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ARCHAEOLOGY

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Cover: Early 5th-century B.C. bronze cauldron handle depicting the river god Achelous
PHOTO: DENIS GLIKSMAN

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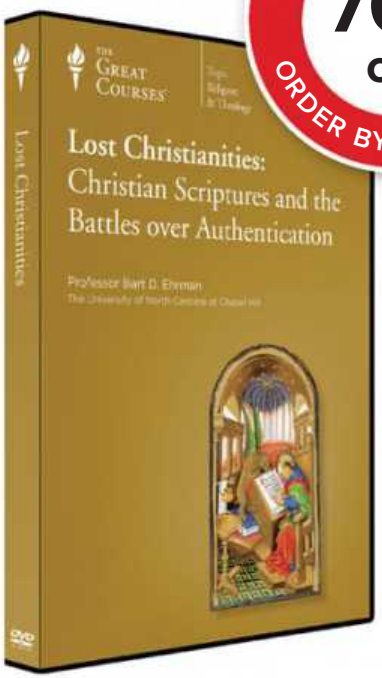

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What did these "other" scriptures say? How could such outlandish ideas ever be considered Christian? If such beliefs were once common, why do they no longer exist? These are just a few of the many provocative questions that arise from **Lost Christianities: Christian Scriptures and the Battles over Authentication**, an insightful 24-lecture course taught by Professor Bart D. Ehrman of The University of North Carolina at Chapel Hill, the author or editor of more than 25 books, including *The New York Times* bestseller *Misquoting Jesus*.

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Trial and Error

The outline of a hand, a bride, a skeleton, the teeth of a slave, the grave of a chaplain—all these and more are the evidence that make up our editors' picks for the "Top 10 Discoveries of 2015" (page 28). This is the stuff of the discipline of archaeology, and this year's field broadens our understanding of the business of becoming, and being, human.

16th-century German alchemical illustration

Much of our knowledge, particularly in the sciences, advances by trial and error. In "The Alchemist's Tale" (page 36), by contributing editor Andrew Curry, we learn how thousands of fragments of glass uncovered at the bottom of a medieval stairwell in Germany are now understood to be the remains of an alchemist's lab. Curry describes both the discovery and the ways in which alchemy, often practiced in secret, was actually an early form of chemistry.

Two modern labs near the ancient city of Pompeii are the scene of "Family History" (page 52), by executive editor Jarrett A. Lobell. She tells of the recent careful reexamination and restoration of a number of casts, some more than 150 years old, of victims of the eruption of Mount Vesuvius almost two millennia ago. CT scans and other techniques are helping archaeologists learn more about the lives of the city's residents and preserve the record of Pompeii's destruction for future generations—even as the still-active volcano looms over the city.

In "Living with the Sea Bear" (page 40), contributing editor Zach Zorich explores the relationship between humans and the wildlife they live among. Researchers have long been puzzled by extraordinarily evocative figurines of polar bears attributed to the Dorset people who lived in eastern Canada and Greenland some 2,500 years ago. Now an archaeologist and a wildlife biologist have teamed up to determine why the Dorset crafted the objects, and what meaning they may have held.

"The Many Lives of an English Manor House" (page 44), by journalist Kate Ravilious, tells the story of Knole House, one of England's grandest estates. Archaeologists and restorers at work on the estate and rambling home, located in Sevenoaks in west Kent, are finding evidence of daily life and social change over its more than six centuries of continuous occupation—both upstairs and downstairs.

And don't miss a special "Letter from Hawaii: Ballad of the Paniolo" (page 56) by deputy editor Samir S. Patel, which reveals the unique and surprising history of the island state's very own cowboys.

Claudia Valentino

Claudia Valentino
Editor in Chief

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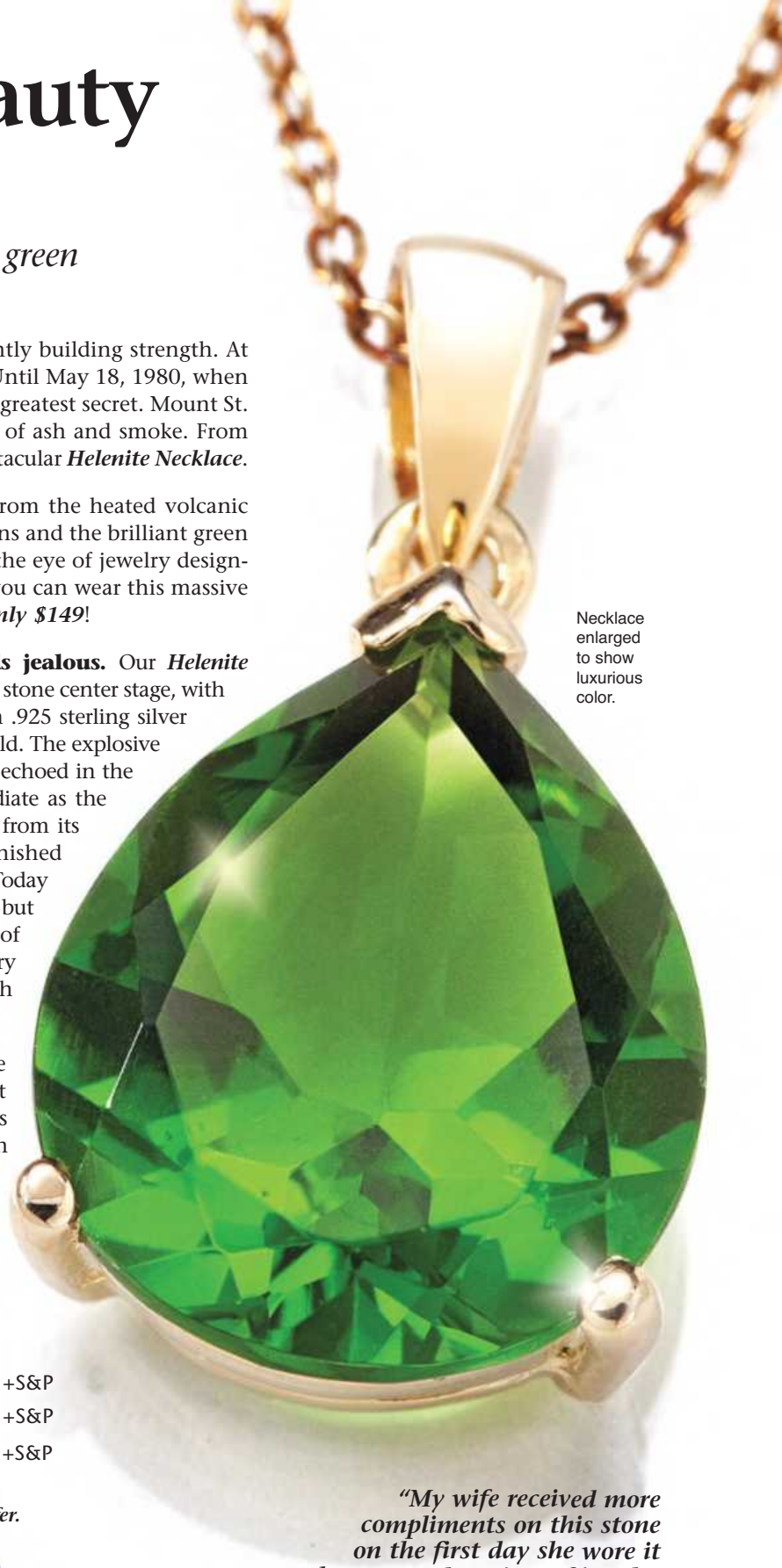

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Croatia's Considered Past

Archaeology can heighten a nation's awareness of its own heritage even as it increases international understanding. The world over, archaeological heritage is regarded as something to be shared by us all. The young republic of Croatia, barely a quarter-century old, exemplifies this idea as it develops its archaeological patrimony with increasing energy. Located in the heart of southeast Europe with the Adriatic Sea on one side and the Danube River on the other, it has, for millennia, been open to influences from all directions, and has incorporated these influences and developed rich cultural traditions of its own.


Roman amphitheater, Pula

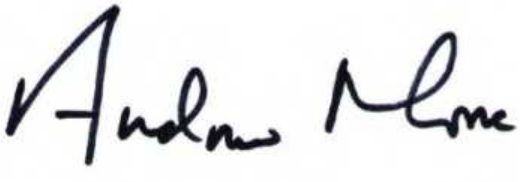
Croatia is home to spectacular archaeological sites that deserve to be better known. The cave sites of Krapina and Vindija near the capital Zagreb have yielded numerous Neanderthal fossils that have proved crucial for reconstructing the Neanderthal genome. The Monkodonja Hillfort in Istria is one of the most impressive Bronze Age citadels in Europe. Pula is renowned for its spectacular Roman amphitheater, one of the best preserved, but also undervisited, anywhere. The center of the port city of Split consists largely of the massive remains of the emperor Diocletian's palace.

Excavations are proceeding at a rapid pace at sites of all periods, from deep prehistory through the classical and medieval periods to Ottoman times. Many have taken place in advance of an extensive program of highway building and other infrastructure projects, greatly expanding knowledge of the entire Croatian past. Croatia also has a cadre of expert underwater archaeologists who have recently excavated several Roman ships and have identified exceptional craft from the Bronze and Iron Ages.

Archaeology education in Croatia is also proceeding with strong programs at the Universities of Zagreb, Zadar, and elsewhere, and an expanding network of national and regional museums. New museums are being constructed to highlight particular sites or special collections. The futuristic museum at Vučedol on the Danube brings to life the fascinating Chalcolithic settlement there, one of Europe's most impressive settlement mound sites. The outstanding displays in the new Museum of Antique Glass in Zadar have proved very popular with visitors, not least the glassblowing demonstrations.

Everywhere there are major restoration projects of archaeological and historic monuments. The recently discovered legionary amphitheater at Burnum in the Krka National Park is currently being restored. And the old city of Dubrovnik, much damaged in the recent conflict, has been brought back to its former splendor as the "Pearl of the Adriatic."

Croatia is providing ever more opportunities for the archaeological traveler. And its vigorous approach to heritage is placing it squarely among the world's nations and peoples who value what heritage can tell us all about our common past.



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LETTERS

We received a number of letters with different interpretations of the gold spirals from Denmark on page 16 of the November/December 2015 issue. Below is a small sample.

The Right Tool?

After reading "Slinky Nordic Treasures" I forced myself to put the magazine down and send a communication to you. The picture of the gold spirals looks to me remarkably like the turnings that result from cutting a soft metal on a lathe, or using a sharp tool in a linear fashion. In my youth I learned how to use lathes and also the turnings, or swarf, from machining. Soft iron or copper would form spirals such as these. The spirals should be examined under a microscope for evidence of tool marks. Perhaps some sort of lathe or scraping tool may have been used to fashion larger artifacts and these were the remnants from that operation.

Brian Pearson
Calgary, Canada

Several years ago I observed the making of bronze cymbals in a small factory on the outskirts of Istanbul. The metal shavings from the final hand finishing looked exactly like the gold Nordic spirals. Since the article mentions that carved gold vessels had been found there, the gold spirals may have been the result of final hand work, then collected in a wooden box, perhaps to be sent elsewhere and made into something else. Gold shavings would be too valuable to be discarded. They may have been engaged in recycling, not a religious ritual.

Marleen Hoover
San Antonio, TX

The "Slinky Nordic Treasures" appear to me to be pre-prepared inlay material for a goldsmith or engraver. I use the same thing to do inlays in objects I engrave. Also, to protect the gold ribbons, I curl them around a quarter-inch shaft so they won't be "kinked" while in storage.

Jim Wright
via email

Archaeologist Fleming Kaul responds: *The idea that the gold spirals are workshop waste came to mind at first glance. However, considering that the carefully made gold spirals are deliberately cut and curled threads of equal size and length, they don't seem to be waste products made by a sort of mill or lathe. The spirals were also uncovered with two dress pins of a type that can be dated to 900–700 B.C. From that time we have no North European evidence of fast drilling or turning instruments that could have created such spirals. Conservators from the National Museum of Denmark will now look for traces of the working processes under a microscope. The gold spirals seem to have been cut into long, flat strings or wire from a very thin plate of sheet gold. Then they were turned around some sort of a thin stick. Finally, the spirals were pressed a bit, probably between two fingers, so that they appear flattened. They are well suited for dress ornaments—for instance, sewn on a hat or a cloak.*

Insect Interlopers

I was intrigued by the mention of "desiccated insect pupae" inside hollow Mexican figurines ("Mexico's Enigmatic Figurines," September/October 2015). What kind of insects could these have been?

Nancy Martsch
Sherman Oaks, CA

Archaeologist Robert Pickering responds: *The insect puparia represent necrophagous ("feeding on corpses") species, possibly the family of small flies call Phoridae. These are the most common insect evidence found. Thus far, 165 of the 858 ceramic figures we have examined have puparia remnants on the exterior or interior, and 52 have puparia remnants on both the exterior and interior. We have also found adult forms of moths, mosquitoes, and spiders, as well as the oothecae (egg masses) of cockroaches inside vessels. Most probably, these insects are modern. Both DNA testing and carbon-14 dating tell us that the cockroaches definitely postdate European contact.*

ARCHAEOLOGY welcomes mail from readers. Please address your comments to ARCHAEOLOGY, 36-36 33rd Street, Long Island City, NY 11106, fax 718-472-3051, or e-mail letters@archaeology.org. The editors reserve the right to edit submitted material. Volume precludes our acknowledging individual letters.

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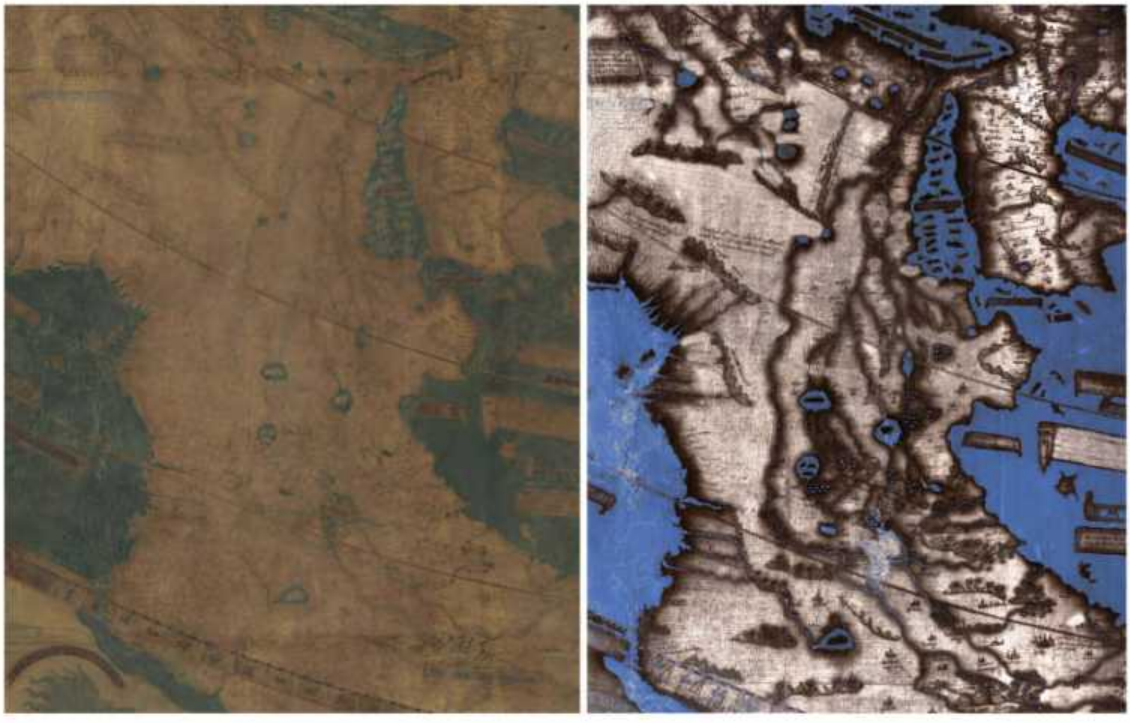
Reading the Invisible Ink

When Christopher Columbus landed in the Caribbean in 1492, he assumed he was in Japan. This was partly due to his fifteenth-century naïveté regarding world geography, but also because he had departed Spain armed with misinformation. It is believed that one of the sources that Columbus consulted before his journey was a map produced by German cartographer Henricus Martellus in 1491. The map locates Japan a thousand miles from the Asian mainland, where Columbus expected to find it on his way to the East Indies. The Martellus map reflected the sum total of European geographical knowledge at that time, and is considered by experts today to be one of the seminal maps of the Age of Discovery. "It seems to have influenced Columbus' ideas about world geography, Martin Behaim's terrestrial globe of 1492, and Martin Waldseemüller's famous world map of 1507," says map historian Chet Van Duzer. A recent project led by Van Duzer has used modern imaging technology to analyze the 525-year-old Martellus map, revealing details that provide a previously unseen glimpse into how Columbus and his peers perceived the world.



Detail of Martellus map under natural light (left) and enhanced with multispectral imaging (right)

The existence of Martellus' map was publicized in the 1960s when it was anonymously donated to Yale University. Measuring six feet by four feet, the map represents the Earth's surface from the Atlantic in the west to the Pacific in the east—with Japan occupying the top right corner. Even as it was declared a vital piece of history, centuries of neglect and mistreatment had left many of the map's details invisible. "Almost all of the text had faded to illegibility," says Van Duzer, "making perhaps the most important map of the fifteenth century unstudiable."

Originally, the map was covered in dozens of Latin passages that described the people or characteristics of certain regions. Over the past two years, Van Duzer and his team have been recovering this information, bit by bit, with the help of multispectral imaging, which involves taking a series of photographs using a variety of frequencies of light, from ultraviolet to infrared. By stitching these images together and using digital enhancement tools, elements no longer visible to the naked eye can be seen. Similar techniques have been used recently to identify hidden details of Etruscan and Roman wall paintings, and to scrutinize ancient papyrus scrolls.

These newly revealed images attest to the ways in which fifteenth-century Europeans regarded unfamiliar lands.

One passage over Asia reads, "Here are found the Hippopodes: They have a human form but the feet of horses." Another in southern Asia describes the Panotii people, who had ears so large they could use them as sleeping bags. Text written over Africa declares, "Here there are large wildernesses in which there are lions, large leopards, and many other animals different from ours." Now that these details have been brought to light, map historians can speculate not only on Martellus' sources, but also on how he influenced later cartographers.

