

Florida

GEOLOGY

Forum

A Newsletter from the Florida Geological Survey Vol. 20 No. 2 October 2006

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Strong Earthquake in the Gulf of Mexico

On September 10 at 10:56 a.m. Eastern Daylight Time some Floridians reported feeling the strong (Magnitude 6) earthquake that occurred about 250 miles (405 km) south-southwest of Apalachicola, Florida according to the United States Geological Survey.

The Department's (DEP) Florida Geological Survey (FGS) office received two inquiries to their website the following day regarding this unusual event. One inquiry from a citizen near Gainesville who was concerned with what was thought to be a tremor noted, "It was fairly strong - our chairs rolled around the floor." Another visitor to the website from the Sarasota area wrote "We thought we felt earth movement, like a wave running through the ground, just like in water, before 11:00 a.m. on September 10th. What would cause this? Our dog even got up."

A Tectonic Summary by the United States Geological Survey (USGS) noted that the earthquake was centered under the Gulf of Mexico far from the nearest active plate boundary. The earthquake is thought to result from forces applied at the plate boundary. The USGS has not linked the earthquake to any specific fault. Magnitude 6 earthquakes are typically unlikely to generate a destructive tsunami. For additional information visit: <http://earthquake.usgs.gov/eqcenter/eqinthenews/2006/usslav/>

The last tremor felt in Florida linked to recorded seismicity occurred in 1978. It was felt in northwest Florida near Lake City and was recorded by a seismic station in Americus, Georgia. The data suggested that the earthquake occurred beneath the Atlantic Ocean. For more information on Florida's seismic history view Open File Report 40 at www.dep.state.fl.us/geology/publications/index.htm

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Surface waters drain into a sinkhole in Lake Jackson, Leon County, Florida.

Florida's Disappearing Lakes

Editors Note: In June 2006 the most recent draining of Lake Jackson began in Tallahassee continuing into September. Also in June 2006, Scott Lake in Lakeland emptied after four sinkholes developed in the 285 acre lake and residents are contemplating the possible plugging of those sinks.

Many lakes in Florida fall into the category of disappearing lakes. It occurs when drought conditions impact Florida's karst terrain. Some, such as Lake Jackson near Tallahassee, disappear frequently. Others, like Scott Lake near Lakeland in Polk County, have not historically drained into sinkholes. The common factor these lakes share is that they were formed as a result of sinkholes which lowered the land surface allowing water to accumulate. Many lakes in the state were formed by multiple sinkholes coalescing into a karst basin. Lake Jackson likely has had hundreds of sinkholes involved in the origin and development of the lake basin.

Some large karst basins have open sinkholes that continuously drain. Lakes do not form in these basins. In others, the sinks are naturally plugged and the accumulating water forms a lake. The lake remains until the plug in the sink breaks or new sinkholes form. Excluding a single incidence, Paynes Prairie, near Gainesville, has drained through Alachua Sink since Florida was settled by people of European descent. The locals enjoyed going to the sink and watching the swirling water drain into the hole. They often threw logs in, watching as they disappeared into the hole. This practice plugged Alachua Sink around 1871 and water filled the basin forming Alachua Lake. For several years steam ships used the lake to transport goods. However in 1891, the man-made plug failed and Alachua Lake disappeared. Since then, only during times of extreme rain events does water in the basin form a shallow lake.

Lake Jackson drains with some regularity – approximately every 25 years – usually in response to drought conditions. The drought conditions lower the water level in the Floridan aquifer system. Lowered water levels facilitate the development of sinkholes. The latest major draining of Lake Jackson occurred in 1999. Since then the lake level has fluctuated but has not returned to its normal water level. Several times since 1999, rainfall was low enough for the lake to go down the hole again. The most recent event began in June 2006 and was continuing as of early September.

The disappearance of lakes usually creates a media event with newspaper, television and radio reporters flocking to the scene. Also, as occurs with Lake Jackson, when the water rapidly drops the last five or so feet, a fishing frenzy occurs as people grab and net bass and other large fish before they disappear down the hole. Contrary to a popular myth that the fish will survive underground, there is not enough oxygen in the waters of the Floridan aquifer system for fish to live.

Disappearing lakes are a natural phenomenon in sinkhole prone regions of Florida. They occur where carbonate rocks are dissolved by rain water and surface water seeping through the overlying sediment and are part of a natural cycle of karst landscape development.

