

BULLETIN

CORPUS CHRISTI GEOLOGICAL SOCIETY



and

COASTAL BEND GEOPHYSICAL SOCIETY



**March
2014**

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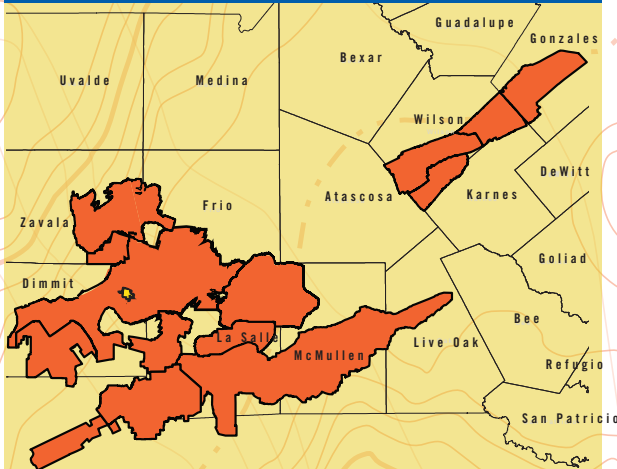
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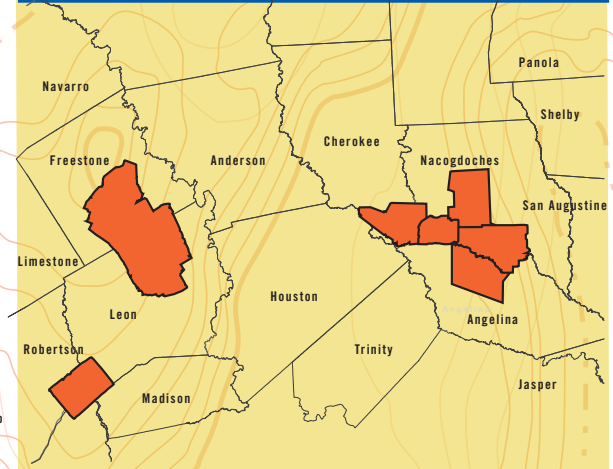
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2013-2014

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2013-2014**

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BLOOD DRIVE

THE BLOODMOBILE – IN MARCH, 2014
WILL BE AT SOME CONVENIENT LOCATIONS
PLEASE CALL 855-4943 for those locations or see below



*Before you celebrate St. Patrick's Day – why not
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Thanks! Mike Lucente

www.coastalbendbloodcenter.com

CCGS/CBGS JOINT MEETING SCHEDULE 2013-2014

September 2013							October 2013							November 2013							
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	
1	2	3	4	5	6	7			1	2	3	4	5							1	2
8	9	10	11	12	13	14	6	7	8	9	10	11	12	3	4	5	6	7	8	9	
15	16	17	18	19	20	21	13	14	15	16	17	18	19	10	11	12	13	14	15	16	
22	23	24	25	26	27	28	20	21	22	23	24	25	26	17	18	19	20	21	22	23	
29	30						27	28	29	30	31			24	25	26	27	28	29	30	

Sept. 12, 2013
5:30p.m.—8:00p.m.
Kickoff BBQ—The Bar-B-Q
Man Patio Cantina

Oct. 16,—11:30a.m.—1:00p.m.
Speaker: Jamie Rich—Professor
Univ. of Ok. “Unconventional
Geophysics: Unique Approaches
For Unique Problems

Nov. 20—11:30a.m.—1:00p.m.
Speaker: Hongliu Zeng--
Bureau of Economic Geology
“Stratal slice: The next
generation”

December 2013							January 2014							February 2014						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
1	2	3	4	5	6	7				1	2	3	4	1	2	3	4	5	7	8
8	9	10	11	12	13	14	5	6	7	8	9	10	11	9	10	11	12	13	14	15
15	16	17	18	19	20	21	12	13	14	15	16	17	18	16	17	18	19	20	21	22
22	23	24	25	26	27	28	19	20	21	22	23	24	25	23	24	25	26	27	28	
29	30	31					26	27	28	29	30	31								

Dec. 18—11:30a.m.—1:00p.m.
Speaker: Eddie Valek, Marathon
“From 0-80 in Ninety Days: Rapid
Play Entry to Fully Integrated
Play Development in the Eagle
Ford Trent, South-Central TX.”

Jan. 15—11:30a.m.—1:00p.m.
Speaker: Kevin Schepel, ZaZa Corp.
“Advanced Reservoir
Characterization for Proof-of-
Concept Drilling in the Eagle
Ford and Eaglebine Shales”

Feb. 19—11:30a.m.—1:00p.m.
Speaker: J. Carl Fiduk, Western
Geco, “A Brief Tectonic and
Depositional History of the
Northern GOM “

CCGS/CBGS JOINT MEETING SCHEDULE 2013-2014

March 2014							April 2014							May 2014						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
						1			1	2	3	4	5					1	2	3
2	3	4	5	6	7	8	6	7	8	9	10	11	12	4	5	6	7	8	9	10
9	10	11	12	13	14	15	13	14	15	16	17	18	19	11	12	13	14	15	16	17
16	17	18	19	20	21	22	20	21	22	23	24	25	26	18	19	20	21	22	23	24
23	24	25	26	27	28	29	27	28	29	30				25	26	27	28	29	30	31
30	31																			

March 19—11:30a.m. 1:00p.m.
 Speaker: Richard Davis (Harte
 Research Institute) “Sea-Level
 Change in the Gulf of Mexico”

April 16—11:30a.m.-1:00p.m.
 Speaker: Robert C. Schoup
 (Subsurface Consultants &
 Associates) “What are Global
 Temperatures Doing & Why
 Are They Doing It?”

Calendar of Meetings and Events Calendar of Area Monthly Meetings

- Corpus Christi Geological/Geophysical Society.....Third Wed.—11:30a.m.
- SIPES Corpus Christi Luncheons..... Last Tuesday—11:30a.m.
- South Texas Geological Society Luncheons..... Second Wed—noon San Antonio
- San Antonio Geophysical Society Meetings..... Fourth Tuesday
- Austin Geological Society..... First Monday
- Austin Chapter of SIPES.....First Thursday
- Houston Geological Society Luncheons..... Last Wednesday
- Central Texas Section of Society of Mining, Metallurgy & Exp..... 2nd Tues every other month
 In San Antonio



CCGS President's Letter

The luncheon meeting speaker this month at the Town Club (Wed. March 19) will be Richard Davis, Professor Emeritus from the University of South Florida and Visiting Research Associate at Harte Research Institute. His topic will be "Sea-Level Change in the Gulf of Mexico." He has written a book on the topic and will have a book signing before the luncheon.

Following is a list of local CCGS events that you should put on your calendar:

- | | | |
|------------|------------------------------|---|
| • April 12 | Earth Day | Heritage Park |
| • April 24 | CCGS/CBGS Shrimp Boil | Art Center |
| • April 25 | Seismic Interpretation Class | EOG 3 rd floor conference room |
| • May ? | Annual Fossil Hunt | Wright Brothers Quarry |
| • July 25 | CCGS/CBGS Fishing Tournament | Port Aransas |

Note the Seismic interpretation class scheduled for Friday, April 25. The class will be taught by Don Herron of PGS (ex-Gulf and BP). He gives a similar class for the AAPG. The cost of the school will be \$200 for non-members, \$150 for members, and \$100 for students. This is a large discount from the standard rate.

Also, the GCAGS convention which will be held in Corpus Christi Sep. 18-20, 2016 has been officially approved and most of the key officer positions have been filled. The 40th anniversary of the CCGS will also be celebrated in 2016.

Nominations for CCGS officers for the 2014-15 year are now officially open. If you want to run for an office or know someone that may want to run for office, please let me know. We currently have candidates running for the following positions:

President	Leighton Devine
President-Elect	Open
Vice-President	Randy Bissell
Secretary	Allison Corcoran
Treasurer	Zach Corcoran

The officer election will be held at the April Meeting.

