HGS Bulletin
Houston Geological Society
Volume 60, Number 3
November 2017

HGS Applied Geoscience Conference Geomechanicals in Unconventionals

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R.E. Sheriff Lecture: Where Offshore Drilling Meets Shallow Geology: Impact of Near-surface Depositional Systems on Deepwater Operations

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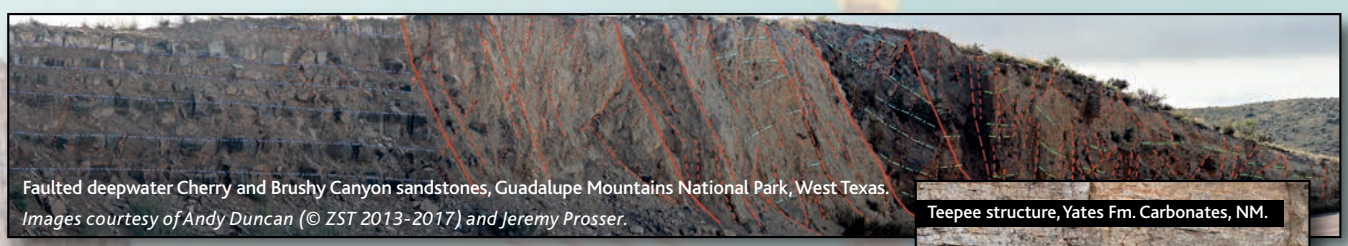
Particularly Unconventional

THE PERMIAN BASIN - NOT SIMPLY UNCONVENTIONAL

...and not simply one basin, but a complex mix of reservoir types, litho types, depositional and structural settings

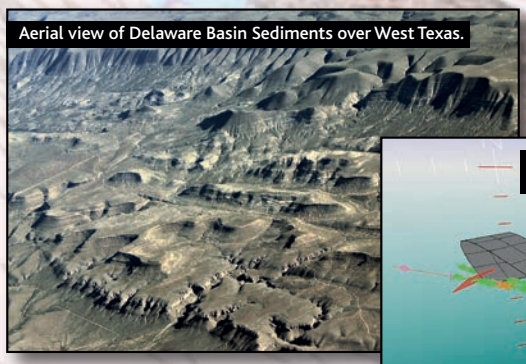


Faulted deepwater Cherry and Brushy Canyon sandstones, Guadalupe Mountains National Park, West Texas.
Images courtesy of Andy Duncan (© ZST 2013-2017) and Jeremy Prosser.

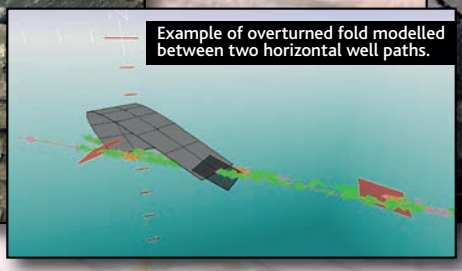
Teepee structure, Yates Fm. Carbonates, NM.

- **Task Fronterra** has subject matter expertise in all major structural and depositional systems
- **Task Fronterra** has vast experience from > 600 wellbores in 16 Counties of the Delaware and Midland Basins, and the Central Basin Platform
- Specialists in the processing and interpretation of all types of image tools using Techlog™, Geolog™ and Terrastation™ software
- Complex structural analysis from multiple wellbores using our ***attitude*** software; with these wellbore visualisation and analysis tools, we can help you to avoid Train Wrecks in well planning with predictive models and help provide solutions to the Head Scratchers.

Cored mudrock reservoir material showing subvertical fracture with slickenside indicating lateral shear *(above)*, and polished surface indicating associated bedding-parallel shear *(left)*.



Aerial view of Delaware Basin Sediments over West Texas.



Example of overturned fold modelled between two horizontal well paths.

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Houston Geological Society

Volume 60, Number 3 November 2017

In Every Issue

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Technical Meetings

Other Features

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

HGS Applied Geoscience Conference

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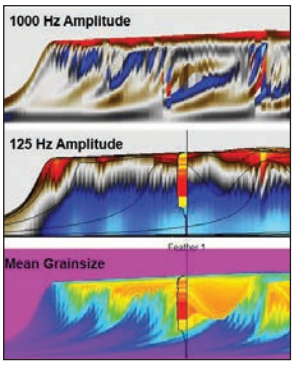

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Second Announcement and Call for Papers

Big Continent - Big Ideas - Big Opportunity

Strategies for Success

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

September 11-12, 2018 • Houston Texas

This annual conference, alternating between Houston and London, has established itself as the primary technical E & P conference on Africa with attendances in recent years exceeding 300, including industry operators, consultants, governments, and academia. There will be a large poster program in addition to the oral program of high quality talks covering aspects of E & P in all regions of Africa. *The best technical contributions will be recognized with prestigious awards from the HGS; as determined by a respected panel of industry judges.* The presentation ceremony will take place at the conference close.

- 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 (up to 2 pages long including illustrations) should be sent as soon as possible and no later than March 15, 2018 to the technical committee, at Africa2018@hgs.org. Guidelines for abstract submission are available on the website: https://www.hgs.org/civicrm/event/info?id=1931

Oral presentations will be systematically arranged in a number of themed sessions and submissions on the following topics are particularly encouraged:

- African E & P in the evolving business environment – above ground risks & rewards

Extended abstracts, of unlimited length, are encouraged for accepted submissions

Details of sponsorship opportunities and exhibition booths are available at office@hgs.org or on the HGS website.

Registration will open in April, 2018. Early bird rates will be available: check the HGS website for details.

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The Houston Geological Society Continuing Education Committee Presents

Interpretation and Analysis of Old Logs

Encore Presentation – Back by Popular Request!

A One-Day Short Course
by Bill Price, Petrophysical Solutions, Inc.
Tuesday, November 28 • 8:30 am – 5:00 pm

Well over 1 million wells were drilled in the US and the rest of the world before 1960. Many of these wells still form our understanding of the subsurface in most large fields and in smaller ones, too. What makes these wells particularly difficult to understand and interpret?

A review of the early history of logging and the myriad of logging tools will be given with hands-on learning examples. After class, students will be able to identify the types of electrical tools and the appropriate methods to properly interpret them.

Pricing
NO WALK-UPS ACCEPTED

Emeritus/Life/Honorary or HGS Members unemployed: call for special pricing

Early Registration: noon, Thursday, November 2, 2017:		**Registration:** noon, Wednesday, November 22, 2017:		**Late Registration:** closes 1 PM (afternoon), Monday, November 27, 2017:
HGS Member:	$100.00	HGS Member:	$110.00	$120 HGS Members
Non-Member:	$140.00	Non-Member:	$150.00	$160 Non-members
HGS Student Member:	$80.00	HGS Student Member: (Student registration closes)	$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.

Online Registration closes when Full. There may be no walk-ups

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

Date: Tuesday, November 28 • 8:30 am – 5 pm (Doors open at 7:30 am)

Venue courtesy of Noble Energy Corp.

Location: Bldg. NEC-1 Conference Center, 1001 Noble Energy Way, Houston, TX 77070 – Off Hwy 249 (Tomball Pkwy.) at Louetta

Please make your reservations on-line through the Houston Geological Society website www.hgs.org

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

Mr. Price is a Petrophysicist with over 35 years of comprehensive and diverse petrophysical and geological experience, he has worked extensively with all aspects of log interpretation, the integration of log data with geological and engineering data, operations, and wellsite geology. Mr. Price also has significant experience with integrated field studies involving multi-disciplinary teams. His other skills include advanced expertise with old electric logs, including Russian logs, and he is recognized as an authority on and instructor of petrophysical methodologies and database applications. Mr. Price, a registered geologist in Texas, is active in professional associations developing best-practice standards for petrophysics. His previous experience includes consulting, software development, operations and exploration and development. His professional affiliations include AAPG, SPE, SEG, HGS, and SPWLA.

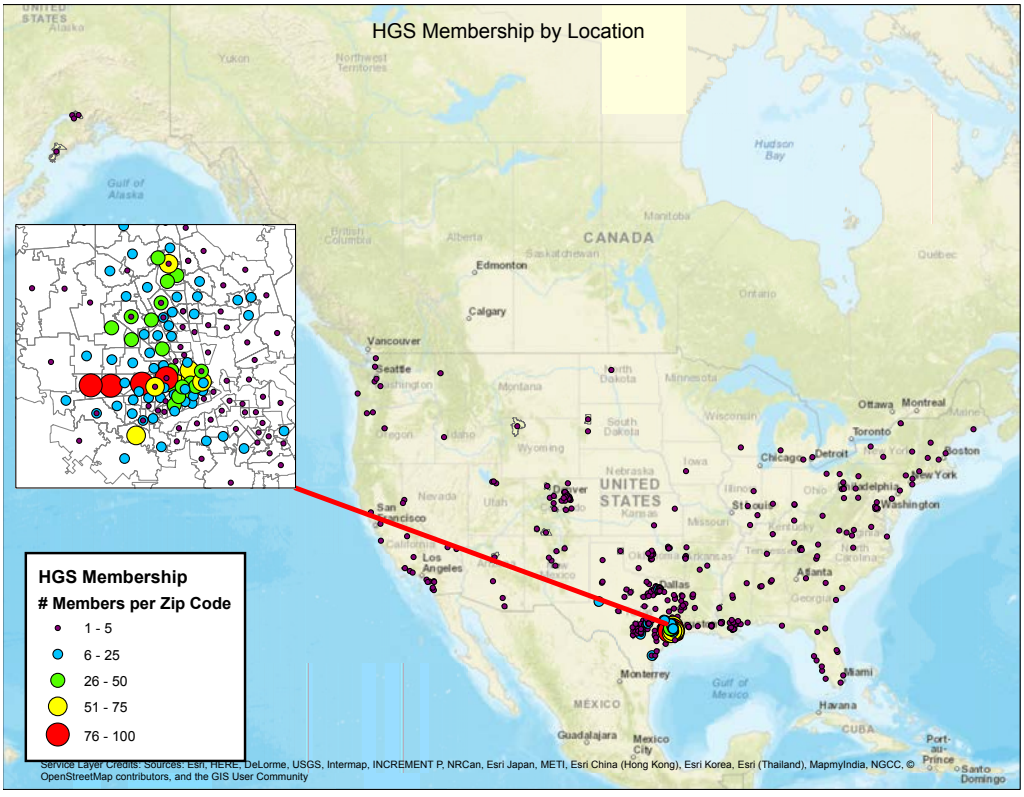
John A. Adamick
john.adamick@tgs.com

Re-Membership…

This is the President's column for November though I am writing it while sitting in my study in early September and contemplating the devastating effect of Hurricane Harvey on Houston. Every single person I have talked to over the last few days was either directly affected or had family, friends, or co-workers that were. The HGS office building itself was flooded for days. Fortunately the office is on the second floor (please don't ask about all the materials we had stored in the basement). My thoughts and prayers go out to those most affected. Within HGS, the NeoGeos Committee has been working hard to set up a benefit dinner named "Energy for Harvey Relief" where all revenue will be donated to the Houston Food Bank. I hope they are successful and that life in Houston is beginning to get back to normal for most people by the time you read this article.