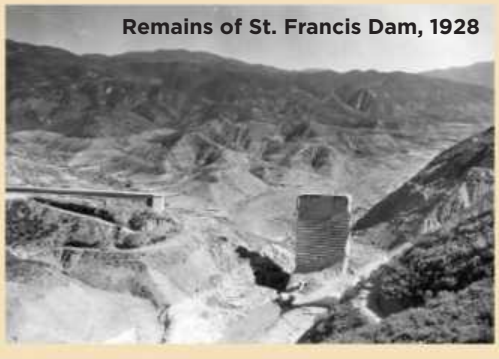
Martellus map being prepared for multispectral analysis

The new research has turned what was an "unstudiable" object into one that can finally be examined. As the use of imaging technology in ancient studies grows, it will have an impact both on new archaeological discoveries and on artifacts and sites uncovered centuries ago. "Multispectral imaging is a powerful tool for recovering texts from damaged manuscripts," says Van Duzer. "I hope that it will prove useful in the study of damaged documents found in archaeological sites, and also perhaps in examining old texts that describe archaeological sites."

—Jason Urbanus

OFF THE GRID

The history of Los Angeles' water supply is long and complicated—remember* Chinatown*?—and continues through today's drought crisis. In the early 1900s, William Mulholland, then superintendent of Los Angeles' Water Department, oversaw the construction of the Los Angeles Aqueduct to bring water to the city from Owens Valley, more than 200 miles away. About a decade later, he built the St. Francis Dam, in San Francisquito Canyon, to guard the city against drought and to generate hydroelectric power. St. Francis, a curved gravity dam like the later Hoover Dam, was completed in 1926. On March 12, 1928, two years to the day after the reservoir began to fill, the St. Francis Dam failed catastrophically, sending a wall of water through the towns of Piru, Fillmore, and Santa Paula that killed at least 450 people. The disaster, the result of flaws in construction, design, and location, is considered one of America's greatest civil engineering failures. It ended Mulholland's storied career and informed the construction of the Hoover Dam, which was completed in 1936. According to David S. Peebles, acting heritage manager for the Angeles National Forest, the recent 100-year anniversary of the Los Angeles Aqueduct sparked new interest in the protected historical site.



Remains of St. Francis Dam, 1928

The site

When 12.4 billion gallons of water surged through the narrow canyon, it scoured much of the dam site. The only portions left standing were part of the wing wall and a section of the middle of the dam, which was nicknamed "The Tombstone." The next year that, too, was demolished. Today, the site is accessible to the public year-round, and can be reached from existing county roads. Visitors can see the narrow valley opening, portions of the wing wall and railings, and massive chunks of concrete that still have ridges remaining from the dam's stair-stepped face. The U.S. Forest Service, Santa Clarita Valley Historical Society, and California State University, Northridge, are all exploring the oral history and documentation of the site, and are making plans to excavate areas associated with dam and aqueduct construction, as well as provide additional interpretive signage for visitors.

St. Francis Dam ruins

While you're there

Angeles National Forest is criss-crossed by hiking, riding, and biking trails that provide sweeping views of the San Gabriel Mountains, just north of the Los Angeles metropolitan area. The Santa Clarita Valley Historical Society in Newhall gives an annual tour of the St. Francis Dam site, maintains a museum of local history, from the pioneers to the film industry, and gives regular tours of Heritage Junction Historic Park, a collection of relocated and restored historic buildings, including a train station.

—Malin Grunberg Banyasz

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Irish Roots

Felled tree, Ireland

Medieval human remains in tree roots

A storm blew over a 215-year-old beech tree in Sligo, Ireland, revealing a skeleton tangled in its root system. Archaeologist Marion Dowd was called in to investigate what she calls "an unusual situation," and found that the remains belonged to a 17- to 20-year-old man who died of what appear to be knife wounds sometime between A.D. 1030 and 1200. Records indicate that there was a medieval graveyard in the area, and although no visible trace of it survives, Dowd suspects there could be more burials nearby.

—Eric A. Powell

A Kestrel's Last Meal

Mummified kestrel

3-D scan of kestrel and stomach contents

A mummified kestrel's CT scan shows it choked on its last meal, probably because it had been force-fed. This bird of prey from Egypt, in the collection of Iziko Museums of South Africa in Cape Town, is one of millions of animals mummified as religious offerings, called votive mummies. Kestrels, which are common in Egypt, usually regurgitate the indigestible parts of their meals as pellets. The virtual autopsy of this bird shows that its stomach already contained digested remains from two mice and a sparrow, some of which it would have regurgitated before it consumed yet another mouse. The tail of that last meal got stuck in the gullet and choked the bird. Ancient Egyptians often force-fed their captive animals, which makes this the earliest known evidence of keeping and possibly breeding raptors.

—Samir S. Patel

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Stauer. A Different Tale to Tell.

Pompeii Before the Romans


Samnite tomb, Pompeii, Italy

In the fifth century B.C., the Samnites, an Oscan-speaking people from the Appenine Mountains of central Italy, occupied the Campania region, including the town of Pompeii. Being mountaineers and shepherds, the Samnites were eager to control the lowlands, toward the Tyrrhenian Sea, to ensure access to commercial routes across the ancient Mediterranean. They turned Pompeii into a thriving city with a two-mile city wall, ritual sanctuaries, and homes. Yet relatively little is known about their presence in the city, including where they buried their dead.

Now archaeologist Laetitia Cavassa from the French National Center for Scientific Research has uncovered an inhumation burial dating to the middle of the fourth century B.C., when Pompeii was still a Samnite stronghold, before it was taken over by the Romans. The tomb, which is believed to be that of a woman between 35 and 40 years old, was filled with high-quality grave goods, including 10 intact vases in a wide variety of shapes and styles. But it is not the artifacts that are the most significant feature of the grave—it's the date. "It's an exceptional discovery because it's the oldest grave ever found in Pompeii," says Claude Pouzadoux, director of the Jean Bérard Center of Naples, which carried out the excavation along with the Archaeological Superintendency of Pompeii. "We will now be able to understand more concerning the funeral rites of the Samnites, which we still have a great deal to learn about."

—Marco Merola


Intact vases


Skeletal remains

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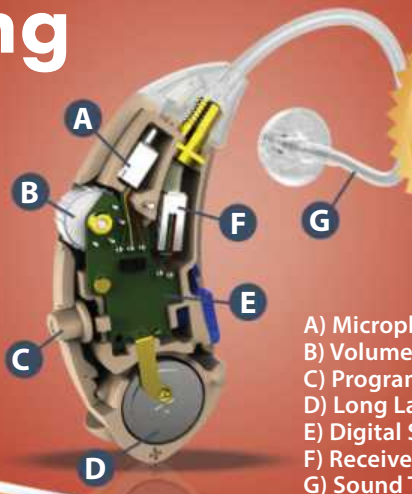

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A Baltic Sea Monster Surfaces

Figureheads, carved decorations on the prows of sailing ships, went out of fashion in the nineteenth century, but judging by the one recently pulled from the Baltic, perhaps it is time for a revival. Maritime archaeologists in Sweden recently raised a figurehead depicting a monster from the fifteenth-century wreck of *Gribshunden* ("Grip Dog") off the southern coast. The warship, belonging to Danish King Hans, sank at anchor following a fire in 1495, and is today one of the best preserved ships from the period, because the cold Baltic kept shipworms at bay. Researchers hope to raise more from the ship soon.

—Samir S. Patel

Figurehead from *Gribshunden*

Built upon Bones

Early medieval bones beneath Victorian-era pipe

When King Henry III's (A.D. 1216–1272) workers began the monumental foundations for a Gothic-style Westminster Abbey, they encountered burials dating to early periods in the abbey's history. They stockpiled the remains and reburied them in charnel deposits in an area that was likely a monastic burial ground. Now excavations in preparation for the building of a new Gothic-style tower have rediscovered these bones, as well as 19 other burials in both cist graves and coffins, under a Victorian-era drainpipe. The burials likely date to between A.D. 1000 and 1250, and will provide important evidence of early medieval life at the abbey.

—Jarrett A. Lobell

An Opportunity for Early Humans in China

Fuyan Cave in southern China does not contain any artifacts, but it did have 47 teeth that came from the mouths of *Homo sapiens* at least 80,000 years ago. The find shows that our species had reached China more than 30,000 years before entering Europe, and is changing ideas about how *Homo sapiens* settled the world beyond Africa.

Early modern human teeth

According to Maria Martinon-Torres, a paleoanthropologist at University College London, Neanderthals and other archaic hominins such as the Denisovans may have kept *Homo sapiens* out of Europe and northern Asia for at least 40,000 years. *Homo sapiens* then could have moved into those areas after the populations of Neanderthals and Denisovans began to collapse. "We should leave behind the idea of hominins dispersing as if they were tourists or a troop marching, in a lineal fashion," says Martinon-Torres. Instead of settling lands closest to Africa first, our species might have traveled the unoccupied coast of South Asia into what is now China.

The teeth came from at least 13 individuals. There is no evidence that people ever lived in the cave, and Martinon-Torres suspects the teeth were washed in by a flood. The 47 teeth all have characteristics of *Homo sapiens* dentition: They are relatively small and lack the complex convolutions on the chewing surfaces of other hominin teeth. They were found among the bones and teeth of other Pleistocene mammals, including hyena, giant tapir, an extinct species of elephant, and a possible ancestor of the panda. Martinon-Torres hopes that genetic analysis and further archaeological investigation will reveal how the people of Fuyan Cave are related to modern-day people.

—Zach Zorich

Roman-era Egyptian mummy portrait

Hidden Blues

Researchers unexpectedly found evidence of Egyptian blue, the earliest known artificial pigment, in sections of paintings from Egypt's Roman era that lack even a hint of visible blue coloring. These areas include swaths of gray background, a white tunic and mantle, and an under-drawing outlining a face. The paintings are part of a collection of mummy portraits and panel fragments housed at the Phoebe A. Hearst Museum of Anthropology at the University of California, Berkeley, and are thought to date to the second century A.D.

Using an array of technologies, including near-infrared luminescence and X-ray diffraction, the researchers were able to detect Egyptian blue, technically known as calcium copper tetrasilicate. The pigment may have been used to subtly modulate colors or add a shiny quality. It is also possible that Egyptian blue, used at least as early as 3100 B.C., was no longer a scarce commodity by the Roman era. "We have perceived it as a pigment that was rare and expensive," says Jane Williams, a conservator at the Hearst Museum, "but maybe it wasn't. Maybe it was just part of what was available in the mix."

—Daniel Weiss

Mr. Jefferson's Laboratory

Renovations in the rotunda at the University of Virginia have led to the discovery of a nineteenth-century chemistry laboratory hidden in the building's walls. The iconic Thomas Jefferson–designed rotunda was constructed in the 1820s as the centerpiece of the university he founded. Recently, while exploring a mysterious void within the walls on the bottom floor, workers found a chemical hearth, which apparently was used by Professor John Emmet during the university's early years. According to Jefferson's letters, he and Emmet discussed the location of the chemistry classroom. "For the Professor of Chemistry, such experiments as require the use of furnaces, cannot be exhibited in his ordinary lecturing room," he wrote. "We therefore prepare the rooms under the oval rooms of the ground floor of the Rotunda for furnaces, stoves, etc." It was also necessary to locate the chemistry lab on the lower floors so that water for the experiments would not have to be pumped upstairs. The semicircular niche was connected to a sophisticated ventilation system through a series of brick tunnels. The hearth was likely walled up in the 1840s when the chemistry department moved to a different location.

Chemical hearth, University of Virginia

—Jason Urbanus

Under a Haitian Palace


Sans-Souci Palace

Archaeological digs have been rare in Haiti because of its political and civil instability. But last summer, a team led by J. Cameron Monroe of the University of California, Santa Cruz, began excavation at the Sans-Souci Palace in the town of Milot. The palace was built in the early nineteenth century by Henri Christophe, who took control of the northern part of the country in a civil war that broke out after independence from France.

The team located a major structure below the palace complex that they believe is an early phase of construction. Under it, they found a midden filled with domestic objects from the mid- to late eighteenth century, including ceramics imported from France and England, locally made tobacco pipes, and Afro-Caribbean potsherds.

Monroe believes the midden was most likely a trash dump from the colonial-era Milot Plantation, whose precise location has eluded researchers, and that its presence suggests that Christophe may have chosen to build his palace directly over the plantation. "The Haitian revolutionaries absolutely detested the French colonial presence," he says. "So one could argue that building on top of the thing is a way of erasing that legacy from the landscape."

—Daniel Weiss

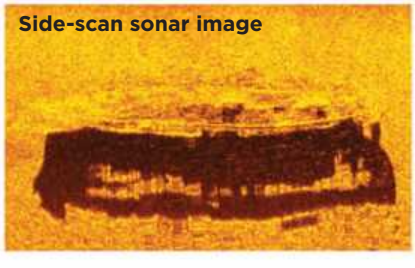
From Yacht to Trawler to Wreck

Ituna began its life as a luxury steam yacht in Scotland in 1886. It went down as a fishing trawler off the California coast in 1920. In between, *Ituna* lived several other lives.

Researchers from the National Oceanic and Atmospheric Administration recently discovered the historic wreck 200 feet down, 24 miles from San Francisco, where it sank in a storm. As a luxury craft, with a hull designed by famed yacht designer George Lennox Watson, *Ituna* saw several owners before it was purchased by Allison V. Armour, a wealthy patron of the sciences. She sent the ship on a three-month research expedition to Mexico in 1894, which resulted in *Archaeological Studies among the Ancient Cities of Mexico*, an early and influential text on Mesoamerican archaeology. Twenty-two years later the ship was refitted as a first-class passenger cargo steamer, and then again two years later as a steam trawler with a crew of 14. The ship sank while transporting a cargo of fish-processing machinery and concrete. Images from the recent wreck discovery show the ship's distinctive elliptical stern, trawl machinery, and triple-expansion steam engine.

—Samir S. Patel

***Ituna*, 1917**



Side-scan sonar image

Stern

Steam engine

Buddha Stands Tall

Korean archaeologists have uncovered a ninth-century Buddhist statue from the Unified Silla period (A.D. 676–935) at a temple site in Yangyang County, Gangwon Province. The statue is the largest known Buddha from the era, and also one of the most intricately decorated from the entire Silla Dynasty (57 B.C.–A.D. 935). The gilt-bronze Buddha measures about 16 inches in height, but when the statue is assembled as a complete set, with the *mandorla* (halo) on top and pedestal on the bottom, it is taller than 20 inches, say researchers at the Hanbit Institute of Cultural Properties. Buddhist statues from this era are usually about half that size. It is also very rare to find gilt-bronze Buddhist statues in Korea that include the mandorla and pedestal.

Researchers say the way the figure is holding the *kundika* (the water vessel used in Buddhist ceremonies) is also unusual. The vessel is held by its handle, whereas in most images of Buddha, the figures are holding the vessel by its long neck or mouth. Scholars are currently studying the statue further, and given its artistic and academic value, they expect it to be designated a state treasure.

—Hyung-eun Kim

Gilt-bronze Buddha statue

Denmark's Bog Dogs

A salvage excavation at the site of a new housing development near Aarhus, Denmark, has revealed the remains of sacrificial victims, including a headless woman and eight dogs, who were dropped into a bog more than 2,000 years ago. Per Mandrup of Denmark's Moesgaard Museum led the excavation. While the bodies of humans preserved in bogs have received a lot of scholarly attention, less is known about dogs. "It's always surprising to find so many dogs and also find a human," says Mandrup. "It was the jackpot." The dogs appear to have been a breed similar to border collies that was probably used for sheep herding. Leashes were found with some of the dogs, but how they were killed is not known. Other sacrifices have been found in another nearby bog, including burned human bones, iron weapons, and 13 more dog skeletons. According to Mandrup, "We can see there was a lot of sacrifice in that area, which is not normal."

—Zach Zorich

Dog sacrifice

Mammoth skull and tusks

Leftover Mammoth

While installing a drainage pipe in his wheat field, a Michigan farmer was surprised to unearth a section of mammoth pelvis. A team led by University of Michigan paleontologist Daniel Fisher then excavated there and recovered 20 percent of the animal's bones, including its skull and tusks. Fisher notes that the bones were arranged in the correct anatomical order, which means they likely never lay on the surface, exposed to the elements and scavengers. He thinks that's because the mammoth was probably butchered by humans, who then stored some of the meat in a pond for future use. Boulders found near the skull might have been used to help weigh down the carcass. "Maybe something happened to the people, or maybe they didn't need the meat," says Fisher. "But for whatever reason, they never came back."

—Eric A. Powell

Finding Parker's Revenge

Archaeologists working in Lexington, Massachusetts, are investigating the little-known site of Parker's Revenge, a small yet important skirmish that took place in the opening hours of the Revolutionary War. On April 19, 1775, tensions between Massachusetts colonists and the British army finally broke out in bloodshed at Lexington Green, as a battalion of 700 British regulars fired on as many as 77 local militiamen led by Captain John Parker. The redcoats, who had marched that morning from Boston, were headed to the neighboring village of Concord to destroy a cache of colonial military supplies. As

Parker's Revenge excavation, Massachusetts

they undertook their 17-mile journey back to Boston, matters quickly turned nightmarish as thousands of colonial militia from the surrounding countryside lined the road and began to attack the retreating column. The British faced particularly heavy fire from a rocky hillside overlooking the road. This engagement is now known as Parker's Revenge, in which the Lexington captain rallied his troops after the morning's defeat to ambush the unsuspecting British.

The Parker's Revenge Archaeological Project has been working at the 44-acre site in Minute Man National Historical Park to reconstruct the events and landscape of the eighteenth-century encounter. They have employed a number of archaeological methods, including excavation, geophysical survey, 3-D laser scanning, and metal detection. Relying on the principles associated with battlefield archaeology, researchers are using retrieved musket balls, both dropped and fired, to determine the location of the combatants and the intensity of the fighting. "What we have found to date is very significant," says project archaeologist Meg Watters. "Due to the location and spatial patterning of the musket balls recovered, we now know the exact place where individuals were standing during the battle." This will allow archaeologists to begin to paint a much clearer picture of what happened that day.

