HGS Bulletin
Houston Geological Society
Volume 57, Number 7
March 2015

The Brazilian Equatorial Transform Margin: A Snapshot in Time of an Oblique Rifted Margin

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New Plays and New Players Bring New Life to the Gulf of Mexico Shelf

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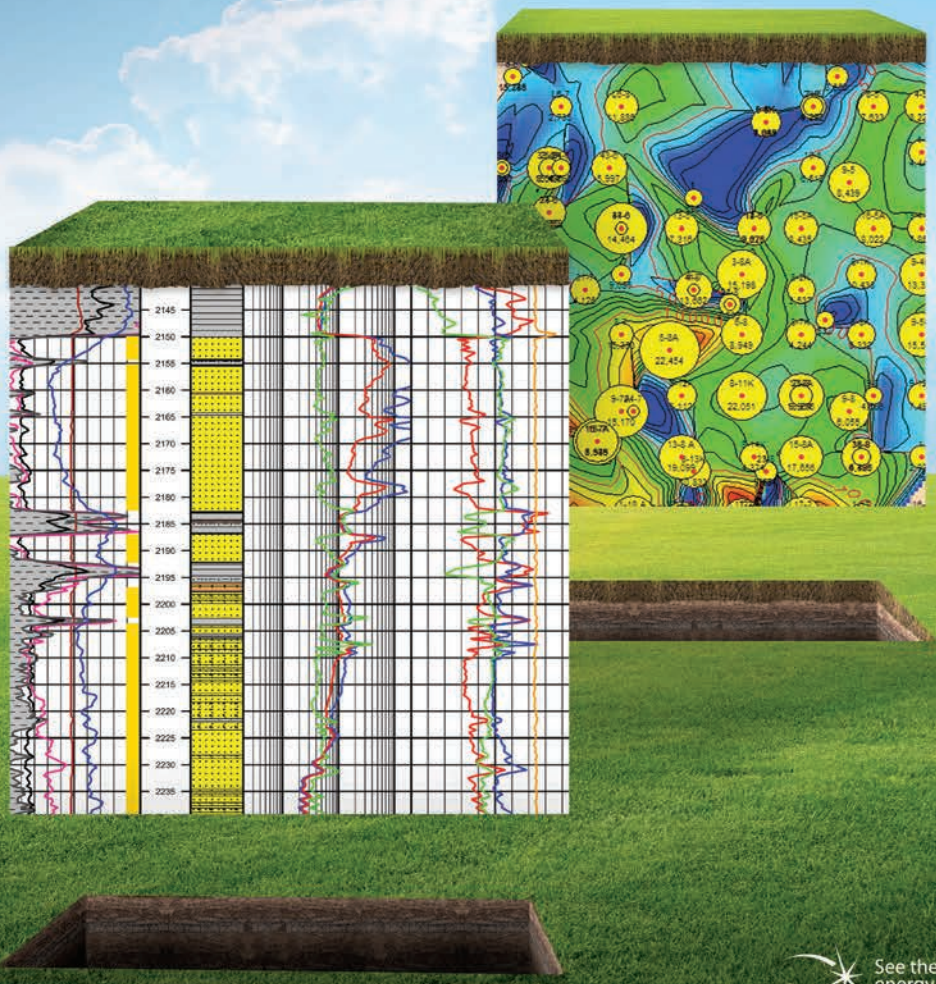

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Houston Geological Society

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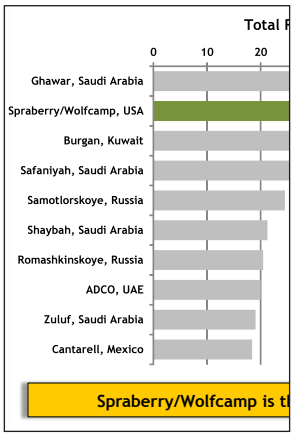

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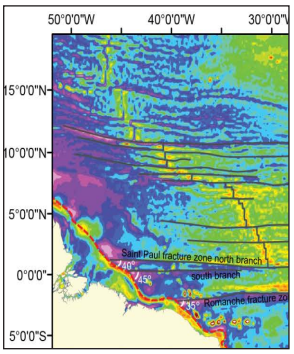

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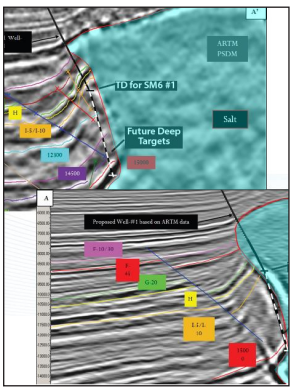

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About the Cover: Limestone terraces in Shete Boka National Park along the northern coast of Curaçao. Photo courtesy of Susan Miller.

GIS PAX

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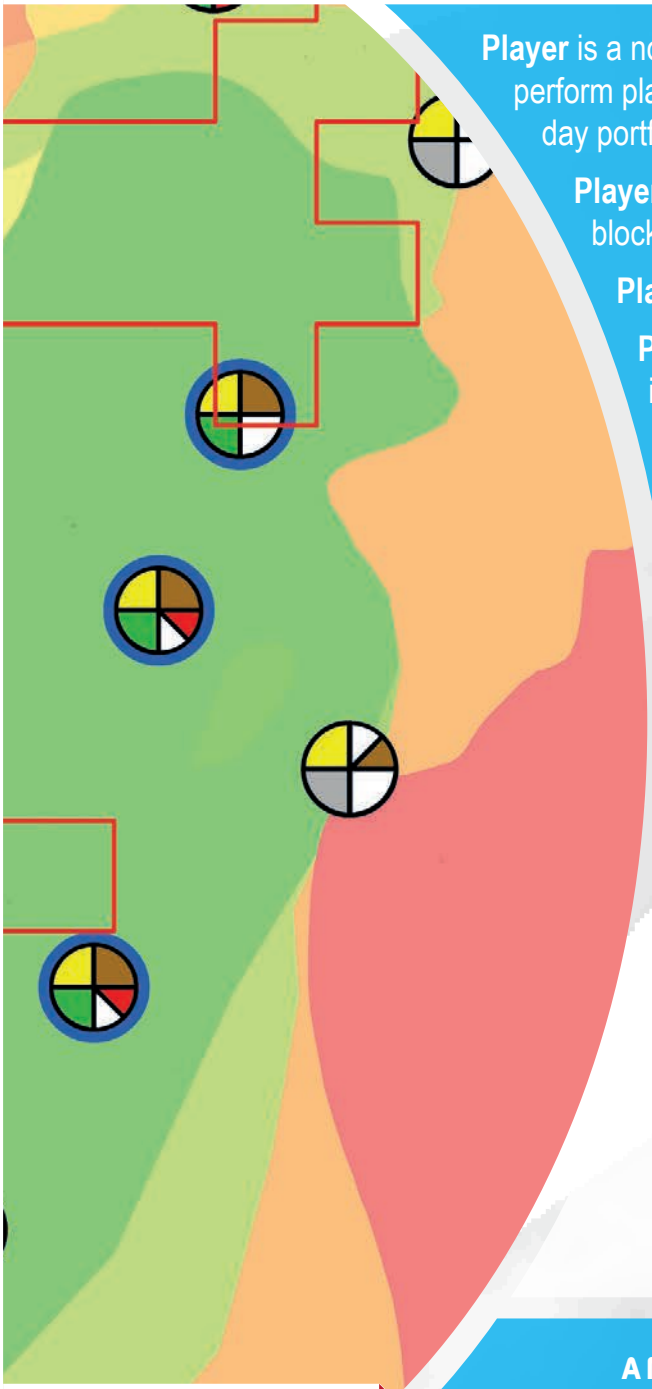

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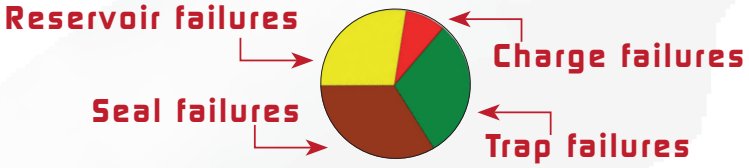

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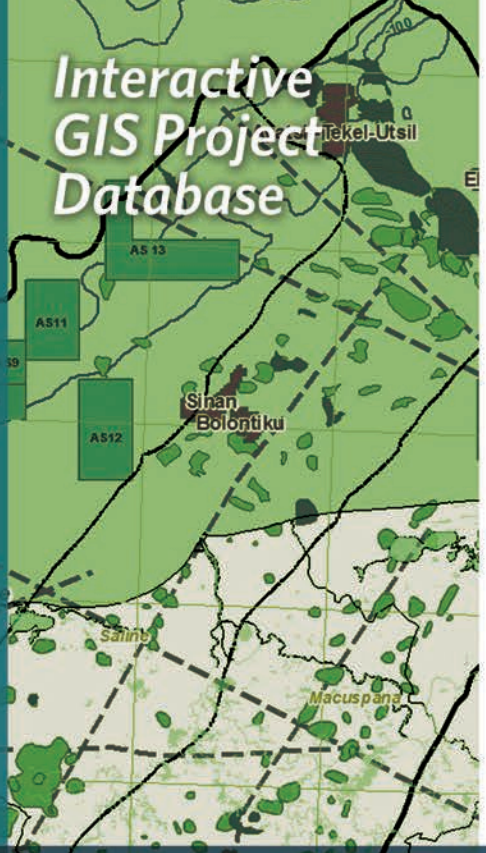

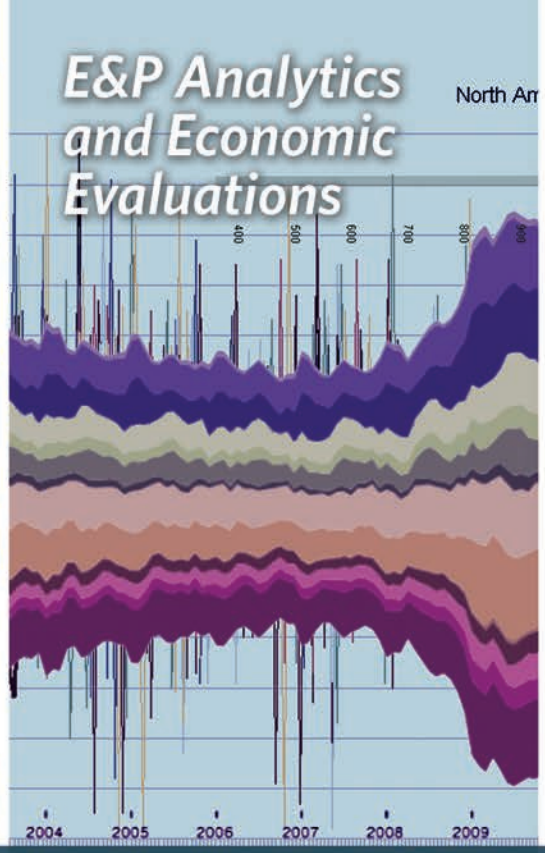

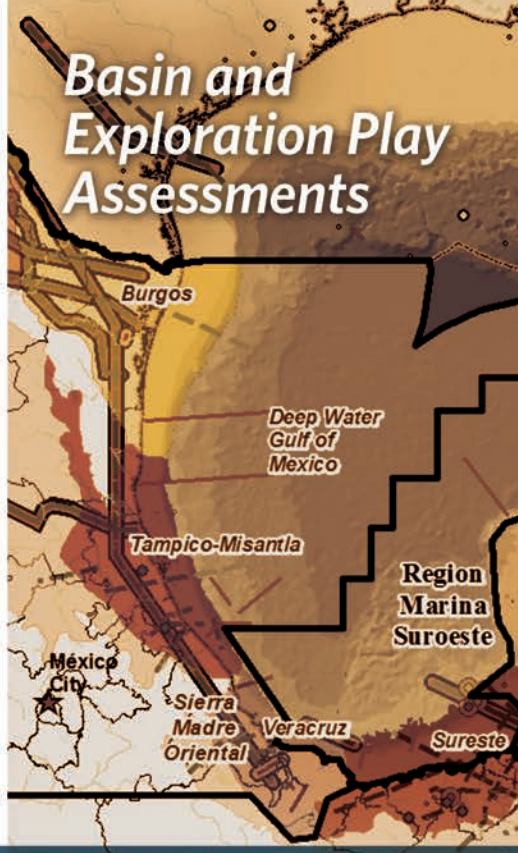

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Presidential Ponderings

It's a wet and cold day in January as I ponder what to expect from oil by the time you read this in March. As I look at the different web sites I see that the WTI price is $45.60 for February delivery and natural gas is $2.88 and gasoline by my house is $1.85 to $1.89. From last month, that's down $30.00 for oil, about $0.84, and $0.84 respectively, from my ponderings last month. Goldman Sachs is calling for oil to fall to $40.00 and Bloomberg TV says that oil will make a significant recovery in two to three years. Forbes doesn't know where the floor is but doesn't expect oil to go above $60 through 2016. I have heard of early retirement packages, quiet layoffs, global layoffs, rig demobilizations, and budget cutbacks. Where will all of this take us?

Although these oil price crunch times bring anxiety, they also can bring opportunity. Now is a good time to look forward and plan on attending a HGS talk or taking advantage of AAPG or HGS seminars.

Well, it should cause us to take another look at our professional development and career paths. Although these oil price crunch times bring anxiety, they also can bring opportunity. Now is a good time to look forward and plan on attending a HGS talk or taking advantage of AAPG or HGS seminars. As exploration slows down, this can create a window of opportunity for developing new skills or doing a special study.

The term networking is overused. We all say we need to do it, but do we really work at it? Social media provides new methods of networking, but how many of us truly use them? Normally, I feel so busy that I seldom access them. When I am out of the office I don't make the time to check on those connections or friends. Now is probably a good time for me to "refresh" those connections, provide some endorsements, and make "friends" with new people. HGS can be a great source for new connections and there is no better way to make them than to attend one of our meetings. Check out the Events Calendar for March and April and sign up for a meeting.

An excellent opportunity to network and improve communications with contacts and friends would be to head up an HGS committee. If you have a talent for organization, want to improve your leadership skills, or just have a good time (Tennis and Shrimp Peel committees need leaders), the HGS needs you!

Elections are fast approaching. Chairman Barry Katz, as Head of the Nominating Committee, provided the slate of candidates in January. In February, the candidates were presented at the General Dinner meeting and nominations from the floor were entertained. Their bios should be in the April Bulletin and elections will take place in April and May. Be sure to vote!

