USGS

Sound Waves Coastal Science and Research News from Across the USGS

http://soundwaves.usgs.gov/

Fieldwork

Surveying Faults and Sediment Outside the Entrance to San Francisco Bay

By Anne Gartner, Holly Ryan, and Patrick Hart

A small group of U.S. Geological Survey (USGS) personnel from the Western Coastal and Marine Geology Team ventured out of San Francisco Bay's Golden Gate for 10 days in late September to survey offshore faults near the epicenter of the great San Francisco earthquake of 1906. They used high-resolution seismic-reflection profiling systems to image several faults considered capable of producing damaging earthquakes, including the San Gregorio, San Andreas, and Golden Gate faults. The USGS and the California Geological Survey have recently focused on updating fault maps to be used by the Working Group on California Earthquake Probabilities in developing a new time-dependent seismic-shaking-hazard model for the State of California. Among other things, this model will be used to set Statewide earthquake-insurance rates.

The scientific crew, headed by **Holly Ryan**, included **Larry Kooker**, **Anne Gartner**, and **Peter Triezenberg**, joined at various times by **Patrick Hart**, **Ray Sliter**, **Gerry Hatcher**, and **Mike Boyle**. The 54-foot boat *Lakota*, recently transplanted to the West Coast from treasure hunting off Florida, was used as the research vessel on its maiden geophysical voyage, with captain **Tim Fleming** at the helm. Although temperatures were a bit chilly, the seas were incredibly calm, almost glassy, for the entire trip. (September in northern California sometimes cooperates.)

Larry Kooker *(left) and* ***Pat Hart*** *monitor data quality in an onboard, real-time display of seismic-reflection data. Photograph by* ***Holly Ryan****.*

Cruise chief scientist ***Holly Ryan*** *pauses while photographing activity on the fantail of the* Lakota *(right). Photographs by* ***Anne Gartner****.*

Data were collected from Fort Funston, south of the Golden Gate, to as far northward as Bolinas, near where the San Andreas fault crosses onto shore. One of the main goals was to study the transfer of seismic slip between the San Gregorio, San Andreas, and Golden Gate faults.

Another part of the mission was to determine the subsurface structure of gigantic (as much as 10 m high and 220 m from crest to crest) sand waves imaged by USGS scientists **Patrick Barnard** and **Dan Hanes** just outside the Golden Gate (see related *Sound Waves* article at URL **http://soundwaves.usgs.gov/2006/09/research.html**) and to provide shelf-sediment information for **Barnard** and **Hanes'** coastal-erosion study off Ocean Beach, located between the Golden Gate and Fort Funston (see related *Sound Waves* article at URL **http://soundwaves.usgs.gov/2006/04/**). This effort included collecting data to calculate the volume of sediment in an ebb-tide delta immediately seaward of the Golden Gate and in Holocene deposits on the continental shelf.

(Fault Survey continued on page 2)

Sound Waves

Editor
Helen Gibbons
Menlo Park, California
Telephone: (650) 329-5042
E-mail: hgibbons@usgs.gov
Fax: (650) 329-5190

Print Layout Editors
Susan Mayfield, Sara Boore
Menlo Park, California
Telephone: (650) 329-5066
E-mail: smayfiel@usgs.gov; sboore@yahoo.com
Fax: (650) 329-5051

Web Layout Editor
Jolene Shirley
St. Petersburg, Florida
Telephone: (727) 803-8747 Ext. 3038
E-mail: jshirley@usgs.gov
Fax: (727) 803-2032

SOUND WAVES (WITH ADDITIONAL LINKS) IS AVAILABLE ONLINE AT URL
http://soundwaves.usgs.gov/

Contents

Submission Guidelines

Deadline: The deadline for news items and publication lists for the May issue of *Sound Waves* is Tuesday, March 13.
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).

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

U.S. Geological Survey
Earth Science Information Sources:

Need to find natural-science data or information? Visit the USGS Frequently Asked Questions (FAQ's) at URL **http://www.usgs.gov/search/faq.html**

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

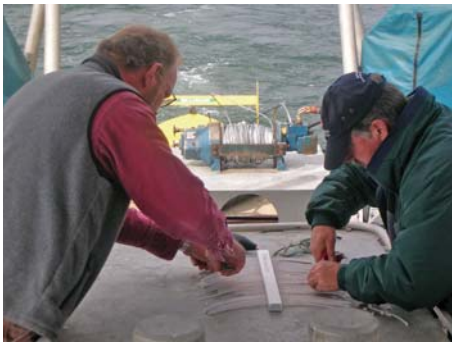
Want to e-mail your question to the USGS? Send it to this address: ask@usgs.gov

Fieldwork, continued

(Fault Survey continued from page 1)

The scientists gathered data with two high-resolution seismic-reflection systems, both of which produce pulses of sound and record the return of their echoes from layers of sediment and rock beneath the sea floor. Such data are used to produce cross-sectional images, or profiles, of the sub-sea-floor layers.

For studies of fault geometry, the scientists used a 50-tip minisparker as the sound source and a short, single-channel hydrophone streamer to receive the echoes. The minisparker is towed just beneath the water 5 to 10 m behind the vessel, where, at regular intervals, it produces an electric spark that vaporizes a small volume of water. Rapid expansion of the vapor bubble generates a sharp pulse of sound that radiates outward through the water. The process is similar to that which produces lightning and thunder, though on a much smaller scale. Wherever the sound energy encounters a change in acoustic impedance, which is the product of density and acoustic velocity (the speed of sound in a given material), some of the sound energy is reflected. Thus, some sound energy is reflected at the boundary between seawater and the sea floor, while sound energy that penetrates the sea floor is reflected from boundaries between sub-sea-floor layers of differing acoustic impedance. The returning echoes are picked up by underwater microphones, called hydrophones, spaced at regular intervals in a clear, oil-filled hose, or "streamer," towed behind the vessel.



Mike Boyle *(left) and* ***Larry Kooker*** *trim the tips on the minisparker system. Photograph by* ***Holly Ryan****.*

To image the sand waves, the scientists used an Edgetech 512i subbottom-profiling system composed of a high-frequency "chirp" source and a small hydrophone array, all housed within a 190-kg "fish" that is towed 3 to 5 m below the sea surface. The chirp system uses a piezoelectric transducer to convert electrical pulses into

(Fault Survey continued on page 3)

(Left to right) ***Peter Triezenberg***, ***Larry Kooker***, *captain* ***Tim Fleming***, *and* ***Pat Hart*** *prepare to deploy the chirp system. The Golden Gate Bridge is in the background. Photograph by* ***Holly Ryan****.*

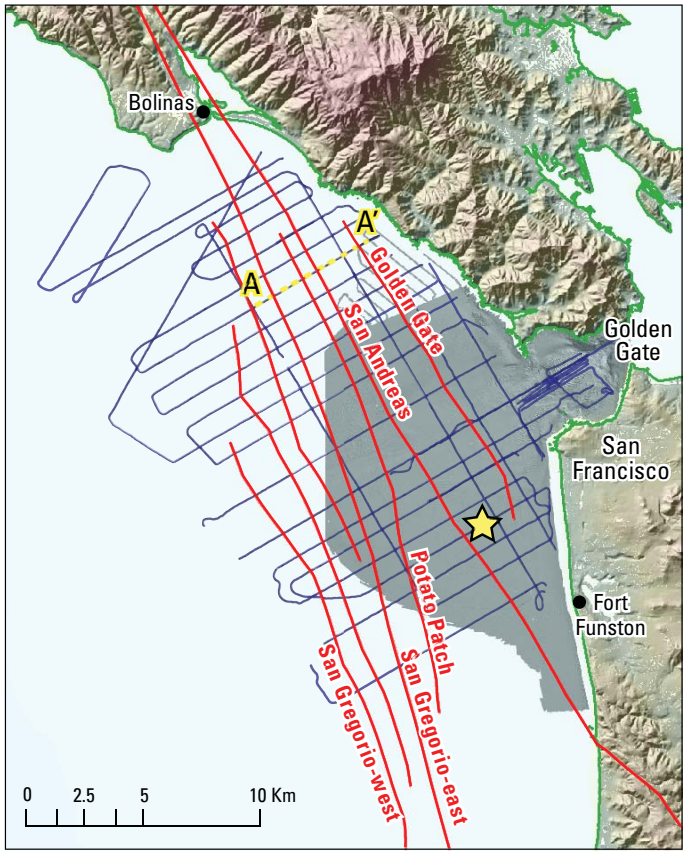
(Fault Survey continued from page 2)

mechanical vibrations, or sound energy. The hydrophones—like those in the minisparker system—reverse the process, converting the mechanical energy of returned echoes into electrical signals that are digitized, displayed, and stored in a computer. (To learn more about seismic mapping, visit URL **http://woodshole.er.usgs.gov/operations/sfmapping/seismic.htm**.)

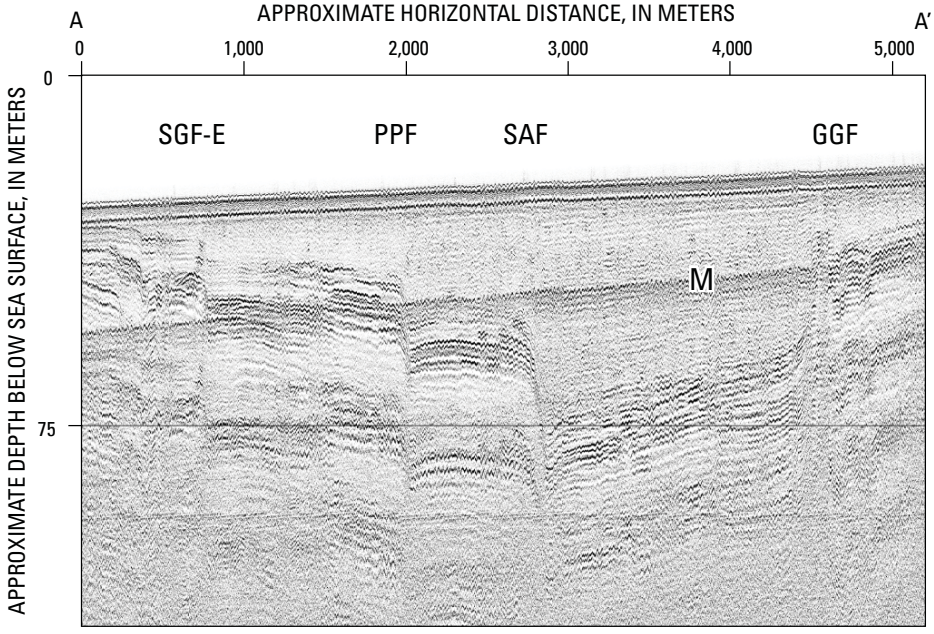
The minisparker system provided deeper imaging penetration below the sea floor but slightly less resolution than the chirp system. Data for both systems were digitally recorded for postcruise processing and interpretation. Several coincident profiles were collected with both systems for data comparison.

