Inside
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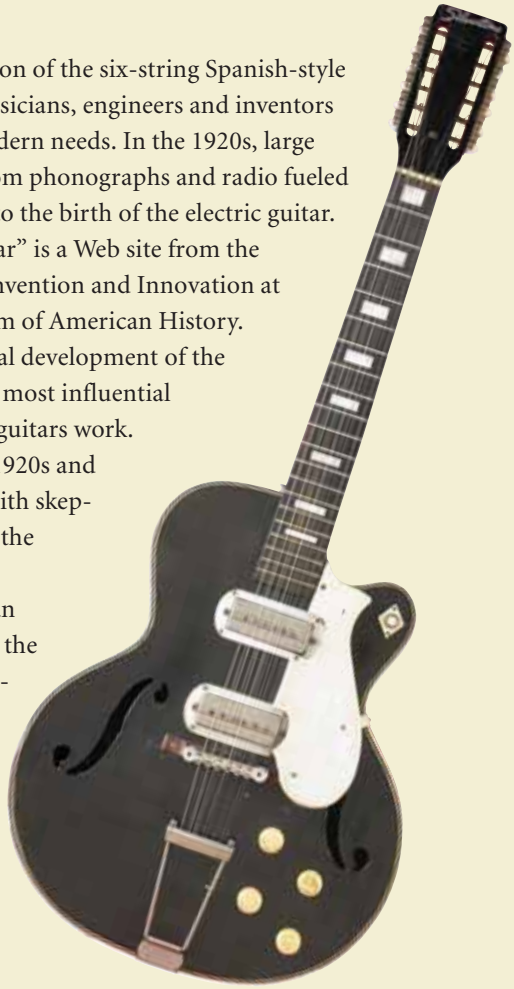
SMITHSONIAN ONLINE

Electric guitar. Since the introduction of the six-string Spanish-style guitar in the early 19th century, musicians, engineers and inventors have modified its design to suit modern needs. In the 1920s, large concert venues and competition from phonographs and radio fueled a desire for amplification, leading to the birth of the electric guitar. "The Invention of the Electric Guitar" is a Web site from the Lemelson Center for the Study of Invention and Innovation at the Smithsonian's National Museum of American History. Chronicling the musical and cultural development of the electric guitar, this site explores the most influential models and explains how different guitars work. The subject of much debate in the 1920s and 1930s, the electric guitar was met with skepticism from many traditionalists in the musical world. Yet its introduction brought a major change to American musical technology and has shaped the sound and direction of modern musical styles. Today, after more than 60 years on the American music scene, the electric guitar has transcended cultures and genres to become a staple for modern artists. It just may be the most important and popular instrument of the last half-century in American music.
—www.invention.smithsonian.org/centerpieces/



Silvertone electric guitar. (Photo by Hugh Talman)

Dear Readers,

This is our last issue of Inside Smithsonian Research. The explosive growth of new communication and social networking tools in recent years presents many opportunities for the Smithsonian to share its collections and resources with people around the globe in ways not previously possible. Please look for future news, stories and information about the work of Smithsonian experts on the Smithsonian home page at the Web address: www.si.edu.

Sincerely,
John Barrat
Editor

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On the cover: A double-wattled cassowary, a flightless ratite native to New Guinea and Australia, in residence at the Bird House of the Smithsonian's National Zoological Park. Recent genetic work by Smithsonian scientists and others working on Early Bird, an ongoing study that is part of the broader Assembling the Tree of Life initiative of the U.S. National Science Foundation, have turned up some surprising findings that are revising the avian family tree. See story Page 6. (Photo by Mehgan Murphy, National Zoological Park)

Smithsonian Institution

Broken tea bowls display precious golden repairs in Freer exhibit

By Michael Lipske
Special to Inside Smithsonian Research

A paper cup, a plastic lid, an insulated cardboard sleeve—these are the accoutrements of today's coffee culture. Filled with lattes, cappucinos and dark roasts, the cups, lids and all, are casually tossed in the trash as soon as the last drop is gone.

Nothing could be further removed from America's grab 'n go coffee clutter than the centuries-old ceramic tea bowls now on view in a quiet corner of the Smithsonian's Freer Gallery of Art in the exhibit "Golden Seams: The Japanese Art of Mending Ceramics." Dating back 300 years or more, these simple vessels have endured from a time when tea, not coffee, was king, and drinking it was regarded as a meditative and spiritual ritual.

One shallow stoneware tea bowl in the exhibit dates from early-16th century Japan. For centuries, its owners spooned powdered green tea into this bowl, added hot water and swirled the contents with a bamboo whisk before passing the steaming beverage to an honored guest. Someone also dropped the bowl—more than once. Tracks of precious gold snake up its side, highlighting fissures in the ceramic where broken pieces of the bowl have been rejoined.

Lacquer and gold repairs hold together the pieces of this elegant Japanese stoneware tea bowl on display in the Freer Gallery exhibition" Golden Seams: The Japanese Art of Mending Ceramics." This bowl dates from the Edo period, mid-17th century.

"It's been repaired a number of times," Freer Curator of Ceramics Louise Cort observes of the antique. Artisans who mended the bowl used lacquer—derived from the sap of a plant related to poison ivy—to glue the pieces back in place. Finely powdered gold was then sprinkled onto the sticky lacquer seams, a purely Japanese technique known as *kintsugi,* or golden joinery, illuminating the repairs.

Tea-ceremony aesthetics often focused on the beauty in imperfection, Cort explains. "Even in tea bowls that were not repaired, people came to look for the slight idiosyncrasies, even flaws, in the glaze that made one bowl more interesting than another. The context of tea

(continued)

drinking created a moment of awareness of transiency, of the way in which all objects, like all human beings, exist in a fleeting way and are decaying."