HGS is a society run by volunteers and supported by a variety of individuals and companies. The society tries to honor deserving individuals and recognize sponsorship each year. Recognition can sometimes make the difference between someone's continued participation and their walking away from being a part of the organization. The Board will be finalizing awards for the 2014-2015 term at its April meeting. I encourage you to go to the HGS website, review the award criteria in the June 2014 Bulletin and make nominations for the awards if you know of a deserving individual or company.

By the time this is published, the society will have honored the foundations' scholarship awardees at Legends Night, had its 2015 Mudrocks Conference, returned to the General Lunch meeting at the Petroleum Club, and participated (I hope) in the Engineering and Science Fair. The Executive Committee will be meeting with the committee chairpersons this month to get and give status reports on the year's activities.

I still haven't gotten back to those *Looks Back in Time* in the history of HGS. However, I did see that the tennis plaques are in the office by Jill's desk. I need to count the number of times Steve Allen has his name on them. I'm thinking that it is more than four. Steve won his championships with a different partner each time. Shows you what good partners can do! Why don't you make HGS your partner in career development?! ■

The Energy Entrepreneurs Social

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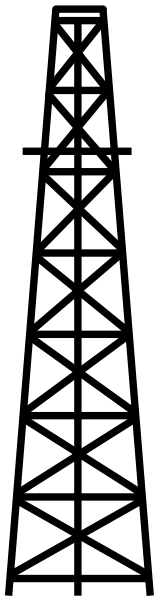

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Do You Hear or Do You Listen?

A few months ago, Ken Nemeth mentioned, in his President's Column, that geologists harbor an intense passion for their profession. To this, I would add that we are also, as a group, quite a curious bunch. We are intrigued by incomplete data sets, challenged by trying to assemble the "jigsaw puzzle" that comes in a box without a photo on the cover, and usually not content with a partial understanding of any issue or problem.

One of the ways we have to satisfy our curiosity is to ask questions. While seemingly trivial, the ability to ask the right question is a talent. I am sure all of us have worked with colleagues who had an uncanny ability to ask just the right question at just the right time, usually causing us to wish that we ourselves had asked it.

If you don't pay attention during a presentation or to the answer to a question you or someone else has asked, you risk becoming one of the "dogs watching television".

Asking questions is fine and it is important. I believe that how we handle the answer is even more important. This brings me back to the title of this month's column. According to Webster's Dictionary, one of the definitions of the verb "to hear" is "to be aware of (sound) through the ear". The verb "to listen", on the other hand, is defined as "to pay attention to someone or something in order to hear what is being said, sung, played, etc." The operative part of this definition, for me, is "to pay attention". Another definition for listening mentions processing and understanding of what someone is saying. I consider hearing as passive and listening as proactive, requiring some effort.

I am sure we have all participated in meetings or discussions in which someone has asked a question and then neglected to listen to the answer. They may have heard it, but did not make an effort to understand what was being said. This happens not only when posing questions, but also when participating in meetings or presentations. While everyone says that there is no such thing as a dumb question, I would argue that dumb questions do exist and are usually a result of hearing and not listening.

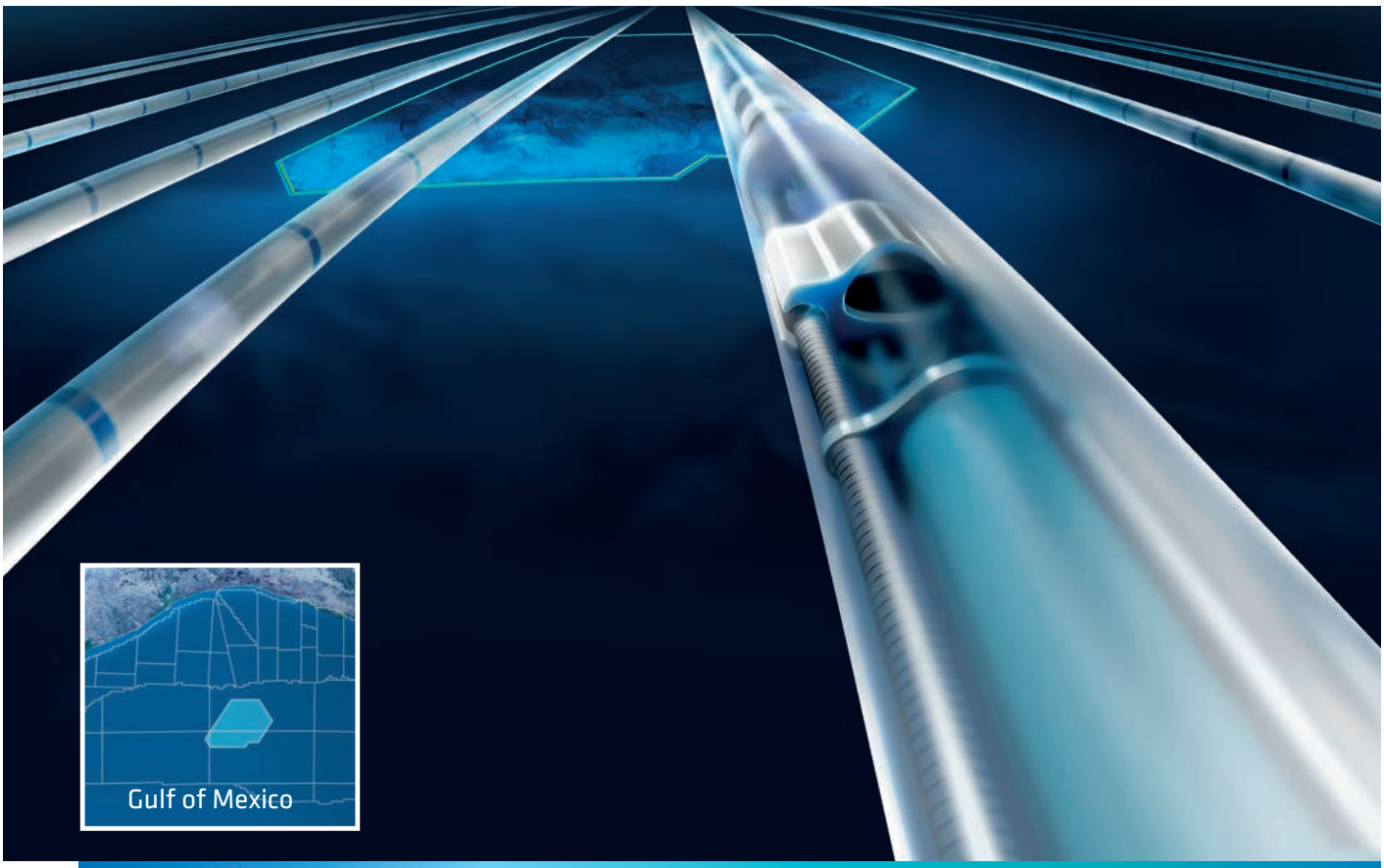
Several years ago a colleague of mine and I were sitting in a meeting where the presentation topic was relatively complex. The presenter did a good job, but the audience had to make a real effort to follow along. It was late in the day and, as usual, there was some lack of focus. My friend leaned over to me and said "They are like dogs watching television. Their heads move in response to changes on the screen and in the sound, but they have no idea what they are hearing". If you don't pay attention during a presentation or to the answer to a question you or someone else has asked, you risk becoming one of the "dogs watching television".

Take the time and make the effort to listen and not just hear.

Visit to the Bindery

The good folks at PrimeSource, the firm that prints our HGS *Bulletin*, were kind enough to arrange a visit to Marathon Bindery, the firm that binds the *Bulletin* and prepares it for shipping. This finally gave me the opportunity to witness the entire process involved in the creation of the *Bulletin*, beginning with the electronic collection of articles and photos, the assembly of a digital version and the printing and assembly of the physical *Bulletin* prior to mailing to the members. Once again, I found myself impressed by the machinery used throughout the process. I planned to include photos, but it seems the speed at which the machines work is much faster than the focusing ability of my camera. I would like to thank Wayne Emmott, the owner of Marathon Bindery, for taking the time from his busy day to give us a tour of his shop and explain how things were done. ■

Until next month, take care.



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Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $45 Preregistered members; $50 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

HGS General Dinner Meeting

Ray Flumerfelt
Pioneer Natural Resources

Appraisal and Development of the Midland Basin Wolfcamp Shale

The discovery of the resource potential of the Midland Basin Spraberry/Wolfcamp shale has helped to re-ignite industry activity in the Permian Basin. Production from the Midland Basin, located within the greater Permian Basin, has increased more than 475,000 barrels of oil equivalent per day (BOEPD) since 2009, and rigs for horizontal drilling now account for more than 40 percent of all drilling rigs in the area.

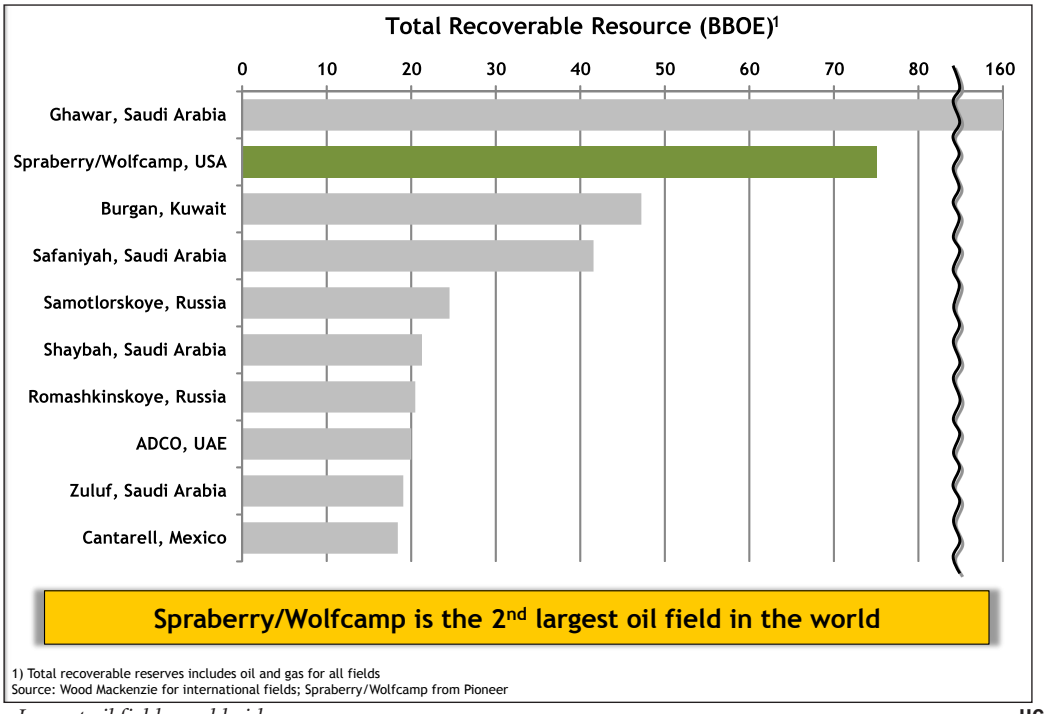
Pioneer's geoscience team, which evaluates extensive geologic data from thousands of existing wells and successful drilling results to date, estimates the Spraberry/Wolfcamp contains more than 75 billion barrels of oil equivalent (BBOE). This ranks it as the largest U.S. oil field and the second largest oil field in the world.

Pioneer, the most active driller and largest producer in the Spraberry/Wolfcamp, has a significant percentage of that resource potential: approximately 9.6 BBOE.

Through the third quarter of 2014, Pioneer has placed over 300 horizontal wells on production in the Midland basin. This presentation will focus on the subsurface technical challenges associated with appraising and developing a multi-formation, shale oil resource, and will highlight the multi-disciplinary workflows that we are currently implementing to answer the key question associated with optimal development. ■

Biographical Sketch

Ray Flumerfelt is Pioneer's Senior Reservoir Engineering Manager of the Southern Wolfcamp Asset Team (or SWAT) in charge of evaluating well performance, appraisal and development in the Southern portion of the Midland Basin. Ray has held a variety of technical and leadership roles at Pioneer, including Senior Staff Engineer, Engineering Advisor, Manager-Corporate Engineering; and Manager-Corporate Reservoir Engineering. Prior to Pioneer, Ray worked in reservoir engineering for a variety of companies, including Shell, S.A. Holditch & Associates, Cabot Oil & Gas, and Matador Resources. Ray received both his BS and MS Degrees in Petroleum Engineering from Texas A&M University.



