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MISSISSIPPI GEOLOGICAL SOCIETY

Volume 62 No. 6 February 2014

SPEAKER - Dr. DAVID T. DOCKERY
CLIMATE CHANGE

RICK ERICKSEN - MSBRPG

Dr. DAVID T. DOCKERY
Monthy Column

MISSISSIPPI STATE UNIVERSITY

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PRESIDENT'S LETTER

Neil Barnes

Greetings from NAPE!

I always see more folks from Mississippi at NAPE than at any other time of year (and many I never see in Mississippi!). I have to get out more!

The Society continues to progress in its efforts to "expand our tent" by providing more value for its current members as well as content that new members – including those not in the oil and gas industry can value. In this Bulletin you will may see reports from student activities at Mississippi State and Jackson State. Please read these and make an effort to encourage their participation. Also, Rick Ericson, the Executive Director of the Board of Registered Professional Geologists will be writing a monthly column for the Bulletin. Dr. David Dockery, Chief of the Surface Geology Division for the Mississippi Geological Survey (now Office of Geology), will be providing monthly columns on Geology of Mississippi. As Matt Caton, Bulletin Editor, and Steve Walkinshaw, Webmaster, remind me regularly, "Content, Content, Content". Both of these guys are doing a great job, we owe them our gratitude. I have encouraged them to find some helpers who could solicit content and support them. If you have an interest in either, please contact Matt or Steve.

The Mississippi Student AAPG Chapter has a team participating in the Imperial Barrel Award Competition. Last weekend Shell hosted all of the teams at a two day Basin Analysis Class in Houston. All expenses for the trip were paid – I am not sure exactly who paid their travel expenses but it might have been GCAGS. This is one of the great benefits to the students who participate in the competition. Other benefits include their exposure to the exploration process and meeting lots of other folks, some of whom may help them find a job! I believe benefits of participation will trickle throughout the department. I look forward to hearing from them……

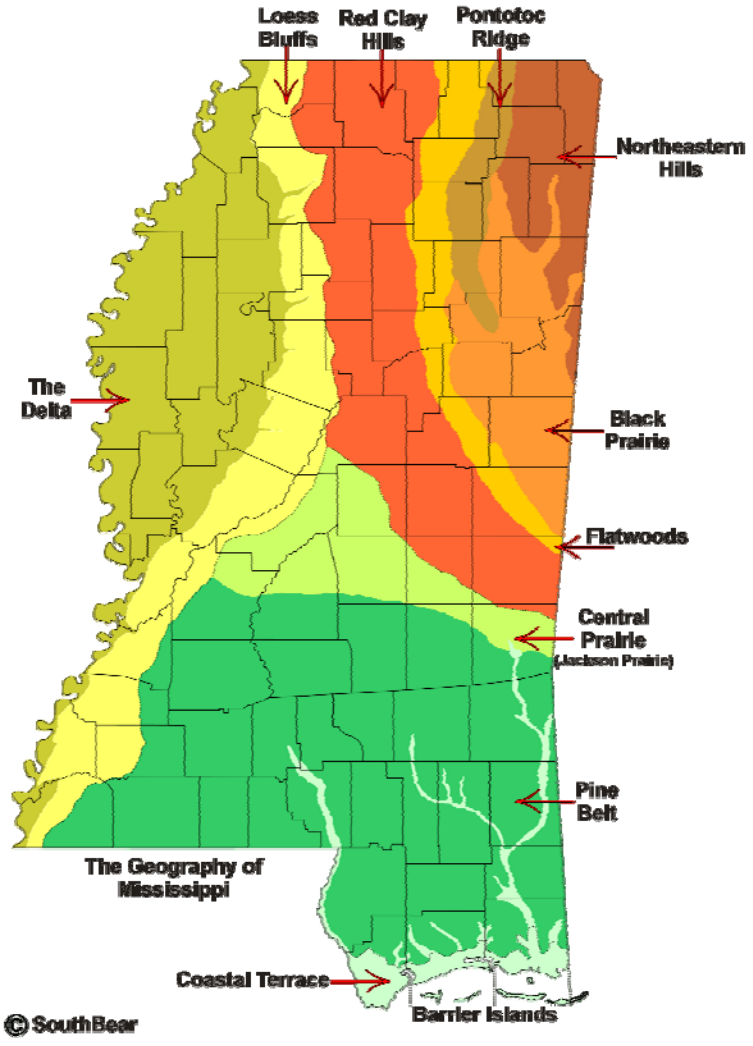
Students at MSU have asked us to facilitate a field trip to a rig. We are glad to assist! If you have an interest in participating, please contact me.

Until next time,

Neil

2013-2014 MGS MEETING SCHEDULE

When	What/Who	Where
September 12, 2013	Fall BBQ	Jackson Yacht Club-5:30pm
October 10, 2013	Steve Craft **Recent Activity: Smackover South Alabama**	River Hills – 11:30am
November 22, 2013	**MSOGB**	River Hills – 11:30am
December 14, 2013	MAPL Christmas Party and Dance	Duling Hall, Fondren District 7:00pm
January 9, 2014	John Ryan HydroFracking - Mississippi Operators	River Hills – 11:30am
February 13, 2014	Dr. David Dockery Climate Change	River Hills – 11:30am
March 13, 2014	TBD	River Hills – 11:30am
April 10, 2014	Boland Scholarship Awards	River Hills – 11:30am
May 8, 2014	Spring Fling	Jackson Yacht Club– 5:30pm



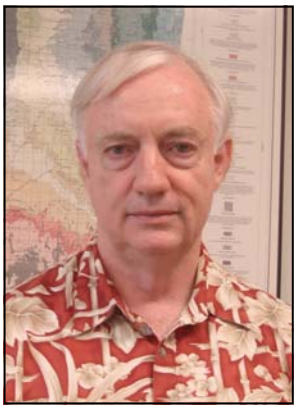
OFFICERS MEETINGS
August 4, 2013
September 10, 2013
October 8, 2013
November 20, 2013
December 12, 2013
January 7, 2014
February 11, 2014
March 11, 2014
April 8, 2014
May 6, 2014

JANUARY SPEAKER

DR. DAVID T. DOCKERY

This month’s presentation will be on "Mississippi's contribution to the science of climate change over the last 75 million years. Mississippi has an exceptional Late Cretaceous to Oligocene marine record, which has and is being studied by leading scientists in relation to the history of climate change. Fossil shells are so well preserved in this section that they contain oxygen isotope records of sea-water temperature and seasonality."

Bio



Dr. David T. Dockery

Native of Jackson, Mississippi.
B.S. in Petroleum Geology from Mississippi State University.
M.S. in Geology from the University of Mississippi.
Ph.D. from Tulane University -- first student in the Tulane-Duke-Emery Ph.D. geology consortium (studied at Duke for one year).
Worked as Chief of the Surface Geology Division for the Mississippi Geological Survey (now Office of Geology) from 1978 to present.
Author of the Mississippi stratigraphic columns for AAPG's COSUNA Gulf Coast chart.

Taught Invertebrate Paleontology at Millsaps College for several years (had Brian Sims, James Sparks, and Steve Walkinshaw as students in the same class in the Spring of 1981).
Was the first recipient of the Gilbert Harris Award in recognition of excellence in systematic paleontology in 1993 awarded by the Paleontological Research Institution of Ithaca, New York.
Recipient of the Gulf Coast Section of SEPM Distinguished Service Award 1993.
Published 9 books concerning Mississippi paleontology and geology and contributed chapters to volumes on the Paleocene-Eocene boundary and Eocene-Oligocene boundary published by Columbia University Press.
Patronymic species: I've had 13 fossil species named after me, including one crinoid, two fish, one mammal, and 9 mollusks.
One gastropod species I named in 1977 was recently discovered to have "living fossil" extant species in the Indo-Pacific realm.

NEWS

MGS WEBSITE

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Please take the time to visit us on our website. You can view current and previous bulletins, update your address, access local and regional organizations, well records/data, oil and gas boards, neighboring societies and upcoming events. There are also several links to interesting articles and papers.

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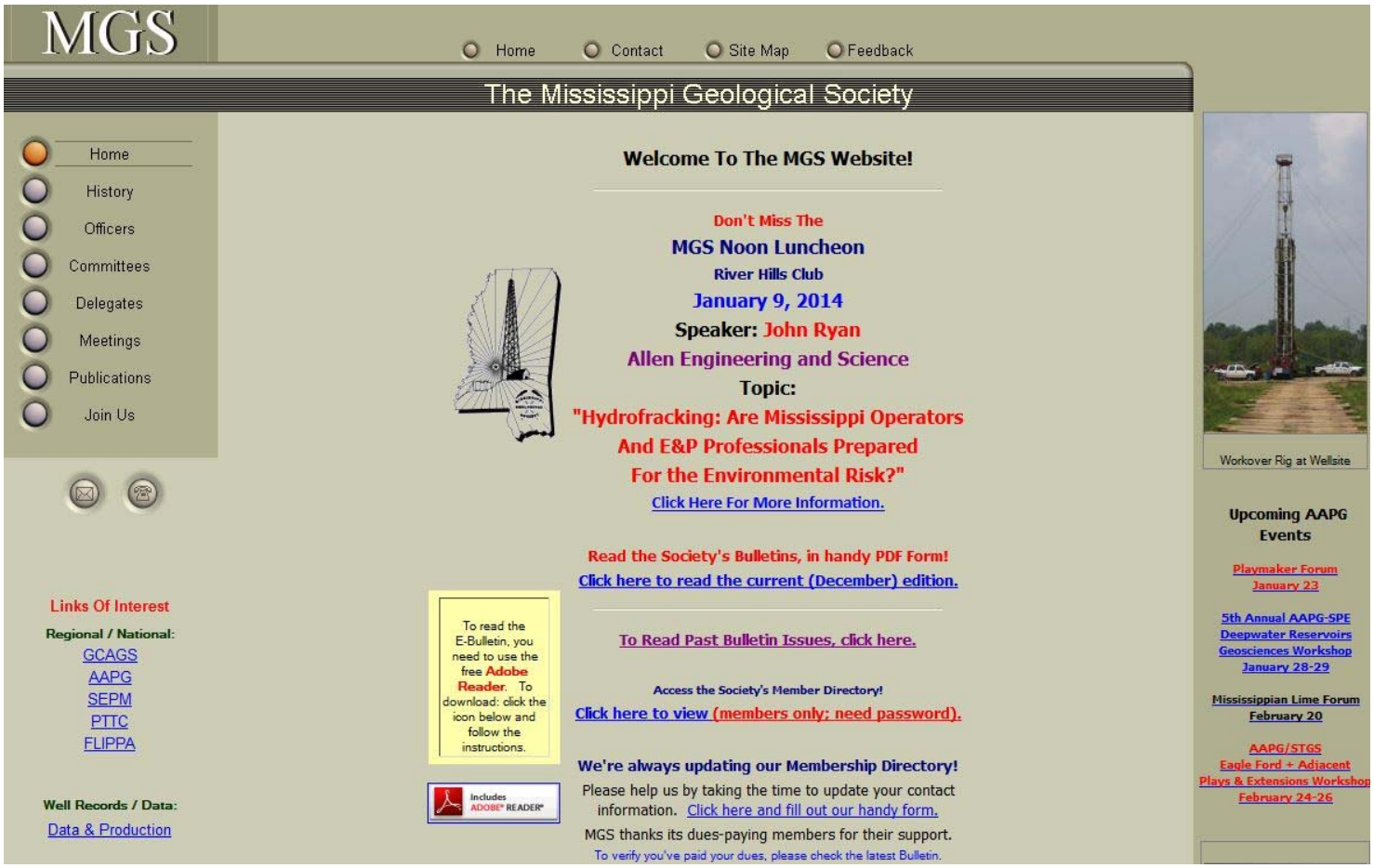

MSBRPG NEWS

Rick Ericksen, RPG, CPG

Update - the MS Board of Registered Professional Geologists (MSBRPG)

Submitted by: Rick L. Ericksen, Executive Director

The Board is pleased to have Ms. Pat Phillips and Dr. David Patrick rejoin the Board after Governor Phil Bryant nominated them to serve. They are replacing Mr. Jay Ferris and Dr. Darrel Schmitz, both of whom have served as Board members for the past eight years. Both Ms. Phillips and Dr. Patrick have served on the Board in the past and join the other, current Board members: Maurice Birdwell, Ken Ruckstuhl (Vice President), and Mike Wright (President).

