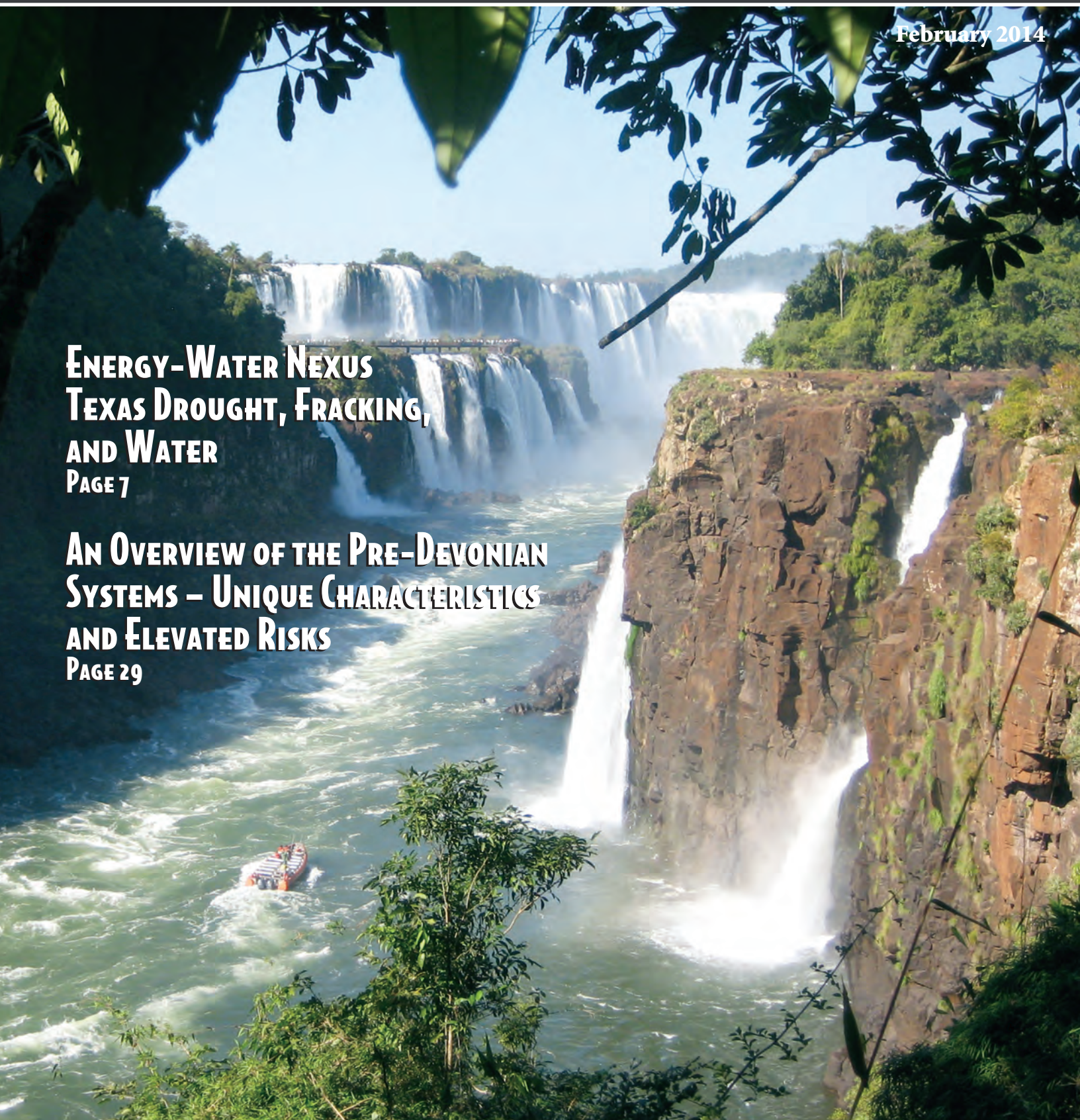
HGS Bulletin
Houston Geological Society
Volume 56, Number 6
February 2014



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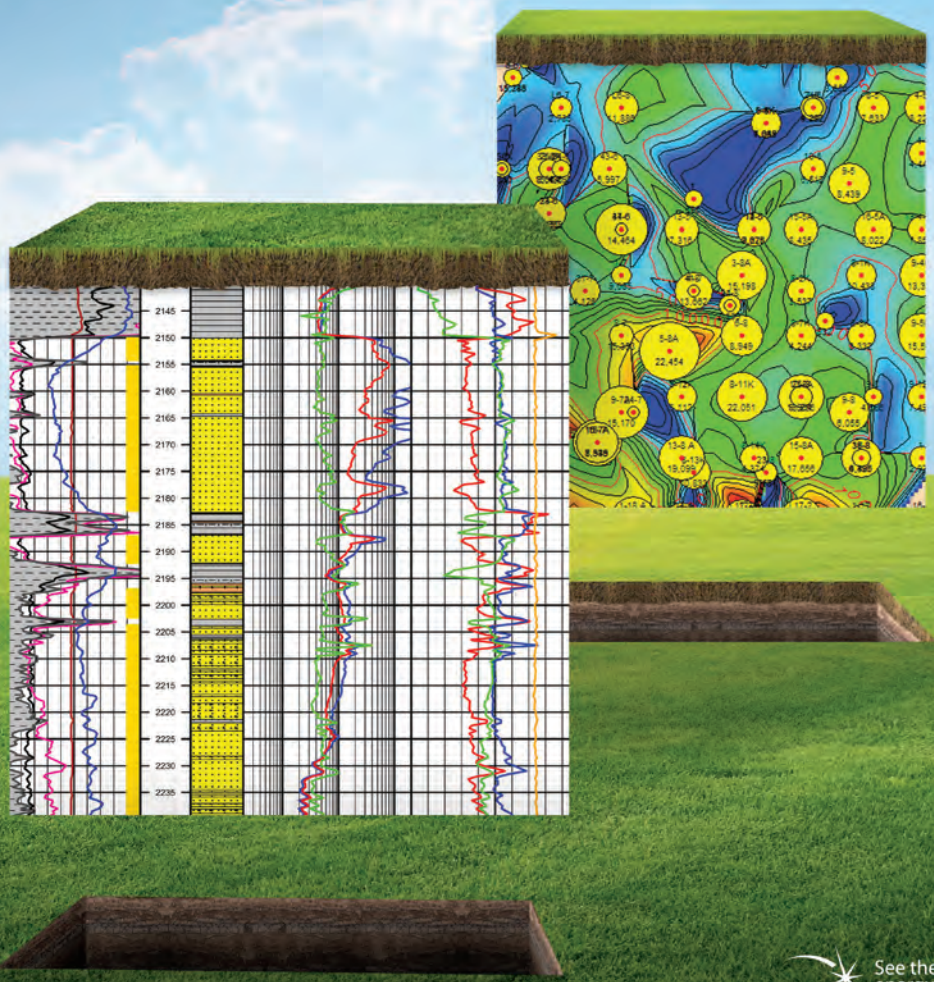

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The Bulletin
Houston Geological Society

Volume 56, Number 6 February 2014

In Every Issue

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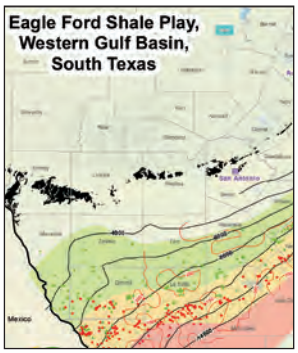

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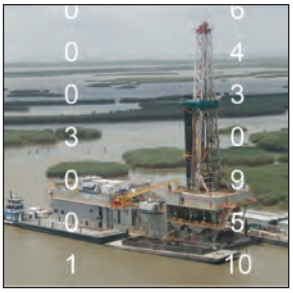
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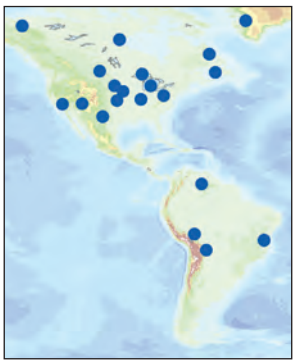
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About the Cover: One of the greatest natural wonders of the world, Iguazu Falls ("Great Water'), consists of more than 275 individual waterfalls that cumulatively discharge at an average flow rate of more than 60,000 cubic feet per second. The falls are located on the border between Argentina and Brazil just downstream of the confluence of the Iguazu and Parana rivers. The waters flow over a great plateau of flood basalts which erupted approximately 135 million years ago during the breakup of the supercontinent Pangea. A layered succession of basalt flows creates stair steps for the cascading waters. This view from the Argentinian side is up river toward "La Garganta del Diablo," the Devil's Throat, where the falls hurl over 350 feet high cliffs. Sightseeing boats take visitors for a drenching close-up view of the falls from below.
Photograph by Michael F. Forlenza, P.G.

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The Houston Geological Society Continuing Education Committee Presents

Critical Assessment of Shale Plays: Bridging the Gap with Engineers

Speaker: Gary Citron, Rose & Associates
March 5, 2014

Rose & Associates continues its series of contributions to the HGS with another installment on the critical assessment of shale plays. For 2014, the one day course covers characterization techniques at the handoff interface between geoscientists and engineers. After a brief refresher on using statistics to describe the uncertainty associated with various shale plays, we address play segmentation via compositing techniques and selection of segments with the preferred geologic attributes for future pilot drilling. We then focus on the relationship between program sample size and the probability of achieving drilling pilot goals, uncertainty associated with various aspects of the production type curve, and finish with decision tree structuring and the aggregation techniques to model the development program.

This course is designed for geoscientists and engineers to enhance effective communication and characterization for unbiased profitable investing.

Pricing

HGS/GSH Member:	$105.00
Non-Member:	$125.00
Emeritus/Life/Honorary	$70.00
Student Member	$70.00
Student Non-Member	$85.00

There is room for 100 attendees.

Date: Wednesday, March 5, 2014 • 8 a.m. – 5 p.m.
Location: Noble Energy • 1001 Noble Energy Way • Houston, TX 77070
Please make your reservations on-line through the Houston Geological Society website www.hgs.org

For more information about this event, contact HGS Office • 713-463-9476 • office @hgs.org

Biographical Sketch

Gary P. Citron (BS, Geology, State University of New York at Buffalo; MS & PhD in Geology, Cornell University)

After a twenty year career as a geoscientist, manager, and internal consultant for Amoco exploration business, Gary joined Pete Rose's consulting firm, which focuses on the field of prospect and play risk analysis, in February 1999. While at Amoco, Dr. Citron actively mentored younger geoscientists on prospect evaluation.

Gary became Pete's first Partner in Rose & Associates, LLP in 2001 and assumed the role of Managing Partner in 2003, leading R&A to multiple consecutive years of profitable growth. Rose & Associates is a recognized leader in professional instruction and consultation related to the field of play and prospect characterization, leading to more reliable portfolio management.

Dr. Citron has developed expertise in consensus building in prospect risk assessments and performance tracking of operational activity. In addition to his teaching and consulting obligations associated with conventional and unconventional resource opportunities, he coordinates a yearly gathering of risk team coordinators to share and compare best practices. He also helps companies benchmark their predictive performance against companies in their peer group. In 1999 he was selected by the AAPG to serve in their Visiting Geologist Program. In 2001, he received the best paper award from the AAPG's Division of Professional Affairs, and again in 2007 he was honored for delivering a 'Top Ten Oral Presentation' at the AAPG annual convention in Long Beach.

Gary regularly donates his time to the AAPG for for its education curricula, teaching courses on prospect, play and shale analysis. Gary has served in the AAPG House of Delegates and in the SPE as an Associate Editor for Economics and Management journal (SPEEM). He is a Texas State certified and licensed Geologist who has authored or co-authored more than a dozen publications, and has been an invited and honored speaker for the SIPES, Geological Society of London, AAPG, SPE and SEG.

Barry Katz

bjkatz.hgs@gmail.com

Some Musings from the President

My letters to the membership as Editor, and now as President, have focused on volunteerism, the need for continuous learning, and mentoring. When I sat down this month to prepare my letter I decided to take a different approach. I will share with you the top ten things that I have learned during my thirty-five year career. I hope they ring true to those of you that have been around a while and will be of some use to those that are just starting out. Not in any specific order these learnings are:

1. **The rocks tell the story.** Back in graduate school we were handed rocks and asked to tell their story — where they formed and how they changed through time. In the field, we learned about four dimensional relationships. Over my career, geology has become much more quantitative and computing capacity has grown. This has led to a growing reliance on numerical modeling and, unfortunately, a decrease in observations. One must remember that models are simplifications of nature. They have a purpose. Models check for consistency of an interpretation. Models provide a means to test what is possible. But only the rocks have recorded the history of a basin and they must be read to constrain our models.

2. **Review the data and the foundation for an interpretation.** Over the course of one's career we are very often presented with a completed study and our time is limited so we focus on the executive summary, abstract, or key conclusions. I can't suggest strongly enough that one needs to "trust but verify." I have seen many cases where limited data have been stretched or twisted beyond reasonable limits. Some of the questions that I ask are: 1) are the data significant and statistically meaningful; 2) are there sufficient data for the area or stratigraphic interval of interest; and 3) are the data internally consistent? Furthermore, I have found that not all work has relied on appropriate foundation. Recently, while reviewing some manuscripts, I read an increasing number of papers simply stating that the interpretation guidelines differ because these samples came from country "X" or the work was down in country "Y." Sorry, but chemical and physical principles are not country dependent.

3. **Geology requires integration and context.** Very often data are viewed out of context and their significance may be lost or overstated. As an example, many years ago as a new professional, I was reviewing data on Cretaceous anoxic events. I came across a large volume of data and many papers published on samples from Gubbio, Italy. This led me to the conclusion that the organic-rich black shales were extensive and volumetrically important. I then had an opportunity to visit the localities discussed; although the shale laterally extensive, it was no more than 1.5 meters thick. Much less important than I had thought. Context was clearly required. Integration also remains a key. Geology is multifaceted and a meaningful interpretation requires that multiple datasets and types be brought together. For example, as a geochemist I work with geochemical data, but to complete my interpretation and extend the interpretation beyond the sampling point, I often pull in stratigraphical information, paleoclimate data, and paleogeographical interpretations.

4. **There are usually multiple valid interpretations.** As a consequence of the number of unknowns in our work, multiple interpretations often exist. One is generally more probable than the others and one may be our preferred option. We need, however, to examine the alternatives

Communication is an important key. No matter how good an idea is it has no value unless it is effectively communicated. Remember that all communication is at least two ways. Ideas must be received.

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AAPG 2014 Houston Convention Special Event

HGS "Night at the Paleontology Museum"

Featuring Dr. Robert T. Bakker

Tuesday, April 8, 2014
6:30pm – 10:30pm

Morian Hall of Paleontology, Houston Museum of Natural Science

$65 per person for adults
$35 per person for students

Tickets sold online at the AAPG convention website www.aapg.org/houston2014/

Admission includes multi-course buffet dinner and IMAX theatre talk. Cash bar.

Free AAPG bus shuttle (leaving and returning) to the George R. Brown Convention Center.
Free museum garage parking for registrants driving personal cars.

Event Sponsor

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Join the Houston Geological Society on Tuesday, April 8, and experience the world-class Houston Museum of Natural Science Morian Hall of Paleontology featuring over sixty huge fossil displays and 30 action-posed dinosaurs. Inspect a real T. rex skeleton featuring the best preserved and most complete hands and feet of any T. rex ever found! See a uniquely well-preserved Triceratops — "mummified" with preserved skin, plus fossil dinosaur eggs and a "prehistoric safari" that includes the grand saga of human evolution! There will be guided tours by volunteer experts inside the exhibit hall, plus time to meet Dr. Bakker and ask questions about the dinosaurs.

Your ticket buys you a delicious buffet dinner, drinks and amazement, as you sit next to the huge dinosaur, reptile and fossil displays. The HGS encourages AAPG convention registrants to bring spouses and young guests to this social event. This night at the museum will include a fascinating talk by Dr. Robert T. Bakker, ground breaking science author ("The Dinosaur Heresies") and authority on dinosaur evolution. Dr. Bakker is a world-famous lecturer, consultant and advisor to the movie Jurassic Park.

