HGS Bulletin
Houston Geological Society
Volume 59, Number 3
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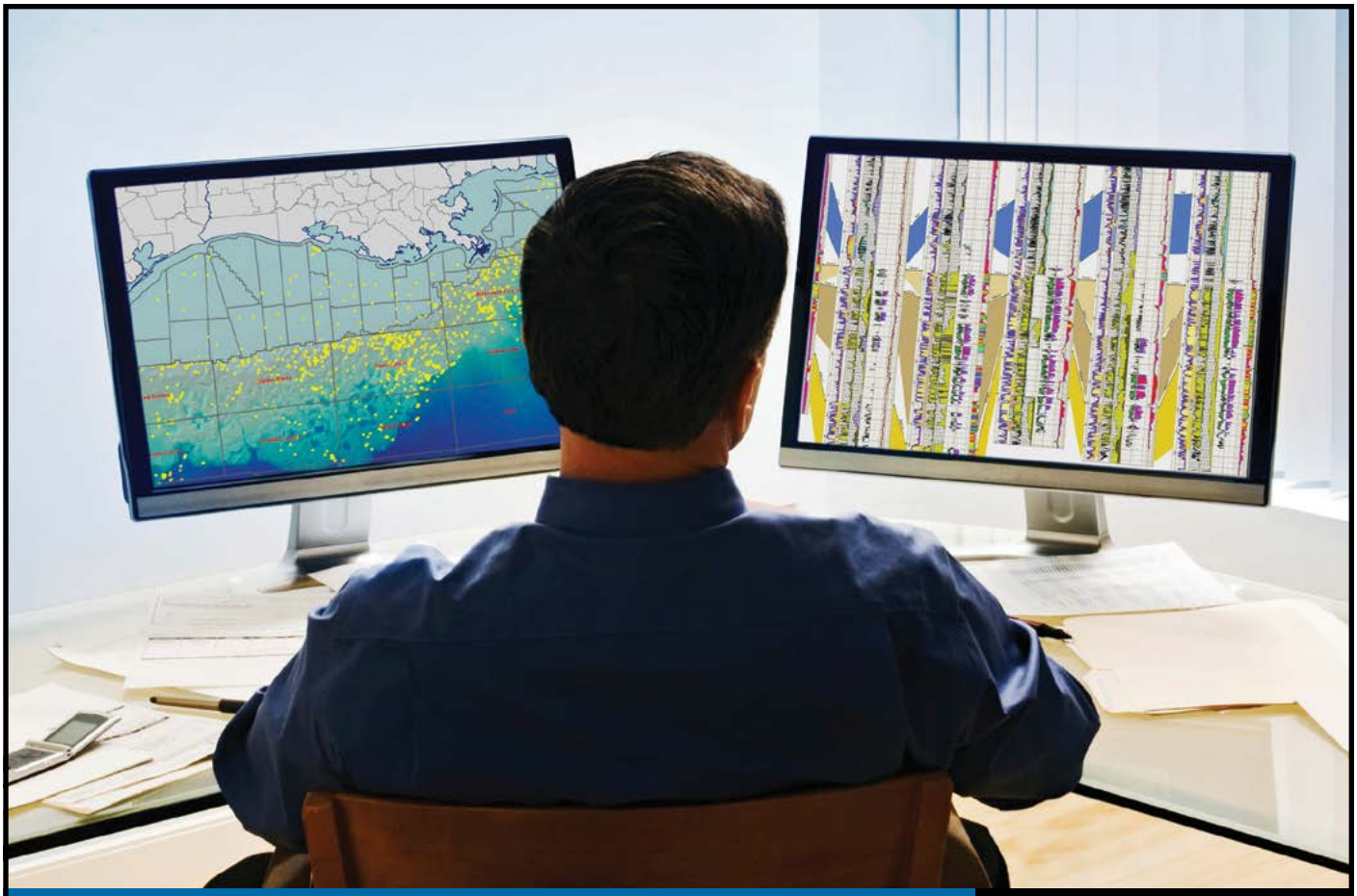

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The Bulletin
Houston Geological Society
Volume 59, Number 3 November 2016

In Every Issue

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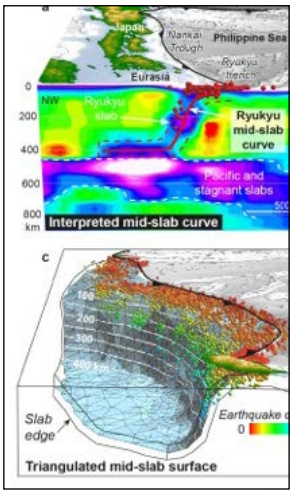
Technical Meetings

Other Features

About the Cover: Captured by NASA Mars Reconnaissance Orbiter spacecraft, on July 15, 2016 shown here are bizarre landforms in Gorgonum Basin. This basin may have contained an ancient lake, with channels draining into the lake from the sides. Image Credit: NASA/JPL-Caltech/Univ. of Arizona, 2016-07-15, http://photojournal.jpl.nasa.gov/catalog/PIA20811



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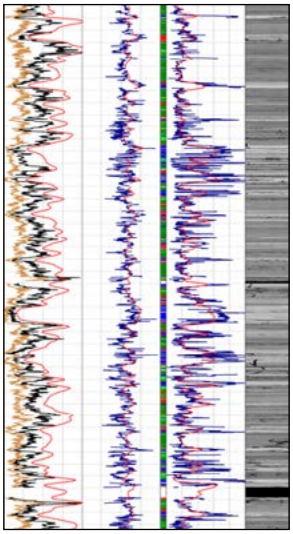

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The Houston Geological Society Continuing Education Committee Presents

Organic Petrological and Geochemical Screening Methods for the Upstream

Asking the Right Questions to Obtain the Best Possible Answers – Geoscientists, Geoscience Managers, and Engineers

A One-Day Short Course
by Thomas Gentzis, PhD & Humberto Carvajal, PhD
Core Laboratories Inc.
Friday, December 9, 2016 • 8:30 am – 5 pm

Focus: Subject matter will include introductions to the portions of both Organic Petrology and Geochemistry relevant to the screening of formations, plays and basins in the exploration for producible Hydrocarbons.

A. Organic petrology of dispersed organic matter (DOM) in unconventional rocks – An integrated approach to petroleum source-rock evaluation.

- Concepts and Definitions (Organic Petrology 101)
- Maceral Groups: - Vitrinite; - Inertinite; - Liptinite; - Zooclasts
- Classification of Dispersed Organic Matter (DOM) in Sedimentary Rocks
- Thermal Maturity Stages: - Diagenesis, - Catagensis; - Metagenesis; - Metamorphism
- Bitumen/Pyrobitumen/Oil Drops
- Organic Matter Textures and Fluorescence (UV light) Microscopy
- Organic-Rich Facies/Palynofacies
- Additive/Contaminants
- Sampling and Sample Preparation
- Microscopy Methods: - Vitrinite/Bitumen/Zooclast Reflectance (Ro) Measurements
- Correlation of VRo to other Maturity Indices; with - Organic Matter in Very Old Rocks
- Organic Petrology: - Application to Oil and Gas Exploration

B. Geochemical screening of source rocks and reservoirs

- Source-rock characterization 101: Source-rock formation; Attributes; Methods; Interpretation
- Geochemical screening of a Reservoir; Geochemical methods; Interpretation
- Recognizing pitfalls and limitations when using geochemical screening data

For a quick introduction to the subject, your attention is pointed to: http://www.petroleumgeo.blogspot.com

Pricing

Early Registration by 5 AM Friday, October 14, 2016
HGS, GSH*, SPE* members $115
Non-Member: $130

Registration: after 5 AM Friday, October 14, 2016
HGS, GSH*, SPE* members: $130
Non-Member: $145

HGS Student member: $80

HGS members affected by the downturn may call the office for special pricing.

*GSH, SPE members must call the HGS office (713) 463-9476 to register

Seating is limited to 100. Online Registration closes when Full.

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

Date: Friday, December 9, 2016 • 8:30 am – 5 pm (Doors open at 7:45 am)

Venue courtesy of Core Laboratories Inc.

Location: Core Laboratories Conference, 6323 Windfern Road, Houston, TX 77040

Registrants will receive by Email, a Map and specific directions for Entrance, Parking and Visitor check-in.

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

John Jordan
john.jordan@hgs.org

2016 PESGB-HGS Africa Conference A Houston Home Run

Wow! The 2016 PESGB-HGS Africa Conference at the Memorial City – Westin was an outstanding event with more than 300 attendees, 27 technical talks and nearly 20 posters. The Houston Geological Society again demonstrated that our volunteers can put together a quality technical conference. Many of you may not know what it takes to host and underwrite a major event like this: more than 30 people volunteered their time over the past 18 months. This does not include the hours of work put in by the HGS office staff, especially by Andrea Peoples.

The heart of a conference like this is the quality of the technical presentations. **Phil Towle**, from Anadarko, worked tirelessly on the technical program. He and his technical committee identified key activity on the African continent and then pursued the operators involved for technical talks on their discoveries. It is always inspiring to hear about exploration successes and new ideas in previously explored areas. **Elizabeth Desser** and **Donna Davis** formed the editorial committee that worked with authors and their abstracts. The technical committee also sought out the resident experts on hydrocarbon exploration across the African continent, emerging exploration concepts, hydrocarbon generation and new insight into reservoirs, traps and seals to chair the four sessions across the two-day event. I would like to thank **Joan Flinch, Ricardo Ramirez, Bill Dickson, Pratt Barndollar, Carol Law, Craig Schiefelbein, Katrina Coterill** and **Dave McLean** for their contributions as session chairs this year. Being a session chair involves more than introducing the speaker. They read, organized and decided which of the abstracts submitted were going to be part of the oral program. I would also like to thank **Patrick Loueiro** and **Onochie Okonkwo** for their hard work on the poster program. This involved getting students to submit poster abstracts and reviewing all of the professional poster abstracts. The Seismic Showcase, which debuted in London last year, was organized and chaired by **John Moran** and **Sam Loree** with help from **Larry Quandt**. This gave our exhibitors the opportunity to give a vendor oriented talk on their services. This was critical to helping a core part of the conference (our exhibitors) generate business opportunities.

It is always inspiring to hear about exploration successes and new ideas in previously explored areas.

The final part of the conference was the awards presentation. I would like to congratulate Jon Keall, Cath Norman, Peter Nicholls, Simon Horan, Thong Huynh and Igor Effimoff (FAR Limited) for their winning oral presentation Senegal-The Emergence of a Major New Hydrocarbon Province. The winning professional poster, *Refinements to Chronostratigraphy of Cretaceous Anoxic Events from the Southern South Atlantic Conjugate Margin (Falkland Segment-Africa): Comparison of Six DSDP Sites*, was submitted by Dr. Sudeep Kanungo and Dr. Eiich Setoyama (University of Utah). In addition, I would like to congratulate the student poster winners, who were all from the University of Houston. Go Coogs! Andrew Steier won first place, Rasheed Ajala was second and Kyle Reuber placed third.

Karina Chevalier, Nkechi Odumodu, and **Brad Hammel** formed the judging committee and recruited the individual judges for the posters and oral presentations. Points were given for the quality of the abstracts in addition to the presentations/posters themselves. Nkechi worked very hard to make sure that within minutes of the last oral presentation all judging forms were tabulated and the winners were identified. The judging committee purchased quality fossil and mineral specimens from Galen Threadgold at GeoInteriors for the paper, poster and "thank you" presenters' gifts.

We are presently looking for a General Chair for the 2018 Africa Conference. It is a fancy name for a very doable job if you are organized, have good industry contacts, and can commit to forming the technical committee and meeting once a month starting next April or May. The HGS office will be working on the venue contract so it is really about the conference theme and the technical program. As the 2016 General Chair of the Africa Conference, I can say that this has been a rewarding experience, seeing the event come together and receiving all of the nice comments on how much everyone enjoyed the conference. Africa is a complex and exciting continent and I believe there are more discoveries to be made there.

Society of Independent Professional Earth Scientists
SIPES Houston Continuing Education Committee 2016 CES

How to be a Successful Independent

A One-Day Symposium

Thursday, November 3, 2016 • 8 am – 5 pm

Bill Bippus, SIPES Houston CES Director, m: 281 787-0758, bbippus@terrafirmaconsulting. net

Topics:

- Legal Considerations, Contracts and Agreements for Independents
- Accounting and Financial Considerations for Independents
- Financing Your Independent Operations
- Case Histories of Successful Independents
- Closing the Deal and Developing an Acquisition

Date: Thursday, November 3, 2016 • 8:00 am – 5 pm (Doors open at 7:30 am)

Location: Live Oak Auditorium, Suite 125 (Apache Corp)
1990 Post Oak Boulevard, Houston, Texas 77056
(Post Oak 3, Galleria Area)

Registration Schedule*	**Price**
Early Bird Registration ends at 12 Noon, October 24, 2016	$100
Pre-Registration ends 12 Noon, November 2, 2016	$150
On-Site Registration	$200

Parking: $5 at the Post Oak 3 parking garage

Certificate of Attendance, Access to Download Presentations, Networking Lunch, Continental Breakfast, Coffee and Break Refreshments are included in the Registration Price.

**Seating is limited to 120 attendees, so please register early to guarantee enrollment.*

Register on the web if you are paying by credit card or PayPal:

https://sipeshouston.org/event/sipes-2016-continuing-education-seminar/

For registration questions, please call B. K. Buongiorno (713-651-1639) or email bkspee@aol.com .

Tami B. Shannon
tami.hgs@gmail.com

Field Trip to Mars

When you were a child (or even a very juvenile-minded grown-up like myself) did you ever dream of becoming an astronaut? I was thinking about this the other day – at age 8 – I couldn't get enough movies about space, or aliens, or black holes, or monoliths. Thank you, Stanley Kubrick! Part of that is due to the fact that my generation grew up just after the space race – and NASA was leading the way to the new frontier. Space exploration was possible.

Those movies seem kind of cheesy as I play them for my children now – I mean, even that wonderfully ridiculous movie, *Total Recall*, and the graphic eyeball-popping scene near the end – it is classic! Today's special effects are so much more realistic-feeling; however, there is still something in these nostalgic old flicks that inspires my soul!

Do you realize that the first people who will visit Mars are sitting in a school today?

And to hear Elon Musk (SpaceX founder) speak about his plans to land the heaviest spacecraft ever sent to Mars on the planet's surface by 2018 and build the largest rocket every built, or hear the words supersonic or retro-propulsion – well, I am in sheer awe of the human race's ability to overcome any obstacle when we work together and set our minds to it.

So when I discovered that Lockheed Martin has created a one-of-a-kind virtual reality experience (that's right, a "Group VR") with a school bus, that same giddy feeling overwhelms me. The Mars Experience Bus is the first immersive group VR vehicle ever built and it replicates the Martian landscape. Riders experience a virtual drive along the surface of the Red Planet.

The technology behind this normal-looking field trip bus is incredible. In this experience, there are no goggles and no headsets. It uses custom-built transparent windows that turn into high-definition displays to interactively display landscape and features in conjunction with the bumpy bus ride. Go 30 miles per hour on earth, you are going 30 miles per hour on Mars. Turning left on the earth – you turn left on Mars. Amazing! Check it out here: http://fieldtriptomars.com/.

The excitement of this technology has me stoked to learn more about it and find out how it could be educationally utilized in other ways. Could the technology be applied to a drilling mechanism and we could experience a field trip through an actual well system? Or what about a field trip to the bottom of a deep ocean trench? Or the top of Mount Everest?

Exploring the VR technology further, I found that Google has a version of this in an app called Google Expeditions. Students can take a field trip to virtually anywhere! It enables teachers to bring students on virtual trips to museums, underwater, and outer space. Essentially they are 360 degree panoramas and 3D images stitched together and annotated with details and points of interest. In this experience, however, you need a physical piece of hardware called a VR viewer, to get the experience.

NASA and SpaceX are so focused on the effort to physically take us to Mars that this new VR technology will allow for scientists outside of these elite organizations to study the Martian surface before we even get there.

Do you realize that the first people who will visit Mars are sitting in a school today? The first astronauts will arrive before today's kindergarteners will graduate college. We could be studying the Martian environment in great detail here on Earth in just a few years. Are you ready?

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Monday, November 7, 2016 HGS Joint International and North American **Dinner Meeting**

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

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

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

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.

John Suppe
Department of Earth and Atmospheric Sciences,
University of Houston
Houston, TX

The Robert E. Sheriff Lecture Series

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

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

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

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

The Sheriff Lecture mission is to

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

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

R.E. Sheriff Lecture:
The Second Half of Plate Tectonics: Finding the Last ~200Ma of Subducted Lithosphere and Incorporating it into Plate Reconstruction

Tomographic imaging is increasingly being used to explore the Earth from the reservoir scale to the global scale. Here we show that petroleum 3D interpretation, data integration, and restoration technologies represent powerful resources for making significant discoveries based on modern tomographic imaging. We illustrated the importance of tomographic data using examples from [1] global plate tectonics and [2] the structural geology of mountain belts.