Currently, the MSBRPG has several activities that are on-going. As most know, the Board's mandated charge is to regulate the public practice of geology in the state and to administer geologic competency exams. With regard to the regulation of public practice, the Board saw a 1,000% increase in complaints filed during the past year. The Board is currently in various stages of investigation and legal review of some 16 cases that appear to be serious enough to merit formal disciplinary hearings. It is anticipated that most of these cases will be resolved by year's end or sooner.

Related to its administration of geologic competency exams, the Board has been offering the ASBOG® Fundamentals of Geology exam as an Assessment/Exit exam at Millsaps, USM, MSU, and Ole Miss since 1999. The MSBRPG was the first board of licensure/registration in the United States to use the FG exam as an assessment tool. Several other states have followed the MSBRPG's lead and are now also using the FG in the same fashion. Many more geologic licensure/registration boards are also very interested in offering the exam to their universities/colleges as an assessment/exit exam. All three Mississippi state universities now require that a geology major student take the exam prior to degree conferral.

The Board's Advisory Committee, chaired by James Hoffmann, is currently making preparations for two of its main activities, the Gem and Mineral Show, February 22 and 23 at the Trade Mart, located on the fairgrounds in Jackson and Legislative Day, March 20 at the State Capitol. Both of these activities are shared with the Lower Mississippi Valley Section of the Association of Environmental and Engineering Geologists.

For those of you who may have missed the Louisiana deadline of December 31, 2013 to "grandfather" in that state without the requirement to have passed geologic competency exams, it is anticipated that Louisiana licensure proponents will introduce legislation to reinitiate their grandfathering period later on this spring when the Louisiana Legislature starts its next session. Also, the MSBRPG has already had discussions with the LA board and it is anticipated that a cooperative licensure agreement (a.k.a. comity/ reciprocity) will be adopted by the two boards that would allow those licensed in Mississippi to become licensed in Louisiana subject to the requirement that you must hold a valid license/registration in Mississippi and vice versa.

It is hoped that these news briefs being provided to the MGS will become a regular short column in this bulletin and the MSBRPG wants to thank Neil Barnes, MGS President and the rest of the MGS Executive Committee for the opportunity to provide general information as well as other related information that may impact the professional practice of the geosciences throughout the MGS publishing year.

MONTHLY COLUMN

Dr. David T. Dockery

CLIMATE CHANGE

To gain notoriety in 2014, a psychic should predict: "There will be heat waves, droughts, and wildfires in some places, too much rain and floods in other places; there will be storms, deadly lightning, hurricanes, and tornadoes." Then as each of these perennial events happen, the psychic should say: "I predicted that. I told you so!" The present-day climate-change scientists and politicians predict and claim all these events as proof of global warming. Now they are blaming this winter's cold weather on global warming for knocking the Arctic Vortex out of sync. To counter claims that the recent cold snap disproved "global warming," the official White House blog went public on Wednesday, January 8, 2014, to say that no single weather event proves or disproves climate change. The president's science advisor John Holdren went on to say, "This week's cold spell is of a type there's reason to believe may become more frequent in a world that's getting warmer, on average, because of greenhouse-gas pollution." If all weather events are proof of global warming, then the climate-change paradigm is unfasifiable and, thus, out of the realm of rational discourse (science) and into the realm of metaphysics.

Speaking of metaphysics, it seems that the scientific method now includes polls. In his State of the Union address (January 28, 2014), the President said: "But the debate is settled. Climate Change [i.e. Global Warming] is a fact!" Meanwhile, outside the Capitol Building, the weather forecast was: "Temperatures will hover at painful levels in the Washington, D.C., area into Wednesday, as they have several times this winter. The combination of gusty winds, dry air and low temperatures will result in AccuWeather RealFeel© temperatures near zero at times. Flights originating from or heading to parts of the South could be delayed in the coming days."

There is a new definition for the difference between weather and climate. When the winter is cold, that's weather. When the winter is warm, that's climate change. The winter of 2011-2012 is featured on the White House Climate Change Website as part of "the second most extreme year on record for the nation. Record heat across the U.S." Fall of 2011 started with a mid-October frost in central Mississippi and a devastating "once-in-a hundred-year" early October snowfall in New England that dumped 31 inches of snow in Jaffrey, New Hampshire. The snowstorm came with leaves still on the trees and left more than three million customers without power across the Mid-Atlantic and New England. The cause of this misery was a switch in Arctic Oscillation from positive to negative mode, a switch in which high-pressure develops in the Arctic, causing the Jetstream and cold air to dip southward (Figure 1). When the Arctic Oscillation is in positive mode, a strong low pressure system centered over the North Pole (i.e. Polar Vortex) bottles the cold air up in the north. Figure 2 gives the Arctic Oscillation time series for the December, January, February, and March winter season from 1899-2011.

Near winter's end on the March 7, 2012, edition of the NBC Evening News, Brian Williams said: "This has been one of the warmest winters ever. In fact, it's the fourth hottest in the lower 48 since they started keeping records of such things back in the 1890s …" The winter of 2011-2012 would have been a possible example of global warming except for the fact that Alaska frozen in January while the Artic Oscillation was in positive mode. When the Arctic Oscillation flipped back to negative mode in February, there was no blocking high pressure system over Greenland, so the cold air poured into Europe and Asia. The following is a chronicle of weather extremes in Alaska during positive mode and in Europe and Asia during negative mode.

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Dr. David T. Dockery III

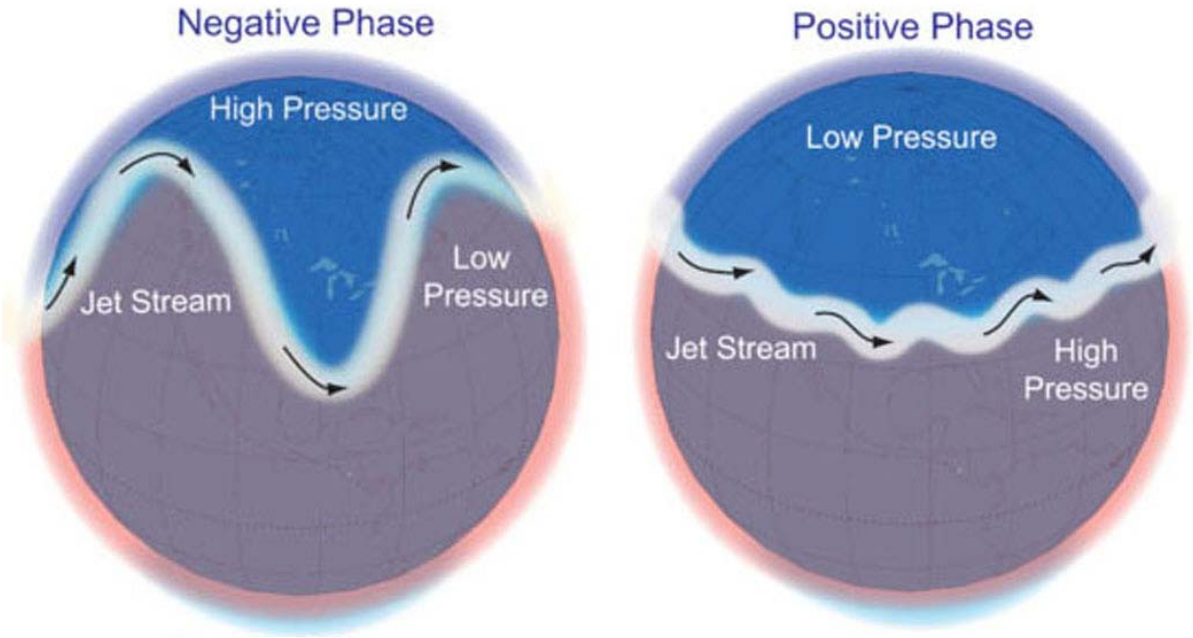

Figure 1. Arctic Oscillation in negative phase with high pressure over the North Pole (left) and positive phase with low pressure over the North Pole (right) (Wikipedia).