Bob Critchlow

CCGS President 2013 – 2014

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- ◆ Federal Refuge and Padre Island National Seashore Permitting
- ◆ Endangered Species, Seagrass, Wetland and Oyster Surveys
- ◆ Wind Farm Permitting

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CBGS PRESIDENT'S LETTER

Geophysical News - Stephen Thomas is getting a local seismic interpretation course put together.

See elsewhere in the bulletin for details or give Stephen Thomas or Lonnie Blake a call.

Other options for learning more about seismic and geophysics:

The SEG has numerous online/web/eLearning/course recordings that are available at the following website.

<http://www.seg.org/professional-development/seg-on-demand>

The SEG also organizes other geophysical of "live" course offerings that can be found at the following website.

<http://shop.seg.org/Default.aspx?TabId=179>

The SEG has also conducted a number of live webinars/lectures on various topics for members that are becoming more popular.

Some interesting statistics:

Seismic Crews - US Onshore	Current Month	Last Month	Difference	(Per SEG/Seismic Crew Reports Survey)
	Onshore/Offshore	Onshore/Offshore		
	46/21	47/17	3(onshore)	
	Current Month	Last Month	Last Year - Monthly	(Per Texas RRC, last reported)
Texas Production	MMBO/BCF	MMBO/BCF	MMBO/BCF	
Oil	54.5	57.6	51.2	
Gas	576	607	667	
	Current Month	Year to date	Last year to date	
Texas Drilling	4	53	70	
Discoveries - Oil	2	31	41	
Discoveries - Gas	2	22	29	
Total Completions	1,611	24,922	15,041	
Oil Completions	1,348	19,249	10,936	
Gas Completions	156	4,917	3,580	
Other	107	756	525	

Parting thoughts:

Curiosity is the wick in the candle of learning. Author: [William Arthur Ward](#)

--

Lonnie Blake—CBGS President 2013–1014

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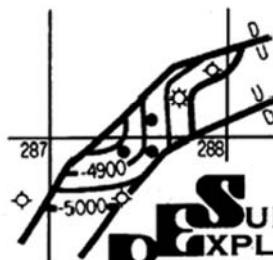
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LUNCHEON MEETING ANNOUNCEMENT

Corpus Christi Geological Society & Coastal Bend Geophysical Society

Wednesday, March 19, 2014

- Location:** The Town Club; 6th floor
- Bar Sponsor:** Pete Graham (Schlumberger)
- Student Sponsor:** Core Lab (Juan Cabasos) and CCGS
- Time:** 11:30 AM, Lunch served at 11:45 AM, speaker at noon
- Cost:** Members \$25 (\$3 Surcharge if no reservation, No-shows will be invoiced)
- Reservations:** Please make your reservations by email allison@aaoperating.com

Sea-Level Change in the Gulf of Mexico

Richard Davis

Professor Emeritus from the University of South Florida and

Visiting Research Associate at Harte Research Institute

Corpus Christi, TX

Biography

Richard A. Davis, Jr. is Distinguished University Professor Emeritus at the University of South Florida and Visiting Professor/Research Associate at the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University – Corpus Christi.

Dr. Davis received his B.S. from Beloit College (Wisconsin) in 1959, his M.A. from The University of Texas at Austin in 1961 and his Ph.D. from the University of Illinois – Champaign/ Urbana (1964) all in geology. His minor for his masters was in Marine Science and for his doctorate was in ecology. He was a post-doctoral fellow at the University of Wisconsin – Madison in 1964-65. Dr. Davis was assistant and associate professor of geology at Western Michigan University from 1965-1973 with a sabbatical year (1971-72) at The University of Texas, Marine Science Institute. He moved to the University of South Florida as professor of geology and chair of the department in 1973. At USF he served in that role until 1982 and then was associate dean (1982-84) and acting dean (spring semester 1984). He was promoted to Distinguished University Professor in 1988. He was the first Director of the USF Environmental Science and Policy Program from 1994-1997 and retired from full-time employment in 2000.

Dr. Davis has been visiting professor at Duke University and the University of North Carolina – Chapel Hill in 1984-85. He has also been visiting professor at the University of Melbourne in Australia three times (1976, 1986, 1991-2); the first time as a Senior Fulbright Scholar. Other visiting professorships have been at the University of Waikato (NZ), University of Sydney, Copenhagen University (3 times), University of Huelva (Spain) and the University of Utrecht. Dr Davis has also been a visiting scholar at the Senckenberg Institute in Germany multiple times. He has recently been a visiting lecturer at the Universities of Tongji, Nanjing and Peking in China. He has been an invited speaker at 42 colleges, universities and research institutes. Dr. Davis has supervised 57 masters theses and 3 doctoral dissertations as well as being on multiple dissertation committees from other domestic and foreign universities.

Richard Davis has been very active in several professional organizations. He was president of the Southeastern Geological Society and was elected as Councilor for Mineralogy and Secretary-Treasurer of SEPM, The Society for Sedimentology. He is a fellow of the Geological Society of America. He has hosted or co-hosted multiple international conferences on geology. Dr. Davis received the Shepard Medal in Marine Geology from, and was elected to honorary membership in SEPM.

Dr. Davis specializes in coastal geology with emphasis on beaches, tidal inlets and barrier islands. He has received many research grants from local, state and national funding agencies totaling more than

continued on page 13

four million dollars. His research has resulted in more than 150 refereed papers, many field trip guidebooks and contract reports. He has authored or edited 20 books from 1972 to the present; one is in press. These range from introductory textbooks to research monographs for both commercial and academic publishing houses. He has also been associate editor of the Journal of Sedimentary Petrology (1984-89).

Abstract
Sea-Level Change in the Gulf of Mexico

Sea level has been changing throughout the history of the earth. There are only two things that can change global sea level; increasing the volume of water in the ocean system and changing the size of the ocean basins. Plate tectonics takes millions of years to change the size of the oceans but changing the volume of water in the oceans can only take decades to centuries. This is primarily through climate change with water being added or subtracted from the global ice sheets and temperature change of the water.

The Gulf of Mexico began to form in the Late Triassic and did not reach a shape resembling its present configuration until the Eocene. Since that time there has been a gradual change to its present morphology that took place about 7,000 years ago.

The maximum elevation of sea level relative to North America was during the Cretaceous when the Western Interior Basin was at its maximum. The lowest sea level position was probably during the Wisconsinan when glacial coverage of the continent was a maximum and sea level was about 125 meters below its present position. The highest sea level during the Pleistocene was about 40 meters above the present position.

Melting of the Wisconsinan glaciers has led to the present coastal morphology and the rise in sea level is continuing. Although the global rate of rise is about 2.7 mm per year there are places around the Gulf of Mexico that it is almost four times the global rate. Most of the variation in the present rate of sea-level rise is geologically based. The most stable situation is associated with carbonate platforms and the least is on coasts with river deltas, the most important being the Mississippi Delta. Human activity is also a contributor. The built environment associated with the Houston metropolitan area has subsided multiple meters during recorded history. The future of places like Houston and the Mississippi Delta will include serious problems of sea level rise. The main question is will there be sufficient funds to mitigate these conditions?

