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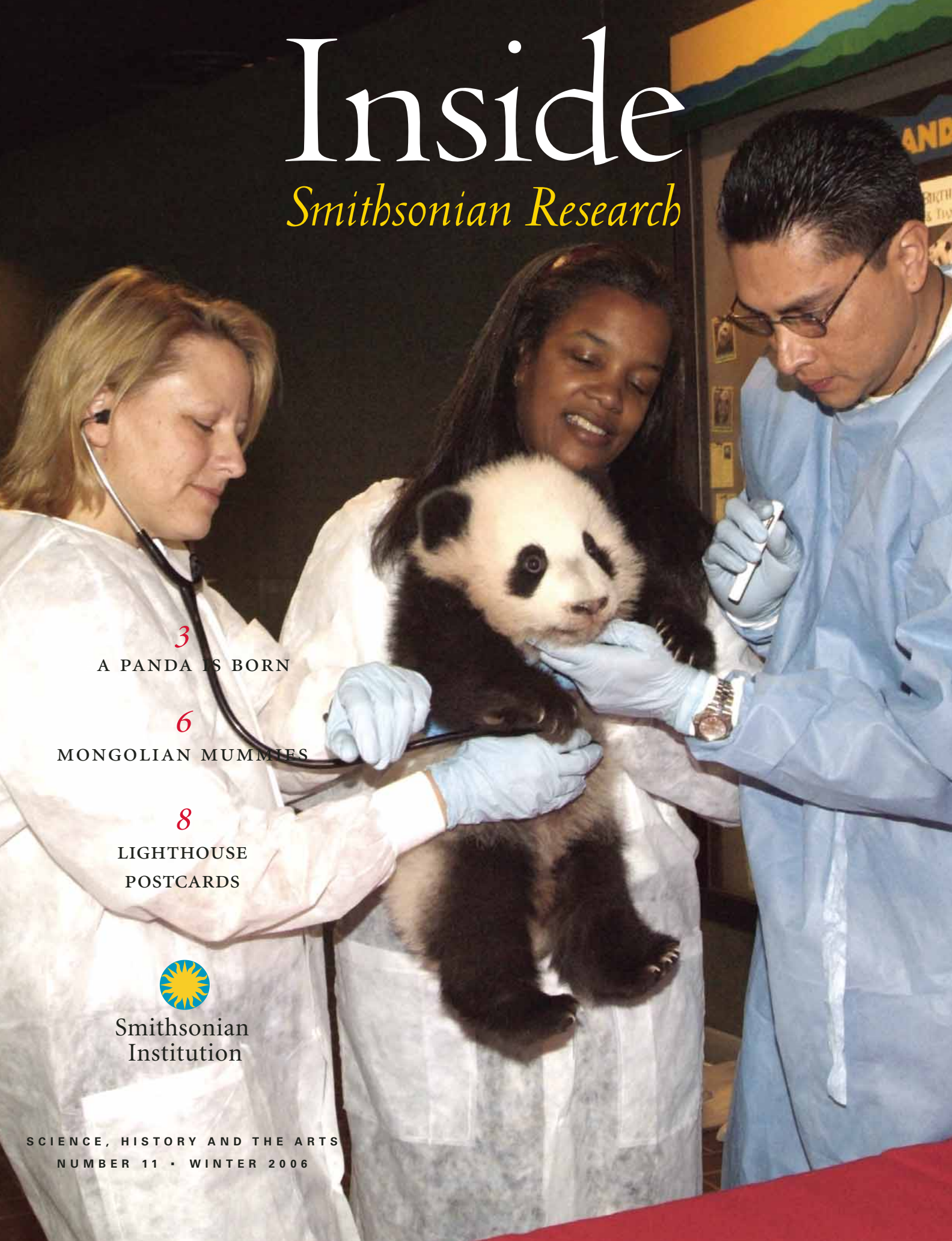
Smithsonian Research



Smithsonian Institution

SCIENCE, HISTORY AND THE ARTS
NUMBER 11 • WINTER 2006

Electricity on film. Since the 1930s, the distinctive images disseminated by the Washington, D.C.-based organization Science Service have captured the attention of newspaper and magazine readers worldwide. These science-focused images and their concise captions helped forge a broader understanding and appreciation of the many scientific and technological achievements made in the last 80 years. A new Web site from the Smithsonian's National Museum of American History features an eye-grabbing selection of Science Service images related to electricity and dating from the 1930s to the 1960s. Accompanied by their original captions, the photos in this online archives are presented exactly as they appeared in period publications. Organized under dozens of subject headings, such as batteries, cables, cameras, computer art, lighting, electron tubes, fiber optics, fire alarms, lasers, recordings, stratovision and television, this Web site is a visual primer on the development and application of electronics in modern life. The laboratories of Westinghouse and General Electric figure prominently in this collection, which was donated with a wealth of other materials in 1971 to the Smithsonian by Science Service.—**scienceservice.si.edu**

In this 1940s Science Service photograph, a model lights a cigarette with General Electric's revolutionary new infrared lamp.

Pochoir prints. Crisp lines, brilliant colors and a freshly painted "wet" appearance are characteristics of the pochoir print. This refined stencil-based printmaking technique was popular from the late 19th century through the 1930s and was used primarily for fashion, pattern and architectural design prints. Paris was the center of pochoir activity, and the technique is strongly associated with art nouveau and art deco. A new Web site from Smithsonian Institution Libraries features 35 vivid examples of pochoir prints from its Cooper-Hewitt Branch, along with a brief history and description of the pochoir process. To create a pochoir print, stencils were cut from celluloid, plastic and other material by a craftsman using a straight-edged knife. Numerous stencils were used for a single print. Next, a colorist applied pigments to a sheet of paper through the stencils using a variety of brushes and methods of paint application. Labor intensive, pochoir eventually came to be replaced by such techniques as lithography and serigraphy. —**www.sil.si.edu/ondisplay/pochoir**

A pochoir print from "Boquets and Frondaisons: 60 Motifs in Couleur," by E.A. Séguy.

