

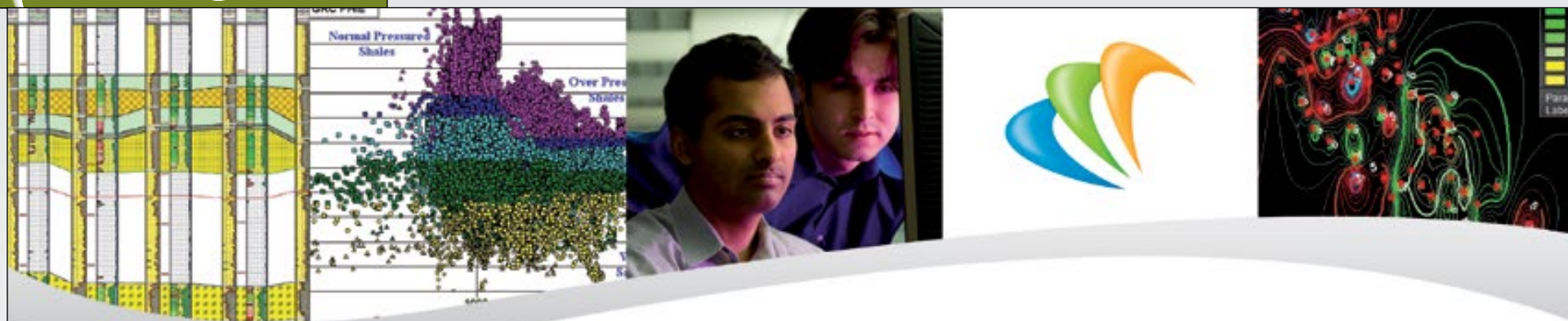
AAPG

# EXPLORER

NOVEMBER 2014

## Finding Oil in the Mind

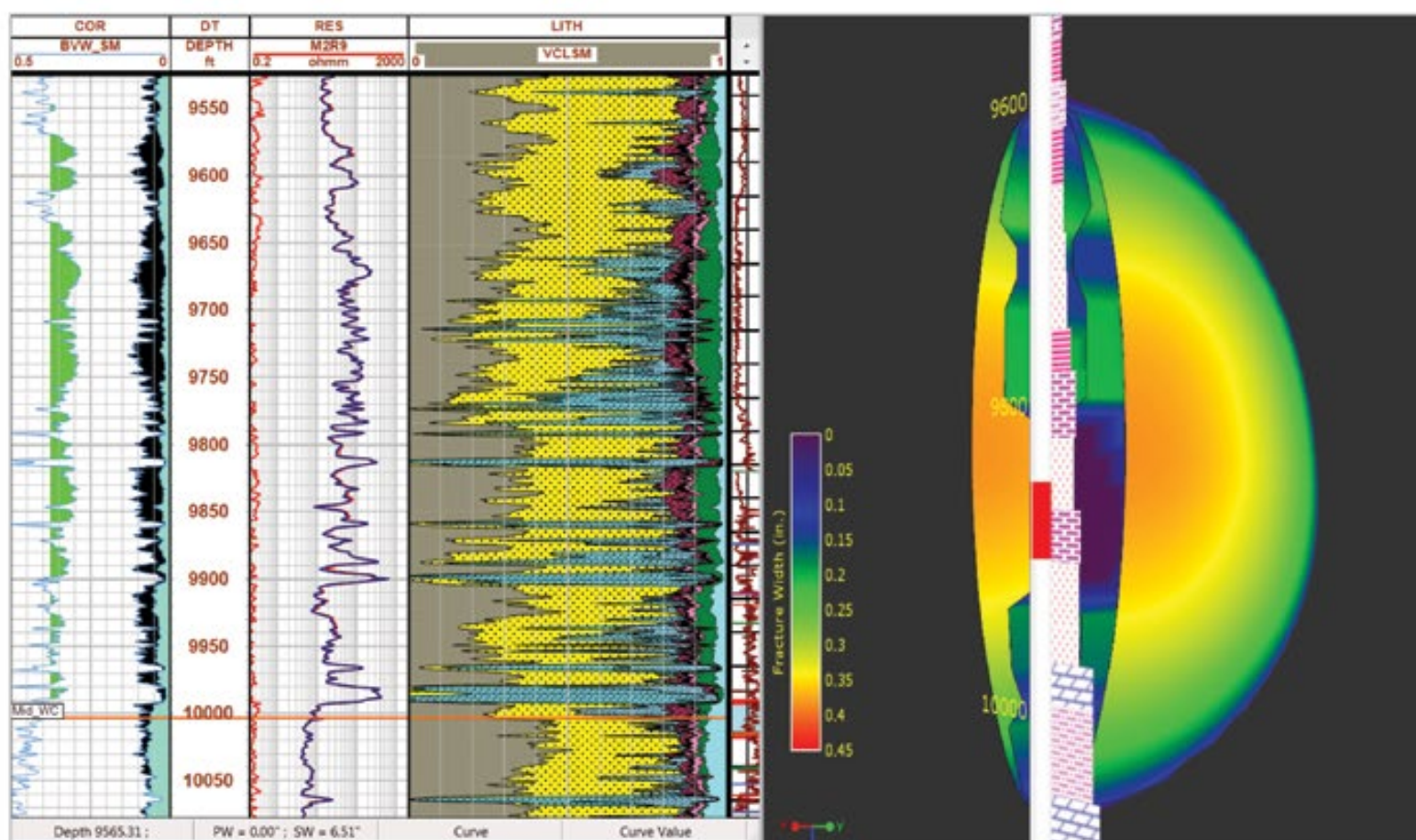
*New ideas offer new possibilities.*



Jason

# Stop Guessing. Frac Right.

## Introducing PowerLog Frac



Powerful. Nimble. Collaborative.

**PowerLog Frac** is the industry's first petrophysical software that quickly generates formatted rock and fluid properties. Leverage your petrophysical analysis to model multiple frac scenarios with increased accuracy in hours instead of days by eliminating manual calculations and spreadsheets. Oil companies and service providers can now combine their knowledge and implement frac simulation as part of a standard completion process.

Collaborate for enhanced fracture design and improved well performance. Frac better with **PowerLog Frac**.

**FREE**  
30-day evaluation

[cgg.com/powerlogfrac](http://cgg.com/powerlogfrac)



**PRESIDENT'S COLUMN**

*Doing what we do better ...*

# Finding Our Strength in Inclusive Unity

By RANDI MARTINSEN

I'm currently sitting up with a bad case of jet lag after our great AAPG International Conference and Exhibition event in Istanbul, watching the movie "Remember the Titans" on TV.

I'm thinking I really ought to go to bed, but then I'm thinking ... this is *really* a great movie.

For those of you who may not be familiar with this movie, it is based on the true story of the dynamics and impacts that occurred when an African-American football coach was appointed to lead a high school team during its first season as a racially integrated unit.

Critics praised the film, often pointing out that although the movie's formula was that of a sports story, its real purpose was in being a parable about harmony.

So ... I'm also thinking there are some parallels between what the "Titans" went through and what AAPG currently is going through.

**INTEGRATION.**

In the movie the issue was integrating black football players with white football players. Obviously, that is not an issue for AAPG – but a barrier we do still face is integrating our U.S. membership and the "rest of the world."

\* \* \*

Frankly, I'm a bit confused by this perceived "U.S.-non U.S." division among some of our members.

I got my start with AAPG via the RMAG (Rocky Mountain Association of Geologists). I have worked internationally, but I'm definitely a Rockies geologist (e.g. domestic member).

However, I, like past AAPG president and Sidney Powers award-winner Marlan



MARTINSEN

**Changes in perceptions are rarely easy to handle. Neither are some perceptions about change.**

Downy, "want to have everyone who loves geology and earth science to be paying, participating members of our organization. No ifs. No ands. No buts."

As I've traveled both domestically and internationally for AAPG since becoming a candidate, I've been overwhelmed by the tremendous enthusiasm of many of our members in all parts of the world – and especially the excitement displayed by our younger members as I connect with geoscientists from around the world.

I in turn am excited about the talent that all our members bring to the profession and to AAPG.

\* \* \*

As AAPG moves into its second century I think it is important to think about our origins while being excited about our future.

In 1917 AAPG was a group of mainly U.S. geologists who were united by a passion for petroleum geology, a thirst for knowledge and a desire to elevate petroleum geoscience to a respectable profession. Our founding fathers may have been from Oklahoma or Texas or California, but their exploration target was the world.

In fact, two articles in the first issue of the BULLETIN dealt with exploration outside of North America (one, written by Dutch geologist and AAPG founder William A.J.M. van Waterschoot Van der Gracht, was on the salt domes of northwest Europe; the other, written by noted international geologist K.D. White, was on petroleum development in Colombia).

As our profession and our industry has become even more global, our AAPG family has expanded to include members from 128 different countries, and our international membership now comprises more than 40 percent of our total membership.

As that statistic would suggest, today's demographics of AAPG members are quite diverse:

- ▶ Our members run the gamut from students to EPs (experienced professionals).
- ▶ We don't all speak the same language.
- ▶ There certainly are cultural differences between us.
- ▶ Our employers and work environments are quite variable.

While these differences can sometimes make us feel a bit uncomfortable – or, like the "Titans" initially discovered, can even create barriers that limit our success – we still are a group of geoscientists united in our passion for petroleum geology and a desire to push the envelopes of our science and technology.

\* \* \*

In the true story of "Remember the Titans," the participants learned that once they realized they were more alike than different – they all wanted to be part of a winning team – the concept of unity and working together was more than just a good idea. It was a better way to approach life.

For AAPG, we too may face some challenges ahead in melding our domestic constituency with our international constituency.

Changes in perceptions are rarely easy to handle. Neither are some perceptions about change.

But I believe what unites us as geoscientists and AAPG members is stronger than what divides us – and I believe that as we focus on those things, the road ahead becomes a path worth taking.

The Titans found strength in unity. I'm very excited about how we all can contribute to AAPG's future.

**STAFF**

**Managing Editor**

Vern Stefanic  
email: vstefan@aapg.org

**Assistant Managing Editor**

Brian Ervin  
email: bervin@aapg.org

**Communications Project Specialist**

Susie Moore  
email: smoore@aapg.org

**Graphics/Production**

Matt Randolph  
email: mrandolph@aapg.org

**Advertising Coordinator**

Steve Praytor  
P.O. Box 979, Tulsa, Okla. 74101  
Phone: (918) 560-2647 – fax: (918) 560-2636  
(U.S. and Canada only: 1-800-288-7636)  
(Note: The above number is for advertising purposes only.)  
email: spraytor@aapg.org

**CORRESPONDENTS**

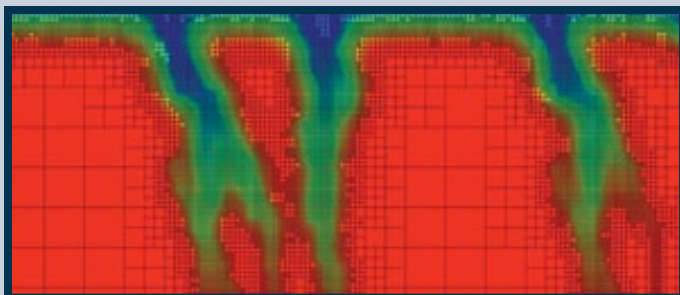
Louise S. Durham      Ken Milam  
Kristi Eaton          Heather Saucier  
Barry Friedman

**TABLE of CONTENTS**

- 6** Competition heats up in the **Gulf of Mexico** as **new technologies** open new possibilities.
- 10** AAPG member **Kurt Marfurt** talks about how **geoscience** is taking some cues from **Amazon** and **Google** to analyze **big data** in the oilfield.
- 16** Though not quite ready for prime time, **aquatic robots** might be the next big thing in gathering **offshore seismic data**.
- 30** Competition and Camaraderie: The ever-popular **Imperial Barrel Awards** are just around the corner.
- 32** They're not just for airstrikes – **UAVs** can reduce human risk and environmental impact in **monitoring midstream infrastructure**.
- 36** Up, Up and Away: Two **airborne geologists** carve out a legend for themselves as the **Flying Florences**.



Scan this for the mobile version of the current web Explorer.



**REGULAR DEPARTMENTS**

- Policy Watch ..... 40
- ProTracks ..... 42
- Regions and Sections ..... 46
- Geophysical Corner ..... 52
- Historical Highlights ..... 54
- Foundation Update ..... 58
- In Memory ..... 60
- Classified Ads ..... 62
- Director's Corner ..... 66
- Divisions Report (EMD) ..... 66

**ON THE COVER:**

Cover: FALCON simulation of mass and heat transport in a network of elliptical fractures, for a cold water injection where red arrows originate. Meshed surfaces show fractures; horizontal plane and vertical backplane represent surrounding unfractured rock. Color represents temperature; arrows indicate relative water velocity; colored lines indicate show fluid pressure distribution (see page 14).

Left: FALCON simulation of mass and heat transport, and mechanical response, in a 2-D network of irregular fractures, for a cold water injection on the upper surface.

Graphics courtesy of Idaho National Laboratory.

**Vol. 35, No. 11** The AAPG EXPLORER (ISSN 0195-2986) is published monthly for members by the American Association of Petroleum Geologists, 1444 S. Boulder Ave., P.O. Box 979, Tulsa, Okla. 74101-3604, (918) 584-2555. e-mail address: postmaster@aapg.org. Periodicals Postage Paid at Tulsa, OK and at additional mailing offices. **POSTMASTER: Please send address changes to AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101. Canada Publication Agreement Number 40063731 Return undeliverable Canadian address to: Station A, P.O. Box 54 • Windsor, ON N9A 6J5 • E-mail: returnsL@imex.pb.com**

Advertising rates: Contact Steve Praytor, AAPG headquarters. Subscriptions: Contact Veta McCoy, AAPG headquarters. Unsolicited manuscripts, photographs and videos must be accompanied by a stamped, self-addressed envelope to ensure return. The American Association of Petroleum Geologists (AAPG) does not endorse or recommend any products or services that may be cited, used or discussed in AAPG publications or in presentations at events associated with AAPG. Copyright 2013 by the American Association of Petroleum Geologists. All rights reserved. Note to members: \$6 of annual dues pays for one year's subscription to the EXPLORER. Airmail service for members: \$55. Subscription rates for non-members: \$75 for 12 issues; add \$72 for airmail service.

## AAPG Candidate Bios Now Online

**B**iographies and individual information for all AAPG officer candidates for the 2015-16 term will be available online at the AAPG website in November.

Video interviews and informational shorts on all candidates will be available online in 2015.

Six candidates for the AAPG Executive Committee will be on the

ballot when voting begins, for the positions of president-elect, vice president-Regions and secretary.

The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2016-17. The terms for vice president-Regions and secretary are two years.

Ballots will be mailed in spring 2015. The slate is:

### President-Elect

- Paul W. Britt, Texplore Inc., Houston.
- Gretchen M. Gillis, Aramco Services Co., Houston.

### Vice President-Regions

- Adebayo O. Akinpelu, Fixital Ltd., Lagos, Nigeria.
- Peter M. Lloyd, Asia Pacific Training Ltd., Falicon, France.

### Secretary

- Heather L. LaReau, Noble Energy Inc., Denver.
- Nicole S. Morris, FireWheel Energy LLC, Fort Worth, Texas.



Headed for Australia: Melbourne's Convention and Exhibition Centre (white building, center) will be the site for AAPG's 2015 International Conference and Exhibition.

Why can Weatherford deliver more real time data at the wellsite than any other mudlogging company?

Tim has cabin fever.



**EXCELLENCE  
FROM THE  
GROUND UP™**

Our Global Operations Manager for Surface Logging Systems, Tim, is all smiles these days. That's because he and his team recently designed a new state-of-the-art mudlogging cabin. The spacious interior makes room for more laboratory services at the wellsite. Now exploration companies have access to more data in real time, so they can make better decisions faster. Combined with Weatherford's patented GC-TRACER™, IsoTube™ AutoLoader™ and other Isotech technologies, it's one more way Weatherford Mudlogging is committed to Excellence from the Ground Up.

**SURFACE LOGGING SYSTEMS**  
www.weatherford.com/surfacelogging  
mudlogging.services@weatherford.com



## Call for Abstracts Announced For ICE 2015

**T**he call for abstracts has been opened for the next AAPG International Conference and Exhibition, which will be held Sept. 13-16 in Melbourne, Australia.

The meeting theme is "A Powerhouse Emerges: Energy for the Next 50 Years," created in part to signify the 50th anniversary of the Gippsland Basin oil discovery, which unlocked Australasian market activity.

But this ICE has other significance: It marks the first-ever ICE that will be co-presented by AAPG and the Society for Exploration Geophysicists (SEG).

And with the Petroleum Exploration Society of Australia (PESA) acting as the official hosts, ICE 2015 also will include PESA's Eastern Australasian Basins Symposium (EABS).

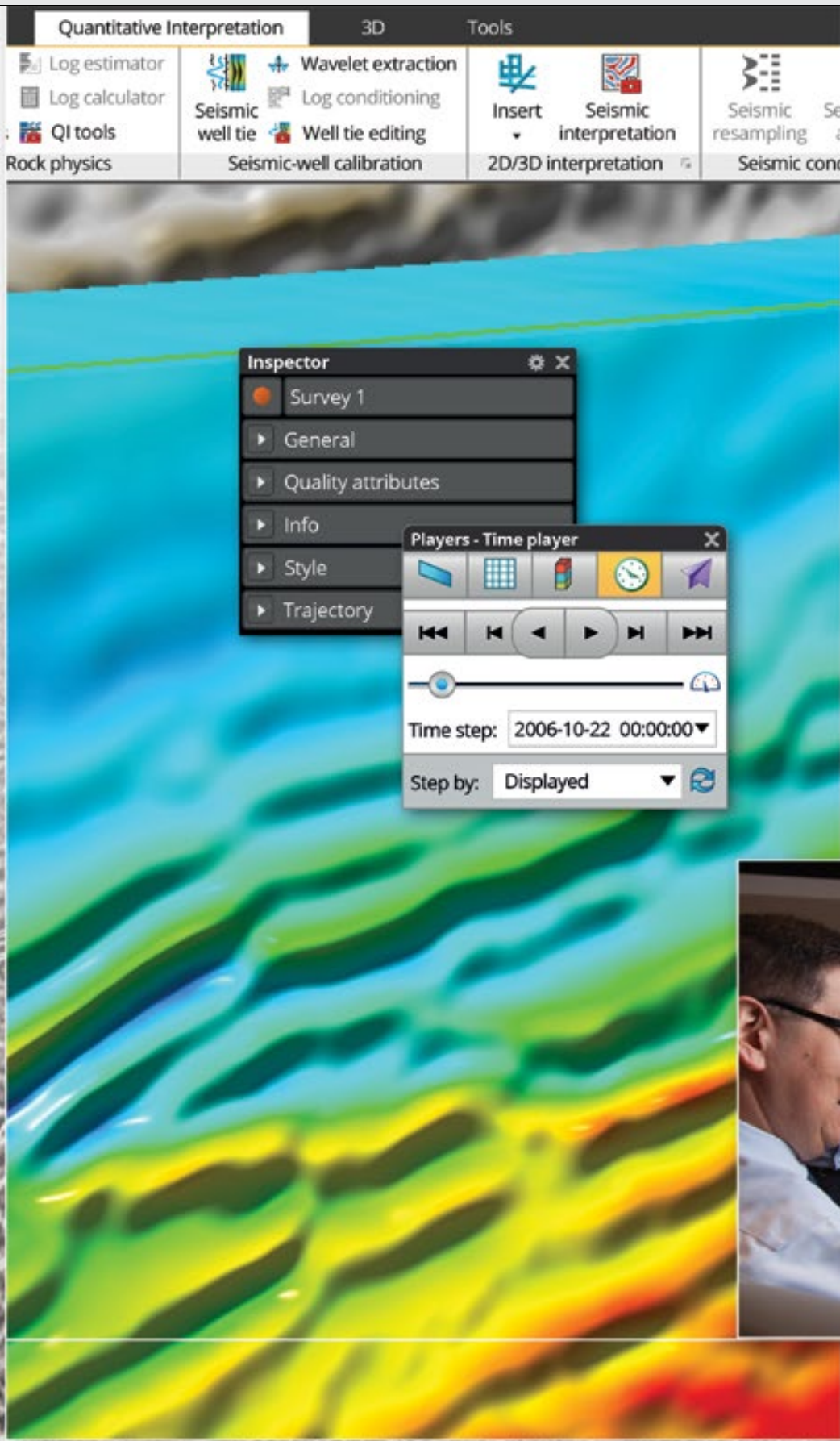
The proposed technical program features 21 session themes. They are:

- ▶ CO<sub>2</sub> Storage.
- ▶ Carbonates.
- ▶ Eastern Australian Basins.
- ▶ Environment, Regulation and Social License to Operate.
- ▶ Geochemistry and Basin Modelling.
- ▶ Geophysics.
- ▶ Getting More out of Mature Basins.
- ▶ Mineralogy.
- ▶ New and Emerging E&P Provinces/ Australia-New Zealand.
- ▶ New and Emerging E&P Provinces/ South East Asia.
- ▶ Petroleum Systems.
- ▶ Petrophysics.
- ▶ Marita Bradshaw – Palaeogeographic Evolution of Australia.
- ▶ Reg Sprigg Memorial.
- ▶ Sedimentology.
- ▶ Stratigraphy and Applied Palaeontology.
- ▶ Structure and Tectonics.
- ▶ Technologies for Unlocking the Future.
- ▶ Unconventional Reservoirs.
- ▶ Worldwide Frontiers – China.
- ▶ Worldwide Frontiers – Other.

The abstract submission deadline is Jan. 15.

To submit an abstract, or for more information, contact Terri Duncan, technical programs coordinator, at (918) 560-2641; or email tduncan@aapg.org; or go to the website, ICE.AAPG.org

Exhibition space and sponsorship opportunities also are available.



**Petrel**  
E&P SOFTWARE PLATFORM



## Take control of your workflows, your data, and your productivity.

The 2014 release of the Petrel® E&P software platform introduces a new user experience, with a range of added features and performance improvements.

Geoscience workflows drive the new, more intuitive user interface—using 35% fewer mouse clicks and 30% less mouse travel—so that you can stay focused on your data.

[software.slb.com/Petrel](http://software.slb.com/Petrel)

**Schlumberger**

*So-called 'Dead Sea' still lively*

# New Technology Drives New Interest in Gulf

By LOUISE S. DURHAM, EXPLORER Correspondent

**W**ithout a doubt, shale plays are the sexy show *du jour* in the oil and gas industry.

Even so, it's likely a stretch to think that this now-exciting shale performance will have the staying power of that old industry workhorse, the Gulf of Mexico.

The Gulf's production history dates back to 1947, over 65 years ago, when the first well drilled from a fixed platform out of sight of land marked the beginning of the offshore oil and gas industry.

Despite a few lean times – including a stretch when it was derided as the Dead Sea – the GOM always comes roaring back to life to reclaim its position as the shining star of domestic hydrocarbon production.

Mere mention of the Gulf conjures up thoughts of giant platforms in the deep water, under the command of big names in the industry, such as Shell, BP, Chevron and the like.

It's a different story on the busy continental shelf, where the water depths measure less than 200 meters.

There are a number of smaller companies who appear to be jockeying for the kingpin designation in this region. To do so, there's an apparent ongoing trend to gobble up one another.

## The Competition

It's a competitive scene, involving some heretofore low-profile actors, relatively speaking.



Shell's Olympus platform on the Mars field in the Gulf of Mexico.

Photo courtesy of Shell

They're willing to pay big bucks to stake a claim on the shelf as evidenced by a few recent deals on record:

▶ Talos Energy Offshore LLC snapped up conventional shelf properties from Lafayette-based Stone Energy, with the transaction just closing in August. The tab: \$200 million cash.

Talos also is assuming \$117 million in estimated future abandonment liabilities. Talos president and CEO Tim Duncan noted that the company is getting more diversity and tracts that fit well in its database.

▶ Relative GOM newcomer Fieldwood Energy LLC is focused on both the shelf

and the deep water. It cut a giant deal with its recent purchase of Apache's shelf operations and properties for a whopping \$3.7 billion in a cash transaction.

Apache will retain 50 percent of its ownership interest in all exploration blocks and in horizons below production in developed blocks, where high potential deep hydrocarbon plays are being tested.

▶ Energy XXI sent waves through the industry with its recent purchase of EPL Oil & Gas for a price of \$2.3 billion. The deal will make Energy XXI the largest publicly-traded independent operator on the Gulf shelf.

However, Chevron has still held on to

Clint Moore and Michael Neese of GulfSlope co-chaired the "Emerging Shelf Plays of the Gulf" oral session at last month's Gulf Coast Association of Geological Societies annual convention at the Cajundome Convention Center in Lafayette, La.

The session included their presentation, "Advanced Exploration Technology and Concepts – Key to Future Gulf of Mexico Deep Shelf Oil and Gas."

its large number of producing fields on the shelf, according to AAPG member Clint Moore, vice president and corporate secretary at Houston-based GulfSlope Energy.

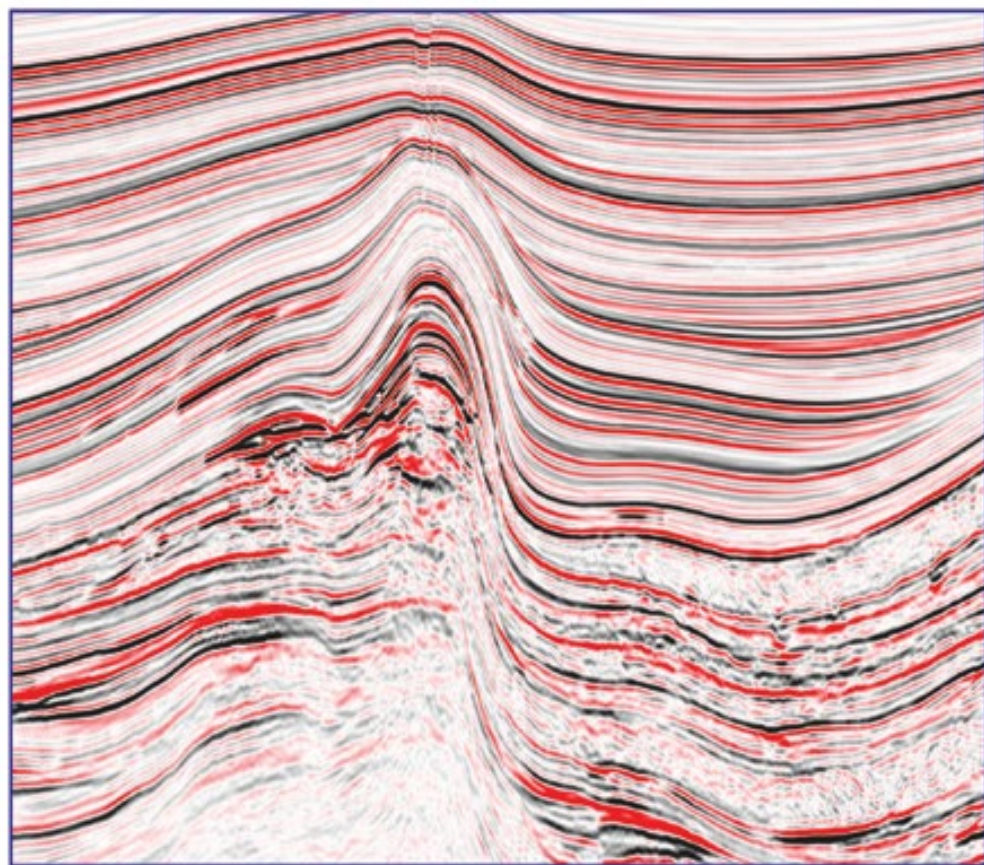
GulfSlope is among the industry newcomers jumping into the area, with its founding executives having worked together in the GOM at Anadarko.

The company, which focuses on the present-day outer shelf and upper slope, picked up 21 lease blocks there at offshore lease sale 231 in the central Gulf of Mexico in March. The firm now controls 98,941 acres, covering 17 prospects with subsalt potential, according to chairman and CEO John Seitz.

Seitz, an AAPG member and former CEO and president at Anadarko, said the company's third-party external estimate

[See Mahogany, page 8](#)

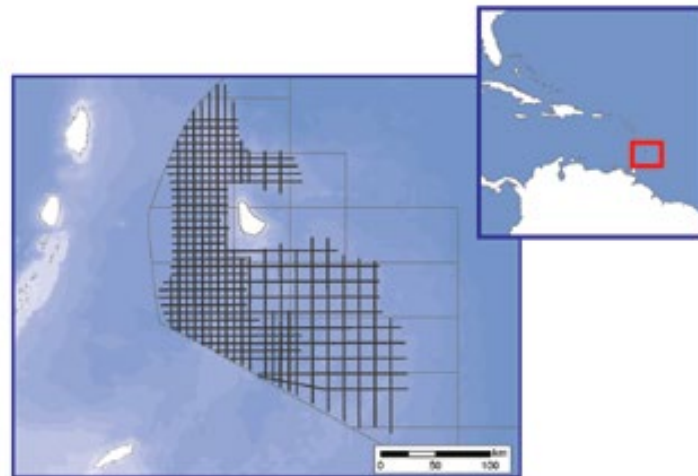
## MultiClient Geophysical



### Offshore Barbados

MCG has available 6,837 km of new Seismic, Gravity and Magnetic data

The data covers all 26 blocks open for bidding



For further information please contact:

Kenneth Mohn  
+1 713 485-9696

Tom Wolden  
+47 66 98 41 18

John Whitcomb  
+65 63 27 97 44

[www.mcg.no](http://www.mcg.no)

# CARBONATES WITH CONFIDENCE

KNOW BEFORE YOU GO



More than half of the world's oil is held in carbonate reservoirs, yet predicting carbonate porosity and permeability is often challenging as it relates not only to the complexity of the rock's properties but also to stress and fracture systems. With global experience and success in evaluation and modelling projects, Ikon Science's Quantitative Interpretation team knows carbonates inside and out. We work with you, following a collaborative and customised process, to unravel the complexities of these reservoirs and remove uncertainty by characterising and predicting carbonates with greater reliability. So you can know before you go. [www.ikonscience.com](http://www.ikonscience.com)



The Present And Future Of GeoPrediction

## AAPG Receives Heroy Award for AGI Support

**A**APG has been named the winner of this year's William B. Heroy Jr. Award, presented by the American Geosciences Institute, for the Association's generous financial support and leadership of AGI programs.

AAPG and the AAPG Foundation's support can be seen in AGI's Education and Outreach, Geoscience Policy, Environmental and Geoscience Community Building programs, AGI said in announcing the award – efforts that demonstrate a multifaceted service to the AGI mission.

The AAPG Foundation has supported Earth Science Week since its inception with both funds and kit materials, and contributed substantially to the formation of the education branch of AGI's Center for Geoscience

Education and Public Understanding. Kit materials and general geoscience outreach has been further enhanced by a collaboration between AGI and the AAPG Youth Educational Activities Committee, which produced a "Handbook for Visiting Geoscientists."

Collaboration between AAPG and AGI also resulted in two Environmental Awareness Series booklets. For the first, AAPG acted as a publishing partner and reviewer for the Petroleum and the Environment booklet; the second booklet, Meeting Environmental Challenges with Remote Sensing Imagery, was authored by AAPG Environmental Geoscience Advisory Committee member Rebecca Dodge.

AAPG also has supported more than 30 Geoscience Policy interns at AGI since

1998, many who continued to careers in public policy.