See slides on pages 14 & 15

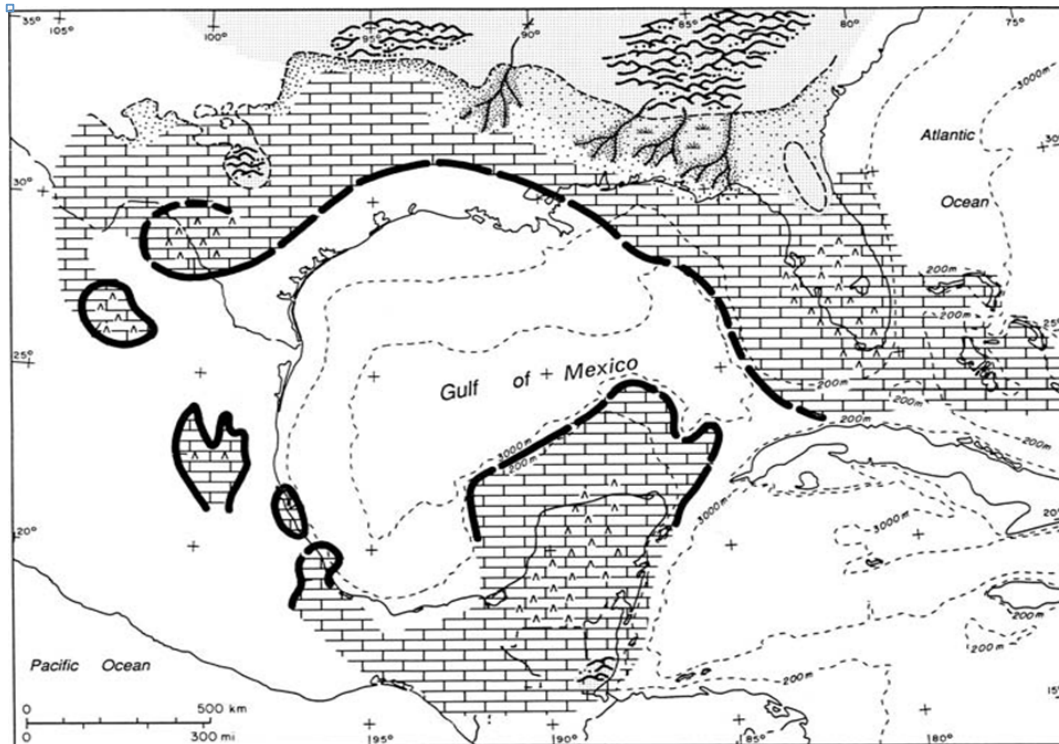


Fig. 1 Cretaceous Gulf of Mexico

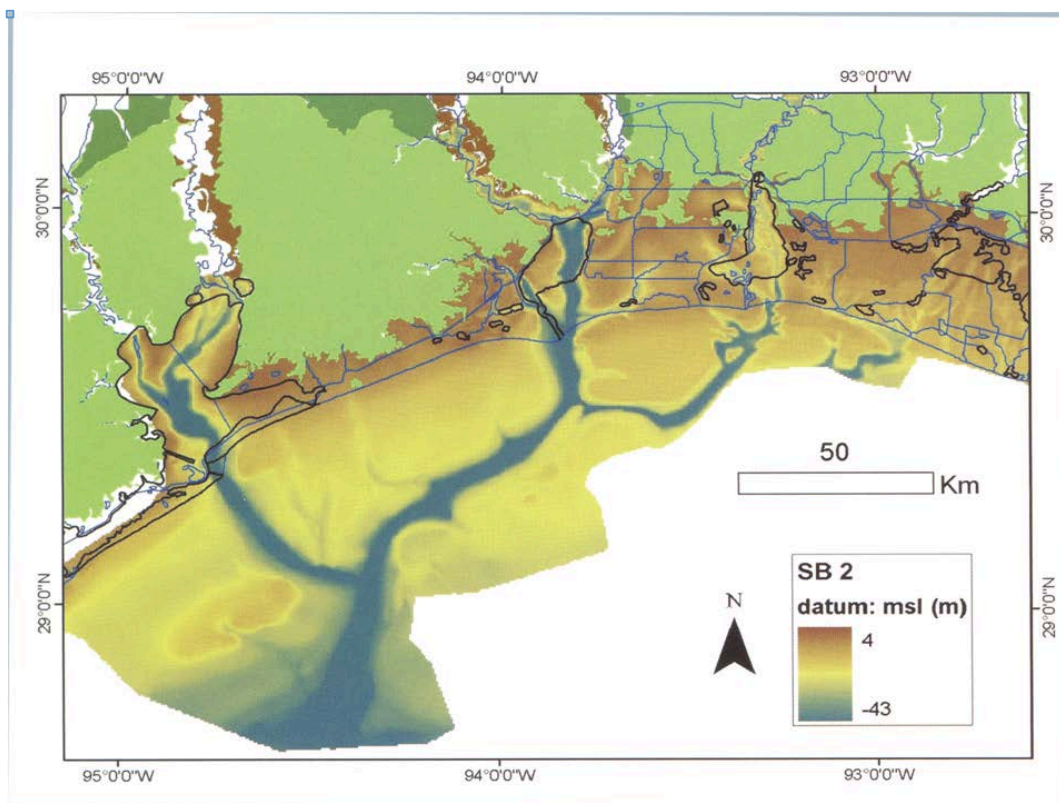


Fig. 2 Lowstand Shelf Morphology

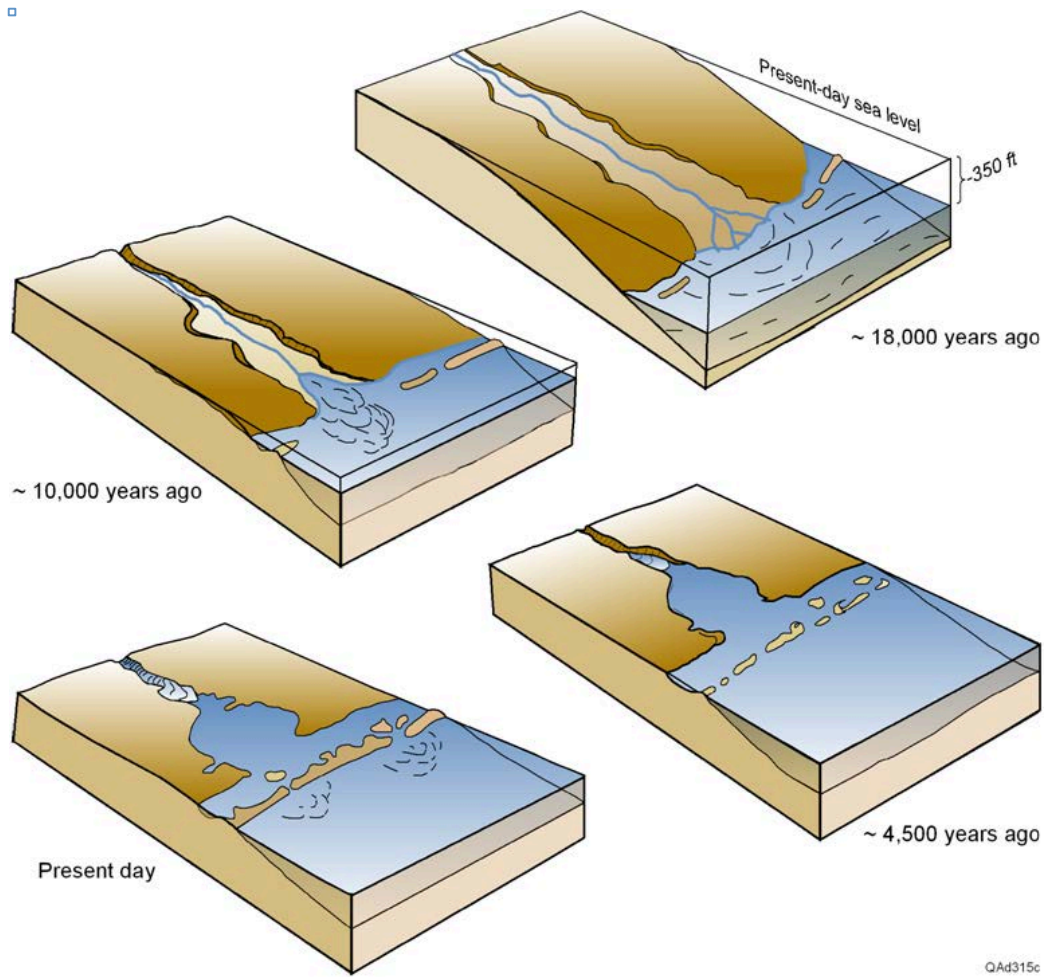


Fig. 3 Gulf Coast Evolution

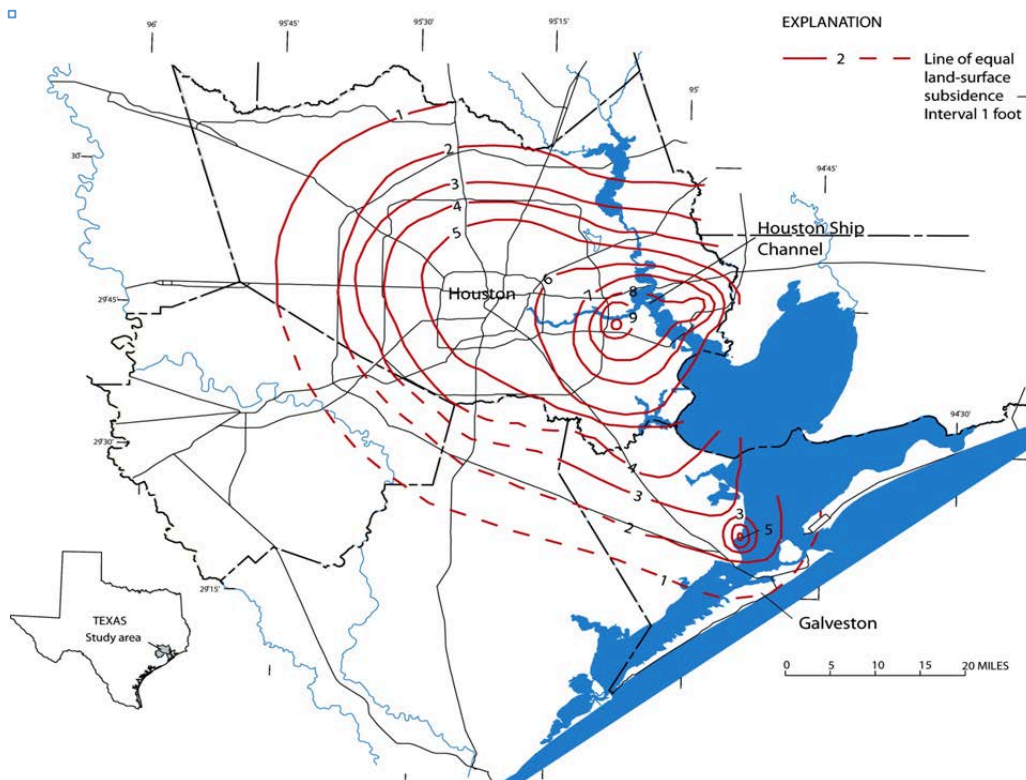


Fig. 4 Subsidence in Houston

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President/Geologist

713.823.8288
EMAIL: wthunderx@aol.com

SCHOLARSHIP APPLICATIONS FOR SUMMER AND FALL

Scholarship applications for the Summer and Fall Semesters are now being accepted. Geology majors attending Del Mar, TAMUCC, and TAMUK area eligible. The application and guidelines are on the website at ccgeo.org or be emailing Dawn Bissell, bissells@swbell.net

The post mark deadline is March 22nd (What else were you going to do over Spring Break? But your professors may have other plans, so ask them now for those letters of recommendation!)

We look forward to hearing from you.

Dawn S. Bissell
CCGS Scholarship Committee

Scholarship information and application are on the following pages. (pages 18 & 19)

continued on page 18



CCGS SCHOLARSHIPS

Summer/Fall 2014 Semester

APPLICATION REQUIREMENTS:

1. Applicant must be majoring in Earth Sciences and currently attending a college in the local area.
2. Fill out the application form clearly, completely, and sign it.
3. Short essay clearly explaining how this scholarship will assist you in achieving your geologic career goals and the reasons your application should be considered by the Committee.
4. Applicant must provide two (2) letters of recommendation- one must be from a geoscience faculty member or from a supervisor with whom applicant has worked with in a geoscientific undertaking.
5. Applicant must provide a school transcript, please make sure it has your name on it. A web printout is acceptable.
- 6. Applications must be postmarked by: March 22, 2014**

Mail completed application to: Dawn Bissell, CCGS Scholarship Committee Chairman / 253 Circle Drive, Corpus Christi, TX 78411

Please send an email to bissells@swbell.net once you've mailed your application so that we know to expect it.