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On the cover: From left, National Zoo Chief Veterinarian Suzan Murray, Assistant Curator Lisa Stevens and Veterinarian Carlos Sanchez give giant panda cub Tai Shan a medical check up on Nov. 10. Born July 9, the male bear was 4 months old at the time this photo was taken. (Photo by Jessie Cohen)

Smithsonian Institution

Decades of research and work result in birth of panda baby at the National Zoo

By Michael Lipske
Special to Inside Smithsonian Research

Don't blink when it gets to 3:41," warns Lisa Stevens, an assistant curator at the National Zoological Park. Stevens is screening a grainy video of Mei Xiang, the Zoo's female giant panda, who is lying on her side and grunting in the final moments of pregnancy. In a corner of the frame, numerals flash the time.

Precisely at 3:41 a.m., July 9, 2005, there are two pandas in the video, one a squalling 4-ounce infant that has suddenly rocketed across the screen—a typically ballistic panda birth—and the other a seemingly mystified mother who, moments later, picks up and begins cuddling her offspring.

It was "a textbook pregnancy," according to Stevens, and Mei Xiang has become a "picture-perfect mom," says Suzan Murray, the Zoo's chief veterinarian. But the birth of Tai Shan, the Zoo's robust male baby panda, also was a milestone in a long road of scientific labor by National Zoo staff. It's a road that reaches back more than 30 years to the Zoo's first panda pair, Ling-Ling and Hsing-Hsing, and winds around the globe to the panda breeding centers of China.

JoGayle Howard, National Zoo reproductive physiologist, has walked much of that road. Arriving at the Zoo in 1980, she recalls, "I lived through every spring when Ling-Ling would come into heat, Hsing-Hsing would again not quite get the knack of mating and then late in the game, people panicked and thought, 'Can you do artificial insemination?' "

The National Zoo could and did, but in those early years, the optimum time to conduct the insemination was a mystery.

Veterinarian Carlos Sanchez gives male panda cub Tai Shan a quick eye exam on Sept. 19 during the baby panda's sixth medical exam. The 2-month, 10-day-old cub weighed 9.57 pounds and was 22.51 inches long. (Photo by Jessie Cohen)

"We only knew about one female and one male," she says of the Zoo's early experience with pandas, "so it was hard to learn anything. It was hard to develop techniques for semen handling and for artificial insemination."

Studies in China

To craft those techniques and deepen their understanding of giant panda reproductive biology, Howard and other National Zoo scientists began traveling to China several times a year, starting in the late 1990s.

"It was a huge effort," Howard recalls. "Every time we went to China, we probably had 20 trunks of equipment. Almost everything in the Zoo's hospital and reproduction labs went with us."

The goal of the giant panda global breeding program is to develop a self-sustaining, genetically diverse population. As a first step, a biomedical survey of captive giant pandas in China was organized by David Wildt, chair of the National Zoo's Department of Reproductive Sciences, and conducted from 1998 through 2000.

Teams of scientists from the United States and China worked hand-in-hand to assess the health, reproduction, behavior, genetics and nutrition of 61 animals. These pandas were kept at major breeding and research centers in China, including in the cities of Chengdu, Wolong and Beijing.

(continued)

To learn about panda diseases, the scientists looked at healthy and unhealthy animals. They studied the reproduction of males and females and evaluated techniques for collecting, storing and using panda sperm.

The Americans drew on China's decades of experience in breeding pandas. In turn, they shared American expertise in such areas as the use of molecular genetics to establish proper pedigrees for China's captive pandas, essential information for managing breeding programs.

"We were able to do critically important research projects, one right after another," Howard says of the China experience. "That's where we learned about giant panda biology."

In December 2000, a female giant panda, Mei Xiang, now 7, and a male, Tian Tian, now 8, came to live at the National Zoo under a loan agreement with China.

Tracking ovulation

Studying such a large number of animals helped the Zoo come to grips with some of the challenges that breeding giant pandas presents. One of the biggest problems is that adult female pandas ovulate only once a year and are fertile for about 24 to 48 hours.

To predict the timing of ovulation, Zoo scientists used such methods as vaginal cytology (the study of vaginal cells). Mei Xiang has been trained to cooperate in these exams without anesthesia. This means Stevens can routinely reach into the panda's cage and use a sterile swab to take a vaginal sample.

Staining the sample and looking at the cells under a microscope reveals changes in cell type and cell color that forecast peak estrus and ovulation. "The color shift that the cells go through gives us a prediction that we're two weeks or two days away from peak ovulation," Howard says.

The Zoo's research also has enhanced its use of hormonal monitoring. Every day this past year, Zoo staff collected urine from Mei Xiang's enclosure floor. The urine was analyzed by Zoo endocrinologists Steve Monfort and David Kersey to monitor Mei Xiang's rising estrogen levels, helping to pinpoint the hormone surge that marks peak estrus.

Top: JoGayle Howard, left, watches an image of female giant panda Mei Xiang's cervix on a video monitor, transmitted electronically by the laparoscope she is holding. The instrument allowed her to position a catheter into the animal's uterus during a March 11 artificial insemination. Biotechnician Lena May Bush injects male giant panda Tian Tian's semen into the catheter as Veterinarian Carlos Sanchez looks on. (Photo by Jessie Cohen)

Bottom left: This Aug. 1 Web camera image shows 23-day-old Tai Shan in the protective grasp of his mother. Bottom right: A sturdy, healthy Tai Shan during his second health exam on Aug. 8. He weighed 2.6 pounds and was 14.25 inches long. (Photo by Jessie Cohen)

Single insemination

Having a precise idea of Mei Xiang's moment of maximum fertility was necessary for Howard's high-stakes approach to artificial insemination. Female pandas must be anesthetized each time they are artificially inseminated. Pandas at Chinese breeding centers are anesthetized from three to as many as seven times during estrus. The National Zoo wanted to show that, by using urinary hormones to determine optimum timing, a single, well-timed artificial insemination could impregnate a panda, avoiding the stress of multiple anesthetizations.

