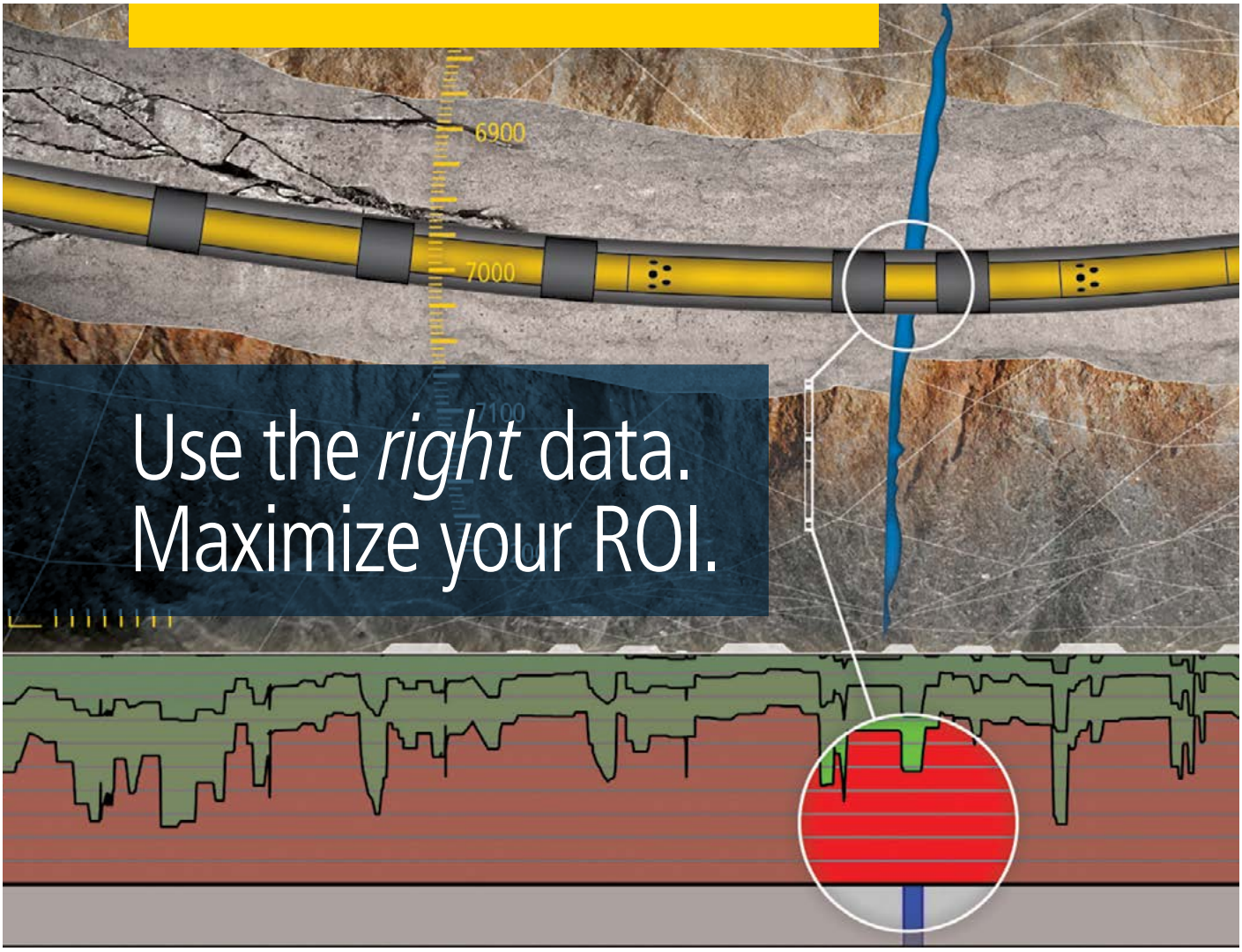
Volume 59, Number 4

HGS Bulletin

Houston Geological Society

December 2016



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The Bulletin
Houston Geological Society
Volume 59, Number 4
December 2016

In Every Issue

The Houston Geological Society Bulletin (ISSN-018-6686) is published monthly except for July and August by the Houston Geological Society, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916. Phone: 713-463-9476; fax: 281-679-5504

Editorial correspondence and material submitted for publication should be addressed to the Editor, Houston Geological Society Bulletin, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916 or to tami.hgs@gmail.com .

Subscriptions: Subscription to this publication is included in the membership dues ($28.00 annually). Subscription price for nonmembers within the contiguous U.S. is $50.00 per year. For those outside the contiguous U.S. the subscription price is $160.00 per year. Single-copy price is $8.00. Periodicals postage paid in Houston, Texas.

POSTMASTER: Send address changes to Houston Geological Society Bulletin, 14811 St. Mary's Lane, Suite 250, Houston, Texas 77079-2916

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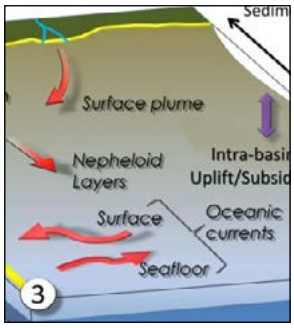

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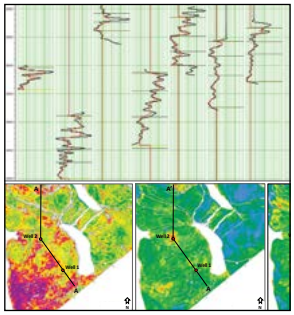

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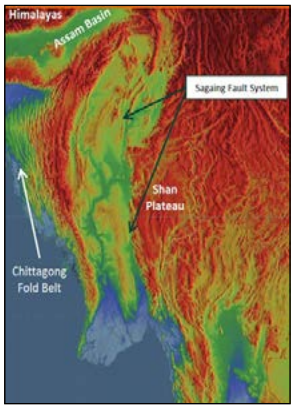

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About the Cover: Marker Ammonite *Allocrioceras hazzardi.* Photo Credit: Tania C. Campbell, Big Bend National Park, April 18, 2015. See page 37 for more information.

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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

HGS, GSH*, SPE* members	$115
Non-Member:	$130
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

Oil Prices: What Next?

This month's topic has been quite a challenge. Most of you do not realize that I am writing this in mid-October for publication in December. This is quite a lot of time for this subject considering we are having a national election and an OPEC meeting in November. A few things I can predict are that (by the time you read this article) we will have a new President, the weather in Houston will be pleasant, OPEC will have met, and experts will continue to predict the price of oil incorrectly. I have had the opportunity to listen to several "experts" talk on oil price recently and the factors that they believe will drive the price of crude oil in 2017. I hope you find this insightful given that the health of our industry is dictated by its price.

Expert #1's theme was "Lack of Change and More of the Same." He stated that in 2016, the United States' demand for crude oil and its refined products was strong. U.S. crude oil demand grew from 19 MM BO/D to 20 MM BO/D in 2016 and this was the highest consumption since 2008. The bulk of this demand in refined product was for gasoline and jet fuel and he believes this demand for refined product is what pulled us back from the abyss of $27.10 in late January this year and moved us to the $40+ range. The 2017 outlook assumes that refiners will reach maximum USA refining capacity, just under 17 MM BO/D, capping imports of crude oil at approximately 8 MM BO/D. Growing U.S. demand for gasoline and jet fuel will increase the import of these products. Furthermore, the increased crude oil exports from the U.S. will limit OPEC's ability to influence the price of crude oil. The net result is that WTI's price will be limited due to constrained refining capacity and the influence of imported refined product. They are predicting a **2017 WTI price range of $44-$54**. Any price above this will have downward pressure from increased domestic production. He is more optimistic on **2017 Brent prices with a price range of $46-$58**. He sees Brent more susceptible to geopolitical events and this, coupled with lack of investment into new production, increases the opportunity for price spikes if demand were to rebound.

Expert #2's theme for 2017 is "Survival of the Fittest." He sees three phases defining the aftermath of the present price collapse. **Phase one** is the continued growth in production of the Arabian/Persian Gulf states, Gulf 6, coupled with USA production momentum and the resilience of the rest of world production. **Phase two** is the choking off of capital for global production growth while the Gulf 6 production growth keeps worldwide production levels at an all-time high. This is where he believes we are presently. **Phase three** is the "The Rise of the Permian." A wave of new projects in West Texas, along with Canadian and Russian production, plus continued Gulf 6 production growth breathes new life into the global over-supply while the rest of the world production continues to decline. The net result is that increased demand in 2016 causes an increase in supply in 2017 through 2018. We will see a continuation in the reduction in inventories we are currently experiencing over the next three quarters with a tapering off of inventory decline at the end of 2017 through the beginning of 2018. This can only be averted by a global economic recovery creating increased demand. Political instability in the most vulnerable oil producing countries, Venezuela, Iraq and Nigeria, is another area of concern. A collapse of production in any of these places caused by political instability would have a large impact on oil prices. Given that none of the above happens they see **2017 WTI price range from $47 to $53 and 2017 Brent from $48 to $54**.

A few things I can predict are that (by the time you read this article) we will have a new President, the weather in Houston will be pleasant, OPEC will have met, and experts will continue to predict the price of oil incorrectly.

I would like to conclude with my own observations. Many in the media are putting a great deal of faith in an OPEC production reduction roughed out in September. I do not hold a lot of hope in this area. Historically, OPEC has had a difficult time building a coalition within OPEC that acts. I guess we will know the outcome of their decision by the time you read this article and we will see if they can act as we move into 2017. When I asked the panel of experts what single thing could positively impact oil price they were unified in their answer of faster growth in demand or global economic expansion. The present price environment should encourage global economic expansion.

As the HGS community nears the end of a tumultuous 2016, I wish all of you peace, health, and prosperity as we go cautiously forward into the New Year.

Tami B. Shannon
tami.hgs@gmail.com

The Challenges of Locational Accuracy (Part 1): The Geodetic Datum

Navigation and mapping have always been in my blood. When I lived in Chicago from 1997-2002, during my extensive commutes to and from work, I would try different routes home on purpose (sans map or cellphone) to "explore" the city. My favorite days were the ones when I would actually get lost – and then have to use key reference points (like Lake Michigan or the Sears Tower) to feel my way back to my neck of the woods. I did find myself in some sticky situations in the city's south-side; but the thrill of getting back to my north-side apartment after a long commute (and cheap gasoline circa 1999) was exhilarating!

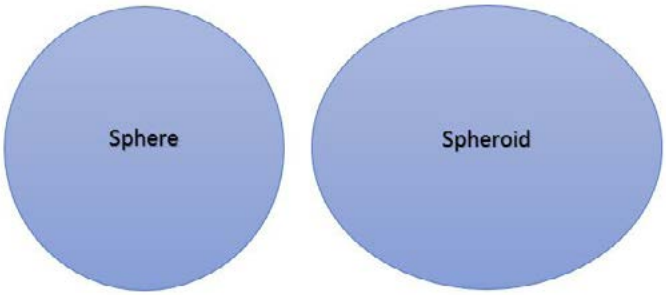


Figure 1: *A sphere is based on a circle, while a spheroid (or ellipsoid) is based on an ellipse.*

So naturally, with my love of the great outdoors, field trips, and geology (and my particularly unusual love of getting lost), I have gravitated towards a career in Geographic Information Systems (GIS). This is just a fancy term for digital mapping of pretty much anything that can be referenced with a spatial location. Yes, I am slightly offended if you say "Ah! Like Google Maps!" That isn't quite it, exactly; however, I will politely nod and smile and say "Yes…something like that."

GIS is used extensively in the oil and gas industry, because, many different data sets may be used to determine any number of decisions pertaining to drilling a well. Along with the multitude of data, however, comes the multitude of potential coordinate reference systems (CRS) that involve different geodetic datums, map projections, and mathematical transformations and the science behind this is called geodesy. I have worked with GIS data in this industry for over 10 years and I don't believe they emphasize the geodetic importance of the data, so I hope I can provide a bit of insight and knowledge to this critical, but less glamourous topic, and spark you to ask more questions about the data you use in your workplace.

GIS is used extensively in the oil and gas industry, because, many different data sets may be used to determine any number of decisions pertaining to drilling a well.

We like to think of the Earth as a sphere, but it's actually a spheroid (ellipsoid); rotational spinning flattens it to make it slightly larger at the equator than the poles (**Figure 1**). While the Earth looks like a smooth ellipsoid from far away (**Figure 2**), in reality, it has a pretty uneven surface (**Figure 3**).

From the Editor *continued on page 9*

Figure 2: *Image generated from ESRI, ArcGIS Earth 1.1*

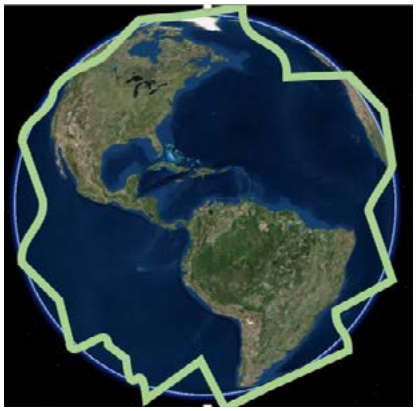
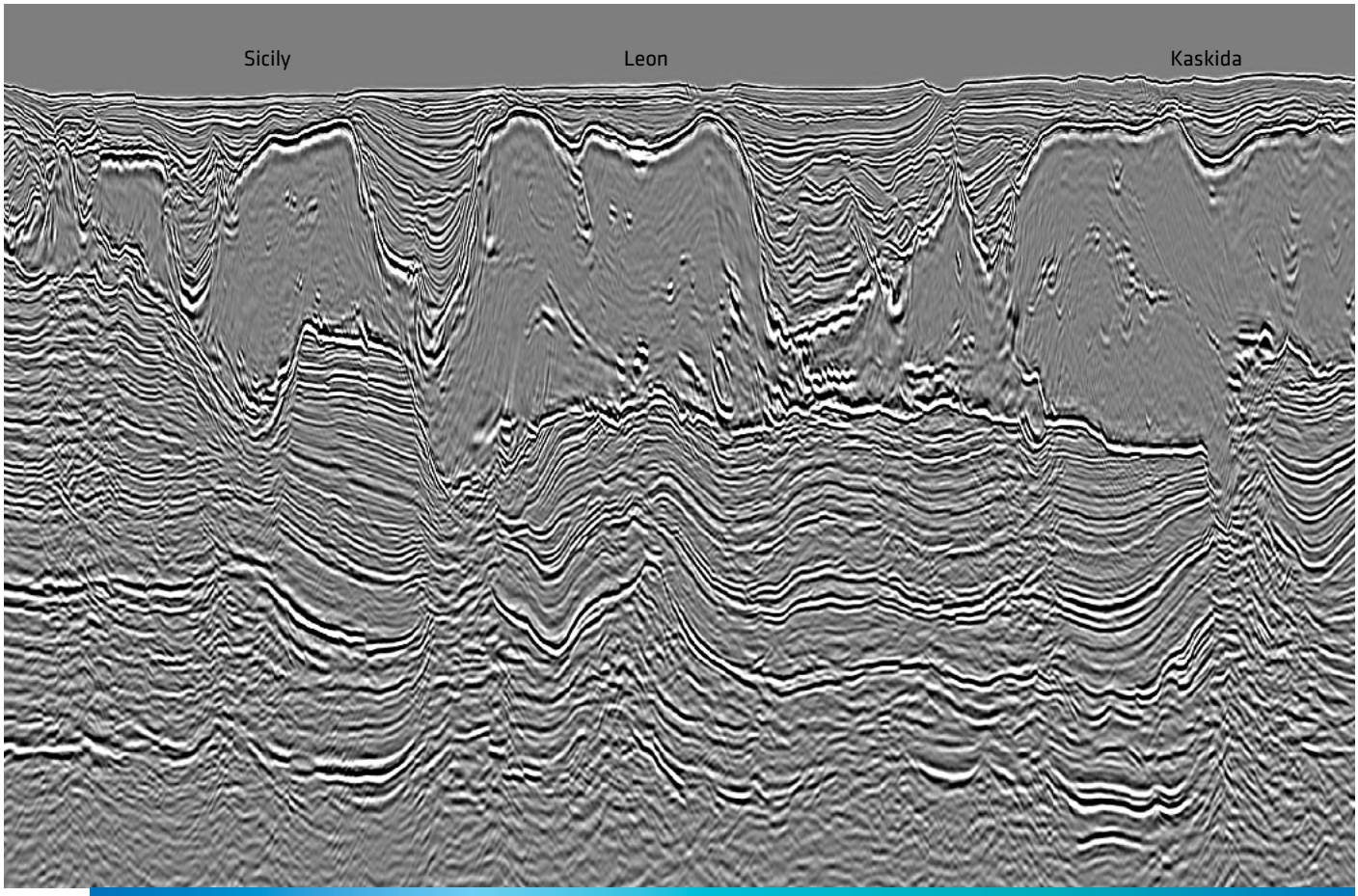
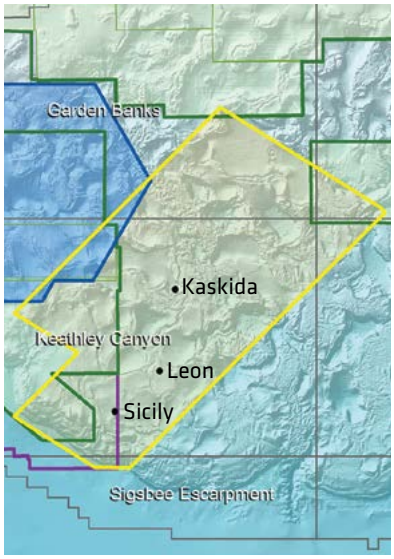


Figure 3: *Exaggerated view of the shape of the Earth.*





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The *geodetic datum* is a mathematical model used to approximate the shape of the uneven Earth to provide a reference origin for accurate position, length, and area calculations (**Figure 4**). A *Geographic Coordinate System (GCS)*, is always calculated based on the datum and uses angular units of latitude and longitude to define locations on the spheroid.