Please read requirements carefully and submit only complete applications. Applicants who have received a CCGS scholarship in the past are eligible to apply again. Scholarships will be awarded based on merit and need. The award amounts may vary with the minimum individual award being \$500. Award recipients will be recognized at the monthly luncheon April 16, 2014 and are strongly encouraged to attend.

Board Members:

Dawn Bissell - Chairman
Brent Hopkins - Vice Chairman
Bob Critchlow - CCGS President
Dennis Taylor - Member

Patrick Nye - Secretary/Treasurer
Beth Priday - Member
JR Jones - Member
Lisa McLaughlin - Member



Corpus Christi Geological Society
Scholarship Application Form
Summer/Fall 2014

Last Name: _____ First Name: _____

Mailing address: _____
(where award may be mailed if applicant is selected)

City: _____ State: _____ Zip Code: _____

Email: _____

Daytime Phone: _____ Best time to call: _____

Alternate Phone: _____

University Currently Attending: _____

Department: _____ Major: _____

Scholarship is for class level (circle one):

Freshman Sophomore Junior Senior Graduate Student

Total Hours Completed: _____ Overall GPA (Minimum 2.5): _____

Total Hours - Geology: _____ Geology GPA (Minimum 3.0) _____

Hours Planned for Scholarship Semester: _____ Geology Hours: _____

Will this scholarship be used toward field camp? Yes No

Prior recipient of CCGS Scholarship? Yes No

Applicant Signature

Date

Mail application, along with essay, two letters of recommendation, and transcript to
Dawn Bissell, CCGS Scholarship Committee Chairman
253 Circle Drive, Corpus Christi, TX 78411

Must be postmarked by March 22, 2014. Email bissells@swbell.net once you've mailed your application, so we know to expect it.



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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 unassailable 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 Arctic 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.

Continued on page 23

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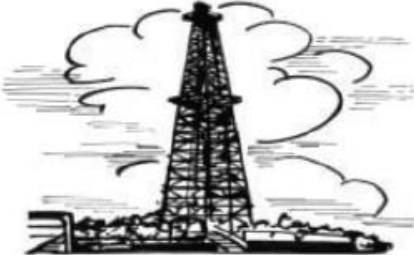
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Dr. David T. Dockery

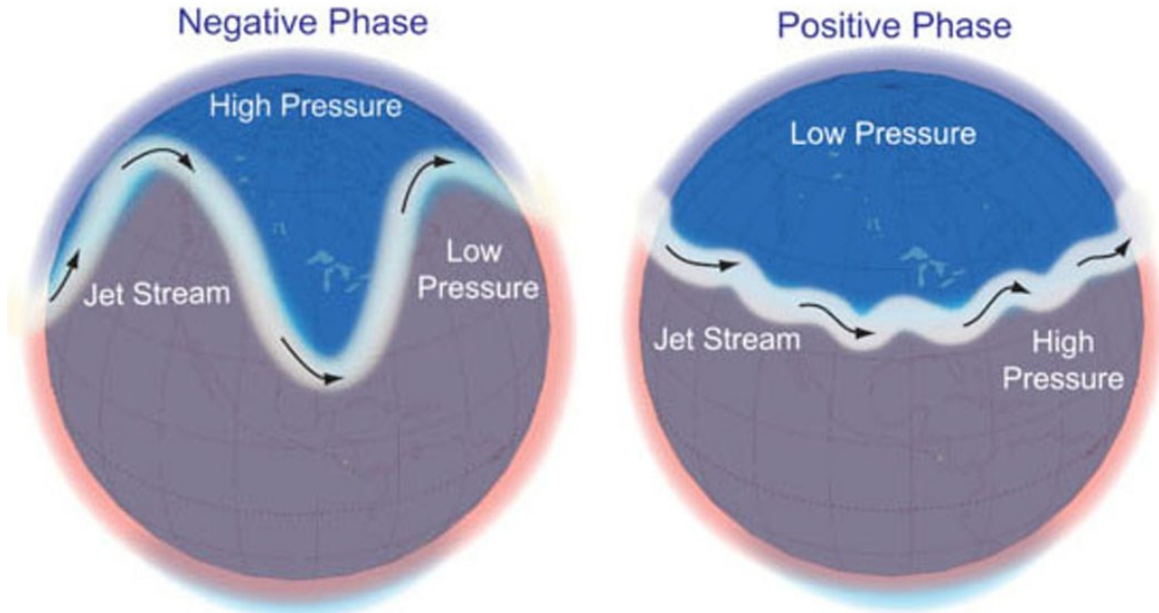


Figure 1. Arctic Oscillation in negative phase with high pressure over the North Pole (left) and positive phase with low pressure over the North Pole (right) (Wikipedia).