The title "Re-Membership" reflects the Board of Directors goal to grow HGS membership over time. In past years HGS membership was much larger than it is today. Some of this is due to structural changes in the industry but there are also numerous geoscientists in the area who are not currently members. For example, there are 1,777 AAPG members in areas around Houston who are not current HGS members! Fortunately, our membership has stabilized and actually has increased a bit over the last few years. The current HGS member count totals 3,469 with about 1% living abroad in 14 different countries. The other 99% of members reside in the US. As we drill down further you can see in map view the distribution of members by state. Somewhat surprisingly the Society has members in 41 states not including Texas, that make up 10% of total membership. Outside the Greater Houston area Texas membership makes up another 9% of total. That leaves 80% of members who live in the Greater Houston area, which is shown in the inset map. The colored circles represent membership counts by zip code. As you can see,

From the President *continued on page 13*



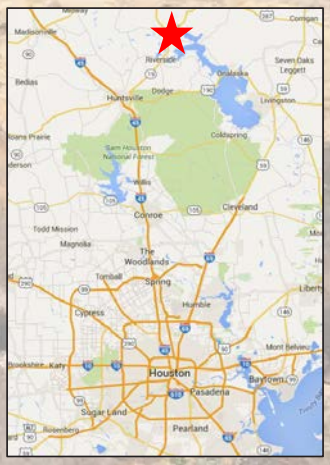
HGS Presents:

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

Brian W. Horn
Brian.Horn@iongeo.com

The Past is the Key to the Present

Being on a cutting edge exploration team is a lot like riding a roller coaster. The slow grinding climb up through a mountain of contradicting data, the thrill of the rapid acceleration when projects take on new meaning and importance within the organization, and the heavy feeling in your stomach when things seem to have bottomed out and what once was a great idea doesn't seem so great anymore. I believe the entire experience is what makes our industry (and our jobs) so great. The opportunity to be able to test an idea, believe in a map that you have made and have others commit financial resources to that endeavor is a great privilege and experience. This process has become much more sophisticated over the past 100 years, but I believe what the early pioneers of our industry encountered is not that different from today.

I recently returned from the AAPG ICE Convention and was impressed by the quality, content and thoroughness of the presentations I was able to hear. The Discovery Thinking session was incredibly enlightening listening to geoscientists describe how many of the world's recent largest discoveries were made; the processes required long hours of work, critical thinking, technical evaluations, team introspection, political changes and in many instances "luck" is involved.

In many frontier exploration efforts analogues are the tool used to understand and reduce the uncertainty around an idea or prospect. Recently an article that was posted on LinkedIn focused on the value in understanding modern depositional environments as a key to interpreting the ancient record. This stems from a fundamental tenant in understanding the Earth's history supported by James Hutton and Charles Lyell. The law of uniformitarianism proposes that the processes we observe on earth today are similar to those that formed the geologic record (outcrop) we observe. Water still flows downhill, gravity is a constant, mass is conserved, rivers form deltas when they enter an ocean etc. While this was the topic of debate in the article – I thought I might turn it around – the past is the key to the future! How well do we know the history and experiences of the men and women who have gone before us and made the industry what it is today?

The law of uniformitarianism proposes that the processes we observe on earth today are similar to those that formed the geologic record (outcrop) we observe.

Above the entrance to Norlin Library at The University of Colorado library the inscription reads, "who knows only his generation will always remain a child". For some reason that stuck with me thirty years later. I began to ask myself how much history of the industry that has been such a big part of my life do I really know. Who were the people? What was their experience? How did they succeed? I'm certain that I am years behind most of the HGS membership on this topic and if this is the case I would ask for your patience. But if we are honest with ourselves we should ask, "How much do I know about the people who have gone before us and what ideas did they develop and what issues they encountered?"

Recently I finished a book that I would encourage any petroleum geologist to read. *The Big Rich* by Bryan Burrough is a fantastic biography of the original four Texas oil men who started the industry in Houston and Dallas in the early 1900's. So much of what we see today in Houston is the result of the hard work, good fortune, and the discoveries of H.L. Hunt (East Texas Field), Sid Richardson (Keystone Gas Field – West Texas), Roy Cullen (who thought of drilling on the flanks of salt domes and drill deeper) and Clint Murchison (Southern Union Co and Clint Jr (son) who owned the Dallas Cowboys). These men lived in a time that most of us would not imagine today, yet because of their intelligence, perseverance, risk-taking mentality and success we have things like The University of Houston and The Cullen Center for Performing Arts to name only two. Much of the philanthropic efforts we see in Texas today can be directly attributed to these four men and their families.

I would encourage the HGS membership to take some time and look around the city in which we live. Some of the largest oil and gas discoveries in the first part of the 1900's are within 50 miles

From the Editor *continued on page 13*

Applied Geoscience Conference

SOUTHWESTERN ENERGY • 10000 ENERGY DRIVE • SPRING, TX 77389

November 8-9, 2017

Geomechanics in Unconventionals

Please join us for the Houston Geological Society's premier two day technical conference, focusing on geomechanical integration and advancement in the assessment of unconventional reservoirs.

The program will highlight field examples of geomechanical workflows, with sessions focusing on Unconventional Geology & Geophysics, and Integrated Workflows & Engineering Design.

Wednesday AM	Session 1	- Geomechanical Characterization
Wednesday PM	Session 2	- Engineering Applications
Thursday AM	Session 3	- Surveillance and Diagnostics
Thursday PM	Session 4	- Case Studies

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November 8-9, 2017

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Applied Geoscience Conference

November 8–9, 2017

Oral Presentations – Wednesday, November 8, 2017

7:00	**Registration and Coffee**	
8:00 - 8:10	**Welcome and Opening Remarks:** Robert Hurt, *Pioneer Natural Resources;* Umesh Prasad, *Baker Hughes, a GE company*; John Adamick, *TGS, HGS President 2017-2018;* Ron Hayden, *SWN Vice President of Technology*	
	Session 1: Geomechanical Characterization **Chairs:** Shihong Chi, *ION E&P Advisors* ; Farid Reza Mohamed, *Schlumberger*	
8:10 - 8:45	A Novel Geomechanical Characterization Methodology for Quantifying Fine Scale Heterogeneity	**Jesse Hampton**, *New England Research*
8:45 - 9:20	Brittleness and Fracability in Stimulating Shale Reservoirs	**Mao Bai**, *Independent Geomechanics Consultant*
9:20 - 9:40	**Coffee, Posters, Exhibits**	
9:40 - 10:15	The Relationship between Natural Fracture Distribution and Elastic Mechanical Properties in the Subsurface: Measurement and Calibration	**Ron Nelson**, *Broken N Consulting, Inc.*
10:15 - 10:50	A Novel Method for Experimental Determination of Biot's Coefficient in Unconventional Formations.	**Munir Aldin**, *MetaRock Laboratories*
10:55 - 11:55	**Open Floor Discussion & Posters**	
11:55 - 1:00	**Lunch, Posters, Exhibits**	
12:15 - 1:00	**Keynote:** What Maintains High Pore Pressure in Gas Shale During Exhumation, Long After Thermal Maturation Ceases?	**Terry Engelder**, *The Pennsylvania State University*
	Session 2: Engineering Applications **Chairs:** See Hong Ong, *Baker Hughes, a GE company*; Cem Ozan, *BHP Petroleum*	
1:05 - 1:40	Complex Fracture Network Creation in Stimulation of Uncoventional Reservoirs	**Ahmad Ghassemi**, *The University of Oklahoma*
1:40 - 2:15	Hydraulic Stimulation in the Presence of Fractures	**Tobias Hoeink**, *Baker Hughes, a GE company*
2:15 - 2:35	**Coffee, Posters, Exhibits**	
2:35 - 3:10	A Holistic Approach to Geologic and Geomechanical Modeling in Unconventional Reservoirs PART 1	**Ewerton Araujo, Sebastian Bayer, Marcus Wunderle,** *BHP Petroleum*
3:10 - 3:45	A Holistic Approach to Geologic and Geomechanical Modeling in Unconventional Reservoirs PART 2	**Ewerton Araujo, Sebastian Bayer, Marcus Wunderle,** *BHP Petroleum*
3:45 - 4:45	**Open Floor Discussion & Posters**	
5:00 - 8:00	**Social Hour**	