Staples

Bowls used in tea ceremonies were often revered antiques, passed down from one generation to another, or highly prized imports—another reason to repair them, because they could not be replaced. The "Golden Seams" exhibit includes bowls made in Japan and those brought to Japan from Korea, Vietnam and China.

Exactly when golden *kintsugi* repairs began is unknown, Cort says. An incident involving an heirloom owned by the shogun (commander) Ashikaga Yoshimasa (1434-1490), however, may have encouraged development of the technique.

A Chinese celadon tea bowl prized by the shogun's family was broken and sent back to China to be repaired. It was returned to Japan with disfiguring metal staples holding it together—at the time, staples were a common and practical way to repair ceramics in China.

"The Japanese were shocked to find large chunky staples stuck into the delicate bowl," Cort says.

Within a century, repairs using lacquer combined with powdered gold or silver became common in Japan. "Sometimes owners even commissioned lavish *maki-e,* or 'sprinkled picture' decoration to replace large fragments," Cort says. In this practice, artisans replaced a missing fragment of a broken bowl by crafting a new piece with built-up layers of lacquer. Powdered silver and gold were then carefully sprinkled upon the sticky patch in a pic-

Finely powdered gold was then sprinkled onto the sticky lacquer seams, a purely Japanese technique known as kintsugi *or golden joinery, illuminating the repairs.*

torial design, such as cherry blossoms.

By the 17th century, some tea-ceremony practitioners were even being accused of breaking their tea bowls on purpose, in the hope that *kintsugi* mends might increase their aesthetic and commercial value.

Different stories

In choosing artifacts for the "Golden Seams" exhibit from the Freer Gallery of Art's extensive collection of ceramic tea utensils, Cort looked for ways to tell different stories about tea ceramics and their repair. "I wanted things that had been spectacularly broken and as spectacularly repaired along with examples in which more subtle repairs had been made," she explains.

One 16th-century tea bowl in the Freer exhibit, a rough, black vessel patched with dark lacquer, is so unassuming that the Washington Post recently dubbed it the "humblest" work of art in Washington, D.C. Another object, an irregularly shaped stoneware dish, dates from 18th-century Japan. To Cort's eye, the dish not only appears to have been badly warped in the firing process but also "may be an example of a piece that was intentionally smashed and repaired so that it could acquire a kind of legitimacy that it didn't have before." To the curator, the gold lines highlighting its cracks enhance "that wonky feeling that adds a kind of elegance to an otherwise distorted piece."

Nuances

Cort's gift for teasing out the stories behind bowls with *kintsugi* repairs stems partly from a visit to the Freer some years ago by a Japanese lacquer specialist and art professor. "I walked with him through our ceramics collection, and we looked at a lot of these pieces. He was able to call my attention to the way in which the nuances of the repairs [such as the slight difference in color of a gold repair on one side of a bowl from a gold repair on the bowl's opposite side] suggested there was more than one episode in which a bowl was broken and was repaired. Such nuances convey information about the history of the bowl, information that was very helpful in preparing for this exhibition."

Cort hopes to continue learning about golden joinery by visiting a lacquer workshop in Kyoto, Japan, that still does lacquer repairs on ceramics. The visit will help her better understand how artisans present and past have used lacquer and gold dust to grant a second or even third life to Japan's treasured tea bowls.

"Outsiders may indeed wonder at this seeming much ado about nothing," historian Kakuzo Okakura wrote of the tea ceremony in his 1906 work *The Book of Tea*. "But when we consider how small after all the cup of human enjoyment is, how soon overflowed with tears, how easily drained to the dregs in our quenchless thirst for infinity; we shall not blame ourselves for making so much of the tea cup. Mankind has done worse."❖

"Golden Seams: The Japanese Art of Mending Ceramics" is on view in the Freer Gallery of Art through May 10.

Opposite top: This oddly shaped Japanese Yatsushiro ware dish dates from the Edo period, 18th-century. Made from stoneware with white slip under clear glaze, it shows gold lacquer repairs.

Opposite bottom: A gold lacquer *maki-e* decoration has been used to replace a missing fragment from the lip of this tableware bowl, used in Japan as a tea bowl. Stoneware with white slip under clear, greenish glaze, this mid-15th century bowl is Punch'ong ware from Kyongsangdo province, Korea, Choson period.

Above: The crack in this colorful Chinese Jun ware tea bowl was repaired with metal staples. This bowl dates from the Yuan dynasty, 1279-1368. (Neil Greentree photos)

DNA evidence is rearranging the branches of the avian family tree

By Harvey Leifert
Special to Inside Smithsonian Research

When songwriter Oscar Hammerstein penned the lyrics "fish gotta swim, birds gotta fly," he clearly did not have the ratites in mind. Large flightless birds, the ratites include ostriches, emus, rheas and cassowaries, along with kiwis and several extinct species. For nearly two centuries, scientists have puzzled over the ratites, questioning how these flightless bird species that appear closely related became so widely dispersed, ending up in Australia, South America, Africa and New Zealand.

New research using DNA from ratites and other bird species is providing some surprising answers. Ornithologists now know that despite their appearance, the ratites are not as closely related as once believed. In fact, some ratite species are more closely related to certain flying birds, the quail-like South American tinamous for example, than they are to other ratites, says Michael Braun, a research scientist in the Department of Vertebrate Zoology at the Smithsonian's National Museum of Natural History.

Braun and his colleagues at the Smithsonian and other institutions reached this unanticipated conclusion while working on Early Bird, an ongoing study that is part of the broader Assembling the Tree of Life initiative of the U.S. National Science Foundation. Under this initiative, systematic biologists from around the world are using DNA and other data to reconstruct the evolutionary origins and relationships of all living organisms.

"For the last 40 years, most people have believed that ratites were more closely related to each other than to any other birds," Braun says. "But historically, the relationships of the ratite birds has been a hotly debated issue, not only in ornithology but in evolutionary biology overall. Thomas Huxley and Charles Darwin wrote about these birds at the very beginnings of evolutionary biology," he continues. Early researchers wondered how the ostrich, rhea and other ratites, often assumed to be each other's closest relatives, ended up on different continents—Africa, Australia and South America—when they could neither fly nor swim.