AGI also awarded AAPG for:

- ▶ Actively supplying members for many AGI committees.

- ▶ Providing time during its annual meeting opening session for the presentation of the AGI Marcus Milling Legendary Geoscientist Medal.

- ▶ Working closely with AGI's Information Services department to assist in comprehensive coverage of AAPG publications in GeoRef.

- ▶ Helping provide expertise for revisions to the Glossary of Geology.

The award is named after William B. Heroy Jr.'s exemplary service to the American Geosciences Institute. 

## Mahogany from page 6

of potential recoverable resources associated with the prospects on the 21 lease blocks awarded is more than two billion boe.

He also noted that these newly acquired leases are located along the edge of the outer continental shelf in 300-800 feet of water, with most drillable using jackup rigs, which are typically much less expensive than the deepwater floating rigs.

Besides giving up considerable production from various formations above the extensive salt sheets, the shelf has garnered a reputation as a locale with significant subsalt production and ongoing potential.

It's where the famed Mahogany well discovery occurred 80 miles offshore Louisiana in 1994. Mahogany was the first commercial subsalt discovery in the Gulf, and both Seitz and Moore were key members of the discovery team.

In the 1990s overall, 350 MMboe were discovered in the shelf Miocene subsalt play, and more recently, billions more have been discovered below salt in the deep water GOM, as well as off Brazil and West Africa.

A number of other companies hold leases in the same general area as GulfSlope, but GulfSlope launched its strategy in May 2013, hiring experienced GOM subsalt geoscientists, licensing 2.2 million acres of seismic, and RTM processing much of that, in time for strategic bidding at the March 2014 lease sale.

Operators are tight-lipped about the ultimate goals of their recent leasing activity. Even so, it's not likely they're interested in anything above "supra-salt" given most of that was heavily drilled and produced in the 1970s and 1980s.

### New Tech

Much of the current action and obvious interest can be traced to advances in technology that can "see" beneath salt sheets, which for decades served as a virtual stop sign to drillers back in the day.


Particularly important are advanced seismic imaging technologies, such as broad-frequency Reverse Time Migration (RTM).

RTM became commercially viable in all phases of the imaging sequence in 2008, according to Moore, who until co-founding GulfSlope was VP at ION Geophysical.

"Industry has successfully used RTM in deep water because of its superior image quality," he said. "The salt out there is not as deformed as on the shelf, so it was easier to reprocess."

The shelf subsalt accumulations require advanced RTM processing, which has only been technically possible in the last five years, according to Moore.

"The industry has not come back to the subsalt play on the shelf earlier," Seitz added, "because it takes this technology in its advanced form to sort out what it is you can see under the salt. The technology is necessary to make the play, but the 3-D velocity models of salt and sediment, provided by interaction with geoscientists, are the key to proper imaging.

RTM's clearer imaging technology cost us many millions of dollars, but it has significantly reduced our risk, allowing us to identify 2 billion boe resource potential." 



Maximum accuracy.  
Minimum time.

Choose Val Nav® because your forecast matters.

You make multimillion-dollar decisions based on your production forecast. Only Val Nav lets you auto-forecast hundreds of wells in seconds, with unparalleled accuracy and no bias. No wonder almost 300 E&P companies worldwide choose Val Nav for decline analysis, economics, budgeting and full-scope planning.



Any device. Anytime. Anywhere.

Guard against overspending with AFE Nav®.

Drastically cut approval times and keep necessary capital flowing. AFE Nav lets you create, send, track and manage AFEs from any web-connected device. Full audit trail, ease of use, and budget control combine to make it a favourite of operations as well as finance.

For more, visit [www.energynavigator.com/aapg](http://www.energynavigator.com/aapg)  
or call Trent Stoker at 281-493-5300.





**DISCOVER NEW WAYS  
TO DRAMATICALLY  
IMPROVE PRODUCTION...**



**AND LOWER YOUR COST PER BOE.**

**Discover CYPHER<sup>SM</sup> Seismic-to-Stimulation Service**

Since introducing CYPHER<sup>SM</sup> Seismic-to-Stimulation service, projects on shale assets using the Halliburton service in several North American basins have delivered a 35% production increase on average. One operator using CYPHER service in the Barnett Shale almost doubled production. CYPHER service now models natural fractures with hydraulic fractures for increased accuracy. In addition, CYPHER service can alter perforation cluster efficiency for quick, iterative optimization of shale asset development plans. Have you discovered CYPHER service?

To learn more about CYPHER service, visit [Halliburton.com/CYPHERservice](http://Halliburton.com/CYPHERservice) >

**HALLIBURTON**

Solving challenges.<sup>TM</sup>

Seismic attribute analysis technology

# Analyzing Big Data For Big Discovery

By HEATHER SAUCIER, EXPLORER Correspondent

Unconventional plays are producing hundreds of wells within relatively small spaces, and all are cranking out more data than any human could possibly track. It's a fact that has driven the oil and gas industry to search for technology that can intelligently quantify such data and increase the odds of a discovery.

The best place to look these days?

Try Amazon and Google, said AAPG member Kurt Marfurt, a professor of geophysics at the University of Oklahoma and frequent contributor to the EXPLORER's Geophysical Corner.

"Technology designed to find patterns is migrating from the marketing industry into geology and geophysics," Marfurt said, "from the good people at Amazon suggesting you buy a structural geology book based on your most recent purchase, to those at Google popping up a coupon on your smart phone when your GPS tells them you are, once again, standing in the Cheerios aisle."

"As the size of seismic volumes and the number of seismic attributes increase, this technology allows us to more rapidly extract and subsequently analyze patterns buried in the data," Marfurt added.

Marfurt gave a presentation on the roots of seismic attribute analysis technology and its future use in the oil and gas industry at the Society of Exploration Geophysicists' annual conference last month in Denver.

Expanding on that talk, he described how a process called "seismic clustering"



MARFURT

**"As the size of seismic volumes and the number of seismic attributes increase, this technology allows us to more rapidly extract and subsequently analyze patterns buried in the data."**

uses algorithms that can help find sweet spots and bypassed pay that can be overlooked by conventional methods of seismic attribute interpretation.

Marfurt predicted that seismic clustering will be the fastest growing attribute analysis technology in the industry in coming years.

The money behind this technology, he said, is enormous.

While businesses are analyzing "big data" looking for improved ways of selling products and services, governments are analyzing telecommunication and financial data for bad guys – money launderers, drug traffickers and terrorists.

### How It Works

"Supervised algorithms" are interpreter-driven, Marfurt explained.

Using well logs, microseismic events and production as hard, but sparse data, the interpreter "trains" the computer to construct patterns that relate hard data to softer, more continuous attribute data, such

as impedance, spectral components, and attenuation, thereby predicting a property of interest, such as areas of more effective reservoir completion.

In contrast, "unsupervised algorithms" are data-driven. The data "speaks for itself," looking for patterns and relationships that the interpreter may not have contemplated, thereby avoiding human bias.

One possible application of "unsupervised learning" would be to map bypassed pay, which by definition has not been sampled by the well bore and completion process.

Hard data also can be human experience.

"Interpreters are excellent at finding Waldo in children's books," Marfurt said.

In this supervised learning application, the interpreter defines facies by choosing them. It is as important to choose the facies that are not of economic interest (such as a tight limestone) as it is the facies of interest (such as a high porosity chert). Fractured non-porous chert and shale make up other

components of the Mississippi Lime play in the Mid-Continent. In this application, an unsupervised learning may identify facies that were not tagged by any well control, such as an incised sandstone channel.

Currently, neural networks are the most established supervised clustering algorithms, and self-organizing maps remain the most established unsupervised clustering algorithms, Marfurt said. The relationships are in general nonlinear.

Correlating fracture density measured in a horizontal image log to seismic attributes is one of the more challenging.

For example, fractures are correlated to strain, which in turn is measured by seismic curvature – but fractures initiate only after a critical amount of deformation. The fracture density then increases with an increasing amount of strain, until the rocks are saturated with fractures.

At this point, further deformation is accommodated by moving the rocks along the fractures, which are now renamed "faults."

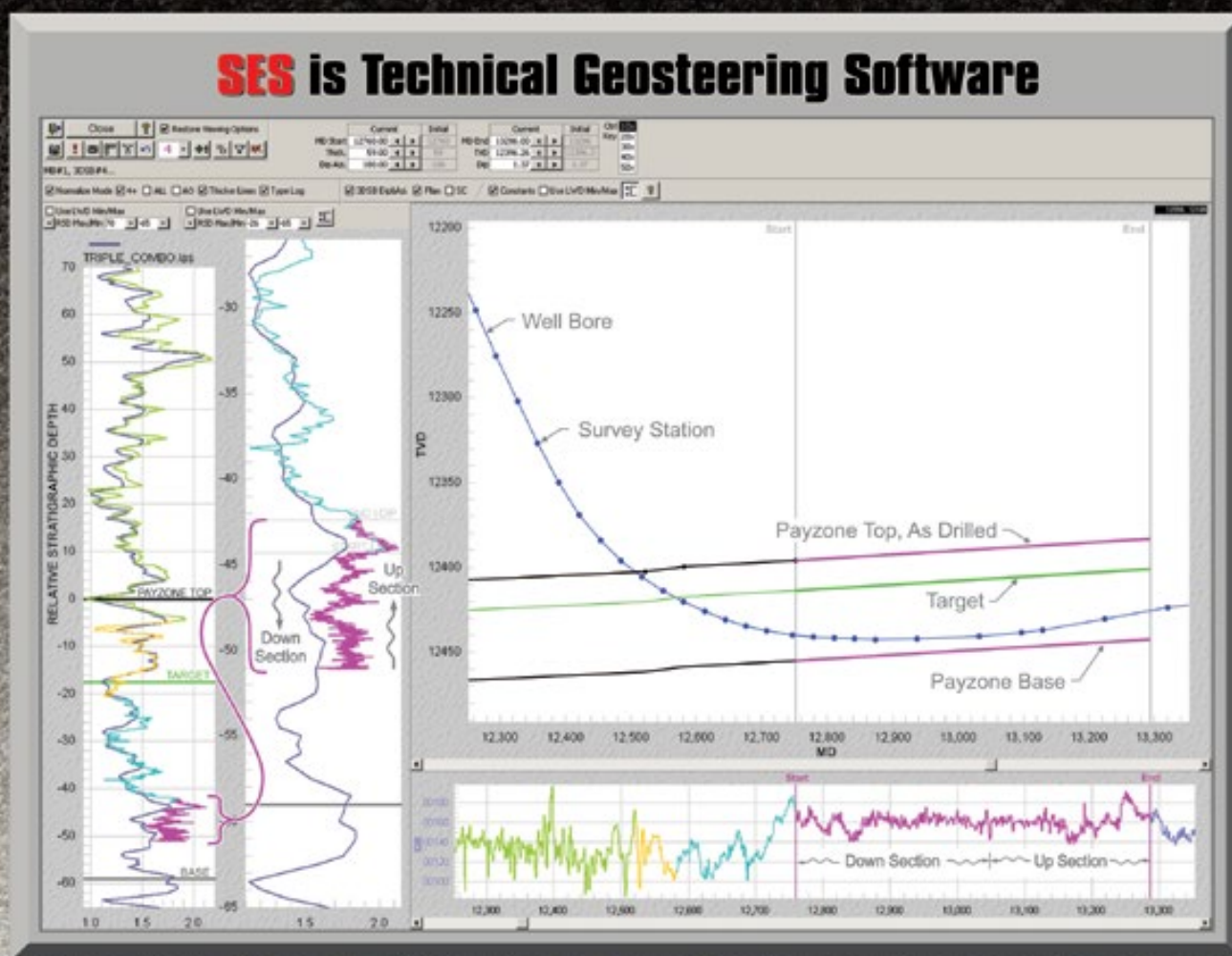
### Breaking Down the Data

Obviously, volumetric attributes generate volumes – even land surveys can be gigabytes in size, Marfurt said.

Yet, if interpreters want to evaluate alternative attribute expression of their geology, they may need to sift through

See *Interpreter*, page 12

## Land your horizontal with *confidence!*



**SES** is for geologists who are dissatisfied with drafting or gridding-tool methods of geosteering horizontal wellbores. **SES** is 3D technical geosteering software that makes wellbore stratigraphic tracking quick-n-easy, accurate, and easily shared. Unlike any other geosteering software, **SES** provides a complete suite of software features to handle your horizontal drilling needs.

To learn more and get a free trial, please contact us at...

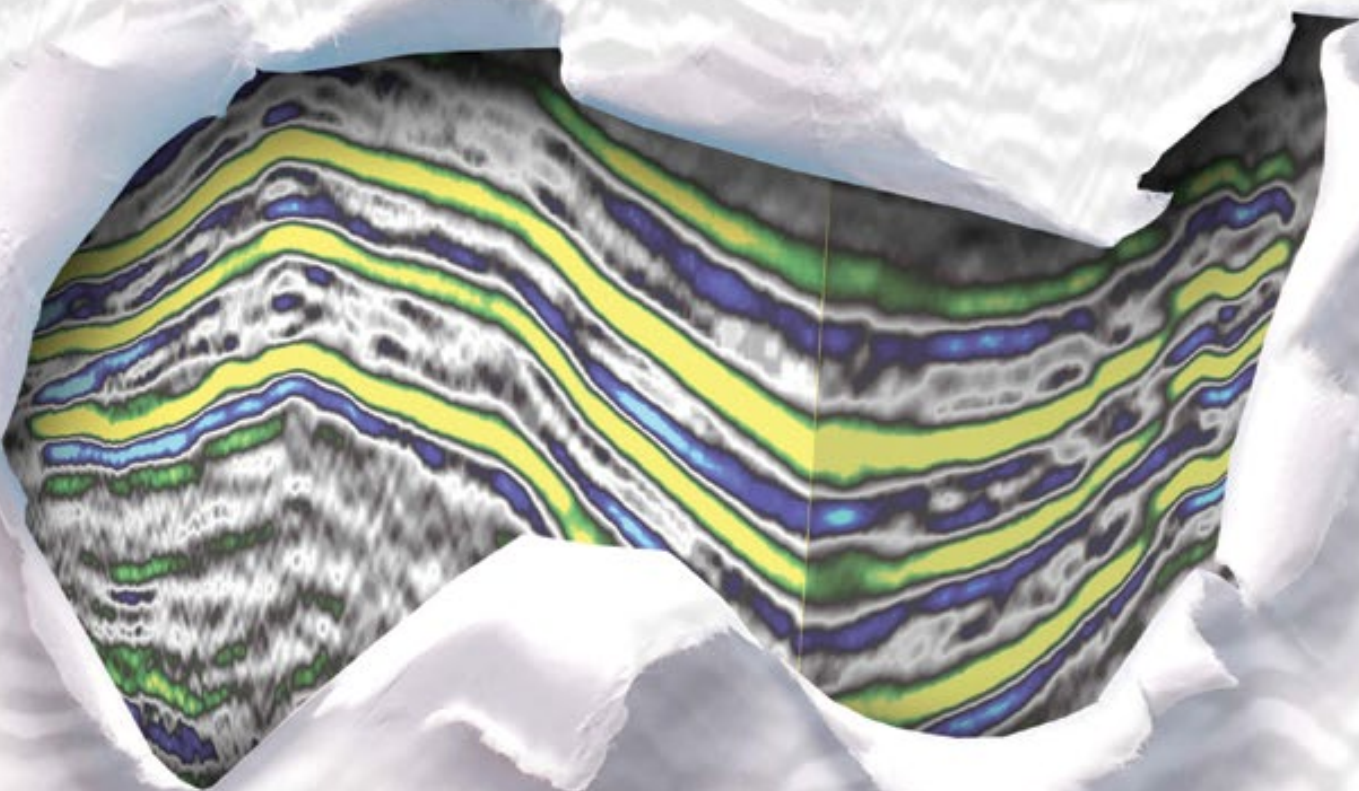
[www.makinhole.com](http://www.makinhole.com)

Phone 720-279-0182  
support@makinhole.com



★ Drill more horizontal pay! ★ Reduce pilot holes! ★ 85+ clients and growing! ★ Free trial software and video!

# discover more...



...with Spectrum  
Multi-Client seismic

**More than just data...**

Spectrum's experienced teams of geoscientists use seismic interpretation to evaluate the hydrocarbon potential of the basins we work in, target key plays and solve imaging challenges. This enables our clients to make better decisions with the data they buy.

Find out more at:



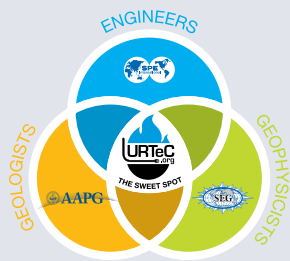
[www.spectrumasa.com](http://www.spectrumasa.com)

## URTeC Call for Papers Open

The call for abstracts has been issued for the next Unconventional Resources Technology Conference, which will be held July 20-22 in San Antonio.

The 2015 technical program will include 11 themes:

- ▶ Regional Case Studies.
- ▶ Characterization of Unconventional Reservoirs.
- ▶ Application and Integration of Well Data.
- ▶ Understanding Your Petroleum System.
- ▶ Optimizing Recovery from Unconventional Reservoirs.
- ▶ Integrated Approaches and Case Studies.



- ▶ Production Performance of Tight Oil and Gas Reservoirs.
- ▶ Social Performance (HSSE).
- ▶ Reserves Forecasting and Estimation.
- ▶ Long-Term Performance.
- ▶ Emerging Unconventional Plays.

To submit an abstract, or for more information, go to [URTeC.org](http://URTeC.org).

## Interpreter from page 10

dozens of attribute volumes to identify patterns of interest.

Software vendors are now marketing programs that build on interpreter experience.

The interpreter defines important facies of interest on key lines, perhaps those with well control. The software then sifts through the multiple data volumes to determine which attributes best differentiate the desired facies.

"I predict that an interpreter will be able to interactively add and subtract attribute volumes to determine which combination of attributes differentiate a given facies of interest," Marfurt said, "thereby testing alternative hypotheses."

Seismic attributes, such as impedance

inversion, are only as good as the seismic data and background model that went into it, he continued.

In a typical workflow:

▶ The petrophysicist generates well log crossplots to define lithologies or geomechanical behavior in terms of P- and S-impedances.

▶ Next, the seismic interpreter ties wells to the seismic data and builds a background P- and S-impedance model.

▶ The seismic data are cleaned up, or "conditioned," and inverted.

▶ The inversion results use the crossplot model to generate a volume of a desired parameter, such as brittleness.

While this workflow requires technology experts, the computer can remember the keystrokes that the experts have made.

One software vendor has prototyped a technology that links these keystrokes, allowing the automatic updating of the final brittleness prediction when a new well measurement, such as a dipole sonic log, becomes available.

Similar updates may be due to improvements in seismic data conditioning.

In addition, the interpretation team can generate a measure of confidence in the final output by tweaking assumptions in the original well log interpretation and crossplots.

**Most of these advancements will be done the hard way, through careful case studies and effective workflows.**

### More Than Technology

While technology is improving, fundamental understanding of the seismic response to different geologic features is critical, Marfurt said.

Most of these advancements will be done the hard way, through careful case studies and effective workflows, he added. Once such workflows have been prototyped and validated by seasoned interpreters, they can be emulated in computer software and distributed to the interpretation community at large.

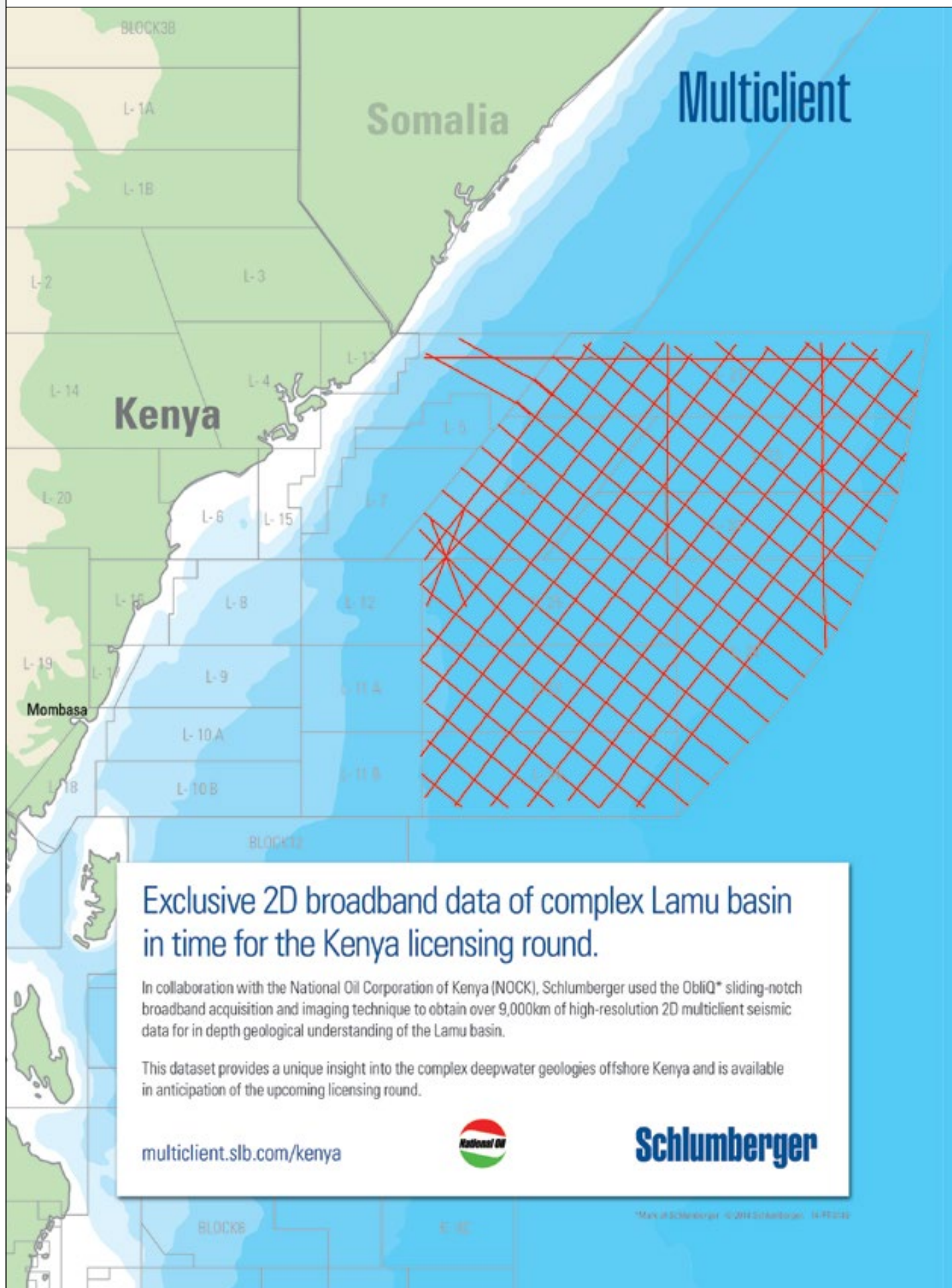
"One of the more common challenges," he said, "is how to link attributes that delineate specific architectural elements of a depositional system that can be imaged by seismic data to reservoir features of interest that fall below seismic resolution."

The classic example is the prediction of sand in point bars of a meandering shale-filled channel. The expression sand injectites on coherence images and differential compaction on curvature images are relatively recent observations.

AAPG member and Robert R. Berg Outstanding Research award winner Henry Posamentier, who helped pioneer the modern approach to sequence stratigraphy, calls these features "FLTs," or funny-looking-things.

Recognition of such FLTs – and placing them in a proper depositional, diagenetic or tectonic framework – is key to conventional interpretation, while the human being "clusters" such features into a geologic model.

Computer software will follow in the footsteps of such innovation. 





**Exclusive 2D broadband data of complex Lamu basin in time for the Kenya licensing round.**

In collaboration with the National Oil Corporation of Kenya (NOCK), Schlumberger used the ObliQ® sliding-notch broadband acquisition and imaging technique to obtain over 9,000km of high-resolution 2D multiclient seismic data for in depth geological understanding of the Lamu basin.

This dataset provides a unique insight into the complex deepwater geologies offshore Kenya and is available in anticipation of the upcoming licensing round.

[multiclient.slb.com/kenya](http://multiclient.slb.com/kenya)

\*Mark of Schlumberger © 2014 Schlumberger 14-PT-0012



Version 2015 coming soon...

[www.mve.com](http://www.mve.com)



Multiphysics Object-Oriented Simulation Environment

# MOOSE Offers Real-World Geophysical Modeling

By KEN MILAM, EXPLORER Correspondent

It's hard to ignore a MOOSE.

Researchers at Idaho National Laboratory have one that's getting attention from scientists in a variety of disciplines, including those at major oil companies and universities.

MOOSE – Multiphysics Object Oriented Simulation Environment – is a software platform designed to make predictive modeling and simulation faster and easier, according to Rob Podgorney of IDL's Energy Resource Recovery and Sustainability Department and director of Snake River Geothermal Consortium.

The product was one of the 2014 winners of the R&D 100 Awards, recognizing exceptional and innovative new products and processes. It has been licensed to at least seven companies, 11 labs and 29 universities.

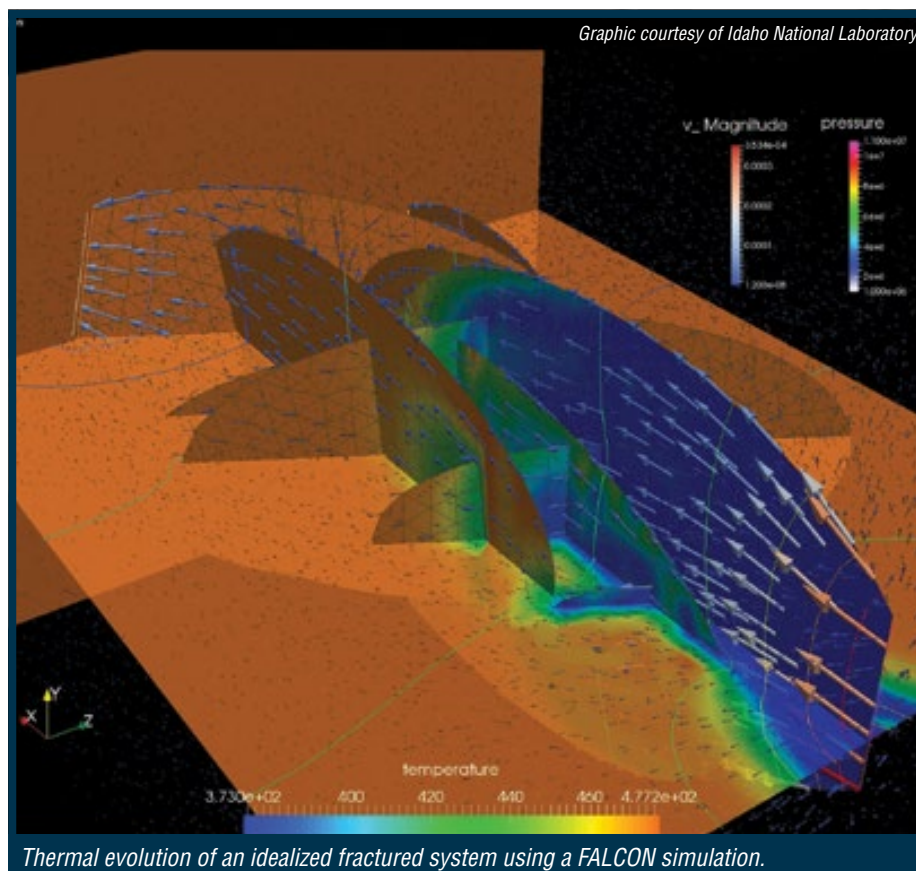
While MOOSE has been around in various stages for several years, Podgorney and his colleagues have been involved with it about four years.

"It was born in the nuclear physics department," Podgorney said.

"They were looking at pebble bed reactors – essentially a porous medium – (and) they were wondering about preferential flow and sought our (geologists') expertise," Podgorney said. "It was a perfect collaboration."

**Wide Application**

Podgorney and his colleagues



Thermal evolution of an idealized fractured system using a FALCON simulation.

developed FALCON, an enhanced geothermal systems application for use within the MOOSE framework.

"The number of applications continues

to grow," including several in nuclear energy, carbon dioxide sequestration and superconductivity, said Keith Arterburn of IDL media relations.

"We have several collaborators still helping develop the code," Podgorney said. "It's a free R&D code, but they share their improvements to it."

While the biggest MOOSE-FALCON footprint may be in geothermal work, "We've done a good bit of work in unconventional fossil," Podgorney added.

"The focus really is on stimulation prediction and understanding shale resources ... shale gas and oil shale," he said.

FALCON was funded with Department of Energy grants to research hydraulic fracturing in hard rock reservoirs.

"It's a framework to do modeling for tightly coupled processes: fluid flow, chemical reactions and geomechanics and how they relate. How does a change in one affect the other three or four?"

"It's an easy numerical framework to solve these equations simultaneously instead of linking with other input files," he continued. "There's no loss of information in the transfer. You get all the physics interacting as in the real world."

Government research support means IDL also has resources for rigorous model evaluation, he said.

"For example, we have a two-meter rock centrifuge," he said. "You can put some pretty big blocks of rock in that ... look at fluid trapping, residuals for different compositions of fluids to validate the model."

See Market Penetration, page 18

GEOSCIENCE AT ITS BEST



We boost your E&P projects

Consulting and Software Solutions in Exploration & Field Development

IN-DEPTH EXPERTISE AND INTERNATIONAL EXPERIENCE • INDEPENDENCE • INNOVATION

**Exploration:** Select the right exploration block and make first-rate oil and gas discoveries in onshore, offshore, deep offshore, mature and unconventional basins. We have the experts and leading petroleum system analysis technology.

**Field development:** Maximize your reserves and increase your production in a cost effective way: from marginal to super giant fields, complex, carbonate, fractured, tight reservoirs. We are experts in the application of innovative IOR and EOR methods and offer best in class reservoir modeling and simulation solutions.

**Technology transfer, mentoring, coaching:** Enhance/reinforce your team know-how through tailored on-the-job training and mentoring solutions.

www.beicip.com



www.beicip.com  
info@beicip.com



# MAX. PRODUCTION.

BUILD A BULLETPROOF BLUEPRINT TO BE  
THE BEST UNCONVENTIONAL PRODUCER.

Pinpoint the precise potential of your assets — and best practices to maximize production. It's a true story.

Eliminate guesswork. Accelerate results.  
Win, with Drillinginfo.