Musket ball

—Jason Urbanus

Gold ivy wreath

Jug handle depicting Dionysus

Aphrodite and Eros figurine

Living the Good Afterlife

Archaeologists are getting a new look at how the other half lived in Classical-era Cyprus thanks to artifacts unearthed at a 2,400-year-old necropolis on the island's northern coast. Discovered during construction of a pipeline, the tombs were near the ancient city of Soloi, a leading supplier of copper and timber for the Athenian navy. The remains of three adults and two young girls were found in two unlooted chambers. The grave goods that accompany them suggest that the Athenian trade was prosperous. "This was a rich aristocratic family," says Ankara University archaeologist Hazar Kaba, who analyzed the artifacts. "Even the children were adorned with elaborate funerary jewelry."

Many objects discovered in the tombs, including a delicate gold wreath shaped like an ivy plant, and 16 bronze and silver vessels, were from Greece. A figurine depicting Aphrodite and her son Eros was made locally but in the Athenian style, suggesting to Kaba that artisans from Athens may have been living in Soloi. Other artifacts came from Anatolia to the north and the Achaemenid Empire to the east. "While the majority of the goods used by these aristocrats were imported from Greece, it was exciting to see that a large amount of Cypriot and Eastern goods were also present," says Kaba. "All this evidence points to a way of living that was combining Greek, Cypriot, and Eastern customs and culture together."

—Eric A. Powell

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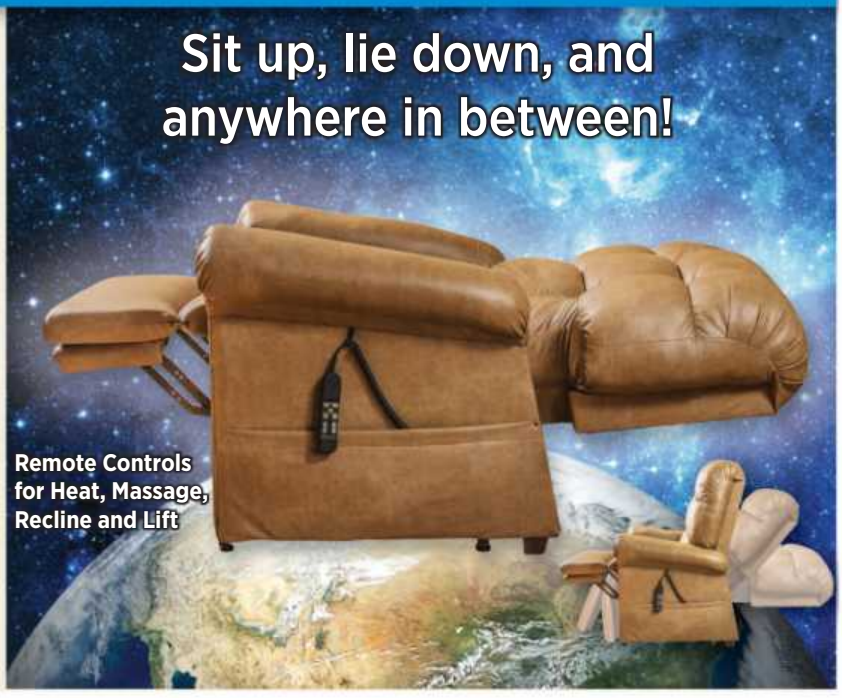

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ALASKA: It was long thought that Ice Age humans in the Americas were primarily big-game hunters. But sharp-eyed archaeologists have found evidence that they ate fish as well. In an 11,500-year-old hearth, researchers found salmon bones, the earliest known evidence for the use of the fish as food in North America. Because the bones were found more than 800 miles from the ocean, it is clear that long-distance salmon migrations likely date back at least to the last Ice Age.

PORTUGAL: In 1536, the Portuguese Inquisition began to police the practice of faith there, subjecting Jews, Protestants, Muslims, and others to torture and death. In an area called the "Jail Cleaning Yard" outside the Inquisition Court in Évora, excavators found, scattered among domestic waste, the remains of at least 12 people. Documents confirm that of the 87 prisoners of the court who died while the dump had been in use, at least 11 were discarded in the dump—as, the researchers report, a punishment to both body and soul.

LIBYA: A hundred and fifty thousand years or so ago—ages before escargot became a delicacy—humans ate land snails on a regular basis. Evidence for this comes from tens of thousands of snail shells documented in Haua Fteah Cave. Some of the shells have holes indicative of drilling, which broke the suction that holds snails secure and made it possible to suck them out. Patterns in the deposits suggest that early humans turned to snails, which can be laborious to collect, during times when other sources of food were hard to come by.

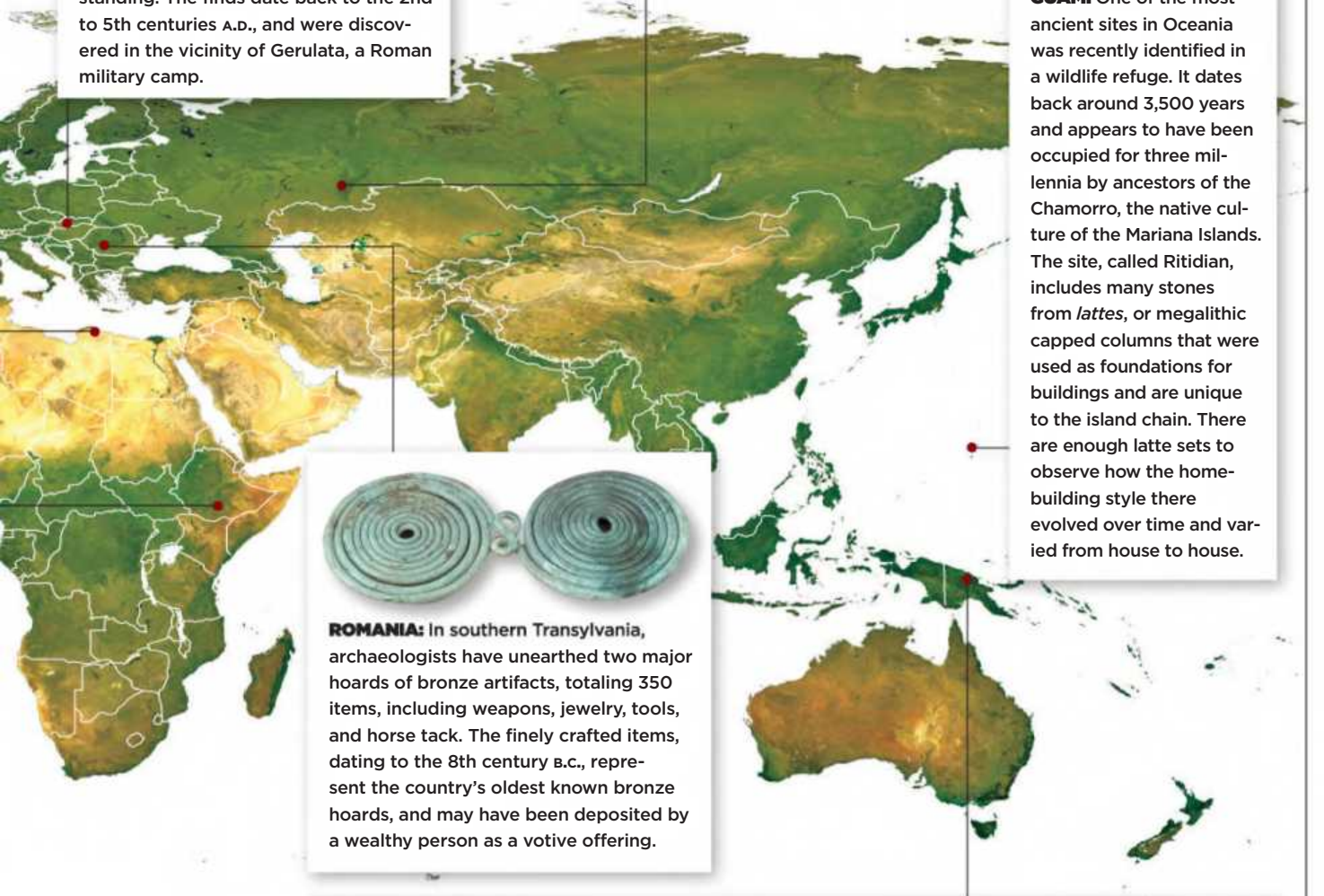
ETHIOPIA: Geneticists have sequenced the first prehistoric African genome. The DNA comes from 4,500-year-old remains found in 2012 in a cave in the Ethiopian highlands. After comparing the genome with more than 100 populations from Africa, Europe, and Asia, scientists found, surprisingly, that it includes DNA from a potentially huge migration of farmers from the Middle East into Africa around 3,500 years ago—DNA that spread across the continent, even to groups in South Africa and Congo that had long been considered genetically isolated.

BRAZIL: It was clear, from the moment it emerged from the ground, that the 9,000-year-old skull excavated at the Lapo do Santo rock shelter was unusual. It had been buried with the jaw and six vertebrae attached, and with the left hand placed over the right side of the face (pointing up) and the right hand over the left side of the face (pointing down). Cut marks confirm that it was a ritual decapitation, the oldest known in the New World by 6,000 years. Researchers believe it was an ancestral relic rather than a war trophy.

SLOVAKIA: The construction of a sewage system outside Bratislava has revealed more than 200 artifacts of high society, including jewelry, coins, clothing buckles, and a fine, intricate, one-of-a-kind silver belt. The belt—which may not have been worn around the waist—was in imitation of *opus interrasile*, a pierced openwork metalworking technique, and likely belonged to a woman of some standing. The finds date back to the 2nd to 5th centuries A.D., and were discovered in the vicinity of Gerulata, a Roman military camp.

RUSSIA: Imanai Cave in the Russian republic of Bashkortostan is the world's largest cave lion tomb. Excavations deep in the cave have uncovered at least 500 cave lion bones or bone fragments. Because the remains were found deep in the cave, and because evidence of human activity is limited to a handful of spearheads, researchers believe that it may have been a religious or ritual site where the remains of the extinct carnivores were brought. The deposit hasn't been accurately dated, but is likely at least 30,000 years old.

GUAM: One of the most ancient sites in Oceania was recently identified in a wildlife refuge. It dates back around 3,500 years and appears to have been occupied for three millennia by ancestors of the Chamorro, the native culture of the Mariana Islands. The site, called Ritidian, includes many stones from *lattes*, or megalithic capped columns that were used as foundations for buildings and are unique to the island chain. There are enough latte sets to observe how the home-building style there evolved over time and varied from house to house.



ROMANIA: In southern Transylvania, archaeologists have unearthed two major hoards of bronze artifacts, totaling 350 items, including weapons, jewelry, tools, and horse tack. The finely crafted items, dating to the 8th century B.C., represent the country's oldest known bronze hoards, and may have been deposited by a wealthy person as a votive offering.

PAPUA NEW GUINEA: It has long been thought that the Austronesian-speaking people from Asia who eventually colonized the remote islands of the Pacific skirted New Guinea and had little influence on the existing culture there, especially in the interior. But new analysis of 12 potsherds from a highland site suggest otherwise. The sherds, the oldest known pottery on New Guinea at 3,000 years old, were locally made, suggesting that Austronesian influence (which includes a pottery-making tradition) made its way up the island's rugged slopes hundreds of years earlier than once thought.

Top 10 Discoveries of 2015

ARCHAEOLOGY's editors reveal the year's most compelling finds

This year's Top 10 Discoveries reach us from vastly different cultures and across eons. Some raise new questions about what it means to be human and what separates us from our species' relatives. Others bring us face to face with individual people, their travels, their faith, their hold on power. Several, covering matters as diverse as slavery and the origins of art, come to us via newly applied scientific methods. Taken together, this year's discoveries present an array of insights into endeavors, large and small, spanning millions of years.

A skull, a composite skeleton, and an array of other bones belonging to multiple members of a previously unknown hominin species

A New Human Relative ■
Johannesburg, South Africa

Scientists have long searched for the transitional species between apelike australopithecines, such as Lucy (*Australopithecus afarensis*), and early humans, such as *Homo habilis*. And now, deep in the Rising Star cave system in South Africa, they may have unearthed it.

When amateur cavers told Lee Berger, a paleoanthropologist at the University of the Witwatersrand in Johannesburg, that they had located hominin remains in the nearby cave system, he knew he could not make it in to retrieve them himself. The passageway was extremely narrow, just seven inches wide at one point. So Berger put out a call on Facebook for diminutive, non-claustrophobic scientists and recruited a team of six women who fit the criteria.

Marina Elliott, an archaeologist from Simon Fraser University in Canada, was the first to enter the chamber. "I was stunned," she says. "I shone my headlight around and picked up flashes of bone all over the place." Elliott and her colleagues retrieved more than 1,500 specimens, from at least fifteen different individuals. A larger team of scientists, led by Berger, determined that the remains belong to a previously unknown species, which they named *Homo naledi* after its resting place—*naledi* means "star" in the local Sesotho language.

The newly discovered species had a novel mix of primitive and modern features. Its head was tiny, with a brain the size of an orange, but its skull was humanlike in shape. Its hands were adapted for manipulating objects and its feet for walking upright, but its shoulders and fingers were built for climbing. "We never expected to see a combination of characteristics like this," says John Hawks, a paleoanthropologist at the University of Wisconsin–Madison, "but they're all in *Homo naledi*, and that's surprising."

The researchers suspect *Homo naledi* may be among the earliest members of the genus *Homo*, which would mean it most likely existed around 2.5 million years ago. However, they have so far been unable to date the remains.

—Daniel Weiss

Earliest Stone Tools
West Turkana, Kenya

Stone toolmaking has been considered one of the defining characteristics of members of the genus *Homo*, but this year it was announced that newly discovered tools predate the first known humans. A research team led by Sonia Harmand and Jason Lewis of the Turkana Basin Institute at Stony Brook University found the tools at a site called Lomekwi 3 in Kenya. They are believed to be 3.3 million years old, predating *Homo habilis*—the first known member of the genus *Homo*—by about 700,000 years. A group of fossils roughly contemporaneous with the tools was discovered nearby in 1999 and dubbed *Kenyanthropus platyops*, a small-brained hominin that seemed unlikely to have used tools—until now. Harmand believes that stones were just one part of the early hominin toolkit and says, "Why not think that our ancestors from the beginning were using many, many tools?"

—Zach Zorich

One of a number of stone tools unearthed in Kenya and thought to be 3.3 million years old

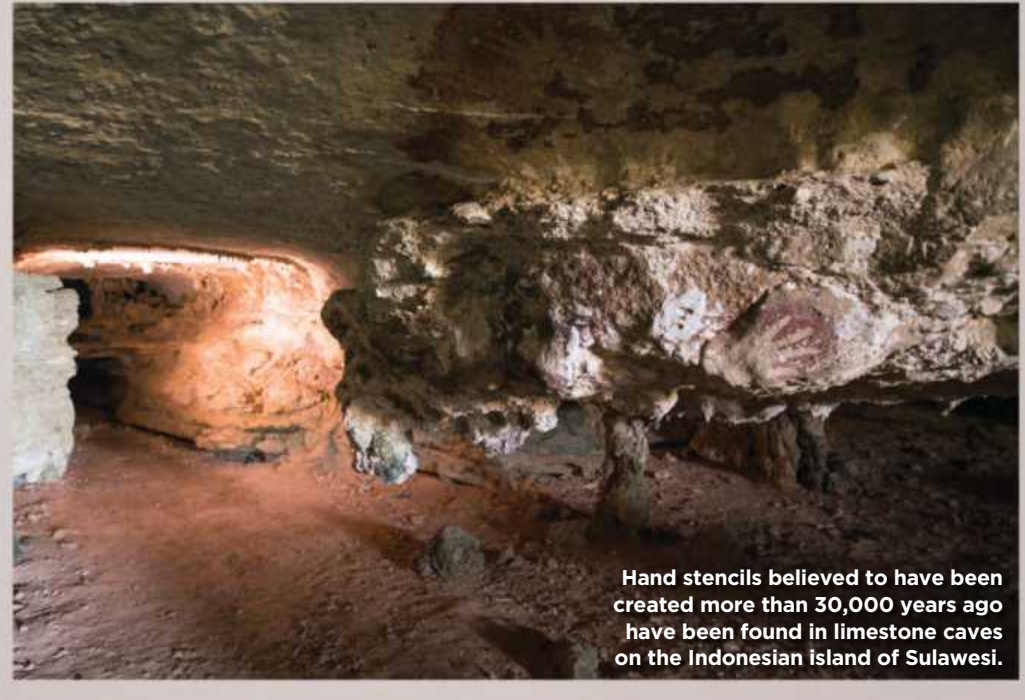
The First Artists
Sulawesi, Indonesia

Dating cave art is notoriously difficult. But a team of researchers has taken advantage of serendipitous conditions in caves on the Indonesian island of Sulawesi to establish that images there rival any known from Western Europe in terms of age. A stencil created as the artist blew pigment around a hand is at least 39,900 years old, they report, and a painting of a piglike animal was laid down at least 35,700 years ago.

The researchers established the designs' minimum ages by calculating the dates of deposits that had built up on top of the pigment. They had observed that, as mineral-laden water percolates through the caves' limestone walls, calcite gradually accumulates on their surfaces. These deposits contain uranium, which decays to thorium at a known rate, so their age can be ascertained from the ratio of the two elements.

The discovery raises a new question: Did people in Southeast Asia and Western Europe develop artistic expression independently, or was it pioneered by early humans before they left Africa? "We don't know," says Maxime Aubert of Griffith University in Australia, "but my opinion is it probably developed a long time ago, in Africa, and then it just spread out."

—Daniel Weiss



Hand stencils believed to have been created more than 30,000 years ago have been found in limestone caves on the Indonesian island of Sulawesi.

Bronze Age Bride
Copenhagen, Denmark

In 1921, the well-preserved remains of a young woman who died around 1370 B.C. were discovered in an elite burial near the town of Egtved, Denmark. For almost a century, she was thought to have been a local, and became known as the "Egtved Girl," but new research has amended her story and what it may say about Bronze Age marriage alliances.

A waterlogged, acidic environment had preserved the young woman's clothing, hair, tooth enamel, fingernails, and parts of her brain and skin. Also preserved were the cremated remains of a young child. A team led by Karin Frei of the National Museum of Denmark analyzed strontium isotopes in the young woman's tooth enamel and found she did not grow up on the Jutland Peninsula, where Egtved is located. Instead, she was most likely raised in the Black Forest region of southern Germany, around 500 miles away. The researchers believe she was sent from her home to marry a chieftain in Jutland. Further analysis of the young woman's fingernails and hair shows that, in the final years of her life, she appears to have moved from the Black Forest to Jutland, back to the Black Forest, then back to Jutland again shortly before her death.