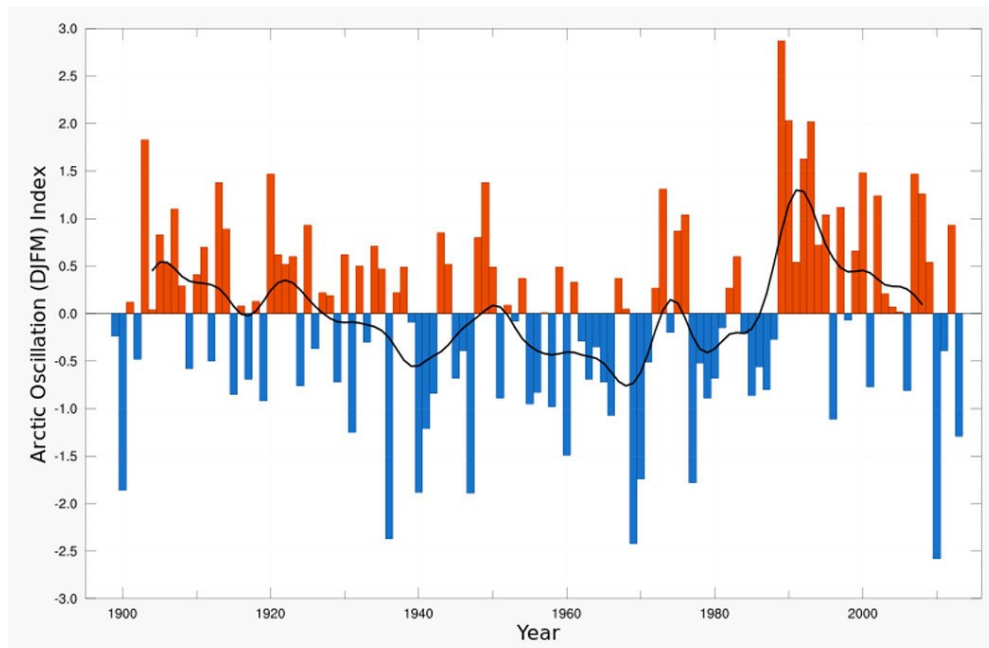


Chart 1. Arctic Oscillation time series for the extended (DJFM) winter season 1899-2011. Over the past century, the Arctic Oscillation alternated between its positive (red) and negative (blue) phases. Starting in the 1970s, the oscillation has trended more to a positive phase, though it has trended to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

Continued on page 27

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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.

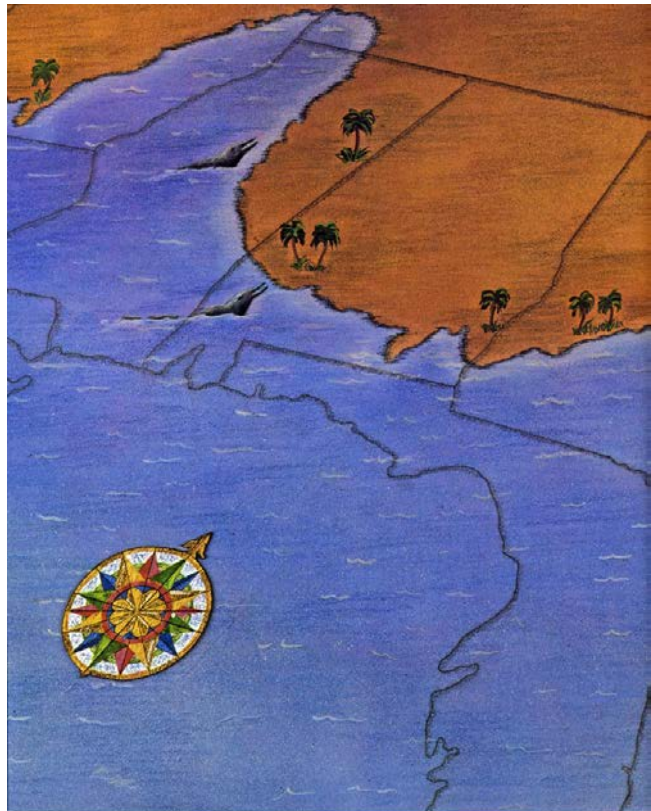
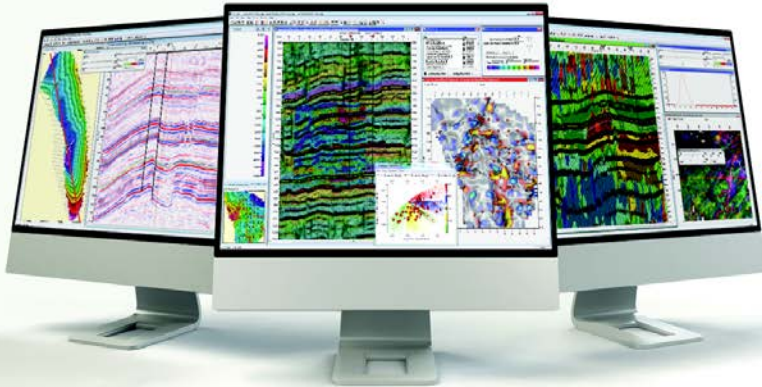


Figure 4. Late Eocene sea covering the northern Gulf Coastal Plain about 38 million years ago. Picture (scanned image) from *Alabama Heritage*, spring 1989, p. 14.

Continued on page 29

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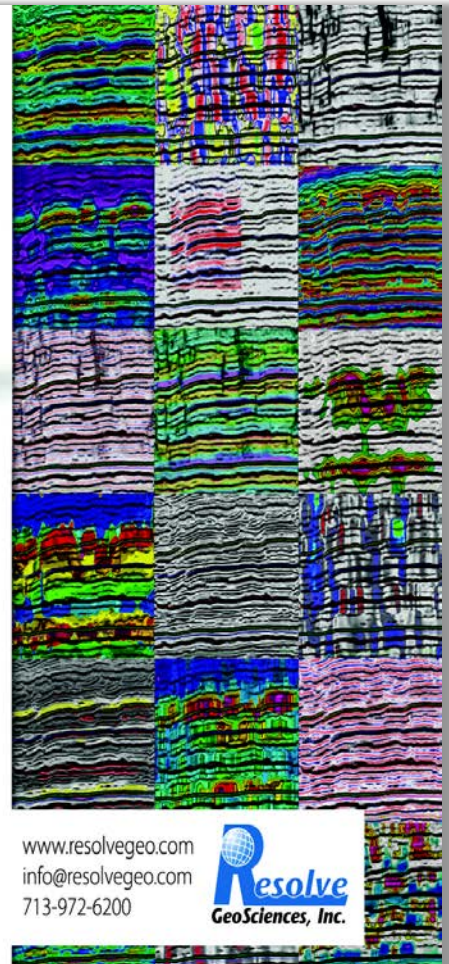


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The Late Eocene sea of the Jackson Group, a group named for its type locality at Town Creek in Jackson, Mississippi (Figure 3), extended into Arkansas and into western Tennessee north of Memphis (Figure 4). Fossil seashells from the 38-million-year-old 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 ($^{18}\text{O}/^{16}\text{O}$) 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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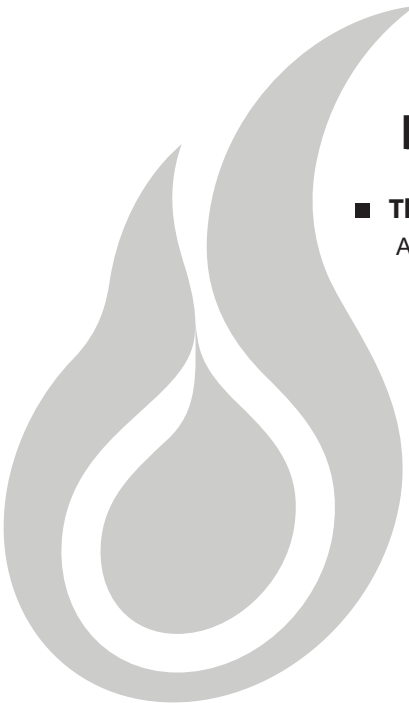


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Takuro Kobashi and his professor Ethan Grossman in the Department of Geology and Geophysics at Texas A&M University (along with this writer and Linda Ivany of Syracuse University) published the oxygen isotopes of cone shells from the Moodys Branch 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.

