



CULTURAL HISTORY

Radio documentary brings to life stories and voices of former slaves

By Vicki Moeser
Smithsonian Office of Public Affairs

A two-hour radio documentary, "Remembering Slavery," produced by Smithsonian Productions, is a first-person account of slavery and its legacy in the United States. Stories of childhood memories are told by former slaves in their own voices from restored recordings and by dramatic readings of interview transcripts by actors Debbie Allen; Clifton Davis; Lou Gossett Jr.; James Earl Jones; Jedda Jones; Esther Rolle, who has since died; Melba Moore; and John Sawyer.

"In the first hour, we hear stories of bondage, slave auctions, life on the plantation, master-slave relationships, beatings and escapes," says series producer Jacquie Gales Webb. "The second hour takes listeners through the former slaves' experiences during the Civil War, their first days of freedom, their lives as sharecroppers, Reconstruction and their lives up to the time of the interview."

"We were slaves," said 101-year-old Fountain Hughes, whose grandfather belonged to Thomas Jefferson. "We belonged to people. They'd sell us like they sell horses and cows and hogs."

The first-person interviews with the former slaves were conducted in the 1930s and 1940s as part of President Franklin Roosevelt's Work Projects Administration, known as WPA. The massive work relief program included the Federal Writers Project. About 7,000 people worked for the FWP, including novelists, poets, professors and journalists.

The FWP collected information and published books of folklore, life stories of workers and immigrants, and interviews with sharecroppers and former slaves. The "Remembering Slavery" stories are among approximately 3,000 interviews recorded by FWP workers by hand and on early mechanical recording machines.

"If I thought I'd ever been a slave again, I'd take a gun and just end it all right away, because you're nothing but a dog," continued Hughes, whose interview was recorded in Baltimore in the 1940s. "You're not a thing but a dog."

Kathie Farnell, with the Alabama-based Institute of Language and Culture, developed the concept for the radio documentary in 1995 while doing research on the WPA at the Alabama Department of



Jacquie Gales Webb, left, and actress Debbie Allen look over a script in the Smithsonian Productions recording studio located in the National Museum of American History. (Photo by Hugh Talman)

Archives and History. Her research led her to the Library of Congress, where she learned about the recordings of interviews with former slaves.

"Soon afterward, I became familiar with Jacquie Gales Webb's work on 'Black Radio' [a Peabody Award-winning radio series on the role of radio in the African American community] through an article in Smithsonian magazine," Farnell says. "I contacted her, and we decided to join forces." Farnell served as the project manager and co-producer of "Remembering Slavery." Wesley Horner, a radio production specialist for Smithsonian Productions, was executive producer.

The project took a little more than a year to complete. Funding was provided by the National Endowment for the Humanities,

the Corporation for Public Broadcasting, the Southern Humanities Media Fund and the Alabama Humanities Foundation. The documentary is distributed by Public Radio International.

Webb spent hours reading transcripts of interviews and listening to audiotapes. "Some of the recordings were not suitable for our needs," she says. "We could not use the recordings that were

of very poor quality. A few of the former slaves interviewed had dialects or accents that were too heavy to be easily understood.

"While reading the transcripts of the unrecorded interviews," Webb adds, "I would try to hear in my mind the sound of the perfect voices to do the dramatic readings. After giving a lot of thought to who would be best, I then had to book the actors."

In the documentary, Academy Award-winning actor Lou Gossett Jr. reads a passage from an interview with Jordan Johnson, who recalled the pain of a man forced to watch his pregnant wife endure a whipping: "Husbands always went to de woods when de know de wives was due fo' a

whippin', but in de fiel' dey dare not leave. Had to stay there, not darin' even look like dey didn't like it. Charlie Jones was one slave dat had his wife workin' in de same fiel' wid him. They was plantin' tobacco—he was settin' out and she was hillin'. Annie was big wid chile an' gittin near her time, so one day she made a slip an' chopped a young shoot down. Ole man Diggs, de overseer, come runnin' up screamin' at her an' it made her mo' nervous, and she chopped off 'nother one. Ole overseer lif' up dat rawhide and beat Annie 'cross de back and shoulders til she fell to de groun'. And Charlie, he just stood dere hearin' his wife scream an' starin' at the sky, not darin' to look at her or even say a word."

Webb found that most of the actors she contacted were enthusiastic about cooperat-

ing with the project. Debbie Allen and Melba Moore came to Washington, D.C., to read their parts. Gossett taped his section in Canada, where he was filming a movie. James Earl Jones did his part in New York City. Others went to studios in California for taping. "For those who taped outside of Washington, D.C.," Webb says, "I was in touch by phone as they did their narration in the various studios."

Most of the interviews with the former slaves were transcribed in dialect. Webb left it up to the actors doing the dramatic readings to decide whether or not they would read their parts in dialect.

Todd Hulslander, production engineer for "Remembering Slavery," says there were several steps in getting the WPA tapes prepared for broadcast. "The original interviews were recorded on aluminum field disks," he says. "Some were nearly inaudible. The Library of Congress transferred the segments Jacquie selected to digital audiotape. Once they were in the 'digital domain,' we were able to work with them in the Smithsonian Productions studios."

The first step, Hulslander says, was to clean up the tapes. "To start with," he explains, "we loaded the audio into our computer hard drive. We could then use special software to remove the clicks, crackles and pops that are inherent in this early form of recording. Once we removed the record surface noise, we could then hear details from the original recording environment, such as wind or machinery, in the background. Finally, we would use a combination of equalization and the computer program to eliminate the undesirable noises and make the voices sound as clear and natural as possible."

Then, Hulslander explains, all the tracks were mixed together—the narration, the

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In the sphere of American art history, the Archives of American Art—one of the Smithsonian's smallest research units—plays an international role. More than 13 million documents make the Archives the world's largest resource for materials on American art. The breadth and variety of the collections are amazing. Materials range from artists' letters, diaries, sketchbooks, personal photographs, accounting books and business correspondence to information from their organizations, magazines and art schools. In addition, the records of art historians, architects and craftspeople are included in the collections.

Recently, the Archives assisted two cultural historians—one from Switzerland studying the origins of modern color theory, the other a Smithsonian scholar studying the impact of technology on the development of modern art. Both were elated to find among the papers of John Goff Rand, who invented the collapsible paint tube in 1841, the patent and prototype for his invention, which also is the model for the modern toothpaste tube. The Swiss researcher was astonished. "I can't believe it!" he shouted.

Such synergy occurs over and over in the Archives, where staff assist researchers and personally guide them to riches in the collections where they might not otherwise have searched. Another unexpected aspect of the Archives is its wealth of information on American artists abroad, as well as European artists in America. Since Thomas Jefferson and Benjamin Franklin, Americans have had a long-standing love affair with Paris. And since the 18th century, most American artists have traveled to France. How these creative individuals lived, where they studied and with whom, and what they saw and how it affected their own works are revealed through the Archives' collections and in its publications.