STATEMAP Update

The STATEMAP Program is a cooperative project funded jointly by the DEP/FGS and the National Cooperative Geologic Mapping Program under the State Geologic Mapping Component (STATEMAP). For each of the last 12 years, staff members from the DEP/FGS have performed detailed geologic mapping of 1:100,000 scale USGS quadrangles and published the results as part of the Open-File Map Series (OFMS). To date, we have completed geological mapping of the following USGS 1:100,000 scale quadrangles: Homestead, Sarasota, Arcadia, Crestview, Marianna and Gainesville.

In September 2005, the DEP/FGS began working on the production of a bedrock geologic map and several geologic cross sections for the western portion of the 1:100,000 scale Lake City Quadrangle. Field mapping began in October, with a completion date set for August 31, 2006. In May 2006, an expedition along the Suwannee River by the STATEMAP field crew was scheduled to finalize mapping in the area and collect additional samples. The STATEMAP field crew at Big Shoals on the Suwannee River is shown in the photograph at the right: Front row (L-R): **Tom Greenhalgh, Jim Balsillie, Jon Bryan**; Back row (L-R) **Steve Petrushak, Dave Paul and Rick Green**. The maps and cross sections for this area are currently available through the DEP/FGS Open File Map Series (OFMS 97).

After receiving input at an October workshop with the STATEMAP Advisory Committee, the eastern portion of the USGS 1:100,000 Perry Quadrangle in north-central Florida was selected for mapping under the STATEMAP program.



STATEMAP Field Crew, May 2006



Geologist Jim Ladner samples sand at a Volusia County Beach.

Coastal Research Program

The U.S. Minerals Management Service (MMS) and the DEP/FGS participate in a continuing cooperative investigation of Florida's offshore marine sand resources. Estimates of potential reserves of sand that may be used for beach restoration are based on this work. Reserves were calculated for two areas lying offshore of Nassau County and two areas that lie offshore of Duval County. A draft form of the results of those calculations is scheduled for completion in December, 2006.

Laboratory analyses were completed on 107 sand samples collected earlier in Volusia County to augment an ongoing offshore sand study. Based on aesthetic and environmental considerations, it is important to match sand used in restoration to the sand that is native to the beach where it will be placed. The DEP/FGS described, photographed and analyzed the grain size of samples collected from the beaches of Volusia County to document characteristics of undisturbed sand. This work follows earlier offshore seismic studies completed for Volusia County.

A Study of Seabed Features Offshore, Steinhatchee, Florida

The DEP/FGS Coastal Research Program examined an area of seabed in Deadman Bay approximately 15 square miles (about 39 square kilometers), offshore from Steinhatchee, using side scan sonar mosaics and bathymetric analysis. The project was the continuation of a DEP program, initiated in 2005 that mapped features on the offshore seabed of Florida's Gulf Coast. This mapping program supported an interdisciplinary Coastal Aquatic Managed Areas (CAMA) project with funding provided both by the Oceans Initiative Act and the DEP/FGS.

Seabed features were mapped using a Marine Sonic side scan sonar system operating at 600 kilohertz (kHz) and a Garmin 168 global positioning and bathymetric system operating at 50 kHz. More than 300 line-miles (482.8 line-kilometers) of side scan sonar and bathymetric data were collected.

Seabed features identified on the side scan sonar mosaics are primarily attributed to differences in bottom sediment reflectance. A number of narrow and relatively linear features lying generally perpendicular to the coast, exhibiting reflectance either higher or lower than the average, were noted. Features which exhibit lower reflectance are interpreted to be the surface expression of drowned channels associated with the ancestral Steinhatchee River. Other features, which exhibit higher reflectance, are interpreted to be low-relief, discontinuous, linear accumulations of sand. In some areas, they appear to overlie features associated with the ancestral Steinhatchee.

This ongoing study, using a Stabilization Elevation Table (SET), measures elevation as a means of monitoring erosional changes of the marsh surface in wetlands. The units are currently deployed in wetlands associated with estuaries of the Apalachicola, the Aucilla, the Steinhatchee, St. Joe Bay, Waccasassa and Cedar Key, the St. Marks and the Ochlocknee Rivers, and the wetlands on Cumberland Island. Comparison of data from these wetlands will enable better prediction of their response to sea level change or the effects of development. During the period of this report, SET measurements were conducted on Cumberland Island and Apalachicola estuarine wetlands. The SET station from the St Joe Bay site and one of the two stations deployed in the Apalachicola wetlands were lost to catastrophic erosion from severe storms associated with the 2005 hurricane season. The new data suggest that the estuarine and marsh environments along Florida's Big Bend are slowly being drowned in response to sea level rise. If sea level rise and sediment accumulation continue at their current rates, Florida's Gulf Coast may experience increased erosion of both upland areas and marsh resulting in loss of valuable habitat.

