

## INSPIRING GENERATIONS THROUGH KNOWLEDGE AND DISCOVERY

*Highlights of New Science Discoveries, Research Programs, and Initiatives*

The work of Smithsonian curators, historians, and scientists is essential to the Institution's ability to meet the four grand challenges of the Smithsonian Strategic Plan: understanding and sustaining a biodiverse planet, unlocking the mysteries of the universe, valuing world cultures, and understanding the American experience. The following stories highlight a few of the many new discoveries, research programs, and initiatives that have occurred recently at the Smithsonian. These achievements reflect the immense resources and intellectual talent of the Smithsonian, as well as demonstrate its commitment to addressing issues and answering questions of global importance.

### UNDERSTANDING AND SUSTAINING A BIODIVERSE PLANET

#### **STRI researchers discover prehistoric thick-shelled turtle species that lived with world's biggest snake**

The discovery of a new fossil turtle species in Colombia's Cerrejón coal mine by researchers from the Smithsonian Tropical Research Institute (STRI) in Panama and the Florida Museum of Natural History helps to explain the origin of one of the most biodiverse groups of turtles in South America.

*Cerrejonemys wayuunaiki* takes its genus name from Cerrejón; *emys* is Greek for turtle. Its species name is the language spoken by the Wayuu people who live on the Guajira Peninsula in northeastern Colombia near the mine.



About as thick as a standard dictionary, the turtle's shell may have warded off attacks by the Titanoboa, thought to have been the world's biggest snake, and other crocodile-like creatures living in its neighborhood 60 million years ago.



The thick carapace (above right) of a newly discovered prehistoric turtle likely protected it from attacks by predators such as the Titanoboa in what is now Columbia's Cerrejón region. Directly above is an artist's rendering of the Cerrejón region some 60 million years ago.

The fossils from Cerrejón provide a snapshot of the first modern rainforest in South America in a period after the big Cretaceous extinctions and before the Andes rose, modern river basins formed, and the Panama land bridge connected North and South America.

The scientists are now trying to understand why six of this turtle's modern relatives live in the Amazon, Orinoco, and

Magdalena river basins of South America but one lives in Madagascar. This discovery helps support the idea that the group originated near the tip of South America before the continent separated from India and Madagascar more than 90 million years ago.

### **SERC ecologists discover forests are growing faster**

Speed is not a word typically associated with trees; they can take centuries to grow. However, Smithsonian Environmental Research Center (SERC) scientists have found



SERC scientist Geoffrey Parker, seen measuring the girth of tree trunks, and his colleagues found that climate change could be driving accelerated tree growth in the Eastern United States.

evidence that forests in the Eastern United States are growing faster than they have in the past 225 years. Their research offers a rare look at how an ecosystem is responding to climate change.

For more than 20 years SERC ecologist Geoffrey Parker has tracked the growth of 55 stands of mixed hardwood forest plots in Maryland. The plots range in size, some of which are as large as two acres.

Parker's tree censuses have revealed that the forest is packing on weight at a much faster rate than expected. He and SERC postdoctoral fellow Sean McMahon discovered that, on average, the forest is growing an additional two tons per acre annually. That is the equivalent of a tree with a diameter of two feet sprouting up over a year.

Forests and their soils store the majority of the Earth's terrestrial carbon stock. Small changes in their growth rate can have significant ramifications in weather patterns, nutrient cycles, climate change, and biodiversity. Exactly how these systems will be affected remains to be understood.

Parker and McMahon's research focuses on the drivers of the accelerated tree growth. The chief culprit appears to be climate change. During the past 22 years carbon dioxide levels at SERC have risen 12 percent, the mean temperature has increased by nearly three-tenths of a degree and the growing season has lengthened by 7.8 days. The trees now have more carbon dioxide and an extra week to put on weight. Parker and McMahon suggest that a combination of these three factors has caused the forest's accelerated biomass gain.

### **Two new frog species discovered by STRI scientists**

While trying to stay ahead of the deadly fungal disease chytridiomycosis (commonly known as chytrid) that has wiped out more than 100 frog species, scientists at the Smithsonian Tropical Research Institute (STRI) continue to discover new frog species in Panama. Two teams of researchers have named two new species so far in 2010: *Pristimantis educatoris*, from Omar Torrijos National Park, and *Pristimantis adnus*, from Darien Province near the Colombian border.



