HGS Bulletin
Houston Geological Society
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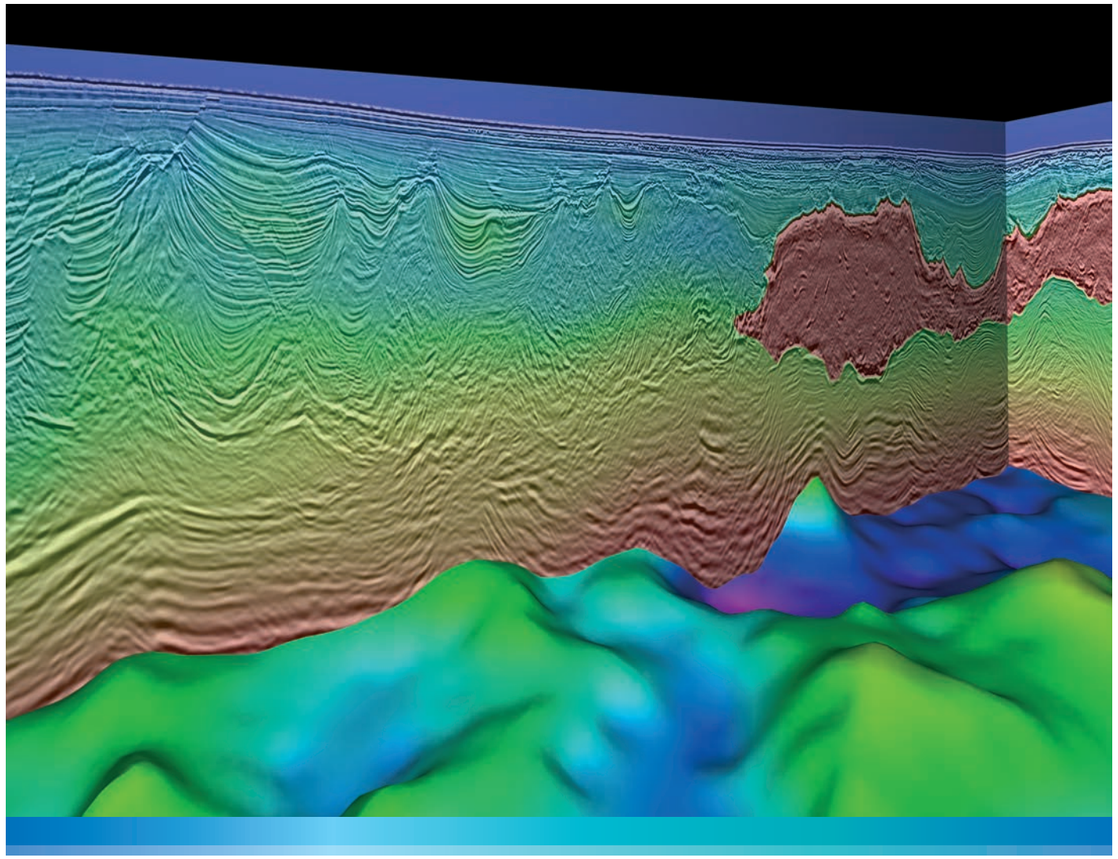
Election Issue



The Bulletin
Houston Geological Society

Volume 60, Number 7 — March 2018

In Every Issue

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Technical Meetings

Other Features

About the Cover: Svalbard, Norway. Photo by Brian W. Horn.

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HGS Presents:

Take a kid to the outcrop family campout!

April 27-29, 2018
Camp Cullen YMCA in Trinity, TX

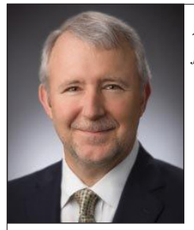
Come join fellow HGS members and their families for a weekend of fun! Activities include:

Interpreted quarry with hunts for fossils and petrified wood
Newly renovated geology lab with samples and flume
Gold panning
Zip line
Archery
Riflery
Arts & crafts
Marathon pipeline slide
Basketball
Gaga ball
Campfires

All of this and more, all only 1.5 hours north of Houston!

Check in Friday evening and check out Sunday morning. Cost is $110/person for up to 4 people. For families of 5+, call for a discounted rate. The fee includes overnight stay Friday and Saturday nights, 4 meals and all activities. Each family will have a private bunkhouse for up to 8 and private family bathroom in newly renovated cabins. For more information on the facilities, please visit the Camp Cullen website at https://www.ymcacampcullen.org/

Reserve your spot today! Reservations accepted through April 19, 2018
Call the HGS office at 713-463-9476



John A. Adamick
john.adamick@tgs.com

More Than Oil…

For many years Houston has been a major hub for oil and gas companies. Today there are probably more industry related companies in Houston than any other city in the world. This has helped HGS continue to be a robust organization as many of our members work in this sector. Although many of our members describe themselves as an Independent/Consultant, we also have a substantial number of members working for corporate employers. Currently, the top corporate employers include Chevron, Shell, Oxy and Anadarko. On behalf of HGS I would like to extend my sincere thanks to these and all companies who support their employee's participation in our society.

Because of membership demographics the HGS rightfully focuses a lot of attention to oil and gas related topics in our lunch and dinner meetings, conferences, and continuing education classes. We also have members devoted to other industries and today I'd like to focus on a couple of committees who perform valuable work in areas outside the general oil and gas arena.

I'd like to first start with the Environmental and Engineering (E&E) Committee. The E&E committee began in the mid-1980s at the height of the oil and gas recession. The objective of the group was, and continues to be, to provide a transition to other fields of geology that center around environmental engineering geology by holding classes, field trips, and a monthly speaker program. The group also serves a networking function for unemployed members. The committee is currently chaired by **Matt Cowan** and holds monthly meetings at the Black Labrador Pub. The E&E dinner meeting this month is scheduled for April 11th and titled "Methodologies for Precision Drilling and Blasting" by Jared Redkey. Although not directly tied to what I do professionally, I am going to try and attend this event and encourage you to as well. It always amazes me when I see those video clips where structures get imploded without damaging anything else. And now I'll have a chance to learn how they do it!

Next, I'd like to focus on the Government Affairs Committee, co-chaired by **Henry Wise** and **Arlin Howles**. Many of us would probably rather do just about anything else other than to try and keep track of government activities related to geoscience. Yet, this is an extremely important subject that can directly affect HGS members and this is the committee that serves as the "eyes and ears" for the Society.

Interest in this topic picked up in the early 2000's when there were several attempts by a Texas state commission to have geologic work certified by engineers rather than geologists. Later, there was a quiet movement to undo the professional geoscientist licensure law for Texas geologists involved in environmental and engineering geology. Henry and Arlin worked on several grass-roots initiatives to track and then act on these developing government issues affecting geoscientists. They also represented HGS by meeting with state senators and testifying on the Senate Floor about these issues. This work led to the formation of the Government Affairs Committee in 2005. There are two regular reports generated by the committee that are beneficial to members. *The Wise Report* is published weekly, as needed, on the HGS website and reports on things that are both of interest to Texas Geologists and time-sensitive. The *Government Update* report is published monthly and takes a broader approach since its readership is much larger and diverse and includes information of interest both inside and outside the state. In addition,the committee also works when needed to recruit government speakers for certain Continuing Education courses such as the HGS Flooding Conference planned for later this year.

Finally I would like to mention the wide variety of social events held each year by HGS. These are of interest to geologists no matter what they do as their "day" job! Among these events are the HGS golf and tennis tournaments, the HGS skeet shoot, and Guest Night. This month we also have the HGS Shrimp Peel to enjoy. The event will be at Bear Creek Pioneers Park (3535 War Memorial Street) on Friday, April 20th. The Shrimp Peel is a delightful event with tasty food, drink, entertainment and company at a time of year when Houston weather is usually quite nice. Please attend if you can!

I'd like to close my column by thanking **Matt Cowan**, **Henry Wise**, and **Arlin Howles** for the excellent work they do on behalf of the HGS. As I described above, their activities are important to many of our members and we are a better Society because of them. Thanks, guys!

The Houston Geological Society Continuing Education Committee Presents

The Lucia Method of Carbonate Reservoir Characterization

A One-Day Short Course
by David Orchard
Friday, April 6, 2018 • Apache Corporation
2000 Post Oak Boulevard, Room 108 • Houston, Texas 77056

Methods developed by Floyd J. (Jerry) Lucia provide a direct link between rock fabrics and the petrophysical behavior of carbonate reservoir rocks. These are core/petrography and log-based methods for modeling relationships between depositional/diagenetic facies, porosity, permeability, and water saturation/height functions in oil reservoirs. They effectively deal with the infamous complexity of carbonate rock properties. They are applicable for both "quick look" evaluations and detailed reservoir models and are widely applied to reservoir studies in the Permian Basin and other carbonate systems.

This one-day course provides lectures and spreadsheet exercises to train attendees in the theory and application of the methods. Mr. Lucia has provided his lecture and exercise materials for use in this seminar and additional new case studies will be introduced by the instructor..

Pricing

HGS Members unemployed: call for special pricing

Early Registration: by 8AM, Friday, March 23, 2018:		**Registration:** Through 8 AM, Friday, March 30, 2018:	
HGS Member:	$100.00	HGS Member:	$110.00
Non-Member:	$140.00	Non-Member:	$150.00
HGS Student Member:	$80.00	HGS Student Member:	$80.00

Non-members can save $10 and receive the Member registration price, if they apply for any category of HGS membership online (https://www.hgs.org/membership_overview), submit the application, including payment, then register for the course by calling the HGS Office (713-463-9476) before receiving formal acceptance.

Registrants will receive by email, before the course, a map and specific directions for entrance, parking, and visitor check-in.

Notebook, Certificate of Attendance, Networking Lunch, Continental Breakfast, Coffee and Break Refreshments are included in the Registration price.

Date: Friday, April 6, 2018 • 8:30 am – 5 pm (Doors open at 7:30 am)

Location: Apache Corporation • 2000 Post Oak Boulevard, Room 108
Houston, Texas 77056
Visitor Parking $5.00 – Enter from Guilford Court

Please make your reservations on-line www.hgs.org

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

Brian W. Horn
Brian.Horn@iongeo.com

Fighting Giants

I recently finished reading Malcom Gladwell's "David and Goliath – underdogs, misfits and the art of battling giants." Its title is taken from the Old Testament and recounts the experience of a young shepherd boy David and his encounter with the Philistine Goliath at the battle in the valley of Elam. Many of us are probably familiar with this story and the unexpected way a young boy with five stones and a sling was able to defeat the most feared warrior of that time. What I found interesting was Gladwell's approach to experiences that would seem to be overwhelming odds against individuals and the subsequent victory of the *underdog*. He goes on to discuss many other events (initial cures for Leukemia, dyslexia, London bombing in WWII) and how these events are turned upside down by individuals who see or overcome weakness in what most perceive to be the overwhelming strength of the *Goliath*.

We often perceive adversity as being a barrier to progress. In many instances our initial reaction to difficult circumstances is to predict a worst case scenario and believe this to be the likely outcome. Just like the army of Saul feared the most certain demise at the hands of Goliath and the Philistines, seeing and believing in an alternative outcome is difficult unless we find new ways of thinking or a different approach. Prior to the German bombing campaign of London in WWII, British officials believed an experience like this would crush the county's resolve and morale to fight the enemy. They saw only the potential for mass panic and hysteria from the impending bombardment by the German air raids. What seemed to be a lost cause in the officials' eyes ultimately turned out to harden the British resolve. What they feared was fear itself. Being afraid of what they thought might happen. However, the experience of the nightly bombings for two and a half months resulted not in total despair, but it gave the English population that survived something that hardened their resolve and led to greater self-confidence of the people. This is attributed to the fact that their fear as a country was not realized and they had conquered fear itself. While the destruction was real and thousands perished, millions survived and realized that these events would not result in the loss of their country.

Our industry has many examples of these types of circumstances. The original Standard Oil was perceived as one of the first industry *Goliaths* in the 20th century. The brilliance and hard work of John D. Rockefeller and his vision for what he believed should be the 'Standard' for petroleum products created the Goliath of the first oil boom. This titan of the industry was ultimately dismantled by Ida Tarbell, a reporter who was able to give the public a version of Mr. Rockefeller that led to the government anti-trust legislation and the dismantling of the Standard Empire. The rise of the Texas oil men (H.L. Hunt, Sid Richardson, Clint Murchison and Roy Cullen) is another example of large companies being beaten at their own game by smart, shrewd and enterprising risk-takers. These men along with many other *Davids* were agile and innovative in their approach and changed the United States into the first oil producing power house of the early 20th century.

The first wave of development in the Permian Basin was largely led by individuals and 'wildcatters' who saw opportunities where others only saw difficulties. Their innovative strategies and understanding of an area led to great success that found the Yates, Seminole and Wasson Fields and the prolific Sprayberry trend. Individuals like these men and women who have continued to develop new ideas and a disruptive approach throughout the history of our industry are too many in number to accurately portray. What is obvious is that the people in our industry have been through many valleys like Elam. In the not so distant past the future of the exploration and production seemed destined to contract and never come back. But history has taught us that regardless of the scenario innovation and thinking and working differently, continuing to look for opportunities is what has led to the vibrant US production we experience today.

I recall an encounter I had with a colleague many years ago. He spent his entire day measuring vitrinite reflectance (maturity) using a microscope. One afternoon I happened to walk past his office and I asked, "Rick, don't you get tired of looking down a microscope eight hours a day five days a week?" His reply has always stuck with me as he paused, recorded the value and the said, "why do you think they call it work!" I realized that innovation and insight is does not usually come from a single thought our insight. Rarely is a stroke of genius like a perfect golf shot by a weekend golfer. What is required is work and residence time in a position to be able to see and assimilate thousands of observations in order to develop new ways of thinking, new approaches and new technologies or different ways in integrating existing ideas. This is the work and therein lies the success.

