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Fieldwork

Researchers Study Benthic Habitats in Glacier Bay, Alaska

By Jodi Harney

Geologists and biologists from the U.S. Geological Survey (USGS) teamed up aboard the research vessel *Alaskan Gyre* in April 2004 to study the sea floor and its inhabitants in Glacier Bay, southeastern Alaska. Coastal and marine geologists **Guy Cochrane**, **Jodi Harney**, **Hank Chezar**, and **Paul Carlson** from the Pacific Science Center (Santa Cruz and Menlo Park, CA) joined ecologists **Lisa Etherington**, **Jennifer Mondragon**, and **Alex Andrews** from the Alaska Science Center (Gustavus and Juneau, AK) for two weeks aboard the 50-ft-long *Alaskan Gyre*, expertly skippered by **Jim de la Bruere** (also of the Alaska Science Center).

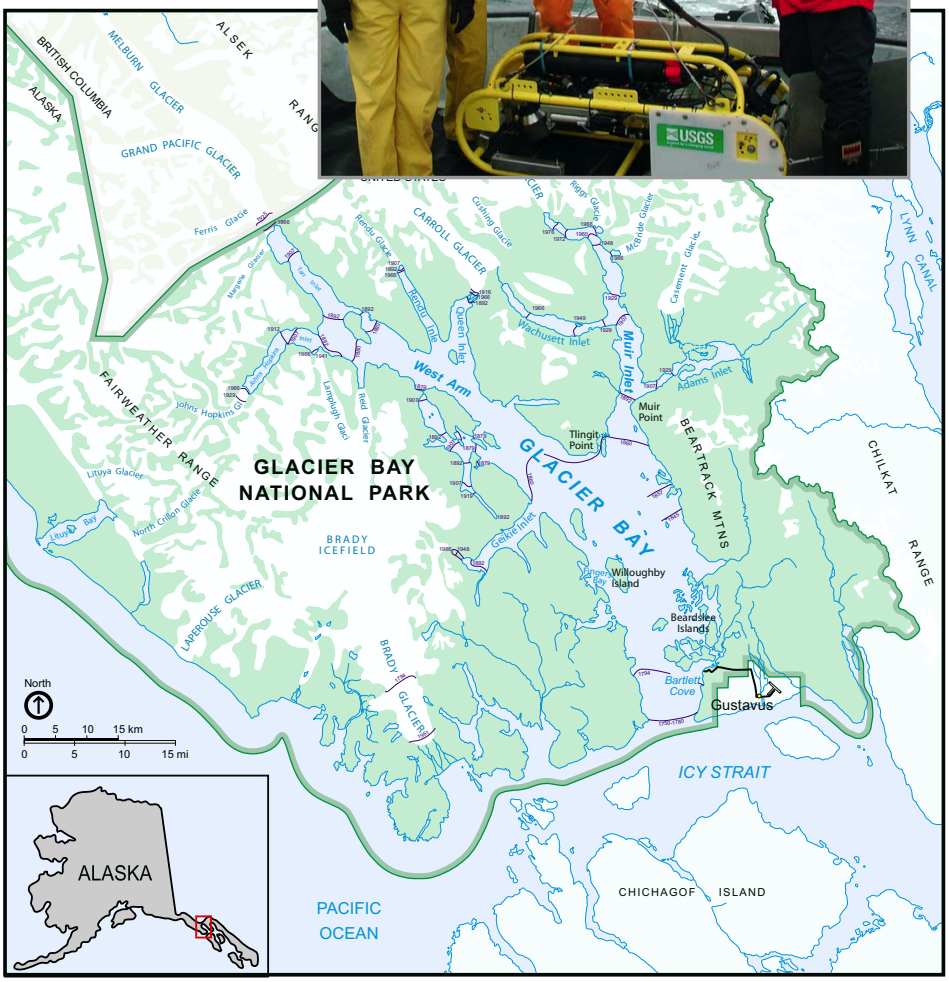
During the cruise, more than 40 hours of georeferenced digital sea-floor video were collected along 52 transects in water depths of 15 to 370 m in Glacier Bay to

- ground-truth bathymetry and acoustic-reflectance data,
- examine and record geologic characteristics of the sea floor,
- investigate the relations between substrate types and benthic communities, and
- develop a model of habitat distribution in Glacier Bay.

The video sled was equipped with forward- and downward-looking color video cameras, a pair of lasers to provide scale (by producing two red dots on the sea floor exactly 20 cm apart), and sensors to measure water depth, heading, pitch, roll, and height above bottom. The data and video were transmitted to computers and digital recorders aboard the *Alaskan Gyre* by a 2,000-ft-long cable, then combined with

(Glacier Bay continued on page 2)

Scientists from the USGS Western Coastal and Marine Geology Team with video sled on the stern of the research vessel Alaskan Gyre *in the West Arm of Glacier Bay, AK. From left to right:* ***Jodi Harney***, ***Paul Carlson***, ***Guy Cochrane***, *and* ***Hank Chezar***.



Glacier Bay National Park and Preserve, southeastern Alaska. Adapted from NPS digital map series; a nearly identical map is available online at URL ***http://www.nps.gov/glba/pphtml/maps.html.***

Sound Waves

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Deadline: The deadline for news items and publication lists for the August 2004 issue of *Sound Waves* is Thursday, July 15.
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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Fieldwork, continued

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the ship's position as determined from differential global-positioning-system (DGPS) data. During video collection, the scientists recorded real-time observations of sea-floor characteristics (including primary and secondary substrate type, slope, roughness, and benthic biomass), as well as the presence of benthic organisms and demersal fish (fish normally found near the seabed).

Commonly observed substrates include bedrock, boulders, cobbles, rippled sands, large sand waves, and mud. The sea-floor video revealed extensive beds of living *Modiolus* (horse mussels) and scallops, features that had not been previously described. Among the other important organisms observed were Tanner, Alaskan King, and Dungeness crabs; halibut, flounder, sole, pollock, rockfish, and sculpins; numerous shrimp; and sessile invertebrates, such as gorgonians, sea pens, sea stars, and urchins. Using these observations, coastal and marine geologists from the Pacific Science Center are collaborating with ecologists from the Alaska Science Center to investigate the relations between geologic features of the sea floor and the biologic communities that inhabit them.

