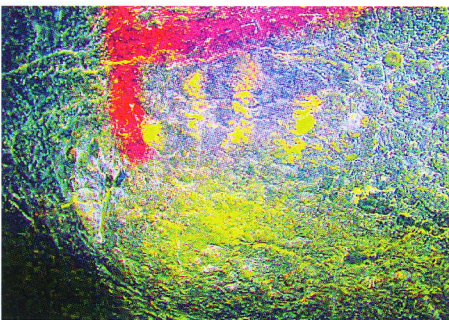
And throughout the site, any given graffiti might be overlying historic or prehistoric markings of unique and irreplaceable value. Effective techniques for removing graffiti but preserving any potential underlying features had to be customized for each of the 75 discrete instances of defacement that were removed during the restoration.

Adding to the challenges is the fact that Sandia Cave is positioned some 300 feet above the floor of Las Huertas Canyon. Materials had to be hauled manually up and down this rise, including rinse water from Las Huertas Creek, which Dr. Loubser recommended for its chemical similarity to the natural elements the site is normally exposed to.

Great care had to be taken to capture all runoff and washed-off debris so no paint remains collected on the floor of the cave to damage the site further.

VALUABLE VOLUNTEERS TRAINED ON SITE

After an initial site assessment in April 2015, Dr. Loubser returned to mount the bulk of the restoration effort, with assistance of USFS employees from multiple ranger districts throughout New Mexico, and a tremendous outpouring of volunteer support from Site Watch, SWR, and Sandia Grotto, and members of the general public from the Albuquerque area.



A stretch of prehistoric handprint on the ceiling, made in the yellow ocher that is naturally occurring in the cave. Photo by Mike Bilbo.

For two consecutive weeks in June and July 2015, the site was closed to the public and Dr. Loubser set about training volunteers in specialized removal techniques. More than 32 individuals logged volunteer hours with USFS during the project, totaling some 670 labor hours.

To say the restoration effort at Sandia Cave was nearly entirely volunteer-based would not be an understatement. Under Loubser's guidance, volunteers trained other volunteers and were immediately able to apply what they were learning to the rock surfaces of the site.

HIERARCHY OF GRAFFITI ASSESSMENT/REMOVAL TECHNIQUES

A wide variety of removal techniques were employed at Sandia Cave, starting with safer "dry" techniques and moving on to riskier "wet" techniques that involved the use of solvents where needed.

Before work began, areas in the second chamber that might contain fragile underlying markings of historic significance were marked off with painter's blue masking tape, and left undisturbed.

1—Dry Methods First

On each area of graffiti designated for removal, we first used dry paintbrushes to remove loose dirt and dry dust from many rock surfaces. Next, we tried nylon-bristle brushes. Then we used steel brushes of various sizes, nylon or steel dental picks, and elbow grease to chip away materials that readily dislodged from the rock. Battery operated drills with rotating steel-haired brushes and Dremel drills with diamond-tipped bits were effective on more resistant and etched graffiti.

Outside of the cave, we used a tungsten-tipped Paasche air eraser on eleven surface sites. However, its efficacy was limited by the physical infeasibility of employing a portable generator and compressor unit at the site. The carbon dioxide tank with pressure gauge provided insufficient air pressure for most media. Containing the aluminum oxide particles blasted forth by the eraser proved problematic for use inside the cave.

2—Creek Water Rinse Required

Even with these "dry" techniques, multiple creek water rinses were necessary to facilitate complete removal, and all 75 instances of graffiti that were removed from the site depended on the application of water. We employed many disposable rag cloths and sturdy low-lint paper towels to catch applied water *before* it flowed down rock surfaces. Pooling of any sort was disallowed. Used rags and towels were transported off-site daily, and we brought along fresh, clean rags and towels for each



Jannie Loubser uses a Dremel tool to break up and blend etched graffiti in the first chamber. Photo by Pete Lindsley.

day's work.

Paper towels soaked in water were applied as poultices on nine panels within the cave and were effective in lifting bonded dust from the rock surface.

3—Specially Tested Products and Protocol

All solvents used in the Sandia Cave restoration were biodegradable and of neutral pH. [Please note: biodegradable also can mean "yummy for biota" and can be harmful to bio-films, invertebrates, bats, other animals, and even humans; we used these products only in the broad entrance area where there is open ventilation and minimal intermittent cave life.]

The most effective solvents were This Stuff Works™ Multi-Master (containing potassium hydroxide), Sensitive Surface Graffiti Remover™ (containing limonene plant oil), and Elephant Snot™ (active ingredients unspecified by manufacturer).

Which of these would be most effective on any given graffiti was determined by testing first. A small cotton-wad poultice wrapped on a wooden stick was soaked with a solvent, then rolled over a portion of the graffiti to gauge how much material was transferred onto the cotton by each solvent.