HGS Shrimp Peel & Crawfish Boil

Friday April 20, 2018
12:00 noon – 6:00pm

Bear Creek Pioneers Park
3535 War Memorial Street, Houston, TX 77084

Boiled Shrimp – Boiled Crawfish
(Corn & Potatoes)
Beer & Beverage – Live Music
HGS Member pre-order $30
Non-member pre-order $35
Walk ups (if available) $45

Register online at WWW.HGS.org
https://www.hgs.org/civicrm/event/info?id=1783

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Shrimp Sponsor $2000.00 - 4 Complimentary event tickets
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Silver Corporate Sponsor $500.00
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To be a Sponsor please call Andrea Peoples at the HGS Office 713-463-9476
or email andrea@hgs.org

HGS Shrimp Peel & Crawfish Boil

April 20, 2018
12:00 noon – 6:00pm

Bear Creek Pioneers Park
3535 War Memorial Street, Houston, TX 77084

Boiled Shrimp – Boiled Crawfish
(Corn & Potatoes)
Beer & Beverage – Live Music

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HGS Guest Night

Explore the New Weiss Energy Hall

How the Weiss 3.0 Was Created Presentation by Paul Bernhard, 3D Model Designer

Saturday, June 9, 2018
Houston Museum of Natural Science
7:00pm to 10:30pm

Free planetarium shows at 6:15pm and 6:45pm
Buffet dinner and cash bar inside the museum
Purchase tickets online – HGS.org
Adults $60
Children under 17 $30

Activities:

Ride the GeoVator into the Subsurface

Buckle into the Eagle Ford Shale Experience

See the Energy City Laser Light Display

Plus Seismic Displays, Drilling Technology

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SCA

Thursday, April 5, 2018
Southwestern Energy Conference Center, 10000 Energy Drive, Spring, TX 77389
Social 11:15 a.m., Luncheon 11:30 a.m.

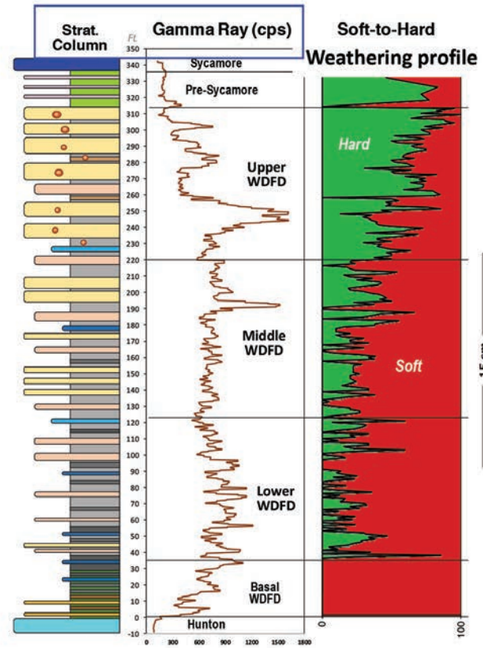
Cost: $35 Preregistered members; $40 non-members/walk-ups

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.

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Roger M. Slatt
Gungoll Chair Professor of Petroleum Geology and Geophysics and Director, Institute of Reservoir Characterization, University of Oklahoma

Outcrop and Subsurface Geology Applied to Drilling, Sweet Spot and Target Zone Detection of Resource Shales: the Woodford Example and Beyond



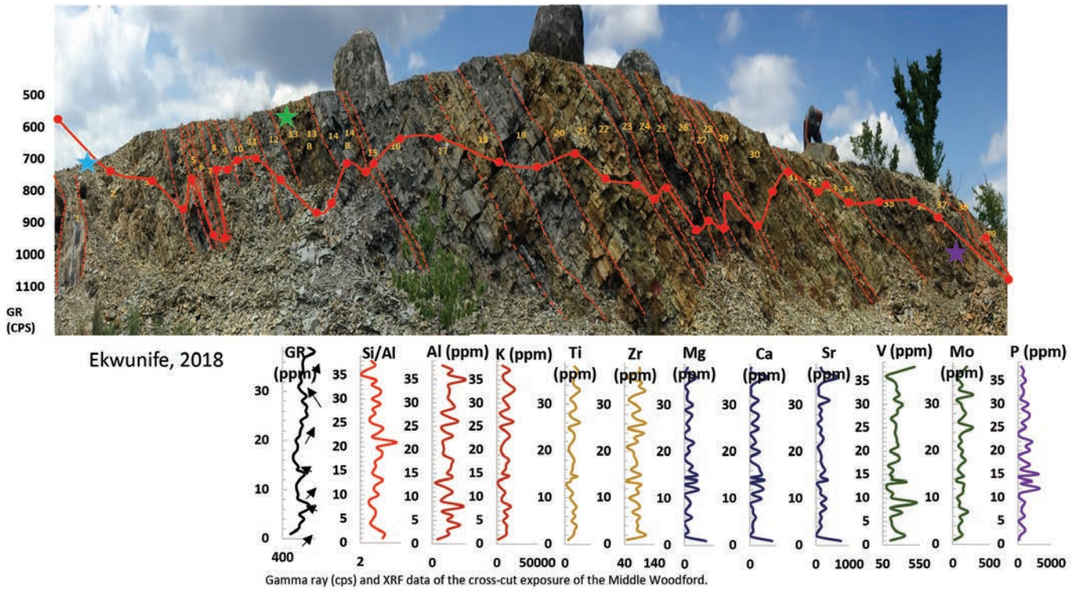
"Brittle-Ductile couplets"; Slatt and Abousleiman, 2012

"Over the past three years, more than 100 oil and gas companies in North America … have filed for bankruptcy…" (Jenkins,SPE Reservoir Study Group lunch, November 3, 2017). Although there are non-technical reasons for this, Jenkins includes *a lack of understanding of the shale reservoir and lack of quality/quantity of properly-sampled rock and fluid data as contributors to less-than-desireable drilling and completion results*. Geology (and geophysics) play an important role in mitigating these shortcomings. Below are presented some of the key geologic factors that should be included in characterizing and screening a (actual or potential) shaly reservoir, and how characterization might improve hydrocarbon discovery and production efficiencies; the example presented below mainly uses Woodford Shale strata.

Outcrops of strata equivalent to the subsurface reservoir provide a good starting point for documenting the reservoir. Vertical rock stratification is measured, and an outcrop gamma ray log of the strata is obtained which records the gamma response of lithology. Comparison of this measured outcrop log with a subsurface gamma log then provides the link to transfer lithology and stratification information onto the subsurface log.

HGS Northsiders Luncheon *continued on page 12*

HGS Northsiders Luncheon Meeting continued from page 11



Gamma ray (cps) and XRF data of the cross-cut exposure of the Middle Woodford.

Outcrop and subsurface cores are sampled for a variety of low-cost rock analyses, including: Chemical (XRF) and mineralogical (XRF, XRD, petrography) composition and stratification, hardness (Leeb rebound hardness tester); microfabric, porosity and permeability (SEM); organic content (TOC, RockEval, biomarkers); fractures/folds (visual observations); and biostratigraphy (if biota are present). Integration of this data set can then determine depositional environment, measure long-/short-distance lateral continuity of strata away from the wellbore, determine fracturability (brittle vs. ductile rock), categorize reservoir quality, and predict the potential for strata to hold open or to close on proppant. It is essential to select samples that are narrowly spaced along the length of an outcrop or core to obtain a detailed stratigraphy from such thinly interbedded rocks.

3D seismic provides a broad image of reservoir geometry and structure, but internal reservoir intervals often are too thin to be seismically resolved. An exception is Woodford 3D seismic volumes which can sometimes detect internal variability that may be a horizontal landing zone. Also, by flattening rock-calibrated, 3D proportional slices along specific horizons, potential sweet spots of extra thickness and/or organic richness can be located. In the Woodford (and other shales), an erosional surface atop the underlying Hunton Limestone has helped pinpoint potential sweet spots (geographically) and locate favored drilling target zones (stratigraphically).

Numerous Woodford studies which follow this scheme have provided insights into those items listed above, and have been successfully employed by companies. There is an informal consensus that exploration and exploitation of shales in Oklahoma has bottomed out. Oklahoma oilfield activity now is ranked No. 2 in the U.S. (Wilmoth, quoting Evans, *The Oklahoman*, Oct. 28, 2017; p.1C). And again quoting Jenkins **"This process requires maintaining consistent drilling and completion practices so variations in reservoir quality [and production] can be understood. The time to do this is NOW, before prices rise again …"** ■

Biographical Sketch

Roger M. Slatt currently holds the Gungoll Family Chair in Petroleum Geology and Geophysics at the University of Oklahoma (OU) and is Director of the Institute of Reservoir Characterization. He was Director of the School of Geology and Geophysics and Eberly Family Chair Professor at University of Oklahoma from 2000-2006, and the Ward Chair Professor of Reservoir Characterization from 2007-10. He formerly was Head of the Department of Geology and Geological Engineering at Colorado School of Mines (1992-2000) and Director of the Rocky Mountain Region Petroleum Technology Transfer Council (1995-2000).

After receiving his Ph.D. in 1970 from the University of Alaska, he taught geology for 8 years at Memorial University of Newfoundland and Arizona State University. He then spent 14 years in the petroleum industry with Cities Service Research, ARCO Research, and ARCO International Oil and Gas. Co. before joining Colorado School of Mines in 1992. He has published over 100 papers and abstracts, and has made numerous presentations on the subjects of petroleum geology, reservoir geology, seismic and sequence stratigraphy, shallow marine and turbidite depositional systems, geology of shale, glacial and Pleistocene-Quaternary geology, and geochemical exploration. He sits on various professional society committees, has organized technical conferences for American Association of Petroleum Geologists (AAPG), and teaches short courses for industry and AAPG on the "Introduction to the petroleum geology of deep-water (turbidite) depositional systems" and on "Principles of geologic reservoir characterization". He also offers a global, web-based course on "Introduction to geologic reservoir characterization" to people from many different countries. He has taught his two courses in many places in the U.S., as well as in many countries, including Colombia, Mexico, Indonesia, Malaysia, Australia, Angola, India, New Zealand, Scotland, and England.

While employed in the international oil and gas industry, he had the opportunity, as Director of Reservoir Evaluation, to study numerous oil and gas fields and exploration prospects worldwide, and to make recommendations to senior management for international investment. Many of Dr. Slatt's publications have dealt with the subject of exploration for, and development of deepwater submarine fan (turbidite; basin floor fan) oil and gas reservoirs. He is considered an expert on deepwater submarine fan exploration and development, and has worked in both industry and as a consultant on many such reservoirs globally. In late 2006 he completed co-authoring a book: *Introduction to the Petroleum Geology of Deepwater Settings*, published by American Association of Petroleum Geologists. He also completed a book in late 2006 (and updated as 2nd edition in 2013) titled *Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers*, published by Elsevier. Also in 2006, he organized the 26th Annual Gulf Coast Assoc. Sedimentary Geologists (GCSSEPM) conference, titled Reservoir Characterization: Integrating Technology and Business Practices, and was chief editor of a CD book comprised of papers from that conference. Since 2002, he has taught a web-based course semi-annually for AAPG titled Introduction to Geologic Reservoir Characterization. In recent years, Dr. Slatt and a team of students and colleagues have developed a comprehensive program in unconventional gas shale geology.

In 1996 he received the AAPG Distinguished Service Award. In 1999 he was the Esso Australia Distinguished Lecturer in Petroleum Geology. In 2001-2, he was an AAPG Distinguished Lecturer, giving a presentation titled "Outcrop/behind outcrop characterization of deepwater (turbidite) petroleum reservoir analogs: why and how". He offered the same presentation as an SPE Distinguished Lecturer in 2003. In 2003, he was awarded with AAPG Honorary Membership. In 2006 he received the AAPG Grover Murray Distinguished Educator Award. In 2007 he received the Society of Exploration Geophysicists (SEG) Special Commendation Award "in recognition of meritorious service rendered the scientific community, the earth sciences and exploration geophysics". In 2011 he received the Jules Braunstein award for co-authoring the Best Poster at the AAPG Annual National Convention. The poster was titled Multiscale brittle-ductile couplets in unconventional gas shales: merging sequence stratigraphy and geomechanics. In addition to teaching, he currently manages a well-subscribed consortium of oil and gas industry companies on the geology of resource shales.

Don't Forget to Vote in the HGS Election

HGS Northsiders Luncheon Meeting

2018 HGS Tennis Tournament

players: $50.00
non-players: $20.00

Saturday, April 14, 2018
8:00 am - 12:00 pm
Pine Forest Country Club
18003 Clay Rd.
Houston, Texas, 77084

Sponsorship Opportunities:
The Big Four: $1,000.00
GOAT: $700.00
Grand Slam: $500.00
ATP World Tour Finals: $300.00

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Monday, April 9, 2018

New Location
Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $40 Preregistered members; $45 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.
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If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Rick Schrynemeeckers
Amplified Geochemical Imaging, LLC

Improving Production While Minimizing Completion Costs in the STACK

Unconventional shale plays present extremely challenging arenas in which to explore. Lack of heterogeneity is not the only problem. Numerous hydrocarbon sources and multiple stacked zones that vary considerably across the play result in mixed drilling success in the Oklahoma STACK.

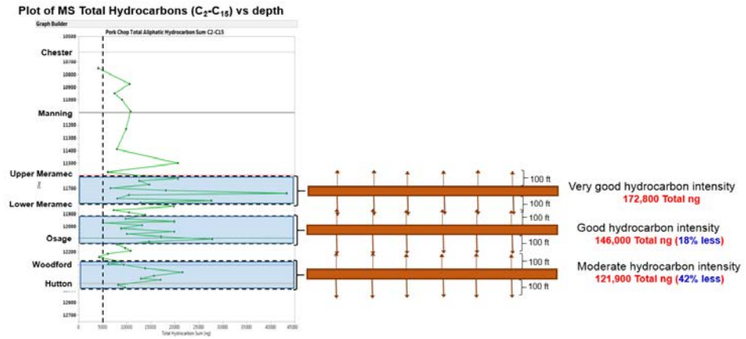


Figure 1

Conventional logging technologies provide important information while drilling to infer the presence or absence of hydrocarbons. However, these logging technologies do not directly measure hydrocarbons, but measure hydrocarbon proxies and infer hydrocarbon presence and phase based on the aforementioned data. These technologies, while sophisticated, can lack specificity and sensitivity when trying to accurately identify hydrocarbon source, hydrocarbon families, hydrocarbon mixing, compartmentalization and water saturation.

