

Fieldwork

Gas Hydrate Studied in the Northern Gulf of Mexico

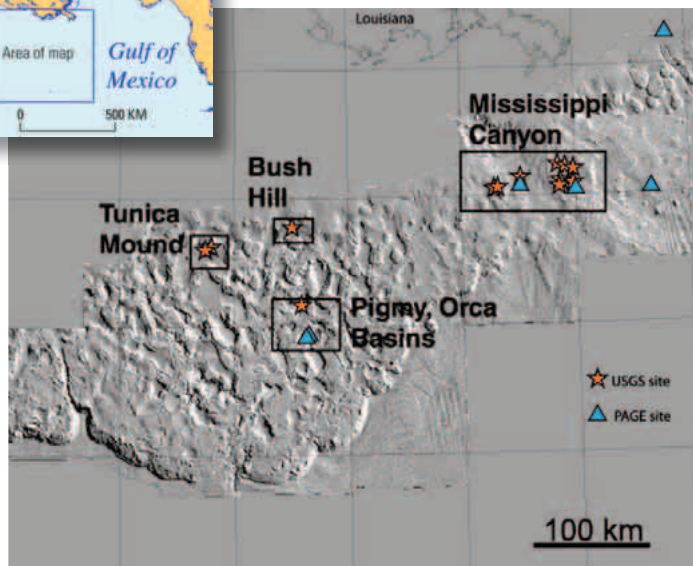
By Bill Winters and Tom Lorenson

A giant piston-coring cruise with multiple objectives was recently completed by a group of scientists from the United States, France, Germany, the Netherlands, Canada, Japan, Greece, Russia, and Mexico to better understand natural-gas-hydrate distribution across the continental slope of the northern Gulf of Mexico. Gas hydrate, an icelike crystalline solid containing high concentrations of methane, is a potential energy resource. It is also a hazard to hydrocarbon exploration and production, and may influence global climate change.

Although the amount of gas hydrate in the natural environment is enormous, little is known about its distribution in sea-floor sediment or even exactly how it forms. Exploring these and other questions was among the goals of the recently completed coring cruise conducted jointly by the Institut Polaire Français, Paul-Émile Victor (IPEV), and the U.S. Geological Survey (USGS) aboard the 120-m-long French research vessel *Marion Dufresne*. The cruise, partly funded by the U.S. Department of Energy, originated in Cancún, Mexico, on July 1 and ended in Tampa, FL, on July 18.

Unlike any U.S. research vessel, the *Marion Dufresne* has a unique, unobstructed starboard main deck that allows the deployment and recovery of IPEV's "Calypso" corer. That piston-coring system, driven by a 6-tonne weight stand, has obtained cores as long as 64.5 m. In the Gulf of Mexico, 18 giant Calypso piston cores as much as 38 m long were collected under the direction of the chief of operations, **Yvon Balut** (IPEV), at Tunica Mound, at Bush Hill, and near or within the Mississippi Canyon (see map). The cores are being used to study the distribution of natural gas hydrate through geochemical analyses of pore water and gas samples, as well as physical-property measurements obtained

Coring from the Marion Dufresne was conducted within three areas of the northern Gulf of Mexico—Tunica Mound, Bush Hill, and Mississippi Canyon—to investigate the effect of different geologic settings and sub-sea-floor conditions on the presence of gas hydrate. Additional coring was conducted in Pigmy and Orca Basins to study pollutant sequestration and contaminant-input history.



The 120-m-long French research vessel *Marion Dufresne* recently recovered a 64.5-m-long giant "Calypso" piston core.

from the cores. The results are also being correlated with seismic records to assess the potential for using such records to locate sub-sea-floor gas hydrate.

The Gulf of Mexico is unique in the world for containing significant amounts of both biogenic gas hydrate (hydrate formed

in shallow sediment by microbial production of methane) and thermogenic hydrate (hydrate formed by deep natural gas leaking into the shallow subsurface sediment). The possible presence of gas hydrate in the northern Gulf of Mexico has been inferred

(Gas Hydrate continued on page 2)

Sound Waves

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Contents

| | |
|------------------------------|-----------|
| Fieldwork | 1 |
| Research | 8 |
| Outreach | 10 |
| Meetings | 13 |
| Staff and Center News | 14 |
| Publications | 15 |

Submission Guidelines

Deadline: The deadline for news items and publication lists for the October issue of *Sound Waves* is Monday, September 16.
Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.

Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator® files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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Can't find the answer to your question on the Web? Call 1-888-ASK-USGS

Want to e-mail your question to the USGS? Send it to this address: ask@usgs.gov

Fieldwork, continued

(Gas Hydrate continued from page 1)

from geophysical data, but before this cruise, samples have been recovered from only the uppermost few meters of sediment by shallow coring or submersible vessels, typically on sea-floor mounds. Much of this cruise focused on finding evidence for the existence of gas hydrate away from obvious sea-floor gas-hydrate mounds and at depth in the sediment.

The generation of gas caused by hydrate dissociation was spectacularly demonstrated when the uppermost several meters of one core blew vertically out the end of the core barrel, flew at least 10 m into the air, and landed in the gulf waters next to the ship. The gas hydrate remained on the surface of the water because of its low density and floated away as it dissociated. Other gas hydrate, recovered during the cruise, was present either as particles distributed throughout the sediment or as massive chunks that filled the entire 10-cm diameter of the core liner. The hydrate samples were preserved in liquid nitrogen for future shore-based laboratory testing.

Shipboard participants included **Tom Lorenson** (cochief), **Pat Hart**, and **Jenni-**

fer Dougherty (USGS, Menlo Park, CA); **Bill Winters** (cochief) and **Bill Waite** (USGS, Woods Hole, MA); **Jim Flocks** (USGS, St. Petersburg, FL); **Charlie Paull**, **Bill Ussler**, **Steve Hallam**, **Rendy Keaten**, and **Patrick Mitts** (Monterey Bay Aquarium Research Institute [MBARI]); **Ivana Novosel** (University of Victoria, BC, Canada); **John Pohlman** (College of William and Mary); **Olya Boldina** (Moscow State University); **Yifeng Chen** (University of Tokyo); and **Efthymios Tripsanas** (Texas A&M University).

Considerable at-sea help was provided by an international group of about 40 scientists under the IMAGES (International Marine Past Global Changes Study) and PAGE (Paleoceanography of the Atlantic and Geochemistry) programs (**Laurent Labeyrie** and **Viviane Bout**, cochiefs). The IMAGES program is an international effort to understand the mechanisms and consequences of climatic changes by using the oceanic sedimentary record.

Also deeply appreciated was onshore assistance from **Dave Mason** (USGS, Woods Hole, MA), **Jesse Hunt** (Minerals Management Service, New Orleans, LA), **Bill Gwilliam** (Department of Energy, Morgantown, WV), and **Manika Prasad** (Stanford University).