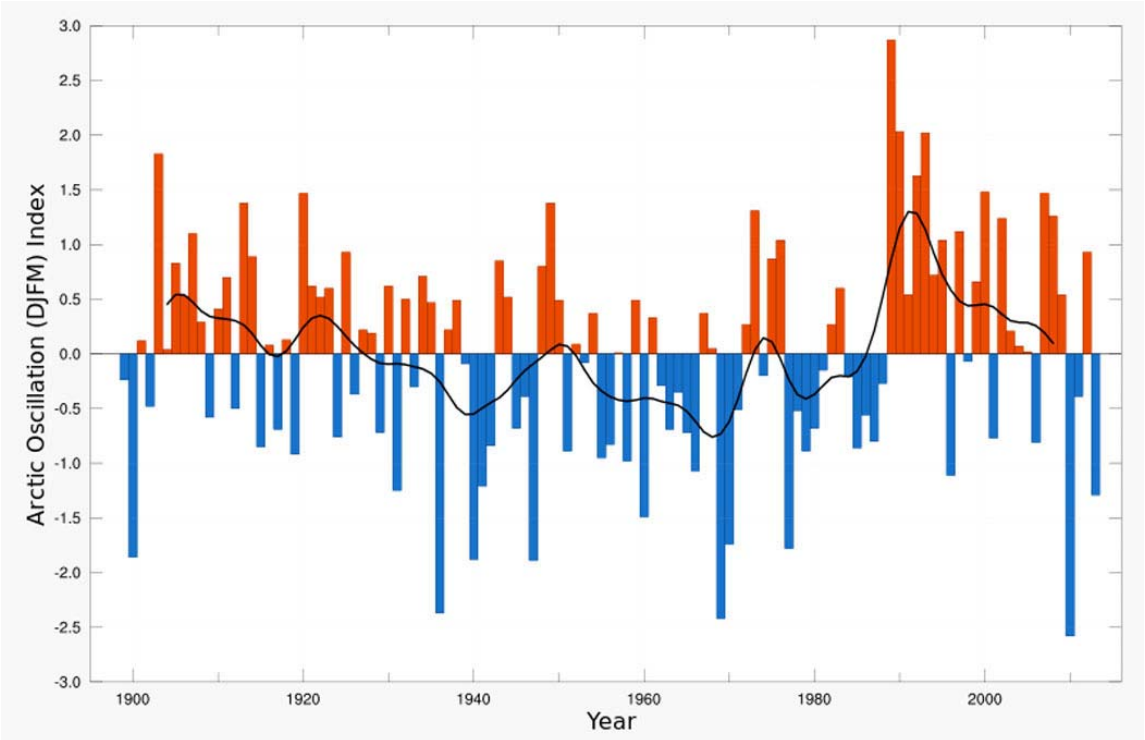

Chart 1. Arctic Oscillation time series for the extended (DJFM) winter season 1899-2011. Over the past century, the Artic Oscillation alternated between its positive (red) and negative (blue) phases. Starting in the 1970s, the oscillation has trended more to a positive phase, though it has trended to a more neutral state in the last decade (Wikipedia).

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1. January 17, 2012, the Alaskan National Guard was called to assist residents of Valdez, Alaska, whose roofs collapsed after a record winter's snowfall of over 27 feet.
2. January 17, 2012, a Russian tanker began offloading more than a million gallons of fuel at the frozen port of Nome, Alaska, a town of 3,500 residents, after a U.S. Coast Guard icebreaker cleared a path for the tanker through hundreds of miles of thick sea ice.
3. January 28, 2012, the weather station at Jim River, Alaska, closed in on the all-time record coldest temperature for Alaska (and the entire United States) of -80 F set in 1971 when the battery died in the weather station just before the critical moment at a temperature of -79 F. Record low temperatures were set for Alaska and Canada from Monday January 23 through Monday January 30, 2012.
4. February 2, 2012, parts of the Black Sea froze over along the Romanian coastline as temperatures in the region sank to -26.5 F in some areas. Sixteen towns in Bulgaria recorded their lowest temperatures since records were started 100 years ago.
5. February 3, 2012, late Friday morning snow fell in Rome, Italy, for the first time in 26 years.
6. February 6, 2012, temperatures fell to -33 F in Ukraine and snowfall as deep as ten feet cut off 70,000 people in Serbia.
7. February 10, 2012, the death-toll from the deep freeze in Europe hits 540 as the Danube River freezes over wholly or partially from Austria to its mouth on the Black Sea. Navigation was impossible or restricted in Serbian, Croatia, Bulgaria, Romania, Hungary, and Austria.
8. February 11, 2012, Podgorica, Montenegro, experienced the heaviest snowfall in 63 years, shutting down roads and railways and closing the main airport. At 20 inches, it was the worst snowfall since 1949. February 17, 2012, the U.S. Army and Europe help Montenegro respond to heavy snowfall during the worst winter weather in decades.
9. February 13, 2012, military planes flew in tons of emergency food to towns and villages in eastern Romania after an accumulation of some 4 meters (13 feet) of snow around homes and some of the coldest temperatures in recent memory.
10. February 22, 2012, Kabul, Afghanistan, recorded its worst cold snap and heaviest snowfall in 15 years and reported 41 deaths due to freezing.

When it comes to climate change, geologists should and do own the subject. Over earth history, and especially in the last 2 million years, climate and sea levels have fluctuated dramatically without the influence of anthropomorphic carbon dioxide. During the previous interglacial warm period 125,000 years ago, sea level was from 5 to 9 meters higher than it is today. The following article is from the December 2009 issue of MDEQ's Environmental News (pages 9-13).

GLOBAL COOLING

The title "Global Cooling" is not a revisionist reaction to "Global Warming," but it is a well known geologic fact that the earth has cooled over the last 38 million years, climaxing with the continental ice sheets of Pleistocene Epoch. Even with the present warm trend, the earth is still much cooler than it was in the Eocene Epoch, when there was little ice at the poles and sea level was much higher. The Late Eocene sea of the Jackson Group, a group named for its type locality at Town Creek in Jackson, Mississippi (Figure 3), extended into Arkansas and into western Tennessee north of Memphis (Figure 4). Fossil seashells from the 38-million-year-old

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Figure 3. The Moodys Branch formation exposed at Town Creek in Jackson, Mississippi, (MGS locality 1) before the construction of a sewer line across the site. A railroad bridge and the South State Street bridge appear in the background. Picture (Kodachrome slide 155-5) taken in September of 1970.

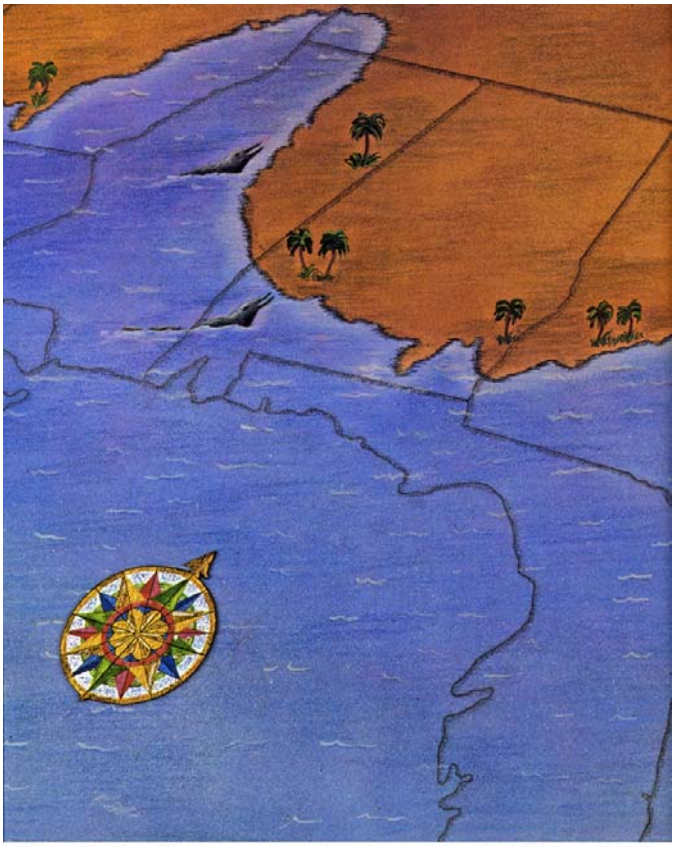

Figure 4. Late Eocene sea covering the northern Gulf Coastal Plain about 38 million years ago. Picture (scanned image) from *Alabama Heritage*, spring 1989, p. 14.

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basal formation of the Jackson Group, the Moodys Branch Formation, contains a great diversity of some 300 molluscan species (more than can be found off the Mississippi coast today) with many tropical forms. Fossil seashells (Figure 5) are so well preserved in the Moodys Branch Formation that the oxygen isotopes within their shell layers can be read as thermometers of the ancient seawater temperature in which the shell lived.

Atmospheric oxygen has three stable isotopes (isotopes that do not undergo radioactive decay): ^{16}O (99.76%), ^{17}O (0.04%), ^{18}O (0.2%). The oxygen isotope ratios ($^{18}O/^{16}O$) of the calcium carbonate ($CaCO_3$) in fossil shells are inversely proportional to growth temperature. Thus, oxygen isotope ratios can be used as a "paleothermometer." Measuring oxygen isotopes in successive growth bands gives a continuous record of seawater temperatures through the seasons. Cone shells of the genus *Conus* are especially useful for this purpose as their spires reveal a complete record of shell growth. Modern cones are noted for immobilizing prey using a modified tooth and poison gland containing neurotoxins; the tooth is launched in a harpoon-like action, and the paralyzed prey is drawn back into the cone's mouth. Human fatalities have occurred from cone bites.

Figure 5. *Conus tortilis* from the Moodys Branch Formation at Town Creek (MGS locality 1) in Jackson, Mississippi, showing pits along spire where shell samples were taken for oxygen isotope analyses. Picture (digital CD #53) taken by George Phillips on July 15, 2008.

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Takuro Kobashi and his professor Ethan Grossman in the Department of Geology and Geophysics at Texas A&M University (along with this writer and Linda Ivany of Syracuse University) published the oxygen isotopes of cone shells from the Moodys Branch Formation at Jackson in *Paleoceanography* (2004). The findings of this study agreed with studies Ivany had previously published on the oxygen isotopes of fossil fish ear bones (otoliths) of conger eels from the Jackson and Vicksburg groups (Figure 6). Ivany et al. (2000) and Ivany et al. (2003) also documented an increase in seasonality across the Eocene-Oligocene boundary in the oxygen isotopes of fossil otoliths. While similar summer sea-water temperatures were obtained for Eocene and Oligocene otoliths, the Oligocene winters were colder, and thus limited the ranges of tropical taxa. This was the beginning of a cooling trend that continued to the Pleistocene ice age

Figure 6. Linda Ivany (far right) and crew collecting otoliths from the Mint Spring Formation at Mint Spring Bayou in the Vicksburg National Cemetery (with a National Park collecting permit). The Mint Spring Formation is in the undercut below the lower ledge of the Glendon Limestone and softer underlying Marianna limestone. Picture (slide 353-5) taken on May 18, 2002.

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Figure 7 shows a graph of oxygen isotope ratios of an Eocene *Conus* shell (reported as $\delta^{18}O$). The shell was sampled along the spire (at the sites of the tiny drill holes) to produce an isotopic record for the entire life of the organism. Note that the $\delta^{18}O$ values record about eight years of growth. Seawater temperatures average about 19°C (67° F) to 23°C (73°F), a range much less than that of modern seawater in the northern Gulf of Mexico. Thus, seasonality has increased since Eocene time due to colder winter temperatures.