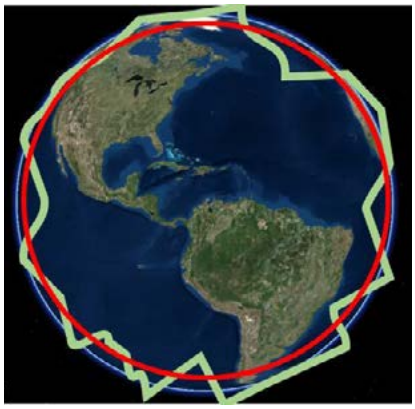

Figure 4: *Red line depicts geodetic datum for the entire Earth (i.e. WGS 1984)*

One such datum is the *World Geodetic System of 1984 (WGS 1984)* which is a generalized model for the whole planet based on the WGS 1984 spheroid and essentially the default for all GPS handheld devices. This datum is earth-centered and a pretty good fit overall and is used by Google Maps as means to show you all those cool restaurants and get you from point A to point B with little trouble.

Another geocentric datum is *North American Datum of 1983 (NAD 1983)*, which is based on the newer GRS80 spheroid. NAD 1983 coordinates are very similar to those of WGS 1984, however, it is imperative to note their origins do not align (**Figure 5**). While most petroleum data in the U.S. happens to be referenced to the local datum of *North American Datum of 1927 (NAD 1927)*, certain government agencies are starting to require data and coordinates be referenced to the *North American Datum of 1983 (NAD 1983)* because they more consistently align with the WGS 1984 data.

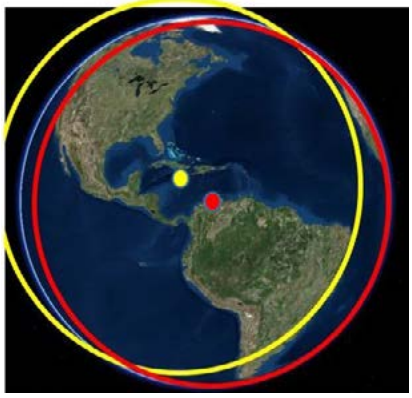

Figure 5: *Depicts approximate geocentric datum locations and shift example (yellow circle: NAD 1983 and red circle: WGS 1984. Origin of each is offset, thereby producing different geographic coordinate locations.*

So what exactly happens if your datums are different? If you have map created using the NAD 1927 datum, and suddenly overlay your existing map with the newer NAD 1983 datasets, these datasets may not align unless you've made sure to convert or transform them with the proper *transformation* equation. They may appear kind of close and in the general vicinity of each other, but the locations will not line up directly.

If you are trying to find the nearest restaurant that serves the best pizza in town, then "kind of close" might work. However, if you are a geoscientist or reservoir engineer frantically trying to align your proprietary data so your boss can make an informed decision on where to drill the next well and accuracy is important to you, you *might* want to think twice about using Google Maps to get your coordinate location or using it to identify your drilling location.

Stay tuned for more information about datums and map projections coming up in January. Meanwhile, enjoy a little CRS quiz and let me know how you do! ■

Problem:

You were given two different well datasets that are supposed to be the identical drilling location next to Mariscal Mine. However, in Google Maps (**Figure 6**), your two points do not align. The well coordinates are known for certain to be **29.095253, -103.18694**. Can you confidently determine which well location is the correct one to assess?
(See page 43 for the answer.)

Figure 6: *Mariscal Mine – Potential Well Locations (Image courtesy of Google Maps.)*

HGS Applied Geoscience Mudrocks Conference Provides a Low Cost, High Quality Training and Networking Opportunity

by Mike Effler and Frank Walles

Please consider attending the upcoming Houston Geological Society 2017 Applied Geoscience Conference titled: "Integrated Approaches to Unconventional Reservoir Assessment and Optimization" scheduled to be held on March 7th and 8th, 2017 at the Anadarko Petroleum Conference Center in The Woodlands, Texas. As a service to advance your personal knowledge in this very important field, this two-day local event will feature the latest on reservoir characterization and optimization of recovery for unconventional reservoirs. A special addition will be a featured speaker, Jeremy Boak, Director of the Oklahoma Geological Survey, who will give a keynote luncheon presentation regarding the Quake Hazards in Oklahoma and their origin. An evening social event will provide opportunities for networking as well as provide time for follow-up discussions with speakers and fellow participants.

Speakers are recognized experts from industry, government, and university who have been specifically selected by our HGS conference organizing committee. The committee-organized technical program will include 20 top expert oral presenters organized within 8 sessions, 15 university research poster presentations, and cores on display from the Wolfcamp and Utica formations (both with presenters).

This is an annual HGS event that was first developed in 2006, at the advent of the combined industry, government, and university early mudrock reservoir characterization research. This conference has established itself as the premier Houston Mudrocks Technical Reservoir Characterization Conference that includes research and applied geology spectrum from the outcrop to the nanoscale. Invited presenters have included the top researchers and experts from the early applied research in the 50s through the present.

This year's technical oral program event includes 16 session Co-Chairs that have developed invited presenter sessions on:

- Diagenetic Components of Mudrocks and Their Impact on Production
- Nanoscale Intra-Kerogen Porosity and Hydrocarbon Phase Producibility/Wettability
- Predicting Petrophysical Flow Properties Using Digital Rock Physics
- Geophysical Methods for Producibility, Fracability and GeoHazards
- Hybrid Unconventional Opportunities
- Tight/Complex Reservoirs Opportunities
- Geo-engineered Completions/Geomechanics
- Operator Cases of Integrated Applied Geoscience for Fun and Profit

As a local Houston Geological Society event, it has proven to be highly cost-effective training for both geoscientists and engineers. The multi-member HGS organizing committee has contributed in making this conference happen for the past eleven years, in part because it would be cost and competitor prohibitive for one single company to organize such a diverse event.

Conference attendees will receive the committee and author-developed expanded abstract/paper technical brochure of the oral and poster presentations to assist in the communication and sharing of the learnings. The HGS provides this industry event to share knowledge of advancing applied geoscience technologies within mudrock reservoir characterization.

This annual Applied Geoscience Conference (AGC) event is a combined education and scientific advancement service for the HGS member community and continues to be generously supported by many industry sponsors. The event location (within conference facilities of Anadarko Petroleum) is a very special tribute from our sponsors and we are especially grateful for the generosity of Anadarko to host this event. Houston Geological Society AGC technical program committee member, Wayne Camp, was especially important in arranging this venue opportunity.

This AGC on mudrock reservoir characterization and optimization has been highly popular since inception with demand frequently exceeding venue capacity. Attendee disciplines include the full range of management through geological, geophysical, petrophysical, production, reservoir and completion engineering. This year, in response to the continued industry downturn, and with the help of our venue sponsor, HGS is again offering this conference at a substantially-reduced cost to make it as affordable as possible. If you are interested in attending, but are encountering financial hardships such as unemployment, please contact the HGS office for further reduced pricing consideration. See www.hgs.org or contact Andrea Peoples at (713) 463-9476.

Applied Geoscience Conference

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.

Day 1

- 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

- Hybrid 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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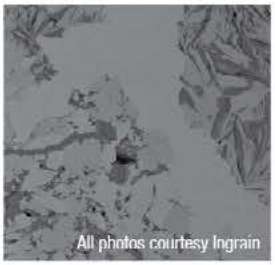
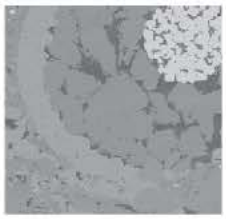
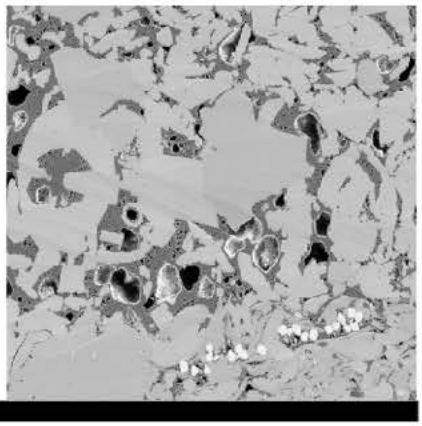
The Woodlands, TX 77380

Anadarko Petroleum Corporation







Registration Open!

For more information please visit: www.hgs.org

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93% Rated the overall quality of the technical presentations as good or exceptional compared to other industry conferences

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Recognition by HGS in Program Book, onsite signage, post show highlights and thank you in HGS Bulletin	✓	✓	✓	✓	✓
Recognition in Conference Announcements and Website (logo with hyperlink)	✓	✓	✓	✓	✓

91% Rated the talks as applicable to their every day work

Mail Sponsor Request to:
Houston Geological Society
14811 St. Mary's Lane, Ste. 250
Houston, TX 77079

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

Applied Geoscience Conference

March 7 - 8, 2017

Integrated Approaches of Unconventional Reservoir Assessment and Optimization

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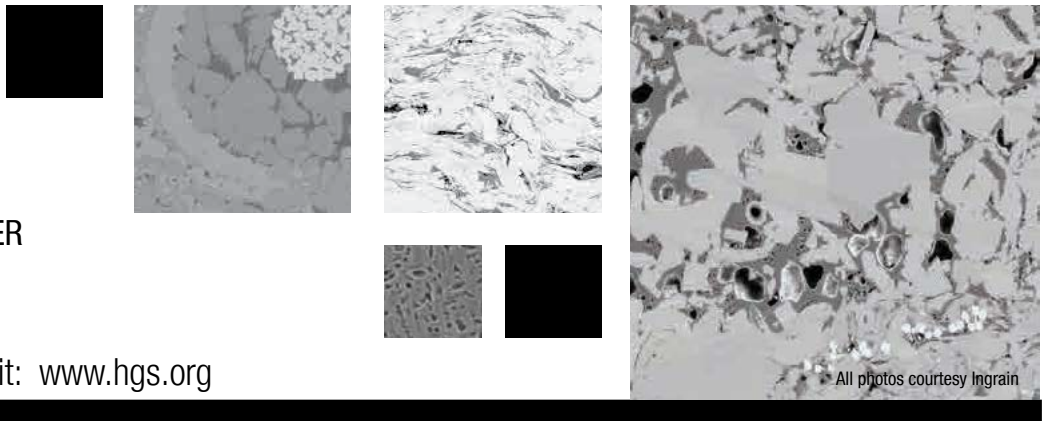

All photos courtesy Ingrain

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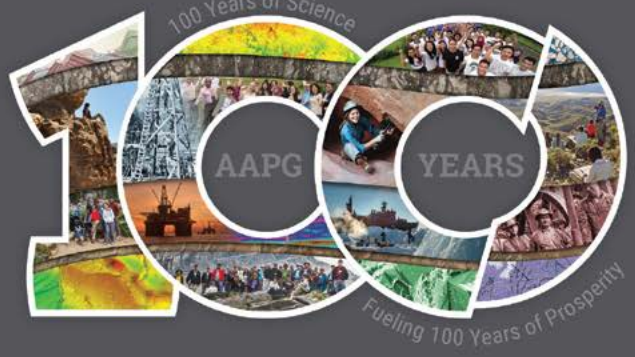
100 AAPG ANNIVERSARY

ACE 2017

ANNUAL CONVENTION & EXHIBITION

2-5 April 2017 • Houston, TX • George R. Brown Convention Center

In conjunction with: SEPM



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As these are challenging times in our industry, we understand the need to be strategic and judicious with your company's marketing and sponsorship investments.

ACE is one of the world's premier geoscience events that is completely created and hosted **by geoscientists for geoscientists**; therefore, your company's support translates into a valuable return on investment for the future of our shared industry success.

In fact, your sponsorship directly supports the valuable ACE knowledge exchange platform for the ongoing research, technology, innovations, solutions and advancements necessary for prosperity in our geosciences community.

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Monday, December 5, 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.

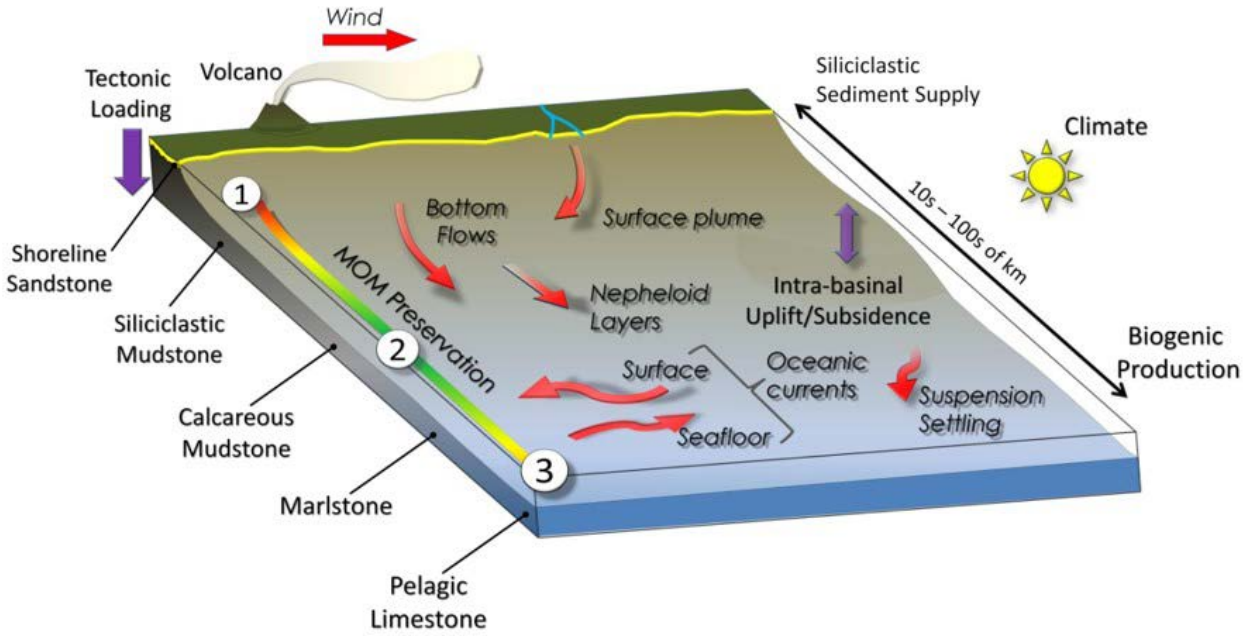
If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

Bruce Hart
Statoil

Mopping up the Shale Mess: Integrated Mudstone Depositional Systems. An Example from the Cenomanian-Turonian Western Interior Seaway

The Shale Revolution caught sedimentary geologists by surprise. Unlike deltas, submarine fans, carbonate ramps or other types of depositional systems, there were no ready-made shale facies models that could be used to help guide the exploration and development of source-rock reservoirs (Haynesville, Barnett, Eagle Ford, etc.). More than 15 years after the initial Barnett Shale boom, the sedimentary geology community still lacks widely applied shale facies models that integrate sedimentology, lithology, organic geochemistry and other aspects of shales in ways that can be used to understand and predict the distribution of properties of economic importance.