This event is sure to sell-out and space is limited to the first 400 people. Tickets for AAPG convention participants and guests will be sold online using the AAPG ACE convention website at www.aapg.org/houston2014/.

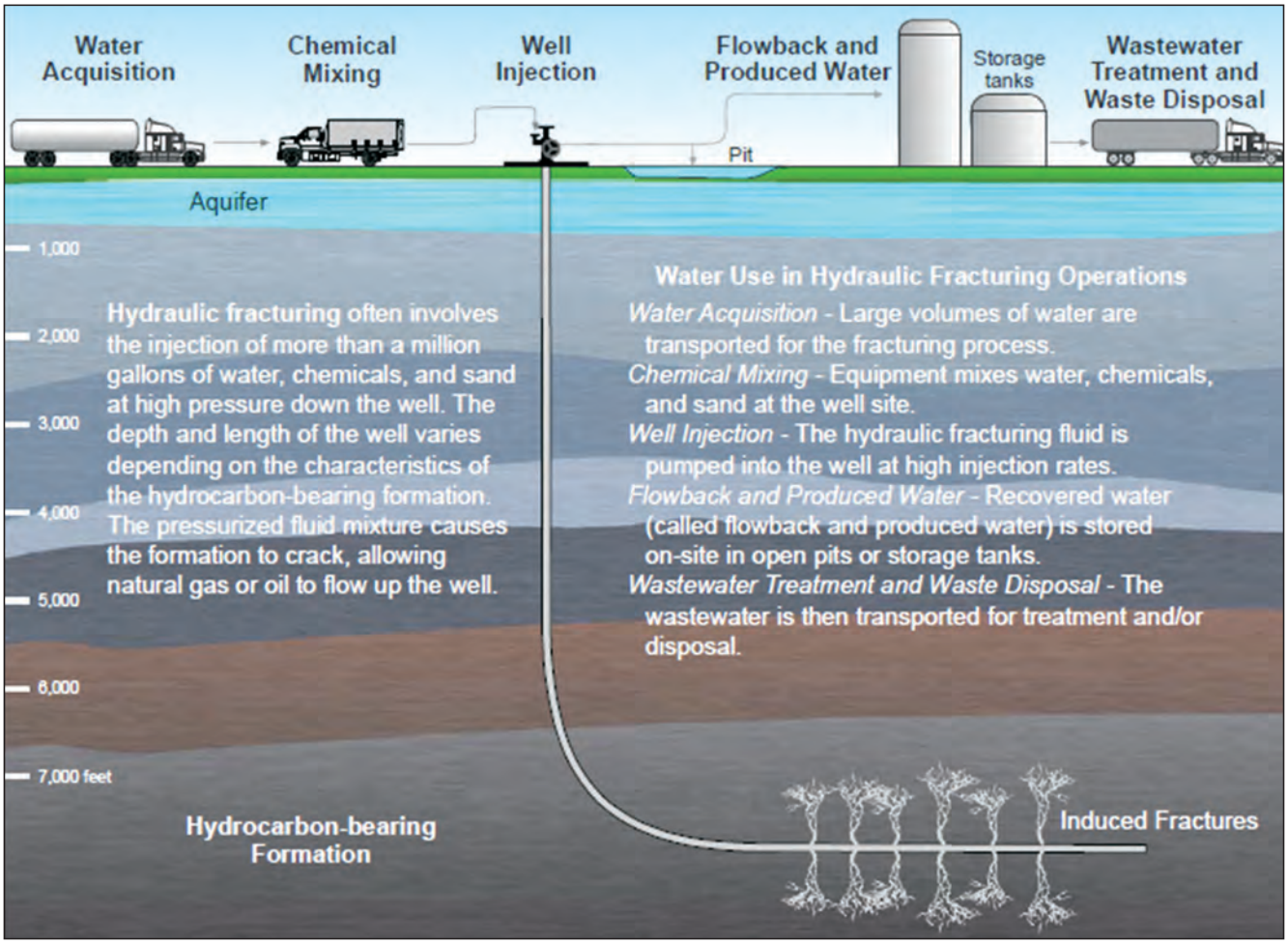
Michael F. Forlenza, P.G.
hgs.forlenza@gmail.com

Energy – Water Nexus: Texas, Drought, Fracking, and Water

Energy and water resources are intricately intertwined in our modern economy. The production or use of one almost always requires the use of the other. Energy is used in water production to power pumps and associated equipment used to lift groundwater from beneath the earth, to desalinate brackish water, and to transport and treat potable supplies to users. Water is used to generate electricity at hydroelectric dams, to cool power generating stations, and during the extraction of fossil fuels. This interdependency is often called the Energy-Water Nexus.

The Energy-Water Nexus webpage of Sandia National Laboratories states: "These two critical resources are inextricably and reciprocally linked; the production of energy requires large volumes of water while the treatment and distribution of water is equally dependent upon readily available, low-cost energy. The nation's ability to continue providing both clean, affordable energy and water is being seriously challenged by a number of emerging issues."

Adequate affordable supplies of both clean water and energy are vital to our nation's well being and prosperity. However, this co-dependancy can lead to conflict. In recent years, one of the most highly-visible areas of friction in the Energy-Water Nexus has been the use of fresh water in **From The Editor** *continued on page 11*



Source: United States Geological Survey

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Saudi Aramco is HIRING innovative, experienced oil and gas professionals. Hiring managers will be in Houston in February conducting prescheduled interviews.

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and gain an understanding as to the probability of each. We then need to determine what additional work could be done to limit the number of options and focus in on the most likely case.

5. **Communication is an important key.** No matter how good an idea is it has no value unless it is effectively communicated. Remember that all communication is at least two ways. Ideas must be received. Tailor communications to your audience. A technical presentation and a management presentation are typically very different. One focuses on the details of the science, the data, and the why. The other focuses on the bottom line, the conclusions and the implications. As technical people, we are proud of all the details, but at times they may cloud the story. Be ready to provide the details and the necessary supporting information, but hold back until asked.

6. **Good mentors and role models are important.** Formal mentors are important. It is a relationship that you can depend on. A mentoring relationship, however, need not be formal and you may not even know that such a relationship exists. Search out people that you admire because of their technical knowledge or understanding of the business. Ask them to serve as a guide to your development. Over time your primary mentor may change as your needs and responsibilities change. You are never too experienced to have a mentor or a coach. Take every opportunity to learn something new. Ask why they see things the way they do. Remember that the relationship is two-way. Most professionals want to share their experiences and leave a professional legacy.

Concepts evolve through time as a result of new data and analytical approaches or by integration of new technologies opening new opportunities where one didn't exist.

7. **Learn to listen, not just hear.** This is one that I am still working on. Realize that everyone was invited to the meeting for a reason and they have something to offer. Make sure that you understand not just the words but also the intentions. Ask for clarification if needed. As our industry becomes more global it is important to realize how cultural differences may influence a discussion. Sometimes "yes" doesn't mean "yes" but rather "I hear you and will consider it".When in doubt confirm what you think you heard.

8. **Document your thought processes, not just the end product.** In a world dominated by PowerPoint decks and bullet point summary slides, we very often lose the foundation for an interpretation. Why and how a conclusion is drawn is as important as the conclusion itself. Concepts evolve through time as a result of new data and analytical approaches or by integration of new technologies opening new opportunities where one didn't exist. By documenting the reasoning for an interpretation, its technical robustness can be assessed through time and adjustments can be made. Remember- it wasn't that long ago that fine-grained rocks were considered sources or seals and not reservoirs. Our understanding can change dramatically over time.

9. **Things very often take longer than expected.** All too often we underestimate the time a job takes. Generally this is a result of underestimating the complexity of the project, the dependency on the work of others, or problems that result from attempting to multi-task. It is always better to complete the job ahead of schedule than late. Learn to build a cushion when estimating time to completion.

10. **The technical foundation evolves and one must adapt.** A study of the history of geology has shown that there have been major changes in our overall understanding. Consider views on the age of the earth, the movement of plates, and evolution. New concepts develop and need to be considered. Think about the roles that seismic stratigraphy, sequence stratigraphy, and seismic geomorphology now play in our interpretations. Very often these develop as a result of new tools and higher quality data. One needs to incorporate new tools and concepts as they become available and their validity confirmed. This does require a scan of the literature to learn what's new.

I hope that these thoughts prove useful.

Finally, I want to remind you that the HGS Applied Geoscience Conference — Integrated Approaches of Unconventional Reservoir Assessment and Optimization (Mudrocks) will be held this month on February 17-18, 2014. As has been the case in the past, **Frank Walles** and his team have put together an excellent technical program. If you are currently or planning to work in unconventional reservoirs, I strongly recommend that you attend. ■

Until next time…

From the Editor continued from page 7

hydraulic fracturing activities. One can hardly open a newspaper without encountering a story about hydraulic fracturing and the affects of the growing use of the technology on clean water.

One of the locations where this conflict is ongoing is in south Texas where hydraulic fracturing activities are being conducted at an increasing pace to extract oil and gas from the Eagle Ford Shale.

Fracking and the Use of Fresh Water

Hydraulic fracturing, the practice of injecting water and a mixture of proppants and chemicals at very high pressure into a low-permeability, hydrocarbon-rich formation, has been used for decades to produce oil and gas. More recent developments in horizontal drilling technologies, combined with hydraulic fracturing, has led to a significant increase in the production of oil and gas from shale formations such as the Bakken in North Dakota, the Eagle Ford and Barnett in Texas, and the Marcellus in Pennsylvania and neighboring states.

Hydraulic fracturing operations involve the use of a large volume of fresh water. In general, one to six million gallons of water are used in the fracturing operations. at each well. The volume varies depending on the length of the target zone and the geomechanical properties of the producing formation. The majority of water used in fracturing operations is drawn from surface water sources. Secondarily, municipal water supplies and groundwater sources are used. Typically, the water is transported to the well site by tanker truck. A single fracturing job can require more than 300 tanker truck loads of fresh water.

Operators prefer to use fresh water for hydraulic fracturing because it is less corrosive than water with higher concentrations of dissolved solids. Lower quality water with higher concentrations of dissolved solids must be treated prior to use in fracturing operations. The additional costs associated with the treatment of low quality water makes the use of fresh water more attractive.

In many areas where hydraulic fracturing is conducted there are adequate supplies of fresh water available. In these areas, the use of the fresh water does not stress the existing available supplies are relied upon by other users. However, in drier regions where rainfall is rarer and surface water sources are allocated, the use of fresh water for fracturing can put stress on the local availability of water. Some of the drier areas where hydraulic fracturing is conducted are in Texas, specifically, in west Texas and south Texas.

South Texas and the Eagle Ford Shale

Average rainfall in parts of south Texas amounts to less than 20 inches per year. During many of the recent years, precipitation totals have fallen short of the annual average and the region is suffering through a persistent long-term drought. According to the United States Drought Monitor for the end of December 2013, more than 71 percent of Texas is in drought and large parts of south Texas are still in moderate or severe drought conditions despite recent rainfall. Under the rolling hills, scrub brush, and dusty ranch lands of south Texas lies the Eagle Ford Shale.

According to the Railroad Commission of Texas, the Eagle Ford Shale is a hydrocarbon producing formation of significant importance due to its capability of producing both gas and more oil than other traditional shale plays. The Eagle Ford contains a higher carbonate/shale percentage than similar shale formations,

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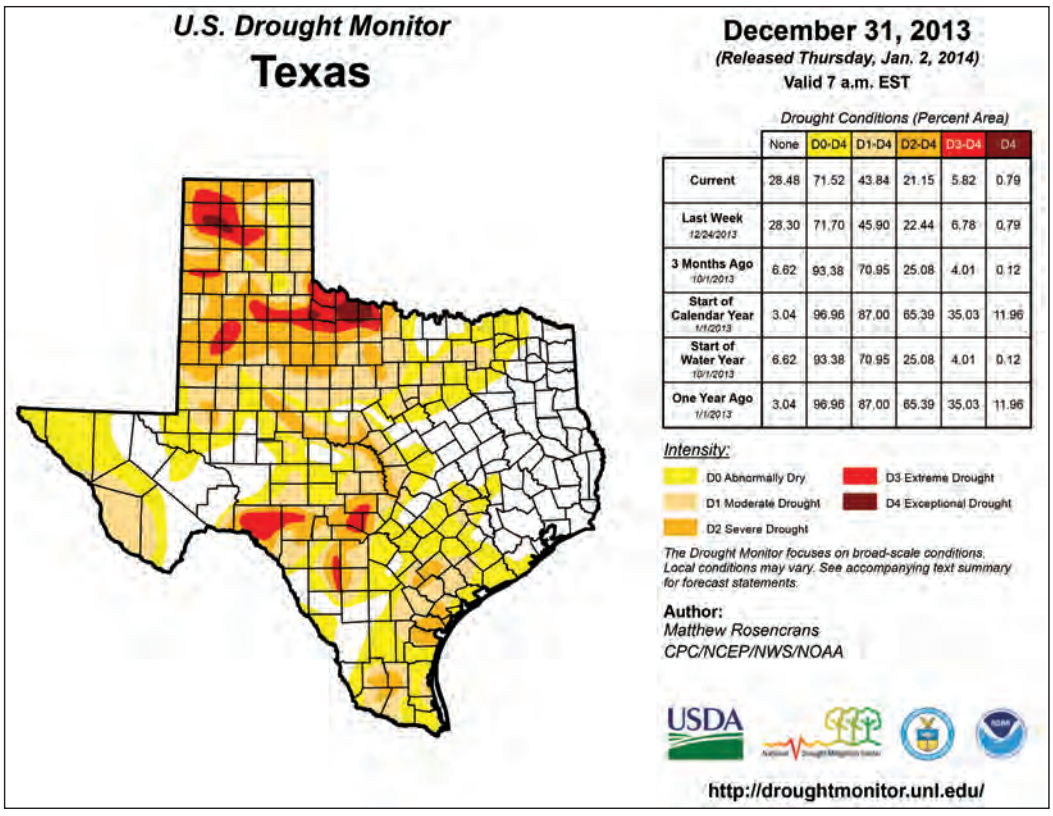

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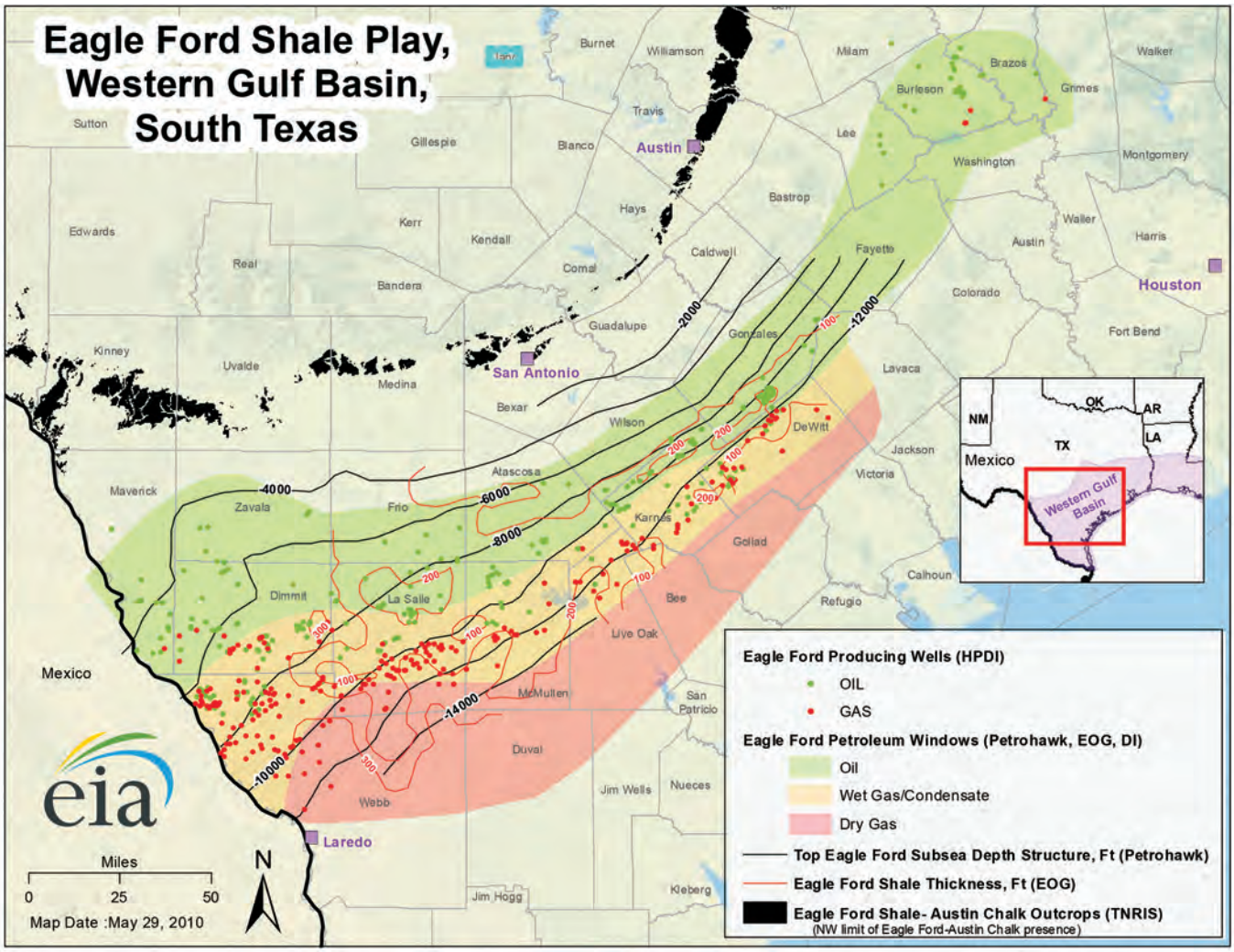


upwards to 70% in south Texas, which makes the formation more brittle and "fracable." The Eagle Ford Shale play trends across 26 Texas counties from the Mexican border northeastward into East Texas, roughly 50 miles wide and 400 miles long with an average thickness of 250 feet. The formation is Cretaceous in age resting between the Austin Chalk and the Buda Lime at a depth of approximately 4,000 to 12,000 feet.