The remains of the child found with the young woman may help explain these travels. "Dynastic marriages were often followed by an exchange of 'foster brothers' to secure the alliance," says Kristian Kristiansen of the University of Gothenburg. In such a scenario, after marrying the chieftain in Jutland, the young woman would have been sent back to the Black Forest along with a boy from Jutland, who would have been raised by her people. She would then have returned to Jutland with a young male relative, who would be raised there. The child's cremated remains led Kristiansen to propose that the death occurred en route and the remains were buried later with the young woman when she, too, died after her return to Jutland.

—Daniel Weiss

Isotopic analysis of the remains of a young woman (right) uncovered in a Danish burial (above) nearly a century ago provides new details of Bronze Age life.

Tomb of a Highborn Celt ■
Lavau, France

During a routine investigation of an area slated for construction in the village of Lavau in north-central France, archaeologists happened upon one of the most remarkable Iron Age discoveries of the past century. Beneath a mound measuring 130 feet in diameter, researchers from France's National Institute of Preventive Archaeological Research were stunned to find the burial of an early Celtic "prince" dating to the fifth century B.C. They were initially unable to determine the individual's gender, and some of the accoutrements associated with dress found near the body suggested the skeleton belonged to a woman. But testing has now confirmed with certainty that the deceased was, in fact, male.

This wealthy Iron Age prince was buried with an assortment of luxury items, including imported Mediterranean vessels, gold jewelry, and a chariot. A finely crafted bronze wine cauldron decorated with the heads of animals and mythological creatures, and a black-figure Greek wine pitcher, indicate that the Celts in this area had robust trade and political ties with the Greeks and Etruscans—and also distinguish this as the grave of a significant person. "He had to be at the top of the local aristocracy," says archaeologist Bastien Dubuis. "All this wealth is a reflection of the central importance of the character buried here, who exercised economic and political power in the region."

Imported Mediterranean wine was a key commodity for the early Celts. This burial and others like it demonstrate that rituals and paraphernalia associated with the drinking and distribution of wine played a vital role in Celtic society.

—Jason Urbanus

An ornate bronze wine cauldron excavated in an early Celtic tomb in north-central France

Baby Bobcat
Springfield, Illinois

The native cultures of ancient North America expressed their close relationship to animals in their art and their rituals, none more so than the Hopewell Culture, which flourished along the rivers of the Northeast and Midwest between 200 B.C. and A.D. 500. When Angela Perri of the Max Planck Institute for Evolutionary Anthropology opened a box in the Illinois State Museum's collection labeled "puppy," she expected to find the remains of a dog burial, common enough in the Hopewell Culture. The bones had come from a 1980s rescue excavation at the Elizabeth Mounds site in western Illinois. "As soon as I opened it, I said, 'I think we have a problem,'" Perri recalls. "I knew right away from its distinctive teeth that it was a cat."

She determined that the nearly complete skeleton belonged to a juvenile bobcat, between four and seven months old. The bones show no signs of trauma, indicating the bobkitten likely died of natural causes, probably malnutrition. "It looks like they came across a baby that they tried to raise but failed," says Perri. "When it died they had become close enough to it that it warranted this special burial."

Along with the bones, Perri found four shell beads and two carved effigies of bear teeth worn as a necklace—grave goods common to Hopewell human burials—making this the only decorated burial of a wild cat found in North America, as well as the only animal buried alone in its own mound. Though the Hopewell had had domesticated dogs for hundreds of years, Perri says that having a tamed bobcat would have been "a very uncommon experience."

—Jarrett A. Lobell

A necklace of shell beads and carved bear teeth was discovered in a burial in Illinois with the remains of a juvenile bobcat.

World's Oldest Pretzels
Regensburg, Germany

Archaeologists digging at the site of the future Museum of Bavarian History in Regensburg, Germany, expected their most exciting finds would date to the Roman era, but they were in for a surprise. In an eighteenth-century privy, they discovered the carbonized pieces of two pretzels. "We never have the opportunity to recover baked goods," says government archaeologist Silvia Codreanu-Windauer. "Generally they were eaten, or, if burned, they were fed to dogs or chickens." She speculates that in this case an absentminded baker or his apprentice forgot the pretzels in the oven and was so disgusted at burning them that he threw them in the toilet. It seems to have happened more than once. In the same privy, the team found the charred remains of three bread rolls and a fragment of a crescent-shaped local delicacy called a *kipferl*.

—Eric A. Powell

Pieces of a burned pretzel found in an 18th-century German privy, positioned atop an image of a complete, modern pretzel

Tracing Slave Origins
Philipsburg, St. Martin

Researchers using a newly developed technique that permits the targeted retrieval of ancient genetic material were able to successfully identify the ethnic origins of three enslaved Africans found buried together on the Caribbean island of St. Martin, even though the surviving DNA was highly fragmented. Known locally as the Zoutsteeg Three, the two men and one woman (ages 25–40) had been found by construction workers in 2010. At that time, archaeologists were immediately struck by the condition of the individuals' teeth, which had been intentionally filed down, a modification commonly associated with certain regions of Africa.

While DNA does not survive well in tropical environments, experts from the University of Copenhagen and Stanford University used whole-genome capture and next-generation sequencing to isolate the scant DNA remains of the Zoutsteeg Three. By comparing this evidence with the DNA of modern West African populations, they have learned that one of the slaves likely originated among the Bantu-speaking population of Cameroon, while the other two probably came from non-Bantu-speaking regions of Nigeria and Ghana. "We were able to show that we can use genome data to trace the genetic origins of enslaved Africans with far greater precision than previously thought possible," says Hannes Schroeder of the University of Copenhagen. "This has important implications for the study of Caribbean slavery and the archaeology of the African diaspora."

—Jason Urbanus

A skull displaying the filed teeth of a person of African origin discovered on the Caribbean island of St. Martin

Mythological Mercury Pool
Teotihuacan, Mexico

Mercury is often found in Mesoamerican tombs in the form of a powdery red pigment called cinnabar, but its liquid form is extremely rare. So it was with some surprise that Sergio Gomez, an archaeologist with Mexico's National Institute of Anthropology and History, discovered traces of liquid mercury this year in three chambers under the early-third-century A.D. Feathered Serpent Pyramid in the ancient city of Teotihuacan. Gomez believes the mercury was part of a representation of the geography of the underworld, the mythological realm where the dead reside. The silvery liquid was probably used to depict lakes and rivers.

Since uncovering the entrance to a tunnel leading beneath the pyramid in 2003, Gomez has found five underground chambers containing thousands of artifacts, including many thought to be offerings, such as skeletons of large jaguars and wolves. Other objects, such as figurines made of jade from Guatemala and seashells from the Caribbean, indicate how far Teotihuacan's influence extended. In addition to helping maintain the mercury in liquid form, the humidity and lack of oxygen in the underground chambers have preserved plant seeds and fragments of something that might be human skin.

—Zach Zorich

A schematic of the Feathered Serpent Pyramid in ancient Teotihuacan, showing a tunnel leading to several underground chambers

The graves of four eminent leaders of colonial Jamestown unearthed in the chancel of the settlement's original church

Jamestown's VIPs
Jamestown, Virginia

Jamestown, the first permanent English settlement in the Americas, is perhaps the United States' most consistently prolific archaeological site. This year researchers have analyzed four previously excavated graves found in the chancel of the original 1608 church, a burial location surely reserved for prominent figures. Scientific, forensic, and genealogical work identified the remains of four members of Jamestown's leadership—and turned up at least one new mystery.

The Chaplain—Reverend Robert Hunt, the chaplain of the settlement, is thought to have died in 1608. His remains were wrapped in a shroud instead of a coffin, reflecting his piety, and he was buried facing the congregation.

The Soldier—By contrast, Captain William West, killed by Native Americans in 1610, was buried in an ornate coffin, of which only the nails remain. His bones had high lead content, due to use of high-status drinking vessels, and found with him were the delicate remnants of a silk military sash.

The Nobleman—An even more elaborate, human-shaped coffin held the remains of Sir Ferdinando Wainman, Jamestown's master of ordnance, who died during the "starving time" of 1609–1610, when some 70 percent of the colonists perished. His remains also had the high lead content of an aristocrat.

The Explorer—Captain Gabriel Archer, another victim of the starving time, had explored much of the northeast coast of America before the colony was established. His grave contained a fragment of a staff carried by British officers, as well as a silver box holding human bone fragments and a lead ampulla—almost certainly a Catholic reliquary. Was Archer a secret Catholic in the Protestant colony, or was the box repurposed and given some new significance for the first American outpost of the Anglican Church?

—Samir S. Patel

Thousands of glass fragments excavated in a Wittenberg basement, alongside reconstructed glass vessels associated with alchemical experiments, sit on a restorer's table in the German city of Halle.

The Alchemist's Tale

Long regarded as a charlatan's game, alchemy is now taking its proper place in the history of science

by Andrew Curry

When we are where we shall exercise
Our mysterious craft, we seem wonderfully wise,
Our terms are so scholarly and so strange.
I blow the fire until my heart faints.
Why should I tell each proportion
Of the things that we work upon...

Geoffrey Chaucer, Prologue, "The Canon's Yeoman's Tale"
The Canterbury Tales

In a light-filled room in a building behind the State Museum of Prehistory in Halle, Germany, a row of tables is lined with oddly shaped glass vessels. When Christian-Heinrich Wunderlich saw them for the first time three years ago, they were in thousands of pieces, enough to fill six crates. Archaeologists had discovered the fragments during a rescue excavation in nearby Wittenberg in a niche underneath what had been a fifteenth-century monastery's basement stairway.

When the crates had first been brought to his lab, Wunderlich, who is the head of the Saxony-Anhalt State Office for Heritage Management and Archaeology's restoration facility, assumed they contained centuries-old ordinary household garbage, likely broken drinking glasses and clay cookware, that had been swept up and forgotten. "At first we thought it was just a lot of glass," Wunderlich recalls. "We noticed the weird shapes, and just shook our heads."

A few of the most misshapen shards landed on Wunderlich's desk. He noted that some were discolored and melted, as though they had been subjected to extreme heat. At least half were coated with curious residues—silvery crystals, for example, or thick, crusty red or brown layers. As Wunderlich pondered them, he began to wonder if there was something else to the story. He decided to pursue a hunch, scraping tiny bits of residue off one of the shards for chemical analysis. The results included the presence of copious antimony and antimony ore. "That's when we understood that these were the tools of an alchemist," he says.

That realization set in motion a herculean effort to piece together the shattered vessels. At the beginning, the task seemed nearly hopeless. When first spread out on tables, the thousands of thin pieces of glass covered more than 300 square feet. Restorer Vera Keil painstakingly sorted, matched, and glued together the delicate artifacts. The project took Keil a year. "It was like a 3-D puzzle," she says, "made out of broken lightbulbs."

Once the vessels were reassembled, it became clear that they corresponded to historical depictions of alchemical tools, including glass and ceramic containers called crucibles capable of withstanding extremely high temperatures, and bulbous distilling apparatuses known as alembics. Taken together, the antimony residue and the specialized glassware convinced Wunderlich that the finds were proof Wittenberg was home to the oldest known alchemist's workshop in Europe, and only the second one ever discovered. They also provide important evidence that could help settle an ongoing debate about an early and hotly contested chapter in the history of science.

When these conclusions were announced, they made headlines in Germany. They also resonated in the small community of historians dedicated to rehabilitating alchemy's reputation. For most of the last century, scholars have denigrated alchemists, arguing that they were nothing better than frauds or con artists.

Joel Klein, an historian at Columbia University who studies the history of alchemy, says early experimenters have gotten a bad rap. Though alchemists never managed to turn lead into gold, their attempts were in earnest, and formed the foundations of scientific chemistry and metallurgy. "These

Glass vessels used for distilling chemicals, called alembics, were one of the common tools of the medieval alchemist's trade.

are absolutely the original chemists," says Klein. "Medieval and early modern alchemists were doing what you might call proto-chemistry."

Historians have come up with the term "chymistry" to describe the fluid mélange of chemistry and alchemy that was practiced for centuries. Not unlike chemists today, alchemists kept elaborate records, corresponded avidly with far-flung colleagues about their discoveries, and published their results in specialized journals. These treatises were filled with jargon, partly to keep the formulas secret, and partly to give them an air of mystery.

Antimony, Wunderlich explains, captivated these early "chymists" thanks to its ability to apparently "clean" gold. This element, found in nature as an ore called stibnite, was referred to as the "Babylonian Dragon," the "Green Dragon," or, in the words of Sir Isaac Newton, whose pursuit of alchemy was as passionate as his research into mathematics and optics, "the menstrual blood of the sordid whore." This abstruse language was more than just a secret code. For those in the know, such convoluted descriptions were metaphors that helped explain what was going on in their smoking crucibles and bubbling alembics.

One influential work penned by the impressively named sixteenth-century Swiss alchemist Theophrastus Bombastus von Hohenheim was titled "The Triumphal Chariot of Antimony." Von Hohenheim, who went by the pseudonym Basil Valentine, advised readers to "take the ravenous gray wolf... [and] throw the king's body before him that he may have his nourishment from it. And when he has devoured the king, then make a great fire and throw the wolf into it so that he burns up entirely; thus will the king be redeemed."

The wolf-king narrative, it turns out, was a common way to describe antimony's capabilities. The gray wolf represented antimony, and gold was the "king" of metals. Mixed together and heated in alcohol—analysis of the glass suggests the Wittenberg alchemists used wine—antimony appears to dissolve (or "devour") the gold, together with any impurities. Heated again, the antimony "wolf" evaporates, leaving a nugget of pure gold behind.

But were the Wittenberg alchemists only trying to turn base metals into gold, the stereotypical alchemist's quest? Evidence gleaned from the rest of the monastery excavation and from historical documents suggests they were chasing after something else altogether. "Alchemy was more than transmutation," Klein says. "The glassware was most likely used to synthesize medicines from metals and minerals." Alchemists believed that antimony's properties could perhaps be curative. Based on their view of how the universe worked, it wasn't such an illogical leap. If antimony could clean gold, they speculated, it might be able to "clean" sick people, too.

LATE MEDIEVAL MAINSTREAM medicine was about balancing the four humors: yellow bile, black bile, phlegm, and blood. Illnesses were blamed on an excess of one humor or another. The remedy was to purge or bleed the patient. Antimony was particularly effective at the former. "Antimony would purge you upwards and downwards, as physicians back then liked to say," says Indiana University historian William Newman, an expert in the history of science and chymistry.

Today, chemists know that antimony is a powerful neurotoxin. Well into the nineteenth century, the fact that it often killed their patients didn't stop doctors from using it as medicine. Most physicians just figured they had the dosage wrong. The element's copious presence in Wittenberg glassware is clear evidence that the lab there was hard at work experimenting with antimony and engaged in medical alchemy—the search for a cure-all that some early alchemists referred to as "potable gold."

In the sixteenth century, the building where the glassware was found became part of the University of Wittenberg, one of the most advanced medical universities in Europe at the time. Andreas Stahl, an historian researching the Wittenberg find for the Saxony-Anhalt State Office for Heritage Management and Archaeology, has located archival documents showing that the monastery building was deconsecrated within a few years after 1517, and that it might have been taken over by

A 17th-century engraving from an alchemical treatise depicts the narrative of the wolf devouring the king. This was a favored way to describe the properties of antimony, one of the chemicals frequently used by alchemists.

the medical faculty shortly before the glass was dumped. In a nearby trench, excavators found grisly evidence of another type of early medical experimentation—a woman's skeleton, the head removed, sawed open, and placed in a pot next to the body. Carbon dating shows the body was buried in the same century as the glass.

At least as far back as the fourteenth century, when Geoffrey Chaucer's "Canon's Yeoman's Tale" mocked alchemy as a fraud, alchemists were regarded as charlatans, promising something they couldn't deliver. Dante, even earlier, reserved a special place in the eighth circle of hell for alchemists. And Goethe, writing in the early nineteenth century, depicts the alchemist Faust as a morally compromised hero, willing to literally deal with the devil to get what he wants.

One of the most bizarre finds from the Wittenberg basement is a small earthenware pot containing the partially charred bones of a lapdog. For Germans today, the canine was an especially tantalizing detail: In Goethe's story, a poodle

In the Wittenberg alchemist's lab, archaeologists found the charred bones of a small dog inside a ceramic vessel, a mysterious find perhaps associated with an alchemical experiment.

follows Faust home and morphs into Mephistopheles. While the German press seized on the Faust connection, Wunderlich turned to chymistry. "Apparently the alchemist tried to make Basil Valentine's wolf allegory real by burning a poodle," he says. Perhaps it was fed antimony or gold first. In a possibly related experiment a half-century later, a Wittenberg alchemist named Daniel Sennert fed silver to a chicken for a month hoping to produce silver-shelled eggs.

Experiments that might seem bizarre to us today, combined with the alchemists' strange writings, led generations of historians to doubt that alchemy had been practiced at all. Well into the twentieth century, scholars poring over alchemical literature interpreted the convoluted language not as references to experiments, but as descriptions of spiritual journeys or visions. "Alchemy does not deal at all, or for the most part at least, with chemical experiments," the psychologist Carl Jung argued in 1936, "but probably with something like psychic processes expressed in pseudochemical language."

Inevitably, the knowledge that some alchemists were probably con artists has largely obscured the fact that many were entirely committed to their scientific endeavors. "For the longest time, alchemy wasn't taken seriously. It wasn't thought of as an important part of the history of science," says Klein. "There are lots of reasons to sideline alchemy. Alchemists have been ridiculed since the beginning." The Wittenberg finds make clear that alchemical experimentation was quite real. They might also help to rehabilitate alchemy's reputation and give it its proper due as a forerunner of modern chemistry. "Anything we can do to connect alchemy to material culture is hugely important," Klein says. "To see that people were going into their lab or basement or kitchen, or wherever they were doing it, and doing physical stuff is great."

Wunderlich is convinced the Wittenberg find is far from unique. Not long after Keil began piecing together the glass, coworkers cleaning up a storehouse associated with the museum that was damaged by severe flooding in 2013 came

The Netherlandish artist Pieter Brueghel the Elder created this engraving, called *The Alchemist,* in 1558, very close to the time that the Wittenberg alchemy lab was in operation.

across several boxes of broken glass, pottery, and twisted metal. Found during a 2005 excavation of a sixteenth-century monastery in Huysburg, about 50 miles west of Wittenberg, they had initially been shelved. Now Wunderlich is taking another look. Mixed in among charred roof tiles and household waste, the Huysburg equipment includes glass objects that look very similar to those in early illustrations of alchemical implements. Some of the glass resembles the Wittenberg finds, including the curious residues.