How have such collections been amassed? The answer lies in the history of the Archives, which, from its founding at the Detroit Institute of Arts in 1954, set out to become a central resource for studies in American art history. The office began by microfilming papers from institutions around the country and gradually became a repository for documents as artists, their families and various art organizations sought a "safe haven" for their precious papers.

Today, scholars may refer to the Archives' collections on microfilm at reference centers in Washington, D.C.; Boston; New York City; San Francisco; and San Marino, Calif. Scholars in other countries can request microfilm internationally through the Interlibrary Loan Program or review original documents in Washington, D.C. The files are replete with testimonials from cultural historians around the world who praise the Archives' easy access and user-friendly services.

In recent years, the Archives has made its holdings even more accessible to a greater audience through a variety of means, including its Web site at www.si.edu/artarchives and its automated catalog, which is available on the Internet. Overall, its Internet activity has increased more than 25 percent in the last year.

In 1998, the Archives formatted several of its publications for the Internet, including those pertaining to African American, Latino and Latin American artists. *A Finding Aid to the Tomás Ybarra-Frausto Research Material on Chicano Art, 1965-1997* was recently published on the Internet. The book is the latest result of the Archives' efforts to collect and make Latino materials broadly available to a wider audience. Other forms of outreach, such as finding aids and publications, include the quarterly Journal and archival displays in the New York Regional Center's gallery space. The Archives also frequently lends its holdings to museums that are mounting exhibitions.

The additional dimension that archival documents bring to the study of humanity is incalculably valuable, and the Smithsonian is proud to count the Archives among its most valuable research resources.

—Dennis O'Connor, Provost, Smithsonian Institution



Matt Nazzaro works on the cockpit canopy of the Aichi M6A1 Seiran. (Photo by Carolyn Russo)

RESTORATION

Aircraft restorers work to rebuild one-of-a-kind Japanese bomber

By Michael Lipske
Special to Research Reports

The Panama Canal crippled by airstrikes? U.S. coastal cities pocked with bomb craters? World War II had to end before Americans knew what had not hit them: A secret Japanese bomber known as the Aichi M6A1 Seiran. Fortunately, the war ran out before Japan could launch planned attacks with this airplane.

Now, the last surviving Seiran is being restored at the National Air and Space Museum's Paul E. Garber Preservation, Restoration and Storage Facility in Suitland, Md.

The Seiran was a special airplane developed to blow up the lock gates of the Panama Canal and close it to Allied shipping. To get a bomber within striking range of the canal, Japan created the first—and, to date, only—attack airplane designed to be launched from a submarine. So that a Seiran could be stowed in a watertight tube on the submarine's deck, the plane was designed with wings that folded back along the fuselage. Thus, a plane with a 40-foot wingspan was squeezed into a storage space no wider than its propeller.

Seirans were to be launched from submarines by catapult. Floats attached to the plane before launching would have enabled the bomber to carry out an attack and then return and land on water near the mother ship. A crane on the submarine would pluck the Seiran from the waves for relaunch.

Each bomber was capable of carrying two men and a payload consisting of two 550-pound bombs or one 1,760-pound bomb or one torpedo.

In August 1945, two Japanese submarines bearing three Seirans each were steaming to attack U.S. Navy aircraft carriers at Ulithi Atoll in the Pacific. Days before the submarines were scheduled to launch their bombers, Japan surrendered.

The six Seirans were scuttled before the submarines were intercepted by U.S. ships.

The still disassembled plane at the Garber Facility is, "to the best of our knowledge, the only one that now exists in the world," Smithsonian aircraft restorer Robert McLean says. Decades of outdoor storage, as U.S. Navy and, later, Smithsonian property, took a toll on the bomber. Its aluminum floats filled with rainwater until the bottoms rotted out. Sunlight

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Smithsonian scientists team up with colleagues in China to save pandas

By Mike Morgan
National Zoological Park

In zoos across the country, the giant panda has always been a favorite attraction. It may even be the world's most popular wild animal. How then can an animal that has been popular for so long be in clear danger of extinction?

Biologists at the National Zoological Park's New Opportunities in Animal Health Sciences Network, known as NOAHS Network, are working to find answers and hope their work might help save the giant panda from the brink of extinction. They have volunteered their expertise in an ongoing international effort to do so.

This past summer, during a NOAHS Network symposium at the National Zoo's Conservation and Research Center in Front Royal, Va., National Zoo theriogenologist JoGayle Howard, along with Research Associate Susie Ellis, discussed the results of a March 1998 research trip to China to work with Chinese colleagues on panda conservation efforts.

"The amount of data we collected is enormous," she said. The biologists from opposite sides of the Pacific worked together to evaluate the health and reproductive potential of 18 pandas at three institutions in China. And for the first time, they began assembling the information that will make it possible to scientifically manage a broad-based panda breeding program in China.

For the panda, it seems the effort is coming none too soon. Ellis painted a bleak picture for the black-and-white bear. "Since the advent of written history, the giant panda has declined from a population of 100,000 to no more than 1,200. Pandas survive in as many as 32 fragmented subpopulations with no opportunity for genetic exchange, and inbreeding might threaten the remaining animals," she said.

The culprit in the panda's demise is, most likely, human activities that, over thousands of years, have encroached upon the panda's natural habitat. There is ample evidence that this threat continues. The World Wildlife Fund reports that information gained from satellite pictures shows "habitat suitable for giant pandas has shrunk by 50 percent over the last 15 years."

At zoos, pandas are faring no better. While important progress has been made toward understanding the species' reproduction—with much of this physiology and behavioral data collected at the National Zoo in Washington, D.C.—the number of giant panda births at zoos around the world continues to be disappointing. "Panda deaths at zoos and breeding cen-

ters continue to outpace births," David Wildt, director of NOAHS Network, says.

Wildt, who led the March studies in China, believes that "Chinese and American biologists will be able to solve the riddle of giant panda breeding if we develop research partnerships and work hand-in-hand."

The giant panda's range is contained within China's national borders, and there also are a lot of pandas living in China's zoos. Conservation biologists see tremendous potential in the estimated 100 pandas under management at Chinese institutions and estimate that this population could double within 10 to 14 years if problems involving panda reproduction can be overcome.

Biologists in Chinese zoos are leading the charge in this effort, and it was the Chinese Association of Zoological Gardens, with the aid of the World Conservation Union, that enlisted the help of Smithsonian biologists.

Wildt's team of investigators included reproductive physiologists, veterinarians, a geneticist and an animal behaviorist. Together, they had the extraordinary opportunity to study pandas at three different Chinese institutions—the Chengdu Zoo, the Chengdu Giant Panda Breeding Center and the Beijing Zoo. The goal of the investigation was to evaluate the health, reproduction status and behavioral status of each panda; to collect and store in China biomaterials useful for future genetic evaluations; and to ensure an unambiguous identification of all individual pandas.