Applied Geoscience Conference

November 8–9, 2017

Oral Presentations – Thursday, November 9, 2017

7:00	**Registration and Coffee**	
8:00 - 8:10	**Welcome and Opening Remarks:** Robert Hurt, *Pioneer Natural Resources;* Umesh Prasad, *Baker Hughes, a GE company*; John Adamick, *TGS, HGS President 2017-2018*	
	Session 3: Surveillance and Diagnostics **Chairs:** Robert Hurt, *Pioneer Natural Resources;* Kim Hlava, *Statoil*	
8:10 - 8:45	Validating Completion Design Using Monitoring of Offset Wells	**Erica Coenen,** *Reveal Technologies*
8:45 - 9:20	DAS Microseismic Monitoring and Integration with Strain Measurements in Hydraulic Fracture Profiling	**Dan Kahn,** *Devon Energy*
9:20 - 9:40	**Coffee, Posters, Exhibits**	
9:40 - 10:15	Focal Mechanism Solutions of Microseismic Events from Hydraulic Fracture Monitoring: A Case Study of the Eagle Ford Shale	**Rongmao Zhou**, *BHP Petroleum*
10:15 - 10:50	Integration of DAS Fiber-Based Strain and Microseismic Data for Monitoring Horizontal Hydraulic Stimulations – Midland Basin Texas Examples	**Rob Hull**, *Pioneer Natural Resources*
10:55 - 11:55	**Open Floor Discussion & Posters**	
11:55 - 1:00	**Lunch, Posters, Exhibits**	
12:15 - 1:00	**Keynote:** Optimized Recovery from Unconventional Reservoirs: How Nanophysics, the Micro-Crack Debate, and Complex Fracture Geometry Impact Operations	**Lans Taylor**, *Energy and Geoscience Institute (EGI) at the University of Utah*
	Session 4: Case Studies **Chairs:** Joel Walls, *Ingrain, a Halliburton service;* BJ Davis, *Baker Hughes a GE company*	
1:05 - 1:40	Quantifying the Impact of Induced Asymmetric Fracturing from Horizontal Development Wellbores; a Geostatistical Perspective	**Doug Walser**, *Halliburton*
1:40 - 2:15	Efficient Well Delivery in Shale Plays – Examples from the Marcellus and Permian	**Julie Kowan,** *J. Kowan Consulting, LLC*
2:15 - 2:35	**Coffee, Posters, Exhibits**	
2:35 - 3:10	Characterization of Fractures from Borehole Images	**Sandeep Mukherjee,** *Halliburton*
3:10 - 3:45	Lateral Characterization and Fracture Optimization Solution with Case Studies	**Sergey Kotov,** *Baker Hughes, a GE company*
3:45 - 4:45	**Open Floor Discussion & Posters**	
	Closing Comments and Invitation to Posters	

Poster Session

Invited Presentations from Graduate Students • Open during Coffee and Lunch Breaks

Applied Geoscience Conference

November 8–9, 2017

Posters – November 8-9, 2017

Poster Session Chair: Mike Effler

University	Student Name	Poster Topic
Georgia Institute of Technology	**Ming Lui** and Haiying Huang	A Poroelastic Solution of Rigid Sphere Indentation into a Compressible Half-Space
Texas A&M University	**Anusarn Sangnimnuan** and Jiawei Li, Kan Wu	Development of an Efficient Coupled Fluid Flow and Geomechanics Model to Predict Stress Evolution in Unconventional Reservoirs with Complex Fracture Geometry
Texas A&M University	**Arash Shadravan** and Behrouz Haghgouyan	Geomechancal Cement Sheath Finite Element Modeling to Achieve Enhanced Zonal Isolation
Texas A&M University	**Edith Sotelo Gamboa** and Richard L. Gibson	Fracture Compliance: Relationship with Fracture Conductivity and effect on Wave Propagation
Texas A&M University	**Guangjian Xu**, Judith Chester and Fred Chester	Developing a Mechanical Stratigraphic Model of the Eagle Ford Formation
The University of Oklahoma	**Ishank Gupta**, Carl Sondergeld and Chandra Rai	Water Weakening: Case Study from Marcellus, Woodford and Eagle Ford
The University of Oklahoma	**Alex Vachaparampil** and Ahmad Ghassemi	Failure Characteristics of Three Shales under True-Triaxial Compression
The University of Oklahoma	**Zhi Ye** and Ahmad Ghassemi	Mechanical Properties and Permeability Evolution of Shale Fractures under Triaxial Loading
The University of Texas	**Matthew Ramos**, D.N. Espinoza, C.I. Torres-Verdín, K.T. Spikes and S.E. Laubach	Stress-Dependent Dynamic-Static Transforms of Anisotropic Mancos Shale
University of Calgary	**Bram Komaromi**, Dr. Per Kent Pedersen and Dr. Paul MacKay	Facies-Controlled Fracture Stratigraphy in Organic-Rich Petroleum Systems, Turonian Second White Specks Formation, Southwestern Alberta
University of Houston	**Ismot Jahan**, John Castagna, and Michael Murphy	Characterization of Faults Using Seismic Attributes From 3D Seismic Data in the Bakken Formation
University of Houston	**Ali Rezaei**	Effect of Pore Pressure Depletion on Horizontal Stresses and Propagation of New Fractures during Refracturing Process

Participating Schools

Georgia Institute of Technology • Texas A&M University

The University of Oklahoma • The University of Texas

University of Calgary • University of Houston

Open During Coffee and Lunch Breaks

From the President continued from page 5

there is a large concentration of members along the I-10 Energy Corridor and other concentrations of members in the general downtown/West University/Bellaire area and in the Woodlands. Significant concentrations can also be seen in northwest Houston and in the Sugarland area.

If HGS is to grow as an organization, we must first and foremost keep the members that we have happy with what they are receiving from HGS. Think back to when you joined HGS in the first place. Why did you join? In my case, I was a freshly minted geologist with my Master's degree. Like most everybody else, I wanted to be a member to take advantage to learn more about my chosen profession by attending HGS lunch and dinner meetings, field trips, short courses, and reading books published by HGS. At the time I joined, it hadn't dawned on me that the networking aspect of the Society's events was an important benefit but I soon learned this was the case. I also felt a strong desire to help and give back to geoscience and HGS. I was fortunate enough in grad school to have received a scholarship from HGS and very thankful for it. I felt that if I became a member of HGS I could give back through sweat equity some of what HGS had given to me. Strangely enough, it took a couple of years of me poking and prodding within HGS before I got on my first committee. This is where the value of networking began to occur to me. Since then, I have been on one committee or another (and often multiple) committees for HGS. In just about every case, I learned a lot and also got a lot of fulfillment in working for HGS members.

I encourage anyone interested in giving back to geoscience to volunteer to be on a committee or two. If you are having a difficult time finding out how to help, please contact me. I personally commit to help you get on a committee and active in the organization. If you are close to the end of your career or considering retirement keep your HGS membership. Our membership needs and understands the great value experienced geoscientists have to offer all members and in particular mentoring young geoscientists and supporting the local community.

There are also a significant numbers of young geoscientists in Houston who have not joined HGS yet for one reason or another. I encourage senior geologists, managers, and other leaders within oil and gas industry to encourage these young geoscientists to join HGS. Understanding the general lack of interest in HGS by younger geoscientists is a priority for the Board. We have recruited **Gustavo Carpio** to serve as chairman of the Membership Growth Committee to focus on this issue. If you have ideas on how to make HGS more appealing to young geoscientists please contact Gustavo or myself directly.

I'd like to conclude this month's article by recognizing **Sharie Sartain**, one of our very active HGS members. Sharie joined HGS in 1983 and has served the Society in a variety of ways. She was on the HGS Executive Board from 1999-2002 as a director and later as secretary. In addition, over time she has served as Volunteer Coordinator, Awards Chairman, and as a delegate and later foreman representing HGS at the AAPG House of Delegates. In each of these roles she served for multiple years. Since 2009, Sharie has served on the New Membership Committee which reviews all new HGS membership applications and makes recommendations concerning approval to the Board. I can't thank Sharie enough for all she has done for the Society and hope that you will also thank her for her service the next time you see her. ■

From the Editor continued from page 7

of downtown Houston. Many of the fields are abandoned, but many are in areas that have been redeveloped several times. Did you know that one of the more significant discoveries in the early part of the century (Pierce Junction) was just a bit south of where the Astrodome is located. Every day thousands drive past/over Katy gas field and never correlate that what powers the energy in their world is directly under their feet. Over the next few months we will try to feature articles that document some of the history of the oil and gas activity around the Houston region. This month features a summary of the Ranger Field by Jeff Spencer.

There is much in the news today that sheds a negative light on our industry. Dare I use the term *fake news*? Many voices with poorly informed narratives tend to dominate the news media. However, my experience is that when people learn I am a petroleum geologist they have many honest questions and want to understand the energy business from a professional. Quite often the disconnect is when people do not see the correlation of energy and the quality of life and modernization we all have come to expect. These are in a large part due to the innovation, risk taking and success of the people in our industry.

In the coming year the HGS will be doing more public outreach and short radio spots to give the greater Houston area a better understanding of what the geoscience community within the oil and gas industry contributes to society, both past and present. If you have ideas and suggestions or ways in which you believe the HGS can present the industry to the community at large please feel free to contact me directly or **Rosemary Laidacker** who is the committee chair for this outreach. ■

Wednesday, November 8, 2017

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.
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.

Peter G. Pope, P.G. and Peter Fisher, P.G.
Railroad Commission of Texas

ETHICS MOMENT

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

Rescheduled from September

Environmental Issues and the Railroad Commission of Texas

The stewardship of natural resources and the environment is an important part of the Railroad Commission of Texas' (RRC) mission statement. Mr. Pope and Mr. Fisher will discuss environmental issues and regulation related to activities under the jurisdiction of the RRC, with a focus on regulation of Oil and Gas Exploration and Production activities. ■

Biographical Sketches

Peter Pope attended Purdue University in the mid-1980s and then Rice University from 1987 to 1991 where he performed graduate-level research in Antarctic glacial marine sedimentation. He began his career in environmental consulting in 1991. After 10 years in the private sector, he took a position in the Site Remediation Section of the Railroad Commission of Texas using his knowledge and experience with contaminant fate and transport modeling and risk assessment to regulatory oversight of oil field cleanups. Mr. Pope currently manages the Site Remediation Section.