Howard's approach involved putting Tian Tian's sperm directly into Mei Xiang's uterus, "to make sure all of the sperm would really get to where it needed to be." On March 10, 2005, Mei Xiang reached peak estrus and ovulated. Tian Tian was introduced and showed promising behavior but failed to mate. Early the following morning, fresh semen was collected from Tian Tian, and Mei Xiang was

anesthetized for a single artificial insemination.

For the procedure, Howard used a laparoscope—a thin telescope with an attached fiber-optic light—that had a secondary channel for the insemination catheter, an instrument designed for inseminating large dogs. Such a laparoscope "had never been used in wildlife before, and especially not on a panda," Howard says.

The reproductive physiologist inserted the laparoscope into the vagina to visualize the cervix, then threaded a long catheter through the secondary channel on the laparoscope and continued passing it through the cervix and into the uterus. Howard then was able to deliver Tian Tian's sperm through the catheter into Mei Xiang's reproductive tract. The insemination was timed to take place approximately 12 to 24 hours after peak estrus and ovulation.

"The goal was to see if one insemination works," Howard says, noting that she received skeptical e-mails and phone calls from other zoos in the United States and China. "You only did one?" they wanted to know. "And that's when I got nervous," says Howard, who responded, "Yes, we only did one, but we think we really got it right."

With birth, new questions

And the rest is panda-cub history. Except that Tai Shan's birth really only extends the Zoo's research road. Care of the baby panda—and its parents—poses as many new questions as were answered in the years of study that went into producing the offspring.

"A lot of panda medicine is a matter of establishing 'normals,' " Murray says. "There's not much known about pandas in the wild or in captivity, so if you have an animal get ill or you're just trying to make an assessment, you need to have an idea of what normal is, so you can compare."

For Tai Shan, every routine exam adds to the database of what constitutes normal health and development in infant pandas. His first health check up came 25 days after he was born. Since then, at frequent intervals, Zoo staff have weighed the cub and measured his foot length and the distance from his nose to the tip of his tail. They have palpated his abdomen, recorded heart and respiration rates and taken his temperature. They recorded when his eyes opened (day 47) and when his first needlelike teeth erupted (day 96).

"Then we talk to institutions like San Diego [the San Diego Zoo, whose panda, Bai Yun, has borne three cubs since 1999]," Murray says. This lets them compare Tai Shan's weight gain with that of other cubs born in captivity. "Our guy seems to be right at the head of the curve there; he seems big."

Essential fieldwork

All of these investigations into panda health and the effort to breed the animals are taking place because giant pandas are one of the most endangered species on Earth. Zoos want to breed more pandas so that someday, animals can be put into the wild to augment dwindling populations. Tai Shan himself will eventually be sent to a Chinese breeding center.

Meanwhile, National Zoo scientists are deeply engaged in fieldwork in China, such as mapping panda forests through the use of satellite imagery and conducting wildlife surveys in the 44 remote reserves that make up the giant pandas' highly fragmented habitat. In fact, more than half of the Zoo's overall effort to help pandas is devoted to field research.

"The fieldwork is absolutely essential," Howard insists. "A lot of fuss is happening because of this one baby, but the moment of truth is in the habitat, whether pandas can survive in some of these habitats."

Through their continued research and training of Chinese conservation biologists, scientists at the National Zoo are helping to give giant pandas better odds of survival, both in the wild and in zoos and breeding centers around the world. ❖

Care of the baby panda poses as many new questions as were answered in the years of study that went into producing the offspring.

Endocrinologist David Kersey uses Mei Xiang's urine to monitor her estrogen levels on March 9, two days before she was artificially inseminated. (Photo by Jessie Cohen)

Evidence of violent death adds mystery to mummies found in remote Mongolian cave

By John Ross
Special to Inside Smithsonian Research

A tuft of brunette hair still clings to the head of the slight, 20-something woman. Dead for 600 years, her flesh has turned a creamy tan. She is patchy and frayed, but irrefutably human.

"We know she died violently," says Physical Anthropologist Bruno Frohlich, standing beside the mummy, which lies in the bed of a gleaming white Siemens Somatom CT scanner on the third floor of the Smithsonian's National Museum of Natural History.

The woman and eight other mummies, pulled from a remote Mongolian cave in the southern Gobi Desert, are on loan to the museum as part of an ambitious collaboration with anthropologists at the Mongolian Academy of Sciences in Ulan Bator, Mongolia.

In part by using data from the CT scanner, a technology that uses sophisticated computer software to generate 3-D images from two-dimensional X-rays, Frohlich and his team concluded that the woman was lying on her stomach when her murderer placed a blunt object on her neck, jerked her head back and dislocated the vertebrae in her neck. So violent was the action that her teeth clamped down, severing the tip of her tongue.

The remaining soft tissue of the other mummies—three infants, four adult males and a child—also bear marks of a violent end. A coil of rope winds around the neck of one of the children.

Local herders first told Mongolian officials in 1974 about the mummies inside the Hets Mountain Cave, three miles north of Mongolia's border with China. The herders in this treeless and largely roadless desertscape believed that the bodies represented the family of a local Buddhist Lama who went on a rampage and killed them in the late 1930s. Several Mongolian anthropologists, however, postulated that the bodies were much older.

Increased visitation to this area and concern about vandalism prompted Naran Bazarsad and Natsag Batbold of the Institute of Archaeology at the Mongolian Academy of Sciences to contact Frohlich. Together, they organized a joint excursion with the Institute and the

Left: After removing the mummified remains of nine people from an underground cave in Mongolia, Bruno Frohlich, at right, and colleagues from the Mongolian Academy of Sciences examine one of the bodies before preparing it for transport to the United States. (Photo by Bruno Frohlich)

Opposite: At the National Museum of Natural History, David Hunt, left, and Bruno Frohlich prepare a mummy for its entry into the museum's CT scanner. (Photo by Don Hurlbert)

Smithsonian to retrieve the mummies.