Six male and 12 female pandas were



From left, JoGayle Howard, David Wildt and Susie Ellis, seen here in China with panda cubs, are working with colleagues in China to save the bears from extinction. (Photo by D.L. Janssan)

examined during the study. Each animal was anesthetized and given a complete physical examination. They were tattooed, and electronic transponder identification chips were implanted under their skin. In addition, skin, blood and hair samples from each animal were collected and stored. Selected males were electroejaculated, and the sperm was evaluated. An ultrasound examination was done on each animal's abdomen, and data on blood chemistry, which is useful in diagnosing illnesses in pandas, was gathered.

Behavioral observations of each animal were recorded, and behavioral and nutritional histories were developed based on interviews with panda keepers. A spinoff of the biomedical assessments—made possible by the collection of semen from a number of animals—created the opportunity to evaluate 16 different methods of preserving panda reproductive material and to create a store of semen that will be used for future artificial inseminations.

Based on these examinations, biologists divided the animals into four categories. The categories were useful in selecting the most promising animals for breeding, as well as in determining possible short- and long-term management decisions about such things as the possible relocation of pandas to other zoos, diet adjustments and mate selections.

The studies revealed both encouraging and disappointing information about giant pandas. An encouraging revelation was that four males and nine females could be classified as prime or potential breeders. Only three animals were considered poor breeding prospects.

Only a small percentage of male pandas living in zoos are successful at producing offspring. And according to Howard, "there is only one known instance where a male panda born in captivity has fathered an offspring." Since all the males tested produced high-quality sperm, it was confirmed during the study that

the poor rate of reproduction is not due to physical problems, but is more likely the result of behavioral incompatibility.

"Information developed through efforts like these with our colleagues in China is tremendously valuable to everyone who works with the species," Lisa Stevens, National Zoo curator of primates and pandas, says. She was not surprised that behavior, rather than infertility, is the apparent problem with male pandas. "This finding," she says, "is consistent with much of our early experience with Ling-Ling and Hsing-Hsing here in Washington."

China has strict laws protecting its wild pandas from poachers, but threats to the once isolated mountainous forests, which are home to the remaining pandas, are becoming more of a concern. Chinese conservationists fear one of their national treasures could be lost if increased demand for forest products brings logging into the remaining conifer and bamboo tracts where these pandas live.

While zoo biologists from the United States and China are fully aware that there is no substitute for a population of wild animals living as part of a productive natural ecosystem, it appears that having a self-sustaining population of captive pandas is a goal with merit. "A breeding population of zoo-housed pandas would serve as a hedge against extinction in nature, provide animals for future re-introductions and constitute a research and education resource that attracts public support for conservation," Wildt says.

Wildt and Howard returned to China in December to report fully on the results and implications of the March 1998 biomedical survey. They are hoping that other zoos in China will volunteer animals for the type of study undertaken last March. They also would like to return to China in the spring during panda breeding season and continue conservation efforts to preserve the giant panda. ■



Hsing-Hsing continues to be a favorite attraction among visitors to the National Zoological Park. (Photo by Jessie Cohen)

Correction

The painting "Reclining Man (John F. Kennedy)," by Willem de Kooning, was incorrectly reproduced in the Autumn 1998 issue of Research Reports. The painting's correct orientation is horizontal.

A new species of wasp and its habitat have researchers seeking more answers

By Brenda Kean Tabor
Special to Research Reports

A rare new species of wasp has led two Smithsonian researchers to the rain forest of Sri Lanka. There, inside the stems of a spindly tree, known as *Humboldtia laurifolia*, the wasp makes its nests.

Beth Norden, an entomologist in the National Museum of Natural History's Department of Entomology, and Karl Krombein, senior scientist emeritus in the department and a renowned wasp expert, have recently traveled to Sri Lanka to conduct extensive research on this rare wasp and its habitat. The island, Norden says, is an entomological utopia because of its diversity of insects and plants.

Krombein's visits to Sri Lanka date back to 1968, when he began an insect collecting initiative known as the Ceylon Insect Project, which produced an abundance of insect data. "Insect specimens collected during more than 20 research trips continue to be sorted and studied by more than 100 authorities worldwide," Norden says. "More than 1,000 new insect species, as well as thousands of poorly known ones, have been found so far."

Norden's first visit to the island, however, came in 1993, when she went to look for and study this intriguing, unknown wasp from Sri Lanka that was first collected in 1992 by Fred Rickson, a botanist and professor at Oregon State University. Initially mistaken for a bee, the insect was sent to Krombein for positive identification. Recognizing the subfamily of wasp, Krombein, in turn, sent it to Jean Leclercq, in Liège, Belgium, who is the world's authority on this particular kind of wasp.

With more specimens from the 1993 Sri Lanka trip, Leclercq described and named this new genus of wasp *Krombeinictus* and its type species *nordenae*, in honor of both Krombein and Norden's pioneering research on the wasp.

Norden and Krombein's 1993 search for the wasp took place in the rain forest of Gilimale, near the Sinharaja Forest Reserve where Rickson had first found the wasp. They discovered that the wasp was, indeed,

rare and were only able to collect nine more specimens.

In addition to time constraints, Norden and Krombein also were hindered by the weather, as "intermittent rains of the delayed monsoon season precluded nesting activity by the wasps," Norden says. Both researchers were, however, able to collect thousands of internodes of the *Humboldtia laurifolia*, in which the wasps nest, before returning to Washington, D.C. Unopened stems were placed directly into alcohol for subsequent study back in the Department of Entomology's lab, where they were carefully cut open and the contents examined.

Encouraged by their find, Norden (as a Smithsonian employee) decided to apply for, and subsequently received, a Fulbright Scholarship to fund a longer period of research in Sri Lanka. Krombein arranged separate funding to accompany Norden back into the field. They left Washington, D.C., on Feb. 1, 1997, and returned in June of that same year.

On this trip, Norden and Krombein were most interested in examining the association of insects and other invertebrates that lived within the stems of the *Humboldtia laurifolia*. "We even took down two entire trees and opened every internode to see the distribution of the organisms inside," Norden says.

Internodes are usually narrow at the base and enlarged at the top where a natural opening develops. Inside the stem, the central pith breaks down as the stem ages, collapsing against the inner wall and creating a hollow region. Certain ants, wasps and bees apparently gnaw at and enlarge the slitlike openings, then clean out the pith inside, creating a hollow cavity in which to nest and lay their eggs.

A total of 15 different ant species, as well as a variety of bees, wasps, beetles, spiders and even an arboreal earthworm, nest in the internodes. "We discovered that the *Krombeinictus* appears to be found only in association with this tree," Norden says.

A lengthy treatise on Norden and Krombein's research on this plant is soon to be published by Smithsonian Institution Press as part of the Smithsonian Contributions to Zoology series.

Humboldtia laurifolia produces copious amounts of fine-grained pollen, which provides a "movable feast" for the resident insects.