**FIND OUT HOW ONE EAGLE FORD  
ASSET MANAGER DID IT:**

[DRILLINGINFO.COM/MAXPRODUCTION](http://DRILLINGINFO.COM/MAXPRODUCTION)

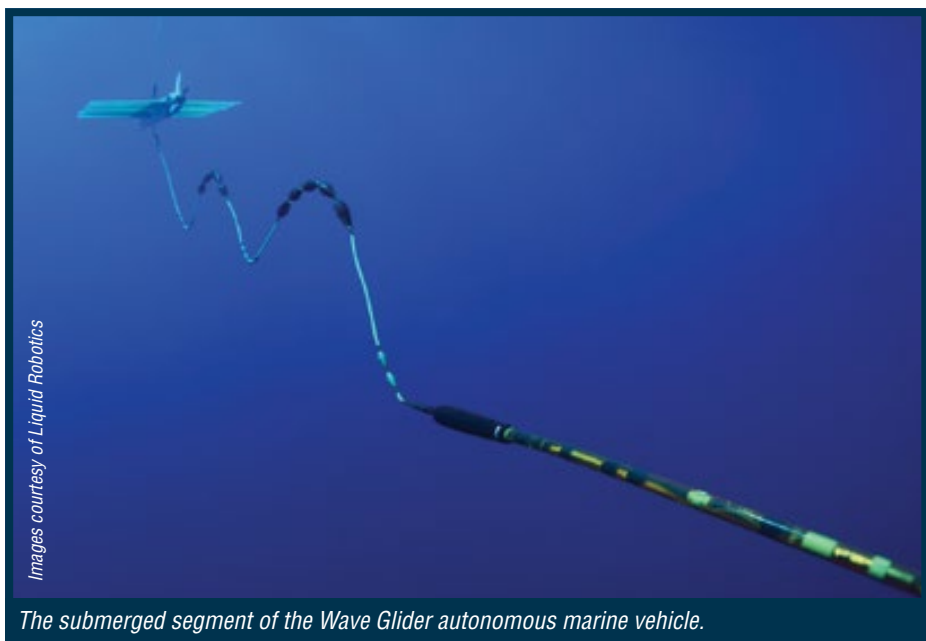


**drillinginfo**

better, faster decisions

# Aquatic Drones For Seismic Acquisition?

By LOUISE S. DURHAM, EXPLORER Correspondent



Images courtesy of Liquid Robotics

The submerged segment of the Wave Glider autonomous marine vehicle.

The mention of nodes for marine seismic data acquisition ordinarily brings to mind a cable-free package-like assembly sitting on the ocean bottom.

Given ongoing advances in technology, that may change soon.

It's time to begin to think floating nodes, or autonomous marine vehicles (AMV).

In the marine environment, towed streamer seismic data acquisition has long been the method-of-choice,

principally because of its efficiency and good quality data – but in obstructed areas or in very shallow water where streamer vessels can't be deployed, other acquisition systems are needed.

Ocean bottom node (OBN) and ocean bottom cable systems come into favor here as a means to negate the towed streamer challenges, owing mainly to the fact that the receivers are deployed on the ocean floor.

But these systems have limitations too, including the cost entailed to deploy OBNs in the deep water using remote operated vehicles (ROV).

## Look Ma – No Wires

Enter the AMV, or Wave Glider, which is being developed by Liquid Robotics and being considered as the technology to potentially acquire seismic data where other equipment is limited.

This somewhat odd-looking apparatus is a two-part vehicle made up of a surface component, or float, and a submerged segment, or sub.

The two are connected by an umbilical tether.

The Wave Glider uses wave energy as the main propulsion system, explained Dave Monk, director of worldwide geophysics and distinguished adviser at Apache Corp.

"As the float is moved vertically by the surface waves, the sub converts this motion into forward thrust via a passive mechanical system," he said. "The wave glider's expected water speed should be compared with expected currents."

"The vehicle has the potential to continuously swim forward or to 'hold station,'" he added.

"Solar panels mounted on the float are used to charge batteries, which provide power to the control system, radios and payload," he said. "Control and communication of the Wave Glider are provided via a secure Web and satellite system."

For seismic applications, the Wave Glider can be equipped with a recording system mounted inside the float and seismic sensors.

"They're a floating device with a receiver," he explained, "so they're like a floating node."

Apache was involved in a 2013 feasibility test of the Wave Glider system to acquire seismic data in the Gulf of Mexico through the course of a shallow water OBN acquisition program.

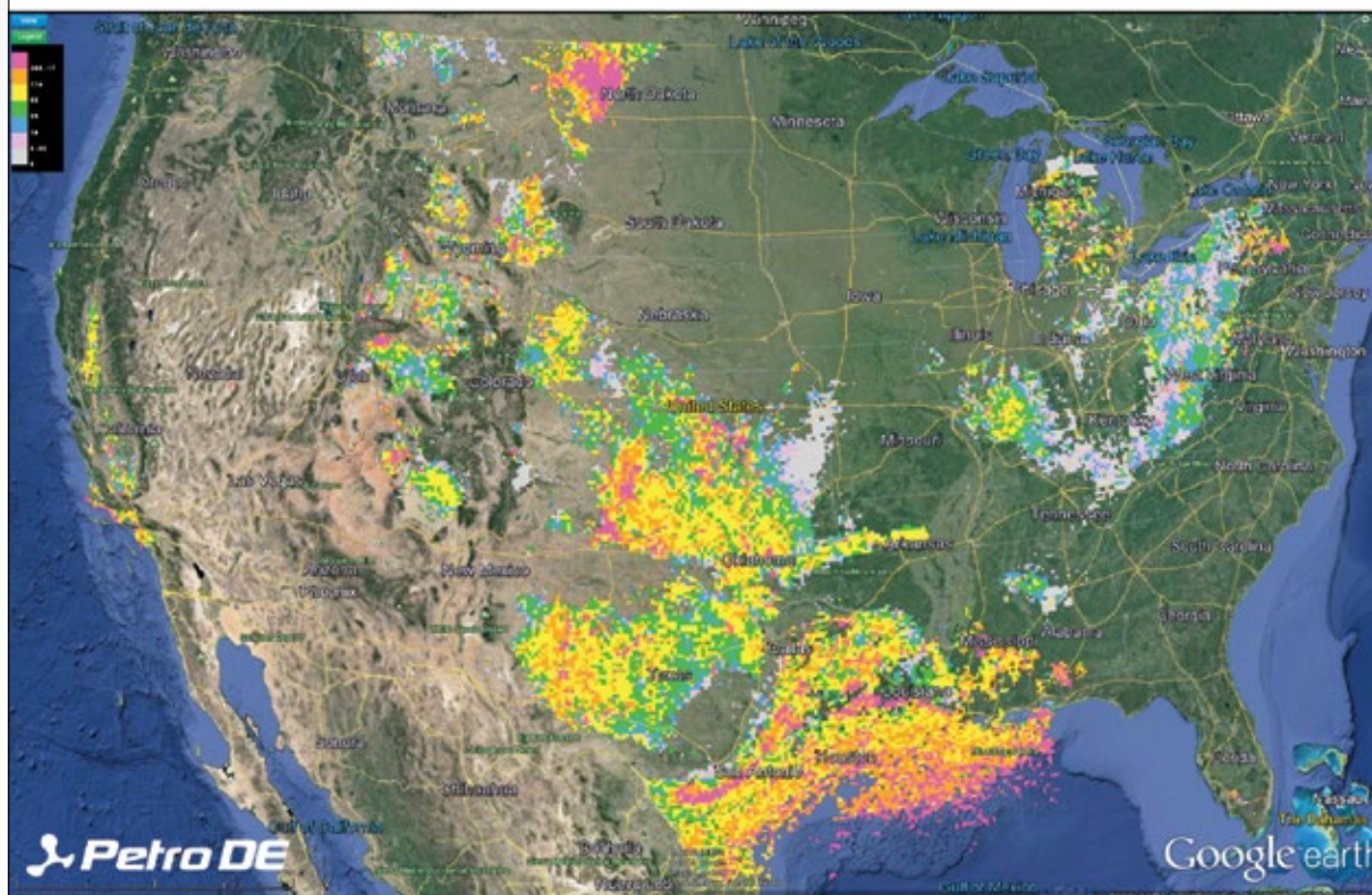
For the test, the Wave Glider had a short streamer attached to the umbilical. The streamer trailed behind the glider, but could have been hung vertically.

Sensors inside the streamer included hydrophones and micro-electromechanical systems to measure the acceleration of water particles in the Z and Y directions, Monk explained.

The seismic recording system installed in the float had continuous recording capabilities.

The test served to demonstrate that the operator(s) can command and control these devices and that they will go where needed and record seismic data.

## Find the next hot play. Fast.



PetroDE created this IP Heat Map based on 4.5 million wells in the IHS US Well Database in less than a minute. IHS

WHAT IF you could search IHS well & production data and immediately see it on Google Earth?  
That would be **AMAZING!**

AND WHAT IF your team could work with this information together regardless of location simultaneously?  
That would be **INCREDIBLE!**

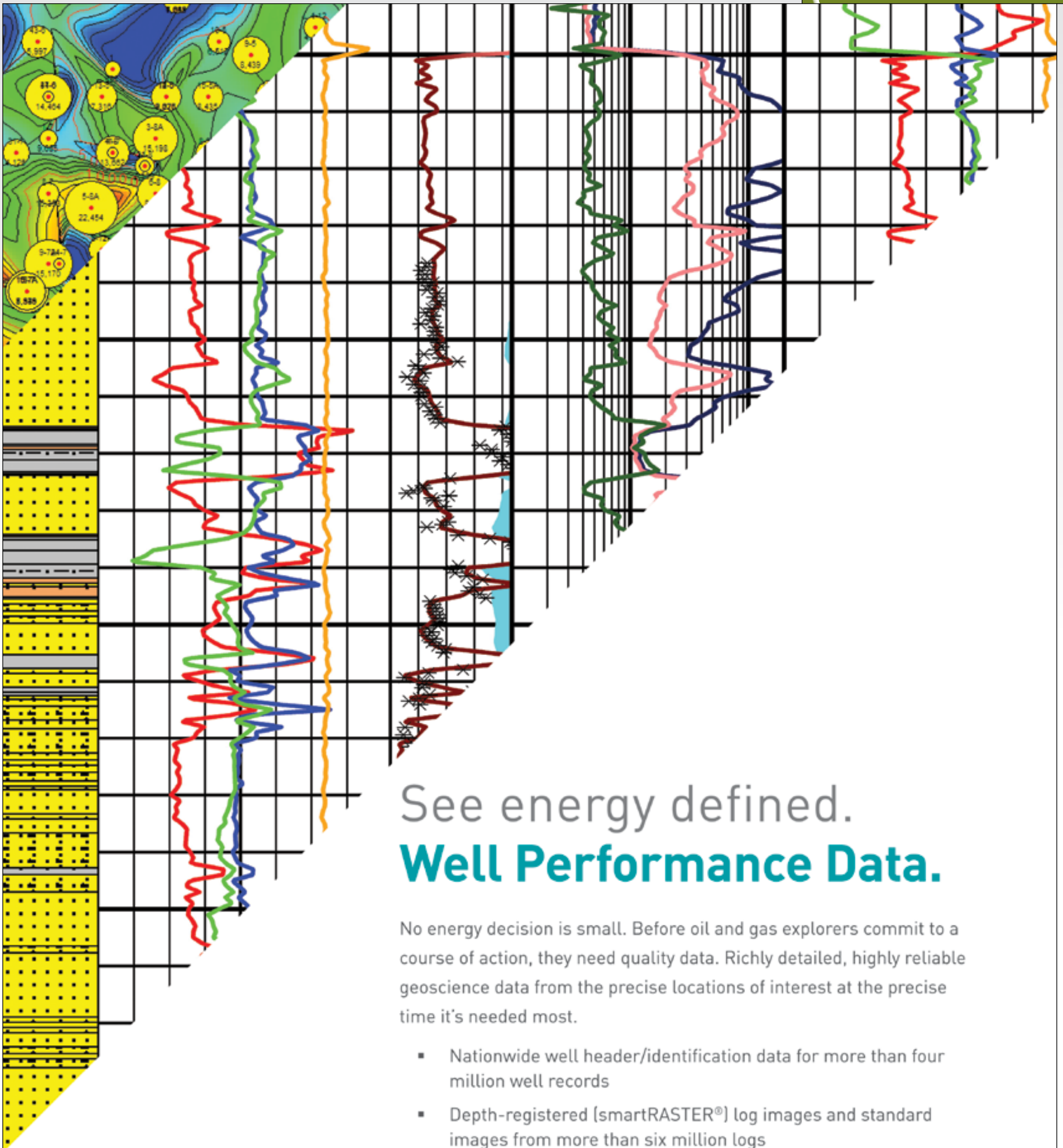
Introducing **Petro DE**, the world's first Petroleum Decision Engine.

**Petro DE**  
PetroDE.com

Copyright © 2014 PetroDE. All rights reserved.

See Applications, page 18





## See energy defined. **Well Performance Data.**

No energy decision is small. Before oil and gas explorers commit to a course of action, they need quality data. Richly detailed, highly reliable geoscience data from the precise locations of interest at the precise time it's needed most.

- Nationwide well header/identification data for more than four million well records
- Depth-registered (smartRASTER®) log images and standard images from more than six million logs
- Detailed US production volumes for approximately 2.1 million wells
- Use of TGS Longbow™, a search and visualization tool

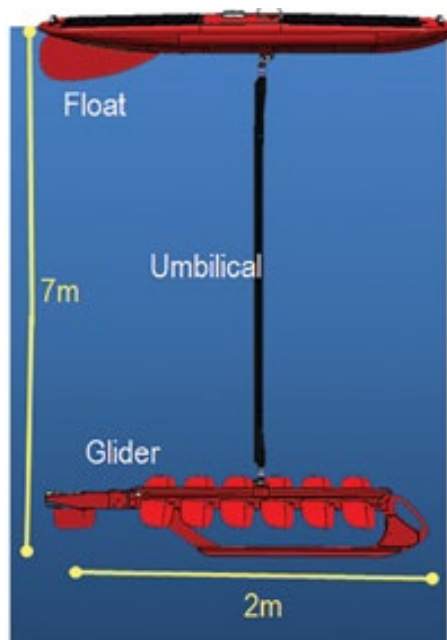
See the energy at [TGS.com](http://TGS.com)



© 2014 TGS-NOPEC Geophysical Company ASA. All rights reserved.



Solar panels mounted to the float charge the AMV's batteries.



**Applications**  
from page 16

**Cool Factor**

But any excitement over that capability is premature at the moment, as it's unlikely that these intriguing creations will be on the market soon enough for any currently planned seismic acquisition ventures.

"Wave Gliders are being used for other technical measurements in the industry, but not yet for seismic data," Monk said. "I think we're at least a few years out for a commercial deployment."

Nonetheless, the cool factor associated with this technology is undeniable.

For instance, Monk said an operator can simply toss them out into the water and tell them to come back later.

"With a Wave Glider, you can potentially just launch it off a pier in Galveston and send it where you want it to go – even if that's halfway around the world," he said. "There's no requirement for power, and they're entirely remote, being commanded and controlled over satellite; there's no requirement to visit the location where you want to record."

"A large number of devices could be tossed out to sea to travel much like a school of fish to the designated location," he noted. "There they would encounter a separate seismic source boat, which would travel around outside of them."

At the end of the day, the data acquired during the 2013 GOM test proved to be comparable to the OBN data.

"We didn't have enough Wave Gliders to really produce anything more than comparisons of shot records and common receiver gathers," Monk said. "But, the shot records or common receiver gathers look entirely comparable to data we got from bottom referenced nodes."

**CALL FOR PAPERS**

► **Submission deadline:**  
**1 December 2014**

<https://mc.manuscriptcentral.com/interpretation>

A joint publication of SEG and AAPG

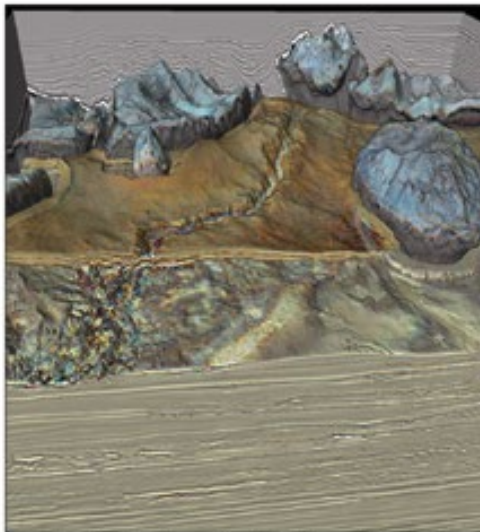
**Interpretation**<sup>®</sup>

A journal of subsurface characterization

**Earth Model: Effective interpretation for conventional and unconventional reservoirs**

The editors of the Interpretation journal would like to follow up the successful 2014 Earth Model Forum with a special section on the same theme. The Earth Model Project is an SEG initiative to promote integration of earth science data and knowledge to provide quantitative interpretations. Both participants and non-participants of the Forum are invited to submit papers to the section. The goal is to help stimulate a fundamental change in visualizing and predicting subsurface structure, rock and fluid properties quantitatively along with estimates of uncertainty. From emerging data types and format handshakes to multidisciplinary workflows, this section's focus is on industry's current best practices with "Effective Interpretation in Conventional and Unconventional Reservoirs" and the value it brings to the business. We are interested in papers that discuss the following topics:

- Interpretation case studies on integration of seismic, well and core data
- Conventional and unconventional reservoir characterization and reservoir property uncertainty
- Quantitative risk reduction and structural uncertainty
- Volume based seismic attributes used in interpretation
- Stratigraphic interpretation – framework building, body identification and tracking
- Interdisciplinary prospecting
- Geoinformatics
- Data types and format handshakes



Salt-sediment interaction near Green Knoll, deepwater Gulf of Mexico. Image courtesy of Schlumberger

Interpretation, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

The submissions will be processed according to the following timeline:

**Submission deadline:**  
**1 December 2014**

**Publication of issue:**  
**August 2015**

Special section editors:

**Carmen C. Dumitrescu**  
carmend@terra-iq.com

**Andreas Laake**  
laake1@slb.com

**Konstantin Osypov**  
KOsyrov@chevron.com

**Market Penetration**  
from page 14

**The Learning Curve**

Podgorney said his group works with several major oil companies.

"We don't advertise – they come to us and see our capabilities. We tackle that 'challenge' problem, behavior they can't reproduce in their models," he said.

"We can use a systems approach to look at groundwater resources like a disposal well. We can do simulations there as well as deep reservoir and run the models at the same time. We can look at it on a basin-wide scale to optimize water usage – look at the whole system, not just product recovery but all the ancillaries," he added.

General market penetration will probably be gradual, he said. Most interest in MOOSE to date involves "the DOE complex, geothermal and from abroad," Podgorney said.

Much of the geothermal research and application is in Australia and New Zealand, with a signature project in the United States being the Raft River project in Utah.

He said MOOSE is a programming framework, which means a learning curve.

"It's not for dummies, you have to understand the physics. The code is pretty intuitive if you understand the equations," he said.

"Learning new code takes effort.

"There's a lot of interest from younger folks seeing the power of these methods," he said. "They're not married to one code ... they're still learning, anyway."



## TRITON: Acquisition now complete

The Triton survey combines its unique full azimuth configuration with GeoStreamer® acquisition technology. GeoStreamer, with its unparalleled low frequency content, has a unique ability to record complementary wavefields and has enabled revolutionary imaging that utilizes both primary and multiple energy.

This technology has resulted in imaging of unseen clarity and is recognized as uniquely suited to producing superior velocity and reservoir property information. PGS is leveraging our full suite of proprietary model building tools, including our PGS hyperTomo technology and TTI RTM utilizing 3D angle gather output, allowing for image optimization and pre-stack data access throughout the model building sequence and for final imaging.

These imaging tools, take full advantage of PGS' unique GeoStreamer® technology, providing never before seen resolution of complex sub-salt structures. Contact us today to find out more.

Steven Fishburn, Tel: +1 281 509 8124, [gominfo@pgs.com](mailto:gominfo@pgs.com)

### A Clearer Image

[www.pgs.com/Triton](http://www.pgs.com/Triton)

MultiClient  
Marine Contract  
Imaging & Engineering  
Operations



*Tripling R&D investment in three years*

# Oklahoma Center is Part of GE's Global R&D Push

By KRISTI EATON, EXPLORER Correspondent

Construction continues for the new GE Global Research's Oil & Gas Technology Center in Oklahoma City – part of the company's three-year effort to triple R&D investment in the oil and gas industry.

The \$125 million facility “will be an incubator for new innovative technologies that will enable safe, efficient and reliable exploration, production, delivery and use of unconventional oil and gas,” said Michael Ming, general manager of the Oil & Gas Technology Center.

The operation is slated to open in early 2016.

The research center, which is focused on accelerating mid- to late-stage oil and gas technology development, comprises five research programs:

- ▶ **Production Systems:** next-generation artificial lift technologies, well pad electrification and other technologies used for production optimization.

- ▶ **Well Construction Systems:** development of transformational technologies for drilling and completion operations, including reducing environmental impact and footprint.

- ▶ **Energy Systems:** bringing modeling and analysis capability for full systems integration and optimization across the entire value chain—upstream, midstream and downstream, including building new markets for natural gas.

- ▶ **Water Systems:** advancing technologies to reduce, reuse and



Images courtesy of GE

Artist's rendering of the GE Research Center currently under construction in Oklahoma City.

recycle water, and research new solutions that replace or eliminate the use of water altogether.

- ▶ **CO<sub>2</sub> Systems:** applying new solutions for capture, transport, storage and beneficial use of CO<sub>2</sub> including enhanced oil recovery.

The center will also explore ways

to use CO<sub>2</sub> in hydraulic fracturing that would eliminate water from the fracturing process.

Brian Rovelli leads a team of scientists, engineers and researchers to deliver technology breakthroughs in the water systems program.

“The group working here, we’re

focusing on oil and gas-related technology,” Rovelli said. “We hire people with backgrounds in electronics, chemistry, computing and, of course, in oil and gas – it would be more reservoir modeling and engineering.”

See **Focal Point**, page 22

## NIOBARRA COMPLETIONS & WELL SPACING

November 18-19, 2014 | Denver | Colorado

The First Dedicated Congress On Optimizing Completions & Well Spacing Strategies In The Niobrara, Based On Production From Operators Working In The Play

FEATURING OVER 20 CASE STUDIES FROM LEADING NIOBRARA OPERATORS, SPEAKERS & PANELISTS INCLUDING:



Dean Tinsley  
Director Of Engineering  
Bonanza Creek Energy



William Lloyd  
Senior VP Operations  
Cirque Resources LP



Craig Rasmuson  
COO  
Synergy Resources



Jordan Gitterman  
Managing Executive VP  
Ranchers Exploration Partners LLC



Michael Eberhard  
Completions Manager  
Anadarko Petroleum



Victor F Hein  
VP Engineering  
Castleton Commodities International

[www.niobrara-well-spacing-completions.com](http://www.niobrara-well-spacing-completions.com)

## 2<sup>nd</sup> Annual EAGLE FORD PRODUCTION ARTIFICIAL LIFT & CHEMICAL TREATMENT 2015

January 28-29, 2015 | Houston | Texas

Artificial Lift & Chemical Treatment: Examining How Production In The Eagle Ford Can Be Optimized To Maximize Well Recovery & Lower Operating Costs

OVER 20 EXPERT E&P SPEAKERS INCLUDING:



Jason A. Churchill  
Operations Engineering Manager  
Venado Oil & Gas



Daryl Mazzanti  
Vice President  
Evolution Petroleum Corp



Phil Martin  
CEO  
New Century Exploration, Inc.

What's New For 2015:

- Greater Paraffin Control Focus
- Rod Pump Alternatives
- Area Specific Lift Strategies
- Automation Focus
- Gas Interference
- Pumping The Curve
- H2S Management & Emissions

[www.eagle-ford-production-2015.com](http://www.eagle-ford-production-2015.com)

## 4<sup>th</sup> ANNUAL PERMIAN HORIZONTAL COMPLETIONS OPTIMIZATION WOLFCAMP AND CLINE FOCUS

February 18-19, 2015 | Houston | Texas

Correlating Adjustments In Frac Variables With Initial And Cumulative Production Results And EUR To Optimize Completions Design In The Hottest Permian Shale Plays

OVER 20 EXPERT E&P SPEAKERS INCLUDING:



Randy Nickerson  
VP Exploration  
Caza Oil & Gas



Lee Stockwell  
Completions Effectiveness Manager  
Shell



Sahil Malhotra  
Well Stimulation Specialist  
Chevron

E&P Case Studies On The Following Key Topics:

- Optimum Fluid Design, Proppant Sizes, Fluid Volumes, Cluster Spacing, Lateral Length & Number Of Stages
- Slick Water Vs. Cross Link Vs. Hybrid
- Plug & Perf Vs. Sliding Sleeve
- Well Spacing
- Completions Logistics

[www.permian-basin-completions-2015.com](http://www.permian-basin-completions-2015.com)

NEW

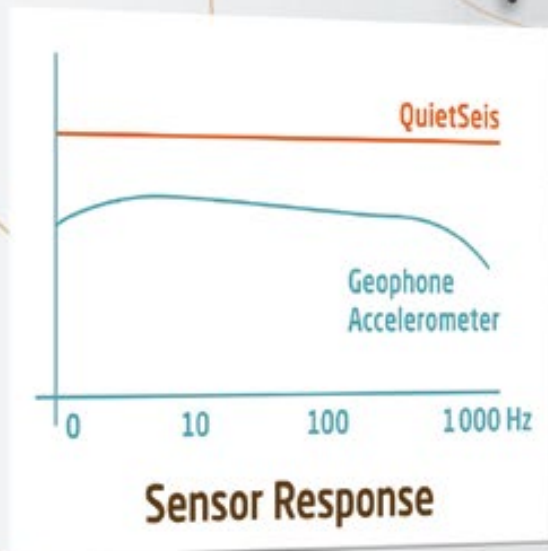


# QuietSeis™

GO BROADBAND!



**QuietSeis** is Sercel's newest and most advanced digital sensor using next generation MEMS technology. Fully integrated with **508XT**, the innovative design of **QuietSeis** provides the most accurate data for any survey type.



// **BEST DATA QUALITY**

- Lowest noise level : 15 ng/√Hz
- Lowest distortion : - 90 dB
- Broadest bandwidth : 0 - 800 Hz

// **ENVIRONMENTALLY FRIENDLY**

- Lowest power consumption : 85 mW

// **ZERO DOWNTIME**

- Fully redundant X-Tech™ architecture
- Immunity to electrical statics



Nantes, France  
sales.nantes@sercel.com

Houston, USA  
sales.houston@sercel.com

[www.sercel.com](http://www.sercel.com)

ANYWHERE. ANYTIME. EVERYTIME.



Ahead of the Curve™



Artist's rendering of the GE Research Center now under construction in Oklahoma City.

## Focal Point from page 20

As head of the water systems program, Rovelli and his team are working to make oilfield technology better and are focusing on technology to help reduce, recycle and reuse water used in the oilfield.

"The oil and gas industry is always looking for better technology, and better technology is allowing us to do what we're doing but make it easier, safer and environmentally sound – that's a very key component that is going on now," he said.

"I think by putting us in this space here," he added, "we're trying to advance that technology and research that is of strategic importance to GE."

## Coming Together

What makes the oil and gas global research center innovative is that top-notch scientists and researchers from all over the world are coming together to solve real-world problems, Rovelli said.

"We're being brought together and with the focal point – the sole purpose – of making oil and gas technology better," he said.

"By having a dedicated center, we're focusing GE's energy and purpose and leveraging all of the 3,000 researchers in GE and putting that energy toward solving some very difficult problems," he added. "Energy, water – these are things that need a real focus on that."

GE has a handful of global research centers all over the world, including those in Shanghai and Munich. Ming said Oklahoma was selected as the site for GE's latest global research center for several reasons, including:

- ▶ Its proximity to customers like Devon Energy, Chesapeake Energy and Continental Resources.

- ▶ Proximity to GE's oil and gas operations.

- ▶ Ability to recruit from established universities in the state.

- ▶ The state's business-friendly climate.

- ▶ The state's affordability for recruiting employees moving to Oklahoma.

Oklahoma State University President Burns Hargis said the research conducted at the center will elevate the engineering, science and geology programs at OSU and other universities in the region.

"Research partnerships with GE scientists and fellow universities, scholars and students will produce discoveries with far-reaching economic and environmental impact for advancing responsible energy development around the globe," Hargis said.

"The GE research center in Oklahoma City will deliver incalculable dividends for Oklahoma's economy and growing research community."

**R**esearchers at GE's centers around the world are working on research and development in the oil and gas industry. Here are some of their innovative research projects:

- ▶ A team of researchers in India is developing a multiphase flow meter that will allow for more accurate measurements of several liquids.

Currently, it is possible to measure only one fluid at a time under certain conditions, but the research team's work is seeking ways to allow for accurate measurements of a mixture of liquids in harsh environments.

The project is a collaborative effort between GE and Chevron.

- ▶ In Munich, a team of researchers is working to develop a subsea plant that can process oil and gas on the seabed floor.

- ▶ GE's High Power Electronic Team in Shanghai is working on technologies that would allow electronics used in oil and gas production to function at deeper depths and higher pressures.

- ▶ Working with local customers, GE's researchers in Rio de Janeiro are developing new sensing, drilling and production technologies to recover oil and gas reserves in the subsalt play offshore Brazil.

– KRISTI EATON

## Warning: Our data has gone mobile

(You may never return to the office)



**gDC**  
geoLOGIC DataCenter

Now, get **geoLOGIC's** value-added data almost any place, any time, any way you want it. Available through **gDCweb** on your tablet, smartphone or computer.

With 30 years of data experience behind it, **gDC** is the source for high quality, value-added well and land data from across Western Canada and the Northern United States. Another plus – our data is accessible through an expanding range of industry software utilizing our own easy-to-use **gDC GIS** and our **geoSCOUT** software.

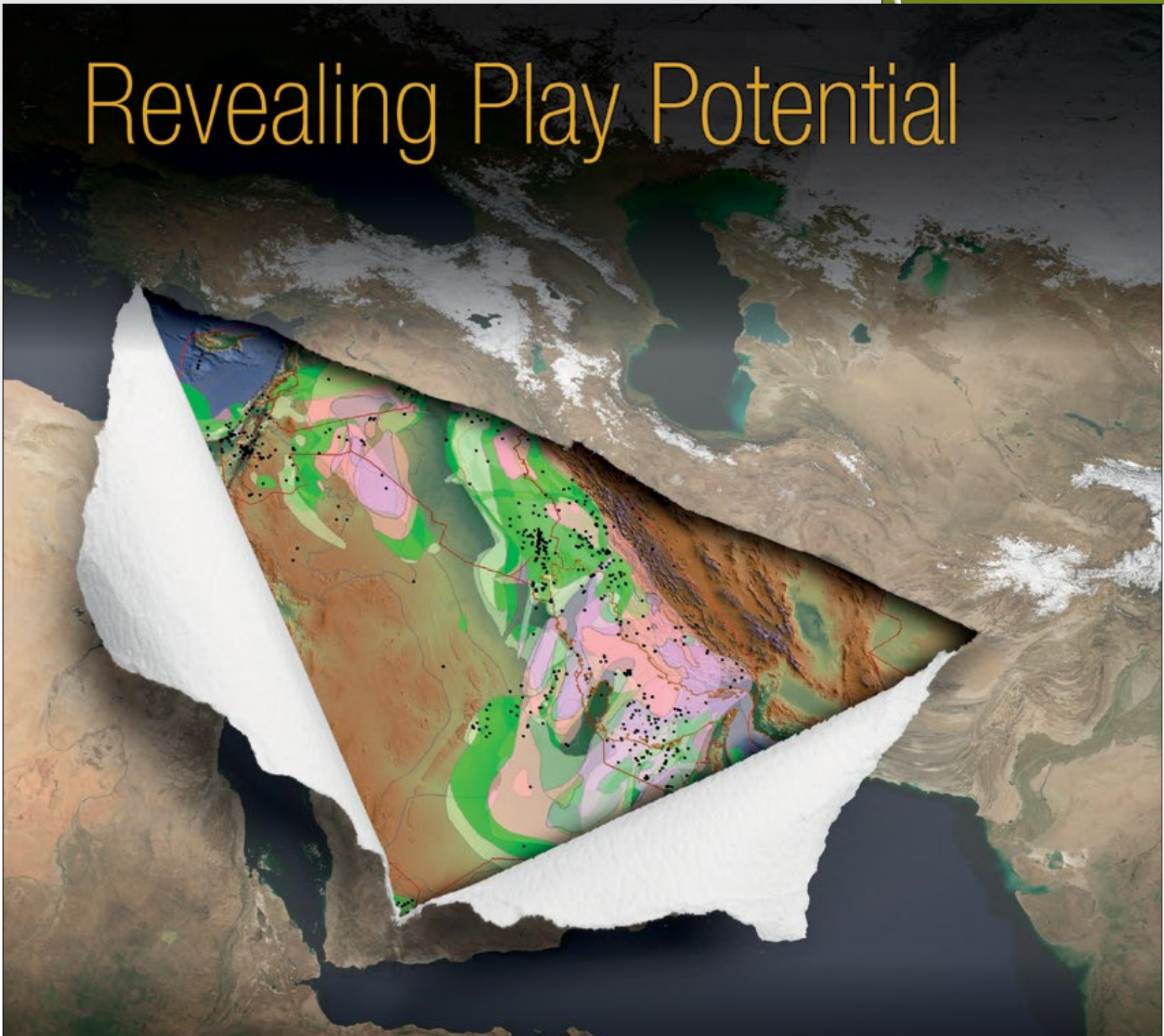
View, search, import and export well, land and production data, documents, logs and more from almost anywhere. For more information visit our website at [www.geoLOGIC.com](http://www.geoLOGIC.com)



Leading the way with customer-driven data, integrated software and services for your upstream decision-making needs.

geoSCOUT | gDC | petroCUBE at [www.geoLOGIC.com](http://www.geoLOGIC.com)

# Revealing Play Potential



To obtain valuable geological insight and generate new ideas and play concepts, you need rapid access to readily available subsurface interpretations.