Continued on page 33

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MONTHLY COLUMN

Dr. David T. Dockery

Figure 7 shows a graph of oxygen isotope ratios of an Eocene *Conus* shell (reported as $\delta^{18}\text{O}$). 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 $\delta^{18}\text{O}$ 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.

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 ($^{87}\text{Sr}/^{86}\text{Sr}$) in the world's oceans have changed over time due to the variable contributions of light isotopes produced by volcanism 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.

The history of ocean strontium isotope ratios can be found in the fossil shells of the Jackson and Vicksburg groups and the Chickasawhay and Paynes Hammock formations of Mississippi. I as-

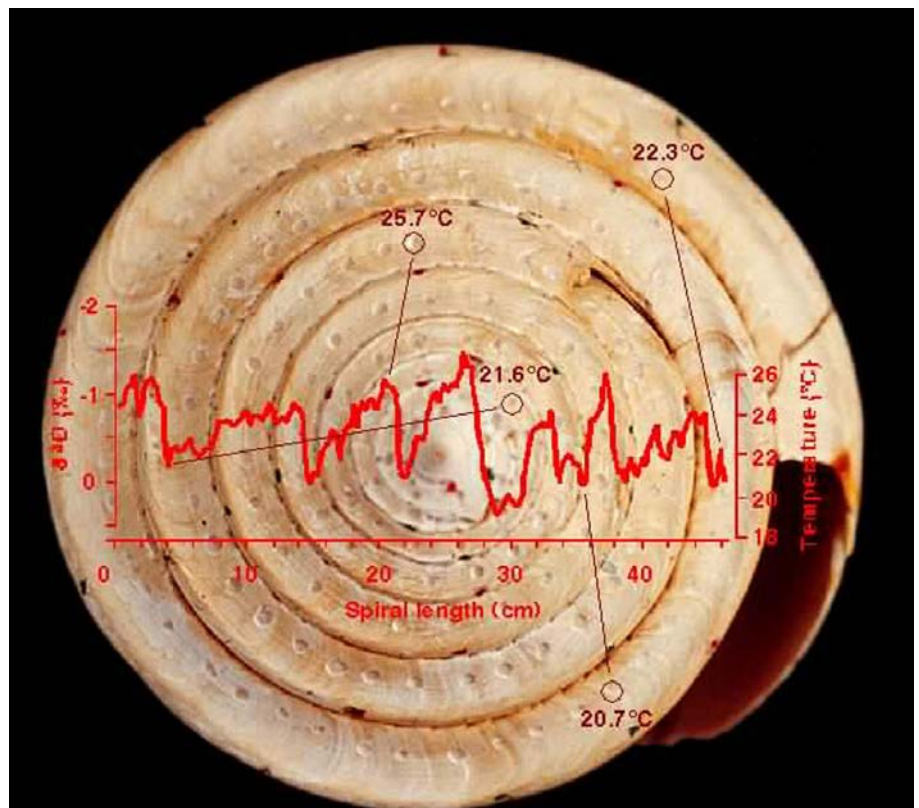


Figure 7

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.

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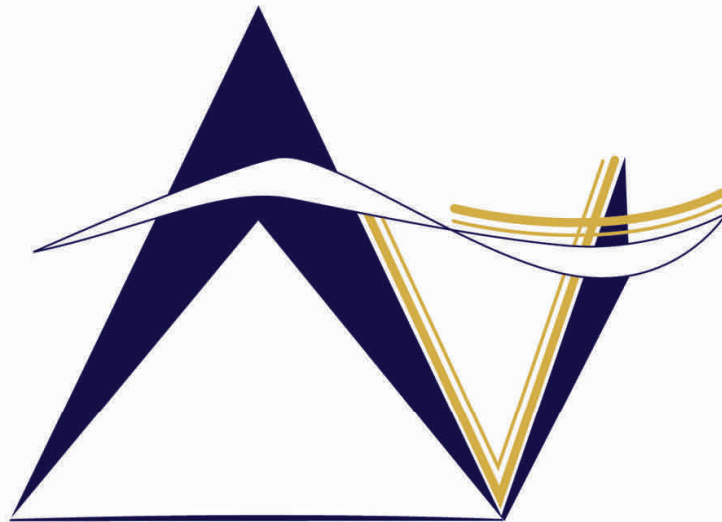
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MONTHLY COLUMN

Dr. David T. Dockery

sisted 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 $^{87}\text{Sr}/^{86}\text{Sr}$ 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 present-day sea water $^{87}\text{Sr}/^{86}\text{Sr}$ ratio is 0.7091 (Figure 8).

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."

