

‘A Giant Leap Forward’

By David Malakoff



CATOCTIN FURNACE HISTORICAL SOCIETY

Historian Cheyney McKnight, creator and principal of Not Your Momma's History, carefully wraps an early 19th-century linen headwrap on a reconstructed bust of an enslaved mother from Catoctin Furnace in Maryland.

A groundbreaking 10-year research project fosters ancestral connections to Catoctin Furnace workers via collective kinship and DNA.

As a child in the late 1960s, archaeologist Elizabeth Comer would accompany her family to Sunday services at Harriet Chapel, an historic Episcopal church in the tiny mountain hamlet of Catoctin Furnace, Maryland. Just up the road she would see the towering stone walls and crumbling ruins of the sprawling iron-making complex that had given the village its name. From 1776 to 1903, the Catoctin Furnace’s blazingly hot crucibles helped transform iron ore dug from nearby quarries into everything from cannon balls for the Revolutionary War to car wheels for the emerging auto industry. “Even then, the furnace kind of captured my imagination,” Comer recalled during a recent visit to the site. “You just knew it held stories.”

Now, more than 50 years later, Comer has helped catalyze a pioneering research effort that has revealed stories of Catoctin Furnace that, until recently, were impossible to tell. In an unprecedented technical achievement, scientists have used powerful DNA technologies to link unidentified Africans and African Americans buried some 200 years ago at Catoctin Furnace to their living relatives. By revealing genetic connections that span nine generations, researchers have helped modern families discover Black ancestors who played a critical role in America’s industrial flowering—and who are often invisible in the historical record. In addition, sophisticated forensic analyses of the recovered skeletons have offered new insights into the



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A 33-foot-high furnace stack named Isabella, next to its reconstructed casting shed, was originally built in 1857 and remained in continuous blast until 1893.



Catoctin Furnace, circa 1890, shows a vibrant operation with furnace stack, Deborah, left, in blast. Pig iron sits in stacks near the Isabella furnace, right, which still retains its boiler and air heater, but is not in operation.

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Iron ore for Catoctin Furnace was mined from three ore banks using mule-drawn carts. This ore pit reached a size of 500 by 200 feet with a depth of 20 feet. Recent research has allowed more accurate artifact dating by tracing zinc and other minerals to specific ore banks.

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often-difficult lives of the enslaved men, women, and children who did most of the heavy labor at Catoctin Furnace during its first six decades.

The findings mark “a giant leap forward both scientifically and genealogically,” said Henry Louis Gates Jr., a member of the research team and a historian who directs the Hutchins Center for African & African American Research at Harvard University. The Black people buried at Catoctin Furnace “were virtually forgotten because there is little or nothing about them in the archives; you hit a dead end,” noted Doug Owsley, also a member of the team and Curator of Biological Anthropology at the Smithsonian National Museum of Natural History. “But these techniques allow us to jump right over that brick wall.”

For Comer, the landmark findings are the welcome result of a dogged, decade-long quest to identify the descendants of the legions of workers—of both African and European descent—who labored at Catoctin Furnace. “An important goal of archaeology is to connect people with their past, and I deeply believe everyone has a right to know their heritage,” said Comer, who is president of the nonprofit Catoctin Furnace Historical Society and leads her own cultural resources management firm. “I want people to be able to come to the furnace and say with pride: ‘My ancestors helped create this.’”

Forging those connections, however, is just one facet of a much larger vision that Comer and the historical society have for using the furnace’s storied past to benefit the present-day

community. Working with an array of public and private partners, it has been creating outreach programs and interpretive exhibits, as well as restoring historic structures, in a bid to bring renewed vibrancy to the historic village. “A heritage site isn’t just about the past,” said Comer. “It can also help build a strong local community and economy today.”

In 1774, it was the promise of profit that prompted four brothers from a prominent Maryland family to start building an iron furnace on the flanks of Catoctin Mountain about 60 miles northwest of Baltimore. Their decision proved timely: two years later, after the American colonies declared independence from Great Britain, orders for cannon balls and other equipment for the Continental Army began to pour in. Records suggest munitions made at Catoctin Furnace even helped the colonists win the Battle of Yorktown, the decisive 1781 clash that essentially ended the war.