Both *Pristimantis educatoris* (left) and *Pristimantis adnus* (right) were previously unknown to science until recently discovered by Smithsonian researchers in Panama.

While collecting at Omar Torrijos National Park, a team of scientists noticed that a common frog was much bigger than specimens collected elsewhere. Colleagues compared the shapes of the frogs’ feet and toes with frogs in museum collections and concluded that the bigger frogs were actually a species new to science—*Pristimantis educatoris*. On an earlier trip in the Darien Province, STRI researchers and colleagues collected another new frog species—*Pristimantis adnus*. Males are about two centimeters long; the skin of both sexes are striped and mottled with several shades of brown. These two reports bring the total number of frog species described in Panama and Costa Rica to 197. Nearly 15 percent of these frog species have been described only in the last seven years.

Chytridiomycosis was first described by a team of National Zoo scientists in 1999. In 2008, researchers first detected the fungus to the east of the Panama Canal. During a collecting trip in November 2009 to Chagres National Park, even further to the east, researchers were dismayed to find that most of the frogs there were already infected and dying.

**Cooper-Hewitt’s *Critical Mass: Design and Urbanization* addresses urban growth**

Cooper-Hewitt, National Design Museum’s groundbreaking 2007 *Design for the Other 90%* exhibition has developed into an ongoing series that will continue to focus on design solutions that address the 90% of the world’s population not traditionally serviced by the professional design community. With the support of a significant grant from the Rockefeller Foundation, *Critical Mass: Design and Urbanization*, the second exhibition in the series, will examine the complex issues arising from the unprecedented rate of urban growth projected to take place over the next 20 years, primarily in the informal settlements

**The Metro Cable System and Vertical Gym** designed by Urban Think Tank connects the dense barrios of Caracas, Venezuela, to the city center’s commercial area and reduces a 2½ hour commute to 20 minutes. The Vertical Gym is a prefabricated multilevel sports complex built on a small footprint that provides safe public space for sports recreation and public events. The design features recycled materials, wind towers, sun panels, and rainwater collection.







Designed by Shidhulai Swanirvar Sangstha, the **Floating School, Library, and Community Center** provides computers, high-speed internet, and cell phone connectivity to students on Bangladesh's Barnoi River, a low-lying delta that floods and displaces millions each year. Sangstha modified traditional flat-bottom river boats with local materials and building methods to create boats that sit low in the water, have a flexible open space, and generate energy with solar panels.

**Kaputei Town** in the Kajiado District of Kenya was initiated by the Jamii Bora Trust, a micro-finance organization of more than 230,000 members that was started by 50 street families in 1999. Built on land purchased by the Trust, the town will provide housing for up to 10,000 residents of overcrowded slums. The houses are built using local materials and labor, and Jamii Bora members receive loans to start small businesses and save enough to purchase a house in the Town.



in developing and emerging economies. Organized by Cynthia Smith, curator of socially responsible design, along with a 10-person advisory committee, the exhibition will explore the multidisciplinary, overlapping relationships among urban planning and design, education, social entrepreneurship, climate change, sanitation and water, migration, public health and affordable housing in these communities. The Museum will make the information it gathers about successful and innovative local and global design solutions accessible through an online open-network database that will enable designers, communities, and other stakeholders to work together to develop design solutions to these challenges. This important dialogue will also continue through a scholarly catalogue and robust education programs.

### **SERC scientists discover key to invasive plants' success is not simply a matter of taste**

Plant flavor is an important area of study for ecologists examining invasive plants. A common theory holds that the success of kudzu and other exotic plant species is due to foreign biochemistry that makes them repugnant to native herbivores. Scientists at the Smithsonian Environmental Research Center (SERC), however, have cast doubt on this popular but little-tested idea.



Using the taste buds of the woolly bear caterpillar (*Pyrrharctia isabella*), ecologists Eric Lind and John Parker tested whether the herbivore preferred eating native or exotic plants. The woolly bear is common in the woods surrounding SERC and, unlike some caterpillars that spend their entire lives feeding off one plant, the woolly bear moves around as it munches.

In one of the first studies to directly test the chemical defenses of native versus non-native plants. Lind and Parker ran 800 feeding trials using 40 plant species. Collected from



SERC scientists Eric Lind (above) and John Parker found that caterpillars show no preference toward native or invasive plants.

nearby woods, 21 species were native and 19 were invasive. In each taste test they gave a caterpillar two options: neutral food and food flavored with carefully extracted plant essence. The plant essence contained whatever chemicals each particular species manufactured to help ward off herbivores.