Results of the seismic-reflection surveys were mixed. The sediment in the area of the shallowest part of the ebb-tide delta—where thick, sandy deposits are present—obscured faulting. In addition, gas from natural seeps scattered the sound energy, making it difficult to map faults in some areas. Evidence of gas in the seismic-reflection data includes bright spots caused by pockets of trapped gas, data "washouts" caused by gas dispersed through sediment, and fuzzy clouds of reflectivity caused by gas bubbles in the water column. (Cruise participant **Pat Hart** notes that gas "has a dramatic effect on data quality—usually bad.") In many areas, however, especially away from the ebb-tide delta, the data were spectacular, thanks in part to relatively calm seas. The data are currently being processed and will be used not only in the new seismic-shaking-hazard model for California but also in studies of tectonics and coastal erosion.

Another important aspect of the cruise involved using USGS staff rather than paid consultants as marine-mammal observers. Several of the Western Coastal and Marine Geology Team research staff have been trained to scan for and identify marine mammals in order to determine whether operations should be shut down to prevent the acoustic equipment from adversely affecting whales, dolphins, or porpoises. Possibly owing to a lack of food sources in the area, only a few sea lions and harbor seals were spotted, to the relief of the scientists and the boredom of the observers. ❁



Study area west of San Francisco, Calif. Red lines, faults (two unlabeled faults are strands in the San Gregorio fault system); star, epicenter of great San Francisco earthquake of 1906; dark blue lines, research vessel's track; dashed yellow line A-A', approximate location of seismic-reflection profile shown here; gray shading, extent of recent high-resolution bathymetric mapping (see Sound Waves *article at URL* ***http://soundwaves.usgs.gov/2006/09/research.html****).*



Minisparker profile across Holocene extensional basin between the San Gregorio fault zone and the Golden Gate fault (line A-A' on map). SGF-E, eastern strand of the San Gregorio fault zone; PPF, Potato Patch fault; SAF, San Andreas fault; GGF, Golden Gate fault; M, multiple (a line that mimics the sea-floor surface at twice the water depth).

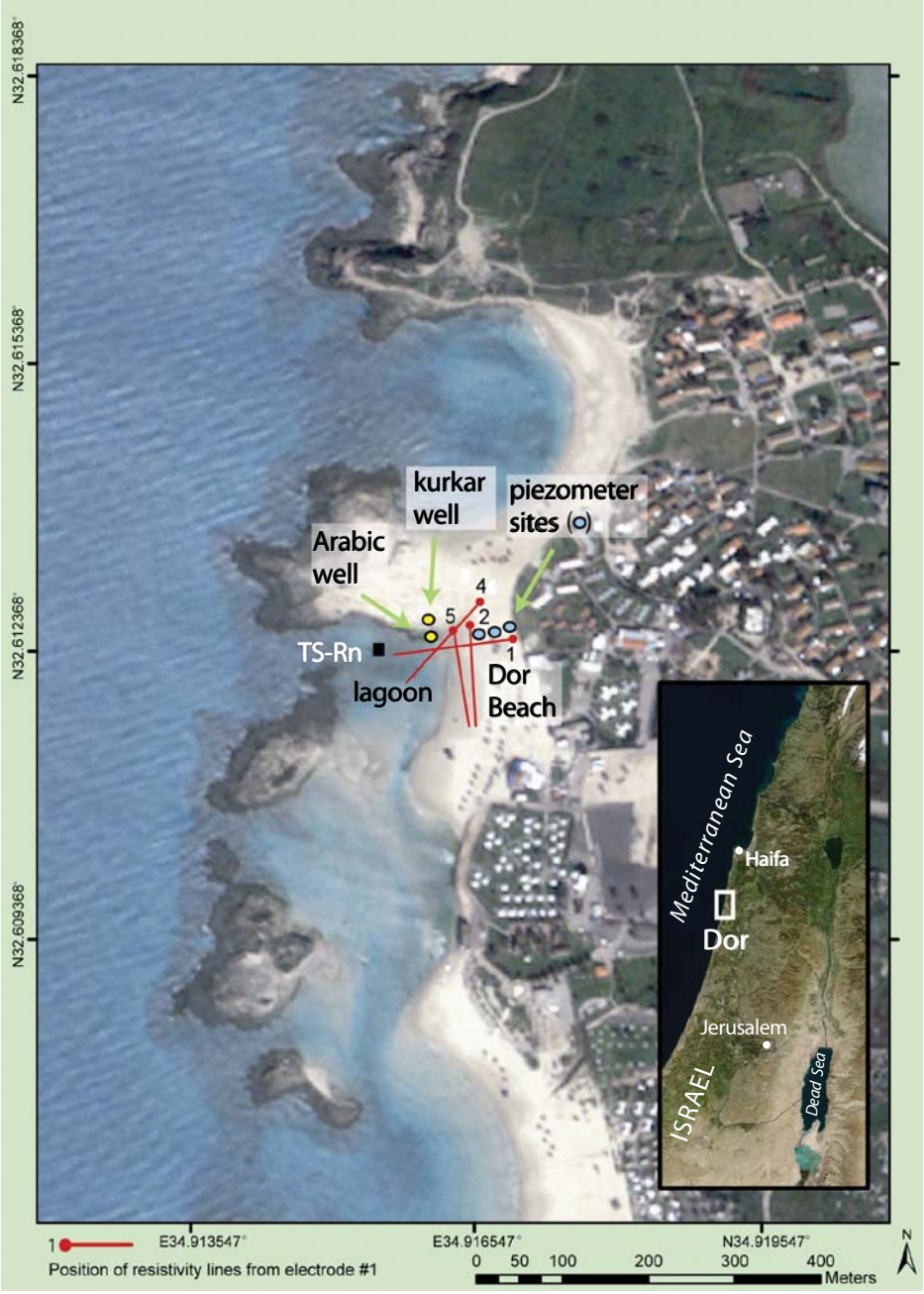
Studying Submarine Ground-Water Discharge at Dor Beach, Israel

By Peter W. Swarzenski

U.S. Geological Survey (USGS) scientist **Peter Swarzenski** traveled to Israel in 2005-06 to study submarine ground-water discharge—the flow of ground water directly into seawater—on Israel's Mediterranean coast. **Swarzenski**, **William Burnett** (Florida State University), **Yishai Weinstein** (Bar-Ilan University, Israel), and additional participants from institutions in Florida and Israel conducted high-resolution geophysical and geochemical surveys at Dor Beach to examine the shallow coastal hydrogeology and its control on the flow of submarine ground water into the Mediterranean Sea. The geophysical surveys employed a multi-electrode cable to measure marine resistivity (which yields information about pore-water salinity), marking the first time this new technique has been used outside of Florida. The scientists reported their results in the December 2006 issue of *Geophysical Research Letters* (URL **http://www.agu.org/pubs/crossref/2006/2006GL028282.shtml**).

About 25 km south of Haifa in northern Israel, Dor is the site of an ancient port where ongoing archeological research has traced evidence of diverse civilizations—including Phoenicians, Israelites, Persians, and Greeks—back to at least 3,000 years before the present (see URL **http://www.hum.huji.ac.il/dor/**). The town lies on the Carmel coastal plain, which has undergone large fluctuations in sea level during late Holocene time. For example, at the Dor Beach study site, an old Arabic well that today is tidally inundated and thus defunct was situated about 7.5 m from the coast line in 1915 and still operational; the well's history implies that sea level at Dor Beach has risen more than 10 cm in just one century. A sea-level record constructed from geologic, geomorphologic, and archeological data indicates mean-sea-level fluctuations of about 1 m above and below present sea level during the past 3,000 years (*Science*, 1984, v. 226, p. 831-832; see URL **http://www.sciencemag.org/cgi/content/abstract/226/4676/831**).

With funding from the United States-Israel Binational Science Foundation, the USGS Submarine Ground-Water Discharge project has conducted studies at Dor since 2004, using various methods to better understand the role of the area's subsurface geology in submarine ground-water discharge and the proportion of recycled seawater in this discharge. The March 2006 fieldwork focused on shallow coastal hydrogeology at Dor Beach and its control on the exchange of submarine ground water with Mediterranean seawater.



Study site at Dor Beach, Israel, showing time-series resistivity lines (1, 2, 4, 5). TS-Rn, anchored boat used for time-series ^{222}Rn measurements; kurkar well, deep coastal well in a shore-parallel sandstone ridge, or "kurkar"; piezometer, temporary well for collecting ground-water samples at discrete depths.

The two-way exchange of coastal ground water with seawater is a ubiqui-

(Dor Beach continued on page 5)