Traces of this pollen were later found in the *Krombeinictus*' nests when they were viewed under



On a research expedition to Sri Lanka, Beth Norden uses an insect net to collect various specimens from the branches of a *Humboldtia laurifolia* tree. (Photo by Karl Krombein)

the museum's scanning electron microscope. "We found larvae in various stages of development, but never with any prey or inedible prey fragments such as wings and legs that one would expect to find in the nest of a predaceous wasp," Norden says.

"We were so excited," she continues, "when we discovered pollen on the mouthparts of the mother and then in the fecal wastes in the cocoon. This discovery confirmed that the mother was feeding pollen to her larva before the larva reached maturity and excreted pollen waste."

This behavior was startling, Norden says, because larval wasps are typically meat eaters that consume paralyzed insects placed in the nest by the mother. "These wasps were behaving like bees that feed pollen to their offspring," she adds.

Krombeinictus is also unusual and possibly unique among wasps because "the female manifests extraordinary maternal care, rearing one larva at a time and feeding it progressively," Norden explains. Study of the relative developmental stages of occupants of two cocoons in one of the internodes suggests the probability that the wasp lays her egg on the inner wall of the cavity near the entrance of the internode, Norden says. When the egg hatches, she feeds the larva and when the first larva is full grown, she carries it down lower in the cavity to spin its cocoon. She then probably deposits another egg near the entrance.

The cocoon, Norden further explains, is unlike that of any other known crabronine wasp. Its unusual flattened shape allows "the mother to crawl toward the lower end of the cavity" and also enables "a newly emerged adult from a cocoon lower in the cavity to reach the entrance. There is a space at least 2 millimeters high between its upper surface and the opposite inner wall of the cavity."

"Typically," Norden adds, "many wasps that nest in pithy stems in wood construct nests containing a linear series of cells. The cells are sealed by partitions that separate siblings, thus preventing cannibalism. Further, nests are normally closed before eggs hatch so that females have no contact with their offspring."

Additional observations, Norden says, would help determine whether this sub-social group of wasps ever reaches a higher level of social behavior by having a daughter join the foundress in caring for later broods as is the case with social wasps, such as yellow jackets.

Norden hopes to return to Sri Lanka sometime in the future to continue studying plant/insect mutualistic relationships. Her research in Sri Lanka has not only yielded interesting scientific results but has also resulted in fruitful international scholarly exchange with Sri Lankan students and researchers. ■



A new genus of wasp, *Krombeinictus*, and its type species, *nordenae*, were named in honor of Karl Krombein and Beth Norden for their pioneering research on the wasp. (Photo by Laurie Minor-Penland)

Powerful radio techniques allow astronomers to explore the heavens

By Meagan Watzke
Smithsonian Astrophysical Observatory

Smithsonian astronomers are giving new meaning to the old saying: The whole is sometimes greater than the sum of its parts.

With colleagues from around the world, researchers at the Smithsonian Astrophysical Observatory in Cambridge, Mass., are employing this concept to combine signals from many separate radio antennas to create a single telescope hundreds—and even thousands—of times larger than any individual element. And, most important, this ultra-high-resolution radio astronomy technique, known as “interferometry,” has recently led to a spate of discoveries that may help solve several long-standing cosmic mysteries.

Using the Very Large Array, a system of telescopes, outside of Socorro, N.M., SAO astronomers have been able to peer into the very center of our galaxy, provide evidence for planets forming around double stars and probe a protoplanetary disk similar to the one that may have shaped our early solar system.

“Radio astronomy lets us see parts of the universe that would normally be invisible,” David Wilner, an astronomer at SAO, says. “Radio waves penetrate the clouds of dust and gas that block our view in visible light and, when combined with interferometry, allow us to see what has never been seen before—in stunning detail!”

Using this technique, Wilner, along with colleagues from Mexico, Spain and Great Britain, discovered a dusty disk orbiting a young star, which, in turn, is in orbit around a stellar companion. In other words, they have found evidence that planets can apparently form in binary or double-star systems.

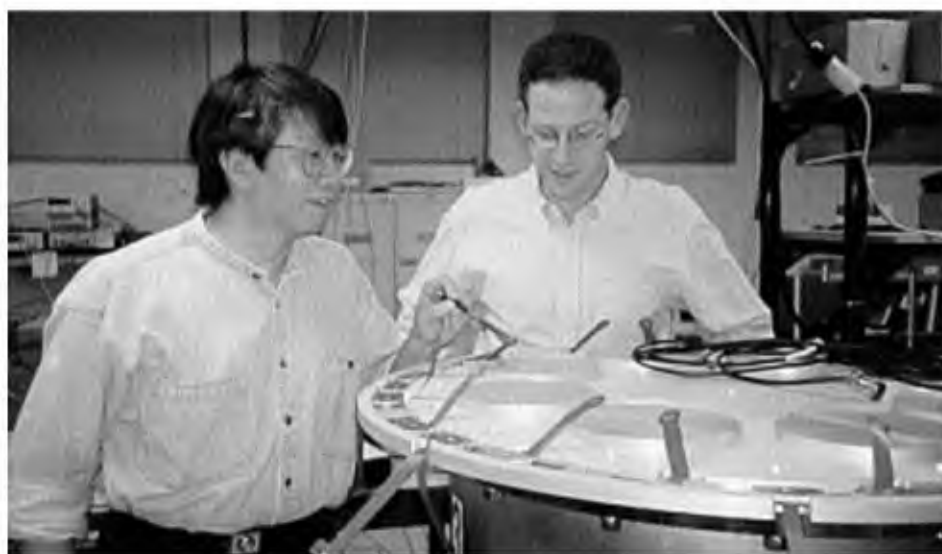
“Unlike our sun, most stars in the universe are not alone, but are parts of double or triple systems,” says Luis Rodriguez, an astrophysicist on the project from the National Autonomous University in Mexico City. “So this means that the number of potential planets is greater than we realized.”

‘First light’

On its first true test run on Oct. 23, 1998, the initial two elements of the planned eight-antenna Submillimeter Array, now under construction at the Smithsonian Astrophysical Observatory’s assembly site in Westford, Mass., obtained strong and stable “fringes” from the planet Saturn, thus achieving the submillimeter wave equivalent of “first light” for this unique instrument. Fringes are the radio astronomer’s term for the interference patterns produced by the simultaneous receipt and combination of signals from two separate telescopes, in this case, two 6-meter-diameter (20-foot-diameter) antennas slated for shipment to Mauna Kea, Hawaii, early this year.

Such a discovery may not have been possible with just a single radio telescope, since studying objects many light-years away—or trying to see closer objects in fine detail—requires very high resolution. The larger the aperture of a telescope, the greater the resolution. However, it becomes very expensive (and unrealistic) to build single telescopes as big as astronomers would like or need. Therefore, scientists and engineers are forced to become creative to increase aperture. And that’s where interferometry comes in.