Petrohawk drilled the first well to produce oil and gas from the Eagle Ford Shale in 2008 in LaSalle County, Texas. In the first six months of 2013, the Eagle Ford produced 2.69 billion cubic feet of natural gas and 599,000 barrels of oil and condensate per day. This rate of oil production represents an increase of 51 percent over the average 2012 production rate. By the end of 2013, oil production from the Eagle Ford had increased to more than one million barrels per day. In 2011, the United States Energy Information Administration reported that the Eagle Ford had proven reserves of 1.25 billion barrels of oil and 8.4 trillion cubic feet of gas. More recent estimates of the oil reserves are in excess of three billion barrels.

Since Petrohawk's initial well in 2008, drilling activity and associated hydraulic fracturing operations have been increasing rapidly in the Eagle Ford. These activities have required the use of fresh water in increasing quantities. But, the Eagle Ford underlies some of the most water stressed parts of the state. Following the severe drought in Texas in 2011, concerns have grown that use of fresh water for hydraulic fracturing in the area has been competing for this scarce resource with municipal, agricultural, and industrial users.

The Search for Fresh Water and Conflicts

Hydraulic fracturing of an average Eagle Ford well requires four to six million gallons of water, or roughly 15 acre-feet, over a period of several days, according to an industry source. An acre-foot, a measurement used in agriculture and municipal calculations, is the volume of water that will cover an acre of land to a depth of one foot. An acre-foot is approximately 326,000 gallons. Drillers working the Eagle Ford Shale in south Texas cumulatively use approximately 15,000 acre-feet (nearly 4.9 billion gallons) of water annually by some estimates. **From The Editor** *continued on page 14*

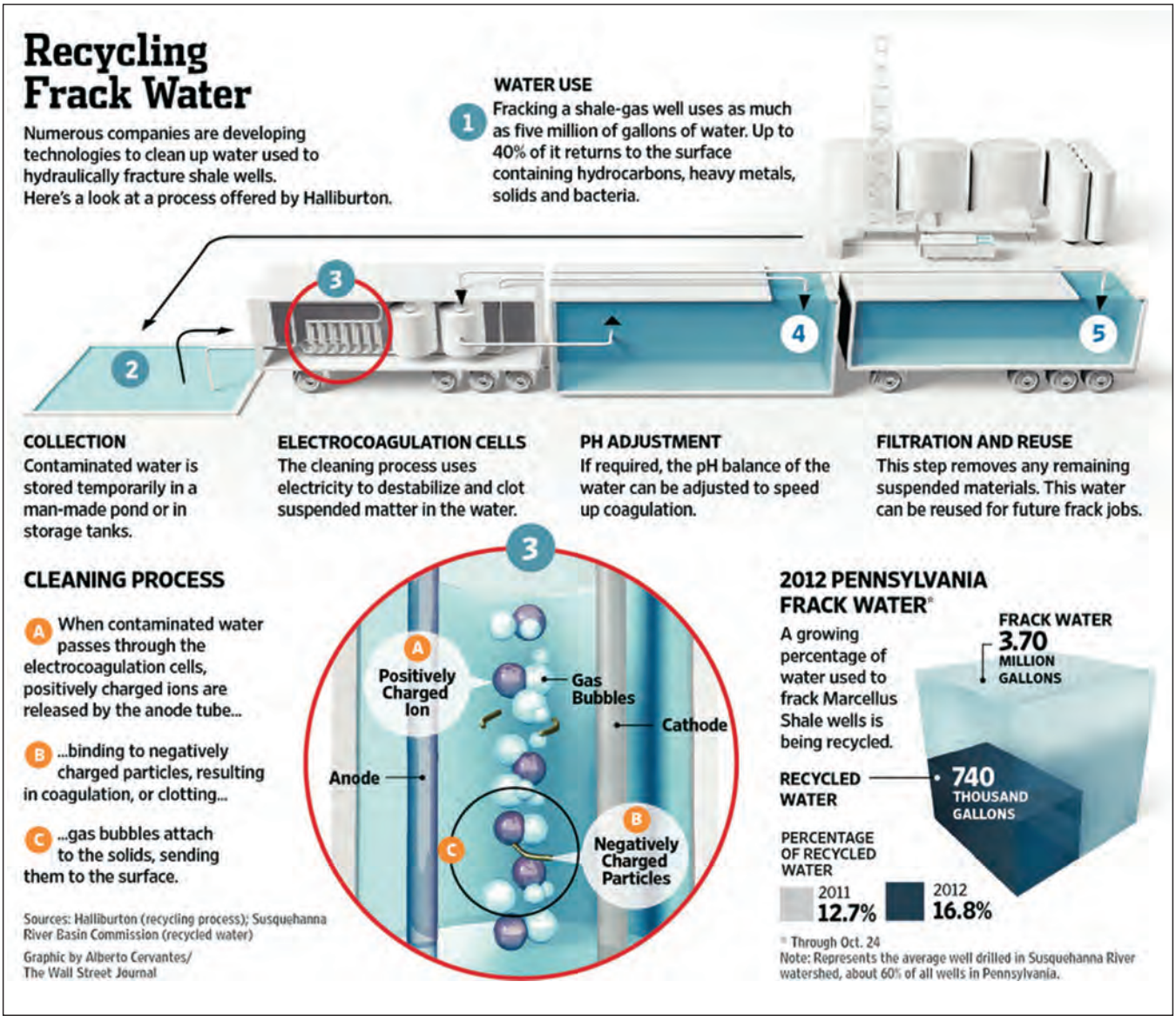
From the Editor continued from page 13

A widely cited study from the University of Texas at Austin, funded by the oil and gas industry, had predicted that hydraulic fracturing in the Eagle Ford would use a maximum of around 35,000 acre-feet of water annually. The lead author, Jean-Philippe Nicot, a research scientist at Bureau of Economic Geology, said he now thinks the actual use in the Eagle Ford is around 40,000 acre-feet annually.

Operators point out that fracturing activities consume only about one percent of all fresh water used in Texas, much less than municipal and irrigation users. While the volume of water used is small compared to statewide water use, the local affects can be magnified. The Southwest Research Institute, a non-profit, San Antonio-based research and development organization, estimated that the cumulative water use for hydraulic fracturing can be equal to approximately half the regional annual recharge in normal years to the Carrizo-Wilcox Aquifer, a major groundwater source for parts of the state.

This other water source might be the 2.7 billion acre-feet of brackish groundwater that lies beneath Texas.

This increasing consumption of fresh water for fracturing operations has caused concerns for some local water users in south Texas. Hugh Fitzsimmons, the owner of a large ranching property in Dimmit County 100 miles southwest of San Antonio and a board member of the Wintergarden Groundwater Conservation District is worried about use of the groundwater that often serves as the primary supply in the sparsely populated county. In 2009, there were just 107 oil and gas wells in Dimmit County. By 2012,

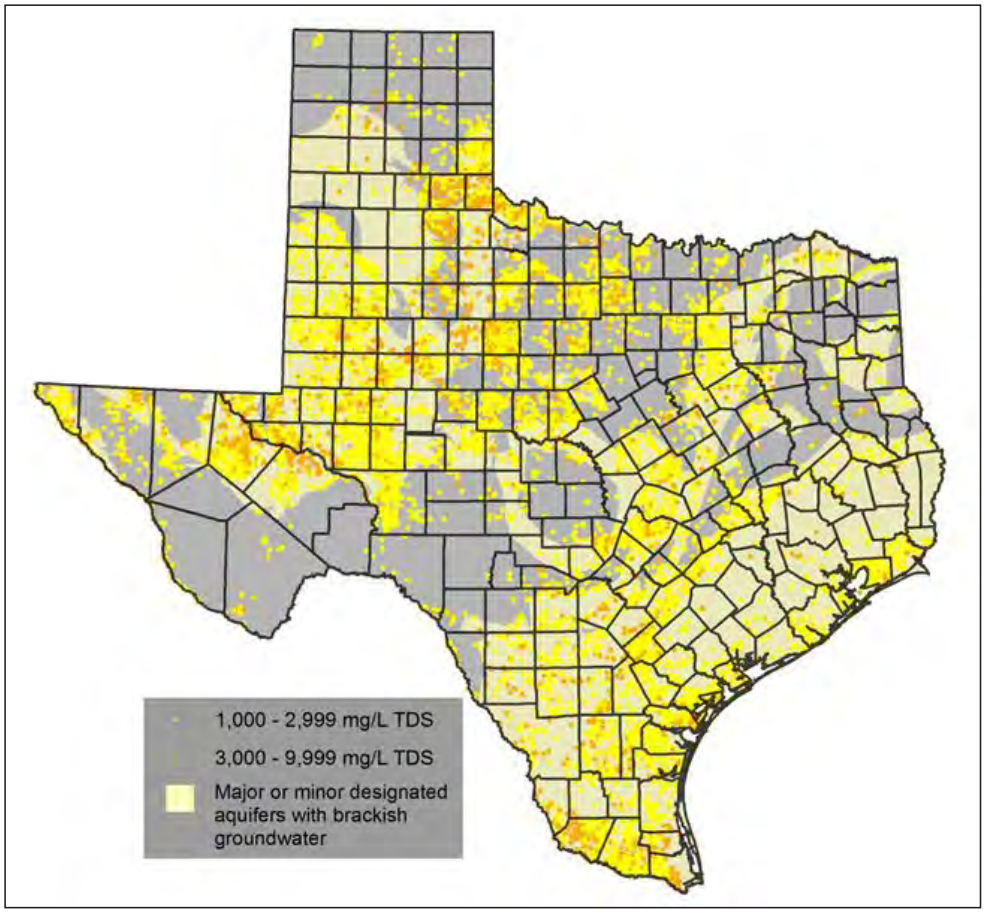


there were 2,137. "It is not the process that I object to," said Mr. Fitzsimmons in a September 2013 article in *Time Magazine* by Hilary Hylton, "but it's all the ancillary issues that come with it. Air quality declines as some wells flare off gases, and heavyweight rigs and water-hauling trucks destroy back-country roads. But most of all, locals want the frackers to use less water."

In a May 2013 column titled "Don't mess with Texas water, frackers warned," John Kemp a Reuters market analyst states that, "the real problem is not water supplies but their management." He notes that the amounts of water employed in hydraulic fracturing are small relative to other uses, even in dry areas, and do not pose a serious threat to the availability of water. The potential for problems arises instead from the unusual system of water rights still employed in Texas and its relatively weak controls on groundwater use in some parts of the state.

Groundwater use in Texas is not regulated at the state level. Rather, state law allows the establishment of groundwater conservation districts which regulate groundwater use at the local or county level. In some counties, the groundwater conservation districts limit the pumping of groundwater. Some of these districts have exempted oil and gas operations from pumping limitations. Hydraulic fracturing has been granted exemptions from water-use restrictions along with traditional oil and gas drilling. But now some conservation districts are distinguishing fracturing operations from drilling and regulating the water use as a separate activity because fracturing uses up to 30 times as much water than simply drilling a well.

The Evergreen Underground Water Conservation District, encompassing all of Atascosa, Frio, Wilson, and Karnes counties, includes 2,461,000 acres or 3,845 square miles. The District's economy is heavily dependent upon agriculture and agriculture related business. Approximately 80 percent of the total groundwater pumpage in the District is used in agriculture. The District, which overlies areas of Eagle Ford Shale production has implemented groundwater use restrictions for fracturing activities since 2008. The restriction limits the pumpage of fresh groundwater and brackish groundwater based on the acreage that the owner holds.



Brackish wells in the groundwater database.
Source: Texas Water Development Board Groundwater Database. Each well has a TDS measurement within the range of brackish groundwater (1,000 to 10,000 milligrams per liter). If a well had more than one TDS measurement, the most recent measurement was used. The major or minor designated aquifers with brackish groundwater were estimated by comparing maps prepared by LBG-Guyton Associates (2003) with brackish wells.
This map was generated by the Texas Water Development Board using geographic information system software. No claims are made to the accuracy or completeness of the information shown herein or to its suitability for a particular use.

The scarcity and search for water sources in south Texas has led to a new revenue stream for some ranchers. According to a comment paper by Taelor A. Allen published in the *St. Mary's Law Journal* in January 2013 titled "The South Texas Drought and the Future of Groundwater Use for Hydraulic Fracturing in the Eagle Ford Shale," it has become common practice for many landowners to capitalize on the ability to sell water for hydraulic fracturing in a lucrative business known as 'water wildcatting.' Some landowners are receiving anywhere from ten to eighty cents per barrel of water."

From The Editor *continued on page17*

From the Editor continued from page 15

Another Water Source

A potential solution to conflict over the use of fresh water may be the use of another water source. This other water source might be the 2.7 billion acre-feet of brackish groundwater that lies beneath Texas. Brackish groundwater is currently going largely unused in Texas so its potential use would not conflict with any current users. Salts and chemicals in the brackish groundwater that are incompatible with the fracturing method can be removed by a variety of treatment methods including reverse osmosis. Halliburton, a major contractor in the hydraulic fracturing business, has a goal to reduce fresh water use by 25 percent in the United States by the end of 2014, according to industry reports. Reducing freshwater use "is no longer just an environmental issue — it has to be an issue of strategic importance," Salvador Ayala, vice president of well production services told an industry group recently, according to the *Wall Street Journal.*

A Water Substitute?

Some operators are looking for ways to reduce the volume of fresh water used in hydraulic fracturing operations and are investigating the use of alternative fluids. In a June 2013 column on the financial website *Motley Fool*, David Smith writes that operators in Tennessee are experimenting with the use of nitrogen gas for shallow fracturing operations in the gas-bearing Chattanooga Shale. The nitrogen is used with water and additives to create a foam. The foam, which is 53 to 95 percent nitrogen, has the viscosity and related properties sought by the operator. The percentage of water used in the foam is often increased for deeper fracturing targets.