HGS General Dinner *continued on page 17*



Schematic representation of a conceptual mudstone/source-rock depositional system in an epicontinental seaway. Red arrows depict processes that transport and deposit sediment. Proximal deposits are dominated by coarse-grained siliciclastic sediments (shoreline sandstones). Further offshore, mudstones begin to dominate. Proximal mudstones are dominated by terrestrial/siliciclastic components (e.g., clay and quartz silt). Further offshore the relative proportion of siliciclastic mud decreases and the relative proportion of biogenic sediments (e.g., planktonic calcite) increases. Calcareous mudstones (e.g., marlstones) and limestones dominate in the basin center. Three main zones can be defined for the preservation of marine organic matter (MOM) in such a system. Area 1 is dominated by siliciclastic mudstones with low preservation potential for MOM. Area 2 is dominated by calcareous mudstones that have good potential for MOM preservation. Area 3 is dominated by pelagic limestones that have low MOM content.

AAPG Education — Upcoming Education Events 2016

HEDBERG CONFERENCE *Submit Your Abstract Now!*

Fundamental Controls on Shale Oil Resources and Production

28-30 April 2017 | Beijing, China

The conference objective is to gather experts from multiple disciplines. Likely participants will include academic and industry scientists with technical backgrounds in petroleum geology, geochemistry, petrophysics, reservoir characterization, fluid flow, basin modeling, seals, reservoir geophysics, and petroleum engineering. New and different perspectives will be sought from researchers in fields that are not traditionally linked. For this reason, the conveners will also strongly encourage applications from researchers in related fields such as hydrogeology, visualization methods, and numerical modeling.

Technical Themes

1. **Petroleum generation, primary expulsion and secondary migration:** Kerogen type and generation kinetics; oil and gas geochemistry (fundamentals related to correlation of in situ and migrated hydrocarbons, molecular tracers for expulsion efficiencies), thermal maturity, thermal cracking and oil to gas evolution
2. **Shale/mudrocks as reservoirs:** Sedimentology of fine-grained organic rich rocks, diagenetic histories, micro and nano-porosity evolution, small pore PVT, water saturation, relative permeability, the importance of quartz and carbonate minerals, NSO compounds, mechanical and hydraulic properties of shales; hydrocarbon storage and delivery mechanisms
3. **Hydrocarbon enrichment mechanisms in shale/mudrock systems:** Shale compaction, TOC by volume and association with other lithofaces, top and bottom seals, hydrocarbon retention and fractionation, the role of kerogen and inorganic/organic CO2 release on processes such as pressure, migration conduits, secondary porosity enhancement involving organic acids, the importance of burial history and timing of structural deformation, the role and challenges of recognizing overpressure zones, multi-episode petroleum charging and seal failure, basin modeling in unconventional plays
4. **Geophysical technologies related to shale oil exploration:** Imaging of fractured reservoirs; wireline logging for detecting organic rich beds and shale oil pays; horizontal well logging
5. **Multistage fracturing for shale/mudstone reservoirs:** Fracturing and monitoring technologies, number of stages and spacing, advances in proppants and surfactants
6. **Innovation production techniques:** Well spacing and design layout, stacked laterals, enhanced recovery from unconventional reservoirs (gas injection)
7. **Production allocation:** Identifying zones contributing to production results, leaking seals/barriers

Abstract submission is open. Deadline to submit is December 31, 2016

Please send a 1-4 page abstract, including optional figures up to 2. Specify that your abstract is for the AAPG 2017 Beijing Hedberg Research Conference. Include all co-authors' names (including contact information for the primary author). An abstract cover sheet is required for all submitted abstracts.

For more information contact AAPG's Innovation and Emerging Science / Technology Department at sbrown@aapg.org.

GEOSCIENCES TECHNOLOGY WORKSHOPS

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 a 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.

Proposed topics for presenters:

- Geochronological determinants, including detrital zircon
- Reservoir characterization and connectivity
- Borehole stability and pressure modeling
- Beomechanical modeling and understanding pressure in reservoirs
- Assessment phase and improvements
- Planning reservoir development
- Tying reservoir measurements with characterization and production planning

If you'd like to share your knowledge and be a part of this workshop, please contact sbrown@aapg.org.

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 the 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 General Dinner continued from page 15

In this presentation, I will propose a mudstone depositional model that links shoreline sandstones, siliciclastic shales, and pelagic carbonates (marlstones, chalks) in an epicontinental basin. The public-domain lithology, sedimentology, and organic geochemistry data I use to construct the model come from Cenomanian-Turonian strata of the Cretaceous Western Interior Seaway (Cardium, Second White Specks, Ferron, Dakota, Greenhorn, Eagle Ford, and other formations). The model is an idealized simplification that facilitates our understanding of the complex natural phenomena active in these settings and should serve as:

1. an integrated basis for process interpretation of the depositional system it represents;
2. a norm for purposes of comparison;
3. a guide and framework for further observations; and
4. a predictor during new inquiry.

The model does not represent all muddy or organic-rich depositional settings, but with its focus on genetic processes, it should be a useful guide for developing similar models that represent those systems. ■

Biographical Sketch

Bruce Hart has been a leading researcher in Statoil's Shale Oil and Gas Research Group since April 2013. He previously held positions with ConocoPhillips, McGill University, New Mexico Tech, Penn State, and the Geological Survey of Canada. He was the 2009–2010 AAPG/SEG Distinguished Lecturer, giving talks about seismic stratigraphy and unconventional reservoirs, and was a guest lecturer for the Canadian Society of Petroleum Geologists in 2006, giving talks about fractured reservoirs. He has authored or coauthored 58 peer-reviewed publications on shales, seismic attributes, clastic sedimentology, fractured reservoirs, pore-pressure prediction, sequence stratigraphy, and other topics. Three of those papers have won "Best Paper" awards, including his 2013 Interpretation paper on seismic stratigraphy. He authored a digital textbook on seismic interpretation for AAPG, and he has given short courses on that topic in Houston, London, Cairo, Kuala Lumpur, Calgary, Vienna, and elsewhere.

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

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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

Tuesday, December 6, 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

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.

Integrating Geological, Petrophysical, and Seismic Rock Property Data to Identify Prospective Areas and High-grade Locations

Cesar Marin
CGG
cesar.marin@cgg.com

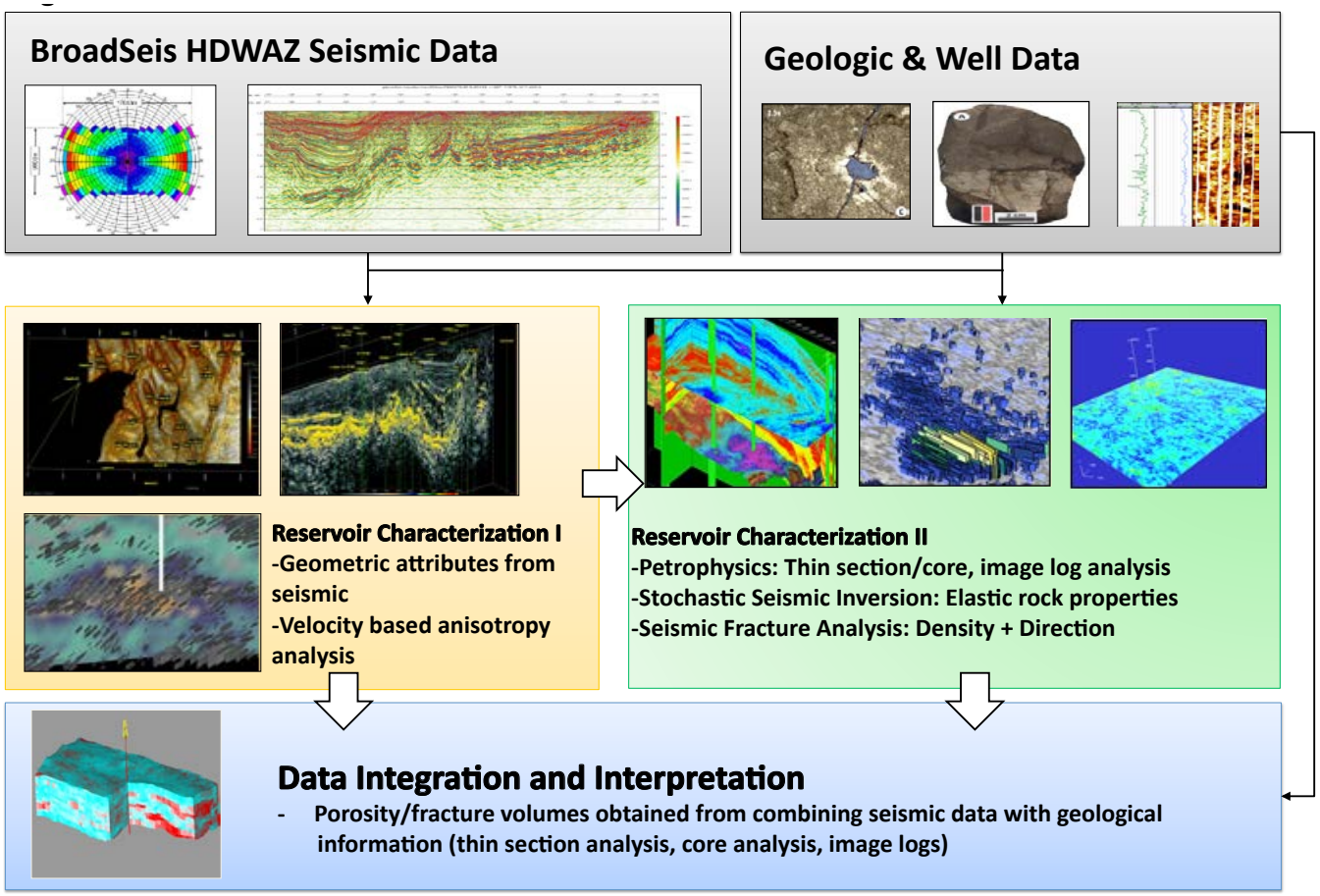


Figure 1

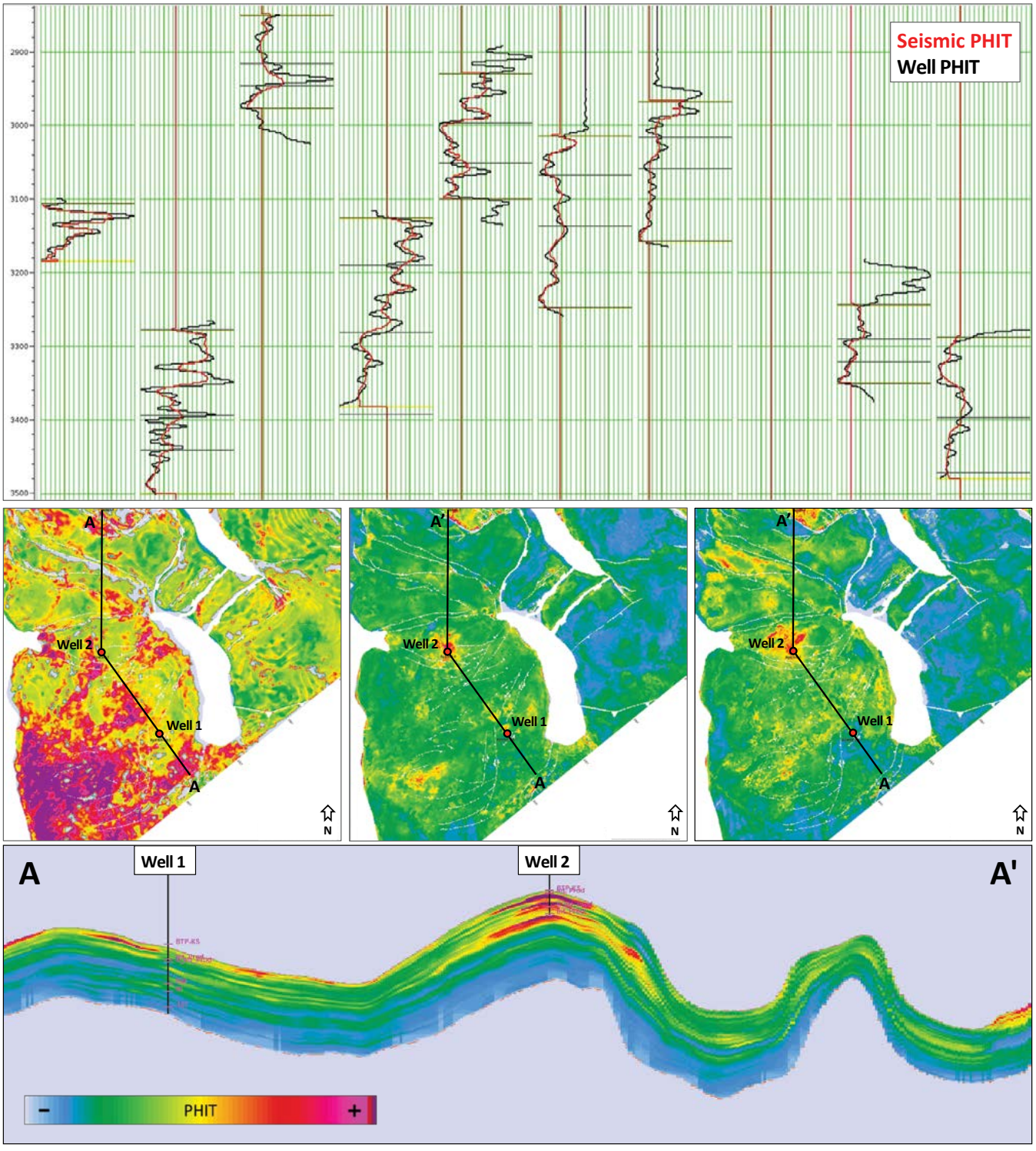
New technologies in seismic acquisition, processing, and reservoir characterization are allowing for a better understanding of hydrocarbon reservoirs. The ability to implement this complete technological value chain allows us to tackle the most complex exploration and development projects (**Figure 1**).

The focus of this study was a shallow water carbonate reservoir located in the southern Gulf of Mexico.

The primary objective of the reservoir characterization was to identify and quantify the generation of secondary porosity within the carbonate reservoir. In the target reservoir, porosity

HGS Northsiders Luncheon *continued on page 20*

HGS Northsiders Luncheon continued from page 19



has been enhanced as a combined result of fractures, dissolution voids (causing vuggy-to-cavernous porosity) and dolomitization of the original limestone. The geological processes responsible for this porosity enhancement are complex and include both regional and local tectonics together with a complex diagenetic history. Understanding the significance of the altered seismic data response associated with the effects of these geological processes is critical to the understanding of the geological model.

A broadband high-density wide-azimuth (HD-WAZ) survey was acquired targeting the shallow water reservoir. Extended seismic bandwidths provided by the broadband acquisition, improved

illumination from the wide-azimuth (WAZ) configuration and high spatial resolution made possible by the dense acquisition technique produced visually compelling imaging and reservoir results. A fully integrated reservoir-oriented processing sequence was applied to the data to facilitate the detailed reservoir characterization study.

Upon completion of the acquisition and reservoir-driven seismic processing stages, the reservoir characterization study was initiated and divided into three phases, as shown in Figure 1. The first phase focused on the generation of geometrical attributes, spectral decomposition and initial fracture analysis based on Horizontal Transverse Isotropy (HTI). During phase two, geological and petrophysical analyses were carried out on well data to identify reservoir properties such as porosity, lithology and fracturing. This information, combined with the subsequent rock physics analysis, allowed for the calibration of well data to seismic attribute volumes derived from elastic and azimuthal inversion processes. The last phase integrated and analyzed geological, petrophysical and seismic data to identify prospective areas and high-grade locations for new wells

The inclusion of geological information into the interpretation phase, along with petrophysical and seismic information significantly enhanced the results. Information obtained from geological studies, including sedimentological core description, petrographic and diagenetic analysis, and structural and fracture studies, provided considerable insight into the reservoir and became an important tool for interpretation of seismic attributes.