As word of the Wittenberg alchemist's laboratory spreads, Wunderlich hopes that archaeologists will take another look at their storerooms and perhaps discover evidence of alchemy right under their noses. "There must be other labs, but archaeologists have just never recognized them as such," he says. "I'm sure once we publish there will be dozens of these things showing up." ■

Andrew Curry *is a contributing editor at* **Archaeology.**

Living with

Carvings unearthed in the Arctic reveal a deep connection between an ancient people and polar bears

by Zach Zorich

A polar bear deftly leaps from ice floe to ice floe. Archaeologists and biologists are now working together to learn how the Arctic Dorset people may have emulated polar bear behavior some two millennia ago.

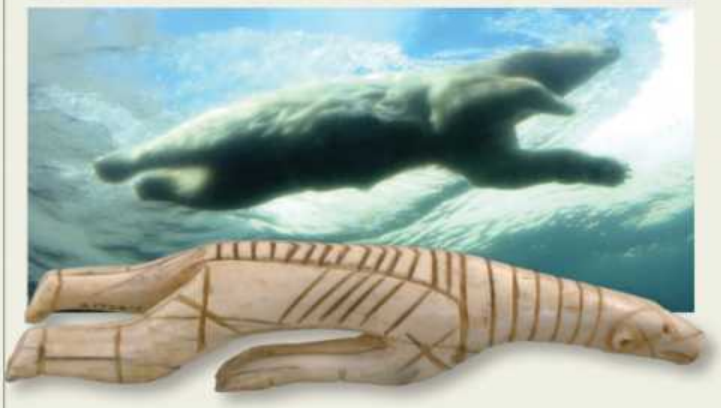
the Sea Bear

AROUND 2,500 YEARS AGO, a people known today as the Dorset flourished in eastern Canada and Greenland. Despite not having boats or bows and arrows, they survived in the harsh Arctic environment by using spears to hunt seals along the edge of the sea ice. The Dorset shared the stark landscape with polar bears, the world's largest terrestrial predator, who are also deadly seal hunters. *Ursus maritimus* ("sea bear") can weigh up to 1,700 pounds, and must have loomed large in the imagination of the Dorset, who fashioned great numbers of bone and ivory figurines depicting polar bears. Matthew Betts, a zooarchaeologist at the Canadian Museum of History, which has a significant collection of the carvings, became interested in what they could reveal about the Dorset people's relationship to these animals. "I thought the figurines were a phenomenon we could use to peer into the minds of

Standing Still-Hunting

For bears and people alike, hunting seal can require extreme patience. Polar bears have been known to stand still for hours at a breathing hole or the edge of an ice floe and wait for seals to swim within striking distance. The hunter must remain absolutely still so that no noise or vibration alerts seals to its presence, an attribute likely observed and emulated by the Dorset. Modern Inuit people still hunt this way, and Dorset hunters may have used the same technique, standing at the ice edge with a harpoon ready.

Lying Still-Hunting or Swimming



A polar bear lying on ice is all but invisible. The bears take advantage of their ability to blend into the snow to stalk prey on the ice surface and to make themselves harder to see at the ice edge. The figurines showing the bear with its forelimbs swept back may either depict a bear lying on the ice waiting for a seal, or a bear swimming. Biologist Ian Stirling explains that polar bears sometimes swim along the ice edge looking for seals that have hauled themselves out of the water. He has observed a polar bear swimming underwater for more than three minutes to sneak up on a group of bearded seals.

the Dorset," says Betts. "They lived with polar bears on a daily basis over a vast period of time, and the effigies should be able to tell us something about that experience."

Scholars have previously speculated that the Dorset polar bear figurines were worn as protection against bear attacks or were meant to provide magic necessary for a successful hunt. That idea stems from the fact that many indigenous peoples across the New World share a belief that physical and spiritual powers can be transferred between humans and animals. In eastern Canada, for example, today's Cree and Mi'kmaq people believe that bears can serve as guardians or spiritual helpers who can lend their abilities to a shaman under the right circumstances. The best-known Dorset figurines seem to show bears in a "flying" pose, and some scholars have linked these figurines to the belief that shamans could transform themselves into animals and fly in the spirit world.

Betts agreed that the figurines might have served a spiritual purpose, but wondered if there isn't something more to the carvings. The variety and anatomical detail of the figures suggested to him that they represented more than abstract poses. Betts had never seen a polar bear in the wild, so he asked Ian Stirling, a biologist at the University of Alberta who has studied seal and polar bear behavior for 45 years, for help. Stirling had no experience with Dorset art, but he was eager to work with Betts. "I don't know anything about archaeology," says Stirling, "but I've always been interested in how early people learned to hunt and make a living in the High Arctic. Standing on the sea ice in early March, when it's 40 below, I'm always struck by the fact that I can get on a helicopter and go home, but those people had to survive there."

Working with Betts, Stirling recognized that many of the polar bear figurines did indeed show the animals in poses that suggested specific behaviors, especially acts of hunting. The famous "flying" bears, for instance, seemed to Stirling to show the bears swimming after prey, or possibly lying on the ice preparing to ambush seals. In all, Betts and Stirling examined 131 polar bear figurines from 42 Dorset sites and grouped them into categories based, in part, on the action being depicted. They found that the major-

Seated Figurines

Polar bear mothers sit while they nurse their cubs, and that may be what many seated bear figurines depict. Others show cubs sitting, and some seem to represent mother bears making a distress call to warn of danger. The maternal devotion of bear mothers may have been held up as an ideal for Dorset mothers. Stirling also thinks that the Dorset possibly were depicting slightly less purposeful polar bear behavior. "Sometimes they'll simply sit there as you or I might to enjoy the scenery," he says. "But I don't know what they are doing."

Leaping

Stirling has only seen a bear leap and catch prey once. "It was a yearling bear goofing off while its mother hunted," he says. "It was taking long leaps on the ice, and just as it was flying through the air, an unlucky seal happened to surface below it." He notes that polar bears often jump from ice floe to ice floe instead of swimming to conserve energy. "In this environment," he says, "taking on energy quickly and spending it slowly is the most important thing for polar bears, and swimming takes a lot of energy." The Dorset depictions of leaping bears capture this important reality of life on the ice edge.

ity of the effigies show polar bears standing still while waiting for prey, a method called still-hunting that the Dorset probably practiced as well.

Stirling and Betts believe the fact that the figurines depict such specific behaviors means they may have served practical as well as spiritual purposes. One purpose might have been to teach children the proper way to hunt, or to remind them how hunters should behave on the ice edge. The level of detail on certain figurines suggests that some carvings may have even represented actual individual bears and could represent specific encounters or stories. Above all, Betts believes the figurines were powerful symbols of a successful ice-edge way of life, and that the Dorset viewed polar bears as a kind of people, with their own identities and souls, who should be emulated. "You could think of polar bears as spiritual kin to the Dorset," says Betts. "The Dorset are making this art to show that they have a connection with the universe in a very similar way that polar bears do." It's no coincidence, then, that the Dorset made more figurines depicting polar bears than any other living thing except humans.

Around A.D. 1000, the Arctic climate entered a warming phase and, as is happening today, the sea-ice hunting grounds began to melt away. At the same time, the Thule Eskimos, the ancestors of the modern Inuit people, moved into the eastern Canadian Arctic. They brought kayaks and bows and new hunting strategies that left little room for the Dorset. This crisis coincided with a period during which the Dorset made many more polar bear figurines than they had in the past. Scholars believe they may have reacted to their diminishing territory and access to seal hunting grounds in part by creating larger numbers of effigies. "As the population went through stress and the people saw things changing, they may have turned to rituals related to polar bears to help manage the crisis," says Betts. Nonetheless, about 750 years ago, the Dorset people disappeared. "Despite their best efforts, they couldn't cope with change." ■

Zach Zorich *is a contributing editor at* Archaeology.

Seen from the air before a major National Trust restoration effort, Knole House in Sevenoaks, Kent, is one of the largest homes in England. It has been expanded and modified many times since the late 16th century.

The Many Lives of an English Manor House

A major restoration project at a grand estate reveals centuries of a nation's history

by Kate Ravilious

If every home tells a story, then Knole House is a tome. By any measure one of the five largest houses in England, this country estate in Sevenoaks in west Kent has seen six centuries of British history, and the reigns of some 30 monarchs. Knole House has been the backdrop for all the ups and downs of the English aristocracy and for the lives of the countless tradesmen, butlers, maids, cooks, and footmen who kept dwellings like it running.

Located just 30 miles outside London, the house occupies four acres, surrounded by 26 acres of gardens and fields, and another

Restoration efforts along the eastern side of the house involved removing stonework and timber from certain areas, which provided archaeologists access to the structure of the home and more.

thousand that make up a medieval deer park. If the house sprawls, it is with good reason. From Sir James Fiennes to the Archbishop of Canterbury to King Henry VIII to many generations of the Sackville family, each new owner has added to its size and complexity, which has resulted in a multilevel labyrinth. It is difficult even to get an accurate count of all the rooms—the best estimate is around 420, connected to courtyards, staircases, attics, and seemingly miles upon miles of corridors. "Knole has almost always had too many rooms," says archaeologist Matthew Champion. "Each owner kept adding to it to increase their status, but they could never keep on top of using them all."

Vita Sackville-West, the early-twentieth-century writer and inspiration for Virginia Woolf's *Orlando*, grew up in the home and described it as resembling "a medieval village with its square turrets and its grey walls, its hundred chimneys sending blue threads up into the air." Today, one wing is occupied by Robert Sackville-West, 7th Baron Sackville, and his family, but the house is owned and managed by the National Trust, to whom it was donated in 1947 by the 4th Baron, Charles. Supported by the Heritage Lottery Fund, the National Trust is conducting a major five-year program of restoration that is offering an unprecedented look at the house and grounds, its construction, and the lives of many of those who passed through its halls.

The project involves lifting floorboards, inspecting rafters, and repointing walls—an excavation of the house itself. Archaeologists have found, behind the walls and across the gardens, stories of the house's occupants and employees, stories that reflect the changing moods of the country through time: the economic impact of the War of the Roses, the paranoia following the Gunpowder Plot, England's obsession with sport, the arrival of modern technology—and, of course, generations of family intrigue.

The King's Rooms were built at the beginning of the 17th century, in anticipation of a visit by King James I. Restoration of the Upper King's Room (above), revealed the presence of "witchmarks" (above, right) intended to protect the occupant from sorcery or possession. An 1889 photograph (right) shows the fully decorated Lower King's Room.

THE HISTORY OF THE SITE of Knole House goes back to well before the first block of dark-gray local Kentish ragstone was laid in 1445. Within the parkland around the estate are what appear to be the remnants of Bronze Age fields, patterns of irregular plots around one acre in size, according to Al Oswald, a landscape archaeologist from the University of Sheffield. A low hill in front of the house, called Echo Mount, may even be topped by a Bronze Age burial mound. "There's been lots of speculation about which 'knoll' the place name refers to," says Oswald. "I just wonder if this burial mound is the knoll, the local landmark, from which the house took its name."

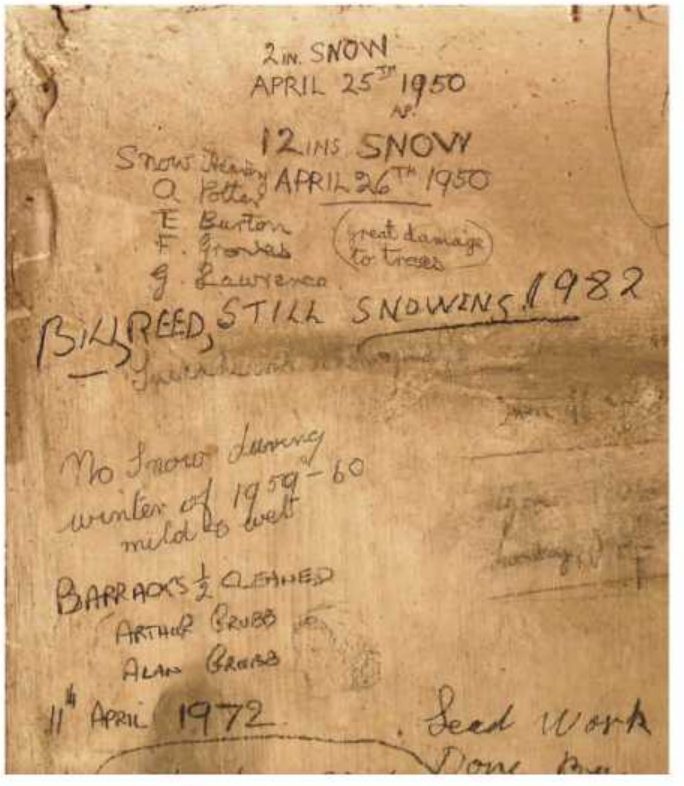
Next to Knole and thought to predate the house is a whopping great medieval stone barn, some 30 feet tall, enclosing an area the size of two tennis courts, that shows off the size of Knole's agricultural estate even before there was a manor house to boast of. In the surrounding parkland, Oswald has also found "lynchets," or terraces formed by plowed soil. The fields likely date to the same time as the barn, but wouldn't have provided anywhere near enough grain to fill it. "It suggests that the barn was used to gather the harvest from a much wider area," says Oswald.

The estate appears to have already been productive when Sir James Fiennes, swashbuckling soldier and cunning politician (and distant ancestor of English adventurer Ranulph Fiennes), began to build a house in 1445 as a way to spend his ill-gotten spoil from the Hundred Years War. Alas, he was beheaded before he could finish the house, and his son sold it in 1456 to Thomas Bourchier, Archbishop of Canterbury, who completed the building works.

The archaeologists and architectural historians working on the house have found, to their delight and surprise, that much of Bourchier's original structure survives. "The original building has been swamped and swallowed up by accretions, but it is still there," says James Wright, a buildings archaeologist from Museum of London Archaeology.

Documentary evidence records that the Pheasant Court building, named for the small courtyard adjacent to it, is one of the oldest structures in Knole House, and that the Chapel adjacent to it was built in 1460. Wright was able to confirm this when he discovered a decorative molded gable at the end of the Pheasant Court building that had been obscured by the later construction of the Chapel. Dating of the timbers reveals that Bourchier, a staunch Yorkist in the War of the Roses, halted construction on the house between 1460 and 1461. "This period coincides with when the Yorkists were losing the battle," says Wright, "and the rapid extensions from 1461 onwards fit with when they were winning the war."

Such older portions of the house display a number of unusual building techniques. For example, most English buildings of the period used "jowl posts," or posts that balloon out at the top to support the weight of the roof. In the East Range of the house, which dates back to the early sixteenth century, after Bourchier had died and bequeathed it to the See of Canterbury, Wright found no evidence of jowl posts. Equally puzzling were



Servants left records of their lives and jobs in the attics of Knole House. In one attic, archaeologists found a detailed, century-long record of snowfall documented by those who were charged with clearing it from the roof.

the unusual decorative molded timbers, each hewn from a single hunk of oak, providing structural support at either side of the windows. "Time and again we find unconventional and sometimes questionable techniques in use at Knole," he says, "which is surprising for such a high-status house."

That status only increased with time, as, in 1538, King Henry VIII claimed the house as a royal country palace. The monarch is known to have been a designer and architect in his own right, and there is debate about how much input he had at Knole. Circumstantial evidence, such as the style of the architecture, hints that he might have been responsible for adding a new range to form a courtyard, the Green Court, in front of the original house, but there is little supporting documentary evidence for this. The house passed through various hands connected to Henry VIII's successors until 1566, when Queen Elizabeth I granted freehold of the estate to her cousin, Thomas Sackville.

Between 1566 and 1604, Sackville could not afford to live in the house, so it was leased out. It is during this period that archaeologists believe another feature, the manor's 26-acre walled garden, began to take shape. It was long thought that the layout of the garden was the result of careful planning. According to documentary sources, one of the lease-holders in this period, John Lennard, built the first garden wall in 1574 to protect four freshwater springs supplying the house. However, landscape archaeologist Oswald's analysis of the garden's features suggests an even more pragmatic explanation.

The far end of the walled garden, known as "The Wilderness," has been densely wooded for the last 200 years, though it was once formal orchards. Curving paths lead visitors into the woodland, past the springs, by a sunken garden (once the site of an ornamental canal), and along an embanked avenue known as Causeway Walk. The woodland also conceals an irregular hollow in the ground, around five acres in size and up to 12 feet deep. It was assumed that all these features had been carefully designed. Oswald studied changes in soil type and the lay of the land, and now believes that the hollow was originally a sand quarry, likely for glassmaking, which Lennard is known to have done. The springs may have emerged when quarrying penetrated the water table, he thinks, and the canal and causeway were later attempts to disguise the eyesore. "The garden gives the impression of a carefully thought-through design, but looking closer shows that in fact it was a bit of a superficial 'garden makeover,'" he says, "making the best of the industrial mess the Sackvilles inherited."

By 1604, THE FORTUNES of Thomas Sackville, English statesman and Lord High Treasurer, had improved. He bought out the Knole lease from Lennard's son, and his family has lived there ever since. Like all the previous owners of the house, the Sackvilles continued to build onto the manor and shape the grounds. Some of these changes began immediately, including the construction of a suite of rooms, the King's Rooms, that are thought to have been prepared specially for a visit from King James I, a visit that never occurred. The current restoration effort has looked closely at the Upper King's Room, peeking behind walls, under floorboards, and above ceilings. There, Wright came across a series of strange patterns inscribed into the floor joists and around the fireplace, including burn marks, cross-hatch patterns, and W-shaped symbols that symbolize the "virgin of virgins," or the Virgin Mary. These are known as apotropaic marks, also called "witchmarks" or "demon traps," placed there to protect the occupant from sorcery or possession.

The direction of the burn marks shows that the symbols were placed before the timber was laid, and tree-ring analysis dates the timbers to between 1605 and 1606—around the time of the Gunpowder Plot, when conspirators (including Guy Fawkes) attempted to blow up Parliament and kill King James I. According to Wright, "These marks give us an insight into the mindset of ordinary people at that time," a time of suspicion and even hysteria.

But times eventually calmed, and the succession of Sackvilles who inherited the house—all men, as specified in Thomas' will—sometimes had more leisurely pursuits on their minds. Oswald spotted one of these interventions while walking through the parkland on a winter's day, when a line of unmelted frost indicated a low embankment running parallel to the front of the house. He followed and mapped the feature and found that there had once been perfectly square, leveled lawns flanking a drive to the Outer Wicket Tower, a later addition that served as gatehouse to the Green Court.