The Neftex Petroleum Systems Interpretation Module integrates Earth Model data to deliver a suite of carefully interpreted petroleum systems maps. Each map depicts source rock maturity and preservation limits to allow you to rapidly assess regional source potential.

**Accelerate the exploration process with the Neftex Petroleum Systems Interpretation Module.**

Contact us today:

Website: [www.neftex.com](http://www.neftex.com)

Email: [enquiries@neftex.com](mailto:enquiries@neftex.com)

Tel: +44 (0)1235 442699

Facebook: [www.facebook.com/neftex](http://www.facebook.com/neftex)

Neftex • 97 Jubilee Avenue • OX14 4RW • UK

Now Explore



Research Showcase

# Connecting Researchers With Funding

By BRIAN ERVIN and SUSAN NASH

**A**APG is committed to connecting promising original research with much-needed funding and is continually seeking – and finding – new ways to make that potential a reality.

Those efforts range from providing exposure and networking opportunities at Geoscience Technology Workshops and various local, regional, national and international conferences and conventions throughout the year, to the Research Launcher program, which makes it possible to review ongoing and proposed research with the click of a mouse.

Along those same lines, AAPG's next related effort is the new Research Showcase, which will be unveiled in Denver at the 2015 Annual Convention and Exhibition, set for May 31-June 3 at the Colorado Convention Center.

The Research Showcase will be an attraction unto itself on the exhibition floor where ongoing or proposed research will be on display (see Director's Corner, page 66).

Susan Nash, AAPG's director of education and professional development, had the opportunity to sit down for a Q&A with three principle players in just one "success story in the making," resulting from AAPG's active efforts to connect researchers with potential funding sources.

Her conversations were with:

► **Bryan W. Turner**, an AAPG student member and doctorate candidate at

the University of Oklahoma, who is doing research on the value and limitations of using hand-held x-ray fluorescence spectrometry for resource shale analysis.

► **Roger Slatt**,

an AAPG Honorary member and Turner's adviser at OU, and director of the Reservoir Characterization Consortium, which is helping to fund Turner's research.

► **Deborah Sacrey**, an AAPG member and former AAPG treasurer, as well as an industry member (Auburn Energy) and an industry supporter of research.

Turner and Sacrey both presented at the Permian Basin Research Exchange Workshop in September – Turner presented a poster of his research, while Sacrey presented on new technology and research in seismic.

**Bryan W. Turner**

**EXPLORER:** What is your relation to the geosciences?

**TURNER:** I am a stratigrapher with an interest in mudrocks and shales. I am currently starting my third year of my Ph.D. with Dr. Roger Slatt, and I have begun using



TURNER



SLATT



SACREY

geochemistry to develop chemostratigraphic frameworks that can be used to build correlations within mudrock successions.

In the process, I am evaluating the value and limitations of using hand-held X-ray fluorescence spectrometry for resource shale analysis.

**EXPLORER:** What is the subject of your research?

**TURNER:** My research focuses on developing chemostratigraphic frameworks within mudrocks and shales and evaluating X-ray fluorescence technology that has become so widely used in unconventional resource shale studies.

Conventional stratigraphic correlation within shale units can be difficult when they appear lithologically uniform in logs, cores and outcrops. Correlation of lateral, coeval facies shifts separated by bounding surfaces is the basis for chronostratigraphic correlations like sequence stratigraphy.

However, as shales may not produce visibly recognizable facies shifts, the

bounding surfaces can be difficult to identify. Therefore, sequence stratigraphic correlation within shales utilizes other techniques.

Sequence stratigraphic correlations within thick successions of shales are conventionally interpreted from gamma ray log response and through physically tracing the relationship to shore facies.

Recent advances in technology make it possible to enhance established sequence stratigraphic interpretations based upon high-resolution chemostratigraphy. High-resolution chemostratigraphy is becoming a common tool in the oil and gas industry for characterizing and correlating shales over broad areas, as well as interpreting their environments of deposition and resource potential.

**EXPLORER:** What exactly are you doing and how does it benefit companies and individuals working in shale plays?

**TURNER:** Chemostratigraphy can be used to evaluate whether there is lateral variability in rates of shale accumulation throughout a depositional basin, as well as for regional correlation of potentially productive and non-productive stratigraphic intervals. This will allow for more detailed sequence stratigraphic correlations within a basin.

Furthermore, this can potentially be used to develop reservoir characterization models and help predict areas of high productivity

See **Stratigraphy**, page 26

## GTW Colombia 2014

10-11 December | **Bogotá Royal Hotel** | Bogotá, Colombia

Discounted hotel room rates available through 25 November

### Expanding Unconventional Resources in Colombia with New Science: *From Heavy Oil to Shale Gas/Shale Oil Opportunities*

Join leading operators from throughout the Americas and across the globe to expand the science of unconventional resources in Colombia. Enhance your knowledge through interactive discussions with experienced practitioners and researchers. Deepen understanding through sharing first-hand experiences and best practices in applying geology, geophysics and engineering to the challenges of exploration, appraisal, development drilling, reservoir characterization and simulation, and advances in recovery processes.

**Session themes:**

- Reservoir Characterization – Unconventionals
- Technology and Applications in Colombia – Unconventionals
- Reservoir Characterization – Heavy Oil Global Analogues
- Technology and Applications in Colombia – Heavy Oil

**Learn more and register online:**

[aapg.to/ColombiaGTW2014](http://aapg.to/ColombiaGTW2014)







أرامكو السعودية  
Saudi Aramco

9:25AM

CAPITALIZING ON A VAST,  
HYDROCARBON-RICH ENVIRONMENT

5:25PM

CAPITALIZING ON SOME DOWNTIME  
ON CALM, BLUE WATERS



## GEOSCIENCE PROFESSIONALS

Join a multidisciplinary team of experienced professionals evaluating conventional and unconventional resources at Saudi Aramco. Take the opportunity to develop frontier source rock and tight reservoir basins among the world's largest known and most complex reserves. Employ advanced seismic processing techniques, including 3D visualization and remote geosteering of multilateral wells, to drill and produce prospects in subsalt plays. Utilize cutting-edge technology to identify and manage reserves in a diverse environment. With the capability and technology to apply your vision, Saudi Aramco is the place to take your career to the next level.

At Saudi Aramco, you'll find an excellent work-life balance, quality healthcare and a family-friendly lifestyle with access to top-rated schools. We offer a competitive base salary, additional financial incentives, and flexible benefit plans that meet individual needs and preferences. If you've ever wondered about a career with Saudi Aramco and the expatriate lifestyle, now is the time to pursue it.

**SAUDI ARAMCO PROVIDES A CHANCE TO DO IT ALL.**

**DREAM BIG** at [www.Aramco.Jobs/EX](http://www.Aramco.Jobs/EX)

## Stratigraphy from page 24

within a basin, and therefore, intervals of high organic content for generation of hydrocarbons.

A high-resolution stratigraphic framework combined with geochemical proxies for environmental conditions indicating horizons where conditions would favor the accumulation of hydrocarbons are critical elements in planning the development of a field.

**EXPLORER:** What are your plans?

**TURNER:** Upon completion of my degree, I plan on continuing my research in mudrock chemostratigraphy and unconventional reservoirs.

**EXPLORER:** How can I find out more about

how to contribute or fund research efforts?

**TURNER:** My funding is directly related to Dr. Slatt's consortium researching the Woodford Shale. Any individuals interested in aspects of my research should contact him. His research consortium currently has 10 member companies.

**Roger Slatt**

**EXPLORER:** What is your relation to the geosciences?

**SLATT:** I am the Gungoll Chair professor of geology and geophysics at the University of Oklahoma and director of the Institute of Reservoir Characterization there.

**EXPLORER:** What is the subject of your research?

**SLATT:** I am guiding my students with a study of the regional to local stratigraphy of the Woodford Shale in Oklahoma, which is a

good oil and gas producer (in other words, unconventional resource shale) as well as a good analog to certain other resource shales.

I fund my students through a consortium of oil and gas companies that currently includes 10 member companies. I provide the companies with quarterly reports of progress, field trips and other updates concerning the Woodford Shale.

**EXPLORER:** What exactly are you doing and how does it benefit companies and individuals working in shale plays?

**SLATT:** We are learning about regional correlations of Woodford stratigraphy, have developed a more detailed stratigraphic characterization that highlights favored zones for horizontal drilling (in other words, landing zones) based upon rock properties and stratigraphy.

We have been using and refining a sequence stratigraphic approach to our

characterization and correlation studies.

**EXPLORER:** What are your plans?

**SLATT:** My plans are to continue to educate students in analysis of resource shales since they are becoming major exploration and development resources globally. My students will be well prepared to enter the petroleum industry upon graduation and work on unconventional resource shales.

I can carry out these plans as long as I have funding to support students and some equipment.

**EXPLORER:** How can I find out more about how to contribute or fund research efforts?

**SLATT:** You can contact me directly if interested in joining the Woodford Stratigraphy Resource Consortium in the Institute of Reservoir Characterization, School of Geology and Geophysics, University of Oklahoma.

**Deborah Sacrey**

**EXPLORER:** What is your relation to the geosciences?

**SACREY:** I graduated with a degree in geology from the University of Oklahoma in 1976.

**EXPLORER:** You are a great supporter of new technology and research in the geosciences. Can you give an example of what you've been involved in recently?

**SACREY:** I have been fortunate for the last three years to be working with an excellent group of geophysicists and software developers working on exciting technology involving unsupervised neural analysis of multiple seismic attributes.

This technology is helping, through the use of advanced pattern recognition processes, to understand the geological information buried in seismic attributes. I personally have used this technology to help find oil and gas reserves in the Gulf Coast, but the application can be used in both conventional and unconventional resource plays around the world using both 2-D and 3-D data.


**EXPLORER:** What are your thoughts about how one can support the research currently being conducted by universities, university consortia and graduate students?

**SACREY:** There are a couple of obvious ways in which one can help.

First, as an alumnus of a university, get involved with your school. Most universities have an alumni advisory council of some sort. This is a great way to funnel energy and monetary support for one's school and specifically direct funds to the most needed areas. As a past chair of the Alumni Advisory Council for the School of Geology and Geophysics at OU, I was amazed at the generosity of the school's alumni.

Second, most schools with larger departments in the geosciences have continuing research programs designed to help graduate students. I know at OU, Roger Slatt has a consortia he is developing to understand the rock properties and stratigraphy of various resource plays, including the Woodford Shales in Oklahoma.

Kurt Marfurt, also at OU, has a consortia called Attribute Assisted Seismic Processing and Integration (AASPI), and Geophysical Insights, the company with whom I have been working on neural analysis, is working on contract agreements to be a sponsor in that consortia.

Certainly, involvement through AASPI will provide funding for research into new seismic technologies by graduate students, as well as provide a networking opportunity for the students and other sponsor companies. 

## AAPG's GeoCare Benefits Members' Private Medical Insurance Exchange

Open Enrollment Begins

November 15, 2014 for January 1, 2015 Coverage



[www.geocarebenefits.com](http://www.geocarebenefits.com) | 877-739-7845

The Exchange is a marketplace where you can choose from the medical insurance products available to you. Choose from multiple plan designs, options, and premium rates available in your state from a variety of insurance companies.

Talk with fully licensed representatives who can guide you through the enrollment process and answer your questions. Here is what AAPL member John Taylor had to say about his experience with Representative Mary Alvarez during last year's open enrollment period:

"I am writing to express my gratitude for the superlative customer service that I have received from Mary Alvarez as she thoughtfully and diligently helped me and made certain that I was able to enroll in a health plan last week. Mary was so pleasant to work with and she did a great job. I am certain that you have already recognized her value as a meritorious individual with a servant's heart, and if not - please take notice. Thank you for your time and have a great holiday season."



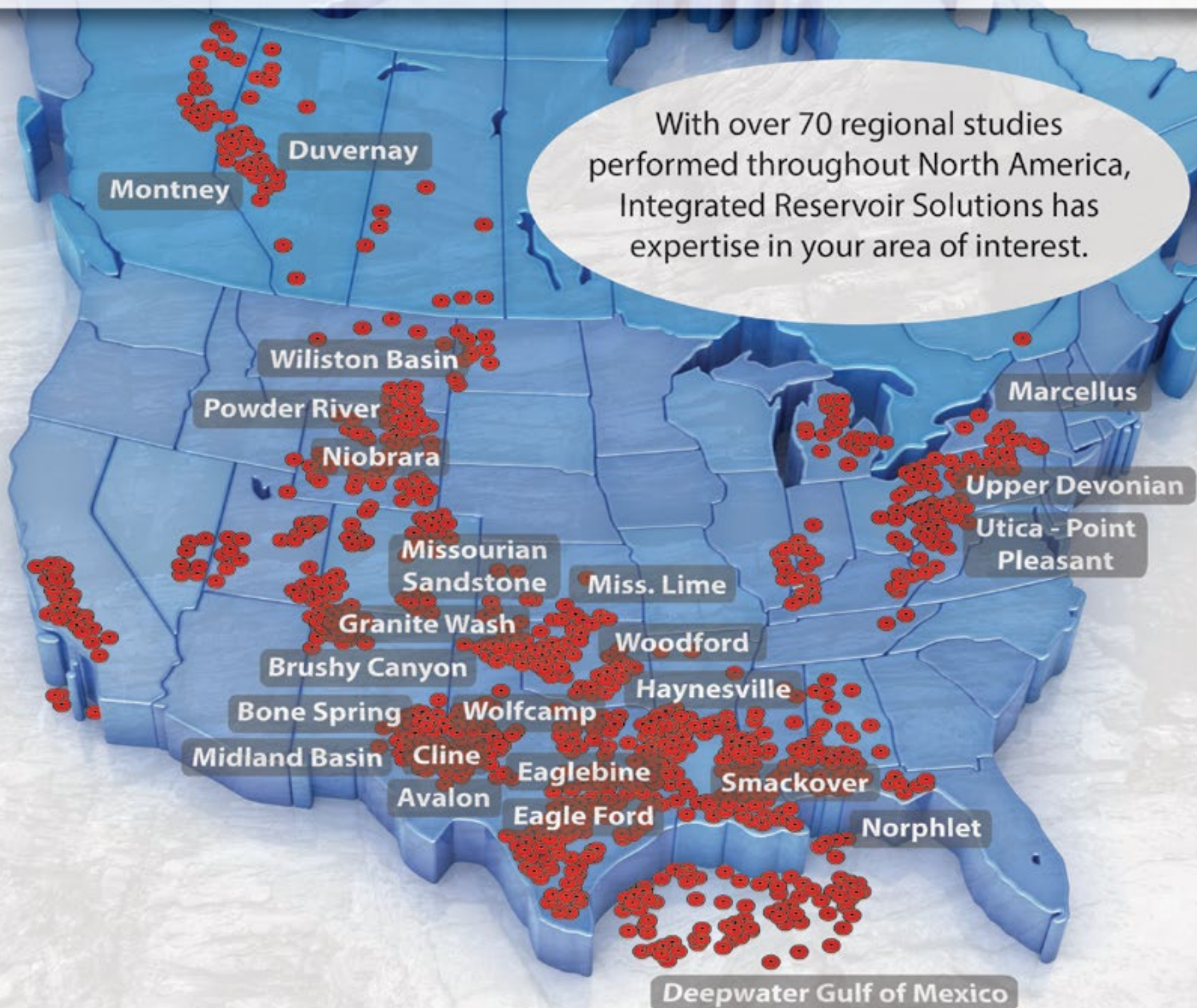
Mary Alvarez



Open enrollment begins on November 15, 2014 for guaranteed-issue medical insurance plans without exclusions for pre-existing conditions effective January 1, 2015.

# Core Lab Joint Industry Projects

- RESERVOIR CHARACTERIZATION
- REGIONAL ASSESSMENT
- ROCK-TO-LOG MODELING
- DEPOSITIONAL ENVIRONMENTS
- GEOMECHANICAL PROPERTIES
- FRACTURE STIMULATION DESIGN
- GEOCHEMISTRY
- PETROPHYSICAL PROPERTIES
- PRODUCTION ANALYSIS



INTEGRATED RESERVOIR SOLUTIONS  
[www.corelab.com/irs](http://www.corelab.com/irs)  
 713-328-2673



# Mississippi Lime: Good Things On The Horizon

By BARRY FRIEDMAN, EXPLORER Correspondent

At first glance it seems there's not much overtly new about drilling in the Mississippi Lime – or overtly new about the Mississippi Lime play, either, for that matter – a play that oozes from northern Oklahoma through southern Kansas (and some say, perhaps, to Nebraska).

After all, the industry has been vertically drilling the play for over 50 years, as evidence of the area's more than 15,000 vertical wells.

But here's the key word in that last paragraph: Vertically.

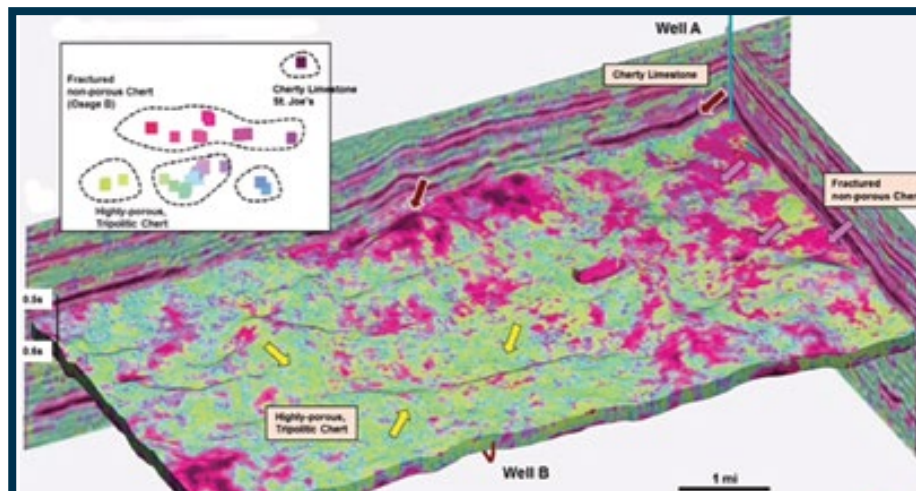
And that's why we're talking about it now. In the Mississippi Lime, there are good things – wait for it – on the horizon.



PRANTER

"Mississippian carbonate and chert reservoirs in northern Oklahoma and southern Kansas have been productive for decades," said AAPG member Matthew Pranter, professor and Lew and Myra Ward Endowed Chair in Reservoir Characterization at the University of Oklahoma.

Pranter and others from the university's ConocoPhillips School of Geology and Geophysics are part of the Mississippi Lime Consortium, which is focusing, specifically, on the thick Mississippian-age carbonate sequence in northern Oklahoma and southern Kansas that includes heterogeneous reservoirs of fractured limestone, porous sucrosic dolomites,



Result of multi-attribute unsupervised seismic-facies classification within the Mississippian limestone using texture-attribute volumes. Dark red and brown correlate to the tight cherty limestone (indicated by the brown arrows), light pink and violet correlate to the layered chert and limestone (indicated by the pink arrows), and light green and yellow correlate to tripolitic chert (indicated by the yellow arrow). Courtesy of ConocoPhillips School of Geology and Geophysics.

tripolite and spiculities (fine sedimentary rocks).

And what's coming, he adds, is what's exciting.

"While the Mississippian interval was initially produced by vertical wells, it has become a significant unconventional play for horizontal development," Pranter said.

And that's because wells, with advance in horizontal drilling and completion techniques, can connect the compartmentalized nature of the Mississippian interval, thus increasing the production originally observed in vertical wells.

As with all innovative ideas, however, there are challenges.

"The geological controls on reservoir-quality distribution and production," he said, "are still elusive."

## The Team Approach

The multidisciplinary OU team, which includes 15 graduate students and is funded through a collection of grants from government and industry sponsors, also includes:

► Seismic interpretation and processing: AAPG member Kurt Marfurt (principal

investigator, AASPI).

► Engineering, characterization and fluid-flow simulation: Deepak Devegowda, assistant professor, Mewbourne School of Petroleum and Geologic Engineering.

► Sedimentologist and Diagenesis, AAPG member R. Doug Elmore.

► Geophysics of unconventional reservoirs and micro-seismic analysis: Jamie Rich, co-principal investigator and assistant professor.

"To better constrain 3-D reservoir models," Pranter said, "the team also is using engineering-petrophysical methods (such as machine learning and pattern-recognition algorithms; see related story on page 10) to estimate lithologies in non-cored wells and 3-D seismic attributes to predict 'sweet spots' in the Mississippian that are commonly associated with various silica-rich carbonates and fractures."

This team approach, all involved agree, means research can be explored from many different angles, including the relationships between data acquired at different scales, such as core, log and seismic data, for example, and those that come from different sources, such as well completions and drilling data.

Pranter said most of the fields originally were produced on closed structural highs and porosity pinch-outs associated with diagenesis and erosion.

"Given the advances in horizontal drilling and completion techniques, wells can connect the compartmentalized nature

See Opportunity, page 32

## Third Annual Mississippian Lime Forum

February 29, 2015 – Oklahoma City, Oklahoma

This year's Mississippian Lime Forum unleashes science, technology, and experience to solve persistent puzzles, and dramatically improve economics. Consider 2015 a breakthrough year as new, sometimes controversial new techniques and technologies are being implemented for the first time.

Join us to gain a new understanding of the reservoirs and their complexity and to apply the knowledge to optimizing the reservoirs. Here are a few of the topics:

- Fracture networks and characterization
- Diagenesis: Processes and patterns
- Migration pathways and reservoir development
- Pore characterization and implications
- Geomechanical processes and implications on production
- New drilling techniques for optimizing reservoirs
- Geochemical insights: fingerprinting for targeting enriched zones
- "Stranded pay" – the new target

This one-day forum will be useful to geologists, engineers, geophysicists, and geochemists who will be able to apply the new knowledge to their operations and also to evaluating properties. Includes Oral presentations, posters, discussions, networking reception.

Don't miss this "must attend" event!  
aapg.to/mississippianLime2015



AAPG | FORUM  
Education

AN AAPG/DPA EVENT WITH JCORET-CERTIFIED EVALUATOR TRAINING CLASS

## Reserves Forum: Reserve and Resource Assessment Challenges

26-27 February 2015 - Houston, Texas

Join leading experts to learn about important new developments in creating rigorous, consistent and statistically valid reserve estimations. It has been 5 years since the SEC published "Modernization of Oil and Gas Reporting" which gave companies more flexibility and options for reserve and resource estimation. In that same period, unconventional activity has skyrocketed, resulting in new challenges for applying SEC guidelines. This forum will focus on what has changed over the past 5 years and how companies and PRMS are adapting to the change. Presentations will include talks on estimating reserves in unconventional reservoirs, applying reliable technology to accelerate P1 bookings, and PRMS challenges and issues. Come hear presentations on the following subjects:

- Geoscience & Engineering: What new reserve challenges are facing earth scientists and engineers?
- Unconventionals: How to approach reserve and resource estimation?
- Reliable Technologies: What are they and how can they impact reserve bookings?
- SEC & PRMS Standards, Guidelines, Challenges, and Issues: What is next?
- Palynology and biostratigraphic advances

This conference will be useful to earth scientists and engineers who are involved in reserve and resource estimation (from exploration discovery through to production) as well as anyone who manages oil and gas assets or the reporting of reserves.

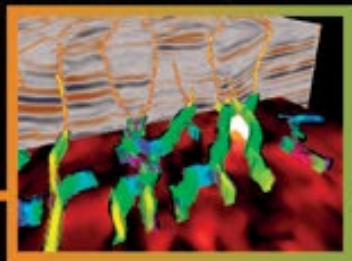
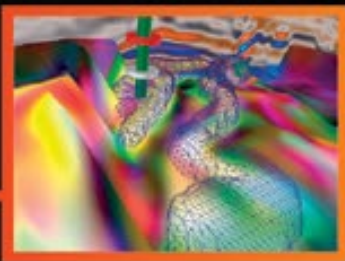
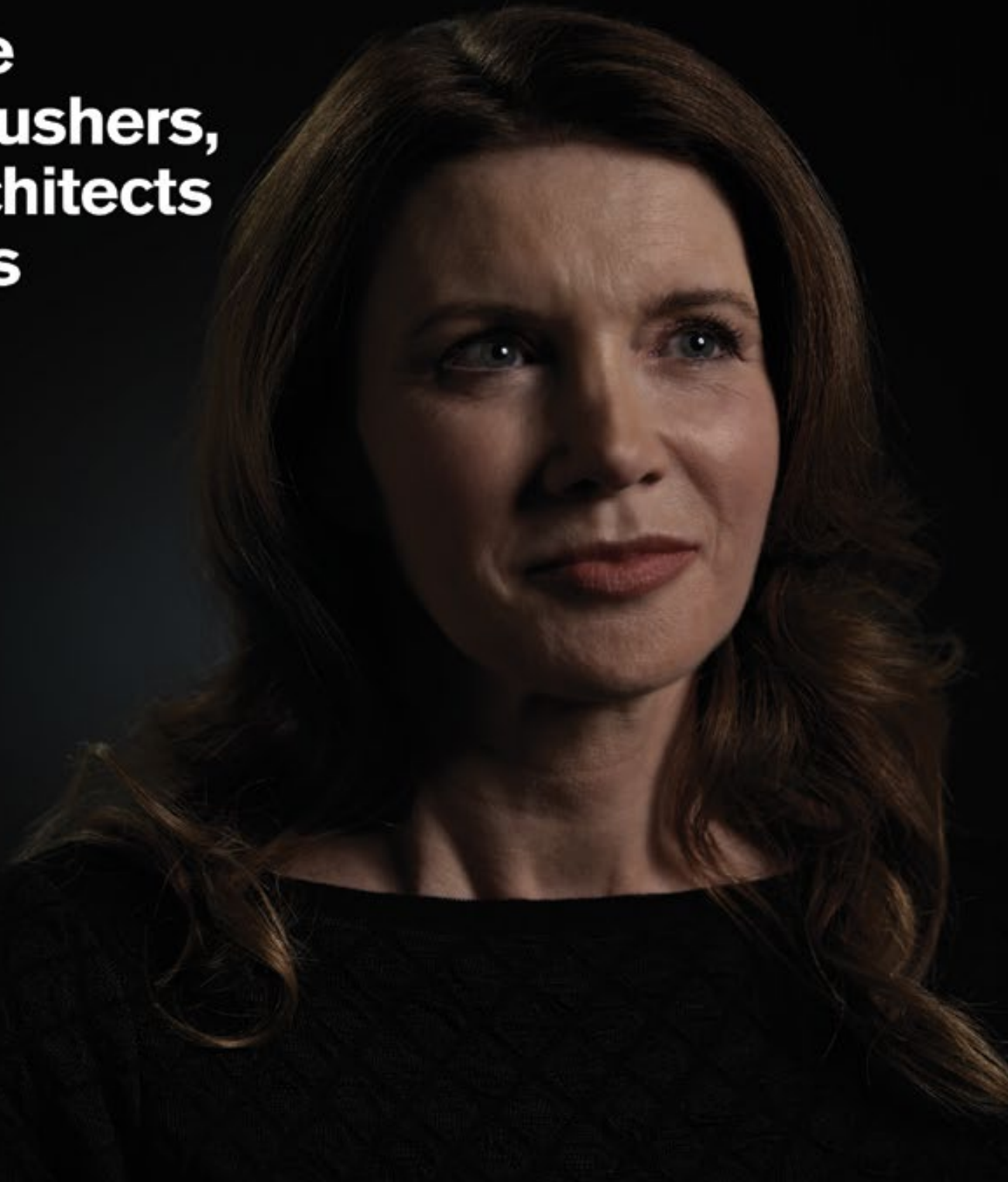
The Forum will take place on Thursday, Feb. 26, followed by a one-day JCORET-certified evaluator training class on Friday, Feb. 27.

Reserve your seat today!  
aapg.to/reservesForum2015



AAPG | FORUM  
Education

**Here for the  
boundary pushers,  
concept architects  
and restless  
minds.**



**GeoTeri<sup>®</sup> is on hand with Geological Expression software, services and support centred around you.**

When a seismic interpretation project hits a problem it's new ideas and insights that get things back on track. GeoTeri gives you intuitive Geological Expression workflows that make it easy to explore multiple avenues in depth, and to put forward the most comprehensive range of scenarios available.

Your thinking is backed by specialist services and technical support whenever you need it, giving you and your team the greatest confidence throughout the interpretation workflow. You'll find GeoTeri is on your side, and at your service.

poweron@GeoTeri.com

poweron with GeoTeri



*Competition and camaraderie*

# Imperial Barrel Award 2015 – Apply Now

By **BARRY FRIEDMAN**, EXPLORER Correspondent

**T**eam registrations are now being accepted for this year's AAPG-AAPG Foundation's Imperial Barrel Award program (IBA), an annual prospective basin evaluation competition for geoscience graduate students from universities around the world.

A record number of teams are expected for the next IBA, which celebrates its ninth season in 2015.

The application deadline is Dec. 12.

The IBA initiative, now an international competition in which students examine geological and geophysical datasets to determine hydrocarbon potential, started, modestly enough, in a classroom in the United Kingdom.

AAPG member David Cook, serving again this year with Charles "Chuck" Caughey as the IBA program co-chairs, is justifiably proud of both the organization and the competition.

"The AAPG/AAPG Foundation Imperial Barrel Award competition is arguably the biggest and best petroleum exploration program for students," he said.

The program is rigorous – students often talk of weeks and months of preparation, including eighteen hour days, sleepless nights, weight gain and cold pizza – and contributes to AAPG's mission of promoting petroleum geoscience training and advancing the careers of geoscience students.

And that last part, while paramount, is not its only mission – but more on that in



*University of Louisiana at Lafayette team celebrate their 2014 IBA win.*

a moment.

The IBA began as a course in the petroleum geology department at Imperial College, London, England, as a way to challenge students and bring them and industry together.

There was much to like about such an idea, much to notice, much to emulate.