Ultimately a reservoir classification scheme was selected utilizing seismic lithology and porosity volumes. A single seismic volume was created to assist in the creation of an integrated geological model and used to support field development. ■

Biographical Sketch

Cesar Marin started his career at CGG back in 2002 as a Geophysicist. He holds a BS in Geophysics from Universidad Central de Venezuela and he is a member of the SEG and GSH. He has worked with CGG for almost 15 years. Ten of those were spent in Mexico in the Processing/ Reservoir Center providing high-end services to the national state company PEMEX. He joined the Seismic Reservoir Characterization Group with CGG in Houston in 2004, and is now a Senior Geophysical Advisor in the GeoConsulting Division utilizing comprehensive workflows to help increase understanding of the reservoir and help reduce risk.

His background includes working in different geological settings ranging from Reservoir-Oriented Seismic Processing QC's, to any type of inversion process best-suited to highlight the reservoir quality while minimizing risk. He has led G&G projects in many of the world's basins including North and South America unconventional plays and he has extensive experience in the Cantarell, Chicontopec, and Ayatsil Fields in Mexico. He has been a collaborator in recent technical papers based on the Gulf of Mexico, Powder River Basin and Williston Basin.

HGS Tennis Tournament

Dear Geoscientist,
Houston Geological Society is organizing a tennis tournament for its members and colleagues in the industry as a fun and active networking event during late spring 2017. At this time we are looking for volunteers to help set up and run the event: find sponsors and vendors, decide on tennis facility, etc. Knowing the sport of tennis is a helpful but not mandatory for the tasks at hand.

Interested parties should contact Constantin Platon at platonpc@gmail.com for more details and how to get involved. Thank you!

Monday, December 12, 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.

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Scott E Thornton
Ecopetrol, Houston and Department of Earth Sciences, University of Southern California
Win Swe and Soe Thura Tun
Yangon University

Regional Tectonics, Structure, and History of Petroleum Exploration in the Union of Myanmar (nee Burma)

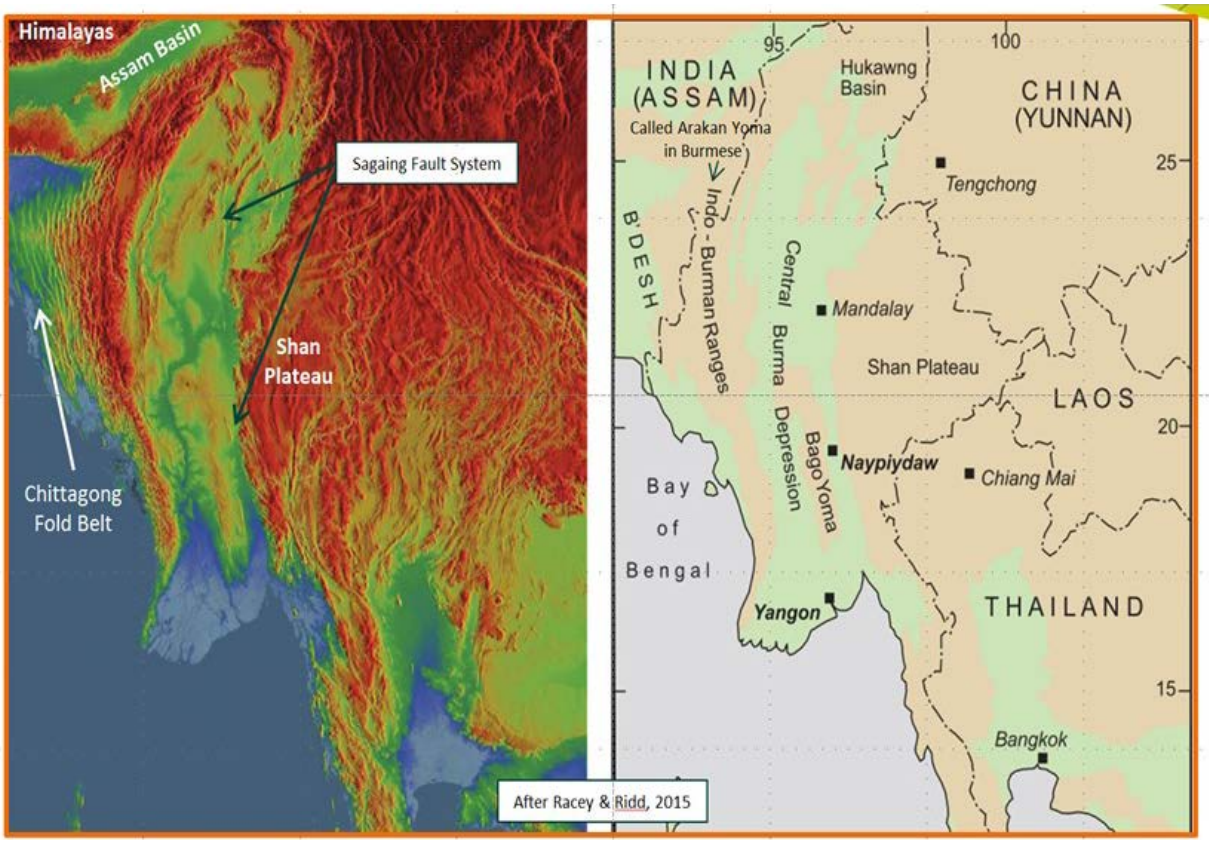

Figure 1. *DEM Image of the Union of Myanmar vicinity with major structural features (after Racey and Ridd, 2015). See also Aug Khin et al., 1970 and Pivnik et al., 1998.*

The Union of Myanmar is located in a plate tectonic setting where compressional and strike-slip tectonics have formed a complex set of fore-arc and back-arc basins (**Figure 1**). Significant anticlines (**Figure 2**) were formed from the compression and transtension, as the Burma Plate moved towards the north past the Shan Plate, and the Indian Plate moved north past the Burma Plate. In the Central Burma Depression (**Figure 3**), sandstone and oil and gas-bearing limestone reservoirs were deposited. Several source rock intervals have been documented, mostly deltaic-fluvial in origin (**Figure 2**, Harun et al., 2014). The provenance of the clastics was from the east and, with an estimate of 303-460 km of offset over time along the Sagaing Fault, a transform fault, the provenance areas are now considerably to the south (Win Swe and Soe Thura Tun, 2007; Win Swe, pers. comm., 1989).

The Union of Myanmar (nee Burma) has had oil exploration since the first hand-dug wells were drilled in the Central Burma basin around 900 BC, using technology first used in China's Szechuan Basin. Starting in 1755, when Myanmar was part of the British colonial empire of India, early British soldier-diplomats visited some of the hand-dug wells in the Central Burma Basin, which

HGS International Dinner *continued on page 24*

HGS International Dinner continued from page 23

were located around prominent surface anticlines in the vicinity of Yenangyaung. In 1755, there were 520 hand-dug wells registered by the British government. Historical estimates establish about 1 million U.S. gallons of oil were produced a day in 1797 by local families organized as corporations. In 1886 the British colonial Rangoon Oil Company, registered in Scotland, was organized to explore for oil with modern techniques. This company became the foundation of the storied Burmah Oil Company. Burmah drilled the first cable tool wells in 1889 in Yenangyaung, which resulted in the "discovery" of Yenangyaung Oil Field in the Central Burma Basin. Burmah Oil Company allowed Burmans who had land rights to continue digging hand-dug wells, while Burmah was drilling cable tool wells very close by (**Figure 4**). A geologist working for the company, in fact, developed the "Anticlinal Theory of Petroleum Entrapment" based on his field studies around this oil field. This, later, became a fundamental aspect of oil exploration from surface anticlines (**Figures 5** and **6**). For a long time, from 1886-1901, Burmah Oil Company held a colonial monopoly in the country, until the Standard Oil Company gained the first lease in 1901. Even with competition, the Burmah Oil Company enjoyed nearly exclusive success in the country, and continued to operate until the Japanese invasion of the country. As the Japanese were seeking a source of oil, British troops destroyed all producing wells with explosives. After the end of WWII (and the promised independence of the Union of Burma after the defeat of the Japanese in Burma), Burmah Oil Company enjoyed an exclusive monopoly on exploration until the Union Oil Company and General Exploration Company partnership obtained a huge lease for most of the Central Burma Basin outside of Burmah's producing fields in 1961. They began extensive field work and air-photo analysis to assess how to proceed with their exploration efforts. With the nationalization of the oil industry in 1963 after the untimely death of Aung San, the leader in independence from Britain, Burmah Oil and Union Oil lost their leases, and the newly formed state oil company, later called the Myanmar Oil and Gas Enterprise (MOGE) assumed all operations. MOGE successfully delineated the older fields and found sizable fields from their own exploration using gravity methods and surface geology. When prospective areas onshore had no surface anticlines, MOGE acquired 2D seismic data and had more discoveries of oil. In 1988, the government opened oil and gas exploration to foreign oil companies for the onshore, and the prize block, Block F, was acquired by Unocal, who competed aggressively with the other bidders, Exxon and Mitsubishi for the most coveted block in the country. As an interesting twist of petroleum history, the Chief Geologist of MOGE at the time, Aung Din, had been trained by Unocal in 1961-62 when Unocal had essentially the same block. He had a warm place in his heart for those days, and the relationship helped in Unocal's block acquisition. Many other companies explored the country during this first foreign involvement, but only Shell tested any significant petroleum, which was sub-commercial at the time. In 1992, Total acquired a previously-discovered gas field in offshore Burma in the Irrawaddy Delta, later called Yadana Gas Field, which had been evaluated by Unocal in 1987. Total was joined by Unocal Corporation as a partner as MOGE valued Unocal's relationship after their joint onshore venture in Block F (**Figures 9** and **10**). This gas field continues to produce today, with well over 5 TCF of recoverable reserves. Texaco, Premier Oil and Nippon Oil discovered the Yetagun Gas Field in 1992, and it began production in 2000. In 2000 Daewoo International acquired exploration acreage in Western Myanmar offshore, where they discovered nearly 5 TCF of gas in the Shwe Project in channelized turbidite fans, including injectives (Cossey et al, 2013). Other exploration efforts, both onshore and offshore, have not yielded economic success to date, but the long saga of oil and gas exploration in Myanmar continues. Even at present, the ingenious Burmans and Arakanese continue to drill hand dug wells, or use home-built rotary machines (**Figures 5** and **6**). The most recent offshore lease sale demonstrates the continued interest of large and small countries in Myanmar's exploration potential. Indeed, we are at the peak of oil and gas exploration in the country, with nearly all prospective acreage under leasehold.

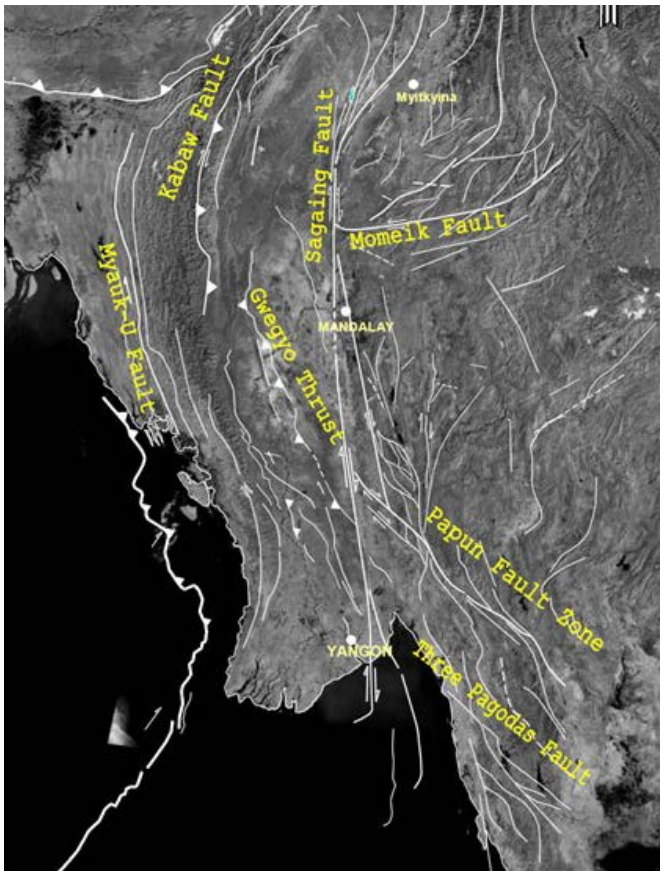

Figure 2. *Structural Trace Map of Myanmar Based on Landsat Interpretation and Field Studies by Win Swe (1970, 1981) and others (After Soe Thura Tun (2005). See also Myint Thein et al., 1991.*

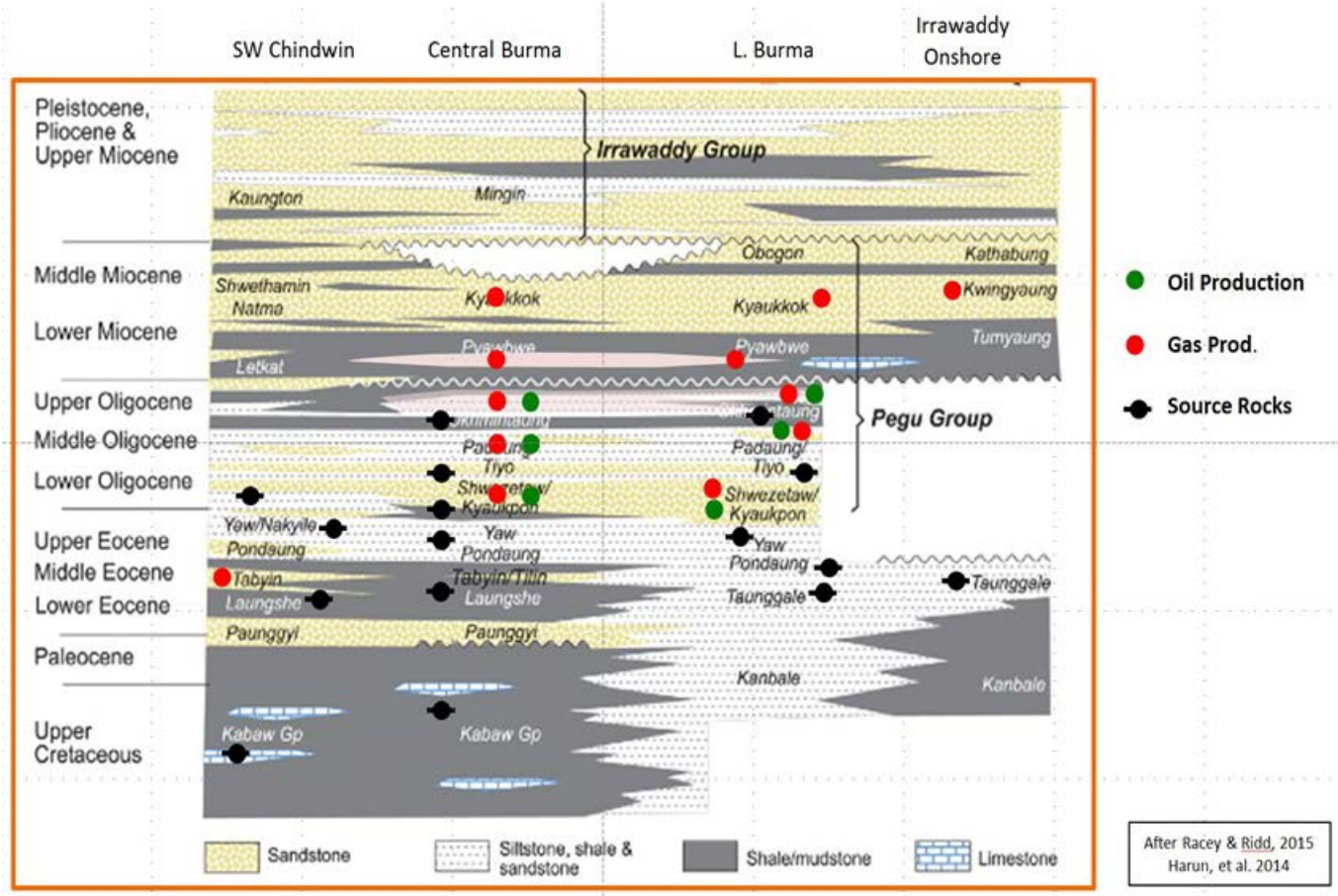

Figure 3. *Reservoir and source rocks of the Central Burma Depression (After Racey and Ridd, 2015 and Harun et al., 2014).*