Peter Fisher, P.G., works as the Houston District Director in the Field Operations Section of the Oil and Gas Division of the Railroad Commission of Texas. Mr. Fisher was promoted to Houston District Director on August 1, 2015, where he had been the Houston Assistant District Director since June 1, 2011. He is responsible for the overall operations of the Houston District office ensuring that all Commission Rules, procedures, and policies are enforced in the District.

Before moving to Houston Peter worked for 11 years in the Site Remediation Section of the Oil and Gas Division of the Railroad Commission of Texas in Austin coordinating site assessments and cleanup of abandoned oil and gas surface sites using State funds. Prior to working in Site Remediation, he worked three years in Technical Permitting of the Environmental Permits and Support Section.

Prior to joining the Railroad Commission of Texas Mr. Fisher worked at Fluor Daniel GTI environmental engineering consulting firm where he managed several underground storage tank sites and helped assess and prepare surface mining studies and applications for lignite in east Texas. Mr. Fisher has a BS in geology from The University of Texas at Austin.

Tuesday, November 21, 2017

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.
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HGS Northsiders Luncheon Meeting

James Kessler
Occidental Petroleum Corporation

Impact of Clay Content on Elastic Anisotropy and Stresses in the Permian Basin Mud Rock Systems

The relationship between the horizontal elastic modulus, E_h, and the vertical elastic modulus, E_v, is a function of clay content in unconventional resource plays in the Permian Basin. Increases in clay content in the Permian Basin mud rock systems are associated with increases in elastic anisotropy, E_h/E_v. When elastic anisotropy is high, over ~1.5, calculated stresses increase and affect the results and interpretation of 1D geomechanical models, wellbore stability models, and hydraulic fracture models. To assess the significance of the impact of clay content and elastic anisotropy on the stress calculation, we analyzed data from 60 pairs of vertical and horizontal one-inch diameter core plugs (120 plugs total) taken from three wells in the Permian Basin.

Whole 4-inch diameter cores were collected from four different formations with lithotypes that included calcareous siltstones, carbonate debris flows, siliceous siltstone, calcareous mudstones, siliceous mudstones, and organic rich mudstones. Each sample was analyzed for clay content and mineralogy using FTIR and XRF techniques. Static and dynamic elastic properties, Poisson's ratio, and uniaxial compressive strength were measured in confined compressive tests. Static elastic anisotropy was calculated at discrete locations over a range of depths and lithotypes. Bivariate regressions between each vertical and horizontal static Young's modulus and a commonly available wireline log were used as a method to upscale static elastic properties from the triaxial core plug measurements to log scale. The upscaled E_h and E_v data were used as input to the vertical transverse isotropic, VTI, stress model and compared to the poroelastic plane-strain model. The results showed an increase in stress in the VTI model compared to the plane-strain model up to 2,500 psi when elastic anisotropy is high. When anisotropy is low, the models converge on similar stress magnitudes, as expected. The changes in stress increase have a significant impact on 1D geomechanical models, bi-wing hydraulic fracture models, and wellbore stability models. Anisotropy increases proportionally with an increase in clay content the preliminary results indicate that a clay content of 4-5% can be enough to effect stress magnitudes. Higher calculated stresses can present commercial challenges impact on well design, well spacing, SRV estimation. All factors that can significantly change the bottom line. ■

Biographical Sketch

James Kessler is a senior geologist currently working as a geomechanics specialist in the Subsurface Technologies group at Occidental Petroleum. His work is focused primarily on the characterization of mechanical stratigraphy through the upscaling of elastic rock properties and rock strength from core to reservoir scale and the characterization of stress in the subsurface. James applies his work to solving wellbore stability problems and enhancing the quality of rock property and stress inputs to hydraulic fracture models. James has over 15 years of experience as a geologist in a variety of research, consulting and petroleum industry roles focused on structural geology, hydrogeology, and geomechanics. He has been at Oxy for for the past four years.

Monday, November 27, 2017

HGS General, International and N. American Dinner Meeting

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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R. Craig Shipp
Shell International Exploration and Production Inc.

The Robert E. Sheriff Lecture Series

Sponsored by the Department of Earth and Atmospheric Sciences at University of Houston and the U.H. Geoscience Alumni Association

In addition to the presentation by the guest speaker, Dr. Hua-wei Zhou, Chair of the Department of Earth and Atmospheric Sciences, will present an update of activities at U.H. as well as the departmental Outstanding Alumni Award. There will be a poster session on current thesis and dissertation research of U.H. students.

Come and meet the next generation of geoscientists from the University of Houston!

The Robert E. Sheriff Lecture Series was initiated in 1999 by the University of Houston Geoscience Alumni Association to honor Dr. Sheriff as an educator, scholar, and proponent for the geosciences. The series has recently been co-sponsored by the Houston Geological Society.

The Sheriff Lecture mission is to

bring some of the best known geologists and geophysicists in the world to the Houston community to share ideas relevant to exploration geology and geophysics, and to showcase geoscience activity at the University of Houston.

A full list of the Student Posters will be available on the HGS Website.

R.E. Sheriff Lecture:

Where Offshore Drilling Meets Shallow Geology: Impact of Near-surface Depositional Systems on Deepwater Operations

Beginning more than forty years ago, 2D high-resolution site surveys conducted in the shefal waters of the North Sea were used to assess the impact of seafloor and near-surface geology on offshore drilling operations. Use of the seismic and other acoustic methods for geohazards assessment, supplemented with the analysis of industry and scientific offset wells, still continues to evolve today. This is particularly true for evaluation in deepwater settings where coverage and quality of both 3D seismic surveys and mutibeam echo sounder data and the abundance of offset wells has increased substantially over the last decade. This increased availability of these key data has led to the improved understanding of the acoustic and seismic response of deepwater surfacial and stratigraphic hetergeneity and the regional near-surface framework. The improved understanding of the variety

Example of shallow gas flow to sea surface from the Central North Sea in 1990.

of depositional systems encountered provides a more integrated approach to deepwater geohazard assessment. This approach places an emphasis on understanding geohazards in the context of the environment of deposition resulting in greater confidence of interpretations. These regional compilations then are integrated with focused prospect areas and well-site assessment utilizing an array of workstation and well-to-seismic correlation tools.

Geohazards that are commonly encountered in gobal deepwater setting are commonly broken into seafloor and subsurface categories. Seafloor geohazards that are tyically encountered are slope stability issues, fluid expulsion, chemosynthetic communites around seafloor seeps, severe topography created by surface faulting and surficial mass failure, and antrophogenic trash. In near-surface deepwater subsurface environments the common issues are are fault crossings, shallow gas, shallow water flow, and gas hydrates, and changes in lithology. Many of these geohazards have acoustic or seismic characteristics that associate them with known depositional systems.

In addition to the potential geohazards another issue that complicates the drilling of most deepwater wells is how the upper part of the well must be drilled. Because of the soft and poorly consolidated sediment in the 1000 m below seafloor the well must be drilled with borehole cuttings produced by the bit and returned to the seafloor as an open system (riserless drilling). In depths ranging form 500 to 100 m below the seafloor (depending on degree of under consolidation of the near-suface sediments) the base of the surface conductor is reached (i.e. the casing shoe), casing is installed, and cement is pumped into the annulus (the space between the casing and the borehole wall) from the casing shoe to the wellhead at the seafloor to stabilize the casing. To drill the rest of the well a mairne riser with a blow out preventer (BOP) unit connected to the riser base is run from the drill floor to the wellhead on the seafloor. Adding this drilling hardware allows substantial increased capabilities for well control for the well path and allows borehole cuttings to be collected at the rig floor in a closed system (riserd drilling). It is in the earlier upper riserless section of the well with minimal well control (i.e., no BOP) that geohazards have the greatest opportunity to create potential drillng problems.

Early recognition and understanding of the geohazard potential

HGS Joint General, International and N. American Dinner *continued on page 23*

Wednesday, November 29, 2017

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.

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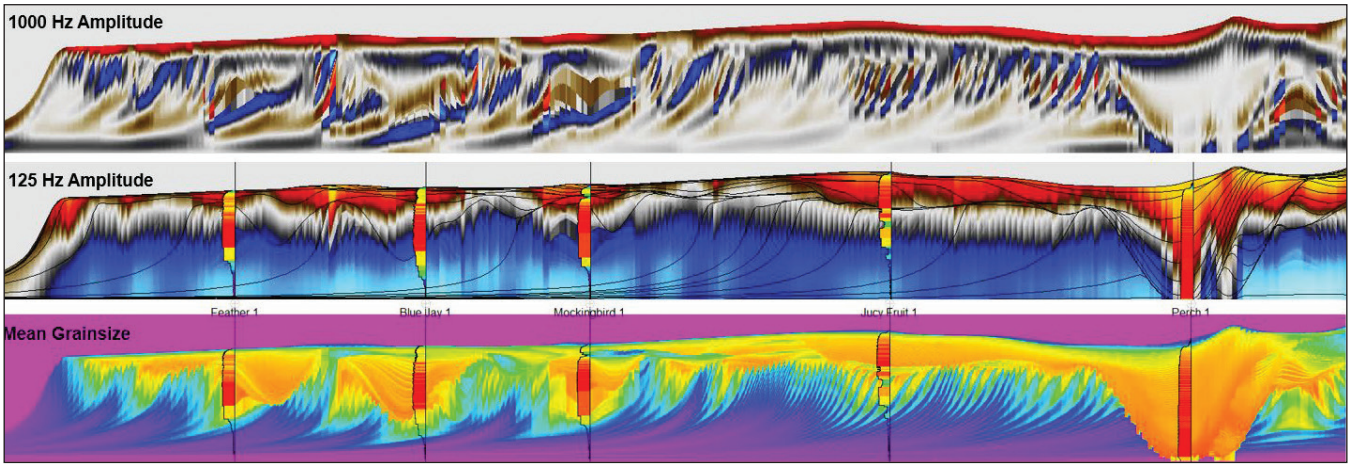
Lisa Goggin, Tao Sun, Maisha Amaru, Ashley Harris, Anne Dutranois, Andrew Madof
Chevron Energy Technology Company

3-D Volumetric Interpretation with Computational Stratigraphy Models



Seismic and property backddrops: how does well density and seismic frequency influence your interpretations?