Other shipboard studies included the collection of 9-m-long box cores from Pigmy and Orca Basins (see map) for measuring contaminant input to the northern Gulf of Mexico from the Mississippi River, part of a project led by **Pete Swarzenski** (USGS,

(Gas Hydrate continued on page 3)



(Clockwise from bottom left) **Rendy Keaten** (MBARI), **Charlie Paull** (MBARI), **Bill Waite** (USGS), **Jim Flocks** (USGS), **Tom Lorenson** (USGS), and **Patrick Mitts** (MBARI) marking and cutting 1.5-m-long sections from one of 18 giant piston cores.

Fieldwork, continued

(Gas Hydrate continued from page 2)

St. Petersburg, FL). Pigmy and Orca Basins are nearly adjacent; however, Orca Basin has been covered by a thick brine layer for most of Holocene time, producing anoxic conditions at the basin floor. Oxic conditions exist in Pigmy Basin. In addition to studying contaminant-input history, USGS scientists will compare the



effects of anoxic and oxic conditions on pollutant sequestration in the two basins.

The cruise was marked by numerous collaborations among the participating organizations. Working with **Louis Geli** and **Cynthia Labails** of the Institut Français pour la Recherche et la Technologie Polaires, USGS scientists obtained 17 deep (about 10-20 m) heat-flow profiles near the piston-core sites. Results indicate that widely varying geothermal gradients exist across the northern Gulf of Mexico, an important observation for defining the subbottom extent of gas-hydrate stability. The USGS is also working with **Catherine Kissel** (IPEV) on paleomagnetic studies and with **Sabrina Nardoza** (Laboratoire des Sciences du Climat et de l'Environnement) on physical-property profiles. The USGS cores collected in the gulf will be archived at

(Clockwise from top left) **Bill Ussler** (MBARI), **Charlie Paull** (MBARI), **Olya Boldina** (Moscow State University), **Valerie Hadoux** (IMAGES), **Jim Flocks** (USGS), **Tom Lorenson** (USGS), and **Maria Green-Blum** (IMAGES) subsampling a 10-m-long box core. **Bill** and **Charlie** are placing sediment in a pore-water squeezer sample mold.



Chunks of gas hydrate recovered from a giant piston core.

Texas A&M University under the guidance of **Bill Bryant**.

Before docking in the Port of Tampa, FL, the *Marion Dufresne* obtained two cores in Tampa Bay for **Terry Edgar** (USGS, St. Petersburg, FL) and **Deb Willard** and **Tom Cronin** (USGS, Reston, VA), as part of the Tampa Bay project (see related article, below). **A.B. Wade** (USGS, Reston, VA) and **Hannah Hamilton** (USGS, Gainesville, FL) visited the *Marion Dufresne* while it was in Tampa Bay and orchestrated a series of interviews and videotaping sessions for both national and local news coverage. ❁

Research Vessel *Marion Dufresne* Cores Tampa Bay, Florida

By **Terry Edgar**

When the research vessel *Marion Dufresne*, France's huge coring vessel, finished coring in the Gulf of Mexico, **Terry Edgar** (U.S. Geological Survey [USGS], St. Petersburg, FL) and **Deb Willard** and **Tom Cronin** (USGS, Reston, VA) arranged to have the ship take as many as three cores in the deepest natural depression in Tampa Bay before it docked in the Port of Tampa. Seismic data acquired by the University of South Florida indicate that about 16 to 17 m of sediment overlies the deepest recorded reflection in this depression. Water depth at the chosen sites is about 9 m, which gave the ship just 3 m of clearance between the hull and the bay floor. The captain of the *Marion Dufresne* agreed to core in just about the shallowest water depth ever attempted from this ship. (The shallowest core is

believed to be from 8-m water depth in Chesapeake Bay.)

Terry, Deb, and **Chris Reich** (USGS, St. Petersburg, FL) and **Gregg Brooks, Bekka Larson,** and **Dave Hastings** (Eckerd College, St. Petersburg, FL) joined the *Marion Dufresne* before dawn on July 18. **Ben Flower** (University of South Florida) participated with the deep Gulf of Mexico team, as well as with our Tampa Bay project team.

Owing to the shallow water depth, the trigger arm on the corer had to be held by hand, because the trigger weight was already on the bottom of the bay before the core barrel was released. In fact, the core

(Tampa Bay continued on page 4)

Water depth was less than the length of the trigger line, and so the trigger arm had to be held down by hand until the core was deployed.



(Tampa Bay continued from page 3)

barrel was already in the bottom before the core was deployed. The first core recovered 11.5 m of sediment that included marine sediment at the top, freshwater sediment in the middle, and marine sediment at the bottom of the core, suggesting that the oldest marine sediment is at least as old as the latest interglacial (stage 5, approx. 125 ka). The second core parted at a weld, and we were left with about 6.5 m of pipe sticking out of the bottom, which **Chris Reich, Keith Ludwig, Rich Young, and Terry Edgar** located, identified, described, and tagged the following day, July 19. **Terry Kelley, Rich Young,** and some commercial divers removed the pipe with a cutting torch on July 20. No sediment was recovered. The third core bent and recovered only 4.5 m of sediment, but it was from this core that **Bekka Larson** (Eckerd College) pulled a gastropod out of black mud in the core catcher. When we opened the cores, it was clear that this core stopped in the nonmarine section, whereas the first core had penetrated the entire freshwater sequence and terminated in the underlying marine sediment. ❁



The first core recovered 11.5 m of sediment.



The last core recovered only 4.5 m of sediment and came up looking like a banana, as bent core pipes are called.

Recent Cruise Completed for the North Carolina Regional Coastal Erosion Study

By Rob Thieler

The sea-floor-mapping group at the Woods Hole Field Center (WHFC) has completed its third year of cruises, compiling work that has imaged the inner continental shelf from False Cape, VA, to Cape Hatteras, NC, as part of the North Carolina Regional Coastal Erosion Study. This survey encompasses an area approximately 90 nautical miles long by 5 nautical miles wide, extending seaward from approximately 8-m water depth (near-shore) to 25- to 30-m water depth (inner continental shelf).

In June and July 2002, two scientific parties from the WHFC conducted a research cruise aboard the merchant vessel *Atlantic Surveyor* that mapped about half the survey area. Participants on the first leg were **Rob Thieler, Dave Foster, Dave Nichols, Erika Hammar-Klose, Chris Polloni, and Chuck Worley**. After a crew change halfway through the cruise, **Tom O'Brien, Bill Danforth, Caroline Roberts, Mark Capone, and Seth Ackerman** joined **Rob** and **Chris** for the second leg. Both the weather and the scientific equipment (interferometric sidescan/bathymetry, sidescan, CHIRP, and boomer subbottom profilers) were very cooperative, allowing maximum time for science.