"AAPG adopted the program in 2006 and turned it into a global event," Cook said, "with the first competition taking place at the Long Beach ACE in 2007."

(For you geological trivia buffs, The University of Aberdeen won that year)

Since the initial event, the competition has grown exponentially and now attracts 123 teams (universities) from 37 countries from every continent (apart from Antarctica, of course).

That translates into more than 2,400 graduate students who have participated.

### The Competition

This year's final competition will be held just prior to the AAPG Annual Convention and Exhibition in Denver on May 31-June



COOK



CAUGHEY

3. The winners are announced during an awards presentation immediately before the ACE opening session.

The rationale for the competition is (and had always been) to give students real world experience and an opportunity to be judged on their work by industry experts.

But that's not the program's only appeal.

There is also the camaraderie from meeting other students, the chance to travel, to compete, to hear the accolades and – not to put too fine a point on this – to win individual recognition for themselves and cash awards for their schools.

First prize in the IBA garners \$20,000 to the winning school. Second place earns the Selley Cup award and \$10,000 for the school, and third place brings the Stoneley Medal plus \$5,000 for the school.

Since its adoption the IBA program

**Continued on next page**



**Continued from previous page**

has awarded more than \$300,000 in scholarship funds to university petroleum geoscience graduate programs.

And while you may assume that the list of winning schools would be dominated by just a few large, rich universities, that's not been the case. Until last year, in fact, each year's competition brought a new winner (last year's winner, the University of Louisiana, Lafayette, became the program's first repeat winners).

And to prove the global nature of the competition, other IBA winners have come from France, Russia and Scotland. Second and third place honors have been won by teams representing AAPG's Middle East, Europe, Asia-Pacific and Canada Regions.

**The Process**

The IBA timeline goes like this: Applications are due by Dec. 12, and once registration closes, the participating teams are announced and then asked to analyze a dataset (geology, geophysics, land, production infrastructure and other relevant materials) in the eight weeks prior to their local competition.

At the local event, each team delivers its results in a 25-minute presentation to a panel of industry experts – and winners are announced.

The process then winnows to Region finals, and then ultimately onto the finals at the AAPG ACE setting.

Once at the finals, students again use state-of-the-art technology on a real dataset, receive feedback from industry representatives and experts, and work and receive guidance from professors

**And the Winners Were ...**

**T**hese are the teams that took home the top prizes in the AAPG-AAPG Foundation Imperial Barrel Award competition.

**2014**

Imperial Barrel Award – University of Louisiana at Lafayette  
 Selley Cup – University of Oklahoma  
 Stoneley Medal – Colorado School of Mines

**2013**

Imperial Barrel Award – University of Utah  
 Selley Cup – University of Oklahoma  
 Stoneley Medal – Sultan Qaboos University, Oman

**2012**

Imperial Barrel Award – University of Louisiana at Lafayette

Selley Cup – Khon Kaen University, Thailand  
 Stoneley Medal – Colorado School of Mines

**2011**

Imperial Barrel Award – University of Texas at Austin  
 Selley Cup – School of Ocean and Earth Science, University of Southampton, England  
 Stoneley Medal – Sultan Qaboos University

**2010**

Imperial Barrel Award – Institut Francais du Petrole (IFP), Rueil-Malmaison, France  
 Selley Cup – University of Calgary, Canada  
 Stoneley Medal – King Fahd University, Saudi Arabia

**2009**

Imperial Barrel Award – Moscow State University, Russia  
 Selley Cup – University of Nebraska  
 Stoneley Medal – Memorial University, Newfoundland, Canada

**2008**

Imperial Barrel Award – University of Oklahoma  
 Selley Cup – Imperial College, London, England  
 Stoneley Medal – Texas Christian University

**2007**

Imperial Barrel Award – University of Aberdeen, Scotland  
 Selley Cup – Imperial College, London, England  
 Stoneley Medal – University of Oklahoma

and those in the field.

Judges select the winning team based not only on the technical quality of the presentation, but its clarity, originality and articulation.

"The program," Cook said, "gives students a taste of the role of a geoscientist in industry. It also provides petroleum geoscience training to students who might not ordinarily receive such training in their university curriculum."

Cook said the value of the competition lies not only in the educational opportunities it provides but also in the opportunities for networking with experienced industry professionals and

gaining insight into what a career in petroleum exploration might offer.

"Industry has a great respect for the program," he said, "and many companies view it as an important item in a CV."


The job component, while a great aspect of the competition, is not the only benefit.

"While many IBA alumni have been recruited through their participation in the competition, the more significant effect of the IBA program is that it fulfills many of the strategic goals of the AAPG and AAPG Foundation by providing education, professional development, and encouragement for AAPG

membership globally," Cook added.

The competition has and continues to receive impressive corporate support from industries through the world. As it grows, the hope is that corporate involvement will, too.

In short, the IBA is an opportunity for students to experience the creative process and the high-tech science, to be introduced to corporate movers and shakers, meet recruiters, share knowledge with the next generation of student geologists and then, together, when their time comes, to change the face of energy.

And if you want to be part of it, the time to apply is now. 

At Chevron, you'll join a team with the technology to take on big challenges, the integrity to do it responsibly, and the drive to keep the world moving forward. Are you up to the job?

**Chevron is hiring experienced earth scientists for positions in the U.S. and around the world. To learn more about our positions and apply, visit us online at [chevron.com/careers](http://chevron.com/careers)**

**JOIN THE CHALLENGE.**



Human Energy®

An equal opportunity employer that values diversity and fosters a culture of inclusion. CHEVRON, the CHEVRON logo and HUMAN ENERGY are registered trademarks of Chevron Intellectual Property LLC. © 2014 Chevron U.S.A. Inc. All rights reserved.

# Flying Robots Manage Human Risk, Impact

By BARRY FRIEDMAN, EXPLORER Correspondent

Technically, this falls under the topic of Unmanned Aerial Vehicles in the Oil and Gas Sector.

You'll want to call them drones. Don't.

Or, if you must, think of these "vehicles" as softer, kinder drones, for while they have their origin in military applications (for which it was designed), the technology has since made its way to the oil and gas industry, specifically in terms of pipeline inspection and assorted applications.

You know what? Don't call them drones. "It's called robotic aviation," said

Wilson Pearce, chief operating officer for ING Robotic Aviation in Canada, laughing, because he knows the word "drone" is a tougher sell.

"We're a business, after all."

What he's proposing for the profession, however, is an application that can be both cheaper for operators, better for the environment and – not to put too fine a point on this – save lives.

But more about that in a moment.

"The technology," he said, "is still quite new and associated with the military in the popular mindset."

And you can see that clearly in the company itself, where 70 percent of the workers at Toronto-based ING Robotic Aviation come from the Canadian military.

ING, in fact, still supplies equipment to the country's armed forces, but what he's talking about here is the opportunity to change the way companies go about fact-finding and inspecting facilities.

And that includes, in a big way, the oil and gas industry.

## The Sound and the Fury

"Our noise footprint is well below the mandated requirement to stay below 120 db," Pearce said.

How loud is that?

"We are about as loud as a sewing machine flying overhead."

And as good as that seems – sounds? – the real savings from the unmanned technology comes from the savings in fuel costs.

"We're talking about a half-liter of fuel per aircraft," Pearce said.

You read that right.

If you're wondering how that's possible, consider of the two crafts: one, the Serenity, is 35 kilograms; the other, the Responder is only 10 kilograms.

Compare that to the size of a typical helicopter that has historically been used for the task, which weighs approximately 4,500 pounds, empty.

Now, compare the fuel consumption of the Serenity to that of the helicopter.

Here, though, is where this technology (and the military has been selling the same benefits for years) is most advantageous.

"You can either have a 10-kilo item come down in unexpected fashion or a helicopter come down in unexpected fashion," Pearce said.

Don't let the focus on weight and equipment get in the way. Pearce is talking about perilous duties. He's talking about crashes, he's talking about tragedy, he's talking about people who go up in helicopters and, when problems occur, come down dangerously in remote places.

"So anything we can do to get people out of aircraft," he adds, "the more sense it makes."



ING's Responder UAV.

## 'Dirty and Dangerous'

At the present time, the primary applications for these UAVs in Canada remain line-of-sight operations: looking for cracks and anomalies in the pipelines, which include flare stack inspections, as well as infrastructure inspections.

"We put these in what we like to call the 'dull, dirty and dangerous' category."

One of the areas most affected by, say, spills is the foliage, literally, that can be found at the foot of the pipelines. If there are anomalies in growth patterns, chances are there's some kind of leak.

And you can't get a helicopter between the pipeline and the ground.

The Responder can.

Selling the UAV, though, is a continuing effort. Operations this year have included wildlife monitoring, environmental monitoring flights and fixed asset surveys.

You would think, then, this would excite environmental groups – and it has, to an extent – but Pearce said conversations with

them are less than satisfying.

"In discussing this informally with environmental and related researchers," he said, "the key issue for them has been our ability to operate using a fraction of the energy and equipment footprint that traditional solutions for wildlife monitoring, require."

But that's solved, right?

Sort of, because, while Pearce has answers, the environmental groups changed the question.

"One person told me, 'Yeah, but you're still working on behalf of the oil and gas industry.'"

You can hear Pearce's frustration when he tells you that story, but he's optimistic.

Moving forward, the key to the UAV, he believes, is the sensors on board, for clearly when you have a 10-kilogram plane, the type, size and sophistication of the sensor is limited.

"Results are driven largely by the sensors," he said. "Therefore, our focus has been on the ability to operate our vehicles in

a fashion that allows us to integrate industry standard sensors for EO/IR/multispectral/LIDAR and related missions."

## The Next Biggest Thing?

Talking about UAVs, Pearce reiterates that while the application may be new in civilian circles, the technology has been around for years.

At the moment, though, it doesn't work without some cooperation, some interfacing between the two groups – often in the same company.

"We still provide services to the military," he reiterated, though he wants to make it clear that there are drones and there are drones.

What his company uses in western Canada is not being used in Kandahar.

"Strictly military technologies are governed and difficult to apply," he commented.

It is, he admits, equivalent to brand-name drugs and how, little by little, year after year, more generics come out.

So, too, in the area of drone and unmanned technology.

There is nothing new here.

"The introduction of a technology for military use, followed by widespread commercialization that rapidly spreads the technology, reduces cost and develops lots of applications."

"Robotic aircraft is the future, but really, it's now."

And yesterday.

He said the United States Department of Defense now trains more UAV operators than traditional pilots. In America, like Canada, he believes the technology is far ahead of the regulations.

It's important and inexorable that they meet.

"This," he said of these small, unmanned robotics that use less fuel than a lawnmower, "is the next biggest thing." ■



ING's Serenity UAV, named for the starship from the TV show "Firefly."

## Opportunity from page 28

of the Mississippian interval," he said, "thus increasing the production originally observed in vertical wells."

## An Opportunity Awaits

The Mississippi Lime (70-80 wells) is a significant reason for the turnaround in the area's crude oil supply, counting for approximately 22 percent of Oklahoma's production, which is up 100,000 barrels since 2005, or 37 percent.

Along with North Dakota's Bakken (180-190 wells), Texas' Eagle Ford (220-230 wells) and the Permian Basin in Texas and

New Mexico (500 wells), the Mississippi Lime is a vital player now in the national conversation.

On this point, there is an interesting dynamic to the Mississippi Lime: It is relatively shallow, with sections between 300 and 500 feet, and found at depth between 3,000 and 6,000 feet, contrasting with the Bakken's 9,000-10,000-foot depth and the 4,000-15,000-foot depth for both the Eagle Ford and Permian/Delaware Basin.

Additionally, its geology is interbedded, with areas of thin porosity alternating with tight limestones and topped by Mississippi chat – a varied combination of chert, limestone and dolomite.

This is the challenge – but this also is

the opportunity.

"Building upon their geophysical expertise at OU in the Mississippian," Pranter said, "the group continues to explore the correlation of seismic attributes (such as volumetric curvature, P-impedance, S-impedance and azimuthal anisotropy) to fractures (measured by image and production logs) and lithology/lithofacies."

This includes conducting integrated and multidisciplinary studies of the Mississippian reservoirs from several angles – geological, geophysical and petroleum engineering.

"The data and methods," he said, "are key to defining the seismic pattern (texture) associated with tripolite "sweet spots." ■



# EXPLORING NEW FRONTIERS



Our Western State Colorado University graduates and students are out there making it happen every day. Pioneer and alumnus Paul Rady, Chairman and CEO of Antero Resources, is helping to expand our top Petroleum Geology program with a recent \$2.5 million donation. Come explore with us.

Apply today at [western.edu](http://western.edu).





© 2014 TGS-NOPEC Geophysical Company ASA. All rights reserved.



# We see energy. **Everywhere.**

We see it throughout the world in North and South America. In Europe, Africa, Asia, Australia and the Arctic. We see its promise. Its vastness. We see it clearly, in sharp relief and exquisite detail. Ensnared in rock and earth 20,000 feet under the sea floor. We measure its magnetism. Gauge its gravity. View its vibrations. We see energy where few others even look. We see its untapped potential. Its true nature. Its hidden value. We see the world of opportunity it creates. We see commerce enabled, progress encouraged, life enhanced. We see energy. Everywhere.

**SEG 2014 • Booth 825**

See the energy at **TGS.com**



*Flying Florences took off in Alaska*

# Pioneer Geologists: Soaring Beyond the Glass Ceiling

By HEATHER SAUCIER, EXPLORER Correspondent

They were known as the “Flying Florences” in the geological world of Alaska – a nickname so fitting it smacked of the obvious, yet still piqued all kinds of curiosity on the North Slope.

In the 1950s, as crews of men braved the hostile climate of the Brooks Range exploring for oil and gas, Florence Weber (nee Robinson) and Florence Collins (nee Rucker) appeared out of nowhere from the sky – steering a Super Cub floatplane over the mountains and landing on the interior lakes of Alaska.

The two were young geologists and pilots, and – aside from wells that struck oil – were the talk of any place north of the Arctic Circle.

Attractive, ambitious and immune to the notion of a woman’s place, they trod on fraternal grounds as if they were one of the boys.

“Just being two women in this field – that was unusual enough,” said Hank Schmoll, a scientist emeritus with the U.S. Geological Survey (USGS) in Denver, who recalled hearing about the Florences before beginning his career in Alaska in 1955.

“Some of the guys would perhaps semi-snort at them,” he said. “What are these gals doing? Nobody ever said that, but I’m reading between the lines, so to speak.”

With their plane, the two best friends could reach places their male counterparts could not. Prior to a determined Weber landing her first field job, she and Collins often gave male geologists lifts to and from spike camps prior to the days of helicopter support. They battled Alaska’s harsh weather conditions and their small aircraft’s frequent need for refueling in areas where fuel was scant.

“It was really quite a feat to fly around Alaska,” said AAPG member Helen Foster, a retired geologist with the USGS in Alaska (see September EXPLORER). “They were a great curiosity at the time.”

### Invading a Man’s World

While getting a plane off a runway requires a standard set of maneuvers in a cockpit, having a geological career take off in Alaska was anything but easy for Weber and Collins.

Their mission started at the University of Chicago, where they initially met as sophomores and simultaneously earned bachelor’s and master’s degrees in geology in the 1940s.

A professor once “stuck them aside” as lab partners, thinking they wouldn’t get very far in their careers, said Shirley Liss, a friend of the pair who are now 93 and reside at an assisted living facility in Fairbanks.

(Weber, a former AAPG member, is battling dementia. Collins is more quiet and not as eager to speak about her legendary days.)

Fresh out of college, both accepted jobs as geologists for two years at Shell Oil in Houston in 1943 when there was a shortage of men during World War II. After visiting a local exhibit of U.S. war planes – intended to encourage citizens to invest in war bonds in an act of patriotism – the women instead felt a desire to obtain pilot licenses.

“Gas rationing meant no fuel for a car, but they could buy gas for a plane,” wrote Collins’ daughter, Julie Collins, in a 2011



Above: From left, Florence Rucker Collins, Florence Robinson Weber, and their friend Alice in Columbus, Texas. Right: Florence Collins

tribute to her mother in the Fairbanks Daily News-Miner. “By the time the pair learned to drive in 1947, they had already flown from Texas to Florida.”

After a summer road trip during graduate school on the newly opened Alaska Highway – constructed during World War II to connect the continental United States with Alaska – the pair decided they wanted to live there and bask in its open space and beauty. In 1949, both landed jobs with the USGS in Fairbanks performing microscopic rock core analysis in an office.

They envied the men who mapped outcrops in the “exotic far north,” Julie Collins wrote.

And if the USGS would not send them into the field, they decided they were going to send themselves. The Florences bought a new, two-place Cessna 140 for \$3,800 for taking weekend trips to Nome, Kotzebue, Anaktuvuk Pass and Canada.

Starting in Kansas, they made their way back to Fairbanks via Texas – hardly a beeline, but a path that clearly revealed a spirit for adventure.

That same spirit was captured in a 20-page article by National Geographic magazine in 1957 after Weber and Collins, four female friends and one lone male decided to take a roughly 700-mile kayak trip down the Yukon River from Whitehorse to Eagle.



Florence Weber on the right.

the USGS to transport male geologists into Alaska’s interior.

However things happened, the Florences flew 5,000 miles from the Potomac River to the Mackenzie Delta in northwestern Canada and down to Fairbanks.

“The sight of a floatplane in remote, isolated villages provoked no surprise, but people were shocked to see the two daring, young women piloting the lanky craft,” Julie Collins wrote.

And so the two women, who purchased a cabin in Lake Minchumina during their first stint in Alaska, settled in for a second time.

### Pushing for a Career

The Florences landed their seaplane on many an undiscovered lake upon their return to Alaska in 1956, naming many of them in the process, Julie Collins wrote.

Several years later, though, Collins married and had three children – and found she preferred married life to geological work.

One might reasonably conclude her decision was based on her inability to get a job in the field.

“We were annoyed. We were disgusted,” she said in a telephone interview of her and Weber’s plight to work under the vast canopy of Alaskan sky. “Girls weren’t supposed to be able to do fieldwork, but we thought we were capable of doing that.”

Collins did produce a USGS report on a vegetated dune field in interior Alaska based on some work she performed in the field. Weber, on the other hand, was determined to pioneer a career that would take her from the office into the field, even after marrying several years later herself.

While working in the NPR-4, Weber and Collins co-authored a paper suggesting that a large subsurface crater near Point Barrow into which the Avak well was drilled was likely formed by the impact of a large meteor – a theory considered far-fetched in its day.

“I don’t know this for certain, but I suspect that interpretations such as this were probably way too controversial for USGS editors at the time,” said AAPG member Gil Mull, retired employee of the Alaska Division of Geological & Geophysical Surveys. “The Florences’ interpretations were not included in the formal report on the exploratory wells drilled at Barrow and Avak.”

However, more recent studies of the area by geologists Arthur Banet, Tom Homza and Robert Swenson, all AAPG members, give substantial amount of support to these interpretations, Mull said.

“The significant thing in my estimation is that the Florences – two women in the USGS, an organization that at the time was predominantly a man’s world – did some really detailed work that revealed a lot of innovative thinking, some of which was way ahead of its time,” he added.

Weber produced a number of studies beginning in the late 1950s that explored various routes for numerous proposed roads across Alaska, including a road to Nome.

“The road to Nome should be of

The pinnacle of the trip was reported in the Fairbanks Daily News-Miner:

“The highlight of the first part of the trip, they said, was shooting the Five Finger Rapids of the Yukon. And they reported it was ‘such an exciting adventure’ that they hoofed back a few miles and did it a second time.”

### Longing for Home

Weber and Collins spent the early part of their careers in Alaska studying the structure and stratigraphy of test wells in the Naval Petroleum Reserve No. 4 (NPR-4) on the North Slope, said Ric Wilson, a USGS research geologist and former assistant to Weber.

NPR-4 consisted of several petroleum and oil reserves and was established in 1923 by the federal government to secure fuel for both world wars. The Florences analyzed well cores, chips and logs for reservoir potential in formations.

When the USGS’s Navy Oil Unit’s Fairbanks office closed, the women were relocated in 1954 to Washington, D.C., where they wrote reports on their findings of the test wells – all while itching to return to Alaska.

Some say a USGS grant for a new study in Alaska paved their way back two years later. Others say they purchased their Super Cub floatplane and made a deal with

See Point Barrow, page 38

CORING SERVICES

**NO CHALLENGE TOO TOUGH,  
NO ROCK TOO HARD**



**FOR HALLIBURTON'S ROCKSTRONG™  
CORING SYSTEM.**

Designed specifically for challenging coring operations in hard abrasive rock, the RockStrong™ coring system delivers. Latest PDC technology core heads combined with low-invasion hydraulics provide best-in-class coring performance. RockStrong system's proactive anti-jamming design absorbs vibrations, keeps the inner barrel stable, and facilitates smooth core entry. Designed to achieve optimum coring performance in extreme conditions, the RockStrong coring system is up for any challenge—no matter how tough or how hard. When the pressure is on, go with RockStrong coring system.

What's your coring challenge? For solutions, go to [Halliburton.com/Coring](http://Halliburton.com/Coring) ▶

**HALLIBURTON**

Solving challenges.™



Florence Weber in front.

## Point Barrow from page 36

particular interest to the state today," said Wilson, explaining the state is finally considering building it.

Weber also added to the knowledge of the regional bedrock geology of interior Alaska – working with renowned geologists Troy L. Péwé and Clyde Wahrhaftig – and eventually published a map of the Fairbanks quadrangle in 1966.

"To this day," Wilson said, "it's the only Fairbanks quadrangle map we have."

Moving full steam ahead, Weber produced engineering geologic maps in 1971 for the TransAlaska Pipeline route from Prudhoe Bay to Valdez.

She also co-authored a preliminary geologic map of the Livengood

quadrangle, which was published in 1971 as well.

In 1986, she returned to the Livengood area as a project leader for the Alaska Mineral Resource Assessment Program and produced a much more detailed map, Wilson said. In a nod to her efforts, a Middle Devonian gastropod of the Livengood quadrangle was named after her by AAPG member Robert B. Blodgett, a consulting geologist and paleontologist in Alaska.

He called it the "Mastigospira weberae."

### Thinking Outside the Box

In the mid-1980s Weber shared what some might consider eccentric insights regarding surficial deposits, namely gold, in the lower parts of rivers on the Alaska Peninsula. While it was commonly held that the deposits came from headwaters, Weber argued that the offshore, heavily mineralized Unga Island was actually the source of the deposits.

She believed they were carried by glaciers moving from the offshore island before their deposition in the lower reaches of the mainland rivers, Wilson said.

Her reasoning was based on her belief that glaciers from the Pacific Ocean flowed northward, pushing toward the mountains of Alaska.

In her day, glacier movement was thought to be the opposite. Her theory later proved to be true.

"Florence has had just incredible insights into such a broad range of geology that I just can't imagine anyone better," Wilson said. "She was my idol."

Further flooring her colleagues, Weber dared to suggest that the Tintina Fault System did not rotate around a bend in the subsurface of the Livengood quadrangle, as was commonly believed. Rather, Weber surmised that the fault originated in British Columbia and developed a series of overthrusts in Alaska's interior.

She concluded that the Denali Fault system acted similarly, in part explaining the terrific height of Mount McKinley, Wilson explained.

"Alaska is an incredibly mobile place," he said. "Everything is moving around. People who were knowledgeable of that part of Alaska probably got what she was saying, but people who approached things from a more general perspective probably didn't get it. She outlasted most of the people who didn't believe her."

Having forever changed the way aspects of Alaskan geology are viewed, and as author or co-author of more than 100 publications on Alaska geology, Weber was awarded an honorary doctorate degree in science from the University of Alaska Fairbanks in 1987.

"She was as dedicated a geologist as you will ever find," Foster said.

In Wilson's eyes, both Florences were making their way through life simply doing what they liked to do. "They weren't out to make history, and they never tooted their own horn," he said. "It was more like, 'What's over the next ridge? What are we going to do next?'"

When Wilson took Weber to the Fairbanks airport in the 1990s to catch a flight, he showed her a large display of Alaskan pioneering aviators that included a picture of her.

"I'm no pioneer," she rebuffed. "I'm not that old." She was in her 70s at the time.

"The insights that Florence had into the geology of the state were built upon by a lot of people. I think we probably only know a small portion of what she figured out," Wilson said. "I miss being able to bounce things off her. I wish we could still talk to her, and learn more, but we can't."

# CALL FOR PAPERS

► **Submission deadline:**  
**1 December 2014**

<https://mc.manuscriptcentral.com/interpretation>

A joint publication of SEG and AAPG  
**Interpretation**<sup>®</sup>  
A journal of subsurface characterization



## Interpretation 3D visualization

AAPG, SEG, and SPE hosted the Interpretation Visualization Hedberg Research Forum in June 2014 in Houston, Texas. This multidisciplinary event focused on visualization efforts and cross-discipline potential for 3D software tools and methods. To broaden our coverage of this topic, we are expanding the call for papers to include with those based on the Hedberg program presentations in this upcoming edition of Interpretation. We are interested in papers that discuss the following topics:

- cybernetics, workflows, and infographics
- 3D seismic visualization techniques and methods
- visualization rendering and enhancement
- geobody, and other geometrical features,
- imaging and analysis techniques and methods

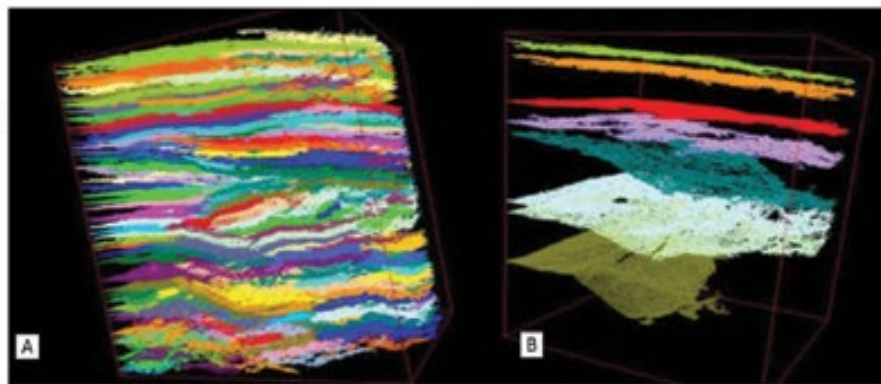


Image courtesy Seisnetics Pty Ltd.

Interpretation, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

The submissions will be processed according to the following timeline:

**Submission deadline:**  
**1 December 2014**

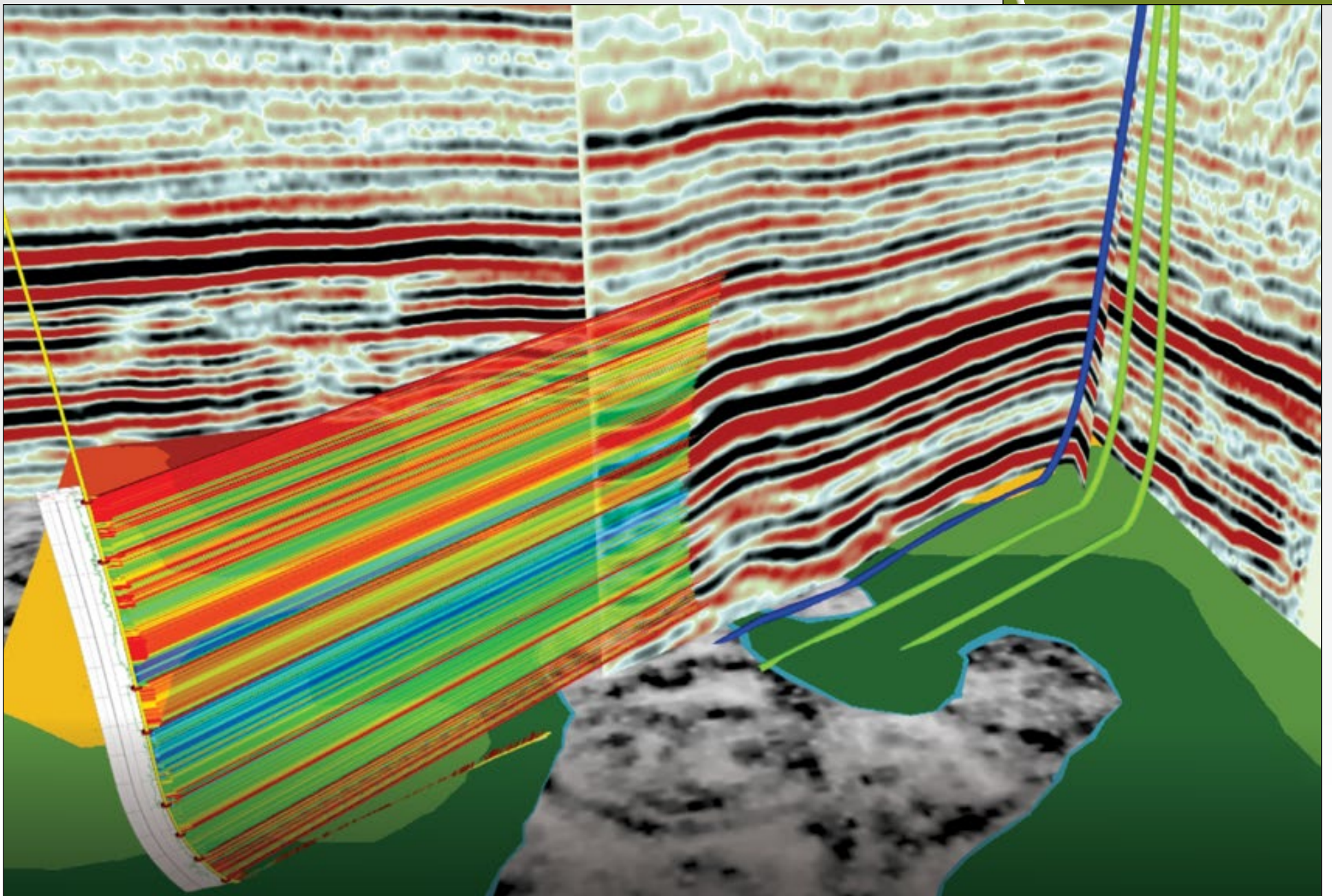
**Publication of issue:**  
**August 2015**

Special section editors:

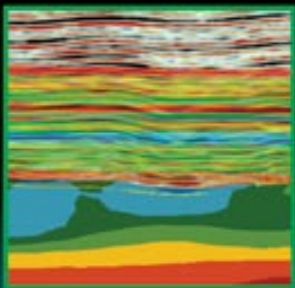
**Steve Adcock**  
[SteveAdcock@ResourceValuations.com](mailto:SteveAdcock@ResourceValuations.com)

**Jean Yves Chatellier**  
[jeanch@usa.net](mailto:jeanch@usa.net)

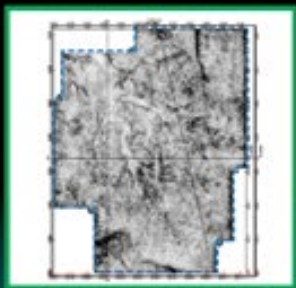
**Linda Sternbach**  
[linda.sternbach@gmail.com](mailto:linda.sternbach@gmail.com)



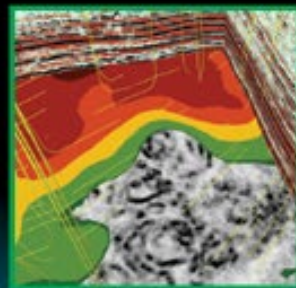
Maximize Your Potential With  
**Advanced Geophysics Capabilities**



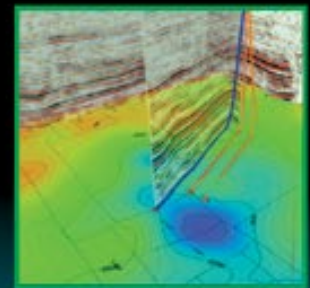
Maximize your reservoir understanding through seamless interpretation of seismic and geological data



Quick & easy high-resolution 3D seismic attribute generation\*



Optimize reservoir characterization away from your wells through high-resolution seismic multi-attribute rock property prediction



Combine seismic interpretation with multi-attributes results and visualize in one scene

\* Requires LMKR Volume Attributes



GeoGraphix® is a registered trademark of Landmark Graphics Corporation. The LMKR Logo is a trademark of LMKR Holdings. LMKR Holdings is the exclusive world-wide licensor and distributor of GeoGraphix® software.