Precise plate-tectonic reconstruction of the Earth has been constrained largely by the seafloor magnetic-anomaly record of the present oceans formed during the dispersal of the last supercontinent since ~200Ma. The corresponding world that was

lost to subduction, which accounts for ~100% of the surface area of the Earth, has been only sketchily known. We have developed methodologies, largely within a modified Gocad software environment, to map in 3D these subducted slabs of lithosphere in seismic tomography and to unfold them to the Earth surface, constraining their initial size, shapes and locations (Fig. 1). Slab edges are commonly formed at times of plate reorganization (for example bottom edges typically record initiation of subduction) such that unfolded slabs fit together in picture-puzzle fashion at times of reorganization, as we illustrate for the Nazca slab at ~80Ma and the western Pacific slabs between Kamchatka and New Zealand at ~50Ma (see Fig. 2). Mapping to date suggests that a relatively complete and decipherable record of lithosphere

HGS Joint International and North American Dinner *continued on page 10*

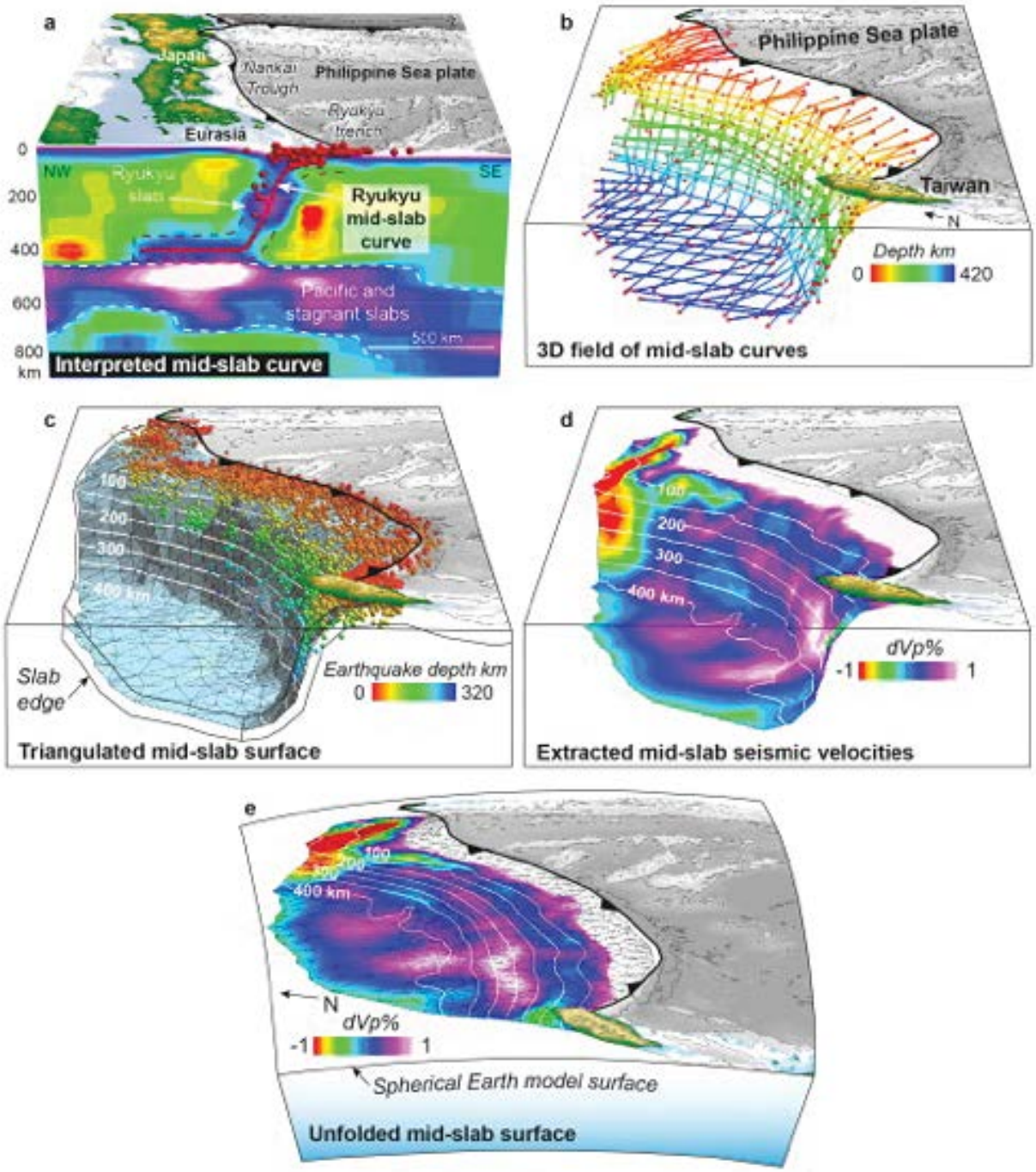


Figure 1. *3D mapping and flexural unfolding of the northern Philippine Sea plate Ryukyu slab* (after Wu et al., 2016.) Philippine Sea and East Asian platetectonics since 52 Ma constrained by new subducted slab reconstruction methods. Journal of Geophysical Research 121, 72pp. doi:10.1002/2016JBO12923

HGS Joint International and North American Dinner *continued from page 9*

subducted over the last ~200Ma may exist in the mantle today, providing a storehouse for new discoveries.

We illustrate our procedure for obtaining slab-constrained plate-tectonic models from tomography with our recent study of the Philippine Sea plate, whose motions and tectonic history have been the least known of the major plates because it has been isolated from the global plate and hotspot circuit by trenches. We mapped and unfolded 28 subducted slabs in the mantle under East Asia and Australia/Oceania to depths of ~1200km, with a subducted area of ~25% of present-day global oceanic lithosphere. We then incorporated them as constraints into a new globally-consistent plate reconstruction of the Philippine Sea and surrounding East Asia, leading to a number of new and unexpected insights, including: [1] discovery of a major (8000 km x 2500 km) set of vanished oceans that we call the East Asia Sea that existed between the Pacific and Indian Oceans, now represented by flat slabs in the lower mantle under present-day Philippine Sea, eastern Sundaland and northern Australia, [2] the Philippine Sea plate collided with the Ryukyu/SW Japan continental margin of Eurasia in arc-arc collision ~20Ma, and [3] the Philippine Sea nucleated as a small trench back-arc system along the East Asian Sea/Pacific boundary, adjacent to the Manus plume, somewhat analogous to the more recent nucleation of the Bismarck Sea at the same Manus plume.

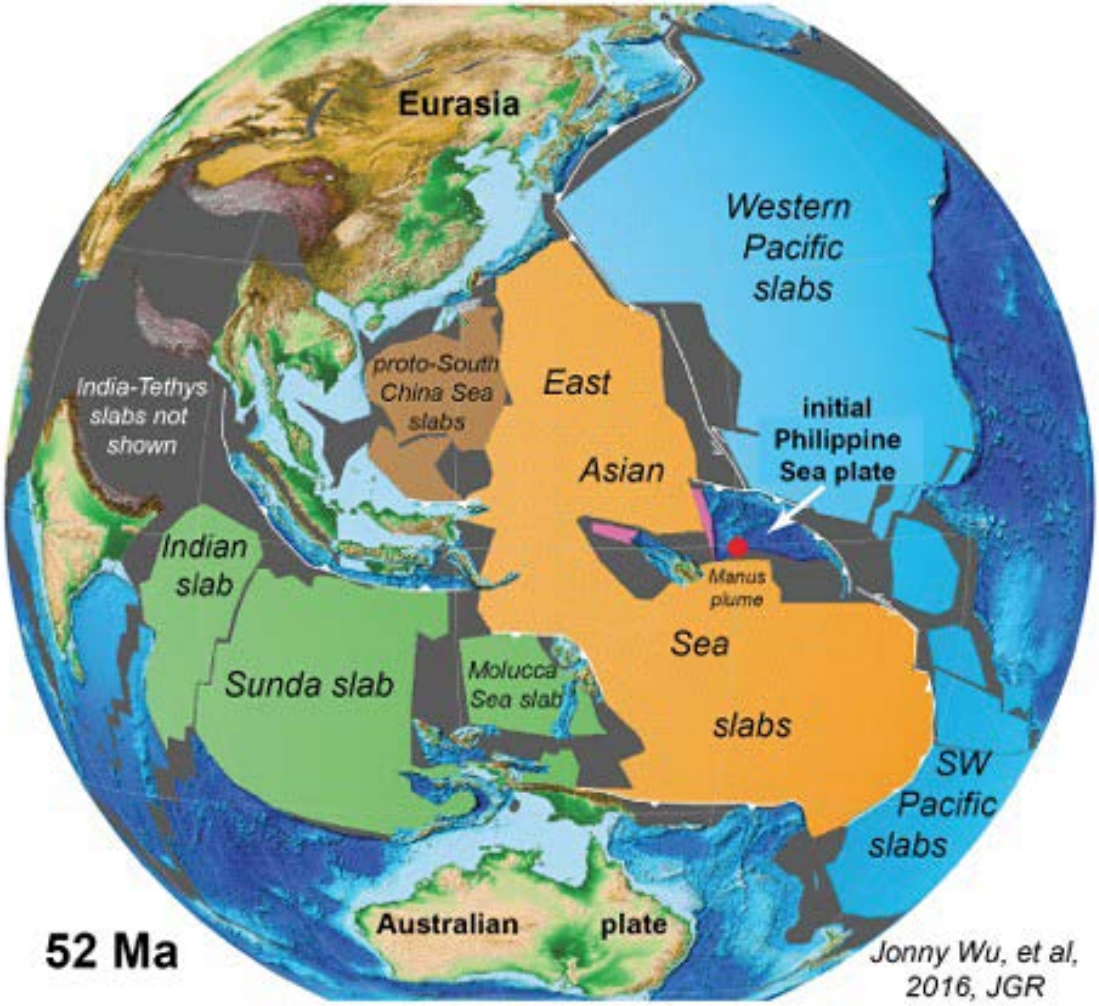


Figure 2. *The set of unfolded slabs fit together within uncertainties in picture-puzzle fashion of ~52Ma plate tectonic reorganisation, which marks the initiation of subduction of the major western Pacific slabs. The now wholly subducted East Asian Sea and South China Sea flat slabs formed a major ocean between the Pacific and Indian Oceans and Southeast Asia. The Mesozoic nucleus of the Philippine Sea plate lay near the Manus plume and the Pacific-East Asian Sea boundary.*

Tomographic images also represent a major driver of new insight into the structure and tectonics at a finer scale, for example at the scale of mountain belts, particularly when coupled with the resource of petroleum 3D interpretation, data integration, and restoration technologies. We illustrate this for the Taiwan mountain belt, which is an active arc-continent collision. Tomographic mapping has led to the discovery of deep rift and continental-margins basins underneath the Taiwan mountain belt (**Fig. 3**) and has illuminated the unexpected ways in which arc-continent collision and flipping of subduction with reversal of thrust polarity is accomplished in 4D. ■

Biographical Sketch

Dr. John Suppe is Distinguished Professor at the University of Houston Department of Earth and Atmospheric Sciences. He also currently holds the positions of Blair Distinguished Professor of Geology Emeritus at Princeton University and Distinguished Chair Professor at National Taiwan University. He earned his undergraduate degree from University of California Riverside and his PhD from Yale University in 1969. He is an expert in structural geology and global tectonics.

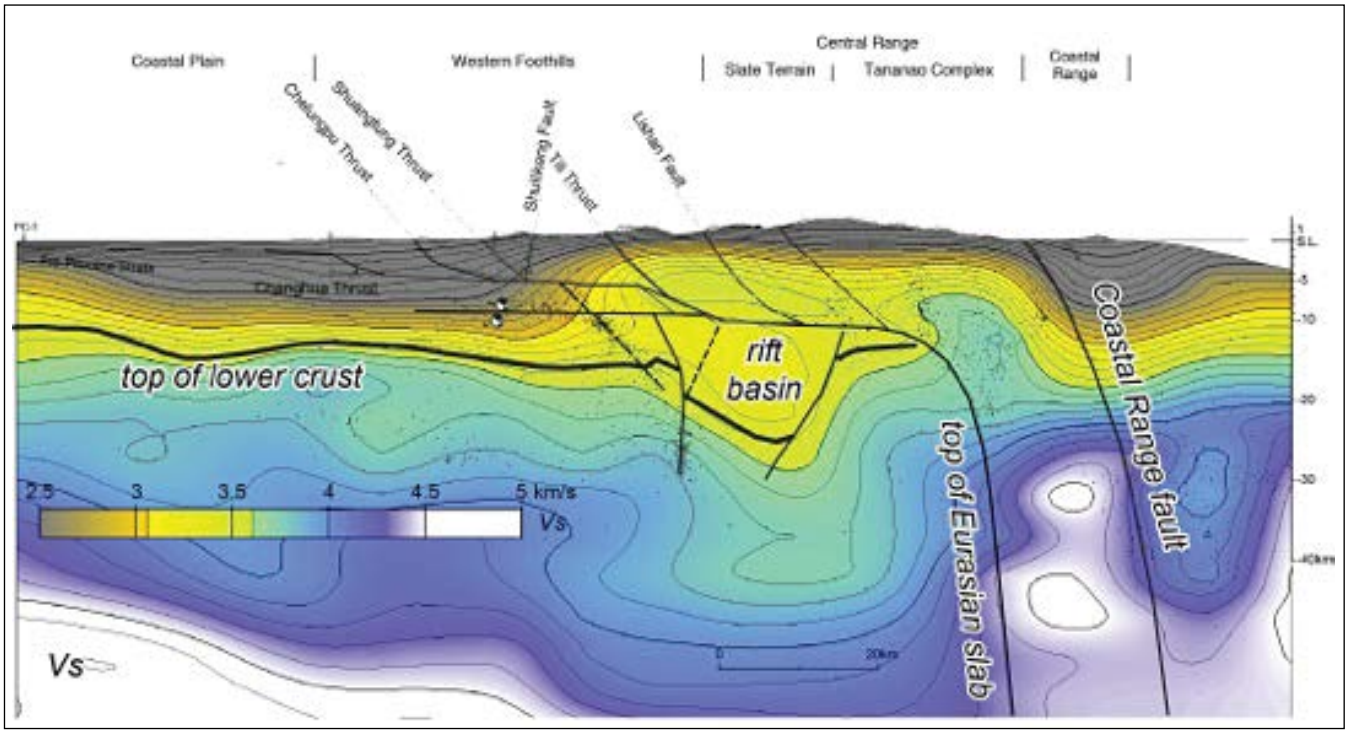
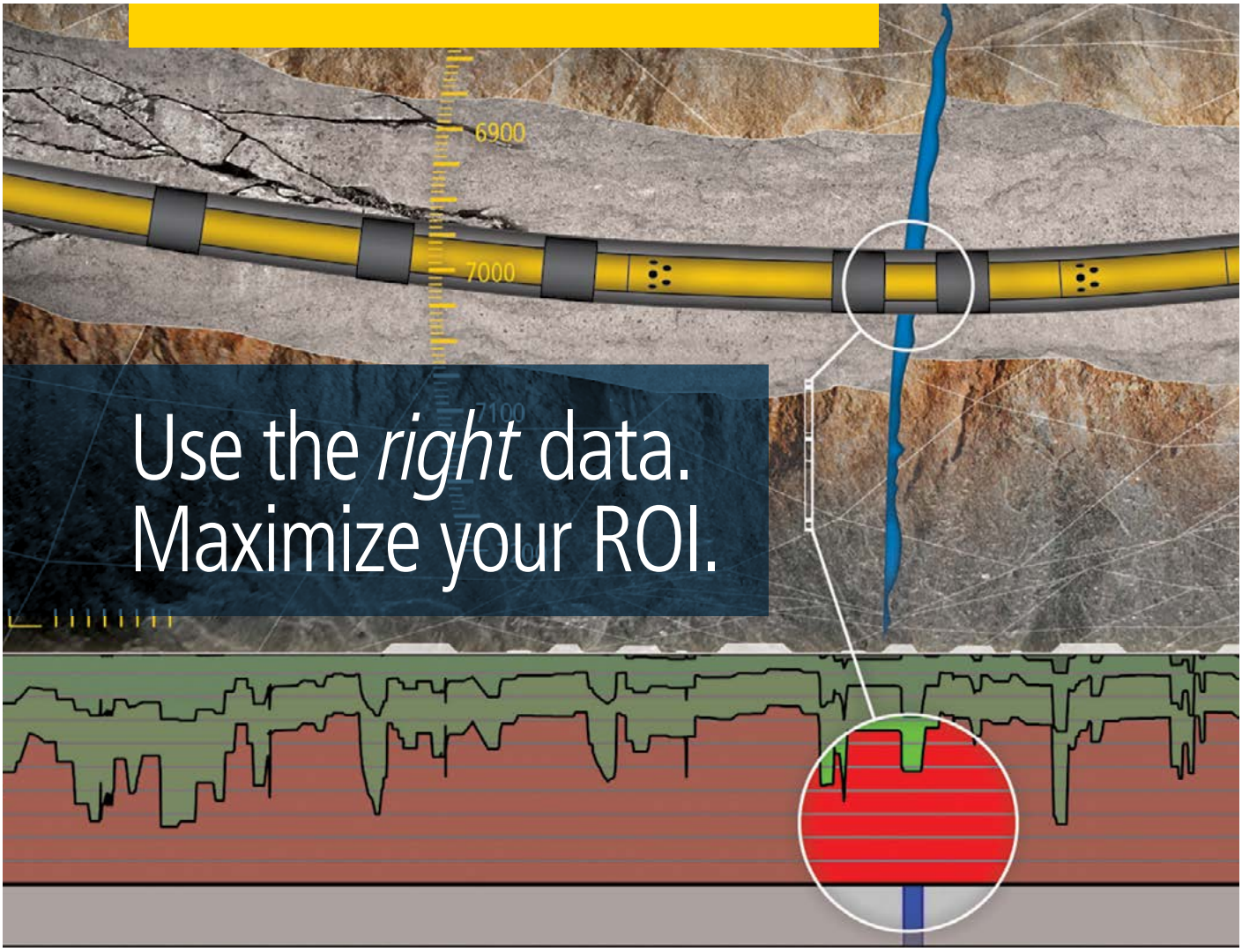


Figure 3. *Deep Paleogene rift basins of the South China shelf imaged in seismic tomography under the Taiwan mountain belt. Allochthonous fragments of these basins are exposed at the surface in the western Taiwan thrust belt. Seismic velocities and Vp/Vs indicate quartz-rich lithologies.*



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Wednesday, November 9, 2016

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

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

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

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.