Education and Outreach

Earth Day at the Capitol: Water is Life

On April 19th DEP celebrated Earth Day in the Capitol Courtyard. The theme for this year's event was: "Water is Life". Displays were presented by the Department, other state governmental agencies and private entities interested in the environment. The DEP/FGS brought its mobile GEOLAB and presented an activity for students to acquaint them with various rock types that make up aquifer systems in Florida. In keeping with this year's theme, the DEP/FGS distributed posters related to geology and spring protection issues. DEP/FGS staff including **Dave Taylor**, **Eric Harrington**, **Walt Schmidt**, **Jackie Lloyd**, **Frank Rupert**, and **Paulette Bond** led students in interactive activities and discussed DEP/FGS programs with interested adults.

Wakulla Wildlife Festival

On April 22nd DEP/FGS staff members, **Tom Scott**, **Carol Armstrong** and **Sarah Ramdeen** participated in the Wakulla Wildlife Festival. They distributed posters and discussed the hydrogeology of Wakulla Springs, explaining how knowledge of the area's hydrogeology is essential to protection of the springs.

Leon Association of Science Teaching

On August 22 DEP/FGS geologist **Paulette Bond** participated in the Leon Association of Science Teaching's a fall membership drive. Flyers were distributed highlighting the DEP/FGS annual Open House as a field trip opportunity and the educational resources



Earth Day at the Capitol: 2006

available on the DEP/FGS and Explore Florida websites. (Explore Florida is the DEP/FGS sponsored, web-based curriculum for middle school).

Marion County Springs Festival

Tom Scott and **Harley Means** attended the 5th annual Marion County Springs Festival on September 15th and 16th at Silver Springs. Dr. Scott opened the festival with the keynote address and Means presented a lecture entitled, “Marion County’s Precious Springs” as part of the informative lecture series. More than 2300 people attended this year’s successful festival venture.

Geophysical Prospecting for Oil and Gas in Florida



Vibrating Trucks along Interstate-10 near Crestview.

Drilling a new oil well in Florida is an expensive gamble. The success rate for wildcat wells is only 2 to 3 percent and the cost of drilling is astronomical. The only commercially productive petroleum deposits in the state are 12,000 to 17,000 feet deep. One recent well with a total measured depth of approximately 18,800 feet (about 3.5 miles or 62 football fields laid end to end) cost \$14 million before producing its first barrel of crude oil.

Since the 1920’s oil companies have used geophysical techniques to model subsurface rock structures prior to committing to the high cost of drilling. Geophysical studies have had an important role in the discovery and development of 22 oil and gas fields in Florida since 1944 and have added significantly to the overall understanding of Florida’s subsurface geology.

There are four basic types of geophysical surveys used for oil and gas exploration in the uplands: 1) seismic surveys using explosives placed in shallow wells, 2) seismic surveys with truck-mounted vibrating energy sources to generate sound waves, 3) gravity surveys involving the measurement of the earth’s gravity at various locations, and 4) magnetic surveys measuring the earth’s magnetic field in different places. Values from these surveys are used to compile maps that allow regional variations and local anomalies to be identified, giving geologists a general picture of trends in subsurface rock.

Seismic surveys, using explosives or vibrating sound pulses that are analogous to sonar are most accurate and preferred by oil companies. Surveys using these energy sources capture sound waves reflected and refracted from different types of rock and rock structures at great depths. The sound waves are recorded by carefully placed “geophones” which feed the data to a central computer in the field. With the help of computer software, geophysicists compare the timing of the recorded sound pulses to known acoustic properties of various types of rock. This data is used to construct cross-sectional models of an area’s subsurface geology. In recent years new techniques for three-dimensional geophysical modeling have become common giving state and industry geologists a substantially better picture of Florida’s subsurface geology.

Since the DEP/FGS began tracking and regulating geophysical field operations in 1984, the Oil & Gas Section has reviewed 162 applications for all four types of geophysical surveys both onshore and offshore.

Geophysical Prospecting Applications in Florida	
Seismic (Explosives)	102
Seismic (Vibration)	47
Gravity	6
Magnetic	2
Offshore (only 2 of 13 were completed)	13
*(Total surveys exceed 162 since some survey applications proposed two types of geophysical data collection.)	