It is clear from the data gathered over the past 3 years that the nearshore sediment budget is coupled to the inner-shelf sediment budget in complex but understandable ways, which are determined primarily by antecedent geology (the distribution and composition of ancient rocks and sediment) and modern physical processes. Cooperative work conducted by the Virginia Institute of Marine Science is extending this geophysical framework from the nearshore to the beach, where it ties into U.S. Geological Survey studies of beach change using LIDAR (Light Detection And Ranging) and SWASH (Surveying Wide-Area Shorelines) beach-survey techniques. ❁

On the Road to Recovery—the Endangered White Abalone (*Haliotis sorenseni*) off Southern California

By Melissa Neuman (NMFS), Guy Cochrane (USGS), Rikk Kvitek (CSUMB), and John Butler (NMFS)

Guy Cochrane and **Fred Payne** of the U.S. Geological Survey (USGS) joined scientists from the National Marine Fisheries Service (NMFS) and California State University, Monterey Bay (CSUMB), on a 10-day research cruise in July 2002 aboard the National Oceanic and Atmospheric Administration (NOAA)'s research vessel *David Starr Jordan*. The goals of the cruise were to use a remotely operated vehicle (ROV) in combination with acoustic remote-sensing tools (sidescan-sonar backscatter data and multibeam-sonar depth data) to locate the endangered white abalone (*Haliotis sorenseni*) on Tanner Bank, 100 mi off the coast of Southern California. Acoustic surveys conducted at night provided high-resolution images of Tanner Bank used to guide the ROV survey for white abalone during the day.

The white abalone was listed by NMFS as an endangered species on May 29, 2001, effective June 28, 2001, after a comprehensive status review of the species. The decline of white abalone was attributed to overutilization by commercial and recreational fisheries in the absence of adequate



Ben Maurer (left) and **John Butler** operate the DOER Phantom ROV, using WINFROG navigation software with sea-floor imagery from nighttime surveying operations.

regulatory mechanisms. The status review identified an urgent need for human intervention in the recovery of white abalone, because subthreshold densities of the animals in nature make it unlikely

that the species will recover on its own. Without intervention, it is estimated that the approximately 1,600 remaining white abalone in the wild will disappear by 2010.

In an effort to recover the species, the NMFS Southwest Region is currently assembling a team that will develop a recovery plan by December 2003. A team of international experts in abalone biology and culture met at the NMFS Southwest Fisheries Science Center in

La Jolla, CA, from November 8-9, 2001, to discuss a rebuilding strategy for white abalone. The team arrived at the following conclusion: a captive-breeding program offers the best chance for white-abalone recovery, and brood stock should be collected as soon as possible.

Implementing a captive-breeding program for white abalone is difficult for several reasons, including the depths at which white abalone occur (20-60 m) and the fragility of the animals. In an effort to design a safe and effective collection protocol, **John Butler**, a fishery biologist at the Southwest Fisheries Science Center, organized the July cruise aboard the research vessel *David Starr Jordan*. His goal was to locate white abalone, record their positions, and produce high-resolution habitat maps of Tanner Bank, using acoustic remote-sensing tools in combination with an ROV equipped with a GPS (global positioning system)-integrated directional hydrophone.

The ROV surveys, conducted during the day, were guided by high-resolution

(Abalone continued on page 6)



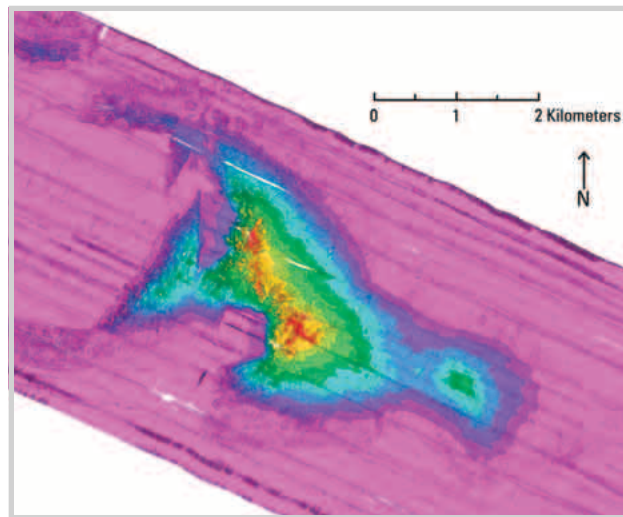
Rikk Kvitek installs the Reson 8101 multibeam-sonar head onto a rotating pipe for deployment. (The same pipe was used to deploy the ORE Trackpoint II pinger for tracking the ROV during daytime operations.) **Jason Mansour** assists.

(Abalone continued from page 5)

images of Tanner Bank collected during acoustic surveys conducted at night. For the acoustic surveys, a Klein 2000 sidescan-sonar system from the USGS and a Reson 8101 multibeam-sonar system from CSUMB were operated simultaneously, at a ship speed of approximately 4 knots. Tests done without the sidescan-sonar system indicate that the multibeam-sonar system could have collected better data and at twice the speed. Future surveys should dedicate several days to 24-hour multibeam-sonar surveying, followed by alternating daytime ROV operations and nighttime high-resolution sidescan-sonar surveying.

Preliminary data from Tanner Bank suggest that the density of white abalone is approximately 0.003 abalone per m^2 , several orders of magnitude lower than the density of 1 abalone per m^2 estimated for the area before intensive harvesting began in the 1970s. Approximately 194 individuals were identified during 60 hours of ROV searching, and their GPS coordinates were logged. It is unknown whether the white abalone on Tanner Bank are a self-sustaining population, because the larval period of white abalone is 8 to 10 days and currents faster than 1 knot sweep over the bank. Thus, larvae from any successful reproduction may be swept out to sea. None of the observed abalone were juveniles.

Butler hopes to return to Tanner Bank in the near future with a team of scuba divers that have been trained in deep diving and are skilled in the safe removal of white abalone from their substrate. These animals will serve as broodstock for a captive-breeding program based out of the Southwest Fisheries Science Center. Establishing multiple culture facilities is essential for creating a successful captive-breeding program. To this end, NMFS is partnering with the Channel Islands Marine Resources Institute and the University of California, Santa Barbara, which currently hold 11 broodstock and 100,000 juveniles resulting from a spawning attempt made during spring 2001. The captive-breeding program will not only serve to rebuild white-abalone stocks through the outplanting (release to the wild) of cultured individuals, but will also advance



Part of a multibeam-sonar bathymetric image collected during the cruise, showing the east half of the top of Tanner Bank anticline. Rough-appearing areas are outcrops of erosionally resistant sedimentary layers of the Pliocene and Miocene Monterey Formation; they provide excellent habitat for white abalone and for rockfish species that are also threatened. Some evidence of secondary right-lateral strike-slip faulting is visible where the sedimentary layers are offset along north-easterly oriented lineations.

scientists' understanding of the biology of the species. Critical research initiatives will include the examination of white-abalone genetic-stock structure, recruitment dynamics, growth and survival patterns, and habitat preferences.