David Smith reports that, according to Air Products and Chemicals, a supplier of nitrogen, the use of the gas is about 15 percent more expensive than the use of fresh water. He notes however that the difference in cost is largely offset by an 11 percent increase in the estimated ultimate recovery of natural gas. An additional benefit of the nitrogen use is the elimination of costs associated with the collection, transport, and treatment of flowback water.

The potential use of nitrogen in fracturing operations is limited by several factors. Nitrogen use is most applicable in shallow operations, typically less than 5,000 feet deep. Also nitrogen is a poor carrier of proppant, so the target formation should be brittle with natural fractures that can stay open with proppant after the pressure is reduced.

The benefits of low-water volume fracturing in times of increasing water scarcity are hardly inconsequential. For instance, whereas in recent years farmers in some parts of Colorado paid from $9 to $100 for an acre foot of water to cities with excess supplies, energy companies are now paying $1,200 to $2,900 per acre foot.

Recycling Returns

About two-thirds of the water used in a hydraulic fracturing operation remains underground after drilling. The remaining third comes back to the surface as flowback. The flowback, which contains the fracturing additives plus residual materials from the formation and dissolved hydrocarbons, is a wastewater that is typically transported offsite for treatment and disposal. Proper management of the this waste stream involves significant costs. Often this wastewater is disposed underground through an injection well. Some states, including Colorado, require recycling of all flowback water recovered at the well site. Texas has added incentives to encourage drillers to recycle, but so far has not made this a requirement.

This increase in the production of energy has led to greater prosperity for many, but has come at the cost of water availability for others.

The oil and gas industry is moving towards greater development of recycling strategies and other injection options for the flowback water, according to David Burnett, director of technology at Texas A&M's Global Petroleum Research Institute. Truck-mounted treatment and recycling units are now operating throughout south Texas. Researchers at the University of Texas at San Antonio are investigating charcoal as a potential water treatment option for the wastewater stream.

Summary

The interdependency and intricacies of the Energy-Water Nexus can lead to imbalances in the use and the availability of critical resources. The increasing application of hydraulic fracturing has led to great increases in the production of oil and gas from shale formations in many parts of the nation. This increase in the production of energy has led to greater prosperity for many, but has come at the cost of water availability for others. But the Energy-Water Nexus does not have to be a situation where one party wins and one party loses. As seen with the implementation of new strategies to reduce the use of fresh water resources in hydraulic fracturing operations, innovation and co-operative efforts can lead toward solutions that accommodate the needs and interests of all stakeholders. ■

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TECHNICAL PROGRAM

2014 Applied Geoscience Conference
Westin Memorial City, Houston, Texas

MONDAY, FEBRUARY 17, 2014

7:00 am	Registration Opens.....Fourth Floor Cedar Room
Breaks & Social Hour	**Core Display**.....Fourth Floor, Pecan and Pine Rooms
	Selected Core from Emerging and Established Unconventional Reservoirs
8:00 am - 5:00 pm	Technical Talks (Oral) Sessions.....Fourth Floor, Azalea Room
11:35 am - 1:00 pm	**Poster Sessions**.....Fourth Floor, Cypress Room
5:00 pm - 7:00 pm	Social Hour & Poster Sessions from Invited Academic Consortia

MORNING — *DAY 1*

OUTCROP TO SUBSURFACE CHARACTERIZATION / MESOZOIC — **SESSION 1**
SESSON CHAIRS: FRANK WALLES / JOHN BREYER

8:00 - 8:10	***Opening Remarks***
8:10 - 8:45	State of Stress in the Marcellus Based on Microfrac Tests ***Terry Engelder, The Pennsylvania State University***; *Thomas Johnston Yunhui Tan, and James Hnat*
8:45 - 9:20	Basin-Scale Controls on Oil Accumulations in the Niobrara Formation of the Denver-Julesburg Basin: Basement Tectonics, Stratigraphic Evolution, and Timing ***Bill Drake, Pioneer***; *Sarah J. Hawkins, and Scott G. Lapierre*
9:20 - 9:55	Integrating Chemostratigraphy, Lithostratigraphy, Biostratigraphy, and Sequence Stratigraphy of the Eagle Ford Formation ***Harry Rowe, BEG, The University of Texas at Austin***; *Stephen C. Ruppel, John Breyer, and Richard Denne*

OUTCROP TO SUBSURFACE CHARACTERIZATION / PALEOZOIC — **SESSION 2**
SESSON CHAIRS: MIKE CAMERON / ERIK KVALE

10:25 - 11:00	Regional Outcrop and Subsurface Sequence Stratigraphy, Depositional Environment, and Facies Distribution in the Middle Devonian Marcellus Formation, Central and Western Pennsylvania. ***Daniel Kohl, Chevron Appalachian/Michigan Business Unit***; *Rusty Gilbert*
11:00 - 11:35	Regional Upwelling During Late Devonian Woodford Deposition in Oklahoma and Its Influence on Hydrocarbon Production and Well Completion ***Erik Kvale, Devon Energy***; *Jamar Bynum*
11:35 - 1:00	***Lunch Provided — Third Floor***

Poster Sessions

Invited Presentations from Academic Consortia

View During
Lunch 11:35 am - 1:00 pm
Social Hour 5:00 pm - 7:00 pm

Cypress Room.....Fourth Floor

Core Display.....

Selected Core from Emerging and Established Unconventional Reservoirs Supporting the Oral Technical Presentations

Open during Coffee and Lunch Breaks

Pecan and Pine Rooms.....Fourth Floor

AFTERNOON — DAY 1

EMERGING PLAYS / MESOZOIC — SESSION 3 SESSION CHAIRS: MIKE VAN HORN / GRETCHEN GILLIS	
1:00 - 1:35	Petroleum Geochemistry of the UJ Bazhenov Shale and Corresponding Crude Oils, West Siberia, Russia ***John Zumberge, Geomark;*** *John Curtis, CSM*
1:35 - 2:10	Characterizing Unconventional Resource Potential in Colombia; a Digital Rock Physics Project ***Dr. Joel D. Walls, Ingrain***
2:10 - 2:45	Saudi Aramco's Unconventional Journey So Far ***Brian Gratto, Saudi Aramco***
2:45 - 3:15	***Coffee Break***
EMERGING PLAYS / PALEOZOIC — SESSION 4 SESSION CHAIRS: OBIE DJORDJEVIC / ROB BEFUS	
3:15 - 3:50	Wolfcamp-Cline Potential – A Detailed Evaluation of Source Rock and Crude Oil Within the Permian Basin ***Jackie Reed, Reed Geochemical Consulting****; John Zumberge, Stephen Brown*
3:50 - 4:25	The Devonian Duvernay Formation: Development and Assessment of a Hot Unconventional Play in Cold Western Canada ***Raphael Wust, Trican***
4:25 - 5:00	Controls on Mississippian Inner Ramp Heterozoan Carbonate & Biosiliceous Deposits in a Midcontinent Setting ***Dr. Evan K. Franseen, University of Kansas****; Diana Ortega-Ariza*

SOCIAL HOUR

Monday 5:00 — 7:00 PM
With Posters from Invited Academic Consortia
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http://www.hgs.org

TECHNICAL PROGRAM

2014 Applied Geoscience Conference
Westin Memorial City, Houston, Texas

TUESDAY, FEBRUARY 18, 2014

7:00 am	Registration Opens.....Fourth Floor
Breaks & Social Hour	**Core Display**.....Fourth Floor, Pecan and Pine Rooms
	Selected Core from Emerging and Established Unconventional Reservoirs
8:00 am - 5:00 pm	Technical Talks (Oral) Sessions.....Fourth Floor, Azalea Room
11:35am - 1:00 pm	**Poster Sessions**.....Fourth Floor Cypress Room
	Invited Presentations from Academic Consortia

MORNING — *DAY 2*

MUDROCK SYSTEMS CHARACTERIZATION - RESERVOIR INSIGHTS FOR INTEGRATION — *SESSION 5*

SESSION CHAIRS: L. TARAS BRYNDZIA / WAYNE CAMP

8:00 - 8:10	***Opening Remarks***
8:10 - 8:45	Early Diagenesis of Fine Grained Sediments ***J. H. MacQuaker, ExxonMobil***
8:45 - 9:20	Evolution of Pore Systems in Eagle Ford Mudstones: Influence of Texture, Diagenesis, and Thermal Maturity ***Aysen Ozkan, Shell****; Calum Macaulay, Kitty L. Milliken, Maxwell E. Pommer, Suzan M. Ergene, Daniel Minisini, James Eldrett, Steve Bergman, and Amy Kelly*
9:20 - 9:55	Total Organic Carbon Trends Within the Eagle Ford of South Texas: Sub-mesoscale Vortices and the Eddy Ocean Hypothesis ***Lowell Waite, Pioneer Natural Resources;*** *William Hay, and Paul Clarke*
9:55 - 10:25	***Coffee Break***

MUDROCK SYSTEMS CHARACTERIZATION - NEW GEOPHYSICAL INSIGHTS — *SESSION 6*

SESSION CHAIRS: BRUCE HART / PAUL COLLINS

10:25 - 11:00	Rock Physics and Seismic Data Used in Characterization of Source Rock Reservoirs ***Paul Collins & Marita Grading, Statoil****; Lars Wensaas*
11:00 - 11:35	Characterization of Hydraulic Fracture Treatments in the Barnett Shale: the Stocker Geophysical Experiment ***Anastasia Mironova, ConocoPhillips****; Baishali Roy, Changxi Zhou, Bruce Hart, and Ulrich Zimmer*
11:35 - 1:00	***Lunch Provided — Third Floor***

Poster Sessions

Invited Presentations from Academic Consortia

View During
Lunch 11:35 am - 1:00 pm

Cypress Room.....Fourth Floor

Core Display.....

Selected Core from Emerging and Established Unconventional Reservoirs Supporting the Oral Technical Presentations

Open during Coffee and Lunch Breaks

Pecan and Pine Rooms.....Fourth Floor

AFTERNOON	DAY 2
RESERVOIR CHARACTERIZATION TOWARDS OPTIMIZED STIMULATION AND PRODUCTION	**SESSION 7**
SESSION CHAIRS: RANDY LAFOLLETTE / JOEL GEVIRTZ	
1:00 - 1:35	Well Performance in Unconventional Reservoirs — Perspectives on Analysis/Interpretation, Models, and Production Forecasting ***Dilhan Ilk**, DeGolyer and MacNaughton*
1:35 - 2:10	Petrophysics and Hydrocarbon Generation, Retention and Production From Ultra-low Permeability Rocks: Learnings From the Late Cretaceous Eagleford Formation and Late Devonian Duvernay Formation ***Dr. Marc Bustin**, University of British Colombia*
2:10 - 2:45	Integrating Data to Optimize Horizontal Completions in Unconventional Reservoirs ***Brian Clark**, Schlumberger*
2:45 - 3:15	***Coffee Break***
RESERVOIR CHARACTERIZATION TOWARDS OPTIMIZED STIMULATION AND PRODUCTION	**SESSION 8**
SESSION CHAIRS: SUNIL GULRAJANI / GREG GETZ	
3:15 - 3:50	Regional PVT Consideration for Unconventional Liquid Production ***Kevin Ferworn**, GeoMark*
3:50 - 4:20	A Multi-scale Discussion on Fluid Behavior under Confinement: Can Molecules in Nano-pores Influence Recovery from the Resource Shale? ***Yucel Akkutlu**, Texas A&M University*
4:20 - 4:50	Diagnostics for evaluating production within Unconventional Laterals ***Stuart Cox**, Reservoir Engineer*

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Andy C. Clifford
President and Director
Saratoga Resources, Inc.

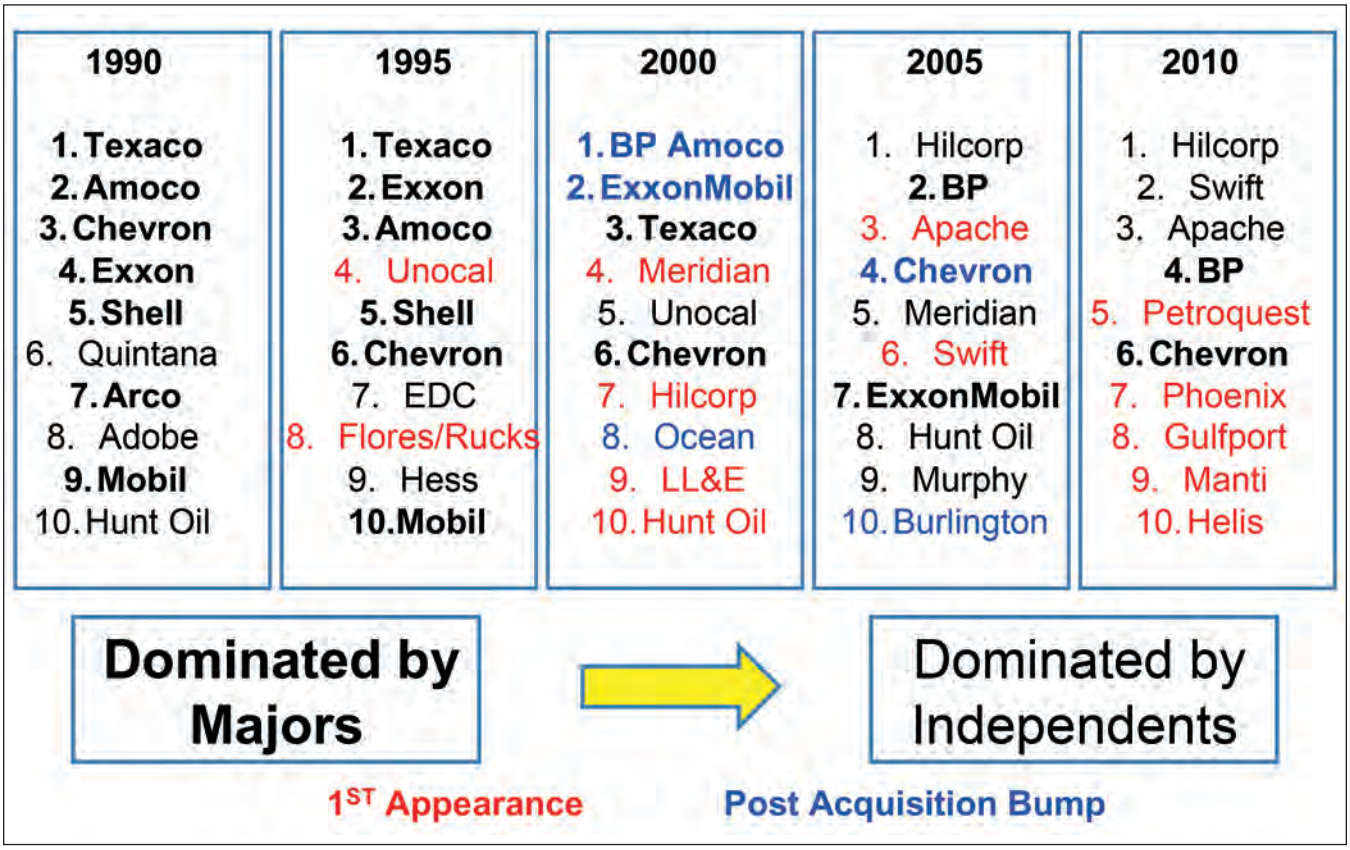
Treasures of the T-Zone: an Overview Of Louisiana's Transition Zone — Past, Present, and Future

The Transition or T-Zone is defined as an area where the water is too shallow for the acquisition of marine seismic data with towed streamers. These areas are located in shallow water near the shoreline and in marshes and lagoons where water depths are typically less than five feet. In a broader sense, the Transition Zone refers to the area of marshland and swamp that constitutes a swath of Southern Louisiana 30 to 50 miles wide, running parallel to the coastline.