Over the next century, the furnace’s financial fortunes waxed and waned as it periodically changed ownership. But its footprint expanded as laborers built housing for a growing workforce, dug quarries to extract ore and ponds to harness water power, and cleared forests for miles around to make charcoal to fuel up to three iron-making stacks. The complex required up to 70 laborers to operate. In the 1840s, however, the increasing cost of clothing, feeding, and housing enslaved Black laborers prompted furnace owners to replace them with free workers



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This home on a 25-acre tract was owned by Robert Patterson, a pig farmer who worked at Catoctin Furnace as a collier and free Black man in the mid-1800s. Crystal Emory, who participated in the DNA study, learned she is related to Patterson.



SMITHSONIAN PHOTOGRAPHERS JAMES D. TILLER & MIGUEL MONTALVO / CATOCTIN FURNACE HISTORICAL SOCIETY

Forensic facial reconstructions, created by StudioEIS and artist Jiwoong Cheh in consultation with Smithsonian scientists, show the faces of two enslaved Catoctin workers whose remains were found at the site. The woman, left, was approximately 30-35 years old, and was buried with her infant son. Her toddler brother was buried nearby. The boy, right, was a 15-year-old whose compressed spine indicated he did heavy labor. He had the deepest burial shaft and sassafras seeds found in his grave have been identified as a burial wreath.

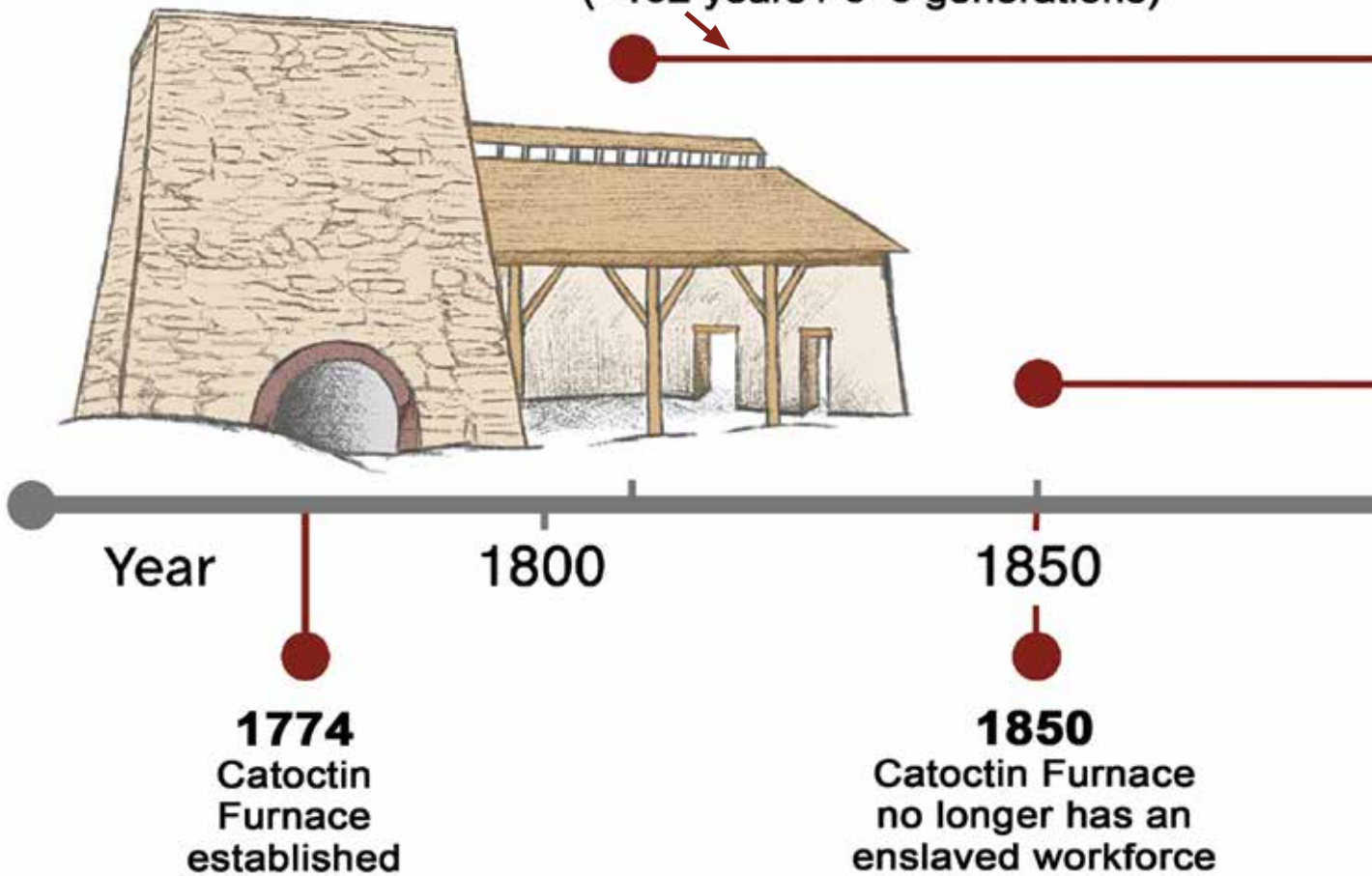
who were mostly white. By the early 1900s, however, competition from more efficient ironworks and changing industry needs forever quenched the furnace's fires.