Commercial-fishing closures mandated by Congress in 1999 in parts of Glacier Bay National Park and Preserve (southeastern Alaska) created a network of five protected areas, which make up one of North America's largest temperate-marine reserves. Twelve active tidewater glaciers remain in the Glacier Bay fiord, where historical rates of glacier retreat are among the highest documented worldwide (more than 60 km of retreat in the past 200 years). In collaboration with the National Park Service, the USGS conducted sidescan- and multibeam-sonar surveys in 1998 and 2001 to map the acoustic reflectance and bathymetry of the sea floor in lower and central Glacier Bay. These data provide information about the geologic characteristics of the sea floor and offer the opportunity to link studies of sea-floor geology and benthic ecology.

Extensive beds of living Modiolus *(horse mussels) and scallops revealed in sea-floor video footage collected in Glacier Bay. Full-size adult* Modiolus *are 5 to 6 inches long.*

The research vessel Alaskan Gyre *docked in Bartlett Cove at the Glacier Bay National Park and Preserve headquarters in Gustavus, AK.*

Geologic features of the sea floor provide essential habitat for benthic communities that sustain the demersal (sea floor) and pelagic (surface and water column) fisheries of the world ocean. An understanding of sea-floor composition and sedimentology, benthic-habitat change, and trophic relations is essential to make informed resource-management decisions and to evaluate the design and long-term utility of marine reserves.

Global climate change may be accelerating glacier retreat and associated

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sedimentation in Glacier Bay, impacting essential habitats for commercially and ecologically valuable fish and crabs. Sediment samples, gravity cores, and digital bed-sediment images that were collected during the cruise will be used to examine rates and patterns of sedimentation, grain-size distribution, and organic-carbon content in the region.

A detailed geographic-information-system (GIS) database has been constructed, using the software program ArcGIS (with help from **Pete Dartnell**, USGS Western Coastal and Marine Geology Team [WCMG], Menlo Park, CA); the database contains geophysical, videographic, and sedimentologic data from WCMG cruises conducted in 1998, 2001, and 2004, as well as data contributed by ecologists at the Alaska Science Center. This GIS database is being used to produce a benthic-habitat map that characterizes the sea-floor geology of Glacier Bay and illustrates the distribution of biologic communities. The map will be used by scientists, managers, and the National Park Service to

- understand the relation between geologic characteristics of the sea floor and the biologic communities that use them;
- identify critical habitats, such as mating and nursery areas;
- identify regions where the potential for benthic-habitat change exists;
- make informed resource-management decisions; and
- direct and plan future research.

Methods developed in the collection and analysis of data from Glacier Bay will be useful in studies of other areas where geologic change is occurring over biologically meaningful time scales. Collaboration between geologists and biologists enables the sharing of knowledge and resources to improve our understanding of habitat structure and function and to make predictions regarding future change in these marine systems.❁

***Guy Cochrane** (left), **Jodi Harney**, and **Jim de la Bruere** (dark jacket) deploy a digital bed-sediment camera in Fingers Bay.*

Integrated Science Team Deploys New Tools to Study Submarine Ground Water in North Carolina

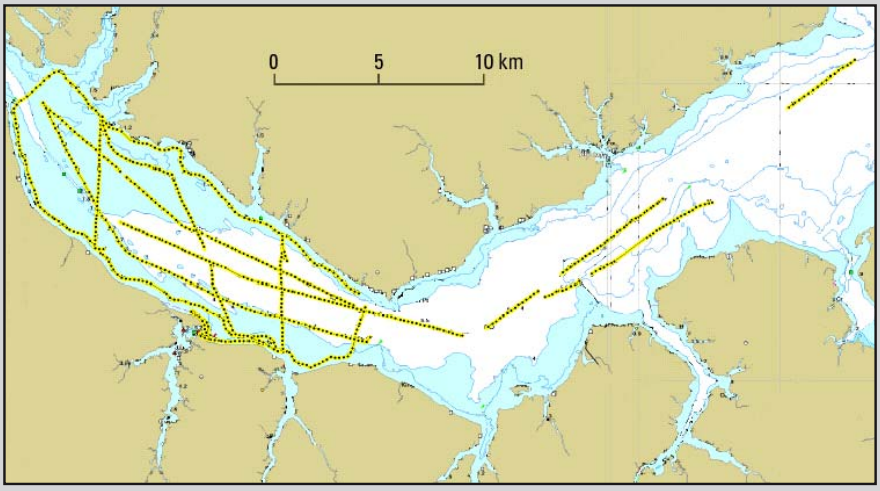
By John Bratton

A U.S. Geological Survey (USGS) team from Massachusetts, Virginia, and North Carolina, along with a graduate student and a boat driver from East Carolina University (ECU), spent the week of April 19-23 on the Neuse River Estuary in North Carolina, conducting studies related to submarine ground-water discharge. Such discharge may be one of the processes that deliver excess nutrients to the estuary, where the nutrients can trigger algal blooms that deplete the water of dissolved oxygen and cause other disruptions to the environment. The Neuse River Estuary has been the site of many fishkills in recent years, several of which have been associated with the occurrence of low-dissolved-oxygen events.

The joint field operation in April was supported by the USGS Eastern Regional Director's Office to address the USGS science priority "Water Availability for Human and Ecological Needs" through the USGS Eastern Region Integrated Science Fund. Work performed was intended to link previous modeling studies of regional aquifers, plus site-specific work at Marine Corps Air Station Cherry Point, to the surface-water quality of the estuary, concentrating on the delivery of nutrients to the estuary from ground water.

(Neuse River Estuary continued on page 4)

Neuse River Estuary in North Carolina, showing survey tracklines.



(Neuse River Estuary continued from page 3)

The specific focus was to map out the submarine hydrogeologic framework and to quantify discharge. The work was carried out by three teams; one team worked from the research vessel *Beeliner,* conducting continuous electrical-resistivity profiling and using a new system for near-continuous and simultaneous measurement of dissolved radon. The electrical-resistivity profiling allowed the scientists to map fresh and saline water layers below the bottom of the estuary, because bottom sediment permeated by saline water is a better conductor of electricity than bottom sediment permeated by fresh water. Radon measurements allowed the scientists to detect ground-water discharge into the estuary, because dissolved radon—a naturally occurring gas produced by the radioactive decay of uranium and other trace elements in common minerals—is far more concentrated in ground water than in surface water. Surface water (fresh or salty) that contains significant radon concentrations indicates recent or ongoing contributions from discharging ground water.