**Discover Your Potential**

[www.lmkr.com/geographix](http://www.lmkr.com/geographix)

# A Case for Reauthorizing the Data Preservation Act

By EDITH ALLISON, Geoscience and Energy Office Director

In the age of 3-D seismic and digitized well logs, the value of cores and other rock samples may not be obvious.

But benefits like those noted by the AAPG in 1948 and described in a 2002 National Research Council report and a recent congressional hearing continue to demonstrate the value of properly archived subsurface samples and data.

These core-based success stories are again in the spotlight as Congress considers whether to support subsurface data preservation.

In September, the U.S. House of Representatives held a hearing to consider reauthorizing the National Geological and Geophysical Data Preservation (NGGDP) Program Act of 2005. The reauthorization, H.R. 5066, introduced by Dan Benishke (R-Mich.), would extend the 2005 law through 2019.

The Data Preservation Act of 2005 instructed the director of the U.S. Geological Survey (USGS) to establish an archive system to preserve geologic, geophysical and engineering data, maps, well logs and samples, and provide a national catalogue of the archived material.

The USGS also was directed to provide technical and financial assistance to state geological surveys and relevant Department of the Interior (DOI) bureaus for archived materials.

The system now includes the core repositories operated by 25 state



ALLISON

Looking forward, core and other subsurface data and samples are likely to grow in importance.

geological surveys and the USGS Core Research Center in Denver.

The 2005 Act authorized \$30 million per year for data preservation; however, total appropriated funds since 2007 equal \$8 million, and annual grants to the 25 states participating in the system have averaged \$27,033 per state.

## History of Subsurface Data Preservation

A brief history of subsurface data preservation sheds light on the importance of this legislation and AAPG's role in data preservation.

▶ AAPG established its Committee on Preservation of Samples and Cores (now the Preservation of Geoscience Data Committee) in 1948 to address the problem that samples of fundamental scientific importance were being lost or discarded at an alarming rate.

The committee found that there was a lack of appreciation of the near- and long-term value of samples (Oil and Gas Journal, 11/15/1999).

During the 1990s the revitalized committee was influential in raising awareness of the need for improved and expanded data repositories.

▶ By the mid-1980s there was a huge network of public and private core repositories.

Many companies, large and small, maintained their own repositories, while other companies donated them to a growing network of state repositories run by the geological surveys.

▶ With the late-1980s industry downturn – tightened budgets, bankruptcies, mergers and corporate decisions to close operations in certain regions – subsurface data were viewed as expensive corporate burdens, and

companies were eager to donate their material to government repositories.

▶ Over the years cores and other data and samples were lost when companies could not afford the shipping expense, or when full repositories were forced to turn away contributions.

▶ In 1994 the American Geological Institute (now the American Geoscience Institute) started a campaign to establish a large national repository and initiated the first national, online core catalogue.

▶ About the same time as companies wanted the states to take their cores, state core repositories were running out of space. By the late 1990s nearly two-thirds of state repositories had less than 10 percent remaining space, according to a National Research Council (NRC) 2002 report, "Geoscience Data and Collections – National Resources in Peril."

AAPG and the AAPG Foundation were sponsors of the NRC study and report.

▶ Several companies acted to assist states in acquiring and maintaining the cores.

In 1994 Shell Oil donated 450,000 boxes of core and its Midland core repository to the Texas Bureau of

See **Nearing Capacity**, page 44

AN AAPG GEOSCIENCES TECHNOLOGY WORKSHOP

## Sixth Annual Deepwater and Shelf Reservoirs

27-28 January 2015 – Houston, TX

Determining reservoir connectivity, calculating pore pressure, understanding the structural subtleties, identifying hazards, and developing accurate images (including subsalt), are deeply affected by new multi-disciplinary discoveries in science and technology. New understanding of ways to map shelf deposit and to accurately map zones, correlate, identify remaining or new reserves and to determine connectivity and conductivity will be featured.

The 6th Annual AAPG Deepwater and Shelf Reservoirs Geosciences Technology Workshop will bring together the latest developments in geology, engineering, geophysics and geochemistry in order to determine the best possible ways to understand and develop fields, as well as identify bold new exploration targets.

Focus will be concentrated on the Gulf of Mexico, shelf and deepwater, including Mexico water.

Reserve your space now to learn how and where new knowledge and technology in geology, engineering and geophysics come together to make deepwater and shelf exploration and development more successful.

Visit us for more information.  
[aapg.to/DeepwaterGTW2015](http://aapg.to/DeepwaterGTW2015)



A JOINT AAPG/EAGE GEOSCIENCES TECHNOLOGY WORKSHOP

## Carbonate Plays Around the World – Analogues to Support Exploration and Development

4-5 February 2015 – New Orleans, LA

The goal of the workshop is to improve understanding of carbonate play types around the world, and to optimize efforts by using analogues for poorly understood discoveries, and challenging reservoirs where characterization may be complex. Studies will include microbialites in Brazil, carbonate-dominated unconventional, and diagenetically altered reservoirs, along with other case studies and research.

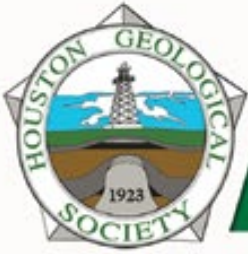
By focusing on case studies, we will incorporate the effective technologies that can lead to a better understanding of reservoir behaviors and optimization strategies. We welcome papers that include some of the following topics:

- 3-D seismic and sequence stratigraphy
- Imaging / image logs to determine fractures and fracture networks
- Carbonates behaviors in horizontals with induced fracture
- Geochemistry and geochemical processes in generation
- Geomechanical factors and transport mechanisms
- Data mining and analytics
- Petrophysical analyses and modeling
- Depositional environments and connection to reservoir characterization
- Palynology and biostratigraphic advances

Register now to reserve your seat!  
[aapg.to/CarbonatePlaysGTW2015](http://aapg.to/CarbonatePlaysGTW2015)







# Applied Geoscience Conference

FEBRUARY 16-17, 2015

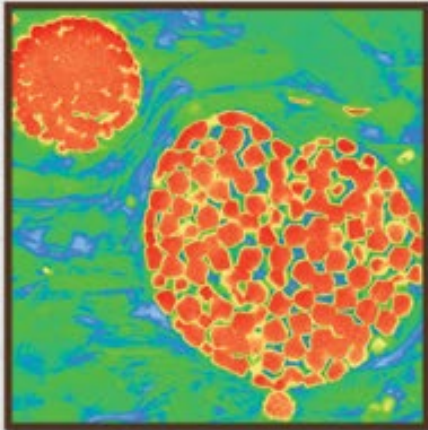


## Integrated Approaches of Unconventional Reservoir Assessment and Optimization

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.

Our 2015 program includes:

- Eight-session oral technical program, featuring talks by invited experts
- Student posters highlighting industry supported research
- Core display supporting oral technical program



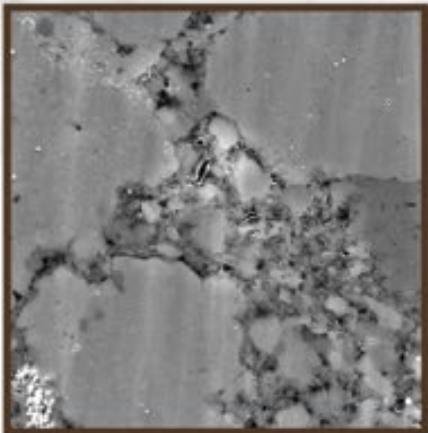
### Day 1:

- Integrated Reservoir Characterization Focusing on Macro to Micro to Nano-scale Components
- Natural Fracture Systems & Producibility
- Reservoir Characterization of Lacustrine Mudrock Systems
- Hybrid Unconventional Systems - Tight Targets



### Day 2:

- Geologically-driven Completion Techniques in Unconventional Reservoirs
- Mudrock Systems Characterization - Advanced Geophysical Insights
- What's Going on Down There? Clues from Produced Fluids and Proppant
- Bringing It All Together: How Reservoir Characterization Improves Stimulation and Production



## Registration Now Open!

WESTIN MEMORIAL CITY  
 945 GESSNER ROAD • HOUSTON, TX 77024  
 For special room rates call before February 1st: 281.501.4300

For more information and to register please visit: [www.hgs.org](http://www.hgs.org)

# Community Outreach Offers Rewards for YPs

By JOE BAUMAN, Southwest Section YP

When the Dallas Geological Society (DGS) formed its local YP group last year, one of the initiatives that was strongly encouraged was community outreach.

YPs are in an excellent position to perform community service. For the most part, our backs and knees are still in good shape – but more importantly, since YPs are making the transition from school to the work force, they make excellent liaisons between young/future geologists and the professional geoscience community.



BAUMAN

Additionally, community service events provide a “change of venue” for YP networking and publically recognize those

who participate.

Simply put, we have found that community service events are as

Simply put, we have found that community service events are as beneficial to our YP group as to the people we have served.

beneficial to our YP group as to the people we have served.

\* \* \*

I grew up in central Iowa. As such, I always understood that hamburgers and corn don't just come from the grocery store.

However, there aren't a lot of outcrops where I come from, so it took a lot longer for me to develop a fascination with rocks and understand that there are a lot of things that don't just come from the store.

Throughout my entire grade school curriculum, I only remember one chapter on geology, which came in fourth grade. Coincidentally, it's the only test I remember failing. Geology seemed so distant. I had never seen a mountain (or even an outcrop!) except on TV, and all the rocks I had ever seen looked pretty much alike to me (in other words, they looked “like a rock”).

I'm pretty sure if a geologist had spent just an hour with us explaining why studying rocks was important (and, even more exciting, if he/she had told us how the rocks we found were each unique!), I would have passed that test on the first try. After all, who can impart more passion about a field of study than a geologist discussing rocks?

Alas, in my hometown, geology and geologists were both in short supply.

Now that I've graduated from school, I enjoy being able to give back to teachers and share my passion for geology with students. And I'm certainly not alone in my thinking or experiences. I've met many geologists who share stories similar to mine, including YP members Nicolas Guerrero and Mandi Beck.

This past year, a local teacher contacted the DGS asking if there was a local geologist who could visit his classes. Nicolas and Mandi jumped at the opportunity to help out and spent an entire day at the school discussing with multiple classes the driving mechanisms of and structures created by plate tectonics, the importance of index fossils like crinoids and trilobites, the properties and uses of a large variety of mineral samples and, of course, questions about dinosaurs.

“It was a wonderful experience and a great opportunity to give back to our community and share our passion for science with the next generation,” Guerrero said.

\* \* \*

In addition to giving back to local schools, community service projects provide YPs with an alternative to after-work mixers. A major benefit of a Saturday morning/midday event is that it draws interest from YPs who may be either unable to attend or disinterested in attending weekday after-work socials.

We participated in one such project in cooperation with the Texas Ramp Project ([www.texasramps.org](http://www.texasramps.org)), and it was a rewarding experience for everyone involved.

Incorporated in 2006, the Texas Ramp Project has built over 5,300 wheelchair ramps for low-income, homebound persons and has chapters all across Texas.

In a single Saturday morning, with

See **Accomplishment**, page 44

**AAPG + SEG + PESA = The groundbreaking geoscience event of the year.**

**A powerhouse emerges:**

## ENERGY FOR THE NEXT FIFTY YEARS

A perfect theme for ICE 2015, not only does it signify the 50th anniversary of the Gippsland Basin oil discovery that unlocked Australasian market activity, but this will be the first ever ICE co-presented by the American Association of Petroleum Geologists (AAPG) and the Society of Exploration Geophysicists (SEG). Hosted by the Petroleum Exploration Society of Australia (PESA) and incorporating PESA's Eastern Australasian Basins Symposium (EABS), ICE 2015 in Melbourne will deliver a premier quality integrated technical program making it the most important, credible geosciences exchange of the year. Be a part of this ground breaking event and submit your abstract now.

ICE.AAPG.org

**AAPG | SEG**

**International Conference & Exhibition '15** Melbourne, Australia  
13-16 September

Incorporating PESA's Eastern Australasian Basin Symposium

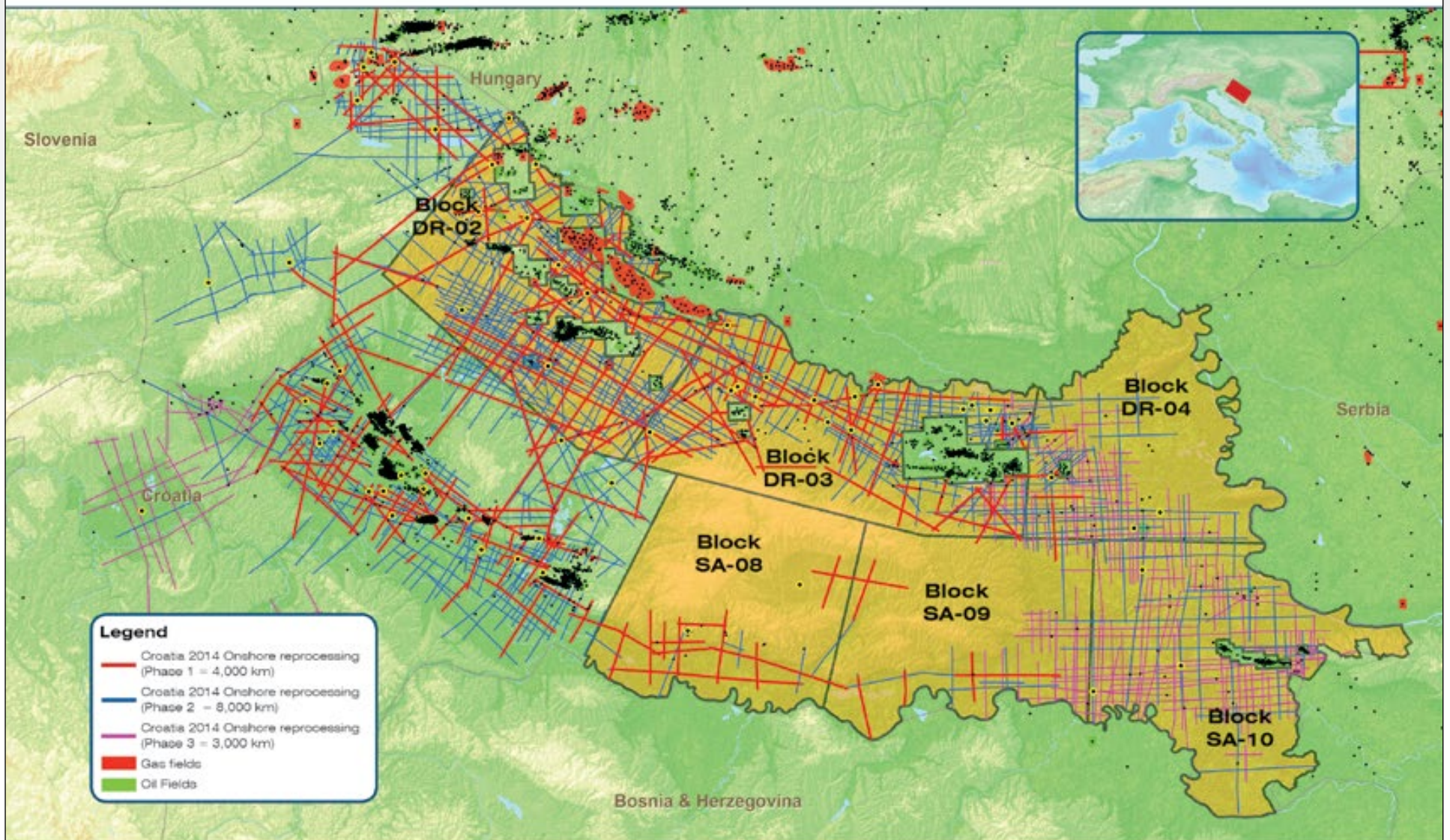
**Submit Abstracts  
now at ICE.AAPG.org**

1. CO<sub>2</sub> Storage
2. Carbonates
3. Eastern Australian Basins
4. Environment, Regulation and Social License to Operate
5. Geochemistry and Basin Modeling
6. Geophysics
7. Getting More Out of Mature Basins
8. Mineralogy
9. New and Emerging E&P Provinces/Australia-New Zealand
10. New and Emerging E&P Provinces/South East Asia
11. Petroleum Systems
12. Petrophysics
13. Marita Bradshaw – Palaeohistory of Australian Geology
14. Reg Sprigg Memorial
15. Sedimentology
16. Stratigraphy and Applied Palaeontology
17. Structure and Tectonics
18. Technologies for Unlocking the Future
19. Unconventional Reservoirs
20. Worldwide Frontiers – China
21. Worldwide Frontiers – Other



# Onshore Croatia

## Newly-Enhanced Seismic for 1st Onshore License Round



Croatia officially opened its first onshore license round in July. This is the first of three tenders for onshore tranches in the forthcoming period. The first license round comprises a total of 6 blocks with a total area of 14,600 km<sup>2</sup> in the Drava, Sava and Slavonija Basins, in the prolific southern Pannonian Basin.

Spectrum has recently enhanced 15,000 km of 2D Multi-Client seismic data over these basins using a modern PSTM sequence. This data displays considerable uplift on the original and is available now.

+1 281 647 0602  
 @mc-us@spectrumasa.com  
 www.spectrumasa.com



**Accomplishment**  
from page 42

assistance and instruction from Texas Ramp Project organization volunteers, we were able to build a ramp for a woman who could no longer safely navigate the steps exiting her home. We were done by lunch – and needless to say, we all left with a sense of accomplishment and an appreciation for our own self-reliance.

There certainly are no shortages of volunteer opportunities – and these are just two examples of service projects available to YP groups.

\* \* \*


In addition to the impact made on the community, service events are an

excellent way to bring together students, YPs and experienced professionals.

It seems most student organizations require community service hours, and many veteran geoscientists enjoy participating in or sponsoring such events. For our build-a-ramp project, DGS members were eager to supply any additional tools needed and DGS readily covered our drinks and snacks.

Most, if not all, are familiar with the warm, heartfelt feelings that come with volunteering with charitable organizations.

However, there is more for YP groups to gain than individual satisfaction.

These events positively promote the YP group and its affiliations – and encourage event participation from a wider spectrum of AAPG and affiliated society members. 

**Nearing Capacity**  
from page 40

Economic Geology (BEG), with an endowment to maintain the cores and facilities. In 2001 BP-Amoco donated 85,000 boxes of core to the BEG, and in 2004 BP donated its Houston facility to the BEG.

The BEG now holds almost two million boxes of geologic material.

▶ State core repositories are once again nearing capacity. Some have exceeded their capacity and are relying on temporary, non-climate-controlled portable storage. Valuable subsurface data can quickly become useless if core boxes and labels get wet and moldy in leaky facilities.

**Success Stories**

At the September hearing representatives of the USGS, the Association of American State Geologists, the Kentucky Geological Survey Well Sample and Core Library, and Michigan Potash Company described the benefits of the legislation in preserving subsurface data that has enormous economic benefits.

▶ **Jonathan D. Arthur**, president of the Association of American State Geologists and state geologist of Florida, stated in his testimony, “In 2008, reinspection of a small manila pouch full of rock chips from a dry oil test well in southern Texas led to the discovery of the Eagle Ford Shale play: A \$25 billion economic impact in a 20-county area supporting more than 47,000 jobs.”

▶ AAPG member **Patrick Gooding**, research geologist/manager at the Kentucky Geological Survey, Well Sample and Core Library, explained the scientific applications and economic benefits of archived core, and how the NGGDP Act aids in subsurface data preservation.

▶ **Kevin Gallagher**, associate director of Core Science Systems at the USGS, testified that in 2009 the Michigan Geological Survey received NGGDP program funds to prepare accurate inventories of rescued core from western Michigan. A search of this inventory by a potash company scientist revealed a large deposit of high-grade potassium chloride, a critical ingredient in fertilizer.

In September 2013, this deposit was estimated to be worth \$65 million.

▶ **Theodore A. Pagano**, general manager, Michigan Potash Company LLC, also testified about the value of this core data, donated to the state repository in the 1980s by Pittsburgh Plate and Glass when the company changed its investment plans, stating that the company believes there is enough potash under Hershey, Mich., to double U.S. output for 150 years.

The timing is fortuitous – New Mexico potash deposits are nearly depleted.

Looking forward, core and other subsurface data and samples are likely to grow in importance.


▶ Cores help geologists understand the relationships between lithology, organic content and geophysical-log signature, and how these components help explain regional sequence stratigraphic correlations and help predict the hydrocarbon potential of shale reservoirs.

▶ Enhanced oil recovery (EOR) will expand as an option to capture the large volumes of oil remaining after primary production and waterflooding.

EOR using injection of carbon dioxide also will grow as a mechanism for storing the greenhouse gas. Detailed reservoir characterization that is required for effective injection demands cores, often collected and preserved decades earlier.

▶ Subsurface data such as well logs have helped identify faults and their link to earthquakes in the Los Angeles basin, helping guide urban planning (NRC, 2002).

This data, collected from wells drilled decades ago, could not be reacquired given the current population density of the region.

Applications like this are likely to grow as our urban population expands in the future. 

**REGISTRATION IS OPEN**

ArcticTechnologyConference.org

**Don't miss the world's most focused and comprehensive Arctic event.**

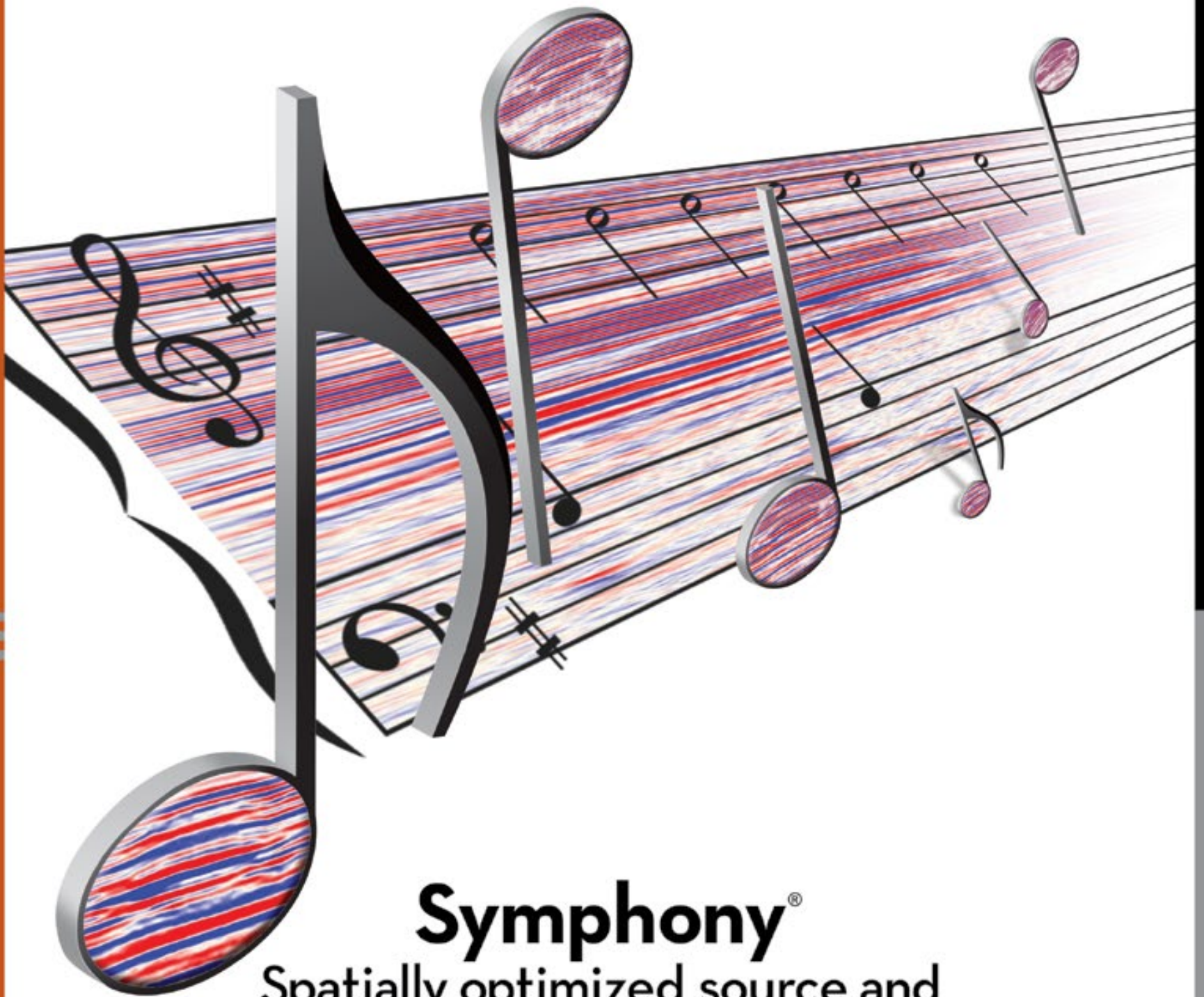
OTC's Arctic Technology Conference (ATC) is part of the successful series of events which includes the flagship Offshore Technology Conference in Houston, OTC Brazil in Rio de Janeiro and OTC Asia in Kuala Lumpur. Anchored by 14 of the energy industry's leading engineering and scientific organizations, OTC's cutting-edge conferences, products and services exhibitions have fostered development of the world's oil and gas resources since 1969. If your job is to discover and effectively and safely produce the vast energy resources in the Arctic, you need to participate in the event that has the industry and society credibility to bring it all under one roof: ATC.



**COPENHAGEN**  
23-25 MARCH 2015  
BELLA CENTER DENMARK



**Save US \$100 when you register by 12 February**  
Exhibit and Sponsor Opportunities Available



# Symphony<sup>®</sup>

## Spatially optimized source and receiver distribution

### Only violins in your string quartet?

Seismic surveys typically employ a single source and receiver type throughout the project, and are designed to prevent aliasing the high frequencies of dipping reflections. By employing multiple source and receiver types, each optimized to a particular frequency band, we can avoid over-sampling the low frequencies, and concentrate the acquisition effort where it is most needed, resulting in optimally sampled, broadband seismic datasets.

Seismic.  
Fully Orchestrated.  
[geokinetics.com](http://geokinetics.com)



**REGIONS and SECTIONS**

# Africa Region Sees 20 Years of Growth

By DAVID BLANCHARD, AAPG Africa Region President



Members of the University of Western Cape Student Chapter and YP group, South Africa, August 2014, Africa Region's newest student chapter and YP group.

Since establishment of AAPG Africa in 2000, the Region's leadership teams over the years have shown strong commitment and passion toward the Association achieving its goals for the region.

Their dedicated efforts have resulted in not only an increased awareness of AAPG, but also steady growth of the Region's membership, from 450 in 1999

to over 3,060 in June 2014.

The Region also has witnessed rapid growth in several of its student programs, including the Imperial Barrel Award competition and student chapters.

This year's IBA, for example, had participation of teams from Uganda, Nigeria, Egypt, Tunisia and South Africa, with teams showing better performance in the competition over previous years.

Student chapter numbers now stand at 44, including new additions from South Africa and Egypt.

Student membership in the Region continues to climb, as does participation – thanks to the annual Local Student Chapter



BLANCHARD

Leadership Summits, student grants and AAPG's continued commitment to sponsorship of student programs and conferences.

This year, five of the L. Austin Weeks grants were awarded to students from Egypt, Nigeria and Uganda, and a Grants-in-Aid sponsorship was awarded to a Nigerian postgraduate research student.

The Region also has supported students at several student conferences held across the region, including the African Geosciences Student Conference, AGSC, which took place in Kumasi, Ghana in May 2014.

AAPG Young Professionals also have been providing educational support to students. For example, YPs in Egypt put together annual events – including the IBA simulation and Discover Egypt lecture series – Meet 'n Greet events have been organized and YPs have successfully taken "The Exciting World of Geology" to several elementary and high schools in Africa in a bid to get young school students interested in a career in the geosciences.

A YP chapter was established in South Africa in September, and we hope to see news about their activities in the near future.

Other AAPG programs, such as the Distinguished Lectures and YP activities in general, have seen increased frequency, and last September AAPG award-winning researcher and past Distinguished Lecturer Henry Posamentier was hosted in in Lagos. This was followed by a joint distinguished lecture with SPE in Tunis in February of this year, and a regional lecture with AAPG Distinguished Lecturer Terry Engelder in Egypt this September.

\* \* \*

The Africa Region now has a newly established AAPG chapter in Angola, plus six affiliated societies:

▶ The Geological Society of South Africa (GSSA).

## CALL FOR PAPERS

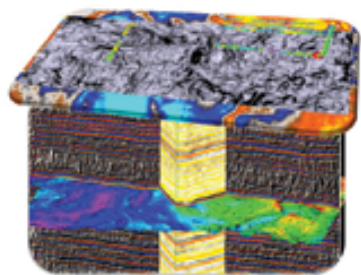
► Submission deadline:  
**15 December 2014**

<https://mc.manuscriptcentral.com/interpretation>



## Geoscience follow-up papers from URTeC 2013 and 2014

Now in its second year, the Unconventional Resources Technology Conference (URTeC), jointly sponsored by SEG, AAPG, and SPE, is proving to be a very successful forum for practicing geoscientists and engineers to present their recent work. These presentations showcase the detailed reservoir analysis and integrated interpretation required for the economic development of these resources. While the presentations and proceedings are available to the attendees, the work deserves to be circulated to a wider audience. The goal of the special section is to address this need.



Integrated interpretation of the Niobrara unconventional resources play, Colorado, USA, courtesy of Jack Wiener, Halliburton Energy Services.

URTeC requires that presenters submit a written article with each presentation. If this paper is sufficiently complete, URTeC presenters may submit it to the special section, greatly reducing the effort required of the authors. Alternatively authors may expand the original article, particularly if they have new information or

data that sheds further light on their work. If the URTeC article is a brief expanded article lacking sufficient detail for peer review, authors should expand on that article. In all cases, submissions will undergo Interpretation's peer review process to assess suitability for publication.

The special section will focus primarily on papers that have been presented at URTeC, but other articles dealing with integrated interpretation for the development of unconventional resource will be considered too, even if they have not been presented at URTeC.