The success of an outplanting program for white abalone will depend upon previous knowledge of the animal's preferred habitat, the ability to locate suitable outplanting habitats in the wild, the ability to monitor these sites, and the ability to protect these sites against poaching. To this end, the high-resolution habitat maps produced by **Guy Cochrane** and **Rikk Kvitek**, director of the Seafloor Mapping Lab at CSUMB, are critically important to the recovery effort for white abalone. By superimposing both the real-time ROV and support-vessel positions on these three-dimensional maps, the ship captain and ROV pilot were able to effectively navigate and focus their search efforts within specifically targeted habitat types. The efficiency of this combined approach was demonstrated dramatically during the July 2002 cruise, when ROV pilots found, on average, 24 white abalone per day by using the new sonar maps generated the night before, in comparison with previous attempts that lasted as long as 1 month and resulted in the identification of fewer than 8 white abalone per day.

Preliminary mapping results from the July cruise indicate that Tanner Bank is an anticline composed of folded sedimentary rocks. Differential erosion of the rock lay-

ers has created a relatively large habitat for white abalone and a good habitat for many types of rockfish (*Sebastes* spp.), as well as a depression in the center of the bank, giving it a shape similar to that of an atoll or volcanic crater. During low sea level, Tanner Bank was probably an island with a large central lagoon.

The techniques employed during this cruise should prove valuable for the recovery and conservation of white abalone. The extension of ROV and acoustic remote-sensing technology to other areas along the coast of Southern California, the Channel Islands, and Baja California will be crucial for reestablishing white abalone throughout its historical range. In addition, the potential for addressing other Federal and State agency initiatives exists. The marriage of ROV and acoustic remote-sensing technologies can help to advance ocean exploration through nondestructive sampling techniques, to determine critical habitat for endangered and threatened species, to aid in establishing marine reserves, and to aid in managing fisheries resources. For example, Tanner Bank is part of the cowcod (*Sebastes levis*, a rockfish) conservation area, and bottom fishing on the bank is restricted to depths of less than 20 fathoms (120 ft, or about 40 m). This area has been designated by the Pacific Fishery Management Council as part of the rebuilding plan for cowcod. The high-resolution habitat map of Tanner Bank will be used to direct the recovery monitoring for cowcod and, possibly, other exploited species. ❁

Radios Lead Researchers to Nests of Elusive Marbled Murrelets

By Catherine Puckett

It's 2 a.m., about 1 mile off the coast of Redwood National and State Parks in Humboldt County, CA, near the northernmost part of the state. In the pitch-black night, researchers talk quietly while they wait aboard the *Coral Sea*, a 90-foot-long Humboldt State University research vessel.

Patient waiting is an essential trait for those who study birds, especially "shy," seldom-seen birds. This time, researchers from the U.S. Geological Survey (USGS) and Humboldt State University have waited for an hour before their small talk and dozing between captures are broken by the sound of the two-way radio.

"*Coral Sea*, this is **Orthmeyer** in *Mobile 1*. We have a bird. We're en route."

What **Dennis Orthmeyer**, USGS research biologist, and the capture team have caught is a marbled murrelet, a seabird about 8 inches long and weighing less than a half-pound. Marbled murrelets feed on

high branches of old-growth redwood and Douglas-fir trees.

In 1992, the marbled murrelet was listed as a Federally threatened species in California, Oregon, and Washington, primarily because of the loss of nesting habitat in old-growth forests. In California, the bird is State-listed as endangered. Until this study began in 2001, only a few marbled murrelet nests had ever been found in California. In fact, no marbled murrelet nest had ever been discovered until the 1970s. In 2001, USGS and Humboldt State University scientists found five nests, aided by radios on the birds. This year, the researchers radio-marked an additional 44 birds and continued the search for nests.

This particular murrelet is captured by scientists with many years of experience who used a spotlight and dip net to scoop up the bird as it rode the waves on the ocean where it was spending the night before returning closer to shore to feed at sunrise. Each member of a breeding pair will return to its nest, switching places with its partner before or at sunrise for a 24-hour stint attending the nest. The bird's travel at sunrise or sunset, when coastal fog is most prevalent, caused early loggers in the area to call it the "fog bird."

The capture team carefully transports the bird in a 14-foot-long inflatable boat to the research vessel, where a bird processing line is ready to go.

To keep the captured bird calm, the researchers handle the

bird carefully and quickly with gloved and gentle hands, using low lights and talking quietly only when necessary. As soon as the bird arrives at the research vessel *Coral Sea*, the murrelet is placed in the hands of Humboldt State University seabird biologist **Percy Hebert**, who examines the bird to determine whether it has a broodpatch—a featherless area on its chest which indicates that the bird is nesting. The bird is then passed to **Tom Jenson** from the Center for



Captured marbled murrelet after processing. Photograph courtesy of Humboldt State University.

Reproduction of Endangered Species in San Diego for an ultrasound, a technique being developed to discern whether a bird is a male or female, because the marbled-murrelet males and females both look alike.

After this, a measuring team quickly weighs the bird, takes its body measurements, and then draws a small bit of blood for information about sex, genetics, and blood characteristics to identify stress. This blood will be used for baseline information about the species, and in oil spills and other situations where the blood characteristics can be compared. Finally, veterinarian **Rick Brown** of Humboldt State University attaches a minute radio transmitter—less than half the size and weight of a nickel—to the bird. Then, a short while later, researchers transport the bird by a Zodiac boat to near its capture site, where the bird is released onto the ocean.

Five days later, a California Department of Fish and Game aircraft reports to researchers on the ground that they have located the bird inland from the coast.

The radio provides essential information on the movements, timing of nesting, and habitat of this secretive bird. By tracking the radio signals from these murrelets, biologists have been able to find murrelet nests, which are commonly 200 feet high in old-growth trees.

(Murrelets continued on page 8)



Capture team on inflatable boat heading out in mid-April for capture attempt. Photograph courtesy of Humboldt State University.

small fish and invertebrates in the ocean, using their wings to "fly" through the water. They are unusual among seabirds because they are commonly solitary or found in groups of two or three, instead of the large social groups of many seabirds. Except when these birds nest and raise young, they spend their entire life on the ocean. Even stranger, though, is the fact that these chubby little birds with whirring wings and a fast flight fly inland to nest on

Fieldwork, continued

(Murrelets continued from page 7)

Knowing the secretive locations of these nests and more about the bird's life history is vital to effectively protecting this unique bird, say **Dennis Orthmeyer** and **Richard Golightly**, the two scientists leading this 3-year study of the effects of human disturbance on breeding marbled murrelets.

Orthmeyer, a scientist with the USGS' Western Ecological Research Center, and **Golightly**, a professor and scientist in the wildlife department at Humboldt State University, Arcata, are pleased because the radios have already led them to five murrelet nests that probably would never have been found through more traditional methods.

After capturing and releasing 23 marbled murrelets last year and 44 this year, the research team is intensively studying the movements and nesting status of the murrelets. Daily ground and airplane crews track the movements of the radioed murrelets on the ocean and inland during the breeding season from April to August.

"The scanner is similar to the radio in your car," says **Orthmeyer**, "and the murrelets are all on different stations. So, if a murrelet signal indicates an inland location during the day, it's at a nest, and ground crews hurry to pinpoint the nest for further study."