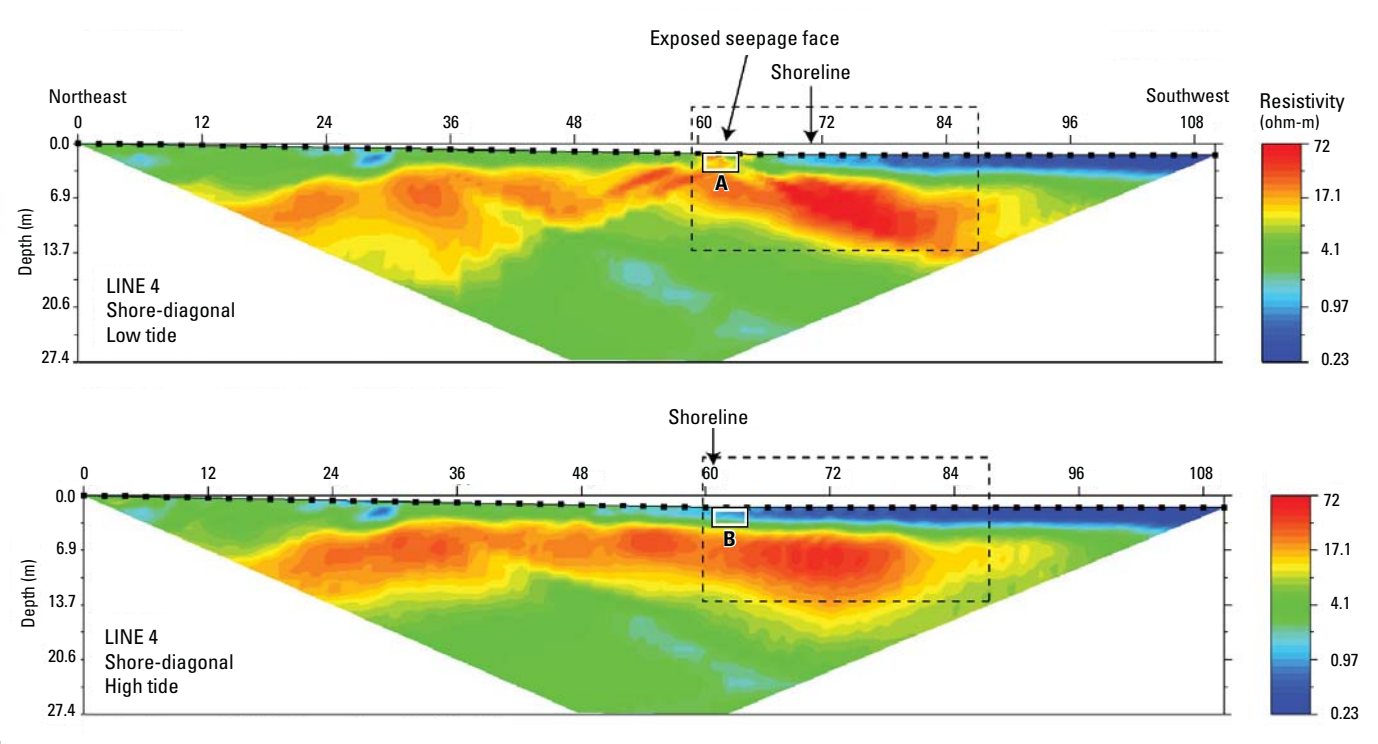
(Dor Beach continued from page 4)

tous phenomenon driven by both marine and terrestrial processes. On the marine side, this exchange is affected by water-level fluctuations, such as waves, tides, and storms, as well as by density differences between various water masses. On the terrestrial side, the flow of ground water toward the sea is affected by the underlying geologic framework and seasonal hydrologic cycles. Although the global volume of freshwater delivered to the sea by submarine ground-water discharge is typically estimated to be much less than that of freshwater delivered by river discharge, the potential of submarine ground water to carry contaminants and excess nutrients into coastal waters makes it an important influence on the nearshore environment.

Swarzenski and his colleagues examined the shallow coastal hydrogeology at Dor Beach by using time-series measurements (measurements taken at regular

(Dor Beach continued on page 6)

Dor Beach, Israel, showing 56-electrode cable used to collect stationary resistivity measurements (line 1 on map). The 112-m-long cable's midpoint was positioned close to the low-tide line; about two thirds of the cable was submerged at high tide. Sandbags were used to enhance contact between each electrode and the underlying sediment. Note sandstone ridges, known locally as kurkar, rising above the water. Time-series ^{222}Rn measurements were conducted from a 15-ft-long boat anchored 40 m offshore (above cable, between shoreline and horizon). View westward.



Profiles of inversely modeled resistivity along a shore-diagonal transect (line 4) during low (upper profile) and high (lower profile) tide. Tidal range, 45 cm. Red colors indicate fresher (ground) water; blue colors, saltier (sea)water. Vertical axis shows depth below ground surface measured from the elevation of the highest electrode, arbitrarily set at zero. A ground-water exchange rate of 7 m^3 per day per meter of shoreline was calculated by using data from the small outlined cell (labeled "A" in upper profile, "B" in lower profile), where ground-water seepage was visible at low tide.

(Dor Beach continued from page 5)

time intervals) of both radon-222 (^{222}Rn) concentrations and multi-electrode electrical resistivity. Resistivity measurements detect pore-water conductivity on the basis of variations in electrical resistance; ground water generally has lower salinity and lower conductivity (higher resistivity) than seawater. Measuring pore-water resistivity with electrical cables towed behind small boats—called streaming resistivity profiling—has proved to be a useful technique (for example, see article in *Sound Waves*, June 2002, at URL **http://soundwaves.usgs.gov/2002/06/research.html**). At Dor Beach, however, the scientists used a new technique: a stationary 112-m long, 56-electrode marine cable laid out in several configurations—shore parallel, shore perpendicular, and shore diagonal—across Dor Beach and into the adjacent lagoon (see map). Pore-water resistivity was measured for about 24 hours (to cover a couple of tidal cycles) in each configuration. The measurements made at Dor enabled the scientists to construct detailed profiles of the subsurface freshwater/saltwater interface and its subtle response over time to tides and other forcing factors. Such data can provide unique information about the extent and rates of submarine ground-water discharge. Before the fieldwork at Dor Beach, the stationary method for collecting marine resistivity data had been used only in Florida (see article in *Sound Waves*, March 2006, at URL **http://soundwaves.usgs.gov/2006/03/fieldwork2.html**.)

Time-series measurements of ^{222}Rn concentrations in the adjacent coastal water column complemented the resistivity data. ^{222}Rn has been shown to be a particularly effective tracer of sediment/water exchange processes, including submarine ground-water discharge, because this isotope is commonly much more concentrated in ground water than in surface water, is chemically inert, and radioactively decays at a rate (half-life = 3.82 days) comparable to the time scales of many coastal processes. At Dor Beach, the scientists measured ^{222}Rn concentrations in the water column nearly continuously for 4 days from a boat anchored about 40 m from shore (see map). Concurrently, they collected a continuous record of the temperature, salinity, and depth of the water column.

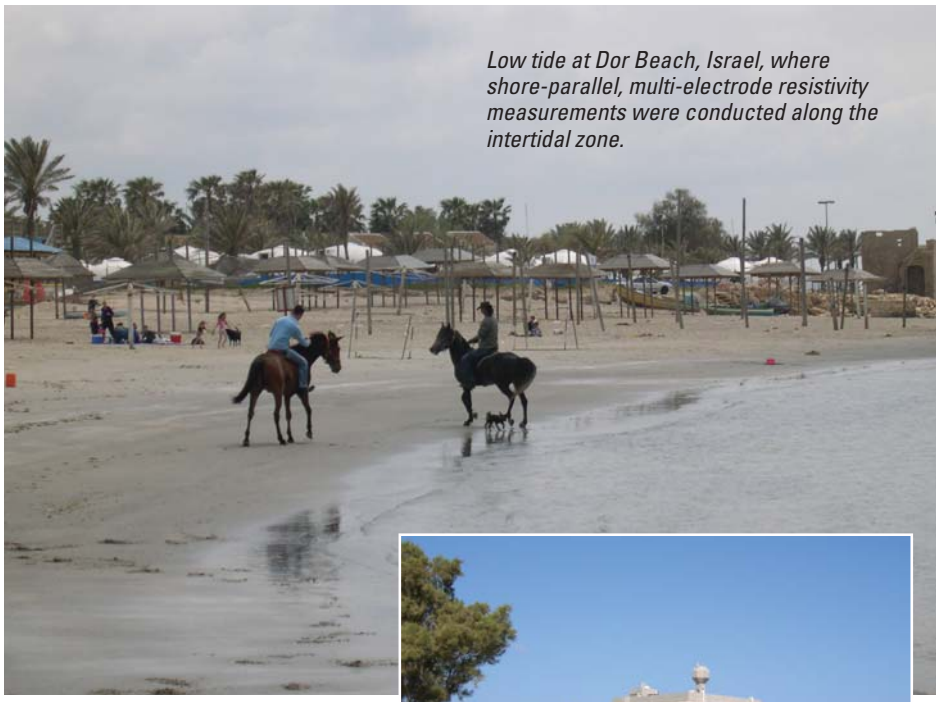
The ^{222}Rn data were modeled to yield flow rates across the sediment/water boundary, which ranged from about 0 to 30 cm per day (mean = 7.1 cm per day), depending on the tidal range. Such results suggest that the underlying hydrogeologic framework at Dor is favorable for substantial submarine ground-water discharge. Extrapolating the mean estimate across a 100-m-wide coastal zone implies a submarine-ground-water-discharge rate of about 7.1 m^3 per day per meter of shoreline, an estimate in good agreement with that derived from the resistivity data. The ^{222}Rn data further indicate that the source of the discharging ground water is a mixture of mostly fresh ground water derived from upland kurkar (shore-parallel sandstone ridges interpreted as lithified sand dunes) and recycled seawater.

The recent fieldwork produced detailed information about submarine ground-water discharge at Dor Beach and demonstrated the value of combining geochemical-tracer studies with stationary high-resolution resistivity measurements. These results have identified the varying geologic controls on coastal-aquifer exchange processes and give coastal-resource managers the information they need to better calculate the amount of nutrient input to these coastal systems.

The full citation for the scientific paper about the recent study at Dor Beach is:

Swarzenski, P.W., Burnett, W.C., Greenwood, W.J., Herut, B., Peterson, R., Dimova, N., Shalem, Y., Yechieli, Y., and Weinstein, Y., 2006, Combined time-series resistivity and geochemical tracer techniques to examine submarine groundwater discharge at Dor Beach, Israel: Geophysical Research Letters, v. 33, L24405, doi:10.1029/2006GL028282 [URL **http://www.agu.org/pubs/crossref/2006/2006GL028282.shtml**].

For additional information about this and other USGS submarine-ground-water-discharge investigations, visit URL **http://coastal.er.usgs.gov/sgd/**. ☸



Low tide at Dor Beach, Israel, where shore-parallel, multi-electrode resistivity measurements were conducted along the intertidal zone.

*Israel Oceanographic and Limnological Research building in Haifa (URL **http://www.ocean.org.il/MainPageEng.asp**). The research institute is directed by **Barak Herut**, a collaborator in the March 2006 study at Dor Beach.*

USGS Helps Middle-School Students Envision a Future City

By Helen Gibbons and LaZena Jones (Helms Community Project)

The buildings at Walter T. Helms Middle School in San Pablo, Calif., are badly in need of the replacement scheduled to begin soon, but that didn't dampen the enthusiasm of students who met with U.S. Geological Survey (USGS) scientist **Don Woodrow** after school on a Tuesday last December. The students had formed a team to design and build a model of a future city for the National Engineers Week Future City Competition, and **Woodrow** had come to talk to them about geologic hazards they should plan for in their design.