Interferometry takes signals from two or more separate telescope antennas, synthesizes the data electronically and, in essence, creates a single telescope with an aperture as large as the distance between the two antennas. By assembling any number of



Paul Ho, left, and David Wilner inspect a part of one of the receivers for the Submillimeter Array telescope now under construction in Cambridge, Mass. Installation of the eight-antenna instrument is scheduled to begin in early 1999. (Photo by James Cornell)

antennas into so-called arrays, scientists can virtually build a telescope any size they wish.

The Very Large Array perhaps is the most famous system of radio telescopes. The VLA facility is funded by the National Science Foundation and used by Smithsonian scientists and others from around the world. It is comprised of 27 radio telescopes, each 25 meters (82 feet) in diameter, that can be moved along rails in a Y-shaped pattern out to a maximum span of 36 kilometers (22 miles).

The VLA’s antennas are moved along the tracks to create different configurations, each with different resolutions and fields of view much the same way a photographer may choose different types of lenses for various shots. In simplest terms, as the antennas are spread farther apart from one another along the rails, the resolution of the “photo” of the sky increases.

With the VLA at its highest resolution configuration, a group of astronomers, including SAO scientists, recently observed what may be the smallest protoplanetary

disk ever seen rotating around a young star. If this result is confirmed, it could provide astronomers with an “ideal laboratory” for studying potential planet-forming disks of a size similar to the one that formed the solar system.

“This result is exciting, because only through understanding protoplanetary disks can scientists answer the question of how easy or hard it is to create planets,” says Jose M. Torrelles, an astrophysicist at the Astrophysical Institute of Andalucia in Spain and longtime SAO collaborator who led the research team.

While the VLA is one of the best known radio interferometers, it is by no means the only one. Around the globe, there are many different radio interferometry arrays of various sizes and sensitive to a variety of different radio frequencies. In fact, SAO scientists contributed significantly to an effort that culminated in synthesizing a radio telescope thousands of kilometers in diameter.

This Very Long Baseline Array, using highly precise timing devices and powerful computers to synchronize observations and consolidate data, attempts to create an Earth-size radio telescope. The VLBA is a series of 10 individual telescopes located at

Project IOTA

Interferometry is not limited to radio wavelengths, of course. The National Aeronautics and Space Administration is now developing the Terrestrial Planet Finder for space flight. This is an orbiting interferometric array that will be able to separate the faint light of a planet from the bright glow of its central star and measure the spectrum of the planet’s atmosphere to search for signs of life. And ground-based Project Infrared and Optical Telescope Array, known as Project IOTA, is already operating at the Smithsonian Astrophysical Observatory’s Whipple Observatory on Mount Hopkins, Ariz. Project IOTA is attempting to image stars optically and obtain their infrared spectra.

Smithsonian astronomers to collaborate with colleagues from Europe, Latin America and Asia to produce some really exciting results,” says Paul Ho, an SAO senior astrophysicist who participated in both the Milky Way and protoplanetary disk observations. “We are really looking forward to getting our own array of telescopes operating in Hawaii.”

When completed, the Smithsonian’s Submillimeter Array will be comprised of eight 6-meter (20-foot) movable reflectors, located near the summit of Mauna Kea, an extinct volcano on the island of Hawaii. In keeping with the trend of international cooperation, the Institute of Astronomy and Astrophysics of Taiwan’s Academia Sinica has joined SAO as a partner, contributing two of the array’s eight antennas.

The Submillimeter Array will be a unique astronomical instrument, designed to have the highest feasible resolution in the last waveband of the electromagnetic spectrum to be explored from Earth—roughly the region between infrared and radio wavelengths. This “submillimeter window” is perfectly suited for studies of the structure and motions of matter that form stars, the spiral structures of galaxies and quasars, and active galactic nuclei.

“We will use the Submillimeter Array to probe the murky dust clouds of the Milky Way where stars are born; peer into the hearts of exploding galaxies; and study cool faint objects of our solar system, including comets,” says SAO Director Irwin Shapiro.

As with other arrays, the Submillimeter Array’s antennas will be movable, but on Mauna Kea, SAO will use a giant wheeled transporter, rather than railroad tracks, to create the various configurations. When placed at their widest separation, the individual elements will act like a single, larger antenna some 500 meters (545 yards) wide.

Using a signal correlator to combine and integrate the radiation received by each of the eight antennas, the Submillimeter Array will produce images of astronomical objects with a resolution comparable to the best optical telescopes and more than 10 times that of any existing single-dish submillimeter telescope.

Working together with their international colleagues, SAO scientists already are addressing some of astronomy’s most puzzling questions. This global effort, when combined with the observing potential of the new Submillimeter Array interferometer, suggests that the next millennium could continue this “golden age” of astronomy. ■

'Slavery,' continued from Page 1

music, the original interviews, the dramatic readings and other sound effects using state-of-the-art technology.

Documentary narrator Toney Stewart is an actress who recently played Samuel L. Jackson's wife in the film adaptation of John Grisham's "A Time to Kill." She tells the story of her Papa Dallas, who lived to be 104:

"...He was blind and had these ugly scars around his eyes. One day [when she was 5 or 6 years old], I asked Papa Dallas what happened to his eyes."

"Well daughter," he answered, "when I was mighty young, just about your age, I used to steal away under a big oak tree, and I tried to learn my alphabets so that I could learn to read my Bible. But one day, the overseer caught me, and he drug me out on the plantation, and he called out for all the field hands. And he turned to 'em and said, 'Let this be a lesson to all of you darkies. You ain't got no right to learn to read!' And then he whooped me and he whooped me.



Stepney Underwood, a former slave, was included in the oral histories conducted by the Work Projects Administration. (Photo courtesy of the Library of Congress)

And he whooped me. And, daughter, as if that wasn't enough, he turned around and burned my eyes out."

Papa Dallas asked Stewart to make him several promises: "Promise me that you gonna pick up every book you can and you gonna read it from cover to cover.... Promise me that you gonna go all the way through school, as far as you can. And one more thing. I want you to promise that you gonna tell all the children my story."

Stewart kept those promises. In addition to being a successful television and film actress, she is a professor and director of theater arts at Alabama State University.

A companion book with audiotapes has been published by The New Press in conjunction with the Library of Congress and the Smithsonian. A free 48-page teaching guide is also available from The New Press. To order the teaching guide, send a check for \$3 to cover shipping and handling to: Remembering Slavery Guide, 450 W. 41st St., Sixth Floor, New York, N.Y. 10036. Additional information can be found at this Web site: remembering-slavery.org. ■

SERIES PUBLICATIONS

The following publications on research in various fields were issued during the period Aug. 1 through Oct. 31, 1998, by Smithsonian Institution Press in the regular Smithsonian series. Diane Tyler is managing editor. Requests for series publications should be addressed to Smithsonian Institution Press, Series Division, 470 L'Enfant Plaza, Suite 7100, Washington, D.C. 20560-0950.