Said **Golightly**, "One of our goals is to provide land managers of Redwood Na-



Radio-marked marbled murrelet on nest. Image from videotape, courtesy of Humboldt State University.

tional and State Parks, as well as nearby landowners, with factual information that will enable them to make sound management decisions to help conserve this Federally threatened species. We hope to identify factors that may contribute to successful reproduction and future generations of marbled murrelets."

Since the marbled murrelet is now restricted to small areas of its former range because of the loss of old-growth forests, said **Golightly**, it is vital that land managers have good science-based information to maintain the successful nesting of the remaining birds.

This team of USGS and Humboldt State University researchers, along with staff from the National Park Service, the Bureau

of Land Management, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game, are studying nest locations, different types of habitat necessary for the birds, and general life-history requirements to understand how nesting murrelets respond to human disturbances or other human use of their nesting habitat.

Preliminary results from the first year of the study include the following:

- All the nests the researchers found were in old-growth trees.
- Of the five murrelet nests examined, three were probably successful in producing and raising young.
- At sea, the radio-marked murrelets ranged over the breeding season from the mouth of Humboldt Bay to Brookings, OR, a distance of about 90 miles.

This project is supported by the USGS, Humboldt State University, the National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management, the California Department of Fish and Game, the California Department of Parks and Recreation, and the California Department of Transportation. ❁

Research

Proposal for Drilling in the Broad, Shallow Seas of Southeast Asia and Australia

By **Terry Edgar** and **Blaine Cecil**

U.S. Geological Survey (USGS) scientists are part of an international group proposing to drill sediment cores in the shallow seas of Southeast Asia and Australia to study the relation between climate and global sea-level change. The group seeks to conduct the drilling through the Integrated Ocean Drilling Program (IODP), scheduled to replace the highly successful Ocean Drilling Program (ODP) in late 2003.

The IODP has three components:

1. The United States will operate a riserless ship, similar to the ODP drill ship *Joides Resolution*, for operations in the deep ocean.

2. Japan will operate a huge, riser-equipped ship (*Chikyu*, weighing 60,000 tons, in comparison with the 10,000-ton *Resolution*) for coring along continental margins. (The riser, a string of pipe from the drill ship to the sea-floor wellhead, permits the circulation of drilling fluids and the use of blowout-prevention equipment. It will enable the ship to drill deeper into sediment along continental margins than a riserless ship.)
3. Europe will manage Mission-Specific Platforms (MSPs)—drilling ships

and barges chartered for specific drilling requirements in shallow water or remote areas not accessible by either the U.S. or the Japanese ship.

Terry Edgar (USGS, St. Petersburg, FL), **Blaine Cecil** (USGS, Reston, VA), **Patrick De Deckker** (Australian National University), **Allan Chivas** (Wollongong University, Australia), **Pinxian Wang** (Tongji University, People's Republic of China), and **Karl Stattegger** (University of Kiel, Germany) prepared a pre-proposal for MSP drilling in the shallow cratonic seas of Southeast Asia and Australia. IODP

(Drilling continued on page 9)

(Drilling continued from page 8)

committees approved the pre-proposal and now require a full proposal, which is being developed after a meeting of **Terry, Blaine, and Karl** on August 5-7 in St. Petersburg, FL, and a visit by **Karl** to USGS headquarters in Reston, VA. **Jack Medlin** of the Office of International Geology is assisting the group in negotiations with nations in the study area.

A major goal of the project is to document the relation between climate and changes in global sea level from 18° south of the Equator to about 18° north of the Equator. The huge regions of the Southeast Asian and Australian continental crust that

are submerged during interglacial periods (such as the present) are exposed during glacial times, causing major changes in climates of the region as well as climates at higher latitudes. Significant climate changes have been demonstrated in Kalimantan (Borneo) at the Last Glacial Maximum. Interbedded marine sediment, terrestrial sediment (ancient soils), and lakebed sediment offer a unique opportunity to unravel the intertwined histories of climate and sea-level change. Because land surfaces in the region are nearly flat, sedimentation there is particularly sensitive to sea-level changes, and evidence of

rising and falling sea level is preserved in ancient soils and lakebed sediment that record sea-level lowstands and in marine deposits that record sea-level highstands. The opportunity to study climate and sea-level changes in a climatically sensitive tropical setting is not afforded anywhere else on Earth.

The positive response by the IODP committees that reviewed the pre-proposal was encouraging to us. The next meeting of the proponents is planned for November 15 and 16, after the East Asian Marginal Seas Meeting sponsored by the American Geophysical Union (AGU) in San Diego, CA. ❁

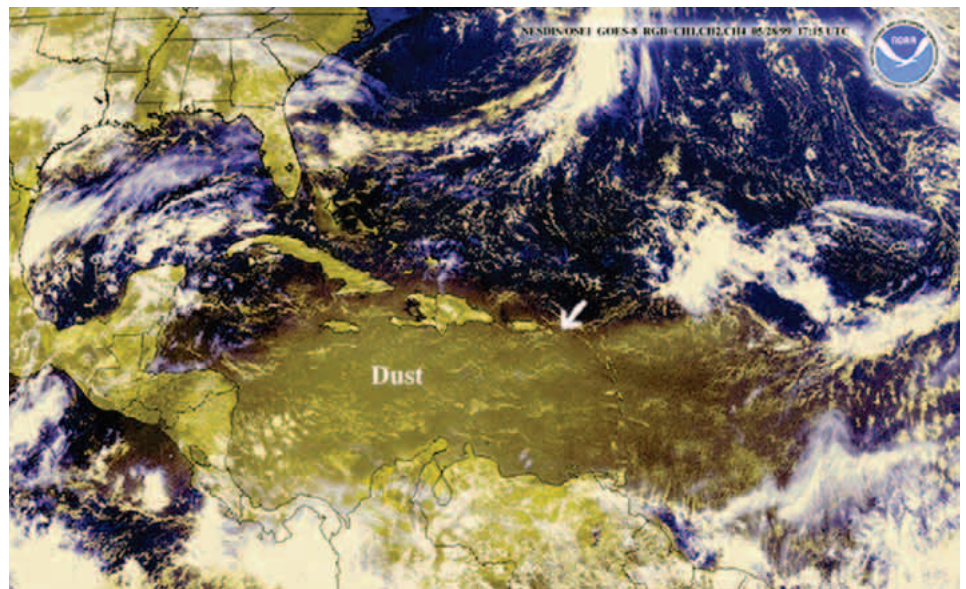
African Dust Microbiology in the Caribbean

By Christina Kellogg

Summer storms and accompanying warm air can lift soil particles as high as 15,000 ft above the African deserts and then carry them across the Atlantic Ocean. Each year, several hundred million tons of African dust are transported westward by the trade winds to the Caribbean as well as to North and South America. About 50 percent of the African dust that reaches the United States affects Florida, while the rest may scatter as far northward as Maine and as far westward as Texas.