Woodrow, who lives in Richmond (just south of San Pablo) and works as a contract geologist at the USGS campus in Menlo Park, Calif., spent an hour and a half at Helms Middle School on December 12, talking to a group of 8th graders about faults, earthquakes, and landslides as hazards that we have to live with and design for in the San Francisco Bay region. He brought a striking 3- by-12-ft mosaic of satellite images, created by USGS geographer **Ben Sleeter** and USGS geologist **Florence Wong**, which gave the students a detailed view of the San Francisco Bay region, its cities and highways, and the shape of the land in less developed areas, where northwest-trending traces of the San Andreas and related faults are clearly visible. "The students really got into it," said **Woodrow**, who has visited Helms Middle School in past years to host a USGS booth at the school's annual career fair, with the help of his wife **Carole**.

This year's Helms Future City team consisted of five male and six female 8th-grade students. They were sponsored by the San Francisco Bay Area Rapid Transit District (BART) Future City Program, which is coordinated by **Bianca Mallory**, and Helms Middle School's After-School Program. **Woodrow** was one of several professionals who met with the students to provide information that would help them design their future city; some of the others were:

- **Adele Ho**, San Pablo's Director of Public Works and city engineer, and **Avanindra Gangapuram**, the city's Planning Division Manager, who gave the students an overview of city government and advice on city planning and renovation;
- **Eric Havel**, Environmental Education Coordinator at Chabot Space and Science Center in the nearby city of Oakland, who gave them a hands-on presentation on fuel cells and other alternative energy sources; and
- **Hassen Beshir**, Principle Civil Engineer in Transit System Development at BART, who mentored the students throughout the building of their model.

Helms Future City team poses at San Pablo City Hall for a photograph that was featured on a postcard (inset) sent to all BART-sponsored schools to advertise the Future City competition and announce the Pre-Competition date.

The Future City competition required participants to design a city of the future (the Helms team chose year 2150) using SimCity software, to build a physical model of the city using recycled materials, to write an abstract describing their city and an essay on energy strategies for powering it, and to give a verbal presentation to a panel of judges.

Guided by **Ricardo Rodriguez**, a mechanical engineering student at Contra Costa Community College, the Helms team had two opportunities to present their vision of a future city. The first, a "Pre-Competition" event sponsored by BART, was held at Chabot Space and Science Center on Saturday, January 6, 2007. The Helms team participated with teams from 10 schools in Alameda County, presenting their model to a panel of judges consisting of city-government representatives, business people, and civil engineers. The

(Future City continued on page 8)

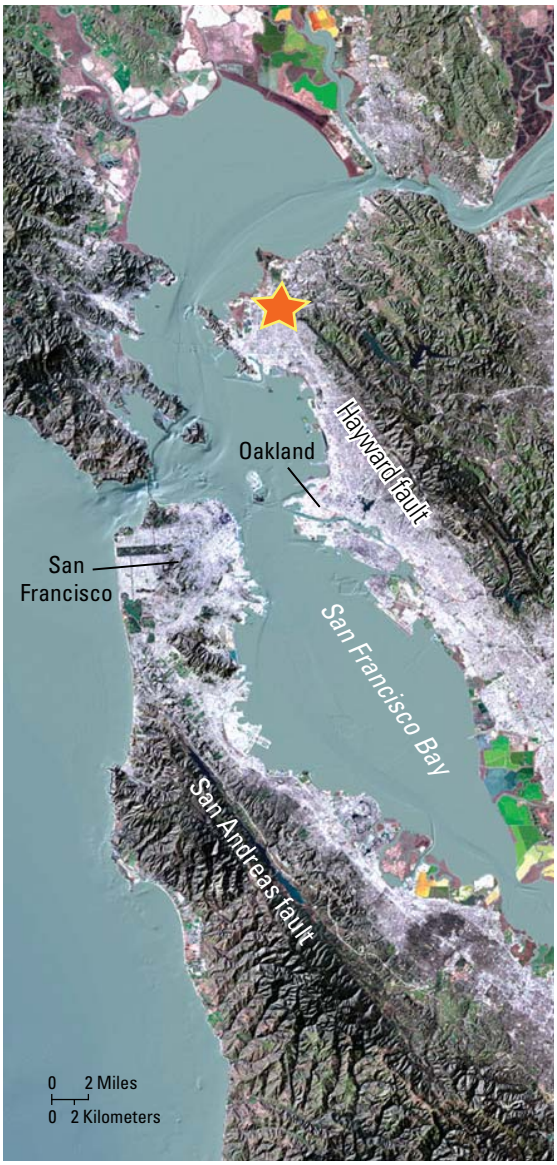
(Future City continued from page 7)

Helms team won the "Best Architecture" award and, like the other teams, received constructive feedback in a closed session with the judges.

The second opportunity was the Future City Regional Competition at St. Mary's College in Moraga on Saturday, January 13, when teams from 25 northern California schools came together to compete. The Helms team won 5th place, to the delight of **LaZena Jones**, director of the school's Helms Community Project and advisor to the students throughout their preparation for the competition. **Jones** noted that the students "were less excited than I" about their win, having "fully expected to come in 1st place!"

The students' enthusiasm was a particularly satisfying outcome of the competition. **Jones** said, "One female student informed the team that she would like to attend college and study to become an engineer!" She added, "They are truly a great group of students, who love to learn and experience new things."

For more information about the National Engineers Week Future City Competition, visit URL **http://www.futurecity.org/**.



*Excerpt from the satellite imagery **Don Woodrow** took to Helms Middle School (orange star) on December 12, 2006, when he spoke to the Helms Future City team about geologic hazards in the San Francisco Bay region. Many northwest-trending fault traces are visible in the image.*

Members of the Helms Middle School team construct their model of a future city.

Assessing Microbes in Ground Water—A Highlight at the Sixth Annual Aquifer Storage and Recovery Meeting in Orlando, Florida

By Ann B. Tihansky

The Sixth Annual Aquifer Storage and Recovery meeting convened local and international experts in Orlando, Fla., on October 16-17, 2006. The meeting was organized by the American Ground Water Trust and cosponsored by the U.S. Geological Survey (USGS), along with many environmental consultants and other Federal and State agencies. Technical experts shared experience and discussed issues regarding the practice of using aquifers to temporarily store water, known as aquifer storage and recovery (ASR), during periods of high water availability so that it can be withdrawn for use during dry periods. The technique is part of Florida's comprehensive water-management plan to develop alternative sources of drinking water in order to meet future projected water-use demands; it is also an integral part of the Greater Everglades Ecosystem Restoration (GEER) plan. If effective, the practice will allow water managers to reduce impacts on both surface-water and ground-water resources by reducing withdrawals and the need to construct large reservoirs.

*USGS microbiologists **Ron Harvey** (right) and **John Lisle** compare two styles of diffusion chambers designed and built by the USGS. The diffusion chambers have been used to conduct* in situ *studies of microbes in ground water.*

Three different designs of diffusion chambers designed to meet specific research needs. The basic design includes a central plate that retains the sample, two outside plates that bolt to the central plate, and a silicone gasket that sits between the central and two outside plates between which a semipermeable membrane is secured. Samples are loaded and removed through syringe fittings. The membranes retain the bacterial cells within the central chamber while allowing chemical and nutrient constituents in the water to diffuse into and out of the chamber but preventing native bacteria from contaminating the internal volume.

Technical issues that affect the feasibility of aquifer storage and recovery include potentially adverse geochemical changes in the aquifer, efficient recovery of the injected water, and availability and timing of water-supply diversions. From a regulatory perspective, the Florida Department of Environmental Protection (FDEP) is primarily focused on the mobilization of arsenic, which in several operating aquifer-storage-and-recovery systems has exceeded the new drinking-water standard of 10 µg/L. Arsenic mobilization in ground water is a complex geochemical problem that can be substantively affected by the activities of indigenous microbial populations. USGS research in characterizing microbial populations in ground water and monitoring accompanying geochemical changes associated with ground-water contamination and ASR techniques suggests that microbial populations can shift in response to changes in ambient ground-water quality such as pH, redox state, or availability of specific ions or metals.

USGS scientists were featured in the Aquifer Storage and Recovery meeting session titled, "How Mighty are the Microbes and Minerals?" The session was moderated by USGS hydrologist **Ann Tihansky** and featured USGS microbiologists **Ron Harvey** and **John Lisle**. **Harvey** discussed the USGS national perspective on new technology, innovative methods, and future directions for understanding microbial communities in ground water. **Lisle** presented results from his cooperative work with the FDEP and utilities in the Tampa Bay area, comparing microbial communities in recharge and native

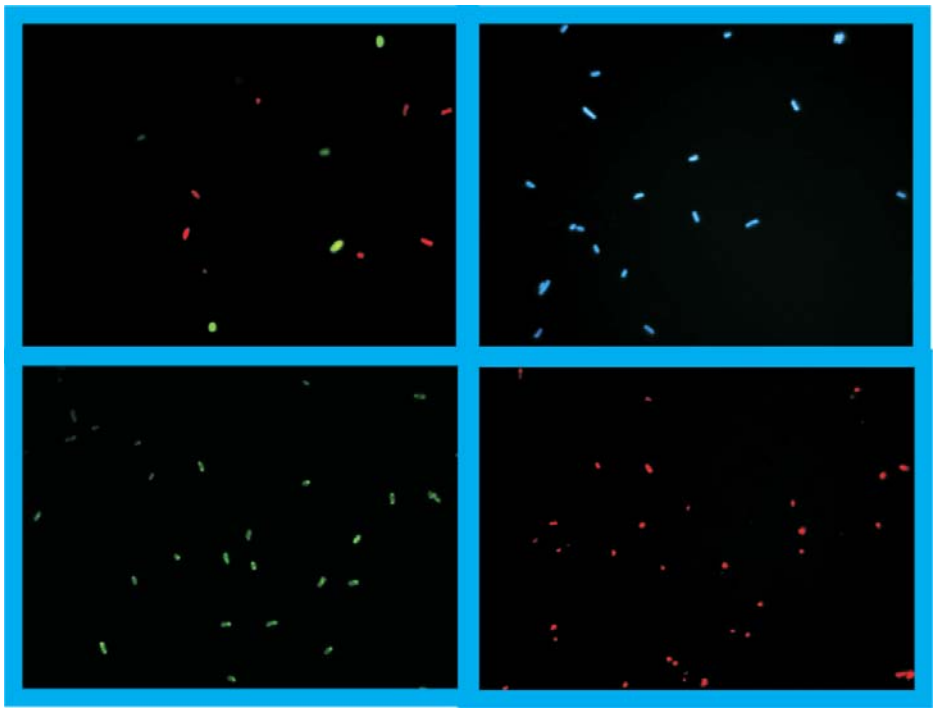
(Aquifer Meeting continued on page 10)

(Aquifer Meeting continued from page 9)

ground water associated with an operating ASR system in Tampa.