Largest oil fields worldwide

HGS General Dinner *continued on page 11*

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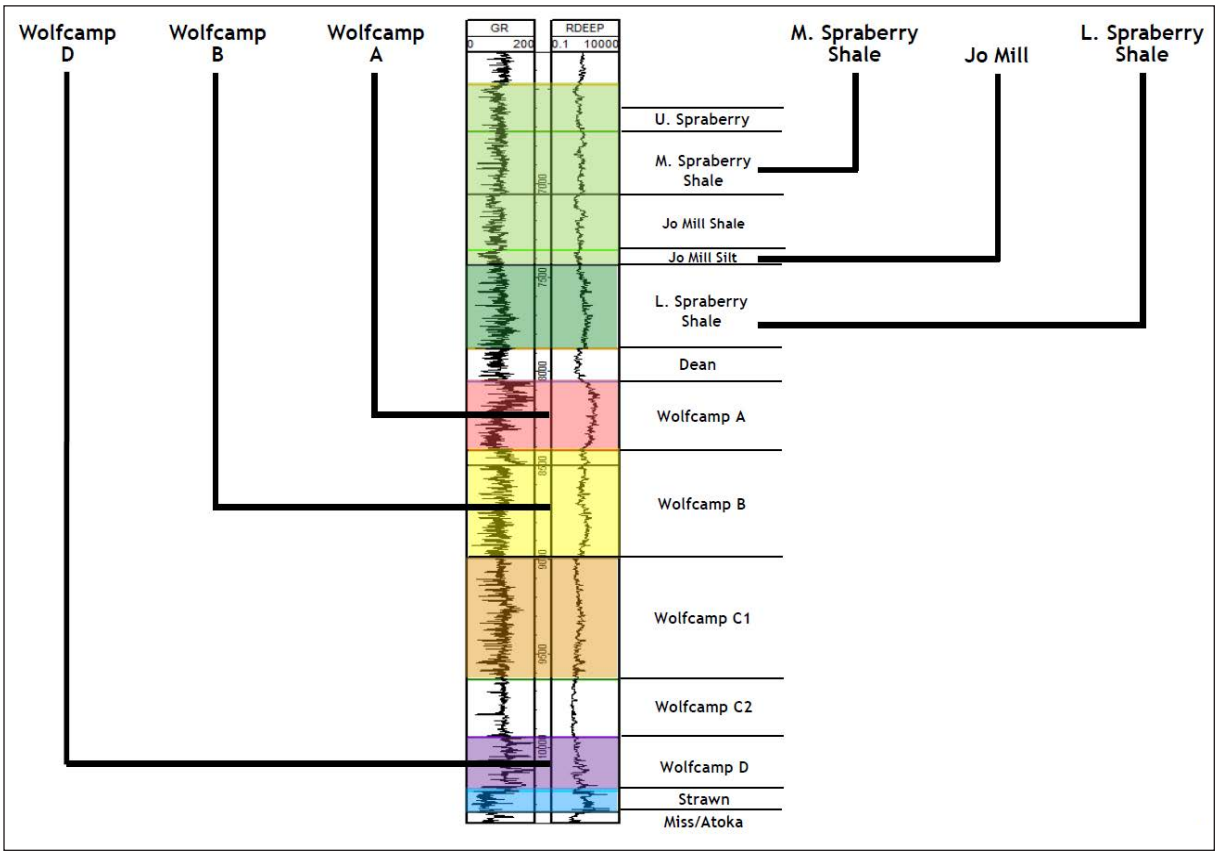
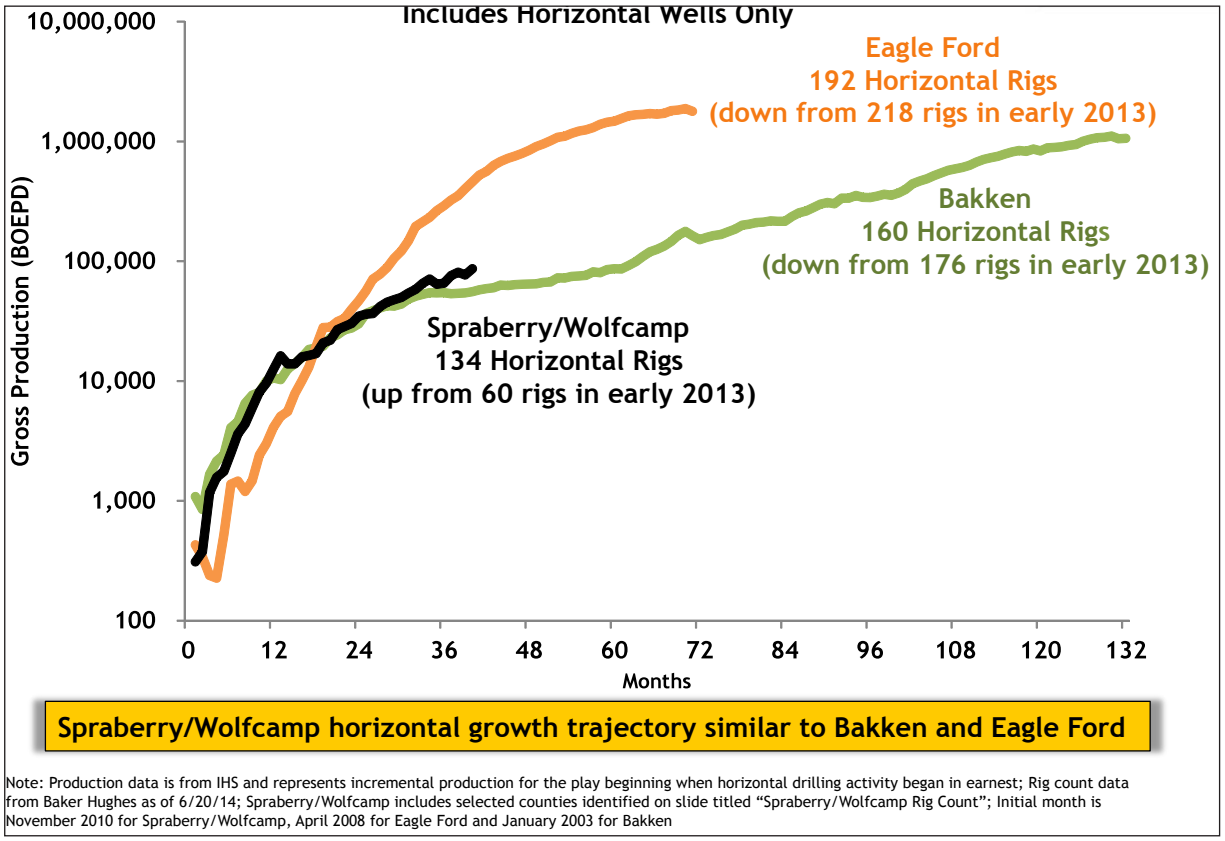


Pioneer's Spraberry/Wolfcamp horizontal drilling to date



Production growth profiles for 3 largest U.S. oil shale plays

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Black Lab Pub, Churchill Room • 4100 Montrose Blvd.

Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $30 Preregistered members; $35 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

Joy Young
Deloitte Financial Advisory Services LLP's

Navigating Pitfalls in Estimating Costs of Environmental Remediation Liabilities for Financial Reporting Purposes

Management of publicly-held companies is responsible for ensuring that the companies' financial statements and reports are presented in accordance with the applicable accounting guidance. Estimates generated to support Management's estimates of environmental liabilities should similarly align with accounting guidance and be fully auditable. In many cases, the base of Management's estimate is one generated by the company's environmental/engineering consultants. Management often has either not informed the consultant that the estimate will be used for financial reporting purposes or, the consultant does not have the appropriate understanding of the accounting guidance. Both of these situations may result in errors to the estimate from a financial reporting standpoint. Estimates of Fortune 500 companies audited in recent years still exhibit gaps in both the recognition of appropriate costs and the auditable support package for these costs. In some cases financial statement adjustments of nearly $100M and subsequent restatements have been made, and management has received significant comments from the financial auditors and/or regulators. Certain pitfalls continue to be observed:

- Incorrect timing of the recognition of costs;
- Incorrect understanding of "probable," "reasonably possible," and "remote" costs and the importance of these distinctions to the financial statements;
- PRP assumptions;
- Omission of Closure costs and other Life Cycle costs;
- Lack of understanding of the audit process and lack of auditable support for the estimate (e.g.,undocumented professional judgment);
- Inclusion of inappropriate Operating costs or costs related to an asset retirement obligation; and
- Estimate methodologies that violate Management's policies.

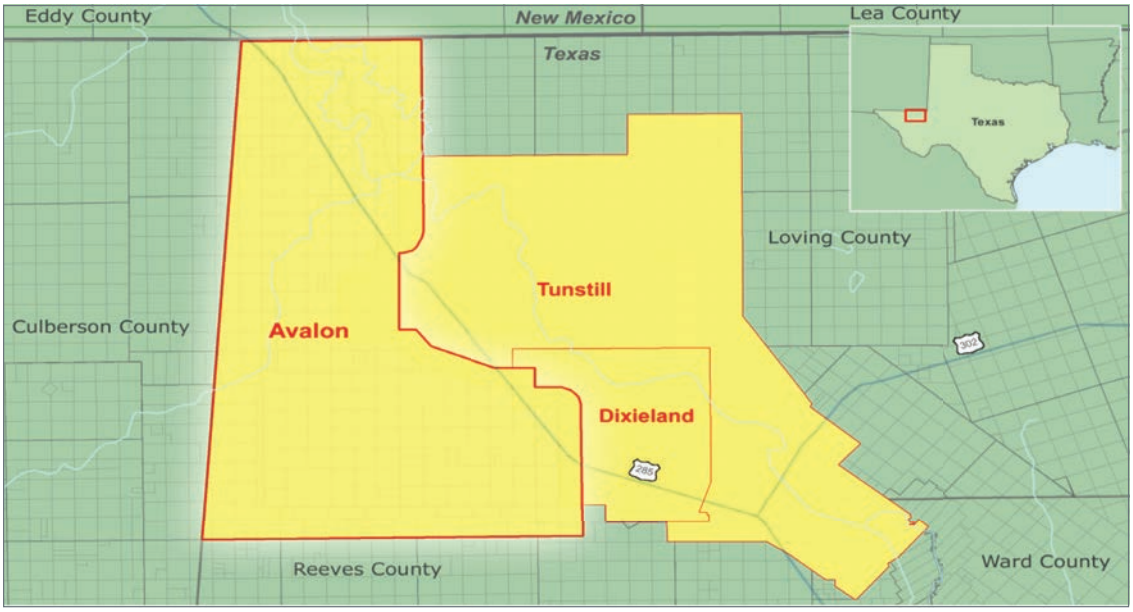
Several case studies demonstrate these errors and the role(s) of the environmental consultant and management's representatives in the generation of the estimate. Lessons learned from these cases illuminate ways to navigate these pitfalls, generate a more defensible management estimate, and improve client service. ■

Biographical Sketch

Joy Young is a Manager in the Environmental & Sustainability Consulting (E&SC) practice of Deloitte Financial Advisory Services LLP's ("Deloitte FAS") in Houston. She focuses on applying her environmental science background to financial and performance reporting and business case development. Prior to joining Deloitte FAS, Joy was engaged with Environmental Resource Management (ERM) in the areas of Site Investigation and Remediation (SIR), Litigation Support, Mergers & Acquisitions (M&A, "due diligence"), Environmental Impact Assessments (EIAs), and Environmental & Sustainability planning. She has been involved in evaluating contingent environmental liabilities for internal evaluations and external financial reporting purposes for approximately six years and is an alum of the University of Houston – Clear Lake (Biology, Eco-toxicology).

Avalon 3D Seismic Survey

A new state-of-the-art multi-client solution in the prolific Delaware Basin



Located in one of North America's most prolific basins, the newly acquired 282 square mile high-end 3D seismic survey offers four hundred fold broadband data. Setting a new standard, Avalon will allow better imaging to address the noise and statics challenges in the area.

Targeting the Bone Springs, Wolfcamp and Cline formations, the complete solution ties the geophysical data to the geology enabling enhanced sweet spot detection and improved hazard avoidance for optimal well placement. The project uses a multi-disciplinary approach comprising advanced imaging, reservoir characterization and microseismic monitoring.

Enhance your return on investment today with this unique solution.

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Cheryl Oxsheer
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CGG
Passion for Geoscience

Monday, March 16, 2015

Westchase Hilton • 9999 Westheimer

Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $45 Preregistered members; $50 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

Ana Krueger
Ana_Krueger@murphyoilcorp.com
Murphy Oil, Houston, TX
Mike Murphy, Kevin Burke
University of Houston, Houston, TX
Ed Gilbert
Consulting Geologist, Katy, TX

The Brazilian Equatorial Transform Margin: A Snapshot in Time of an Oblique Rifted Margin

The Brazilian Equatorial margin was first described as a transform margin by Matos (1987, 1992, 1999, 2000, and 2002). Yang and Escalona (2011) used the term oblique rifted margin and Bird (2001) used the term shear margin to describe the Equatorial South Atlantic. Greenroyd et al., (2008) were the first to describe the segmentation of the margin as a series of rift-dominated and transform-dominated segments that they named rifted and sheared segments respectively. Antobreh et al. (2009) described similar segmentation in the counterpart Guinean coast of Africa, and used the term "sheared margin" to describe segments of the Ghanaian margin that are parallel to the main fracture zone traces and rifted margins to describe the segments in between. Here we describe the Equatorial margin as a transform margin in the Piauí-Ceará Margins and its counterpart Côte d'Ivoire margin, evolving to the north in Amapá.

Most passive margins are orthogonal to seafloor-spreading, but there are some margins like most of the Equatorial Atlantic Margins that are oblique. Other examples of oblique rifted margins include the Gulf of California (Lizarralde et al. 2007, Umhoefer et al. 2002, Umhoefer et al. 2011), the Gulf of Aden (d'Acremont et al. 2006, Fournier et al. 2007, Autin et al. 2010, Daoud et al. 2011), the East coast of Madagascar and the Dead Sea (Cochran, et al. 1983, Bird 2001). We use the continent-ocean transition zone (COTZ) definition from Direen et al. (2012): a region of highly attenuated continental crust on the continental margin that lies between the outboard edge of unequivocal continental crust and the inboard edge of unequivocal oceanic crust. Note that this definition is similar but not identical to the term ocean–continent transition (OCT) as used by Manatschal