Smithsonian Contributions to Paleobiology

• 86 *Reflections on the Morphology, Anatomy, Evolution and Classification of the Class Stenolaemata (Bryozoa)*, by Richard S. Boardman, 59 pages, 129 figures.

• 87 *Ostracoda From the Late Permian of Greece (Thaumatocyprididae and Polycopidae)*, by I.G. Sohn and Louis S. Kornicker, 34 pages, 20 figures, 2 tables, 1 map.

Smithsonian Contributions to Zoology

• 598 *A Revision of Axinellidae (Porifera: Demospongiae) of the Central West Atlantic Region*, by Belinda Alvarez, Rob W.M. van Soest and Klaus Rützler, 47 pages, 23 figures, 18 tables.

RESEARCH HIGHLIGHTS

'River of Song,' Smithsonian Productions has produced a series for public television and radio that explores the richness and vitality of American music along the banks of the Mississippi River at the close of the 20th century. Through live performances and intimate discussions with more than 40 musicians and groups, the series "The Mississippi: River of Song" discovers the music that flourishes in the heart of the nation. The series features four one-hour programs on the Public Broadcasting Service. In addition, there are seven one-hour radio programs that began airing on Public Radio International affiliates in January; a two-set compact disc released by Smithsonian Folkways Recordings in November 1998; and a companion book. (Copies of the book can be ordered from St. Martin's Press, 1 (800) 221-7945. To order the CD, see "Books and Recordings," Page 8.) To learn more about the project, visit its Web site at www.pbs.org/riverofsong, or call (202) 357-2985.

African American photography. African American photography—from 1840 to 1998—is the focus of a major research project at the Anacostia Museum and Center for African American History and Culture. The research spotlights 300 African American photographers who have been active in photography during the last 158 years. Collections Manager Deborah Willis-Kennedy has written a book, *A History of African American Photography: 1840 to 1998*, in conjunction with her research. It is scheduled for release later this year. In

'Highlights,' continued on Page 7

'Seiran,' continued from Page 2

damaged plexiglass, and heat melted rubber in the cockpit. Also, many of the airplane's instruments had disappeared by the time the Seiran was acquired by the National Air and Space Museum in 1962.

Restoring a timeworn airplane to its original condition takes thousands—even tens of thousands—of hours of gifted labor. "Very few people anywhere put in the kind of time and energy we're able to put into these restorations," McLean says. "We have to be artisans, mechanics, researchers and conservators all in one." Additional Garber staff working on the Aichi Seiran are museum specialists Matt Nazzaro, Karl Heinzl, Anne McCombs and Ed Mautner; museum technicians Derek Hodge and Bob Weihrach; machinist George Vencelov; and welder Bill Stevenson. Eleven Garber volunteers also have lent their time and expertise to the restoration.

Detailed engineering data on the Seiran came to the Garber Facility from two unexpected sources. One was Hiroyuki Nagashima, a Japanese motorcycle designer who dreamed of restoring aircraft in America. "Hiro is an airplane nut," McLean says. "We all have that in common."

When Nagashima came to the Garber Facility as a volunteer about five years ago, he brought more than a passion for old airplanes. He remembered assembling a plastic scale model of a Seiran from a kit years earlier in Japan. More important, Nagashima recalled that the kit's instruction booklet reproduced factory photographs and diagrams of a genuine, full-size Seiran.

He tracked down one of the old booklets. With a magnifying glass, he studied the photo of a Seiran instrument panel for clues on missing labels. A diagram in the booklet also showed the layout of Seiran radio systems. This helped restorers fabricate a replica homing radio.

"It was astounding," McLean says. "From this model kit, we received more technical information on the airplane than we had received through our own resources."

More help came from Tetsukuni Watanabe, a quality assurance engineer at the company that manufactured Seirans during the war and that now makes automobile parts. A friend of the son of the Seiran's

designer, Watanabe shared Aichi Aircraft Co. documents that, McLean says, "aided us immensely in the interpretation of what we had to do to replace some of the missing items that were in the airplane."



This photograph shows the Aichi M6A1 Seiran at Park Ridge, Ill., before it was transferred to the National Air and Space Museum's Garber Facility. The float attached to the bottom of the plane would allow a bomber returning from an attack to land on water near the mother ship.

Ultimately, some of those missing items were borrowed from the Seiran from the National Air and Space Museum's collection of aircraft instruments. Others, like a special compass in the Seiran, were recreated through the efforts of Vencelov and the museum's Exhibits Department.

Alas, no original bombs were available. But McLean tracked down the appropriate machine gun in museum storage and mounted it in the rear of the cockpit. McLean says he still does not understand how the rearward pointing gun could be fired, especially in the heat of battle, without risk of shooting off the airplane's tail.

A grant from Japan's Tamiya Co., a model maker that recently issued a new scale-model kit of the Seiran, helped pay

for restoration work on the aircraft's aluminum floats. "It only took a Japanese sailor six minutes to put the pylon on the float and then on the aircraft," notes Hodge, a licensed aircraft mechanic. "It's

taken me a year and four months," he says, to restore one of the badly corroded floats.

Great patience is just another job skill for Garber's specialists, says McLean, who has worked on the Seiran, along with other aircraft, for seven years.

"The Seiran is an extremely valuable, one-of-a-kind artifact," says Tom Alison, head of the Garber Facility. "An immense amount of work has gone into the historical research and craftsmanship by our Collections Division staff and volunteers. It shows in this restoration."

The completely restored Aichi M6A1 Seiran is scheduled to be displayed at the National Air and Space Museum's Dulles Center, opening in 2003 at Washington Dulles International Airport. ■

'Highlights,' continued from Page 6

addition, her research will be the subject of an upcoming exhibition of the same name in the Smithsonian's Arts and Industries Building in the fall. Willis-Kennedy, along



Photos of black women in the 19th century are few. This image (detail) of a woman from Tuskegee Institute, Alabama, taken by Prentice H. Polk, circa 1937, will be in the book *The Black Female Body in Photography*.

with Carla Williams, a photo historian at the Getty Museum in Los Angeles, also is researching African American women's imagery and representation in photography during the same period. This research also will be the focus of a book *The Black Female Body in Photography* and an exhibition later this year.

Biodiversity research in Vietnam. The Smithsonian Institution Monitoring and Assessment of Biodiversity program is collaborating with a team of experts from Vietnam and Cambodia to establish the first monitoring plots at Ba Vi National Park near Hanoi. The plots will be the focus of biodiversity research, monitoring and education over the next several years. The team is collecting data for monitoring vegetation, and eventually, similar data on mammals, amphibians, birds and arthropods will be collected. Ultimately, they hope to use the information to help design management plans and environmental policies to protect biodiversity in Vietnam. This effort is part of a four-year project in

Southeast Asia that is aimed at devising a framework for forest biodiversity conservation and management, as well as expanding the global Smithsonian biodiversity monitoring network.