A second team worked from shore, setting up continuous-radon-measurement devices at several stations in the estuary to detect changes over tidal cycles. This team also collected ground-water samples from wells and from a cross-shore transect, using drive-point piezometers—temporary wells that enabled the scientists to collect ground-water samples from discrete depths.

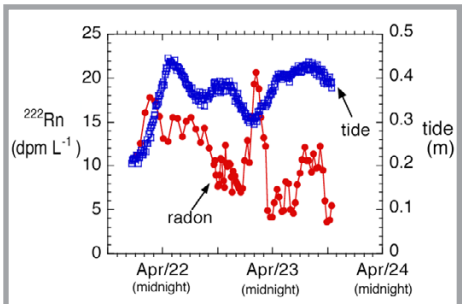
Electrical-resistivity streamer being towed behind the survey vessel.

Water-spray chamber for degassing of radon from surface water (left), and three attached devices for measuring radon at offset intervals (right). This arrangement provides dissolved-radon measurements about every 10 minutes, or every half-mile for a research vessel traveling at 3 mph.

The third team measured hydraulic heads in wells and offshore piezometers. Members of this team also deployed seepage meters to measure discharge from the sediment at multiple sites around the estuary and along selected shore-to-channel transects.

Significant early results include the detection of a region of high ground-water discharge at one beach location and electrical-resistivity imaging of a freshened plume of ground water beneath the central part of the estuary, possibly associated with a former channel of the river that is now buried and filled with permeable sediment. Data from one site suggest that tidal variation may have influenced ground-water discharge there. Future efforts will focus on integrating results from all three teams as processed data and analytical results become available.

Participants in the April work included **Tim Spruill**, **Beth Wrege**, **Eric Sadorf**, and **Erik Staub** (USGS, Raleigh, NC); **Jeff Meunier** (USGS, Reston, VA); **Eric Diaddorio** and **Erin Must** (ECU); **Matt Allen** (Woods Hole Oceanographic Institution); and **John Crusius**, **Emile Bergeron**, **Dirk Koopmans**, and **John Bratton** (USGS, Woods Hole, MA). A Woods Hole-ECU team will be back out on the Neuse River Estuary this summer, collecting seismic-reflection data as part of a related project on the geologic framework of coastal North Carolina. Additional submarine ground-water surveys and sampling are planned for low-flow conditions during fiscal year 2005.



Plot suggesting an inverse relation between radon concentration (a proxy for ground-water discharge) and tidal height. Although other interpretations are possible, the most likely explanation is that ground-water discharge is higher when tide level is low. m, meters; dpm, disintegrations, or number of atoms of radon decaying, per minute.

An offshore ground-water sample being collected by using the drive-point piezometer system. The research vessel Beeliner *is in the background, making high-resolution radon measurements while anchored in shallow water.*

Coral Mucus Goes Mainstream—New Discoveries in Mucus-Hosted Microbial Communities

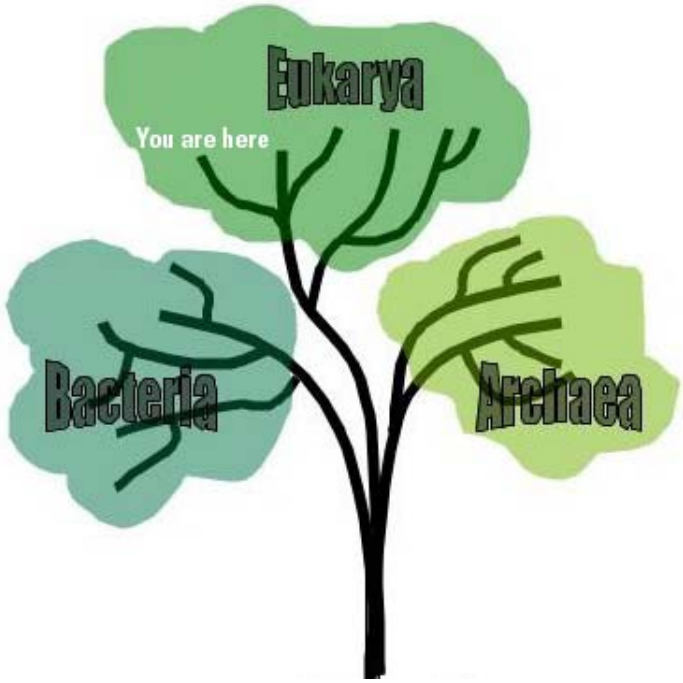
By Christina Kellogg

Coral mucus (or "coral snot," to the more irreverent) is just what it sounds like—mucus that corals secrete. Hard corals, soft corals, tropical corals, and deep-water corals (and some other related organisms) all produce mucus. Corals create a mucus layer around them and use it like a slipcover; when too much dirt (sediment) collects on the mucus layer, the coral sloughs it off and makes a new one. Some corals also use the sticky mucus to catch food. The mucus is also loaded with microbes, not unlike our skin.

Who cares about coral mucus? More people than you would think. The cover story of the March 4, 2004, issue of *Nature* was a paper that quantified the mucus some corals release and calculated its contribution to the nutrient and energy budget of the reef environment.

It has been known for several decades that coral mucus hosts a concentrated bacterial community relative to the overlying seawater. Microbial-ecology studies continue to examine the microbial communities of corals in an effort to better understand the whole organism (the sum of the coral animal, the photosynthetic algal symbiont, and the associated microbes). It is imperative to understand the relations between microorganisms and healthy corals in order to tease out what goes wrong and allows or causes coral diseases.

The microbial ecology of corals is just beginning to be characterized. It has been speculated that coral-associated bacteria benefit the coral by fixing nitrogen, breaking down waste products, cycling basic nutrients back to the zooxanthellae (photosynthetic algal symbionts), and warding off other potentially harmful microbes by producing antibiotics or just occupying the available space. Changes in the bacterial communities in coral mucus echo changes in the health of the coral, suggesting that bacteria are at least tuned to their host's metabolism and at most may have an active role in maintaining the overall health of the organism.