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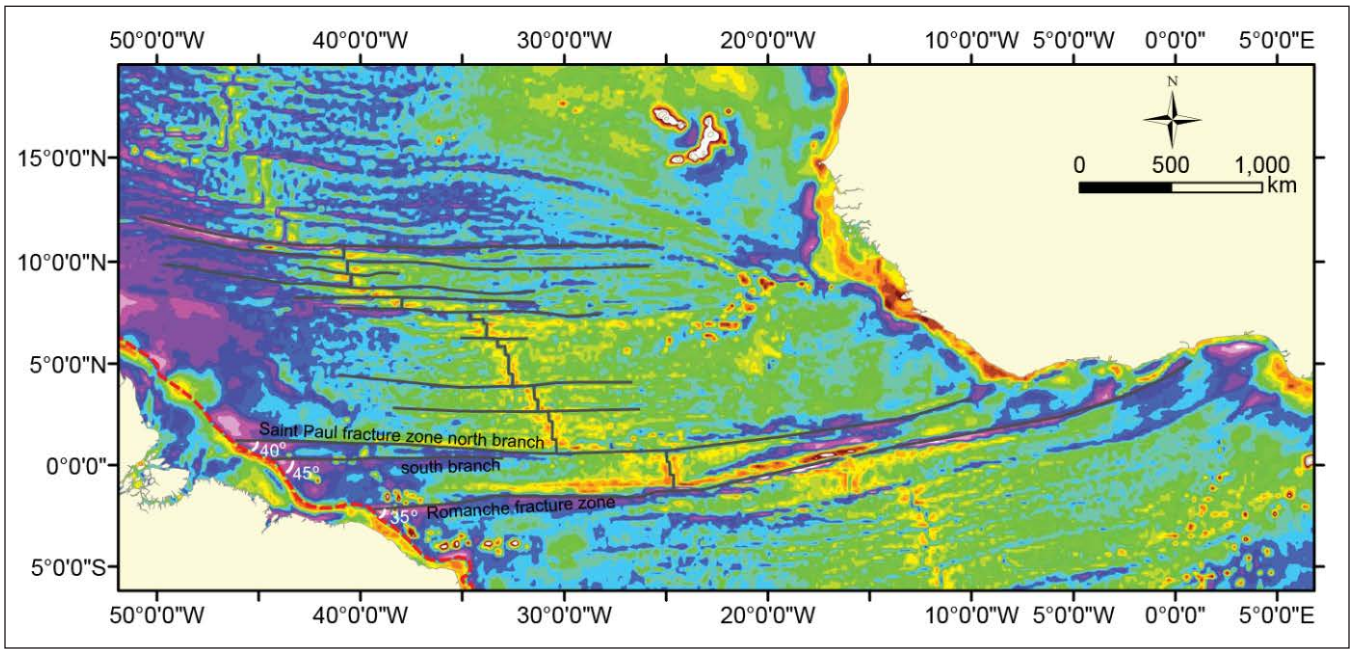
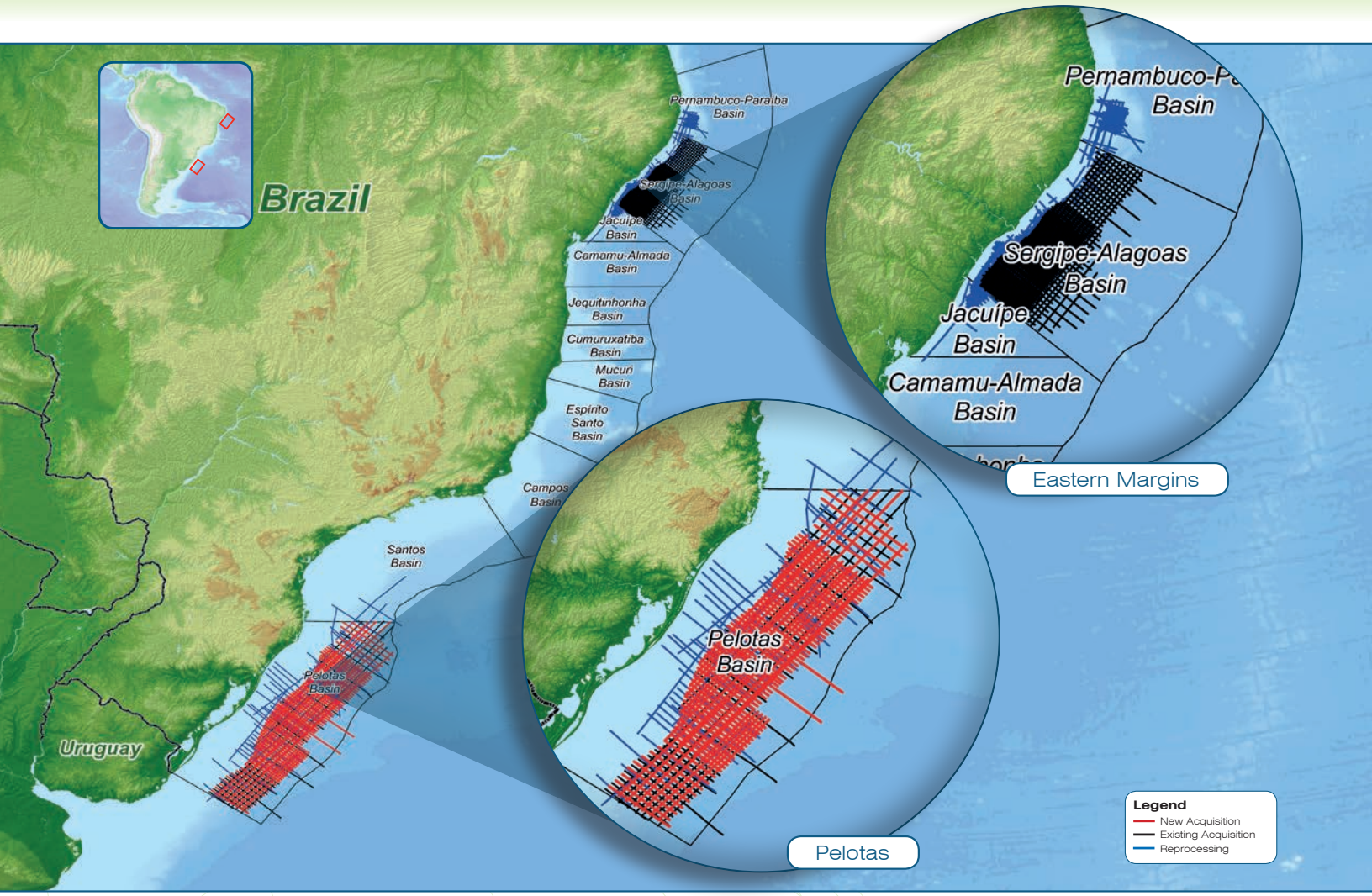


Figure 1. *Free-air gravity map of the Equatorial South Atlantic, showing geometric relationship between COTZ and oceanic fracture zones. Free-Air data obtained from the SATELLITE GEODESY gravity data (Sandwell and Smith, 2009). Fracture zones and mid-ocean ridge displacements are interpreted based on the free-air gravity anomalies. COTZ is represented in the map in red dashed lines and was interpreted using free-air gravity data combined with seismic data.*

Brazil: Eastern Margins & Pelotas

Extensive 2D Multi-Client Seismic Data



In anticipation of the 2015 bid round in Brazil, Spectrum offers 45,000 km of seismic data from the Pelotas Basin in the south and the Jacuipe, Sergipe-Alagoas and Pernambuco Basins along the eastern margin of Brazil. Of the 45,000 km, approximately 23,000 km of long offset data was acquired in 2013/2014 and approximately 22,000 km was reprocessed during the same time period. All lines will have both time and depth products, and the Sergipe 2014 new acquisition will have additional broadband and AVO products available.

An infill seismic survey for the Pelotas Basin is expected to commence in Q1 2015.

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Spectrum

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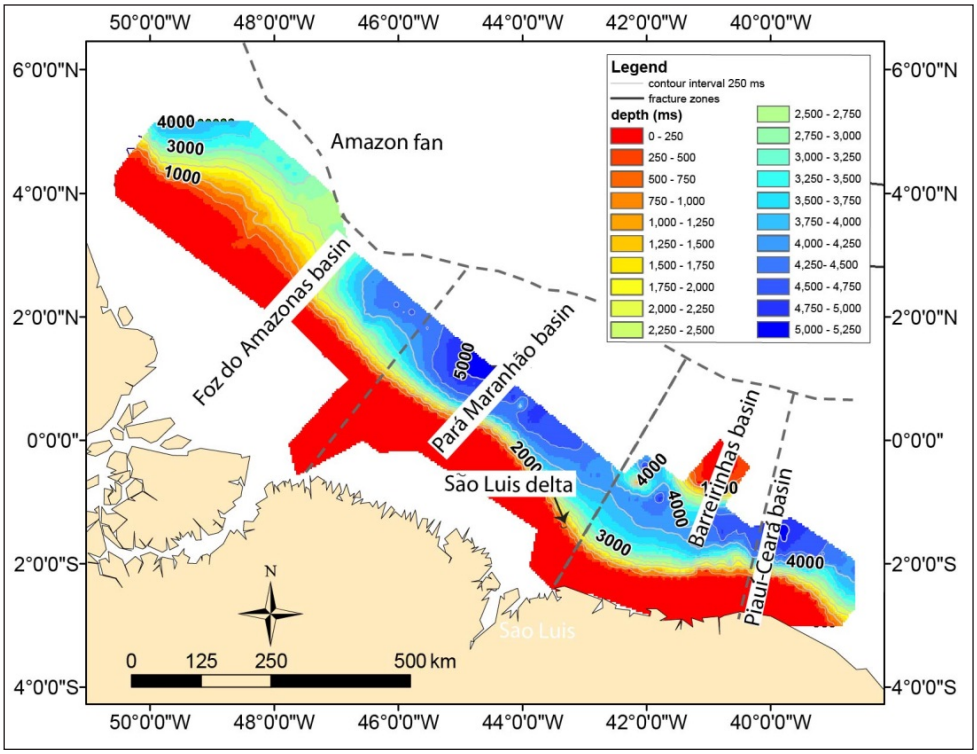

Figure 2. *Bathymetry of the Brazilian Equatorial margin, mapped on the water bottom signal of ~ 500,000 km of 2D seismic reflection profiles. Offshore basin outlines are from Agência Nacional de Petróleo (www.anp.gov.br).*

(2004) and Reston (2007) for the transition from the distal continental margin to the first oceanic crust.

The Brazilian Equatorial Margin and the Opening of the Equatorial Atlantic

Cretaceous rifting within Northeast Brazil and the Guinean coast of Africa reactivated Pan-African faults as strike-slip mega-shear zones (Darros de Matos, 1987, 1992, 1999, 2000, 2002; Greenroyd et al., 2008, Antobreh et al., 2009). Earlier deformation dates back to Late Jurassic (Matos, 1987). At least three different rifting stages were recognized from Late Jurassic to Early Cretaceous (Chang et al. 1992, Conceição et al. 1998, Destro et. al. 2003, Matos 1987, 1992, and 1999). The extensionally deformed region, associated to early stages of rifting, onshore NE-Brazil is 600 km wide (Conceição et al. 1988, Magnavita 1992). Rifts of diachronous ages and wide areal distribution on the Brazilian North-East suggest polyphasic deformation and changes of stress direction through the rifting of that portion of Gondwana.

Oblique rifts are those in which the continent ocean transition zone (COTZ) is not normal to the direction of seafloor spreading and to the trend of fracture zones. Therefore rifting and later the plate boundaries are not normal to the general direction of separation between the plates. Also angles between COTZ and the fracture zones vary among different segments of the margin. That is the case in the Brazilian Equatorial margin, where the contact angle between the COTZ and the fracture zones vary around the margin. Because the angle between the fracture zone and the mid-ocean ridge is always 90 degrees, that difference is accommodated by segmentation at the mid-ocean ridge.

Relationship Between Basement Fault Geometry and Obliquity of the Rift

The geometry of the continental oceanic transition zone (COTZ) is established at the time of the initiation of seafloor spreading. Rift faults grow prior to the emplacement of oceanic crust, but movement ceases as soon as oceanic crust is emplaced. Therefore the COTZ geometry gives a snapshot in time for the geometry of the fault system at the time of the rifting. Oceanic fracture zones are solely located on oceanic crust, and oceanic fracture zone strike direction represents seafloor spreading direction at that point in time. Strike directions of the oceanic fracture zones immediately adjacent to the COTZ in the Brazilian Equatorial margin therefore represent seafloor spreading direction at earliest Central Atlantic drift phase. Assuming no change in extension direction from early drifting to the end of rifting, the angle between a normal to the COTZ and the projection of the oceanic fracture zone to the COTZ represents the obliquity of the rift direction in relationship to the main direction of separation between the continents. Comparing the strike directions of the COTZ basement faults, located predominantly on continental crust, with the strike direction of the adjacent oceanic fracture zone was used to classify the Equatorial margin as a transform margin in the Piauí-Ceará portion of the margin, and oblique in the Barreirinhas and Pará-Maranhão (**Figure 1**).

In the Piauí-Ceará margin (**Figures 2** and **3**) E-to-W striking basement faults are predominant, and are parallel to the Romanche fracture zone segments; therefore in the Piauí-Ceará margin the COTZ is parallel to the Early Cretaceous spreading direction, and that makes it a transform margin. Along the Barreirinhas and Pará-Maranhão basins the COTZ and the basement faults have a NW strike (**Figures 2** and **3**). The COTZ forms an angle of 35 to 40 degrees with the Saint Paul fracture zone and that

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makes it an oblique margin (**Figure 1**). North of the Foz do Amazonas, along the Amapá margin, oceanic fracture zones could not be traced all the way to the COTZ; but a change to a N-S strike direction on the basement faults on the COTZ suggests a more orthogonal rifting direction (**Figures 2** and **3**). Where the continental margin is oblique, basement fault lengths are shorter with a limit of 50 km, which is in agreement with physical models (Clifton and Schlische 2001). The observed basement fault geometries through the margin require a strike-slip component during the early rift stages. We infer N-striking segments to be dominantly extensional while E-W striking segments would primarily accommodate strike-slip motion and NW-striking segments would accommodate oblique motion. Therefore the most likely model of evolution for the Central Atlantic rift is a complex pattern of pull-apart basins along strike-slip fault systems that eventually coalesce into through-going systems, as described by Mattos (1999) for the Central Atlantic. ■

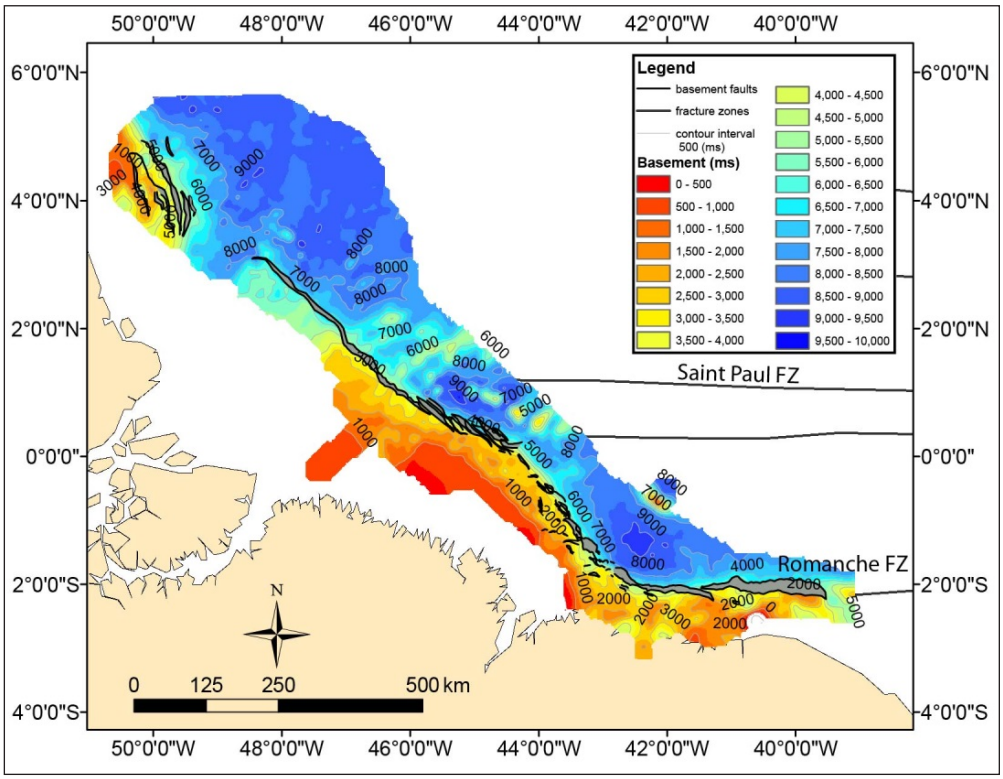

Figure 3. *Depth to basement in milliseconds. Basement faults and fracture zones mapped are part of this study. The basement faults mapped are preferentially located around the COTZ and the most seaward fault zones mapped mark the contact with oceanic crust in the hanging wall. Faults shown in the map are in the basement which is now overlain by 1 to 5 seconds of sediments. Basement faults under the Amazon fan are not mapped as they are deeper than the seismic record.*

Biographical Sketch

Ana Krueger is a Senior Structural Geologist with Murphy Oil. She gained her B.Sc. in Oceanography from the State University of Rio de Janeiro, M.Sc. in Geophysics in the Brazilian National Observatory and Ph.D. in Geology from the University of Houston. Prior to joining Murphy she worked for HRT, Devon Energy, and Schlumberger.

