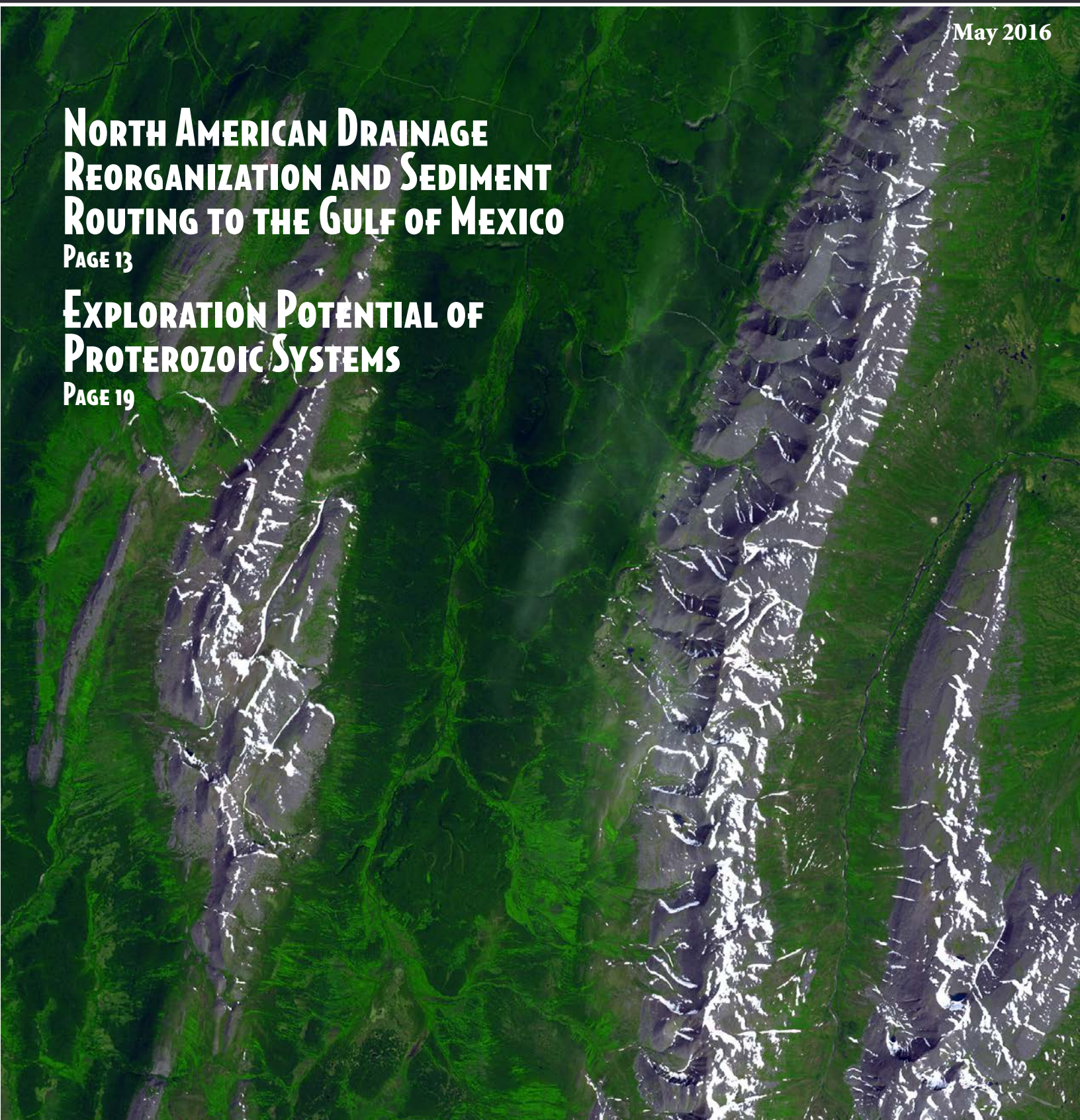
HGS Bulletin
Houston Geological Society
Volume 58, Number 9
May 2016



North American Drainage Reorganization and Sediment Routing to the Gulf of Mexico

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Exploration Potential of Proterozoic Systems

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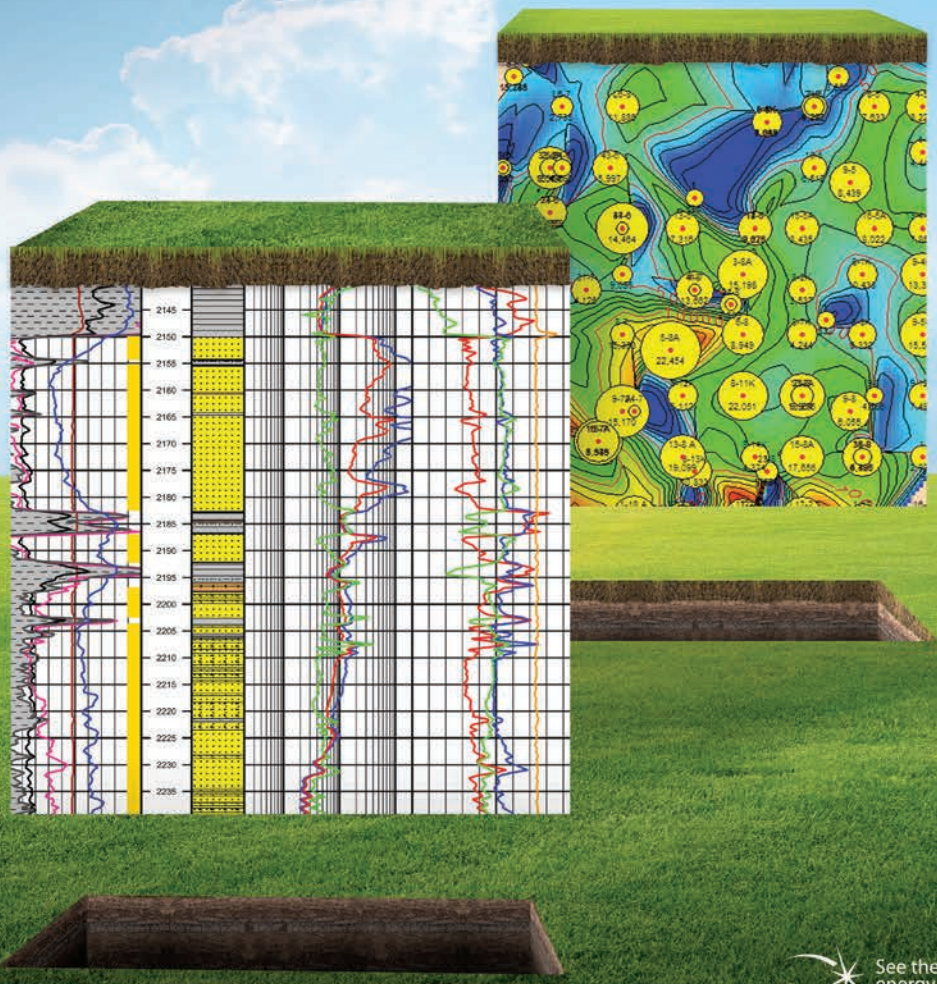

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The Bulletin
Houston Geological Society

Volume 58, Number 9 May 2016

In Every Issue

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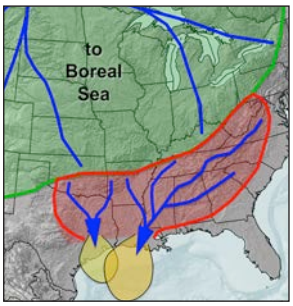
Technical Meetings

Other Features

About the Cover: The Ural Mountains trend N-S across western Russia, forming a natural divide between Europe and Asia. The mountain range spans 2,500 kilometers passing through Arctic tundra in the north to forested and semi-desert landscapes to the south. The highest elevations are found in the Nether-Polar Urals, the second-northernmost section of the range's five segments. On 13 July 2011, the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite acquired this view of the northern part of the Nether-Polar Urals. The scene extends from the northern boundary and ends just short of Mount Narodnaya: at 1,895 meters it is the highest point in the entire range.
NASA Earth Observatory image by Jesse Allen, using data from NASA/GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team. Caption modified from original by Kathryn Hansen. http://earthobservatory.nasa.gov/IOTD/view.php?id=87198



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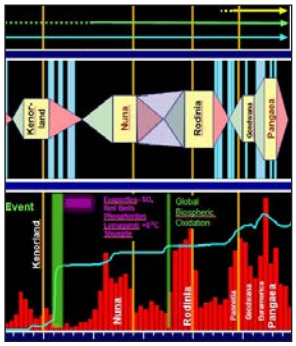

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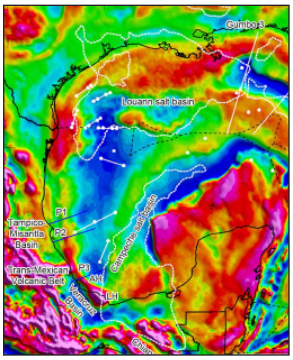

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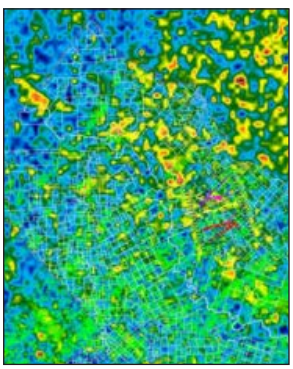
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The Houston Geological Society Continuing Education Committee Presents

Interpretation and Analysis of Old Logs

Bill Price

Petrophysical Solutions Inc.

Friday, May 6, 2016 • 8:00 am – 5pm

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 myriad 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

Registration after April 22, 2016

All including walkups: $110.00

Registration includes notebook, certificate of attendance, networking lunch, continental breakfast, and break refreshments.

Date: Friday, May 6, 2016 • 8:00 am – 5 pm
Doors open at 7:30 am, presentation begins at 8:30 am

Location: Shell Woodcreek Complex, Bldg. A
200 N Dairy Ashford Rd,
Houston, TX 77079

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

Annie Walker
HGS Director, 2015-17
Annie.Walker@iongeo.com

Free Range

Geology is fundamentally, by definition, a field science; I'm not talking about potential fields here. I'm talking about lava fields, glacial ice fields, cow fields you need to cross to get to your outcrop—I'm talking about going outside!

Most geologists agree that fieldwork and field-based experiences are intrinsic to the study of geology because they provide ground-truth; promote spatial awareness and three-dimensional visualization; and allow you to observe and synthesize natural geologic features in the context of the complex, interconnected systems in which they formed. Like surgeons, mechanics, and other practitioners, geologists also gain a deeper understanding of our subject with the practical application of concepts, theories, and models to nature. Most geologists will also tell you fieldwork is a lot of fun.

I am very pleased to announce that we are now developing a fresh, revitalized field trip program that will make local, single-day and weekend field trips available to the HGS community once again.

Field trips, fieldwork, and field-based courses have been an integral and formative part of my education from primary school through my graduate studies, and continue to inform every aspect of my career today. I've worked extensively in Iceland and the Southern Appalachian Blue Ridge; participated in studies in the Adirondacks, the Central and Northern Appalachians, and at the Gerace Research Centre on San Salvador Island; and attended geologic field trips to the Galápagos Islands, Grand Canyon, and the French and Swiss Alps. I can recall, with surprising clarity and detail, visiting kettle lakes, herds of drumlins, and the Tully Valley landslide on Ms. Foster's class field trips almost 20 years ago. These experiences had a profound and lasting influence on my development as a student, as a geologist—and in many ways—as a person.

I believe deeply in the value of field-based experiences to inspire new generations, stimulate our thoughts, reinforce and deepen our understanding, and enrich our careers and lives. For this reason, I am very pleased to announce that we are now developing a fresh, revitalized field trip program that will make local, single-day and weekend field trips available to the HGS community once again. Our goal is to create a series of events that address a broad range of industry and non-industry topics, and accommodate many skill levels and physical abilities so all members have the opportunity to participate. We also plan to revive some of your favorite trips from years past, and to develop companion guidebooks for each trip that may also be available for general sale in the HGS bookstore, and at future HGS events. We look forward to possible future collaborations with other HGS committees, professional societies, and universities, and to your suggestions, requests, and enthusiasm.

Finally, to kick-off this new initiative in style, it's my great pleasure to announce the revival of the much-loved Hockley Salt Mine tour—with many thanks to **Janet Combes** and **Chuck Caughey** of the HGS Educational Outreach Committee, whose engagement and quick actions made it possible. ■

View from Skaftafellsjökull, Skaftafell National Park, SE Iceland

The Houston Geological Society Continuing Education Committee Presents

Getting Started as a Self-Employed Geoscientist/Consultant

Jointly presented by HGS – SIPES – GSH
Sponsored by dGB Earth Sciences – dgbes.com & opendtect.org
May 20, 2016 • 8 am – 5pm

Join us for a day filled with practical experience, wisdom and insight from HGS, GSH, Society of Independent Earth Scientists (SIPES) members, and industry professionals who have successfully transitioned into creating their own business.

Tentative Agenda:

- Setting Up Your Practice as a Consultant
  Robert Pledger, CPG, SIPES, Ashford Oil & Gas
- Accounting and Financial Considerations for your Consultancy
  Neil Blakely, CPA, Accountant
- Legal Considerations, Contracts and Agreements for the Consultant
  Charles Knobloch, Attorney, former Chair TxBPG
- Discovering Mineral Owners and Leaseholders — Courthouse Work
  Roger Soap, CPL, Landman
- Finding Work as a Consultant
  Deborah Sacrey, CPG, SIPES, Auburn Energy, HGS President
- Free, Low-Cost, and Open Access Data and Software for Petroleum Exploration and Production
  Susan S. Nash, Ph.D., AAPG, Director of Education and Professional Development

Pricing

Early Registration by 5 AM Thursday, May 6, 2016
HGS/GSH/SPE Member: $60.00
Non-Member: $85.00

Registration after Thursday, May 6, 2016
All including walkups: $105.00

Notebook, networking lunch, continental breakfast, coffee and break refreshments are included in the registration price.

Parking $10 with credit card across Cullen Blvd., in stadium parking structure.

Date: Friday, May 20, 2016 • 8:30 am – 5 pm
Doors open at 7:30 am, presentations begin at 8:30 am

Location: University of Houston
Lecture Hall 117
Science & Research Bldg. 1

Parking: Stadium parking structure
Entrance 14, Cullen Blvd.
Houston, TX 77204

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

For more information about this event, contact HGS Office
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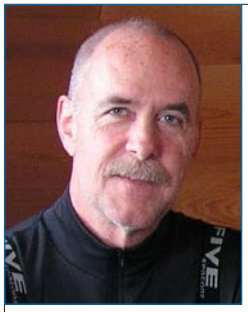

Jon Blickwede
jonblickwede.hgs@gmail.com

The Field

I think it's ironic, in a sad sort of way, that one of the main aspects of the vocation of geoscience that attracted most of us to it in the first place was the opportunity to spend time outdoors in the field: traipsing around the countryside, contemplating and analyzing outcrops from afar and up close, measuring and describing sections, mapping, collecting samples, deploying geophysical instruments, etc.—and at the same time reveling in beautiful landscapes, daytime "skyscapes," the wondrous nighttime canopy of a gazillion stars, and experiencing the ineffable, profound peace (or at times violent but beautiful chaos) of the precious part of God's creation far from the city. Of course, being in the field at times also entails discomfort, frustrations, bug bites and perhaps other negative things. After all, it's a part of life. But as geoscientists we greatly treasure our field experiences.

I say "ironic" and "sad" because so few of us geoscientists, at least in the modern day oil & gas industry, ever get out to the field anymore, at least for our companies' business. And if we do, it's typically not to perform traditional field work but rather to participate in brief field seminars. Why did this happen? I'll suggest a couple of reasons. Time in the field has long been perceived by many non-geoscientist managers (and unfortunately, a few geoscientist managers too) as being frivolous and unproductive, contrived only for fun—i.e. "boondoggles." Moreover, the geologist who's doing field work is out of the office, out of sight of management, and therefore more difficult to monitor and control. While the latter may be true, the value of getting out in the field to study outcrops relevant to subsurface work in the same basin, or an analogous basin, is unassailable. And what's wrong if a part of one's job happens to be fun?!

If the main focus of the science of geology is the Earth, it logically follows that the primary approach to studying the Earth would be to observe it directly and gather data to analyze and interpret. And the only way to directly observe mesoscale features of the Earth is by getting out into the field. See page 5, where HGS Director **Annie Walker** makes her own concise, eloquent case for the value of field work.