The molecular biologist's "Tree of Life" is constructed by comparing sequences of a universal gene (for example, the ribosomal RNA gene, which is present in all forms of life, because its product is essential to cellular function). The root of the tree is a presumed common ancestor; the branches are the three domains: Bacteria, Archaea, and Eukarya (which includes fungi, plants, animals, and us!).

Diploria labyrinthiformis*, a type of brain coral, was one of the three reef-building species analyzed for coral-associated archaea.*

Knowing that coral mucus hosts a diverse bacterial community, I wondered whether it also contained archaea. Archaea (formerly called archaebacteria) are the third domain of life. Superficially, they look like bacteria, but on a genetic level, they are as different from bacteria as we are. For years, archaea were found only in extreme environments, such as hot springs or deep-sea hydrothermal vents. More recent molecular-biological studies, however, have uncovered archaea in plain sight; in temperate coastal waters, archaea can account for as much as 30 percent of the microbial plankton. Archaea have also been detected in marine sediment and as symbionts in sponges. Archaea remain difficult to cultivate in the laboratory, however, and so most current research is based on detection of archaeal DNA sequences, which are used to identify different types of archaea.

In July 2002, I collected mucus from three species of reef-building corals in the U.S. Virgin Islands: *Montastraea annularis* complex, *Diploria strigosa*, and *Diploria labyrinthiformis*. Total microbial DNA was extracted from the coral-mucus samples, and polymerase chain reaction (PCR) was performed with archaeal-specific primers. The resulting DNA fragments were sequenced and identified by comparison to known sequences in GenBank, an international repository for

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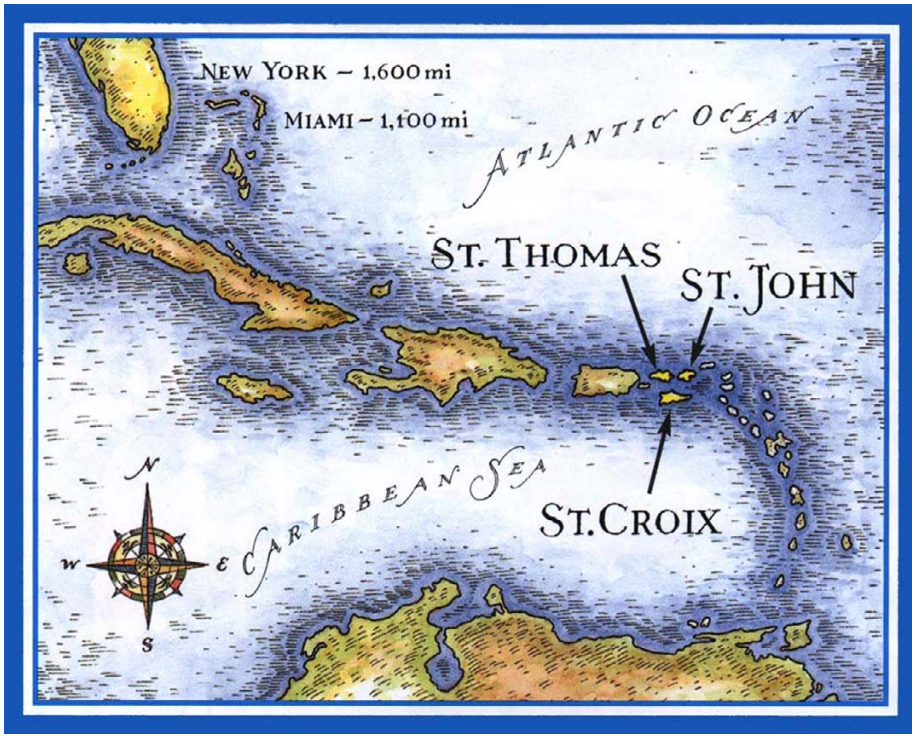
sequence information. A diverse archaeal community was detected in each of the mucus samples. Most of the coral-associated archaeal sequences were most closely matched to archaea previously detected in marine water-column samples; the remaining sequences were most similar to those of archaea detected in anoxic sediment and hydrothermal vents. Some archaea that have rarely been detected were identified from the coral mucus, as well as a few sequences that were different enough to be considered novel archaeal types. Unlike previous bacterial studies, which found specific associations between certain bacterial and coral species, this study found that archaea seem to be generalists, with the main types detected being observed in all three coral species tested.

This work was one of two simultaneous, independent studies to detect the presence of archaea associated with tropical reef-building corals. The detection of archaea, with their varied (and, for the uncultivated specimens, mostly unknown) metabolic capabilities, adds to the likelihood of unique biogeochemical processes. These processes and their hosts must be identified in order to integrate microbial functions with the biology of the coral animal and algal symbiont and begin to study the ecology of the synergistic system as a whole. The paper describing this work was published on June 8 in the journal *Marine Ecology Progress Series* (v. 273, p. 81-88).



Coral mucus samples were collected from a reef in Hawksnest Bay, St. John, inside the Virgin Islands National Park.

Strategic Plan for Gulf of Maine Mapping Initiative

By Page Valentine

The Gulf of Maine Mapping Initiative (GOMMI) released its strategic plan in May. GOMMI is a collaboration of government and nongovernmental partners in the United States and Canada that is endorsed by the Gulf of Maine Council for the Marine Environment. The formation of GOMMI was inspired by the recommendations of a workshop on Gulf of Maine Habitat Characterization and Mapping held in October 2001. The strategic plan outlines a framework for mapping priority areas of the Gulf of Maine sea floor and was assembled by **Page Valentine** (USGS), **Brian Todd** (Geological Survey of Canada), **Tom Noji** (U.S. National Marine Fisheries Service), and **Susan Snow-Cotter** (Massachusetts Office of Coastal Zone Management), with the support of a peer-review panel of marine mapping scientists and managers.

The goal of GOMMI is to produce and make widely available sea-floor images, maps, and biological surveys that are fundamental for resource management, planning, and many commercial activities. This initiative is an excellent example of regional marine management as recommended in a recent report by the U.S. Commission on Ocean Policy (available from the commission's Web site at URL **http://www.oceancommission.gov/**). In addition to the strategic plan, GOMMI has conducted outreach efforts in the past year that have resulted in fact sheets on applications of sea-floor mapping and an article in NOAA's *Coastal Services* magazine (available online at URL **http://www.csc.noaa.gov/magazine/**).