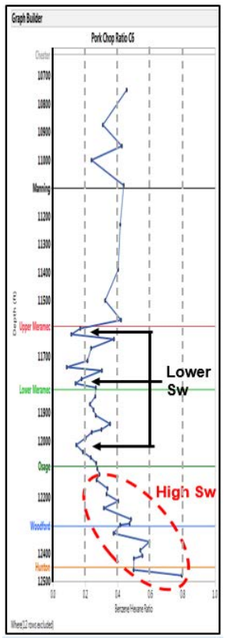
Downhole Geochemical Logging (DGL) provides an ultra-sensitive assessment of the hydrocarbons in a well by analyzing cutting samples to directly characterize the composition of hydrocarbons vertically and laterally through prospective sections. This methodology has the unique ability to look at a broad compound range from C_2 to C_{20}, which is significantly more expansive than the limited traditional ranges of C_1 - C_5 for mud logs or C_1 - C_8 from laboratory analyses. The result is a detailed granular hydrocarbon characterization in stratigraphic intervals that is a thousand times more sensitive than traditional methods.

For example, in the Blane-1 well hydrocarbons were detected from the lower Manning formation through the Woodford formation. **Figure 1** shows the total hydrocarbon intensity (i.e. C_2 - C_{15}), plotted in green, verses depth. The orange bars show possible lateral landing points with a hundred foot drainage above and below the lateral. The DGL data shows the Upper Meramec formation at ~11,730 ft as the most hydrocarbon-rich zone in the vertical well with 172,800 ng of hydrocarbons within the 200 ft drainage window. The second best vertical section was in the Lower Meramec at ~12,040ft with 146,000 ng of hydrocarbons and the third best vertical section was in the Woodford formation at ~12,370 ft with 121,900 ng of hydrocarbon richness. Due to the vertical complexity of the STACK play it is not possible to place all laterals in a predetermined location (e.g. the top of the Lower Meramec) and gain maximum production from each well. Each of the five wells tested in this program had a different optimum hydrocarbon rich zone to maximize lateral placement.

DGL was also used to determine a water saturation (Sw) proxy by ratioing benzene/ hexane. For the Blaine-1 well (**Figure 2**) the Sw proxy was plotted verses depth. Increasing ratios on the Sw proxy scale from left to right indicate increased water saturation. The data indicated very high water saturation in the deeper Hunton formation with high water saturation in the Woodford formation as well. This result was contrary to previous results obtained from wells in Canadian Co., Blaine Co., and Garfield Co. in which the Woodford formation typically had very low water saturation.

HGS General Dinner *continued on page 16*

HGS General Dinner Meeting continued from page 15



Sw proxy

Figure 2

A geologic map of the area shows a fault near the well. It is believed that the fault was acting as a conduit to transfer water from the deeper Hunton formation into the Woodford and Osage formations, thus creating unusually high water saturation levels.

Given the DGL data indicated that the Upper Meramec formation as the most hydrocarbon rich zone with the lowest water saturation, it appeared the Upper Meramec at ~11,730 ft would be the most productive and economic zone to land the lateral and maximize production.

DGL was also used to evaluate horizontal drilling. While the results in these examples have been sanitized and modified for presentation purposes the message remains the same. **Figure 3** shows samples collected every 150 ft along a 10,000 ft lateral. The green bars represent hydrocarbon intensity while the light blue line indicates the Sw proxy. The red bars indicate frac stages spaced at 500 ft intervals. Note there appears to be good hydrocarbon richness along the lateral with the exception of ~11,600 ft – 13,600 ft where the lateral enters Zone 3. This section of the lateral appears to not only have very low hydrocarbon richness, but also extremely high water saturation. Setting frac stages in this 2,000 ft section would only add very little production, but would also add tremendous volumes of water. Eliminating four frac stages in this 2,000' section would dramatically reduce water disposal costs and reduce completion costs by ~$800,000 (i.e. $200K per frac × 4 fracs = $800K).

Lateral 2 (**Figure 4**) shows a low Sw proxy throughout the lateral, but also shows poor hydrocarbon richness as the lateral is primarily landed in Zone 3 until the toe of the lateral rises into Zone 2. With hydrocarbon richness 52% less than Lateral 1, one would not expect high production from this well.

Lateral 3 (**Figure 5**) showed good hydrocarbon richness throughout the well with exceptional hydrocarbon response as the lateral penetrated Zone 1. With hydrocarbon richness of 345,000 ng as compared to 273,000 ng in Lateral 1 (i.e. 26% higher) and very low water saturation throughout, it is expected that Lateral 3 would be one of the highest producers in the field. Thus, it is believed that with all things being equal between wells (e.g. lateral length, number of frac stages, frac stage spacing, propant, etc.) that the lateral DGL hydrocarbon summation and Sw proxy may be a good general indicator of well production performance.

In conclusion the Downhole Geochemical Logging data helped to:

- Clearly distinguish between multiple gas, condensate, and oil signatures vertically and laterally in the field,
- Infer separate hydrocarbon sources,
- Identify by-passed pay,
- Increase production by focusing lateral placement in hydrocarbon-rich and porosity rich zones,
- Identify a thermal maturity transition across the field,
- Identify zones with high water saturation which would decrease production economics,
- Compare water saturation levels laterally across the field.

The client also discovered:

- The data coincided well with well logs and gave them more confidence and a better understanding of their logs
- The DGL hydrocarbon intensities correlated well with moveable oil and better porosity in their well logs
- The water saturation proxy (i.e. the benzene / hexane) ratio became very important because it related to economics (i.e. the more water in a zone the less profitable the zone)
- The data gave them valuable information they were not aware of (i.e. an increasing gas trend in the Lower Manning Fm or higher Sw in deeper formations in the Blaine-1 well)

Biographical Sketch

Mr. Schrynemeeckers holds a Bachelor's of Science degree in Biochemistry from Texas A&M University and MSc degree in Chemistry from the University of North Texas. He began his career working for Sun Oil Company in Dallas in the Enhanced Oil Recovery (EOR) division. He then worked for many years in the environmental arena. He has served as a Laboratory Director and General Manager of several laboratories in his career.

Mr. Schrynemeeckers returned to the oil industry working for Baseline Resolution a geochemistry laboratory in The Woodlands, TX. His focus was developing partnerships and satellite geochemistry laboratories around the world in countries like Venezuela, Brazil, Argentina, and Egypt. He then worked for StratoChem Services, a geochemistry laboratory in Cairo for two years, and now promotes surface geochemical surveys and Downhole Geochemical Logging for Amplified Geochemical Imaging's Exploration division.

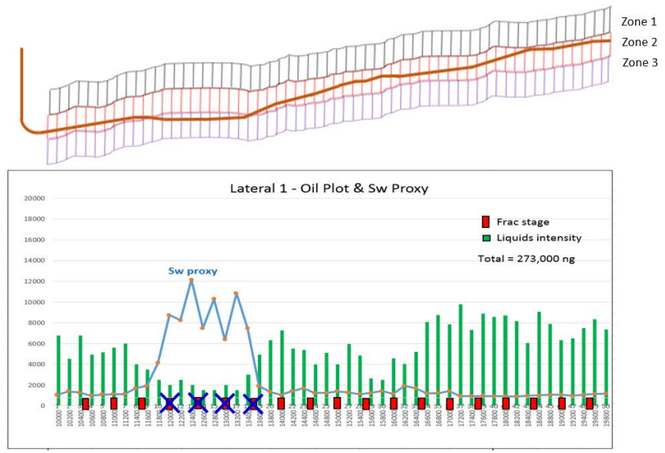


Figure 3

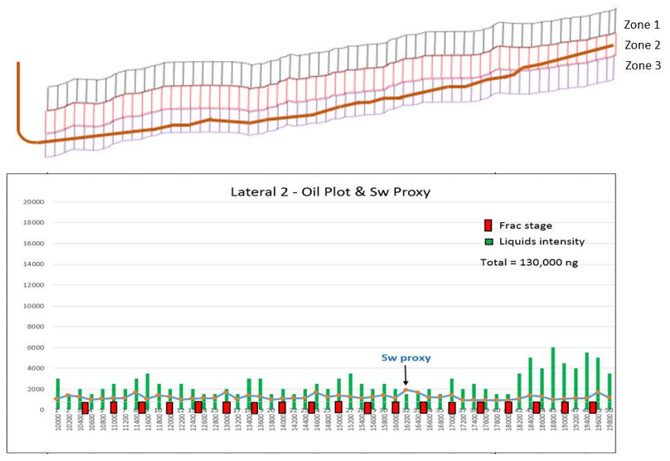


Figure 4

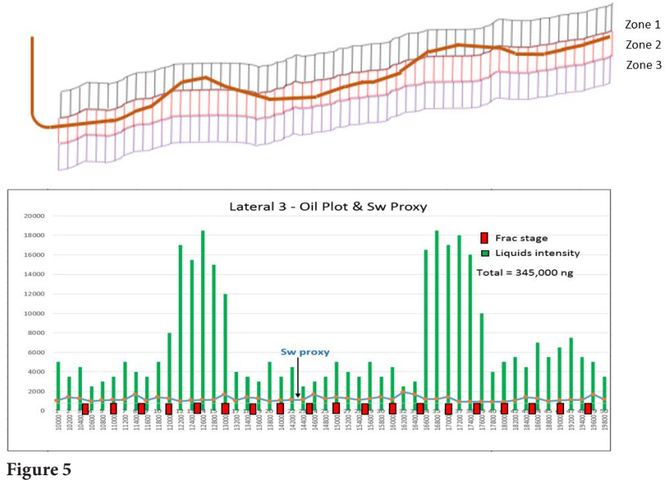


Figure 5

SAVE THE DATE

Houston Geological Society Presents

A Two-Day Conference

Flooding in Southeast Texas: The Science Behind the Floods

An educational conference bringing together stakeholders, including scientists, engineers, citizen coalitions, business, and governmental agencies to exchange current knowledge and ideas for the future.

Wednesday, June 6 and Thursday, June 7, 2018

At the

UNIVERSITY of HOUSTON

Student Center South, Houston Room #220
4455 University Drive
Houston, TX 77204

TOPICS ADDRESSED:

- **HISTORICAL OVERVIEW**
- **CAUSES OF FLOODING AND RISKS FOR THE FUTURE**
- **PRESENT DAY DESIGN OF MITIGATION**
- **CURRENT AND PROPOSED ACTIVITY TO ADDRESS FLOODING ISSUES**

Registration Cost TBA

Registration includes:
Continuing Education Certificate of Attendance, Continental Breakfast
Networking Lunch, Coffee and Break Refreshments

Wednesday, April 11, 2018

Black Lab Pub, Churchill Room • 4100 Montrose Blvd.
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 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.
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If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Jared Redyke
President, Dykon
Blasting Corporation

ETHICS MOMENT
We will dedicate 15 minutes at the beginning of each meeting to ethics to apply towards 0.25 hours of ethics credit.

Methodologies for Precision Drilling and Blasting

Biographical Sketches

Jared Redyke is President of Dykon Blasting Corporation (Dykon). Dykon is a precision drilling and blasting company specializing in the application of high explosives for controlled blasting for excavation of rock and reinforced concrete on both land and water. Mr. Redky has been servicing the blasting industry since 1989. Prior to this date, he worked for this father's explosive demolition company during summers, holidays and weekends for several years. He is a graduate of John Brown University with a degree in Business Administration and Construction Management. His experience in the use of explosives includes Precision controlled rock blasting, trenching, tunneling, quarry blasting, building implosion, smokestacks, bridges, industrial structures and various other applications. Jarad holds a Blaster's licenses in over 30 states as well as Blasting licenses in various provinces in Canada. He is a member of the International Society of Explosive Engineers and National Association of Demolition Contractors.

HGS After-Work Mini-Short Course

Your Money Mind®

by Stephen Bauer

Have you ever wondered why you think about money in certain ways, but your friends or spouse think about it differently? Or why it hurts when you have to spend money on certain items, and on other purchases, your fine with spending the money? The reason is that everyone has a different Money Mind just like you have different business strengths and weaknesses. So if you want to learn about your Money Mind and also get your other financial questions answered, then you should come to our event.

April 18, 2018
Black Labrador Pub
Register HGS.org

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June 6 & 7, 2018

An Educational Conference

Bringing Together Stakeholders
To Exchange Current Knowledge and Ideas for the Future

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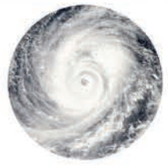

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Flooding in Southeast Texas: The Science Behind the Floods

June 6 & 7, 2018

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OPPORTUNITIES	Platinum Sponsors $10,000	Titanium Sponsors $7,500	Gold Sponsors $5,000	Silver Sponsors $2,500	Bronze Sponsors $1,000
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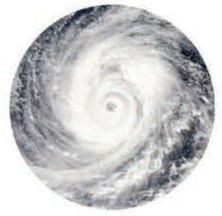
Complimentary Full Registrations	4	3	2	1	
Complimentary Vendor Booth	✔	✔	✔		
Recognition by HGS in Program Book, onsite signage, post show highlights and thank you in HGS Bulletin	✔	✔	✔	✔	✔
Recognition in Conference Announcements and Website (logo with hyperlink)	✔	✔	✔	✔	✔

Exchange

Current Knowledge and Ideas for the Future



Mail Sponsor Request to:
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For more information and to register please visit: www.hgs.org

Monday, April 16, 2018

New Location
Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $40 Preregistered members; $45 non-members/walk-ups

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Sub-Aerial Basins Below Sea Level (SABSEL Basins) Mothers to Several Super Basins

Martin M. Cassidy
University of Houston

SABSEL Basins: Formed at the beginning of the plate tectonic cycle during continental rifting before the basin has open access to the sea. Basaltic volcanic deposits, lacustrine organic-rich shales, and salts are common. These are young basins of J. Tuzo Wilson (1968) and often underlie large basins that subside with time after the ocean returns, such as the Southern North Sea and the South Atlantic basins. At present the deepest SABSEL basin is the Dead Sea at 1371 feet below sea level.

These basins can also form at the end of the plate tectonic cycle during early continental collision as a basin is closed off from the sea. Salt deposits are again common along with sudden changes in sedimentation. They are the terminal basins of J. T. Wilson, 1968 that become closed to open ocean and dry up forming deep SABSEL basins before the ocean floods the basin again (e.g. Mediterranean Sea).