If the main focus of the science of geology is the Earth, it logically follows that the primary approach to studying the Earth would be to observe it directly and gather data to analyze and interpret. And the only way to directly observe mesoscale features of the Earth is by getting out into the field.

It's rare, but in recent years there still have been some larger oil & gas firms that have allowed, and even encouraged field work. One of the things I've admired about Mexico's state oil company Pemex is that they required, up until a few years ago, that each new-hire geologist spend the first couple of years of his/her career doing field mapping as part of a team. These *brigadas* were typically led by senior-level geologists in Pemex, who used the program to pass on their years of accumulated knowledge to the next generation. In addition, through shared adventures in the *brigadas*, a strong sense of camaraderie was created which in many cases carried on through entire careers in the company.

There's an iconic quote in geology that's worth remembering: Herbert Harold Read (British geologist and Professor of Geology at Imperial College London in 1947-1948, and one-time President of the Geological Society) once said "The best geologist is he who has seen the most rocks." Most recently, I saw this quote engraved on a plaque hung prominently on the wall at the head of the main hall of the Geology Department at the University of Yangon in Myanmar when I visited there in the summer of 2014 (see photo on page 11 of the January 2016 issue of the HGS *Bulletin*), and so was heartened to see that the value of field work is still recognized in some parts of our world.

From the Editor *continued on page 9*

From the Editor continued from page 7

A final note on this topic—one of the trends in our industry that I've observed over the course of my career has been an ever-increasing emphasis on safety. Among other improvements, this has resulted in beneficial new rules and regulations related to company-sponsored field seminars, such as the requirement to wear protective headgear. But sometimes these rules and regulations have at times become overly obsessive: such as the recent experience of one friend, who was instructed to wear a helmet while in the field in a prairie setting, with nary a rock to be found above knee-level. Maybe it was meant to mitigate the risk of a meteor shower… ■

- I'd like to thank geophysicist Elizabeth Desser for her contributions to this column.

The beautiful field: Sierra de San Julian, Zacatecas State, Mexico, summer of 1980.

Africa: What's Next?

The 15th HGS-PESGB Conference on African E&P

September 12-14, 2016

The Westin Houston, Memorial City, 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 600, including industry operators, consultants, governments, and academia. There will be a large poster program in addition to the oral program of about 25 high quality talks covering aspects of E & P in all regions of Africa.

Theme 1: African Exploration in a Global Context
Session Chair: Joan Flinch (Repsol)

Theme 2: Knowledge Transfer: Emerging Exploration Concepts, Conjugate Margins and Analogues
Session Chair: Bill Dickson (DIGS)

Theme 3: Hydrocarbon Generation Through Time and Space
Session Chair: Carol Law (Soaring Eagle Energy)

Theme 4: Storage and Containment: New Insights into Reservoirs, Seals and Traps
Session Chair: Katrina Coterill (BHP)

Interactive Seismic Showcase and Geology Workshop
Session Chair: John Moran (Anadarko)
Ongoing throughout the conference – see website for announcement of details.

Invited Keynote and Other Speakers A number of respected industry leaders have accepted invitations to deliver keynote presentations: Presenters include: opening keynote address by Bob Fryklund (Chief Upstream Strategist-IHS Energy) on *Africa Exploration – Dealing with the New Reality?*, plus Peter Elliott (PVE Consulting Ltd) on *Exploration Strategy and Performance in Sub Saharan Africa*, GlobalData on *Commercial Aspects of Exploration in Africa* and Cynthia Ebinger (University of Rochester) on *Fluid Flow in East African Rift Systems*. Further announcements to be revealed in due course; please consult the HGS website.

Short Courses 2 short courses will be held in conjunction with the conference
Duncan Macgregor – *Petroleum Basins and Recent Discoveries in North and East Africa*
Ian Davison – *South Atlantic Margins: Geology and Hydrocarbon Potential*

Conference Opening Evening Lecture Prof. Andy Nyblade (Penn State University) will present the Conference Opening lecture on *Imaging First-Order Structure of Large Karoo and Younger Basins in Central, Eastern and Southern Africa Using Passive Source Seismic Data*. The lecture will be held on the evening of Monday September 12th. Details to be announced shortly.

Conference
Early Bird registration April 1 through June 30, 2016 = $300
Regular registration July 1 through August 31 = $400
Late/onsite registration September 1 through September 14, 2016 = $450

Short courses
Early Bird registration April 1 through June 30, 2016 = $200
Regular registration July 1 through August 31 = $250
Late/onsite registration September 1 through September 14, 2016 = $300

A $50 discount will be given to individuals that sign up for both the conference and a short course

Registration opens April 1, 2016.

Information: office@hgs.org
Registration: www.hgs.org

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

The 15th HGS-PESGB Conference on African E&P

September 12-14, 2016 • Houston Texas

Exhibitor/Sponsorship Form

Company _____

Contact _____

Address _____

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City State/Province Postal Code Country

Phone _____ Fax _____

Email _____ Web Site _____

Exhibitors: With the purchase of a 10' X 10' space you will get one table, 2 chairs and a waste basket.
You will receive 2 exhibitor passes good for admittance to the exhibit hall only.
Exhibitors can also make a presentation (25 slots available) highlighting their services at a cost of $250 in addition to the exhibitor's booth fee of $1,900.
EXHIBIT SPACE ORDER $1900.00 per 10' X 10' booth space: _____ booth(s) + _____ presentation(s) = $_____
Contact Andrea Peoples at the HGS office for booth selection 713-463-9476 Booth # _____.
Do you require internet access at your booth? ☐ Yes ☐ No
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(You must purchase electricity from the hotel, HGS will send out the required form.)

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$9,000	$4,500	Day One Reception – 2 Drinks plus Food	$11,000	
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$5,000	$2,500	Meeting Room Rental	$5,000	
$5,000	$2,500	Technical Session	$5,000	
$5,000	$2,500	Breakfast Day One	$12,000	
$5,000	$2,500	Breakfast Day Two	$12,000	
$5,000	$2,500	AV Equipment and Services	$25,000	
$5,000	$2,500	Am & PM Break Food & Beverage Day One	$5,000	
$5,000	$2,500	Am & PM Break Food & Beverage Day Two	$5,000	
$2,500	$1,250	Poster Gallery	$2,500	
$2,500	$1,250	Delegate Bags	$2,500	
$1,000	$500	Speaker Gifts	$3,000	
$1,000	$500	WIFI	$2,000	
$1,000	$500	Conference Signage	$3,000	
$1,000	$500	Printing Proceedings Catalogue	$10,000	
$500	$250	Note Pads, Pens	$1,000	
$	$	General Fund – You fill in the amount		
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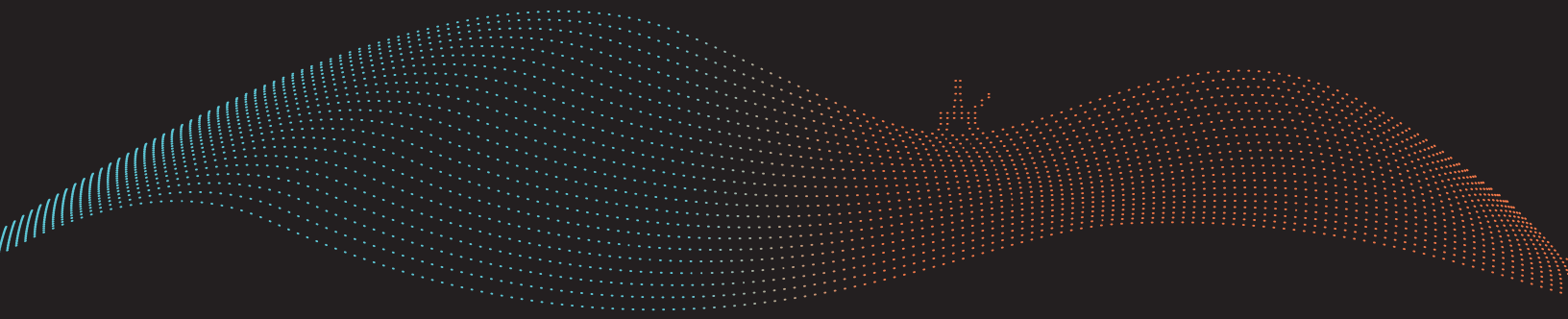

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Mike Blum
Department of Geology,
University of Kansas,
Lawrence, KS

Cretaceous through Paleogene North American Drainage Reorganization and Sediment Routing to the Gulf of Mexico from Detrital Zircons

Scaling relationships between sediment-dispersal system components can be useful for predicting the length scales of basin-floor systems (Sømme et al., 2009; Blum et al., 2013). For example, basin-floor fans scale to feeder fluvial-system length, hence proxies for length-scales of ancient drainage basins and fluvial systems can assist prediction of the dimensions of basin-floor fans (**Figure 1**). This paper summarizes mid-Cretaceous to Paleogene North American drainage reorganization, and Gulf of Mexico (GoM) drainage integration from detrital zircons (DZs), as a test of concept for using such techniques to predict the scale of basin-floor systems. This paper primarily draws on Blum and Pecha (2014).

The GoM DZ dataset includes >7000 U-Pb and Pb-Pb ages from 83 samples of Cenomanian Tuscaloosa-Woodbine, Paleocene

HGS General Dinner *continued on page 15*

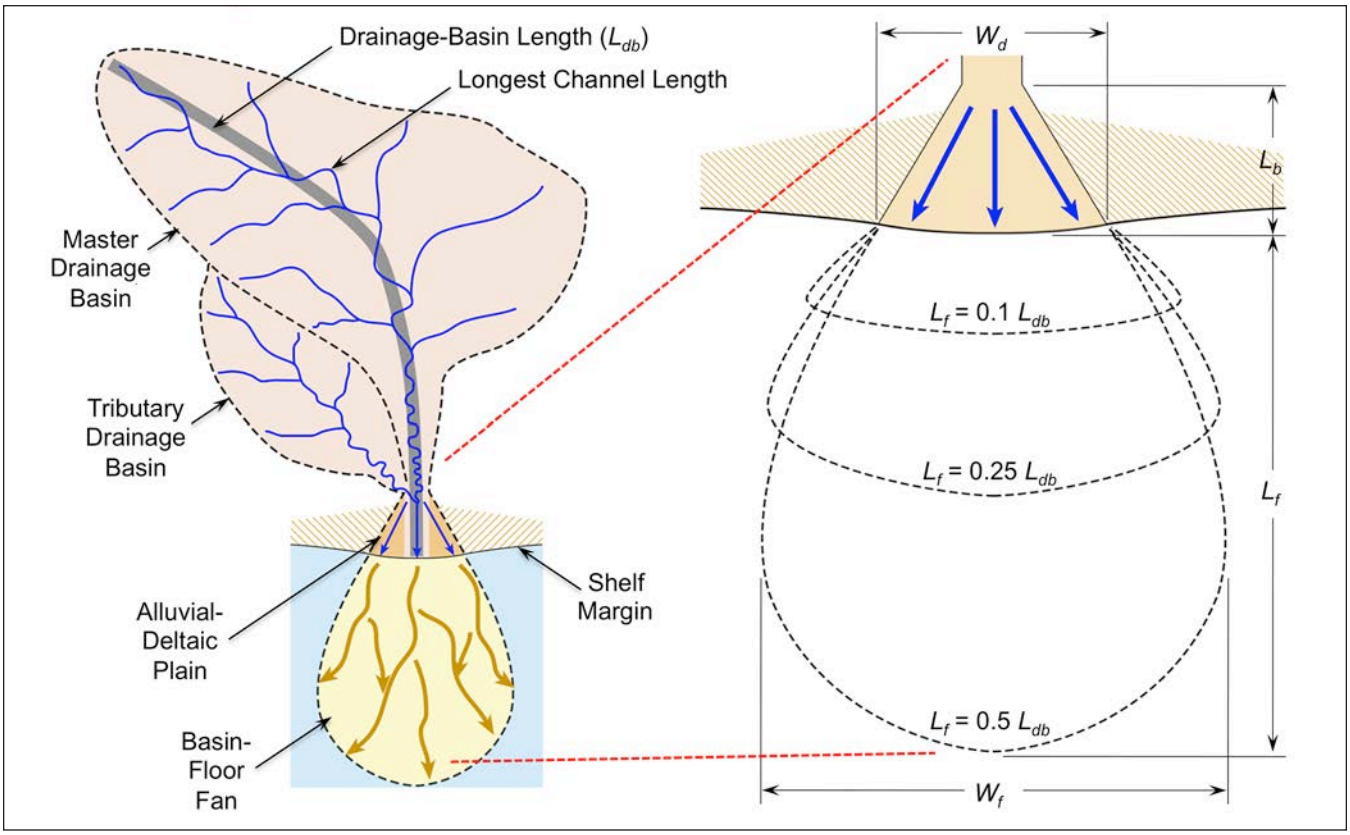

Figure 1. *Definition sketch for predicting the length scales of basin-floor fan systems. (Left) Sketch of idealized contributing drainage basin and drainage-basin length (Ldb), distributive alluvial-deltaic plain, and linked basin floor fan. (Right) Sketch of alluvial-deltaic depocenter and linked basin-floor fan, illustrating the range of scaling relationships; Wd = alongshore width of the alluvial deltaic plain, which approximates the radial dispersal distance for fluvial sediment delivery to the slope and basin floor; Lb = backwater length, and Lf = length of basin-floor fan.*

HGS General Dinner continued from page 13

Wilcox, and Oligocene Frio-Catahoula fluvial deposits: samples were collected across each outcrop belt on the inner Gulf Coastal Plain, from Alabama to Texas. DZ samples were also collected from river systems that feed the GoM, so as to examine their efficacy at recording drainage basin signatures. Other DZ data includes samples from the Aptian-Albian Mannville Group of the Alberta foreland basin system.

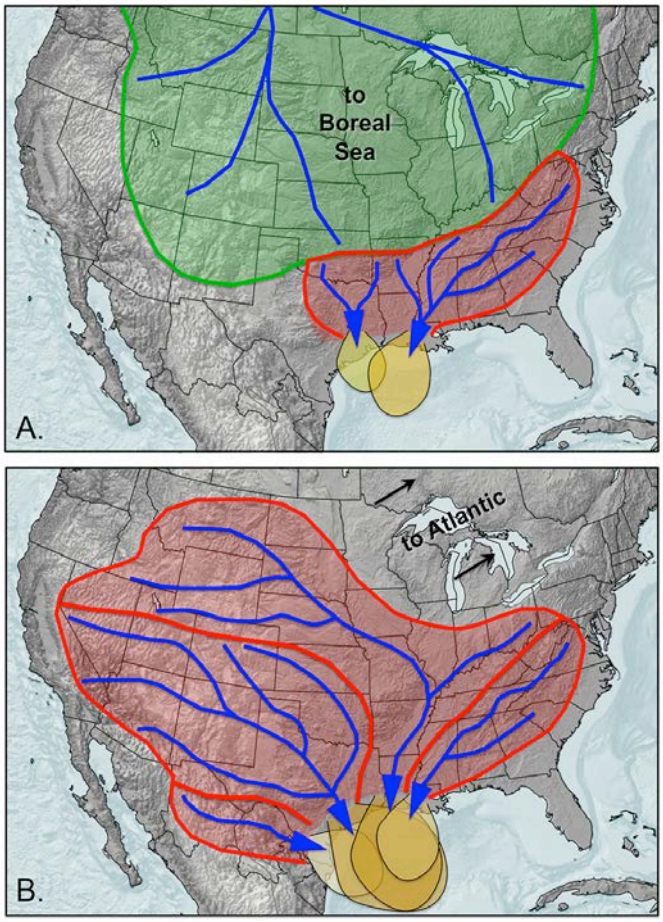

Figure 2. *Mid Cretaceous to Paleocene continental-scale drainage reorganization, and GoM basin-floor fan scales. (a) The major Mid Cretaceous (Aptian-Cenomanian) drainage system was sourced in the Appalachian Mountains, and routed through to the Boreal Sea (green). Tributaries joined from the southwestern United States and eastern Canada. Only a small part of North America south of the Appalachian-Ouachita orogen (orange) was routed to the Gulf of Mexico: the major GoM fluvial axis was the paleo-Tennessee system, which deposited the Cenomanian Tuscaloosa sandstone of the eastern GoM, and which would be predicted to have sourced the largest Cenomanian fan system. A minor system sourced from the Cenomanian Woodbine of the western GoM. (b) By the Paleocene, fluvial systems of the western United States were routed directly to the Gulf of Mexico, or to the Mississippi Embayment, where they joined fluvial systems from the Appalachians and deposited the updip Wilcox Group: much of western Canada may have drained to the Atlantic, although this is somewhat speculative (see Blum and Pecha, 2014 for more explanation). Paleocene Wilcox fluvial systems are predicted to have been large enough to form coalescing/overlapping basin-filling fan systems.*

Collectively, these data show that much of early-mid Cretaceous North America drained through a continental scale network with headwaters that extended from the Appalachian-Ouachita orogenic belt to the SW US, and routed sediments to the Alberta foreland and Boreal Sea, where they comprise the reservoirs of the Alberta Oil Sands. GoM drainage was, by contrast, restricted to the area south of the Appalachian-Ouachita orogen through at least the Cenomanian: Tuscaloosa-Woodbine fluvial deposits of the inner Gulf Coastal Plain contain no indicators of connection with the Western Cordillera, or the continental interior north of the Appalachians, fluvial systems were of regional scale only (<<10^6 sq. km), and the largest system is interpreted to represent a paleo-Tennessee River that discharged to the eastern Mississippi Embayment. From these data, the largest deep-water fan system would be predicted to have been sourced from Tuscaloosa fluvial systems that represent the paleo-Tennessee River, and the Woodbine systems of east Texas would have produced minor fans with limited basinward extent.