Dr. Robert E. Mace
Texas Water and Development Board

ETHICS MOMENT

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

Glenn R. Lowenstein, P.G
Ethics in a Toxic Environment – a historic case discussion/analysis of the warping of ethical rules and conduct in politics and business.

Secret, Occult, and Concealed: An Overview

Before there were too many people and too many wells, Texans could do whatever they wanted with groundwater. The seminal case that laid the foundation of Texas groundwater law came in 1904 when the Texas Supreme Court put into place the Rule of Capture after a railway drained a neighbor's well (a ruling that was also seminal in oil and gas law). The Rule of Capture is, essentially, a tort law that says someone can pump as much as they want and not be held liable for damages caused by their pumping. Calls for state control of groundwater started after the Dust Bowl when water providers became concerned that agricultural pumpers were lowering the Ogallala Aquifer. The Legislature responded in 1949 by allowing the creation of groundwater conservation districts. These districts have the ability to modify the Rule of Capture by requiring well spacing or production. The Rule of Capture was further modified in the 1970s due to concerns that groundwater pumping was inducing land subsidence. The Texas Supreme Court ruled that groundwater pumpers were liable for subsidence caused by their pumping. Protecting endangered species that rely on springflow from the Edwards Aquifer has been the primary focus of groundwater litigation over the past 20 years that has, interestingly, looked toward oil and gas law for inspiration. The Texas Supreme Court decision on Day and McDaniel in 2012 established that the landowner owns the groundwater in place and that groundwater was subject to takings lawsuits. The heated debates since, debates that will surely end up in court at some point in the near future, are what extent groundwater should be managed like oil and gas. Oil and water don't mix, but oil and water law seemingly do.

HGS Environmental & Engineering Dinner *continued on page 15*

Spring Artesian Well. Houston, Texas

Fountain of Youth (Stump Well). Lake View Park, Glen Rose, Texas.

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March 7-8, 2017

Integrated Approaches of Unconventional Reservoir Assessment and Optimization

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

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- Microbiologic Components (including Volcanic Ash Diagenesis) Defining Producibility of Unconventionals
- Nanoscale Intra-Kerogen Porosity and Hydrocarbon Phase Producibility/Wettability
- Predicting Petrophysical Flow Properties Using Digital Rock Physics
- Geophysical Methods for Producibility, Fracability and GeoHazards

Day 2

- Hybird Unconventional Opportunities
- Tight/Complex Reservoirs Opportunities
- Geo-engineered Completions
- Operator Cases of Integrated Applied Geoscience for Fun and Profit

We will also feature posters highlighting university research, a multi core program supporting the oral technical program and a luncheon keynote address.

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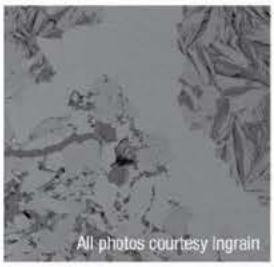
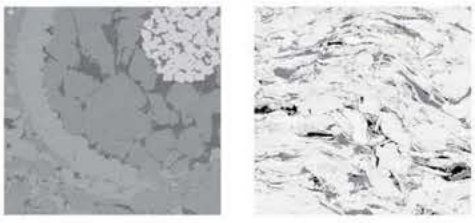
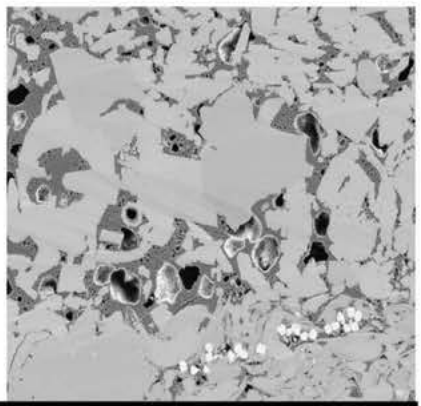






Registration Coming Soon!

For more information please visit: www.hgs.org

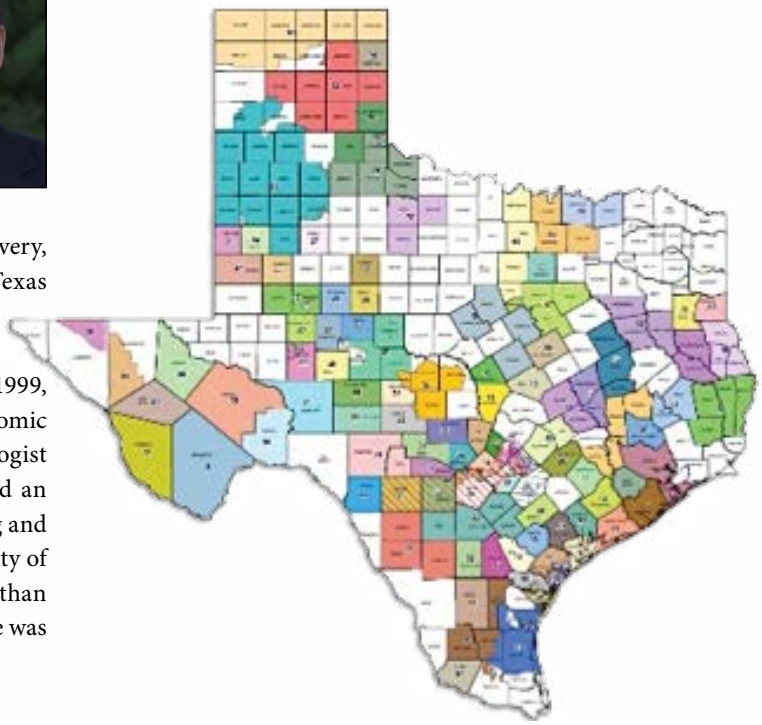
HGS Environmental & Engineering Dinner continued from page 13

Biographical Sketch

Dr. Robert E. Mace is a Deputy Executive Administrator at the Texas Water Development Board and leads the agency's Water Science & Conservation office, a department of 70 scientists, engineers, and specialists dedicated to better understanding groundwater and surface water resources; advancing water conservation and innovative water technologies such as desalination, aquifer storage and recovery, reuse, and rainwater harvesting; and better preparing Texas for floods.

Prior to joining the Texas Water Development Board in 1999, Robert worked for almost nine years at the Bureau of Economic Geology at The University of Texas at Austin as a hydrologist and research scientist. Robert has a BS in Geophysics and an MS in Hydrology from the New Mexico Institute of Mining and Technology and a PhD in Hydrogeology from The University of Texas at Austin. His residential consumption of water is less than 30 gallons per person per day (and would be lower if his wife was more cooperative).

Location of the 99 groundwater conservation districts and 2 subsidence districts in Texas (as of November 2015). The legend for the map (listing the individual districts) can be accessed at http://www.twdb.texas.gov/mapping/



E&E Group Meeting | Sept 13.
Left to Right: Laurie Long, Andrea Murray, Glenn Lowenstein, and Robert Traylor.

Monday, November 14, 2016

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

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

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

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.

Andrew S. Pepper
(asp.tips@mac.com)
This is Petroleum Systems LLC
Houston, TX, USA

Back to the Rocks: Framework of Depositional Acmes in Upper Jurassic-Mid Cretaceous Source Rocks of the Gulf of Mexico Basin and North Caribbean Margin

Great progress has been made in understanding the origin of Gulf of Mexico petroleum since the 1970's and 80's, when many geologists considered the young Tertiary reservoirs of the U.S. Gulf Coast and offshore shelf to be charged from inter-bedded and adjacent mudrocks. We now recognize that these organically lean mudrocks are not material thermogenic source rocks. Rather, considerable vertical migration has occurred from underlying 'real' Paleogene and Mesozoic source rocks (Pepper & Yu, 1995). Due to their extreme burial depth, these source beds are rarely penetrated in-situ, but rafts associated with salt canopies in the basin center occasionally present opportunities to reach Mesozoic-Paleogene stratigraphy with the drill bit, for example at the Norton prospect in the Garden Banks protraction area (e.g. Jarvie et al, 2004). A more novel organic-matter sampling method is to use bitumen dyke material intruded into the Neogene stratigraphy (Weatherl, 2007), since these bitumens represent liquified and extruded organic matter, rather than migrated petroleum fluids (Han et al, 2010).

Published source rock studies in the Gulf of Mexico typically lack details of precise age, Organofacies and the net thickness represented by the samples studied. Therefore, a 'basin-processing' effort is needed to bring sources of geologic and geochemical data together as a basis for an improved understanding. This is Petroleum Systems LLC (t!Ps™) is building a stratigraphic framework for the GoM-North Caribbean within which 'basin-processed' source rock data can be placed, so that the Source Potential (Ultimate Expellable Potential or UEP) of each source bed can eventually be mapped. This framework names each Acme of OM deposition for its absolute age in MY, which allows easy recognition of regional and even wider global correlations. These equivalences would otherwise be obscured by rapidly varying litho-stratigraphic nomenclature.

Upper Jurassic and younger Acmes recognized so far range in age from Acme 156 (late Oxfordian) to 16 (Early-Middle Miocene). Depending on the depositional and preservation mechanisms, some are developed in all paleo-water depths / depositional tracts, some are limited to areas of (paleo-) deep-water deposition, while others are more prominent on shallower water shelves.

Over an area the size of the Gulf of Mexico, significant lateral shelf-to-basin variations in Organofacies can occur (**Figure 1**;

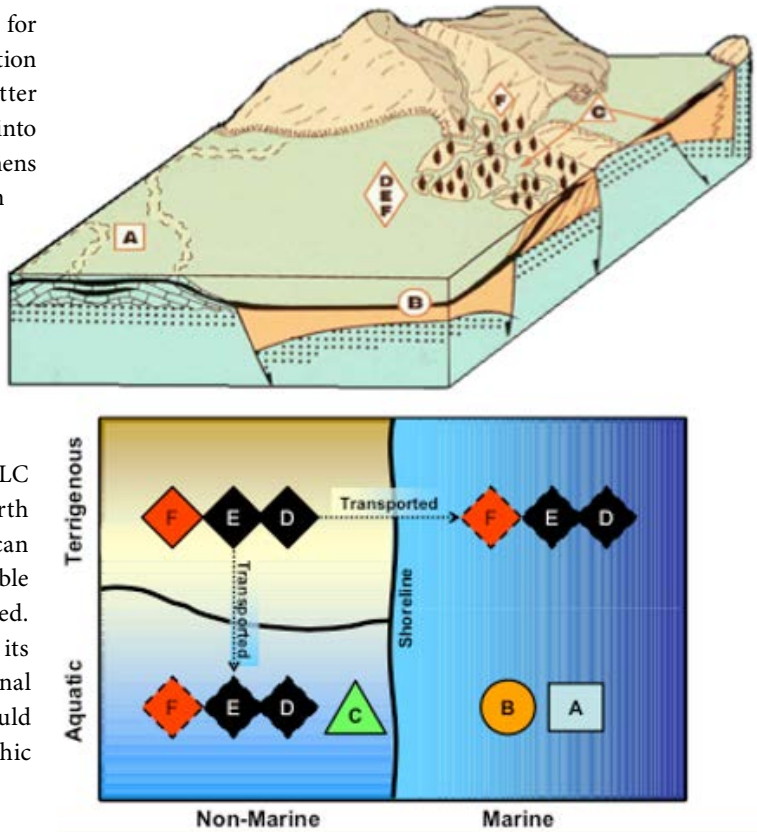


Figure 1. *The Organofacies scheme of Pepper & Corvi (1995)*

for further explanation of the Organofacies scheme see Pepper and Corvi, 1995, and Pepper, 2016a).

For example

- **Acme 148** (Tithonian) transitions from a clay-rich marine Organofacies B in the US Gulf coast to a clay-poor, carbonate-rich Organofacies Ac in the central deep-water basin and on shelves of the transform and opposing margins in Mexico. In the eastern US deep-water, seismic inversions tied to logs show the OM Acme diminishing in potential and becoming clay-rich across the Florida escarpment, pinching out beneath the present-day Florida shelf (Pepper, 2015).
- **Acme 94** (late Cenomanian-Turonian) also transitions from a clay-rich marine Organofacies B in Mississippi, Louisiana and the East Texas basin to clay-poor, carbonate-rich Organofacies Ac in the central deep-water basin and on shelves of the transform and opposing margins in Mexico. The productive Eagle Ford trend in South Texas is transitional between these two end-members.
- **Acme 57** (late Paleocene-early Eocene) ranges in facies from up-dip non-marine Organofacies D/E coal measures to clay-rich shelf and slope marine Organofacies B-D/E to pelagic basinal Organofacies B.

Historically, unable to perform direct oil-to-source correlations, most workers have attributed oil families to their source rocks using geologic arguments and extrapolations of oil chemistry from the onshore shelfal basins. This is potentially problematic, since lateral changes within an OM depositional Acme can be accompanied by changes in biomarker and isotopic signature, even when the gross Organofacies remain broadly similar. Here is an example within Acme 156:

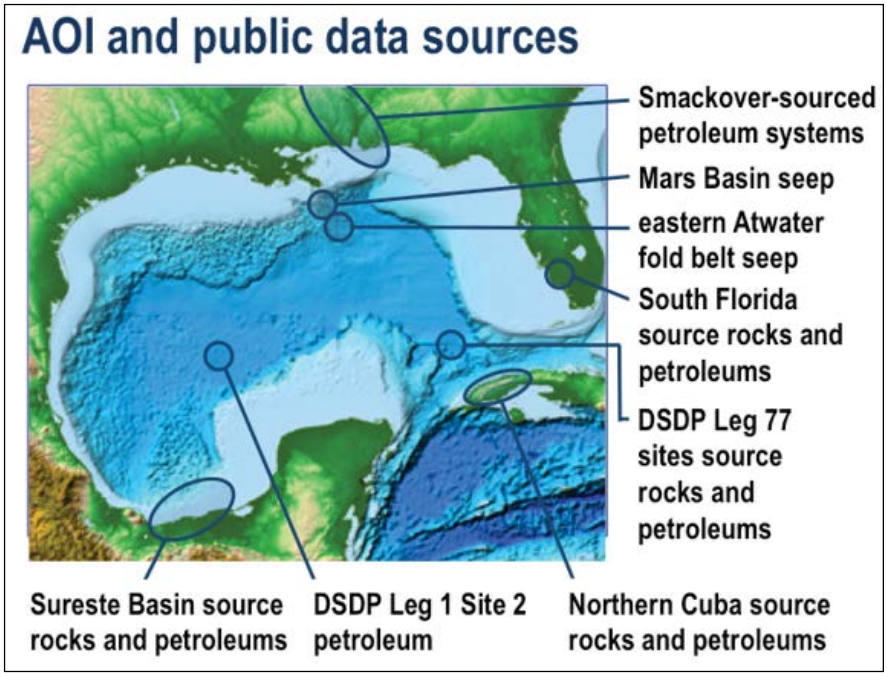


Figure 2. *Area of investigation and data sources for the analysis*

Acme 156 (late Oxfordian)

Research to-date (This Is Petroleum Systems, 2016a; (Pepper, 2016b and c) has established that the fingerprint of Acme 156-sourced seeps and shows in the present deep water basin, and Mexican and Cuban flash liquids, is quite different to the fingerprint 'typical' of this Acme in the U.S. onshore. Here, data from Sofer (1988) show the Acme 156-sourced flash liquids from northern Mississippi and southern Arkansas have a characteristic 'twin peaks' tricyclic-tetracyclic fingerprint (Pepper, 2016c). If this fingerprint were assumed to be typical of all Acme 156 source rocks in the GoM, we could incorrectly conclude that Acme 156 is the source of the dominant family of oils with the same biomarker pattern from the northern Paleo-Caribbean margin in Cuba and in the Sureste Basin of Mexico. Oil-source correlations by Pepper (2016c) based on data from Cuba and the Sureste Basin (Guzman-Vega and Mello-Rocha, 1999) show that here, the 'twin peaks' pattern is a fingerprint for Acme 148 (Tithonian)-sourced petroleum systems, not Acme 156!