Plate tectonics

In the 1960s, the newly accepted science of plate tectonics, or continental drift—"a godsend from a completely different branch of science, geology," Braun says, with a smile—seemed to provide a mechanism to explain ratite distribution. Under this hypothesis, the common flightless ancestor of all ratites was living on Gondwana, the single giant supercontinent that made up much of the southern landmass of the Earth more than 167 million years ago.

When Gondwana broke apart into what is now South America, Africa, Australia and Antarctica, populations of this early ratite ancestor would have been carried off in several directions on the drifting continental plates. Over millions of years, these isolated populations might have evolved into the distinct, but similar appearing, giant flightless ratites that we know today.

"It is a beautiful, serendipitous theory that is in all the textbooks," Braun laughs. But it seems to be wrong.

Flight to flightless

By closely comparing the DNA of a representative sampling of 171 (so far) out of the 9,000 to 10,000 living bird species, Early Bird scientists have gained new insight into the avian family tree, Braun says. One of the most startling findings is that birds of the tinamou family, which can fly, fall squarely in the middle of the ratites, which cannot. Early evidence of this relationship came from work on the c-Myc gene by John Harshman and Scott Steppan, former postdoctoral researchers at the Smithsonian. "I didn't believe it at first" Braun says, but with supporting data from 20 genes in the Early Bird project, today the conclusion is inescapable.

This discovery led to a new question: Was the common ancestor of ratites and tinamous a flying bird or a flightless bird? If flightless, then the tinamous must have gained the ability to fly at some time during their evolution. If the common ancestor was a flying bird, then ostriches and other ratites possessed, and then lost, the ability to fly.

The latter explanation is by far the more likely, Braun explains. The fossil record holds hundreds of examples of bird species that became flightless over time. No example exists of flightless birds evolving the ability to fly. Therefore, it is most likely that the ancestor of both ratites and tinamous was a small flying bird. Each ratite species became flightless independently in its different geographic area, a location that was reached early in its evolution through flight, not continental drift. Ratite species experienced a minimum of three—and possibly five or more—

separate transitions to flightlessness at different times and places during millions of years, Braun says.

Genetic data also show that ostriches are not close cousins of rheas or any of the other ratites, Braun says—another result of DNA analysis in the Early Bird study. The new ratite findings were published last September in the Proceedings of the National Academy of Sciences.

Rearranging relationships

The Assembling the Tree of Life initiative and its Early Bird component could not have been undertaken before the 1980s, Braun notes, prior to a thorough understanding of DNA and the availability of fast, inexpensive computers to process enormous amounts of data. In 2002, the National Science Foundation awarded its first grant for Early Bird, about $2 million, which has been supplemented by funds from participating institutions, he adds. Early Bird involves scientists at the National Museum of Natural History, the University of Florida, Louisiana State University, Wayne State University and the Field Museum of Natural History. Three of these institutions—the Smithsonian, Louisiana State University and the Field Museum—are known for their extensive tissue-sample collections of living bird species, essential to the DNA studies at the core of the project.

Early Bird's first results, a brief overview of the avian tree of life published last June in Science, shook up the ornithological world by reporting that whole families of birds thought to be closely related were not and that other, seemingly unlike, species were actually near relatives. Parrots, for example, are related to songbirds, and flamingos are related to the duck-like grebes rather than other long-legged waterbirds.

Among the practical consequences of Early Bird and related research is that publishers must eventually revise the hundreds of birding field guides that list bird species in taxonomic order, an approximation of their relative ages. North American guides generally begin with loons and end with the house sparrow. Whole sections of those guides must now be rearranged, based on the findings of Early Bird researchers and others. As a result, loons will surrender their coveted first-page ranking to the waterfowl, quail and turkey.

Of greater scientific import is the fact that comparative biologists will have a much better framework of avian evolutionary history to help interpret their data. Birds are among the most popular organisms for studies of ecology, behavior and life history. To understand how they evolved, Braun says, we need a stable and accurate tree of life for all birds.❖

Top: double-wattled cassowary, native to New Guinea and Australia. (Photo by Mehgan Murphy, National Zoological Park) Middle: elegant crested tinamou, native to Argentina and Chile. Bottom: African ostrich. (Photos by Jessie Cohen, National Zoological Park)

Egg and arsenic found among the silhouettes in an early American album

By Carla Borden
Special to Inside Smithsonian Research

Art historians do not know if William Bache (1771-1845) used fine scissors or a tiny knife to painstakingly cut the silhouettes that he is known for today. They do know that he used a device, the physiognotrace, to trace each sitter's likeness on paper. Subjects placed their chins on the instrument, cheek to paper, while Bache carefully moved a stylus across their forehead, brow and lips, following the unique profile of each. Although Bache did not invent the physiognotrace, he did patent his own version of it.

Bache traveled from city to city in the United States in the early 1800s, earning a living from the popularity of these keepsake "shadow portraits." While antique silhouettes by Bache can turn up today on online auction sites and fetch hundreds of dollars, much about his life remains a mystery, including details of the processes and materials he used to create the portraits.

Remarkably, in 2001, the Smithsonian's National Portrait Gallery acquired a nearly two-century-old album once owned by Bache containing more than 1,800 duplicate silhouettes with the identities of many of the sitters recorded in Bache's own hand. Among the album's subjects are Thomas Jefferson and George and Martha Washington.

Recent research on the Bache album by Smithsonian conservators is helping answer some long-standing questions about Bache's method of portrait making and turned up one unexpected explanation as to how the album has remained in such good condition for some 200 years.