SABSEL basins occur throughout Geologic time and can be the site of major hydrocarbon accumulations. We will discuss three international examples and the Norphlet Fm. of the Gulf of Mexico basin.

Evidence of deposition in a sub-aerial sub-sea basin consists of:

- Deep water deposits over sub-aerial deposits with no transition. Cross-bedded sand dunes under marine sediments with no loss of dune form or reworking of dune sands thick reservoirs with porosity preserved to great depth.
- Salt deposits. Good reservoir rocks are possible both above and below salt deposits.
- Canyons cut in basin margins to the level of basin bottom.
- Fluvial or shallow water deposits over deep water sediments, with no transition. Sand reservoir facies are displaced far into basin.
- Deep karst in marginal carbonates. Thick reservoirs if sealed.

Examples of SABSEL basins:

1. The Southern North Sea basin wherein Permian Rotliegendes sandstones lie on Carboniferous coal bearing clastics and limestones. A desert about 250 meters below sea level existed until suddenly flooded. The sand dunes are good reservoirs and provide natural gas to the UK.
2. The Mediterranean entry at the Straits of Gibraltar was sealed by the collision of the African and European continents. The Mediterranean dried up and basins as deep as 12,000 feet deep existed during the Late Miocene Messiness Salinity crisis. Salt was deposited as well as Sapropels source of biogenic gas. The returning sea rapidly covered the area preserving the gas sources.
3. The South Atlantic offshore Brazil-West Africa. Notable production exists in the passive margin basin formed above the salt and from an extensive rift basins under the salt. The sub-salt early lacustrine and desert basin contains organic-rich in source rock, but it is also host to basic volcanic rock and deposits of CO_2 gas. The reservoirs include extensive limestones deposited by bacteria and algae. The potassium salts are interpreted to indicate high temperatures in the subaerial deep basins. There is much to be learned about this amazing rift of several thousand kilometers length.
4. Gulf of Mexico (USA) Jurassic Norphlet formation desert sand dunes formed on top of the Louann salt as the entry of marine waters ceased. When the sea returned, the deep-water Brown dense portion of the Lower Smacker was deposited, forming a source rock and seal overlying the Norphlet sand dunes. Even below 20,000 feet subsea, the dunes are adequate gas reservoirs. The Norphlet Desert and its Sand Dunes are in a sub-aerial basin below sea level.

Sub-Aerial Basins Below Sea Level

Fig. 1. Are formed during continental rifting before the basin has access to the sea. They are young basins of J. Tuzo Wilson, 1968. Notable for salt deposits.

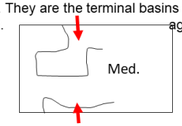


Fig. 2. Are formed at the end of the plate tectonic cycle during early continental collision as a basin is closed off from the sea. They are the terminal basins of J. Tuzo Wilson, 1968. again, salt bearing. a

Southern North Sea Gas fields

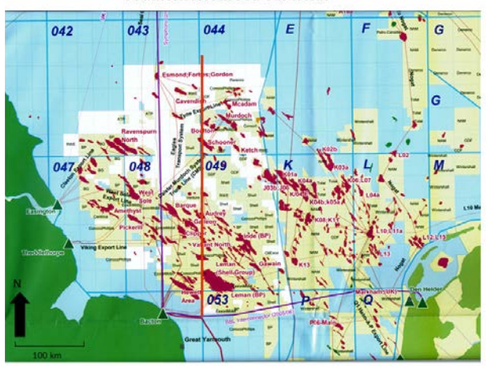


Fig. 3. Red gas fields are almost all productive from Rotliegend sandstone. They are sealed above by Zechstein Kupferschiefer, and evaporites.
Modified from Offshore magazine, 2003

Mediterranean Sea

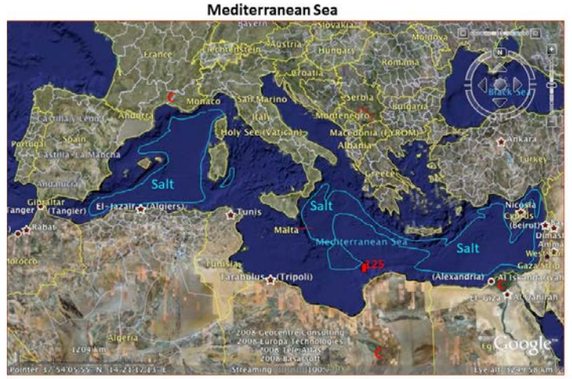


Fig. 4. Mediterranean Sea (Google Earth image, data from Hsu, 1983. DSDP leg 13, Sonnenfeld 1985.)
Salt basin C Canyon Site 125

Gulf of Mexico

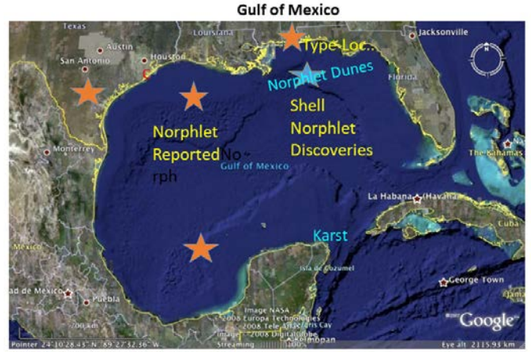


Fig. 5. Jurassic Norphlet formation sand dunes are preserved on top of the Louann evaporites. Dark organic rich Smackover deep water limestones deposited above seal the Norphlet sands below. ***Modified from J. Rosenthal***

South Atlantic Basin during the Albian

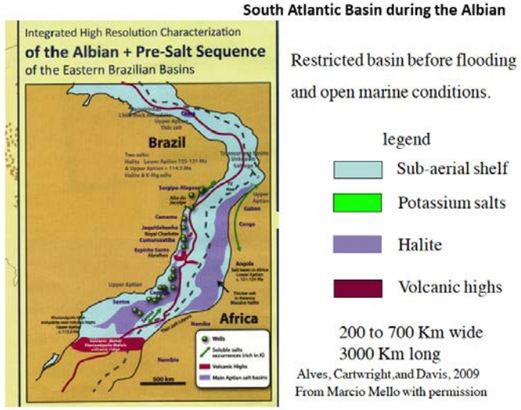
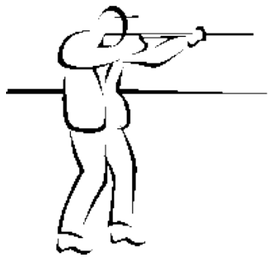


Fig. 6. Map of Albian South Atlantic Basin showing paleogeography, sub-aerial shelves & Aptian salt basins

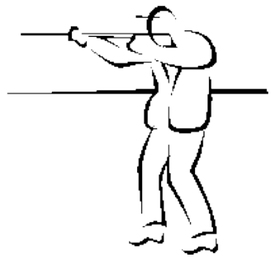
During the late Triassic extension of Pangaea future Gulf of Mexico rifting began with a horst and graben terrain that was filled with clastic non-marine sediments. As extension and subsidence continued marine water led to deposition of evaporates and the Louann Salt formation. At that time the portal from the Pacific Ocean was closed, but the area of the present Gulf of Mexico continued to subside well below sea level. The arid environment and subsequent desert sand dunes were deposited in the Norphlet desert on top of the Louanne salt.

Sands on the margin of the basin were swept into cross-bedded red sand dunes that were distributed throughout the basin by regional and adiabatic winds. When the barrier to marine water was breached the sea flooded the basin. The dunes were not eroded but submerged by hundreds of feet of water. Deepwater, black, finely-laminated pyritic

HGS International Dinner *continued on page 25*



HGS SKEET SHOOT



Saturday, June 9, 2018
Greater Houston Gun Club
6702 McHard Road, Missouri City

This tournament is a 50 target event. Shells are provided, however **you must bring eye and ear protection.** Greater Houston Gun Club and National Skeet Shooting Association safety rules will be in effect. Trophy winning shooters will be determined by the Lewis class system. Door prizes will be awarded by blind drawing after the conclusion of shooting. All competitors are automatically entered into the door prize drawing, but you must be present at the time of the drawing to win. BBQ lunch will be provided from 11:30 until 1:30. Refreshments will be available throughout the day. **Non-shooting guests are welcome to enjoy lunch and refreshments at a cost of $20 per guest.**

HGS recognizes that 2018 is a lean year in the oil patch, and sponsorship for events like this is hard to find. **For $150, you'll receive paid entry for one shooter and one guest (total value of $120) and be listed as a platinum sponsor on the webpage and at the event.**

We are limited to 160 shooters in four rotations. Entry fee is $90 per shooter for registrations received by FRIDAY, JUNE 1st. After June 1, registration will be strictly on a "space available" basis and the entry fee will be $120 per shooter. ***Register early!!***

For more information, contact: Gready Hunter at (281) 384-9035 or greadyhunter@comcast.net

For directions to the club, visit www.greaterhoustongunclub.com

****

ONLINE REGISTRATION INFORMATION AT: www.hgs.org/civicrm/event/info?id=1969

To pay by check, mail this form with a check made out to HGS to:
Houston Geological Society, 14811 St. Mary's Lane, Ste. 250, Houston, TX 77079

To pay by credit card, please call the HGS office: (713) 463-9476.

Name: _____ Company: _____

Email: _____ Phone: _____

Preferred time: (circle one) 9:00 10:00 11:00 12:00 Ammo: (circle one) 12 gauge 20 gauge

Entry Fees: $ _____ + Guest Fees: $_____ + Sponsor Contribution: $ _____ = Total: $_____

If you wish to register as a squad, please return forms for all squad members together.

ALL SHOOTERS WILL BE REQUIRED TO SIGN A DISCLAIMER OF RESPONSIBILTY BEFORE THEY WILL BE ALLOWED TO SHOOT!

HGS International Dinner Meeting continued from page 23

limestones (the lower Smackover limestone) directly overly the dunes with no transitions. The dunes maintained their shapes and were not been eroded by a transgressing sea.

Norphlet sandstones are good reservoirs even at 20,000 feet below sea level as seen in Mobil well 76-1 in Mobile bay, Alabama. The 412 feet of fine- to medium-grained sandstones of the gas column had an average porosity of 11.1%, 7.7 md permeability. At 11,240 psi formation pressure and BHT of 414 degrees Fahrenheit, the well had an AOF of 37.3 MMCF/D. Chlorite coatings of grains prevent quartz overgrowths preserving porosity and permeability at great depth. Norphlet reservoirs should exist in local areas throughout the Gulf of Mexico and be prospective of gas production where ever within drilling depth. Good seismic will help predict location of thick deposits. The distinctive shape of the large dunes can be seen even on 2D seismic lines. The Norphlet Sandstone is the prospective reservoir immediately above the autochthonous Louann salt or carried up on allothonous salt domes. The laminated fine-bedded dark limestone/dolomite of Smacker Brown dense formation is a marker of deep-flooded basins and may mark areas prospective for underlying sand dunes of the Norphlet. The updip edge of the black organic-rich mudstone should mark the edge of the first filling of the SABSEL basin like the bathtub ring left by dirty bathwater. The black mudstones overly the Norphlet in deep-water fields and the deep fields of Mobil Bay.

The Norphlet desert sand dunes are probably prospective in all the basins wherein the Louanne salt was deposited. Cross-bedded Jurassic desert sandstones equivalent to the Norphlet are even found offshore Mexico west of the Yucatan and are reported to be productive there from the E.K. Balam Field.

Considering the model of the South Atlantic, is there a terrain under the original Louanne Salt wherein tilted fault block are bounded by organic rich lacustrine shales? Are early sandstones and microbial limestones present? Only the drill bit can tell us! ■

Thanks are due to all the many oil companies that have published about the deep reservoirs of the Gulf of Mexico and especially to Exxon Mobile for their detailed presentations about Mobile Bay fields.

Biographical Sketch

Martin Cassidy worked for Amoco for 32 years around the world in assignments in production geology, new ventures, and operations. After his retirement from Amoco, he earned a PhD in geology from the University of Houston. (His undergraduate degree in geology was from Harvard University, and he also has an MS in geology from the University of Oklahoma.)

Since receiving his PhD, Mr. Cassidy has continued as a research scientist at the University of Houston, and he also continued to write and consult about petroleum exploration, basin analysis, and subsurface gases (both hydrocarbon and non-hydrocarbon). He gives special emphasis to CO_2, particularly its relevance to exploration for oil and gas.

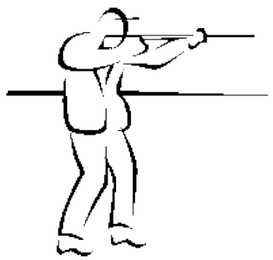
During 2012-2013, Martin also served as President of the Houston Geological Society.

His publications include:

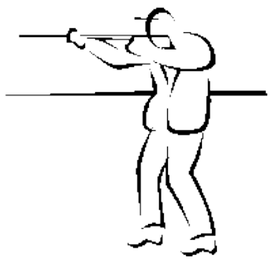
Cassidy, M. M. (2005), Occurrence and origin of free carbon dioxide gas deposits in the earth's continental crust. Houston, Texas, University of Houston, Dept. of Geosciences. Ph. D. Dissertation, 242 pages.

Gilfillan, S.M.V., C. J. Ballentine, G. Holland, D. Blagburn, B. Sherwood Lollar, S. Stevens, M. Schoell, M. Cassidy (2008), The noble gas geochemistry of natural CO_2 gas reservoirs from the Colorado Plateau and Rocky Mountain provinces, USA. Geochimica et Cosmochimica Acta v. 72, p. 1174-1198.