Prior to 1985 geophysical surveys were not regulated or tracked in Florida, although a substantial number were conducted in the state. Most pre-permit operations used explosives, while some regional vibratory surveys were conducted. The permitting of geophysical surveys began in 1985. Florida was one of the first and is still one of the few states to fully regulate oil and gas geophysical field activity. Regulation was established in response to an incident that arose from an aborted geophysical survey in south Florida. In 1980-81 a seismic contractor failed to complete a seismic survey leaving approximately 1200 unexploded charges in the ground. In April 1985, an ATV rider was accidentally injured when he came in contact with one of these charges and it exploded.

The area was remote when the surveys began, but with Florida’s continuing increase in population, land use has changed. Some of the areas where unexploded charges were located subsequently became residential properties, building sites, a state park and even a playground. The state responded with statutes and rules to ensure that the public’s safety would not be compromised by the geophysical industry. State overview in the form of rigorous permitting, licensing and inspection of all oil and gas geophysical field operations became mandatory.



Geophysical technician installs a 5-pound explosive charge into a shothole.

In August 1985 the DEP/FGS set up a Geophysical Observer Program consisting of temporary inspectors supervised by the Oil and Gas Section staff. All clearing of vegetation, drilling, detonation and reclamation activities are now observed and logged. After each survey is completed the Oil & Gas Section staff compiles and reconciles all observer logs to verify that all explosive charges have been detonated or otherwise accounted for. **Dave Taylor**, the Oil & Gas Section's Geophysical Engineer, is responsible for the oversight of geophysical regulation and supervision of field observers.



Pleistocene Anastasia Formation exposed at House of Refuge, Martin County.

New DEP/FGS Photo Archive Online

The DEP/FGS has initiated a new service which enables the public to access photographs in the archives online. The photos were taken by various DEP/FGS staff members and other geologists. The photo categories are organized into picture folders containing many geologically significant images including formations, caves, geomorphology, old maps, fossils, rocks and minerals, sinkholes and other karst features, springs and geologists. As of September 12, 2006, there were 1,457 pictures on the site. This is an ongoing project with photos continually being added. As time permits, a short description will accompany each photo file.

The images include both film-based pictures (scanned using a dedicated film scanner) and digital photographs taken with a variety of cameras. The files were sized to 5.3 by 3.5 inches at 150 pixels per inch allowing the photos to be incorporated into Power Point presentations. The images are available for downloading by anyone with proper credit at no charge. If higher resolution photographs are needed for publications, contact **Tom Scott**, **Rick Green** or **Harley Means** at the DEP/FGS – 850.488.4191.

The DEP/FGS Photo Archive Online can be found at:
<http://www.pbase.com/floridageologicalsurvey>

Chief's Corner

by Walt Schmidt

The DEP/FGS often receives inquiries from the public regarding their concerns for the welfare of their property. Photographs of urban sinkholes in Florida are widely broadcast both within the state and beyond its boundaries. Property owners (and sometimes prospective property owners) need to have what they perceive as the “imminent danger” of sinkhole development explained. Although sinkholes are widely distributed in Florida they are much more likely to occur in some areas than others. The large areas of Florida that have few sinkholes and the areas that are characterized by shallow sinks that form gradually over many years are not considered newsworthy. As geologists, we must communicate that information in such a way that the general public understands that while caution is always appropriate, there are large areas of the state where problems are minimal.

Another type of inquiry that we encounter has to do with flooding associated with rising sea level. Popular media reports often describe climate change and sea level changes that may be associated with it. Responsible estimates of the time over which these changes will probably occur or the amount of change expected in a given time period may be deemphasized or may not be provided at all. Those of us who live and work in Florida, with its low topographic relief and elevations and rapidly growing coastal communities, should be aware of the issues. However, estimates of sea-level rise on the National Oceanographic and Atmospheric Administration Website for the years 1990 to 2100 vary from 0.3 feet (.09 meters) to 2.89 feet (.88 meters) depending on the details of the model used. Although this information suggests that inland residents of Florida with homes that are in excess of 100 feet above mean sea level have no reason to be concerned about their property values because of sea level rise the DEP/FGS still receives calls from concerned residents.

These inquiries emphasize the need for geoscientists to be responsible in their communications with private citizens and the news media. We must strive to communicate *relative risk* in such a way that useful information is conveyed. Sound estimates of the time frame associated with sea level change are available. Large areas of the state are rarely troubled by sinkholes. This information is not the stuff that makes headlines. It is, however, the foundation of a rational understanding of the dynamic earth processes that affect our environment and its protection.