It is not clear that the effects of such lateral changes in biomarker pattern have been taken into account in previous interpretations of the petroleum family distribution in the GoM. The exploration significance of the ongoing re-evaluation by t!Ps lies in understanding source rock depositional and expulsion kitchen limits in ongoing exploration play extensions. These include the ongoing exploration to extend the Acme 156-sourced petroleum system in the eastern US deep water (Appomattox and nearby discoveries); and the aspiration to extend Mexican shelfal production from the Tampico-Misantla and Sureste basins into deep water.

These initial results show that we still have much to learn about the source rock distribution in the Gulf of Mexico. The outcome of this type of Acme-mapping, on completion, will be an integrated framework of source rock deposition and potential for the entire basin that will allow the petroleum systems of the basin, including the effects of lateral changes in facies, to be understood with greater clarity.

Today's talk focuses on the Upper Jurassic to Mid-Cretaceous OM depositional Acmes, within the AOI shown in **Figure 2**.

I discuss the Ultimate Expellable Potential and the likely lateral distribution of these Acmes as a consequence of the pre- and post-140 MY spreading history of the Gulf of Mexico basin; and the impact of looking at the deep basin from the south - rather than

HGS General Dinner *continued on page 19*

HGS General Dinner continued from page 17

the north — on understanding the Petroleum Systems in US, Mexican and Cuban deep water exploration.

Back to the rocks!

Biographical Sketch

Andrew Pepper founded This is Petroleum Systems LLC 't!Ps' in September 2015.

In the field of Petroleum Systems Analysis, t!Ps aims to:

- Enable People — educate generalists, experts and leaders
- Define Direction — identify technical gaps or weaknesses and develop new Tools
- Deliver Results — perform Studies, both business and research

Andy is an innovator with over 35 years' industry experience in Petroleum E&P, across Business delivery and in Research.

As an individual contributor:

- After obtaining a 1st Class Honors degree in Geological Sciences at the University of Leeds, UK, he began his career with BP in 1981 as a Geologist in international exploration
- Given the opportunity to work in BP's Geochemistry Research Lab in the late 80's, he went on to devise models of petroleum formation that are now industry standards
- Subsequently returning to the business as a geologist as — what we would now call — a Petroleum Systems Analyst, Andy broadened his world-wide experience and reach, culminating in a role in BP's highly successful Gulf of Mexico sub-salt exploration program

As a leader:

- By 2000, Andy had defined Petroleum Systems Analysis as a new workflow and introduced the Petroleum Systems Analyst as a new team role at BP; subsequently advocating these ideas more widely in the Industry
- He continued at Hess and BHP Billiton as a functional leader in Geology and Geoscience; alternating with business roles leading US and International Exploration and New Ventures teams, both Conventional and Unconventional
- Throughout his leadership tenure, Andy has continued as a strong advocate for technical rigor in petroleum geoscience, and specifically Petroleum Systems Analysis, together with its practical application to Volume, Risk and Value assessment.

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This Is Petroleum Systems (2016b): Petroleum Systems of the Deep Water Gulf of Mexico Basin and North Caribbean Margin – Insights from the Deep Sea Drilling Program. Basin Processed Data volume BPD 01, January 2016, www.thisispetroleumsystems.com

Tuesday, November 15, 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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Bryan Guzman, Anyela Morcote, Radompon Sungkorn, Gustavo Carpio, Michael McGroarty
Ingrain Inc., Houston, TX
Michael Everts
Halliburton, Houston, TX

Applying Machine Learning to Multi-Scale Rock Imaging for Reservoir Characterization: a Wolfcamp Case Study

Digital rock analysis (DRA) embraces multi-scale rock imaging and is becoming a standard tool for reservoir characterization. One of the challenges resides in how to link together rock properties derived from such different scale of magnitude. In this paper we demonstrate that rock properties can be upscaled throughout the nano-scale to core scale by combining DRA, Machine learning (ML) techniques, and high performance computing (HPC) platforms.

The approach is based on the understanding that a rock consists of multi-scale rock fabrics intermixed spatially. Here, fabrics refer to complex visual patterns formed by distinct features which properties are extracted using mathematical models. Thus, rock fabrics are captured as groups of patterns within a digital image. These fabrics are linked with rock classes. Rock typing classification is performed on high resolution log data. It is based on simultaneous multi-dimensional cluster analysis within datasets using an appropriated ML technique.

Introduction

Machine learning (ML) has accelerated advances in many industries. ML brings together multiple disciplines such as computer science, statistics, and natural science to create algorithms that can learn from data. DRA can harness the power of ML to learn from its data, the digital image of rocks, to generate breakthroughs in the oil and gas industry. In this paper, we combine advances in DRA and ML to characterize rock samples at different scales. The framework is based on an understanding that a rock consists of multi-scale rock fabrics intermixed spatially. A rock fabric is defined as a combination of rock features. Similar rock fabrics have similar properties or follow similar property trends.

We developed ML algorithms that can automatically learn about rock fabrics and their patterns. These algorithms have the ability to build a model from data without strict instructions. Detailed discussion regarding ML can be found in Bishop, 2006 and Bengio, 2009. Examples of ML-based computer vision applications include autonomous vehicle technology, automatic tumor detection, and object recognition. Digital images produced in DRA can be also considered as data. Based on this perspective, DRA can harness the power of ML to discover and learn from its data.

Theory

Mudrocks have complex multi-scale heterogeneous features. A variety of imaging and detection techniques have been used to gain insights into rocks. Ideally, the image resolution being used should resolve all significant rock features and provide a reasonably large field of view. Imaging starts at whole core at sub-millimeter resolution to plug samples at nanometer resolution. At core scale, rock classes are obtained using continuous high resolution log data computed from dual-energy X-ray CT and spectral gamma ray.

The classification is based on an automatic identification of rock classes from log data based on multilayer machine learning. The method uses an artificial neural network method, a clustering method and a graph-base method. This classification is unsupervised. Then, it does not require a predefined number of rock classes. Also, the method chooses optimal depth locations from where plugs will be taken in order to perform further digital analysis.

Plugs from the selected locations are imaged at a relatively coarse resolution to cover a large field of view at about 250nm per pixel. Rock fabrics in this image are detected and segmented using the texture analysis method discussed in Sungkorn et al., 2015. Rock features larger than the image resolution are resolved while smaller ones are unresolved. A rock feature is considered resolved

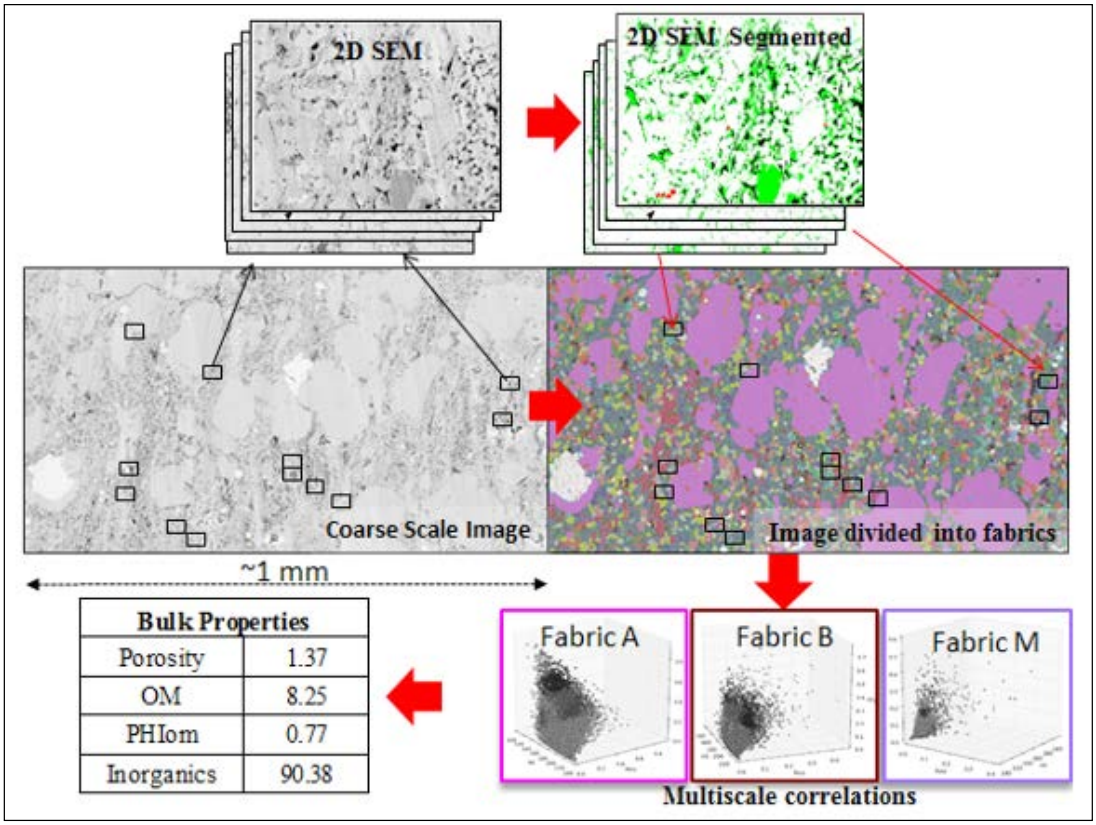


Figure 1: *Schematic diagram showing the process for upscaling rock properties from high resolution image analysis onto coarser resolution images.*

when it is represented, in every direction, by at least two pixels. Then, the unresolved rock fabrics are segmented into groups. Information concerning the unresolved rock feature is analyzed from additional images acquired at a much finer resolution and smaller field of view such as SEM. SEM images are analyzed and provide quantitative rock properties such as organic matter content and porosity. Then, these rock properties are propagated back onto the much coarser image through the identify fabrics (**Figure 1**).

Examples

The core under study is from Delaware Basin, Texas. It is a whole core, 246 ft. in length from Upper Wolfcamp formation. Whole core was CT scanned and high resolution RHOB and PEF were computed. CT volumes and images of the core were generated as well.

Also, core spectral gamma ray, uranium, thorium, and potassium, were acquired. Combining these data sets and X-ray fluorescence (XRF) data at multiple depths, we obtain fraction volumes of the main rock components such as clays, silicates, carbonates and TOC. Brittleness index (BI) is estimated based on a relationship between Young's modulus and Poisson's ratio of the composite (mineral volumes and TOC). The relationship between them is similar to that of Rickman, et al., 2008. BI is a relative quantity that describes how easy a rock should break.

HGS Northsiders Luncheon *continued on page 22*

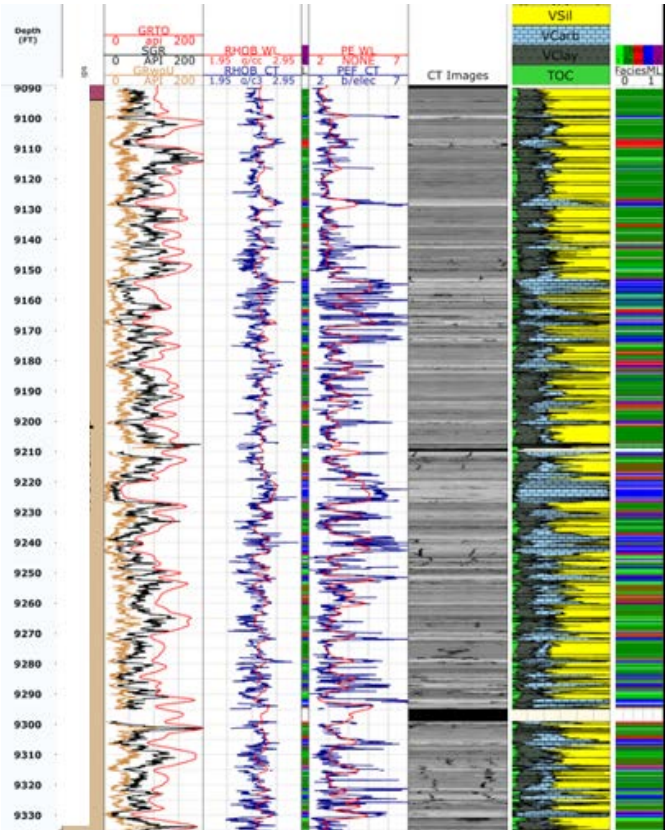


Figure 2: *Core spectral gamma ray, CT data (RHOB and PEF), CT images, interpreted mineral component, TOC content, and machine learning rock classes along the cored interval. Cored interval is 247 feet.*

HGS Northsiders Luncheon continued from page 21

With a multilayer machine learning algorithm and having as inputs high resolution mineral volumes and TOC, an automatic classification of rock classes is obtained (**Figure 2**). As a result five main rock types are identified which are represented by the following colors:

- Light Green: siliceous mudrocks with high OM content.
- Dark Green: siliceous mudrocks with low OM content.
- Red: mixed siliceous calcareous mudrocks with low OM content
- Purple: Mixed calcareous mudrocks with high OM content
- Blue: Limestones

Each rock class has distinctive mineralogical composition and TOC content, and it shows a constrained range in BI (**Figure 3**). Greater BI means the rock tends to break easier than low BI. Then, limestones are the rocks that would break easier.

For reservoir quality assessment and production, to get a good understanding of TOC and porosity distribution is a crucial step. Due to the finer scale of these properties in mudrocks, further plug digital analysis at much higher resolution is performed at multiple depths.

One of the challenges resides in the ability to upscale rock properties from high resolution images such as SEM onto coarser images. We achieve this upscaling using ML techniques based on texture analysis. Rock fabrics are detected on a coarse scale image. Then, high resolution SEM images at optimal locations are acquired and analyzed. The quantitative results of the SEM segmentation; OM, porosity, porosity associated with organics are populated back onto the coarser image. The final results of the upscaling are a map of the fabrics on the coarser image and the quantitative bulk properties for the entire coarser image (**Figure 4** and **5**).

Figure 4 corresponds to a sample from light green rock class, siliceous mudrocks with high TOC content. On the other hand **Figure 5** correspond to a sample from blue rock class; limestones. There are clear differences between the two samples not just in composition but in texture as well. The siliceous mud rock shows grains surrounded by a much finer mix of materials. The mix has varying amounts of organic matter, porosity, and clays. In contrast, the limestone sample shows coarser grains and lower mix material content.