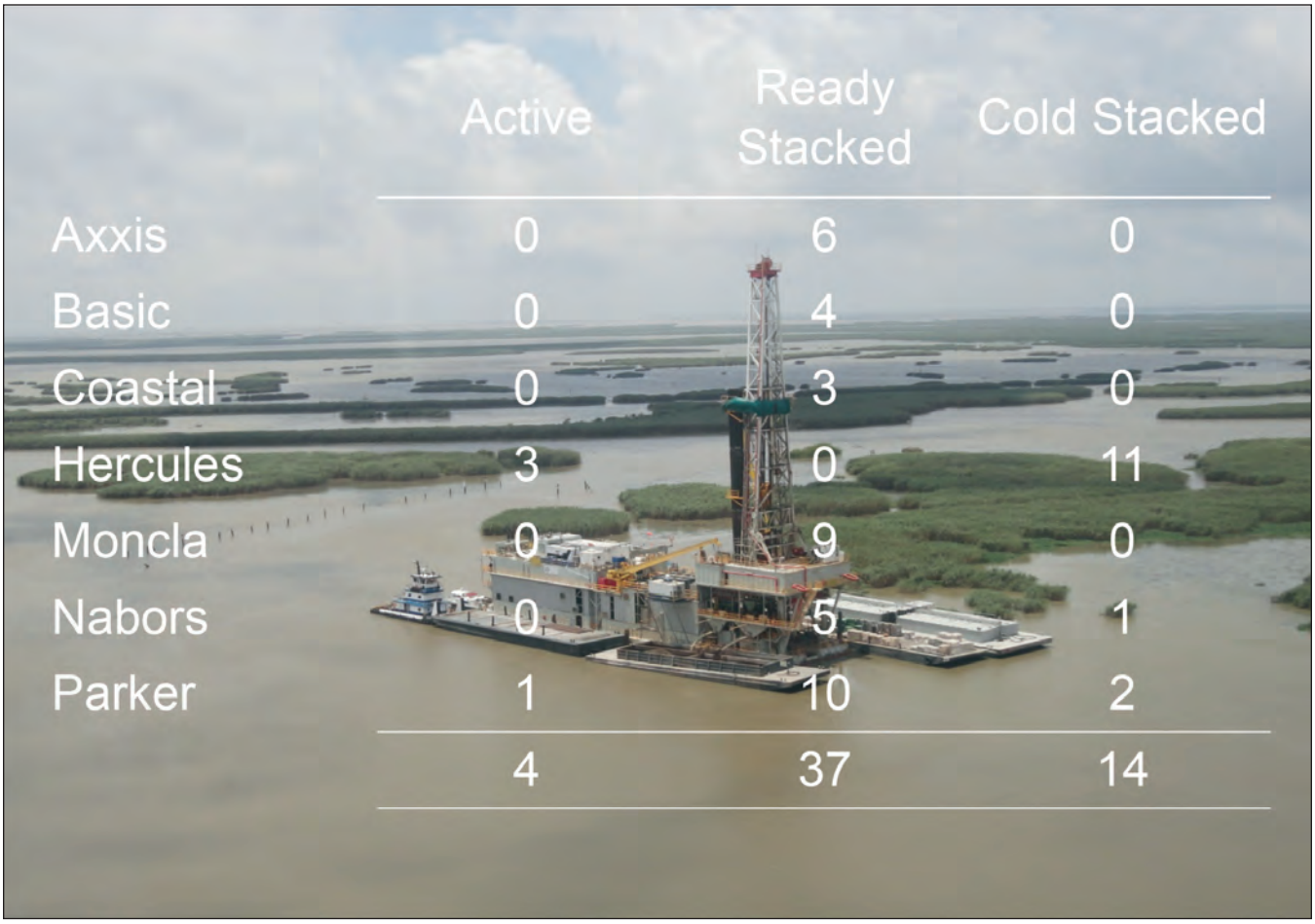
Many of the Gulf Coast's giant oil and gas discoveries have been made in the Transition Zone but the majority of these discoveries were made in the 1950s or earlier.

Many of the Gulf Coast's giant oil and gas discoveries have been made in the Transition Zone but the majority of these discoveries were made in the 1950s or earlier. Three-dimensional seismic data were notoriously of inferior quality in the Transition Zone because of the difficulties and cost of data acquisition across the land/sea interface. Additionally, data acquisition has been hindered by the presence of field facilities and infrastructure such as tank batteries, compressors, and pipelines. Because of the high cost of data acquisition, many of the earlier surveys were compromised either in terms of overall quality or due to the areally-limited extent where data were

HGS General Dinner *continued on page 27*



HGS General Dinner continued from page 25



South Louisiana barge rig inventory

collected only on the crests and immediate flanks of salt domes, with little or no three-dimensional survey coverage between known fields.

The author will show examples of some notable successes among the independents and will try to demonstrate that there is substantial untapped potential remaining in the T-Zone. This potential is not just in the "ultra-deep" plays, but also in plays at conventional depths and even in the "ultra-shallow." Trap styles, seismic data, and log data will be presented. ■

Biographical Sketch

Andy Clifford is President and Director of Saratoga Resources Inc., Houston, a small, publicly-traded independent oil and gas producer with operations focused on the inshore transition zone of Louisiana state waters. Mr. Clifford has more than 33 years of experience in domestic and international exploration, development, and production and a proven track record of exploration and acquisition success in practically every important basin in the world. He is credited with the discovery of over two billion barrels of oil equivalent in Africa, Alaska, Asia, Gulf of Mexico, Latin America, and the UK North Sea. He has worked for ExxonMobil, Kuwait Oil Company, BHP Billiton, and Aurora Gas. Prior to ExxonMobil, Mr. Clifford worked for GSI and Horizon Exploration. He has a BS in geology from London University and is a frequent speaker a and published author on geophysics as well as a variety of energy related topics.

Monday, February 24, 2014

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HGS Joint North American and International Dinner Meeting

Barry Katz
Chevron Energy Technology Company
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An Overview of Pre-Devonian Petroleum Systems – Unique Characteristics and Elevated Risks

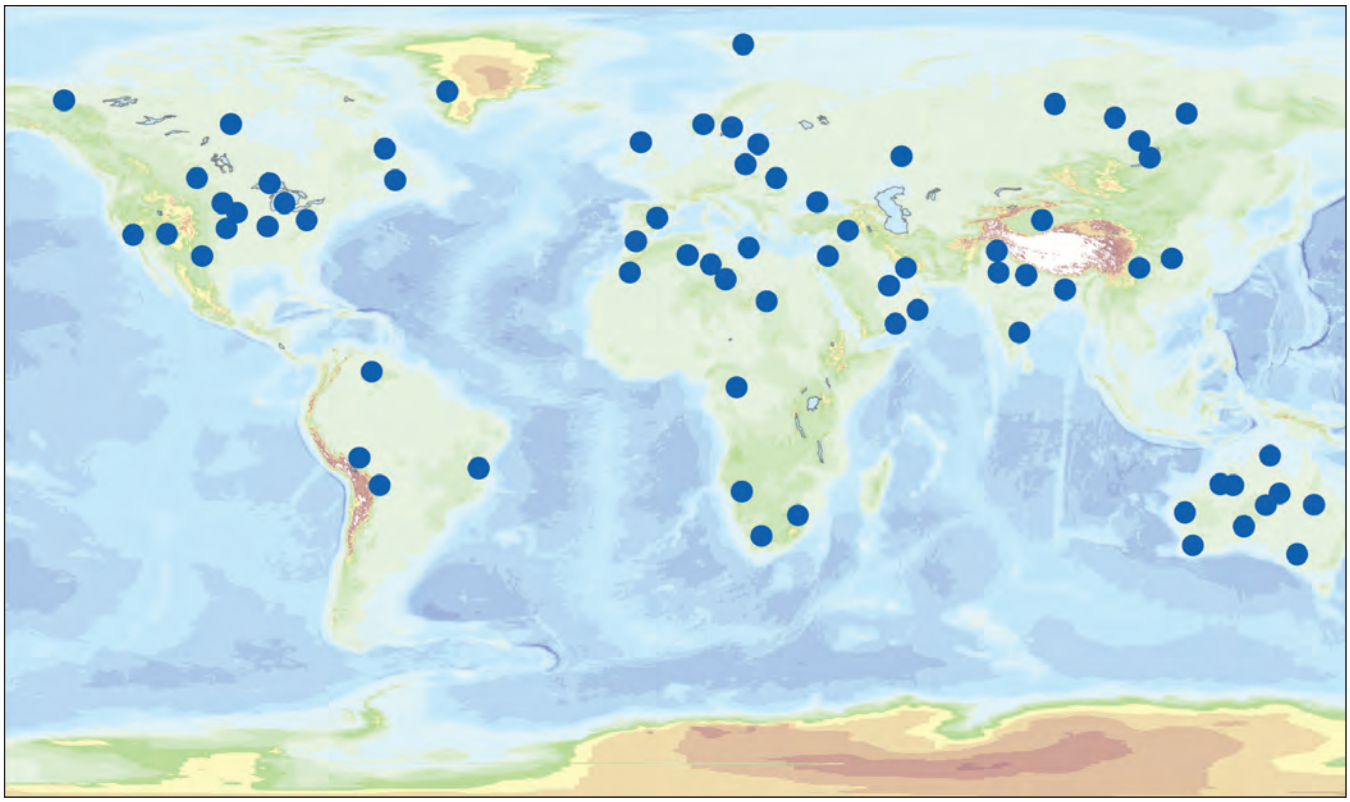

Figure 1. *Locations of Pre-Devonian Source Rocks. Potential source rocks as old as 1.69 billion years, such as the lacustrine Barney Creek Formation, have been identified in Australia. Pyrobitumens have been recovered from rocks as old as 2.7 billion years in the Witwatersrand basin (McKirdy and Imbus, 1992). Resource estimates for the Upper Proterozoic ranging from 665 to 1050 billion barrels of oil and 1236 to 2472 trillion cubic feet off gas have been published (Kontorovich et al 1991).*

Conventional hydrocarbon resources have been associated with pre-Devonian petroleum systems across the globe (**Figure 1**). These include the Neoproterozoic–Infracambrian Huqf Supergroup of the Oman basin, the Riphean - Vendian sequences of East Siberia, the Cambrian of the Sirte basin, the Ordovician of the Tarim basin, and the Silurian Qasaiba of Saudi Arabia. Although individual accumulations can be quite significant (e.g., Hassi Messaoud in Algeria has proven reserves of approximately 6.4 billion barrels), the relative importance of pre-Devonian-derived oils is limited compared to the global conventional resource-base. With growing interest in unconventional resources, the relative importance of these systems is expected to increase as plays such as the Ordovician Utica Shale of the Appalachian basin, the Cambrian of China, and the Silurian of Central and Eastern Europe develop.

The ages of these systems result in unique properties and amplify risks that may not exist in younger petroleum systems. Differences in the nature of the biomass contributing to pre-Devonian source rocks give rise to oils which may display unique geochemical characteristics. For example, there are some Precambrian oils where C_{29} steranes dominate even though land plants were absent. There are also Ordovician source rocks dominated by Gloeocapsamorpha prisca, a primitive prokaryote, which yield oils containing limited amounts of C_{20+} components and nearly lack pristane and phytane.

HGS Joint North American and International Dinner *continued on page 31*

2014 GSH-SEG SPRING SYMPOSIUM & EXHIBITION

Rock physics, well log properties, and seismic amplitudes

Fred Hilterman
Honoree

A banquet toasting and roasting Fred will be held during lunch Wednesday, 12 March

A Challenge Bowl competition will be held during lunch Tuesday, 11 March

11-12 March 2014
Westchase Hilton, Houston, Texas
Technical Program Chairman: Richard Verm
General Chairman: Phil Schultz, 1st VP

Symposium Topics

- Rock physics and seismic amplitudes
- Seismic response of fluid and solid interfaces
- Incident angles, amplitude, and phase
- Shale properties from amplitudes
- Inversion of seismic data
- Migration and anisotropic analysis for AVAZ
- Case histories and tutorials
- *Social gathering event*

Invited speakers and extended discussion

12 invited expert speakers will present topics over the two-day symposium that will expand your understanding and challenge your thinking

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Early Registration will be available starting 1 December 2013

HGS Joint North American and International Dinner *continued from page 29*

The potential for unconventional reservoirs in pre-Devonian systems may also be highly dependent upon the age of the system, as biological evolution influences the availability and nature of biogenic silica, an important factor controlling brittleness and fracability. Literature has shown that biogenic silica from different sources displays varying degrees of resistance to diagenesis, which builds the silica network and influences brittleness. For example, radiolaria developed during the Cambrian are more resistant to diagenesis than diatoms, which did not evolve until the Jurassic.

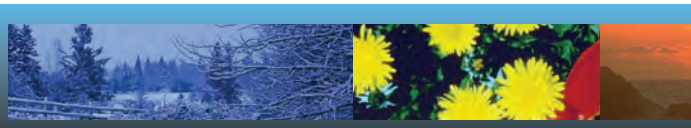
Risks associated with preservation of hydrocarbons may be amplified in pre-Devonian petroleum systems. Many such systems have been exposed to significant thermal stress resulting in cracking of oil and wet gas. Others have had complex tectonic histories potentially resulting in breaching of seals or changes in pressure-volume-temperature (PVT) conditions that may result in gas loss. Gas loss may also occur through diffusion from conventional reservoirs as a result of long residence times. ■

Biographical Sketch

Barry Katz received his B.S. in geology from Brooklyn College in 1974 and his Ph.D. from the University of Miami in 1979 in marine geology and geophysics. After receiving his doctorate, he joined Texaco's Bellaire Research Center where he held numerous technical and supervisory positions. He continued with Chevron after the merger in 2001, where he has been part of Chevron's Energy Technology Company. He currently serves as a team leader for hydrocarbon charge. His work has focused on the applications of geochemistry. He has been engaged in both research and technical support activities and has worked in approximately 50 basins onshore and offshore on six continents.

Dr. Katz has authored more than 75 papers and has edited five books. He serves as editor and reviewer for 10 journals, including editor-in-chief of the *Open Geology Journal,* and as a senior associate editor of the *AAPG Bulletin.* He has been chairman of International Ocean Discovery Program's (IODP) Environmental Protection and Safety Panel for the past decade. His honors include being named a Chevron Fellow and being named an Honorary AAPG Member. He served as Elected Editor for Houston Geological Society and currently serves as President of the Houston Geological Society.