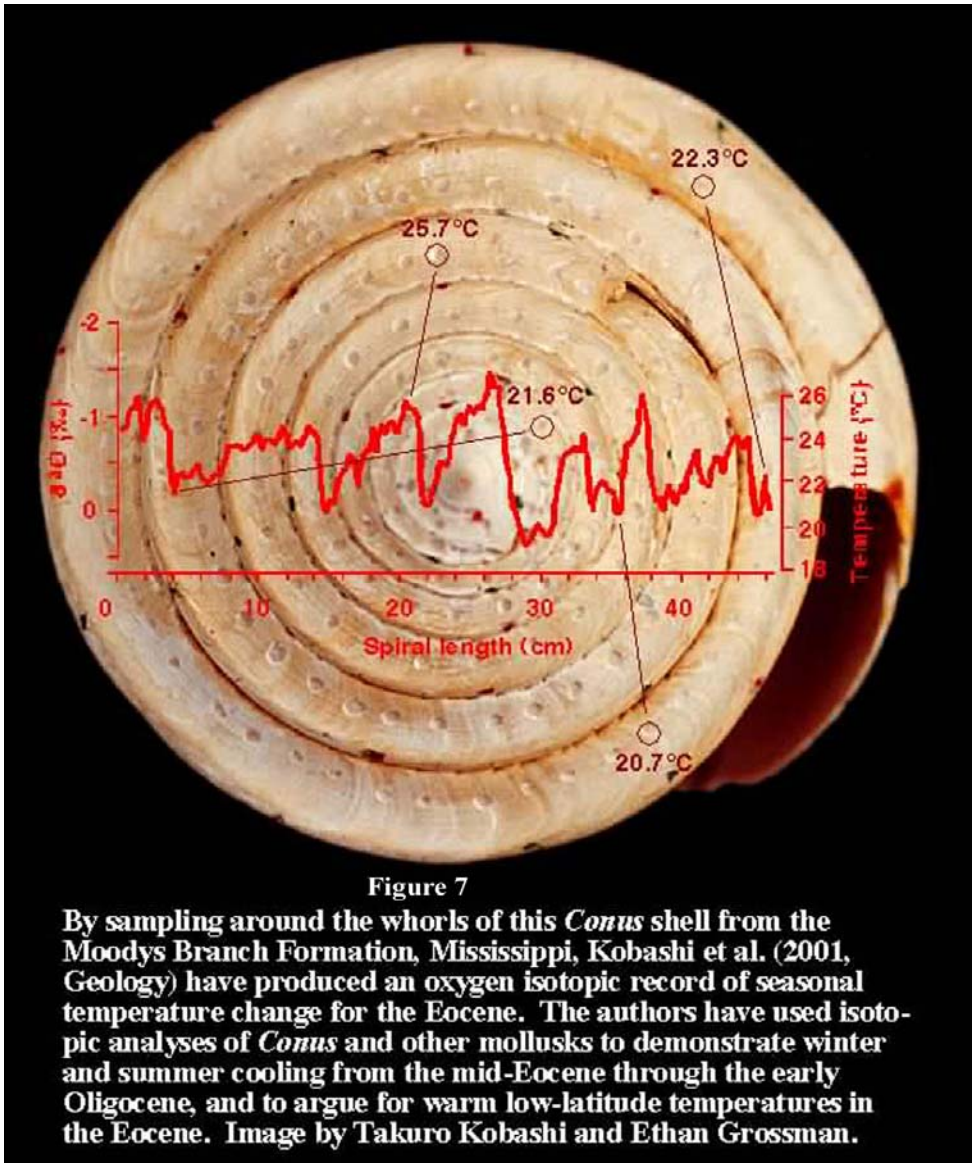

Figure 7

By sampling around the whorls of this *Conus* shell from the Moodys Branch Formation, Mississippi, Kobashi et al. (2001, Geology) have produced an oxygen isotopic record of seasonal temperature change for the Eocene. The authors have used isotopic analyses of *Conus* and other mollusks to demonstrate winter and summer cooling from the mid-Eocene through the early Oligocene, and to argue for warm low-latitude temperatures in the Eocene. Image by Takuro Kobashi and Ethan Grossman.

So why has the Earth cooled over the last 38 million years? Ice ages are not common in Earth history and have occurred only about every two hundred million years. In order for continental ice sheets to form, large continental masses must have moved (by continental drift) to cold places as they have today. Antarctica has the largest ice sheet and is over the south pole and is almost completely within the Antarctic Circle; North America, Greenland, Europe, and Asia have enclosed much of the Arctic Ocean. Greenland lies largely within the Arctic Circle and has the second largest ice sheet, which is up to 10,000 feet thick. Another reason for cooling was found partly as a result of strontium isotope research done in Mississippi. Strontium isotope ratios ($^{87}Sr/^{86}Sr$) in the world's oceans have changed over time due to the variable contributions of light isotopes produced by vulcanism on the sea floor and heavy isotopes produced by weathering of bedrock on the continents. At times of greater exposure of continental rocks such as in mountain ranges, the oceans acquire a heavier strontium isotope ratio. Weathering of mountain rock also takes carbon dioxide from the atmosphere and sequesters it in the weathering products of soils and sediments, thus lowering the level of greenhouse gases and cooling the planet. Today's world is particularly mountainous due to the continental collision between India and Asia and the uplift of the Himalayan Mountains and the Tibetan Plateau, a process that has increased bedrock exposures over the last 38 million years.

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The history of ocean strontium isotopes ratios can be found in the fossil shells of the Jackson and Vicksburg groups and the Chickasawhay and Paynes Hammock formations of Mississippi. I assisted Tim Denison and others with Mobil Research and Development Corporation in Dallas, Texas, in sampling the strontium isotopes in Eocene and Oligocene calcitic shells of oysters and pectens from Mississippi. The lowest $^{87}Sr/^{86}Sr$ ratio value Denison and others found in Cenozoic seawater was 0.707592±15 for the 38-million-year-old shells of the Moodys Branch Formation. This ratio increased in the shells of successively younger formations to a high of 0.70787±7 in the 28-million-year-old Paynes Hammock Formation. The

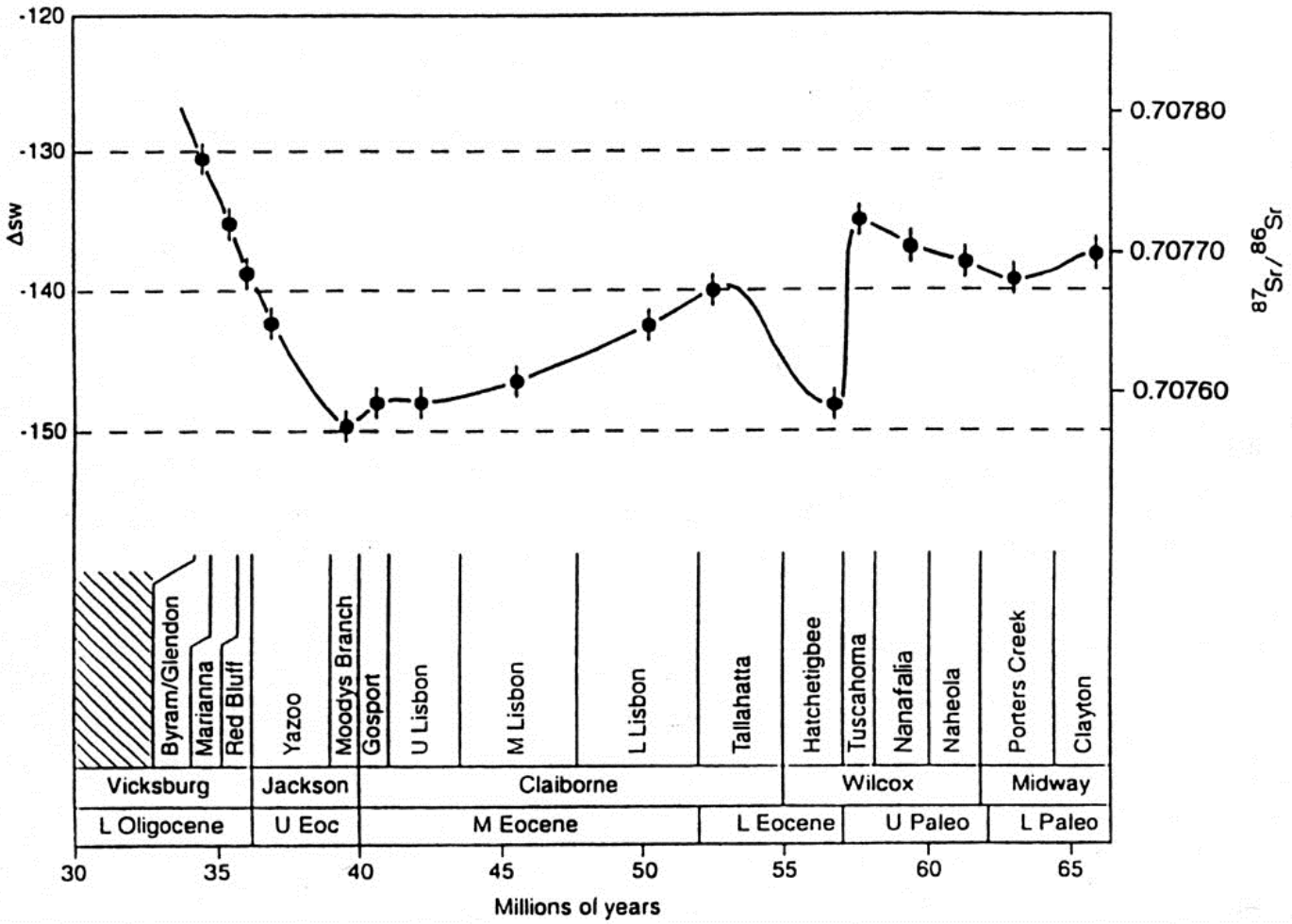

Figure 8. Strontium isotope ratios for the Gulf Coastal Plain Paleogene section as determined from the calcitic shells of oysters and pectens by Denison and others.

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The initial time of cold winters and Global Cooling occurred near the Eocene-Oligocene boundary, which coincides with the boundary between the Jackson Group and the overlying Vicksburg Group. Global cooling is blamed for the extinction of many tropical species at this boundary. Columbia University Press, in their "Critical Moments in Paleobiology and Earth History Series," published a volume on global cooling with the subtitle "Paradise Lost."

During the present ice age of the last 2 million years, a time called the Pleistocene Epoch, glaciers have advanced and retreated over 20 times, often blanketing much of North America in ice. Today's climate is actually a warm interval between periods of glaciation. The most recent period of glaciation, lasted 100,000 years and reached its height approximately 20,000 years ago." During this time thick sheets of ice covered Canada and the northern United States.

During the Pleistocene, glacial periods were long lived while interglacial periods were relatively short, lasting on the average only about 12 thousand years. The present interglacial period, called the Holocene, has already lasted over 11 thousand years but would have been on the order of 15 thousand years long if not for a climatic glitch 12,800 years ago that sent the planet back into a thirteen-hundred-year-long ice age. This ice age is known as the Younger Dryas (from 12,800 to 11,500 years ago). At about this time, central Mississippi was covered by a boreal forest (like that of northern Minnesota), as is evidenced by spruce pollen (more than 10,000 years old) found by the U. S. Corps of Engineers in the Pearl River alluvial sediments, during their coring of the Pearl River flood plain for the proposed Shoccoe dam project in Leake County.

One alarming aspect about the climate change 12,800 years ago is that it occurred over a period of ten years or less (Figure 9).