After the meeting, **Harvey** visited the USGS center in St. Petersburg, Fla., to work with **Lisle** on the latest designs of *in situ* (downwell) filter chambers designed to sequester specific nonindigenous and indigenous microbial populations in order to quantify population dynamics under ambient and altered ground-water conditions. According to **Lisle**: "We want to be able to demonstrate that we can safely contain known microbial communities in aquifers without letting them loose into the ground-water system. These chambers are designed to keep the bugs in and yet allow them to interact with the ground-water chemistry as they normally would. The idea is that we would deploy them for a period of time, allowing them to interact with the chemistry in the native or altered ground-water system; then we would quantitatively recover them and analyze for any changes. This will give us a much more realistic idea of what these populations are capable of doing and what their role is in mediating the biogeochemical changes in ions of interest as the ground-water environment changes."

The USGS is leading the way in developing new technologies that will ultimately help manage ground-water resources more effectively. According to **Harvey**: "Work done in aquifers throughout the country suggests that microbes play important roles in remediating aquifers contaminated by specific compounds. However, they also can mobilize other undesirable constituents, such as arsenic, depending upon the geochemistry of the aquifer." By better understanding these processes, the USGS will be able to advise resource managers about aquifer-remediation techniques and also help regulators determine guidelines for effective ASR practices.



Representative collection of photographs showing bacteria (bright spots) that have been isolated from ground water. All cells have been labeled with fluorescent stains.

The agenda for the Aquifer Storage and Recovery meeting is posted at URL **http://www.agwt.org/events/2006/ASR6Program.pdf**. For more information about the group that organized the meeting, visit the American Ground Water Trust Web site at URL **http://www.agwt.org/**.

Chinese Delegation Briefed on USGS Science During a Visit to Menlo Park, California

By Helen Gibbons

A delegation from China headed by **Mr. Sun Wensheng**, the Minister of Land and Resources, visited the U.S. Geological Survey (USGS) center in Menlo Park, Calif., on January 26, 2007, for briefings on USGS scientific activities in the United States and Asia. The delegation had asked to visit the Menlo Park campus on their way to Washington, D.C., where they met with Interior Secretary **Dirk Kempthorne** on January 31 to sign a Memorandum of Understanding to promote future cooperation on natural resources.

Among the USGS scientists who briefed the visitors in Menlo Park were Western Coastal and Marine Geology Team Chief Scientist **Sam Johnson** and oceanographer **Jingping Xu**. **Johnson** and **Xu** presented a half-hour summary of Coastal and Marine Geology Program activities, with a particular focus on sea-floor and benthic-habitat mapping, tsunami hazards, and coastal-change assessments. The Chinese delegation was particularly impressed

(Chinese Delegation continued on page 11)

***Sun Wensheng** (left), China's Minister of Land and Resources, greets USGS oceanographer **Jingping Xu** in Menlo Park, Calif.*

(Chinese Delegation continued from page 10)

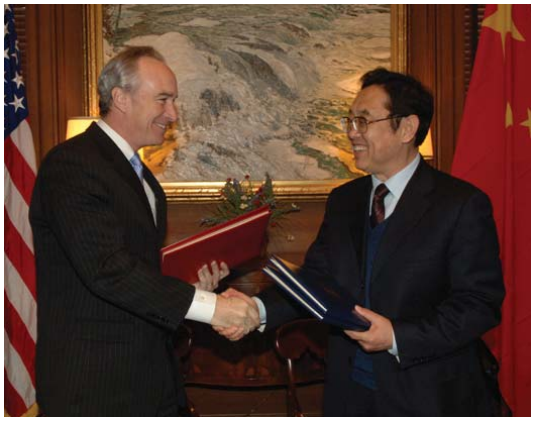
with the high relevance of the program's activities to societal needs.

The delegation also received briefings on the mineral resources of Asia by **Warren Nokleberg** (leader of the USGS Global Mineral Resource Assessment Project), integrated studies of the San Francisco Bay and Delta by **Lisa Lucas**, *The National Map* (URL **http://nationalmap.gov/**) by **Tom Sturm**, and USGS geographic research by **Susan Benjamin**.

Along with **Minister Sun**, the delegation included six additional members of China's Ministry of Land and Resources, which has had agreements with the USGS since the Ministry's creation in 1998, a time of significant reorganization within the Chinese government. Before 1998, the USGS dealt with several of the Ministry's predecessors, going back to 1980, when the USGS signed its first protocols with various Chinese government organizations.

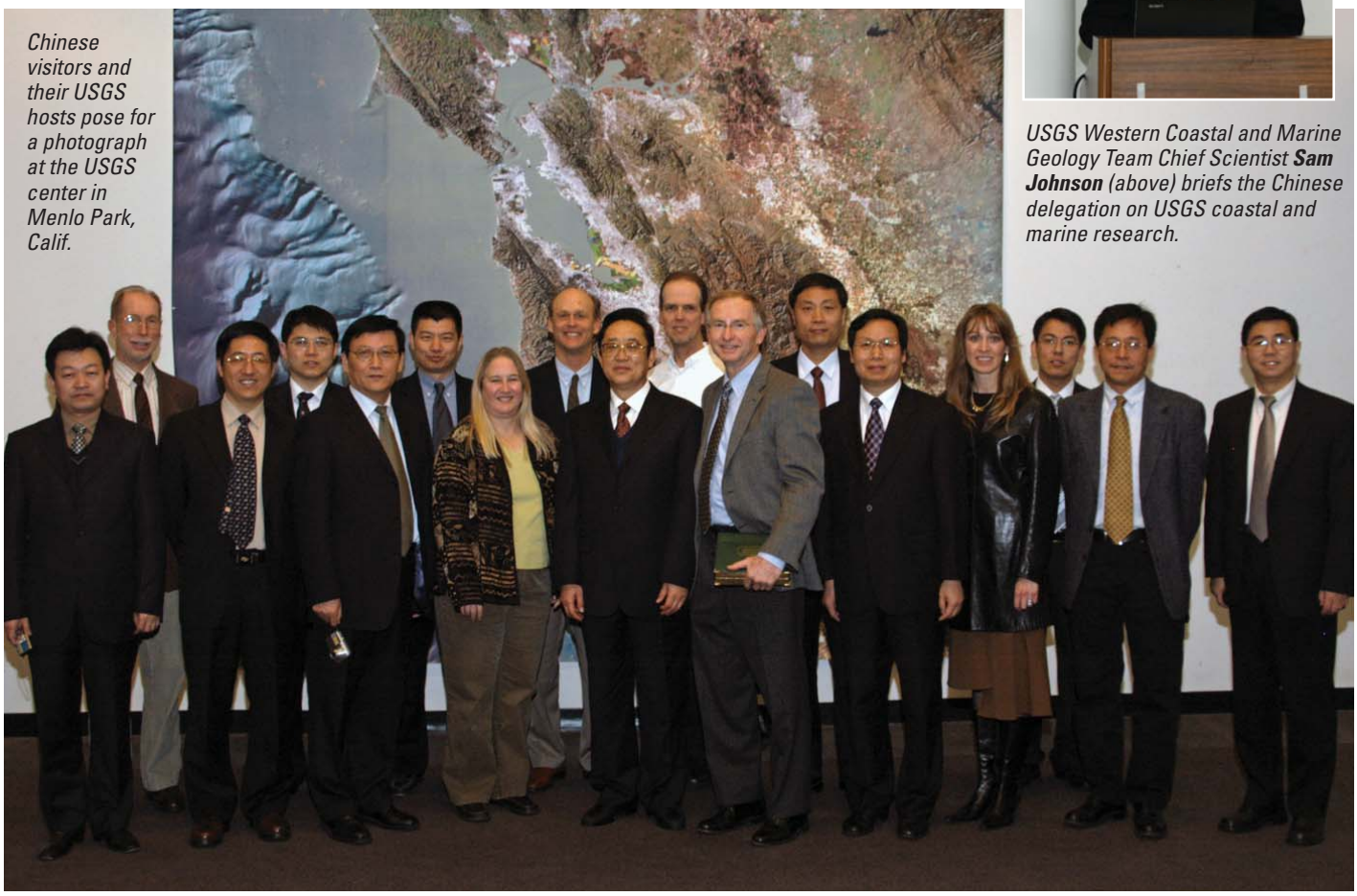
Although this trip did not include a visit to the Southeastern United States, USGS coastal scientists in St. Petersburg, Fla., and biologists in Lafayette, La., have been discussing cooperative, integrated studies in both China and the Gulf of Mexico with their counterparts in the China Geological Survey (a bureau within the Ministry of Land and Resources) and hope to craft a formal agreement soon.

The delegation's host in Menlo Park was USGS Western Region Deputy Director **Brian Cole**, who wrote in a thank-you note to the USGS presenters: "Our guests could not help but be impressed with the quality of scientific endeavors you and your colleagues are involved in….As [**Minister Sun**] said in his closing remarks, clearly our science is of tremendous value to the Nation and our people."❁



*At a ceremony in Washington, D.C., on January 31, Interior Secretary **Dirk Kempthorne** and **Minister Sun** signed a Memorandum of Understanding that will facilitate cooperation between the United States and China.*

*USGS Western Coastal and Marine Geology Team Chief Scientist **Sam Johnson** (above) briefs the Chinese delegation on USGS coastal and marine research.*



Chinese visitors and their USGS hosts pose for a photograph at the USGS center in Menlo Park, Calif.

Restore America's Estuaries Conference in New Orleans

By Doug George

The Third National Conference on Coastal and Estuarine Habitat Restoration drew a record crowd of 1,400 participants, including 25 U.S. Geological Survey (USGS) scientists, 4 of whom came from the Western Coastal and Marine Geology Team. Sponsored by Restore America's Estuaries (RAE, URL **http://www.estuaries.org/**) and held December 9-13, 2006, in New Orleans, the conference attracted ecologists, hydrologists, civil engineers, environmental consultants, anthropologists, and municipal planners. **Guy Gelfenbaum**, **Amy Foxgrover**, **Theresa Fregoso**, and **Doug George** exhibited five posters on two studies to this diverse group of attendees. **Amy** and **Theresa** presented posters related to bathymetric and habitat surveying in south San Francisco Bay, while **Guy** and **Doug** presented posters about a numerical-modeling study of sediment transport and morphological change for estuary restoration efforts in Puget Sound. Both studies provided science and information that fit well with the motivation behind the conference—focusing on the goals and practices of coastal and estuarine habitat restoration.