The next step for GOMMI is to complete an assessment of mapping needs, to further refine the mapping approach, and to identify priority areas to be mapped. A needs-assessment survey will be conducted this summer. GOMMI is hosting a marine-habitat-mapping workshop to be sponsored by the National Oceanic and Atmospheric Administration (NOAA) in early October in Maine to share results of the survey and to discuss implementation of the strategic plan. The GOMMI strategic plan, fact sheets, and information on the needs assessment and workshop are posted at URL **http://www.gulfofmaine.org/gommi/**.

Geologist Analyzes Soil Samples to Assist the Search for a Missing Person

By Terry Edgar

Earlier this year, U.S. Geological Survey (USGS) geologist **Terry Edgar** (St. Petersburg, FL) analyzed a set of soil samples to help the Sheriff of Lee County, FL, and his staff narrow the range of locations where they might search for a missing person. **Terry** was brought into the investigation last February when **Michelle Barret**, Chief of Communications for the USGS' Eastern Region, asked him whether he could assist. **Terry** replied that although forensic geology was not his specialty, he would have a go at it or would contact folks who could help.

According to **Sheri Alfaro**, Crime Scene Technician with the Lee County Sheriff's Office (southwest Florida), a young woman was reported missing from Fort Myers, FL, in early January. She was last seen with a male companion she had met on the Internet a year earlier and had invited down from Washington State to stay with her. The male friend, now "suspect," was picked up in Corpus Christi, TX, on a separate charge. He was driving her car, which contained most of her belongings. The victim was not with him and was still missing at press time.

The Texas authorities found soil samples in the trunk of the car and on the floor of the rear passenger side. In addition, a shovel was found in the trunk with a few grains of sand on it. The suspect used the victim's credit card on the trip from Fort Myers to Corpus Christi, leaving a trail from south Florida to Goodyear (near Phoenix), AZ, and back to Corpus Christi.

The three samples and a list of all the stops the suspect made, based on the credit-card records, were sent to **Terry**. The suspect followed Interstate Highway 75 northward through Florida, joined Interstate Highway 10 (I-10) in northern Florida, and took it all the way to Goodyear, AZ. The two soil samples found in the car consisted of calcium carbonate-cemented sand grains, rather typical Florida sediment. The few grains recovered from the shovel, however, are igneous, consisting of quartz, plagioclase, and a black mineral that looks like hornblende. This mineral assemblage is not typical of Florida or the southern Gulf Coast, including the part of Texas traversed by I-10. Granitic rocks of Precambrian age occur in the Llano Uplift, north of San Antonio, but those rocks contain abundant orthoclase, none of which was apparent in the shovel sample.

A call to the Arizona Department of Mines and Mineral Resources confirmed that the State has a lot of material similar to the sediment on the shovel. With this information, the Lee County Sheriff's investigators redirected their search for the victim from Florida to Arizona. At the time of publication, the victim had not been found.❁

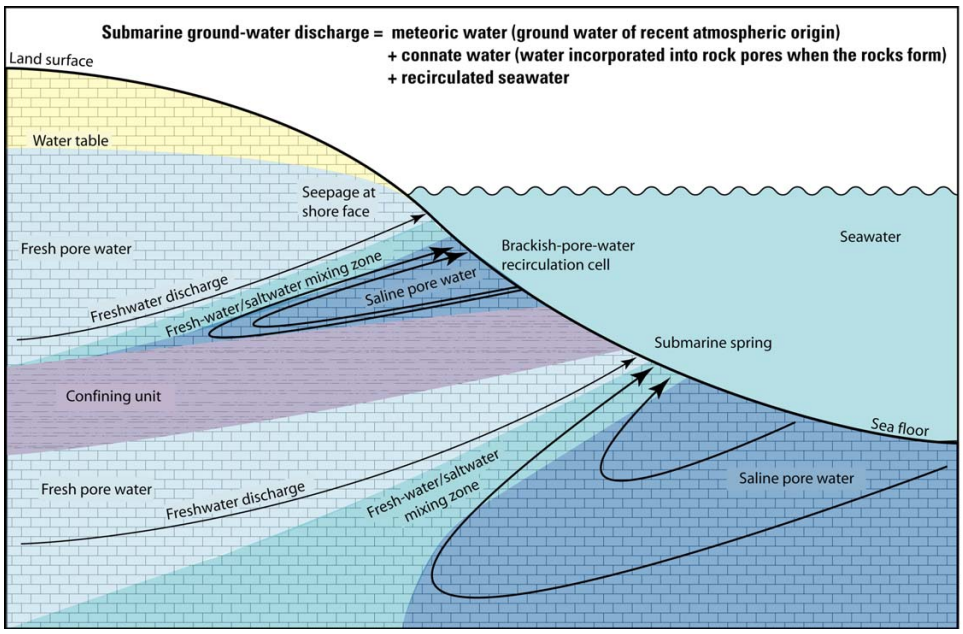
Submarine Ground-Water Discharge and Its Influence on Coastal Processes and Ecosystems

By Peter Swarzenski, John Bratton, and John Crusius

Submarine ground-water discharge has recently been recognized as a ubiquitous phenomenon that can strongly influence coastal-water and geochemical budgets and drive ecosystem change. For example, the discharge of nutrient-enriched ground water into coastal waters may contribute to eutrophication, the process by which a body of water becomes enriched in dissolved nutrients that stimulate the growth of aquatic plant life, commonly resulting in excessive algal blooms and the depletion of dissolved oxygen. Similarly, submarine ground-water discharge can also directly affect the availability of fresh water to coastal communities, impact fragile coastal ecosystems, such as estuaries and coral reefs, and influence shoreline geomorphology.