In 1936, the National Park Service acquired the furnace site and adjoining Ironmaster's Manor. But much of the complex had been torn down or was in ruins by 1960, when Elizabeth and G. Eugene Anderson—Comer's parents—bought a nearby dairy farm and began attending services at Harriet Chapel. For Comer, a researcher who has since traveled the world, it was the start of what has become a lifelong association with Catoctin Furnace. By the late 1960s, she recalled, her parents had become deeply enmeshed in a years-long struggle to preserve the village. State officials had sparked controversy by proposing to widen Route 15, a major thoroughfare. The construction plan called

for obliterating two of the village's historic ore pits, Elizabeth Anderson wrote in *Catoctin Furnace: Portrait of An Iron-Making Village*, a 2013 history. And the new freeway would sit just 50 feet from the iconic stone stack of Catoctin's only remaining blast furnace, known as "Isabella," which was built in 1857.

In response, the Andersons joined with National Park Service officials and many others in a successful campaign to force state officials to comply with environmental and historic preservation laws and move the highway farther from the furnace. "They really held their feet to the fire," Comer said. The heated activism produced more than just a rerouted freeway. In 1972, part of the village was added to The National Register of Historic Places. The next year, the Andersons and several other local families founded the historical society, which soon began

Average separation between historical and living individuals (~162 years / 5-6 generations)