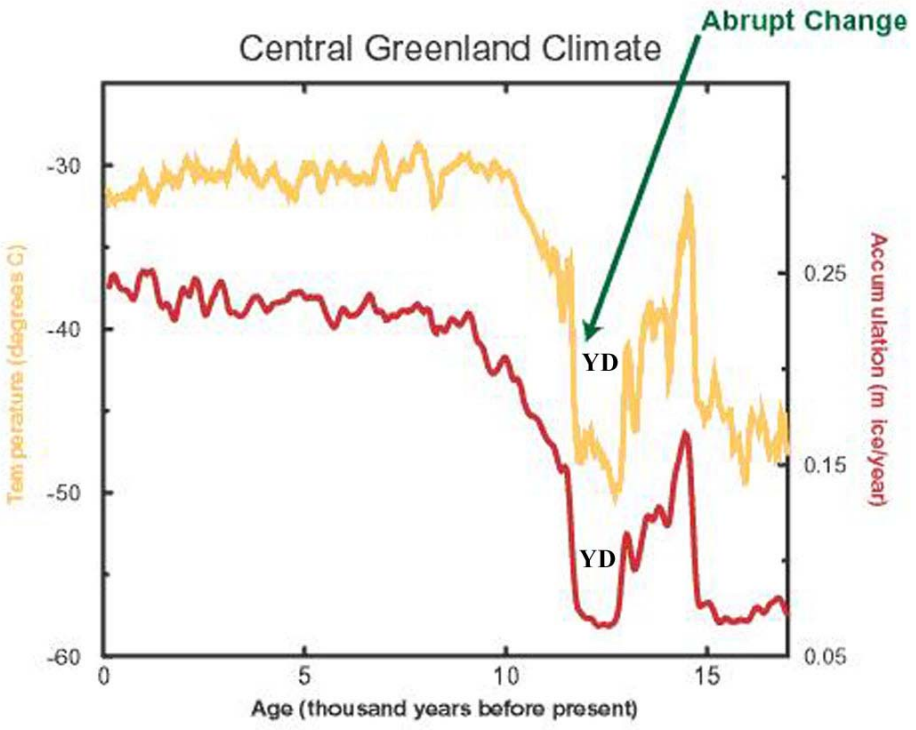

Figure 9. The yellow curve gives the temperature in degrees C for central Greenland over the last 18,000 years. The red curve gives the accumulation of ice in meters per year over the same time period. YD designates the Younger Dryas glacial period. This diagram was published online by the Lamont-Doherty Earth Observatory.

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This rapid climate change was the inspiration for Kim Stanley Robinson's novel *Fifty Degrees Below*, for Art Bell and Whitley Strieber's book *The Coming Global Superstorm*, for John Christopher's novel *The World in Winter*, and for the 2004 apocalyptic science-fiction film *The Day After Tomorrow*. If the initial Younger Dryas climate event happened again today, the next ice age would come in our lifetime. Such an apocalyptic scenario would be much worse than the disasters forecasted for global warming. The unpredictability of what's to come, whether too hot or too cold, brings to mind an episode of the *Twilight Zone* entitled *The Midnight Sun*, which originally aired on television on November 17, 1961. In this episode, the earth's elliptical orbit has changed, and the planet is spiraling inward towards the sun. New York City is largely deserted as the population has moved north, leaving Norma (Figure 10) and her landlord Mrs. Bronson behind in the heat of a sun so bright that daylight continues to midnight. The situation changes in the last scene when a feverishly sick Norma awakens from her delirium to an earth that is actually spiralling away from the sun into the darkness and coldness of space; Norma's doctor leaves her bedside to move his family south.

Figure 10. Lois Nettleton as Norma in "The Midnight Sun," from the Wikipedia.

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Dr. David T. Dockery

From her sick bed, Norma says to her landlord, “Isn’t it wonderful to have darkness, and coolness?” Mrs. Bronson dreadfully replies, “Yes, my dear, it’s….wonderful.”

Figures 11 and 12 show recent cold weather, which mirrors that which Norma found when she awoke from a heat spell (like the summer of 2012) to snow and ice (in the winter of 2014).

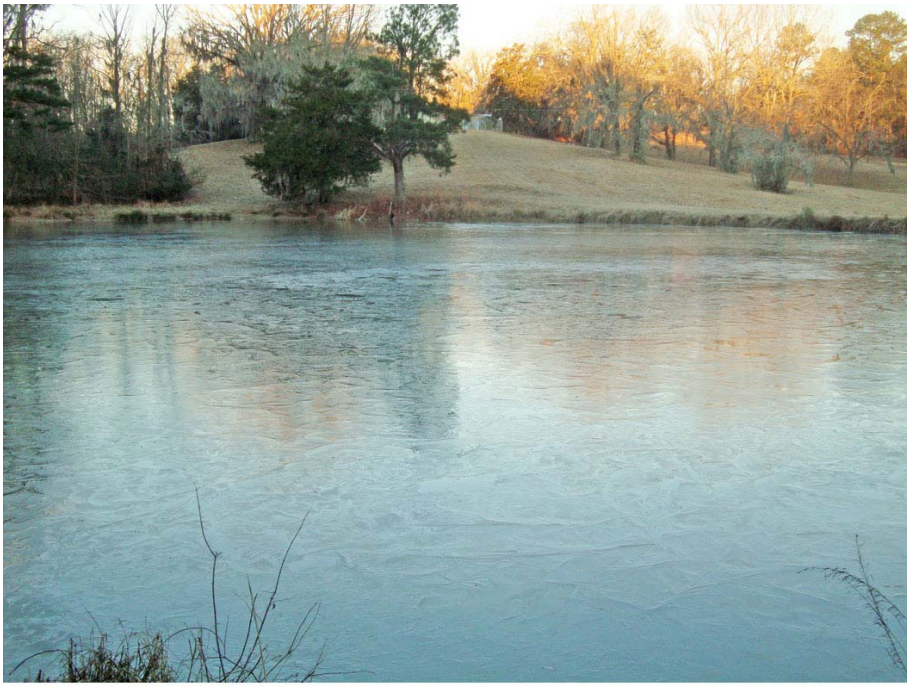

Figure 11. My frozen upper lake in northwest Hinds County at daybreak on January 8, 2014, during a cold spell of 62 cosecutive hours of freezing temperatures (Ken South WJTV blog, January 8, 2014).

Figure 12. January 8, 2014. The picture shows the U.S. side of Niagara Falls frozen around Prospect Point at Niagara Falls State Park due to the polar vortex cold spell.

Greetings!

AAPG value's our relationship with you! Because of this we want to make your website and events visible to AAPG members and website visitors, by adding you to the AAPG Website!

Simply send us your society name (or name of a specific upcoming event), logo, and a link to your website (the main portal page, or a page within the site). People who visit our site will have a direct link to the web pages you'd like them to visit.

In return, we ask that you list our events on your calendar or website and include a link to the specific event as listed below.

Mississippian Lime Forum
20 February 2014 // Oklahoma City, OK
http://www.aapg.org/forum/2014/MississippianLime/index.cfm

AAPG/STGS Eagle Ford plus Adjacent Plays & Extensions Workshop
24-26 February 2014 // San Antonio, Texas
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To receive your gift, simply complete the following easy steps:

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You are cordially invited to the
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The Geology and Wine of Eastern France

Champagne, Alsace, Burgundy, and Rhône

April 11, 2014

Petroleum Club of Shreveport, 16th Floor

Champagne – 6:30 p.m.
Presentations and Dinner – 7 p.m.

with presentations by

Kevin Hill, geophysicist

and featured guest speaker

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Five courses, seven wines - $85 per person
Seating is limited to the first 100 paid reservations
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MISSISSIPPI STATE UNIVERSITY

NEWS

Brown Bag talks have begun for the spring semester in the Department of Geosciences at Mississippi State University. These are short talks given on Fridays during lunchtime on a topic of interest by students, professors, and industry experts in the geosciences field. Light refreshments are usually provided. Erik Larson schedules the roster below. He can be contacted via email ebl47@msstate.edu if anyone is interested in filling the available slots for this semester.

Jan. 17th: Erik Larson- NSF-REU's and GeoCorps: An Introduction to the Programs and My Experiences

Jan. 24th: Erik Larson & Dr. Renee Clary- Geology Field Camp

Jan. 31st: Mississippi Geological Society, Neil Barnes- A Mélange of Geologic and GIS Topics

Feb. 7th:

Feb. 14th: Greg Hempen- "Hello??? Are you ready for the Big One?"

Feb.21st: Tim Wallace- Derecho: The Storms that Chase People

Feb. 28th: Mississippi Geological Society, person and topic to be decided

----------Spring Break March 10th- 14th ----------

MISSISSIPPI STATE UNIVERSITY

NEWS

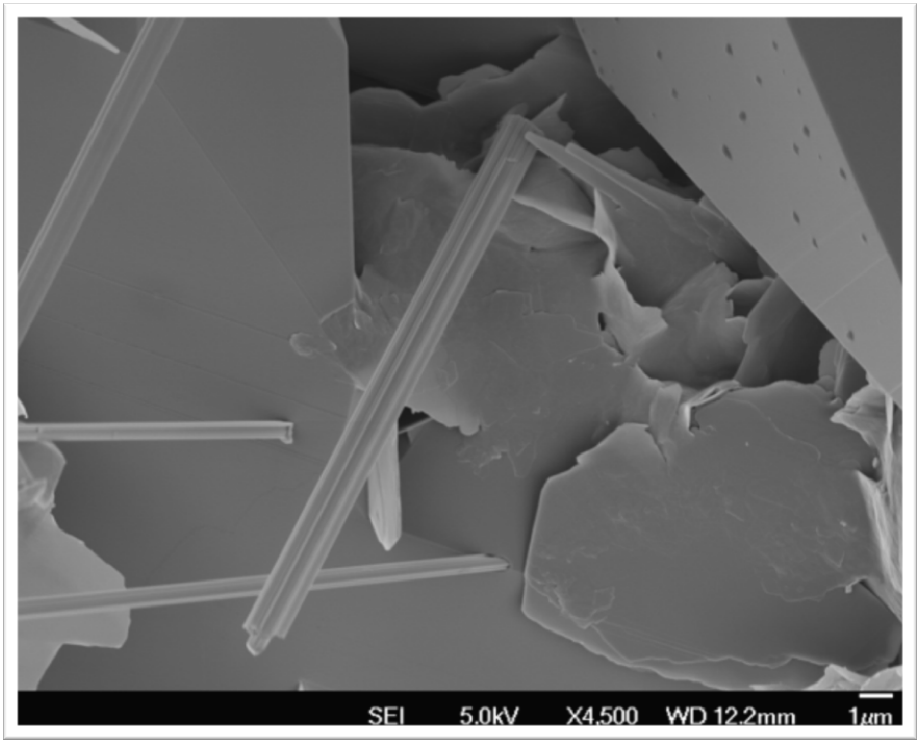
Good luck to the first MSU team to enter and be accepted into the annual AAPG Imperial Barrel Award Program (IBA). The team consists of Ryan Travis (team leader), Benjamin Breland, Micheal Brooke, Max Cooper, and Jonathon Geroux (see photo). Dr. Brenda Kirkland will be supervising the team. This competition is open to all geoscience graduate students from universities around the world who compete for scholarship funds, international recognition, and hand-on experience with sophisticated software. The competition involves analysis of a dataset and a 25-minute presentation is given on a prospective basin evaluation to a panel of industry experts. Collectively, the team's areas of interest include: SEM analysis of shale in an unconventional reservoir, sequence stratigraphy, carbonate deposition and diagenesis, paleokarst reservoirs, geochemistry, seismic interpretation, and subsurface mapping.