A 1996 paper by **W.S. Moore** in *Nature* (v. 380, p. 612-614) raised awareness of the global importance of submarine ground-water discharge, and much effort

(Submarine Ground Water continued on page 8)



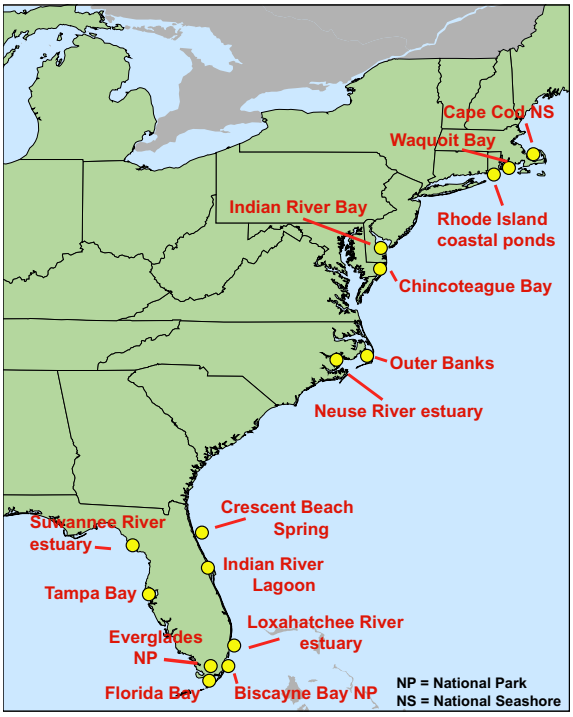
Idealized hydrogeologic cross section showing submarine ground-water discharge.

(Submarine Ground Water continued from page 7)

has subsequently been devoted to developing new tracer techniques and methods for identifying and quantifying submarine ground-water discharge. Because the discharge of coastal ground water commonly occurs as diffuse seepage rather than focused discharge, assessing submarine ground-water discharge has remained difficult for both oceanographers and hydrologists. Through national and international research programs, scientists have developed a variety of complementary approaches for quantifying submarine ground-water discharge, using a wide assortment of tracers and methods. Intercalibration experiments, such as those conducted in coastal waters off Australia, Brazil, and Long Island, NY, demonstrate that careful measurements can accurately quantify submarine ground-water discharge, confirm some of the driving mechanisms (such as climatic and tidal forcing), and constrain the spatial and temporal scales at which these mechanisms operate. Now that approaches for rigorously quantifying submarine ground-water discharge are becoming better established, scientists can begin to investigate the wide variety of coastal processes affected by submarine ground-water discharge.

*Two coastal submarine-ground-water-discharge sites (arrows) in Tampa Bay, FL, directly affecting shoreline geomorphology. Aerial photograph courtesy of **C. Kovach**, Florida Department of Environmental Protection.*

The U.S. Geological Survey (USGS) is uniquely poised to conduct comprehensive investigations of submarine-ground-water-discharge processes in coastal ecosystems because of its broad scientific expertise. For example, USGS scientists representing the Water Resources Discipline (WRD) have well-established expertise in ground-water sampling and variable-density-modeling techniques. USGS scientists representing the Coastal and Marine Geology Program are developing and applying a host of new, complementary geophysical and geochemical tools. For example, sites of submarine ground-water discharge can be inferred by using streaming electrical-resistivity instrumentation, which detects pore-water conductivities based on variations in electrical resistance. This technique complements more traditional methods (such as sidescan sonar, multibeam sonar, and subbottom acoustics) for mapping subsurface geology. New instruments capable of *in situ* analyses of radon-222 (a naturally occurring radioactive gas with a half-life of 3.8 days that is more concentrated in ground water than in surface water) can also help pinpoint locations of submarine ground-water discharge. This technique can also be used to infer regionally averaged discharge rates by contrasting ground-water and surface-water activities. A new complementary tool is the autonomous seepage meter, which allows direct quantification of bidirectional submarine ground-water discharge over areas of approximately 1 m^2. Multiport piezometers and other equipment, including floating drilling platforms, allow samples of submarine ground water to be collected at different depths. These samples can then be analyzed for a suite of constituents, such as salinity, chlorine ions (Cl-), chlorofluorocarbons (CFCs), and nutrients. Residence times of coastal waters and submarine-ground-water-discharge rates can be derived by measuring four natural isotopes of radium whose half-lives range from 3.7 days to 1,600 years. The USGS science centers in St. Petersburg, FL, and Woods Hole, MA, have recently acquired many of these capabilities, and additional analyses are available through collaborations with other USGS and academic scientists.



U.S. east coast, showing some of the sites where the USGS is studying submarine ground-water discharge.

The study of submarine ground-water discharge is valuable for understanding the availability and quality of coastal ground water and its control on many coastal processes that span the disciplines of geology, geomorphology, geochemistry, biology, hydrology, and ecology. Specific examples of research areas where USGS submarine-ground-water-discharge studies can help to solve interdisciplinary problems include:

- assessment of the redox-controlled and microbially controlled delivery of nutrients and trace elements in submarine ground-water discharge (linking the fields of geochemistry and coastal hydrogeology)

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(Submarine Ground Water continued from page 8)

- evaluation of coastal-ecosystem change in response to variations in submarine ground-water discharge (linking the fields of biology, ecology, and biogeochemistry to coastal hydrogeology and meteorology)
- examination of shorefaces breached by submarine ground-water discharge and the influence that submarine ground-water discharge associated with paleochannels has on erosional hotspots (linking the fields of coastal geology and geomorphology to coastal hydrology)
- developing the capability to forecast processes and events associated with submarine ground-water discharge (for example, can we predict lagtimes between the initiation of wastewater discharge into coastal aquifers and the onset of impacts on coastal ecosystems by nutrients derived from submarine ground-water discharge?)

Current USGS projects on submarine ground-water discharge are primarily focused on such first-order questions as "What are the locations and rates of discharge?", as well as studies of nutrient delivery from submarine ground-water discharge. Some of the areas on the U.S. east coast where the USGS is studying submarine ground-water discharge are shown on the map accompanying this article. Additional studies are underway in other parts of the United States and on Israel's Mediterranean Sea coast.

MarineQuest X—USGS Supports Florida Marine Research Institute's Open House

By Jennifer Leigh Oates

Scientists from the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies in St. Petersburg, FL, participated in the 10th annual MarineQuest, an open house hosted by the Florida Marine Research Institute (FMRI) on April 3 in downtown St. Petersburg.

A group of children and adults eagerly waited their turn to learn about the similarities between Florida's geology and the dissolving of sugar cubes by water from an eyedropper. USGS hydrologist **Ann Tihansky** and her daughter **Tasia** explained that limestone is porous, and after many years of water running through the pores, the holes typically increase in diameter as the limestone dissolves, just as sugar dissolves (much more quickly) in drops of water. A popular ground-water model was used to demonstrate how porous zones in limestone can rapidly transport contaminants from the land surface into the Floridan aquifer.