A page from the Bache silhouette album arranged with 30 numbered silhouettes (Photo by Nora Lockshin)

Iron and ink

Bache arrived in Philadelphia from England in 1793 with no apparent training as a silhouettist. Like many other silhouette artists who came to America from Europe, he worked mainly along the East Coast.

Perhaps to use his recently patented physiognotrace or to capture a historic moment, Bache went to New Orleans in 1804, about a year after the Louisiana Purchase. There he made silhouettes of a diverse cross-section of local men, women and children reflecting the region's transfer from Spain to France to the young United States. Recently, these silhouettes were chosen for display in a Portrait Gallery exhibition focusing on the relationship between Spain and the United States from 1763 to 1848.

To prepare the album for display, Rosemary Fallon, paper conservator at the National Portrait Gallery's Lunder Conservation Center, conducted a routine examination with Nora Lockshin, a paper conservator at the Smithsonian Center for Archives Conservation. After deciding the album's binding needed stabilizing, they turned their attention to the individual leaves of the album. There was a lot to consider, Lockshin says. "The album contains so much variation in ink, gloss spots on the ink and touching up of the silhouettes," she explains. Wendy Wick-Reaves, curator at the National Portrait Gallery, asked if anything could be done about a reddish-brown powder on the surface of many of the silhouettes.

Based on past analysis of silhouette materials used by Bache and other artists, the conservators initially speculated that the powder was a kind of rust, caused by deterioration of the iron content in the ink—possibly a component of Prussian blue or iron gall ink. Iron gall ink was used widely for writing and drawing for centuries. However, the acidic properties of this ink "very aggressively deteriorate paper," Fallon says. Such an ink seemed a strange choice for Bache, who would have used a thick, opaque layer of ink.

Basic tests did not show "sufficient iron in the ink to account for rusting," Lockshin says. So she and Fallon turned to sci-

entists at the Smithsonian's Museum Conservation Institute to take a closer look.

Egg

The silhouettes were next studied under ultraviolet light. Although silhouettes with a matte finish did not fluoresce or glow under the ultraviolet light, some of the glossy silhouettes did. This unexpected finding led to a new hypothesis: It was not what was in the ink but rather what was *on* the ink that was deteriorating.

It was common practice in Bache's time to put a coat of varnish on watercolors and silhouettes. Staff at the Museum Conservation Institute next conducted tests of Bache's varnish with X-ray fluorescence, infrared spectroscopy, gas chromatography and a scanning electron microscope. Their work revealed that the coating contained pine tar and possibly albumin, an egg protein.

Why would Bache have mixed tree resin with egg?, the conservators pondered. "Varnishing or glazing was far more often gum-based on ink and watercolor drawings," Fallon says. A conversation with Don Williams, senior furniture conservator at the Museum Conservation Institute, provided a clue. When Williams was told that one of Bache's partners was a framer and gilder—someone who covers objects with thin layers of gold—he suggested a recipe from a 19-century varnisher's manual for "sign-painter's glaire." This glaire, made from egg-white mixed with turpentine, was used as an adhesive for gilding and was likely on hand for Bache's use.

Close examination revealed that the brownish dust appeared primarily on the most raised areas of each silhouette. Instrumental analysis confirmed that abrasion between facing pages over time had worn away the coating in these areas, scratching the glossy surface and leaving the red powder as a residue. Before selected pages of the album were exhibited, each silhouette was swabbed to remove as much of the powder as possible. The remaining pages were interleaved with sheets of protective silicone to prevent further abrading.

Arsenic

During the ink analysis, X-ray fluorescence testing detected the presence of arsenic throughout the album, including in its binding.

Although historically arsenic was used as a preservative for textiles and for ethnographic and botany specimens, "we don't expect to find it in books," Fallon and Lockshin say. Analysis of the arsenic by Nicole Little, a physical scientist at the Museum Conservation Institute, turned up trace amounts of arsenic fluoride chloride, arsenic sulfide (a naturally occurring mineral) and lead aluminosilicate.

"Portrait Gallery staff handle things from this period all the time," Fallon says. "We never thought that they might be dangerous," Lockshin adds. "In the future we need to monitor such materials and be sure that people are protected."

Fallon and Lockshin have since consulted with industrial hygienists to develop appropriate protocols for handling and storage. No longer on display, the William Bache silhouette album is now sealed in plastic and labeled "hazardous." ❖

Above top: In the Smithsonian Center for Archives Conservation paper lab at the Museum Conservation Institute in Suitland, Md., Rosemary Fallon uses a stereo microscope to examine a silhouette in the William Bache silhouette album. Nora Lockshin looks on at left. (Photo by Julie Heath)

Above: This Bache silhouette of the first Governor of Louisiana, William Charles Claiborne, shows areas where its varnish has been abraded. (Photo by Nora Lockshin)

Twin asteroid belts circle nearby star in a planetary system much like our own

By Christine Pulliam
Smithsonian Astrophysical Observatory

We think of our solar system as normal, but actually, it is an oddball. Most of the planetary systems surrounding other stars that astronomers have discovered during the last 15 years are nothing like our own. Many consist of Jupiter-sized worlds snuggled in very close orbits—closer than Mercury's orbit is to our sun—swiftly orbiting their stars in a matter of days while being scorched by sizzling heat. The orderly arrangement of small, rocky inner planets and giant, gassy outer planets that characterizes our solar system is out of the ordinary.

At last, however, astronomers have found a solar system surrounding the star Epsilon Eridani that is very much like a young twin of our own, with one glaring exception: it has not one but two asteroid belts. Because wayward asteroids can strike and damage or destroy a planet, the two asteroid belts in the Epsilon Eridani system make it a dangerous place for any planet, particularly an Earth-like world.

The star Epsilon Eridani, slightly smaller and cooler than the sun, is located about 60 trillion miles from Earth in the constellation Eridanus. Epsilon Eridani is the ninth closest star to the sun and is visible to the unaided eye. It also is younger than our sun, with an approximate age of 850 million years.