The Imperial Barrel Award team (from left) Max Cooper, Benjamin Breland, Dr. Brenda Kirkland, Jonathon Geroux, Michael Brooke and Ryan Travis.

MISSISSIPPI STATE UNIVERSITY

NEWS

The Department of Geosciences would like to welcome its newest member, Dr. Adam Skarke. He is an assistant professor of Sedimentary Deposition who received his B.S. degree in Geology from Colgate University, and his M.S. degree along with his Ph.D. from the University of Delaware, where his research topic focused on the "Coastal Morphodynamics of the Estuary-Shelf Interface." Before joining the geosciences department at MSU, he was employed at the National Oceanic and Atmospheric Institute Agency (NOAA) as a research scientist. His research interests include coastal geomorphology, sediment transport processes, bed form evolution, autonomous underwater vehicle development and ocean observing systems.



This SEM image shows rutile crystals (TiO_2) lying on top of quartz and shale. In the middle of the picture towards the bottom is a rutile crystal either growing out of the quartz or the quartz grew around the rutile. Cotton Valley Formation. Image taken by Michael Brooke.

MISSISSIPPI STATE UNIVERSITY

Dr. John Mylroie

Carbonate rocks host over 50% of the world's oil, and a significant fraction of those reservoirs are Paleokarst, meaning that the oil is hosted by mega-porosity and associated breccias produced by rock dissolution and collapse. Many past models of paleokarst reservoirs have assumed that the karst was produced at the Earth's surface by stream caves and was subsequently buried to become a reservoir. Stream caves are called "epigene" caves as they form near the earth's surface, and collect water from one place on the surface (sinkholes and sinking streams) and deliver it to another place (springs). These caves are coupled to the surface hydrology. Some workers, notably Dexter Craig in 1988, working on the Yates Field in Texas, proposed a model involving carbonate islands and dissolution of the rock in the fresh-water lens. At the same time, the author, working in the Bahamas (Mylroie and Mylroie, 2007), developed a new model of cave formation called the *flank margin cave model,* which explains the preferential development of large caves at the margin of the fresh-water lens, under the flank of the enclosing landmass (hence the "flank margin cave" name). These caves develop by mixing dissolution created by seawater and fresh water mixing at the lens margin, where the decrease in cross sectional area means higher flow velocities (while still laminar flow). The caves that develop have no natural entrances, they are mixing chambers fed by diffuse flow that also discharges by diffuse flow to the sea. The dry flank margin caves that can be explored today in the Bahamas formed about 125,000 years ago when during the last interglacial, sea level was 6 m (20 ft) higher than today. Sea level is now lower, the caves are drained, and hillslope erosion and collapse have made the caves accessible for investigation. These mixing chambers start out small, but as they grow larger, each chamber begins to intersect neighboring chambers, and these collections of chambers can intersect other collections, making caves of large size and complexity (Figure 1).

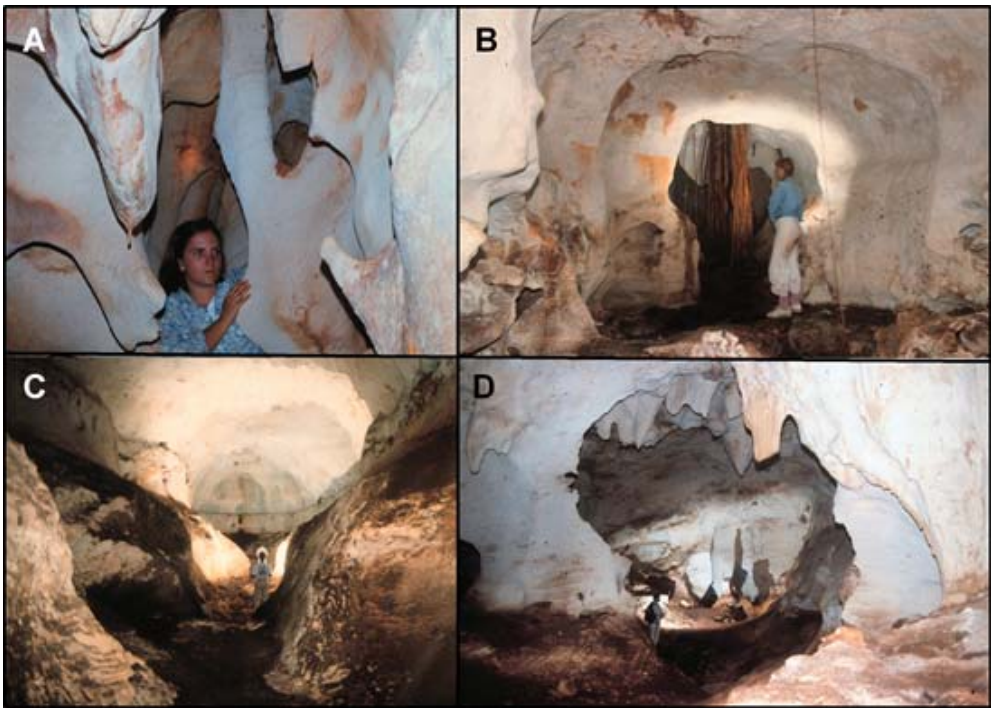


Figure 1: Images of cave passages and chambers in flank margin caves in the Bahamas. Note the smooth dissolutional sculpturing of the cave walls, produced by mixing-zone dissolution in laminar flow conditions. A) Lighthouse Cave, San Salvador Island. B) Harry Oakes Cave, New Providence Island. C) Salt Pond Cave, Long Island. D) Hamiltons Cave, Long Island. From Mylroie, 2013.

MISSISSIPPI STATE UNIVERSITY

Dr. John Mylroie

The largest flank margin cave in the world is Sistema Faro on Isla de Mona off the west coast of Puerto Rico, with 20 km of surveyed passage configured as a maze-like series of globular chambers (Figure 2). Because these caves are common around the world in carbonate coasts, they are proximal to the carbonate depositional environment, and are predisposed to be buried and preserved as the carbonate banks subside under their own weight (as the Bahamas have been doing at a rate of 1-2 m (3 to 6 ft) per 100,000 years since the early Cretaceous).

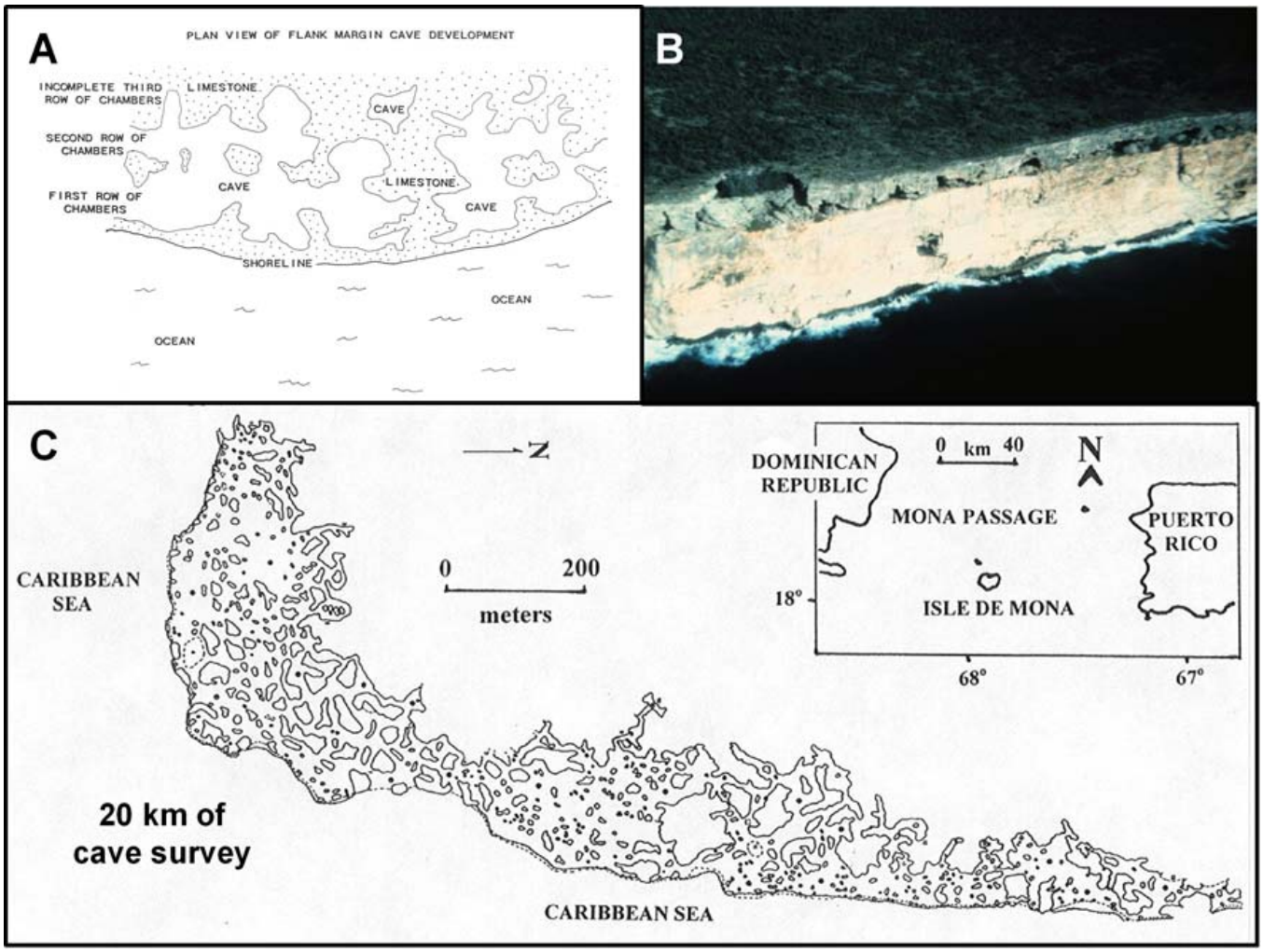


Figure 2: Sistema Faro (aka Lirio Cave), Isla de Mona, Puerto Rico. A) A diagrammatic model of cave passages forming in ranks parallel to the coastline. B) Aerial photograph of the Isla de Mona sea cliffs, where cliff retreat has breached and opened numerous entrances into Sistema Faro. The grey versus tan horizontal contact is the Lirio Limestone over the Moan Dolomite; the cave formed at the contact. C) The plan view map of Sistema Faro. Note how the cave wraps around the curved island perimeter as it developed in the discharging fresh-water lens margin. From Mylroie, 2013.