Seismic sequence stratigraphic approaches rely upon the basic assumption that seismic reflections represent time-equivalent surfaces. Many studies demonstrate that tracked seismic reflections reveal apparent morphological forms of depositional systems but these studies seldom address how seismic reflections, impedance contrasts and formation boundaries relate. Formation and fluid boundaries create scale-dependent seismic responses. We should expect that as vertical and lateral facies changes occur and seismic frequency degrades the impedance and seismic amplitude responses will also be altered. Complex relationships between facies and seismic response can create reflections that are discordant with geologic time. Recognizing how seismic response relates to lateral and vertical facies changes is critical to understanding whether seismic reflections accurately reveal the geomorphologic form of time-equivalent geologic surfaces.

To investigate whether seismic reflections accurately capture geomorphology stratal boundaries and test how frequency content in seismic volumes changes reflection response we utilize computational stratigraphy to generate 3D geological depositional models that are transformed into scalable seismic analogs. Honoring the physics of depositional process and grain transport a scale model of a fluvially-dominated delta was created. The depositional model is converted into seismic volumes of various frequencies (1D convolutional approach) and the resulting seismic reflections are compared to known positions of time-equivalent depositional/erosional surfaces and facies from the synthetic model. At all tested seismic frequencies we observed reflections discordant with known time-synchronous events from the model. The observed discordance often worsened with frequency loss and occasionally resulted in amplitude responses that were discordant with facies trends in the model. This result suggests that the assumption that seismic reflections are time-synchronous boundaries in the subsurface requires further investigation. We conclude that scale and seismic frequency are critical components of sequence stratigraphic classification and should not be overlooked in our quest to classify our interpretations. ■

HGS General Luncheon *continued on page 23*

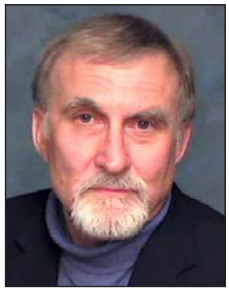
HGS Applied Geoscience Conference Nov. 8-9

See pages 8-12

HGS Joint General, International and North American Dinner *continued from page 19*

of these deposition environments and knowing the design depth of the riserless section can be leveraged to avoid or mitigate most operational deepwater concerns. The geophysical expression of depositional systems that exist in global deepwater settings can be used to quickly identify drilling and development problems in a new basin and/or where offset well control is sparse. Thus, a thorough study of seafloor morphology and near-surface stratigraphy helps to identify possible drilling and safety issues, and aids in determining the impact of each geohazard on each well-site or field-development scenario.

Biographical Sketch



Craig Shipp joined the Shell Development Company in Houston as a research geologist in 1988, after completing a PhD in Geological Oceanography from the University of Maine. For most of his industry career he has concentrated on the development and support of the current evaluation group that specializes in the assessment of geohazards for offshore and recently onshore drilling and field developments globally. In 2013, he was named Principal Technical Expert in recognition for his long-term efforts in the discipline within Shell. Craig founded and convened the Operators' Geohazards Forum (2003-2009), was an AAPG Distinguished Lecturer (2006-2007), a member of the Expert Panel on Gas Hydrates for the Canadian Council of Academies (2007-2008), chaired the Houston Offshore Site Investigation and Geotechnics Committee of the Society for Underwater Technology (2010-2011), and was the Technical Program Chair for the 2017 AAPG Annual Meeting. Presently, Craig serves on the Environmental Protection and Safety Panel for the Integrated Ocean Drilling Program (2003-present) and is a member of the U.S. Dept. of Energy Methane Hydrate Advisory Committee (2008-present). His current interests are the effects of mass-failed sediments and marine-gas hydrates on deepwater operations and understanding the breadth of issues related to onshore drilling and development.

HGS General Luncheon *continued from page 21*

Biographical Sketch

Dr. Lisa Reneé Goggin developed an early interest in chemistry, a love of outdoor activities and a penchant to collect rocks led to a pursuit of advanced degrees in geology and chemistry. An opportunity to sit a well as a mud-logger during her undergraduate years gave her a passion for finding oil and gas and after completing multiple internships in the oil industry. She completed her PhD in Geology in 1999 at Indiana University after joining Chevron in 1997. Lisa has served as an exploration and development geologist, described and interpreted cores, led field schools and taught seismic interpretation and visualization techniques to teams around the globe. She is currently a Senior Staff Research Geologist and a team member of new technology and applied geologic workflows designed to bridge the gap between low-resolution data and high-resolution modeling. She is a proven Oil Finder and received several patents and currently has numerous additional patent applications on file at the US Patent office. She is an enthusiastic speaker and leader who is passionate about sharing technology and ideas. Her Professional associations include: Registered Professional Geologist (ASBOG), member of AAPG, GSA, HGS, Sigma Xi & Sigma Zeta Honor Societies and is currently serving on the Board of the National Cave and Karst Research Institute.

Applied Geoscience Conference

March 6-8, 2018

Integrated Approaches of Unconventional Reservoir Assessment and Optimization

Please join us for the Houston Geological Society's premier technical conference, offering the latest breakthroughs, technical perspectives and integrated approaches to unconventional reservoir assessment.

DAY 1

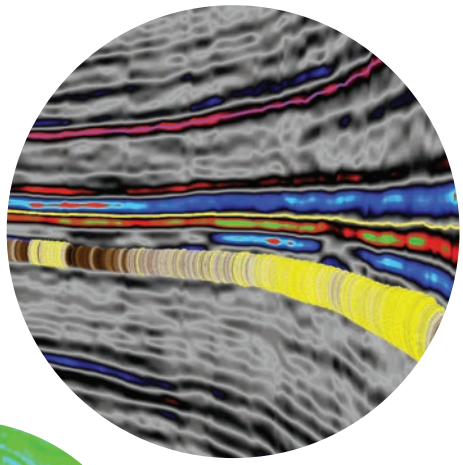
- **Session 1:** Diagenetic Components of Mudrocks and Their Impact on Production
- **Session 2:** Nanoscale Porosity and Hydrocarbon Phase Producibility / Wettability
- **Session 3:** Predicting petrophysical flow properties using digital rock physics
- **Session 4:** Geophysical Methods for Producibility, Fracability and GeoHazards

DAY 2

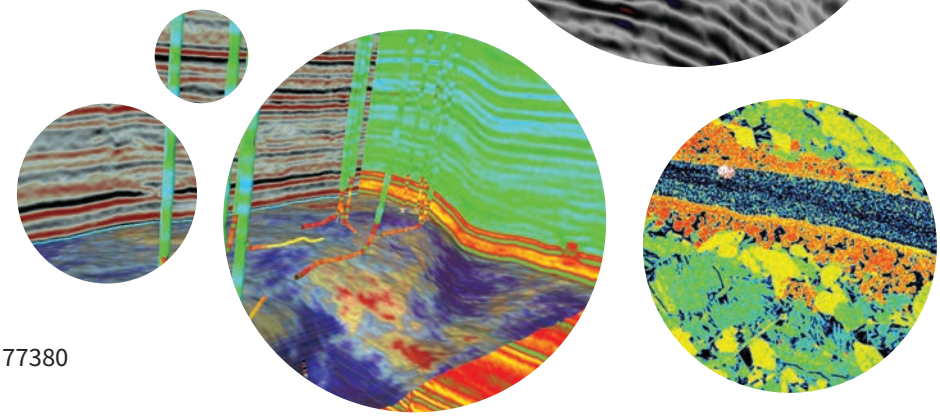
- **Session 5:** Analytical Applications for Improved Hydrocarbon Recovery
- **Session 6:** Hybrid Tight / Complex Opportunities
- **Session 7:** Technology Applications for Stimulated Rock Volumes Versus Drained Rock Volume
- **Session 8:** Operator Cases of Integrated Applied Geoscience for Fun and Profit

DAY 3

- **Workshop (separate registration):** Applied Methods of Core Descriptions to Maximize Value to an Operator (geared for the novice to the expert)



The full integrated industry member developed program includes the latest University Research (Poster Program Event), supporting Cores (Multi-Core event) and a Luncheon Keynote SME Speaker, as well as an first evening industry social.



Anadarko

ANADARKO CONFERENCE CENTER
1201 Lake Robbins Drive, The Woodlands, TX 77380

Registration Open!
For more information please visit: www.hgs.org

Applied Geoscience Conference

March 6-8, 2018

Integrated Approaches of Unconventional Reservoir Assessment and Optimization

To sponsor, please indicate your sponsorship level _____ with payment (payable to HGS) to: **HGS, 14811 St. Mary's Lane, Ste. #250, Houston, Texas 77079, Attn: Andrea Peoples**. You may also email your completed sponsorship form to andrea@hgs.org.