In historical records, Oswald found a note of a payment to three laborers in 1612, for "beating & rowling the green before the gate to make it even," suggesting the leveled area was a pair of bowling greens. Interestingly, they strongly echo the symmetrical bowling greens laid out by previous Knole House owner King Henry VIII in front of the only palace he designed and built from scratch: Nonsuch, in Surrey. Perhaps the hand of that royal designer was responsible for these as well. "I love the fact that these slight, grassy humps and bumps can tell us things about the building that the building itself can't tell us," says Oswald. "In this case we can see that the bowling greens match the extent of the Green Court [that may have been designed by the king] and echo Henry's work at Nonsuch."

The examination of roof timbers at Knole House has revealed that much of the wood was recycled from at least five earlier roofs, possibly reflecting a financial need to save money.

A century later, another sporting feature came into shape. In the parkland northeast of the house is Knole's private cricket pitch. Oswald believes it may be the oldest purpose-built cricket ground in England. Until now it has been assumed that the Vine cricket pitch in Sevenoaks, on what was once a Knole estate vineyard, was England's oldest, with the earliest documented match occurring in 1734. But Oswald has found circumstantial evidence to suggest that a pair of cricket-mad Sackville brothers—Charles and John—may have honed their skills closer to home. "We know that this area was plowed during the food shortages of the English Civil Wars in the later seventeenth century, and we have a fleeting reference to the deliberate leveling of the plow ridges in 1720," says Oswald. "For what purpose, if not the creation of the cricket pitch?"

ANY ESTATE OF THE SIZE and complexity of Knole House needs more than owners to keep it running. An army of servants, groundskeepers, housemaids, craftsmen, and more lived and worked in and around the house. While most of the remains in the house reflect the desires and tastes of its owners, others who spent their lives in service of Knole left evidence of their presence too. Long, narrow, dusty attics span the breadth of the house (about the length of a bowling lane), and archaeologist and graffiti expert Matthew Champion has found vast collections of graffiti scrawled there, on walls, rafters, and eaves.

Most of the graffiti currently visible begins around 1890—when the walls were last given a coat of limewash. But it is clear, Champion says, that the practice goes back much further. "We have found some earlier inscriptions in places that missed the 1890 limewash, including one dating to 1758," he says. They run from the personal to the purely utilitarian. For example, Eileen Joyce Knight, an underhousemaid in the 1940s, had the habit of declaring her presence by writing her name in a variety of locations.

Elsewhere, above part of the house known as the South Barracks, rain drains off the roof via a series of internal gutters. Snowmelt can make the gutters overflow, causing water to pour down into a gallery room below. To prevent flooding, servants were sent up to clear snow from the roof. On the wall in the associated attic area, those servants made a complete record of snowfall from the 1890s to the 1990s, including date and depth.

In other cases, the walls served as a kind of notepad, where workers jotted down what they were doing. One inscription reads, "Temprey Gasspipe for Grate Hall Hunt Ball January

6th 1895." "It tells us about the technology being used at Knole and the importance of these social events," says Champion. "Weeks and weeks of preparation, installing a temporary gas supply to power gas lights, just for one evening!"

In other places, carpenter's marks are visible, sometimes in a way that reflects the fortunes of the Sackvilles, which rose and fell as is common among such old families. Wright examined roof timbers on the eastern side of the house and saw unusual patterns. "We found that the carpenter's marks—the numbers that carpenters scored into the timbers to remind them which piece went where—are all out of sequence," he explains. The timbers are, surprisingly, a hodgepodge recycled from at least five different earlier roofs. During the eighteenth century, when these changes were made, there was likely some financial need to reuse older materials.

English statesman Thomas Sackville (top, 1601 portrait by an unknown artist) was the first of his family to occupy Knole House. Had writer Vita Sackville-West (bottom, 1918 portrait by William Strang) been male, she would have stood to inherit the estate.

THE TWENTIETH CENTURY brought a great deal of change to the English nobility, and the Sackvilles, by then the Sackville-Wests, were no exception. They are not a direct inspiration for the fictional Crawley family of *Downton Abbey*, but their scandals, dramas, and angst should be familiar to viewers of the show. The 2nd Baron Sackville, Lionel, for example, fathered seven children with a married Spanish dancer, Josefa de la Oliva, known as Pepita. One of these sons claimed to be the rightful heir, but was denied by the courts, and ownership of Knole passed to another Lionel, a nephew. This Lionel, in turn, married his first cousin, Victoria, another of the 2nd Baron's children with Pepita. Their only child was Vita Sackville-West, famed writer affiliated with the Bloomsbury Group, who wrote *Knole and the Sackvilles* about the experience of growing up there. She, of course, couldn't inherit the estate, so it passed to her uncle Charles, who made the gift of Knole House to the National Trust. Then, in 1962, his son Edward, known as Eddy, became 5th Baron Sackville.

In 1925, the notably rather eccentric Eddy had been given a suite of rooms in the Outer Wicket Tower, thought to have been built in the late fifteenth or early sixteenth century. Eddy was musically gifted as a child and became a noted music critic (and middling novelist) and proponent of British composers. Up a steep set of spiral stairs, in the music room of the Outer Wicket Tower, which would have contained Eddy's Steinway baby grand piano, faint marks on the walls indicate the site of a significant set of shelves. "The spacing and arrangement of the shelves suggest that they were specially designed to house his extensive gramophone record collection," says Vicky Patient, a research volunteer. Eddy is credited with helping to found BBC Radio 3, the United Kingdom's premier classical music radio station.

Vita remained bitter that she had no claim as heir to Knole, and described Eddy "as floppy as an unstaked delphinium in a gale." Peeling paintwork, in "Bloomsbury set" colors, including dusky pink, striking turquoise blue, and pale sea green, in his private suite, would have been chosen by Eddy himself. "We've been able to date the paintwork by looking behind the electrical wiring," explains Knole curator Emma Slocombe. "We know that Knole had electricity installed in 1906."

Following Eddy's death as a bachelor in 1965, another cousin named Lionel became 6th Baron. He presided over a major restoration of the grounds following a disastrous storm in 1987, and had five daughters. Again the house passed by them to a cousin, Robert, the current Baron Sackville, a publisher and author of two additional books about the family and home. He lives in a portion of the house that is not open to the public and, unlike several of the Barons, has a son.

Britain has been a busy place for thousands of years, and much of its history has been lost as stones are reused, fields plowed, and housing estates and industrial complexes built. There are only a few places like Knole, from the ancient paths that still crisscross the estate to the hidden stories behind its walls, where history accretes, layer upon layer, generation upon generation. And surprising even to the archaeologists is the breadth of the memories these stately homes can store, from the impacts of world-changing events and social shifts to the details of the lives of the house's illustrious occupants to the rarer remnants left by ordinary, oft-unheard servants. ■

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To see more images of Knole House, go to archaeology.org/knole

BURIAL STYLE

During the Song Dynasty, widespread wealth encouraged the creation of lavish, even garish, tombs

by Lara Farrar

China's Song Dynasty (A.D. 960–1279) was a prosperous time. The population was growing, and business and commerce boomed, conferring financial success that even reached the lower classes. With that prosperity came a taste for status symbols—even in death. A large, dual-chamber tomb recently uncovered in southern China shows one way that common people in the period tried to show off their newly acquired social mobility.

The massive modern city of Chongqing has long been known as a fertile ground for Song Dynasty discoveries. More than 40 Song tombs have been found within its environs, so the discovery last August of a new one at a construction site in the Jiangjin district wasn't a great surprise. The Jiangjin tomb, like many now being uncovered, had been looted long ago, but its scale and decoration prove interesting nonetheless.

Its rectangular double chamber is 28 feet long, 25 feet wide, and 10 feet high, and its decorations, carved into stone, include a depiction of a warrior standing next to the entrance, symbolizing protection or guardianship. Elephant and lotus

A rare, centuries-old dual-chamber tomb in the Jiangjin district of Chongqing, China, reveals the extravagant tastes of the newly rich classes, who were experiencing unprecedented prosperity during the Song Dynasty.

Unlike the more austere aristocratic tombs of the Song Dynasty and later periods, the Jiangjin tomb (top left) was highly decorated. Among the tomb's carvings are an elephant (above left), considered an auspicious symbol, and a warrior (above right) protecting the tomb's entrance.

patterns, considered auspicious symbols, show the influence of Buddhism in China, but do not necessarily mean the tomb's owners practiced the religion. Typical of Song tombs but missing here—perhaps taken or destroyed by looters—are a portrait of the owner and a painting of a woman opening a door.

The designs, textures, and patterns of tombs for aristocrats were determined by state regulations, and generally were more spare. The designs of the Jiangjin tomb, while lavish and ornate, are not unusual, and reflect the fashions, tastes, and aspirations of nonaristocratic Song Dynasty people, according to Han Xiaonan, a Song Dynasty expert with the Guangzhou Academy of Fine Arts. Every indication is that it belonged to a family from a lower class. Highly decorated tombs such as this one likely would have been considered garish at the time, says Han. The dual chambers, a rare feature, mean that it was probably intended for a couple.

Song Dynasty burials like the one in Jiangjin were the last flourish of China's highly decorated plebian tombs. Thereafter plainer design and decoration were favored. Archaeologists say this shift, particularly noticeable in the Yuan (A.D. 1271–1368) and Ming (A.D. 1368–1644) Dynasties, may be related to changes in customs, with more emphasis placed on the funeral ceremony itself rather than on the structure built to house the deceased. ■

Lara Farrar *is a journalist based in Shanghai.*

A wall painting from the House of the Golden Bracelet in Pompeii dating to the 1st-century B.C. or the 1st-century A.D. depicts a garden filled with dozens of local species of plants and birds, a birdbath, herms supporting plaques showing sleeping women, and theater masks.

Family History

Giving new life to some of Pompeii's dead

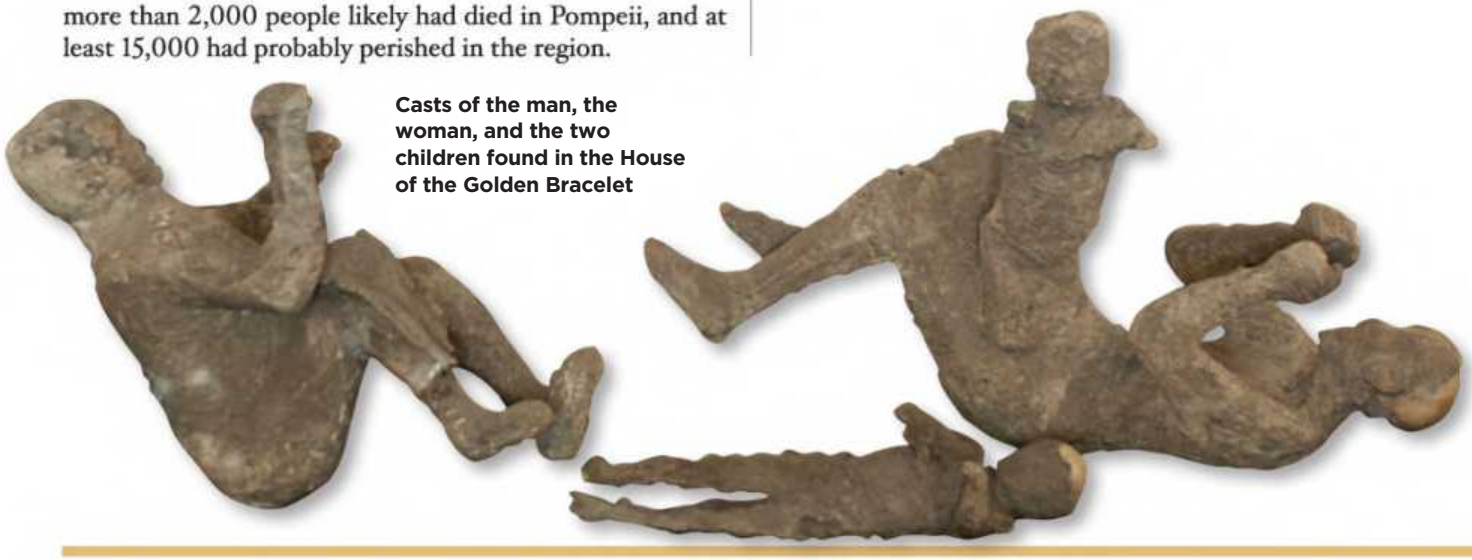
by Jarrett A. Lobell

THE THREE-STORY House of the Golden Bracelet on the Vicolo del Farmacista was one of the most opulent in Pompeii, its walls covered with vibrant frescoes depicting theatrical scenes and imitating expensive marble paneling, its floors paved with intricate black-and-white geometric mosaics. At the rear of the house lay a verdant garden with a splashing fountain and quiet pools, its natural beauty echoed by wall paintings depicting oleander, viburnum, arbutus, bay, palm trees, irises, roses, daisies, and poppies, home to doves and house sparrows, a swallow, a golden oriole, and a jay. From the terrace was a view of the sea, whose breezes cooled the house during hot Mediterranean summers.

The morning of August 24, A.D. 79, was relatively quiet in Pompeii, perhaps disturbed only slightly by a series of earthquakes common enough to the region. But by just past noon things drastically changed, when, according to the first-century Roman writer Pliny the Younger, a cloud of "unusual size and appearance" spewed from nearby Mount Vesuvius. Soon ash, pumice, and stone began to fall, flames could be seen leaping from the mountain, buildings shook and swayed, and, in places, although it was still day, there was "darkness blacker and denser than ordinary night." For two days, the volcano erupted ferociously, on the first day expelling millions of tons of debris, burying Pompeii at a rate of roughly six inches an hour. Thousands of people were trapped: "You could hear the shrieks of women, the wailing of infants, and the shouting of men; some were calling to their parents, others their children or their wives, trying to recognize them by their voices," writes Pliny. On the second day, surges of superheated rock, ash, and gases, called pyroclastic flows, rushed down the mountain at speeds of more than 100 miles per hour, flattening the buildings that remained standing, and scalding or perhaps suffocating those who had not already been buried. By the end of August 25, more than 2,000 people likely had died in Pompeii, and at least 15,000 had probably perished in the region.

Giuseppe Fiorelli became director of excavations in Pompeii in 1860. Realizing that it was not just structures, paintings, mosaics, and artifacts that had been covered by volcanic debris, but also plants, animals, and people, Fiorelli developed a new method for recovering these once-living specimens. When excavators encountered voids in the hardened ash and pumice created by the decay of organic material, they poured plaster into them. They then left the plaster to dry, after which they removed the material around the plaster, revealing the bodies of victims at the very moments of their deaths.

In 1974 four people were discovered in voids under a flight of stairs leading to the House of the Golden Bracelet's garden. Using the technique pioneered by Fiorelli, casts were made of the bodies, revealing them to be a man, a woman, and two small children who had likely died on the eruption's second day, killed either by the collapse of the staircase or by the pyroclastic flow. The casts have now been moved to a lab in Pompeii as part of an ambitious project to study and restore 86 of the 103 that have been made, including the four people from the House of the Golden Bracelet. Some casts are more than 150 years old, and their surfaces have become marred and pitted. Iron rods used for reinforcement have rusted and expanded, cracking



Casts of the man, the woman, and the two children found in the House of the Golden Bracelet

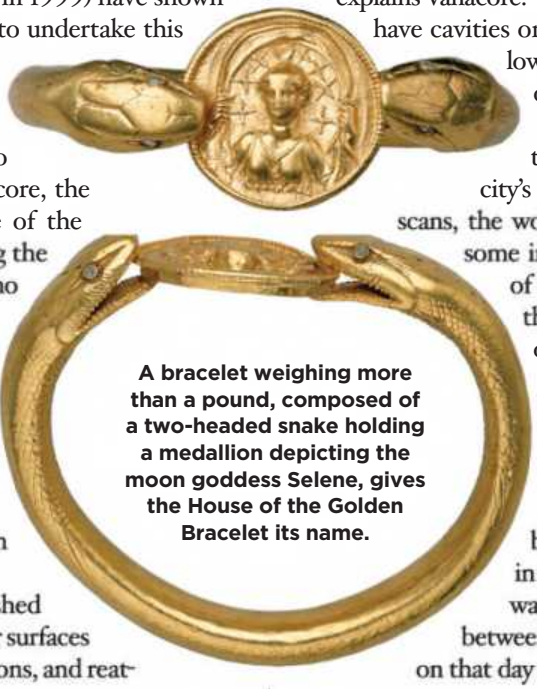
ONE CHILD'S FATE

Cast of the older of the two children at the restoration lab in Pompeii

Stefano Vanacore and his team examine the cast

The cast being transported through Pompeii's streets

the casts, and preserved bones have decayed. Even some of the newer ones (the most recent was made in 1999) have shown need of immediate care. "We decided to undertake this project now because we need to maintain the casts' structural integrity. It will also bring the story of Pompeii's destruction to those living now, and to future generations," says Stefano Vanacore, the director of the lab in Pompeii. None of the casts has ever been restored, presenting the team with a huge challenge. "There was no experience of how to restore the casts, and no single way to do so because they were made over such a long time using many different materials," Vanacore says. "For example, Fiorelli used very high-quality plaster reinforced with wood, so his casts are in much better condition than those made later with poorer quality materials."



A bracelet weighing more than a pound, composed of a two-headed snake holding a medallion depicting the moon goddess Selene, gives the House of the Golden Bracelet its name.

To begin the process, restorers brushed loose debris from the casts, cleaned their surfaces using quick-evaporating chemical solutions, and reattached loose fragments and broken limbs. To consolidate them, they used an acrylic resin suitable for both plaster and bone, and, where possible, replaced the iron rods with noncorrosive fiberglass. "We had to make sure that there were no adverse reactions between the different, old materials, and the new ones we introduced," says Vanacore.

The work did not stop there. All 86 casts have been scanned with lasers to create 3-D images that are giving researchers a highly detailed view of their surface deterioration. In addition, small copies of the casts were made using 3-D printing technology. Of the 86, 16 were moved to a lab for CT scans—the choice of which casts to scan was determined by which could fit through the scanner's opening—allowing researchers to see inside them for the first time. "We don't just want to restore the casts, we also want to better understand the eating habits, diseases, and even causes of death of these ancient Pompeians," explains Vanacore. "For example, we learned that they didn't have cavities or tooth decay, likely because they had a low-sugar diet and used only sweeteners derived from fruit."