23ANDME

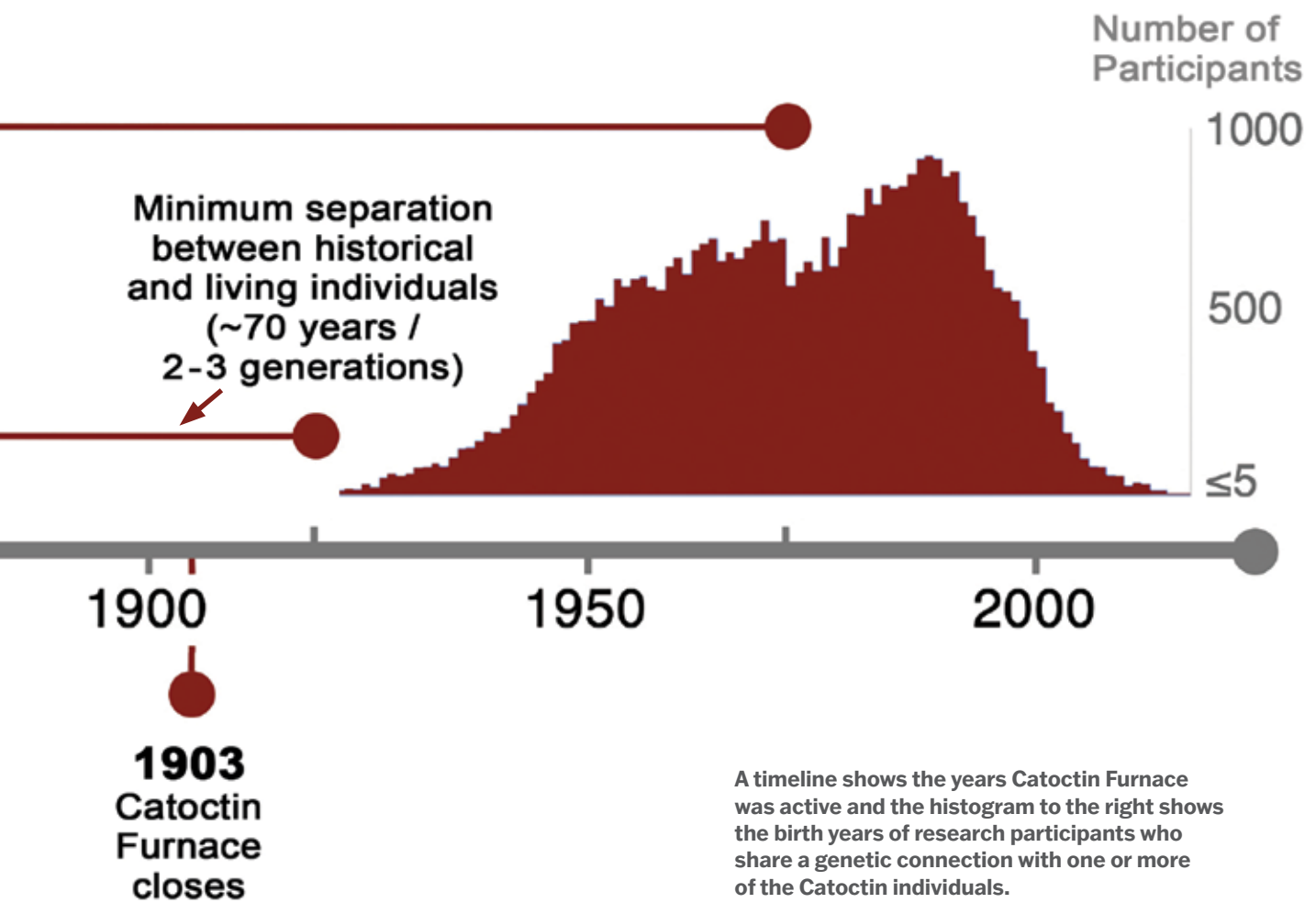
purchasing and restoring historic structures. Archaeologists, meanwhile, launched several legally-required pre-construction surveys. In 1979, after one of those surveys identified burials dating to the early 1800s in the path of the new road, archaeologists launched a rescue dig. From 35 graves, they recovered 32 sets of human remains, which were ultimately sent to the Smithsonian Institution. Researchers there said the morphology of the skulls and bones indicated the deceased were Africans or African Americans. About half were young children, and many of the bones showed signs of injury or disease. The researchers then carefully stowed the bones away in the Smithsonian's massive collection.

For some 40 years, the remains “were pretty much forgotten—until we got in touch,” Comer recalled last year as she walked through an undisturbed portion of the burial ground near the Isabella stack. Cars whooshed past just yards away. Chunks of stone sat hidden among tree trunks and a thick carpet of dry leaves. “Grave markers,” Comer explained, noting that in 2014 researchers had used ground-penetrating radar to identify at least 23 additional burials. “But the stones don’t tell us much about who is buried here.”

Comer has gone to great lengths in recent years to try to fill that gap. About a dozen years ago, after her mother and

other founders of the historical society died, Comer took on a more active role. She regularly made the 90-minute drive from her home in Baltimore to help tend to the historical society’s small museum and other properties. And she raised money and recruited numerous allies to launch an array of projects aimed at learning more about the furnace’s history and communicating it to the public. “She’s a hurricane in a bottle,” said Ranger Mark Spurrier, who manages Cunningham Falls State Park, where the furnace site and museum are located. “I do get about 20 ideas a day about what we need to be doing,” Comer said.

One focus of the historical society’s work has been fostering what Comer calls “collective kinship”—using oral histories, archival records and other resources to allow African Americans to learn about their community’s historical ties to Catoctin Furnace. In recent years, that effort resulted in the identification of the living relatives of two African American laborers, one enslaved and one free, who had toiled at the furnace. One of those living descendants is Crystal Emory, who learned that she is related to Robert Patterson, a free Black man who worked at Catoctin Furnace in the mid-1800s. Emory, who identifies as white, says that the discovery “opened up a whole new world for me, about my family’s history and African American culture.” When she visits Catoctin Furnace, she said, “I can get a little emotional. I look over at that mountainside and know that I’m



walking on ground where my ancestors walked.”