Lind and Parker discovered that the woolly bear caterpillar had distinct preferences among the 40 plant species. However those preferences had little to do with whether the plants were invasive or native. In fact, three of the top four plants that the caterpillar preferred are invasive to Maryland: kudzu, wineberry, and autumn olive.

Lind said that although people tend to “think of invasive species as being super-plants that are able to avoid getting eaten and can grow fast, our study suggests that we should rethink these assumptions.”

### Genetic analysis by SERC scientists reveals promiscuous nature of invasive reed

Scientists at the Smithsonian Environmental Research Center (SERC) made a significant advance in understanding how an invasive plant, *Phragmites australis*, has succeeded at blanketing as much as a third of the Chesapeake Bay's tidal wetlands. Among other impacts, *P. australis* challenges native flora for turf. Until plant ecologists Karin Kettenring, Melissa McCormick, and Dennis Whigham looked into the problem, scientists and resource managers did not accurately understand how it was spreading.



*Phragmites australis*, also known as the common reed, is an invasive large perennial grass now found in wetlands in every U.S. state, and is particularly invasive in the eastern states along the Atlantic Coast.



Through extensive DNA analysis, the trio discovered that seeds are the secret to the invasive reed's success. The plant has been reproducing sexually. This finding replaces what had been the prevailing theory: that *P. australis* was spreading clonally, through underground stems called rhizomes. Unlocking the plant's reproductive mechanism will allow resource managers to better plan and execute strategies aimed at containing *P. australis*. The SERC scientists published their findings in the journal *Wetlands* and have been actively sharing their discovery with resource managers around the Chesapeake Bay.

## UNLOCKING THE MYSTERIES OF THE UNIVERSE

### Harvard-Smithsonian Center for Astrophysics helps discover missing primitive stars

Scientists at the Harvard-Smithsonian Center for Astrophysics were part of a team of astronomers that recently discovered a relic from the early universe—a star that may have been among the second generation of stars to form after the Big Bang. Located in the dwarf galaxy Sculptor some 290,000 light-years away, the star has a remarkably similar chemical make-up to the Milky Way's oldest stars.

Its presence supports the theory that our galaxy underwent a “cannibal” phase, growing to its current size by swallowing dwarf galaxies and other galactic building blocks.

Dwarf galaxies have just a few billion stars, compared to the hundreds of billions in the Milky Way. In the “bottom-up model” of galaxy formation, large galaxies attained their size over billions of years by absorbing their smaller neighbors.

Among the stars found in the Sculptor dwarf galaxy was one faint, 18th-magnitude speck designated S1020549. Spectroscopic measurements of the star's light with Carnegie's Magellan-Clay telescope in Las Campanas, Chile,

determined it to have a metal abundance 6,000 times lower than that of the Sun; this is five times lower than any other star found so far in a dwarf galaxy.

The researchers expect that further searches will discover additional metal-poor stars in dwarf galaxies, although the distance and faintness of the stars pose a challenge for current optical telescopes. The next generation of extremely large optical telescopes equipped with high-resolution spectrographs, such as the proposed 24.5-meter Giant Magellan Telescope, will open up a new window for studying the growth of galaxies through the chemistries of their stars.



The newly discovered red giant star S1020549 dominates this artist's conception. The primitive star contains 6,000 times less heavy elements than our Sun, indicating that it formed very early in the Universe's history.



## VALUING WORLD CULTURES

### National Museum of the American Indian explores the “Royal Road of the Inka”

The National Museum of the American Indian (NMAI) is participating in an ambitious study of the Qhapac Ñan, or “Royal Road of the Inka,” a pre-Columbian road system that was essential to the economic and political power of the Inka Empire. Encompassing places and peoples throughout six nations (Argentina, Bolivia, Chile, Colombia, Ecuador, and Peru), the project seeks to examine and understand the Inka Empire’s ability to develop a monumental and sophisticated road system that provided a major axis for communications and control of the Inka territories. The physical and cultural significance of the Qhapac Ñan has been recognized by UNESCO’s World Heritage Centre and led to its pioneering effort to coordinate, with the assistance of the six countries, the nomination of Qhapac Ñan for inclusion in the World Heritage List.