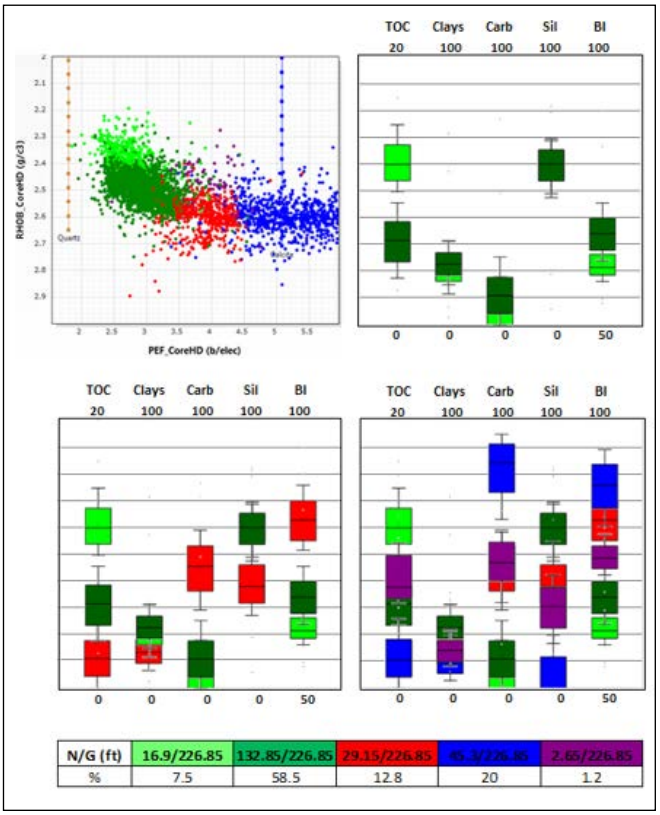


Figure 3: *Multilayer machine learning rock classes and their compositional characteristics. Also, BI associated to each class. The table at the bottom shows net to gross calculation by classes. Mineral volumes and TOC content are in volume percent.*

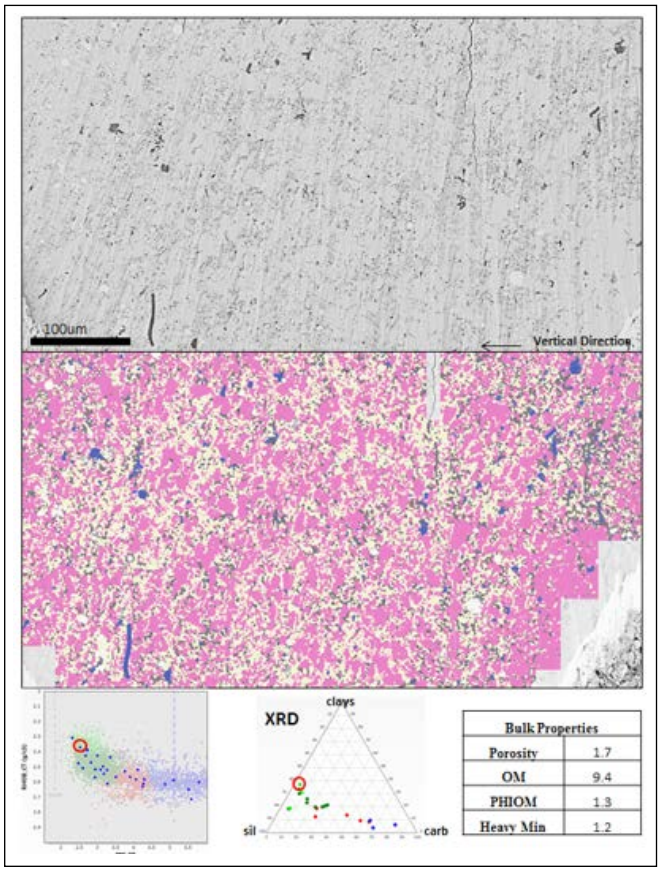


Figure 4: *Machine learning fabric segmentation and upscaled bulk properties on siliceous mudrocks with high organic matter content.*

A total of 19 plugs were upscaled using ML and DRA together. These plugs characterize the rock classes in a quantitative and qualitative sense. In **Figure 6**, track 7, red dots correspond to upscaled TOC while blue dots correspond to Leco TOC values. There is a very good agreement between both types of TOC analysis. Therefore, TOC upscaled values can be used for improving TOC computations along the cored interval

Conclusions

Machine learning methods can provide rock typing classification and upscaled reservoir properties. With the introduction of ML techniques and its ability to analyze multidimensional data, we can obtain rock types combining different sets of log data such as CT data, SGR, and their estimated properties.

DRA utilizes 2D images of rock samples to obtain petrophysical and geological properties at different scales. Thus, using ML techniques and DRA analysis together, we have the ability to propagate these properties from a very small subsample to a larger sample via fabric analysis. Results from the upscaled process have quantitative and qualitative components; therefore, they can be integrated into multiple disciplines such as petrophysical analysis and geologic interpretations. In addition, and despite of the

HGS Northsiders Luncheon *continued on page 25*

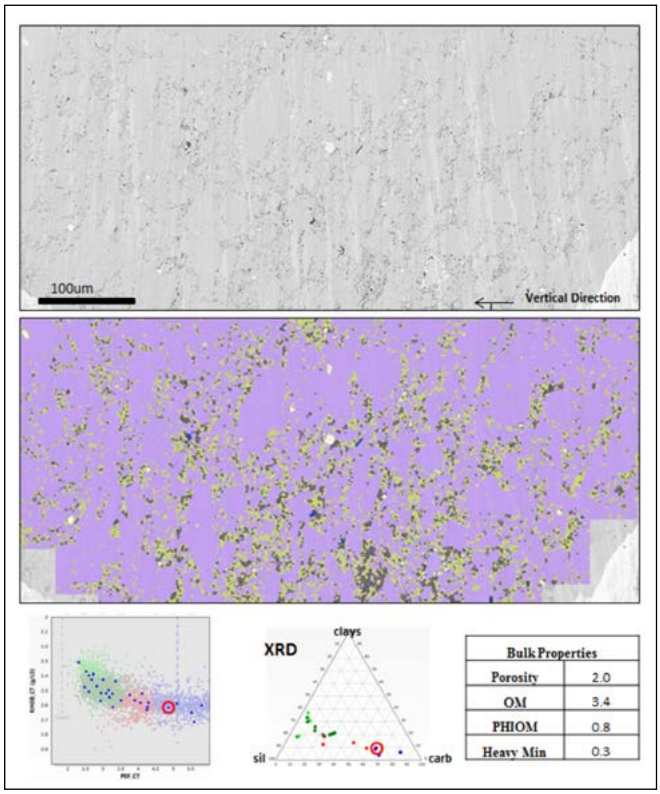


Figure 5: *Machine learning fabric segmentation and upscaled bulk properties on limestones.*

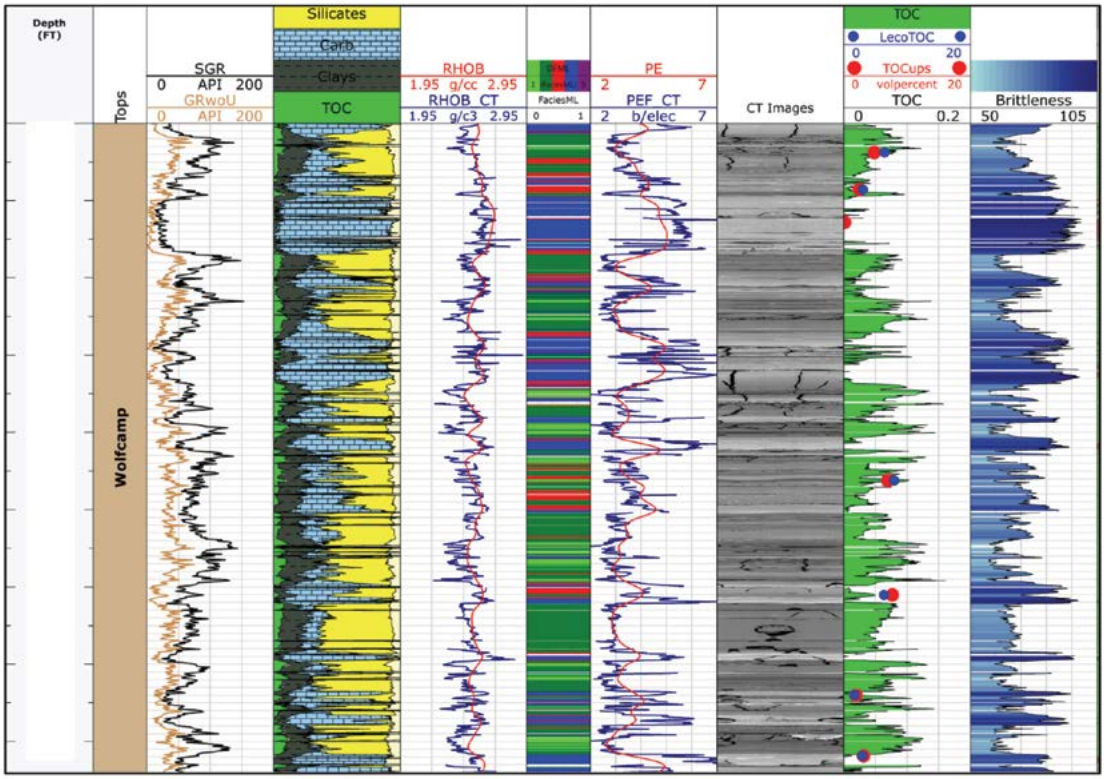


Figure 6: *Estimation of TOC along the cored interval anchored with TOC results from ML and DRA process upscaling. Red dots upscaled TOC and blue dots Leco TOC. Depth interval shown is about 80 ft.*

AAPG Education — Upcoming Education Events 2016

GEOSCIENCES TECHNOLOGY WORKSHOP

New Opportunities with Drones: New Needs, FAA Rule Changes, New Technologies

1-2 December 2016 | Houston, Texas

Commercial opportunities for drones are headed for explosive growth thanks to new technology and regulations (Rule 107) which are removing many barriers to entry and are expanding their applications. Drones are used in the oil and gas industry from upstream to downstream, and in many other industries.

But, how do you get started? Or, if you have commercial drone/Unmanned Aerial Systems (UAS) operations, how do you expand your business? Welcome to a workshop in which we will bring together experts, equipment providers, robotics experts, and others knowledgeable in a wide range of commercial drone usage, which includes monitoring in the oil industry, digital outcrop surveying, safety and security monitoring, utility inspection, real estate, agriculture, construction, environmental protection, and more.

Deepwater and Shelf Reservoirs: New Technologies for New Understanding

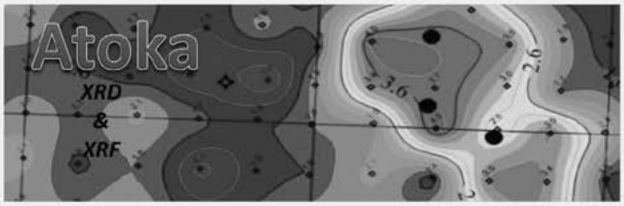
24-25 January 2017 | Houston, Texas

The goal of this event is to bring together new technologies and developments in both exploring for new frontiers and developing known provinces in both deepwater and shelf environments. The event brings together geology, geochemistry, engineering, and geophysics.

SHORT COURSES

Use of Surface Geochemistry in Petroleum Exploration

29 November 2016 | Houston, Texas



This course will present a one day discussion of the use of surface geochemistry in petroleum exploration for conventional production. Topics will include theory of vertical migration, optimal sampling methods, caveats, statistical analysis of data, radiometrics, iodine, soil gas, petroleum fluorescence, microbial, XRF and trace metals to locate areas of micro-seepage. Several case histories integrated with seismic and subsurface geology both domestically and internationally.

Working with Drone Data 101

30 November 2016 | Houston, Texas

In this course participants will learn about the types of data that can be acquired by drones, render that data into 3D models, orthomosaic and NDVI maps, and import the rendered data into business platforms such as ArcGIS, Google Earth and SketchFAB. This is an interactive course where students are encouraged to bring their own drone data problems.

FIELD SEMINAR

Astrogeology Total Solar Eclipse 2017 Field Seminar

18-22 August 2017 | Casper, Wyoming

We will be in Casper, Wyoming to see the rare total solar eclipse of August 21, 2017, learn basic astronomy through presentations and star gazing, and do field geology at world class paleontology sites and a documented terrestrial impact site. Casper is also home to historic petroleum geology sites such as nearby Teapot Dome. Jack Schmitt and Jim Reilly will be at the eclipse event to discuss the challenges of a manned mission to Mars and a return to the Moon to embark on a new energy frontier with He-3 fusion.

www.aapg.org/career/training/

HGS Northsiders Luncheon continued from page 23

unsupervised nature of ML, our methodology allows experts to integrate their knowledge into the analysis to increase benefits.

References

Bengio, Y., "Learning deep architectures for AI," Foundations and Trends in Machine Learning, 2009. 1, pp. 1-127.

Bishop, C.M., Pattern Recognition and Machine Learning, Springer, Cambridge U.K., 2006.

Rickman, Rick, Mike Mullen, et al., A practical use of shale petrophysics for stimulation design optimization: all shale plays are not clones of the Barnett shale, SPE Annual Technical Conference and Exhibition, Denver, CO, 2008, SPE 115258.

Sungkorn, et al., Multi-scale and upscaling of digital rock physics with a machine that can learn about Rocks. Society of Core Analysis International Symposium 2015, SCA2015-A050.

Biographical Sketch

Bryan Guzman received his BS in Geology from the University of Texas at San Antonio in 2008. He joined Ingrain Inc. as a Geologist where he was an integral part of the company's validation period that lead to the commercial launch of Ingrain's product line. Since joining Ingrain he has worked on Digital Rock Analysis (DRA) within both complex conventional and unconventional resource plays.

For two years he coordinated the development and application of DRA for shale drill cuttings where data is being utilized to make near real time decisions. Presently, he is focused on the development of DRA applications for reserve estimations within various unconventional resource plays.

He has over 7 years' experience in the utilization of DRA with patents on rock sample preparation methods involving micro computed tomography (Micro-CT) and drill cuttings methods.

GSH – Potential Fields SIG Meeting

Thursday, November 17, 2016

Location: HESS Club (Houston Engr. & Science Society)
5430 Westheimer, Houston, TX 77056

Dinner meeting timings::
5:30 Registration / Cash Bar
6:30 Dinner Served
7:30 Presentation Begins
8:30 Adjourn

Registration Schedule

Pre-Registered	Late/Walk-Up	
Member	$30	$40
Non-Member	$35	$45
Student Member	$15	$25

Using Gravity to Determine Basement Geology between the Mid-Continent Rift (MCR) and the Southern Oklahoma Aulacogen (SOA)

In this study, the upper crystalline basement lies between the basement topography and 16 km below mean sea level. The residual gravity anomaly of the upper basement is estimated by stripping the gravity effects of known and geologically consistent 3D model density distributions of known and expected geologies above and below the upper crystalline basement. Modeling the geology as piecewise continuous density distributions allows me to model 100 square degrees of mapped and expected surface and subsurface geologies from the topographic surface to 100 km below sea level. Then inverting these expected density distributions I minimize the misfit between the observed and estimated free-air gravity. This residual free-air anomaly reflects the density distribution in the upper basement.

The observed gravity data are 3D free-air gravity point data collected at unique spatial locations and times, and the free-air gravity measures the gravity effect of the Earth's unique 3D density distribution. Modeling the Earth's 3D density distribution consist of representative 3D geology models containing observed, expected, and geologically consistent 3D formation and lithology boundaries. Then using lithology to density relationships, I build an expected 3D density distribution. The gravity effect of the model 3D density distribution is calculated at each 3D gravity data point using SIGMA, a recently developed gravity and gravity gradiometry algorithm.

Then, using a geologically and statistically constrained density inversion, the expected density model is adjusted to minimize the misfit between the observed and estimated free-air gravity. The residual free-air anomaly, RFAA, represents the basement geology mass distribution and indicates a complex basement geology and geologic structure that appear to be consistent with earthquake seismicity and thermal maturity sources as reflected in the Woodford Shale vitrinite reflectance data.

Speaker Biography

Kevin Crain earned his BS in geophysics from New Mexico Institute of Mining and Technology and his MS and PhD in Geosciences from The University of Texas at El Paso. His research interest have focused on atmospheric electric-field studies, then later studying surface wave and ultrasonic non-destructive test techniques of geomedia, as well as 3D gravity modeling for minerals, and petroleum exploration. Currently he is working as a Research Scientist for the Oklahoma Geological Survey focusing on 3D gravity modeling associated with Oklahoma earthquakes.

Wednesday, November 30, 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.

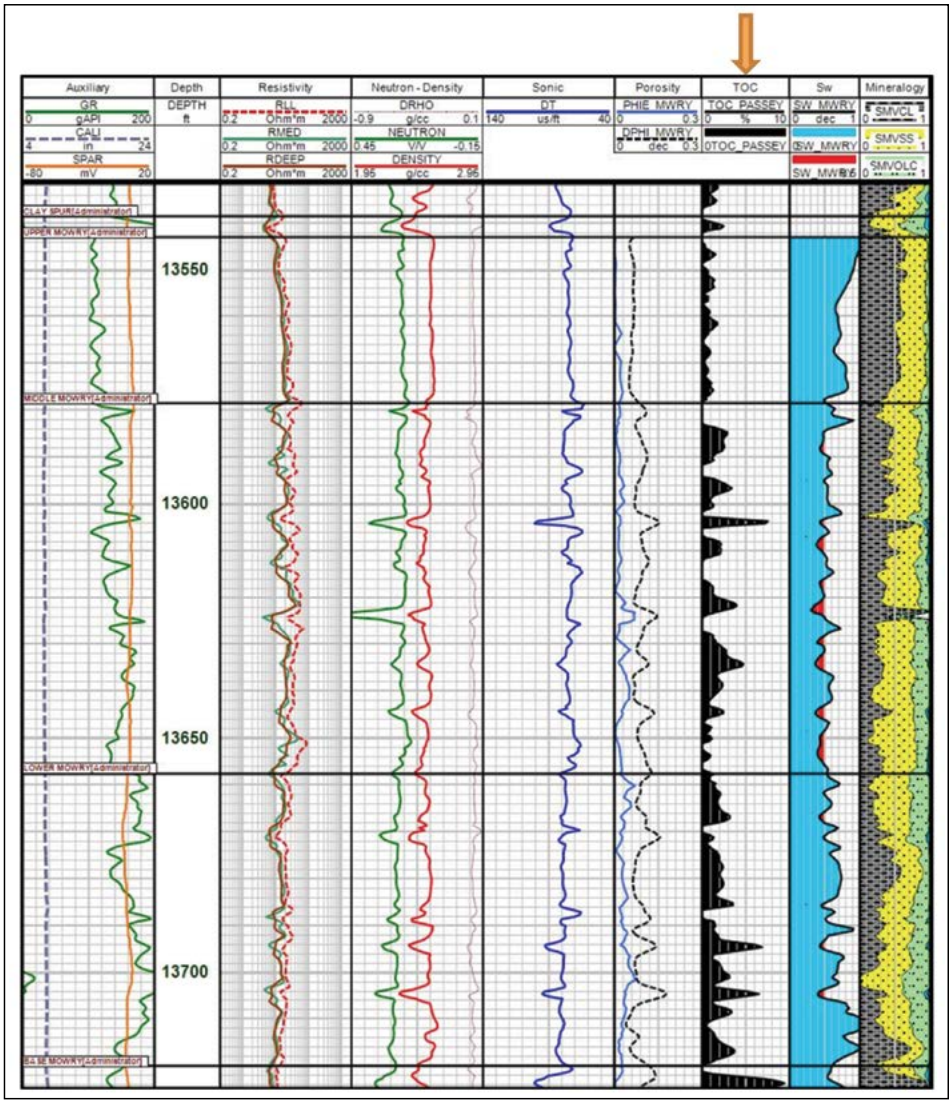
Dr. Ceri Davies and Ronald Kenny
CGG GeoConsulting
ceri.davies@cgg.com
Ronald.kenny@cgg.com

Using Palynology and Petrophysics to Delineate the Key Components of Your Reservoir – A Powder River Basin Example

Advances in engineering techniques have re-stimulated interest in some of North America's great hydrocarbon producing basins. Whilst the basins have been extensively mapped, drilled and discussed, the success of future drilling campaigns lies in the detail of these complex systems. The Powder River Basin (PRB) contains a number of stacked plays, each varying in their capacity and complexity. Intra-play heterogeneities only serve to compound this complexity, with micron scale observations impacting regional scale completion programs.