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Tuesday, March 17, 2015

Hyatt North Houston (former Crowne Plaza Hotel – Greenspoint)

Social 11:15 AM, Luncheon 11:30 AM

Cost: $45 Preregistered members; $50 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

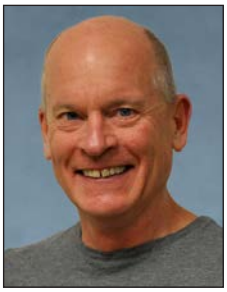
Clifford (Cliff) Knitter
Golder Associates Inc.
Alfred Lacazette, Global Geophysical Services Inc.*
William Dershowitz, Golder Associates Inc.
Jan Vermilye, Global Geophysical Services Inc.

Geomechanical and Flow Simulation of Hydraulic Fractures Using High-Resolution Passive Seismic Images

Successful hydraulic fracture treatments require sound frac designs based on reservoir geomechanics and geology. This paper demonstrates a workflow that integrates Discrete Fracture Network (DFN) simulation with Tomographic Fracture Imaging™ (TFI), a passive seismic monitoring method (Geiser et al, 2012; Lacazette et al, 2013). DFN models are built at the level of detail of individual fractures using information resolved using the TFI approach. These DFN models are then used to understand reservoir production and geomechanics.

This paper shows examples of DFN simulations that predict frac propagation and reactivation of natural fractures by hydro-shearing and hydrojacking. By tracking fracture propagation and reactivation, the simulator produced hydraulic fracture fields that can be compared to and calibrated with observed TFIs. This process provides confidence in both the Stimulated Rock Volume (SRV) and Tributary Drainage Volume (TDV) determined for the fracture treatment. The distinction between SRV and TDV is important, because induced hydraulic fractures and natural fracture reactivation can produce seismic activity in a larger volume than actually contributes production. Also, natural fractures can contribute to production from regions outside the SRV if hydraulic fractures effectively connect the well to the natural fracture network. The calibrated simulations of TDVs provide a basis for improved frac designs, well-test analyses and production forecasts. ■

Biographical Sketch



Mr. Knitter is a Principal Geologist with Golder Associates Inc. He has been with Golder's Seattle office for 30 years and is working with clients worldwide on fractured reservoirs as part of Golder's FracMan Technology Group. His practice involves characterizing and modeling unconventional resource plays and unconventional fractured carbonate reservoirs. Recent work has included resource plays in several of the United States shale basins and northern Europe and fractured carbonate reservoirs in Far East Asia and the Middle East/Central Asia. He received his B.S. degree in Geology from Western Washington University and his M.Sc. degree in Geology from the University of Calgary.

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Monday, March 23, 2015

HGS North American Dinner Meeting

Westchase Hilton • 9999 Westheimer
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $45 Preregistered members; $50 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

Jacob (Jake) Covault
Chevron Energy Technology Company

Predictive Organization of Deep-Water Lobes

The connectivity and facies heterogeneity of low permeability, terminal deep-water lobes are important uncertainties in reservoir characterization and development. Deep-water lobes have been conceptualized as basinwide, sheet-like deposits. However, recent work has shown more complex 3D architecture and spatial variability of petrophysical properties, which can have significant impact on reservoir performance. We use high-resolution seismic-reflection data (dominant frequency ~40 Hz) from the shallow subsurface of the Niger Delta continental slope to illustrate the stratigraphic architecture and facies variability of a deep-water lobe system. The interval of interest is a package of high-amplitude seismic reflections that is lobate in plan view and externally mounded in cross section. This interval comprises at least three sub-packages of continuous, single- or multi-cycle seismic reflections, which locally exhibit bidirectional downlap and compensational stacking. Reflections bounding the uppermost sub-package represent channel avulsion, compensation and modification of initial deposits, unconfined deposition at the channel mouth, and downstream channel bifurcation. We place our interpretations within an architectural hierarchy and consider the impact of depositional heterogeneity on fluid flow behavior during hydrocarbon production. These interpretations inform the modeling and prediction of 3D heterogeneity of deep-water lobes and illustrate the importance of detailed characterization in order to understand reservoir connectivity and quality. ■

Biographical Sketch

Jacob Covault is a senior research scientist at Chevron Energy Technology Company. His expertise is the sedimentology and stratigraphy of petroleum reservoirs. Prior to his present position at Chevron, Jacob served the Department of the Interior at the U.S. Geological Survey, and he received Ph.D. and B.S. degrees in Geological and Environmental Sciences at Stanford University. Jake has published a number of peer-reviewed research papers and scientific conference abstracts pertaining to petroleum geology, reservoir characterization, sedimentology, stratigraphy, basin analysis, Earth surface processes, and marine geology.

AAPG Imperial Barrel Award for the Gulf Coast Region

Over the past seven years since the initiation of the Imperial Barrel Award program, participation has grown from the Gulf Coast universities from 3 university teams to 13. As a result costs are rising. This year we will engage approximately 100 students and the total cost approaches $60k for costs associated with training, competition and AAPG fees. This is only $650 per student to really enhance their understanding of our business. The number of graduates of IBA program in the industry is growing. With the great crew change underway, this is an awesome tool to help students entering the workforce add value immediately.

This year the regional competition is scheduled for April 15-17 and will be held at the Schlumberger offices in the Galleria area. We are reaching out to you to help grow this valuable program. The IBA program is in need of sponsorship to cover the costs of the program and the AAPG fee. If you or your company would like to sponsor the IBA in the Gulf Coast section, please contact Janice Gregory-Sloan at jgregorysloan@gmail.com or Tom Bulling at bullintp@bp.com or at 281-366-2669.

Wednesday, March 25, 2015

Petroleum Club of Houston • 1201 Louisiana (Total building)

Social Hour 11:30 a.m.
Luncheon 12:00 p.m.

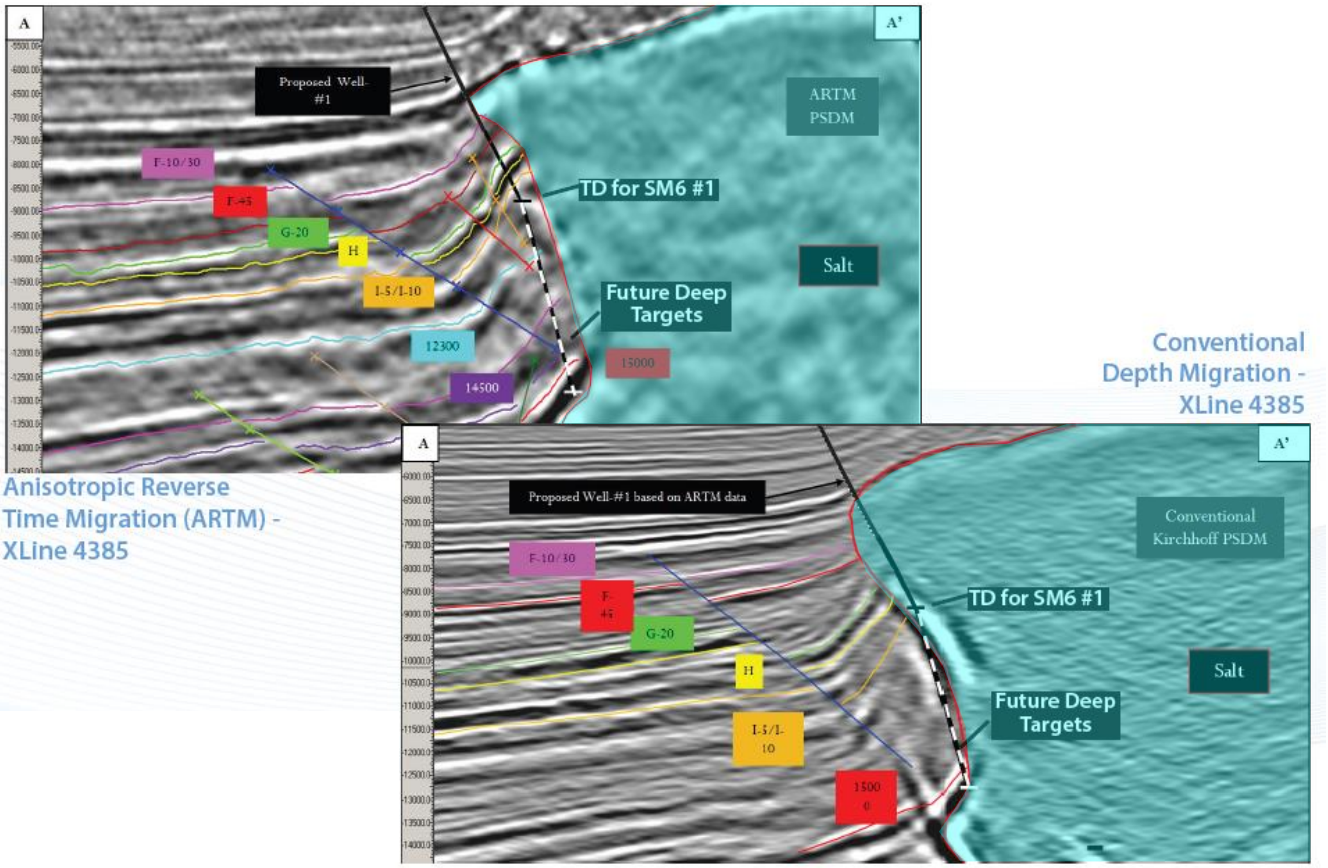
Cost: $45 Preregistered members; $50 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
Pre-registration without payment will not be accepted.
Walk-ups may pay at the door if extra seats are available.

HGS General Luncheon Meeting

Andy C. Clifford
Saratoga Resources, Inc.

New Plays and New Players Bring New Life to the Gulf of Mexico Shelf



Seismic data owned by FairfieldNodal. Slide courtesy of Byron Energy, Inc.

Every time the Gulf of Mexico Shelf is pronounced dead there seems to be a bounce back in activity, driven by commodity pricing, by new exploration technology application or by the appearance of new independent oil and gas companies. While commodity prices, particularly natural gas, are critical to the economic development of smaller discoveries, new technologies such as wide azimuth seismic (WAZ), full azimuth nodal (FAN) acquisition, high frequency reverse time migration (RTM) and horizontal drilling are leading to larger prospect sizes and discoveries with higher recovery efficiencies. The new discoveries and future expected discoveries will most likely be in the geopressured sequence below 12,000 feet around the deeper flanks of allochthonous salt features, in deep-seated turtle structures caused by salt withdrawal, in drag features along regional listric faults or in stratigraphic traps such as channel/levee complexes. These have been more extensively explored in deepwater. Freeport-McMoRan and partners have finally proven the productivity of the ultra-deep play with the Highlander discovery in Tuscaloosa sands. While this discovery is onshore, there are many similar prospects on the GOM Shelf. A new breed of independents such as Byron Energy, GulfSlope Energy, Saratoga Resources and Talos Energy are bringing new interest back to the shelf, while established players such as Energy XXI are