Walt Schmidt in the field, Gainer Springs, Bay County.



DEP/FGS Employees line up for lunch, Alfred B. Maclay Gardens State Park.

2006 Annual Awards Luncheon

In February 2006, the DEP/FGS held its 18th Annual Employee of the Year Awards Luncheon at the Gardener's Cottage of the Alfred B. Maclay Gardens State Park in Tallahassee. The annual ceremony began in January 1989 to recognize the DEP/FGS staff for their dedicated work ethics and exceptional achievements throughout the year. The management team from the Division of Resource Assessment and Management (DRAM) were guests at this year's event.

Employee of the Year was awarded to **Ed Garrett**, Environmental Administrator for the Oil & Gas Section. Ed was promoted to his current position in 2005 and is consistent and extremely diligent in his work to advance the Oil & Gas Section. During his transition into the position as Environmental Administrator, Ed received the Certified Public Manager certification from the State of Florida and the Florida Center for Public Management. Ed was also awarded the George C. Askew Award from the American Academy of Certified Public Managers (AACPM) at their annual meeting. In March 2006, Ed received distinction as the Department of Environmental Protection's Employee of the Month.

Individual Extra Effort Awards were awarded to **Paulette Bond, Dave Files, Sharon Lee and Susan Trombley**. The Individual Extra Effort Award is given to staff members who continually go above and beyond the call of duty to keep the DEP/FGS mission on-time and on-track. Team Extra Effort Awards were presented to both the STATEMAP and Tallahassee Drilling Operations Teams which include **Ken Campbell, Craig Berninger, Eric Harrington, Lee Booth, Bridget Coane, Will Evans, Jake Halfhill, Clint Kromhout, David Paul and Sarah Ramdeen**. The Drilling Operations teams spend a tremendous amount of time in the field. They work in conditions that would make most cringe and they perform their jobs with the spirit of teamwork.

A special FGS Staff Extra Effort Award was presented to **Walt Schmidt**, Bureau Chief and State Geologist, by **Tom Scott**, PG Administrator for Geologic Investigations. The award recognized Walt's extreme dedication to DEP and the DEP/FGS staff.

DEP/FGS Personnel Changes

Farewells

The DEP/FGS recently bid a fond farewell to four exceptional employees. They will all be missed but are wished well as they pursue new professional opportunities elsewhere.

Paula Polson joined the DEP/FGS in 1998 as an Environmental Specialist I. She resigned from her position on June 1, 2006 to take a web programming position with the Department of State. Her superior performance was confirmed by her selection as the 2002 Florida Geological Survey Employee of the Year and the DEP Employee of the Month for September 2003.

Carol Armstrong served as the DEP/FGS Geological Research Librarian from February 2001 through her resignation on July 10, 2006. Carol is now serving as Librarian of the Tall Timbers Research Station and Land Conservancy. Another excellent employee, Carol was honored with Florida Geological Survey's Extra Effort Award in 2001 and 2002.

Susan Trombley joined the DEP/FGS as Secretary Specialist in November 2001. Her exemplary service was rewarded with a promotion to Administrative Secretary in February 2005 as well as receiving peer recognition with a 2005 Florida Geological Survey Individual Extra Effort Award. Susan resigned on August 16, 2006 to take a position in the Leon County Clerk of Courts office.

Jeremy Poarch began working at the DEP/FGS as the OPS IT Assistant in October 2002 and was promoted to full time System Programmer I in July 2005. As with our other departing employees, Jeremy's performance was exemplary. He and three other staff members received a 2003 Florida Geological Survey Team Extra Effort Award. Jeremy resigned on September 22, 2006 to work with private industry in a position where he will have the opportunity to gain IT network administration experience.

DEP/FGS Welcomes New Employee Doug Calman

On August 10, 2006, we welcomed **Doug Calman** as our new DEP/FGS Geological Research Librarian. Doug served in this position from September 1977 through November 1980 when the DEP was known as the Department of Natural Resources. He departed to work as a Science and Academic Librarian and also spent time as a Computer Systems Administrator. His experience, library and technical skills make him an excellent asset to the DEP/FGS and we welcome him back.



Rapids on the Aucilla River, Taylor County.

State of Florida
Department of Environmental Protection

JEB BUSH, Governor
COLLEEN M. CASTILLE, Secretary

Florida Geological Survey
WALTER SCHMIDT, State Geologist
Florida Geology Forum

Designed by Paulette Bond and Paula Polson. Editing by Paulette Bond, Jackie Lloyd and Walt Schmidt.

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