By the Paleocene, drainage of much of southern North America, from the Appalachians to the Sierra Nevada, had been reorganized and was routed to the GoM through a series of fluvial axes that represent the Wilcox Group alluvial-deltaic deposits of the Gulf Coastal Plain, and which remain extant today. Wilcox fluvial axes included the paleo-Tennessee and its Appalachian source terrain, and an ancestral Mississippi-Arkansas system with an estimated drainage area >10^6 sq. km that included the central and northern Rockies. However, the largest axes were farther west in Texas, and included an ancestral Colorado-Brazos system with headwaters in the Sierra Nevada, Sevier fold and thrust belt, and the Laramide Rockies, and an ancestral Rio Grande with headwaters in the Mexican Cordillera: as recognized in previous work, the paleo-Colorado-Brazos axis was the largest system, with an estimated drainage area >>10^6 sq. km, and length scales >2000 km (**Figure 2**). The large collective drainage area that produced Wilcox alluvial-deltaic systems of the coastal plain would be predicted to produce deep-water fans that are basin-filling in scale, with individual fans of a lateral extent that they would overlap and interfinger along strike: the largest system would have been derived from the paleo-Colorado-Brazos axis, what is classically referred to as the Rockdale deltaic system.

Predicted fan scales from the detrital zircon approach approximate those known from existing data. Hence, this approach can be applied to frontier deep water parts of basins elsewhere that are data limited. ■

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Blum, M.D. and Pecha, M.A., 2014, Mid-Cretaceous to Paleocene North American drainage reorganization from detrital zircons: Geology, v. 42, p. 607-610

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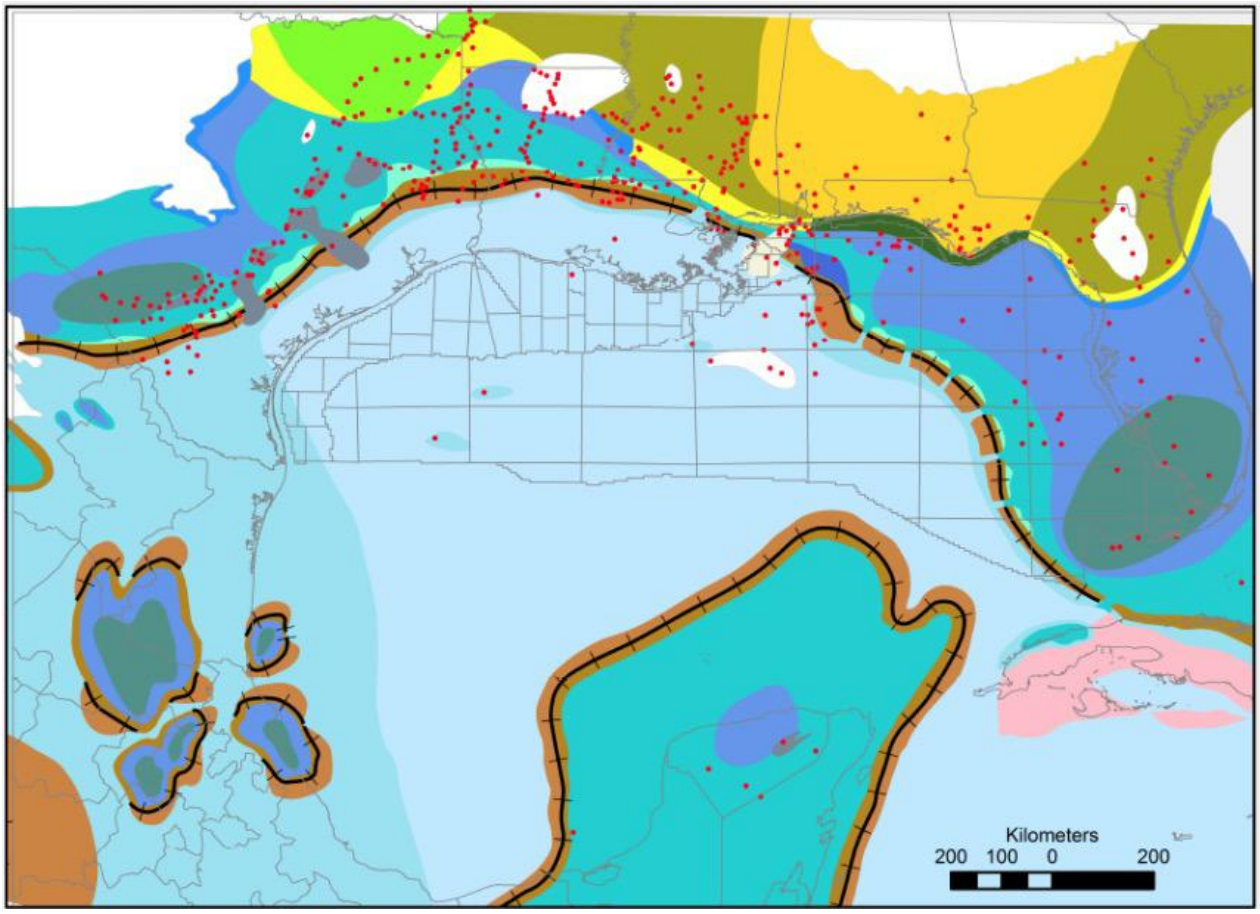
HGS General Dinner continued from page 15

Blum, M.D., Martin, J.M., Milliken, K.T. and Garvin, M.A., 2013, Paleovalley systems insights from Quaternary and experimental studies: Earth-Science Reviews, v. 116, p. 128-169

Sømme, T.O., Helland-Hansen, W., Martinsen, O.J., Thurmond, J.B., 2009, Relationships between morphological and sedimentological parameters in source-to-sink systems: a basis for predicting semi-quantitative characteristics in subsurface systems: Basin Research 21, 361–387.

Biographical Sketch

Mike Blum received his PhD (1992) from the University of Texas at Austin, focusing on climatology, geomorphology, and sedimentology. He held faculty positions at Southern Illinois University (Assistant Professor, 1991-1995), the University of Nebraska-Lincoln (Assistant and Associate Professor, 1995-2003), and Louisiana State University (Harrison Family Professor, 2003-2008), then served as Research Advisor at ExxonMobil Upstream Research (2008-2014). His research interests include fluvial to shallow-marine processes and deposits, connections between fluvial-deltaic and deepwater systems, and source-to-sink analysis. Mike is now the Ritchie Distinguished Professor in the Department of Geology of the University of Kansas, where he pursues these themes through his research and teaching.



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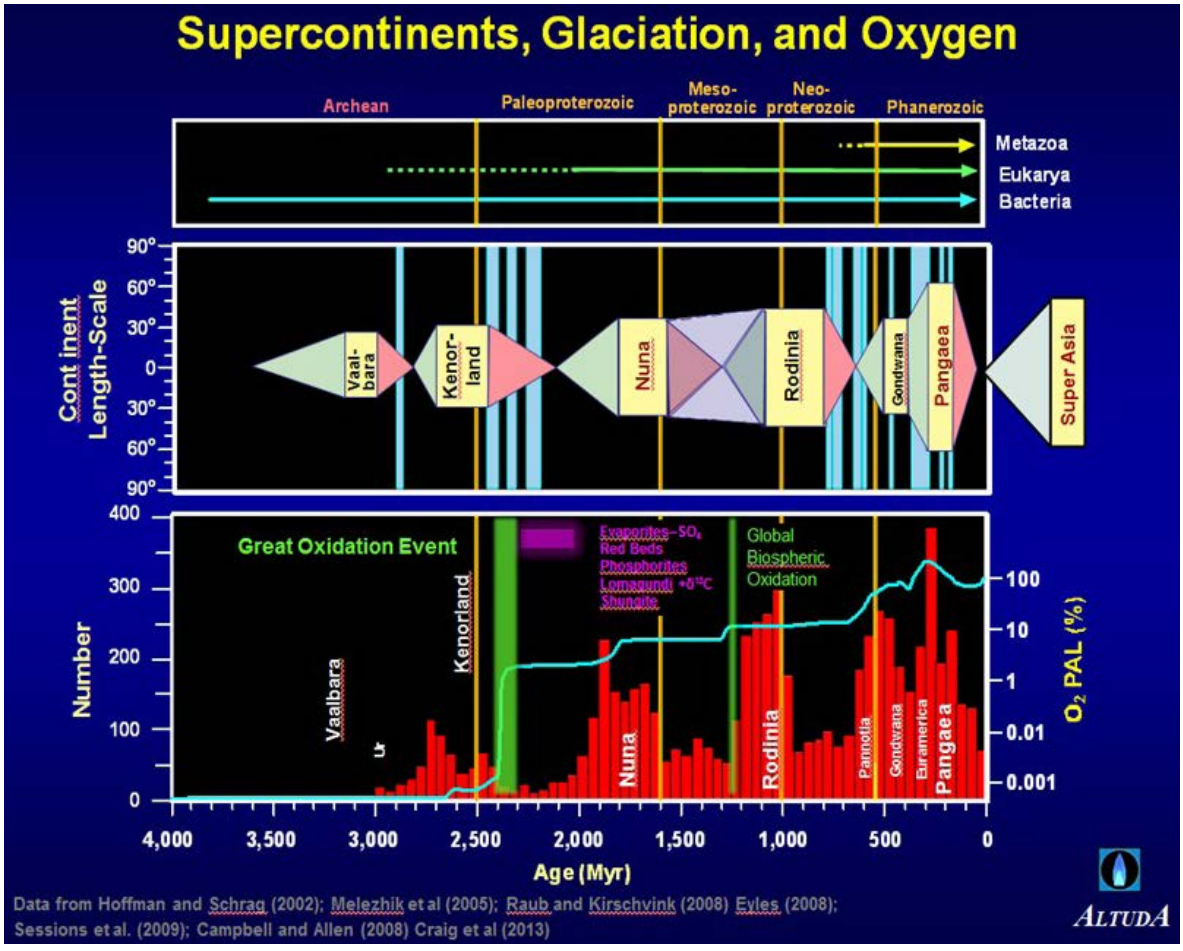
Andrew R. Scott
Altuda Energy Corporation
San Antonio, Texas
andrew@altuda.com

Proterozoic Dogmas Revisited: Exploration Potential of Proterozoic Systems

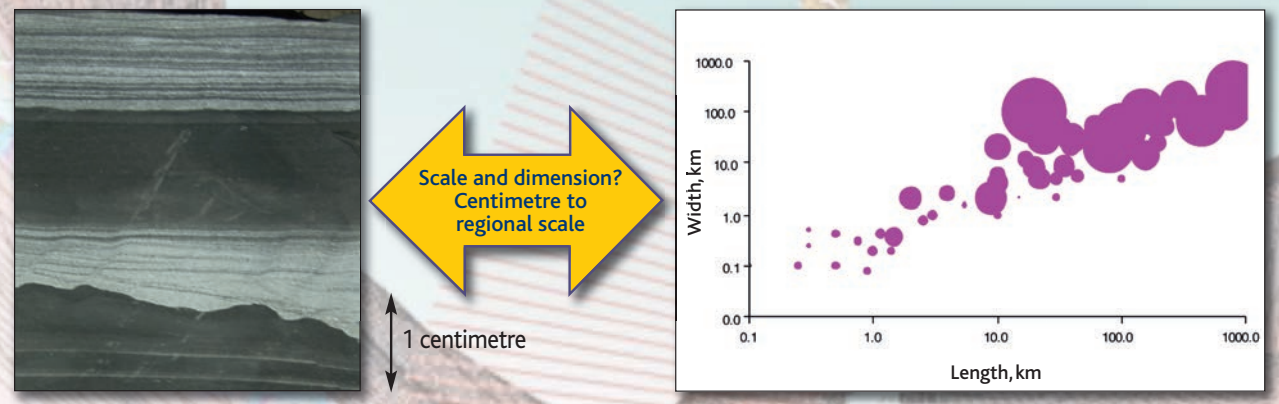


The hydrocarbon and exploration potential of Proterozoic systems worldwide has largely been ignored because of preconceived notions and misunderstandings about Proterozoic source rocks, reservoirs and seals. These Proterozoic dogmas include that reservoir quality has been lost through diagenesis, that there is insufficient organic matter because of the paucity of life, and that ubiquitous tectonic activity over billions of years has ruptured seals. Therefore, the generally accepted doctrine is that Proterozoic hydrocarbons simply cannot exist in such old rocks.

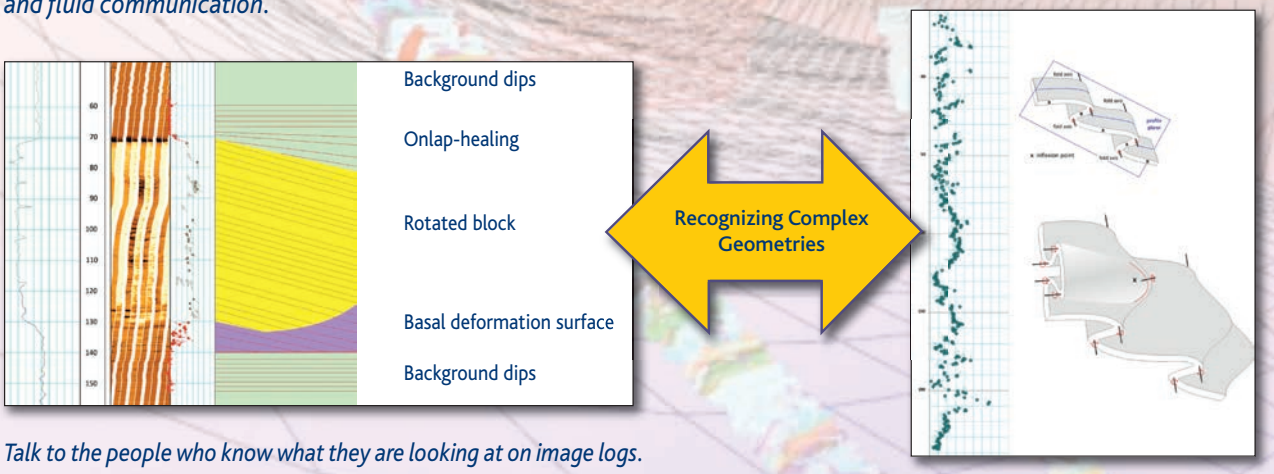
Proterozoic hydrocarbon systems are present on every continent, ranging in age from 0.54 to 2.2 Ga (Neoproterozoic to Paleoproterozoic). The amalgamation and fragmentation of supercontinents, particularly the formation of Kenorland, Nuna (Colombia), and Rodinia played a significant role in weathering, nutrient supply, and ultimately the accumulation of organic matter. The Great Oxidation Event (~2.35 Ga) associated with a Proterozoic snowball Earth increased global oxygen levels more than two orders in magnitude and essentially set the stage for the accumulation of widespread **HGS International** *continued on page 21*

Getting into **Deep Water**

RECOGNISING MASS TRANSPORT COMPLEXES (MTC) are part and parcel of any exploration or development in continental margin, abrupt margin and submarine canyon plays. Based on hundreds of kilometres of image and cores studies, **TASK FRONTERRA** has determined that at least 12% of deep marine deposits are deformed by creep, failure or rotational slumping. We have conducted numerous studies in the Gulf of Mexico, West Africa, Brazil, West of Shetlands, Nile Delta, Australia: North West Shelf and Malaysia.