The opening plenary session consisted of three keynote speakers, starting with Department of the Interior (DOI) Deputy Secretary **Lynn Scarlett**, whose remarks highlighted the importance of the human element in restoration work. The gravity of this point with respect to coastal Louisiana was brilliantly expanded upon by the two succeeding speakers: **Nick Spitzer**, host and producer of National Public Radio's *American Routes*; and **Mike Tidwell**, author of *Bayou Farewell* and *The Ravaging Tide*.

Theresa Fregoso *(third from left) and other volunteers at the New Orleans City Park restoration project.*

Despite the lingering effects of Hurricane Katrina, the theme of the conference was rebirth, not only of New Orleans but of the national relationship with wetlands. Sixteen field trips enabled conference participants to explore cultural attractions, bayous, and restoration efforts around the city and coastal Louisiana. **Theresa** participated in a restoration project in New Orleans' 150-yr-old City Park, where she and other volunteers removed post-Katrina debris and planted native plants along the lakeshore. **Theresa**, **Amy**, and **Doug** joined a group of 20 conference attendees for a tour of the Tchefuncte Marsh wetlands-assimilation project along the north edge of Lake Pontchartrain. The marsh functions as a sewage-treatment facility for the 12,000 residents of Mandeville, while providing "green infrastructure" and critical habitat along the rapidly developing lakeshore. After the tour, the group embarked on a canoe trip through one of the last intact lakeside marshes to observe how the natural environment endured Hurricane Katrina. **Guy**, along with **Tim Smith**, **Curtis Tanner**, and **Rich Innes** of the Puget Sound Nearshore Partnership (URL **http://pugetsoundnearshore.org/**), visited the Davis Pond Freshwater Diversion Project outside of New Orleans (URL **http://www.mvn.usace.army.mil/pao/dpond/davispond.htm**). The Davis Pond diversion is an example of large-scale ecosystem restoration resulting from a successful State, Federal, and local partnership. The group saw firsthand some of the biological response to the restoration project.

Amy Foxgrover *and* ***Doug George*** *reach Lake Pontchartrain after canoeing through one of the last intact lakeside marshes.*

Guy Gelfenbaum *gets to know the local wildlife at the Davis Pond Freshwater Diversion Project outside of New Orleans.*

The RAE conference takes place every other year and has been held in Baltimore, Md., and Seattle, Wash. The New Orleans conference was the largest to date, an encouraging sign that the idea of restoration is engaging broader audiences and offering opportunities for USGS scientists to provide science to the growing habitat-restoration effort.

Scuba Scouts Recognize USGS Employees

By Lisa Robbins

On November 18, 2006, the Scuba Scouts, USA, of Tampa Bay (SSUSATB) held a banquet in Tampa, Fla., recognizing the mentors and sponsors within the community who work with the Scouts. The U.S. Geological Survey (USGS), a long-time supporter of this program, was one of the organizations that were honored. USGS Dive Safety Program Manager **Marc Blouin**, from the USGS Great Lakes Science Center in Ann Arbor, Mich., was presented a plaque for his exceptional support of the program in Scuba Scout, USA, training. Also recognized were other USGS scuba enthusiasts who have helped through the years: **Chris Reich** and **Don Hickey**, both from the USGS Florida Integrated Science Center office in St. Petersburg, Fla. Students presented the awards with skits and poems to the mentors and sponsors.

Dan Basta, Director of the National Oceanic and Atmospheric Administration (NOAA)'s National Marine Sanctuaries, gave an inspiring keynote address on "Education Through Exploration"

Captain David Olson *(left) presents a plaque to* ***Marc Blouin*** *(USGS Dive Safety Program Manager) for his exceptional efforts in supporting the Scuba Scouts, USA, of Tampa Bay.*

and how the SSUSATB embodies this vision. Organized in 2001 by **Captain David Olson** (U.S. Navy), the SSUSATB program—the first of its kind in this country—was created to give young men and women the opportunity to learn about many aspects of marine science. A multidisciplinary approach allows the scouts to develop skills in scuba diving and apply them to different underwater research activities, including special environmental and undersea conservation projects. Each Scuba Scout is trained and certified to the advanced open-water-diver skill level before being trained in science, technology, and emergency response. Scouts in SSUSATB are mentored by scientists and professionals from the USGS, the U.S. Coast Guard, the Florida Fish and Wildlife Research Institute, the University of South Florida's College of Marine Science, the Florida Aquarium, and the Florida Keys National Marine Sanctuary. **Captain Olson** indicated that he would like to expand this opportunity to other parts of the country to help develop "America's next generation of explorers."

To read about a training class in which **Marc Blouin** served as an instructor, visit ULR **http://soundwaves.usgs.gov/2006/06/meetings3.html**.

Special Issue of *Estuaries and Coasts* Shows Environment Resilient in the Face of Hurricanes, But Questions Remain

Several U.S. Geological Survey (USGS) scientists contributed to a special issue of the journal *Estuaries and Coasts*, focused on the effects of hurricanes on coastal systems. "One surprising conclusion that can be drawn from this collection of research is that natural systems are actually quite resilient in the face of these storms," said **Holly Greening**, senior scientist for the Tampa Bay Estuary Program and one of the guest editors for the special issue. "While hurricanes often wreak havoc with human systems and infrastructure, many of the habitats and organisms we studied rebounded quite well in the weeks and months following the 2004 storms."

Estuaries and Coasts is a bimonthly scientific journal published by the international Estuarine Research Federation (ERF) to report research about ecosystems at the land-sea interface. The hurricane special edition, published as the journal's December 2006 issue, is available to the public at URL **http://www.erf.org/**. The impetus for this special issue was the intense 2004 hurricane season, in which four major hurricanes made landfall in Florida within a 3-month period. USGS contributions include articles on shoreline change caused by the 2004 hurricanes, the effects of major storms on processes that control coastal-wetland elevations, red mangrove reproduction and seedling colonization after Hurricane Charley in 2004, and possible effects of the 2004 and 2005 hurricanes on manatee movement and survival rates.

"This special issue compiles research findings and results of long-term monitoring to give us a chance to look at these large, anomalous storms in the context of long-term trends," said **Greening**. The articles' authors explore both the individual and cumulative effects of storms on coastal environments, animals, and plants, and examine the effect of these storms on coastal management. The severe hurricanes in 2005 make such findings of great interest to scientists, the public, and coastal resource managers.

(Hurricane Issue continued on page 14)

(Hurricane Issue continued from page 13)

For example, water quality and phytoplankton productivity—a measure of the health of the base of the food web—were impacted by winds and heavy rainfall, but returned to normal within months. One study found that storm-induced movements of manatees away from their home ranges were much smaller than expected. Aquatic plants, referred to as submerged aquatic vegetation (SAV), had a more varying response to hurricane-induced stress, in some cases rebounding and in others exhibiting long-term damage.

Damage to shoreline ecosystems varied as well. Dune erosion due to hurricanes was severe in some places but not others. In some parts of coastal Louisiana, large sections of wetlands were lost in extreme-storm events.

"A major research goal is to use these unique data sets to develop and test a new hurricane scale for predicting the coastal impacts of extreme storms," noted issue contributor **Abby Sallenger** of the St. Petersburg, Fla., office of the USGS.

The varying impacts seemed to depend, at least in part, on the characteristics of the storms themselves: direction and speed of approach, point of landfall, and intensity all made a difference in the extent of environmental damage. Storms that carried more rainfall seemed to do more long-term damage than "hit-and-run" storms with higher winds.

Cover of special issue of Estuaries and Coasts, *showing a small part of the east coast of Florida, including the south end of Indian River Lagoon, St. Lucie inlet, and St. Lucie estuary. Barrier island on upper right is Hutchinson Island, where Hurricanes Frances and Jeanne had almost identical landfalls within a 3-week period in September 2004, providing a rare opportunity to examine the effects of repeated hurricane impacts on coastal-ecosystem responses.*

"The research compiled in this issue of *Estuaries and Coasts* is an excellent start in understanding the environmental impacts of these storms," said **Greening**, "but many questions still need to be answered. We still need to know how storm frequency and intensity, both predicted to increase in the coming years, interact to impact coastal environments and communities. Another outstanding question is the extent to which human alteration of the shoreline determines the coast's resiliency to storms."

Scientists and managers contributing to the special issue represent more than 25 institutions, including the USGS, the University of Florida, the University of North Carolina, Alabama's Dauphin Island Sea Lab, and a host of local governments. ❁

Recently Published Articles

Banakar, V.K., Hein, J.R., Rajani, R.P., and Chodankar, A.R., 2007, Platinum group elements and gold in ferromanganese crusts of the Afanasiy-Nikitin Seamount, equatorial Indian Ocean; sources and fractionation: Journal of Earth System Science, v. 116, no. 1, p. 3-13 [URL **http://www.ias.ac.in/jess/**].

Barnard, P.L., Hanes, D.M., Kvitek, R.G., and Iampietro, P.J., 2006, Sand waves at the mouth of San Francisco Bay, California: U.S. Geological Survey Scientific Investigations Map 2944, 5 sheets [URL **http://pubs.usgs.gov/sim/2006/2944/**].

Barnhardt, W.A., Baldwin, W.D., Denny, J.F., Schwab, W.C., Gayes, P.T., Driscoll, N., and Voulgaris, G., 2006, Integrating high-resolution mapping of the seafloor with sediment-transport measurements to understand coastal erosion in northern South Carolina [abs.]: Eos (American Geophysical Union Transactions), v. 87, no. 52, Fall Meeting supp., abstract NS24A-01 (invited) [go to URL **http://www.agu.org/meetings/fm06/waisfm06.html** and search on "barnhardt"].

Cahoon, D.R., 2006, A review of major storm impacts on coastal wetland elevations: Estuaries and Coasts, v. 29, no. 6A, p. 889-898 [URL **http://estuariesandcoasts.org/contents/ESTU2006_29_6A.html**].

Calderon, K., Dadisman, S.V., Flocks, J.G., Kulp, M.A., Miner, M.D., and Wiese, D.S., 2006, Archive of digital boomer and chirp seismic reflection data collected during USGS cruise 04SCC01 in Terrebonne, Timbalier, and Barataria Bays and Lake Pelto, Louisiana, June and July 2004: U.S. Geological Survey Data Series 237, DVD.