Dr. Martin M. Cassidy, research scientist. Department of Earth and Atmospheric Sciences, University of Houston. Houston, Texas
77204-5007 mcassidy@uh.edu
(713) 503 8331
University of Houston



HGS SKEET SHOOT



Saturday, June 9, 2018
Greater Houston Gun Club
6702 McHard Road, Missouri City

Sponsorship Form

CAP SPONSOR $1,000.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
LUNCH SPONSOR $1,000.00
Registration for a Team of 5
Company recognition on the HGS website, Bulletin and event
BEVERAGE SPONSOR $750.00
Registration for 2 team members
Company recognition on the HGS website, Bulletin and event
AMMO SPONSOR $750.00
Registration for 2 team members
Company recognition on the HGS website, Bulletin and event
FIELD SPONSOR $750.00
Registration for 2 team members
Company recognition on the HGS website, Bulletin and event
FLURRY SPONSOR $750.00
Registration for 2 team members
Company recognition on the HGS website, Bulletin and event
PLATIMUN WEBSITE SPONSOR $150.00
Registration for 1 shooter and 1 non-shooting guest
Company recognition on the HGS website, Bulletin and event

To pay by credit card, please complete the form and return to office@hgs.org or call 713-463-9476
To pay by check, mail this form with a check made out to HGS to:
Houston Geological Society, 14811 St. Mary's Lane, Ste. 250, Houston, TX 77079

Name: _____ Company: _____

Email: _____ Phone: _____

Sponsorship Level: _____ Amount: _____

Credit card # _____ Exp. Date: _____

For more information, contact: Gready Hunter at (281)-384-9035 or greadyhunter@comcast.net
For directions to the club, visit www.greaterhoustongunclub.com

Monday, April 23, 2018
New Location
Live Oak Room • Norris Conference Center • 816 Town and Country Blvd #210
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.
Cost: $40 Preregistered members; $45 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.
If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Alex Fick (Speaker), James Keay, Jason Kegel, Hossein Nemati

Lower Paleozoic Reservoirs in the Delaware Basin: Gas and Liquids Distribution

We discuss early results of a project in the Delaware basin aimed at providing a more comprehensive and accurate view of the distribution of gas and liquids. A detailed basin-wide stratigraphic framework has been built and well perforations are correlated to specific zones and intervals enabling accurate assignment of public production data and EUR analysis specific to the producing zones.

The lower Paleozoic section in the Delaware Basin is well known for prolific dry gas production and this study intends to identify potential areas of gas liquids.

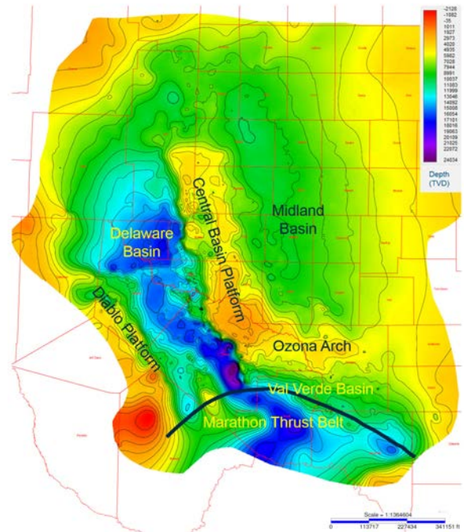


Figure 1: *Permian Basin Structure Map on the Devonian Carbonate with major tectonic elements (Contour interval 1,000 ft)*

Biographical Sketch

Alex Fick received his BSc in 2013 and MSc in Geology from the University of Houston in 2016. His 5 years of industry experience has focused on exploration and evaluation in the US Gulf Coast, Permian Basin, Midcontinent, and onshore and offshore Mexico. His graduate work focused on interpreting newly imaged structural and stratigraphic elements in the Mexican Ridges deep-water fold and thrust belt. Currently Alex is a geoscientist for TGS working on the interpretation and assessment of newly released seismic and geologic data sets from onshore Mexico as well as regional evaluations in the Permian and Anadarko Basins in support of new seismic acquisition and project development.

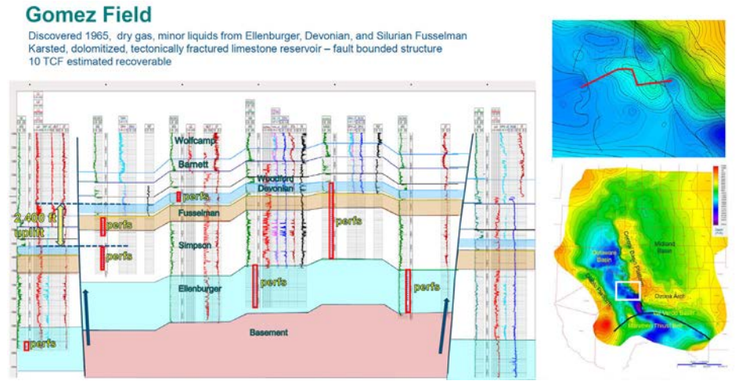


Figure 2: *Structural Section through the Gomez Field illustrating significant basement uplift setting up the field and highlighting perforated intervals.*

Wednesday, April 25, 2018

Petroleum Club of Houston • 1201 Louisiana (Total Building)
Social Hour 11:15 a.m.
Luncheon 11:45 a.m.

Cost: $35 Preregistered members; $40 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.

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

HGS General
Luncheon Meeting

Hydrocarbon Prospectivity of Rifted, Conjugate Margins of the Gulf of Mexico, Central Atlantic, and South Atlantic

Paul Mann
University of Houston

The concept of upper and lower plate margins formed on opposite sides of a low-angle detachment during the early rift phase was proposed over three decades ago Wernicke and Burchfiel (1983), Lister et al. (1986) and others. This conceptual model remains controversial to the point that the upper and lower plate terminology seldom appears in recent studies on conjugate margins. In this talk I will show that many conjugate margins can be classified into the upper and lower plate types using the basic, crustal elements and geometries outlined by the early asymmetrical rifting proponents that are summarized in the diagram below from Davison (2012). Less extended, upper plates in cross section have narrow and steep crustal profiles while the more extended lower plates produce tapered profiles with lower-relief belts of rifts where the sag phase can localize giant salt basins. Examples of these two different margin profiles was noted by Marton and Buffler in the 1990's for the less extended Yucatan GOM margin (upper plate) and the more extended US GOM with an extensive salt basin (lower plate). Similarly, Davison (1997) noted the alternation of the two margin types along the Brazilian margin.

Within the framework of these concepts of upper and lower plates a comparison from geophysical seismic reflection and refraction data are used to characterize upper and lower plates, symmetrical or neutral conjugates – in a much more systematic approach that was not available to the early proponents of the upper and lower plate concept. These geophysical data can also be used to compile the locations of volcanic margins that form late in the rifting process and are characterized by voluminous, volcanic flows expressed as "seaward-dipping reflectors". The regional map of the locations of proposed upper and lower plates along with volcanic margins is then overlain on a map of present hydrocarbon production to identify the most promising areas for future exploration. ■

References

Davison, I., 1997, Wide and narrow margins of the Brazilian South Atlantic, Journal of the Geological Society, v. 154, p. 471-476.

Davison, I., 2016, South Atlantic margins: Geology and hydrocarbon potential, HGS/PESGB Africa pre-conference shortcourse, September 12, 2016.

Lister, G., Etheridge, M., and Symonds, P., 1986, Detachment faulting and the evolution of passive, continental margins: Geology, v. 14, p. 246-250.

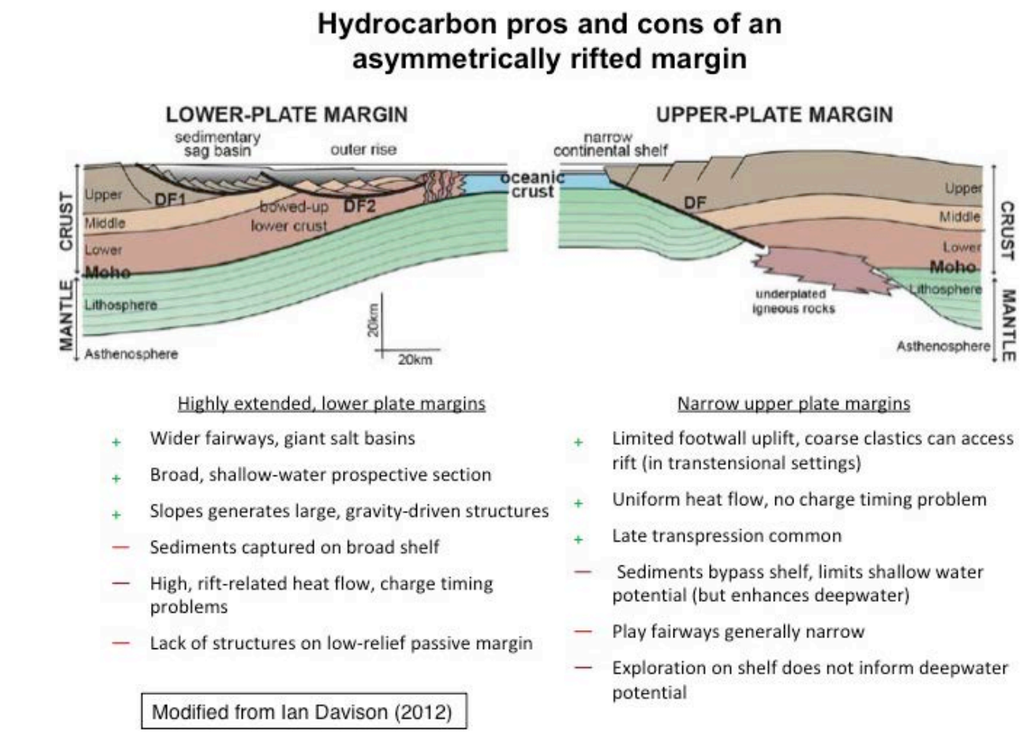
Marton, G., and Buffler, R., 1993, Application of simple-shear model to the evolution of passive continental margins of the Gulf of Mexico basin: Geology, v. 21 p. 495-498.

Wernicke, B., and Burchfiel, C., 1982, Modes of extensional tectonics, Journal of Structural Geology, v. 4, p. 105-115

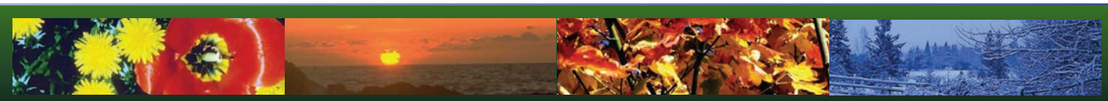
Biographical Sketch

Paul Mann graduated with a BS in geology from Oberlin College and a PhD from State University of New York at Albany. He is currently is the Robert E. Sheriff endowed professor of geology at the University of Houston. Dr Mann has led the CBTH study of conjugate margins in the Caribbean, Gulf of Mexico and circum-Atlantic since 2005.

Paul Mann, Department of Earth and Atmospheric Sciences, University of Houston, Houston, Texas 77204



April 2018 GeoEvents



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5 **HGS Northsiders Luncheon Meeting** *"Outcrop and Subsurface Geology Applied to Drilling, Sweet Spot and Target Zone Detection of Resource Shales: the Woodford Example and Beyond," Roger M. Slatt* *Page 11*	6 **HGS Continuing Ed** *"The Lucia method of Carbonate Reservoir Characterization," David Orchard* *Page 6*	7
8	9 **HGS General Dinner Meeting** *"Improving Production While Minimizing Completion Costs in the STACK," Rick Schrynemeeckers* *Page 15*	10 **HGS Board Meeting** *6 p.m.*	11 **HGS Environmental & Engineering Dinner Meeting** *"Methodologies for Precision Drilling and Blasting," Jared Redyke* *Page 19*	12	13	14 **HGS Tennis Tournament** *Pine Forest Country Club* *Page 14*
15	16 **HGS International Dinner Meeting** *"Sub-Aerial Basins Below Sea Level (SABSEL Basins) Mothers to Several Super Basins," Martin M. Cassidy* *Page 22*	17	18 **An After-Work Mini-Short Course** *"Your Money Mind®," Stephen Bauer Black Labrador Pub* *Page 19*	19	20 **HGS Shrimp Peel & Crawfish Boil** *Bear Creek Pioneers Park* *Page 8*	21
22	23 **HGS North American Dinner Meeting** *"Lower Paleozoic Reservoirs in the Delaware Basin: Gas and Liquids Distribution," Alex Fick* *Page 27*	24	25 **HGS General Luncheon Meeting** *"Hydrocarbon Prospectivity of Rifted, Conjugate Margins of the Gulf of Mexico, Central Atlantic, and South Atlantic," Paul Mann* *Page 28*	26	27 **HGS Outcrop Family Campout** *Camp Cullen YMCA Trinity, TX* *Page 4*	28
29	30					

Members Pre-registered Prices:

Dinner Meetings members	$40
Emeritus/Honorary members	$40
Student members	$10
Nonmembers & walk-ups	$45
Except - Env. & Eng.	$30
Nonmembers & walk-ups	$35
Emeritus/Honorary members	$15

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 office@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.**

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

June 6-7, 2018
HGS Conference
Flooding in Southeast Texas: The Science Behind the Floods *(Page 18)*

June 9, 2018
HGS Skeet Shoot
Greater Houston Gun Club *(Page 24)*

June 9, 2018
HGS Guest Night
Houston Museum of Natrual Science *(Page 10)*

September 11-12, 2018
The 17th HGS-PESGB Conference on African E&P
Houston, TX *(Page 2)*

Candidates for the 2018–2019 Executive Board

Houston Geological Society Officer Election

The candidates put forth by the Nominations Committee are:

President - Elect: Jon Blickewede, Justin Vandenbrink

Vice President: Geoffrey Haddad, Penny Patterson

Secretary: Tami Shannon, April Parsons

Treasurer-elect: Ryan Yarrington, Annie Walker

Editor-elect: Fang Lin

Directors (2 positions):
Mike Alison, Brent Boyd, Bryan Guzman, Rachel Todkill

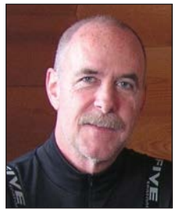
HGS Election Voting Instructions
Members will be able to vote in one of two ways:
To submit your mailed, paper ballot for HGS Board officers, mark an [X] one candidate for each Office, and two candidates for Director positions. Then reseal the ballot, add postage and mail back to the HGS office.

You may also vote online using your personal Voter ID Number printed your mailed, paper ballot. Log in to your HGS Profile at www.hgs.org, go to my account and click Vote Now. Once you have done this, enter your Voter ID Number, select your desired candidates and click submit at the bottom of the page.