Astronomer Massimo Marengo of the Smithsonian Astrophysical Observatory carefully scrutinized Epsilon Eridani with NASA's Spitzer Space Telescope, searching for signs of cosmic dust surrounding the star. Where there is dust, he reasoned, there are larger, rocky chunks—asteroids.

Studying Epsilon Eridani is like having a time machine to look back at our solar system....

Massimo considered Epsilon Eridani a good candidate for study because it shows remarkable similarities to how our own solar system may have looked four billion years ago.

"Studying Epsilon Eridani is like having a time machine to look back at our solar system when it was young," Marengo says.

Warm, dusty rings

Using the Spitzer Space Telescope, which is sensitive to infrared light or heat from cosmic objects, Marengo found telltale signs of two warm, dusty rings encircling Epsilon Eridani. The dust is produced when asteroids smack into each other and pulverize themselves into bits.

Our solar system has a rocky asteroid belt between Mars and Jupiter, about 300 million miles from the sun. In total, it contains about one-twentieth the mass of Earth's moon spread out over a wide area. The inner asteroid belt of Epsilon Eridani is a virtual twin of our asteroid belt. Both are located about 300 million miles from their star and contain a comparable amount of material.

Farther out, though, Marengo and his colleagues detected a second asteroid belt orbiting Epsilon Eridani at a distance similar to where Uranus is located in our solar system. Epsilon Eridani's outer asteroid belt contains 20 times more material than its inner asteroid belt.

Above: This artist's concept shows the planetary system Epsilon Eridani. Observations from NASA's Spitzer Space Telescope show that this system hosts two asteroid belts in addition to previously identified planets and an outer icy ring of material. The inner asteroid belt appears as the yellowish ring around the star, and the outer asteroid belt is in the foreground. The outermost icy ring is too far out to be seen in this view, but comets originating from it are shown in the upper-right corner. (Image courtesy of NASA/JPL-Caltech)

Opposite: Massimo Marengo looks through a telescope at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. (Photo by Christine Pulliam)

Icy belt

A third, icy ring of material discovered earlier around Epsilon Eridani extends from the distance of Neptune's orbit in our solar system to well beyond that of Pluto. A similar icy reservoir of material in our solar system is called the Kuiper (rhymes with "wiper") Belt and is a source of comets. However, Epsilon Eridani's outer ring of ice and rock contains about 100 times more material than our Kuiper Belt.

When the sun was 850 million years old, theorists calculate that our Kuiper Belt looked about the same as the outer icy ring surrounding Epsilon Eridani. Since then, much of the material in our Kuiper Belt has been swept away. Some material was hurled out of our solar system and some material plunged in toward the inner planets in an event astronomers call the Late Heavy Bombardment. (Giant craters that formed the lunar seas of lava called mare on the moon are evidence of the Late Heavy Bombardment.) It is possible that Epsilon Eridani will undergo a similar clearing of material from its icy outer ring in the future.

Three gas giants

In addition to two asteroid belts and one outer icy ring, Epsilon Eridani is believed to host several planets. Data from the Spitzer Space Telescope show gaps between each of the three rings surrounding Epsilon Eridani. Such gaps are best explained by the presence of planets that gravitationally mold the rings, just as the moons of Saturn constrain its rings.

"Planets are the easiest way to explain what we are seeing," Marengo says.

Specifically, three gas-giant planets with masses between those of Neptune and Jupiter would fit the observations nicely. One planet near the innermost asteroid belt already has been detected. A second planet is believed to lurk near the outermost asteroid belt and a third at the inner edge of Epsilon Eridani's outer belt of icy material. Future studies may detect these currently unseen worlds, as well as any rocky planets in orbit inside the innermost asteroid belt.

Ultimately, astronomers such as Marengo hope to find and study worlds similar to Earth—small, rocky worlds with liquid water, atmospheres and perhaps even life. If we find such worlds, then we will know our solar system is not so odd as it seems right now. Instead, we may find that we have company in our galaxy. ❖

American History reopens. Amid much fanfare and ceremony, the Smithsonian's National Museum of American History reopened its doors to the public Friday, Nov. 21, after a two-year, $85 million renovation that dramatically transformed the museum's interior architecture and renewed the presentation of its extensive collections. The renovation focused on three areas: architectural enhancements to the museum's center core, including a grand staircase and skylight; construction of the new Star-Spangled Banner Gallery; and updates to the 44-year-old building's infrastructure. Many new exhibitions and programs will be unveiled at the museum in the coming year.

Visitors to the National Museum of American History admire the Star-Spangled Banner in its new gallery. (Photo by Hugh Talman)

Obama portrait. The mixed-media stenciled collage by Los Angeles artist Shepard Fairey that came to symbolize the historic campaign of President Barack Obama has been acquired by the Smithsonian's National Portrait Gallery. Fairey's large-scale artwork was the central portrait image for the Obama campaign and was distributed as a limited-edition print and as a free download. The collage, now on exhibit at the Portrait Gallery, was donated by art collectors Heather and Tony Podesta.

Shepard Fairey's portrait of Barack Obama.

Ceramics catalog. The Smithsonian's Freer Gallery of Art and Arthur M. Sackler Gallery recently launched the first online catalog of their collection of Mainland Southeast Asian ceramics. Spanning 4,000 years, the Freer/Sackler collection highlights historical ceramics made in or traded to Vietnam, Cambodia, Laos, Thailand and Burma. The catalog includes multiple color images and detailed texts, a library of commissioned essays and translations, a bibliography of more than 1,300 citations and an introduction to ceramic sherds housed in the Freer Gallery Study Collection. This online resource can be accessed at the Web address: seasianceramics.asia.si.edu.