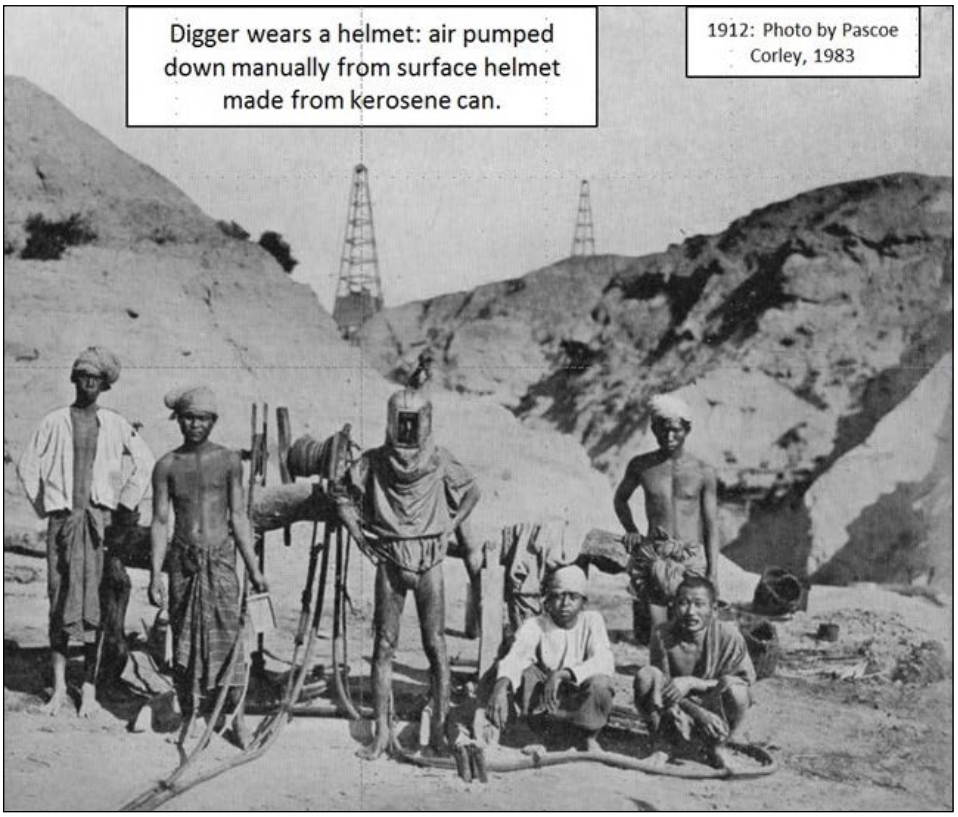

Figure 4. *Burmese people had simple drilling techniques. They were able to dig to greater depths with the appearance of the kerosene can, as a helmet, and air pumped down from the surface, as this 1912 picture shows (After Corley, 1983). Note Burmah Oil rigs in the distance. Native shallow drilling claims were honored by Burmah Oil, often located within 50-100 meters of cable tool rigs.*

HGS International Dinner

continued on page 26

HGS International Dinner continued from page 25

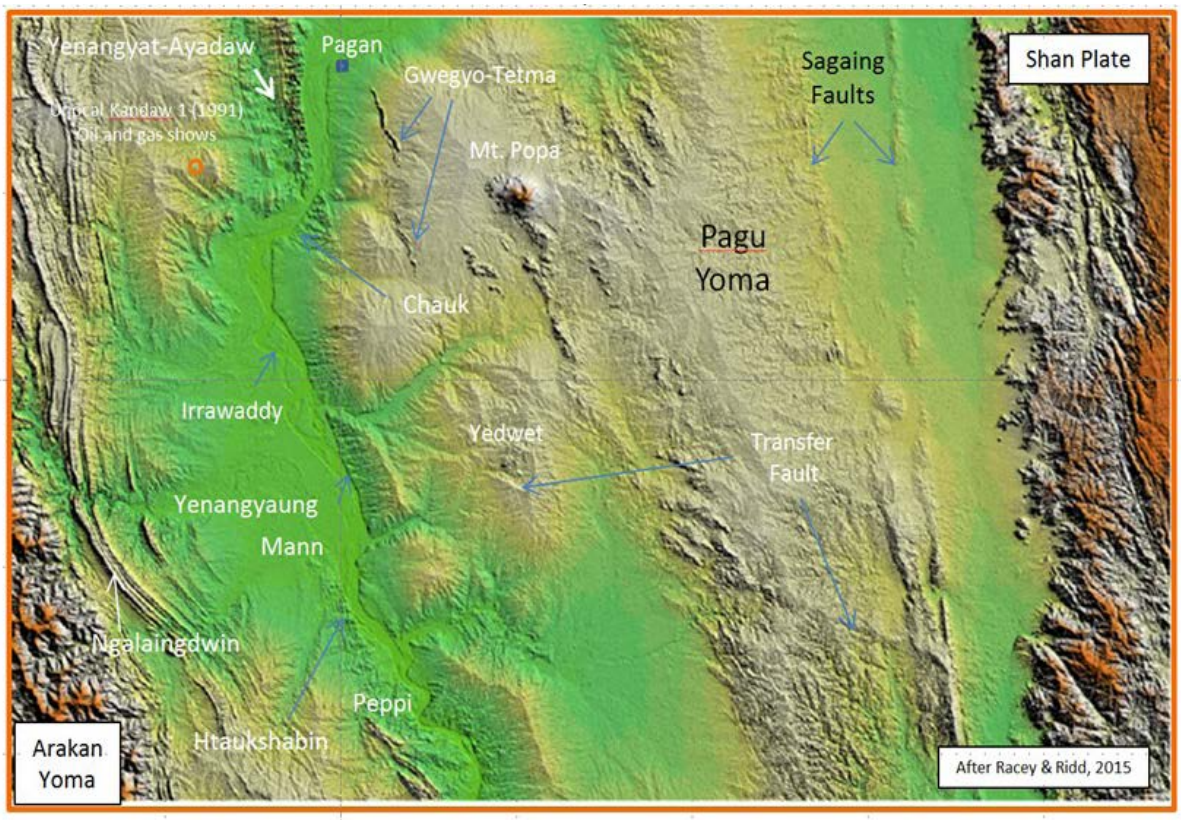

Figure 5. *Central Burma Basin: structure, surface anticlines and oil fields. It was in this basin, where four 100 mmbo plus oil fields are found, where the Anticlinal Theory of Petroleum Accumulation was first elucidated in 1855 by Thomas Oldham, an Anglo-Irish geologist working for the Indian Geological Survey, while performing field work on the Yenangyaung Anticline. Note the location of the Sagaing Fault System (Win Swe and Soe Thura Tun, 2007) and transfer faults cutting across the Pegu Yoma Fold Belt (DEM image after Racey and Ridd, 2015).*

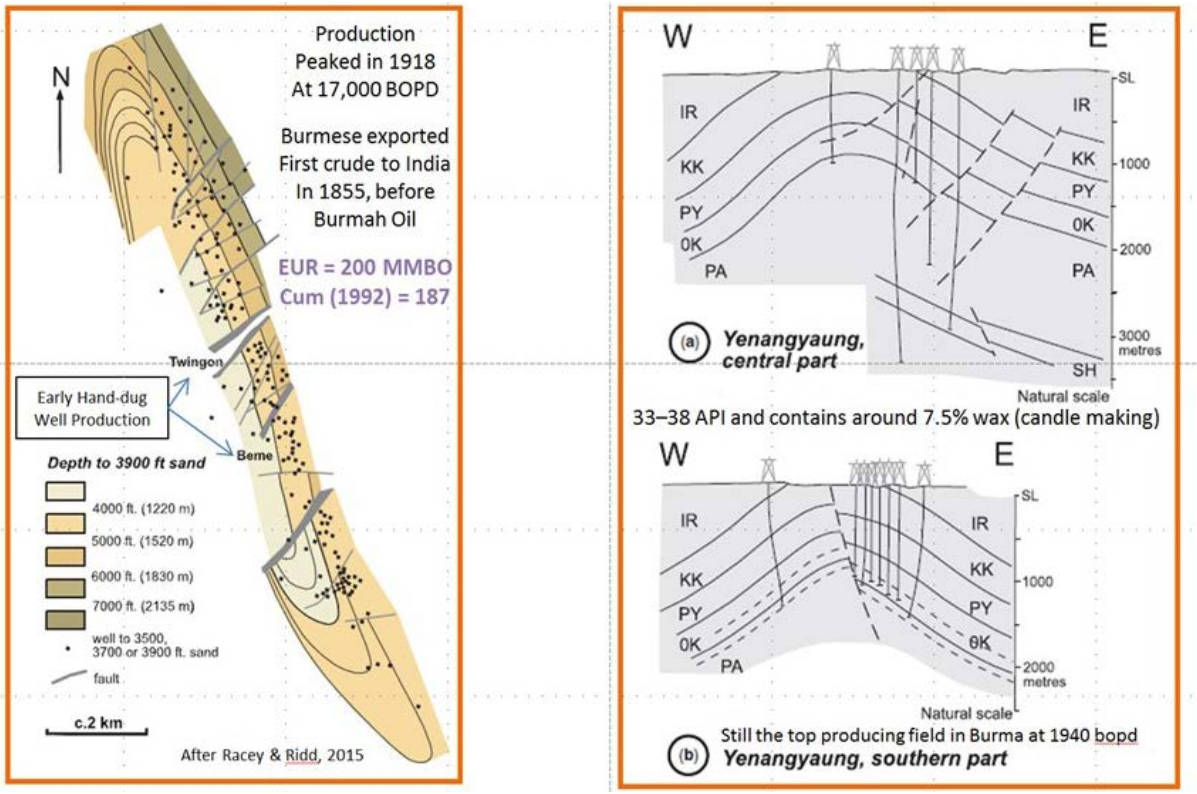

Figure 6. *Yenangaung anticline, where it all began. Structure Map showing the locations of early hand-dug wells and cross sections of oil fields. Note the changing vergence of the thrust faulting on the anticline (Racey and Ridd, 2015 after Pascoe, 1912).*

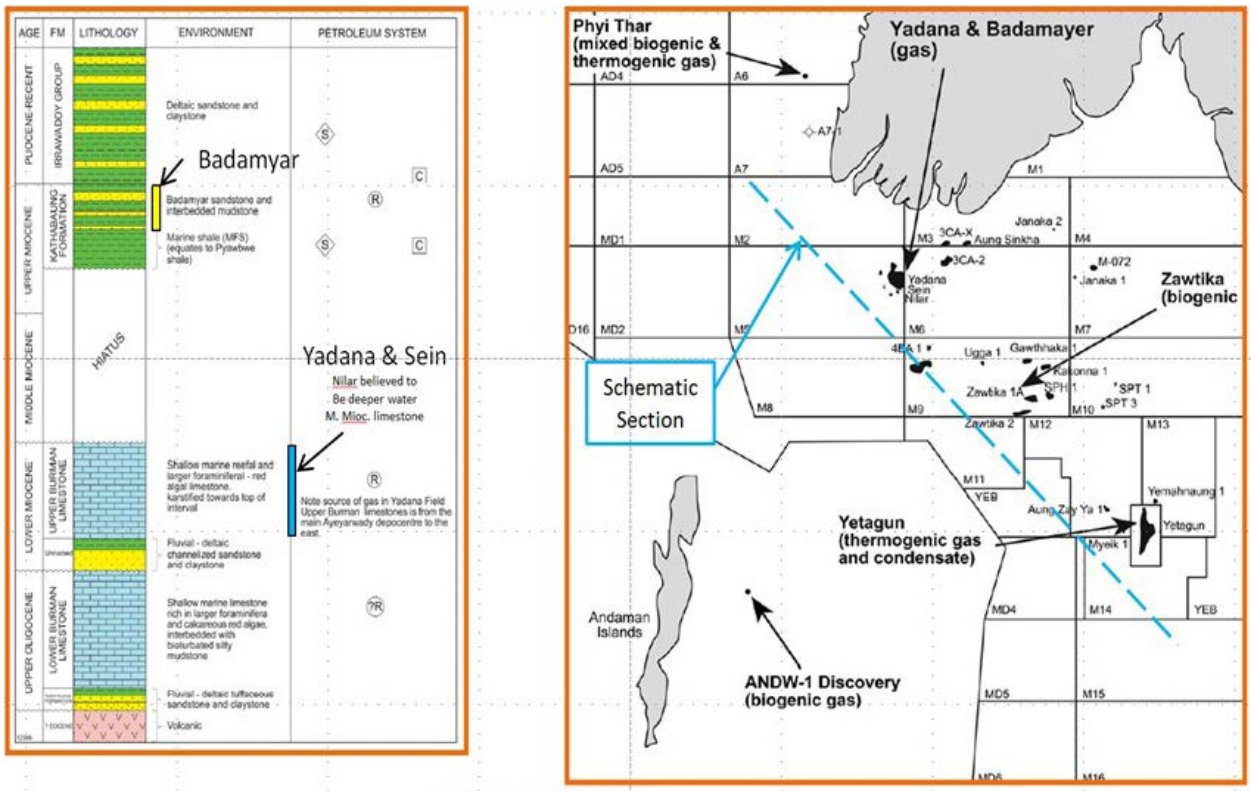

Figure 7. *Stratigraphy and fields. The Offshore South area in the Gulf of Martaban has been a very profitable enterprise by Total, Chevron and PTTEP. The Yadana Field was actually discovered by the Burmese through a blowout, later safely exploited by the Total-operated group, which discovered more gas (after Racey and Ridd, 2015).*

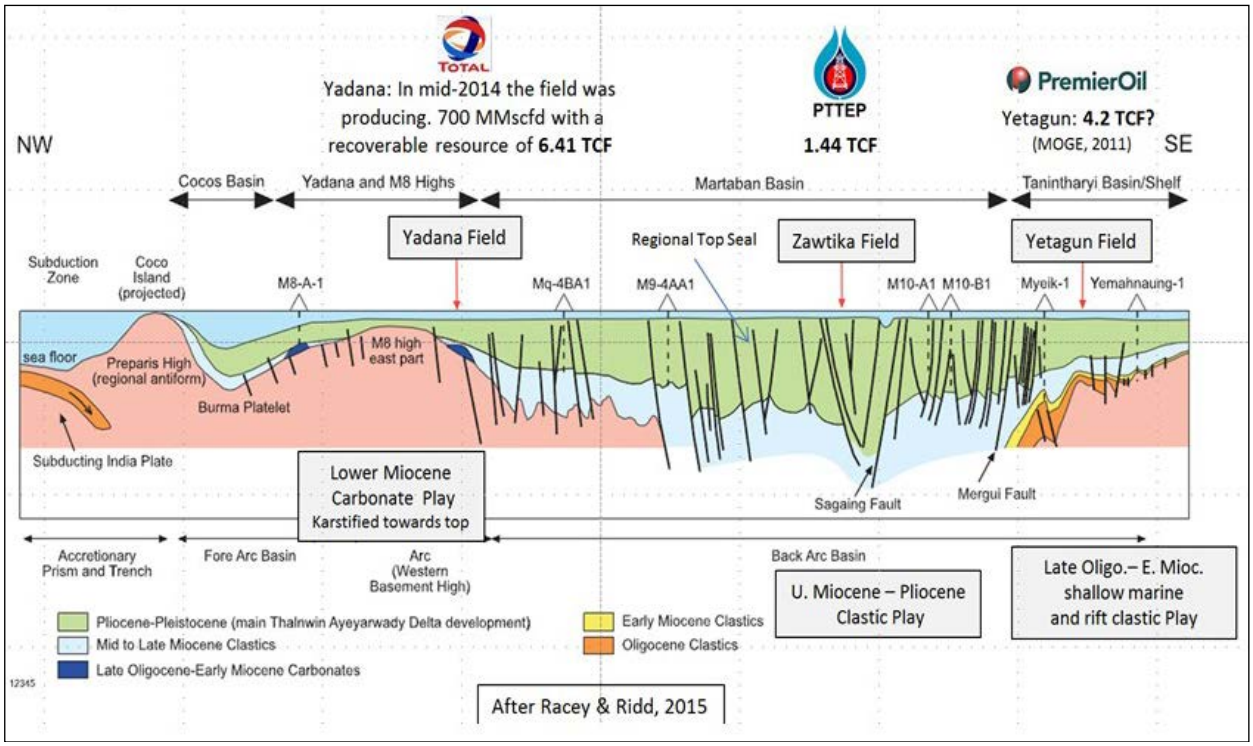

Figure 8. *See location of cross-section in Figure 6. The lucrative gas play in the Yadana Field rests on a basement high and a volcanic arc. The karstification of the carbonates in Yadana has been attributed to subaerial exposure, but there is also high CO_2 in the gas from the volcanics (after Racey and Ridd, 2015).*