A long-term drought in the Sahel region of North Africa that began in the early 1970s, along with poor land-use practices and the drying of Lake Chad, is believed to have contributed to an increase in transatlantic dust over the past few decades. Coincident with the increase is a notable decline in the health of coral reefs in the Caribbean and Florida. A hypothesis was put forth suggesting a relation between degradation of Caribbean marine species and airborne pathogens (bacteria, fungi, viruses) that could be transported with the African dust. The dust could also be contributing to human health problems, such as asthma. To address these questions, our group (**Eugene Shinn, Ginger Garrison, Dale Griffin, Christina Kellogg, and Chuck Holmes**), in collaboration with the National Aeronautics and Space Administration (NASA), began a study to identify the microbes and

(Caribbean continued on page 10)



A satellite view of African dust blanketing the Caribbean on May 28, 1999. White arrow points to the U.S. Virgin Islands.

Christina Kellogg checks wind-speed and air temperature while taking a dust sample on St. John, U.S. Virgin Islands. The liquid impinger, about the size of a lunchbox, is in the rocks to her left (circled).



Research, continued

(Caribbean continued from page 9)

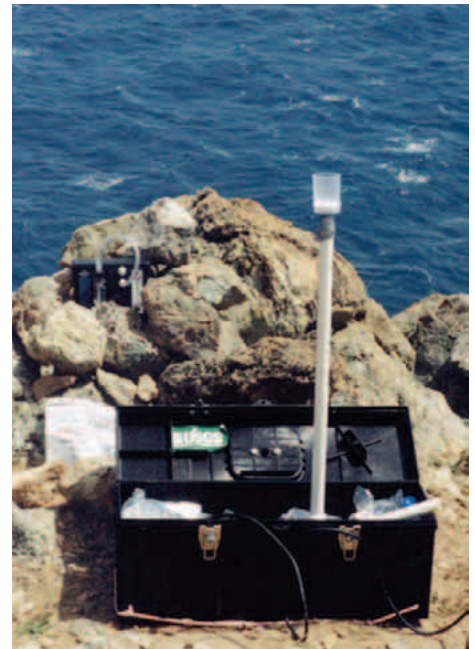
pesticides transported with African dust, which could be affecting human and marine ecosystem health in both the Caribbean and the Eastern United States.

We have published results proving that African dust does carry living microbes. That work, involving culturing of air filters on agar, revealed the presence of bacteria and fungi, of which 25 percent are plant pathogens and 10 percent are opportunistic human pathogens. The agar medium was chosen because cultivation and visible growth immediately answer the question, "Are these microbes viable?" However, the method limits detection to only those organisms that are capable of growing on that particular agar medium, which is typically only about 1 percent of the total population of bacteria and none of the viruses (which require a living host to reproduce).

The obvious next step is to develop methods that allow us to detect the total microbial community, which means being able to extract DNA (microbial genetic material) directly from the dust sample. During July and early August, **Christina** hiked out to a remote sea cliff on the island

of St. John (U.S. Virgin Islands) to test two new methods. She collected a series of air samples during periods of clear skies and periods of African dust events, using both a vacuum-pump/filter apparatus and a liquid impinger. The new filters being tested can be dissolved in an organic solution to capture all the organisms on the filter. The liquid impinger works by bubbling the air sample through 25 milliliters of buffer, which catches even the smallest viruses that would pass through the filters. The DNA can then be extracted directly from the liquid buffer. If these methods test well, we will be able to probe the microbial community DNA for specific pathogens of interest, such as the bacterium that causes white-plague disease in corals.

For more information on this topic, visit the Web sites "Coral Mortality and African Dust Project," at URL http://coastal.er.usgs.gov/african_dust/, and "Conference on the Effects of Globally Transported African and Asian Dust on Coral Reef and Human Health," at URL <http://coastal.er.usgs.gov/conferences/dust2001/>. ☼



Dust samples are taken by using two different methods. The liquid impinger (small black box at left) bubbles air into a sterile liquid buffer in the glass tube. The vacuum pump (toolbox, foreground) sucks air through sterile filters in the bottom of the plastic cup unit on top of the PVC pipe.

Outreach

The Tall Ships in St. Petersburg, FL

By Terry Edgar

On Thursday, June 27, a fleet of tall ships paraded into Tampa Bay and docked in St. Petersburg, FL. The U.S. Geological Survey (USGS) was involved on several fronts. Our center chief, **Lisa Robbins**, received a couple of passes to ride aboard the U.S. Coast Guard barque *Eagle* as it led the parade of ships, and she invited **Terry Edgar** to join her. Reluctantly, **Terry** said he would go, and put on a remarkably realistic display of enthusiasm. They joined St. Petersburg's **Mayor Rick Baker** and most of the city council on a small Coast Guard boat that took them to the ships outside the bay, where they transferred to the *Eagle*. The bay was littered with small boats participating in the parade, which were kept at least 50 m



The *Eagle* approaching the Skyway Bridge at the entrance to Tampa Bay.

from the tall ships by various authorities with lights and horns. The *Eagle* is a magnificent sailing ship, capable of speeds as high as 17 knots under full sail. Unfortu-

nately, the wind did not join the festivities, and so all the ships with square sails motored into the bay under bare poles. A

(Tall Ships continued on page 11)

(Tall Ships continued from page 10)

couple of sloop-rigged ships were able to raise their sails, but they also had to parade under power.

The ships paraded past downtown St. Petersburg and reversed course to return to the port. At this time, the *Eagle* fired a few shotgun shells from a small cannon (30-cm barrel), and the Brazilian *Cisne Branco* (White Swan) responded with a few attention-getting blanks (we think) from its life-size cannons. The *Cisne Branco* was built a few years ago and is a copy of the *Eagle*. These two large vessels were docked by tugs in the port, and they and the other tall ships were on display and open to the public on Friday and Saturday. The *Eagle* departed early Sunday morning, but all the others remained through the weekend.

The *Eagle* was built in Hamburg, Germany, in 1936, was commissioned as the *Horst*

Wessel, and was one of three such vessels used for training. Only five were built. During World War II, the ship served as a transport and training ship in the Baltic Sea, reputedly shooting down three aircraft. At the end of the war, the *Eagle* was taken by the United States as a war prize and sailed from Germany to the United States by an American and German crew. The crew of the *Eagle* must handle more than 22,000 ft² of sail and about 8 km of rigging.

The USGS also had its “tall ship” docked with the visiting tall ships. **Dennis Krohn** managed to get **Kim Yates’** houseboat *SHARQ Express* along the dock, where it was visited by many people interested in research in Florida, particularly in Tampa Bay. (See article about the *SHARQ Express* in May 2002 *Sound Waves*.) USGS hosts on the *SHARQ Express* in-



Just a few meters of the 8 km of rigging needed to sail the *Eagle*.

cluded **Kim Yates**, **Nate Smiley**, **Marci Marot**, **Bob Halley**, and **Terry Edgar**. One of our group put an appropriate sign on the side of the aluminum superstructure that said “This side up,” with a red arrow, fortunately pointing up. ☼



The *Cisne Branco* passing under the Skyway Bridge.