The Qhapac Ñan project seeks to better understand the Inka sovereigns’ vision, including their drive to develop their empires and demonstrated engineering abilities. It will examine the road system’s ability to incorporate communities and support communications, the many products that traveled on the Qhapac Ñan, and the continuing use of many stretches of the Royal Road of the Inka. To preserve the rich cultural and artistic life that is still practiced by the descendants of the Inkas, NMAI researchers also are collecting ethnographic material and oral histories from traditional Quechua and Aymara communities.



Dr. Jose Barreiro (right), assistant director for the NMAI History and Culture Department and director of the NMAI Office for Latin America, and NMAI Board of Trustees member Jose Zarate examine Inka stonework in Cusco, Peru.

The Museum’s research will culminate in the future exhibition *Qhapac Ñan: The Way of Inka*, and will support scholarly publications, conferences, and public programs. Drawing from the Museum’s extensive collection of 350 archaeological and ethnographic objects related to the Inka period, the exhibition will consider the political and religious history—and legacy—of the Inka through the Qhapac Ñan and include testimonials from contemporary Quechua communities and other Inka descendents, as well as previously unpublished colonial source materials. By examining the engineering and construction of a 23,000-kilometre-long road network that was built without the aid of sophisticated tools, iron, or the wheel, *Qhapac Ñan: The Way of Inka* will present both the rise and the fall of the Inka Empire, and highlight contemporary communities’ persistent and faithful preservation of the Inka heritage, the prophecy of the Inkas’ return, and the faith in the return of better futures for indigenous communities.

### Three Smithsonian museums co-organize colloquium on conserving time-based art

In March 2010, the Smithsonian American Art Museum (SAAM), the National Portrait Gallery, and the Hirshhorn Museum and Sculpture Garden co-organized the colloquium



*Electronic Superhighway*, a 1995 video installation by Korean-born American artist Nam June Paik (1932–2006), was one of several works discussed by SAAM senior media arts curator and keynote speaker John Hanhardt.

“Collaborations in the Conservation of Time-Based Media Art.” The three-day colloquium brought together curators, artists, conservators, exhibition designers, and audiovisual specialists to discuss the conservation of film, video, and digital art, including the collaborative efforts that provide for the proper interpretation, conservation, and exhibition of international works of time-based art.

The colloquium concluded with a day-long working group/brainstorming session devoted to how the Smithsonian can become a leader in the field of time-based media conservation. The

sessions attracted more than 50 Smithsonian staff, as well as more than 5,000 viewers via live Webcast, and were moderated by the Office of Planning and Analysis, which is preparing a report with recommendations based on the discussions.

John Hanhardt, SAAM senior media arts curator, provided the keynote address, *Re:Presenting the Moving Image: Time-Based Art in the Museum and Other Spaces*. Citing the work of the late Korean-born American artist Nam June Paik, whose studio archive was recently acquired by SAAM, Hanhardt discussed the challenge of establishing conservation practices that respond to and represent the full range of historical and contemporary art.

The Hirshhorn hosted an evening lecture by Irish artist John Gerrard, whose work uses customized 3-D gaming software to reimagine landscape art. Representatives from the Museum of Modern Art, the San Francisco Museum of Modern Art, the Indianapolis Museum of Art, and the Anthology Film Archives, as well as two professionals whose work involves time-based art or its conservation, also led sessions devoted to the challenges presented in the conservation of time-based art.

### National Museum of African Art organizes *African Cosmos: Stellar Art*

National Museum of African Art Deputy Director and Chief Curator Christine Mullen Kreamer is preparing the major exhibition *African Cosmos: Stellar Art*, scheduled to open in June 2011. Accompanied by a comprehensive exhibition catalogue of the same name, *African Cosmos: Stellar Art* will be the first major exhibition that uses traditional and





*African Cosmos* will include 19th and 20th century works of traditional African art that illustrate the use of astronomical knowledge as a rich source of metaphor in the arts. The masks worn by these Dogon, Mali, *kanaga* dancers illustrate mankind's intensely personal relationship with and between the earth and sky.

contemporary African art to illuminate Africa's contributions to the science and practice of astronomy and to show how celestial observations are central to social, cultural, and artistic expression.

The show, part of a series of exhibitions developed by Dr. Kreamer to explore the intersection between art and knowledge, will be supported by multidisciplinary and multimedia educational programs and outreach activities designed to engage visitors in learning about African contributions to cultural astronomy and its connections to beliefs, values, and the arts.