Resources brochures. The Smithsonian's Office of Public Affairs has recently updated two of its brochures, "African and African American Resources at the Smithsonian" and "Native American Resources at the Smithsonian." The brochures are intended for researchers, teachers, students and others interested in Smithsonian resources. They provide information on research resources, including collections, databases, publications, fellowships and internships, archives, libraries and more. To obtain copies of the brochures, write to Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560-0010; call (202) 357-2700; or send an e-mail to viarc.info@ic.si.edu.

Mammalogists online. Professional mammalogists throughout the world can communicate with each other through an online discussion group maintained by the National Museum of Natural History's Division of Mammals. "Mammal-L" is a discussion group about mammal biology. Approximately 850 mammalogists from about 45 countries participate. To become part of the group, send an e-mail to listserv@sivm.si.edu and type in the following message: `Subscribe Mammal-L <your first name, last name>`. In addition, a list of 1,500 to 1,600 mammalogists with e-mail addresses can be found on the division's Web site at www.nmnh.si.edu/vert/mammals. For additional information, send an e-mail to Richard Thorington Jr., curator in the Department of Vertebrate Zoology, at thoringt@nmnh.si.edu.

BOOKS & RECORDINGS

Spirit of Siberia: Traditional Native Life, Clothing and Footwear, by Jill Oakes and Rick Riewe (Smithsonian Institution Press, 1998, \$45). This richly illustrated volume details how indigenous peoples of Siberia make, wear and interpret the meaning of their traditional clothing.

Glen Edwards: The Diary of a Bomber Pilot, by Daniel Ford (Smithsonian Institution Press, 1998, \$24.95). Using Edwards' own diary, the author provides a first-person look at the life of a bomber pilot and a broad view of aviation in an era of extraordinary change.

The Cahokia Chiefdom: The Archaeology of a Mississippian Society, by George R. Milner (Smithsonian Institution Press, 1998, \$40). Drawing on his own research and extensive surveys and excavations, the author argues that Cahokia-area society differed little in its basic organization from the smaller, less complex chiefdoms that dotted the southern Eastern Woodlands.

Ancient Monuments of the Mississippi Valley, by Ephraim G. Squier and Edwin H. Davis; edited by David J. Meltzer (Smithsonian Institution Press, 1998, \$60

cloth; \$29.95 paper). First published in 1848, this new edition—complete with a new index and bibliography and illustrated with the original maps, plates and engravings—provides a firsthand view of this pioneer era in American archaeology.

Plateau: Vol. 12, edited by Deward E. Walker (Smithsonian Institution Press, 1998, \$55). This latest volume in the Handbook of North American Indians series thoroughly surveys the Native American peoples of the Plateau area.

Rethinking Hopi Ethnography, by Peter M. Whiteley (Smithsonian Institution Press, 1998, \$39.95 cloth; \$18.95 paper). Six essays examine the dynamics of clan-ship and polity, the importance of personal names, Hopi engagement with the environment in the face of mining-company water depletion and more.

The Papers of Joseph Henry, Vol. 8: The Smithsonian Years, January 1850-December 1853, edited by Marc Rothenberg (Smithsonian Institution Press, 1998, \$75). This volume of the papers of Henry, the first Secretary of the Smithsonian, documents a difficult period early in his 31-year tenure as Secretary.

Forest Biodiversity Research, Monitoring and Modeling: Conceptual Background and Old World Case Studies, Vol. 20, edited by Francisco Dallmeier and James A. Comiskey (The United Nations Educational, Scientific and Cultural Organization; the Parthenon Publishing Group Inc.; and the Parthenon Publishing Group Ltd., 1998, \$95). From the Man and the Biosphere series, this volume provides details about plot-based biodiversity research and monitoring. The majority of the chapters are based on papers presented at the first international symposium on measuring and monitoring biodiversity, organized by the Smithsonian Institution Monitoring and Assessment of Biodiversity program, for-

merly the Man and the Biosphere program, in May 1995. To order copies, call 1 (800) 735-4744.

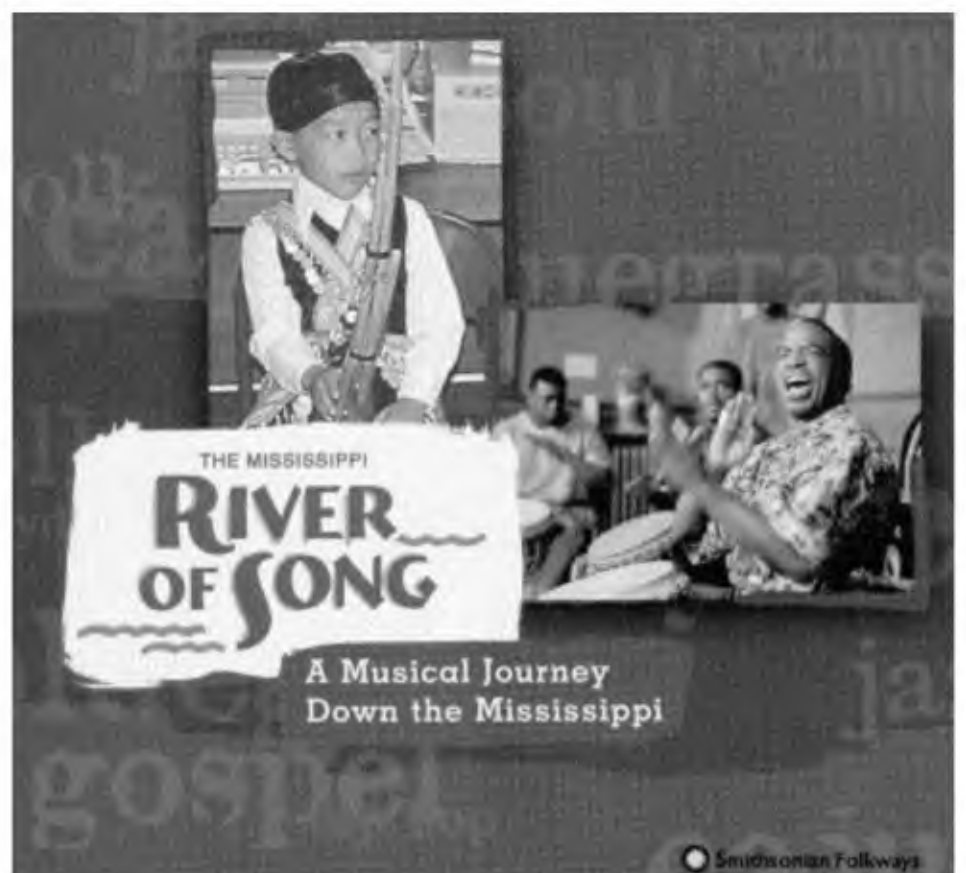
A Garden for Art: Outdoor Sculpture at the Hirshhorn Museum, by Valerie Fletcher (Thames and Hudson, in association with the Hirshhorn Museum, 1998, \$15.95). This 96-page volume highlights the works displayed in one of the country's best known museum sculpture gardens, the history of the garden, conservation efforts to save outdoor sculpture and more. Copies may be ordered from the Hirshhorn Museum Shop by calling (202) 357-1429 or faxing orders to (202) 786-2682. (Faxed orders should include your name, address and credit-card information.)