February 2014



Sunday	Monday	Tuesday	Wednesday
	Reservations: The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476. **Reservations for HGS meetings must be made or cancelled by the date shown on the HGS Website calendar, normally that is 24 hours before hand or on the last business day before the event.** If you make your reservation on the Website or by email, an email confirmation will be sent to you. If you do not receive a confirmation, check with the Webmaster@hgs.org. Once the meals are ordered and name tags and lists are prepared, no more reservations can be added even if they are sent. **No-shows will be billed.**		
2	3	4	5 **HGS Environmental & Engineering Dinner Meeting** *"Ethics and the Environmental and Engineering Geoscientist"*
9	10 **HGS General Dinner Meeting** *"Treasures Of The T-Zone – An Overview of Louisiana's Transition Zone, Past, Present and Future," Andy C. Clifford, Saratoga Resources, Inc.* *Page 25*	11 **HGS Board Meeting** *6 p.m.*	12
16	17 **HGS Applied Geoscience Conference** *Integrated Approaches of Unconventional Reservoir Assessment and Optimization* *Houston, TX* *Page 19*	18	19 **55th Anniversary Science Engineering Fair of Houston** *George R. Brown Convention Center*
23	24 **HGS Joint North American and International Dinner** *"An Overview of Pre-Devonian Petroleum Systems -- Unique Characteristics and Elevated Risks," Barry Katz, Chevron Energy Technology Company* *Page 29*	25	26 **HGS General Luncheon Meeting** *Tentative*

GeoEvents

Thursday	Friday	Saturday
	You can make your reservations NOW online at ww.hgs.org	1
6	7	8
13	14	15 **10th North American Paleontological Convention** *Gainesville, FL*
20	21	22
27	28	**Members Pre-registered Prices:** General Dinner Meeting..... $30 Nonmembers & walk-ups..... $35 Env. & Eng. ..... $30 Luncheon Meeting ..... $30 Nonmembers & walk-ups ..... $35 International Explorationists ..... $30 North American Explorationists $30

February 10-12, 2014
Arctic Technology Conference
Houston, TX

February 24-25, 2014
SPE/EAGE European Unconventional Resources Conference and Exhibition
Vienna, Austria

March 22-23, 2014
Natural Gas Hydrate Systems — Occurrence and Dynamic Behavior
Gordon Research Seminar, Galveston, TX

April 6-9, 2014
AAPG Annual Convention & Exhibition
Houston, TX

April 8, 2014
HGS Night at the Houston Museum of Natural Science
Houston, Texas

April 16-17
AIPG 5th Annual Symposium: *Marcellus, Utica, and Point Pleasant Shale: Energy Development and Enhancement*
Columbus, OH

May 5 –8, 2014
2014 Offshore Technology Conference
Houston, Texas

May 12-16, 2013
GeoConvention 2014: Focus Calgary
Alberta, Canada

June 9-14
Society of Independent Professional Earth Scientists (SIPES) Annual Meeting
New Orleans, LA

June 15-23
HGS Grand Canyon Field Trip

HGS to Host April 8th Tuesday Night at the HMNS Paleontology Museum Social Event at the AAPG Convention

by Linda Sternbach

Dr Robert T Bakker, HMNS Curator of Paleontology

Inside the Morian Hall of Paleontology

Geoscientists who love fossil dinosaurs, reptiles, and mammals will want to attend a special social event on Tuesday evening, April 8, 2014 during the 2014 AAPG Annual Convention in Houston, Texas. The HGS "Night at the Paleontology Museum" will be held at the Museum of Natural Science from 6:30 PM to 10:30 PM. Participants can register for the HGS social event on the same webpage that they use to register for the AAPG 2014 ACE conference http://www.aapg.org/houston2014. Click on "Tuesday Night at the Paleontology Museum" to add tickets for AAPG attendees, spouses, and friends. Students get a special discount. Prices are $65 for adults and $35 for students. The price includes bus transportation or parking, buffet steak dinner, tours of the fossil exhibits, and special guest lecture by Dr. Robert T. Bakker, HMNS curator and famous author. No tickets will be sold at the door for this event.

Registering through the 2014 AAPG Convention page will generate tickets to be picked up with the registration packet at the convention check-in. The event price includes bus transportation from the George R Brown Convention Center starting at 6:00 PM and back to the convention center after 10:30 PM. Attendees not using the bus service may drive personal cars to the Museum parking garage for free parking at the event.

Organization of the Social Night

The Houston Museum of Natural Science opened the new Morian Hall of Paleontology in June 2012, a major expansion of the fossil collection that now includes an entire building of mounted dinosaurs and other fossils. There are more than 60 new major mounts featuring more than 30 dinosaurs as well as large mammals — all in "action" poses. You can see a real Tyrannosaurus rex featuring the best preserved and most complete fossil hands and feet of any specimen ever found, as well as patches of original skin — which has never previously been discovered.

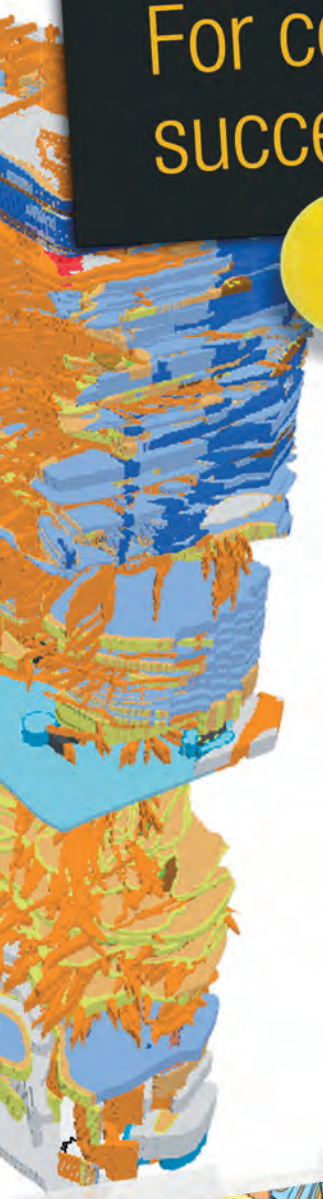
Dr. Robert T. Bakker HMNS curator and designer of the paleontology hall will be the guest speaker in the IMAX theatre at 8 PM during the Night at the Museum. His talk will be after the dinner, which will be served among the dinosaur exhibits. Dr. Bakker is a world-renowned paleontologist, one of the first to discover that some dinosaurs had feathers. Dr. Bakker has changed the perception of dinosaurs from slow-moving, slow-witted, cold-blooded creatures to, in at least some cases, warm-blooded giants well equipped to dominate the Earth for 200 million years. Dr Bakker is a fascinating and entertaining speaker, as well as an author and gifted artist.

The HGS organizing committee includes **Charles** and **Linda Sternbach**, **Neal** and **Inda Immega** (docents at the museum), **Dawne Jordan**, and **John Adamick** (scholarship sponsor). Special thanks to AAPG 2014 General Chair **Steve Brachman**, and past HGS President **Martin Cassidy** for their advice. Any volunteers who would like to assist at the April 8 event should contact linda.sternbach@gmail.com. We need onsite people for collecting tickets and to coordinate tours during the event.

HGS to Host Tuesday Night at the HMNS Paleontology Museum

continued on page 37

For comprehensive and successful exploration...



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HGS to Host Tuesday Night at the HMNS Paleontology Museum continued from page 35

Dr Neal Immega gives a guided tour

T Rex

Triceratops

A generous sponsor came forward to donate a significant gift to support the social event. Rusty Walter, of Walter Oil and Gas, donated $25,000 to enable the Night at the Museum Event to reduce attendee fees. Mr. Walter was also responsible for funding the creation of the "Paula and Rusty Walter Mesozoic Gallery" inside the Paleontology Hall that includes some of the most impressive dinosaur fossils found in any museum.

WALTER OIL & GAS CORPORATION

TGS Nopec executive John Adamick is coordinating additional fund raising to support the HGS Undergraduate student scholarship. TGS will be donating money to add to existing HGS student scholarships using this special event as a backdrop. This April 8 Night at the Museum is expected to add significant money to the HGS student scholarship funds which will be distributed as undergraduate and graduate cash awards for university geoscience research.

From Micro- to Macro-scale: a Geomechanics Summit for Unconventional Reservoirs

by Gang Han, Lansing Taylor, Sandra Babcock

On November 4-5, 2013, HGS held an applied geoscience conference featuring interdisciplinary micro- to macro-scale Geomechanics. The event was co-hosted by the American Rock Mechanics Association (ARMA) and attracted more than 250 geologists, geophysicists, and engineers. There were seventeen invited talks from operators, service providers, and academia all on the theme of how Geomechanics can help to optimize completions and improve production from unconventional reservoirs. There were also four panel discussions which drew a high level of audience participation, illustrating the relevant and timely nature of the subject matter. Based on the success of this year's event, HGS has added an annual Geomechanics conference to its applied geoscience conference series. Planning is already underway for the next Geomechanics conference scheduled for May 2015.

Figure 1. *Speaker Laurent Maerten of Schlumberger discussed forward modeling in the session chaired by Heather Davey and Lans Taylor.*

The discipline of Geomechanics, or Rock Mechanics, describes the deformation of rock in response to physical loading. Of particular interest are changes in porosity and permeability that occur when stress or fluid pressure changes in the subsurface. Deformation also produces anisotropic fabrics such as fractures which can form as rock experiences strain. These types of changes occur naturally over geologic time and are induced during well completion. Geomechanics comes into play at various length scales too, from the grain-scale through core, well, reservoir, basin, all the way to tectonic plates and mantle plumes, as pointed out by Dr. Lansing Taylor, opening speaker and co-chair of the conference. As unconventional plays have taken center stage in the past a few years, the interdisciplinary nature of geomechanics has become evident. Through four technical sessions, this meeting clearly demonstrated how geomechanics is closely allied with geology, geophysics, petrophysics, microseismic, and engineering.

- Geologists apply principles of geomechanics to characterize natural fractures because it is widely believed that fractures play a critical role in successfully developing unconventional resources. Different methods to characterize these such as the integration of logs, cores, seismic data, drilling records, and tectonic history were presented by Dr. Mohammed Ameen of Saudi Aramco. A forward model with 3D boundary elements and a Monte Carlo simulation technique were presented by Dr. Laurent Maerten of Schlumberger (**Figure 1**).

- Petrophysicists appreciate the integration of geomechanics to characterize shale and identify production potential. Shales are notoriously heterogeneous. Understanding heterogeneity is fundamental for understanding unconventional reservoirs, as stated by Roberto Suarez-Rivera from TerraTek. Shale properties can be strongly influenced by water saturation (David Dewhurst of CSIRO) and kerogen effect (Younane Abousleiman of the University of Oklahoma). Quantifying the heterogeneity requires a robust rock physics model defined not only by the rock itself but also by natural fractures and in-situ stresses (Colin Sayers of Schlumberger).

- Microseismic activities are probably the most direct evidence of the rocks' response to induced hydraulic fracturing. Even though there are challenges to translating microseismic events into a stimulated reservoir volume (SRV), diligent efforts have been made that reveal many mysteries of what is recorded in the events (Dave Eaton from the University of Calgary) and what can be interpreted from them (Michael Thorton of MicroSeismic Inc). Geomechanical models extend the promise further and leverage the microseismic recordings to calibrate coupled fluid-stress reservoir models (Tony Settari of Taurus Reservoir Solutions and Neal Nagel of Itasca Houston).

From Micro- to Macro-scale: a Geomechanics Summit *continued on page 41*

 continued from page 39

Figure 2. *Panel discussions followed by Session 2 presentations. From the left: Drs. Colin Sayers and Roberto Suarez-Rivera of Schlumberger, Dave Dewhurst of CSIRO, Amy Fox of Canadian Discovery (session chair), Mark Zoback of Stanford University, Younane Abousleiman of the University of Oklahoma, Gang Han of Aramco Services Company (session chair).*

- Completion and production engineers incorporate geomechanics to optimize fracture stages and efficiency, as showcased in the Eagle Ford Formation by Jeff Rutledge from Marathon Oil. Mike Vincent discussed evidence indicating that hydraulic fractures can lose their conductivity over time and that refracturing optimization could be as important to EUR as the original fracturing operation.

In addition to the technical sessions, Prof. Mark Zoback from Stanford University gave a keynote address, "The Geomechanics of Shale Gas Reservoirs: From NanoScale to Reservoir Scale." Dr. Zoback shared the results of several research projects investigating how rock properties, natural fractures, and the state of stress affect the success of hydraulic fracturing operations.

To encourage knowledge sharing, each session was followed by a one hour long open floor discussion. **Figure 2** shows the panel from the Petrophysics session interacting with the audience. As with any good discussion, there were respectful disagreements reflecting the complex nature of unconventional plays and highlighting the importance of continuing our multi-disciplinary interrogation of these systems.

Another highlight of the conference was the student poster competition. Graduate students from eight universities, including MIT, University of Massachusetts, Rice University, University of Houston, University of Wyoming, Colorado School of Mines, University of Alberta, and University of Utah, showcased their research results at the meeting. Alireza Ashrafi Moghadam of the University of Alberta received the Best Poster award for his work, "Analytical Study of Gas Slippage" (**Figure 3**).

As the first major geomechanics event for unconventional reservoirs in Houston, the meeting featured speakers from across the US, Canada, Australia, and France; and participants came from as far away as Germany and South Africa. The success of the meeting had a lot to do with a year-long effort by the organizing committee and HGS staff. This enthusiastic group of more than thirty members was led with boundless energy by Heather Davey from Wintershall. "What an awesome event!" said organizer **Dr. Frank Walles** from Talisman USA. "Our HGS office team of **Sandra Babcock, Nina Hoeny, Troy Fearnow,** and **Jill Kimble** is extraordinary and amazing." With such a dedicated and professional team, the planning for next year's geomechanics event is already under way. Stay tuned… ■

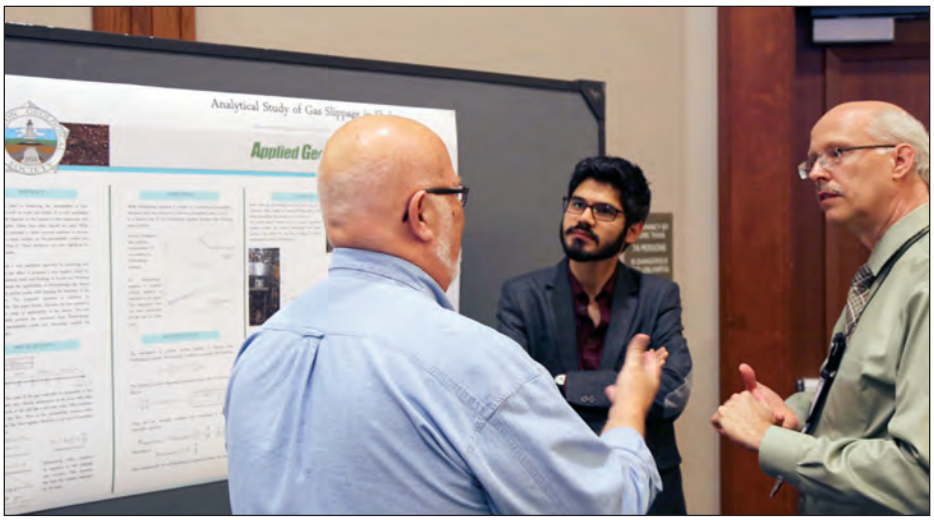

Figure 3. *The best poster award winner, Alireza Ashrafi Moghadam of the University of Alberta, discussed his research with industry veterans at the student poster contest.*

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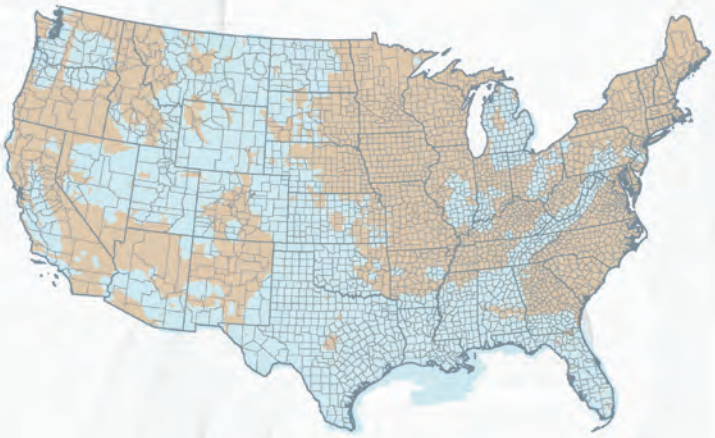
Onshore US gravity and magnetic data

Gravity Data *Getech data (light blue), Public infill data (tan)*



Cost effective evaluation of prospective targets

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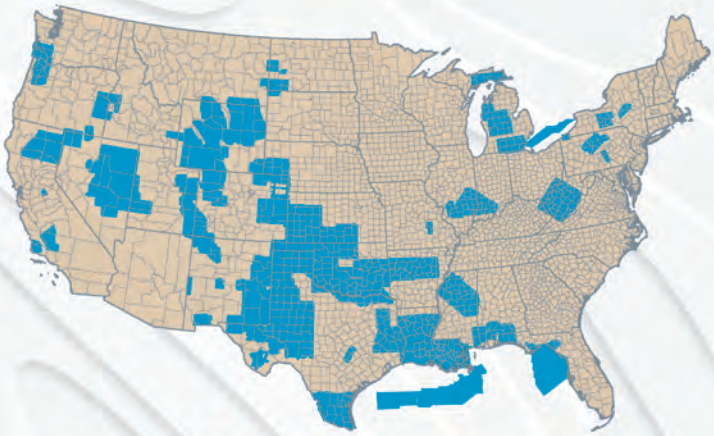
Magnetic Data *Getech data (dark blue), Reprocessed public data (tan)*



Map structures and basement architecture

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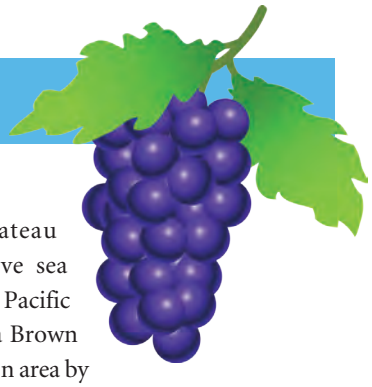
Vintage Geology

by Michael F. Forlenza, P.G.