Calderon, K., Dadisman, S.V., Kindinger, J.L., Flocks, J.G., and Wiese, D.S., 2006, Archive of digital boomer and chirp seismic reflection data collected during USGS cruise 03SCC03 in Lake Pelto and Timbalier and Terrebonne Bays, Louisiana, September 2003: U.S. Geological Survey Data Series 238, 2 DVDs.

Cross, V.A., Bratton, J.F., Bergeron, E., Maunier, J.K., Crusius, John, and Koopmans, D.J., 2006, Continuous resistivity profiling data from the Upper Neuse River Estuary, North Carolina, 2004-2005: U.S. Geological Survey Open-File Report 2005-1306, CD-ROM [URL **http://pubs.usgs.gov/of/2005/1306/**].

Dadisman, S.V., Flocks, J.G., and Calderon, K., 2005, LASED geodatabase; a tool to manage, analyze, distribute, and archive geologic data from the Louisiana coastal zone, *in* Digital Mapping Techniques '05—workshop proceedings: U.S. Geological Survey Open-File Report 2005-1428 [URL **http://pubs.usgs.gov/of/2005/1428/**].

(Recently Published continued on page 15)

(Recently Published continued from page 14)

Gelfenbaum, Guy, Mumford, Tom, Brennan, Jim, Case, Harvey, Dethier, Megan, Kurt, Fresh, Goetz, Fred, van Heeswijk, Marijke, Leschine, T.M., Logsdon, Miles, Myers, Doug, Newton, Jan, Shipman, Hugh, Simenstad, C.A., Tanner, Curtis, and Woodson, David, 2006, Coastal habitats in Puget Sound; a research plan in support of the Puget Sound Nearshore Partnership: Seattle, Wash., Puget Sound Nearshore Partnership Report No. 2006-1.

George, D.A., Gelfenbaum, Guy, Lesser, Giles, and Stevens, A.W., 2006, Deschutes Estuary Feasibility Study; hydrodynamics and sediment transport modeling: U.S. Geological Survey Open-File Report 2006-1318 [URL **http://pubs.usgs.gov/of/2006/1318/**].

Gutmacher, C.E., Ross, S.L., Triezenberg, P.J., Sliter, R.W., Normark, W.R., and Edwards, B.D., 2006, High-resolution boomer seismic-reflection profiles of the shelf off southern California from cruise A-1-00-SC; Santa Monica Bay to San Diego: U.S. Geological Survey Open-File Report 2006-1373 [URL **http://pubs.usgs.gov/of/2006/1373/**].

Hart, K.M., and Lee, D.S., 2006, The diamondback terrapin; the biology, ecology, cultural history, and conservation status of an obligate estuarine turtle, *in* Greenberg, R., Maldonado, J.E., Droege, S., and McDonald, M.V., eds., Terrestrial vertebrates of tidal marshes; evolution, ecology, and conservation (Studies in Avian Biology, no. 32): Camarillo, Calif., Cooper Ornithological Society, p. 206-213.

Krebs, J.M., Hearn, C.J., McIvor, C.C., and Brame, A.B., Using hydrological modeling to explain patterns of habitat use by fishes and crustaceans in channelized tidal wetland [abs.]: Eos (American Geophysical Union Transactions), v. 87, no. 52, Fall Meeting supp., abstract OS33F-04 [go to URL **http://www.agu.org/meetings/fm06/waisfm06.html** and search on "krebs"].

Kuffner, I.B., Brock, J.C., Grober-Dunsmore, Rikki, Bonito, V.E., Hickey, T.D., and Wright, C.W., 2007, Relationships between reef fish communities and remotely sensed rugosity measurements in Biscayne National Park, Florida, U.S.A: Environmental Biology of Fishes, v. 78, no. 1, p. 71-82, doi: 10.1007/s10641-006-9078-4 [URL **http://www.springerlink.com/content/u158q5w0gl11j325/?p=2129f6b3a4244bbbaf2e2488955c1f9d&pi=5**].

Langtimm, C.A., Krohn, M.D., Reid, J.P., Stith, B.M., and Beck, C.A., 2006, Possible effects of the 2004 and 2005 hurricanes on manatee survival rates and movement: Estuaries and Coasts, v. 29, no. 6A, p. 1026-1032 [URL **http://estuariesandcoasts.org/contents/ESTU2006_29_6A.html**].

McMullen, K.Y., Poppe, L.J., Signell, R.S., Denny, J.F., Crocker, J.M., Beaver, A.L., and Schattgen, P.T., 2007, Surficial geology in central Narragansett Bay, Rhode Island; interpretations of sidescan sonar and multibeam bathymetry: U.S. Geological Survey Open-File Report 2006-1199 [URL **http://woodshole.er.usgs.gov/pubs/of2006-1199/**].

Morford, J.L., Martin, W.R., Kalnejais, L.H., Francois, Roger, Bothner, M.H., and Karle, I.M., 2006, Insights on geochemical cycling of U, Re and Mo from seasonal sampling in Boston Harbor, Massachusetts, USA: Geochimica et Cosmochimica Acta, v. 71, no. 4, doi:10.1016/j.gca.2006.10.016.

Parsons, Tom, 2006, $M \geq 7.0$ earthquake recurrence on the San Andreas fault from a stress renewal model: Journal of Geophysical Research, v. 111, no. B12, B12305, doi: 10.1029/2006JB004415 [URL **http://www.agu.org/pubs/crossref/2006/2006JB004415.shtml**].

Parsons, Tom, 2006, Tectonic stressing in California modeled from GPS observations: Journal of Geophysical Research, v. 111, no. B3, B03407, doi: 10.1029/2005JB003946 [URL **http://www.agu.org/pubs/crossref/2006.../2005JB003946.shtml**].

Parsons, Tom, Thompson, G.A., and Cogbill, A.H., 2006, Earthquake and volcano clustering via stress transfer at Yucca Mountain, Nevada: Geology, v. 34, no. 9, p. 785-788, doi: 10.1130/G22636.1 [URL **http://www.gsajournals.org/perlserv/?request=get-abstract&doi=10.1130%2FG22636.1**].

Parsons, Tom, Yeats, R.S., Yagi, Yuji, and Hussain, Ahmad, 2006, Static stress change from the 8 October, 2005 M = 7.6 Kashmir earthquake: Geophysical Research Letters, v. 33, L06304, doi: 10.1029/2005GL025429 [URL **http://www.agu.org/pubs/crossref/2006.../2005GL025429.shtml**].

Poppe, L.J., Ackerman, S.D., Doran, E.F., Beaver, A.J., Crocker, J.M., and Schattgen, P.T., 2006, Interpolation of reconnaissance multibeam bathymetry from north-central Long Island Sound [abs.]: Eos (American Geophysical Union Transactions), v. 87, no. 52, Fall Meeting supp., abstract OS31D-1658 [go to URL **http://www.agu.org/meetings/fm06/waisfm06.html** and search on "poppe"].

Proffitt, C.E., Milbrandt, E.C., and Travis, S.E., 2006, Red mangrove (*Rhizophora mangle*) reproduction and seedling colonization after Hurricane Charley; comparisons of Charlotte Harbor and Tampa Bay: Estuaries and Coasts, v. 29, no. 6A, p. 972-978 [URL **http://estuariesandcoasts.org/contents/ESTU2006_29_6A.html**].

Reich, C., Halley, R.B., Hickey, T., and Swarzenski, P., 2006, Groundwater characterization and assessment of contaminants in marine areas of Biscayne National Park: U.S. National Park Service, Water Resources Division Technical Report, NPS/NRWRD/NRTR—2006/356, 158 p. [URL **http://www.nature.nps.gov/water/technicalReports/ReportsIndex.cfm**].

Rosenberger, K.J., Xu, J.P., Stein, E.D., Noble, M.A., and Gartner, A.L., 2007, Circulation and physical processes within the San Gabriel River estuary during summer 2005: U.S. Geological Survey Open-File Report 2007-1011 [URL **http://pubs.usgs.gov/of/2007/1011/**].

Ryan, H.F., and Noble, M.A., 2006, Alongshore wind forcing of coastal sea level as a function of frequency: Journal of Physical Oceanography, v. 36, no. 11, p. 2173-2184 [URL **http://ams.allenpress.com/perlserv/?request=get-abstract&doi=10.1175%2FJPO2972.1**].

Sallenger, A.H., Stockdon, H.F., Fauver, Laura, Hansen, Mark, Thompson, David, Wright, C.W., and Lillycrop, Jeff, 2006, Hurricanes 2004; an overview of their

(Recently Published continued on page 16)

(Recently Published continued from page 15)

characteristics and coastal change: Estuaries and Coasts, v. 29, no. 6A, p. 880-888 [URL **http://estuariesandcoasts.org/contents/ESTU2006_29_6A.html**].

Stein, R.S., Toda Shinji, Parsons, Tom, and Grunewald, Elliot, 2006, A new probabilistic seismic hazard assessment for greater Tokyo: Royal Society of London, Philosophical Transactions, ser. A, v. 364, no. 1845, p. 1965-1988, doi: 10.1098/rsta.2006.1808.

ten Brink, U.S., Al-Zoubi, A.S., Flores, C.H., Rotstein, Y., Qabbani, I., Harder, S.H., and Keller, G.R., 2006, Seismic imaging of deep low-velocity zone beneath the Dead Sea basin and transform fault; implications for strain localization and crustal rigidity: Geophysical Research Letters, v. 33, no. 24, L24314, doi: 10.1029/2006GL027890 [URL **http://www.agu.org/pubs/crossref/2006/2006GL027890.shtml**].

Tsunami Pilot Study Working Group, 2006, Seaside, Oregon Tsunami Pilot Study—modernization of FEMA flood hazard maps: U.S. Geological Survey Open-File Report 2006-1234 [URL **http://pubs.usgs.gov/of/2006/1234/**]. [Also published as: Tsunami Pilot Study Working Group, 2006, Seaside, Oregon Tsunami Pilot Study; modernization of FEMA flood hazard maps: NOAA OAR Special Report, NOAA/OAR/PMEL, Seattle, Wash., 94 p.]

Waite, W.F., Kneafsey, T.J., Santamarina, C.J., Winters, W.J., Yun, T.-S., Mason, D.H. and Ruppel, C.D., 2006, Physical property changes in hydrate-bearing sediment samples due to depressurization/repressurization [abs.]: Eos (American Geophysical Union Transactions), v. 87, no. 52, Fall Meeting supp., abstract MR43A-1060 [go to URL **http://www.agu.org/meetings/fm06/waisfm06.html** and search on "kneafsey"].