The most effective solvent was then applied either by the tedious cotton poultice method to remove media layer-by-layer, or



Jannie Loubser and two volunteers use paper towel poultices and steel dental picks to remove acrylic paint. Photo by Pete Lindsley.



First chamber of Sandia Cave, pre-restoration. Layers of spray-painted graffiti on the walls and extensive smoke damage along the ceiling are evident. Photo by Pete Lindsley.



First chamber of Sandia Cave, post-restoration. The natural appearance achieved here has been greeting visitors since July 2015, and to date remains unmarred by new graffiti. Scott Christenson in background. Photo by Pete Lindsley.

with a paintbrush application to a small, manageable area. The treated area was then scrubbed with a steel brush and carefully rinsed repeatedly with water, employing special vigilance to catch all the rinse water containing solvent.

Rinsing with creek water during and after removal with solvents was vital throughout the site to ensure no solvent residue splashed, sprayed, or remained on the rock. We completed each small area before moving and treating the next small area.

Volunteers conducting the removal were ubiquitously seen balancing a spray bottle of water, a cloth rag for blotting, a steel brush for scrubbing, and a small container of solvent with paintbrush for application.

The process was painstaking, repetitive, and slow-moving, and involved treating the same area multiple times to remove graffiti layer-by-layer. This conservative approach, while time-consuming, allowed for safe and controlled removal while preventing damage to underlying rock and any markings of archaeological significance.

4—Pro Camouflage Finishing after Graffiti Removal

Post-removal camouflaging was required on more than half the instances of graffiti at Sandia Cave. Hard brushing and abrasive techniques had the potential to remove not just unwanted graffiti but the outer skin of the rock as well.

Lighter-colored patches that were left in these instances required the application of inorganic pigment powders to visually blend the treated area with the surrounding rock. Many volunteers were surprised to learn of this additive component of the restoration process; graffiti was first removed and camouflaging was then applied with artistic feathering and blending to achieve a complete restoration.

The camouflages used at Sandia were

Earth Pigments (dark umber, burnt sienna, and light-yellow ocher), as well as charcoal harvested from fires burned in the vicinity—the carbon remains of the area's natural vegetation. For each instance of graffiti, the color profile of the surrounding rock was assessed and a customized combination of pigments was mixed.

Creek water was applied to wet the surface to be treated, and the pigment mixture was combined with creek water to make a paint-like liquid that could be applied to the rock surface with a fluffed paintbrush or spray bottle.

Charcoal was frequently applied dry, and was especially effective in camouflaging etched graffiti inside the cave. While the lighter pigments were used extensively on the lower surfaces of the cave and exposed trail rocks, a mixture of black manganese pigment powder and pulverized charcoal was employed on the ceiling of the cave to blend with the darker surfaces found there.

Volunteers followed protocols clearly defined by Dr. Loubser, first employing dry techniques, then moving through the testing and removal strategies described above. All graffiti and markings in the cave were photodocumented and tied to survey points before any removal began. Historic markings and potential cultural markings on the walls and ceilings were inventoried, photodocumented, and marked off-limits for the duration of the restoration project.

PUBLIC OUTREACH INFORMATION EVENT

One of the most valuable and enduring aspects of the Sandia Cave restoration project was the Cave Open House that was held on June 27th in the midst of the restoration work. For this single day the site was opened to the public, and over a hundred visitors had the opportunity to see the restoration in progress, to speak with volunteers from their own communities who were carrying out the

work, and to get guided tours of the cave from USFS Cave Specialist Jason Walz and USFS Archaeologist Sandra Arazi-Coombs. Reporters from local news outlets covered the event, and the project was publicized in both print and television, enabling the restoration effort to reach an even broader audience.

ENCOURAGING OUTCOMES

The results of the restoration work at Sandia Cave are both striking and enduring. Since the end of the project in July, *no new graffiti has appeared in the cave, lending credence to the idea that graffiti attracts more graffiti*, and that a site that is clean and well-maintained is more likely to remain so.

To protect the achievements attained during the restoration, Sandia Grotto volunteers and USFS employees implemented weekly monitoring of the site immediately following the restoration, and that monitoring continues today. Fewer than ten new incidents of graffiti have appeared along the trail since the end of the restoration. These incidents are small in size, and have been photodocumented and painted over or removed and camouflaged quickly after application.

The ongoing, visible presence of these volunteers offers opportunities to connect with and educate the visiting public, and communicates that this is a site that is actively cared for and respected.

A new standard of comportment appears to be emerging at Sandia Cave, evidenced by a reduction in litter, partying, and abuse of the site. Through the efforts of all who have contributed, Albuquerque's "sacrifice cave" is becoming a place of education, awareness, and respect for our common natural and cultural heritage. For updates on the continuing restoration of Sandia Cave, visit Sandia Grotto's Web site at http://caves.org/grotto/sandia/Sandia_Cave/