The *SHARQ Express* under the shadow of the *Cisne Branco*.

◀ The *Eagle* cruising east under bare poles.

Joint Teacher Workshop on the Gulf of Mexico

By Susan Horton

On July 18, U.S. Geological Survey (USGS) scientists from the National Wetlands Research Center (NWRC) in Lafayette, LA, teamed up with Fugro Chance, Inc., an international surveying and positioning company in Lafayette, to offer a workshop for local teachers. The theme of the workshop was the Gulf of Mexico, a fitting choice because both the USGS and Fugro Chance have worked and conducted research in and around the Gulf Coast region. NWRC presenters included USGS employees **Clint Jeske** and **Andrea Anteau** and USGS contract employees (through Johnson Controls) **Jill Rooth**, **Gabrielle Bodin**, and **Susan Horton**. Talk topics included interesting sea life, the offshore oil industry, mapping the sea floor, hurricanes, global climate change (including a tour of NWRC's greenhouse study on plants and carbon dioxide), and an update from **Kyle Rodriguez** of the Louisiana Governor's Office of Coastal Activities on the emerging national cam-



*Wildlife biologist **Clint Jeske** displays a live duck as he discusses the biodiversity of life along the Gulf of Mexico coast.*

paign to save coastal Louisiana. More than 90 educators received handouts, posters, CD-ROM's, and information to take back to their students about the Gulf of Mexico, an extraordinary resource right in their own "backyards." The USGS and Fugro Chance are already making plans to offer another workshop next summer. A teacher described the workshop as "totally awesome, the best inservice workshop I attended in 31 years." ❁



*(From left to right) **Carla Nelson** (Lafayette Parish School System) presents a certificate of appreciation for the Gulf of Mexico teacher workshop to organizer **Susan Horton** and National Wetlands Research Center Director **Bob Stewart**.*



***Kyle Rodriguez** (Louisiana Governor's Office of Coastal Activities) asks teachers for suggestions on how to raise national awareness of Louisiana's critical loss of wetlands.*

Mr. Bill's Creator Interviews Jeff Williams on Geologic History and Hazards of Coastal Louisiana

By Jeff Williams and Helen Gibbons

Those old enough to have seen *Saturday Night Live* back in the early 1970s, or reruns, will recall the now-cultlike clay character, Mr. Bill, and his co-stars (Sluggo, etc.). Many may have wondered who created him and what has happened over the past 3 decades. As it turns out, Mr. Bill's creator is alive and well and recently interviewed U.S. Geological Survey scientist **Jeff Williams** for his latest film project.

The Mr. Bill series was the brainchild of **Walter Williams** (no relation to **Jeff**), who created the figures and made the low-budget film productions in his living room while a student in New Orleans. **Walter** worked for a while in New York and, more recently, in Los Angeles as an independent filmmaker. He still revisits Mr. Bill on occasion, but his latest film project is producing an eight-part series covering the history of New Orleans. The first segment under production is titled "New Orleans: The Natural History." **Walter** is in the process of gathering background information, maps, and interviews of experts on various aspects of New Orleans and the Mississippi Delta region.

Jeff Williams (Woods Hole, MA) was interviewed in July 2002 to give his perspective, based on research in Louisiana over the past 15 years, on the geologic history of the deltaic plain, the effects of storms and sea-level rise on the region, and what can be done to restore the barrier islands and wetlands, as well as to help the public deal with the multiple coastal hazards facing New Orleans. The film is slated for completion by summer's end. It's unknown whether Mr. Bill will have a starring role in the film. For information on Mr. Bill, visit the Web site at URL <http://www.mrbill.com/>. For the film schedule later this year, keep an eye on PBS at URL <http://www.pbs.org/>. ❁

Marine Realms Information Bank Makes Headlines

By Kristin McKee

Three years of cataloguing, designing, and programming has paid off for the Marine Realms Information Bank (MRIB) team. Last month, *ArcUser Magazine*, a tutorial publication created by the geographic-information-system (GIS) software company ESRI (Environmental Systems Research Institute), described MRIB as a “sophisticated” digital library of the future.

MRIB, an effort of the Coastal and Marine Geology Program, is headed by **Fran Lightsom** and **Fausto Marincioni** of the Woods Hole Field Center (WHFC). This

information portal serves as an online library that gives users many different ways to search catalogued information about the marine and coastal environments.

The article that honored MRIB, “Better Document Management Through Georeferencing,” refers to the importance of digital libraries, such as MRIB, in retaining global access to scientific information. It states that the work being done on MRIB and other leading digital libraries, such as the Federal Geographic Data Committee’s MARC 21, the Online Computer Library

Center’s Dublin Core fields, and the Alexandria Digital Library Project, will “ultimately lead to powerful and flexible information-mining tools.”

ArcUser Magazine is a quarterly publication that highlights emerging technologies in the GIS field and provides information on the use of GIS equipment in various industries.

The article can be found at URL <http://www.esri.com/news/arcuser/0402/docmanage1of3.html>. (The mention of MRIB is on page 3 of the online article.)✻

Meetings

U.S. Commission on Ocean Policy—Boston Regional Hearing and Briefings in Woods Hole

By Debbie Hutchinson

In August 2000, the U.S. Congress passed the Oceans Act of 2000, which established a 16-member Commission on Ocean Policy (Ocean Commission) to undertake a study and make recommendations to the President and Congress about a national ocean policy for the United States. After two meetings in Washington, DC, the commission embarked on a series of regional meetings to gather information for its formidable charge. U.S. Geological Survey (USGS) Director **Chip Groat** was one of the lead speakers to the commission at its regional meeting in February 2002 in St. Petersburg, FL. The most recent regional meeting, held in Boston, MA, in historic Faneuil Hall in July 2002, included a visit to the USGS’ Woods Hole Field Center (WHFC).

As a precursor to the Boston hearings, five commission members visited the Woods Hole science community. The Woods Hole Oceanographic Institution (WHOI) hosted the commissioners by holding a series of four short poster-display briefings. The USGS poster briefing, which was delivered by **Debbie Hutchinson** (WHFC), was entitled “Stewardship of the Oceans—the Important Role of Sea-Floor Geology.” **Debbie’s** presentation emphasized **Chip’s** earlier message to the Ocean Commission on the importance



Ocean Commissioners and staff being briefed in Woods Hole, MA, by Debbie Hutchinson before the Ocean Commission hearings in Boston.

of integrated science in doing research needed to address societal issues. **Debbie** talked about four themes (monitoring, exploration, prediction, and information), with examples of USGS studies in the Northeastern United States as models for studies in all parts of the Nation.

WHOI Director **Bob Gagosian** then proceeded to further highlight the importance of USGS research in the Boston

Harbor restoration efforts underway since the mid-1980s. Two poster briefings were given by WHOI, emphasizing global climate change and ocean exploration; and the fourth briefing was by scientists of the National Oceanic and Atmospheric Administration (NOAA)’s National Marine Fisheries Service on marine biological and fisheries issues.