Papers are invited which address topics such as:

- multidisciplinary data integration
- microseismic fracture mapping
- imaging unconventional reservoir pore systems
- unconventional field case studies
- formation evaluation for unconventional reservoirs
- seismic attributes
- fracture characterization
- shale core analysis
- reservoir modeling

Interpretation, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

The submissions will be processed according to the following timeline:

Submission deadline:  
**15 December 2014**

Publication of issue:  
**August 2015**

Special section editors:

**John O'Brien**  
John.O'Brien@Anadarko.com

**Ken Beeney**  
K.Beeney@gmail.com

**Gene Sparkman**  
Gene.Sparkman@luminageo.com

**Mike Kendrick**  
Michael.Kendrick@DVN.com

**Troy Beserra**  
Troy.Beserra@anadarko.com

**R. Randy Ray**  
RRandyRay@aol.com

**Marc Marshall**  
Marc.Marshall@DVN.com



Global Pacific & Partners

www.globalpacificpartners.com

Global Pacific & Partners  
With the proven 35+ year  
track record in & on Africa

# 21<sup>st</sup> Africa Oil Week

## Africa Upstream

3<sup>rd</sup> - 7<sup>th</sup> November 2014 | Cape Town International Convention Centre, South Africa

- ★ Expected 1,600 Delegates from across the Globe
- ★ Plenary Sessions with 100+ Speakers
- ★ Over 160 Exhibitors
- ★ Dinners and Networking Receptions
- ★ Government Showcases & Roadshows
- ★ 16<sup>th</sup> Scramble for Africa: Strategy Briefing Presented by Dr. Duncan Clarke
- ★ Keynote Speaker: Paolo Scaroni Deputy Chairman, Rothschild, London



**The landmark Conference occasion for the Continent**

Lead Sponsor:	Titanium Sponsor:	Platinum Sponsor:	Rhodium Sponsor:	Gold Sponsor:	Silver Sponsor:	Bronze Sponsor:

**Contact:** The Hague, The Netherlands: +31 70 324 61 54 / Johannesburg, South Africa: +27 11 880 70 52  
**Registration:** Jodee Lourensz: jodee@glopac-partners.com / Judith Moore: judith@glopac-partners.com  
**Senior Partners:** Duncan Clarke: duncan@glopac.com / Babette van Gessel: babette@glopac.com

Follow our company on

**AMERICAN  
GEOSCIENCES INSTITUTE**

**2015 - 2016**

**WILLIAM L. FISHER  
CONGRESSIONAL  
GEOSCIENCE FELLOWSHIP**

The AGI Congressional Geoscience Fellowship represents a unique opportunity to gain first-hand experience with the legislative process on Capitol Hill. The successful candidate will spend 12 months (starting September 1, 2015) in Washington working as a staff member in the office of a member of Congress or a congressional committee. Fellows make practical contributions to the effective and timely use of geoscientific knowledge on issues relating to the environment, resources, natural hazards, and federal science policy.

Prospective applicants should have a broad geoscience background and excellent written and oral communication skills. Minimum requirements are a Ph.D. or an engineering master's degree with three years of post-degree work experience. Although prior



experience in public policy is not necessary, a demonstrable interest in applying science to the solution of public problems is desirable.

The fellowship carries an annual stipend of \$68,000 plus allowances for health insurance, relocation, and travel. Additionally, it may be possible to extend the fellowship for up to four months. Support for the fellowship is provided by an endowment through the AGI Foundation honoring William L. Fisher.

Interested candidates should submit a cover letter and curriculum vitae with three letters of reference through our online application. For further details, please visit our website at [www.americangeosciences.org/policy/internships-and-fellowships](http://www.americangeosciences.org/policy/internships-and-fellowships), call (703) 379-2480, ext. 228, or email [govt@agiweb.org](mailto:govt@agiweb.org). AGI is an equal opportunity employer.

All application materials must be submitted by February 1, 2015.

Several of AGI's Member Societies also sponsor Congressional Science Fellowships. For further information, contact the American Geophysical Union [www.agu.org](http://www.agu.org), Geological Society of America [www.geosociety.org](http://www.geosociety.org), Soil Science Society of America [www.soils.org](http://www.soils.org), or Society for Mining, Metallurgy, and Exploration, Inc. [www.smenet.org](http://www.smenet.org). It is acceptable to apply to more than one society. Stipends, application procedures, timetables, and deadlines vary.

**PROFESSIONAL news BRIEFS**

**Zahie Anka**, to senior geologist-new ventures, petroleum system analysis, Total Exploration, Paris, France. Previously senior geoscientist, GFZ German Research Centre for Geosciences, Potsdam, Germany.

**Steve Appel**, to seismic interpreter, Schlumberger, Houston. Previously contract geophysicist, Sequitur Energy, Houston.

**Eleazar Benedetto-Padron**, to vice president, Ryder Scott, Houston. Previously senior petroleum geologist, Ryder Scott, Houston.

**Randy Bissell**, to geoscience adviser, Headington Energy Partners, Corpus Christi and McKinney, Texas. Previously senior geoscientist, Headington Oil, Corpus Christi, Texas.

**Robert W. "Bob" Broomhall** has retired from ExxonMobil Exploration. He resides in Bend, Ore.

**Sharma Dronamraju**, to director, AKD Professional Solutions, Houston. Previously senior geoscientist, Petrobras, Marathon Oil, Houston.

**Roger Humphreville**, to director of technology integration-upstream technology, BP, Houston. Previously senior director, government affairs-technology, BP, Washington, D.C.

**Nathan Kuhle**, to geologist-global exploration new ventures, Chevron, Houston. Previously geologist-Kitimat upstream, Chevron, Calgary, Canada.

**David A. Miller**, to geologist-reservoir characterization, Devon Energy, Oklahoma City. Previously senior staff geophysicist, EP Energy, Houston.

**Stefano Santoni**, to exploration manager, Dragon Oil, Dubai, U.A.E. Previously new venture director, TAQA, Abu Dhabi, U.A.E.

**Valary Schulz**, to consulting geologist, Dallas. Previously geologic manager, Cinco Resources, Dallas.

**Franklin C. Snyder** has retired from ConocoPhillips, Anchorage, Alaska. He resides in Pagosa Springs, Colo.

**Donald A. Soper** has retired from Arch Coal in St. Louis, Mo. He resides in Meridian, Idaho.

**Tom Tomastik**, to senior geologist and regulatory specialist, ALL Consulting, Tulsa. Previously geologist IV-retired from Ohio DNR-oil and gas resources management, Columbus, Ohio.

**Paul Wagenhofer** has retired from New Zealand Oil and Gas, Wellington, New Zealand. He is now a consultant in South Burlington, Vt.

**Leadership  
from page 46**

- ▶ The Egyptian Petroleum Exploration Society (EPEX).
- ▶ Nigerian Association of Petroleum Explorationists (NAPE).
- ▶ Ghana Institution of Geoscientists (GhIG).
- ▶ Moroccan Association of Petroleum Geologists (MAPG).
- ▶ The Earth Science Society of Libya (ESSL).

The Region also has held geoscience conferences, programs and events in Angola, Ghana, Nigeria, Egypt, South Africa and Morocco.

Immediate past president Gilbert Odior has been recognized and appreciated for a job well done during his two-year term, during which the

Africa Region office and AAPG Angola chapter were established, and during whose tenure the Region witnessed increased participation in the Imperial Barrel Award competition and better working relations with NAPE.

AAPG Africa Region's new leadership team assumed office in July and shall lead the Africa Region through June 2016.

The officers are:

- ☐ President – David Blanchard.
- ☐ Vice President – Femi Esan.
- ☐ Secretary – Antonio Ingles.
- ☐ Treasurer – Ajibola Oyebamiji.

The leadership, along with delegates, AAPG committee members and programs coordinators, is poised to continue the Region's unprecedented progress.

For more information on the Africa Region contact program manager Delia Kuye at [dkuye@aapg.org](mailto:dkuye@aapg.org).



**COMPARTMENTS,  
SATURATIONS, AND  
PERMEABILITY**

**GEO2FLOW WORKSHOP USING YOUR DATA**

**Discover how to model compartments, saturations, and permeabilities for your field – not a generic one.**

Learn about the science behind the modeling – not just the "button clicks". Engage in interdisciplinary discussions that are stimulated by Geo2Flow's enforcement of consistency in model building. Gain knowledge, understanding, and tangible results that are immediately applicable to your company's assets.

- Designed for geologists, reservoir engineers, and petrophysicists to understand the science and workflows for building consistent 3D reservoir models of saturations, permeabilities, compartments, and volumetrics.
- Analyze your field(s), using Petrel models and ancillary spreadsheets.
- Go "hands-on" with Geo2Flow software that implements these workflows and stimulates interdisciplinary cooperation.
- Quality control input data and reduce uncertainties in your models.
- Workshop leader: Daniel J. O'Meara, Ph.D., 35 years of experience in the industry and an expert in these topics.
- Onsite and private workshops to ensure confidentiality - either three or five days in duration, depending upon the number of Petrel models and their complexity.

Read more at [www.geo2flow.com](http://www.geo2flow.com) or contact us at [vicki@geo2flow.com](mailto:vicki@geo2flow.com)

**Rose & Associates**

**Courses Consulting Software**

**Risk Analysis, Prospect Evaluation & Exploration Economics**

Houston:	Jan 19 – 23, 2015	Calgary:	November 3 – 7, 2014
	April 20 – 24, 2015		April 13 – 17, 2015
	Sept 14 – 18, 2014		Sept 21 – 25, 2015
Perth:	March 9 – 13, 2015	Bali:	June 8 – 12, 2015

**Unconventional Resource Assessment and Valuation**

Houston:	May 11 – 15, 2015	Calgary:	May 11 – 15, 2015
	Oct 26 – 30, 2015		Oct 5 - 9, 2015
OK City:	Aug 10 – 14, 2015	Denver:	June 15 – 19, 2015
Pittsburgh:	Oct 5 – 9, 2015	Beijing:	Feb 2 – 6, 2015

**Evaluating Tight Oil and Gas Reservoirs**

Calgary:	March 9 – 13, 2015	Houston:	May 18 – 22, 2015
Denver:	Oct 5 – 9, 2015		Sept 21 – 25, 2015

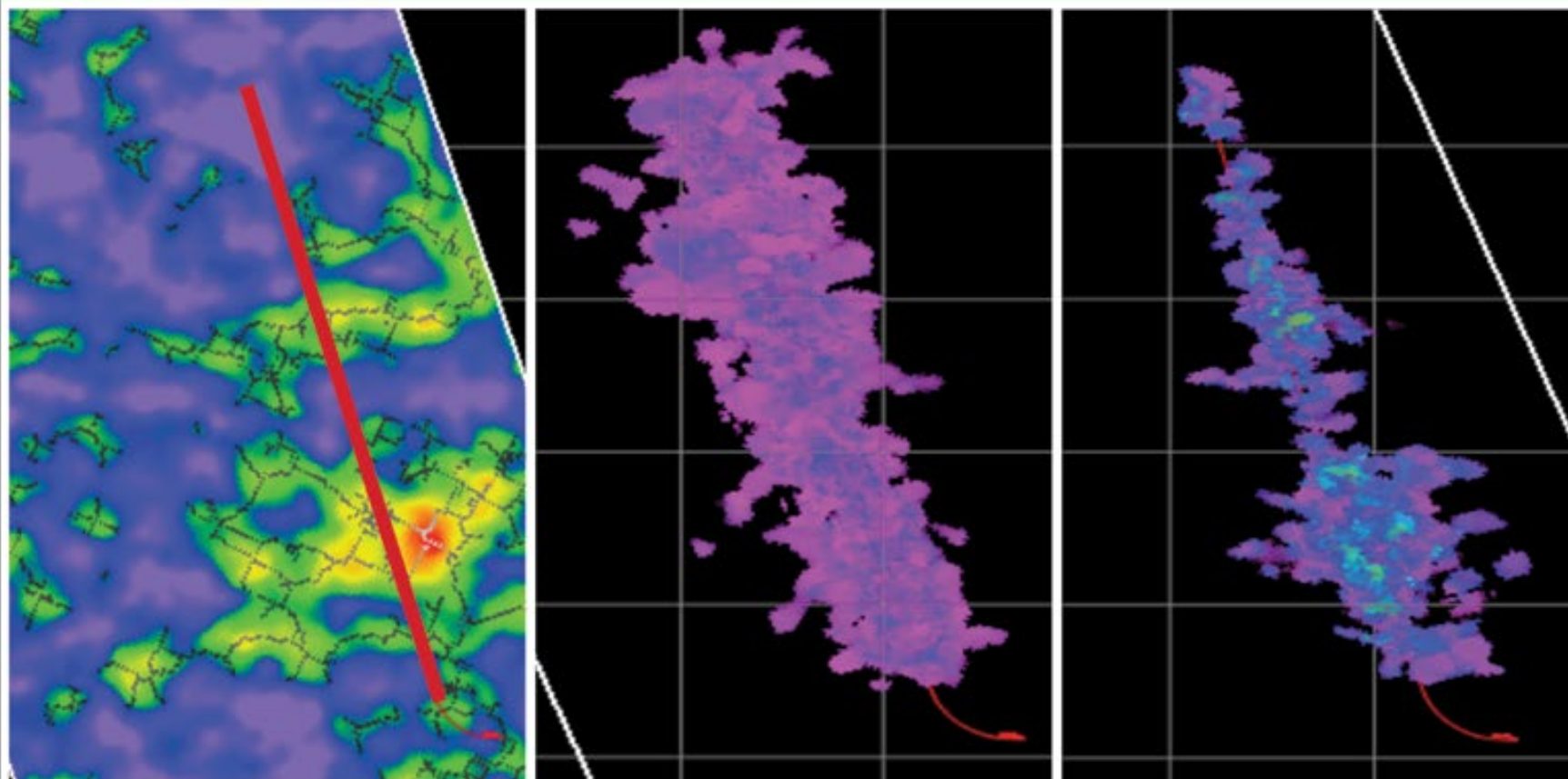
**Play-Based Exploration: Mapping, Volumetric and Risk Analysis**

Houston:	November 3 – 5, 2014	Aberdeen:	Sept 14 – 16, 2015
----------	----------------------	-----------	--------------------

For more information visit [www.roseassoc.com](http://www.roseassoc.com)



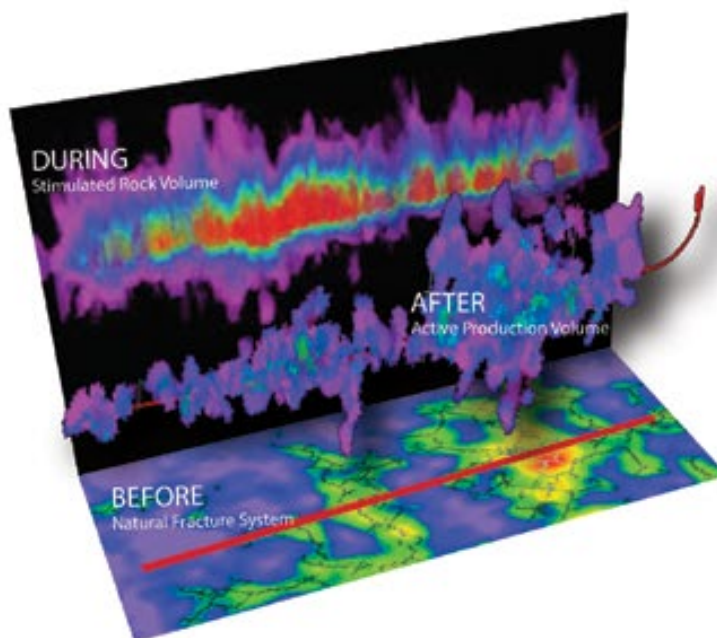
# the ACOUSTIC VIEW



## BEFORE. DURING. AFTER.

Global Geophysical's innovative approach to microseismic provides direct imaging of acoustic activity in the subsurface. This allows us to identify areas or zones that are acoustically active due to naturally-occurring activity, hydraulic stimulation or production-related activities. Our microseismic results can be presented as 3D attributes such as semblance, as discrete volumes of acoustic activity or as Tomographic Fracture Images™. A key and differentiating capability of our approach is that we capture acoustic activity before, during and after stimulation; providing you with knowledge of natural fractures and faults, stimulated rock volume and the active production volume. This Before, During and After approach allows you to discern the impact of both natural and induced fractures and to determine the cumulative affect they have on actual well productivity.

Our seismic solutions include data acquisition, microseismic, data processing, reservoir geophysics and integrated interpretation & consulting services.



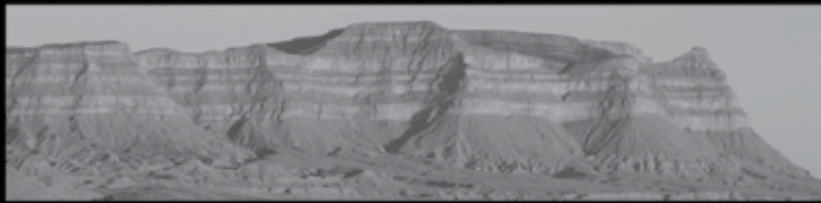
**Before:** Quiet Time recording before the frac images natural fractures and faults. **During:** Pumping time recording images the microseismically active volume during stimulation. **After:** Quiet time recording post-frac reveals the microseismically active production volume.

Global Geophysical Services, Inc.  
tel +1 713-972-9200 [www.globalgeophysical.com](http://www.globalgeophysical.com)



For more information:  
[www.globalgeophysical.com/MONITORING](http://www.globalgeophysical.com/MONITORING) or  
Contact us at [MONITORING@globalgeophysical.com](mailto:MONITORING@globalgeophysical.com)

**THE BOOK CLIFFS, UTAH: A CASE STUDY IN COASTAL SEQUENCE STRATIGRAPHY**



Course led by: **William W. Little, Ph.D.**

**2015 Schedule**  
 20 – 24 April 4 days in premier Book Cliffs localities applying sequence stratigraphy  
 18 – 22 May 1 day at the Utah Core Research Center in Salt Lake City  
 24 – 28 Aug \$3500 (includes tuition, lodging, and lunch) Limited to 20 per session

See the website for trip details and course outline at **NASHVILLEGEO.COM**

Offered through Nashville Geoscience, LLC

# Distinguished Lecture Tours Set For November

**T**hree speakers from the AAPG-AAPG Foundation's Global Distinguished Lecture Program will be on tour in November, making stops in the western parts of North America and throughout the Asia-Pacific Region.



**FOUKE**



**MILLER**



**TOWERY**

The lecturers, representing AAPG's flagship initiative for offering audiences the latest in geologic science, will be speaking

to AAPG affiliated geological societies and university groups.

Touring in November will be:

► **Bruce Fouke**, director of the Roy J. Carver Biotechnology Center and professor of geology, microbiology and the Institute for Genomic Biology at the University of Illinois, Urbana-Champaign, Ill.

Fouke is this year's Roy M. Huffington Lecturer, and he will be offering three talks, ranging from "state-of-the-art oil field geobiology" to coral reef ecosystems to "insights from the deep microbial biosphere."

His lecture itinerary is:

Nov. 3 – VNU University of Science, Vietnam National University, Thanh Xuan, Hanoi, Vietnam.

Nov. 5 – Okinawa Institute of Science and Technology, Onna-son, Kunigami-gun, Okinawa.

Nov. 10 – James Cook University, Townsville, Australia.

Nov. 12 – University of Otago, Dunedin, New Zealand.

Nov. 14 – University of New South Wales, Sydney, Australia.

► **Ken Miller**, Distinguished Professor, Department of Earth and Planetary Sciences, Rutgers, Piscataway, N.J.

Miller is this year's Dean A. McGee Lecturer, and he also offers three talks, on subjects ranging from with sea-level rise, deep sea isotopic records and sequence stratigraphy.

His lecture itinerary is:

Nov. 3 – Grand Valley State University, Allendale, Mich.

Nov. 4 – Louisiana State University, Baton Rouge, La.

Nov. 5 – Albuquerque Geological Society, Albuquerque, N.M.

Nov. 6 – University of Oklahoma Student Chapter, Norman, Okla.

Nov. 7 – Four Corners Geological Society, Durango, Colo.

Nov. 10 – Wyoming Geological Association, Casper, Wyo.

Nov. 11 – Montana Geological Society, Billings, Mont.

Nov. 13 – Saskatchewan Geological Society, Regina, Canada.

► **Lisa Towery**, senior geologist, BP America, Houston.

Towery's lecture is titled "Appropriate Reservoir Modeling: Integration Across Subsurface Disciplines."

Her lecture itinerary is:

Nov. 18 – Colorado School of Mines, Golden, Colo.

Nov. 19 – Wyoming Geological Association, Casper, Wyo.

Nov. 20 – Montana Geological Society, Billings, Mont.

Nov. 21 – Saskatchewan Geological Society, Regina, Canada.



## AAPG Annual Convention & Exhibition 2015

31 May – 3 June // Denver, Colorado

## Exhibit Space and Sponsorships Available Now

Invest with confidence – the world's geosciences community meets at ACE. Experience the unique positioning and world-class exposure synonymous with participating in ACE:

- **Target audience:** Approximately 8,500 geologists, geophysicists and engineers from around the world will be at ACE in Denver.
- **International appeal:** On average, 1,350+ geoscientists from outside the U.S. attend ACE each year, making it the perfect place to make global contacts.
- **Technical content:** Highly regarded, peer-reviewed oral and poster presentations attract industry leaders who appreciate the strength of the ACE technical program.
- **Extensive event marketing:** Pre-show advertising in the *Explorer*, email blasts, an online presence drawing thousands of visitors each week, guest passes for top clients and publicity at AAPG-attended events supports the value of your investment.
- **On-site promotions:** Explore the Floor giveaways, coffee and refreshment breaks, the cyber c@fe and a sponsored luncheon take place on the exhibition hall floor to keep your audience at hand, as well as poster sessions strategically located throughout to encourage traffic.
- **Location:** Geoscientists love Denver!

[ACE.AAPG.org](http://ACE.AAPG.org)



## Geometric Freedom™ starts here.

**It's a new way of thinking that opens up a whole new world of possibilities.**

Suddenly, you're free to design the seismic survey of your dreams. Anywhere, any time, any way you want.

Forget the limits of fixed intervals. Banish the idea that obstacles are obstacles. These cable-free nodes go wherever you need them—on land, in transition zones, in shallow water or deep—so you can optimize subsurface illumination and spatial sampling in the most cost-effective way.

Solve your most complex challenges without compromising a thing. And get better data no matter where in the world you need it.

Put the power of Geometric Freedom to work for you, with the ultimate nodal technology.



**fairfield**nodal

fairfieldnodal.com

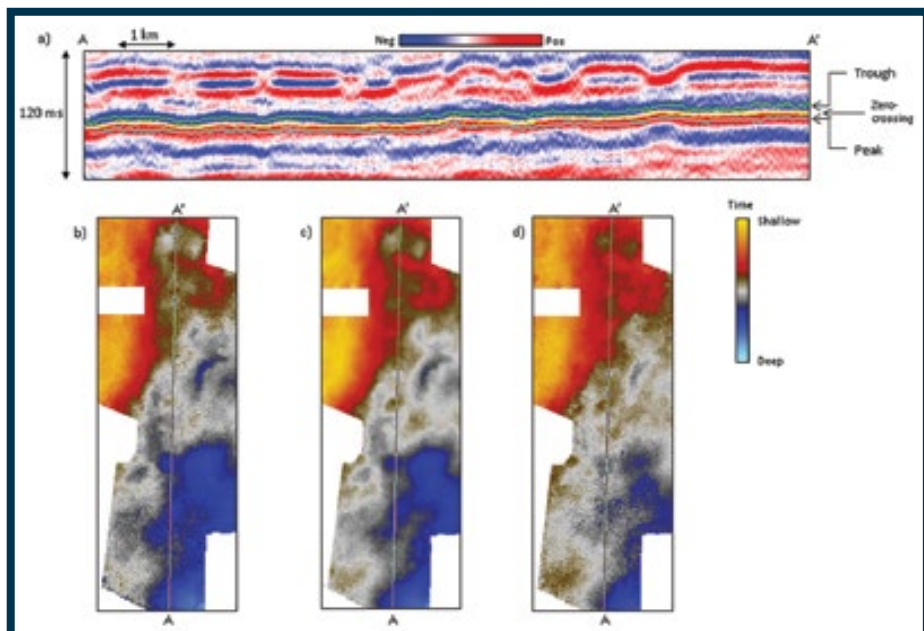


Figure 1 – (a) Vertical slice AA' through seismic amplitude showing three alternative horizon picks corresponding to autotracked troughs, zero-crossings (going from trough to peak) and peaks. Note how the yellow zero crossing horizon pick is smoother. Corresponding time-structure maps computed from picks of (b) peaks, (c) zero-crossings and (d) troughs. Note that (c) is less contaminated by noise. Data courtesy of Arcis Seismic Solutions, TGS.

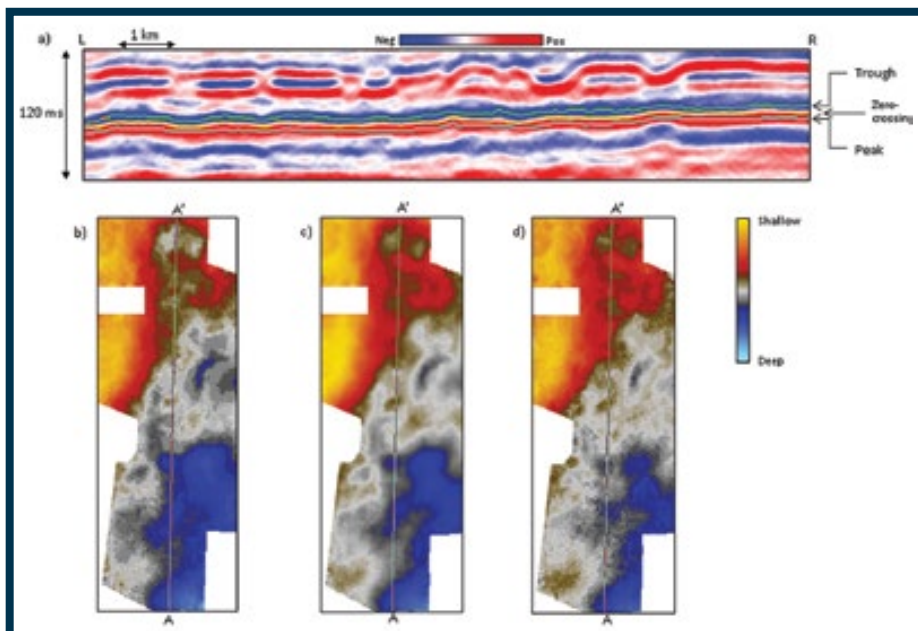


Figure 2 – (a) Vertical slice AA' through seismic amplitude after structure-oriented median filtering showing three alternative horizon picks corresponding to autotracked troughs, zero-crossings (going from trough to peak) and peaks. Corresponding time-structure maps computed from picks of (b) peaks, (c) zero-crossings and (d) troughs. All three time-structure maps exhibit less noise, though (b) and (d) exhibit a "patchy" appearance common to median filters. Data courtesy of Arcis Seismic Solutions, TGS.

# Autotracking Your Way to Success

By SATINDER CHOPRA and KURT J. MARFURT

A horizon is a reflection surface picked on a 3-D seismic data volume that is considered to represent either a lithologic interface or a sequence stratigraphic boundary in the subsurface.

Usually, an interpreter begins the exercise of identifying the different subsurface horizons by correlating the available well log data with the seismic data.

In its simplest form, such identification can be done by hanging an impedance log curve on the seismic data – or more quantitatively, by generating a synthetic seismogram from the impedance log curve using an appropriate wavelet and correlating the result with measured seismic traces about the well.

Depending on the seismic data quality and either the presence or lack of isolated strong reflectors, identifying horizons can be a trivial exercise or a challenging problem.

\* \* \*

In the beginning, horizons were handpicked, posted on a map and hand-contoured.

In the 1970s and '80s the hand picks were manually digitized by a technician, loaded into a database and then contoured using a mainframe computer. Removing bad picks from the database required extra requests. Such a task was laborious, inefficient and usually not very accurate.

With the introduction of the workstations, this task became automated – much to the relief of the seismic interpreters.

Today's automated horizon-picking algorithms are much more sophisticated than those of a decade ago. While automated pickers appear to simply find peaks, troughs and zero-crossings on adjacent traces, internally there are constraints of correlation coefficient, dip and coherence that provide the ability to pick through moderate quality data with relatively complicated waveforms.

Nevertheless, autotracking is sensitive to the variations in the signal-to-noise (S/N) ratio of the seismic data:

▶ High S/N ratio of data implies locally smooth and continuous phase of the reflections to be picked, and usually yields a

good autotracked surface.

▶ Data with low S/N ratio implies no smoothness or consistency in the phase to be tracked and prevents reliable horizon picking.

Autotracking works very well on coherent seismic reflectors. With a single click of a cursor on the given phase (peak, trough and positive to negative or negative to positive zero crossings) the complete surface can be rapidly picked in no time. Through the use of time-structure and dip magnitude maps, one can just as rapidly

identify busts in the picking algorithm that may need to be interactively repaired.

Almost as important as autopicking, most software packages provide an autoerasing option, which removes either the last one or two steps or provides erasure within user defined polygons.

Because of lateral changes in overburden and vertical changes in reflectivity, seismic data quality often varies laterally and vertically. While 3-D autopickers

Continued on next page

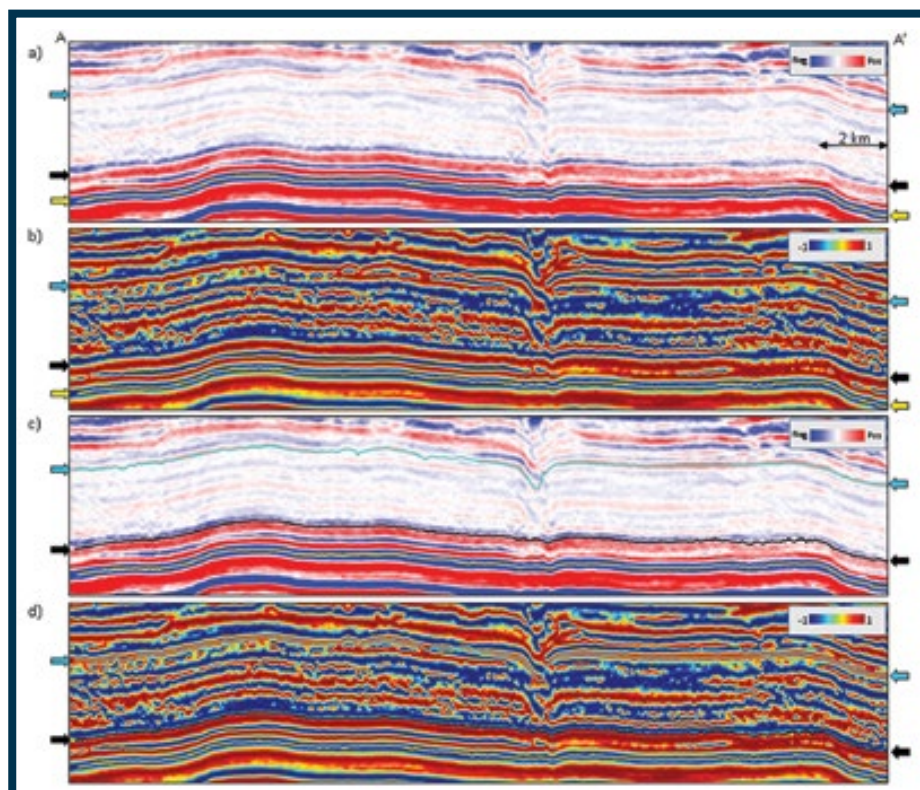
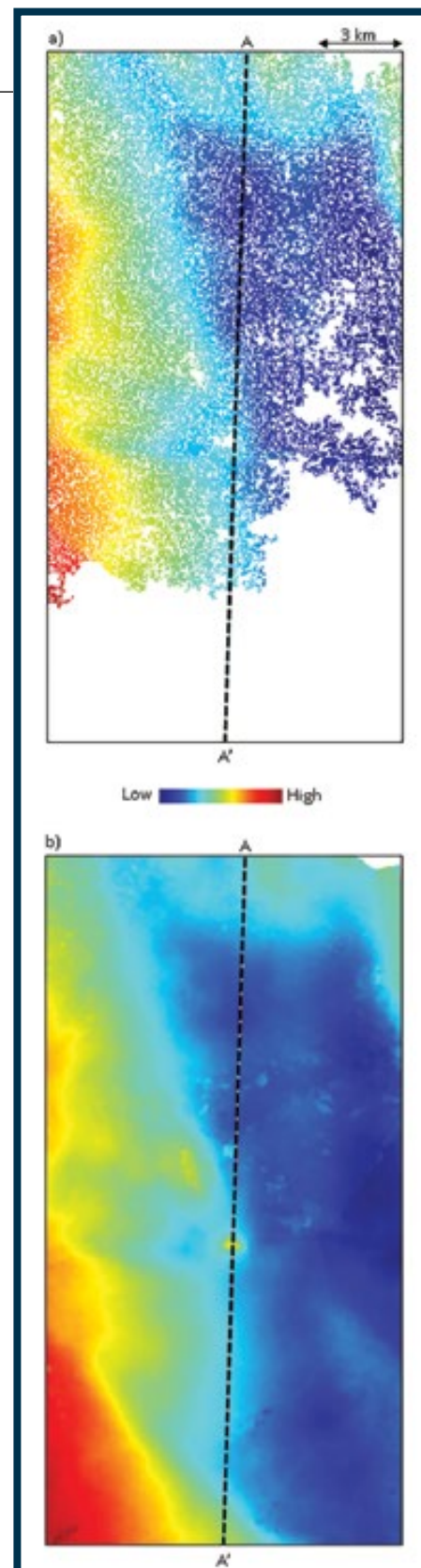


Figure 3 – Segment of a seismic section (crossline) through (a) the input seismic volume after median filtering, (b) the equivalent section through the cosine of instantaneous phase attribute. The prominent horizon in yellow was auto-tracked on the blue trough and is shown on both sections. The zero-crossing at the location of the black arrows and the peak at the location of the cyan arrows cannot be successfully autotracked. In contrast, autotracking works well for these horizons on the cosine of instantaneous phase attribute shown in (d) and then overlaid on the seismic shown in (c). They seem to fit perfectly.