HGS General Luncheon *continued on page 29*

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*For talk proposals, please contact **peter.woodroof@petrofac.com or chris.howells@tgs.com.**
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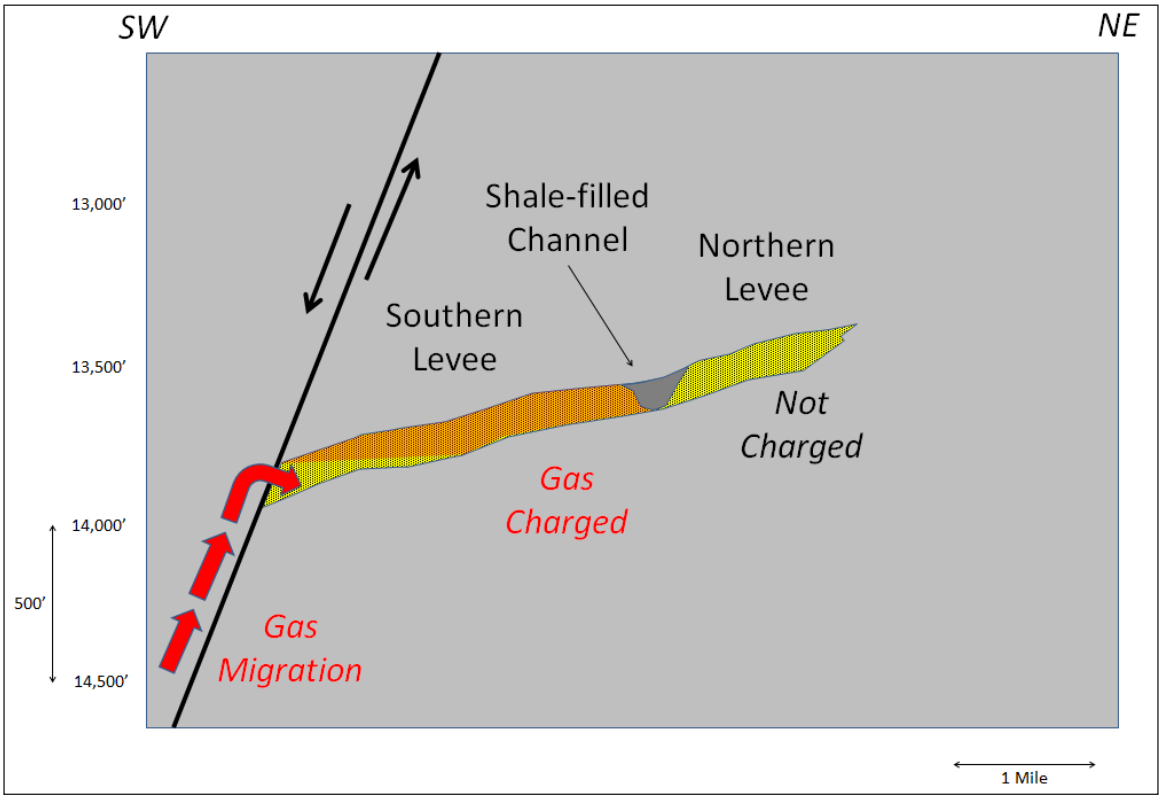
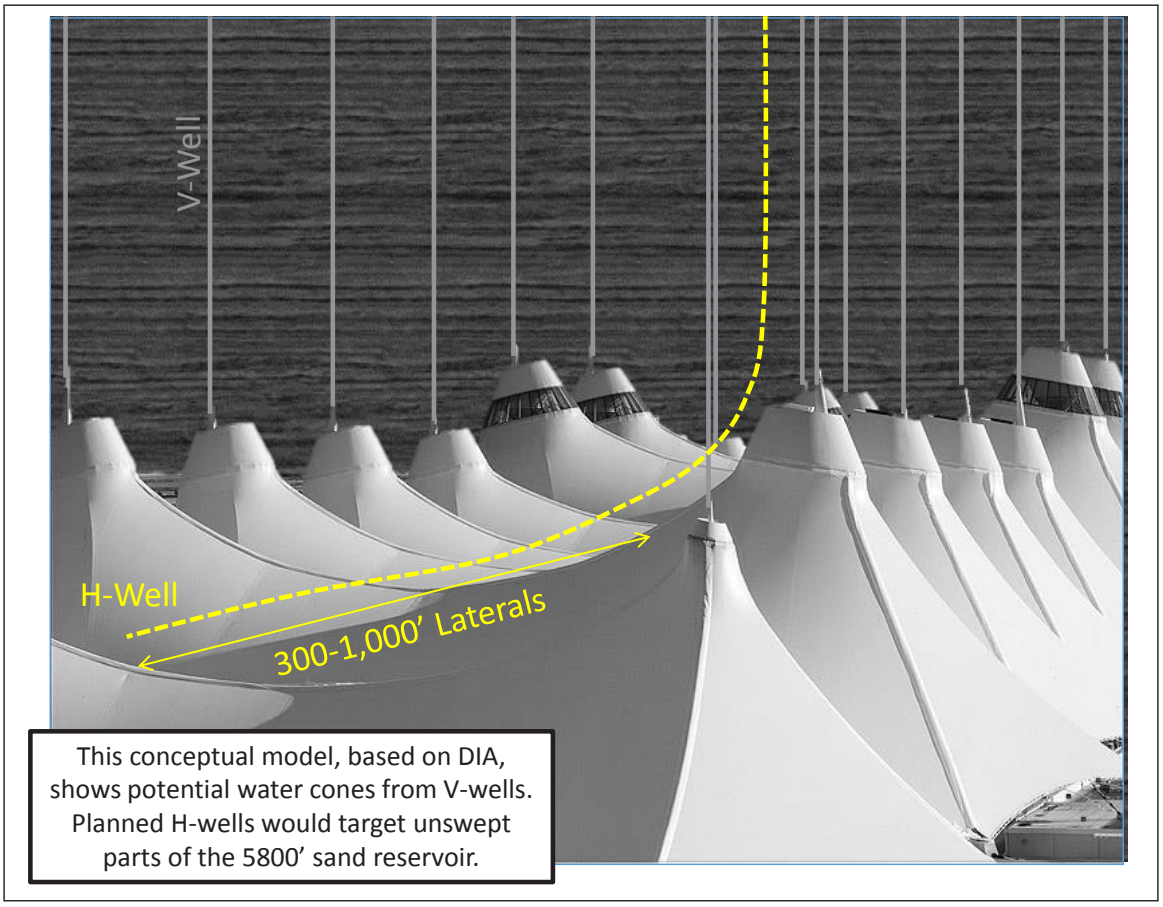
HGS General Luncheon continued from page 27



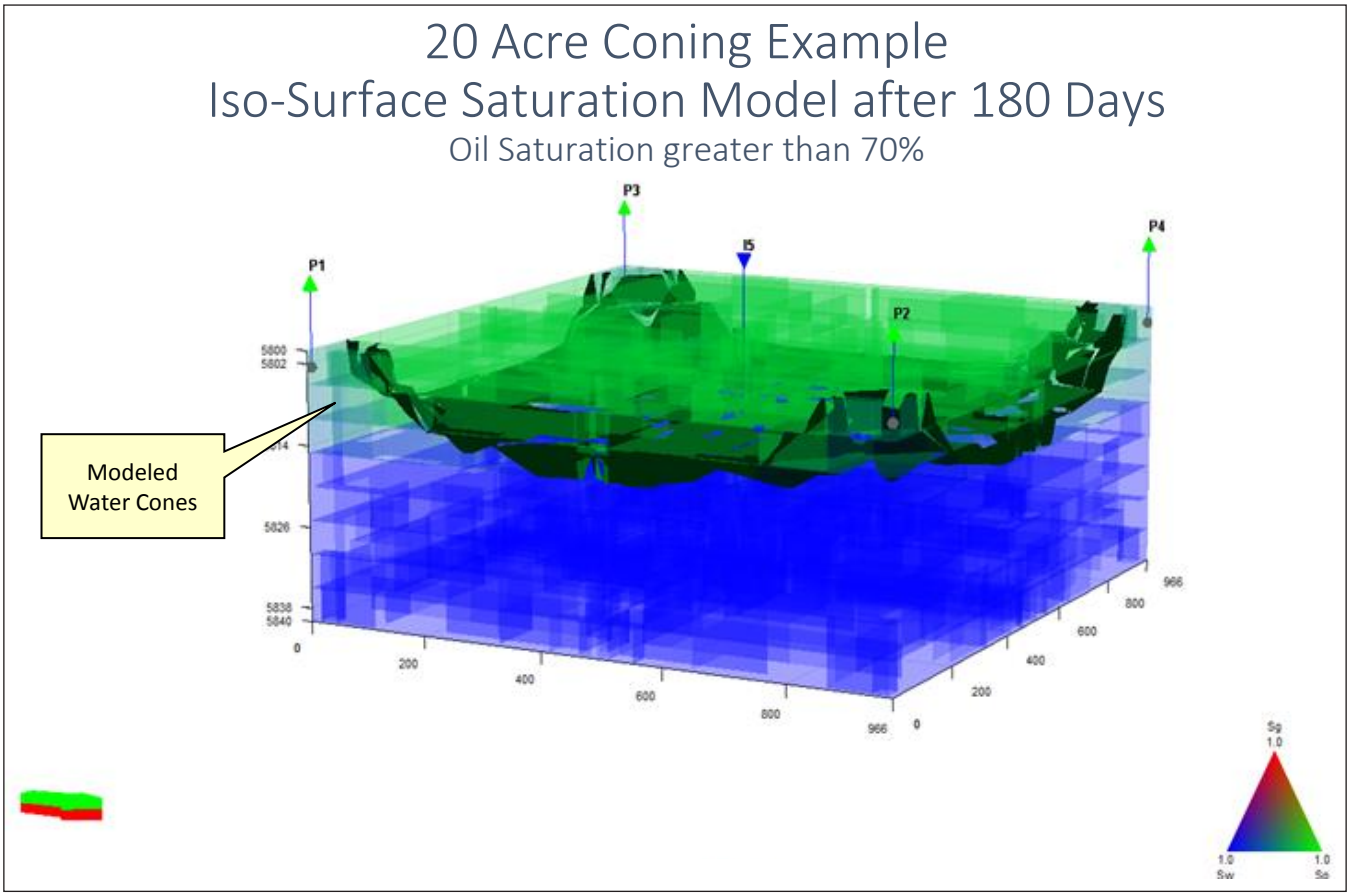
Example of Channel/Levee Play in SS-110



5800' Sand "Coning" Model in BS-32

HGS General Luncheon *continued on page 31*

HGS General Luncheon continued from page 29



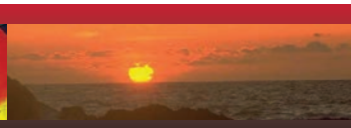
Reservior Simulation Model, BS-32

deploying cutting-edge technologies not only to discover larger fields but also to recover more hydrocarbons from their existing fields. Two other important factors to the attractiveness of the GOM shelf are ready access to abundant infrastructure and the exodus of larger independents who invariably have left a "lot of meat on the bone" in their former fields. ■

Biographical Sketch

Mr. Clifford has over 35 years of experience in the domestic and international arenas as a geologist/geophysicist with a proven track record of successful financings and acquisitions, as well as leadership of exploration and development programs in practically every important basin throughout the world. He has been involved in the exploration with the drill bit and development of over 2 billion barrels of oil equivalent reserves. He has discoveries in Africa, Alaska, Asia, Latin America, the UK North Sea, Gulf of Mexico and most recently in Louisiana with Saratoga Resources, where he serves as President and Director. Prior to Saratoga, Mr. Clifford's experience includes having worked for ExxonMobil, Kuwait Oil and BHPBilliton.

March 2015



Sunday	Monday	Tuesday	Wednesday
1	2	3 **HGS Board Meeting** *6 p.m.*	4
8	9 **HGS General Dinner Meeting** *"Appraisal and Development of the Midland Basin Wolfcamp Shale," Ray Flumerfelt, Page 9*	10	11 **HGS Environmental & Engineering Dinner Meeting** *"Navigating Pitfalls in Estimating Costs of Environmental Remediation Liabilities for Financial Reporting Purposes," Joy Young, Page 13*
15	16 **HGS International Dinner Meeting** *"The Brazilian Equatorial Transform Margin: A Snapshot in Time of an Oblique Rifted Margin," Ana Krueger, Page 15*	17 **HGS Northsiders Luncheon Meeting** *"Geomechanical and Flow Simulation of Hydraulic Fractures Using High-Resolution Passive Seismic Images," Clifford (Cliff) Knitter, Page 23*	18
22	23 **HGS North American Dinner Meeting** *"Predictive Organization of Deep-Water Lobes," Jacob (Jake) Covault, Page 25*	24	25 **HGS General Luncheon Meeting** *"New Plays and New Players Bring New Life to the Gulf of Mexico Shelf," Andy C. Clifford, Page 27*

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.**

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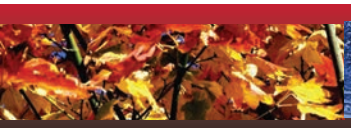
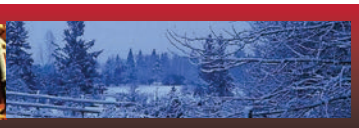


GeoEvents



Thursday	Friday	Saturday
5	6	7
12	13	14
19	20	21
26	27	28

Don't wait, make your reservations online at ww.hgs.org

March 11-12, 2015
Industry-Rice Earth Science Symposia
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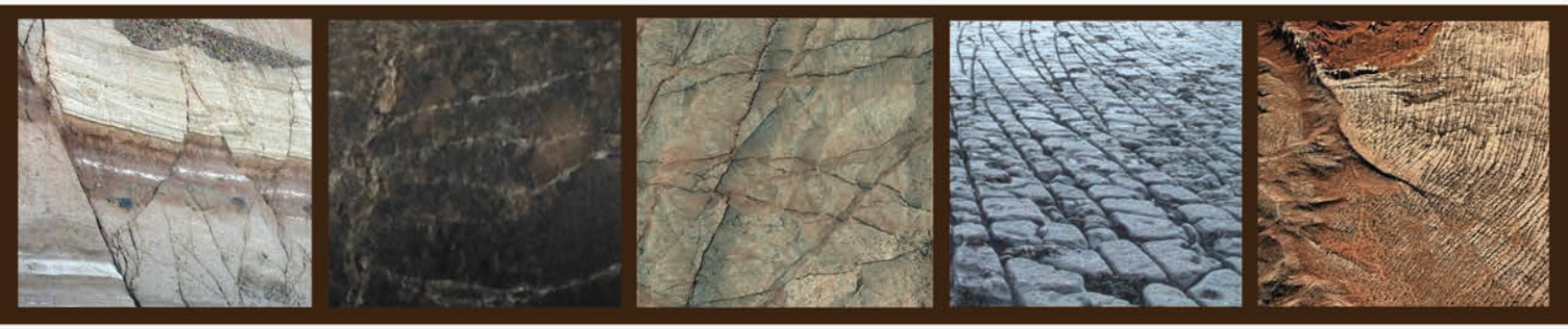
Applied Geoscience Conference



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Reservoir Characterization and Production Properties of Source Rocks	**March 23-24, 2015** Tulsa, OK
Description and Interpretation of Shale Facies	**March 25-26, 2015** Tulsa, OK

SHORT COURSES

Sequence Stratigraphy: Principles & Applications (with AAPG Annual Meeting)	**May 30-31, 2015** Denver, CO
Exploration in the Bakken Petroleum System (with AAPG Annual Meeting)	**May 30, 2015** Denver, CO
Integrating Data from Nano- to Macro-Scale (with AAPG Annual Meeting)	**May 31, 2015** Denver, CO
Practical Aspects of Petroleum Geochemistry (with AAPG Annual Meeting)	**May 31, 2015** Denver, CO

FIELD SEMINARS

Sequence Stratigraphic Facies Architecture & Reservoir Characterization of Fluvial, Deltaic and Strand-Plain Deposits	**May 1-8, 2015** Utah
Geology of Grand Canyon, Bryce Canyon and Zion National Parks	**May 23-29** Nevada
Deep-Water Siliciclastic Reservoirs	**June 5-10, 2015** California
Carbonate Reservoir Analogues: Play Concepts and Controls on Porosity	**June 8-13, 2015** Spain
Utica, Marcellus and Black Shales in the Northern Appalachian Basin	**June 15-19, 2015** New York
The Lodgepole-Bakken-Three Forks Petroleum System	**June 24-26, 2015** Montana

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www.aapg.org/career/training/

AAPG Education

HGS Undergraduate Scholarship Foundation Presents Six Scholarships

The HGS Undergraduate Scholarship Foundation has provided over $253,000 in scholarships to deserving geoscience students since 1984. This year the Foundation awarded scholarships totaling $16,000 to students from six universities participating in our program. Maya Stokes from the Rice University was awarded the Maby Scholarship, presented each year to the Foundation's top applicant. Foundation Chairman John Adamick presented the scholarships to the recipients at the January 19th HGS Legends dinner meeting. The Foundation was also fortunate to have a large number of corporate sponsors support Legends Night and the HGS scholarship programs. Over $42,000 in scholarship funding was raised from 24 different sponsors.