PLEASE VOTE – Upon receiving the paper ballot or the e-mailed instructions!

The voting period opens April 10, 2018 and continues to May 10, 2018.

President-elect (two candidates)



Jon Blickwede

Education
University of New Orleans, MS
Earth Sciences 1981
Tufts University, BS Geology 1978

Experience

2017-present	Teyra GeoConsulting LLC - Founder and Chief Geologist
2005-2017	Statoil - Exploration Geologist
2002-2005	Unocal/Chevron - Exploration Geologist
1997-2002	IHS - Manager, Mexico, Central America & the Caribbean
	The Andrews Group/ AGI Mexicana - Manager of Geoscience
1981-1997	Amoco - Exploration Geologist

Professional Affiliations and Activities
Houston Geological Society (HGS Bulletin Editor-elect/Editor 2014-2016)
AAPG (Chairman, Secretary of Publication Pipeline Committee 2011-present; Co-chair, Deepwater Frontiers technical session, 2004 ICE, Cancun, Mexico)
GCAGS (co-organizer, symposium on Petroleum Systems of Northern Deepwater Gulf of Mexico, 2004 Annual Convention, San Antonio)

Jon Blickwede *continued on page 38*

Justin Vandenbrink

Education
University of British Columbia - Bachelor of Science, Geology, 1995
British Columbia Institute of Technology - Diploma, Broadcast Journalism 1998

Work Experience

2017	Director, Geologic Products and Services, TGS
2016	Technical Director, Core Group Resources
2012 - 2016	Petroleum Consulting, Weatherford
2001 - 2011	Petroleum Consulting, RPS Energy
1996	Mining Exploration Geologist, INMET
1995	Petroleum Exploration Geologist, Renaissance Energy

Society Experience

2017 - 18	Secretary/Editor Delegates Voice, AAPG
2016 -19	HoD delegate for HGS
2016 -18	HoD Honors and Awards Committee, AAPG
2015 -16	HoD Foreman, HGS
2015 -17	Board Director, HGS
2012 -13	Vice President, HGS
2008 -12	Chairman, International Explorationists, HGS
2008	Joined HGS
2007	MC, Ring Ceremony and Induction Weekend, APEGA

Justin Vandenbrink *continued on page 39*

Candidates for the 2018–2019 Executive Board *(continued)*

Vice President (two candidates)

Geoffrey Haddad

Education
BA Geology, Rice University, 1982
MS Geology, Duke University, 1986
PhD Geology, Rice University, 1994

Professional Affiliations:
HGS; AAPG; SEPM; GCSSEPM

Boards
Rice University Professional Science Master's Board of Affiliates.

Professional & Academic Experience

1982-1983	Exploration Geologist - Superior Oil - Houston
1986-1987	Exploration Geologist - Exxon Exploration - Houston
1994-1995	Research Associate & Lecturer - Rice University - Houston
1995-1996	Research Associate - CNRS Lab - Gif sur Yvette, France
1996 - 1997	Postdoctoral Fellow - Houston Advanced Research Center
1998 - 2001	Stratigrapher - Elf / TotalFinaElf Technology - Pau, France
2001 - 2006	Stratigrapher - ConocoPhillips Technology - Houston
2006	Chief Geologist DW Gulf of Mexico - ConocoPhillips - Houston
2006 - 2008	Exploration Manager DW Gulf of Mexico - ConocoPhillips - Houston
2008 - 2011	Exploration Manager Alaska - ConocoPhillips - Anchorage
2011 - 2013	Manager Geological Technology - ConocoPhillips - Houston
2013 - 2016	Manager Senegal Exploration - ConocoPhillips - Houston
2016 - Present	Geological Fellow - ConocoPhillips - Houston

Statement
I have had the good fortune of having a career that has led me in and out of academic, technical and management roles in the oil Industry. I have enjoyed and learned a great deal from each of these roles. Reflecting on my career I've realize three strengths that made my career rewarding: 1) strong and relevant technical

Geoffrey Haddad *continued on page 39*

Penny E. Patterson

Education
1990, PhD, Geology, University of Colorado
1981, MS, Geology, University of Colorado
1976, BA, Geology, University of Colorado

Experience

2016	Present: Senior Technical Advisor, ExxonMobil Production Company
2013 - 2016	Senior Technical Advisor, ExxonMobil Development Company
2006 - 2013	Senior Geoscience Advisor, ExxonMobil Exploration Company
1990 - 2006	Senior Research Geologist, ExxonMobil Upstream Research Company
1981 - 1986	Geologist, Research Planning Institute
1975 - 1976	Field Assistant, USGS

Professional Affiliations
HGS (15 years); AAPG (35 years); SEPM (35 years); GSA (35 years)

Professional Activities

2007 - Present	Advisory Board Member: University of Colorado, Department of Geological Sciences
2014 - 2016	Houston Geological Society: Director

Statement:
The Houston Geological Society is a vibrant and integral organization in our geoscience community that provides critical resources to our members through HGS technical meetings and conferences, publications, networking social functions, and the HGS website. As an HGS Director, I was involved with seven educational committees, which provide exceptional training and learning opportunities for geoscientists of all ages, including our young K12 scientists, industry and academia scientists, and our retired scientists. It is this dynamic engagement of our community that continues to advance and transfer our excellence in geoscience.

I enthusiastically support HGS and enjoy the camaraderie and benefits of networking with fellow geoscientists. The HGS technical meetings, seminars, and workshops are all vital to our geoscience community and provide a sounding board and exchange for news ideas and technologies. I was honored to be

Penny E. Patterson *continued on page 39*

Candidates for the 2018–2019 Executive Board *(continued)*

Secretary (two candidates)

April Parsons

April began her career at Marathon oil working International Exploration on a variety of projects including Kenya, Syria, Gabon, Tunisia, North Sea and Timor Gap. She worked in Midland as the geologist responsible for the Delaware Basin handling a variety of operated and outside operated fields, exploitation and lease sale evaluations. She holds both a Master of Science and Bachelor of Science in Geology from University of Texas at Arlington.

She has been the team lead for Hydro GOM, LLC's shelf exploration where she managed a team responsible for prospect generation, maturation, drilling and evaluation. After the Statoil acquisition of Hydro, April worked to package and sell assets to Mariner. She has also worked exploration projects in the Gulf of Mexico shelf for El Paso, Coastal and Marathon Oil. Through 2013 April worked for Statoil in the Houston office and was responsible for Statoil's interests in the Chukchi Sea of Alaska and handled all geologic aspects of maturing the newly acquired frontier leases to drillable status. Before taking on the Alaska project she worked the deep water eastern Gulf of Mexico.

April joined Cobalt in 2013 and was involved in the planning, drilling and post well evaluation of almost all of Cobalt's wells in the Pre-Salt Kwanza Basin as well as and being responsible for assessment and appraisal of the Orca discovery in Block 20. Recently she has been working the deep water Gulf of Mexico inboard lower Tertiary Wilcox evaluating the depositional history of the North Platte discovery, Shenandoah Field during appraisal and towards filing of a SOP as well as the Heidelberg Field.

April has been a member of HGS and AAPG for many years and currently serves on the House of Delegates and the Grants in Aid Committee, and it would consider it a pleasure to continue that service as secretary of the local organization.

Tami B. Shannon

Education
Texas A&M University - Corpus Christi - Master of Science Degree, Environmental Science, 2007
Winona State University - Bachelor of Science Degree, Hydrogeology, 1997

Experience

1997-2000	Systems Engineer, CompuCom Systems
2001-2003	Transportation Engineer, Wilbur Smith Associates
2003-2006	GIS Technician, City of Corpus Christi
2006-2007	GIS Analyst, UT Marine Science Institute
2007-2010	Senior GIS Analyst, Deloitte - Petroleum Services Group
2010-2012	GIS Coordinator, Fugro GeoConsulting, Inc.
2012-2014	Senior GIS Programmer/Analyst, Resource Data Inc
2013-2014	GIS Application Developer, Gulf Interstate Engineering
2014-2015	GIS Project Lead, RPS Knowledge Reservoir
2015-2017	GIS Application Systems Expert, Oxy, Inc
2017-Current	International Appraisal Data Lead, Oxy, Inc.

Professional Affiliations
Houston Geological Society
Geophysical Society of Houston
Texas Board of Professional Geoscientists GIT #46

Professional Activities & Awards

2018-2019	Candidate for HGS Secretary
2016-2017	HGS President's Award
2016-2017	Editor, HGS Bulletin
2015-2016	Editor-Elect, HGS Bulletin

Statement
Thank you for considering me for your 2018-2019 HGS Secretary. I have been a member of HGS since 2007, when I first moved to Houston and learned of this esteemed organization. As a "silent" member for many years I participated in numerous meetings and events, but in 2015, it was an honor to have the HGS membership elect me HGS *Bulletin* Editor for 2016-2017. I worked closely with the HGS Board and its talented volunteers for over two years to gain great knowledge of the Society and to understand the Board's objectives and inner workings. As a nominee for HGS Secretary for 2018-2019, I am confident my previous experience as HGS Editor and Board member would make me an excellent candidate for this honored position. ■

Candidates for the 2018–2019 Executive Board

Candidates for the 2018–2019 Executive Board *(continued)*

Treasurer-elect (two candidates)

Annie Walker

Education
MSc, Structural Geology & Tectonics, University of Tennessee, Knoxville
BSc, Natural Systems Science, Le Moyne College

Experience

2017-present	Secretary, Houston Geological Society
2015-2017	Director, Houston Geological Society
2013-2017	Structural Geologist, ION Geophysical
2012-2013	Research Assistant, Structural Geology & Tectonics Research Group, University of Tennessee
2010-2012	Graduate Teaching Assistant, University of Tennessee
2009-2010	Executive Assistant (civilian) CG93, The Columbia Group & United States Coast Guard
2006-2008	Research & Field Assistant, Le Moyne College

Professional Affiliations
Houston Geological Society
American Association of Petroleum Geologists, PSGD
Geological Society of America
The Geological Society, London
Sigma Xi, The Scientific Research Honor Society

Statement
Serving the HGS as a Director and currently as Secretary has been a fantastic experience. I've truly enjoyed learning the ropes from our Committee members, my fellow Board members, and all of you along the way. As a group the HGS has weathered a challenging few years, but we've also pulled together to preserve and sustain the educational, professional, and outreach activities that are the core of the HGS community. During my time on the Board I've had the benefit of observing four dynamic Treasurers and Treasurers-Elect navigate the HGS through a grueling downturn and all the financial concerns it brought with it. Our next goal is to set the HGS on a path to stronger, long-term financial independence to help stabilize the Society against future downturns and the changing landscape and moods of our industry. I'm very grateful I've had this opportunity to get to know the HGS, and I'd be honored to serve you again as the 2018 Treasurer-Elect. ■

Ryan Yarrington

Ryan Yarrington is currently an Enterprise Account Executive at Oildex. Prior to working at Oildex Ryan has worked in 2D and 3D Onshore and Offshore Seismic Acquisition, Microseismic , Data Processing and HSE. He is currently the Treasurer of HGS and has spent the last 3 years volunteering for the HGS International Committee. Ryan looks forward to working with the HGS and serving in many different roles in the future. ■

Candidates for the 2018–2019 Executive Board *(continued)*

Director – Two-year term *Vote for two candidates*

Mike Allison

Education
MS Geology, University of Tennessee, Knoxville, TN
BS Geology, University of Miami, Coral Gables, FL

Experience

2017 - Present	Owner/Consultant, Raptor Aerial Services
2014 - 2016	IT & Business Systems Manager, Fieldwood Energy
2005 - 2013	IT Manager, Devon Energy
2000 - 2004	R&D Product Geoscientist, Landmark Graphics Corporation
1985 - 2000	Chevron, Various IT Leadership and Geoscience Technical Positions
1983 - 1985	Gulf Oil Corporation, Development Geologist

Professional Affiliations:
HGS (2004), AAPG (1982), SPE (2005)

Statement
I am honored to be invited to run for the position of Director for the HGS. I have 35 years of experience in the oil and gas industry and been involved with the HGS for over 14 years in various volunteer capacities. My recent Leadership positions with the HGS include Treasurer (2017-2018) and Treasurer-Elect (2016-2017). I have also been the Treasurer for the HGS Northsiders and a long-time volunteer with the HGS Continuing Education Committee and HGS Video Committee. ■

Brent Boyd

Brent Boyd has a long career (33 yrs) in petroleum exploration as data subsurface interpreter and manager. He enjoys making maps, discussing ideas about finding oil and has had the privilege to work with many great teams in the hunt for new reserves in throughout career.

Brent graduated in 1985 with a BS in Geophysics from Texas A&M University. He began his career with Arco Oil and Gas working in the Midland office. He worked the Permian Basin acquiring and interpreting seismic until 1993 prior to being reassigned to Vastar Resources in Houston. From 1993 to 2000 Brent worked the Arkoma Basin prior to joining Anadarko Petroleum working in international exploration. He has worked primarily the Australian and African basins. In 2012, he started a five-year rotational assignment in Algeria as the G&G Manager of the Anadarko assets in that country. He recently returned to Houston as G&G Manager of the International New Ventures group.