USGS microbiologist **Christina Kellogg** fielded questions about African dust and other areas of ongoing research in the USGS. A hurricane video played in the center of the display, to increase awareness of the destruction hurricanes have caused in the past. Teacher packets, buttons, handouts, USGS bags, and USGS Open-File Reports were popular items for the public to take home.

The USGS and FMRI have a history of assisting in each other's open houses; for example, a representative from FMRI participated last year in the fifth annual USGS Open House in St. Petersburg.

Ann Tihansky *(left) used a ground-water model to show how surface pollutants can enter porous limestone and contaminate local ground-water supplies.*

Christina Kellogg *(right) discussed her research of African dust blown across the Atlantic Ocean and described additional studies being conducted at the USGS center in St. Petersburg, FL.*

Workshop Addresses Tsunami Hazard to Puerto Rico, the Virgin Islands, and Other Caribbean Islands

By Uri ten Brink

A Caribbean Tsunami Hazard workshop was convened on March 30-31, 2004, by the National Science Foundation in cooperation with the Puerto Rico Emergency Management Agency, the Department of Marine Sciences at the University of Puerto Rico at Mayagüez, and the Sea Grant Program at the University of Puerto Rico.

The primary objective of the workshop was to characterize and quantify the multiple tsunami-generation sources in the Caribbean region, which include local and remote earthquakes, submarine and subaerial slope failures, and volcanic eruptions. Another objective was to summarize warning, mitigation, and public-education efforts in the Caribbean and to learn from similar efforts in the Pacific.

Tsunami hazard, warning, and mitigation is an interdisciplinary topic involving marine geologists, seismologists, hydrodynamic modelers, emergency warning and management personnel, city planners, and educators. The 38 participants of the workshop came from diverse organizations, including State and Federal governments, academia, private consulting firms, and foreign universities. The USGS was represented by **Carol Prentice** and **Judy Zachariasen** from the Earthquake Hazards Program (EHP) and **Uri ten Brink** from the Coastal and Marine Geology Program (CMGP).

Uri ten Brink presented an analysis of recently acquired high-resolution sea-floor morphology, which shows active slumping along the north shore of Puerto Rico. Preliminary modeling of one of the submarine slides, carried out by **Eric Geist** (CMGP), indicates a maximum wave runup of 20 meters near Arecibo, Puerto Rico. The participants agreed on the need for further studies of the following topics:

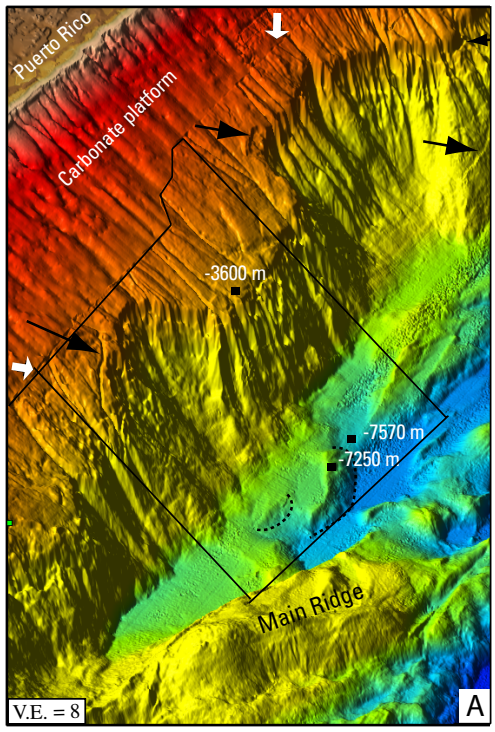
- assessment of the sea-floor morphology and geology in areas prone to earthquakes and slumps;
- differentiation between hurricane and tsunami deposits—in particular, quantitative estimates of the forces required to pick up and move boulders and large rocks;
- the potential effect of tsunami waves on coastal infrastructure, ports, and cruise ships; and
- additional paleotsunami studies around the Caribbean, preferably with absolute dating of the deposits.

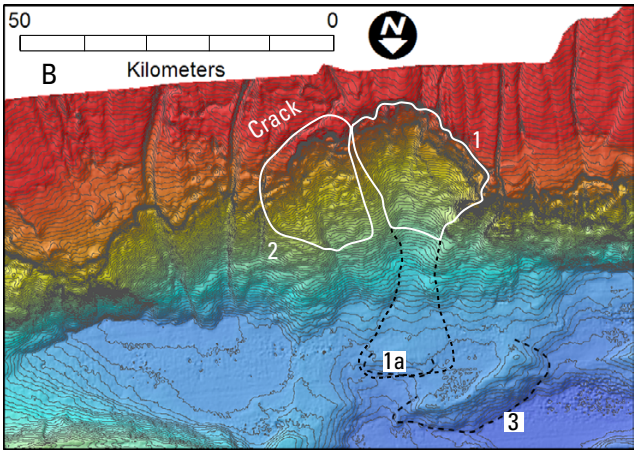
(The tsunami deposits indicate many more tsunamis than were historically accounted for in eyewitness accounts by the Spaniards in the Caribbean Islands.)

Additional workshop recommendations included

- the need to have the U.S. National Tsunami Hazard Mitigation Program include U.S. citizens in the Caribbean,
- the need to promote and provide funding for the collection of bathymetric and topographic data around the various nations in the Caribbean region,
- the need to export the tsunami-hazard-quantification work in Puerto Rico to the rest of the Caribbean, and
- the need for high-frequency sampling and real-time transmission of sea-level data as part of a tsunami-warning system.

A proceedings volume summarizing many of the contributions to the meeting is currently being prepared❁.