Whether you are looking to sequester CO_2 in compartmentalized sediments, or looking at field development strategies – you want to be using the people who can measure and characterize these sediments in terms of geometry, scale, contacts and fluid communication.



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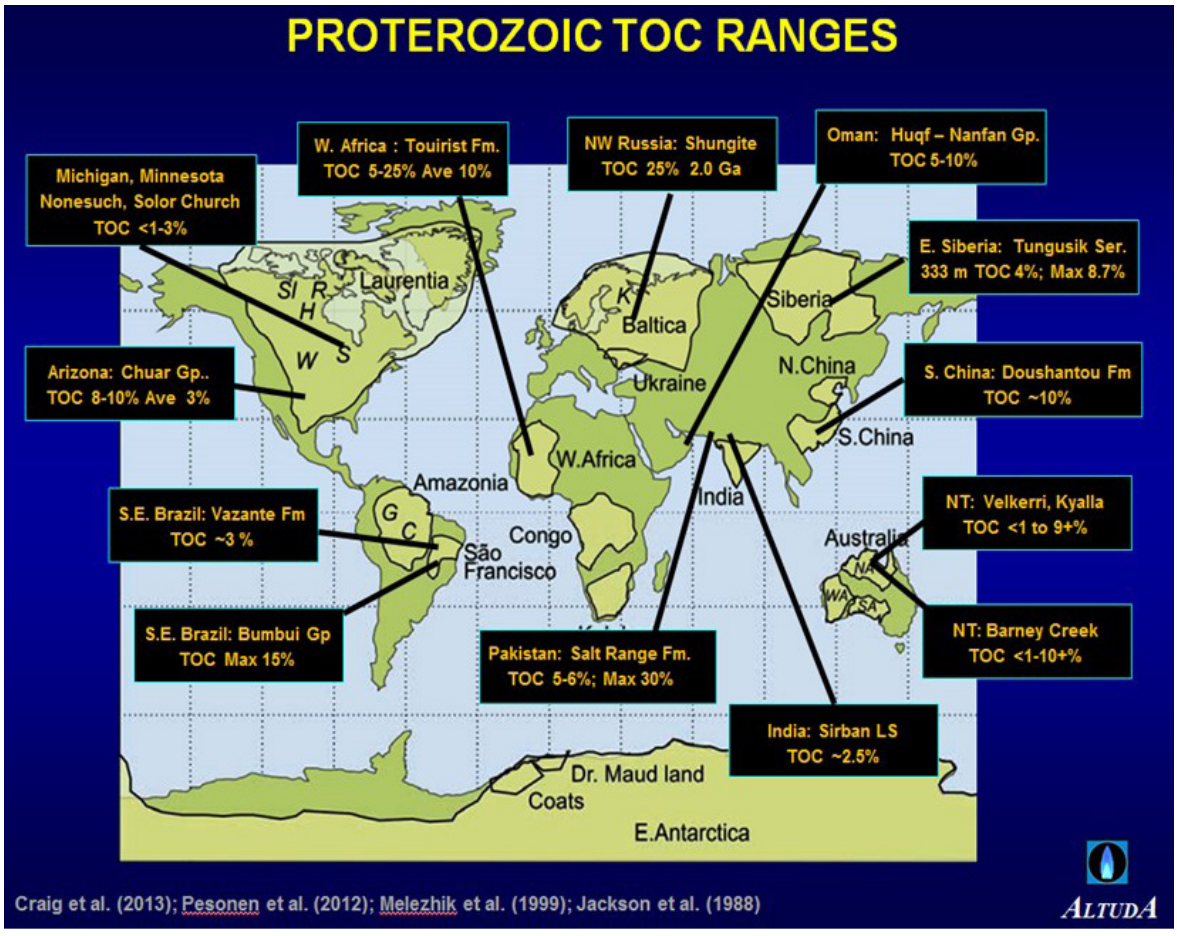
HGS International Dinner continued from page 19

organic-rich shales. The oldest significant accumulation of organic matter is the Shungite in Russia (2.0 Ga) where TOC averages 25% and individual shale beds reach 230 ft (70 m) in thickness. A metamorphosed, breached, paleo-oil field and oil seeps are associated with the Shungite.

The oldest recovered live oil worldwide comes from northern Australia where Proterozoic sediments have undergone relatively minor tectonic deformation, thereby enhancing seal preservation for conventional reservoirs over extensive areas; unconventional shale plays do not require such seals. The world's oldest potential source rocks are Paleoproterozoic (1.6 to 2.5 Ga), but commercial accumulations have not yet been identified. The oldest oil and gas deposits with commercial potential are from Mesoproterozoic (1.0 to 1.6 Ga) sediments in Australia, but Neoproterozoic petroleum systems may represent the best exploration potential. Neoproterozoic hydrocarbon production occurs in Oman and the Sichuan Basin in China. The Huqf Supergroup (0.55 Ga) sourced approximately 12 BBO and undetermined amounts of gas in Oman, and the Weiyuan Field in China has produced 508 Bcf from Neoproterozoic reservoirs. ■

Biographical Sketch

Andrew Scott has more than 25 years of experience in unconventional and conventional resource exploration and development. Prior to starting Altuda Energy Corporation, he worked at the Bureau of Economic Geology (UT Austin), where he served as Program Director of Domestic Energy Research and Director for the PTTC Texas Region. He also served as President of the Energy Minerals Division of AAPG. In 2004, Andrew was a Distinguished International Lecturer for the Petroleum Exploration Society of Australia (PESA) and in 2005 was Keynote Speaker for the Gussow Conference hosted by the Canadian Society of Petroleum Geologists. He was also a Keynote Speaker for the 2010 Geology of Unconventional Reservoirs conference sponsored by The Geological Society, London. More recently he was Head of Exploration for a privately held Australian company that branched from coalbed methane into conventional and unconventional exploration.



Wednesday, May 18, 2016

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

Cost: Active/Associate Members - $30, Emeritus/Life/Honorary - $25

Students who are members of HGS - $10, Non-members - $40

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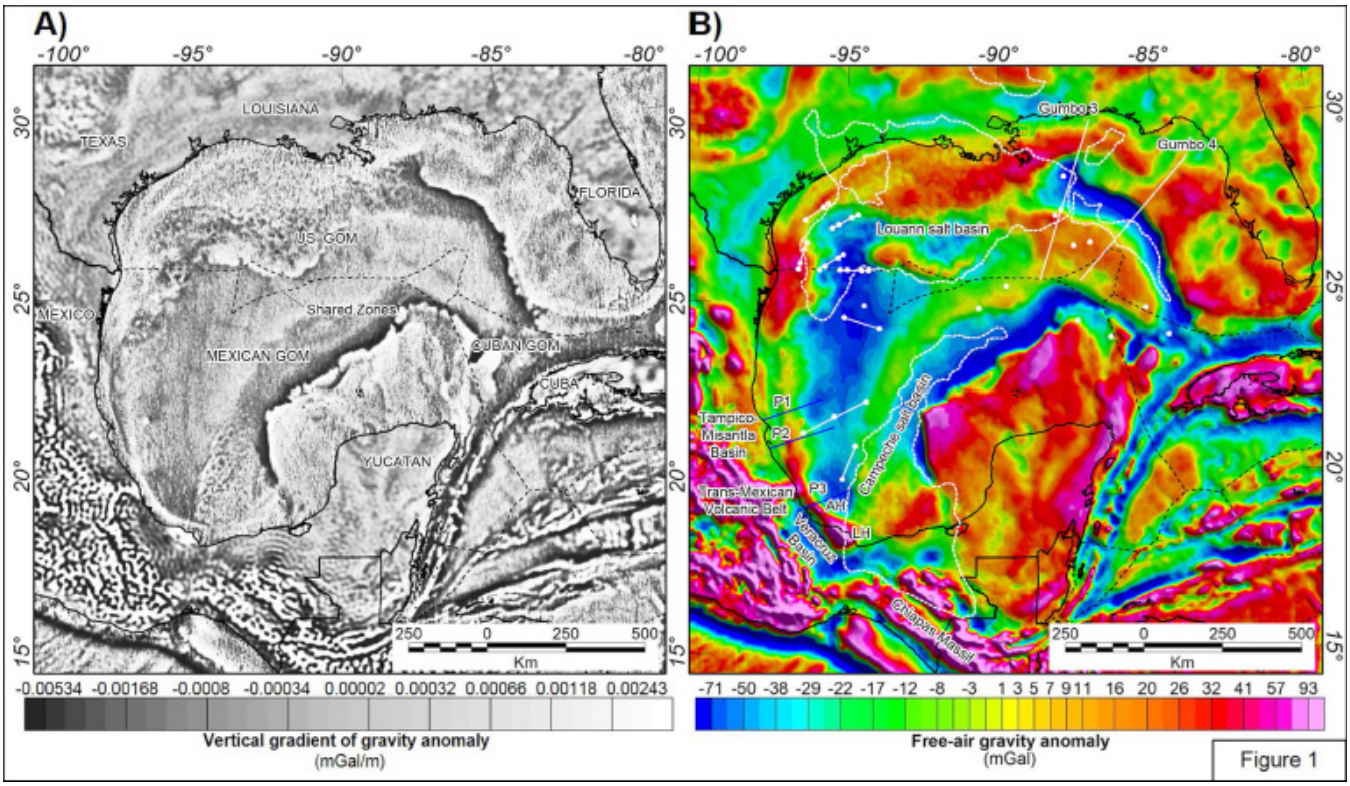
HGS Northsiders Luncheon Meeting

Paul Mann
University of Houston, Professor of Geology and Robert E. Sheriff Endowed Chair

Recent Progress in Understanding a Two-stage Opening Model for the Gulf of Mexico and its Implications for Deepwater Exploration in the US and Mexican Maritime Zones

Models for the opening of the Gulf of Mexico (GOM) will be reviewed in light of our own studies of integrated gravity and magnetic data, and interpretation of seismic reflection lines.

Most previous workers agree that the first phase of syn-rift GOM opening is Late Triassic-Early Jurassic (235–174 Ma) in age, NW-SE in extension direction, and responsible for creating a broad zone of thinned, continental crust along the northern



Left: *Geographic setting of the Gulf of Mexico basin (GOM) with overlay of vertical gradient of gravity anomaly from Sandwell et al. (2014) showing slightly darker, linear expression of the extinct, deeply buried, Jurassic ridge-fracture zone system occupying the center of the deepwater GOM.*

Right: *Overlay of same area showing free-air gravity anomaly also from Sandwell et al. (2014). Onshore data is derived from the EGM2008 geoid model (Pavlis et al., 2012). Dashed white outline represents now-separated areas of the Louann salt basin to the north (US side of GOM) and the Campeche salt basin to the south (Mexican side of GOM). AH = Anegada High volcanic field; LH = Los Tuxtlas volcanic field. This is from a student paper just submitted to the journal* Interpretation.

HGS Northsiders Luncheon *continued on page 25*

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HGS Northsiders Luncheon continued from page 23

margin of the GOM and underlying the northern salt basins of Texas, Louisiana and Mississippi. This Late Triassic-Early Jurassic rift zone is an along-strike continuation of Triassic rifts present along the eastern margin of North America, but in the northern GOM area these rifts failed to culminate in production of a parallel and contiguous zone of oceanic crust. Progress has been slow in understanding the early history and crustal structure of this area in the GOM due to the obscuring presence of an overlying sag basin of post-Early Jurassic age filled by 3–4 km of depositional salt (now remobilized).

The second and much better understood phase of GOM opening is Late Jurassic (156–145 Ma), post-salt in age and formed a large expanse of salt-free, Jurassic oceanic crust underlying the deepwater GOM shared by the U. S., Mexico and Cuba. This second opening phase occurred along a highly arcuate, slow spreading ridge system now precisely imaged on basin-wide satellite gravity maps. We have georeferenced our grid of deep-penetration seismic and well data in the eastern GOM, along with recent refraction studies, to both ground-truth these satellite images and provide details of the early breakup and separation. The eastern and northeastern GOM continent-ocean boundary defined by deep seismic profiles is within 20 km of that inferred from satellite gravity. Gravity and magnetic models are used to constrain the location and shape of the deeply-buried, Jurassic age, and right-lateral main Western Transform Fault that sharply defines the continental edge of eastern Mexico. We have used the shape of the satellite-imaged fracture zones in the central Mexican GOM along with the shape of the main Western Transform Fault to improve the pole position for this second phase of GOM opening which is located in the Straits of Florida. This pole restores trends of Paleozoic crustal fabric in Florida and the Yucatan Peninsula imaged on gravity and magnetic maps to pre-rotation parallelism, along with reuniting the now widely separated U. S. Louann salt basin and Mexican Campeche salt basin. This pole position is used to create a kinematic plate model for the second phase of GOM opening that respects all available seismic reflection, refraction, and well data, as well as satellite imagery.

Implications for deepwater exploration from this work include: 1) more precise locations of the continent-ocean boundaries in the U. S., Mexican and Cuban maritime zones; 2) the locations of passive margins overlying rifted margins versus those passive margins overlying "transform passive margins" and their consequent effects on heat flow and passive margin subsidence; and 3) the question of whether or not Upper Jurassic source rocks and petroleum systems can exist on the extensive, deepwater area of oceanic crust formed during the second stage of GOM opening. ■

Biographical Sketch

Paul Mann is Professor of Geology and Robert E. Sheriff Endowed Chair at the Department of Earth and Atmospheric Sciences of the University of Houston. He was previously a senior research scientist and lecturer at the University of Texas at Austin. He received his Bachelor of Arts in geology from Oberlin College and his Ph.D. in geology from the State University of New York at Albany. His main interests are tectonics, basin analysis, and petroleum geology. He is the principal investigator of an oil industry-funded consortium at the University of Houston called CBTH (Caribbean Basins, Tectonics, and Hydrocarbons) that conducts basin-scale mapping and modeling in the Gulf of Mexico, Caribbean, northern South America, and related conjugate margins. The project currently employs 23 University of Houston geology and geophysics students at the graduate and undergraduate level who work on a variety of research projects along with maintaining a GIS (Geographic Information System) surface and subsurface database for the CBTH study area.

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Pavlis, N., Holmes, S., Kenyon, S., and Factor, J., 2012, The development and evaluation of the Earth Gravitational Model 2008 (EGM2008): *Journal of Geophysical Research*, v. 117, B04406, doi:10.1029/2011JB008916.

Wednesday, May 18, 2016

Black Lab Pub, Churchill Room • 4100 Montrose Blvd.
Social 5:30 p.m., Dinner 6:30 p.m.