Warner, J.C., Schoellhamer, D.H., Burau, J.R., and Schladow, S.G., 2006, Flow convergence caused by a salinity minimum in a tidal channel: San Francisco Estuary and Watershed Science, v. 4, no. 3, art. 1, p. 91-102 [URL **http://repositories.cdlib.org/jmie/sfews/vol4/iss3/art1/**].

Williams, S.J., Arsenault, M.A., Poppe, L.J., Reid, J.A., Reid, J.M, Jenkins, C.J., Surficial sediment character of the New York-New Jersey offshore Continental Shelf region; a GIS compilation: U.S. Geological Survey Open-File Report 2006-1046 [URL **http://pubs.usgs.gov/of/2006/1046/**].

Publications Submitted for Director's Approval

Barnhardt, W.A., Denny, J.F., Baldwin, W.D., Schwab, W.C., Morton, R., Gayes, P.T., and Driscoll, N., Geologic framework of the Long Bay inner shelf; implications for coastal evolution in South Carolina: Coastal Sediments 07 Conference, New Orleans, La., May 13-17, 2007, Proceedings.

Bratton, J.F., Holocene sedimentation in a kettle pond breached by rising sea level on Cape Cod [abs.]: Geological Society of America, Northeast Section Annual Meeting, 42nd, Durham, N.H., March 12-14, 2007.

Brock, J.C., Wright, C.W., Patterson, Matt, Nayegandhi, Amar, and Patterson, Judd, USGS-NPS-NASA EAARL bare-earth topography, Assateague Island National Seashore: USGS Open-File Report, DVD.

Brock, J.C., Wright, C.W., Patterson, Matt, Nayegandhi, Amar, and Patterson, Judd, USGS-NPS-NASA EAARL bare-earth topography, Fire Island National Seashore: U.S. Geological Survey Open-File Report 2006-1384, DVD/CD.

Collins, B.D., and Kayen, Robert, Coastal bluff erosion monitoring in the Monterey Bay National Marine Sanctuary using terrestrial LIDAR [abs.]: Monterey Bay National Marine Sanctuary, Sanctuary Currents Symposium, Seaside, Calif., March 3, 2007.

Cooper, Alan, and Raymond, Carol, Antarctica; a keystone in a changing world—online proceedings for the Tenth International Symposium on Antarctic Earth Sciences: U.S. Geological Survey Open-File Report.

Draut, A.E., Clift, P.E., and Scholl, D.W., Introduction, *in* Draut, A.E., Clift, P.D., and Scholl, D.W., eds., The sedimentary record in arc collision zones: Geological Society of America Special Paper.

Fisher, M.A., Geist, E.L., Ruppert, N.A., Freymueller, J.T., Sliter, R.W., and Wong, F.L., An out-of-sequence thrust fault near the epicenter of the 1964 Great Alaska earthquake (Mw 9.2) and its potential as a source for local tsunamis [abs.]: Geological Society of America, Cordilleran Section Annual Meeting, 103rd, Bellingham, Wash., May 4-6, 2007.

Flocks, James, Ferina, Nicholas, and Kindinger, Jack, Summary of knowledge regarding the recent geologic framework and geomorphology of the Mississippi-Alabama shelf, northern Gulf of Mexico, *in* Holmes, C.W., and Buster, N.A., eds., Geology, v. 1 *of* The Gulf of Mexico—origins, waters, and biota: College Station, Texas A&M University Press.

Gauron, L.C., Raabe, E.A., Suwannee Information Gateway; a Web-based tool for management and research [abs.]: Association of American Geographers Annual Meeting, San Francisco, April 17-21, 2007.

Haidvogel, D.B., Arango, H.G., Budgell, W.P., Cornuelle, B.D., Curchitser, E., Di Lorenzo, E., Fennel, K., Geyer, W.R., Hermann, A.J., Lanerolle, L., Levin, J., McWilliams, J.C., Miller, A.J., Moore, A.M., Powell, T.M., Shchepetkin, A.F., Sherwood, C.R., Signell, R.P., Warner, J.C., and Wilkin, J., Regional ocean forecasting in terrain-following coordinates; model formulation and skill assessment: Journal of Computational Physics.

Harris, C.K., Sherwood, C.R., Signell, R.P., Bever, A., and Warner, J.C., Sediment dispersal in the northwestern Adriatic Sea: Journal of Geophysical Research.

Harrison, A.S., Dadisman, S.V., Flocks, J.G., Wiese, D.S., and Calderon, K., Archive of digital chirp seismic reflection data collected during USGS cruise 05SCC01 offshore of Port Fourchon and Timbalier

(Publications Submitted continued on page 17)

(Publications Submitted continued from page 16)

Bay, Louisiana, August 2005: U.S. Geological Survey Data Series.

Kellogg, C.A., Microbial ecology of *Lophelia pertusa* in the northern Gulf of Mexico, chap. 6 *of* Sulak, K.J., ed., Characterization of northern Gulf of Mexico deepwater hard bottom communities with emphasis on *Lophelia* coral: U.S. Geological Survey Scientific Investigations Report.

Krebs, J.M., Brame, A.B., and McIvor, C.C., Altered mangrove wetlands as habitat for estuarine nekton; are dredged channels and tidal creeks equivalent?: Bulletin of Marine Science.

Lightsom, F.L., and Allwardt, A.O., U.S. Geological Survey digital libraries for coastal and marine science: Encyclopaedia of Digital Libraries.

McGann, M.L., Grossman, E.E., Takesue, R.K., and Walsh, J.P., Arrival and expansion of the invasive foraminifer *Trochammina hadai* Uchio in Padilla Bay, Washington; a new geologic datum [abs.]: Geological Society of America, Cordilleran Section Annual Meeting, 103rd, Bellingham, Wash., May 4-6, 2007.

Morton, R.A., Goff, J.R., and Nichol, S.L., Impacts of the 2004 Indian Ocean tsunami on the southwest coasts of Sri Lanka: Coastal Sediments 07 Conference, New Orleans, La., May 13-17, 2007, Proceedings.

Mustain, Neomi, Griggs, Gary, and Barnard, P.L., A rapid compatibility analysis of potential offshore sand sources for beaches of the Santa Barbara littoral cell: Coastal Sediments 07 Conference, New Orleans, La., May 13-17, 2007, Proceedings.

Osterman, L.E., Cambell, P.W., Swarzenski, P.W., and Ricardo, J.P., Biological, physical and chemical data from Gulf of Mexico gravity and box core MRD05-04: U.S. Geological Survey Open-File Report.

Pendleton, E.A., Thieler, E.R., Williams, S.J., Hammar-Klose, E.S., and Beavers, R.L., Visualizing coastal vulnerability at Cape Cod National Seashore with Google Earth [abs.]: Cape Cod Natural History Annual Conference, 12th, West Barnstable, Mass., March 17, 2007.

Raabe, E., Robbins, L., and Schwarz, M., Florida Shelf Habitat (FLaSH) Map project presents the world beneath the waves [abs.]: Association of American Geographers Annual Meeting, San Francisco, April 17-21, 2007 [invited].

Rathje, Ellen, Kayen, Robert, and Woo, K.S., Remote sensing observations of landslides and ground deformation from the 2004 Niigata Ken Chuetsu earthquake: Japanese Geotechnical Society Journal.

Reid, J.A., Zimmermann, Mark, Jackson, Adam, and Jenkins, Chris, Alaska's surficial seabed characteristics in usSEABED [abs.]: Marine Habitat Mapping Technology Workshop for Alaska, Anchorage, April 2-4, 2007.

Richards, T.M., Krebs, J.M., McIvor, C.C., and Szelistowski, W.A., A new method for collecting and assessing microhabitat associations of the mangrove rivulus, *Kryptolebias marmoratus* [abs.]: American Fisheries Society, Florida Chapter Meeting, Altoona, Fla., February 20-22, 2007.

Richmond, B.M., and Morton, R.A., Coral-gravel storm ridges; examples from the tropical Pacific and Caribbean: Coastal Sediments 07 Conference, New Orleans, La., May 13-17, 2007, Proceedings.

Rosenberger, K.J., Xu, J.P., and Noble, M.N., Measuring currents and suspended material in Monterey Submarine Canyon [abs.]: Monterey Bay National Marine Sanctuary, Sanctuary Currents Symposium, Seaside, Calif., March 3, 2007.

Ross, S.L., Michael, A.J., Klein, F.W., and Kirby, S.H., Insights into the 2006 Kiholo Bay earthquake and Pacific plate flexure from double-difference relocations and stress inversions [abs.]: Seismological Society of America Annual Meeting, Kona, Hawaii, April 11-13, 2007.

Sanay, R., Voulgaris, G., Trowbridge, J., and Warner, J.C., The influence of tidal asymmetry and residual circulation on sediment transport in linear sandbanks; a processes-oriented numerical study: Journal of Geophysical Research.

Storlazzi, C.D., and Jaffe, B.E., Time scales of spatial and vertical variability in flow, temperature and sediment flux over a fringing coral reef; west Maui, Hawaii: Estuarine, Coastal and Shelf Science.

Thieler, E.R., and Ashton, A.D., Was there a fifth cape in the Carolinas during the Holocene? [abs.]: Geological Society of America, Southeastern Section Annual Meeting, 56th, Savannah, Ga., March 29-30, 2007.

Valentine, P.C., Collie, J.S., and Reid, R.N., Establishment of the colonial ascidian *Didemnum* sp. on gravel habitats of northern Georges Bank—effect on benthic fauna and a probable source for further infestation of the bank [abs.]: International Conference on Marine Bioinvasions, 5th, Cambridge, Mass., May 21-24, 2007.

Warner, J.C., Sherwood, C.R., Signell, R.P., Harris, C.K., and Arango, H.G., Development of a three-dimensional, regional, coupled wave, current, and sediment-transport model: Computers and Geosciences.

Warrick, J.A., DiGiacomo, P.M., Weisberg, S.B., Nezlin, N.P., Mengel, Mike, Jones, B.H., Ohlmann, J.C., Washburn, Libe, and Terrill, E.J., River plume patterns and dynamics within the southern California Bight: Continental Shelf Research [and] final report, Bight '03, Southern California Bight Regional Marine Monitoring Program.

Wiberg, P., Sherwood, C.R., Calculating wave-generated bottom orbital velocities from surface wave parameters: Computers and Geosciences.

Williams, S.J., and Foley, M.K., A National Park Service barrier island breach management plan for Fire Island National Seashore, including the Otis Pike High Dune Wilderness Area, Long Island, New York: U.S. National Park Service Technical Report NPS/NER/NRTR.