Sponsors for 2015 included

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Individual Level

Core Lab, Gideon Powell, John Tubb, Linda Sternbach, Talos Energy, and Vitruvian Exploration II

Thank you sponsors for your generous support!

Vitae for our scholarship winners are provided below. These students are to be commended for their accomplishments.

John Adamick
HGS Foundation Chairman

Maya Stokes
Maby Scholarship recipient
Rice University

Maya Stokes is a senior, majoring in earth science at Rice University. Her academic interests are broad, but she has focused her undergraduate research on sedimentology under the advising of Dr. Jeffrey Nittrouer. She has participated in a GIS project investigating the bathymetry of the Mississippi River as well as a field campaign in County Clare, Ireland. Outside of the classroom she works at the GIS Data Center at Rice University and serves as captain of the women's Ultimate Frisbee club team which won the Division III Collegiate National Championships in May, 2014. She founded the Rice Undergraduate Geoscience Society (RUGS) and enjoyed one year as president. In October, 2014 she presented her research at the GSA Annual Meeting in Vancouver and won an SEPM award for best student poster presentation. After graduation this May she plans to attend graduate school to research topics in sedimentology and geomorphology.

Wanda Crupa
University of Houston

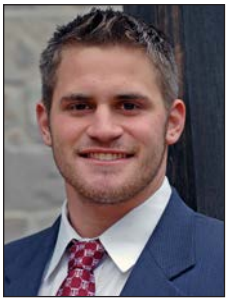
Wanda Crupa is a junior at the University of Houston and is currently completing a double major in geophysics and geology with a minor in mathematics. She has made the Dean's List every semester and was awarded the Outstanding Sophomore Award last spring; she is a member of the Alpha Lambda Delta National Honor Society and the National Society of Collegiate Scholars. In her free time Wanda enjoys knitting, reading, and learning languages. This spring semester she will be working with Dr. Khan to examine the hydrocarbon-rich Eagle Ford Formation in West Texas where she will be applying processing techniques to GPR data profiles. After graduation she plans to attend graduate school and attain a master in geophysics, as well as possibly study abroad.

Undergraduate Scholarships *continued on page 39*

HGS Undergraduate Scholarships *continued from page 37*

Patrick Taylor
Lamar University

Patrick Stephen Taylor is a senior at Lamar University majoring in geology. Before transferring to Lamar University, he was a member of Phi Theta Kappa and graduated Cum Laude from Lamar State College – Orange with an Associate of Natural Science degree. Since the fall semester of 2013, Mr. Taylor has been active with Lamar's Earth and Space Science department. In the fall of 2013 he worked as a research assistant to Dr. Joseph Kruger, which entailed quantifying gravitational anomalies and elevation changes of Southeast Texas. Patrick, being an Eagle Scout, also planned and hosted a Cub Scout Pack at Lamar University and helped them earn their Geology badges with the assistance of Dr. Jim Westgate and Christine Gartner-Lee. Currently, Mr. Taylor is the treasurer of the Lamar University Geological Society, has worked as a teaching assistant for fall 2014, and plans to work as a student teacher for the spring semester of 2015. Patrick is an avid outdoorsman and enjoys experiencing all aspects of the natural world, especially the magnificence of geology and its complex inner workings. After earning his Bachelor's degree, Patrick plans to attend graduate school for geophysics and work in the petroleum industry.



Nicholas McDaniel
Texas A&M University

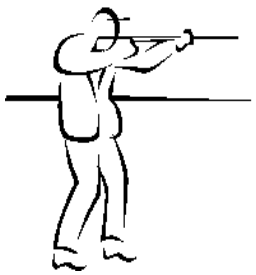
Nick McDaniel is a senior at Texas A&M University, where he studies geophysics. Throughout the course of his studies, Nick has maintained a 4.0, which has resulted in his inclusion on the Dean's List every semester. His work ethic and scholastic aptitude is recognized both by his peers and by his professors, which has led to his election to the SEG Program chair, in which he plans to serve colleagues within the geophysical community. Nick has been involved in various research projects, including his current research in cooperation with Utrecht University, where he will be using shallow seismic acquisition to locate optimal drill sites for paleo-environmental research. Following his graduation in December, Nick intends to pursue a Master of Science degree in geophysics.

Seth Thomas
Sam Houston State University

Seth Thomas is a senior at Sam Houston State University where he is pursuing a degree in geology. His passion for earth science prompted him to return to school after previously receiving a B.S. in geography from Brigham Young University. He is an active member of the AAPG and Sam Houston Association of Geology Students. He currently instructs Physical Geology lab and takes great pleasure in helping others become more interested in earth science. Besides studying and teaching geology, he enjoys camping, mountain biking, and traveling. After graduation, he plans to attend graduate school, and hopes to do research that may further energy resource exploration and eventually have a rewarding career in the petroleum industry.

Rose Palermo
University of Texas

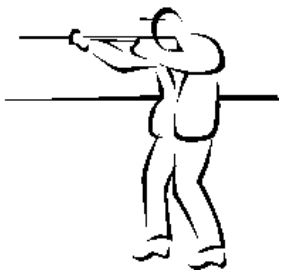
Rose Palermo is a junior at the University of Texas, where she is pursuing dual degrees in geology and Plan II Honors. She currently serves as an officer in the Undergraduate Geological Society and is a member of the Geological Leadership Organization for Women. She is a Jackson Honors student, working on her thesis studying coastal erosion with Dr. David Mohrig. Her academic interests also include deep-water geology, as she assists on projects in the Mohrig group focused on transitional flow deposits. Outside of the classroom, she enjoys playing on UT's Club Tennis team and exploring Austin. Ms. Palermo plans to attend graduate school after graduation in May 2016.



ANNUAL HGS SKEET SHOOT

Saturday, June 27, 2015

Greater Houston Gun Club
6702 McHard Road, Missouri City



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If there are any questions, please contact Tom McCarroll—713-419-9414 or tom_mccarroll@yahoo.com.

To register online, please go to http://www.hgs.org/eventskeetshoot

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.

AGI Geoscience Policy Monthly Review (December 2014)

President Obama Prohibits Offshore Drilling in Bristol Bay

On December 16, 2014 President Obama enacted an indefinite moratorium on offshore oil and gas development in Bristol Bay, Alaska. The area in the eastern Bering Sea has historically been placed off-limits to drilling by Democratic presidents and opened to energy leases by Republican administrations; this action will halt drilling through Obama's last term, but future presidents could once again open the area.

An estimated total of $7.7 billion of oil and gas reserves underlie Bristol Bay, while its fisheries bring in an average of $2.5 billion every year and supply 40 percent of U.S. wild-caught seafood. Because of the risk posed by oil spills and other chemical leaks, President Obama's action received a favorable reaction from the fishing industry, as well as Native Alaskan and conservation groups. Oil and gas companies have not expressed significant recent interest in Bristol Bay, but industry groups objected to the blanket ban on drilling.

The Bristol Bay watershed is also the proposed site of Pebble Mine, a large project that would produce copper, gold, and molybdenum. Environmental and fishing interests have expressed concerns over the mine's effect on Southwest Alaska and Bristol Bay's ecosystems, while proponents cite the jobs and economic growth that the mine could provide.

New York Bans Hydraulic Fracturing; Maryland Reinstates It

Following the results of two reports that assessed public health risks associated with hydraulic fracturing, New York Governor Andrew Cuomo upheld his state's moratorium on the practice while Maryland's outgoing-Governor Martin O'Malley plans to overturn their moratorium, allowing hydraulic fracturing in the state.

Hydraulic fracturing, commonly known as "fracking," is a well-stimulation technology in which pressurized fluids are injected into preexisting wellbores, opening fractures in the rock usually to release natural gas or petroleum products.

Governor Cuomo's administration announced on December 17, 2014 that it will ban high volume hydraulic fracturing (HVHF), continuing a state moratorium on the extraction method that has been in place since 2008. Although not defined by the New York report, high-volume hydraulic fracturing is defined by the University of Michigan as a "well completion operation that is intended to use a total of more than 100,000 gallons of hydraulic fracturing fluid."

Acting New York State Health Commissioner Howard Zucker stated that after reviewing health studies on the effects of hydraulic fracturing, his department determined that not enough evidence exists showing that fracking is performed safely. He went on to cite anecdotal reports of adverse effects on air, water, and soil quality, and community health near wells where the technique is used. Industry representatives criticized the New York ban, arguing that hydraulic fracturing is performed on many wells without contamination and citing the jobs and economic growth that its use could bring to the region. Despite the announcement, the ban may be subject to future legal challenges, most notably from property owners who now cannot financially benefit from local drilling.

Conversely, outgoing Maryland Governor Martin O'Malley announced this November that he would lift the state's current ban on hydraulic fracturing and institute strict regulations instead. Governor O'Malley's announcement comes after the release of the third installment of a Marcellus Shale Safe Drilling Initiative study. Some environmental groups praised this step, particularly a measure to limit methane emissions, but others objected to opening the state to fracking at all. Industry groups were critical of the regulations, stating that they would be the most rigorous in the country. It remains to be seen what level of regulation Governor-elect Larry Hogan will retain; he has previously expressed support for the technique when it is performed "in an environmentally sensitive way."

Lima Climate Negotiations Create Road Map for 2015 Paris Negotiations

United Nations (UN) climate negotiations in Lima closed on December 15, 2014 with an agreement that could lead to a global climate accord in Paris later this year. The main disagreement during the two weeks of talks occurred between developing countries and wealthier nations on how to allocate responsibility for dealing with climate change.

In negotiations since the Kyoto Protocol, wealthy countries have taken on the majority of emissions cuts and other measures. The rationale is that nations that industrialized by using cheap coal

Government Update *continued on page 45*

Government Update *continued from page 43*

energy are responsible for much of the anthropogenic carbon currently in the atmosphere, and it would be unfair to stunt growth in newly developing countries by introducing large emissions restrictions. Based on objections to this principle, the U.S. has repeatedly refused to sign on to the Kyoto accord.

However, under the new framework developed in Lima, all countries will be expected to cut carbon emissions after 2020, although poorer nations will receive financial and technological assistance from wealthier ones.

Many delegates were relieved to reach an agreement after the heated negotiations and were hopeful that this compromise will enable a binding global treaty in Paris. However, environmental groups were critical of the result. They expressed frustration that the emissions cuts were not aggressive enough and that the language of the document is not binding.

Noaa Releases Annual Arctic Report Card

The National Oceanic and Atmospheric Administration (NOAA) released its annual Arctic report card on December 17, 2014 which analyzes climatic trends in the region. The report, which is divided into seven topics including sea ice and snow cover extent, tundra conditions, and air and sea surface temperatures, highlights warming trends and their ripple effects in the Arctic environment. For example, record low sea ice cover has allowed solar radiation to penetrate the upper ocean, encouraging primary production and warming the sea surface. The report also notes that a sinuous jet stream in early 2014 was responsible for unusually warm temperatures in Alaska and frigid weather in eastern North America; however, scientists were hesitant to link the jet stream conditions with declines in Arctic sea ice.

Changes in the Arctic climate have wide-reaching impacts: melting of the Greenland continental ice sheet contributes to global sea level rise, while decreases in sea ice could open the Arctic to shipping and offshore drilling. Permafrost also stores significant amounts of methane and carbon dioxide, which are released as it melts. Because of the global nature of these impacts, many of the report's authors called for increased research funding to allow further Arctic observations and analysis.

Senate Confirms Energy Nominees

On December 16, 2014 the Senate unanimously confirmed by voice vote several of President Obama's long-standing nominees for energy advisory posts in one of the final actions of the 113th Congress.

The Senate confirmed Franklin (Lynn) Orr as Under Secretary for Science and Energy within the Department of Energy (DOE).

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The University of Texas at Austin Research Position in Clastic Sedimentology

The Bureau of Economic Geology, Jackson School of Geosciences at The University of Texas in Austin invites applicants for a full time research position in clastic sedimentology and stratigraphy. We seek an experienced candidate to conduct cutting edge research and lead the Quantitative Clastics Laboratory (QCL), a consortium-funded research group focused on the description, analysis, and quantification (morphometrics) of clastic depositional systems that are potential reservoir analogues.

This is a senior-level position. Requirements include a PhD in geology or closely related field, five to ten years of post-PhD experience, a strong record of publishing, evidence of successful leadership, as well as the ability to acquire and retain industry sponsors.

The candidate's research focus could include, but would not be limited to, source-to-sink dynamics, process sedimentology, evolution of complex continental margin settings, basin analysis, sequence stratigraphy, and application of seismic geomorphology to reservoir characterization. The candidate should be motivated to work with colleagues in developing improved understanding of scaling issues from the core to seismic level, including the roles of outcrop description and physical modeling. A strong desire and ability to successfully sponsor PhD and Master's level students is also highly valued.

Success in this position requires a desire to lead a small team, and to craft a long-term vision that will result in growing and sustaining the QCL. Abundant opportunities exist for collaborating with industry researchers, interacting with other researchers and faculty of the Jackson School, advising graduate students, and acquiring or sharing laboratory and field equipment.

Preference will be given to candidates with deepwater clastics systems expertise, and those who have an appreciation of energy industry needs and challenges.

The Bureau of Economic Geology, with a staff of 250 including approximately 60 graduate student research assistants, is the oldest research unit of The University of Texas at Austin. The Bureau hosts ten research consortia, strongly supported by industry. We enjoy outstanding IT resources and support. The Bureau has a diverse workforce, extensive laboratory facilities, and operates the largest rock-core collection in the U.S. (~1500 miles of core). The Jackson School of Geosciences is highly ranked and is the largest U.S. geoscience program. Austin is a thriving city of about 1 million, renowned for live music and Texas Hill Country ambiance.

Candidates can apply at the Research Scientist or the Senior Research Scientist level, depending upon qualifications. Go to https://utdirect.utexas.edu/apps/hr/jobs/nlogon/search/0/ for complete description and to apply for posting number 141111010702 (Research Scientist) or 141111010701 (Senior Research Scientist).

The University of Texas at Austin is an equal employment opportunity/affirmative action employer. All positions are security sensitive, and conviction verification is conducted on applicants selected.

BUREAU OF ECONOMIC GEOLOGY

THE UNIVERSITY OF TEXAS AT AUSTIN
JACKSON
SCHOOL OF GEOSCIENCES

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In his new capacity, Orr will focus on science and energy research and clean energy technology, and will oversee several DOE mission areas including Fossil Energy, Energy Efficiency and Renewable Energy, and the Office of Science. He will also direct the majority of DOE's National Laboratories.