HGS International Dinner *continued on page 28*

HGS International Dinner continued from page 27

Figure 9. *The Burmese people are very ingenious, able to improvise and make things that work well for little money, like this rotary rig on the left, and this cluster of small rotary rigs on the right (The Irrawaddy Times, 2013)*

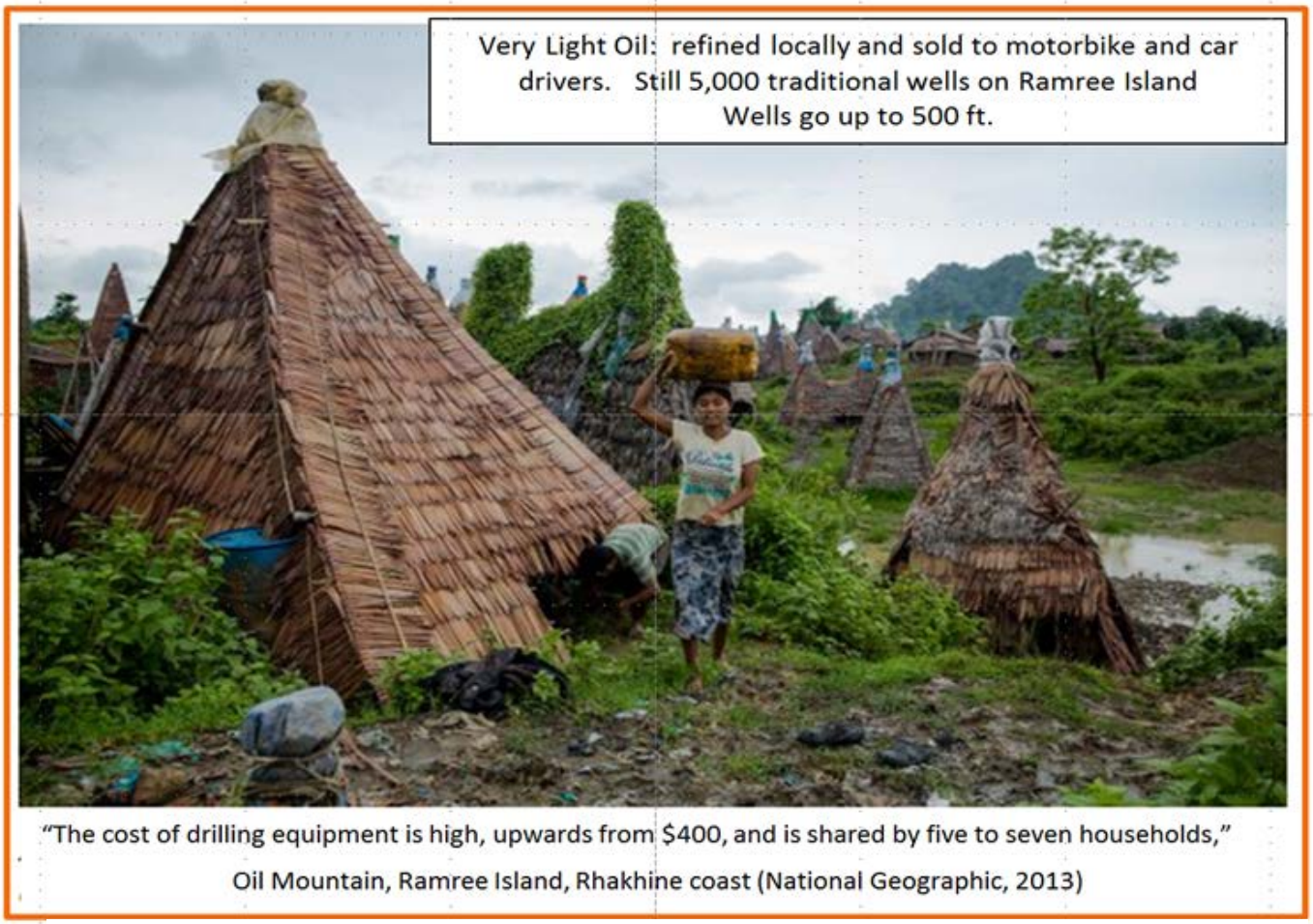

Figure 10. *The Arakanese (Rohingya) people have been producing oil for as long, probably as the Burmans, who started in 905 AD. The Arakanese used oil for waterproofing boats and simple oil lamps, as well as medicinal purposes.*

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Win Swe and Soe Thura Tun, 2007, A field trip guide to the Sagaing Fault Zone in the Sagaing Hills area, central Myanmar: Myanmar Earthquake Committee, 44 pp.

Biographical Sketch

Scott Thornton came to work on Myanmar (nee Burma) as a result of his career in New Ventures at Unocal, which has consumed 33 of his 35 years of oil industry experience. When it became apparent that Myanmar was holding its first onshore bid round ever in 1989 after a visit by Ed Robinson from Business Development, the small International Exploration team in Los Angeles eagerly jumped on the opportunity. Scott was working for Fred Dekker in Asia Pacific New Ventures for Unocal in Los Angeles, a very experienced explorationist in the Gulf of Thailand. Scott eagerly volunteered to work on Myanmar, as he previously had been involved evaluating the offshore gas discovery, 3DA, in 1988, which later became the Yangon Field. Scott and his geophysical teammate, Mike Hursey, made several trips to Myanmar, including field reconnaissance, and chose the block he felt had the best potential. His close teammates in the venture were Philip Grove, as a New Ventures/Business Development lawyer, as well as Fred Dekker. The rest of the story is the history presented in this talk. Scott has worked for Unocal and Shell for about 20 of his 35 years, and several other employers and clients. His new ventures work has covered South Asia, China, SE Asia, Western South America, Australia, and, for 12 years, the South Atlantic Basins of Brazil and West Africa. He currently works on the Mexico New Ventures Team, has consulted to Pemex in Mexico for 2 years and looks forward to one last visit to Burma on vacation in his retirement to sit on Aung Din's back porch.

Wednesday, December 14, 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.

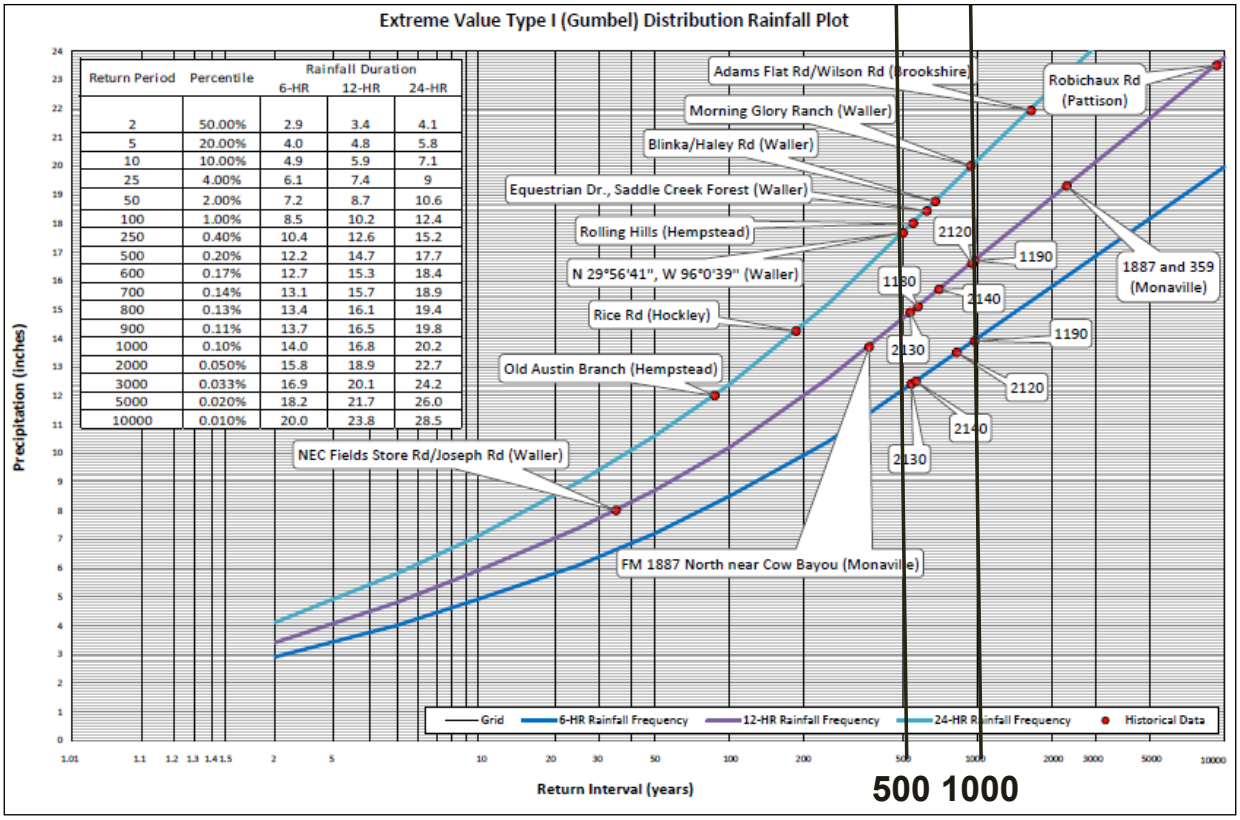
Jeff Linder
Harris County Flood Control District

ETHICS MOMENT

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

Danny Bailey Kingham of GSI
Safety and Ethics in the Professional World.

The "Tax Day" Flood of April 17-18, 2016



2016 Tax Day Flood – rainfall

Devastating flooding impacted Harris County and southeast Texas in the spring of 2016. The "Tax Day" Flood of April 17-18, 2016 was one of the most significant flood events in Harris County since the catastrophic damage brought by Tropical Storm Allison in 2001. The presentation will cover the actions taken by the Harris County Flood Control District, the Harris County Office of Emergency Management, and the National Weather Service during this historic event to protect property and save lives and provide a detailed look at the resultant flooding on several of the Harris County watersheds. Additionally, there will be discussion on Addicks and Barker Reservoirs which surpassed previous pool records and resulted in the closing of major roadways for weeks along with statistics on structural damages and data showing how HCFCD projects prevented homes from flooding.