Another cave type, first recognized in the late 1980s, is the hypogene cave, so named for its development at depth, isolated from the surface hydrology (Palmer, 1991). The dissolution of these caves is caused by hydrothermal waters, or the oxidation of H2S from oilfield brines into sulfuric acid. These caves have no surface expression until uplift brings them near the land surface, and these long-abandoned caves are intersected by erosion. Carlsbad Caverns in New Mexico is an example of a H2S cave, while Wind Cave in South Dakota is a hydrothermal cave. Both caves are extremely large but have only one or two natural entrances, as their exposure to the surface is a geologic accident. The pattern and distribution of these caves is hard to predict, as the fluid flow that made them operated under conditions of pressure, temperature, stress field, and geochemistry at depth, conditions no longer active at those surface sites today. Carlsbad Caverns is largely a collection of giant chambers and passages, Wind Cave is a rectilinear maze following a dense network of intersecting joints (Figure 3).

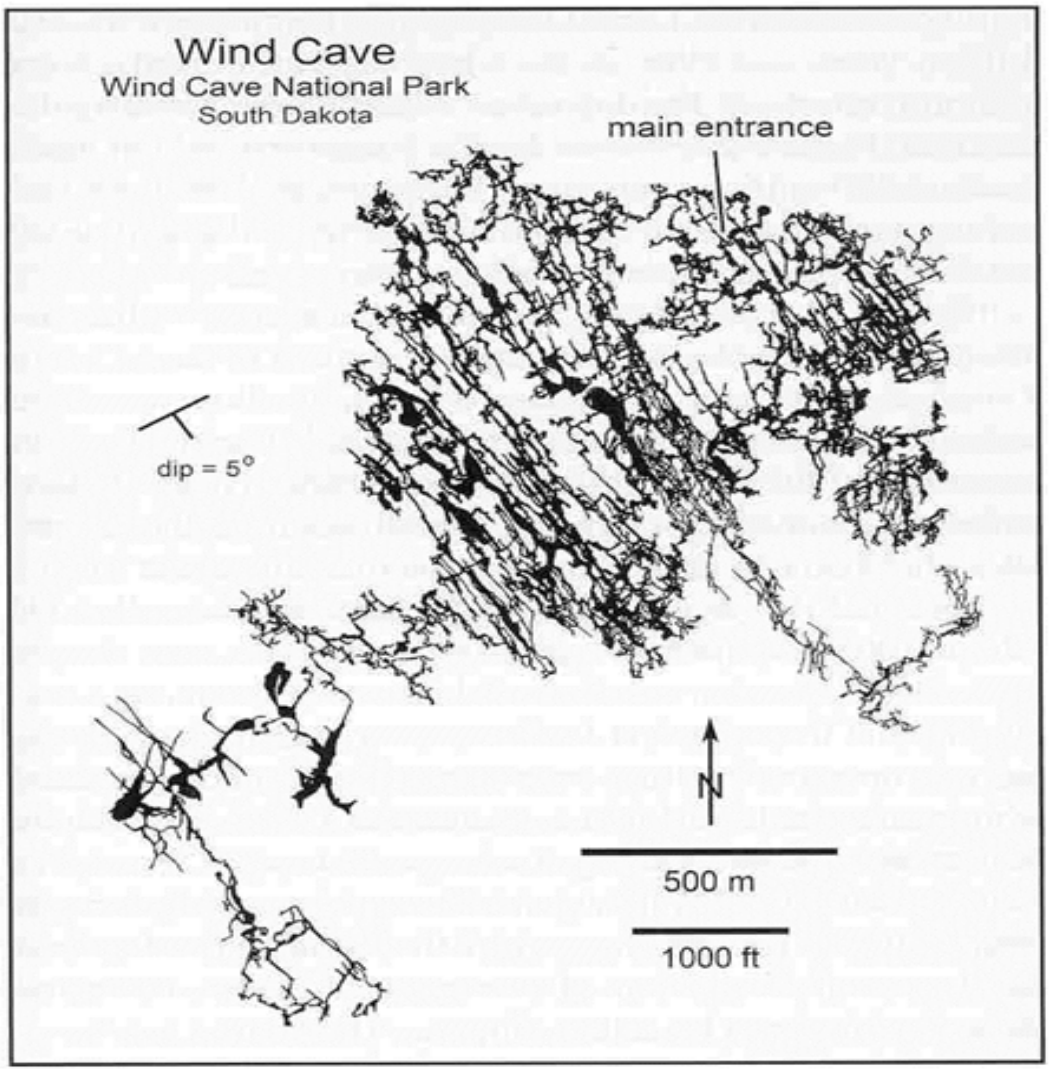


Figure 3) Plan view map of Wind Cave, South Dakota. Note the strong joint control of the hydrothermal hypogenic cave. From Palmer, 2007.

Flank margin caves are tied to the fresh-water lens margin, which is parallel to depositional strike; traditional epigene stream caves, on the other hand, drain land mass interiors towards the sea, so their passages are perpendicular to depositional strike. Both oil exploration and reservoir development strategies require that the type of paleokarst cave occupied by the hydrocarbons be known. Recently, several oil companies (Total and ExxonMobil) have contracted with the Department of Geosciences at MSU to develop new ways of modeling the configuration and distribution of paleokarst reservoirs, based on applying new models of cave development, and on the re-analysis of existing cave databases. The research has sent graduate students from the Department of Geosciences to the Bahamas, Barbados, Curacao, and as far away as Mallorca to look at coastal cave development on both tectonically active and tectonically stable carbonate islands. New software has been written that turns cave survey data into an accurate 3-D representation of cave voids (Figure 4). The program is also used in a re-analysis of existing cave survey data. Caves like Mammoth Cave Kentucky, Carlsbad Caverns, New Mexico, and Wind Cave, South Dakota are all hundreds of miles in length, with over 50,000 survey stations each. Being able to utilize existing survey data is far more efficient than re-surveying these caves.

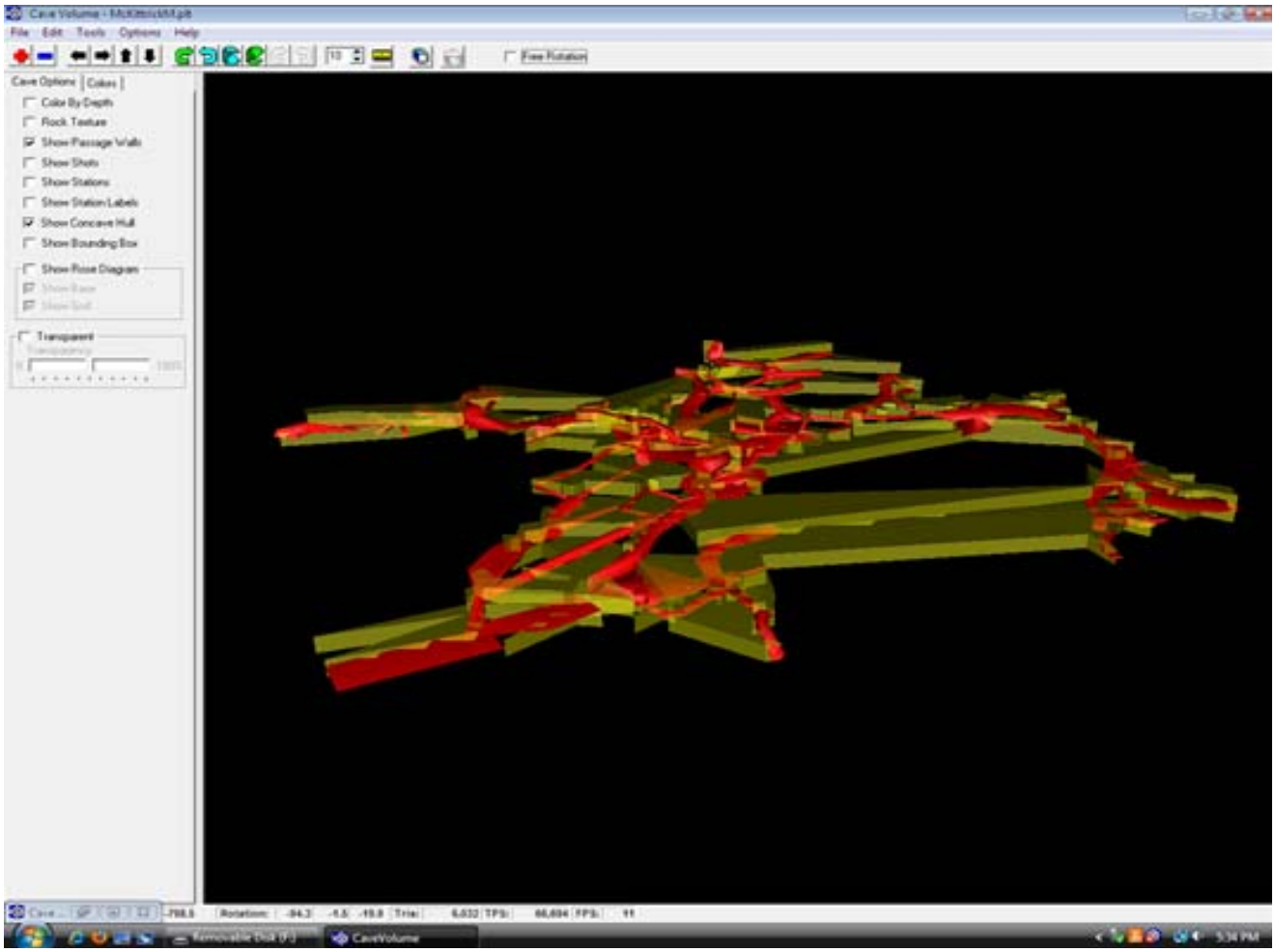


Figure 4) Three-dimensional map of Fulford Cave, Colorado, produced by special cave mapping software produced by Mississippi State that allow the cave to be contained within a boundary box that is fit to the cave for accurate cave porosity determinations

MISSISSIPPI STATE UNIVERSITY

Dr. John Mylroie

Paleokarst caves rarely exist in the deep subsurface as open voids, as when the voids subside to great depths, they undergo collapse that modifies their footprint. The cave, which began as a single giant pore or void, is subdivided into man smaller (but still well-connected) openings as a collapse breccia. This collapse process extends upward and outward from the original void, greatly expanding the footprint of the paleokarst. This collapse expansion also allows adjacent cavities that were previously isolated to integrate and make a larger paleokarst reservoir. Again, the traditional cave form used in the modeling of cave collapse has assumed that the paleokarst is made up of buried epigene stream caves, however these cave types are the least likely to be preserved as paleokarst. The flank margin caves, as noted earlier, are in an environment predisposed to preservation, and hypogene caves form already in the deep environment. Those latter two cave types are the most likely to form paleokarst reservoirs. The modeling being done by students at Mississippi State is applying new cave collapse equations that better define the paleokarst reservoir footprint and 3-D configuration, to allow better exploration and development strategies by major oil companies.