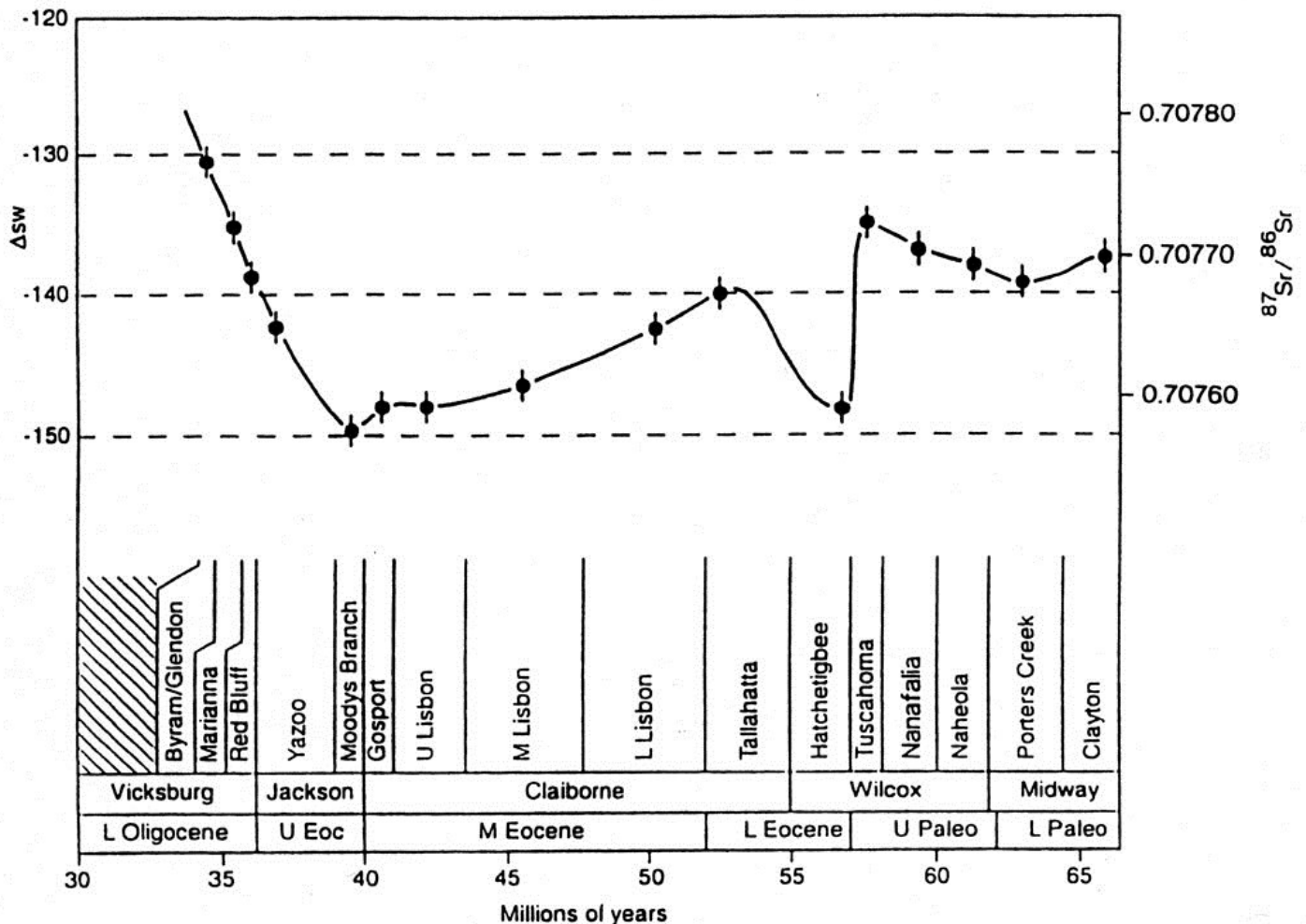


Figure 8. Strontium isotope ratios for the Gulf Coastal Plain Paleogene section as determined from the calcitic shells of oysters and pectens by Denison and others.

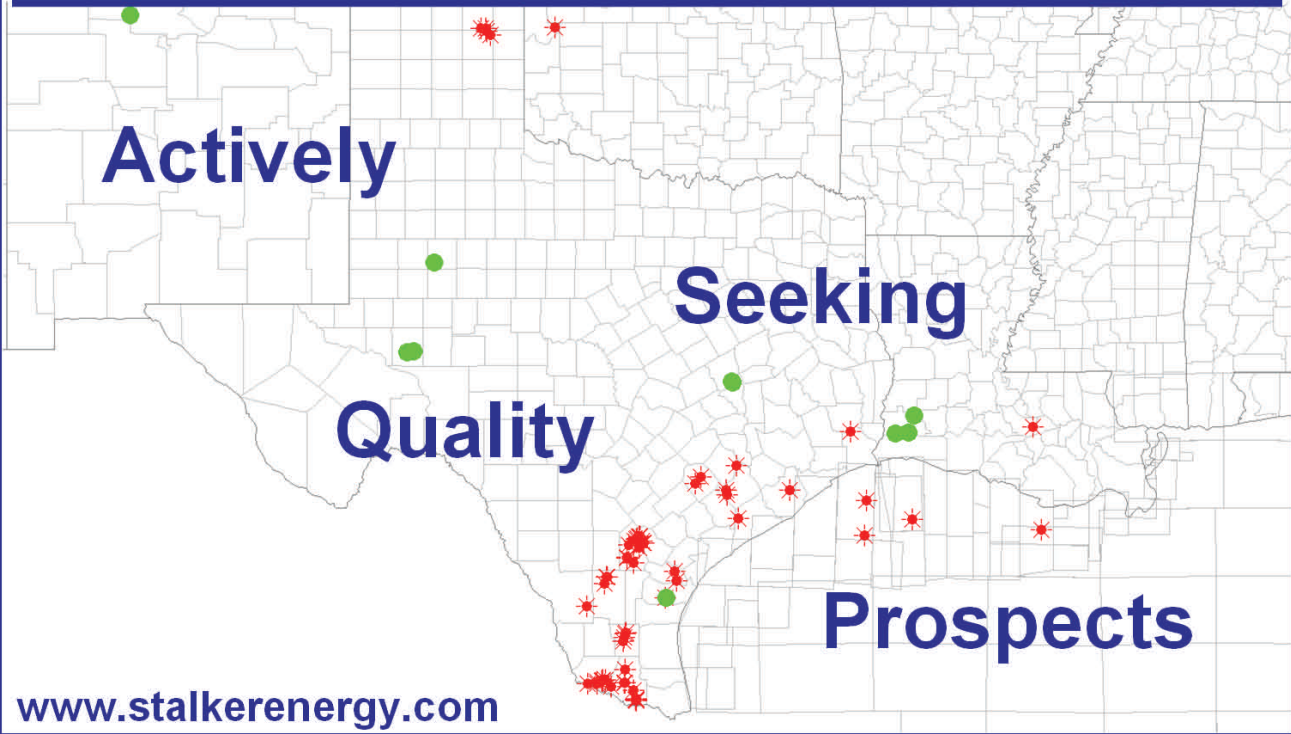
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During the present ice age of the last 2 million years, a time called the Pleistocene Epoch, glaciers have advanced and retreated over 20 times, often blanketing much of North America in ice. Today's climate is actually a warm interval between periods 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.

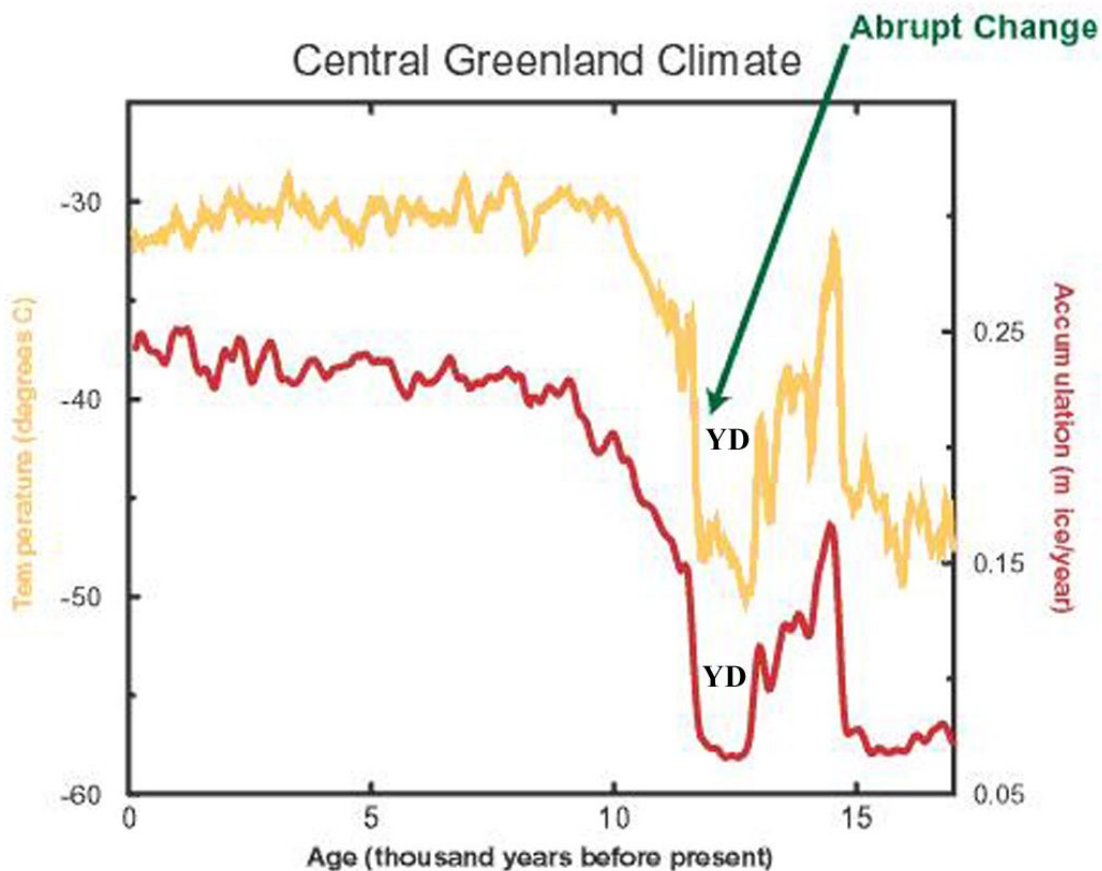
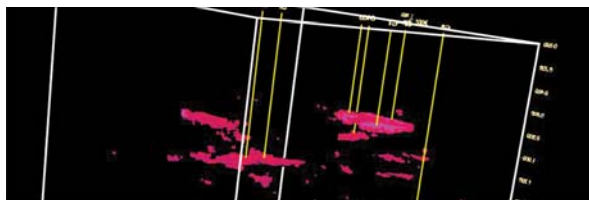
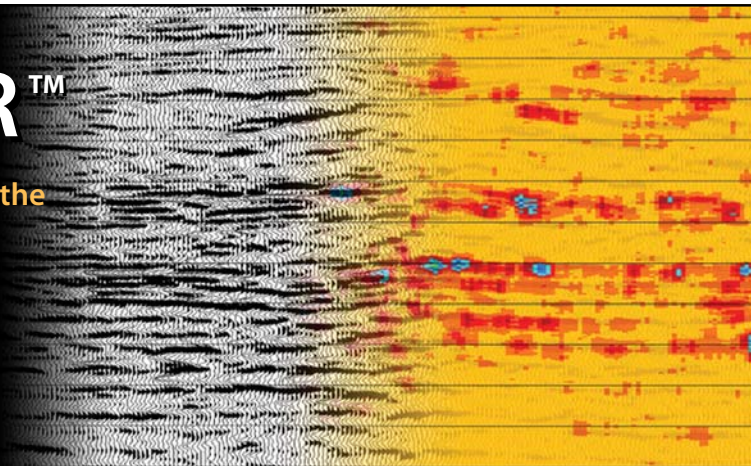