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If you would like HGS to invoice your sponsorship, please complete the section below:

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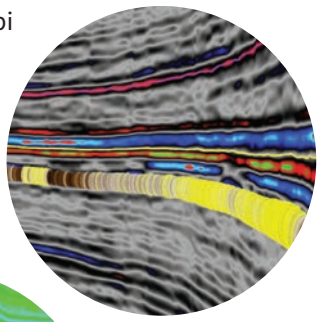
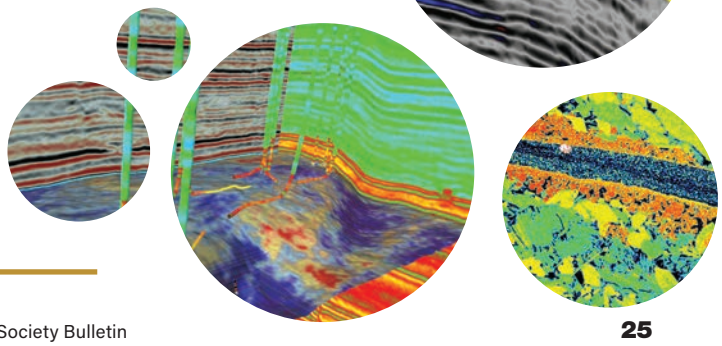
Please email your company logo to andrea@hgs.org. Note: Please send only company logos at 300+dpi





Anadarko

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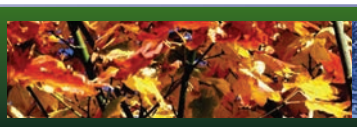
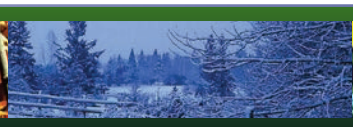
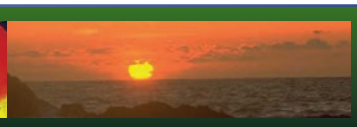
For more information please visit: www.hgs.org

November 2017





Sunday	Monday	Tuesday	Wednesday
	Reservations: The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail 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.**		1
5	6	7 **HGS Board Meeting** *6 p.m.*	8 **HGS Applied Geoscience Conference** *Page 8* **HGS Environmental & Engineering Dinner Meeting** *"Environmental Issues and the Railroad Commission of Texas," Page 15*
12	13	14	15
19	20	21 **HGS Northsiders Luncheon Meeting** *"Impact of Clay Content on Elastic Anisotropy and Stresses in the Permian Basin Mud Rock Systems," James Kessler Page 17*	22
26	27 **HGS Joint General, International, North American Dinner Meeting** **R.E. Sheriff Lecture:** *"Where Offshore Drilling Meets Shallow Geology: Impact of Near-surface Depositional Systems on Deepwater Operations," Page 18*	28 **HGS Continuing Education** *"Interpretation and Analysis of Old Logs," Bill Price Page 4*	29 **HGS General Luncheon Meeting** *"3-D Volumetric Inte rpretation with Computational Stratigraphy Models," Lisa Goggin Page 21*



GeoEvents

Thursday	Friday	Saturday
2 Don't wait, make your reservations online at hgs.org	**3**	**4**
9 HGS Applied Geoscience Conference *Page 8*	**10**	**11**
16	**17**	**18**
23 *Thanksgiving Day* HGS Office Closed	**24** HGS Office Closed	**25**
30	**31**	**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

November 8-9, 2017
HGS Applied Geoscience Conference
Geomechanics in Unconventionals
Houston, TX (Page 8)

November 28, 2017
Continuing Education
Interpretation of Old Logs
Houston, TX (Page 4)

March 6-8, 2018
HGS Applied Geoscience Conference
Integrated Approaches of Unconventional Reservoir Assessment and Optimization
The Woodlands, TX (Page 24)

April 27-29, 2018
Take a kid to the outcrop family campout
Camp Cullen YMCA
Trinity, TX (Page 6)

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

Bone Cleaning
A Walk Back in Time

by Scott McWhirter

"We have such a brief opportunity to pass on to our children our love for this Earth, and to tell our stories. These are the moments when the world is made whole. In my children's memories, the adventures we've had together in nature will always exist."

-Richard Louv, *Last Child in the Woods*

I grew up in Spring, Texas in a fantastic setting of woods, creeks and wildlife. I would fish before catching the bus to school in the morning, build forts in the woods and explore for hours on end. More than twenty years have passed since that time. Recently, my heart sunk when looking at these old stomping grounds on Google Earth. The woods I roamed have been cleared and new homes and a manicured park built in their place. Curious to see the changes firsthand, I took my oldest son to walk through the new park. We found nails in trees from our old fort, and I tried to connect him to my past through stories of the woods, the forts, rusted nails and floods.

"Man's heart, away from nature, becomes hard; The Lakota knew that lack of respect for growing, living things soon led to lack of respect for humans too."

Luther Standing Bear

We create history every day. What history will my sons and I remember together? What will they find on their own and how can I get them to discover that education is a portal into their character and the wider world? Yes, they can learn great history from fantastic authors, documentaries, museums and their studies, but when we can touch and emotionally connect education to science, history, etc., we allow education to become a part of us. The opportunity to bring flooded pre-historic bones into our home to hold, inspect and clean was an opportunity we seized with excitement! To hold mammoth bones and think about the story that put them into the ground was like reading James Michener. My wife teaches the boys mental math to help them become comfortable with numbers and not fear them. I hope to give them experiences allowing them to engage the physical world and fall in love with it, all of it!

We had a great time and I probably should have let them be a little silly with brushing the mammoth teeth, but wanted to be careful with the bones and the hazardous material. At times, the water was so filled with silt that we could not see what we were cleaning. Engaging the senses was not hard to do on this project and the results were gratifying. ■

Editors Note – After the recent floods at the HGS office Scott and his son's Owen and Jace took the flooded boxes of samples from the HGS office home and cleaned and restored the samples. We are greatly indebted to the McWirter men and thankful for their true spirit of involvement.

Owen (13) enjoys theater, Shakespeare, hunting, basketball and Minecraft.

Q: What did you think about this experience?

A: It is a once in a lifetime opportunity to handle these fossils and bones. It is cool to see how big the bones actually are, and really cool to see all the pores and the difference between dirty and clean. The mammoth was larger than I expected. I was surprised at how much care it took to work to clean the bones without damaging them.

Jace (11) enjoys soccer and basketball, building anything, spending time with family.

Q: What did you like the most?

A: Getting to spend time with Dad and getting to touch millions of years old bones. I learned that mammoth have a lot of teeth and big joints.

Ranger, Texas Oil Centennial 1917-2017

by Jeff A. Spencer

Ranger, Texas is located on Interstate 20 between Abilene and Fort Worth in northeastern Eastland County. The name is derived from the Texas Rangers who in the 1870s had a camp about two miles to the northeast of the city. On October 14, 2017 a week long centennial oil celebration will begin with a parade and a park and historical marker dedication on a portion of the old McCleskey farm.

Figure 1. *McClecsky well*

In August 1917, Texas Pacific Coal Company drilled its first well in the area, the No. 1 Nannie Walker. The well was somewhat of a disappointment as it first produced only gas. Later that year the company drilled their second well, the No. 1 J.H. McCleskey. The September 2, 1917 edition of the *Houston Post* reported that the No.1 McCleskey well's flow was "50 barrels or better at a depth of only five feet in the sand and the well is expected to flow when drilling is begun again on Monday." The company's Walker well was reported as a "5,000,000 foot gasser at 3200 feet and is spraying oil." Interestingly, the Walker well would become a strong oil producer a few months later. The McCleskey well was then deepened and on October 22nd the well gushed oil (**Figure 1**) (Woodard, 1998, p. 106). On October 25th, a test of 1200 BOPD from a depth of 3484 feet was reported for the well (Warner, 1939, p. 64) and rates as high as 1750 BOPD have been published. The No. 1 McCleskey well produced approximately 275,000 barrels of oil before it was plugged in 1930. By the spring of 1918 Ranger's population had grown from approximately 1,000 to over 6,000 and then to approximately 30,000 a year later. Tent cities sprang up near town to help house all of the new inhabitants. A request to the United States Department of Labor asked for 5,000 men to work for wages from $5 to $22 dollars a day. Ten trains arrived in Ranger daily; five from the east and five from the west carrying soldiers returning from WWI that were looking for work.

Texas Pacific Coal Company added "Oil" to their name and partnered with several larger oil companies, such as Humble, Magnolia, and Prairie Oil & Gas. In less than two years 300 wells were drilled in the field. The field produced 93,000 barrels of oil in 1917, 3.1 million barrels in 1918, and peaked at over 14 million barrels in 1919. The maximum average daily rate was 80,000 BOPD during July of the same year. The No. 1 Norwood tested at 11,500 BOPD and produced 1.35MMBO in just over a year. Wells were drilled and completed at a rapid pace during 1919 resulting in several well fires. The Gulf No. 5 Perkins, flowing at a healthy 4,000 BOPD and 10MMCFD, ignited in September, 1919 (**Figure 2**).

The field's oil made a major contribution to the war effort in Europe. "The boom that won the war" is often quoted in publications about Ranger Field.

Oil field service companies rushed to Ranger. The Independent Torpedo Company (Findlay, Ohio) built their first Texas nitroglycerin factory at DeLeon, southeast of Ranger in 1917and in 1918 opened their first Texas office in Ranger. The company provided well shooting services to the oil fields near Ranger and Breckenridge and other oil fields of North Texas. "Nitroglycerin blast Shakes Ranger" was the *Ranger Daily Times* July 20, 1925 edition's major headline. There were no injuries or fatalities associated with an explosion at the Independent Torpedo

Ranger, Texas Oil Centennial 1917-2017 *continued on page 30*

Ranger, Texas Oil Centennial 1917-2017

continued from page 29

Company's storehouse near Ranger, but the blast was felt in buildings and on oil rigs four to eight miles distant.

In 1918, several pipelines were laid from Ranger to larger cities; the Texas Pipe Line Company's line to Dallas, Prairie Pipe Line Company with lines to Galveston and to Cushing, Oklahoma, and Gulf Pipe Line Company with a pipeline to Fort Worth. In 1919 the Humble Pipe Line Company completed a pipeline from Ranger to Webster, near Houston. This was the fledgling company's first major pipeline project. By July, 1920 the field's rate was down to 20,000 BOPD.

During the first five years of drilling at Ranger, oil was produced from Pennsylvanian age sandstones and limestones. Most of this early production was from the "black lime" within the Marble Falls limestone at depths of 3,200-3,400 feet. Ranger wells produced a 35-40 API gravity high-grade crude oil (Reeves, 1922).

Sources for early views of the oil activity at Ranger include Rundel (1997, p. 153-164), Rogers (2010), and Spencer (2013, p. 85-89). The Rex Beach 1922 novel *Flowing Gold*, set in the Ranger oil field, was the basis for the 1925 movie of the same name. For some interesting and entertaining historical stories about the Ranger oil boom, look to Texas author and humorist, Boyce House (1896-1961). House authored: *Were you in Ranger?* (1935 and 1937) *Roaring Ranger: the World's Biggest Oil Boom* (1951), and *Oil Boom: the Story of Spindletop, Burkburnett, Mexia, Smackover, Desdemona, and Ranger* (1941). ■

Figure 2. *The Gulf No. 5 Perkins fire*

Resources

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Reeves, Frank, 1922, Geology of the Ranger Oil Field, USGS Bulletin 736, 57p..