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Kathy S. Haggar, Les R. Denham, and H. Roice Nelson, Jr.
Dynamic Measurement LLC

Aquifers, Faults, Subsidence, and Lightning Databases

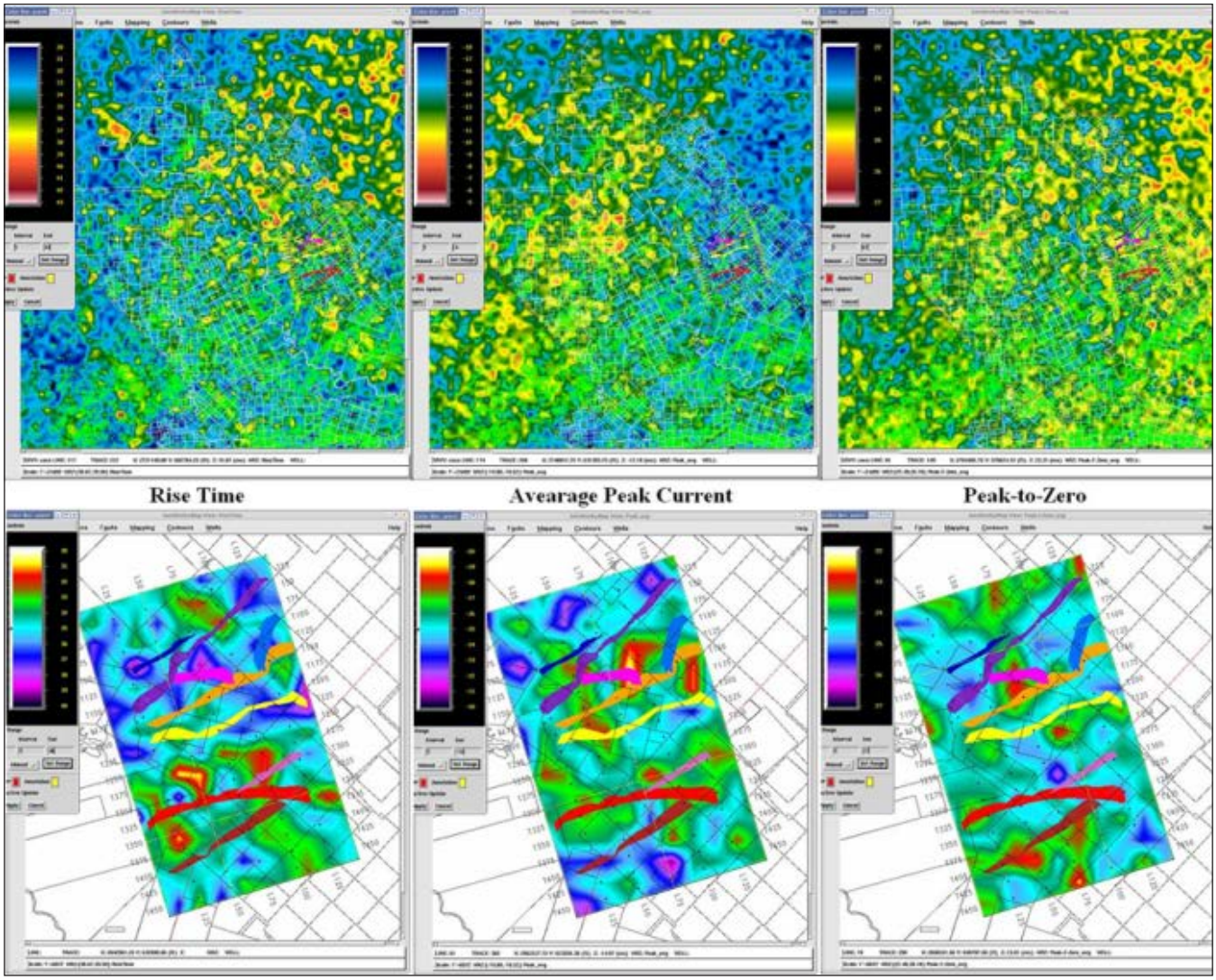

Figure 1. *Maps of rise time, average peak current, and peak-to-zero time from lightning strikes in southern Colorado County, Texas, with faults interpreted from a 3D seismic survey.*

In discussing characteristics of aquifers, faulting, subsidence, and lightning database we recognized similar measurement and monitoring issues and solutions.

Lightning data occurs everywhere, covering the spatial extent of aquifers. **Figure 1** shows lightning attribute maps at regional and prospect scales. Lightning strikes cluster, these clusters are somewhat consistent over time, and the resulting lineaments tie to fault lines. Lightning strikes are impacted by tides (Nelson, et al., 2013), and the impact of tides on marshes and swamps increases with subsidence.

Lightning databases open new ways to measure and monitor

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natural resources (Denham et. al, 2013), including aquifers, faults, and subsidence. Lightning data is evergreen, in that new lightning strike measurements are added to lightning databases every time there is a thunderstorm. Lightning strikes are primarily controlled by earth currents (Nelson et al., 2014). Earth currents are modified by aquifers (resistive if fresh water, and more conductive with increased salinity), faults (disrupting lateral flow of electrons along conductive layers), and subsidence (changes in compaction). ■

References

Nelson, H.R., D.J. Siebert, and L.R. Denham, 2013, Lightning data, a new geophysical data type: AAPG Convention, Pittsburgh, PA

Denham L.R., H.R. Nelson, and D.J. Siebert, 2013, Lightning data and resource exploration: SEG Convention, Houston, TX

Nelson, H.R., D.J. Siebert, and L.R. Denham, 2014, Telluric and earth currents, lightning strike locations, and natural resource exploration: AAPG Convention, Houston, TX

Biographical Sketch

Kathy Haggar studied geology at the University of New Orleans (BS) and Tulane(MS). Her first career in oil & gas started at the New Orleans office of Chevron (1974-1990). During those years she worked in exploration, geophysics, and production. Along the way, as for many who worked in O&G, there were dry holes, producers, and many great experiences. Among the fields she worked were Main Pass 299, West Bay, and Delta Farms. The latter provided a bridge to Greenhill Petroleum, Inc. (1990-1993) as Chevron sold properties and reduced staff. As Greenhill closed their Metairie, LA office, she started her MS in biology at Southeastern Louisiana State University and made Riparian, Inc. (wetland consulting) her next career, one that spanned some 23 years. In 2013 she joined Dynamic Measurement LLC as a geologist and sales consultant. Having a diverse background in geology and in the environment, she recognizes opportunities benefitting clients in O&G as well as civil works projects. Kathy is an active member of NOGS and BRGS and has served on their boards and committees. She is also an active member of HGS and AAPG. She has served on convention committees for GCAGS in Baton Rouge and in New Orleans. She and her co-authors have contributed several professional papers to the Transactions. Receiving the GCAGS Grover Murray Award in 2015 was a great honor. The repeat of this award in 2016 in recognition of Dynamic Measurement LLC's contribution of a new geophysical tool, lightning strike data analysis benefitting geological applications to E&P as well as natural hazard analysis, is greatly appreciated.

Nomination for HGS Teacher of the Year Award is Open

The HGS Teacher of the Year Award was established to honor teachers who have made extraordinary efforts or unique contributions in earth science education. The selected Teacher is given a $500 cash award along with a plaque presented at a HGS Event. The HGS Teacher of the Year will also be encouraged to apply to the GCAGS and AAPG Teacher of the Year Programs which offer greater cash bonuses ($1500 and $5000 respectfully). If you know of a teacher who might be interested, please have them check out requirements and procedures at the HGS.org website, or contact the HGS Awards Chairman at mike.deming.HGS@gmail.com.

Monday, May 23, 2016

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Dinner 6:30–7:30 p.m.

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Ryan Sitton
Texas Railroad Commissioner
Railroad Commission of Texas
Austin, TX

The Energy Race

Nothing has changed the world more than having access to affordable and reliable energy. During the past five years, the United States has undergone an energy renaissance, where the advent of new technology has allowed the United States to surpass both Russia and Saudi Arabia in combined oil & gas production. Texas has been blessed with geologic formations that have greatly contributed to the United States, and its influence globally. Texas Railroad Commissioner Ryan Sitton will explain how Texas, specifically, has diminished OPEC's market dominance leading to a changed global energy landscape, and will explore the path forward to the incredible opportunity of achieving energy independence. ■

Biographical Sketch

Ryan Sitton grew up in Texas, where his parents were both science teachers. He graduated from Texas A&M with a degree in Mechanical Engineering. Ryan has spent his entire career in the energy industry and in 2006 founded an engineering and technology company, helping make the world's most complicated facilities more reliable. Since then, Pinnacle Advanced Reliability Technologies has been recognized by Inc. magazine as one of the fastest growing privately held business in the world… three years in a row. Today, PinnacleART employs over 500 people.

In 2014, Ryan was elected to the Texas Railroad Commission, and is the first engineer in 50 years to serve as Railroad Commissioner. He is working to make the Commission more efficient and effective, so that Texas can lead America to energy independence. Ryan is also widely considered an expert in energy and regulatory policy. He is a proud husband to Jennifer, and proud father to Sarah, Luke, and Lance — and is often asked about his family's impressive collection of over 100,000 Legos.

Wednesday, May 25, 2016

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

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

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

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.

W.C. Riese
W.L. Pelzmann
BP America Production Co., Houston
G.T. Snyder
Rice University, Houston
G.K. Arp
Booz Allen Hamilton, Las Cruces, New Mexico

Hydrocarbon Systems of the Fruitland Formation Coalbeds, Northern San Juan Basin, USA

The Fruitland Formation coal hydrocarbon system originates from a unique collection of depositional environments, tectonic framework, and structural and landscape evolution. This system is more complex than recognized by previous workers. The presence of biogenic gas in the formation is recognized, and we conclude that recharge of the regolith is taking place, but that biogenic methane is probably sourced by microbes introduced to the formation 35 to 40Ma.

Our work indicates that four distinct waters are present in the coals. Connate waters fill the formation in the center of the basin. Meteoric recharge is restricted to coal and regolith no more than a few kilometers from the outcrop. Meteoric water found further down dip is fossil meteoric water and reflects recharge between 35 and 40Ma. Waters from deeper formations also locally recharge fractures in the coals.

The Paleozoic architecture of the basin continues to influence fluid flow in the coals. Fractures or faults in the coals may contribute to the high permeability found in the fairway, and to its abrupt southern boundary. The Cenozoic Rio Grande Rift event imposed a second fracture set. Intersection of these fracture sets with the outcrop provides the locus for most methane seeps.

Methane seeps at the coal outcrop have been active for decades. The presence of these seeps is due in part to continued weathering and breaching of biosome-scale reservoir compartments, which is more rapid along fracture systems. Our research concludes that major seep activity varies on a thirty year cycle. We attribute this cyclicity to variations to the 30-year frequency of magnitude 3+ earthquakes. The epicenters of these quakes closely correspond with the areas of most active seepage. As such, major pulses in seep activity are due to releases from deeper reservoirs whose seals are periodically breached. ■

HGS General Luncheon *continued on page 35*

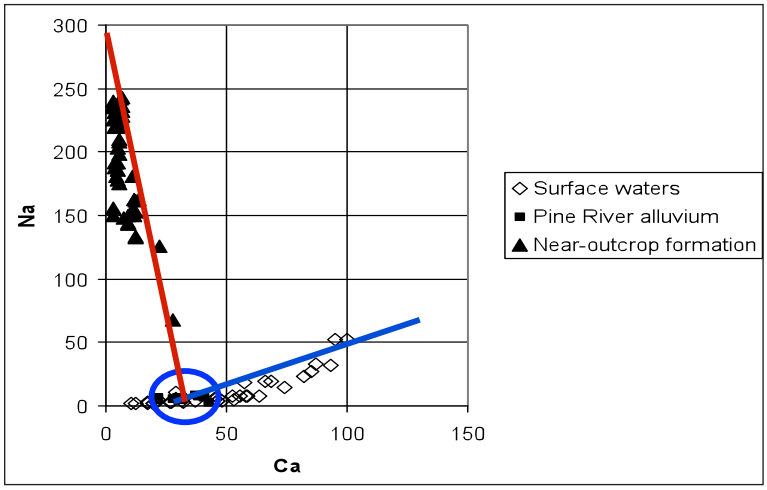


Figure 1. *Near-outcrop Fruitland formation waters through time plotted with surface waters and waters in the alluvium of the Pine River. A pattern of mixing via discharge from the formation to the alluvium is clearly present.*

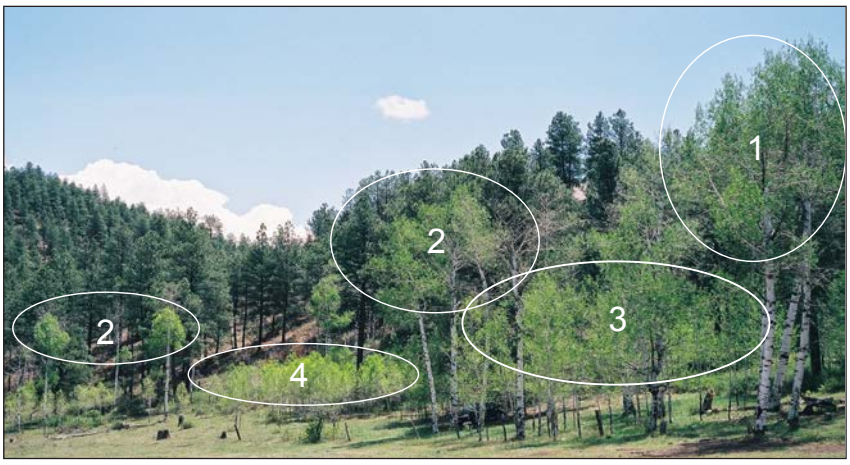


Figure 2. *Botanically anomalous aspen grove on the Fruitland outcrop showing four generations of growth and regrowth, and implying as many (seep-related) stress events.*

HGS General Luncheon continued from page 33

Biographical Sketch

Dr. W.C. (Rusty) Riese is a geoscientist based in Houston. He is widely experienced having worked in both minerals and petroleum as a geologist, geochemist, and manager during more than 40 years in industry. He participated in the National Petroleum Council evaluation of natural gas supply and demand for North America; in its more recent analysis of global supply and demand; and in the National Research Council analysis of coalbed produced waters and their management in the western United States. He is currently a member of the American Association of Petroleum Geologists Committee on Resource Evaluations, a member of the House of Delegates, and past Sections Vice President.

Rusty has written extensively and lectured on various topics in economic geology including biogeochemistry, isotope geochemistry, uranium ore deposits, sequence stratigraphy, and coalbed methane petroleum systems, and he holds numerous domestic and international patents. He has more than 35 years of teaching experience including 31 years at Rice University where he developed the curricula in petroleum geology and industry risk and economic evaluation, as well as several other courses. He is currently an Adjunct Professor at Rice University and the University of New Mexico. He is a fellow in the Geological Society of America and the Society of Economic Geologists, and a member of the American Association of Petroleum Geologists and several other professional organizations.

He earned his PhD from the University of New Mexico in 1980; his MS in geology from the same university in 1977; and his BS in geology from the New Mexico Institute of Mining and Technology in 1973. He is a Certified Professional Geologist, a Certified Petroleum Geologist, and is a Licensed and Registered Geologist in the states of Texas and South Carolina respectively.

Figure 3. *A botanical seep-indicating anomaly on the Fruitland outcrop. All of the dead trees in this grove died between 1993 and 1995.*

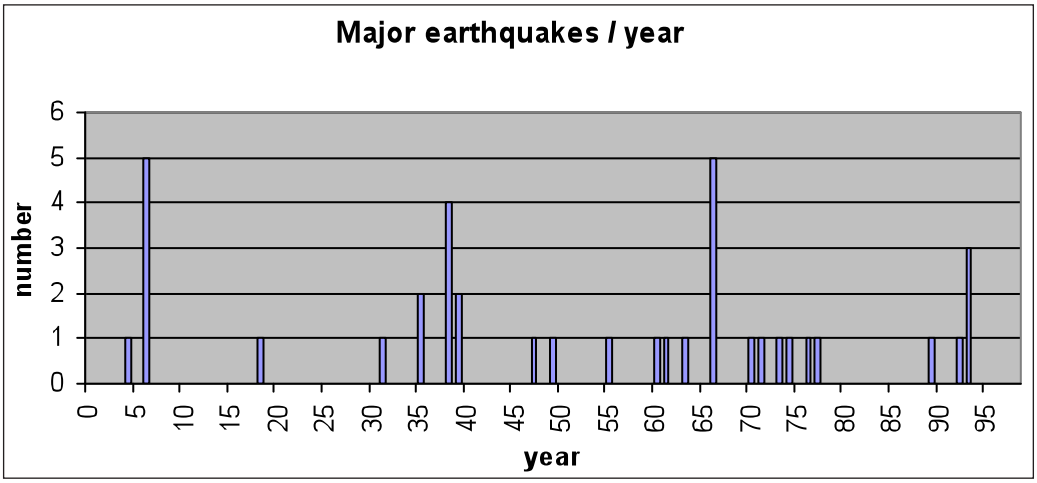
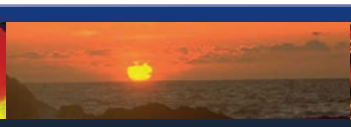
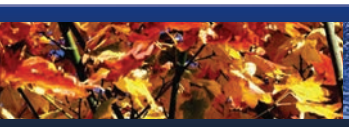


Figure 4. *Magnitude three or greater earthquakes per year in the San Juan Basin through the 20th century.*

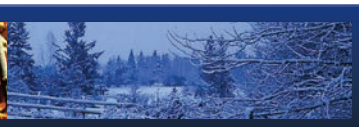
May 2016

Sunday	Monday	Tuesday	Wednesday
1	2	3 **HGS Board Meeting** *6 p.m.*	4
8	9 **HGS General Dinner Meeting** *"Cretaceous through Paleogene North American Drainage Reorganization and Sediment Routing to the Gulf of Mexico from Detrital Zircons," Mike Blum, Page 13*	10	11
15	16 **HGS International Dinner Meeting** *"Proterozoic Dogmas Revisited: Exploration Potential of Proterozoic Systems," Andrew R. Scott, Page 19*	17	18 **HGS Northsiders Luncheon Meeting** *Paul Mann, Page 23* **HGS Environmental & Engineering Dinner Meeting** *Kathy S. Haggar, Page 27*
22	23 **HGS North American Dinner Meeting** *"The Energy Race," Ryan Sitton, Page 31*	24	25 **HGS General Luncheon Meeting** *"Hydrocarbon Systems of the Fruitland Formation Coalbeds, Northern San Juan Basin, USA," W.C. Riese, Page 33*
29	30	31	