Vaquita. Staff of the Marine Mammal Program at the Smithsonian's National Museum of Natural History recently organized a symposium in Washington, D.C., to address the conservation of the world's most endangered cetacean: the vaquita (*Phocoena sinus*), or Gulf of California harbor porpoise. This small animal lives only in the northern part of the Gulf of California, and its wild population is estimated to be just 125. Threatened by accidental death in fishing nets, the vaquita's risk of extinction is very high. Scientists from the Smithsonian, the National Oceanic and Atmospheric Administration the U.S. Marine Mammal Commission, and other experts discussed solutions to the vaquita's diminishing numbers.

Conservation studies. The Smithsonian National Zoo's Center for Conservation Education and Sustainability and the Center for Conservation Studies at George Mason University in Fairfax, Va., have launched a new program that offers students the opportunity to live and study at the Zoo's 3,200-acre Conservation and Research Center in Front Royal, Va., where the Zoo houses and cares for more than 30 critically endangered species. The new Smithsonian-Mason Global Conservation Education Program will provide academic opportunities for up to 50 undergraduates each semester and accommodate an additional 60 participants for professional training and certificate programs.

First geological survey of Panama's Kuna Yala coastline conducted by Smithsonian scientists

Last fall, eight geologists and paleontologists from the Smithsonian Tropical Research Institute carried out the first geological survey of the Kuna Yala coastline in northeastern Panama, exploring the coast from the city of Colón to the border of Colombia. Traveling by boat, they explored the coast and rivers where native Kuna communities granted them access, and they collected more than one ton of rock and sediment for further analysis.

"We discovered some amazing outcrops and a variety of rocks that will be extremely important in understanding how and when the Isthmus of Panama formed," says Smithsonian paleoecologist Aaron O'Dea. "The most impressive feature we found was close to the Colombian border: a massive section of uplifted oceanic crust and deep sea oozes, tilted at an angle of nearly 50 degrees."

In striking contrast to the Caribbean coast west of the Panama Canal, where outcrops consist of uplifted sea sediments, most outcrops along the Kuna Yala coastline are volcanic in origin.

"We found only a few fossil-bearing rocks. Most likely erosion has washed the sedimentary rocks away," O'Dea says.

Analysis of the rocks will assign geologic dates to highly fault-segmented blocks of coastline, adding significant pieces to the puzzle of how and when the Isthmus of Panama severed the tropical American seaway and linked the continents of North and South America. Previous maps of the Kuna Yala coastline show only two geological zones. Survey participants have reclassified the coast into approximately 15 zones.

Previous research in Bocas del Toro and Darien Provinces revealed that the Isthmus of Panama began to rise out of the sea 20 million years ago to form a barrier between the Pacific and Atlantic oceans and by 3 million years ago, to form a land bridge connecting North and South America. But the details of the formation, closure and connection remain a mystery.

The missing piece of the puzzle was the geologic history of the Kuna Yala, where no systematic survey of the geology of the coastline had ever been done—until now.

—*Beth King*

Scientists gather rock samples from seaside cliffs along the Kuna Yala coastline in Panama. (Aaron O'Dea photo)

Donation enables processing of Emmerich collection at Archives of American Art

Before his death in 2007, renowned art dealer André Emmerich donated some 300 linear feet of his personal and business papers to the Smithsonian's Archives of American Art. The collection provides extensive documentation of the almost 50-year operation of the André Emmerich Gallery, one of New York's most influential galleries of contemporary art—a focal point for Color Field painting and a leading venue for color abstraction and monumental sculpture.

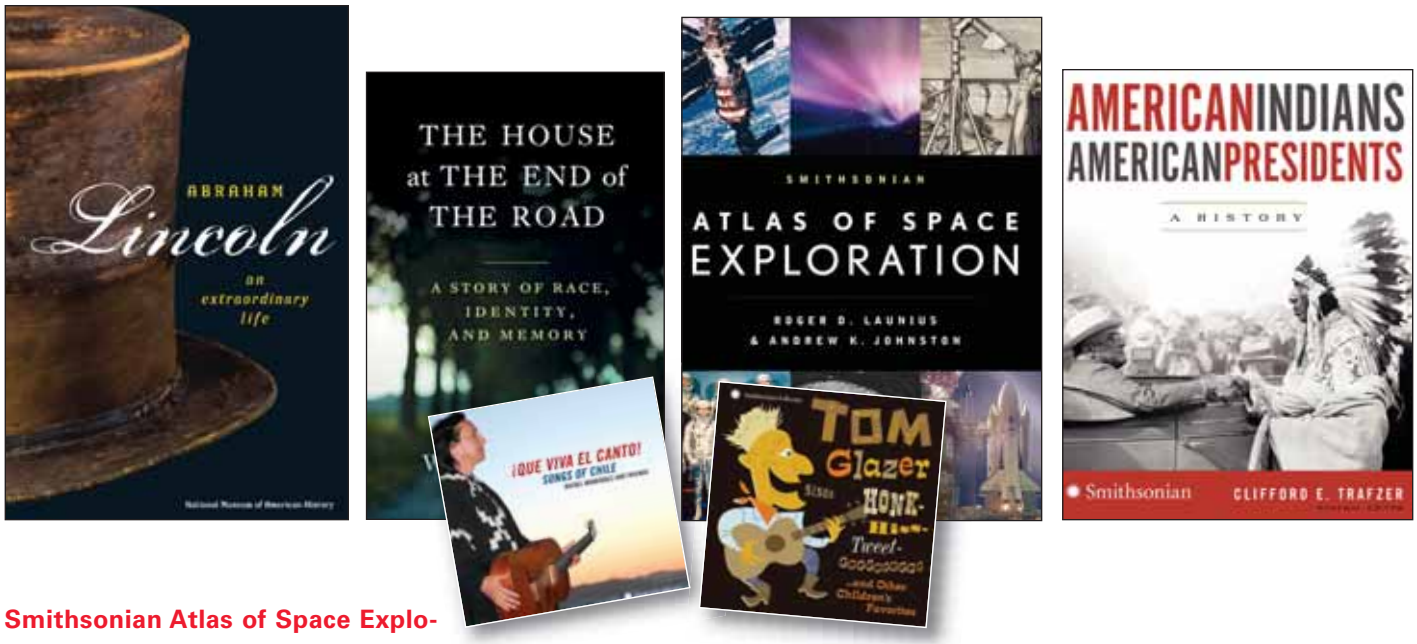
Now, a generous three-year grant from the Leon Levy Foundation will enable the Archives' staff to organize and catalog this large collection and make it readily available to curators, scholars, students and the public.