(Ocean Commission continued on page 14)

Meetings, continued

(Ocean Commission continued from page 13)

After the briefings, commission members were taken on a tour of the community and attended an elegant reception and dinner hosted by **Bob Gagosian** and his wife for the commissioners, their staff, and the heads of the various institutions and scientific organizations in the Woods Hole community.

Chip Groat's statement to the Ocean Commission at its regional meeting in St. Petersburg, FL, in February 2002 can be found on the World Wide Web at URL http://www.oceancommission.gov/meetings/feb_22_02/groat_statement.pdf. Transcripts of the Boston hearings

held in July 2002 are available at URL http://www.oceancommission.gov/meetings/jul23_24_02/july23_24_02.html. General information about the Ocean Commission is at URL <http://www.oceancommission.gov/>. ☼

USGS Scientists Attend U.S. Army Corps of Engineers' Numerical-Modeling Workshop

By Chris Sherwood

John Warner (Woods Hole, MA) and **Jingping Xu** (Menlo Park, CA) attended the Surface-Water Modeling System (SMS) workshop from July 29 to August 2 in Vicksburg, MS. More than 50 scientists and engineers from the U.S. Army Corps of Engineers (USACE), the U.S. Geological Survey (USGS), and private consulting firms attended the workshop to learn the SMS modeling system. The SMS software provides graphical user interfaces to several hydrodynamic, wave-current, and sediment-transport models, grid-generation tools, model-input-parameter selections, intermodel communication, and model-output-visualization tools. The un-

derlying models presented at the workshop consisted of ADCIRC, M2D, STWAVE, and CGWAVE; however, the SMS system contains many other numerical models.

The workshop was held at the USACE's Engineer Research and Development Center (ERDC), formerly the Waterways Experimentation Station (WES), in Vicksburg, MS, one of the leading centers for coastal engineering in the world. Attendees were given a tour of the ERDC facilities that included visits to physical models of Grays Harbor (WA) and Chicago Harbor (IL), large-scale flume studies of littoral sand transport, and inlet-study models. The workshop was under the direction of the USACE's Coastal Inlets Research Program,

led by **Nicholas Kraus**. USGS participation at the workshop was part of a continuing effort to learn about existing models of sediment transport and ultimately to develop, test, and utilize community coastal-sediment-transport models. The exchange of information will strengthen working relations between the two Federal agencies.

For more information about the workshop, visit the USACE Web site at URL <http://cirp.wes.army.mil/cirp/cirpnews.html>. For more information about the Surface-Water Modeling System (SMS), see URL <http://www.veritechinc.com/navigate.htm>. ☼

Staff and Center News

Farewell to Employees at the Woods Hole Field Center

By Kelle List, Ellen Mecray, and Debbie Hutchinson

Lester North of the Woods Hole Field Center (WHFC) has been selected as the Information Scientist with the Chief Information Officer in Reston, VA. **Lester** will work with U.S. Geological Survey (USGS) information technology (IT) managers and specialists to develop the Geologic Discipline (GD)'s IT policy within the USGS' IT framework, and to establish an Information Technology Security program for GD.

Since joining the USGS in 1970, **Lester** has worked in both the foreign and domestic programs in the Geologic and Water Resources Disciplines. Since 1986, **Lester** has worked as a computer specialist with the Coastal and Marine Geology Program (CMGP) in Woods Hole, MA. Computer activities at WHFC are temporarily under the direction of **Boyce Blanks**, who has agreed to serve pending

the recruitment of a permanent replacement later this summer.

Boyce is an Information Technology Specialist for the Water Resources Discipline (WRD) in Columbus, SC. He is serving his last year as a systems analyst for the Geographic Program Office. **Boyce** is a member of the WRD Windows Technical Advisory Committee (NT-TAC). He will be in Woods Hole until September 2002 as the WHFC Systems and Security Administrator, carrying out **Lester's** daily duties and assisting in the recruitment of a suitable replacement.

The WHFC is sadly bidding farewell to **Mario Santos**, who will be heading off to begin his college studies at Tufts University. **Mario** has been working with the geo-

(Farewell continued on page 15)



Mario Santos is leaving WHFC to begin his college studies at Tufts University.

(Farewell continued from page 14)

chemistry laboratory team under the supervision of **Ellen Mccray** for the past 3 years. After coming to the USGS during his sophomore year of high school, to escape paving tennis courts in the summer, **Mario** stayed on throughout his school days, working in the lab in the afternoons and on vacations.

The whole team will miss **Mario's** presence, his attention to detail, and his overall willingness to take on just about any task and see it through to completion. What will we do without our sediment grinder, sample splitter, acid-washer, sample weigher,

freeze-drying specialist, and lab-archive organizer? We hope he comes back often during his vacations at home in Falmouth to visit, and maybe help out in the lab some more! Meanwhile, we'll be thinking of him as he exceeds all expectations for his college professors in chemistry!

WHFC is sadly saying goodbye to **Becky Deusser**, who will be starting graduate school at the Boston University Knight Center for Science and Medical Journalism this September, after working

for more than a year on the Knowledge Bank project with **Debbie Hutchinson**. After receiving her M.S. in science journalism, **Becky** plans to write for a major newspaper or magazine, covering timely science and health issues.

This is our second time saying goodbye to **Becky**, who also worked in the data library with **Nancy Soderberg** from 1996 to 1998 while she was in high school. We'll miss her organizational and writing skills, as well as her diligence and helpfulness. Best of luck in this new and challenging change! ❀

Goodbye and Welcome—a Change in the *Sound Waves* Staff

By Helen Gibbons

The *Sound Waves* staff bids a fond farewell to **Becky Deusser** and extends a warm welcome to her successor, **Ellen Mccray**, as Contributing Editor to *Sound Waves* from the Woods Hole Field Center (WHFC).

As noted in the previous article, **Becky** will leave the USGS to begin graduate school this fall. **Becky** has served as WHFC's Contributing Editor to *Sound Waves* since December 2001. Her crisp editing and ability to round up articles from busy scientists have been a boon to the monthly newsletter.

Ellen Mccray will take over as WHFC's Contributing Editor starting with the next (October) issue. **Ellen's** work on *Sound Waves* will be on top of her considerable duties at WHFC, which she joined in 1997 as an operational oceanographer. In addition to conducting sediment geochemistry studies in Long Island Sound and the New York Bight, **Ellen** is the WHFC's lab manager, overseeing the budget for all the center's labs, such as the geochemistry lab, the sediment lab, and the GHASTLI (Gas

Hydrate and Sediment Test Laboratory Instrument) lab. **Ellen** is also the WHFC's Chemical Hygiene Officer, and she served for 4 months last summer as the center's Acting Assistant Chief Scientist. Last winter, she also took on the task of developing a collaborative operational plan for all of the Coastal and Marine Geology Program's labs. **Ellen's** high energy and organizational skills will be of great value to *Sound Waves*. ❀

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