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Rundell, Walter Jr., 1977, *Early Texas Oil. A Photographic History, 1866-1936*, Texas A&M University Press, College Station, Texas, 260p.

Spencer, Jeff A., 2013, *Texas Oil and Gas*, Arcadia Publishing Co., 128pp.

Warner, C.A., 1939, *Texas Oil & Gas Since 1543*, Copano Bay Press, 2007 reprinting, 510p.

Woodard, Don, 1998, *Black Diamonds! Black Gold! The Saga of Texas Pacific Coal and Oil Company*, Texas Tech, Press, 322 pp.

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 (July 2017)

House and Senate Committees Approve Five Appropriations Bills for DOE, CJS, and Interior and Environment

The House of Representatives has been moving Fiscal Year (FY) 2018 budget bills out of committee more quickly than the Senate. The full House has passed one bill, for the Department of Defense; no appropriations bills have reached the Senate floor yet. Congress and the President must agree a budget or a Continuing Resolution by September 30, 2017 to avoid a government shutdown.

The House Appropriations Committee approved FY 2018 funding for the Department of Energy (DOE), providing the DOE with $29.8 billion, which is $898 million below the FY 2017 enacted level and $1.8 billion above the President's budget request. The House allocated $634.6 million to Fossil Energy Research and Development, a $33.4 million decrease below the FY 2017 level and $354.6 million above the President's request. The bill provides flat funding for the Office of Science at $5.3 billion, although it eliminates funding for Advanced Research Projects Agency-Energy (ARPA-E).

The House Appropriations Committee approved $54 billion in discretionary funding to Commerce, Justice, and Science agencies for FY 2018. The total discretionary funding is $2.6 billion below the FY 2017 level but $4 billion above the President's budget request. The bill funds the National Science Foundation (NSF) at $7.4 billion, a decrease of $72 million from the 2017 enacted level but a $748 million increase above the President's request. The bill does not reduce Research and Related Activities at NSF, funding it slightly above the FY 2017 enacted level. The bill also provides the requested $175.8 million for continued development of NASA's Landsat-9 mission, which is due to launch in 2020.

The House Appropriations Committee approved a $31.4 billion FY 2018 Interior and Environment Appropriations Bill, which is $824 million below the 2017 enacted level and $4.3 billion above the President's request. The bill provides $10.2 million for the USGS Earthquake Early Warning System, a project that the President's budget proposal would have eliminated entirely. The FY 2018 appropriations bill also provides $24.4 million to USGS for the National Cooperative Geologic Mapping Program (NCGMP) and $22.5 million for 3DEP (3D Elevation Program) National Enhancement.

The Senate Appropriations Committee approved $31.4 billion in FY 2018 funding to the Department of Energy (DOE), a $718 million increase from the FY 2017 enacted level and a $4.1 billion increase above the President's budget request. The bill funds the Office of Science at $5.5 billion, $138 million above the FY 2017 enacted level and $1 billion more than the President's request. Within the Office of Science, the Advanced Research Projects Agency-Energy (ARPA-E)—which funds research and development of high-impact energy technologies—is funded at $330 million, a $24 million increase above the FY 2017 level. In contrast, the House appropriations bill eliminated all ARPA-E funding for FY 2018.

The Senate Appropriations Committee approved a Commerce, Justice, and Science FY2018 Appropriations Bill for $53.4 billion, which is $3.2 billion below the FY 2017 enacted level and $4.4 billion above the President's FY 2018 budget request. The bill provides $19.5 billion for the National Aeronautics and Space Administration (NASA), including $100 million for education programs that were otherwise slated for elimination in the President's budget request. The National Oceanic and Atmospheric Administration (NOAA) is funded at $5.6 billion, a $85 million decrease from the FY 2017 enacted amount. NOAA's Operations, Research, and Facilities are funded at $3.4 billion, which is $452 million above the President's budget request.

Secretary Zinke Signs Order to Streamline Permitting for Onshore Resources Development

Interior Secretary Ryan Zinke signed Secretarial Order 3354 on July 6, 2017 to promote energy exploration and development through better management of leasing programs for onshore oil and gas resources and solid mineral resources on federal lands. The Order directs the Bureau of Land Management (BLM) to hold quarterly lease sales, as outlined in the Mineral Leasing Act of 1920, and to identify additional options to enhance the leasing programs. The Order also intends to streamline the permitting process overall.

The Mineral Leasing Act requires oil and gas lease sales, where eligible, to be available at least quarterly or more frequently if determined necessary by the Secretary of the Interior. According to Secretary Zinke, multiple quarterly federal lease sales have been postponed or cancelled since 2009.

Government Update *continued on page 32*

Government Update continued from page 31

The Order aligns with the Trump administration's goal to make America energy dominant, as announced by Energy Secretary Rick Perry in the White House Daily Briefing on June 27. Over the past decade, the total amount of onshore and offshore oil production on federal lands has fallen by 10%, while oil production on private and state lands in the same time frame has more than doubled. Secretary Perry expressed his belief during the briefing that unleashing the energy potential in this country with a diverse energy portfolio will lead to job growth and economic expansion in every sector.

Atlantic Offshore Oil and Gas Development Discussed in House

The House Natural Resources Subcommittee on Energy and Mineral Resources held an oversight hearing on July 12, 2017-08-26to evaluate the potential development of offshore drilling on the Outer Continental Shelf (OCS).

Earlier in the year, President Donald Trump issued an executive order "Implementing an America-First Offshore Energy Strategy," which authorizes the Department of the Interior (DOI) to begin oil and gas leasing on the OCS. Following the Executive Order, Interior Secretary Ryan Zinke issued Secretarial Order 3350 to implement the president's order and establish regulations for the leasing process.

While offshore drilling has long been a part of American energy production, it is currently limited to the Gulf, North Atlantic, and West coasts. One provision of the secretarial order is to expedite the consideration of seismic permitting applications in the Atlantic. A witness at the hearing, Dr. James Knapp, pointed out in his testimony that the Mid- and South Atlantic regions have never been adequately explored for oil with commercial seismic surveys.

Several representatives from coastal states, however, were hesitant at the prospect of leasing on the Mid- and South-Atlantic OCS. Representatives Niki Tsongas (D-MA-3) and Anthony Brown (D-MD-4) voiced their concerns about the impact OCS energy production would have on the tourism, recreation, and fishing industries for their respective states.

DOI Announces Craters of the Moon, Hanford Reach, and Canyons of the Ancients No Longer Under Review

On July 13, 2017 Interior Secretary Ryan Zinke announced that Craters of the Moon National Monument in Idaho and Hanford Reach National Monument in Washington are no longer under review by the Department of the Interior (DOI). The announcement of another unaltered monument, the Canyons of the Ancients in Colorado, came days later.

The DOI announced on May 11, 2017 it would be conducting a review of 27 National Monuments created since 1996 that are larger than 100,000 acres or the Secretary deems were made without sufficient public input, pursuant to an executive order issued by President Trump in April of this year. AGI submitted written comments to the Secretary detailing the geologic significance of several National Monuments under review, including Craters of the Moon and Hanford Reach National Monuments.

Craters of the Moon boasts a high density of diverse and well-preserved volcanic features, the youngest of which formed just 2,100 years ago. Also at Craters of the Moon, the Great Rift has exposed fissures, lava fields, lava tubes, craters, and cinder cones of immense scientific interest. The White Bluffs at Hanford Reach contain a sedimentary sequence of Ice Age floods, which may be the largest known floods to have every occurred on the Earth, as well as late Miocene fossils of the Ringold Formation.

On July 21, 2017 Secretary Zinke announced that he would not recommend any alterations to Canyons of the Ancients National Monument in Colorado. Canyons of the Ancients is home to the densest concentration of archaeological sites in the United States, as well as the McElmo Dome, which contains one of the largest geological carbon dioxide reservoirs in the United States.

Secretary Zinke released an interim report on June 12, 2017 providing his preliminary recommendations for the Bears Ears National Monument in Utah, in which he suggested reducing the monument by an unspecified amount. As of the end of July, Zinke has not announced his recommendations for any of the other monuments on the list.

House Holds Oversight Hearing on Hardrock Mining

On July 20, 2017 the House Natural Resources Subcommittee on Energy and Mineral Resources held an oversight hearing to discuss the future of hardrock mining in the United States. Streamlining the permitting process, royalties reform, and reclamation concerns were among the topics discussed at the hearing.

In his opening statement, Subcommittee Chairman Paul Gosar (R-AZ-4) expressed his support for domestic mineral exploration and reforms to the permitting and reclamation processes. Ranking Member Alan Lowenthal (D-CA-47) also highlighted the need for changes to hardrock mining reclamation programs, and advocated for a federal hardrock mining royalty program similar to those implemented for oil, gas, and coal.

The permitting process for hardrock mines can take anywhere from one month to 11 years, but averages around two years according to a U.S. Government Accountability Office (GAO) report from 2016. However, the process can take even longer; Mitchell Krebbs, President and Chief Executive Officer of Coeur

Mining, testified during the hearing that it took over 19 years to obtain proper permits at the federal, state, and local levels for the Kensington Gold Mine in Alaska.

While many states have royalty programs to mitigate the local impacts of mining, there is no federal royalty fee for hardrock mining on production from federal lands. Unlike coal mining and Abandoned Mine Lands (AML) reclamation, hardrock mining operations do not require a reclamation fee, and mining companies face significant liability when undertaking reclamation projects.

Representative Doug Lamborn (R-CO-5) intends to introduce a bill which will include Good Samaritan legislation for hardrock mine cleanup.