GeoEvents



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

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

Reservations:

The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476. **Reservations for HGS meetings must be made or cancelled by the date shown on the HGS Website calendar, normally that is 24 hours before hand or on the last business day before the event.** If you make your reservation on the Website or by email, an email confirmation will be sent to you. If you do not receive a confirmation, check with the Webmaster@hgs.org. Once the meals are ordered and name tags and lists are prepared, no more reservations can be added even if they are sent. **No-shows will be billed.**

Members Pre-registered Prices:

Dinner Meetings members	$45
Emeritus/Honorary members	$40
Student members	$10
Nonmembers & walk-ups	$50
Except - Env. & Eng.	$30
Nonmembers & walk-ups	$35
Emeritus/Honorary members	$15

May 2-5, 2016
Offshore Technology Conference
Houston, TX

May 8-16, 2016
HGS Grand Canyon Field Trip
Grand Canyon

June 8-11, 2016
Mexican Petroleum Congress
Monterrey, Mexico

June 19-22, 2016
AAPG ACE
Calgary, Alberta

September 6-9, 2016
AAPG/SEG ICE
Cancun, Mexico

September 12-14, 2016
HGS-PESGB Africa Conference
Houston, TX

September 18-20, 2016
GCAGS Annual Convention
Corpus Christi, TX

HGS Undergraduate Scholarship Foundation Presents Seven Scholarships

The HGS Undergraduate Scholarship Foundation has provided over $271,000 in scholarships to deserving geoscience students since 1984. This year the Foundation awarded scholarships totaling $18,500 to students from all seven universities participating in our program. Adeene Denton from the Rice University was awarded the Maby Scholarship, presented each year to the Foundation's top applicant. Foundation Chairman, John Adamick presented the scholarships to recipients at the January 25th HGS Legends dinner meeting. The Foundation was also fortunate to have sponsors support Legends Night and the HGS scholarship programs. Over $30,000 in scholarship funding was raised from 11 different sponsors. Sponsors for 2016 included: Platinum Level: Chevron and Geophysical Insights; Silver Level: EOG Resources and Apache; Bronze Level: Thunder Exploration, Subsurface Consultants & Associates, TGS, and John Tubb; Individual Level: Auburn Energy, R.A. Blake and Vitruvian Exploration II. Thank you sponsors for your generous support!

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

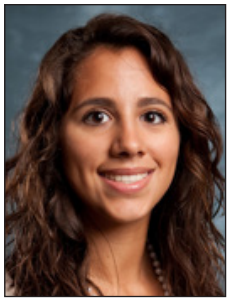
John Adamick
HGS Foundation Chairman

Adeene Denton
Maby Scholarship recipient
Rice University

Adeene Denton is a senior at Rice University. She co-founded and serves as co-vice president of the Rice Undergraduate Geosciences Society, and is also active in the department's Women of Earth Science group. Last summer, she was a SSERVI intern at the Lunar and Planetary Institute working on fault motion in Meteor Crater, AZ. She is currently working on her honors thesis with Dr. Adrian Lenardic and Dr. Helge Gonnermann in planetary science. In addition to being a student, she enjoys dancing and choreographing for Rice Dance Theater and working as a late-night radio DJ for Rice's college radio station. She is grateful for the support of her professors, thesis advisors, and department, and looks forward to graduate school after she earns her bachelor's degree in May 2016.

Rhen Storms
Lamar University

Rhen Storms is a senior at Lamar University majoring in geology. He has been interested in geoscience since high school. He has received recognition on the Dean's List for the year of 2015. He has also received the Charles Knight Scholarship in Earth Sciences and the R. Joe Ware Presidential Scholarship for fall 2015 and spring 2016. Rhen is a member of Lamar University Geological Society, affectionately known as LUGS. He is currently working under the supervision of Dr. James Westgate researching Eocene Epoch micromammals from the Uintan Basin in Utah. Rhen enjoys camping, spending time with his friends, collecting geological samples, and learning in general. After graduation in summer 2016, he plans on beginning his career in the geosciences immediately or beginning graduate school in geology.



Vanessa Alejandro
University of Houston

Vanessa Alejandro is a senior at the University of Houston pursuing a degree in geology. She is currently the President of the Association of Environmental and Engineering Geologists at UH, a member of the Honors College, and co-founder/President of a science education non-profit. She has experience doing research on the Perseverance Drift on the Antarctic Peninsula with Dr. Julia Wellner. After graduation, Ms. Alejandro plans to attend graduate school.

Eileah Sims
Texas A&M University

Eileah Sims is a senior at Texas A&M University and is pursuing a degree in geology. She has been a member of the Phi Eta Sigma Honor Society and the National Society of Collegiate Scholars since fall of 2013 and is a member of the Texas A&M Geology & Geophysics Society. She has received four College of Geosciences scholarships in the past two years. Eileah participated in a geochemical/paleoclimate research group with Maya Reimi (advisee of Dr.

Franco Marcantonio) chemically analyzing the radiogenic isotopes in dust from equatorial pelagic cores to determine dust sources to infer the location of the ITCZ and interpret paleoclimate. The group's preliminary results were presented at Student Research Week in March 2015 where they won first place in their category. Eileah will continue paleoclimate research in the coming semester with Dr. Denise Kulhanek at IODP (Integrated Ocean Drilling Program) involving the making of slides from piston sediment cores and accumulating quantitative data on nannoplankton populations to provide sea surface temperature data for climate models of the early Holocene. Her research interests include paleontology, paleoclimatology, and paleoecology and she enjoys riding horses, art, and reading books. After graduating in May 2016, she plans to attend graduate school to pursue Master's and Doctorate degrees in paleontology and hopes to become a museum curator, a research professor, or a paleontological artist and possibly work in the petroleum industry.

Mallory Ramos

Sam Houston State University

Mallory Ramos is a senior at Sam Houston State University pursuing a degree in geology. She returned to SHSU in 2014 after completing a bachelor's degree in animal science in 2009. Mrs. Ramos participated in a research project during the summer of 2015 under the supervision of Dr. Jonathan Sumrall correlating outcrops of the Engadine group in the Hiawatha National Forest of the upper peninsula of Michigan, with an emphasis in magnetic susceptibility and stable isotopes. She is currently a lab instructor for physical geology and is a member of both the Sam Houston State University AAPG Chapter and the Sam Houston Association of Geology Students. Mrs. Ramos enjoys spending time with family and friends, and teaching her son as much about geology as she can. She also relishes the numerous field trip opportunities available. After graduating, Mrs. Ramos plans on attending graduate school and pursuing a career in petroleum geology.

Natalie Raia

University of Texas

Natalie Raia is a senior at the University of Texas in Austin pursuing a BS in geology and a BA in Plan II Liberal Arts Honors. She is a Jackson Honors student, currently completing her thesis on the geochemistry of serpentinites from the Cyclades, Greece with Dr. Jaime Barnes. In Summer 2014, Ms. Raia spent two months living and researching on the Juneau Icefield, traversing 80 miles on skis, living at remote camps, and conducting isotopic research aimed at identifying storm events and vapor source changes in snowpack. She most recently returned in December from five months studying and researching at the Australian National University in Canberra, Australia. Ms. Raia has been an active leader in the Jackson School's Geoscience Leadership Organization for Women. When not traveling or studying rocks, she enjoys hiking, backpacking, sewing, and participating regionally and nationally as a member of the UT women's handball team. Ms. Raia aims to pursue a Master's degree combining structural geology and geochemistry following graduation.

Moira Lyons

Stephen F. Austin State University

Moira Lyons is a senior at Stephen F. Austin State University with a major in geology and a minor in business. Moira has maintained a 4.0 GPA in Geology, and a 3.88 overall. She has consistently made the dean's list and presidents honor roll. Moira has also received scholarships from the Geology department as well as the Shreveport Geological Society. Moira is a student member of HGS as well as AAPG. She enjoys camping and travel and hopes to combine those interests with her future exploring earth's natural resources. Moira is preparing for a career in exploration geology and geophysics, particularly for petroleum exploration. She enjoys learning more around exploration seismology, sequence stratigraphy, surface processes, and the physics of fluid flow. Moira appreciates the knowledge and support she has gained from the Geology department at SFA and is looking forward to her graduation in December of 2016. She hopes to find a position or internship in the energy sector prior to starting graduate school in the fall of 2017.

AAPG Education — Upcoming Education Events 2016

LAST CHANCE!
AAPG HEDBERG RESEARCH CONFERENCE CENTER
The Future of Basin and Petroleum Systems Modeling
April 3-8, 2016, Santa Barbara, California, USA

The conference aims to bring together professionals from academia, government agencies and industry who are actively involved in pushing the technical limits and application of basin modeling. New ideas are welcomed from R&D scientists (whether they have an academic or industry background), the hardware/software computing industry, exploration business units of the oil and gas industry, or any closely related disciplines, e.g., geochemistry or geothermal industry. Students are also welcome as long as they are able to actively contribute.

The four main goals of this conference are:
1. To share knowledge, experience and opinions across different affiliations in BPSM
2. To identify limitations of concepts, workflows and technologies and to explore new solutions and potential improvements in BPSM
3. To promote awareness that integration is key to solving complex E&P challenges
4. To better understand the subsurface processes for specific areas of interest through case studies

Mudstone Diagenesis: Implications for Exploration and Development of Unconventional Reservoirs
16-19 October 2016, Santa Fe, New Mexico

The purpose of this conference is to foster the free exchange of new ideas among leading experts from industry, academia, and government on the controls and impacts of inorganic and organic diagenesis on mudstone hydrocarbon generation, reservoir properties and seal quality.

FORUMS

LAST CHANCE!
Pittsburgh Playmaker Forum
April 13, 2016, Pittsburgh

This forum is a one-day event preceded with a PAPG monthly dinner meeting on the evening of 12 April 2016; providing an opportunity to come to Pittsburgh the day prior to the forum, network with local geoscientists and enjoy an Appalachian Basin technical talk.
The workshop will provide insight to the strategy and tactics used to propel a company from start-up into a successful player and ultimately through an initial public offering, in an area of the Marcellus and Utica Shale plays dominated by large independent exploration and production companies. Networking opportunities will be available during the morning and afternoon breaks, before and after the luncheon and during a planned mixer after the forum. Register Today

GTW
New Thinking and Value Propositions: ProActive Steps Now
May 17-18, 2016, Houston

The goal of this two-day workshop is to proactively create opportunities yourself and your company in a low price environment. You will learn how to bring value propositions to operators. Revitalize reservoirs for less than the cost of plugging and abandoning, paid for by increased production. Rethink reservoirs and push paradigm shifts that will result in breakthroughs. We will discuss how to use these times to pilot new products and technologies and thus position innovative companies to boom when conditions improve. This event is for engineers, geologists, geophysicists, land professionals, and entrepreneurs. Register Today

SCHOOLS AND SHORT COURSES

LAST CHANCE!
Basic Well Log Analysis — April 25–29, Austin, TX; July 11–15, Golden, CO

LAST CHANCE!
How to Find Bypassed Pay in Old Wells Using DST Data — April 26–28, Austin, TX

Petroleum Geology for Engineers — May 1, Houston, TX (with OTC)

Modern Terrigenous Clastic Depositional Systems — May 31–June 7, 2106, South Carolina; September 11–18, 2016, South Carolina

PROFESSIONAL DEVELOPMENT AT ICE BARCELONA 2016

AAPG|SEG International Conference & Exhibition 2016
April 3-6 2016, Barcelona, Spain

ICE BARCELONA SHORT COURSE

Advanced Sequence Stratigraphic Applications for Exploration (SEPM Course)
2-3 April 2016

Instructor: Vitor Abreu
Includes: Course materials & refreshments

ICE BARCELONA FIELD TRIPS

Granada, Spain
7-10 April 2016

Reservoir Analogues from Modern and Ancient Turbidite Systems, Tabernas Basin, Spain

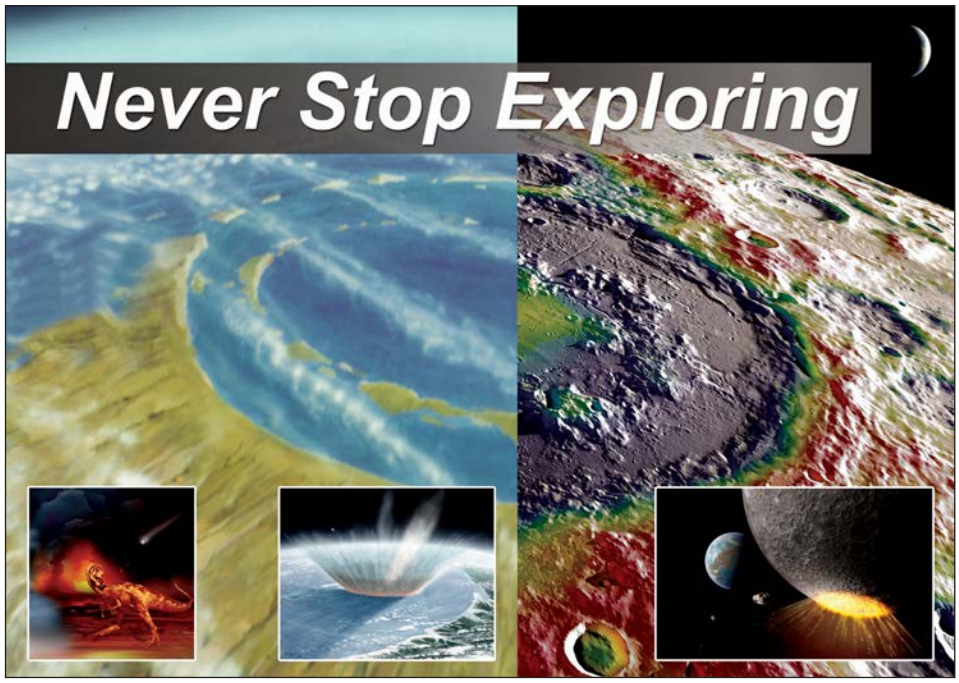
Barcelona, Spain
7-10 April 2016

Thrust Belt Structure and Foreland Basin Evolution in the Southern Pyrenees (Aragon, Spain)

www.aapg.org/career/training/

HGS Guest Night to Discuss Origin of Life on Earth and Connection to Lunar Impacts 3.8 Billion Years Ago

by Linda Sternbach



HGS Guest Night, to be held on Saturday, June 11, will feature Dr. David Kring, Senior Staff Scientist of the Lunar and Planetary Institute here in Houston. The lecture topic is one of science's biggest questions: did life on Earth arise because of meteor impacts from space? His research focuses on evidence of early catastrophic bombardment of the Moon and Earth 3.8 billion years ago, including rock evidence collected by the Apollo missions. Dr. Kring advocates new manned missions to the Moon, and is a NASA advisor on astronaut training.

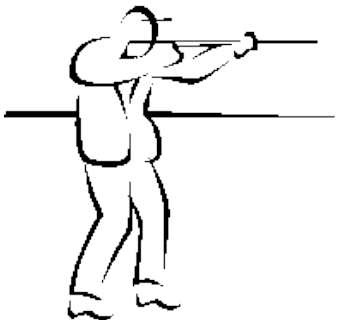
Guest Night will be held at the Houston Museum of Natural Science, starting at 7 pm. The event includes a buffet dinner amongst the fearsome T-Rex, triceratops and other dinosaurs of the Hall of Paleontology. After dinner, Dr. Kring will take the stage in the Giant Screen Theatre and talk about cosmic collisions. Following the talk and Q&A, we will show the 3D movie "Journey to Space" narrated by Star Trek captain Patrick Stewart. Adult tickets are $60; children and student tickets are $30. Tickets may be purchased on the calendar event page on the HGS website.