American Bamboos, by Emmet J. Judziewicz, Lynn G. Clark, Ximena Londono and Margaret J. Stern (Smithsonian Institution Press, 1999, \$45). Drawing on two decades of fieldwork in the United States and Latin American countries, the authors bring together current knowledge of the structure, ecology, human uses, conservation value, evolution and diversity of 41 genera of American bamboo.

Ella Jenkins: African American Folk Rhythms (Smithsonian Folkways Recordings, 1998, \$14 CD; \$8.50 cassette). Topics of work, humor, protest and aspirations comprise this compact disc of spirituals, gospel songs and rhythmic chants, which was originally released on LP in 1960 by Folkways Recordings.

The Mississippi: River of Song (Smithsonian Folkways Recordings, 1998, \$24.95 CD). Thirty-six full-length performances on this two-set compact disc feature the rich musical heritage found along the banks of the Mississippi. A book accompanies the series. To order, call St. Martin's Press, 1 (800) 221-7945.

'Recordings,' continued on Page 8



This two-volume compact disc features contemporary musicians who have forged their styles from the rich musical heritage found along the banks of the Mississippi River.

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Ella Jenkins: Call and Response

(Smithsonian Folkways Recordings, 1998, \$14 CD; \$8.50 cassette). This first recording by Jenkins, which was originally released on LP in 1957 by Folkways Recordings, explores rhythmic group singing through chants from the United States, Africa and the Middle East.

Music of Indonesia—Music From the Southeast: Sumbawa, Sumba and Timor, Vol. 16 (Smithsonian Folkways Recordings, 1998, \$14 CD). This compact disc features the music from each of the three islands—from voice and violin to funerary gong ensembles and string bands of home-made guitars and violins.

Music of Indonesia—Kalimantan: Dayak Ritual and Festival Music, Vol. 17

(Smithsonian Folkways Recordings, 1998, \$14 CD). Twenty-four tracks offer a variety of musical styles from seven ethnic groups in West, East and South Kalimantan.

Books published by Smithsonian Institution Press can be ordered from P.O. Box 960, Herndon, Va. 20172-0960. To order by phone or for more information, call 1 (800) 782-4612. There is a \$3.50 postage

and handling fee for the first book ordered and \$1 for each additional book.

Smithsonian Folkways Recordings can be ordered by writing to Smithsonian Folkways Mail Order, 955 L'Enfant Plaza, Suite 7300, Washington, D.C. 20560-0953. To order by phone or for more information, call (202) 287-7297 or 1 (800) 410-9815. There is a \$4 fee for shipping and handling of the first three recordings ordered; call for other shipping prices.

Off the Shelf

Fountains, Splash and Spectacle: Water and Design From the Renaissance to the Present

Edited by Marilyn Symmes (Published by Rizzoli International Publications Inc., United States and Canada editions, and Thames and Hudson Ltd., international English-language edition, in association with the Cooper-Hewitt, National Design Museum, Smithsonian Institution, 1998, \$60)

Fountains unite design with one of nature's most essential resources—water. Water continuously shapes our world, and people constantly devise ways to shape water, capture it and control it to fulfill daily needs and desires.

Originally created to satisfy basic refreshment needs, fountains developed to reflect mythology, politics, memory, power and culture. Some of the world's greatest cities—Rome, Paris, New York and Chicago—as well as some of its smallest towns, are enhanced by fountains.

A new book, *Fountains: Splash and Spectacle*, celebrates achievements in fountain design and explores their social significance and underlying principles. The richly illustrated book presents more than 300 works of art, historical and modern photographs, and architectural drawings. It accompanied an exhibition of the same name on view at the Cooper-Hewitt, National Design Museum June 9 through Oct. 11, 1998.

Considerable effort and expense have been devoted to creating artificial effects with water for people to enjoy, says Mari-

lyn Symmes, editor of the book and curator of drawings and prints at the Cooper-Hewitt. "Fountain designers consider how water should move—with gentle insistence or raging force; how water should sound—as a soothing trickle or as a surging splash; and how water should look—clear and smooth or frothy and white," Symmes, who also curated the exhibition, writes in the book.

"While water is a familiar substance," she also writes, "understanding its versatile qualities and how best to use them in fountains requires sustained observation of nature, knowledge of technical hydraulics and artistic sensibility. Many glorious fountains attest to the ingenious ability of designers to transform a dry, solid monument into a vibrantly wet and changeable work of art."

Symmes began working on both the book and the exhibition in 1991. "When I first came to the Cooper-Hewitt, National Design Museum in the early 1990s," she says, "I was reviewing the collections and noticed that many drawings and prints were about fountains. I realized that these works were design documents that survived from an ocean of fountain ideas created by generations of designers and engineers. I then studied actual fountains.

"Some of the world's greatest designers, architects and artists," Symmes continues, "devised structures and sculptures specifically for moving water, in order to create fountains that would enhance a city square or a garden."

The book is organized thematically, rather than geographically or chronologically. The chapters explore fountains from the standpoint of refreshment, metaphor,

commemoration, urban oases and entertaining spectacles. Symmes notes that while the book may appeal to scholars, it also will be interesting reading for anyone who enjoys fountains.

The book and exhibition were quite an



The International Fountain was the central attraction of the 1962 World's Fair in Seattle. Designed by two young Japanese architects, the fountain symbolized mankind's efforts to ascend to the heavens and to explore the farthest regions of outer space.

undertaking, Symmes says. "No one," she adds, "had ever attempted to compare and contrast European and American fountains—from the Renaissance to the present. Various authors had written about fountains, but not in such a broad context."

The earliest fountain featured in the book is the Fonte Gaia (Fountain of Joy) erected in Siena, Italy, in 1419. The most recent are the waterfall fountains created as part of the Franklin Delano Roosevelt Memorial in Washington, D.C., which was dedicated in 1997.

All of the 11 authors Symmes chose to contribute to the book have special expertise on some aspect of fountain design history. Prior to writing, each visited the actual fountain sites in order to experience the range of effects the designers created with water.

Symmes herself visited quite a few fountains and has some favorites of her own. The Triton Fountain, designed by Gian Lorenzo Bernini for the Piazza Barberini in Rome, "revolutionized the idea of fountains as a dynamic focal point in a city square." The International Fountain in Seattle also is impressive, she says. "As a central attraction of the 1962 Seattle World's Fair, it suggested mankind's soaring aspirations to explore outer space." Today, the colossal fountain is a popular site for cultural festivals and concerts.

"We all realize that water is an object of great necessity," Symmes says. "It refreshes us physically and spiritually. Yet, it is amazing how designers harmonize static structures with spectacular water effects to create fountains that enchant us all."

—Jo Ann Webb

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