The collection consists chiefly of artist files; publicity files; inventory records; photos of works of art and artists Emmerich represented, their studios and exhibition installations at the gallery and elsewhere; video- and audiotapes; and personal correspondence with artists, galleries, museums, universities, customs officials and many others.

A 1960 poster from the André Emmerich Papers. (Archives of American Art photo)

Artists represented in the collection include Chuck Close, Richard Diebenkorn, David Hockney, Hans Hofmann, Jasper Johns, Roy Lichtenstein, Morris Louis, Miriam Schapiro, George Segal and Esteban Vicente.

"The Emmerich papers are one of our most crucial collections documenting the art and artists of the latter half of the 20th century," John Smith, director of the Archives of American Art, says.



Smithsonian Atlas of Space Exploration, by Roger D. Launius and Andrew K. Johnston (Smithsonian Books, 2009, $34.95). A unique, lavishly illustrated and extensive history of space exploration, from Ptolemy and Copernicus to today's Mars missions.

To Keep the British Isles Afloat: FDR's Men in Churchill's London, 1941, by Thomas Parrish (Smithsonian Books, 2009, $26.95). An inside look at the work and adventures of Harry Hopkins and Averell Harriman in the creation of history's most remarkable international partnership—the World War II Anglo-American alliance.

The House at the End of the Road: A Story of Race, Identity, and Memory, by W. Ralph Eubanks (Smithsonian Books, 2009, $26.95). Using interviews, oral histories and archival research, the author weaves a powerful story about race and identity through the lens of one American family across three generations.

American Indians/American Presidents: A History, edited by Clifford E. Trafzer (Smithsonian Books, 2009, $29.95). An illustrated, multiauthor exploration of how Native Americans have interpreted the power and prestige of the presidency and advanced their own agenda for tribal sovereignty.

Alan Bean, Painting Apollo: First Artist on Another World, by Alan Bean (Smithsonian Books, 2009, $48.50). Eyewitness testimony from the unique perspective of the only artist, and one of only 12 humans, who have walked on the moon—features 120 of Alan Bean's luminous paintings.

Abraham Lincoln: An Extraordinary Life, edited by Harry Rubenstein (Smithsonian Books, 2009, $12.95). Commemorating the 200th anniversary of Lincoln's birth, this book tells Lincoln's extraordinary story as only the Smithsonian could tell it, through the stunning Lincoln collections at the National Museum of American History.

Chapinlandia—Marimba Music of Guatemala (Smithsonian Folkways Recordings, 2008, $15). Steeped in centuries of tradition, Chapinlandia and its music express the "modern" marimba sound drawn from the African, Indian and Ladino (Creole) roots of Central America.

Tom Glazer Sings Honk-Hiss-Tweet-GGGGGGGGGG and Other Children's Favorites (Smithsonian Folkways Recordings, 2008, $15). Tom Glazer's uncanny ability to "speak to children as saints speak to birds," as touted by the New York Times, rings loud and clear in this collection of live performances.

¡Que Viva el Canto! Songs of Chile, Rafael Manríquez and Friends (Smithsonian Folkways Recordings, 2008, $15) More than 100 years of tradition and three regions of Chilean folk-song style are summed up in this contemporary musical tour-de-force led by singer, guitarist and composer Rafael Manríquez.

Books listed on Pages 14 and 15 can be ordered through online book vendors or purchased in bookstores nationwide.

Recordings can be ordered from Smithsonian Folkways Mail Order, Smithsonian Folkways Recordings Dept. 0607, Washington, D.C. 20073-0607. To order by phone, call (800) 410-9815 or (202) 275-1143.

The Gardner Heist: The True Story of the World's Largest Unsolved Art Theft

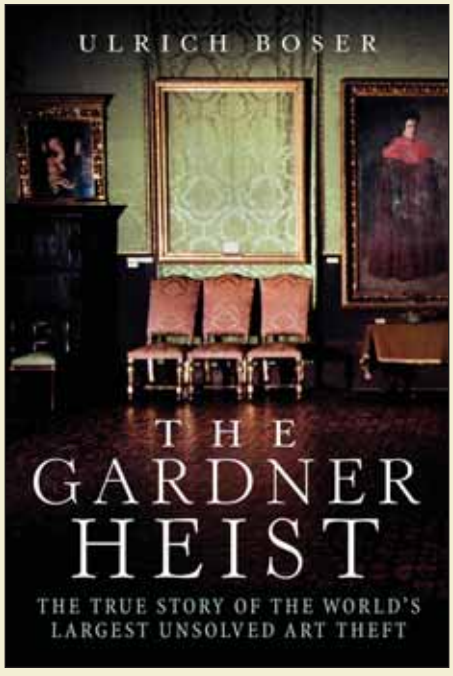
By Ulrich Boser (Smithsonian Books, 2008, $25.95)

Around 1:24 a.m. on March 18, 1990, two men wearing police uniforms walked into the Isabella Stewart Gardner Museum in Boston, bound the security staff and taped their mouths, then stole 13 artworks that today have an estimated value of $500 million. Among the stolen paintings were Vermeer's "The Concert," Rembrandt's "A Lady and Gentleman in Black" and "The Storm on the Sea of Galilee" and "Chez Tortoni" by Manet.