HGS Environmental & Engineering Dinner *continued on page 32*

HGS Environmental & Engineering Dinner

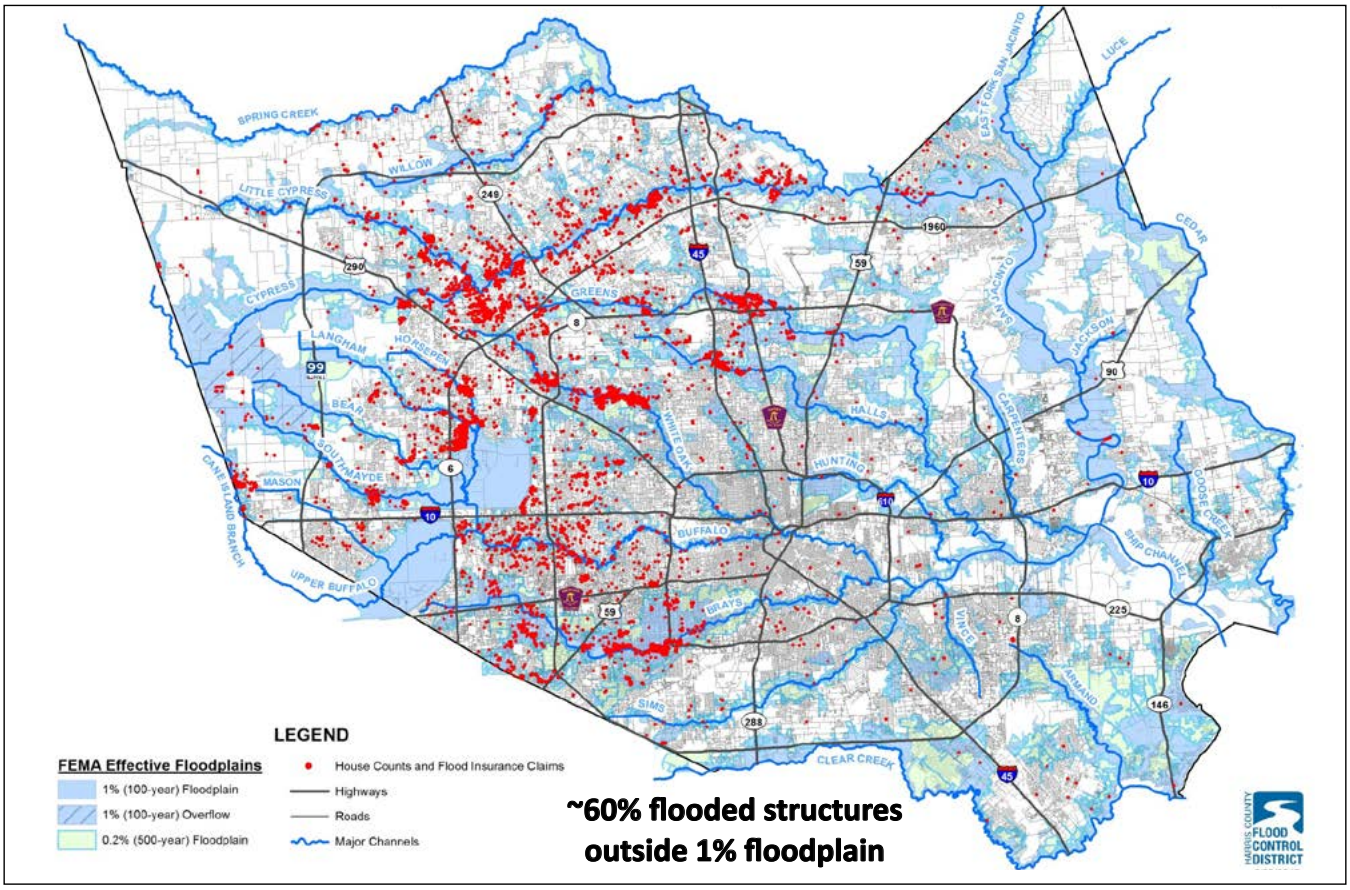
continued from page 31

Biographical Sketch

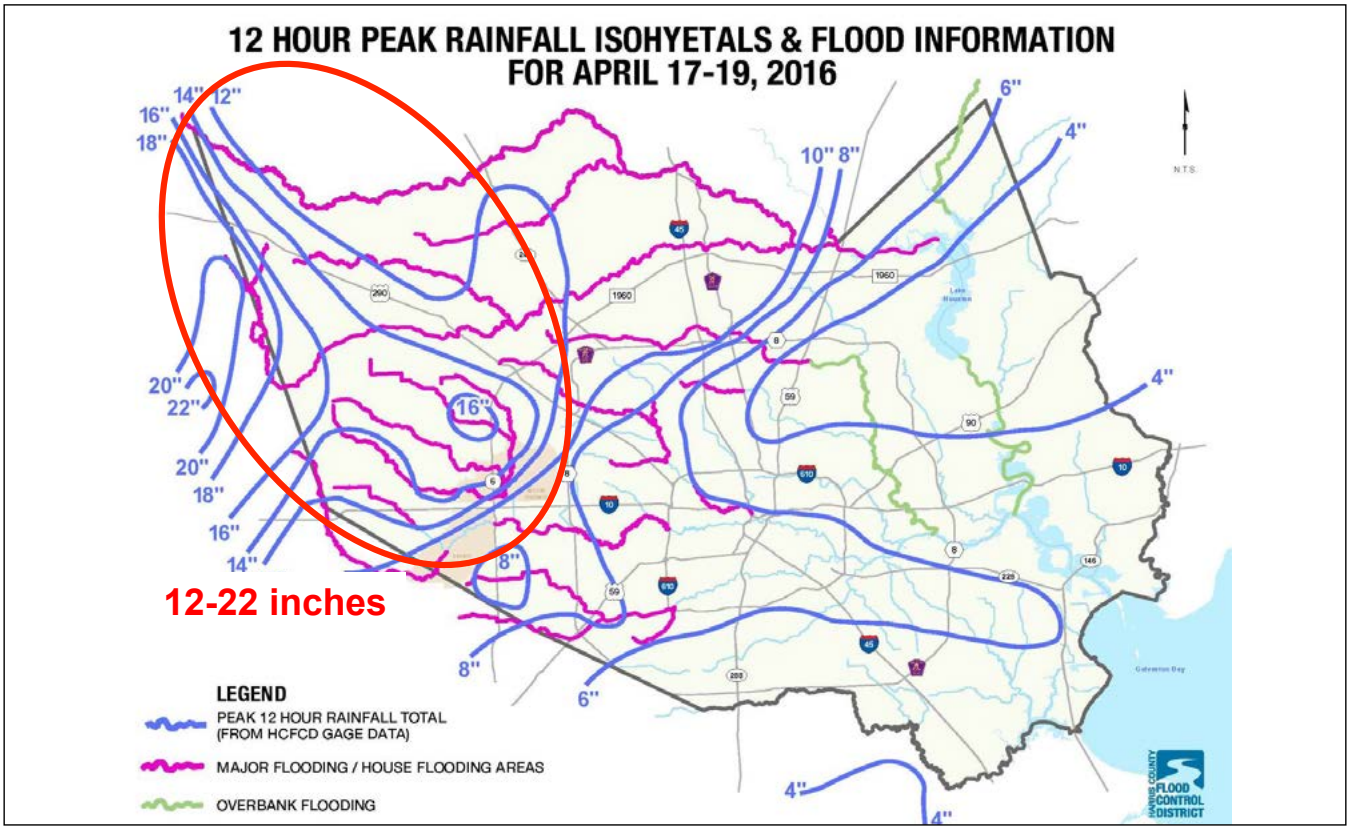
Joining the Harris County Flood Control District in 2004 as the District's first meteorologist is one of many precedents set by **Jeff Lindner**. In his primary role as manager of the District's Flood Watch Program, Jeff implements regular communication with the National Weather Service and the Harris County Office of Emergency Management (HCOEM) during times of flooding while monitoring 140 rainfall and stage gages and collecting data at over 400 bridges located on many of Harris County's 2,500 miles of channel. In addition, he oversees the operation of the Harris County Flood Warning System and the Regional Flood ALERT Partners group, as well as establishing flood levels for all 140 gage sites in Harris County. Jeff has developed multiple presentations and preparedness materials on hurricane impacts, flooding, and drought and how to prepare and respond to these weather episodes. Jeff holds a Bachelor of Science degree in meteorology from Texas A&M University. He is a member of the national and local chapters of the American Meteorological Society and of the Texas Gulf Coast Emergency Managers Association, the National Hydrological Warning Council, Texas Flash Flood Coalition, and ALERT Users Group.

Date	Elevation
Apr 2016	102.65
Mar 1992	97.64
Apr 2009	97.08
Nov 2002	96.63
Nov 1998	95.88

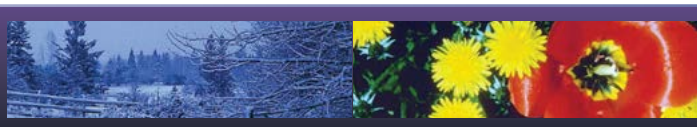
Addicks Reservoir



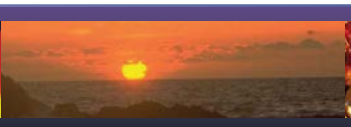
House flooding locations



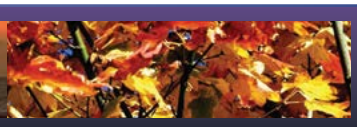
December 2016



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	**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.**	
4	5 **HGS General Dinner Meeting** *"Mopping up the Shale Mess: Integrated Mudstone Depositional Systems. An Example from the Cenomanian-Turonian Western Interior Seaway,"* *Bruce Hart* *Page 15*	6 **HGS Board Meeting** *6 p.m.* **HGS Northsiders Luncheon Meeting** *"Integrating Geological, Petrophysical and Seismic Rock Property Data to Identify Prospective Areas and High-grade Locations," Cesar Martin* *Page 19*	7
11	12 **HGS International Dinner Meeting** *"Regional Tectonics, Structure and History of Petroleum Exploration in the Union of Myanmar (nee Burma),"* *Scott E. Thornton,* *Page 23*	13	14 **HGS Environmental & Engineering Dinner Meeting** *"The "Tax Day" Flood of April 17-18, 2016,"* *Jeff Linder* *Page 31*
18	19 **HGS Office Closed**	20	21
25 Christmas Day	26 **HGS Office Closed**	27	28



GeoEvents



Thursday Friday Saturday

1	**2** **Don't wait, make your reservations online at hgs.org**	**3**
8	**9** **HGS Continuing Education One Day Short Course** *"Organic Petrological and Geochemical Screening Methods for the Upstream," Houston, TX* *Page 4*	**10**
15 **February 2017 Bulletin** CONTENT DUE	**16**	**17**
22	**23**	**24**
29	**30**	**31**

December 1-2, 2016
AAPG Geosciences Technology Workshop
New Opportunities with Drones
Houston, TX

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

April 26-28, 2017
Seapex Exploration Conference
Singapore, Asia

April 28-30, 2017
AAPG Hedberg Conference
Beijing, China

Spring 2017
HGS Tennis Tournament
Houston, TX

August 18-22, 2017
AAPG Geosciences Technology Workshop
Astrogeology Total Solar Eclipse Feild Seminar, Casper, WY

About the Cover

by Kathryn Fry

The cover photo was taken by Tania C. Campbell at Big Bend National Park in April 2015 during a trip with some Women of Geoscience Network members. The ammonites are in the San Vicente Member of the Boquillas Formation (~ 100 MYA Late Cretaceous – Coniacian). The fossils can be found just above the Turonian-Coniacian boundary (marked by 4 alternating brownish red beds), and contain the marker ammonite *Allocrioceras hazzardi*.

One of the WGN members on the trip, Kathryn Fry, had some first-hand knowledge of the geologic history of Big Bend from her Master's experience and she provided additional insight of the region in a letter to the Editor:

Dear Tami:

After months of diligently planning and prepping, digging through decades of publications and past field guides, researching the climate and locale, we finally ventured into the wilds of Big Bend National Park in the late spring of 2013. After the countless hours researching the potential depositional environment of the Cretaceous Western Interior Seaway, I was actually going to have the opportunity to document and describe the Boquillas Flags – a beautifully cyclic carbonate sequence that was deposited in a chrono-synchronous and possibly analog environment to the South Texas shale play, the Eagle Ford Group. While most visitors to BBNP are interested in the rumored healing powers of the geothermally heated mineral water of the natural hot springs, miles of remote hiking trails, the ruins and ghost towns of an era-gone-by, and one of the darkest night skies in the world, I was captivated by the opportunity to observe millions of years of earth history by simply hiking along the base of the gently dipping bluffs. The outcrops accessible within the park capture major environmental changes that occurred during the Cenomanian, Turonian, and Coniacian stages including: the lively and healthy fossiliferous Buda Limestone; the overlying unconformity marking a major sea level rise and subsequent drowning of the healthy carbonate shelf; and the initiation of the cyclic, flaggy carbonate deposition that is the iconic namesake of the Boquillas Flags. Somewhere hidden within these carbonate bluffs, there is evidence of the Oceanic Anoxic Event II – a major event that occurred at the Cenomanian-Turonian stage boundary. The twelve plus hour field days were arduous, but so immensely rewarding. The gentle breeze, the eternal babbling of the Rio Grande, the endless miles of untouched natural landscape – all made for an incredible and unforgettable experience in my quest to unlock the secrets of the Late Cretaceous Western Interior Seaway.

All the best on your next adventure!

Biographical Sketches

Katie Fry received her BS in Geological Sciences from University of California at Santa Barbara in 2008. During her time there, she worked as a research assistant under the instruction of Dr. Jim Boles and completed a senior thesis focused on U-Pb dating and petrography of microdiorite intrusives under the direction of Dr. Phil Gans. In 2012, Katie ventured outside of cozy California to the fabled land of Texas to attend the University of Texas at Austin where she made the switch to soft rock geology. Under the co-direction of Dr. Bob Loucks, Dr. Gregory Frébourg, Dr. Harry Rowe, and Dr. Steve Ruppel, Katie undertook an Eagle Ford-centric project that explored lithofacies, biostratigraphy, chemostratigraphy, and stratal architecture of both outcrop and core data sets. She received her MS in Geological Sciences in the spring of 2015.

Tania C. Campbell graduated from the University of Miami in 2001 with a dual BS degree in Marine Science and Geology. She graduated from the University of Texas at Austin in 2004 with a MS in Geology. A summer internship with Oxy in 2002 sparked her interest as a production geologist. Tania began working full time for Oxy in 2004, where she started in Permian Exploration and Exploitation (Houston) for 2 years, then spent 4 years working Monterrey shales and heavy oil fields in Bakersfield, California. In 2010, she returned to Houston to work mature waterflood and CO_2 floods in Permian. In 2015, she became a reservoir team lead for mature CO_2 and waterflood fields in the Midland basin and mature CO_2 source fields in Colorado and New Mexico.

2016 GSH/HGS Saltwater Tournament

2016 GSH/HGS SALWATER TOURNAMENT WINNERS

FLOUNDER

1st Place: Andrea Peoples

REDFISH

1st Place: Bill Sanstrom
2nd Place: Ron Casso
3rd Place: Keith Peoples

STRINGER

1st Place: Randy Appleby
2nd Place: Brian Elias
3rd Place: Richard Barron

TROUT

1st Place: Sheridan Elias
2nd Place: Jake Marson
3rd Place: Keith Peoples

*Special Thanks to TGS-NOPEC Geophysical Company

TGS

HGS Membership Announcements

HGS would like to celebrate your good news! Please send your submissions of wedding, wedding engagements, milestone birthdays and anniversaries, graduations, birth announcements, promotions, etc to office@hgs.org. Also include a small description about your good news.

Brittany and Trevor Morris
welcomed
Taryn Brielle Morris
Born 07/11/16 @ 2:30pm
Brittany is the HGS Web Content Manager.

Bryan and Kellen Guzman
welcomed
Ezekiel James Guzman
Born 10/14/16 @ 11:09am
Bryan is the HGS Treasurer and Exhibits Chairman.

John B. Tubb, Jr.
80th Birthday - November 2, 2016
John was the 2010-2011 HGS President and current Office Management Chairperson.

HGS Welcomes New Members

New Members Effective October 2016

ACTIVE MEMBERS

Bradley Arnett
Lonnie Blake
Christine Devine
Joey Dineen
Stephania Gerbaudo Laronga
F. John Gregory
Ozkan Huvaz
David Lackenby
Bjorn Petter Lindhom
Martin Long
Cliff Naylor Jr
George Pumphrey
Brian Shin
Myint Thu
Clay Wilcox

EMERITUS MEMBERS

Gerritt Wind

STUDENT MEMBERS

Sameer Baral
Jordan Coe
Patrick Jordan
Stephen Nguyen
Christopher Odezulu
Jonathan Root
Alex Santoni
Leiser Silva
Eric Udick
Alex Vachaparampil

Welcome New Members

AAPG Foundation is seeking nominations for a Houston area K-12 Earth Science Teacher of the Year for 2017!

DEADLINE: January 15, 2017

EMAIL: toty@aapg.org for more information and submissions.

http://foundation.aapg.org/programs/toty/judge_guides.cfm

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 (August 2016)

Senator Introduces Bill to Promote Energy Research and Cut Wind Tax Credits

Senator Lamar Alexander (R-TN) introduced a bill (S. 3169) that would authorize new basic energy research funding for the Department of Energy (DOE) Office of Science programs by eliminating the long-standing wind production tax credit (PTC) that has helped to expand wind power production in recent years.

Since it was established 1992, the PTC has been renewed 10 times and is currently scheduled to expire on December 31, 2019. Sen. Alexander's plan, however, would eliminate the credit at the beginning of 2017, which he estimates would free up $8.1 billion over the next ten years.

Sen. Alexander's bill contends that between 2008 and 2014 the wind PTC cost taxpayers $7.3 billion, and "distort[ed] the electricity market and [made] other sources of electric power less cost competitive." The bill also maintains that wind power is a "mature technology" that no longer needs the support of tax credits.

Funds made available by the bill would support the authorization of $8.524 billion in FY 2017 for DOE's Office of Science, a boost from the President's FY 2017 request of $5.572 billion, as well as support $8.936 billion in FY 2018 and $9.377 billion in FY 2019. By nearly doubling the amount of funds available for basic energy research activities, the bill aims to "increase innovation in energy technologies" and "produce clean, reliable and affordable energy."

Interior Department Recommends States Move Away From Self-Bonding

The Department of the Interior's (DOI) Office of Surface Mining Reclamation and Enforcement (OSMRE) has issued guidance suggesting that states move away from accepting self-bonding, where companies use their current financial health as collateral to guarantee reclamation of lands disturbed by coal mining.

Under the Surface Mining Control and Reclamation Act, coal companies are required to reclaim or restore mined land after they are finished with production. Many companies choose to comply with this regulation through unsecured or non-collateralized self-bonds. Self-bonding is most prevalent in Colorado, North Dakota, Indiana, Wyoming, and Texas where more than half of potential clean-up costs are self-bonded.

Though federal regulations require that companies pass a financial strength test to qualify for self-bonding, some companies may be approved in spite of questionable financial status. For example, Wyoming re-approved Arch Coal to self-bond in September 2015, but the company filed for bankruptcy four months later. Today, three companies in Chapter 11 reconstructing, Peabody Energy Corp., Arch Coal Inc., and Alpha Natural Resources Inc., hold roughly two-thirds of the nation's $3.8 billion in self-bonds.

The coal industry has pushed back against the efforts, citing that states have already begun to explore the problem, in conjunction with OSMRE, and that rulemaking before those investigations are complete would be "premature." Emily Fisher, vice president, legal at Edison Electric Institute, argued that modifying self-bonding requirements would reduce coal supply for electricity generation.

Hesitation among states and industry to end self-bonding persists due to fear that additional expenses could put coal companies out of business, bringing mining and ongoing reclamation activities to a halt and negatively impacting communities reliant on coal revenue.

Thirteen States Sue Over EPA Methane Rule

Thirteen states have sued the Environmental Protection Agency (EPA) over three new updates to the New Source Performance Standards (NSPS) under the President's Climate Action Plan: Strategy to Reduce Methane Emissions and the Clean Air Act. The rules, which were finalized in May, are part of the Obama Administration's effort to reduce methane emissions from the oil and gas sector by 40 to 45 percent below 2012 levels by 2025.

The EPA's first update sets requirements for monitoring, finding, and addressing methane leaks. The second update issued the first draft of an Information Collection Request (ICR), seeking a broad range of information on the oil and gas industry. The third update issued two rules to clarify permitting requirements: the Source Determination Rule and a final federal implementation plan for the Minor New Source Review Program in Indian country.

According to EPA Administrator Gina McCarthy, the updates "will help combat climate change and reduce air pollution that immediately harms public health... [and] every leak that is fixed means more gas is available to be used or sold and less pollution is affecting the health of our communities, as well as the stability of our climate."