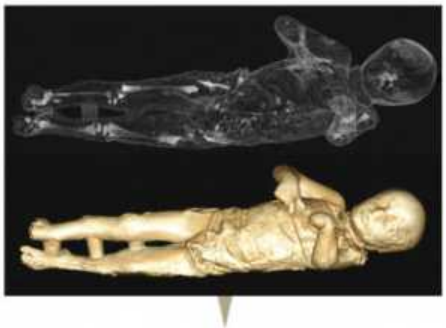
In addition to such new information about the overall health of the city's inhabitants now being revealed by the scans, the work may also provide specific details of some individuals' lives. For example, CT scans of the teeth of one of the children from the House of the Golden Bracelet, the only child to be scanned, shows that he was between four and five years old at the time of his death, not three as had previously been thought. Researchers also discovered that he wore an amulet around his neck—it had never been seen before because it was deeply embedded in the plaster. DNA testing currently under way may help determine the relationships between the four people hiding under the stairs on that day in August.

FOR ANYONE WHO sees the casts, it's impossible not to be affected by them. "I have a lot of emotions when I look at the casts," says Vanacore. "The restoration is a scientific intervention and an investigation of the deaths caused by Vesuvius, but I have respect for what and how unique these casts are. For example, I think of the family in the House of the Golden Bracelet, joined together until death. They aren't just graphic representations of people, but actual people made of bones, teeth, and skulls. Though they lived a long time ago, they were people just like us." ■

Jarrett A. Lobell *is executive editor at* **Archaeology.**
To see more images of the restoration of the casts, go to archaeology.org/pompeiicasts

The cast being prepared by the team for a CT scan

Researchers evaluate the CT scan

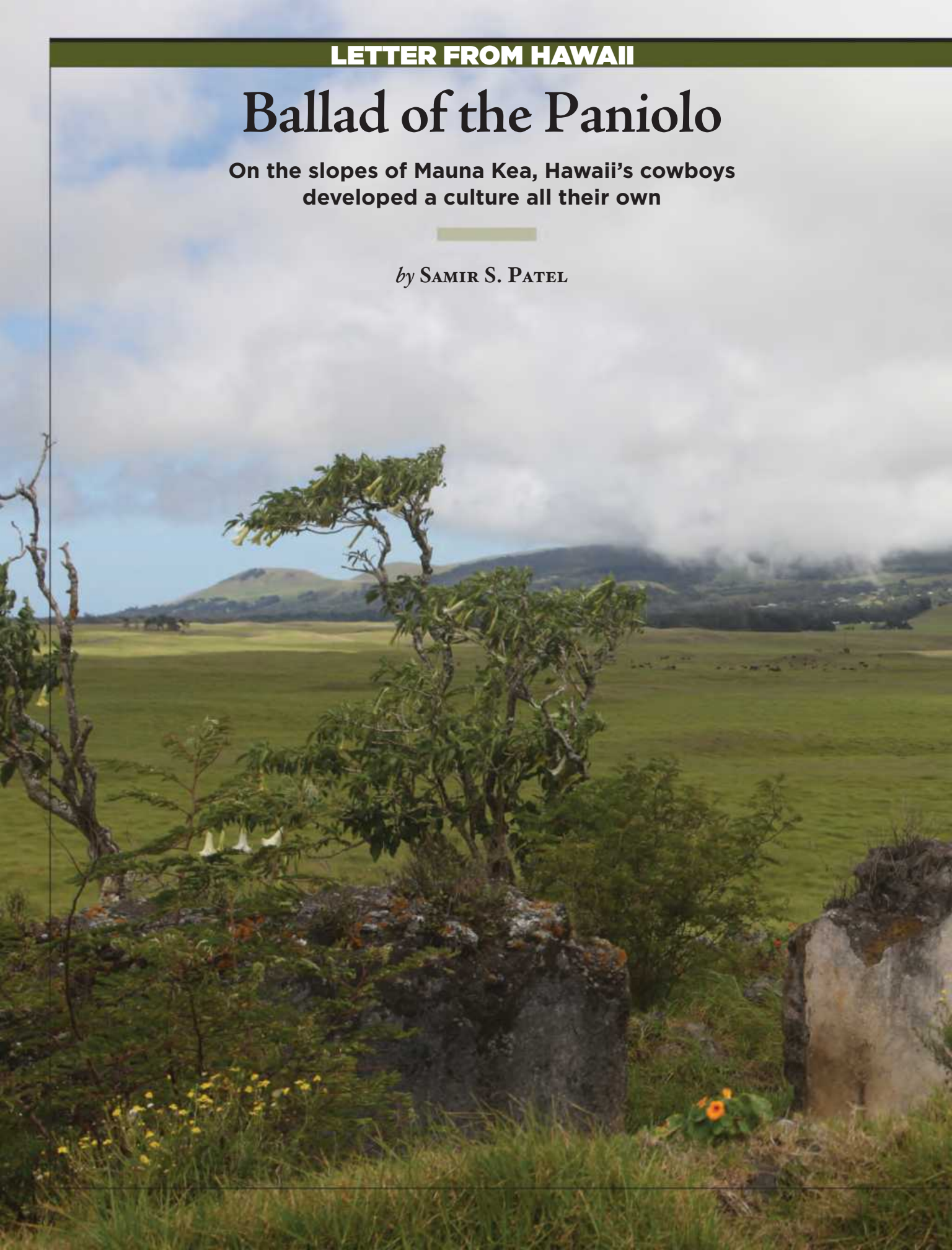


3-D images of the cast

Ballad of the Paniolo

On the slopes of Mauna Kea, Hawaii's cowboys developed a culture all their own

by Samir S. Patel



The Frontier Day Rodeo in Cheyenne, Wyoming, in August 1908, brought together some of the best riding and roping champions from across the Americas, from Alaska to the Argentine Pampas. Among them were three unusually dark-skinned cowboys who, according to a newspaper report, were initially mocked by other competitors. But after two days of steer roping, Ikua Purdy, Archie Ka'au'a, and Jack Low finished first, third, and sixth—with Purdy cementing a claim as the champion steer roper of the world.

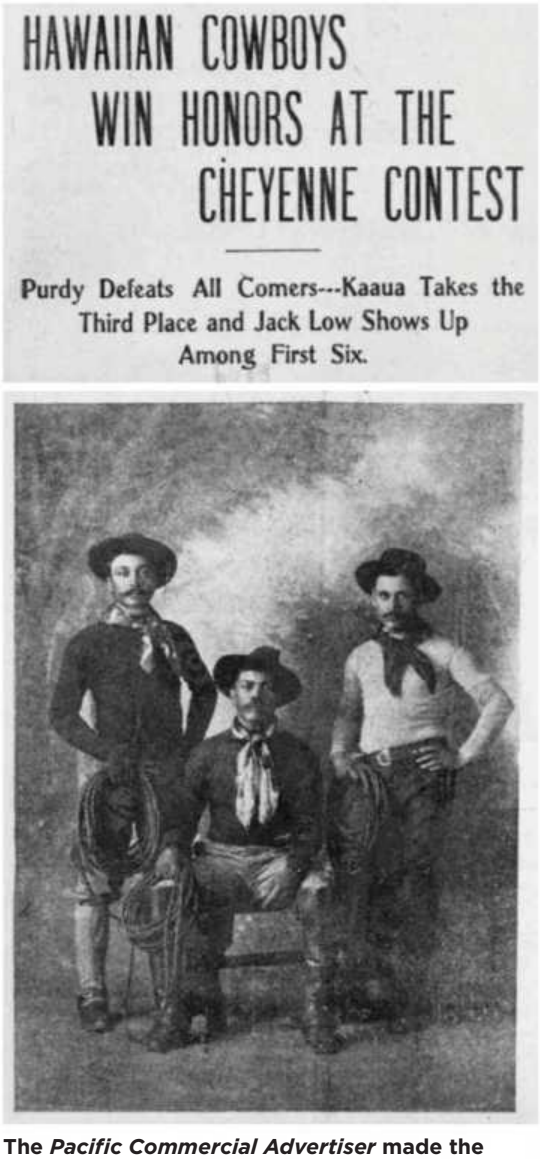
What the other competitors didn't understand about these cowboys was that they had earned their spurs roping irritable feral cattle on the unpredictable terrain of a dormant volcano: Mauna Kea. The rodeo proved to the mainland what Hawaiians, who greeted the returning heroes with a parade, already knew: that Hawaiian cowboys, called *paniolo*, are some tough customers.

The Hawaiian monarchy had been overthrown in 1893, and the island chain was annexed by the United States five years later, so the paniolo who beat the mainlanders at their own game became a great source of native pride. They were cowboys, to be sure, but also Hawaiian by blood, culture, and temperament. The paniolo folk tradition evolved over decades, entwining European, Hispanic, and Asian influences with Hawaiian roots. Archaeologists and anthropologists have a term for the creation of a new cultural identity: ethnogenesis. "I think it's one of the best examples of ethnogenesis," says Peter Mills, an archaeologist at the University of Hawaii at Hilo, who has studied the history and archaeology of ranching on Mauna Kea for more than a decade. By surveying and excavating ranching stations on the volcano's slopes, Mills and his colleagues have added a new layer of understanding to the oral history, journals, and ledgers that document the ethnogenesis and life of the paniolo.

The 19th-century homestead of Jack Purdy, an early bullock hunter on Hawaii's Big Island, is located on the lower slopes of Mauna Kea. Hunters such as Purdy represent the beginnings of Hawaii's unusual cowboy culture.

You don't have neck problems, do you?" says Mills as he guides a 4x4 along the first of a series of increasingly harrowing dirt tracks through the ranchlands of Mauna Kea, on the Big Island. After a stop at the palatial headquarters of Parker Ranch—one of the United States' largest and oldest—for permission to enter its holdings, Mills guides the truck along the lower north slope. The destination is the Humu'ula district, around 250,000 acres halfway up the mountain's eastern flank. Humu'ula has been an important site for Hawaiian ranching since it began in the mid-nineteenth century, and is home to all the ranching stations Mills has studied.

After a few minutes, the clouds part and a crown of white spheres appears briefly on the volcano's peak, collectively the world's largest astronomical observatory, nearly 14,000 feet above sea level. Native groups are opposing the construction of another, the massive, sophisticated Thirty Meter Telescope, because Mauna Kea is considered by native Hawaiians to be the islands' most sacred place. Hawaii's tallest peak has a long history of visitors from across the ocean, and the earliest of these international migrants—cattle—completely reshaped its landscape.


HAWAIIAN COWBOYS WIN HONORS AT THE CHEYENNE CONTEST

Purdy Defeats All Comers---Kaaua Takes the Third Place and Jack Low Shows Up Among First Six.

The *Pacific Commercial Advertiser* made the Hawaiian cowboy rodeo victory front-page news on August 23, 1908. The photo shows champion Ikua Purdy, Archie Ka'au'a, and another cowboy named Spencer.

The first cattle arrived in 1793, when British naval officer George Vancouver made a gift of cows and sheep to King Kamehameha I, with the idea that they might help provision ships. The king accepted the gift—he even ferried some of the cattle ashore in his own canoe—and placed a 10-year *kapu*, or customary restriction, on hunting them. The cattle thrived and sometimes ran roughshod through villages. The king eventually allowed limited hunting, and not long after his death in 1819, the monarchy began to pay foreigners called "bullock hunters" to track, trap, and shoot feral cattle for the trade in hides, tallow, and salt beef. These men didn't ride horses or throw lariats at first, but they were the source of Hawaiian cowboy culture.

Mills pulls up next to a field piled with thick, pillowy kikuyu grass, native to Africa and one of the state's most important pasture grasses. After sliding carefully between strands of barbed wire and high-stepping through knee-deep pasture, Mills arrives at the remains of a stone house that wouldn't look out of place in County Galway. It was the home of Irishman Jack Purdy, who arrived in Hawaii in the 1820s or 1830s and hunted cattle for the monarchy. He built a house in a markedly Western style, with stone walls, coral lime mortar, and a roof of imported slate at a time when local accommodations were thatch. "I see Ireland when I look at the architecture," says Mills, "but when I look at the lifestyle, I see something completely different." Purdy twice married Hawaiian women and started the kind of mixed family that would form the foundation of paniolo culture, which would include his grandson, rodeo champion Ikua Purdy. Mills and archaeologist Adam Johnson of the National Park Service recently used lidar to scan the standing remains, which include the house, stone corral, family graveyard, giant cistern, and more. "Nothing else has been done with this site at all," says Mills, who hopes to organize a field school, with the permission of the Purdy family and Parker Ranch, to study it in more detail.

Back in the truck, Mills pushes on through clouds, a series of gated fences, and laconic herds of burly cattle, perhaps descendants of Kamehameha's, to the Humu'ula area. His paniolo project, co-led by Carolyn White of the University of Nevada, Reno, begins up here, between 4,000 and 7,000 feet above sea level. Since 2001, the project has surveyed 15 sites and dug eight of them. "Plenty of people who grow up here never see this landscape," Mills says. It's easy to see why the cattle like it. It's cool and lush and there are no swarms of gnats or mosquitoes. "There are a lot of things people hate about the outdoors that they don't have at 6,000 feet."

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The sun comes back out and the trail becomes more precarious and less traveled. The next stop is Lahohinu (literally, "Greasy Scrotum"), the site of the homestead of another early bullock hunter, Englishman Ned Gurney. Like Purdy, Gurney married two Hawaiian women, but, unlike Purdy, he married both at the same time and built his home in the local style. It has since disappeared under the kikuyu. (Gurney also had a memorable run-in with David Douglas, the Scottish botanist of fir fame who, after having breakfast with Gurney, died when he fell into a bullock trap—occupied at the time). Lahohinu also has a site from the next phase in paniolo history. A massive, sprawling koa tree grows out of the stone foundation of a building that was used as a commercial ranching station in the 1870s.

The site of Keanakolu, or "Three Caves," is the densest and richest site for artifacts of paniolo culture on Mauna Kea.

Around 1830, more and better horses arrived, and native governor of the island Kuakini improved the roads. Business connections with the mainland made the hide and tallow trades increasingly profitable. The monarchy invited experienced Hispanic cowboys from the Mexican territory of Alta California, men with names such as Joaquin Armas, Miguel Castro, and Frederico Ramon Baesa, to round up cattle more effectively. These cowboys, or *vaqueros*, figure prominently in the history of ranching across North America. Unlike the bullock hunters, they came on horseback and didn't shoot cattle; the blasts scared off other cows and bullet holes decreased the value of hides. The vaqueros lassoed 'em, hamstrung 'em, and finished the job later. If the first bullock hunters provided the genealogical roots of many paniolo, their skills and style came from vaqueros.

Over time many of the Hispanic cowboys returned to the mainland, leaving the ranching work to native Hawaiians and immigrants from Europe and Australia. This community inherited from the vaqueros braided lariats, adorned saddles, bright ponchos, long spurs, bandanas, and floppy wide-brimmed hats. The island cowboys even took their name from Spanish. "I just love that 'paniolo,' which means 'Español' or 'Spaniard,' can come to mean 'Hawaiian,'" says Mills. But they also maintained and adapted Hawaiian traditions, and incorporated cultural influences from

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around the world. One can imagine the paniolo working in uncomfortable, isolated places, sharing danger, camaraderie, and ideas—all adding up to "a new version of what being a cowboy is," says Ben Barna, who worked on a paniolo site for his Ph.D. at the University of Nevada, Reno.

The transition from the monarchy to Western-style land ownership in 1848 opened the way to the construction of more traditional ranches and lowland plantations. By the 1850s, there were 12,000 wild cattle and 8,000 tame cattle on the mountain, fetching between $1.00 and $1.25 a hide. The Gold Rush, the whaling industry, and new plantation laborers made beef a more important and valuable commodity. In Humu'ula, organized industry took the form of the Waimea Grazing and Agricultural Company (WGAC), which leased the land in 1861.

Archaeologist Peter Mills led the excavation of a ranching station at Old Laumai'a (left) in 2011. A ca. 1900 photograph (below) shows a later station, called Laumai'a Cabin, built next to the old one.

WGAC established ranching stations, including the one at Lahohinu. Mills has excavated part of the site and found records of its construction in an 1868–1869 WGAC ledger, a detailed resource on company operations. It was only used for a brief period, resulting in a modest archaeological assemblage. "The paniolo sites reflect the transience of the population," says White. "The sites are small and have diverse material culture, but they contain evidence of short-term, even ephemeral, occupation." For all the official documentation and oral history, archaeology is probably the only source on how day-to-day paniolo culture emerged and developed.

The next station along the road is the largest and richest WGAC site, Keanakolu, or "Three Caves." It is named for a cluster of lava-tube caves nearby that likely provided shelter well before the cattle arrived, when the mountain was roamed by bird-catchers collecting feathers for Hawaii's dramatic royal cloaks. In a gentle depression are the remains of a stone cabin next to a sprawling landscape of black lava corrals, including the remains of an "80-fathom" perimeter wall built by a Hawaiian laborer in 1868 and documented in the WGAC ledger. Mills and his team surveyed the site in 2003 and excavated the cabin in 2005. "This is one of the richest, densest sites for household items," says Mills.

In the cabin were patent medicine bottles, such as Perry Davis' Painkiller and Brown's Pain Destroyer, usually containing opiates, which suggest physical hardships, self-medication, and even addiction. Percussion caps from rifles dispel the idea that paniolo never used guns, though they may have been used to keep wild dogs at bay. The ammunition also contained fulminate of mercury, certainly a health risk when combusted more or less directly in someone's face when they were firing a rifle. None of these items are unusual for a ranching site, on the mainland or anywhere, but there are also distinctively Hawaiian artifacts, such as fish bones and seed casings from kukui nuts, both of which must have been brought up from the lowlands and don't appear in the company ledger. In the lowlands, the oily kukui nuts were burned for light, but the ranching stations were provisioned with kerosene. Mills theorizes that the nuts were used to waterproof leather jackets, chaps, and boots.

There are also artifacts that present mysteries, such as two late nineteenth-century bottles, each with a hole carefully drilled in it. They might have been used as smoking pipes or to measure gunpowder. The cabin itself would have been occupied by a *luna*, or overseer, and it contained some surprisingly expensive materials, such as a copper embossed lion and a cognac bottle. The pendulum from a wall clock speaks to the commercial nature of the site—after all, time is money.