President Trump Reestablishes National Space Council

On July 7, 2017 the Executive Office of the President published Executive Order 13803, which was signed by President Trump on June 30, 2017 reestablishing the National Space Council. The National Space Council was created in 1989 under the H.W. Bush administration. Although the Council was never formally disbanded, it was last chaired in 1993 by Vice President Quayle.

During the past three administrations, the Office of Science and Technology Policy (OSTP) and the National Security Council (NSC) have jointly developed the President's space policy. The OSTP is currently working with one-third of the staff it had under the Obama administration and President Trump has yet to nominate a science advisor, therefore an independent council focused on space policy may be an alternative way to make timely policy decisions.

The Council intends to bridge the gap between the Executive Office, NASA, and commercial space activities to present a unified national space agenda. The Council is responsible for making recommendations to the President on space policy and strategy, as well as monitoring the implementation of the President's policy. It will also advise the President on how the U.S. participates in international space activities.

Vice President Pence will become chair of this iteration of the Council, coordinating with Acting NASA Administrator Robert Lightfoot, Executive Director Scott Pace, and other Cabinet Members and staff. ■

HGS Welcomes New Members

New Members Effective October 2017

ACTIVE MEMBERS

Daniel Allen
Thad Bay
Jack Christiansen
Kristin DeBone
Lisa Dell'Angelo
Clayton Gafford
Daniel Gualtieri
Thomas Jones
Chimok Jung
Evan Kias
David Kosmitis
Stefano Mazzoni
Ekenedilichukwu Okoye
Eric Peavey
Ricardo Perona Jimenez
Jonathan Primm
Erin Savala
Maria Squier
Joanna Walker

ASSOCIATE MEMBERS

John Swantner
Russ Whisonant

EMERITUS MEMBER

David Morton

STUDENT MEMBERS

Muhammad Nawaz Bugti
Kirstie Haynie
Jack Kenning
Didi Lam
Didi (Sher) Ooi
Chad Sims
Haley Snyder

Welcome New Members

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.

Remembrance

Dr. Roger W. Cooper
1949-2017

Dr. Roger W. Cooper, passed away yesterday, October 24, 2017, in Beaumont, Texas. He was 68 years old and was a resident of Lumberton, Texas.

Dr. Cooper was retired from the Earth & Space Science Department at Lamar University and had been the chair of the department when it was still the Geology Department. He was one of the field trip leaders for the 2008 HGS/AEG field trip to Big Bend, and he and his wife Dee Ann authored the 2014 HGS field guide publication "Field Guide to Late Cretaceous Geology of the Big Bend Region". Over the years, Roger had field mapped nine quadrangles in the Big Bend area on foot. His maps were incorporated into the USGS's geologic map for Big Bend.

There is no planned visitation at this time. The funeral service will be held at St. Michaels Antiochian Orthodox Christian Church at 680 N. 15th Street in Beaumont, Texas on Friday, October 27, 2017, at 10:00 am.

Burial will follow at St. Michael's Cemetery which is within the Magnolia Cemetery at 2291 Pine Street in Beaumont, Texas. Arrangements are being handled by Broussards Mortuary on McFadden Street in Beaumont.

Submitted by Richard Howe

Earth Science Celebration at Houston Museum of Natural Science – October 14, 2017

by Sharon Choens and Inda Immega

The Houston Geological Society and Houston Museum of Natural Science hosted Houston's eighteenth annual Earth Science Celebration at the HMNS on October 14, 2017 with an enthusiastic crowd of over 350 children and parents. This event kicked off Earth Science Week, an international celebration of earth science coordinated by the American Geosciences Institute.

The participants received a passport that guided them through activities that focused on this year's theme *Earth and Human Activity.*

Seven passport stations with a wide range of engaging STEM activities were located in the exhibit halls. The University of Houston SEG Wavelets brought their GPS/LiDAR equipment and laid out a seismic line in the Glassell Hall. The HMNS station delighted everyone with a Van der Graaf generator. The Consumer Energy Alliance shared information on conservation. The Houston Gem and Mineral Society brought fossil wood to explain how wood becomes petrified and what plant fossils can tell us about environments of the past. Visitors had the opportunity to see fossil wood microstructure. The Geophysical Society of Houston demonstrated seismic wave behavior with large springs andexplained how oil is trapped with a drilling for oil activity. Participants had the opportunity to make trilobite models at the station in the Morian Paleontology Hall lobby. The Gulf Coast Section of the SEPM and North American Micropaleontology Section of SEPM brought five binocular scopes to show microfossils of foraminifera, radiolaria, invertebrate shelf fauna and conodonts.

Upon completion of their passports, participants received a gift bag featuring a Dig Into Fossils booklet and labeled rock, mineral and fossil specimens at the HGS Headquarters' table.

Forty teachers who attended the event received an AGI Toolkit for their classrooms.

HGS volunteers **Sharon Choens** and **Inda Immega** served as the event Chairpersons. Many thanks to the HMNS staff for their support and to the more than 53 volunteers who assisted with the event. A special thanks to the above participating groups who organized and staffed "passport stations" and to the University of Houston American Meteorological Society student volunteers. ■

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

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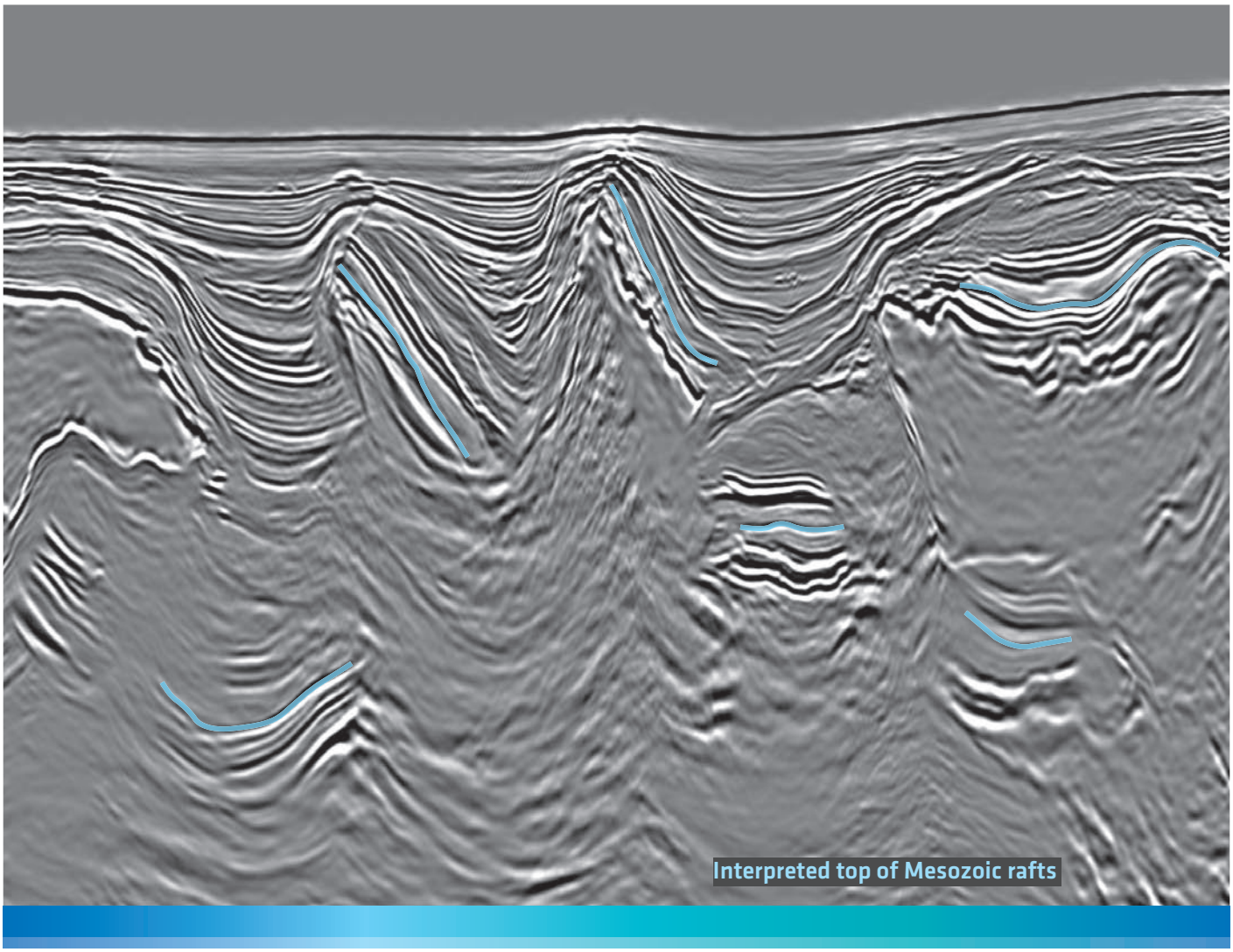

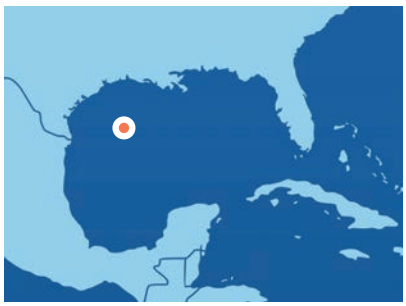

Triton FAZ Depth Imaging

Rafting in Garden Banks and Keathley Canyon

PGS recognizes that accurate migration velocity models are critical for successful depth imaging of the complex geology of the deepwater Gulf of Mexico. In building the velocity model for the full-azimuth (FAZ) ultra-long-offset Triton survey in Garden Banks and Keathley Canyon, PGS identified and incorporated rafted Mesozoic strata as essential elements of the model.

The rafted section drilled in suprasalt positions and between stacked salt sheets in Garden Banks wells within the Triton survey area contains a significant fraction of high-velocity Mesozoic carbonates. PGS included rafts as high-velocity geobodies in the Triton velocity model to optimize the imaging of prospective subsalt Wilcox targets.

Please contact: Tel:+1 (281) 509 8000 | Email: gominfo@pgs.com

A Clearer Image | www.pgs.com/Triton

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