In the spring of 2004, Frohlich and his Mongolian colleagues drove 559 miles south from the capital city of Ulan Bator along unpaved tracks, carefully coordinating their movements with the Mongolian army, which oversees a highly militarized border with China. The scientists located the cave entrance—a hole the size of a manhole cover—then descended 30 feet with the aid of a rope into a cave with two rooms, each the size of a small living room.

Although looters had disturbed some of the bodies—some skulls had been taken—six of the nine bodies lay stacked in a heap in the front room largely undisturbed. The position of the bodies, Frohlich says, suggests that they were killed quickly, without ritual.

The dry and sterile cave conditions resulted in a "rapid process of natural mummification," Frohlich notes. This led to preservation of up to 80 percent of the soft tissue in some of the bodies, including muscle, skin, intestinal tissue, nails and hair. Whereas a skeleton alone can reveal a wealth of information, finding preserved soft tissue is "like opening a treasure box," Frohlich explains.

After spending some time in the Institute of Archaeology, the crated mummies traveled via Korean Air in 2005 to Washington, D.C. Radiocarbon dating by Frohlich established that the Mongolians died about 1300 A.D. This was during the Yuan Dynasty, when descendants of Mongol leader Genghis Khan ruled Mongolia from Beijing. By 1368 A.D., popular uprisings among the Chinese would help end the Yuan Dynasty and the Great Mongolian Empire.

"It was a difficult and transitional time in Mongolia," Frohlich explains. "We're hoping that the mummies can tell us more about it."

The historical record suggests that the Mongolian population suffered profound malnutrition during the Yuan Dynasty, as Mongolian leaders diverted resources to China. Frohlich and Smithsonian Physical Anthropologist David Hunt will examine the skeletons for clues to the long-term nutrition of the people whose remains were found in the cave.

CT scanning will enable the scientists to examine the contents of the mummies' stomachs, small intestines and colons. Food trapped between their teeth and dental wear patterns may provide additional clues to dietary habits.

Frohlich and colleagues plan to conduct more digital autopsies using the CT images, consult a forensic expert on hanging and bring in a forensic pathologist to examine the preserved skin. DNA samples sent to the Henry C. Lee Institute in New Haven, Conn., will help establish ethnicity and determine whether the people in the cave were related.

As for the details surrounding the grim fate of these nine people, it's too early to know much yet. "We'll sort through this enormous amount of material and see what it tells us," Frohlich says.

In the meantime, these long-dead people have sparked a lively dialogue among Mongolian scientists and Smithsonian experts. The Mongolian Academy of Sciences, the Smithsonian and the University of Ulan Bator—where an anthropology and biological anthropology master's degree program has just been established— are working to start an exchange program of students and scientists. ❖

Lighthouse postcards find a harbor on the Internet

By Michael Lipske
Special to Inside Smithsonian Research

President Thomas Jefferson signed the order to build the lighthouse at West Quoddy Head in Lubec, Maine, in 1806. Rebuilt in 1858, and still standing on the easternmost point of mainland United States, the lighthouse's beacon, now automated, can be seen some 18 miles out to sea. Painted in alternating 25-inch-wide red-and-white stripes, this colorful 49-foot-high brick building has long been a popular subject for calendars and postcards sold along Maine's northern coast.

In fact, just such a Kodachrome postcard from the 1950s, titled "West Quoddy Light," can be found tucked away in an archival box at the Smithsonian's National Museum of American History, Behring Center, along with a large selection of other lighthouse postcards. Donated to the Smithsonian decades ago by a hobbyist collector, the postcards depict lighthouses in 25 states and Canada.

The collection is maintained as a research tool by the museum's Division of Engineering, says Jeffrey Stine, chair of the Division of Work and Industry. "Documenting large engineering projects, such as dams, bridges, tunnels and lighthouses, is a special challenge for a museum curator. We cannot go out and collect these objects, so we collect models, drawings, photographs, postcards and other items that tell their histories."

Studying the cards, Stine says, "can lend insight to such questions as: What did these lighthouses and their seascapes and harbors look like 50 to 100 years ago? What materials were used in their construction? How did lighthouse architecture vary from region to region?"

This Photochrome-era postcard published for Bromely and Co. Inc. shows Maine's West Quoddy Head lighthouse.

Going online

Today, thanks to the work and dedication of volunteer curator Morton Goldman, this unusual collection has been liberated from its cardboard storage box and made accessible to all at the Web site american history.si.edu/collections/lighthouses.

To navigate the site, visitors can click lighthouse icons on coastal maps, browse regional or state lists of lighthouses or scroll down a list of lighthouse names. Each postcard has its own page, with a front and back view of the card, along with such information as height, year built and, for active lighthouses, the beacon's flash sequence. West Quoddy Head's light, for example, flashes around the clock in the sequence two seconds on, two seconds off, two seconds on, nine seconds off.

Nautical charts

A former avocational sailor who once piloted his 30-foot sloop around the Chesapeake Bay and sailed chartered sailboats in the Caribbean, Goldman knows lighthouses as aids to navigation, not just as subjects for seaside vistas. In creating the Web site, he worked closely with the National Oceanic and Atmospheric Administration, which contributed customized nautical charts that pinpoint the location of each lighthouse and its surroundings.

"My purpose was to give the landlubber a view of how lighthouses were used by sailors, in conjunction with charts, to find out where they were and where they needed to go," Goldman explains.

Goldman's work for the postcard Web site required months of research into the history of the 272 lighthouses it features. "There are lots of lighthouse books that have small errors that get perpetuated," says Stine, the project's director. "Mort's cross-referencing and use of data were really quite sophisticated and detailed."