Early African interest in and observation of the cosmos can be seen in the 5th millennium B.C.E. stone circle and megaliths of Nabta Playa, Egypt, that have been interpreted as some of the world's earliest archeoastronomical devices that mark star alignments and the summer solstice.

In *African Cosmos*, selected ancient Egyptian and Nubian works of art and centuries-old illustrated manuscripts from Timbuktu will frame the topic historically, demonstrating Africa's early engagement with celestial observations and its connections to the visual arts.

The *African Cosmos* project will demonstrate that observations of the heavens inform artistic expression and ritual practice in African cultures. Far from abstract concepts, African notions of the universe are intensely personal, and place human beings in relationships with earth and sky, including the celestial bodies of the sun, moon, and stars. Standing at the core of creation myths and the foundation of moral values, celestial bodies are often accorded sacred capacities and are part of the "cosmological map" that allows humans to chart their course through life.



The exhibition will include contemporary African work, such as *Untitled (Zulu series)* (1989-90), an acrylic on canvas painting by South African artist Gavin Janties (b. 1948).

## UNDERSTANDING THE AMERICAN EXPERIENCE

### National Museum of American History's American Journeys Project

Understanding the American experience involves comprehending the centrality of immigration and migration, analyzing the social formulation of racial and ethnic identities, and considering the construction of new communities. In 2009, National Museum of American History (NMAH) curators collaborated with staff from the Latino Center, the Asian Pacific American Program, and the Center for Folklife and Cultural Heritage to launch the multi-year American Journeys project. Over the course of the project, staff will conduct field research and acquire objects emblematic of cultural identity.

This past year, under a Latino Pool Initiative Grant, two curators in NMAH's Division of Home and Community Life collected clothing that embodies the multiplicity of Latino and ethnic identities and relationships in Mexican American communities in San Antonio, Los Angeles, and Chicago. Curators collected everyday wear and clothing worn for celebrations, including clothing and objects from *escaramuza* riders, sewing cooperative workers, boot makers, *pastorela* participants, and mariachi singers. Because the *quinceañera*, or 15th birthday celebration for Latina girls, has become a momentous coming-of-age ritual in many Latino communities, an important acquisition was the *quinceañera* dress and related accessories worn by a Chicago Latina on the occasion of her *quinceañera*.



The collection of Asian American objects and clothing is supported by the Asian Pacific American Program, which assisted in the acquisition of a *hanbok* worn by a Korean-American adoptee when she arrived to meet her new American parents in 2003. The *hanbok*, a traditional dress worn on a Korean girl's first birthday, complements the collection's 1956 *hanbok* worn by one of the first Korean children adopted by an American family; the family subsequently established the first inter-country adoption agency in the United States. Both dresses reflect the respect for cultural lineage that many adoptive parents foster in their children's lives.

A very different immigrant story is portrayed by the trousers, blouse, and hat worn by Catherine Hann on her flight by boat from Vietnam to a Malaysia refugee camp in 1981. These recently donated objects tell of the struggle to leave a familiar place to find a new life in America.



Immigrants from all cultures are part of the American experience, and the collections must continually expand to reflect these stories. Staff are now focused on acquiring objects and stories that reflect the lives of East Indian and Muslim peoples, as well as continuing to research "descent communities" that have retained their ethnic distinctiveness in language, religion, foodways, dress, and other cultural practices. The many ways that ethnicity intersects with, complicates, and compliments the notions of "Americanness" demonstrate the diversity and cultural unity of the nation.

## National Museum of American History pursues research and scientific study of earliest American daguerreotype collections

National Museum of American History (NMAH) curator Michelle Delaney and NMAH Preservation Services Unit conservators recently coordinated a one-day XRF (X-ray) scientific analysis project for early American daguerreotype photographs by Henry Fitz Jr. The study also included photographic conservators and scientists visiting from The Metropolitan Museum of Art and the National Gallery of Art.

Fitz is considered to be one of the most important early American photographers. He worked in Baltimore and New York and produced what is considered to be the first American self-portrait. This and more than 20 other Fitz daguerreotypes are held in the NMAH Photographic History Collection, which comprises the largest known collection of Fitz images. With his business partner, Alexander Wolcott, Fitz developed and patented a daguerreotype camera—the first patented in America—that is also now part of the patent model collection at NMAH.