References:

Craig, D.H., 1988, Caves and Other Features of Permian Karst in San Andres Dolomite, Yates Field Reservoir, West Texas: Paleokarst, p. 342-363.

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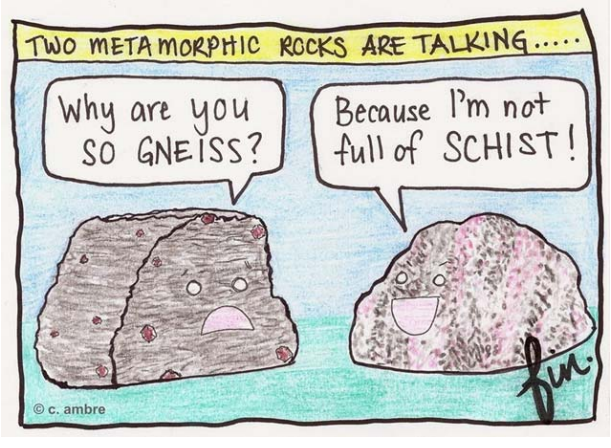
Mylroie, J.E. and Mylroie J.R., 2007, Development of the Carbonate Island Karst Model: Journal of Cave and Karst Studies, v. 69. p. 59-75.

Palmer, A.N., 1991, Origin and morphology of limestone caves: Geological Society of America Bulletin, v. 103, p. 1-25.



GRADUATE STUDENTS

The following is a preliminary list of current graduate students and their thesis work. I would encourage you to offer your knowledge and expertise and help our future geologists gain the experience they need as they move forward in their careers.

Name: David Luke Thompson
Email: dlt168@msstate.edu
Phone: 601-750-5497
Career Goal: mining industries and/or economic geology industries
Thesis Title: "Stratigraphy, Environments of Deposition, and Mineralogical Characterization of Heavy Minerals from Selected Cretaceous Formations of the Northern Mississippi Embayment"

Name: Ryan Travis
Email: rtravis1123@gmail.com and rwt85@msstate.edu
Phone: 214-796-2443
Career Goal: Hydrocarbon Industry
Thesis Title: Void Collapse as Related to Dissolution Megaporosity.
I am developing new collapse equations, based off of Loucks' (1999) Cave Collapse Model, to better understand and model paleokarst reservoirs.
I am also working on an ongoing research project with Dr. Jon Sumrall utilizing petrographic and geochemical tools to understand the diagenetic history of a paleosol collapse breccia on Aruba.

Name: Michael Brooke
Phone: 601-594-6309
Email: jmb374@msstate.edu
Thesis Title: A Sequence Stratigraphy of the Haynesville/ Bossier interval in Jefferson County, MS using SEM analysis.
Interested in someone who has worked in the newer shale plays. Also information about the Burkley-Phillips #1 well will be greatly appreciated.

Name: Natalie Odegaarden
Phone: 601-826-3903
Email: nao23@msstate.edu and napsamai@yahoo.com
I would like to focus my thesis on the Smackover Formation in the Jay Field. I need help locating a core and logs in order to perform correlation, sequence stratigraphy, depositional environment and thin section analysis to name a few.

Name: Claire E. Babineaux
Email: ceb445@msstate.edu and clairegeobx@gmail.com
Thesis Title: Glass cullet as an alternative aggregate for beaches: an ecological compatibility and public opinion survey. Area of research: Coastal processes-- The research I do focuses on the ecological compatibility of glass cullet to natural beach sand. I will simulate a natural beach environment and determine what grows naturally on sand. Then I will simulate a beach environment in which the composition is 100% glass cullet and determine what will grow naturally on the glass cullet as compared to natural sand. During this process, I will also be monitoring how coastal grasses and native biota within each of the simulated environments in order to determine whether it is affected. Sample will be taken and analyzed using microscopes and SEM. I will also be doing a public opinion survey to determine whether the general public will accept glass on the beaches in areas in which they live or visit in Mississippi.

Name: Courtney Killian
Email: ck695@msstate.edu
Phone: 724-549-3544
My thesis will be geared towards hydrology, groundwater and surface water interactions.

GEOLOGY POST

ARTICLES, PAPERS or NEWS?

ATTENTION!!!!! Industry, Professors and Students:

I would like to add more content from the industry and our schools.

Submissions can include anything from professional papers, thesis abstracts, job opportunities to pictures. Anything!!!!

If you have any information or news you would like to share with the Society **PLEASE** email them to the MGS Editor at:

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Thanks,

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Editor

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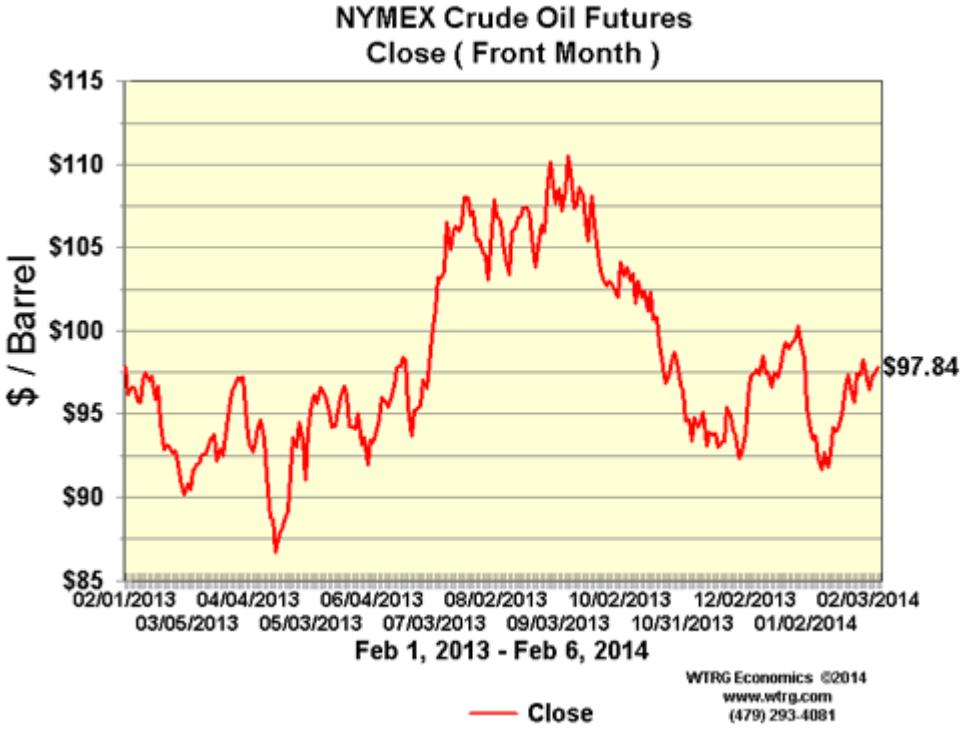

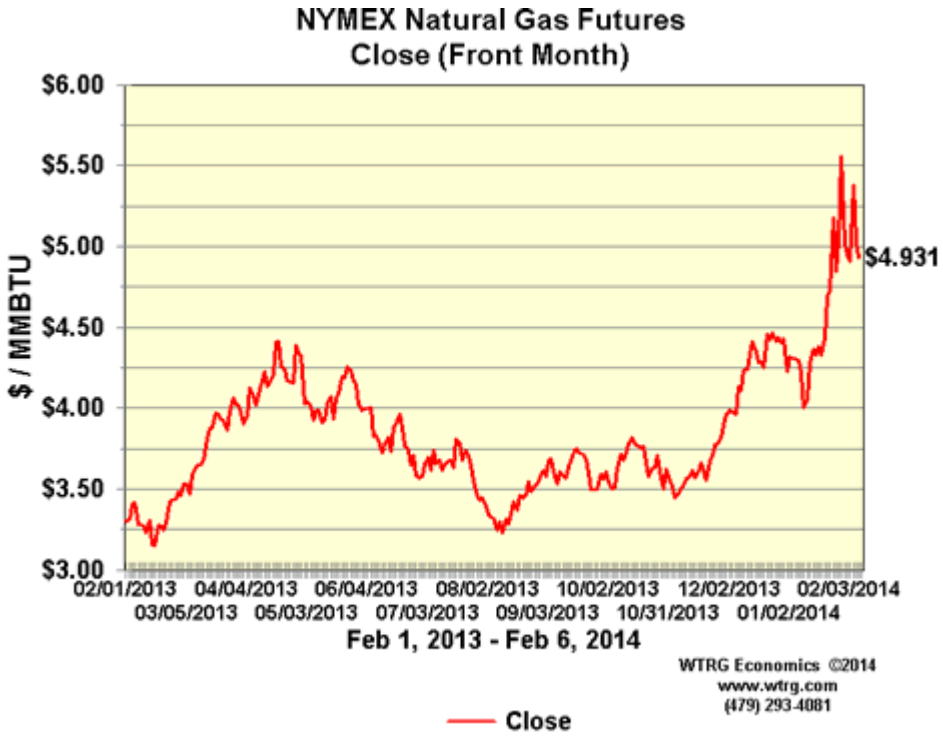

BOLAND SCHOLARSHIP WATCH

Faculty & Students,

The Mississippi Geological Society along with the Boland Scholarship Fund would like to remind you that we want to honor the most outstanding overall students for the 2013-2014 year.

Each year, the Boland Scholarship awards 1 student from each institution a check that rewards students for their hard work and dedication to the Geosciences and their community.

We look forward to a great year and hope to see you at our monthly meetings.

Best Regards,

Matt Caton
Editor

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GEO LINK POST

USGS TAPESTRY OF TIME AND TERRAIN http://tapestry.usgs.gov The CCGS is donating to all of the 5th and 6th grade schools in the Coastal Bend. Check it out—it is a spectacular map. You might want a framed one for your own office. The one in my office has glass and a metal frame, and it cost $400 and it does not look as good as the ones we are giving to the schools. Call Owen 510-6224 if you want one for your office for $150. Duncan, Mike, Chris, Dave, Bob Randy, Seb., Kevin, Ken, Craig, Patrick, Robert.

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http://www.geographynetwork.com/ Go here and try their top 5 map services. My favorite is 'USGS Elevation Date.' Zoom in on your favorite places and see great shaded relief images. One of my favorites is the Great Sand Dunes National Park in south central Colorado. Nice Dunes.

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II. Web Page Advertisements (www.missgeo.com):

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EXPLOITATION GEOLOGIC MANAGER

Email: bsims@tellusoperating.com

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John G. Cox
Geologist

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