Other nominees approved by the Senate include Christopher Smith, who was confirmed as the Assistant Secretary for Fossil Energy at DOE, Colette Honorable, who will join the Federal Energy Regulatory Commission, and John Cruden, who was confirmed as the Assistant Attorney General of Environment and Natural Resources within the Department of Justice.

Interior Secretary Names New Director of Bureau of Ocean Energy Management

Interior Secretary Sally Jewell named Abigail Ross Hopper as Director of the Bureau of Ocean Energy Management (BOEM) on December 18, 2014. Hopper succeeds Acting Director Walter Cruickshank and will be the second director of the agency, following Tommy Beaudreau who left the position in May to be Chief of Staff to Secretary Jewell.

BOEM was formed out of the former Minerals Management Service in the wake of the 2010-2011 Deepwater Horizon oil spill. BOEM oversees oil and gas development and renewable energy development on 1.7 billion acres of federal waters.

As Hopper joins the agency, BOEM faces critical questions on whether to open new waters to oil and gas leases in its 2017-22 leasing plan and whether to move forward with proposed lease sales in 2016 in Alaska's Beaufort and Chukchi Seas. She will oversee 569 employees and a $170 million budget at BOEM. Hopper currently serves as the Director of the Maryland Energy Administration and oversaw passage of the Maryland Offshore Wind Energy Act of 2013.

Los Angeles Mayor Proposes Seismic Retrofit for Riskiest Buildings

Los Angeles Mayor Eric Garcetti released a report on December 8, 2014 that proposes new, stricter building codes aimed at the structures mostly likely to collapse in an earthquake. The codes would require seismic retrofits to wooden structures with a "soft-story" first floor, such as a garage, and concrete buildings without enough steel reinforcement, most of which were built before updated safety regulations were applied in 1980. Most earthquake fatalities result from building collapses, so the retrofits are designed to keep buildings standing even if they sustain significant damage. This would greatly reduce casualties for the thousands of people that currently live and work in these types of structures.

Mayor Garcetti stated that although the retrofit would require substantial investments by building owners, inaction could lead to severe economic consequences for Los Angeles and the entire U.S. should an earthquake strike.

According to the Southern California Earthquake Center (SCEC), there is a 67% probability of a magnitude 6.7 or larger earthquake near Los Angeles over the next 30 years. The proposed requirements are more advanced than those instituted in other earthquake-prone cities in the U.S. It remains to be seen if other jurisdictions will follow suit.

Joint SR 530 Landslide Commission Releases Final Report on Oso Landslide

On December 15, 2014 the Washington State Joint SR 530 Landslide Commission released its final report in response to the tragic March 2014 Oso landslide that destroyed homes and roads and claimed 43 lives. Formed by Washington State Governor Jay Inslee and Snohomish County Executive John Lovick, the Commission laid out lessons learned and 17 recommendations for responding to future landslide hazards in its report.

Among its key recommendations, the report advises state and local officials to support increased landslide hazard mapping, to establish a state mobilization plan for non-fire hazards, and to convene a task force to evaluate regional and state-wide natural hazards and existing emergency response systems. To read the full report go to: http://www.governor.wa.gov/documents/SR530LC_Final_Report.pdf

New Data Measure Water Losses Across the Western U.S.

On December 16, 2014 NASA and U.S. Geological Survey (USGS) scientists released separate studies reporting significant declines in groundwater in the Western U.S. NASA scientists announced that water levels in the Sacramento and San Joaquin River basins, which include the western slope of the Sierra Nevada

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HGS Welcomes New Members

New Members Effective January 2015

ACTIVE MEMBERS

Frederick Hines

Stephanie Ingle

Zane Jobe

David Kennedy

Amanda Musgrove

Terri Olson

Juan Peralta

Deborah Resley

Timothy Sherry

Gonzalo Zamora Valcarce

EMERITUS MEMBERS

Eugene Peeples III

STUDENT MEMBERS

Adewale Amosu

Scott Hamilton

Xiang Ling

John Mohr

William Smolik

Rabab Zehra

Welcome New Members

Government Update continued from page 47

and the northern half of the Central Valley, are 11 trillion gallons below normal levels. Scientists used data from NASA's Gravity Recovery and Climate Experiment (GRACE) satellites to measure surface and groundwater levels, finding that most of the water deficit is the result of groundwater extractions. Farmers have relied on these basins to irrigate crops during the past three years of drought conditions. Despite significant recent rainfall, hydrologists estimate that California would need 150 percent of its normal rainfall this winter to ease the drought and recharge the aquifer.

The USGS report summarizes recent declines in the High Plains Aquifer, which underlies parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Based on well measurements, the study compared current groundwater levels to measurements before significant extractions began in the 1950s. Measurements taken in 2011 showed an eight percent decline in aquifer levels, with an additional one percent depletion occurring between 2011 and 2013, which the report's lead author called "substantial" and attributed to increased groundwater pumping.

Draft World Ocean Assessment Available for Review

A draft of the first World Ocean Assessment (WOA) opened for review by registered experts on December 20. The WOA stems from the 2002 World Summit on Sustainable Development, where the United Nations established a systematic review of the state of the world's oceans from economic, environmental, and social perspectives. The 2015 assessment is the first to be completed, and in the future they will be conducted every five years. ■

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George H. W. Bush Library

Barbara Peck, Phyllis Carter, Millie Tonn

Norma Jean Jones, Shirley Gordon

Sheri McQuinn, Paige Moore, Jeannette Coon

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 or Adobe Photoshop. Files should be saved and submitted in .ai, .eps, .tif or .jpg format. Send them as separate attachments via email or CD if they are larger than 5 MEGs 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 5 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.**

Random Inside Ad Placement **Black & White Prices Shown** **Color add 30% to prices shown below**					**Specific Page Color Ad Placement**					
No. of Issues	**Random Eighth Page**	**Random Quarter Page**	**Random Half Page**	**Random Full Page**	**Inside Front Cover Full Page**	**Inside Back Cover Full Page**	**Page 2 Full Page**	**Outside Back Cover Half Page**	**Back of Calendar Full Page**	**Calendar Quarter Page**
10	$823	$1,387	$2,488	$4,734	$7,830	$7,560	$7,384	$6,858	$6,750	$2,700
9	$823	$1,387	$2,488	$4,734						
8	$750	$1,260	$2,242	$4,307						
7	$665	$1,123	$2,014	$3,834						
6	$590	$990	$1,782	$3,392						$1,890
5	$497	$837	$1,503	$2,860	$4,698	$4,536	$4,466	$4,104		
4	$405	$683	$1,223	$2,326						
3	$327	$550	$990	$1,886						$1,080
2	$232	$392	$704	$1,339						
1	$146	$246	$443	$842	$1,404	$1,296	$1,313	$1,080	$1,296	$810
Professional Directory Section Business Card Ad 10 Issues – $160 ($30 for each additional name on same card)										

Website Advertising Opportunities

HGS has multiple website advertising opportunities for your company! We've expanded our offerings to include a 275 x 800 pixel, rotating banner ad on the front page of the website. We have kept the popular Event Calendar and Geo-Job Postings advertisement locations!

	Home page Banner	**Home Page (200 x 400 pixels)**	**Event Calendar (200 x 400 pixels)**	**Geo-Jobs (120 x 90 pixels)**	**Website Business Card (Members Only)**	**Personal Resumes (Members Only)**
One year	$3,000.00	$2,800.00	$2,500.00	$1,400.00	Free	Free
6 months	$2,000.00	$1,800.00	$1,500.00	$750.00	Free	Free
3 months	$1,500.00	$1,300.00	$1,000.00	$450.00	Free	Free
Monthly	$ 700.00	$500.00	$ 400.00	$200.00	Free	Free

We still offer Geo-Jobs - where your company can post job openings for 14 days at $50.00 or 30 days at $100.00.

For more information regarding website advertising visit HGS.org or email jill@hgs.org.

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.

Qualifications for Associate Membership (including students)

1) Be involved in the application of the earth or allied sciences.
2) Be a full-time student enrolled in geology or in the related sciences.

Apply online at www.hgs.org and click on Join HGS

Annual Dues Expire Each June 30. (Late renewals – $5 re-instatement fee)
Annual dues are $28.00; emeritus members pay $14.00; students are free.

Mail this application and payment to:
Houston Geological Society
14811 St. Mary's Lane, Suite 250 • Houston, TX 77079-2916
Telephone: 713-463-9476 Fax: 281-679-5504

Payment method:

☐ Check, ☐ VISA, ☐ MasterCard, ☐ American Express, ☐ Discover

Card # _____

Expiration Date: _____ Card I.D. _____

(Card I.D. – 3 or 4 digit number on front or back of card)

To the Executive Board: I hereby apply for ❑ Active or ❑ Associate membership in the Houston Geological Society and pledge to abide by its Constitution and Bylaws. ❑ Check here if a full-time student.

Name: _____

Address: _____

_____

Home Phone: _____ *Spouse's Name:* _____

Email: _____

Job Title: _____

Company: _____

Company Address: _____

_____

Work Phone: _____ *Fax Number:* _____

Circle Preferred Mailing Address: Home Office

Professional Affiliations: _____

❑ AAPG member No.: _____

Professional Interest:

❑ Environmental Geology
❑ International E&P
❑ North American E&P (other than Gulf Coast)
❑ Gulf Coast E&P (onshore & offshore)

School _____

Degree _____ *Major* _____ *Year* _____

_____

School _____

Degree _____ *Major* _____ *Year* _____

Earth Science Work Experience _____

_____

_____

_____

Applicant's Signature _____ *Date* _____

Endorsement by HGS member (not required if active AAPG member)

Name: _____

Signature _____ *Date* _____

Membership Chairman _____ *HGS Secretary* _____

revised 7/30/14

Houston Petroleum Auxiliary Council News

Janet Steinmetz, 281-531-7204

ATTENTION ALL HUSBANDS! Please share this article with your wife. Spouses of geologists, geophysicists, landmen and engineers are invited to join HPAC, an organization designed especially for you.

March is here which means *St. Patrick's Day and Game Day* are also upon us. We will be celebrating them simultaneously at the Braeburn Country Club on March 17. **Daisy Wood** and her committee will show us how it's done. Be sure to make your reservation by calling Daisy at 832-581-3132. You have your choice among a variety of games – bridge, kings on the corner, chicken foot dominoes and scrabble, or you can bring your own. Invite your friends. Enjoy a special lunch, and there are always plenty of door prizes.

Myrtis Trowbridge has agreed to share a bit of her background and her life as the wife of a geologist. Here is her story:

"I was born September 27th, 1925, in Thibodaux, Louisiana, to Paul and Augusta Legendre. We lived in Thibodaux for several years and then moved to New Orleans, where my father had a job with Metropolitan Life Insurance Company. Later my father was diagnosed with cancer and died in September of 1932. My mother decided after my father's death that she would move to Thibodaux where my father was buried and my grandparents lived. There were 5 of us children (3 boys and 2 girls) – she had her hands full.

"I finished high school in Thibodaux in 1943. After working a year or two, I decided to go to Soule's Business College in New Orleans. Upon finishing Soule's I returned to Thibodaux and worked a few years. Then I decided to go to Lake Charles, Louisiana where I worked for Stanolind Oil and Gas Company. Later I transferred to the New Orleans office and in 1954 I met my husband Gene who was also employed with Stanolind. We were married in May of 1955. Gene had been applying at different companies for a job in Geology. In September, he was offered a job with F. A. Callery in Houston, Texas. We moved to Houston in September, and stayed here until his death on May 27th, 2008.

"In the meantime we had started our family. We had 2 boys and 4 girls. Needless to say I was a stay-at-home Mom. After a few years, I joined the Houston Geological Auxiliary (HGA). I thoroughly enjoyed my association with HGA and looked forward to the meetings. In 1989, I was asked to be President of the Auxiliary for the '89-'90 term. That was a busy but exciting time of my life. Getting to know many of the ladies was delightful. We really had a fine group of ladies, and I consider myself very fortunate to be associated with such a group.

"My life changed in 2008. My husband Gene had COPD, and after 12 days in the hospital with pneumonia, he died of a heart attack. After Gene's death I stayed in Houston, finally sold my home in 2013; and moved into The Terrace near Memorial City Mall. Several months later I got sick and decided I needed to be near one of my daughters. So I moved to San Antonio where my daughter Martha lives." Thank you, Myrtis, for your years of service and your contribution to the success of HGA. We look forward to your visits to Houston.

As usual, our *Exploring Houston* tour last month was fabulous. We thank **Martha Lou Broussard** and **Linnie Edwards** for all the time and energy they put into these tours. They took us to museums and historical sites in Houston's Third Ward; many of them places we never knew existed.

The *Book Club* enjoyed another in-depth discussion in February. Kudos to **Kathi Hilterman** for her insights into *Mrs. Lincoln's Dressmaker* by Jennifer Chiaverini. We certainly got a different viewpoint of the period before and doing the Civil War. Thanks also goes to **Marjorie Shea** for hosting. At the May 4th meeting we will discuss Donna Tartt's *The Goldfinch.* This is a very long book; you might want to start reading it now. It will be quite an adventure!

Our Bridge Groups are always looking for new members. *Cinco Más* will meet Thursday, March 12 at the Westlake Marriott. Call **Audrey Tompkins** at 713-686-0005 to join. *The Petroleum Club Group* will meet on March 18 at their new location. Call D**aisy Wood** at 832-581-3132 for details.

The following pictures were taken by **Wanda Shaw** during our tour of the George H.W. Bush Library and Messina Hof Winery and also at our December luncheon where we were entertained by an Elvis impersonator.

For information about joining HPAC please call **Susan Bell** at 281-597-0858. Come and join in the fellowship and fun.

HPAC *continued on page 49*

Wanda Shaw, "Elvis"

You are invited to become a member of

HPAC

2014–2015 dues are $20.00 Mail dues payment along with the completed information

to **Susan Bell** • 11431 Legend Manor • Houston, Texas 77082

YEARBOOK INFORMATION

Last Name	First Name	Name Tag
Spouse Name	Company	
Street Address	City State	Zip
Email Address	Home Fax	
Home Phone	Cell Phone (Optional)	Home Email Address

Please choose a committee assignment if you are interested.

☐ Fall Event ☐ Yearbook ☐ Bridge ☐ Membership

☐ Christmas Event ☐ Spring Event ☐ Notification ☐ Book Club

☐ Exploring Houston ☐ Courtesy

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