X-ray and digital analysis showed ways that Fitz experimented with the daguerreotype process. Fourteen of 23 plates tested were standard, sensitized copper plates, but eight others were made of brass and zinc.

The Fitz analysis is just one element of Delaney’s pan-institutional team project entitled “Inventing American Photography.” The first American photographers are well represented in both the NMAH and Smithsonian American Art Museum collections. The team is researching and exploring how American innovation and invention in the first decades of photography fostered a thriving and productive community of photographers who experimented and competed at an international level to advance the new medium. Supported by the Getty Foundation, earlier research in the project focused on the study and scientific analysis of NMAH’s 62 Hillotypes, a rare collection of early color photography experiments made on daguerreotype plates by Reverend Levi L. Hill in the 1850s.



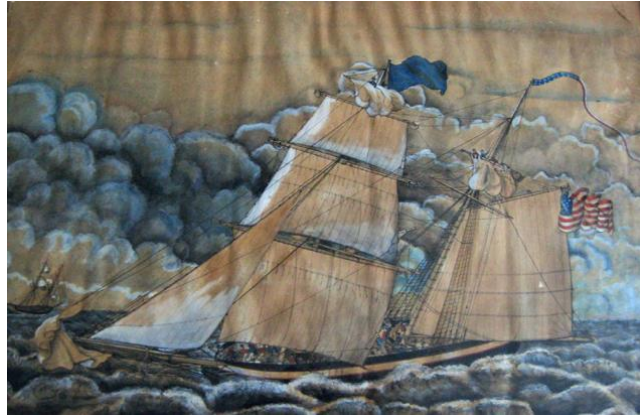
The first-known American self-portrait, c. 1839, by Henry Fitz Jr.; an unidentified daguerreotype by Fitz; and the first American patent for a camera, a collaboration by Fitz and Alexander S. Wolcott, were among the objects studied by Smithsonian scholars and conservators from The Metropolitan Museum of Art, the National Gallery of Art, and the George Eastman House.



## Museum of American History searches for historic American slaver wreck

The captain of the slave ship *Enrique* made a fatal error on January 8, 1817, while sailing for the safety of Cuba's Matanzas Bay with his human cargo. Under hot pursuit by a British anti-slavery patrol vessel, the swift 100-foot brig cut the shoreline too closely and struck a reef at the mouth of the bay. *Enrique* was lost, including its entire cargo of enslaved Africans, estimated to be between 113 and 278 persons. By stark contrast, the entire crew managed to survive.

*Enrique* began as the privateer *MacDonough* of Bristol, Rhode Island. It was built at the end of the War of 1812 by Captain Caleb Carr of Warren, Rhode Island, for wealthy Rhode Island merchant, slave trader, and U.S. Senator James DeWolf. *MacDonough* made a successful privateering voyage, but was forced to relinquish all of its captured British ships as the war had formally ended the prior month.



Detail of Jonathon Alger's 1880 watercolor of the hermaphrodite brig *MacDonough*.

DeWolf promptly outfitted *MacDonough* for slaving between Africa and the West Indies. His nephew George DeWolf bought the ship and nominally transferred it to the Spanish firm of Disdier & Morphy in Havana, since slaving had been banned in the United States in 1808. Although *Enrique* Disdier gave the vessel his first name, recently discovered documentation reveals that its ownership remained with the DeWolf family, who had multiple plantations on Cuba, including one near Matanzas Bay.

Three significant factors make this shipwreck worthy of further investigation. First, no slave ship built, owned, or captained by Americans has ever been found. Second, of the handful of foreign slaver wrecks located to date, none was on the middle leg of the triangle trade when lost. Last, no wrecked slave ship has ever been found with its entrapped human cargo and their possessions. The remains of *Enrique* will present all three.



The original half hull "hawk's nest" ship model, used for *MacDonough*'s construction at Caleb Carr's Warren shipyard in 1815.

In partnership with the National Museum of African American History and Culture, an application to search for the *Enrique* wreck site has been filed with the Cuban Ministry of Culture. Led by American History Museum curator Dr. Paul F. Johnston, the project team plans to conduct an underwater archaeological survey for the wreck site in the summer of 2010. If found, the site promises to cast an unparalleled and unblinking eye on the realities of the American slave trade before 1820, when the implementation of the death penalty finally made it too risky for the direct trafficking of human cargo.