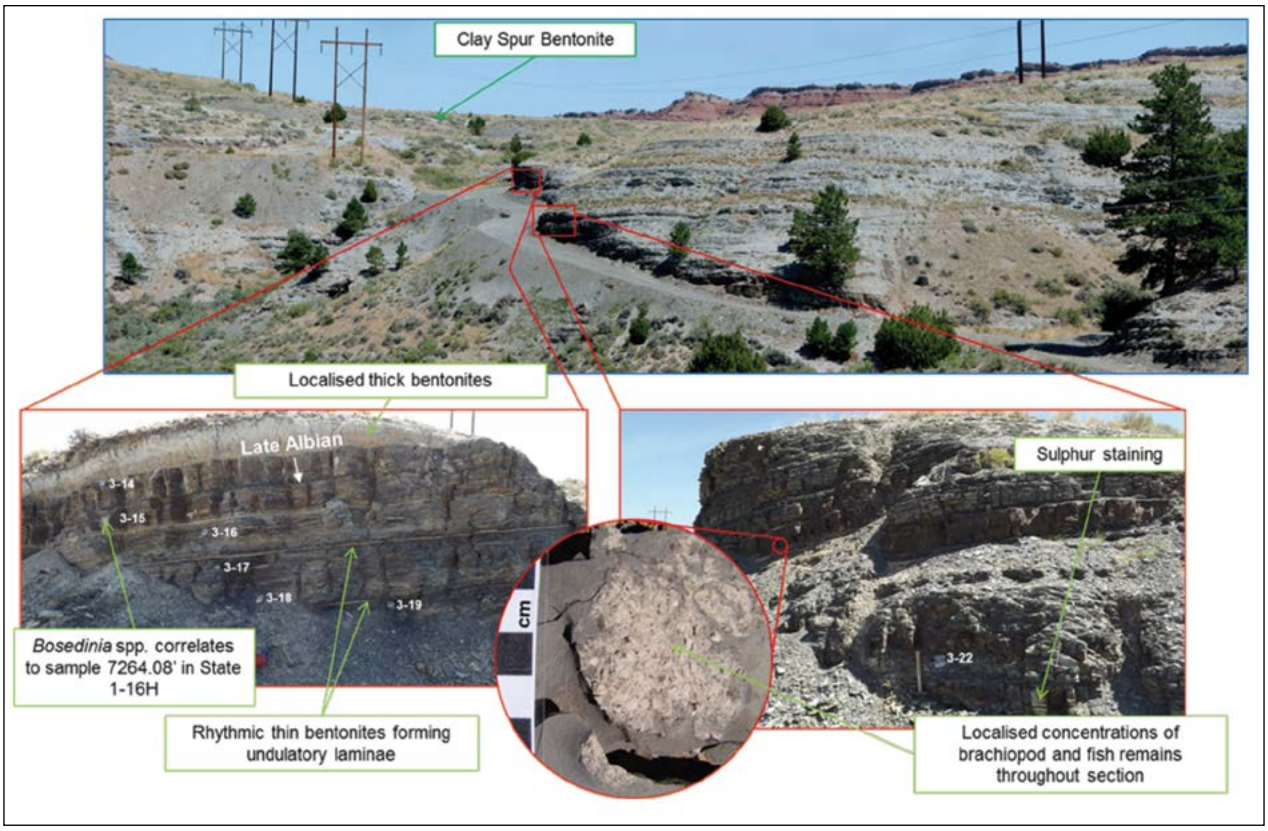
The strata of the Early to Mid-Cretaceous of the PRB reflect the periodic high- and low-stand episodes of the Cretaceous Western Interior Seaway. During this time, varying volumes of water and sediment infiltrated the basin and admixed with the seaway resulting in a series of interbedded marine and terrestrial-dominated silts, muds and sands. Typically these sediments are well preserved as thick successions of stacked plays. The connectivity of these units has delivered the conventionally prosperous Frontier and Muddy sandstone reservoirs, fed by the adjacent Belle Fourche and Mowry shale source rocks.

HGS General Luncheon *continued on page 28*



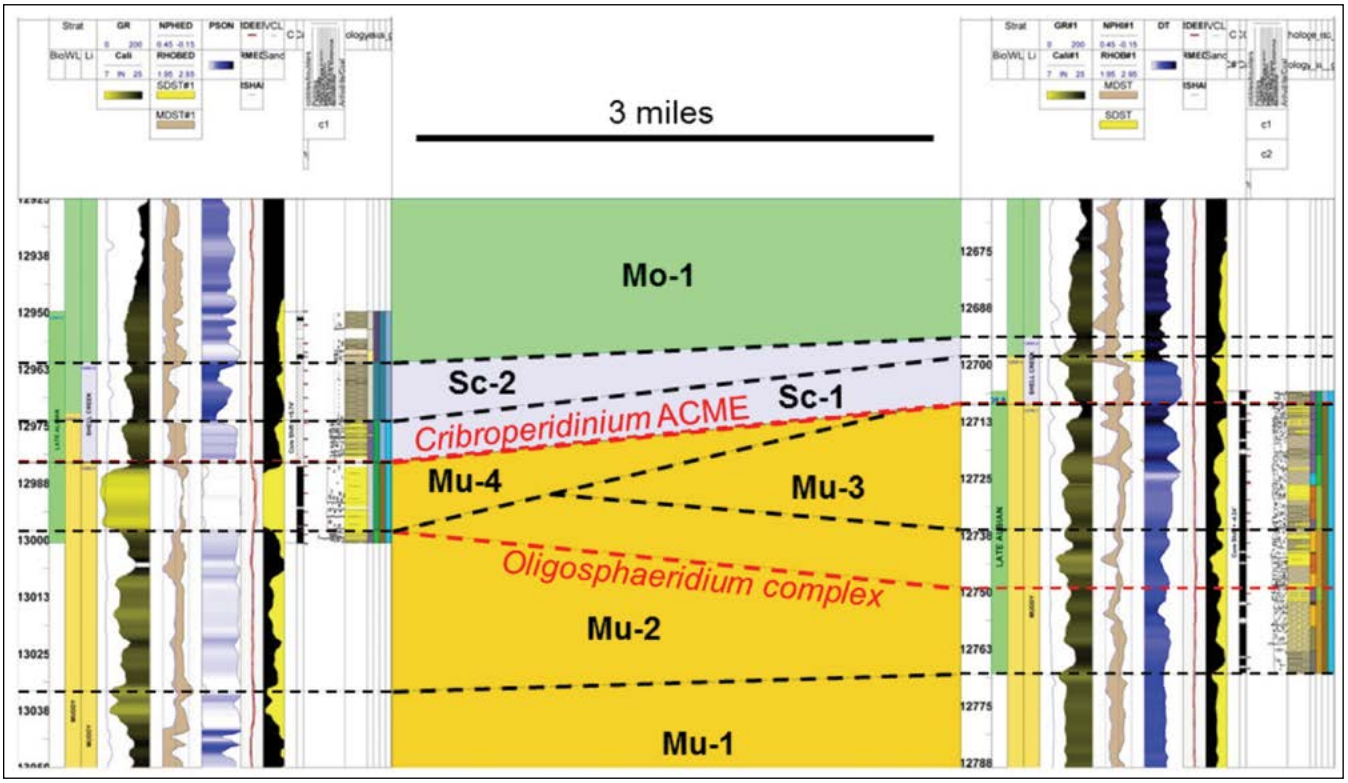
A sample log section of all Mowry units with petrophysical analysis. Note in the TOC Column, the net increase of TOC down-section and low water saturation in the Middle Mowry. SW is shaded red below 50%. Image Provided Courtesy of CGG GeoConsulting

HGS General Luncheon continued from page 27



Field observations from the Middle Mowry. Jurassic red-beds are visible in the background. Image Provided Courtesy of CGG GeoConsulting

'Wyomingia elongata' – Robertson in house marker taxon.
Description: Superficially appears bisaccate. Affinity uncertain. The terminal 'pads' lack infrastructure or ornament, but some North Caspian specimens display longditudinal ribs/folds which originate on the body and extend almost the entire distance across the 'pad'. Body ornament highly variable, may be smooth, scabrate or strongly reticulate, the latter sometimes with densely distributed grana in the lumina. Image Provided Courtesy of CGG GeoConsulting



Section between two wells showing distinct lithological differences that can be easily defined by palynology and petrophysics. Image Provided Courtesy of CGG GeoConsulting

Here, we analyze the evolution of the PRB during the Early to Mid-Cretaceous and its representation in a variety of media accessible in the present day – outcrop, core, wireline log and seismic data. Through combining these observations and interpretations, we qualify and quantify key stratigraphic members within the Cretaceous, their distribution, and the residual impression syn- and post-depositional events had on their constituents.

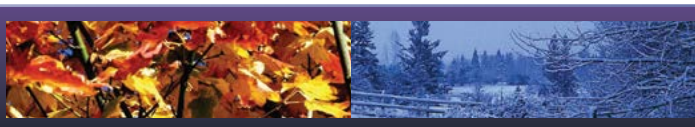
Biographical Sketch

Ronald Kenny received his B.S. in geology from Boston College in 2010, and joined Baker Hughes as a Geoscientist that same year. He later worked with Weatherford's Petroleum Consulting group, before joining Fugro-Jason, a division of CGG, in 2013. At CGG, Ron is a Petrophysicist in the CGG GeoConsulting Group where he provides petrophysical interpretation and rock physics modeling for inversion projects, as well as geological insight into subsurface analyses projects.

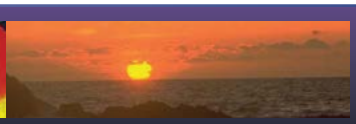
His experience includes the integration and upscaling of geological and petrophysical properties to seismic attributes. Ron has consulted with major companies to assist in geological evaluation, production optimization, and exploration in North & South America, North Sea, Caspian, and Asia-Pacific. He also has significant experience in the US Shale plays and is currently working on rock physics analysis in the Powder River Basin and the Eagle Ford Shale.

Mr. Kenny presented his first paper in August at URTeC 2016 in San Antonio, and has a published article in EAGE's *First Break* publication. He is a member of AAPG, and is an active participant in both SPWLA and HGS.

November 2016



Sunday	Monday	Tuesday	Wednesday
	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	1 **HGS Board Meeting** *6 p.m.*	2
6	7 **HGS Joint International and North American Dinner Meeting** *The Robert E. Sheriff Lecture Series* *"The Second Half of Plate Tectonics: Finding the Last ~200Ma of Subducted Lithosphere and Incorporating it into Plate Reconstruction," John Suppe,* *Page 8*	8	9 **HGS Environmental & Engineering Dinner Meeting** *"Secret, Occult, and Concealed: An Overview," Dr. Robert E. Mace* *Page 13*
13	14 **HGS General Dinner Meeting** *"Back to the Rocks: Framework of Depositional Acmes in Upper Jurassic-Mid Cretaceous Source Rocks of the Gulf of Mexico Basin and North Caribbean Margin," Andrew S. Pepper* *Page 16*	15 **November 2016 Bulletin** **CONTENT DUE** **HGS Northsiders Luncheon Meeting** *"Applying Machine Learning to Multi-Scale Rock Imaging for Reservoir Characterization: a Wolfcamp Case Study," Bryan Guzman* *Page 20*	16
20	21	22	23
27	28	29	30 **HGS General Luncheon Meeting** *"Using Palynology and Petrophysics to Delineate the Key Components of Your Reservoir – A Powder River Basin Example," Dr. Ceri Davies and Ronald Kenny, Page 27*

GeoEvents

Thursday Friday Saturday

3 **SIPES Houston Continuing Education One Day Symposium** *"How to be a Successful Independent" Apache Corp, Houston, TX Page 6*	**4** **Don't wait, make your reservations online at hgs.org**	**5**
10	**11**	**12**
17 **GSH Potential Fields SIG Meeting** *"Using Gravity to Determine Basement Geology between the Mid-Continent Rift (MCR) and the Southern Oklahoma Aulacogen (SOA)," Kevin Crain Page 26*	**18**	**19**
24 Thanksgiving Day **HGS Office Closed**	**25** **HGS Office Closed**	**26**

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

December 1-2, 2016
AAPG Geosciences Technology Workshop
New Opportunities with Drones: New Needs, FAA Rule Changes, New Technologies,
Houston, TX

December 9, 2016
HGS Continuing Education One Day Course
Organic Petrological and Geochemical Screening Methods for the Upstream
Core Laboratories Conference,
Houston, TX

January 24-25, 2017
AAPG Geosciences Technology Workshop
Deepwater and Shelf Reservoirs: New Technologies for New Understanding,
Houston, TX

March 7-8, 2017
HGS Applied Geoscience Conference

April 2-5, 2017
AAPG
ACE Annual Convention & Exhibition
Houston, TX

The Seapex Exploration Conference

SEC2017

For the Industry : By the Industry

Early Bird Registration 1 July onwards **SGD950**

SEC2017 will be held 26th-28th April 2017 at Fairmont Hotel, Singapore

Registration Open !

Early Bird Delegate Fees: SGD950 (Normal SGD1400)

- Three days of discussions, technical sessions and case studies from across Asia-Pacific disseminating critical upstream knowledge
- First-rate networking opportunities and promotion of investment in the region
- Ice breaker, Quiznight, Pubnight
- Exhibition, Farmout Forum
- Technical Courses, Golf

Technical Programme Sessions:
Asia-Pacific/Industry Focused Keynotes.
Exploration and development themed sessions covering:

- Myanmar and the Bay of Bengal
- PNG
- Malaysia
- Indonesia (including Unconventionals)
- Vietnam and Philippines
- Australia and New Zealand
- Thailand and Cambodia
- North East Asia

Sponsorship Opportunities Are Available!!

Higher level, prestigious sponsorships; Lanyard; Social Events; etc
Move fast. These will go!!!

Lower Level sponsorships: SGD7500 (US$5000; GBP3750) gets signage, and a booth (on a first come first served basis). An affordable bargain!

Visit: http://www.seapexconf.org/ and click on sponsorship, or
Contact **Andy Kitts** (andyoilandgas@gmail.com) or **Judy Foong** (judy.foong@seapex.org)

or talk to a Committee Member
Farmout Forum booths - 18 available. Release end of the year

www.seapexconf.org

July 28, 2016

Mr. Larry Quandt
Houston Geological Society
14811 St. Mary's Lane, #250
Houston, TX 77079

Dear Larry:

Our sincere thanks to the Houston Geological Society for its recent gift to the Fossil Discovery Fellowship Program. We appreciate your enthusiasm for the Park and your support of Big Bend Conservancy, as well as your patience in getting all the particulars set up to make this work correctly within the scope of a federal partnership. Both fellows are delightful, enthusiastic and a great help in preparing this exhibit for the public. Our Park Geologist Don Corrick could not be more pleased with them.

As you already know, Big Bend Conservancy was established in 1996 "to support, promote, and raise funds for Big Bend National Park and the Rio Grande Wild and Scenic River in partnership with the National Park Service."