Finally, Keanakolu also had remains of the Asian influence that arrived on the mountain after the vaqueros left. Immigrant laborers—first from China, then Japan—were brought in to work the lowland plantations. Eventually some were moved seasonally to help with sheep-shearing and other tasks at ranching stations, where they commingled more freely with the paniolo, and where some even made it to horseback. At Keanakolu, the Chinese influence appears in the remains of stoneware food jars imported from Guangdong.

Several hours further along the road, the flora changes dramatically from koa and kikuyu to the uniform, bristly dark green of gorse, a spiny, noxious weed from Scotland, by way of New Zealand, that has consumed large swaths of the volcano. Hidden from view beneath it are the remains of two consecutively occupied ranching stations, separated by a gulch and a decade, and both

Doctor ***Designed.*** Audiologist ***Tested.*** FDA ***Registered.***

Affordable *New* Digital Hearing Aid *Outperforms* Expensive Competitors Delivers *Crystal - Clear* Natural Sound

Reported by J. Page

Chicago: Board-certified Ear, Nose, and Throat physician Dr. S. Cherukuri has done it once again with his newest invention of a medical-grade, ALL-DIGITAL, affordable hearing aid.

This new digital hearing aid is packed with all the features of $3,500 competitors at a mere fraction of the cost. Now, most people with hearing loss are able to enjoy crystal clear natural sound — in a crowd, on the phone, in the wind — without suffering through "whistling" and annoying background noise.

After years of extensive research, Dr. Cherukuri has created a ***state-of-the-art*** digital hearing aid that's packed with the features of those expensive $3,500 competitors – at a ***fraction of the price***.

Digital Hearing Aid Outperforms Expensive Competitors

This sleek, lightweight, fully programmed hearing aid is the outgrowth of the digital revolution that is changing our world. While demand for "all things digital" caused most prices to plunge (consider DVD players and computers, which originally sold for thousands of dollars and today can be purchased at a fraction of that price), yet the cost of a digital medical hearing aid remains out of reach.

Dr. Cherukuri knew that many of his patients would benefit but couldn't afford the expense of these new digital hearing aids. Generally they are not covered by Medicare and most private health insurance policies.

The doctor evaluated all the high-priced digital hearing aids on the market, broke them down to their base components, and then created his own affordable version — called the MDHearingAid ***AIR*** for its virtually invisible, lightweight appearance.

- ✓ Nearly ***invisible***
- ✓ ***Crystal-clear*** natural sound
- ✓ No suffering with ***'whistling'*** or background noise
- ✓ ***Outperforms*** $3,500 models
- ✓ Amazing ***low price***

Affordable Digital Technology

Using advanced digital technology, the MDHearingAid ***AIR*** automatically adjusts to your listening environment — prioritizing speech and de-emphasizing background noise. Experience all of the sounds you've been missing at a price you can afford. This doctor designed and approved hearing aid comes with a full year's supply of long-life batteries. It delivers crisp, clear sound all day long and the soft flexible ear domes are so comfortable you won't realize you're wearing them.

Try it Yourself at Home with a 45-Day Risk-Free Trial

Of course, hearing is believing and we invite you to try it for yourself with our RISK-FREE 45-Day home trial. If you are not completely satisfied, simply return it within that time period for a full refund of your purchase price.

MDHearingAid® AIR

Ecstatic Users Cheer

"It is very comfortable, light and almost invisible. I can't stop raving about it." — Laraine T.

"I'm a physician, and this product is just as effective as (if not more than) traditional overly-priced hearing aids. I will be recommending (it)."— Dr. Chang

"As a retired advanced practice nurse, I purchased the MDHearingAid AIR after the Wall Street Journal *review. I am so pleased with the quality. You are providing a real service to our affordable health care."*— Ned R.

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called Laumai'a, or "Banana Leaf." The older one, which the archaeologists dubbed Old Laumai'a, was used as early as the 1850s and into the 1860s. The later one, Laumai'a Cabin, was used from about 1880 into the 1950s. "The presence of the two sites so close to each other," says White, "suggests the flow of people across the landscape and the need for places to stay while on the mountain, as opposed to camping out in the rough."

Old Laumai'a was one of the first WGAC stations. After crawling through the gorse to conduct a survey, and returning later with reciprocating saws to clear the area, the archaeologists excavated the site in 2011. They found artifacts typical of a rugged ranch camp, such as pipe fragments, trade beads, burned bone, bottle fragments, and lead waste. But they also found another side of paniolo culture: a thin, delicate, faceted glass ring, buttons with floral designs or faced in jet, a piece of a patterned teapot, and a cologne bottle. "You might be kind of hard-pressed to say there are cowboys up here," says Barna. According to White, who is interested in expressions of gender in such predominantly male frontier sites, "Masculine fashion does not always reflect our modern sense of masculinity." There appears to have been a certain sense of style, even flamboyance, among the paniolo, flourishes that came from both vaqueros and Hawaiian culture. The use and appearance of flowers in Hawaii, for example, is not associated with either gender. "But what the hell is that glass ring doing out here?" Mills says. "You start to build a much more complex picture of who was here and what they were doing."

White is leading the ongoing study of the more recent Laumai'a Cabin site. In 1876, WGAC had sold the lease to the Humu'ula Sheep Company, which built the later cabin. One significant change in the period between the two stations was the arrival of Japanese laborers in 1885. In a garbage dump behind the cabin the archaeologists found remnants of tea or sake cups. Barna says they are evidence that the different cultural groups may have been drinking together socially. At several other sites on the mountain are the remains of *furo*, or Japanese bathhouses built to allow a fire to be lit under a tub. Many Hawaiians today are still familiar with the term.

This photograph shows paniolo Archie Ka'au'a as he ties a cow to a tree "for safety" in 1906.

All these cultural influences accreted in the paniolo: a group of people—mostly men—on a nineteenth-century frontier, with Hawaiian language and values, a Western capitalist economy, Hispanic-American horseback skills and style, and strong Asian influences. It never became a static, mature culture, but was rather, by its nature, in a constant state of becoming, of adding layers of cultural complexity. "You can picture those early cowboys getting together in this communal space and creating this communal culture," Mills says.

The nature of Hawaiian history and culture were central to making this happen. "The sites underscore the long history of multiethnic interactions in Hawaii and the important roles that Hawaiians played," says White. The monarchy was strong when colonialists arrived, and Hawaiians were willing and able to adopt outside influences without losing their own identity. The story of the paniolo defies the traditional frontier narrative of "cowboys and Indians," as well as the traditional colonial narrative of the noble, resistant indigenous society overwhelmed by Western capitalism and exploitation. "The archaeological evidence points to the ways that colonialism and ethnogenesis are organic, and develop in ways that are unpredictable," says White. Mills and White plan to explore a few more sites and establish a heritage management program, especially as reforestation projects are implemented to control gorse and undo the landscape changes that two centuries of cattle helped cause.

The success of the three paniolo in Wyoming in 1908 secured the place of the paniolo in Hawaiian tradition. Following the overthrow of the monarchy and annexation of Hawaii by the United States in the 1890s, paniolo culture continued to evolve, incorporating more influences from mainland cowboys. Eben Parker Low, one of the great nineteenth-century paniolo, who sponsored the Wyoming trip, had English and Germanic surnames, King Kamehameha I's blood in his veins (on his mother's side), and drove cattle at Laumai'a using vaquero techniques and style. He was known as "Rawhide Ben." He grew up on the Parker Ranch, and eventually owned a ranch of his own. He met Teddy Roosevelt at the White House. In 1892 he badly injured his hand in a roping accident, and walked six miles to Hopuwai Camp, where the first doctor to attend to him was a Japanese plantation physician.

"I cannot compare the cowboys of this age to what they were fifty or sixty years ago," he wrote in 1941. "Time has changed the environment and the life of everything and it is difficult to write these lines and believe that I am stating the exact and unadulterated facts. The difference to me is like cheese and chalk to compare the past to the present." ■

Samir S. Patel *is deputy editor at* Archaeology.

Dispatches from the AIA
www.archaeological.org
EXCAVATE, EDUCATE, ADVOCATE

International Archaeology Day Celebration Largest to Date

Monitor National Marine Sanctuary and friends host a booth at the Outer Banks Seafood Festival in North Carolina

International Archaeology Day (IAD) continues its rapid growth as a global celebration of archaeology. October 17, 2015, the fifth anniversary of the program, featured more than 500 events organized by more than 400 Collaborating Organizations in 27 countries. Preliminary estimates indicate that more than 100,000 people participated in these events—almost seven times as many people as participated in the first celebration in 2011. The number of Collaborating Organizations increased from 14 to more than 400 between 2011 and 2015, and the number of participating countries from three to 27 during that same period. The popularity and phenomenal growth of IAD is a testament to the worldwide interest in archaeology and archaeological discovery.


Processing cacao at an Archaeology Fair in Belize


Writing Linear B on clay tablets in Tennessee (AIA-East Tennessee Society)

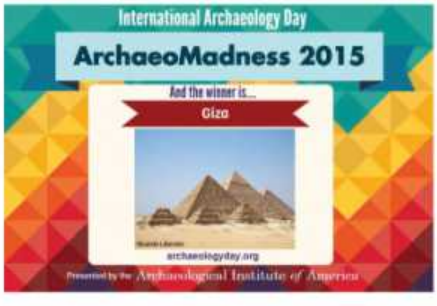
From an Archaeology Fair in Belmopan, Belize, to a walking tour of Chinatown in Walla Walla, Washington, IAD's diversity of events ensures that there is something for everyone, no matter what their age or level of interest. For participants, IAD events offer the opportunity to engage with archaeology and archaeologists on a personal and local level. For Collaborating Organizations, the celebration is an opportunity to showcase the work they do and the resources they create and provide. For the Archaeological Institute of America (AIA), the program is an opportunity to highlight global archaeology and advance its mission of informing the public. A website, events calendar, and blog keep millions of people around the world apprised of IAD events and news.

Since 2014, the AIA's efforts have been aided by the support and sponsorship of the U.S. National Park Service and the U.S. National Oceanic and Atmospheric Administration's National Marine Sanctuaries program. Their support ensures that IAD activities celebrating archaeological discoveries and educating the public about the importance of preserving and protecting cultural heritage are accessible to more and more people every year.

The AIA is now looking forward to next year and an even richer and expanded program of IAD events. To read more about International Archaeology Day and how you can join in next year's celebrations, please visit archaeologyday.org. There, you will find a list of Collaborating Organizations and IAD events near you.

4,500-Year-Old Pyramids Outlast the Competition in ArchaeoMadness

After several days of intense competition, the Pyramids of Giza in Egypt emerged as the 2015 ArchaeoMadness champion! The iconic pyramids beat out 31 other sites including the Colosseum, Olduvai Gorge, Copán, and the Taj Mahal. ArchaeoMadness, a bracket-style competition similar to college basketball's March Madness, was introduced in 2014 as a way for people around the world to participate in the excitement of International Archaeology Day. Thirty-two archaeological sites are selected to compete in ArchaeoMadness, and each day two sites are matched up in a head-to-head elimination contest. Participants are encouraged to vote for



their favorite of the two. The winning site from each matchup moves on to the next round. The competition is fun and encourages people to learn about each site before they make their choices.

Tweet your nominations for next year's competition to @ArchaeologyDay and be sure to use the #ArchaeoMadness hashtag. The tournament will feature four sites from each of the following geographic regions: Africa, Central America, Central and Eastern Asia, Europe, the Near East, North America, South America, and Oceania.

The AIA and Boston's Museum of Science Team Up for Two-Day Fair

On October 16 and 17, 2015, the AIA and the Museum of Science (MOS) in Boston hosted the Ninth Annual AIA-MOS Archaeology Fair. The AIA and MOS were joined by 19 other organizations. Presentations and activities covered a wide variety of topics that focused on technologies such as flintknapping, glassblowing, and weaving, and on archaeological


Simulated excavations at the AIA-MOS Fair

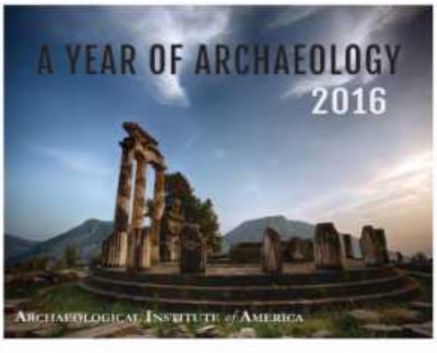
techniques such as excavation—both on land and underwater—remote sensing, and artifact reconstruction. Fair visitors were able to interact with archaeologists and could reconstruct artifacts, map a historic shipwreck, learn about ancient spear-throwers, and receive a lesson in Maya math.

The Annual AIA-MOS Archaeology Fair is now AIA's signature International Archaeology Day event. Started nine years ago, the fair was created to highlight archaeology in New England. Each year between 15 and 20 local organizations gather at the Museum of Science to present informative, entertaining, and interactive archaeological activities for people of all ages. The event regularly receives between 5,000 and 6,000 visitors over a two-day period. Typically, school groups on field trips are the bulk of the first day's attendees. More than 1,500 students, teachers, and chaperones attend the fair each year. The fair is growing in popularity with home-schoolers and families, and is now a fixture on many of these groups' annual calendar of activities.

The fair was envisioned, from its inception, as a fun and enriching public outreach opportunity to connect people in a direct way with archaeology. Of equal importance, it allows local archaeological and historical groups to demonstrate what they do for large and appreciative audiences. Plans are already under way for next year's AIA-MOS Fair and it promises to be bigger and better than ever.

AIA 2016 Calendar "A Year of Archaeology" Now Available

The 2016 AIA calendar "A Year of Archaeology," featuring 12 stunning photos from the AIA Photo Contest, is now available for purchase at archaeological.org/calendar. All proceeds from the sale of the calendar go directly to the AIA Site Preservation Program and will be used to protect and preserve archaeological sites around the world. Enjoy the beauty of archaeology all year long, even as you help the AIA preserve archaeological sites.



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THE BLACK SEA
September 25 - October 6, 2016 with Kathleen Lynch

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WHAT IS IT
Head of Medusa

CULTURE
Roman era

DATE
Late second to early third century A.D.

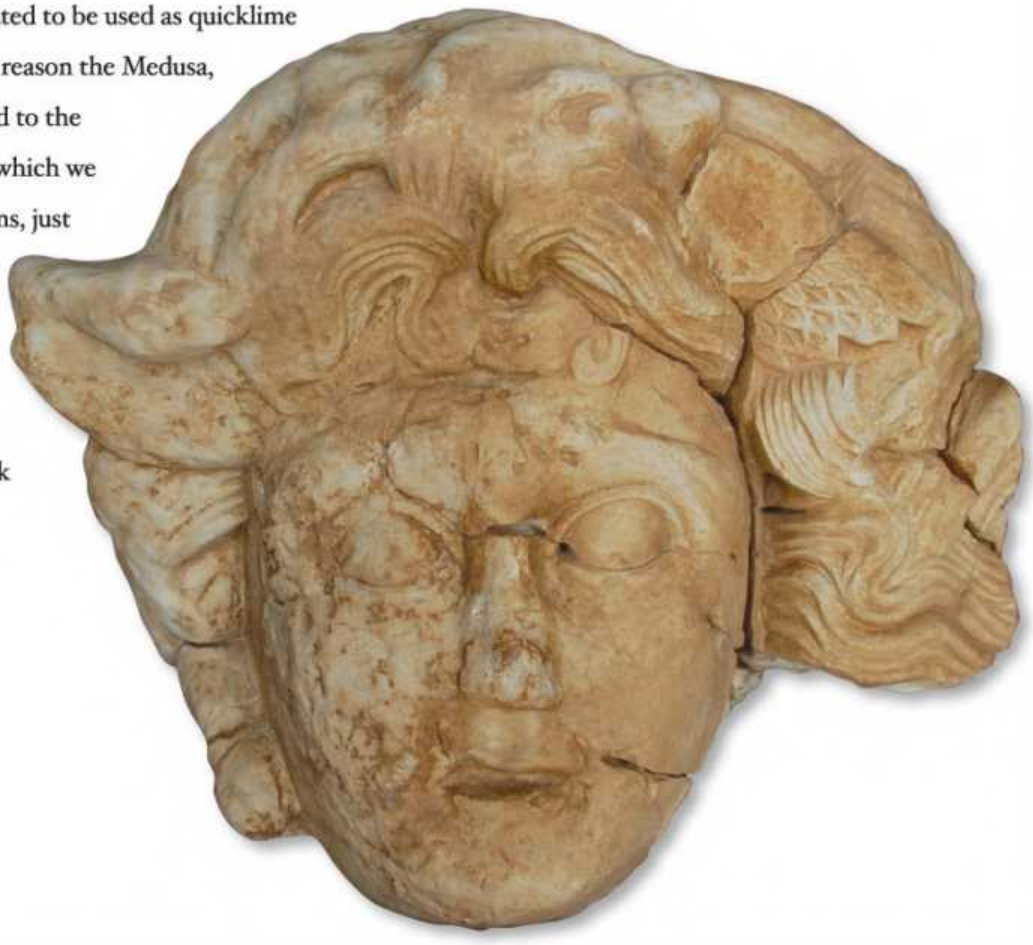
MATERIAL
Marble

FOUND
Antiochia ad Cragum, southwestern Turkey

DIMENSIONS
11.81 inches high and 12.99 inches wide

In the fourth century A.D. Christianity became the official religion across the Roman Empire, which, at the time, extended from Britain to North Africa, and from Spain to Mesopotamia. In some locations, the new faith brought with it a desire to eradicate the symbols of the past. By its very nature, iconoclasm can be difficult to find in the archaeological record. At the small city of Antiochia ad Cragum in Rough Cilicia, an image of the snake-haired gorgon Medusa survived the fourth- or fifth-century destruction of the earlier Roman building it once adorned. "It was fortunate that we found the Medusa head," says Michael Hoff of the University of Nebraska, who, with Birol Can of Uşak University, excavated the sculpture. "The folks living in Antiochia ad Cragum in the late Roman period took to heart their desire to fulfill the first commandment and get rid of these pagan images." From the beginning, Cilicia, the birthplace of St. Paul, was a region deeply invested in Christianity.

The residents of Antiochia ad Cragum were also "killing two birds with one stone," says Hoff. His team has found a kiln at the site filled with fragments of monumental sculptures in the process of being heated to be used as quicklime for concrete. "For some reason the Medusa, which was once attached to the building's pediment, of which we have found other sections, just didn't make it into the kiln," he says. "We also have a lot of statue bases with no statues, and I don't think we'll find them."

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