Figure 9. The yellow curve gives the temperature in degrees C for central Greenland over the last 18,000 years. The red curve gives the accumulation of ice in meters per year over the same time period. YD designates the Younger Dryas glacial period. This diagram was published online by the Lamont-Doherty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

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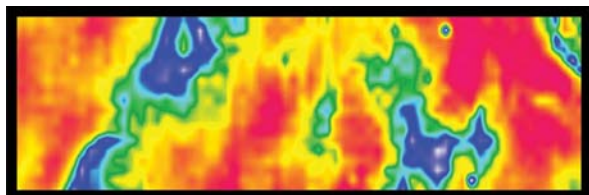
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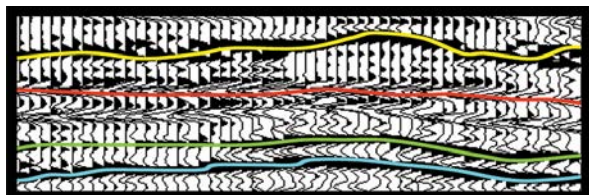
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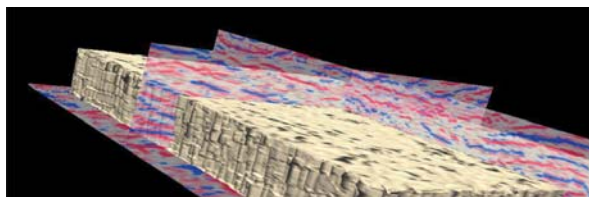
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Dr. David T. Dockery

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). 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. 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."



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



MONTHLY COLUMN

Dr. David T. Dockery

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 consecutive 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.

GEO LINK POST

<http://www.lib.utexas.edu/books/landsapes/index.php> Free service. Rare, fragile, hard-to-find, public domain documents covering various topics about the landscape of Texas. Includes the Texas Geological Survey from 1887 until 1894.

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 to frame 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.

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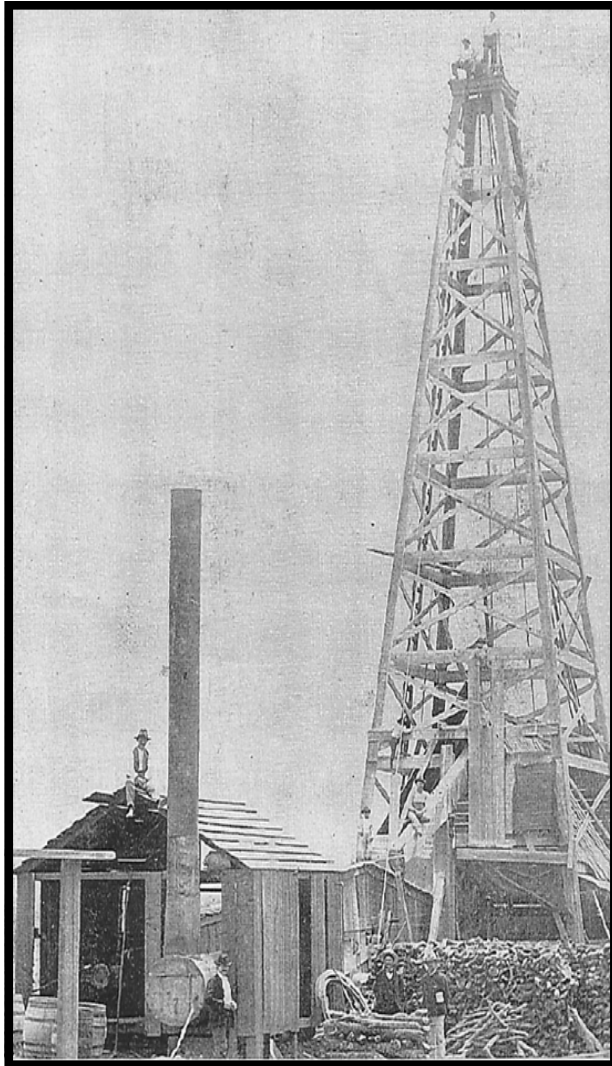


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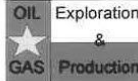
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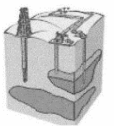
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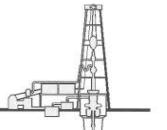


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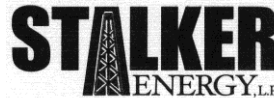
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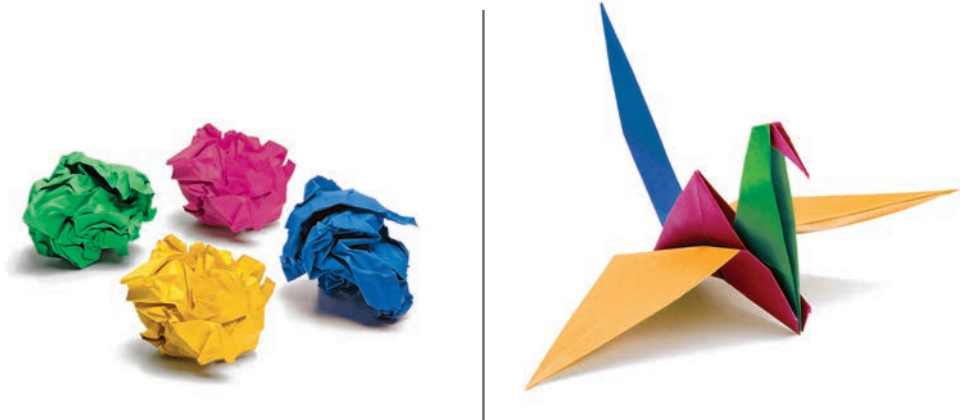
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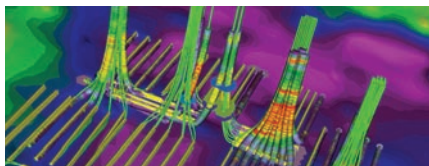
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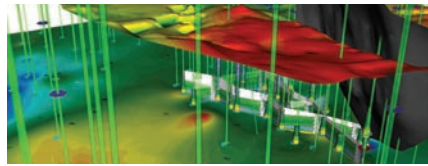
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