Since 1997 Big Bend Conservancy has donated over $3.2 Million to Big Bend National Park. We are proud to have established a Trails Endowment with proceeds from the Big Bend Ultra Run and garnered more than $85,000 in grants for wetlands restoration. This year we will complete our $1.32 million campaign to renovate and expand the paleontology exhibit in the park. We can't wait to open it in January 2017! Please let us know if we need to get you any information for the Grand Opening, if anyone from HGS is interested in attending.

Big Bend Conservancy is a non-profit organization EIN 75-2670331. As you received only nominal goods or services for this gift, your entire donation of $6,000 is tax deductible to the fullest extent allowed by law.

Thank you again for your ongoing support for Big Bend Conservancy. As always, you can contact me if you have any questions about the Conservancy!

Sincerely,

Courtney Lyons-Garcia

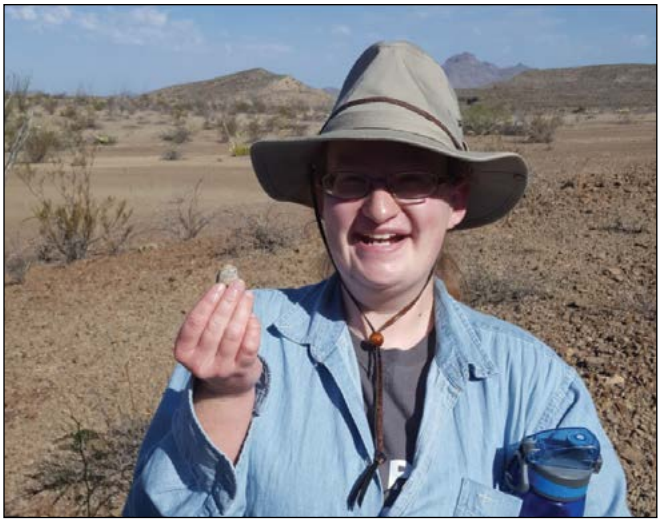
Courtney Lyons-Garcia
Executive Director

Thank you all!

Big Bend National Park Fellowship – Summer 2016

by Eileah Sims

Ever since I was young, I've had a passion for paleontology, and that hasn't changed. I've always loved fossils from the smallest nanofossil to the largest dinosaur. When I saw the posting for this fellowship at Big Bend National Park, I was immediately interested. I had only been to Big Bend once before on a geology tour of Texas before starting my freshman year at Texas A&M University. We only went on one trail, so I liked the idea of spending more time at the Park. It sounded like a great opportunity and challenge for me after graduating from Texas A&M with a BS in Geology (Class of 2016). When I got the call that I received the fellowship, I was surprised, excited, and apprehensive, but ready to take on the challenge. I worked with Park geologist, Don Corrick, and the other fellow, Amy Atwater, on promotional materials for the new upcoming Fossil Discovery Exhibit opening January 14th, 2017.



The upcoming Fossil Discovery Exhibit will showcase Big Bend's 130 million years of recorded geologic history. The park has one of the longest and most complete sequences of geologic time in the National Park Service and is also the only national park with strata crossing the K-Pg boundary. Over 1200 species have been found at Big Bend with some found nowhere else in the world. Our main job was to work on articles for the Fossil Discovery Exhibit website. I wrote articles about the first three rooms (5 rooms total) in the exhibit which describe the geologic history of Big Bend and some of the fossils on display at the exhibit such as mosasaurs, the horned *Agujaceratops*, and the pterosaur, *Quetzalcoatlus* (the largest flying creature). I also wrote articles that connect the fossils and geology on display at the exhibit to

Big Bend National Park Fellowship – Summer 2016 *continued on page 37*

Big Bend National Park Fellowship continued from page 35

the Park itself. These include a list of road waysides involving geology, 3 places to see the K-Pg boundary in the park, and where you can see fossils on the various trails in the Park. I also helped with the "Dig Deeper" part of the website in that I helped compile lists of museums and paleontology parks in Texas as well as volunteer paleontological dig opportunities. I also wrote an orientation for the exhibit detailing where the exhibit is and the amenities included on location. I can't wait to see the completed exhibit in January and I'm sure it's going to be amazing!

In addition to working on the website, we also wrote articles for the Park newspaper, *The Paisano*. We worked with interpretive Park rangers to write these articles and help design this edition of *The Paisano*. I wrote articles detailing Big Bend's amazing fossil resources, paleontology myths, and how marine limestones form. This edition is currently in the process of publication and will be published in the Fall of 2016.

When Amy and I weren't in the office, we had the opportunity to explore the Park. We went on many trails including Lost Mine, Hot Springs, and my personal favorite, Grapevine Hills. Making it to the end of Lost Mine Trail was extremely satisfying for me. Mr. Corrick also took us to several fossil localities. During the first week, he took us to a couple of Aguja Formation sites where we found shark and crocodile teeth, crocodile scutes and hadrosaur (duck-billed dinosaur) bones. I found a *Deinosuchus* (large alligatoroid) tooth that was thicker than my thumb! At a Boquillas Formation site, we found an abundance of ammonites and belemnites. At the Rio Grande Overlook, I found some beautiful *Exogyra* oysters in the trail tread. Finding these fossils was like a dream come true and I can't wait to find more in my future.

This fellowship was definitely a learning experience for me. Working at a national park was not what I expected. I met so many people and learned so much the first couple of weeks, it was a little overwhelming. But I learned so much and met so many amazing people at Big Bend who were so excited about the Fossil Discovery Exhibit and so appreciative that we were there, it was all worth it. And when I would get tired, all I had to do was look up and see the great Big Bend sky and the Chisos Mountains towering over me and the desert below, I would just say to myself, "Look at where you are!" The experiences that I have gained from my visit to Big Bend National Park will no doubt help my future plans in the short and long term. I plan on going to graduate school to receive my master's and PhD in paleontology. I aspire to become a museum curator, research professor or paleontological artist. My future is bright and I'm ready to hit it head on. Thank you for the opportunity!

What's Next in Africa
HGS-PESGB 15th Africa Conference

by Linda Sternbach

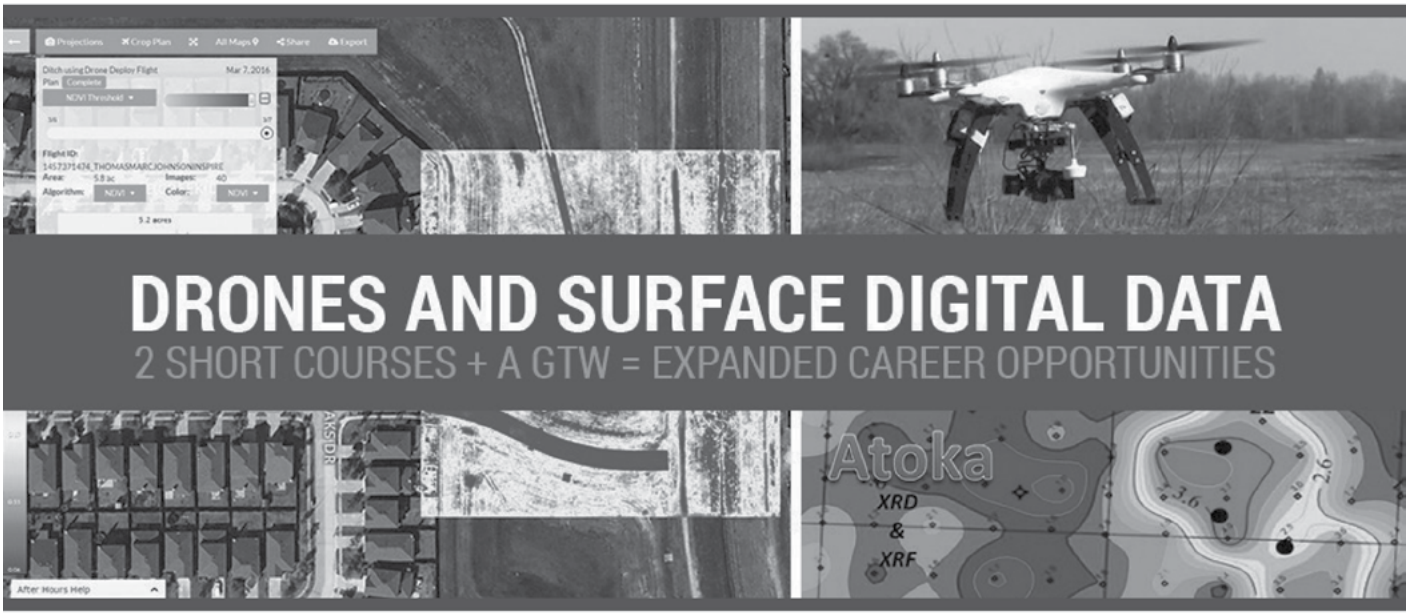
The Houston Geological Society and the Petroleum Exploration Society of Great Britain (PESGB) achieved a fifteen-year milestone with their joint two-day conference, September 13 -14, at the Westin Houston Memorial City, attended by over 300 geoscientists. The conference also included two short courses held September 12 and a dinner meeting lecture by Dr Andrew Nyblade of Penn State. The short courses were taught by Dr. Duncan MacGregor, and Ian Davison.

Credit for the success of the Africa Conference goes to General Chair and HGS President, **John Jordan**, and co-chair, **Andrea Peoples**, HGS Office Manager, for the successful rollout of two days of talks, exhibits and vendor seismic presentations. The conference committee included: **Phil Towle**, Technical Chair, and advisors **Al Danforth, Ian Poyntz**, and **Peter Mullin**. Session chairs included **Bill Dickson, Craig Schiefelbein, Carol Law, Joan Flinch, Katrina Coterill, Pratt Barndollar**, and **Richard Ramirez**. Many more people helped judge talks and posters and contributed to the Africa Conference; thanks to them for their help! Big thanks to the conference corporate sponsors: Noble Energy, Global Data, ION Geophysical, Casmar CO_2, Burmah Oil and IKON.

The next Africa Conference will be August 31 to September 1, 2017, in London England, at the Business Design Centre. Send 2017 abstract proposals to Helen Doran at Helen.doran@opfir-energy.com to be a speaker at the next Africa Conference.

HGS-PESGB 15th Africa Conference *continued on page 41*

AAPG Education Upcoming Education Events 2016



Use of Surface Geochemistry in Petroleum Exploration | November 29, 2016
Working with Drone Data 101 | November 30, 2016
New Opportunities with Drones: New Needs, FAA Rule Changes, New Technologies | December 1-2, 2016

HGS-PESGB 15th Africa Conference continued from page 39

Africa Conference Award Winners

Professional Posters:

3RD: An Integrated Stratigraphic Framework and Hydrocarbon Prospectivity of the Southern African Offshore Basins – Jean A. Malan, Getech Group, Petroleum Agency South Africa

2ND TIE: Integrated Interpretation of Basement Structure in the Benin Basin Using Falcon Gravity Gradient Magnetic Data – Dr. Janine Weber, CGG

2ND TIE: Pleistocene Stratigraphic History of Lake Tanganyika, and Influence of Upstream Rift Lakes Kivu and Rukwa – Dr. Christopher Scholz, Syracuse University, NY

1ST: Refinements to Chronostratigraphy of Cretaceous Anoxic Events from the Southern South Atlantic Conjugate Margin (Falkland segment-Africa): Comparison of Six DSDP Sites – Dr. Sudeep Kanungo/Dr. Eiich Setoyama, University of Utah

Student Posters:

3RD: South Atlantic Conjugate Margins: The Significance of Pre-Rift Western Gondwanan Orogenic Domains on Syn-rift Infill. – Kyle Reuber, University of Houston, TX

2ND: Gravity Modeling of the Flexural Response of Loading of the Niger and Amazon Deltas onto Their Underlying Thinned Continental and Oceanic Crust – Rasheed Ajala, University of Houston, TX

1ST: South Atlantic Conjugate Margins: The Significance of Pre-Rift Western Gondwanan Orogenic Domains on Syn-rift Infill. – Andrew Steier, University of Houston, TX

Oral Session:

3RD: Somalia Offshore – East Africa's Frontier Oil Province – Neil Hodgson, Spectrum Multi-Client UK

2ND: Petroleum System Analysis of the Deepwater Mauritania/Senegal Basin – Tracey Henderson, Kosmos

1ST: Senegal – The Emergence of a Major New Hydrocarbon Province – Jon Keall, Cath Norman, Peter Nicholls, Simon Horan, Thong Huynh and Igor Effimoff, FAR Limited

HGS Welcomes New Members

New Members Effective August 2016

ACTIVE MEMBERS

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Dan Pratt

STUDENT

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Julian Chenin
Rykley Crowe
Elizabeth Desser
Meghan DiBacco
Shruti Lakkaraju
Gary Linkevich
Jingxuan Liu
Mariah Michie
Julie Monluc
Rodrigo Parra
Brandon Randall
Sean Romito
Stephen Volz

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.*

AGI Geoscience Policy Monthly Review (July 2016)

Obama Administration Releases New Set of Rules to Govern Offshore Exploratory Drilling in the Arctic

The Department of the Interior (DOI) released their final Arctic Rule regulating exploratory drilling on the Arctic Outer Continental Shelf (OCS). The rule was prepared by the Bureau of Safety and Environmental Enforcement (BSEE) and the Bureau of Ocean Energy Management (BOEM).

The rule's stated objective is to "[protect] the unique and sensitive Arctic ecosystems, as well as the subsistence-based health and culture of nearby Alaska Native communities, while reducing reliance on imported oil and strengthening National energy security."

The rule outlines extensive contingency plans, requiring companies to maintain a backup rig in case of a blowout, and requiring them to have access to control and containment equipment, such as capping stacks and containment domes. It also requires each applicant to submit an integrated OCS exploration plan 90 days before submitting a request to drill in the Arctic and to construct a plan to manage and oversee contractors.

According to Brian Salerno, Director of the Bureau of Safety and Environmental Enforcement, the rules reflect issues identified after Shell's 2012 rig accident, when Kulluk, an oil rig, ran aground off the coast of Alaska.

DOI estimates that complying with the regulations could cost the industry $2.05 billion over ten years; however, an Arctic spill could be far more expensive than the $40 billion spent on cleaning up the 2010 Deepwater Horizon spill due to the treacherous conditions.

The American Petroleum Institute's Upstream Operations Director, Erik Milito, said in a statement that the proposed requirements "may not improve safety and in fact may inhibit innovation and technological advancements," adding to existing concerns about over other regulatory activities related to offshore energy development.

Interior Department May Move Offshore Oil and Gas Lease Sales Online

The House Natural Resources Subcommittee on Energy and Mineral Resources held a hearing on the Innovation in Offshore Leasing Act (H.R. 5577). The bill would amend the Outer Continental Shelf Lands Act to direct the Department of the Interior to make offshore lease sales internet-based, ending the practice of accepting sealed offers from companies and then reading bids aloud at the Superdome in New Orleans. The bill would also require all data regarding lease sales to be publically available online.

The bipartisan bill, introduced by Representatives Garret Graves (R-LA) and Alan Lowenthal (D-CA), received support from industry representatives and policy experts, who claimed the transition would increase competition and participation, ensure a fair return for taxpayers, increase revenue for government and revenue-sharing states, and avoid situations like the March protest during a Superdome lease sale.

Committee Chairman Doug Lamborn (R-CO) praised the bill as a "transition to the 21st century for federal agencies that have been slow to follow suit behind industry." Some states, such as Texas and Louisiana, have transitioned to online lease sales for onshore oil and gas production, and the Bureau of Ocean and Energy Management (BOEM) already conducts online leases sales for offshore wind production.

Walter Cruikshank, deputy director of BOEM, expressed concerns about the expedited transition to online lease sales within one year and the "prescriptive nature" that could bar the agency from making future improvements to improve its lease sale procedures. However, Cruikshank was supportive of the bill overall, claiming that BOEM is considering live-streaming the proposed Western Gulf of Mexico Lease Sale 248 in August.

On July 13, 2016 the full Committee passed the bill with bipartisan consensus. It will now head to the House floor for consideration.

House Natural Resources Panel Considers Renewable Energy on Public Lands

The House Natural Resources Subcommittee on Energy and Mineral Resources held a hearing to discuss the Public Land Renewable Energy Development Act (H.R.2663), a bipartisan bill with 67 cosponsors that was introduced by Rep. Paul Gosar (R-AZ) in 2015.

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If enacted, H.R.2663 would streamline the permitting process for wind, solar, and geothermal energy development on federal lands by limiting the National Environmental Policy Act (NEPA) review process. Instead of conducting new programmatic environmental impact statements (PEIS) for each proposed project, the bill would allow renewable energy projects to use preexisting, preapproved final PEISs for wind, solar, and geothermal projects on federal lands.

The bill also establishes a royalty and revenue structure for states and counties with renewable energy development. The Secretary of the Interior would determine royalty rates, with 25 percent of generated royalties going to the state, 25 percent to the counties, 15 percent to the Treasury, and 35 percent to a Renewable Energy Resource Conservation Fund aimed at supporting wildlife and recreation.

Ranking Member Alan Lowenthal (D-CA) called the bill "a win for taxpayers, win for the environment."