Brent will bring to the role of Director at HGS the same thing he brings to all his team assignments – dedication, reliability, and servant leadership. He will work to see that HGS remains the best place in Houston for exchanging ideas and business cards with other people in the petroleum exploration industry. ■

Candidates for the 2018–2019 Executive Board

Candidates for the 2018–2019 Executive Board *(continued)*

Director – Two-year term *Vote for two candidates*

Bryan Guzman

Education
2008, BS Geology University of Texas at San Antonio
2018, MS Analytics Texas A&M University

Experience

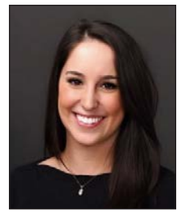
2007 - 2008	Geo-Tech Balcones Energy Library
2008 - 2011	Geologist - Ingrain Inc.
2011 - 2013	Geoscientist - Ingrain Inc.
2014 - 2015	Product Champion - Drill Cutting Technologies - Ingrain Inc.
2015 - 2017	Geologic Advisor - Ingrain Inc.
2018 - Present	Technical Advisor - Ingrain a Halliburton Service

Professional Affiliations
HGS, AAPG, SPE, SPWLA

Professional Activities

2011 - 2017	HGS Chairman Exhibits Committee
2013 - 2014	HGS Secretary
2015 - 2016	HGS Treasurer Elect
2016 - 2017	HGS Treasurer
2017 - Present	HGS Advertising Committee Chairman

Statement
Since joining the HGS I have enjoyed the benefits of education, networking, and friendship. Currently I have been working on ways to grow the advertising for the bulletin, website and HGS organized conferences. I have spent much of my time working on the exhibits committee organizing the set-up and transportation of the HGS booth for various conventions throughout the year. When I served as HGS Secretary it afforded me the opportunity to learn more about the many functions of the HGS. I was also exposed to the duties as the HGS Treasurer-elect and Treasurer where I witnessed the society's dedication to the various efforts through the annual budget. It has been a pleasure meeting many people along the way and I am thankful to the opportunities the HGS has provided me while serving as a chairman, secretary and treasurer. It would be my great pleasure to serve in the capacity of HGS Director. ■



Rachel Todkill

Education
BS, Geology, Texas A&M University, 2012
MS, Geology, University of Texas at San Antonio, 2015

Experience

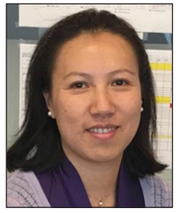
2016-2017	Secretary, Houston Geological Society
2017-Present	Drillinginfo, Strategic Account Director
2016-2017	Drillinginfo, Technical Account Manager
2015-2016	Drillinginfo, Account Development Manager
2013-2015	University of Texas at San Antonio, Teaching Assistant: Historical Geology and Paleontology Laboratories

Professional Affiliations
Houston Geological Society
American Association of Petroleum Geologists
Young Professionals in Energy
Women's Energy Network
Society of Petroleum Engineers

Statement
I have been a member of HGS since I moved back to Houston after completing my graduate degree in geology. I found the HGS to be a wonderful organization and industry network. I had the honor of serving as HGS Secretary for the 2016-2017 term, which was a fantastic experience. During that time I learned that the success of the HGS organization is dependent on its members and their contribution. Without a large group of volunteers and trail blazers HGS would not be the educational and professional association it is today. I was humbled to see people that give time away from their jobs and families to make HGS run smoothly. I would be honored to serve as a Director for the 2018-2019 D term. If elected, I will work increase member awareness of the educational and networking opportunities provided to the industry through HGS. ■

Candidates for the 2018–2019 Executive Board *(continued)*

Editor-elect (one candidate)



Fang Lin

Education
BS, Geology, Chengdu University of Technology
MS, Ore Deposit Geology, Chengdu University of Technology
PhD, Geosciences, Virginia Tech University

Experience

2005 - present	Chevron Energy Technology Company, Petroleum Geochemist
2000 - 2005	Virginia Tech University, Graduate Assistant
1998 - 2000	Chengdu University of Technology, Instructor

Professional Awards and Activities

2011 - 2012	Houston Geological Society Editor's Award
2010 - present	Reviewer for AAPG *Bulletin*
2009 - 2014	Index Editor for HGS *Bulletin*

Statement
My involvement in Houston Geological Society began when I registered for a professional training course offered by HGS years ago. I became a regular member of the Society and served as the index editor for HGS *Bulletin* from 2009 - 2014. Working as the index editor was a great learning experience and opened my eyes about the breadth and depth at which HGS operates and engages our local geological community and the communities far and beyond. As the HGS *Bulletin* evolves into the digital era facing new challenges and opportunities, I am honored to be nominated to run for the HGS Editor-elect, and I am grateful for having the opportunity to continue to serve our great community. ■

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Jon Blickwede—*Candidate for President-elect*

Gulf Coast Section-SEPM (Technical Committee Co-chair, 1989 Perkins Conference; co-convener of 2007 Perkins Conference)
New Orleans Geological Society (Chairman, Short Course Committee 1983-1985)
Asociación Mexicana de Geólogos Petroleros
Sociedad Geológica Mexicana
Sociedad Venezolana de Ingenieros Geofísicos (Secretary, 1994 Congress)

Honors and Awards
Houston Geological Society, Best Paper Award 2004-2005
GCAGS Convention 2004, 3rd Place Best Oral Presentation
New Orleans Geological Society, Best Paper Award 1988-1989
Invited Speaker, 1988 William Smith Meeting, The Geological Society, London
Invited Speaker, Best of AAPG for SEG, 1988
AAPG George C. Matson Award for best technical paper presented at 1988 AAPG Annual Meeting (Perdido Foldbelt: A New Deepwater Frontier in Gulf of Mexico)
AAPG Student Paper Award, 1981

Statement
I am honored to be a nominee for President-elect of the Houston Geological Society and I look forward to the opportunity to serve our professional community in the preeminent location for petroleum geoscience & technology.

My primary duties as President-elect will be to assist 2018-19 HGS President Cheryl Desforges, become familiar with the key issues and future challenges facing HGS and start to formulate the best ideas for addressing them. These challenges will include 1) continuing to improve the ways in which HGS can support and encourage the new generation of geoscientists (including transmission of knowledge from the elders in the community, so many of whom are now heading into retirement), 2) provide relevant and timely continuing geoscience education opportunities, 3) offer a broad spectrum of networking opportunities that appeal to a broad cross-section of the membership.

In addition, a major responsibility of the 2018-19 President-elect will be to help ensure optimal HGS support for the GCAGS Annual Convention scheduled for 2019 in Houston. As such, I look forward to working with GCAGS 2019 General Chairman Mike Erpenbeck to prepare for another great meeting.

I hope to get your vote! ■

Candidates for the 2018–2019 Executive Board

Candidates for the 2018–2019 Executive Board *(continued)*

ontinued from page 32

Justin Vandenbrink—*Candidate for President-elect*

2005	Joined APEGA
1994	Joined AAPG

Additional AAPG activities

2017	HGS Tennis Tournament, Director
2016	HGS Golf Tournament, Director
2012	HGS/PESGB Africa Conference Committee Member

Professional Affiliations
Houston Geological Society, HGS
American Associated of Petroleum Geologists, AAPG
Association of Professional Engineers and Geoscientists of Alberta, APEGA
Canadian Society of Petroleum Geologists, CSPG
Society of Exploration Geophysicists, SEG
Society for Sedimentary Geology, SEPM

Professional Honors and Awards

2016	Presidents Award, HGS
2012	Chairman's Award, HGS
2009	Rising Star Award, HGS
2005	Professional Geologist, APEGA

Statement
I am honored to be nominated as a candidate for the office of President of the Houston Geological Society.

For the past decade I have volunteered with the HGS in various roles. During this time I have learned about how the Society works, what is needed for it to be successful and its importance to the members.

Hopefully the Oil and Gas industry is hopefully turning around and the next few years will be a critical time for the HGS to focus on its future and how it will grow. I want to bring a fresh perspective that includes more engagement with our younger professional members and more exposure in the city of Houston itself.

My career has developed because of my ability to network. If elected President, I would use my skills to help the HGS grow and expand its network as well. ■

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Geoffrey Haddad—*Candidate for Vice President*

skills, 2) developing a broad perspective (cross geology disciplines; multiple world basins; cross functional), and 3) building a solid network of trusted colleagues and friends who share a common passion for the geosciences. I believe HGS is uniquely positioned to help geoscientists in the Houston area develop these strengths by continuing to advance and improve on the society's objectives of "stimulating interest and promoting advancement in geology for the Houston area; disseminating and facilitating discussion of geological information; and encouraging academic training in the science of geology".

As Vice President of HGS I will leverage my strengths to help the society continue to attract excellent speakers to technical meetings. I would like to see a mix of topics covering conventional and unconventional reservoirs presented by geoscientists from industry and academia. I would also like to work on finding ways to attract more Neogeos into the organization. I am certain that HGS membership would benefit from bringing in greater numbers of these young, dynamic and innovative geoscientists. The future of the HGS depends on them. We are working in changing times with tremendous innovations that are altering the landscape of the energy industry. To help meet the challenges that lie ahead I will contribute my time, energy, and leadership to the roll of HGS Vice President and sincerely seek your vote. ■

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Penny E. Patterson—*Candidate for Vice President*

asked to give a presentation at a fall Luncheon Meeting and to my surprise I received the 2011 HGS Best Speaker Award of the Year. Through this invaluable experience I discovered the depth and diversity of our geoscience community, the critical interests and needs of our community, and the keen interest of our community in the growth and advancement of the field of geoscience.

I am honored to be nominated for the position of Vice President of the Houston Geological Society. One key role for the HGS Vice President is to work closely with the HGS Board, HGS members and our community at large to develop technical talks at the HGS Luncheon and General Dinner Meetings. With my previous experience as a speaker plus my years of knowing many people within our industry, I believe I can find speakers that will be of interest to the HGS membership. If elected, I will work closely with our geoscience community throughout the south Texas region to provide exemplary and timely technical talks relevant to the needs of our changing times. With oil prices reaching new highs from previous years, our geoscience community is uniquely poised for working together to develop innovative technology that will lead our energy industry into new directions. HGS should be an integral linkage to guide us into future geoscience opportunities and adventures. ■


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 (December2017)

USGS Releases New Assessment of Oil and Gas Resources in Alaska's North Slope, Following Annual Lease Sale

On December 22, 2018 the U.S. Geological Survey (USGS) released a new assessment of undiscovered oil and gas resources in the National Petroleum Reserve in Alaska (NPR-A), pursuant to a secretarial order issued in May 2017 to jump-start energy production and update resource assessments for Alaska's North Slope. In 2010, the USGS estimated that 8.96 billion barrels of oil and 53 trillion cubic feet of gas remained undiscovered in the NPR-A. The 2010 report also concluded that, of these estimated volumes of undiscovered resources, only about 1.6 billion barrels of oil and 2.2 trillion cubic feet of gas may be technically recoverable. The updated 2017 assessment, however, estimates that undiscovered, technically recoverable resources in and near the NPR-A include 8.7 billion barrels of oil and 25 trillion cubic feet of gas – acknowledging these estimates are associated with large ranges of uncertainty.

Just weeks before release of the USGS report, the Bureau of Land Management (BLM) held its annual oil and gas lease sale for all available tracts in the NPR-A on December 6, 2017. The 2017 lease sale included 900 tracts, covering approximately 10.3 million acres of petroleum reserve land, which is the most territory ever offered for leasing in the NPR-A. Energy companies, however, showed little interest in the record sale. The sale lasted less than 10 minutes and received only 7 bids, all of which were placed jointly by ConocoPhillips and Anadarko, for less than 1 percent of the land offered. The sum of all seven bids was approximately $1.16 million – a modest result compared to the $18.8 million in revenue generated from the 2016 NPR-A sale.

Trump Administration Moves to Revise Obama-Era Energy Regulations Through Rulemaking Process

Following several executive orders issued by President Donald Trump earlier this year to suspend, revise, or rescind regulations or actions that unnecessarily burden the development of domestic energy resources, the Department of the Interior (DOI) and the Environmental Protection Agency (EPA) announced rulemaking revisions to offshore drilling protections, fracking regulations, and the Clean Power Plan (CPP) in the final days of 2017.

On December 29, 2017 the Bureau of Safety and Environmental Enforcement (BSEE) published a proposed rule (82 FR 61703) to amend certain regulations for oil and natural gas production and safety standards that were previously instituted under the Obama administration. This rule would update the 30 CFR part 250, subpart H, Oil and Gas Production Safety Systems regulations, which were substantially revised by a final rule (81 FR 61834) that BSEE published on September 7, 2016, addressing issues such as production safety systems, subsurface safety devices, and safety device testing in an effort to better protect workers and the environment. The new regulatory proposal from BSEE states that these new amendments would reduce unnecessary burdens imposed on operators under the current regulations, while providing the same level of safety and protection of the environment. In an Initial Regulatory Impact Analysis, BSEE estimates that the proposed rule would reduce industry compliance burdens by $33 million annually.

Similarly, the Bureau of Land Management (BLM) published a final rule (82 FR 61924) to rescind a 2015 rule on hydraulic fracturing (80 FR 16128) that never took effect due to pending litigation. The rule was intended to ensure that wells are properly constructed to protect water supplies, make certain that the fluids that flow back to the surface as a result of hydraulic fracturing operations are managed in an environmentally responsible way, and provide public disclosure of the chemicals used in hydraulic fracturing fluids. The BLM now justifies rescinding the rule due to unreasonable administrative burdens and compliance costs.

A day prior, the EPA moved forward in rewriting the CPP, promulgated under Section 111 of the Clean Air Act (42 U.S.C. 7411), by asking for public comments on a replacement rule by February 26, 2018 (82 FR 61507). Key to former President Barack Obama's climate mitigation plan, the CPP was challenged by 27 states and a number of other parties, and the Supreme Court issued a stay on implementation of the CPP on February 9, 2016. Following President Trump's executive order (13783) on energy independence, the EPA conducted a review of the CPP, concluding that "suspension, revision, or rescission of [the CPP] may be appropriate" based on the agency's reinterpretation of the statutory provisions underlying the CPP, and then published a Federal Register notice proposing to repeal the CPP on October

Government Update *continued on page 43*

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10, 2017. The December 28, 2017 advanced notice of proposed rulemaking solicits information on systems of emission reduction for the agency to consider in developing a future rule intended to reduce carbon dioxide emissions from existing fossil-fueled electric utility generating units.

House Lawmakers Discuss Grand Staircase-Escalante During Natural Resources Subcommittee Hearing

On December 6, 2017, in response to President Donald Trump's executive order shrinking the Grand Staircase-Escalante National Monument released two days prior, Representative Chris Stewart (R-UT-2) introduced new legislation aiming to provide greater conservation, recreation, economic development, and local management of the federal lands in his district. Representative Stewart's bill, the Grand Staircase Escalante Enhancement Act (H.R. 4558), would create Utah's sixth national park, the Escalante Canyons National Park and Preserve. The bill would prohibit mineral extraction within the new park and preserve – an area that is rich in energy and mineral resources, and contains invaluable cultural artifacts that are vulnerable to disruption from potential mining operations.