In 2015, Comer’s brainstorming also led her to contact Owsley at the Smithsonian. Would his team, she asked, be willing to give the Catoctin remains a fresh look? Comer was particularly interested in what researchers could learn by applying increasingly powerful forensic techniques, such as analyses of chemical isotopes and heavy metals in the bones that can provide clues to diet and exposure to pollutants. “At first, I told her we were too busy,” Owsley recalled. But he and his colleagues, including anthropologist Kari Bruwelheide, ultimately added the task—which would take months—to their to-do list. In part, Owsley said, the project was intriguing because enslaved people who toiled at early American industrial sites have received less scholarly attention than those who worked at mostly agricultural plantations.

Their findings, published in *Historical Archaeology* in 2019, offered a host of new insights. For example, the bones of one female, aged 30 to 34, contain much higher levels of lead—a heavy metal that can cause serious health problems—than the other individuals, and isotopic studies indicated she had a different diet. Both findings suggest she was a servant in the furnace owner’s home, Bruwelheide and her co-authors wrote, where she likely consumed food served on lead-laced pewter or lead-glazed ceramics. (Poorer people typically used wood or clay

vessels.) The woman had absorbed so much lead that “she likely had health consequences,” the authors wrote. Other bones from an older male hold a concentration of zinc that is more than five times higher than normal. The worker might have inhaled zinc dust as he quarried and carted zinc-laden iron ore or breathed in zinc fumes billowing from the ironwork’s stacks. Such exposure can cause an array of health issues, the authors noted.

Even as the Smithsonian researchers pursued those studies, however, discussions with David Reich, a geneticist at Harvard, raised the possibility of taking an even deeper biological dive into the Catoctin remains. Over the past few decades, Reich’s lab has been a pioneer in the study of ancient DNA—genetic material recovered from long-buried bones and other tissues. Ancient DNA has enabled researchers to sequence the genes of long-extinct animals and trace how humans have moved around the planet over many millennia. Catoctin Furnace, however, posed a new challenge: could researchers connect DNA extracted from the unidentified remains to people living today?

Not that long ago, that task would have been impossible. But the scientists suspected it was now feasible, thanks to the rise of direct-to-consumer sequencing firms, such as 23andMe and AncestryDNA, that have collected DNA from millions of customers. 23andMe, for example, holds DNA sequences from more than 9.2 million people who have agreed to let their

anonymized data be used for research. In theory, such databases could allow scientists to match the Catoctin individuals to living relatives.

The project raised thorny ethical issues, however. The long-dead Catoctin Furnace residents, for instance, could not give consent for their DNA to be used for research. And there was no guarantee that any living relatives, if they could be found, would want to know they had a Black ancestor who was likely enslaved. There were also questions about how the data would be shared among scientists and the public.

The researchers spent months working through the issues. They negotiated data-use rules and sought input from scholars who specialize in African American history, including Gates. They also consulted groups such as the African American Resources Cultural and Heritage Society, a nonprofit in Maryland's Frederick County, where the furnace is located. The historical society created an advisory group that included relatives already identified through archival research. Gates, for one, saw the DNA study "as a tool for empowerment of African Americans, rather than exploitation of a vulnerable population. I think it is a model of engagement to be emulated."

Still, the technical challenges were daunting. "When we started, there was no guarantee that it was going to work at all," recalled Éadaoin Harney, a geneticist at 23andMe and lecturer at Harvard who is a former member of Reich's lab. The team had to find ways to fill gaps in the often incomplete DNA sequences obtained from the burials, for example, and develop robust computational methods for finding matches. Ultimately, the researchers created an approach that allowed them to start trying to match relatively long DNA sequences from 27 of the Catoctin individuals to sequences in 23andMe's database.



Three sizes of cannonballs found at the furnace could be ammunition crafted there for the Continental Army during the Revolutionary War.

The innovative study, published last August in *Science*, grabbed global headlines. The DNA revealed that the Catoctin individuals or their ancestors originated in what is now Senegal and Gambia. But many also had European ancestors, mostly from Britain and Ireland, likely indicating that white men had raped enslaved women. Fifteen of the Catoctin individuals belonged to five families, with some mothers, children, and siblings buried together. Several carried genes that put them at risk of disorders such as sickle cell anemia, a disease still common among African Americans.