About our Guest Night speaker, Dr. David Kring:

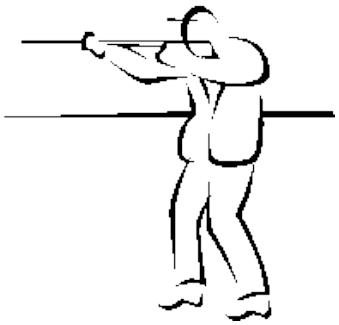
Dr. Kring received his PhD in Earth and Planetary Sciences from Harvard University. He specializes in impact cratering processes produced when asteroids and comets collide with planetary surfaces. Kring is perhaps best known for his work with the discovery of the Chicxulub impact crater, which he helped to link to the K-T boundary mass extinction of dinosaurs. The science community, through the International Astronomical Union (IAU), honored Dr. Kring and his work by assigning asteroid 8391 the formal name "Kring" in the year 2000. Based on the astronomically measured absolute magnitude of the asteroid, the diameter is estimated to be 10 to 15 kilometers. That is comparable in size to the asteroid that produced the Chicxulub impact crater and extinguished most life on Earth 65 million years ago.

Dr. Kring has studied how impact cratering may have affected the early evolution of the Earth-Moon system. In particular, he has led a decade-long campaign to test the lunar cataclysm hypothesis, which is one of the great intellectual legacies of the Apollo program. Indeed, the bombardment of the Earth-Moon system remains the highest science priority for our nation's return to the Moon. Kring has suggested that an intense period of impact bombardment may have affected the origin and early evolution of life on Earth. Dr. Kring also led a joint academia-industry-NASA design team for a robotic lunar lander and rover system that can be deployed anywhere on the lunar surface. He is particularly interested in the interfaces between science, exploration, and operations, to ensure our nation's return to the Moon maximizes productivity while enhancing safety and efficiencies during robotic and crew operations. He has trained astronauts how to move around on planetary surfaces (e.g., the Moon, Mars, and asteroids) affected by impact cratering and volcanic processes. He has also developed mission concepts for human-assisted lunar sample return missions, human exploration of the lunar surface, and helped lead simulations of lunar and near-Earth asteroid missions in analogue terrains here on Earth. ■

For more information about Dr. Kring see http://www.lpi.usra.edu/science/kring/



HGS SKEET SHOOT



Saturday, June 25, 2016
Greater Houston Gun Club
6702 McHard Road, Missouri City

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

HGS recognizes that 2016 is a lean year in the oil patch, and sponsorship for events like this is hard to find. **For $150, you'll receive paid entry for one shooter and one guest (total value of $120) and be listed as a platinum sponsor on the webpage and at the event.**

IMPORTANT!!

We are limited to 160 shooters in four rotations. Entry fee is $90 per shooter for registrations received by FRIDAY, JUNE 17. After June 17, registration will be strictly on a "space available" basis and the entry fee will be $120 per shooter. Register early!!

For more information, contact: Tom McCarroll at (713) 419-9414 or tom_mccarroll@yahoo.com.

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

ONLINE REGISTRATION INFORMATION AT: www.hgs.org/civicrm/event/info?id=1643

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

Name: _____ Company: _____

Email: _____ Phone: _____

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

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

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

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

Membership Directory Update

by Bonnie Milne-Andrews

"Organizing is what you do before you do something, so that when you do it, it is not all mixed up."

A. A. Milne

An important function of The Houston Geological Society is to enable members to network and interact. An updated and organized HGS Directory can be a powerful tool allowing members to find each other and connect. As it stands, the Membership Directory requires significant updating and improvements to provide the best possible venue for networking and business purposes. With the numerous changes in our industry during the past two years, we find inaccuracies in member contact information.

The goal of the Directory Committee this year has been to initiate interest in and prepare a robust and searchable Membership Directory. Progress has been made, but HGS Members are again urged to update their profile information.

The Directory Committee will be finalizing the Directory upon the conclusion of the annual dues paying deadline in June. At that time, an updated HGS Directory will be available as an online tool and a downloadable pdf for those who prefer working with hardcopy.

Although the submission of personal data and information will be the personal choice of the Member, the Directory Committee will format the request to allow members to add the following to their profiles:

- Name and Title
- Company
- Address
- Phone Number
- Email address
- Status of Membership (Active, Associate, Emeritus) and date of joining HGS
- Degree - School - Year Degree Received
- Spouse/Partner Name
- Photo
- Resume (available only if submitted by member and available as a 'drop down' on the Website Directory. The resume will be available for review only online and will not be included in the printable version.

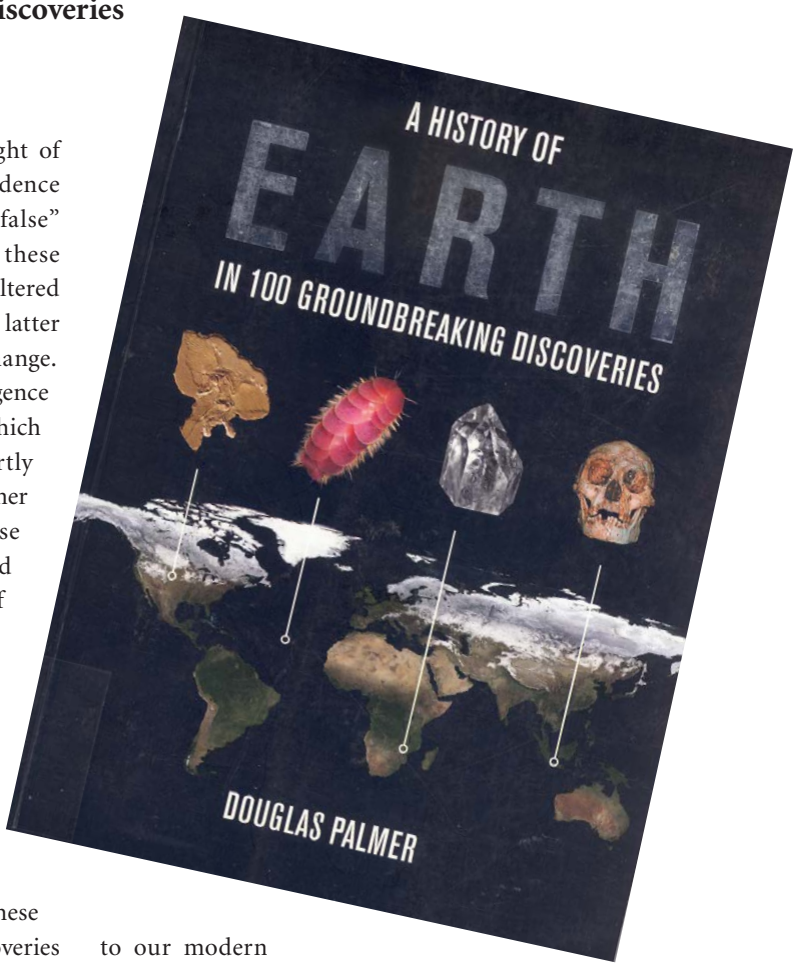
Again, all personal information submitted will be at the discretion and choice of the member.

Please help our organization effort! ■

Book Review *by George O. Chandlee (goc@consolidated.net)*

A History of Earth in 100 Groundbreaking Discoveries

by Douglas Palmer, 2011, Firefly Books Ltd., 415 pp.



The history of science has traditionally been thought of and presented as a progressive narrative. As evidence accumulates, theories are replaced gradually from "false" to "true" theories. Thus, the narrative continues, these replacements form a continuum in which beliefs are altered slowly. This description of scientific history has, in the latter half of the twentieth century, undergone substantive change. This change portrays the history of science as the emergence of multiple competing explanations, or paradigms, in which one single paradigm ultimately becomes accepted, partly because of the compelling, complete, and integrative manner in which scientific observations are explained. These "paradigm shifts" become the framework in which old and new observations are incorporated and direct the efforts of future research.

When viewed in this context, the designation of the "greatest events" or "groundbreaking discoveries" becomes a phrase that directly relates to these paradigm shifts. The cataloguing of these "groundbreaking" events renders a useful description and manner of cataloguing these shifts. As a way of understanding important historical scientific concepts, cataloguing of these events provides a way to classify the very important discoveries that characterize the history of the geosciences.

A History of Earth in 100 Groundbreaking Discoveries by Douglas Palmer is an excellent book that maps well known and important "paradigm shifts" in the history of geology. Mr. Palmer is a Cambridge, England-based science writer who has popularized Earth history as a consultant to B*BC Wildlife Magazine*, an author of numerous books, and contributor to several education TV series. This book presents a detailed summary of what the author identifies as "groundbreaking discoveries" that have contributed to our modern understanding of Earth history. This collection of scientific discoveries is not a textbook. As the author states in the Introduction (page 7), the "aim of this book is to illustrate some the most interesting current scientific studies across the entire range of Earth sciences".

The book is structured in a way to convey information quickly, and the structure works very well. Each of the 100 chapters begins with key facts that are divided into four groups: definition, discovery, key breakthrough, and importance. This brief summary is followed by a 2-4 page discussion of the timing, significance, process, and implications of the "discovery". This structure does not alter through the book.

Topics covered range from "Birth of a planet" (Chapter 1) to "The fate of the Earth" (Chapter 100). The topics are arranged roughly chronologically. Major themes are the origin and history of complex life, major extinctions in Earth history, climate changes, plate tectonics, and volcanoes. The color diagrams and photographs in the book are excellent and provide the reader with multiple visual impacts to convey the significance of the discovery. ■

HGS Welcomes New Members

New Members Effective March 2016

ACTIVE MEMBERS

Stephen Adeniran

T Dale Bagwell

Sushanta Bose

Matt Boyce

April Coker

Matthew Czerniak

Laurence Darmon

Thomas Dvis

Isaac Easow

Gordon Fielder

Ariel Malicse

Alonso Navarro

Dianne Padgett

Anine Pedersen

Michael Peffer

Carla Phelps

Marcie Phillips

Jennifer Pickering

Anna Popik

Ryan Rambo

Merril Stypula

Daniel Sutton

James Wallace

EMERITUS MEMBERS

Daniel Jarvie

Jerry Mattiza

STUDENT MEMBERS

Anna Krylova

Andrew Pineda

Welcome New Members

Government Update

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

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

Texas Board of Professional Geoscientists Issues Advisory Opinion AOR #13 (2015).

The question asked was: Is Texas P.G. licensure and/or firm registration required if a P.G. licensed in another state physically moves his or her firm to Texas and engages in the following activities?

1. Establishes a Texas LLC (is a Texas corp. for at least some tax purposes).
2. Solicits and engages in work solely within his/her original state of practice and residence, except for the fact that the office-based portion of the work (report preparation, administration, etc.) is done in the new Texas LLC's office.
3. Maintains current licensure in the original state.
4. The LLC advertises that services are offered only in the original state of licensure.

Opinion: If the firm solicits and engages in work solely within another state, except for the office-based portion of the work (report compilation, administration, etc.); maintains licensure in the other state; and the LLC advertises that services are offered only in the state of licensure, the firm is exempt from TBPG registration.

Arizona Bill Proposed to Eliminate Professional Geologist Registration

The Arizona legislature has a proposed bill that will eliminate geologists as a registered profession in Arizona (HB2613). HB 2613 (Regulatory Boards; Licensing; Revisions), introduced by Representative Warren Petersen (R-Gilbert), was heard in the House of Representatives Commerce Committee on Wednesday, February 17, 2016 in Phoenix. HB 2613 ends the licensure of Geologists and Landscape Architects, among other provisions. A total of 14 individuals signed in to support the bill and 366 individuals, mostly Geologists and Landscape Architects, signed in to oppose the measure. There was additional opposition from the American Council of Engineering Companies of AZ, the Arizona Chapter of Associated General Contractors, the Arizona Petroleum Marketers Association, the Arizona Planning Association, the Arizona American Institute of Architects and the Arizona Board of Technical Registration. The bill is being pushed by Arizona Governor Doug Ducey as a solution to address the perceived over licensure of professions in Arizona. The hearing for HB 2613 lasted approximately two hours and the committee heard testimony from four Geologists against the bill. The bill was passed on a party line 5 - 3 vote with the Democratic members dissenting. The bill has two procedural hurdles before being considered by the full Arizona House of Representatives for an up or down vote. During testimony the Governor's staff noted that the bill needs additional work and assured the interested groups that they will have input in this process. The American Institute of Professional Geologists and the Association of Environmental and Engineering Geologists is leading the opposition to this measure and is seeking to remove the Geologists from this bill.

AGI Geoscience Policy Monthly Review (January 2016)

House Science Committee Marks Up Civilian Nuclear Energy Bill

The House Committee on Science, Space, and Technology has voted to approve the Nuclear Energy Innovation Capabilities Act (H.R. 4084), legislation aimed at increasing nuclear research within the Department of Energy (DOE). The bill would authorize DOE national laboratories to collaborate with the private sector to create nuclear prototypes and increase funding for DOE nuclear programs.

Sponsored by Committee Chairman Lamar Smith (R-TX), Committee Ranking Member Eddie Bernice Johnson (D-TX), and Representative Randy Weber (R-TX), the bipartisan bill will now move on to the House floor for consideration. Proponents of the bill claim that increasing nuclear research will allow the U.S. to maintain nuclear technology leadership and address threats of climate change.

Oil And Gas Companies Cutting Production and Workers

The price of oil fell to $38 per barrel in December 2015, leading to massive cuts in the industry's budget and workforce. The Bureau of Labor Statistics show that the oil and gas industry saw a loss of almost 14,000 jobs between September and December 2015; job losses are expected to increase through 2016 as oil prices continue to fall.

In general, smaller companies with budgets less than $100 million have made the most reductions (averaging 49.6 percent), while major multibillion-dollar companies have cut the least (averaging 19.8 percent). These reductions will likely cause a $200 billion loss in oil field production worldwide.

Government Update *continued on page 49*

Remembrance

William E. (Bill) Harlan, III
(1935-2016)

William E. (Bill) Harlan III, passed away Wednesday, February 3, 2016. He was a lifelong Christian and a loving husband, father, grandfather, and great-grandfather. Bill was full of life, always cheerful, and a blessing to be around and he loved his family dearly. If you dropped by for a visit, he was always ready to talk about Exxon, geology, his grandchildren, the U of H Cougars, or the latest article he read in the *Wall Street Journal*.

Bill grew up in Baytown, Texas, and was a proud graduate of The University of Houston, with a degree in Geology. He had a longstanding and successful career in the oil and gas industry, working for Exxon and Columbia Gas Development Company. Following that, he was an independent geophysical/geological consultant, co-founding Quatre Exploration. He was a member of the American Association of Petroleum Geologists, Society of Exploration Geophysicists, Houston Geological Society, Geophysical Society of Houston and he was the Chairman of the Houston Chapter of the Society of Independent Professional Earth Scientists from 1983 to 1984.

Bill was preceded in death by his beloved wife of 54 years, Delia; his sister - Patricia Carr; and parents - William and Ada Mae Harlan. Bill is survived by his brother – Ron Harlan and his wife, Dorothy; son – Wade Harlan and his wife, Karen; daughter – Karen Dickens and her husband, Kelly; grandchildren – Hanna Cauthen and her husband, Tommy; Meghan Harlan Baker and her husband, Lance; Wes Harlan and his wife, Megan; Austin Schumacher; Aaron and Kyle Dickens; and Leah Harlan; great-grandchildren – Norah Baker, and Wyatt and Cooper Cauthen, and many other relatives and friends.

Funeral services were held at Sterling-White Funeral Home and Cemetery in Highlands, Texas with family members officiating. To send the family condolences online, visit www.sterlingwhite.com.

-Published in *Houston Chronicle* on Feb. 7, 2016

-Revised by Tami B. Shannon

Government Update continued from page 47

Oklahoma Calls for a Reduction in Wastewater Injection
Oklahoma experienced a 50 percent increase in earthquakes magnitude-3 or greater last year—up from 585 in 2014 to 881 in 2015. Scientists and state officials now agree that many of these earthquakes are caused by the disposal of wastewater from oil and gas operations into deep sedimentary structures.

Consequently, the Oklahoma Corporation Commission (OCC) has directed more that 27 disposal wells in the Fairview area of western Oklahoma to cease or reduce wastewater injection operations. Fairview has been shaken by magnitude-4.3 and magnitude-4.8 quakes, the strongest the state has seen in years. This reduction is a part of a larger approach by the OCC to decrease wastewater disposal in the entire northwestern Oklahoma region.

Abandoned Mine Reclamation Safety Act Seeks to Prevent Pollution, Increase Worker Safety
Rep. Raúl Grijalva (D-AZ) has introduced a bill that would direct the Department of the Interior (DOI) to create environmentally responsible regulations for reopening abandoned mines. The bill, the Abandoned Mine Reclamation Safety Act (H.R. 4323), aims to ensure worker safety and reduce uncontrolled wastewater releases.

This bill comes after a major spill at the Gold King Mine in Colorado, in which three million gallons of wastewater was accidentally released into the Animas River this August; Rep. Grijalva has heavily criticized EPA efforts to clean up the spill. The proposed bill hopes to implement recommendations from a Bureau of Reclamation report that evaluated the Colorado spill.