A Tasting of Geologically-Themed Wines



Zinfandel 2011
Calcareous Vineyard
Paso Robles, California
www.calcareous.com

15.9% alcohol
$29.88 retail

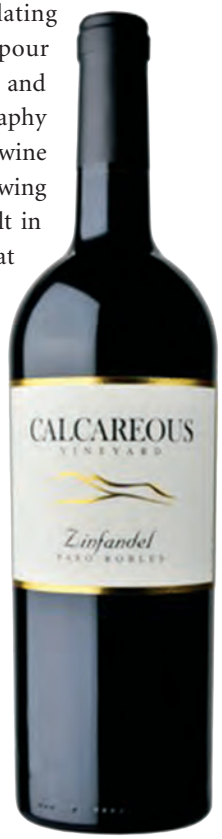
"Let the soil speak," the label declares. The winemaker's objective at the Calcareous Vineyard is to allow the character of the Earth to find expression through the crafting of wines that have a sense of place. That place is along Peachy Canyon in the hills west of Paso Robles in San Luis Obispo County, California. Peachy Canyon lies within the Paso Robles American Viticultural Area (AVA) as designated by the United States Department of the Treasury in the Code of Federal Regulations.

The Wine

This month's wine is the 2011 Zinfandel from the Calcareous Vineyard. The Zinfandel grape has been a cornerstone of the California viticulture scene since the mid-1800s. Long thought to be a grape originally from Italy, DNA testing carried out in the last 10 to 12 years has revealed that Zinfandel's original roots are traced to Croatia. The grape, also known as Primitivo, found its way to the United States in the mid-19th century, and became known by variations of the name "Zinfandel," a name of uncertain origin. The grape's high sugar content can be fermented into levels of alcohol exceeding 15 percent.

Calcareous Vineyard was founded by father and daughter Lloyd Messer and Dana Brown. While operating a beer and wine distributorship in Iowa in the early 1990s, they discovered the wines of the Paso Robles area and became early supporters of the region's winemakers. After many trips to California, they bought 342 acres of property in the hills west of Paso Robles in 1998 with the idea of creating their own wines. The winery was established in 2000. Unfortunately, Mr. Messer passed away in 2007 just as the winery building was completed. The family's ambition has been carried on by Dana Brown and her sister Erica Lloyd with winemaker Jason Joyce.

The vineyards lie on plateau approximately 1,800 feet above sea level just twelve miles from the Pacific Ocean. Lloyd Messer and Dana Brown were drawn to the Peachy Canyon area by the calcareous rock and chalky soils. Due to the unique soils in the area, they dedicated their efforts to producing high-quality, terroir-driven wines.



The richly calcareous soils, the regulating maritime influence of the fogs that pour through both the Templeton Gap valley and Salinas valley, and steep hillside topography create a spectacular setting for growing wine grapes. Long, warm days during the growing season, followed by the cool nights, result in large diurnal temperature variations that are important in producing balanced wines. The terrain, climate, and geology west of Paso Robles, the terroir, are well suited to the production of wines typical of Bordeaux, Rhone, and Burgundy varietals.

The grapes for Calcareous' Zinfandel are estate grown, meaning that the winery owns and operates the vineyards which are the source for the fruit used in during the winemaking. At Calcareous, the Zinfandel grapes are grown in a vineyard called Kate's Vineyard located ½-mile southeast of the Calcareous tasting room. The 12-acre vineyard, planted in 1988, produces a low yield of fruit with great intensity.

The Region

The Paso Robles AVA was designated in 1983 and covers 666,618 acres in the Coast Range and Central Valley of California approximately 150 miles north of Los Angeles. Approximately, 26,000 of these acres are under cultivation for wine grapes. Grapes were first introduced into the Paso Robles area in 1797 by missionaries at Mission San Miguel Arcangel, where more than one thousand vines were planted. Commercial wine growing in

Vintage Geology *continued on page 45*

PESGB

HGS - PESGB
13th Conference on African E&P
Africa: A World of Opportunities

September 9-10, 2014

The Westin Houston, Memorial City, 945 Gessner Road, Houston, Texas

Call For Papers, Posters, Sponsors and Exhibitors

In twelve years this conference has become established as a leading technical E&P forum on Africa, with attendance that can exceed 400. Participants include operators, service companies, consultants, governments and academia. The two day program of talks, technical posters and vendors' exhibits will be held on September 9-10, 2014 in Houston, Texas.

The conference, which alternates annually between London and Houston, is organized by the Houston Geological Society (HGS) and Petroleum Exploration Society of Great Britain (PESGB). The HGS-PESGB African Conference covers all aspects of African E&P, with particular emphasis on new ideas for plays and prospects, the geology of the continent and its conjugate margins, and application of emerging technologies.

Abstracts (~200 words) should be submitted as soon as possible but no later than March 15, 2014 to the technical committee, Africa2014@hgs.org. The program will be finalized by the end of April.

Currently, volunteers are being sought to be proactive Session Chairs and anyone interested should contact the Technical Committee as soon as possible.

Details of sponsorship opportunities and display booths are available from the HGS office. To become a sponsor or inquire about exhibit space, contact sandra@hgs.org

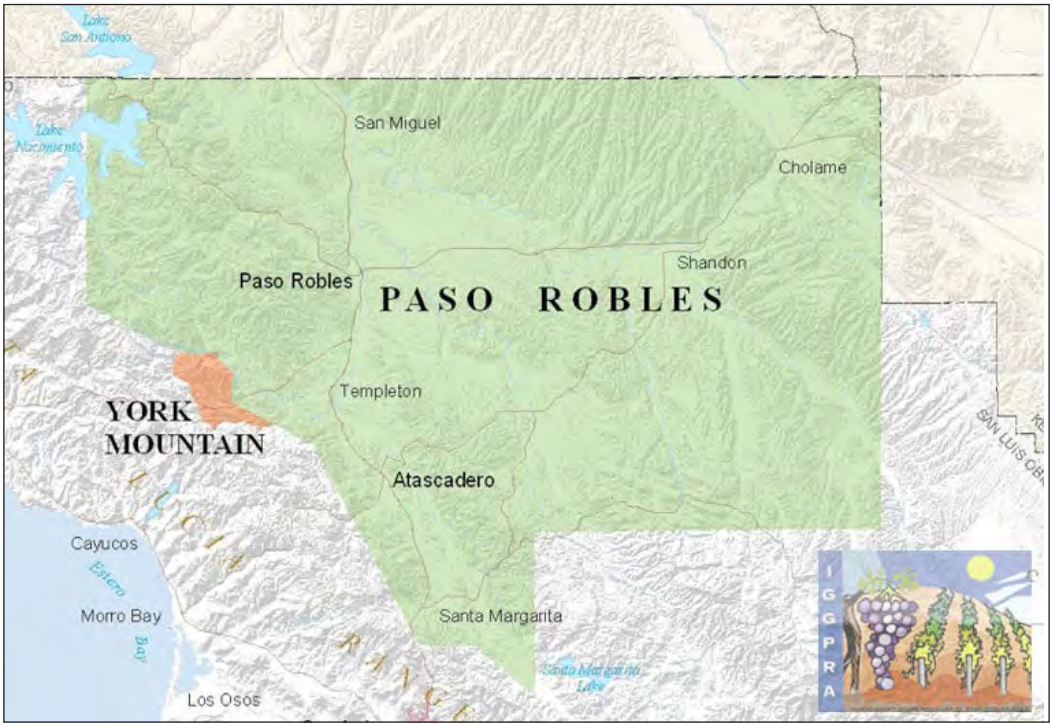
Registration will be available from April 2014and Early Bird benefits will apply for a few weeks.

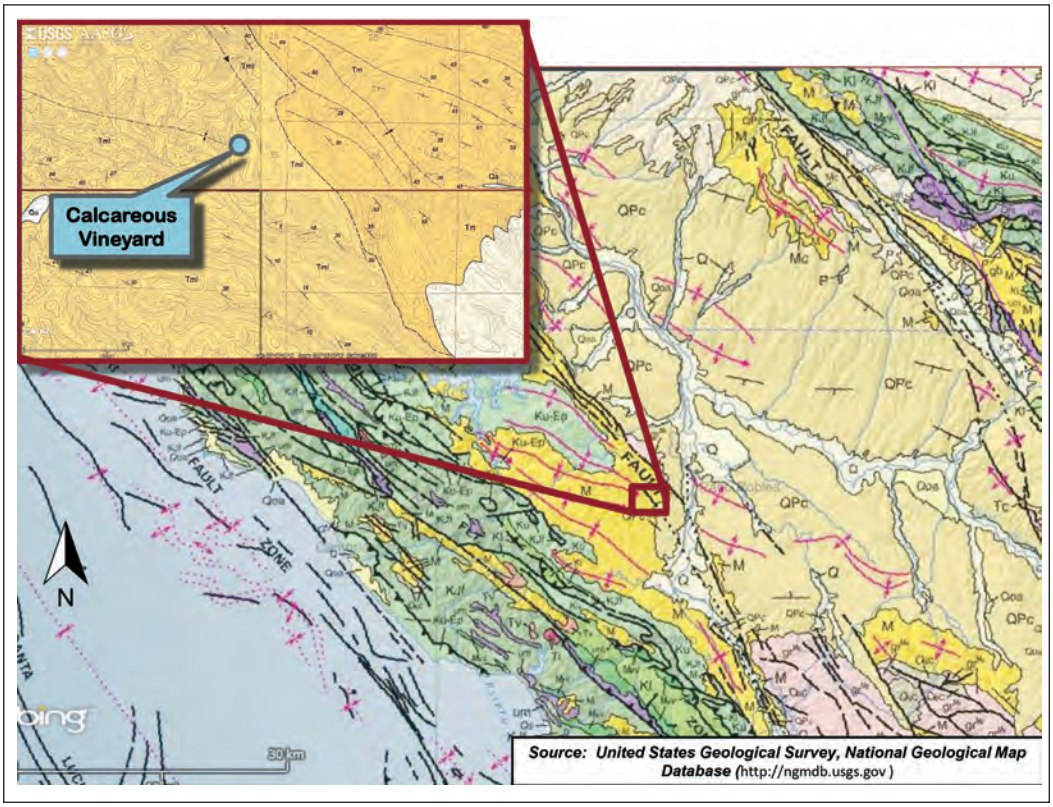
Further details will appear in the HGS and PESGB bulletins and on their websites, www.hgs.org and www.pesgb.org.uk.

Conference Committee for 2014:
Martin Cassidy (chair), Al Danforth, Ian Poyntz, Donna Davis and Sandra Babcock (HGS)
Ray Bate and Duncan Macgregor (PESGB).

Vintage Geology continued from page 43

the area started in the 1880s with the establishment of Ascension Winery, today known as York Mountain Winery, the longest continuously operating winery in the county. Since 1990, when there were fewer than 20 wineries in the Paso Robles areas, a large expansion of viticultural activity has resulted in the number of wineries rising to more than 200 today. The Paso Robles AVA is acknowledged for the use of its heritage grape, Zinfandel, but has also gained recognition for wines from a wider range of grape varietals.





Geological Setting

The term calcareous can be applied to a sediment, sedimentary rock, or soil type which is formed from, or contains a high proportion of, calcium carbonate in the form of calcite or aragonite. Limestone and calcareous rocks are rare in California. The Calcareous Vineyard lies on the lower part of the marine middle Miocene Monterey Shale, known in the region as the Sandholdt Member. The Monterey Formation is an extensive Miocene oil-rich geological sedimentary formation in California, with outcrops of the formation in parts of the Coast Ranges, Peninsular Ranges, and on some of California's off-shore islands.

According to the Geologic Map of the Adelaida Quadrangle, San Luis Obispo County, California – 2006, by T.W. Dibblee and J.A. Minch, the Sandholdt Member of the Monterey Formation is cream-white to tan shale, thinly-bedded, semi-silicious, platy, fissile and includes thin layers and nodules of light gray to yellow-tan dolomite. The rock contains locally abundant Foraminifera micro shells and fish scales. The type area for the

continued on page 47

Vintage Geology continued from page 45

dominantly calcareous beds of the Sandholdt Member is in Reliz Canyon about 50 miles to the north.

As reported in the paper "Geology of the Jolon and Williams Hill Quadrangles, Monterey County, California," a study of the stratigraphy and structure of Cenozoic sedimentary rocks in part of the Salinas Valley, United States Geological Survey, Bulletin 1181-Q, the Sandholdt Member is mainly calcareous mudstone and shale, but in some places it contains conspicuous amounts of siltstone, sandstone, porcelaneous rocks, chert, and dolomitic carbonate rock. The predominance of calcareous rocks in the member is the chief lithological distinction. The upper contact of the Sandholdt Member is conformable and gradational with the overlying upper Monterey Formation.

But how important are calcareous soils to grape growing? The bedrock types of many great wine regions of France are limestone. The calcite and related minerals in the limestone weather chemically to supply calcium ions to the soil where they are available for plant uptake. The calcium ions lower the soil acidity, raising the pH. The higher pH enhances availability of calcium, magnesium, and other nutrients. Calcium also tends to aggregate clay, that is, it allows clay minerals to combine with organic matter to form clay aggregates — clay grains stuck together in sand-size particles — allowing deeper root growth and more water retention in clay-rich soils. This structure improves permeability and enhances water holding properties.

Tasting Notes

The tasting panel enjoyed the medium to full-bodied nature of the Calcareous Zinfandel. Hearty red wines of this nature are better enjoyed during cooler weather which occurs during our brief Houston "winters." One taster noted the forward fruit flavors of raspberries and cherries. Another remarked on aromas of mocha and tobacco, as well as black pepper tastes. The wine is well structured with a nice mouth feel with a long finish. As for detecting the calcareous soils of the vineyard, one taster detected a dusty chalkiness. This wine would pair well with rich stews and roasts.

The winemaker proclaims: "The singular mix of soil, water, sun, and air in each vineyard creates individual wines as snowflakes formed in the chaos of storm clouds. That is why we here at Calcareous celebrate above all other factors, our place." The result is a bright wine with lively fruit flavors. ■

Government Update

*by **Henry M. Wise, P.G.** and **Arlin Howles, P.G.***

If you'd like the most up-to-date Texas rules, regulations, and governmental meeting information, we direct you to the HGS website to review The Wise Report. *This report, which comes out as needed but not more often than once a week, offers the most up-to-date information that may be of interest to Texas geologists.*

Texas Versus New Mexico Water Lawsuit Should Move Forward (TCEQ News Release)

On December 10, 2013 the U.S. Solicitor General's office said that the State of Texas has provided enough legal evidence at this stage to move forward with its water compact dispute case against the state of New Mexico before the U.S. Supreme Court. Earlier this year, Texas filed its original action claim against New Mexico regarding damages to Texas from New Mexico's diversions of project water below Elephant Butte that have harmed Texas' allocation in accordance with the Rio Grande Project and the 1938 Rio Grande Compact. Texas, New Mexico and Colorado each filed briefs on the case. The Supreme Court asked the U.S. Solicitor General to weigh in on the case before deciding to take the action.

The brief says in part, "The Court should grant Texas' leave to file its complaint. Texas alleges an interstate dispute of sufficient importance to warrant this Court's exercise of its original jurisdiction, and there is no other forum in which the controversy practicably can be resolved." For more information go to: http://www.tceq.texas.gov/news/releases/12-13texnewmexico.

AIPG eNews (November 26, 2013)

Greenland Ice Sheet was Smaller 3,000-5,000 Years Ago.