In 81 minutes, the thieves cut and ripped the paintings from their gilded frames inside the four-story museum at 2 Palace Road and then drove away. Today, despite thousands of leads, hundreds of interviews and the offer of a $5 million reward, not one painting has been recovered. No one has been arrested. The missing masterpieces have become the Holy Grail of the art world and one of the world's most extraordinary unsolved thefts.

This infamous robbery is meticulously chronicled in *The Gardner Heist: The True Story of the World's Largest Unsolved Art Theft*. The author, Ulrich Boser, became obsessed with solving the mystery after meeting one of the crime's most dogged investigators, Harold Smith. Shortly before Smith died of cancer in 2007 at age 79, Smith believed he was just steps away from cracking the case. The extensive files Smith kept detailing his investigation were irresistible to Boser, a journalist, and he took up where Smith left off.

The story begins with the Gardner Museum's namesake: Isabella Stewart Gardner. Born in 1840, the heiress was an adventurer and gossip-column staple. Her father died when she was 51 and left her the equivalent of $40 million in today's dollars. She spent the money on art and became devoted to building a world-class collection and a lavish museum, which she designed as a replica of a Renaissance-era Venetian palazzo.



After carefully describing the many masterworks that Gardner purchased, Boser turns to the crime itself, spinning an intriguing web from the myriad leads and suspects that Smith pursued for more than a decade.

In continuing Smith's detective work, the author finds himself immersed in a world of art detectives, FBI agents, shady art and antiques dealers and gangsters. He met and interviewed many of Smith's sources, ran down unfinished leads and investigated any and all new tips.

At the height of his obsession, Boser finds himself chasing "the Irish lead," skulking about Galway Bay trying to ferret out the "incontestable king of the Boston underworld," James "Whitey" Bulger. Despite an offer of $2 million for his capture and being featured on television's "America's Most Wanted" 12 times, Bulger remains at large.

Boser does catch up with suspect Myles Connor, a Mensa-member and ex-rocker who once headlined for the Beach Boys. Connor's 30-year crime spree includes robberies of almost every major museum on the East Coast.

Boser also profiles Boston gangster David Turner, who bears a strong resemblance to an FBI witness sketch of one of the Gardner suspects. Turner at first wanted his picture on the cover of Boser's book but stopped cooperating when Boser seemed to be getting too close to the truth.

Eventually, Boser comes to believe he has solved one of the biggest mysteries of the case, uncovering the identities of the thieves who robbed the museum nearly two decades ago. Today, however, the frames that once held world masterpieces hang empty on the Gardner's walls, and the paintings' whereabouts remain unknown.

"If a museum were filled with all of the world's stolen artworks, it would be the most impressive collection ever created," Boser observes. Yet the clearest understanding of this cultural tragedy is articulated by Smith, who reveals his motivation in trying to solve the Gardner Heist for more than a decade when he says: "The thieves stole our heritage, they've stolen who we are. That's wrong....When art is stolen, it's stolen from humanity."

—Daniel Friend

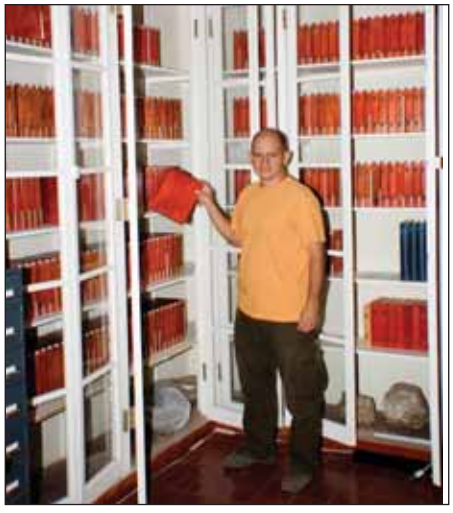
Research collection of pollen grains given to Smithsonian Tropical Research Institute

Any child can recognize the difference between a rosebush and an oak tree, but given a sample of the tiny pollen grains produced by each of these two plants, few people could match the pollen with its owner. At a microscopic level, however, pollen grains are quite distinct in size, shape and surface structure.

The Smithsonian Tropical Research Institute in Panama was recently given a collection of more than 25,000 different pollen grains and spores, each mounted on a microscope slide and labeled according to the plant that produced it. "The collection is worldwide in coverage with an emphasis on plants of the Americas," explains collection donor Alan Graham, professor emeritus at Kent State University and curator at the Missouri Botanical Garden.

Graham began the collection in 1954, gathering pollen from plants in the field and from dried specimens in large herbarium collections. A card catalog accompanying the collection is cross-referenced to the slides and contains information on each plant species represented.

Covered by a tough wall, or 'exine,' many pollen grains are incredibly resilient,



Carlos Jaramillo with labeled boxes that hold some 25,000 samples of pollen grains that were mounted on microscope slides by Alan Graham. (Photo by Marcos Guerra)

so much so that they show up as fossils in sedimentary rock tens of millions of years old. "It is not unusual to find rich assemblages of fossil pollen and spores in sediments where no other plant fossils—leaves, stems, seeds—exist," Graham says. Graham, a paleobotanist, uses fossil pollen to reconstruct the vegetative and ecological history of the Americas, with an emphasis on the last 100 million years. "To quickly identify the prehistoric pollen I retrieve from rocks, it was necessary to create this reference collection of known pollen types," he explains. Some fossil pollen in the collection is 40 to 45 million years old.

A critical bit of information included in the plant descriptions in Graham's card catalog are the ecological conditions under which each plant grows and its geologic range. This data is essential to understanding the history of the vegetation and environments of the New World, "giving us a picture of how the earth got to this one brief instant of time we are living in right now, and where it may be headed," Graham says.

"This is one of the largest pollen collections in the world, unique in its coverage of North America and Latin America," says Carlos Jaramillo, a stratigrapher at the Smithsonian Tropical Research Institute. "Soon, we plan to have all of the components of this collection in digital format, to share on the Web with everyone around the world." —*John Barrat*

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