Goldman frequently sought help—e-mailing questions along with pictures of postcards—from the large community of lighthouse history buffs and preservationists around the country. He also scoured

the Internet for Web pages and books to add to the site that offered additional details, photographs and histories of specific lighthouses.

In addition, the Web site holds the potential of expanding to include images and information about the many other lighthouse artifacts in the Smithsonian's collection. These include Fresnel lenses (invented in 1822 by Frenchman Augustin Fresnel, the lens produced a much brighter light than the reflectors then being used), old lighthouse lamps and the tools used to maintain them, and even uniforms worn by lighthouse keepers.

Postcard dating

For a historian, handwritten dates and postmarks on a postcard can help determine when the photograph on its front was taken. Yet only a handful of the cards in the Smithsonian lighthouse postcard collection were ever used for correspondence, making dating them a challenge.

To assign periods to the undated cards in the collection, Goldman had to acquaint himself with a dating system long used by deltiologists, or postcard collectors. Cards with divided backs, for example—the left side devoted to correspondence and the right to stamp and address—belong to the Divided Back Era, which began in 1907. Photochrome postcards, using new color printing technology, first first appeared in 1939.

"This online exhibit testifies to the critical role played by volunteers in the work of the Smithsonian," Stine says. "The depth of research that Mort put into this project is extraordinary."

Having spent a great deal of time in New England as a student and researcher—"everywhere you looked, there were lighthouses"—it came as a surprise to Goldman that the state containing the most lighthouses is neither Maine nor Massachusetts. Bordered by three of the Great Lakes, Michigan has the most lighthouses. ❖

Top: A white border dates this Early Modern Era postcard from 1915 to 1930. Middle: This early 1900s postcard shows the harbor of Duluth, Minn. Bottom: The Hudson, N.Y., lighthouse appears on this Early Modern Era card. All of the lighthouses shown here are still active aids to navigation.

Stone sculptures yield clues to Cambodia's ancient Khmer culture

By Virginia Myers Kelly
Special to Inside Smithsonian Research

With cracks in his smooth stone belly and his plump arms severed at the elbows, the statue of the god Shiva from Cambodia's Angkor Wat region is not the imposing figure he once was. Shiva's regal head, crowned in a conical diadem, still towers above the faithful who arrive to place offerings of flowers where his feet—long lost in the countryside of Cambodia—should be.

At the National Museum of Cambodia in Phnom Penh, art conservators are slowly resurrecting Siva—the Hindu god of restoration and destruction—and other stone sculptures dating from the sixth to 13th centuries. There is Vishnu, preserver and sustainer of life, his legs and torso intact but arms and head missing; Buddha, still highly revered despite this particular statue's head-only state; and King Jayavarman VII, his benign visage perched atop an armless torso.

Jayavarman VII, one of the most notable rulers of Angkor, reigned when that kingdom's elaborate temples were the center of a complex civilization. "Angkor was the most extensive preindustrial city in the world," explains Conservation Scientist Janet Douglas, who is working hard to discover more about Jayavarman's past. "It was a huge civilization that we're just beginning to understand."

Douglas, of the Smithsonian's Freer Gallery of Art and Arthur M. Sackler Gallery, is conducting petrographic detective work on 29 samples of stone obtained from Khmer sculptures, such as the one of Jayavarman. Bertrand Porte, the École Française d'Extrême-Orient conservator who sent Douglas the samples, is painstakingly piecing the statues together.

Before Douglas began her investigation, art historians weren't sure exactly what types of stone the ancient carvers used and where it was quarried. In her laboratory, she has begun to unlock these secrets.

This general lack of knowledge of Ankor's statues has been aggravated by a

Left: In her laboratory, Janet Douglas uses a microscope to study a stone sample from a statue of King Jayavarman VII. (Photo by Michael Bryant)

Inset at left: This micrograph of a thin section of sandstone from the King Jayavarman VII statue shows it is made up of large quartz and feldspar grains (gray and white) in a finer matrix of feldspar laths and iron hydroxide minerals.

Opposite top: The National Museum of Cambodia in Phnom Penh. Opposite bottom: National Museum of Cambodia staff pose with a sculpture of King Jayavarman VII dating to the 12th to 13th century. This photo was taken shortly after the statue's conservation. (Photos by Bertrand Porte)

number of factors. Tangled in jungle temples long buried by time, the statues were made inaccessible by years of war and political instability in Cambodia, land mines, unpaved or nonexistent roads, and a population that only recently has begun to appreciate the significance of its national treasures.

Douglas' work is limited by a dearth of samples of reliable provenance. "By removing minute stone fragments from select spots on the statues, Porte has provided a rare opportunity to analyze the stone used by the Khmer," with minimal harm to the artworks, Douglas says. Normally, "taking samples from sculpture is to be avoided, because we do not want to cause further damage to these historically important works of art."

In a lab at the Freer and Sackler galleries, the precious Khmer stone samples are stored near other artifacts under Douglas' purview—among them fifth-century Korean gold earrings, an ancient jade ax and a dagger crusted with decayed cloth. The stone fragments look dull beside these treasures until she looks at them using a petrographic microscope.

The Khmer sculpture samples are all composed of various types of sandstone. Sliced into translucent slivers and attached to microscope slides, the tiny brown stone samples, when magnified, become dazzling mosaics of jagged shapes fitted together like an ancient puzzle.

Douglas is using petrographic microscopy to categorize the sandstone fragments based on their grain types, using color, shape, texture and other rock characteristics, such as porosity and cementing materials. Douglas conducts higher magnification studies on a scanning electron microscope, where chemical compositional information can be collected on the grains within the sandstone.

Cathodoluminescence microscopy is another tool being applied with the help of Sorena Sorensen, a geochemist in the Department of Mineral Sciences at the Smithsonian's National Museum of Natural History. This method uses electrons to bombard a sandstone sample until it emits light to produce an image resembling brilliantly colored abstract art. These images are then analyzed to characterize the color, size and texture of the mineral grains.