The House Natural Resources Subcommittee on Federal Lands held a legislative hearing on December 14 to consider the Grand Staircase Escalante Enhancement Act. Among the expert witnesses invited to provide testimony, Michael Leavitt, former governor of Utah, said he believes that there was insufficient consultation or warning prior to the original designation of the Grand Staircase-Escalante National Monument by former President Bill Clinton in 1996. Mr. Leavitt suggested this action demonstrated an abuse of power and "a deliberate effort to conceal and keep monument planning out of public view."

Other witnesses at the hearing expressed their support for the bill, which some expect will stimulate economic growth for nearby communities. Utah Office of Tourism Director Vicki Varela stated that the proposed designation of a sixth national park in Utah would generate prosperity in what is now considered to be an economically distressed region of the state. Susan Hand, co-owner and manager of the local Willow Canyon Outdoor Company, agreed that protected public lands can act as economic engines for local communities, but she added that the excised monument units and proposed national park included in this bill would not replace the loss of the Grand Staircase-Escalante National Monument as a whole. Leland Polluck of the Garfield County Board of Commissioners explained that the bill will provide a better balance between federal management and local input, and establish a platform to allow for both the enjoyment and use of the land at present, as well as preserving its natural resources for future generations.

While the Grand Staircase-Escalante National Monument has drawn criticism since it was first established in 1996, it remains a frontier with countless opportunities for quiet recreation and solitude, according to the Bureau of Land Management. The monument area has spurred significant scientific discoveries, where fossil excavations have yielded more information about ecosystem change at the end of the dinosaur era than any other place in the world. Since its designation, 21 new species of dinosaurs have been discovered within the monument's boundaries.

House Natural Resources Hearing Revisits U.S. Dependence on Foreign Minerals

The electronics and defense industries, among other key industries in the United States, rely upon the supply and availability of minerals – many of which are imported to the U.S. from other countries. Not only are these elements integral to the production of high-end electronics and advanced military technologies, but they also make up the foundation of many of our infrastructure projects. U.S. dependence on foreign sources for nonfuel mineral materials has more than doubled over the past 30 years. A recent U.S. Geological Survey (USGS) report revealed that the U.S. imported more than one-half of the apparent consumption of 50 nonfuel mineral commodities in 2016, and was 100 percent import-reliant for 20 of those. In 2016, China and Canada were the largest suppliers of nonfuel mineral commodities to the U.S.

On December 12, 2018 the House Subcommittee on Energy and Mineral Resources held an oversight hearing, "Examining Consequences of America's Growing Dependence on Foreign Minerals," to discuss reasons for the declining self-sufficiency of the United States for mineral commodities, and the consequences of relying on foreign sources for critical minerals. The hearing

Government Update *continued on page 45*

HGS Welcomes New Members

New Members Effective March 2018

ACTIVE MEMBERS	EMERITUS MEMBER	STUDENT MEMBERS
Katrina Cox	Michael Folger	Kazeem Ayodele
Thomas Foster		Kimberly Cardenas
Scott Gardner		Itzel Cardenas
Lori Hathon		Mohab Dessouki
Hui Long		MD Golam Kibria
Colin McHattie		Aaron Limas
Justin McLeod		Britt Mitchell
Daniel Mizsei		Travis Plemons
Michael Nieto		Josia Simanjuntak
Tyler Patrick		
Denet Pernia		
Timothy Prather		
Mary Jane Riley		
Kim Shih		
Gary Simpson		

Welcome New Members

Government Update *continued from page 43*

featured expert testimony from Ronnie Favors, Administrator at the Defense Logistics Agency and Strategic Minerals of the Department of Defense (DOD); Murray Hitzman, Associate Director for Energy and Minerals for the USGS; Richard Silberglitt, Senior Physical Scientist for the RAND Corporation; Kate Sweeny, Senior Vice President of Legal Affairs and General Counsel for the National Mining Association; and Carletta Tilousi, Council Member of the Havasupai Tribe.

At the hearing, witnesses addressed the concept of mineral "criticality" – determined by a number of factors for minerals that are essential in use, with limited or no viable substitute, and vulnerable to supply chain disruption – and the challenges associated with the U.S. mining regulatory system. Mr. Favors recognized that given recent mine closures, export restrictions, and volatility of the world market, there is a growing focus on decreasing import reliance and increasing domestic material production in the United States. However, according to Ms. Sweeny, mining in the U.S. is not appealing to private corporations because of the difficult and uncertain regulatory system. According to Dr. Hitzman, less than one-third of the United States has complete topographic, geologic, and geophysical 3D mapping coverage at the scale needed to inform mineral resource management. Increased domestic mining, particularly for uranium in the Grand Canyon was heavily criticized by Ms. Tilousi, due to perceived negative health and environmental impacts.

President Trump and Secretary Zinke Sign Orders to Advance Domestic Production of Critical Minerals

On Wednesday, December 20, 2017 President Donald Trump signed an executive order to reduce America's dependence on foreign sources of critical minerals. The order requires the Departments of the Interior, Agriculture, Defense, and Energy to submit a report that includes a strategy to accomplish this goal, an assessment of progress toward developing recycling technologies and alternatives to critical minerals, a plan to improve the topographic, geologic, and geophysical mapping of the United States, and recommendations to streamline permitting, enhancing access, and increasing discovery, production, and domestic refining of critical minerals.

Shortly after President Trump's executive order, Interior Secretary Ryan Zinke released a secretarial order on Thursday, December 21, 2017 directing the initial steps to producing a nationwide geological and topographical survey of the U.S. In particular, the Secretary directs the U.S. Geological Survey (USGS) to ensure that U.S. miners and producers have electronic access to the most advanced topographic, geologic, and geophysical data, with appropriate limitations to protect critical infrastructure data such as those related to national security areas. Secretary Ryan Zinke explains, "Drafting a complete topographical and geographic survey of the United States is exactly the kind of task the USGS was created to do." The order also directs Interior bureaus to begin identifying domestic sources for critical minerals, and, upon finalization of a critical minerals list, to provide recommendations for streamlining review processes and access for developing critical minerals.

The executive and secretarial orders follow the release of a USGS report on 23 mineral commodities that are critical for the U.S. economy and security. The new volume, entitled Critical Mineral Resources of the United States, updates a previous USGS report that was published in 1973. The new report finds that the U.S. relies on overseas supplies for at least 50 percent of all but two of critical minerals – beryllium and titanium – and that most of those are sourced from China. ■

Big Continent - Big Ideas - Big Opportunity
Strategies for Success

The 17th HGS-PESGB Conference on African E&P

September 11-12, 2018 • Houston Texas

Guidelines For Abstract Submission

Submit your abstract for consideration as either an oral presentation or poster, by sending it, as an email attachment, to Africa2018@hgs.org. Submissions should be sent as soon as possible and no later than March 15, 2018.

Assessment of the abstracts will be based upon the quality of the abstracts and the relevance to the suggested topics as listed below:

- African E & P in the evolving business environment - above ground risks & rewards
- New and emerging exploration trends
- Gas and oil in N. and E Africa
- Developing and integrating geological concepts: Impact on exploration in Africa
- Big data, AI and innovative technologies applied to African E & P
- What we thought we knew – Exploration concepts to production reality

Abstracts should be:

- Length should be a maximum of two 8.5 x 11-inch pages, and may include diagrams in color or black and white, and references. Please use Arial font, size 10, left justification alignment, and single spacing.
- Submit as either MS Word 2016/ 2013/2010 documents with graphics embedded in to the document.
- Each file submitted should include the principal author's surname in the file name.
- Include contact information (email address) for the principal author in the abstract.
- Indicate the speaker with an asterisk (*) after the name in the author list.

The principal author of submitted abstracts will be notified of the committee's decision no later than April 30, 2018.

Accepted Submissions:

Each author is requested to submit a Short Abstract (up to 2 pages) with an opportunity to also submit an Extended Abstract for their oral or poster presentation.

Short Abstracts (due by July 31)

Short abstracts (up to 2 pages) will be reproduced on 8.5 x 11-inch paper and handed out at the meeting in the proceedings volume.

- A formatting template will be provided to authors of all accepted submissions to assist in preparing of abstracts.
- Authors are solely responsible for the content of the material submitted and will be asked to release HGS, PESGB and the sponsors from any consequence of distribution of the material.
- Accepted abstracts may be posted and/or archived on the HGS web site.

Big Continent - Big Ideas - Big Opportunity
Strategies for Success
The 17th HGS-PESGB Conference on African E&P
September 11-12, 2018 • Houston Texas

Guidelines For Abstract Submission Continued

Extended Abstract (due by July 31)
Authors of accepted oral and posters are also encouraged to submit an extended abstract that may include references, appendices, figures and maps and will be eligible for higher marks within the awards system. Extended abstracts will be compiled on a CD in Adobe Acrobat (PDF) format, reproduced and distributed along with the proceedings volume of short abstracts to participants at the conference. The CD will not be secured or protected by copyright.

- Length may be several pages in length and can include B&W or color graphics.
- Include contact information for the author(s) in the abstract (email and/or mailing address).
- Page size should be 8.5 x 11 inch. A formatting template will be provided to authors of all accepted submissions to assist in preparing extended abstracts.
- Graphics can be text figures, page-sized or oversize and may be in color.
- All or part of your PowerPoint presentation can be included.
- Oversize maps or figures from your poster could also be used.

Registration
The principal author (Speaker) of each accepted submission for oral presentations and posters will receive complimentary registration to the conference.

Awards
The HGS will be recognising the best technical contributions with its prestigious awards; made by a respected panel of industry judges. The presentation ceremony will take place at the conference close.

Awards will be made for
- Best Student Poster
- Best Poster
- Best Oral Paper

Importantly authors should note that 50% of the marks from the judges will be allocated for the abstract. Also, extended abstracts are encouraged and will be eligible for higher marks within the awards system.

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 hard copy 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.

HGS *Bulletin* 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 ads@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 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	$950	$1,350	$2,550	$4,750	$8,000	$7,500	$7,050	$6,850	$6,650	$3,000
9	$800	$1,300	$2,500	$4,700						
8	$750	$1,250	$2,250	$4,300						
7	$600	$1,100	$2,200	$3,850						
6	$550	$950	$1,800	$3,500						$2,000
5	$500	$800	$1,600	$3,000	$4,700	$4,500	$4,350	$4,000		
4	$450	$650	$1,300	$2,500						
3	$300	$550	$950	$2,000						$1,000
2	$250	$400	$700	$1,500						
1	$150	$250	$450	$1,000	$1,500	$1,400	$1,250	$1,000	$1,250	$850
Professional Directory Section Business Card Ad: 10 Issues – $160 ($30 for each additional name on same card)										

Website Advertising Opportunities

There are currently 5 opportunities to help spread the word about your business or event and generate traffic to your website or campaign. Please submit all ad materials five (5) days prior to the go-live date for testing.

Placement	Rate	Specifications/Description
HGS Website Home Page Banner Ad	$800 – Monthly $1800 – 3 Months $2800 – 6 Months $3600 – 12 Months	275 x 875 pixels; home page top banner ad. All Home Page Banner Ads rotate every 10 seconds.
HGS Website Home Page Column Ad	$700 – Monthly $1500 – 3 Months $2400 – 6 Months $3600 – 12 Months	200 x 400 pixels; home page right column ad
HGS Website Event Page Ad	$600 – Monthly $1200 – 3 Months $1600 – 6 Months $2600 – 12 Months	200 x 400 pixels; calendar page left column ad. All Event Page Ads rotate every 10 seconds.
Geo-Jobs	$50 – 14 days $100 – 30 days $300 – 3 Months $600 – 6 Months $1200 – 12 Months	Posting of job opportunities on HGS website. Click the Geo-Jobs tab to get started. Must be filled out completed and the dates set appropriately.
Vendor Corner	$250 *4 Pack option with 1 FREE bonus event for $1000.00 available. Send request to vendorcorner@hgs.org.	Company logo, company website, and company description will be highlighted on HGS Calendar website event. This is an opportunity to display company wares, gain personnel exposure and hand out product information at HGS dinner meetings.
Event/Short Course Calendar Ad	$100 – Monthly	An event ad posted within the HGS website calendar under the Events tab.
Bundle & Save!	• 30% off website ads when combined with print ads in all 10 HGS *Bulletin* issues. • 20% off website ads when combined with print ads in 5 HGS *Bulletin* issues. • 10% off website ads when combined with print ads in 3 *Bulletin* issues.	

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 $30.00; emeritus members pay $15.00; 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 ❑ North American E&P (other than Gulf Coast)

❑ International E&P ❑ 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 5/02/17

Professional Directory

Available for Consulting in México or Other Countries

Victor H. Abadie III
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Tamia Cloud Bible, CPA
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howardwhite@centurytel.net
Texas State Geol. #2096 CPG #5624

RENEW YOUR HGS MEMBERSHIP
WWW.HGS.ORG

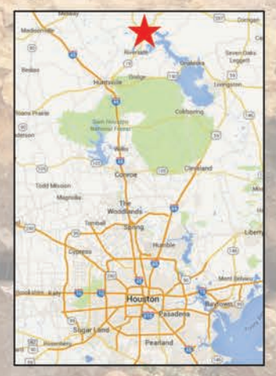
HGS Presents:

Take a kid to the outcrop family campout!

April 27 - 29, 2018
Camp Cullen YMCA in Trinity, TX

Come join fellow HGS members and their families for a weekend of fun! Activities include:

Interpreted quarry with hunts for fossils and petrified wood
Newly renovated geology lab with samples and flume
Gold panning
Zip line
Archery
Riflery
Arts & crafts
Marathon pipeline slide
Basketball
Gaga ball
Campfires



All of this and more, all only 1.5 hours north of Houston!

Check in Friday evening and check out Sunday morning. Cost is $110/person for up to 4 people. For families of 5+, call for a discounted rate. The fee includes overnight stay Friday and Saturday nights, 4 meals and all activities. Each family will have a private bunkhouse for up to 8 and private family bathroom in newly renovated cabins. For more information on the facilities, please visit the Camp Cullen website at https://www.ymcacampcullen.org/

Reserve your spot today! Reservations accepted through April 19th, 2018
Call the HGS office at 713-463-9476

HOUSTON
GEOLOGICAL SOCIETY
14811 St. Mary's Lane, Suite 250 • Houston, TX 77079