Most notably, the team identified 41,799 people who are likely related to one or more of the Catoctin individuals. For most, the relationship is distant; they might share an ancestor who lived centuries ago in Africa or Europe. But 2,975 participants were deemed close relatives, meaning they could be just five to nine steps removed from a Catoctin individual. That means the living person could be anything from a great-great-great-grandchild to the equivalent of a first cousin six times removed.



This depiction of the slave quarters at Catoctin Furnace was installed on an interpretive panel at the site.



Elizabeth Yourtee Anderson, left, was a local historian who spent decades chronicling Catoctin Furnace history. Her daughter, Elizabeth Anderson Comer, right, has carried on and expanded her historical work at the site. The two are pictured here circa 2009.

When the researchers mapped the locations of the close relatives, they found the highest concentration was in Maryland, indicating that the families of some Catoctin laborers had remained in the area. Another hot spot was in southern California.

This past February, researchers took the next step, confirming that one of those 2,975 close relatives was linked to a young girl, a toddler, found in the graveyard. Archival research had already revealed that octogenarian Agnes Jackson of Hagerstown, Maryland, was a great-great-grandchild of Henson Summers, an enslaved ironworker at the furnace in the mid-1800s. With Jackson's permission, the scientists then tried to match her DNA with the buried individuals. They discovered that Jackson shared 1.8% of her genome with the toddler, who was buried near a woman and a young boy. "This toddler was most likely either a half-sibling or first-cousin of Henson Summers," said 23andMe spokesperson Andy Kill. Comer sees this detailed DNA work as complementing, not supplanting, the collective kinship research. "Now, DNA will link specific family lines," she said. "However, that number will be very small, comparatively speaking. We feel very strongly that descendants linking themselves to Catoctin via collective kinship, as well as direct (genetic) kinship, are all equal partners."

The landmark Catoctin Furnace study has put what was once a relatively obscure industrial site at the cutting edge of American archaeology. Other research projects are already moving to harness the approach 23andMe developed, and "there are many, many sites where this kind of work could be

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incorporated," Harney said. One day, it might even be possible for customers of 23andMe and other sequencing firms to check a box indicating that they'd like to be informed if it looks like they are related to someone buried long ago in an historic graveyard.

In the meantime, Comer and the historical society have been working to harness the energy created by the high-profile research to advance their efforts to make Catoctin Furnace a vibrant heritage site. They've incorporated the results into their small museum, housed in an ironworker's cabin built in the early 1800s. In addition to displaying artifacts and selling products made by local residents, it features two striking busts of Catoctin laborers, created by an artist able to reconstruct facial features from their skulls. One is of a young woman, aged 30 to 35, who shared a grave with her infant son. "It's possible she died in childbirth," Comer said. The other is of a teenage boy whose compressed spine indicated he did heavy labor, which likely put him at risk of a fatal accident.

Next to the museum is a functioning ironworker's forge, where people can watch the metal being made into a variety of objects. Nearby, a new walking trail is lined with interpretive signs that illuminate the site's history. Just down the street, visitors can stay overnight in a restored stone Forgerman's House, built in 1820, that is owned by the society. In a section of floor covered with glass, renters can gaze down on a collection of items, including toys, that represent some of the 30,000 artifacts that archaeologists recovered during the restoration. The society is also restoring several other worker homes, with the goal of creating housing for village residents. And it is helping spruce up a historic storefront, which along with other structures will host an array of events, including projects for at-risk youth.

"Heritage sites can do much more than just provide history lessons," Comer said. "They can help create community and economic opportunity. We want Catoctin Furnace to be a place people can visit and can appreciate. But it should also be a place where they can live, work, and make a life."

DAVID MALAKOFF is the International News Editor at Science and a frequent contributor to the magazine.

FURTHER RESEARCH

- Catoctin Furnace Historical Society, catoctinfurnace.org
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- 23andme Blog, Aug. 3, 2023, *Ethics and the Study of Historic DNA of African Americans Buried at the Catoctin Furnace*, tinyurl.com/CatoctinEthics
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