Using these analytical tools, Douglas can see past the gray sandstone and begin to consider its unique characteristics that are hidden on a microscopic level. Distinctions among the sandstones are based on relative amounts of various rock grains, such as quartz, feldspar, igneous, limestone and basalt, as well as natural cementing materials, weathering and geologic origins of certain grains.

In her examinations, Douglas has discovered that five of the samples are composed of grains weathered from igneous rock sources. This leads her to conclude that an important group of sculptures carved in the Bayon style and dated to the 12th to 13th century most likely originated from a common source, such as Cambodia's Kulen Mountains.

At the National Museum of Cambodia, Porte continues to restore the sculptures as they become available. Although Porte's efforts are dwarfed by the vast challenges of his location, Douglas is reinforcing his work in her laboratory on the National Mall. She expects that her research will someday help art historians lift the veil of mystery surrounding Angkor's long-obscured past and its remarkable Khmer artisans. ❖

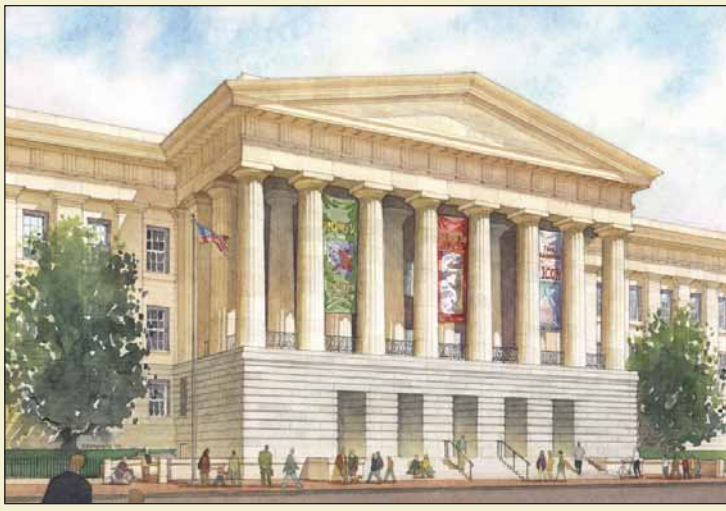
Using analytical tools, Douglas can see past the gray sandstone and begin to consider its unique characteristics that are hidden on a microscopic level.

Coal Age fossil. A 16.5-ton fossil of a giant scale tree (Lepidodendron)—the largest ever collected—was donated recently to the Smithsonian's National Museum of Natural History. Found in the late 1970s in Pella, Iowa, the fossil shows the intricate pattern of "scales" that give the tree its name. Fossil scale tree bases are well-known, but this complete specimen reveals the elegant branching pattern characteristic of this group of plants and, as a result, is exceptionally rare.

African art donation. A magnificent 525-piece collection of traditional African art was donated by the Walt Disney World Co. to the Smithsonian's National Museum of African Art. Known as the Walt Disney-Tishman African Art Collection, it includes most major styles of African art, ranging from a highly abstract Cameroon mask to a naturalistic carved wooden male figure from Madagascar. The variety of materials, types of objects and styles in this collection make it one of the world's finest.

Ivory figure carved by Nigeria's Edo people, from the Disney-Tishman Collection

Reynolds Center. The Donald W. Reynolds Foundation recently gave a $45 million gift to the Smithsonian for the renovation of and for exhibitions in the Smithsonian's National Portrait Gallery and the Smithsonian American Art Museum. This gift, combined with the $30 million contribution from the foundation in 2001 for the acquisition and display of the Gilbert Stuart "Lansdowne" portrait of George Washington, makes the Reynolds Foundation the second-largest donor to the Institution. In recognition of these gifts totalling $75 million, the two museums located in the historic Patent Office Building in downtown Washington, D.C., will be known as the Donald W. Reynolds Center for American Art and Portraiture.



The F Street entrance to the Donald W. Reynolds Center for American Art and Portraiture, opening July 2006

New director. Camille Giraud Akeju, former president and chief executive officer of the Harlem School of the Arts Inc. in New York City, has been named director of the Smithsonian's Anacostia Museum. As director, Akeju will oversee the museum's many innovative exhibitions, educational programs and publications that focus on a variety of African American topics. The collections of the Anacostia Museum feature significant holdings in African American art, religion and photography, with a focus on community and family history.

"The Last Trek" (detail) a drawing by J.E. Millais in the Russell E. Train Africana Collection

Africana Collection. Smithsonian Institution Libraries has acquired a collection of approximately 2,000 books and an extensive array of manuscripts, photographs, watercolors, sketches, maps, newspaper clippings, artifacts and other ephemera related to early British and American explorers in Africa. The Russell E. Train Africana Collection consists of first-person accounts of expeditions to Africa, ranging from those of French scientist and traveler Francois le Vaillant in the 1780s to a safari undertaken by Ernest Hemingway in the 1950s.

Roberts elected chancellor. John G. Roberts, Chief Justice of the United States, was elected chancellor of the Smithsonian by the Board of Regents, the Institution's governing body, on Nov. 9. As chancellor, Roberts is the presiding officer of the board. Since the Smithsonian's establishment in 1858, the Institution has had 15 chancellors—12 were chief justices and three were vice presidents of the United States.

Study shows soil microbes could become major source of atmospheric CO_2

In a modest greenhouse at the Smithsonian Environmental Research Center on the Chesapeake Bay, a dozen clumps of marsh grass sprout from pots made from inexpensive plastic PVC pipe. After subjecting the plants to a carbon-dioxide (CO_2) rich atmosphere, scientists covered each pot with an airtight cap. They then sampled the gas released, or "exhaled," inside the caps.