Chairman Doug Lamborn (R-CO) also praised the bill, highlighting its ability to streamline the often arduous NEPA process that can take many years to complete.

The Bureau of Land Management has identified 20.6 million acres of public land with wind potential and 19 million acres of public land with solar potential; however only 1.4 percent of wind capacity was sourced from public lands in 2012.

Hearing Addresses the Future of the Proposed Yucca Mountain Nuclear Waste Site

The House Energy and Commerce Subcommittee on Environment and the Economy held a hearing led by Subcommittee Chairman John Shimkus (R-IL) and Subcommittee Ranking Member Paul Tonko (D-NY) to gather information in order to move forward with federal licensing of a nuclear waste repository at Yucca Mountain, Nevada. Members of Congress, the Nye County, Nevada Commission, and private stakeholders provided testimony.

Although Yucca Mountain has been a topic of frequent debate in Congress since it was first designated a nuclear waste repository site in 1987, the Department of Energy (DOE) is not currently considering it or other locations in Nevada in their new nuclear waste strategy. Chairman Shimkus advocated for a consent-based siting process, noting that requests for involvement from Nye County locals have not been granted by the DOE.

The secure transportation of spent fuel rods dominated the conversation during the hearing. Rep. Bob Latta (R-OH) commented that a model of safe transportation would help to address safety concerns among locals and augment public confidence in the repository. Rep. Jerry McNerney (D-CA), however, voiced concerns that even with safe laws, sound science, and honest information, a deep mistrust of government will limit public approval.

Rep. Bill Johnson (R-OH) highlighted the possibility for economic growth through employment and research, and opportunities for nuclear science education that Yucca Mountain could initiate.

The Yucca Mountain repository receives strong support in the House, and the approaching retirement of Senate Minority Leader Harry Reid (D-NV), a vigorous opponent of the repository, may affect Senate views on the issue

Hearing to Revise Superfund Implementation for First Time Since Enactment

The Environment and the Economy Subcommittee of the House Energy and Commerce Committee held a hearing to examine implementation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. Through CERCLA, the Environmental Protection Agency (EPA) is responsible for the cleanup of hazardous waste sites, as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

In its 36-year history, CERCLA has not been refined to improve clean up efficiency and cost-effectiveness. As a result, the number of annually completed projects has declined since 1999, while the number of annual sites designated for the program has increased.

Democratic representatives voiced concern that EPA lacks the funding needed for many of the sites. Ranking Member Paul Tonko (D-NY) called for reauthorization of the "polluter pays" tax that expired in 1995, which required the chemical and oil industries to support a trust fund for cleaning up spills. Two companion bills to restore the tax were introduced last year, H.R. 2783 and S.B. 2400, but neither has made progress. Robert Spiegel, executive director of the Edison Wetlands Association, warned that without the tax, companies will continue polluting unabated.

Republicans cited mismanagement at EPA as the root of the problem. Chairman John Skimkus (R-IL) stated that more authority should be given to states and local governments for clean up measures and suggested that current federal processes impede timely and efficient cleanups. Marianne Horinko, President of the Horinko Group, an environmental consulting firm, echoed these concerns, stating that states have developed adequate clean up plans.

Many questions were directed at Mathy Stanislaus, EPA's Office of Land and Emergency Management (OLEM) Assistant Administrator. Stanislaus acknowledged that the program suffers from a "lack of full funding" and "decades of mismanagement," and that "there's more we [EPA] can do for" the states.

Chairman Skimkus concluded the hearing by optimistically comparing it to the early stages of the reform of another bill that regulates chemicals, the Toxic Substances Control Act (TSCA). The Subcommittee's efforts led to passage of the Frank R. Lautenberg Chemical Safety for the 21st Century Act, TSCA's first update since being enacted in 1976.

House Approves Bill to Help Clean Up Abandoned Mines

With supermajority approval, the House Chamber passed the Bureau of Land Management Foundation Act (H.R. 3844) to address the issue of acid mine drainage from an estimated 500,000 abandoned mine operations in the U.S.

Introduced by Rep. Jody Hice (R-GA) in October 2015, the bill establishes a nonprofit Bureau of Land Management Foundation to help fund the clean-up of abandoned mine lands and orphaned oil and gas sites to "further the conservation of natural, scenic, historic, scientific, educational, wildlife habitat, or recreational resources."

Inspired by the need for more private sector resources after the Gold King Mine spill, the bill would allow the Foundation to obtain and administer private donations for clean-up efforts, as well as educational and technical resources.

The Secretary of the Interior would appoint the Foundation's governing Board of Directors, which would consist of nine members with experience in energy or mineral production, land reclamation, or energy and mineral resource financing, law or research.

Although the Foundation would not be associated with an agency or government establishment, it would report to the House Natural Resources and the Senate Energy and Natural Resources Committees annually on its activities.

H.R.3844 is part of a three-part bill package that also includes the Mining Schools Enhancement Act (H.R.3734) and the Locatable Minerals Claim Location and Maintenance Fees Act (H.R.3843), which have yet to pass through the House.

The bill is now being considered by the Senate Energy and Natural Resources Committee. Further action will take place after the Congressional summer recess ends in September 2016.

Solving Western Water Supply Problems Remains an Ongoing Debate

Water supply remained a hotly debated topic in the House Natural Resources Committee on Water, Power, and Oceans Subcommittee. During an oversight hearing on Changing Demands and Water Supply Uncertainty in California, members and witnesses discussed conflicting proposals between the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) on water release from the Shasta Dam. The process is currently managed by the Bureau of Reclamation (USBR) through a planned water delivery schedule. The Shasta Dam is part of the Central Valley Project, which is responsible

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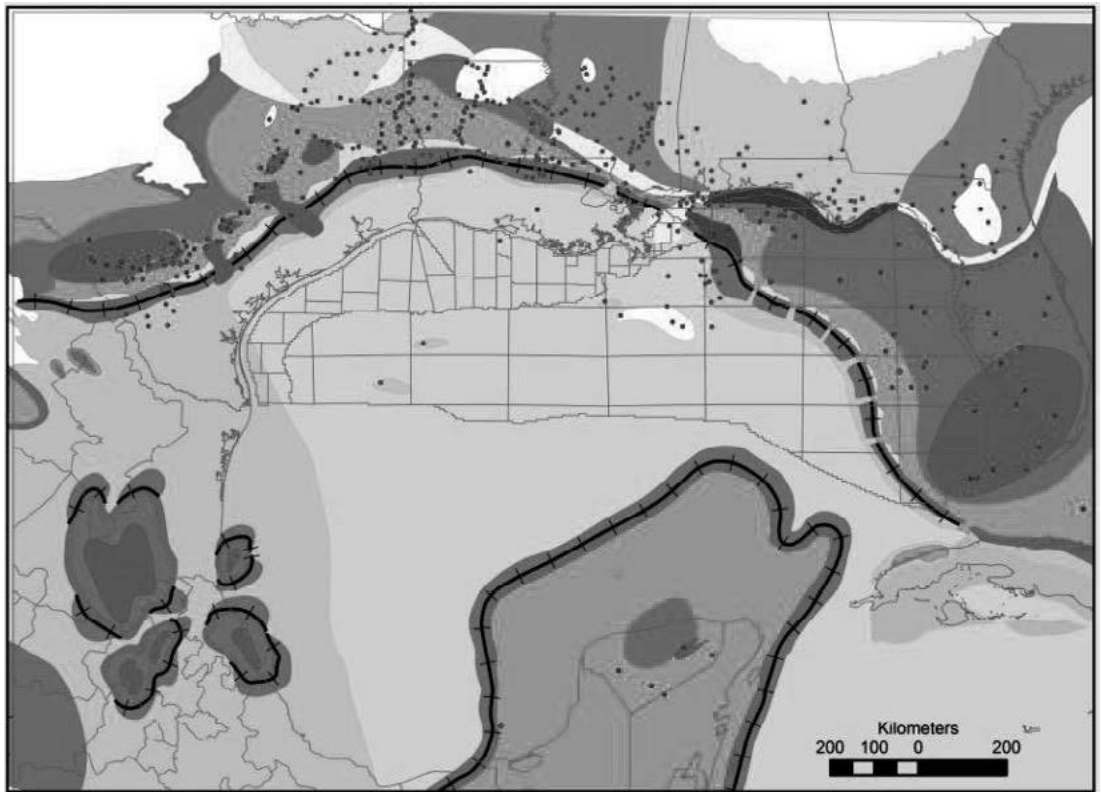
for transporting water from Northern California reservoirs to population centers and agricultural regions farther south.

Due to five years of drought in California, water supplies are increasingly limited. Federal agencies have struggled to manage demand from the farming community, while also protecting endangered species that rely on the same water sources. According to Jeffrey Sutton, general manager for the Tehama-Colusa Canal Authority, drought conditions have resulted in a reduction in water allocations, "causing a lack of certainty and an absolute tragedy [for farmers]." Even some senior water rights holders, who have first claim to withdraw water over holders who have filed later claims, and own what are called junior water rights, have seen their water allocations reduced.

The USFWS proposes releasing more water into the Pacific Ocean to increase flow and improve conditions for the Delta smelt, an endangered and native species in the upper Sacramento-San Joaquin Estuary of California. The NMFS, however, wishes to hold back water through the summer and fall to preserve cold water for the winter-run Chinook salmon, a species that sustains 30,000 jobs and contributes $1 billion to the West Coast fishing economy, according to Bob Borck, a Pacific Ocean fisherman. On June 28, 2016 NMFS approved a revised operation plan from the Bureau of Reclamation although an agreement has not yet been reached with USFWS.

Separately, the state of California has released its own Delta Smelt Resiliency Strategy, which proposes measures to boost populations of the smelt through habitat enhancement and predator removal, among other tactics.

One solution seeks to create a single USFWS-NMFS plan. Representative Paul Gosar (R-AZ) proposed merging the two agencies' responsibilities under the Endangered Species Act to improve collaboration. Alternatively, Representative Jim Costa (D-CA) suggested removing predators of the smelt and improving habitat rather than focusing on water release, claiming that "continuing to do what we've always done and expecting a different result… is the definition of insanity."



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AAPG Young Professionals × neoGeos

Young Professional Tech Conference
August 15th, 2016

Remembrance

Robert Goodall Behrman, Jr.
(1914-2015)


Robert (Bob) Goodall Behrman, Jr., was born in La Porte, Texas, February 4, 1914, and died peacefully on Thursday, December 4, 2015, after a brief illness.

Robert Behrman had been a commercial artist in high-school and went to Rice University to study architecture on a band scholarship. A career in architecture during the Great Depression was not meant to be, and so he left Rice to work for Gulf Oil Co. as a "Hall Boy" delivering mail, samples, maps, logs, and so on. He quickly made it out of the "hallway" and became active washing samples and drafting maps, and so joined the emerging field of petroleum geology.

It was exciting: Gulf was not just a company with striking orange colors – a brand now re-appearing in gas stations and convenience stores all across the nation. Gulf also sponsored air-racing. As a young field geologist, Bob joined with his friends to buy a tiny Piper Cub (Yellow Peril) and they learned to fly.

At one critical juncture, Gulf was running out of time to drill a prospect they had sub-leased from Humble Oil. Bob flew to Pittsburgh, where the deal had been made with Standard Oil of New Jersey, and came back with boxes of materials to be analyzed. They turned that data into a development plan for Gulf's portion of the newly discovered field.

Many geologists and engineers in Houston had learned to fly in and out of the "oil patch", and quite a few of them ended up in the Navy for the duration of World War II. Robert became a naval aviator, a Navy flight instructor, and later used his artist-turned-geologist skill set as an officer in the Navy's first aerial photo-intelligence squadron in Okinawa.

After the war, Bob spent more time in the field with Gulf Oil Co: Texas, Louisiana, swamps and shallow-water fields offshore. But, he moved back to Houston and became an independent geologist when his wife Genevieve insisted life in the swamp wasn't for her.

Bob and a few colleagues with shared interests in flying and in oilfields formed Gulf Coast Leaseholds. The independent exploration and production firm had only one plane: a Beechcraft Bonanza, a much smaller plane that those used by the big firms. But that plane took Robert far afield. His company acquired the leases over an ancient oil province in Ecuador, where shallow oil had been leaking into the Pacific since pre-Columbian times. This field had been a British "naval stores" concession before the war, but was acquired by some Houston investors for redevelopment using modern technology.

The oil business was compelling for a young and, eventually, nearly 102-year-old man. It was always art and science for Robert. His hand became palsied but his mind never lost the youthful wonder of the universe and the earth he beheld.

Robert was an Emeritus member of the Houston Geological Society and a member of the Water Color Art Society of Houston. At the time of his death, he was the oldest living member of South Main Baptist Church in Houston, which he and Genevieve had joined upon his return to Houston after the war.

Bob's wife Genevieve was an active member of the Houston Geological Auxiliary. She served as the group's President during the 1960's. She passed away on November 30, 2006.

Robert and Genevieve are survived by their children in Houston, John Robert Behrman, Susan Riley and husband Brian, Charles Thomas Behrman and wife Kathy, a foster son in Los Angeles, California, Joe Stewart; seven grandchildren and four great grandchildren.

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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.

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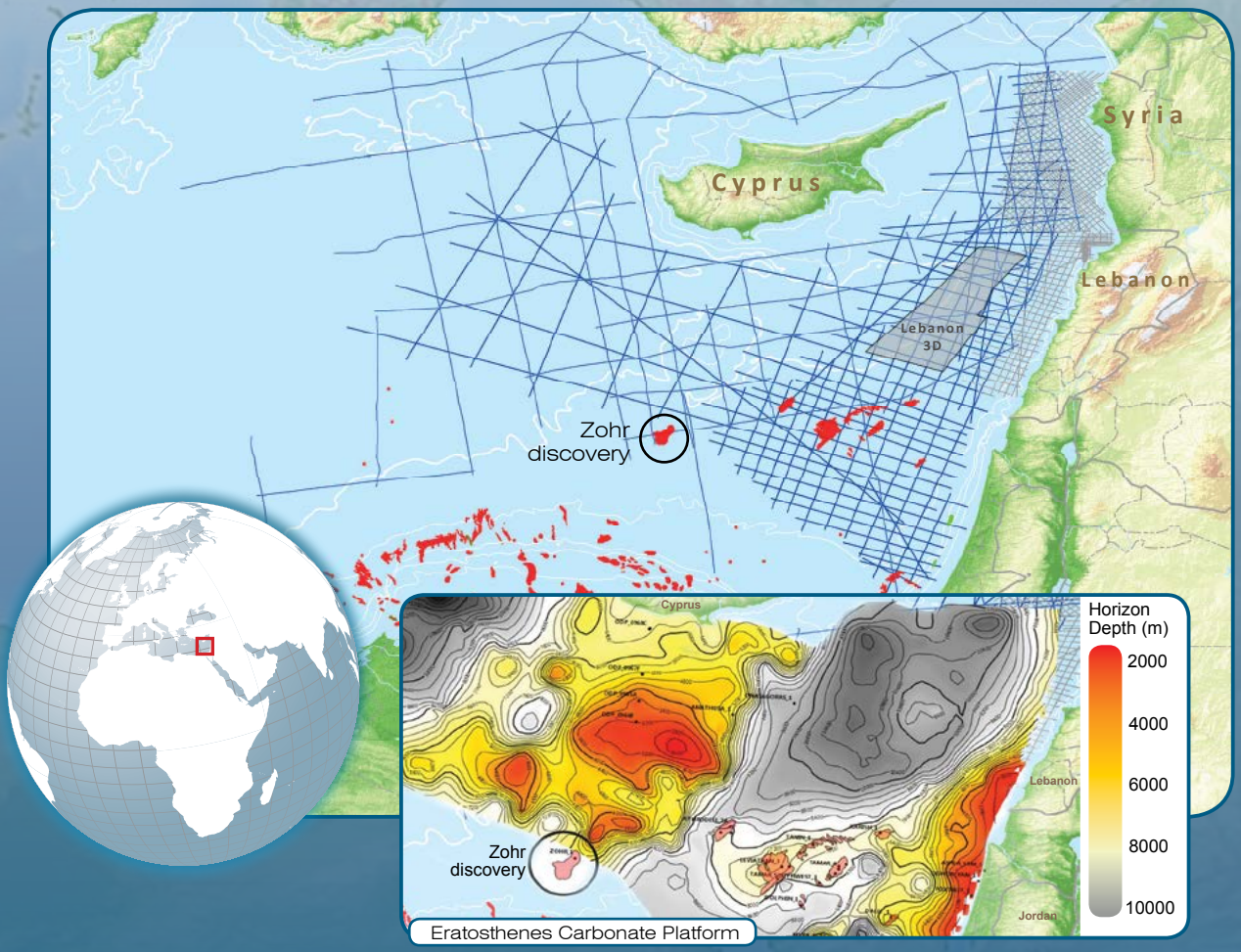

The gas discovery in the Zohr-1 well (ENI 2015) has created a step change in the understanding of carbonate plays offshore Egypt and throughout the Eastern Mediterranean.

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