There have been many studies telling us how small the Greenland ice sheet is today. A new study, published in the journal *Geology*, reveals that the ice sheet was actually smaller between 3,000 and 5,000 years ago. Surprisingly, the sheet was as small during this period as it has ever been in recent history. The international research team used a new technique they developed for interpreting the Arctic fossil record. For more information go to: http://www.redorbit.com/news/science/1113011781/greenland-glacier-was-smaller-in-the-past-112313/

Sinkhole Maps Will Show State's Vulnerability

The Florida Geological Survey is building a map to show the risk of sinkholes around the state. The project is the result of what happened last year after Tropical Storm Debby.

Florida was enduring an extended drought when Debby brought record-rainfall in June of 2012. All that water weighed down the soil and loosened the dry limestone and other porous rock underneath. The result: a lot of sinkholes.

The Federal Emergency Management Agency gave state geologists a $1.1 million grant to find Florida's most vulnerable areas.

The project is "an important hazard mitigation planning tool," said Dr. Jon Arthur, Florida Geological Survey Director. "There is a national interest in our innovative approach to this project." For more information go to: http://wlrn.org/post/sinkhole-maps-will-show-states-vulnerability?utm_referrer=http%3A//m.wlrn.org/%3Futm_referrer%3Dhttps%253A%252F%252Fwww.google.com%252F%23mobile/23917

AIPG eNews (December 3, 2013)

Guadalupe Mountains Get Special Geological Designation

Guadalupe Mountains National Park has long attracted hikers for its rugged terrain, sightseers for its panoramic views, and geologists for its unique surface features. Now the land is a scientific mecca for those wishing to study the Earth's geological timeline. The International Commission on Stratigraphy (ICS) recently designated the 86,416-acre park as having the world's best example of middle Permian Period geology. For more information go to: http://www.currentargus.com/carlsbad-news/ci_24601446/guadalupe-mountains-get-special-geological-designation

South Australian government releases new geological data outlining mineral potential of the highly prospective Far North

Geological data aimed at identifying as much as $35 billion of mineral treasure in South Australia's Outback has been released. Describing it as a "game changer for exploration", SA's chief geologist Steve Hill said the data were being made freely available to companies to help target the highly prospective Far North of the state. The data covers an area larger than the size of England and focuses on a zone in the Woomera Prohibited Area which has not been properly explored and an area in the Marree region. For more information go to: http://www.theaustralian.com.au/news/south-australian-government-releases-new-geological-data-outlining-mineral-potential-of-the-highly-prospective-far-north/story-e6frg6n6-1226770477967

AGI Geoscience Policy Monthly Review (November 2013)

Simpson to Lead Energy and Water Development Subpanel

Congressman Mike Simpson (R-ID) has been appointed as

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Chairman of the House Appropriations Subcommittee on Energy and Water Development. The Subcommittee funds all functions of the U.S. Department of Energy, the US. Army Corps of Engineers, the Bureau of Reclamation, the Tennessee Valley Authority, the Nuclear Regulatory Commission, and other agencies. Simpson was formerly Chairman of the Interior and Environment Appropriations Subcommittee. He will remain a member of the Subcommittee on Interior and the Environment as well as the Subcommittee on Health and Human Services, Labor, and Education.

Calvert Leads House Appropriations Subcommittee on Interior, Environment

Congressman Ken Calvert (R-CA) has taken over from Congressman Mike Simpson (R-ID) as Chairman of the House Appropriations Subcommittee on the Interior, Environment, and Related Agencies. Calvert, whose district lies near California's San Bernardino and Angeles National Forests, has said he will focus his attention as Chairman on wildfire prevention and management, as well as loosening restrictions on energy development.

The Interior Subcommittee has jurisdiction over the Environmental Protection Agency, the Department of the Interior (excluding the Bureau of Reclamation), and the U.S. Forest Service, among other agencies. Former Interior Chairman Simpson will assume the chairmanship of the House Appropriations Subcommittee on Energy and Water Development and Related Agencies.

Legislation Loosening Hydraulic Fracturing Restrictions Passes House

On November 20, 2013 the House of Representatives passed legislation limiting federal regulations on hydraulic fracturing in states where regulations already exist. Rep. Bill Flores (R-TX) and Sen. Orrin Hatch (R-UT) released their companion bills, H.R. 2728 and S. 1743, in anticipation of new Bureau of Land Management rules further regulating hydraulic fracturing. The draft rules have received more than a million comments and would potentially require companies to disclose the chemical composition of their fracturing fluids, as well as increase standards for borehole integrity.

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Where Are You? ***by Michael F. Forlenza, P.G.***

Known as the "Land of Beautiful Horses," this eerie landscape is formed of deeply eroded Miocene/Pliocene volcanic tuff. Inhabitants often excavate their homes into the soft rock. Vertical pinnacles of eroded tuff are called "fairy chimneys."

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Proponents of H.R. 2728 and S. 1743 argue that the bills will only protect states from superfluous regulation, while allowing the federal government to impose regulations in states without existing frameworks. Opponents of the legislation argue that if approved, the bills will exempt states from other important legislation including the Endangered Species Act.

Executive Order to Prepare for Climate Change

On November 1, 2013, President Barack Obama signed an executive order, Preparing the United States for the Impacts of Climate Change. The Executive Order directs federal agencies to take steps to help local communities strengthen their resilience to extreme weather and prepare for the impacts of climate change. A Task Force on Climate Preparedness and Resilience, composed of state, local, and tribal leaders will advise the Administration on how the federal government can help communities prepare for the impacts of climate change. The order also establishes an interagency Council on Climate Preparedness and Resilience to implement federal efforts. The Executive Order builds on the Climate Action Plan issued in June 2013 by the President.

The Climate Action Plan aims to cut carbon pollution and lead international efforts to prepare for the impacts of climate change. The plan includes reducing domestic carbon dioxide emissions by 17 percent between 2005 and 2020. It also increases renewable energy production on federal lands, raises efficiency standards and prepares communities to prepare for increasing global temperatures.

Full Committee on Natural Resources Markup of H.R. 2824

The House Committee on Natural Resources met to markup the bill on Preventing Government Waste and Protecting Coal Mining Jobs in America (H.R. 2824), and other bills. Rep. Bill Johnson (R-OH) introduced H.R. 2824 on July 25, 2013 with the purpose of stopping the federal Office of Surface Mining Reclamation and Enforcement (OSM) from moving forward with its Stream Protection Rule (SPR). A majority of the Committee disapproves of SPR due to its increased regulation at mines, which is aimed to protect waterways. H.R. 2824 was adopted and favorably reported to the House of Representatives by a vote of 24 yeas and 15 nays. The bill awaits approval by the full House, Senate, and must be signed by the President before it can be enacted.

NASA and Amazon Web Services Partner to Bring Geoscience "Big Data" to the Public

NASA and Amazon Web Services (AWS) are partnering to make NASA climate and Earth science satellite data available to users via AWS cloud. This effort by NASA is in line with the Obama Administration's Open Data Executive Order. The service encompasses certain NASA satellite and global change data sets

Government Update *continued on page 55*

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AAPG | Winter Education Conference 2014

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such as temperature, precipitation, and forest cover. It will also include data processing tools from the NASA Earth Exchange (NEX), a platform that combines supercomputing, Earth system modeling, workflow management and remote-sensing data. The cloud allows researchers and educators to gain worldwide access to data sets, and information they can use independently, while reducing the time and cost associated with transferring large data sets.

Obama Expected to Designate More National Monuments

Interior Secretary Sally Jewell recommended that President Obama take executive action to create new national monuments. In the next few months, Jewell said she will be meeting with communities to locate public lands deserving of protection as national monuments. The Department of the Interior plays a role in the stewardship of 20% of the nation's lands, including national parks and national wildlife refuges.

In response to Jewell's announcement, dozens of Republican lawmakers wrote a letter to the Secretary urging for the disclosure of locations considered for national monument designations. The letter also requested that the Obama administration contact members of Congress representing the state at least 90 days prior to announcing a monument. The request comes after former President Clinton's controversial decision to designate the Grand Staircase-Escalante National Monument in Utah, putting one of the nation's largest coal reserves off limits. So far, President Obama has established nine national monuments, which were all locally supported. The president has the authority to designate national monuments without congressional approval under the Antiquities Act of 1906.

Conference Committee Established for Water Resources Bills

A House-Senate conference committee met on November 20, 2013 to begin resolving the differences between their versions of Water Resources Development Act (WRDA). The committee consists of 28 House members and 8 Senators with Sen. Barbara Boxer (D-CA)

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Imperial Barrel Award Committee

Looking for Volunteers

The HGS Imperial Barrel Award Committee is looking for people interested in becoming involved with the HGS IBA Committee. Whether you're an IBA Alum or just interested in learning more about the IBA program and HGS's involvement, please contact us at HGS.IBACommittee@gmail.com to find out more.

Candidate Search Underway

The nominations committee of the Houston Geological Society has begun its search for candidates in the two spring elections, one for delegates for the AAPG House of Delegates, of which a number of candidates are needed, and the other to elect a new HGS Board. To be considered for either of these you must be an active member of the HGS. Additionally, to run for the AAPG House of Delegates you must be a member of the AAPG.

If you are interested in running for an HGS office or for the AAPG House of Delegates, please contact Nominations Committee Chair **Martin M. Cassidy** at mcassidy.hgs@gmail.com or by phone at 713-503-8331. If you have any questions you may direct them to Martin. Information about the AAPG House of Delegates is also available from **Martha Lou Broussard** or **Bonnie Milne,** immediate past chair of the House of Delegates. Join the leadership, help guide the ship!

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as chairwoman. WRDA promotes investment in the nation's water resources infrastructure, accelerates project delivery, and reforms the implementation of Army Corps of Engineers projects. The last WRDA bill passed in 2007 and members are looking for an update. The House and Senate have each passed versions of WRDA, but differ in authorization levels.

In May, the Senate passed their version of WRDA (S. 601), which includes provisions to ensure water infrastructure projects are processed in an efficient manner. The bill also makes reforms to the US Army Corps of Engineers.

The House approved their version (H.R. 3080) in September, which authorizes 23 water resources projects that have completed the technical review by the Army Corps of Engineers, and creates a new system for future authorizations that begins with recommendations at the local level.

Conference committee members expressed optimism that they can work together to develop a bipartisan bill that will easily pass in both chambers. Sen. Boxer said they are working hard in the next couple of weeks to finish the bill and she hopes the next time they meet will to be to sign the conference report. ■

Full Color Ads Now Available!

HGS *Bulletin* Instructions to Authors

All materials are due by the 15th of the month, 6 weeks before issue publication. Abstracts should be 500 words or less; extended abstracts up to 1000 words; articles can be any length but brevity is preferred as we have a physical page limit within our current publishing contract. All submissions are subject to editorial review and revision.

Text should be submitted by email as an attached text or Word file or on a clearly labeled CD in Word format with a hardcopy printout to the Editor.

Figures, maps, diagrams, etc., should be digital files using Adobe Illustrator, Canvas or CorelDraw. Files should be saved and submitted in .ai (Adobe Illustrator) format. Send them as separate attachments via email or CD if they are larger than 1 MEG each, accompanied by figure captions that include the file name of the desired image. DO NOT EMBED them into your text document; they must be sent as separate files from the text. DO NOT USE POWERPOINT, CLIP ART or Internet images (72-DPI resolution) as these do not have adequate resolution for the printed page and cannot be accepted. All digital files must have 300-DPI resolution or greater at the approximate size the figure will be printed.

Photographs may be digital or hard copy. Hard copies must be printed on glossy paper with the author's name, photo or figure number and caption on the back. Digital files must be submitted in .tif, .jpg or .eps format with 300-DPI or greater resolution at the printing size and be accompanied by figure captions that are linked by the file name of the image. The images should be submitted as individual email attachments (if less than 1 MB) or on CD or DVD.

Advertising

The *Bulletin* is printed digitally using InDesign. Call the HGS office for availability of ad space and for digital guidelines and necessary forms or email jill@hgs.org. Advertising is accepted on a space-available basis. **Deadline for submitting material is 6 weeks prior to the first of the month in which the ad appears.**

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Application to Become a Member of the Houston Geological Society

Qualifications for Active Membership

1) Have a degree in geology or an allied geoscience from an accredited college or university; or
2) Have a degree in science or engineering from an accredited college or university and have been engaged in the professional study or practice of earth science for at least five (5) years.

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1) Be involved in the application of the earth or allied sciences.
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revised 8/6/10

Houston Petroleum Auxiliary Council News

Edie Bishop, *HGS Liaison* 713-467-8706 or ewbishop@bishorb.com

The winter holidays are now over along with all the bowl games. Some games made us proud alumni and others left us a little disappointed. **Martha Lou Broussard** and **Linnie Edwards** lifted members' spirits at the end of January with a wonderful HPAC Exploring Houston Winter Tour to the Houston Museum of Natural Science for a viewing of the special exhibit of the Cave Paintings of Lascaux. The caves have been dubbed the "Sistine Chapel of Prehistory."

Discovered on September 12, 1940, the caves had more than one million visitors until 1963 when they were closed to protect and preserve this major site of archeological prehistoric art. Thus, even though we are unable to visit the actual site, lucky attendees were able to view five exact replicas of the paintings. These paintings are set in the Nave and the Well Scene in an atmosphere of silence and lamplight to remind one of the origins of humanity. There was some talk of members getting to meet with a Cro-Magnon family! If you missed this tour, all is not lost. The exhibit continues at the museum until March 23rd though it's not as much fun as with Martha Lou's group!

Daisy Wood will set stage for HPAC'ers to get in the mood for Valentine's Day by hosting our annual Game Day on February 12th at the Braeburn Country Club. Daisy is continually evolving this event to the delight of everyone. A recent addition is the performance of Beverly Smolenski on the piano during lunch.

Of course, the main event is the participation in one of the numerous games offered. If you are a bridge player, you might elect to play at your own table of friends. If you wish to meet new friends, let Daisy know and she will have you join a group of delightful individuals in progressive bridge. Beyond just bridge, the games being enjoyed include kings in the corner, chicken foot, and a table of mahjong has been known to appear. This is a wonderful time with a great lunch and loads of door prizes. Guests are welcome – just give Daisy a call at 832-581-3231 and don't miss the fun!

Friends since the heyday of exploration in Libya: Marge Shea, Daisy Wood and Tad Shea enjoy sharing their adventures with Dick Bishop at the Winter luncheon.

Camille Amarouso at the Winter Luncheon

A special thanks is extended to Game Day Chairs **Daisy Wood** and **Norma Roady** along with their committee **Linnie Edwards, Suzanne Howell, Lois Matuszak, Millie Tonn**, and **Cherry Yvette** for their contributions of their time and talents.

The Book Club is enjoying a very successful year due in large part to the Chairs **Phyllis Carter** and **Anita Weiner**'s careful planning and selection of excellent books. The next meeting will be on February 3rd at the home of **Kathi Hilterman** where **Cathy Gerztenhorn** will lead the discussion of the historical novel "Trapeze" by Simon Mawer. The *Washington Post* describes the book moving swiftly from Marian Sutro's recruitment as an undercover operative during World War II through her training and her dangerous mission in France to a cliffhanging climax in a train station that ought to have a neon sign flashing "Sequel This Way." Mr. Mawer is an interesting person himself, a Brit who lives in Italy but writes of France! As expected from an author on the Booker Mann shortlist, this is a wonderful book selected by Phyllis and Anita. Thank you!

An appreciation is extended to all our special interest groups leaders: *Bridge:* **Audrey Tompkins**, 713-868-0005 or **Daisy Wood,** 832-581-3231, *Book Club*: **Phyllis Carter**, 281-397-9888 or A**nita Weiner**, 713-572-9874, and *HPAC Exploring Houston*: **Martha Lou Broussard**, 713-665-4428 or **Linnie Edwards**, 713-785-7115. Spouses and guests are also always welcome and encouraged to attend all events.

Geologists, please encourage your spouses to join HPAC, where they will have an opportunity to meet other spouses of geologists, geophysicists, engineers, and landmen. They will participate in informative and entertaining programs, delicious lunches and welcoming fellowship. The HPAC membership form is included in the HGS *Bulletin*. Contact **Edie Bishop** at 713-467-8707 or ewbishop@bishorb.com for more information. ■

You are invited to become a member of

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