Government Update *continued on page 42*

Government Update continued from page 41

The states involved in the suit are Alabama, Arizona, Kansas, Kentucky, Louisiana, Michigan, Montana, Ohio, Oklahoma, South Carolina, West Virginia, and Wisconsin. The Kentucky Energy and Environmental Cabinet (EEC) and North Carolina Department of Environmental Quality (NCQEQ) have signed on as well. North Dakota filed its own lawsuit in July.

Industry and government agency representatives from the thirteen states argue the updates are unnecessary, duplicative, and would add new costs to oil and gas drillers. Howard Feldman, the American Petroleum Institute's (API) Senior Director of Regulatory and Science Affairs, voiced his disapproval, pointing out that the industry is "incentivized already to prevent methane emissions" because they can sell methane on the open market.

BLM, Industry, and Interest Groups Spar Over Public Land Lease Sales

The Western Energy Alliance (WEA), which represents more than 300 oil and gas producers and service companies across the Western United States, filed a lawsuit in the U.S. District Court for New Mexico to challenge the Bureau of Land Management (BLM) for not holding quarterly oil and gas lease sales, as required by the Mineral Leasing Act. Sales have been called off in Colorado, Montana, New Mexico, North Dakota, Oklahoma, Texas, Utah, and Wyoming.

An 1987 update to the law states "lease sales shall be held for each State where eligible lands are available at least quarterly and more frequently if the Secretary of the Interior determines such sales are necessary." This mandate is reiterated by related BLM regulations, specifying that state offices are to hold lease sales "at least quarterly if lands are available for competitive leasing."

According to Alex Obrecht, an attorney representing WEA, "the failure to hold regular lease sales consistent with the Mineral Leasing Act's mandate results in unnecessary delays for – and can completely halt – development of certain federal minerals."

Various environmental groups argue that BLM has broad authority to decide when lands are not available, even if they're listed as open for the area's resource management plan. The groups view the lawsuit as an attempt to undo the progress of the "keep it in the ground" movement. Michael Saul, a senior attorney for the Center for Biological Diversity, voiced concerns about the lawsuit, claiming that "this baseless lawsuit ignores well-established authority for the President and BLM not to offer new climate-destroying leases to industry."

EPA Science Advisory Board Concerned Over Hydraulic Fracturing Conclusions

The Environmental Protection Agency's (EPA) Science Advisory Board (SAB) released its final report assessing EPA's recent study of potential impacts of hydraulic fracturing for oil and gas on drinking water resources. Congress requested the study in 2009, and EPA released its draft review in June 2015.

EPA found that drilling activities had contaminated groundwater, but concluded that hydraulic fracturing hasn't caused "widespread, systemic" problems with contaminated drinking water. The 2015 draft report was then subject to peer-review by a 30-member SAB panel of scientists and academics.

The reviewers were concerned that the EPA study made national-level conclusions about localized drilling problems. In particular,

the reviewers asked for more information on drinking water contamination cases in Dimock, PA; Pavillion, WY; and Parker County, TX.

EPA officials said they "will use the SAB's final comments and suggestions… to revise and finalize the assessment," with new studies and public comment periods. The study should be finalized in the coming months.

NOAA Launches New Computer Model for Flood Forecasting

The National Oceanic and Atmospheric Administration (NOAA) recently launched its National Water Model (NWM), a new hydrologic model that the agency claims will yield the "biggest improvement in flood forecasting the country has ever seen." The new model will allow NOAA's National Weather Service to incorporate the new information into its forecasts to determine when there could be too much or too little water.

Using a new NOAA supercomputer, the model will simulate how water moves throughout the nation's rivers and streams using mathematical representations of different processes, such as soil moisture, runoff, stream velocity, and vegetation type. Additionally, by providing information on fine spatial and temporal scales, the NWM will allow NOAA to increase the number of locations where it can forecast conditions from 4,000 to 2.7 million.

The launch coincides with the current historic flooding in Louisiana after days of torrential rain inundated the Baton Rouge area with over 20 inches of rainfall. The flood is responsible for the death of at least nine people and has impacted over 40,000 homes, leading Louisiana Governor John Bel Edwards to announce an emergency declaration on August 14, 2016.

The new model will eventually allow for street-level predictions of flooding and water quality, but in the meantime, it will improve flash flood forecasts and expand the current areas where flood forecasts are available.

UNESCO and IUCN Issue Report Calling for the Creation of Oceanic World Heritage Sites

The United National Education, Scientific, and Cultural Organization (UNESCO) World Heritage Centre and the International Union for Conservation of Nature (IUCN) are calling for the creation of the first oceanic World Heritage Sites.

In a joint report titled, "World Heritage in the High Seas: An Idea Whose Time Has Come," the agencies reason that oceanic sites fit the World Heritage Convention, which defines the natural and cultural places that can be included as a World Heritage sites.

The report presents five diverse sites that could be recognized as having "outstanding universal value," a key principle of the World Heritage Convention. The proposed sites include the Costa Rica Thermal Dome in the Pacific Ocean, a spawning and feeding site for many endangered and commercially valuable species; the White Shark Café, the only known gathering point for white sharks in the north Pacific; the Sargasso Sea in the Atlantic Ocean, known for its "golden floating rainforest" of Sargassum algae; the Lost City Hydrothermal Field in the Atlantic Ocean, an 800 meter-deep area dominated by carbonate monoliths; and the Atlantis Bank, a sunken fossil island in the subtropical Indian Ocean.

The desire to classify these locations officially as World Heritage Sites is largely inspired by the opportunity to protect them. "These areas are exposed to threats such as pollution and overfishing, it is therefore critical to mobilize the international community to ensure their long-term conservation," argued Dan Laffoley, Principal Advisor on Marine Science and Conservation for IUCN.

However, these oceanic sites are located far offshore, outside any national jurisdiction. Currently, only countries can propose sites for inscription, meaning that current nominating and approval processes must be amended before any high-seas location can officially be given heritage status. ■

From the Editor – Answer:

Your first question should have been "*What coordinate reference system are the well coordinates?*"

The well coordinates are provided in *North American Datum of 1927 (NAD 1927)*. Your mapping software display must be in the correct coordinate reference system to display your coordinates correctly.

Since Google Maps uses *World Geodetic System 1984 (WGS 1984)*, if you load the well coordinates (*29.095253, -103.18694*) into Google Maps, the well appears southeast of Mariscal Mine. This is NOT the correct location.

Using either one of the following methods should help you arrive at the correct location:

1. The NAD 1927 coordinates should first be converted to WGS 1984 using a mathematical transformation equation. (I use 79_CONUS – but more on this next month!), or
2. The coordinates should be provided to you in the WGS 1984 format.

The correct coordinates to use for the well location are:
29.0955, -103.187343 – World Geodetic System 1984

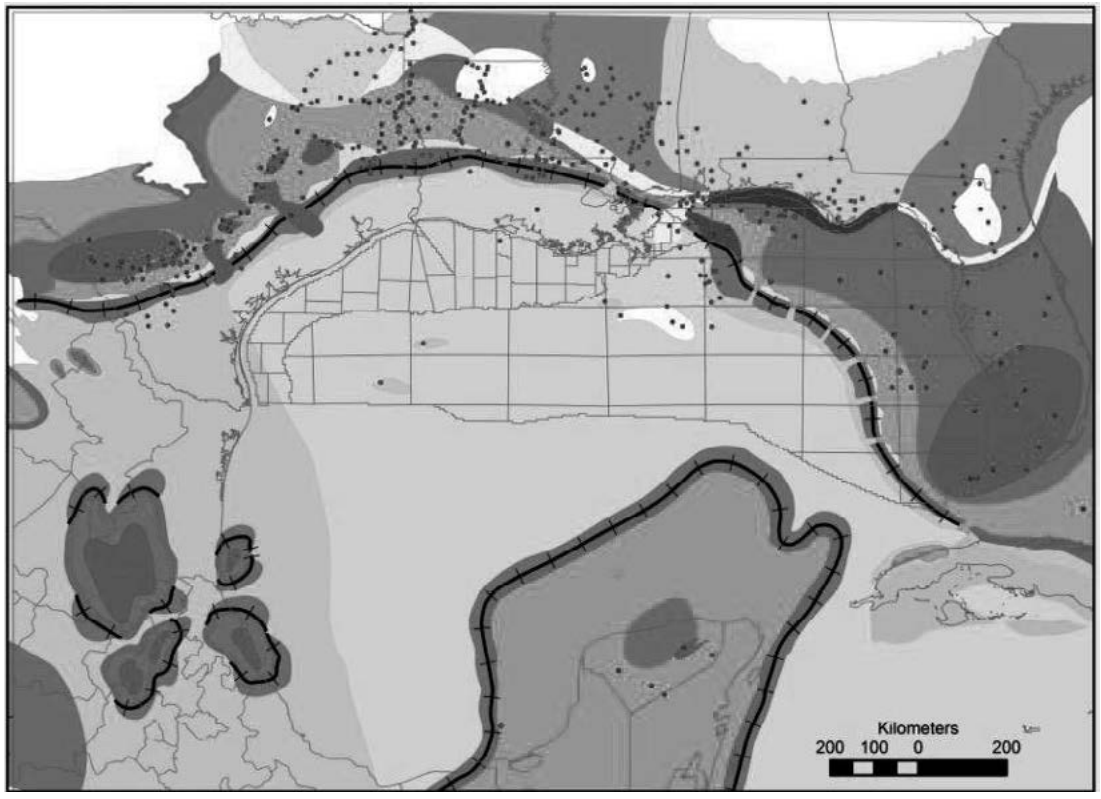
29.095253, -103.18694 – NAD 1927 – Texas South Central State Plane 4204

Remembrance

Dennis A. Drake
April 29, 1935 - September 13, 2016

Dennis A. Drake, of Dallas, Texas, passed away on September 13, 2016. Dennis was born in Beaumont, Texas. He graduated from Lamar College and the University of Texas. Dennis proudly served in the Army National Guard. He was a petroleum geologist. His fifty year career in the exploration for oil and gas took him to Louisiana offshore, and the Texas Gulf Coast on and offshore. Dennis also traveled to China for oil and gas study and research. He often spoke of his goal to leave much energy for the future generation. He served as Vice President of Exploration for Strata Energy-Armco Steel and worked for other companies. Dennis retired from Devon Energy Houston. His survivors are his wife of 56 years, two children, 4 grandchildren and a sister. A memorial service was held at Sparkman/Hillcrest Funeral Home in Dallas. In lieu of flowers memorials may be made to Veterans-Wounded Warriors. Condolences can be made at www.Sparkman-Hillcrest.com

Published in *Houston Chronicle* on Sept. 25, 2016



HGS *Bulletin* Instructions to Authors

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

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

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

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

HGS *Bulletin* Advertising

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

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9	$800	$1,300	$2,500	$4,700						
8	$750	$1,250	$2,250	$4,300						
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Vendor Corner	$250 *4 Pack option available. Send request to vendorcorner@hgs.org.	Company logo, company website, and company description will be highlighted on HGS Calendar website event. This is an opportunity to display company wares, gain personnel exposure and hand out product information at HGS dinner meetings.
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Qualifications for Active Membership

1) Have a degree in geology or an allied geoscience from an accredited college or university; or
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Qualifications for Associate Membership (including students)

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

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

Annual Dues Expire Each June 30. (Late renewals – $5 re-instatement fee)

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

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New Orleans, LA 70170
504-262-5985
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NOLEX

Kevin McMichael
kmcmichael@nolexllc.com

350 N. Sam Houston Pkwy., E.
Suite B118
Houston, Texas 77060
713-655-9700
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JonRotzien@BasinDynamics.com
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SeismicVentures

Robert D. Perez
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Seismic Ventures, LLC
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Houston, Texas 77041
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Texas Professional Geoscientist – Geophysics

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Direct: 713-335-3021
Fax: 713-972-1180
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CKNOBLOCH@ARNOLD-IPLAW.COM
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PETROLEUM GEOLOGIST/FOUNDER

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(832) 969-3662
MHACKWORTH@WOLFMOONEXPLORATION.COM
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METAROCK LABORATORIES

Zach Arasteh
Business Manager

2703 Highway 6 S, Suite 280A
Houston, TX 77082
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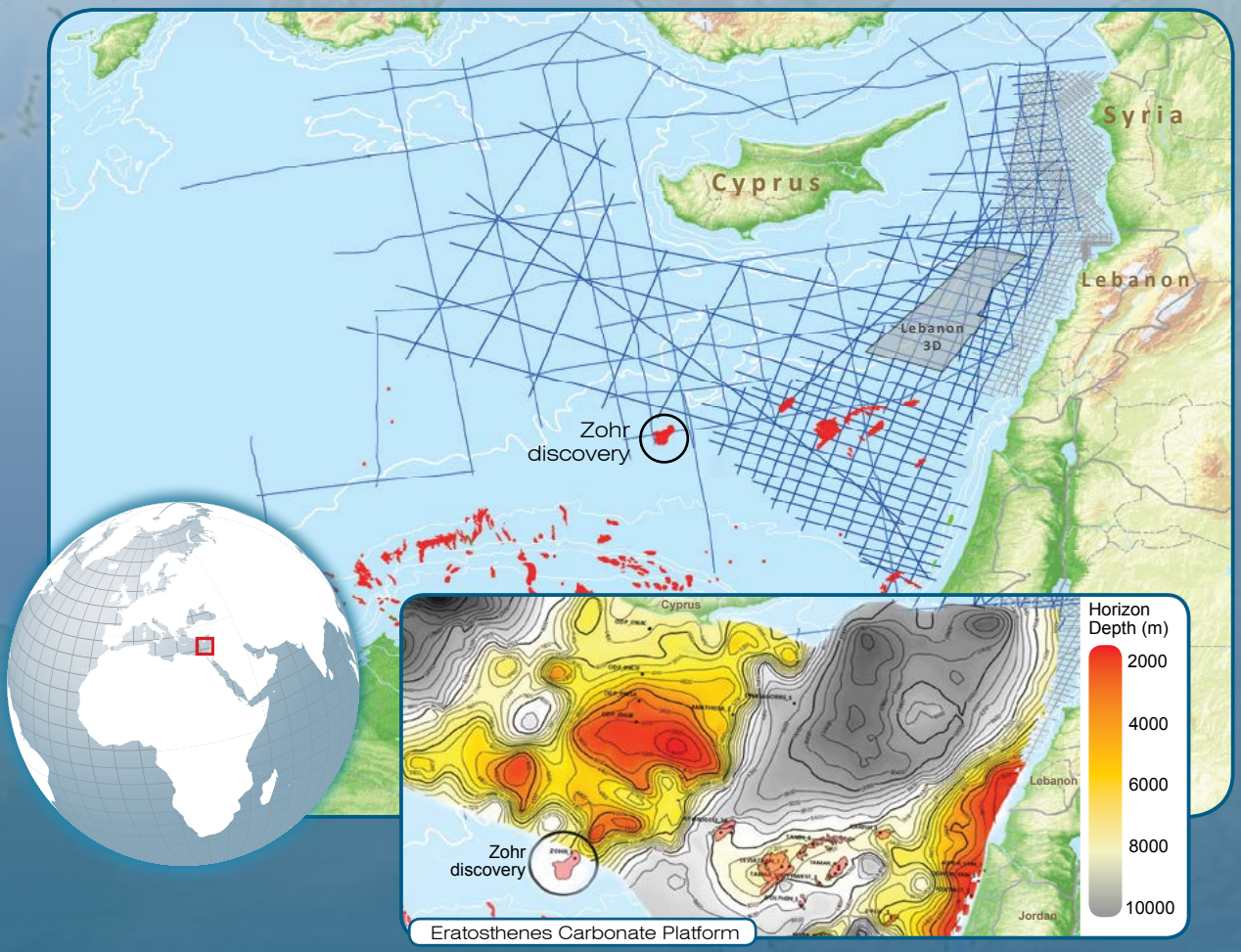

The gas discovery in the Zohr-1 well (ENI 2015) has created a step change in the understanding of carbonate plays offshore Egypt and throughout the Eastern Mediterranean.

The new discovery was encountered in shallow water deposited limestone, dating from the Miocene. It is thought to represent part of a much more expansive carbonate platform extending northward and comprising several phases of carbonate build-up around the edges of the Levant Basin.

Spectrum's extensive Multi-Client seismic coverage offers a unique regional insight into this exciting newborn carbonate trend.

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