Smithsonian biologists Patrick Megonigal, Amelia Wolf and Bert Drake found high levels of CO_2 inside the caps that had been emitted by both the grass and microbes in the soil in which the grass was growing. Surprisingly, the researchers found, the soil microbes were consuming not only freshly dead plant detritus but also large amounts of very old soil detritus."

"High levels of atmospheric carbon dioxide stimulate microbial activity in soil," Megonigal explains. "It has a priming effect that accelerates the decomposition of older, more stable carbon in the soil and releases it into the atmosphere as carbon dioxide gas."

The findings represent a new twist for scientists trying to predict the impact rising levels of CO_2 will have in coming decades as industrialization increases. Previous studies have shown that plants respond to increased CO_2 by growing faster and absorbing more carbon, a phenomenon some have come to regard as a critical hedge against swift global warming.

Yet, increased plant growth means more decaying vegetation. As fungi, bacteria and other communities of soil microbes attack this decaying material, they also attack the soil, seeking nutrients, such as nitrogen, that dead plants don't provide in abundance. In the process, "older, stable carbon in the soil is released into the atmosphere," Megonigal says. In the experiment, microbe respiration of this old soil detritus increased by 157 percent in pots exposed to elevated CO_2.

The use of old soil detritus by microbes is of concern because vast amounts of carbon reside in the soil. "Twice as much carbon resides in the soils as stable detritus as is found in the atmosphere as CO_2," Megonigal explains. Thus, increased use of soil detritus by microbes could mean more CO_2 will be emitted into the atmosphere where it will contribute to global warming.

"The equation is a bit more complicated than just the impact that humans will have on the atmosphere," Megonigal points out. "The soil and oceans are going to have a lot to say."

—John Barrat

Above: Patrick Megonigal examines marsh grass in a greenhouse.

Painter LeRoy Neiman donates his papers to Archives of American Art

A paint-splattered jumpsuit, sketchbooks, newspaper clippings, memorabilia and thousands of letters are some of the items inside 90 boxes of archival material recently donated by renowned American painter LeRoy Neiman to the Smithsonian's Archives of American Art.

LeRoy Neiman

"The collection is most notable for its sheer volume and Neiman's enormous reach into popular culture—the magnitude of the people he's painted and his means of distribution," Archives of American Art Curator Liza Kirwin says. Those "means" have included Wheaties cereal box covers, souvenir posters distributed by Burger King and the pages of Playboy magazine, to which Neiman contributed sketches and paintings for the column "Man at His Leisure."

"LeRoy has been a highly visible figure in American culture," says Liz Gill Neilson, Neiman's personal archivist. "If something big was going on, he was there."

Neilson produced a detailed index of Neiman's archives to help researchers navigate the huge collection. "Looking into these files really gives you a sense of LeRoy's works in the context in which they were created," Neilson explains. "One can view several types of materials—such as letters, artifacts and catalogs—all together in the context of a certain 'project,' which might be an event or specific work or series."

The Archives of American Art provides researchers with access to the largest collection of documents on the history of the visual arts in the United States. The collection totals more than 13 million items, consisting of the papers of artists, dealers, critics, art historians, curators and administrators and the records of art dealers, museums and other art-related businesses, institutions and organizations.

Neiman, 84, is still hard at work, and his expectations for his archives are modest. "I will be pleased if my work succeeds in reaching the maximum number of eyes," he says. "Meanwhile, my responsibility is to continue in my art, maintaining the highest level of quality possible."

—Barbara Wells

Extreme Nature, by Mark Carwardine (Collins, 2005, $34.95). An informative and lavishly illustrated guide to the weirdest and most remarkable living organisms on our planet—from the hungriest animal to the deadliest plant.

More Than Words: Illustrated Letters From the Smithsonian's Archives of American Art, by Liza Kirwin (Princeton Architectural Press, 2005, $24.95). A compilation of personal letters by some of America's most revered artists. Each letter is adorned with an illustration.

Smithsonian Intimate Guide to Human Origins, by Carl Zimmer (Collins, 2005, $29.95). A journey from the savannahs of Africa to modern-day laboratories of biomechanical analysis and biomolecular genetics, revealing how anthropologists are swiftly revising the human family tree.

Retratos: 2,000 Years of Latin American Portraits, by Elizabeth P. Benson [et al.] (Yale University Press, 2004, $65). This richly illustrated book is the catalog accompaniment to a groundbreaking exhibition that explores Latin American art and history through portraiture.

Aviators: A Photographic History of Flight, by Michael J.H. Taylor (Collins, 2005, $24.95). Historic photographs selected from the archives of the London Times vividly tell the compelling story of a century of powered flight—from Kitty Hawk to the jet age.

A Revision of the New World Species of the Shore-Fly Genus *Nostima* Coquillett (Diptera: Ephydridae), by James F. Edmiston and Wayne N. Mathis (Smithsonian Contributions to Zoology 623). Thirty-eight New World species of shore flies are revised, with 21 new species named and described.

War at Sea in the Age of Sail, 1650-1850, by Andrew Lambert (Collins, 2005, $29.95). A comprehensive look at key naval conflicts, from the highest strategic level to the experiences of the ordinary sailor. Fully illustrated. From the Smithsonian History of Warfare series.

The Mighty Sparrow First Flight: Early Calypsos From the Emory Cook Collection (Smithsonian Folkways Recordings, 2005, $15). Eighteen tracks recorded between 1956 and 1959 by the unrivaled Calypso king of the world, Sling Francisco, aka, the Mighty Sparrow.

Snooks Eaglin: New Orleans Street Singer (Smithsonian Folkways Recordings, 2005, $15). This 1959 acoustic blues album by Snooks Eaglin showcases his idiosyncratic and passionate singing and guitar-playing. On CD for the first time, with seven previously unreleased tracks.

Books listed on Pages 14 and 15 can be ordered through online book vendors or purchased in many bookstores nationwide. The Smithsonian Contributions publication listed here can be requested by sending an e-mail to schol.press@si.edu.

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.