Views of the sea floor 50 km north of San Juan, Puerto Rico, showing submarine slope failures, debris toes, and cracks. The bathymetry was collected by using SeaBeam 2112 aboard the National Oceanic and Atmospheric Administration (NOAA) ship Ronald H. Brown, *with funding from the NOAA Office of Ocean Exploration.*
A, Oblique view of the area north of Puerto Rico showing slope failures, debris toes (dashed lines), and cracks in the sea floor (black arrows). White arrows denote the boundary between our newly acquired high-resolution bathymetry data and older, lower-resolution data compiled from various sources.
B, Colored bathymetric map of area within and east of black polygon in the oblique view. Shallowest sea floor is red; deepest is violet-blue. The crack (labeled) is several hundred meters wide, 150 m deep, and 15 km long. Outline on right (labeled "1") delineates a slope failure covering a 360-km² area (solid white line) with a 35-km-long debris field (dashed black line, 1a). Outline on left (2) shows the maximum expected area of slope failure should the crack open completely. Dashed line at lower right (3) shows toe of a debris field that has been largely covered by the younger debris field (1a).

USGS Wins 15 Blue Pencil, Gold Screen Awards

By Gaye S. Farris

The U.S. Geological Survey (USGS) received 15 awards in the annual Blue Pencil and Gold Screen Competition sponsored by the National Association of Government Communicators (NAGC).

The USGS received five awards in each of the three levels of first place, second place, and award of excellence. The USGS swept the individual-map category, with two entries tying for first place, two tying for second, and four tying for awards of excellence.

According to NAGC officials, ties were necessitated by the high quality of entries in some categories. Judging was done across the Nation by both governmental and nongovernmental information professionals who volunteer their time to judge and give peer feedback on entries. More than 500 entries were submitted in the annual competition.

The National Association of Government Communicators is a national, nonprofit professional network of Federal, State, and local government employees who disseminate information within and outside government.

Award-winning USGS products and recipients are as follows.

First-Place Awards

A tie for first place in the individual-map category went to two USGS products: (1) "Evolution of the Landscape Along the Clear Creek Corridor, Colorado—Urbanization, Aggregate Mining, and Reclamation," by **Belinda Arbogast**, **Daniel Knepper, Jr.**, **Roger A. Melick**, and **John Hickman**, authors; **Craig Brunstein**, editor; **Carol Quesenberry**, graphic artist; and others in the Central Publications Group (USGS Geologic Investigations Series I-2760, URL **http://pubs.usgs.gov/imap/i-2760/**); and (2) "The North American Tapestry of Time and Terrain," by **Kate E. Barton**, computer specialist; **David G. Howell**, geologist; and **José F. Vigil**, multimedia specialist (USGS Geologic Investigations Series I-2781, URL **http://geopubs.wr.usgs.gov/i-map/i2781/**).

First place in the technical-report category went to "Ground-Water Resources in the Black Hills Area, South Dakota," by **Janet M. Carter** and **Daniel G. Driscoll**, hydrologists; **Ella M. Decker**, editor; and **Connie J. Ross**, illustrator (USGS Water-Resources Investigations Report 03-4049, URL **http://water.usgs.gov/pubs/wri/wri034049/**).

First place in the media-event category went to the USGS's "Black Hills Hydrology Study, Presented to Governor" by **Janet Carter** and **Daniel Driscoll**, hydrologists; **Van Linquist**, host; and **Brenda Athow**, outreach coordinator.

First place in the video-documentary category went to "Delta Revival: Restoring a California Ecosystem," by **Stephen Wessells**, producer, and **James E. Cloern** and **Sam Luoma**, executive producers.

Second-Place Awards

Ties for second place in the individual-map category went to two USGS products: (1) "Under San Francisco Bay—a New View of the Floor of West-Central San Francisco Bay" by **Dave Cacchione**, **Paul Carlson**, **Pat Chavez, Jr.**, **John Chin**, **Pete Dartnell**, **Jim Gardner**, **Helen Gibbons**, **Dave Rubin**, **Miguel Velasco**, and **Florence Wong**; Western Coastal and Marine Geology Team; and the Western Publications Group (USGS Open-File Report 01-90, URL **http://geopubs.wr.usgs.gov/open-file/of01-90/**); and (2) "Crater Lake Revealed," by **Dave Ramsey**, **Pete Dartnell**, **Charlie Bacon**, **Joel Robinson**, and **Jim Gardner**; Volcano Hazards and Western Coastal and Marine Geology Teams; and the Western Publications Group (USGS Geologic Investigations Series I-2790, URL **http://geopubs.wr.usgs.gov/i-map/i2790/**).

Second place in the technical-report category went to "The Pu'u 'O'o-Kupaianaha Eruption of Kilauea Volcano, Hawaii, 1983 to 2003, the First 20 Years," by **Christina Heliker**, **Donald Swanson**, and **Taeko Jane Takahashi**, volcanologists; Volcano Hazards Team; and the Western Publications Group (USGS Professional Paper 1676, URL **http://geopubs.wr.usgs.gov/prof-paper/pp1676/**).

Second place in the internal-newsletter category went to "Sound Waves—Coastal Science and Research News from Across the USGS," by **Helen Gibbons**, physical scientist; **Trent H. Faust**, World Wide Web developer; and the Western Publications Group (URL **http://soundwaves.usgs.gov/**).

Second place in the special-projects category went to the "Circumpolar Arctic Vegetation Map Poster," by the National Wetlands Research Center Publications Staff, in partnership with the Institute of Arctic Biology and the U.S. Fish and Wildlife Service.

Awards of Excellence

Awards of excellence in the individual-map category went to four USGS products: (1) "Lewis and Clark: A Legacy of Science," by **John Kosovich**, cartographer; **Becky Garcia**, graphics designer; **Bruce Boman**, cartographer; and the Information Services Product Development Team; (2, 3) "Color-Coded Topography and Shaded Relief Maps of the Lunar Hemispheres" and "Topographic and Color-Coded Contour Maps of Mars," both by the Astrogeology Team and the Western Publications Group (USGS Geologic Investigations Series I-2769, URL **http://geopubs.wr.usgs.gov/i-map/i2769/**); and (4) "Circumpolar Arctic Vegetation Map," by the National Wetlands Research Center Publications Staff, in partnership with the Institute of Arctic Biology and the U.S. Fish and Wildlife Service.

An award of excellence also went to the "USGS Menlo Park, California, Monthly Public Lecture Flyers," by **William L. Rambo**, geologist; Western Region Office of Communications; and the Western Publications Group. (Most-recent flyers are available at URL **http://online.wr.usgs.gov/calendar/**.)

The complete list of award winners can be viewed on the National Association of Government Communicators Web site at URL **http://www.nagc.com/awards/**.

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