Reps. Doug Lamborn (R-CO) and Jody Hice (R-GA) have introduced two other bills, H.R. 3843 and H.R. 3844, respectively, to emphasize a three-pronged approach to addressing abandoned mine cleanup. The three bills now head to the House Committee on Natural Resources' Subcommittee on Energy and Mineral Resources for consideration. In the Senate, Tom Udall (D-NM) has also introduced a bill to address cleanup efforts for abandoned mining sites.

Science Advisory Board Questions EPA Hydraulic Fracturing Report
A study released by the Environmental Protection Agency (EPA) in June 2015 reports that hydraulic fracturing does not cause "widespread, systemic impacts on drinking water resources in the United States." In response to the study, the agency's Science Advisory Board (SAB), which provides independent scientific advice to the EPA, has submitted a critical draft letter expressing their concerns with the report's findings.

Industry is defending the agency's abovementioned statement, while the SAB and green groups are criticizing it, claiming that the statement is ambiguous and does not reflect the uncertainties and limitations within the report.

Carbonate Growth Rings on Rocks Tell About North America's Climate Past
According to a new study published in the Proceedings of the National Academy of Sciences this January, growth rings that record pedogenic (soil) carbonate mineral accumulations on rocks may tell us about weather patterns from thousands of years ago. The new study, conducted by a team of researchers at the University of California, Berkeley, and funded in part by the National Science Foundation, found that soil deposits on rocks, or pedothems, can help determine ancient weather patterns.

During their research, the team used uranium isotopes to date the pedothems and analyzed their oxygen and carbon content to determine precipitation, temperature, and soil respiration at the time the soil deposits accumulated. The team then used the data to draw conclusions about North America's past climate.

Government Update continued on page 51

Remembrance

Dr. Joel Smith Watkins, Jr.
(1932-2016)

Joel Smith Watkins, Jr., 83, of New Braunfels, Texas, passed away from complications due to stroke on Tuesday, February 23, 2016. Joel was born May 27, 1932 to Joel and Eva (Byers) Watkins in Poteau, Oklahoma, and grew up in Warren, Arkansas.

In 1953, Joel was commissioned an officer in the United States Marine Corps upon completion of the Naval Reserve Officers Training Corps program at the University of North Carolina at Chapel Hill, where he received a B.A. in Geology. After his medical retirement from the Marine Corps as a First Lieutenant, he attended the University of Texas at Austin, where he received his PhD in geophysics in 1961.

After completion of his doctorate, Joel worked as a geophysicist for the U.S. Geological Survey, the Massachusetts Institute of Technology, the University of North Carolina at Chapel Hill, the University of Texas at Austin, and Gulf Oil Corporation; ultimately retiring from Texas A&M University as a Professor Emeritus in 2002. For his work training astronauts and designing seismic instruments for Apollo 14, 16 and 17, he was awarded the NASA Medal for Exceptional Scientific Achievement and the USGS Outstanding Performance Award. He was the Vice President of Exploration Research for Gulf, and was the Earl F. Cook Professor, Departments of Oceanography and Geophysics, at Texas A&M University from 1986 to 2002.

Joel was an active member of the New Braunfels Lions Club and a member of multiple professional societies in the areas of geology and geophysics. His work took him all over the world, and he loved to travel.

Survivors include his two daughters, Catherine Barker of Pittsboro, NC and Victoria Pinkston of Aberdeen, NC; two sons-in-law, Bradley Barker and Robert Pinkston; one grandchild, Rebecca Watkins of Chapel Hill, NC; his brother Don and sister-in-law Carol Watkins of St. Louis, MO, his dear friend Lilly Santamaria and several nieces and nephews. Joel was a loving and beloved father, grandfather, brother, uncle and friend.

Online condolences can be left on Joel's obituary at the Lux Funeral Home website at luxfhcares.com/obituary.

Memorial donations can be made to the Texas Lions Camp at www.lionscamp.com/Memorials.html.

-Posted in the *New Braunfels Herald-Zeitung*, March 4, 2016

Government Update continued from page 49

The study found that from 70,000 to 55,000 years ago, our predominantly west-to-east weather events were dominated by south-to-north atmospheric flows, causing wetter summers and drier winters. This new paleoclimatic data will help improve the accuracy of modern climate models by providing them with known ancient conditions for improved calibration.

BLM Proposes Methane Reform to 30-Year-Old Oil and Gas Regulations

The Bureau of Land Management is proposing an update to the 30-year-old regulations for oil and gas operations on federal and Native American lands. The proposal aims to reduce the venting, flaring, and leaking of methane from the 100,000 onshore oil and gas wells on federal lands. The new regulation aims to reduce intentional and unintentional gas releases on federal lands by 50 percent and would create gradually reducing caps for methane leaks, phasing out reductions over a three year period. The reform includes requirements for replacing old infrastructure with best available technology, periodically testing for leaks, and submitting a "waste minimization plan" before a new lease can be approved.

Methane, the main constituent of natural gas, is a green house gas that is 25 times more potent than carbon dioxide. Between 2009 and 2014, 375 billion cubic feet of methane was vented, leaked, or flared by federal leases, enough to power 5.1 million homes for a year.

DOE Will Work to Craft a Strategy to Dispose of Nuclear Waste in 2016

The Department of Energy (DOE) is launching an initiative to find a long-term solution for dealing with U.S. radioactive waste and spent nuclear fuel. Based on a 2013 report from the Blue Ribbon Commission on America's Nuclear Future, their new strategy will attempt to protect public health, safety, and the environment while identifying facilities for both interim storage and long-term geologic repositories.

DOE's Office of Nuclear Energy, which received an eight percent increase in funding in the fiscal year 2016 omnibus spending bill, will oversee the initiative. Due to the shutdown of the Waste Isolation Pilot Plant (WIPP), the nation's sole geological repository for nuclear weapons waste, from a fire in 2014, the Office of Nuclear Energy has decided to focus on identifying long-term geologic repositories first. They will work with DOE's Office of Environmental Management to find a solution to the country's need for a permanent nuclear waste disposal site.

House Passes Bill Blocking Controversial Stream Rule

On January 13, 2016 the House passed H.R. 1644, legislation blocking the implementation of the controversial Office of Surface Mining Reclamation and Enforcement's (OSMRE) Stream Protection Rule.

The Stream Protection Rule, proposed last year by OSMRE, required the department to update their 30-year-old regulations governing coal mining to reflect the "current best available science and technology." The rule mandated a clear definition of material damages to streams from coal mines and required permits to identify how mining-related activities impacted ground and surface water quality. In addition, the rule required coal mine operators to collect environmental data about sites prior to mining in order to establish a baseline for evaluating environmental impacts.

While lawmakers with ties to the coal industry and mining groups opposed to the rule praise the legislation, environmental groups criticize it. The White House has threatened to veto the bill, claiming that it inhibits OSMRE and the proposed rule from strengthening water monitoring requirements and gathering environmental information. ■

HGS *Bulletin* Instructions to Authors

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

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

Figures, maps, diagrams, etc., should be digital files using Adobe Illustrator or Adobe Photoshop. Files should be saved and submitted in .ai, .eps, .tif or .jpg format. Send them as separate attachments via email or CD if they are larger than 5 MEGs each, accompanied by figure captions that include the file name of the desired image. DO NOT EMBED them into your text document; they must be sent as separate files from the text. DO NOT USE POWERPOINT, CLIP ART or Internet images (72-DPI resolution) as these do not have adequate resolution for the printed page and cannot be accepted. All digital files must have 300-DPI resolution or greater at the approximate size the figure will be printed.

Photographs may be digital or hard copy. Hard copies must be printed on glossy paper with the author's name, photo or figure number and caption on the back. Digital files must be submitted in .tif, .jpg or .eps format with 300-DPI or greater resolution at the printing size and be accompanied by figure captions that are linked by the file name of the image. The images should be submitted as individual email attachments (if less than 5 MB) or on CD or DVD.

Advertising

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

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

Website Advertising Opportunities

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

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

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

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

Application to Become a Member of the Houston Geological Society

Qualifications for Active Membership

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

Qualifications for Associate Membership (including students)

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

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

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

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

Payment method:

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

Card # _____

Expiration Date: _____ Card I.D. _____

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

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

Name: _____

Address: _____

_____

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

Email: _____

Job Title: _____

Company: _____

Company Address: _____

_____

Work Phone: _____ *Fax Number:* _____

Circle Preferred Mailing Address: Home Office

Professional Affiliations: _____

❑ AAPG member No.: _____

Professional Interest:

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

School _____

Degree _____ *Major* _____ *Year* _____

_____

School _____

Degree _____ *Major* _____ *Year* _____

Earth Science Work Experience _____

_____

_____

_____

Applicant's Signature _____ *Date* _____

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

Name: _____

Signature _____ *Date* _____

Membership Chairman _____ *HGS Secretary* _____

revised 7/30/14

Houston Petroleum Auxiliary Council News

by Shirley Gordon, HPAC-HGS Liaison

Houston Geological Society members, please ask your spouse to have a look at this article. Perhaps they will find something of interest to them. All spouses of geologists, geophysicists, petroleum engineers and landmen in good standing with their respective organizations are invited to become a member of the Houston Petroleum Auxiliary Council (HPAC). Our organization was formed in 2008. Because of the decrease in membership of each of the auxiliaries, we decided it was time to unite. It has proved to be a very good decision. Through the unification of the four entities, we have formed many new friendships in our common cause of supporting all the above professional societies.

We have had some very interesting programs this year, beginning with Brookwood's renowned bell choir at the Brookwood Community Chapel and lunch in their equally famous tea room. Then in December we were treated to our very own mini performance of "The Nutcracker Ballet" at the Houston Racquet Club. February found us at Braeburn Country Club, enjoying our longstanding tradition of "Game Day." And, for the finale to our 2015-16 programs, we will be back at the Houston Racquet Club where we will be entertained with a wonderful fashion show by "Soft Surroundings." **Sally Blackhall** and **Sara Nan Grubb** are the co-chairs for this event. Models will be from our membership which always makes it special since you can actually envision yourself in the clothes. The date of the last meeting is May 10th, 10:30 am to 1:30 pm, and will include the installation of new officers. Style shows are always fun, so put on your "Sunday" best and bring your friends.

The next-to-last meeting of the HPAC Book Club is May 2nd, in the home of **Barbara Peck**. **Mickey Murrell** will be the discussion leader, and the book to be discussed is *Dead Wake, the Last Crossing of the Lusitania* by Eric Larson. Finally, the Club has chosen *A Spool of Blue Thread* by Anne Tyler; the meeting to discuss it will be on August 1, 2016 in the home of **Kathi Hilterman**, 1324 Neeley Dr. with **Gale Vilyus** as discussion leader. The book club meets at 10:30 am.

Attention All Bridge Players: As I have mentioned in all the articles, there are two active bridge groups associated with HPAC and they would love to have you play. One meets the third Wednesday of each month at the Petroleum Club, 201 Louisiana – **Daisy Wood** in coordinates those players. Daisy can be reached at 832-581-3231. FYI, Petroleum Club parking is $15 and lunch is $30. There is also a prize fee which goes to several of the highest scores. The second group meets the second Thursday at the Westchase Marriott 2900 Briarpark, and is called "Cinco Mas." **Audrey Tompkins** coordinates this group, and can be reached at 713-686-0005. Lunch is $18 and there is a prize fee also. If you would like to play in either group, please call the coordinator. It is always a good game of bridge, and good cards make it even better.

For your enjoyment, we're sharing some pictures from this year's "Game Day" below. ■

Sally Blackhall and Donna Parrish

Incoming HPAC President Bernadine Billard with Treasurer Kathi Hilterman

HPAC 2015-16 President Norma Jean Jones, and Event Chairman Daisy Wood

You are invited to become a member of

HPAC

2015–2016 dues are $20.00 Mail dues payment along with the completed information

to **Wanda Shaw** • 1506 Haven Lock Drive • Houston, Texas 77077

YEARBOOK INFORMATION

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

Please choose a committee assignment if you are interested.

☐ Fall Event ☐ Yearbook ☐ Bridge ☐ Membership

☐ Christmas Event ☐ Spring Event ☐ Notification ☐ Book Club

☐ Exploring Houston ☐ Courtesy

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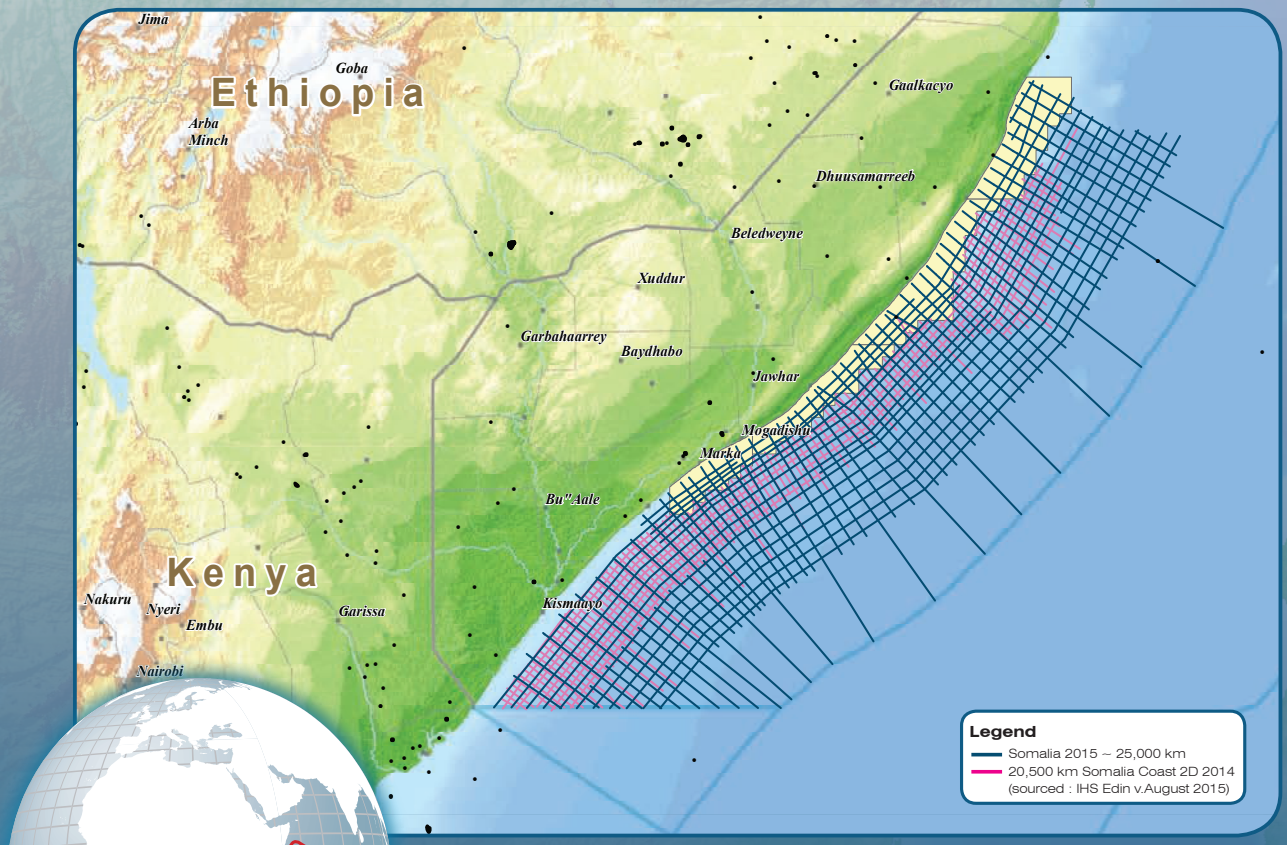
New 2D Multi-Client Seismic Unlocks Potential



During Q4 2015 Spectrum entered into a co-operation agreement with the federal government of Somalia to acquire approximately 28,000 km of modern 2D seismic. Seismic acquisition began toward the end of 2015 and completion is expected in early 2016.

The data is being acquired at depths of between 30 m – 4000 m, resulting in coverage over the shelf, slope and basin floor with dip, strike and recording time intervals suitable for defining a range of leads and prospects. Streamer lengths of 10,050 m will be used in order to adequately record information at all offsets, further assisting imaging of the underlying syn–rift geometries.

Once completed, modern processing algorithms will be applied to allow optimal imaging of the steeply dipping extensional and compressional features and illumination of subtle amplitude anomalies.

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