Washington's Secret War: The Hidden History of Valley Forge

By Thomas Fleming (Collins, $27.95, 2005)

December 1777. Gen. George Washington has retreated from British-occupied Philadelphia with his starving, half-naked Continental Army.

The pain of the defeat is punctuated by thoughts of King George III's soldiers feasting and drinking in the taverns and sleeping in warm beds back in the City of Brotherly Love. In the dead of winter and with no chance of victory in sight, America's declaration of independence from England on July 4, 1776, seems an empty gesture to Washington's troops.

They've been kicked out of the largest city in America. To make matters worse, certain members of the Continental Congress now are publicly questioning Washington's resolve and ability to lead the army.

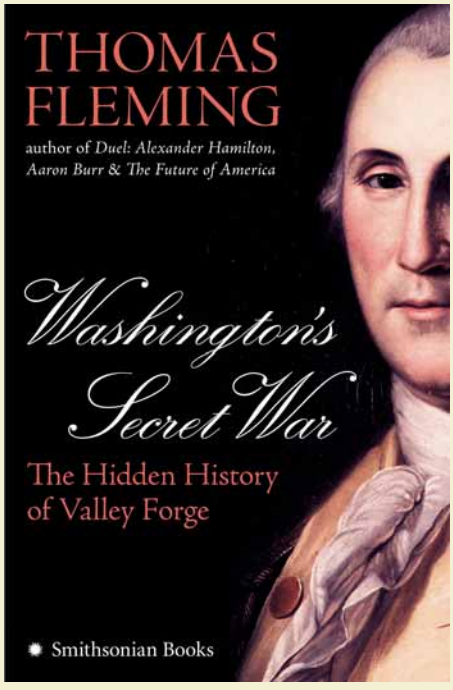
Washington's eventual triumph over his own congress, misguided political zealots and even former friends is chronicled in *Washington's Secret War: The Hidden History of Valley Forge*, a new book by celebrated historian and writer Thomas Fleming.

For three decades, Fleming has captivated critics, readers and historians with his provocative insight into American history. Now, the award-winning author of *Liberty! The American Revolution* and *Duel: Alexander Hamilton, Aaron Burr and the Future of America* returns to the American Revolution with startling revelations about Washington's private battles within the public war, conflicts that pitted him against his own government.

"George Washington's political performance at Valley Forge is nothing less than a tour de force that adds a new dimension to his historical portrait," Fleming writes in his introduction to *Washington's Secret War*.

The book offers new insight into the bitter, unseen struggles that define Valley Forge as a pivotal moment in the Revolutionary War and, most important, as a turning point for George Washington as an American leader.

"Washington never lost sight of his goal, which was not a petty personal triumph



over his adversaries but the rescue of his army, which he rightly saw as America's sole hope of victory in a long, bloody war," Fleming writes. "To achieve that aim, he had to out-think the conspirators who sought to destroy him and persuade others to out-vote the congressional ideologues whose wrongheaded policies were the source of the Continental Army's woes."

Fleming offers a fresh look at every aspect of Valley Forge, including thoughtful characterizations of such notable figures as Martha Washington, a revised assessment of the profile of the Valley Forge soldiers, and an in-depth examination of the ideological and societal forces that set civilian against military, rich against poor and general against general.

The result is an inspiring David-and-Goliath tale of a beleaguered army that defeated one of the world's strongest military powers.

Fleming's 350-page book contains 27 illustrations, including maps and portraits of some of the primary characters of the American Revolution, such as the wealthy Marquis de Lafayette, a major general in the Continental Army at 19 and a key player in the defeat of Washington's enemies during the Valley Forge winter. A second portrait is of Quartermaster General Thomas Mifflin of Pennsylvania, who was called the "pivot" of a plot to force General Washington to resign.

With *Washington's Secret War*, Fleming peels away the layers of illusion and myth surrounding the father of our country to reveal a leader with tenacity, vision and inspiring humanity.

Washington's Secret War masterfully tells the story of the man who would become America's first president, outmaneuvering his political enemies, holding his army together and rescuing the revolution from extremism. It is a spellbinding account of George Washington's political will to win.

—Daniel Friend

CIGNA firefighting collection given to National Museum of American History

George Washington did it. So did Benjamin Franklin. In fact, many prominent early Americans dropped what they were doing when they heard alarm bells ringing and rushed to fight the fires that periodically broke out in their communities. In an age when distinctions of class and economic status were as rigorously observed as they ever have been in the United States, bluebloods and the merely rich stood shoulder-to-shoulder with shopkeepers and laborers against the common enemy of flame.

Recently, the Smithsonian's National Museum of American History acquired a treasure trove of nearly 4,000 historical artifacts and works of art representing two divergent aspects of this country's past: its maritime traditions and its involvement in firefighting. The collection was donated by the insurance company CIGNA Corp.

Many of the artifacts date from the golden age of volunteer firefighting, about 1825 to 1875. The collection also includes objects from as early as 1750, when firefighting efforts in young Colonial communities were less coordinated but no less earnest. Artifacts range from pressed-felt parade hats and metal hose nozzles to paintings of historic fires, firefighting helmets crested with American eagles, a full-size horse-drawn ladder truck and a steam pumper.

"It's an extraordinary collection," says Bill Yeingst, chair of the American History Museum's Division of Home and Community Life. "It charts the changes in firefighting history from voluntary, community-based organizations to municipally funded professional units."

Leather water buckets—some decorated with eagles and other symbols of liberty and vigilance, along with initials and dates—occupy a special place in the history of firefighting in America, Yeingst points out.

"Before the first water lines were laid, citizens were asked to keep these buckets in their homes. When a fire broke out, people would fill the buckets from barrels, cisterns or other nearby water sources. Until the late 18th century, fighting fires was a shared responsibility of every citizen." —*Donald Smith*

This colorful felt parade hat from the Schuylkill Hose Company of Pennsylvania dates to 1833. (Photo by Richard Strauss)

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