Figure 4 – Auto-tracking attempted on seismic data on the zero-crossing horizon indicated by the black arrows on Figure 3. The lower part of the horizon was not successfully tracked. Similar auto-tracking attempted on cosine of instantaneous phase attribute tracks the horizon completely. Data courtesy of Arcis Seismic Solutions, TGS.



Continued from previous page

may work on strong, isolated reflectors, they may work poorly at the target of interest.

In such cases, the interpreter manually or semiautomatically picks a grid of every 10th or 20th inline and crossline. With this extra guidance, the autotracker will work for much if not most of the survey.

\* \* \*

A question that usually arises is: Why should one pick a zero-crossing if the seismic well tie is a peak or a trough?

If the objective is to map an abrupt change in impedance between thick layers, the well tie usually will be a peak or a trough. If the objective is to map a thin bed, the well tie is usually a zero-crossing.

Our experience has shown that seismic travel time picks are less contaminated with noise along a zero-crossing than along a peak or a trough. Peaks and troughs are locally flat, so a small amount of noise shifts them vertically.

In contrast, zero-crossing occurs where the amplitude changes most rapidly, such that its location is less impacted by low amplitude noise.

Of course, the quality of such horizon displays will depend on the S/N ratio of the data, which certainly can be improved by using structure-oriented filtering or median filtering (see Geophysical Corner, October 2014 EXPLORER).

In figure 1 we show a vertical slice through a seismic amplitude volume with automatic picks made of peaks (in cyan), troughs (in green) and zero-crossings (in yellow).

Notice the resulting time structure maps from the peak and trough picks are noisier than that from the zero-crossing picks. As the input seismic data has random noise on it as it was not conditioned before picking, each of the horizon displays has a jittery appearance.

In figure 2, we show the equivalent segment of the seismic section shown in figure 1, but after application of a structure-oriented median filter. The same horizons are again picked and mapped as before.

Notice the cleaner look of the seismic section as well as three horizon displays.

Needless to mention, horizon-based dip magnitude, dip azimuth and curvature will show even greater improvements.

The take-away from this simple exercise is that horizons could be picked along zero-crossings in preference to peaks or troughs. If the well tie is to a peak or trough, one simply computes the quadrature (also called the Hilbert transform and the imaginary part) of the seismic data, which converts peaks and troughs to  $-/+$  and  $+/-$  zero-crossings.

\* \* \*

Not all geological markers of interest may correspond to a strong peak or a strong trough. Many times a horizon has to be tracked along a weak amplitude peak or trough, where autotracking breaks down.

In such cases the use of seismic attributes has been suggested.

In the November 2004 issue of the Geophysical Corner, an interesting application in terms of the use of the cosine of instantaneous phase attribute for autotracking was discussed. The complex trace attributes serve to examine the amplitude, phase and frequency delinked from each other. The instantaneous phase attribute can be analyzed without the amplitude information, but is discontinuous for both 180 degrees and -180 degrees.

The cosine of instantaneous phase has a

value of unity for both these angles, and so is a better attribute to pick horizons on.

In figure 3a we show a segment of a seismic section, where a strong trough (yellow arrows) has been conveniently autotracked. However, if the zero-crossing corresponding to the blue and black arrows has to be picked, it does not track well.

The equivalent cosine of instantaneous phase attribute section is shown in figure 3b. Horizons are tracked corresponding to the zero-crossings along the blue and black arrows on this data volume (figure 3d) and overlaid on the seismic as shown in figure 3c.

Both the horizons appear to be



CHOPRA



MARFURT

tracked well.

In figure 4a we show the display of the autotracked horizon attempted on the seismic corresponding to the black arrow.

Notice, it is not tracked as a complete surface.

The same

horizon when tracked on the cosine of the instantaneous phase attribute is shown in figure 4b and is seen as a complete, relatively smooth surface.

Most autotrackers internally use a cross-correlation algorithm to compare adjacent waveforms. Weak reflectors can be overpowered by adjacent stronger reflectors as well as by stronger cross-cutting noise.

By balancing the amplitude, the cosine of instantaneous phase attribute minimizes

these interference effects.

Conclusions

If horizons are autotracked along zero-crossings on 3-D seismic traces, they yield smoother surfaces than those picked on peaks or troughs. One therefore can obtain more accurate surfaces by picking zero-crossings on the corresponding quadrature of the original data volume.

Structure-oriented filtering applied to the amplitude data results in less noisy time-structure maps.

In the case of weak reflectors, the application of the cosine of instantaneous phase attribute can help commercial autotrackers perform better.

(Editor's note: AAPG member Kurt J. Marfurt is with the University of Oklahoma, Norman, Okla.)

WELLSITE GEOSCIENCE SERVICES

## When time is money, Wellsite Geoscience is money well spent.

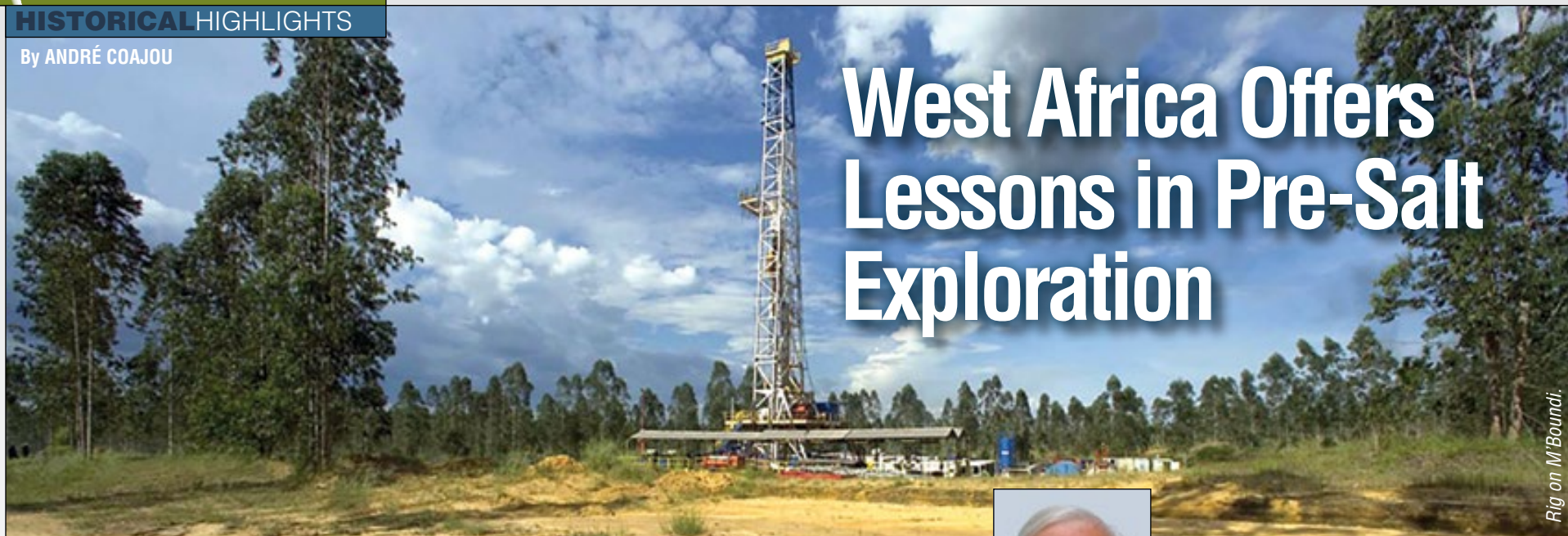
Whether you're exploring a basin, producing a well or completing a shale play, time is money. That's why Weatherford Laboratories brings a suite of formation evaluation technologies right to the wellsite. Utilizing mud gas and cuttings, these technologies provide detailed data on gas composition, organic richness, mineralogy and chemostratigraphy in near real time. As a result, operators now have an invaluable tool to assist with sweet spot identification, wellbore positioning, completion design and hydraulic fracturing. We call it Science At the Wellsite. You'll call it money well spent.

**SCIENCE AT THE WELLSITE™**  
www.weatherfordlabs.com

©2013 Weatherford. All rights reserved.

Formation Evaluation | Well Construction | Completion | Production

By ANDRÉ COAJOU



Rig on M'Boundi.

# West Africa Offers Lessons in Pre-Salt Exploration



COAJOU

AAPG member André Coajou spent most of his career with Elf (now Total), and was instrumental in positioning Elf in the deep offshore, which led to the discoveries of Girasol and Dalia in Angola, and Bonga and Usan in Nigeria. He also was sponsor chair for the 2005 AAPG International Conference and Exhibition in Paris, and won the best poster award in 1995 for the AAPG international conference in Nice, France.

### Pre-Salt Exploration in Congo

The conclusions of a 1982 Elf pre-salt study group on Congo and the South Gabon offshore, which I was leading, were not very optimistic.

Later, Jean-Marie Masset, Elf exploration manager in Congo, proposed the hypothesis that the Grès de base (Vandji) may have better characteristics closer to the basement and started a seismic survey over this area.

This CGG survey (1989) was stopped before its completion as crew members were taken hostage by Cabinda rebels.

Thankfully they were released after several days and a long march in the forest.

Nevertheless, with the few lines recorded, it was possible to define a prospect: Kouakouala, which René Vernet, who succeeded J.M. Masset, decided to drill in 1993. This prospect appeared better defined than the M'Boundi prospect located about twenty kilometers westward.

As anticipated the Grès de base were encountered with fair characteristics – however it remains a modest discovery (15 million barrels reserves).

This success was an incentive to carry on exploration, and new stratigraphic studies run on the Holle 1 well indicated that the poor reservoir quality encountered in this well could be attributed to the Djeno formation – and proved that the Grès de base had not been reached.

The M'Boundi prospect, although not very well defined, started to look interesting.

Nevertheless, Elf – despite the unrisks 80 million barrels stakes – was disappointed by the modest size of

The relatively recent, very large discoveries offshore Brazil have put pre-salt exploration in the South Atlantic back in the foreground.

Pre-salt exploration history, however, is far more ancient and marked with some major successes – but also many failures.

Here's a brief overview of this exploration in West Africa until the M'Boundi discovery, which will be described in detail as it brings some lessons that readers can discover for themselves.

### Problems for Pre-Salt Exploration

It may be useful to explain, with our present knowledge, what makes pre-salt exploration particularly difficult.

Schematically two main plays can be described:

► First we look at the the clastic Chela Congo-Gamba (Gabon) formation, which is linked to the salt formation, acting as a seal, and may function by structural trapping. These sandstones have generally good characteristics and the reserves may be increased by the sands of the Dentale formation, found only in Gabon and deep offshore Congo.

The first major discovery was made onshore Gabon by Shell (1963) with the Gamba field – 50 years and 230 million barrels later it is still in production.

Immediately below the salt we encounter, although less frequently, the Toca formation, a good carbonate reservoir, associated with local preservation following penneplanation of the pre-Gamba formations.

Part of the Takula field in Cabinda, discovered by Gulf in 1971 with the 44-1-X well (about 150 million barrels reserves), is associated with this play.

► Second, there are the older formations, some related to the rift, which have generally poor reservoir characteristics. The traps are either structural (mainly fault related) or stratigraphic.

Within these series only small or sub-commercial fields have been discovered, such as Lucina, M'Bya and Tchibala, offshore Gabon; Mengo, a significant accumulation (1979); and Kundji (1980) onshore Congo, which, before production stopped in 1993, produced fewer than one million barrels.

Exploration of these plays faces many challenges:

► The salt can be a screen for penetration of the seismic waves as well as generating multiples (although these can be removed more easily today) and the varied components of the salt have different velocities that represent complexity for time-depth conversion.

► The seismic quality also is damaged by carbonate turtle back features and dissolution basins.

► In addition, seismic acquisition in rain forest and swamp areas is very expensive.

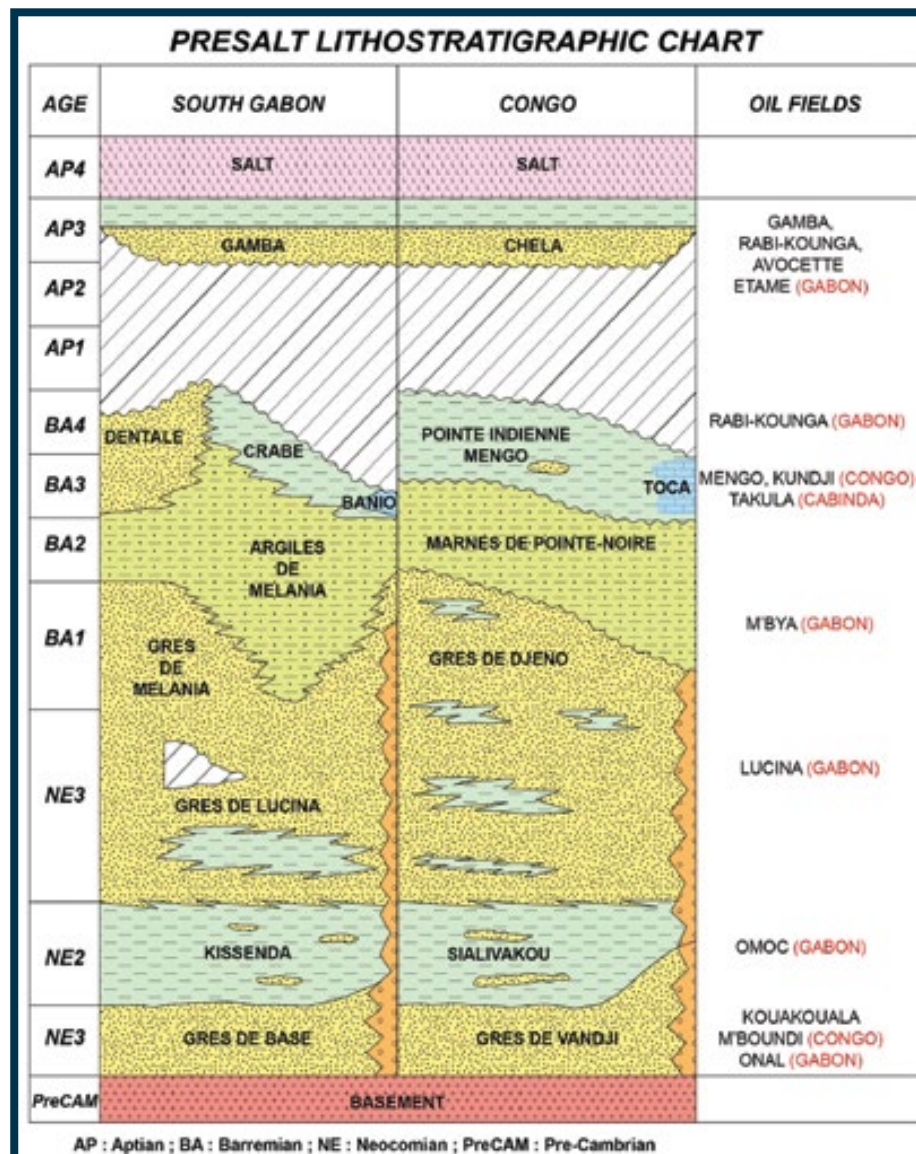
► The existence of excellent quality source rocks, which partially compensates for the rather poor quality reservoirs and sparse trapping, results in effective petroleum systems.

### The Rabi-Kounga Discovery

In 1985, Shell-Elf JV, encouraged by

the Echira discovery (1984) and oil shows on the M'Bari 1 well (1978), drilled the Rabi 1 well. After some appraisal wells the giant Rabi-Kounga field was confirmed onshore Gabon with ultimate reserves of about one billion barrels within the Gamba-Dentale formations.

This discovery was followed by a rush of oil companies, with huge commitments mainly on onshore permits in Gabon as well as in Congo. This activity resulted in dusters or minor discoveries such as Etame (1998) offshore Gabon, when the Rabi-Kounga trend was still a prospective-but-difficult play; Coucal (1987, 70 million barrels); Avocette (1989, 150 million barrels); and Tsiengui (2004).



See M'Boundi, page 56



Congo Gabon map and the main pre-salt oil fields.

# The Gulf of Mexico experts.



PROCESSING CENTERS: HOUSTON, DENVER, OKLAHOMA CITY, CALGARY, RIO DE JANEIRO, PORT OF SPAIN, LONDON, CAIRO, PORT HARCOURT, LUANDA, MOSCOW, DELHI (GURGAON), PERTH

Since introducing the industry-leading RTM and 3D SRME solutions, ION's GX Technology group (GXT) has continued its pioneering research efforts to develop innovative, advanced imaging technologies such as WiBand™, FWI, extended frequency RTM, and more. These technologies, in combination with our geoscientists' experience processing and imaging data from the Gulf of Mexico, make us an ideal candidate for partnering with you to solve your most complex subsalt challenges. To learn more, visit [iongeo.com](http://iongeo.com).

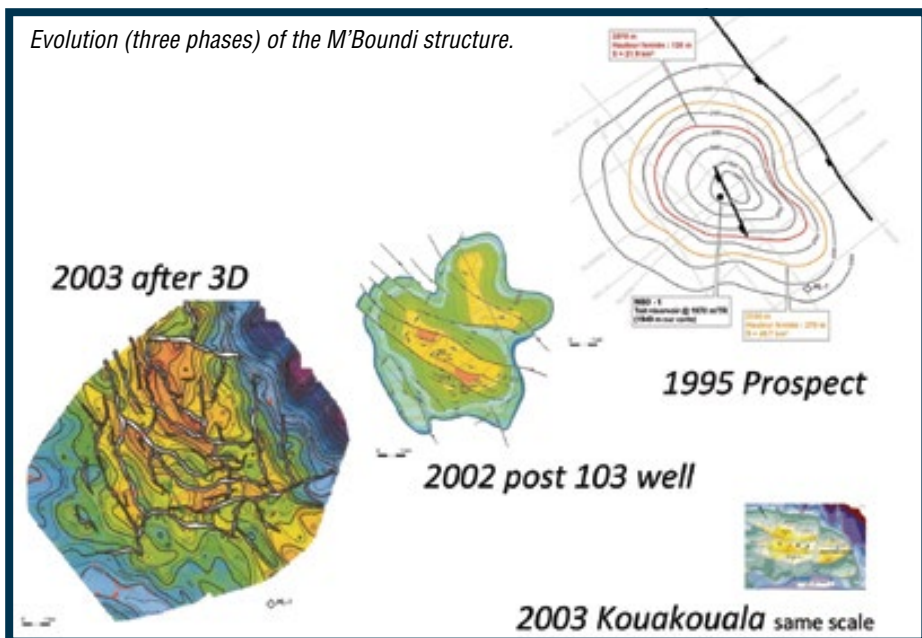
#### AREAS OF EXPERTISE

- Unconventional Reservoirs
- Challenging Environments
- **Complex Geologies**
- Basin Exploration
- Reservoir Exploitation



GX TECHNOLOGY

Evolution (three phases) of the M'Boundi structure.



## M'Boundi from page 54

Kouakouala and the amount of exploration spendings made on this permit, and the company proposed the relinquishment of the La Loeme permit.

At that time Arco, interested in M'Boundi, started discussions with Elf. I had moved from Africa exploration vice president (1987) to vice president-new ventures and negotiations, and I received a phone call from Marlan Downey. I knew Marlan since his time as president of Pecten (the international branch of Shell U.S.), which was a partner of Elf in Cameroon, where I had been previously exploration manager (1983).

Marlan was now Arco E&P president. He proposed that M'Boundi could be drilled without additional seismic that would have

been equally as expensive as the well.

But he did not succeed in convincing Elf, which relinquished the permit in 1995.

### The Maurel & Prom Period

Jean-François Hémin, CEO of Maurel et Prom, wished to transform this shipping and trading company into an oil company.

After the Elf relinquishment, Kouakouala and the Kouilou permit (including the former La Loeme permit) were granted to an African businessman, who later sold some interests to Heritage and Tacoma, two junior companies. In 1999 Maurel & Prom joined the J.V. and became the operator. Maurel & Prom had a budget for only three wells, two on Kouakouala, as they wanted to start early production by truck.

M'Boundi 1 was spudded in May 2001. The rig Maurel et Prom contracted was in a poor condition; the drilling difficult and longer than forecast. Maurel & Prom being short of cash, was tempted to stop the operations in what, some thought, to be conglomerates close to the basement.

Peter Mey, the Maurel & Prom geologist who had taken the permit with Philippe Labat, operations manager, realized that on Kouakouala 1, a carbonate layer was present above the Grés de base, and this layer had not yet been reached in the well.

The technical team managed to convince Jean-François Hémin that drilling should continue, and after crossing the prognosed carbonate layer the well encountered the Grés de base with a 130-meter oil column! The reservoirs were better developed and better still than on Kouakouala. The reservoir could not be logged to TD, but the well was tested (1,400 bopd).

After the discovery, Daniel Pélerin, who had just joined Maurel & Prom, managed to acquire a 3-D survey on the field in 2002, which enabled accurate field definition. The relatively smooth structure mapped by Elf in 1995, modified in 2002 after the first three wells (101 to 103), transformed into a larger structure consisting of tilted blocks inherited from the Barremian rift.

The reserves were estimated at one billion barrels OIP – far larger than the initial Elf estimations. However, the complexity of the field with various compartments made production and water injection difficult.

After an initial production without water injection, Maurel & Prom decided to sell the field to ENI, which took over operatorship in 2007. This is another story ...

To date about 130 million barrels have been produced (and only five million barrels on Kouakouala).

At the same time Maurel & Prom was positioning itself along the basement in Congo and Gabon. This strategy led to the Onal discovery and some satellite fields in Gabon, south of Lambarene in the Grés de base, as well as Omoc, within the Kissenda formation (Djéno equivalent), and the Loufika discovery close to Kouakouala in Congo, in the Pointe Indienne formation.

All these successes were modest, as well as the others drilled by the Industry both onshore and offshore Gabon.

### Conclusions

Pre-salt exploration in West Africa has had euphoric periods followed by disappointments.

The post M'Boundi period has not yet been brilliant. However the large pre-salt discoveries in the deep offshore Brazil have encouraged similar exploration in West Africa, with some successes already in Angola (Cameia), Gabon (Diaman) and in Congo, with the Néné discovery in 50-meter water depth.

## Two Great Events and Growing Stronger

**95%**

would recommend URTeC to a colleague\*

"Highly successful blend of technical papers, individual speaker sessions and excellent exhibition"\*

**97%**

overall satisfaction with URTeC\*

URTeC 2014 attracted a record 5,000 petroleum engineers, geoscientists and other energy professionals collaborating on all things unconventional under one roof.

\*2014 URTeC survey response

## Plan to Participate in URTeC 2015

The integrated event for unconventional resource teams

**UNCONVENTIONAL**  
RESOURCES TECHNOLOGY CONFERENCE  
FUELED BY SPE • AAPG • SEG [URTeC.org](http://URTeC.org)

20-22 JULY 2015 • SAN ANTONIO, TEXAS • HENRY B. GONZALEZ CONVENTION CENTER

- A superior quality science and technology event attended by more than 5,000 professionals
- An integrated conference developed by an interdisciplinary program committee comprising engineers, geophysicists and geologists
- One of the industry's most interactive networking forums for companies and individuals across all segments of the unconventional market

SUBMIT ABSTRACTS AT [URTeC.org](http://URTeC.org)







# National Hydrocarbons Corporation

Head Office : P.O.BOX 955 Yaounde, Cameroon - Tel : (237) 22 20 19 10 - Fax: (237) 22 20 98 69

**INTERNATIONAL CALL FOR THE EXPRESSION OF INTEREST N°01/AMI/SNH/14 OF THE 25<sup>th</sup> August 2014 FOR THE PRESELECTION OF ENTERPRISES WISHING TO PARTICIPATE IN THE RESTRICTED INTERNATIONAL CONSULTATION FOR THE SPATIAL GRAVITY MAPPING BY GPS OF THE MAMFE AND GAROUA/KOUM SEDIMENTARY BASINS IN CAMEROON**

### 01.SUBJECT

The National Hydrocarbons Corporation (SNH) hereby launches a Call for the Expression of Interest to enterprises or institutions wishing to participate in the restricted international consultation for the spatial gravity mapping by GPS of the Mamfe and Koum/Garoua sedimentary basins in Cameroon.

### 02.CONTEXT AND JUSTIFICATION

The National Hydrocarbons Corporation of Cameroon (SNH), which has as main mission to manage State interest in the oil and gas sector, is empowered to participate in petroleum activities undertaken in the coastal basins (Cameroon's littoral), in the intracratonic northern basin as well as Mamfe basin in the South West. The present oil production originates essentially from the offshore fields situated in the coastal basins (Rio Del Rey, Douala/Kribi-Campo).

In view of the implementation of its oil and gas exploration/production policy in the northern zone and in the South West, of which the geology is still relatively unknown compared with the coastal basins, SNH envisages to draw up a spatial gravity mapping by GPS of the Mamfe basin, South West of Cameroon, and Garoua/Koum basin in North Cameroon, with the assistance of a specialized enterprise or institution.

The project to Map the intracratonic northern basins (Garoua/Koum) and Mamfe basin in the South West, will mostly consist in the acquisition, processing and interpretation of intensity variation data derived from space gravity by GPS, with a view to drawing up maps characterizing the abovementioned sedimentary basins. The said maps will facilitate knowledge of the aforementioned sedimentary basins in view of oil and gas exploration.

### 03.TERMS FOR PARTICIPATION

The Terms of Reference of services the envisaged by SNH within the framework of this Call for the Expression of Interest may be consulted at the Petroleum Information Centre of SNH in Yaoundé or on the SNH Website: [www.snh.cm](http://www.snh.cm).

### 04.PARTICIPATION

Participation in this Call for the Expression of Interest is opened to enterprises or institutions specialised in spatial gravity mapping by GPS.

### 05.DOCUMENTS AND PRESENTATION OF FILES FOR THE EXPRESSION OF INTEREST

The file for the Expression of Interest shall comprise two envelopes labelled as "Envelope A" and "Envelope B":

#### a) Envelope A: Administrative File

**Name and Profile of the enterprise:** The Bidder must give its full company name (including complete address, telephone, fax, e-mail, etc.), as well as the names of officers in charge of its activities.

#### b) Envelope B: Technical File

- **Technical Experience:** The Bidder must provide written evidence of the enterprise's appropriate professional experience in the execution of similar or envisaged mapping works.
- **List of material and equipment for spatial gravity mapping by GPS:** The Bidder must produce the list of material and equipment he intends to use in the execution of the envisaged mapping works.
- **Project Key Personnel:** The Bidder must produce the list of names, together with detailed curriculum vitae (qualifications, professional experience) of key personnel he intends to assign to the execution of the envisaged spatial gravity mapping by GPS.

Envelopes A and B mentioned above, presented separately and labelled as such, shall be placed in another sealed envelope and labelled as follows:

« To the attention of the Executive General Manager of the National Hydrocarbons Corporation

**CALL FOR THE EXPRESSION OF INTEREST N°01/AMI/SNH/14 OF THE 25<sup>th</sup> AUGUST 2014 FOR THE PRESELECTION OF ENTERPRISES WISHING TO PARTICIPATE IN THE RESTRICTED INTERNATIONAL CONSULTATION FOR THE SPATIAL GRAVITY MAPPING BY GPS OF THE MAMFE AND GAROUA/KOUM SEDIMENTARY BASINS IN CAMEROON- CONFIDENTIAL – TO BE OPENED ONLY DURING THE OPENING SESSION. »**

### 06. EVALUATION OF BIDS

#### ❖ Elimination criteria

1. Incomplete administrative documents or false statements;
2. Failure by the enterprise to produce professional references in the domain of spatial gravity mapping;
3. Mark of technical file below seventy five over one hundred (75/100).

#### ❖ Essential Criteria

N°	Criteria	Points
1	Professional references of the enterprise in the execution of the envisaged or similar spatial gravity mapping by GPS works or similar (attach copies of contracts, evidence of proper execution of works, works acceptance reports, etc.): • Number of justified references >= 5 : 30 points • 3 <= Number of justified references < 5 : 25 points • 1 <= Number of justified references < 3 : 15 points • No references : 0 point	40
2	Total turnover of the enterprise, over the past ten years, in the execution of the envisaged spatial gravity mapping by GPS works or similar (attach copies of contracts, evidence of proper execution of works, works acceptance reports, etc.): • Total turnover >= 100 million CFA francs: 20 points ; • 75 <= Total turnover < 100 million CFA francs: 15 points; • 50 <= Total turnover < 75 million CFA francs: 10 points ; • 5 <= Total turnover < 50 million CFA francs: 5 points	20
3	Qualification and experience of the key personnel the enterprise intends to assign to the execution of the spatial gravity mapping by GPS (attach their Curriculum Vitae) : • Presence of at least two Geoscientist : 25 points ; • Presence of one Geomatician (computer science applied in geography) : 10 points	35
4	Presentation of the technical file • Presence of chapters relating to the 4 essential criteria mentioned above: 3 points • Presence of a summary : 0,5 point • Paging of document : 0,5 point • Binding/Document's binder : 0,5 point • Page setting/Formatting : 0,5 point	5
<b>Total mark of technical file</b>		<b>100</b>

### 07. SUBMISSION OF FILES

The files, drafted in French or English, in six (6) copies including one (1) original, must be sent in a sealed envelope to the Secretariat of the Executive General Manager of SNH, P.O. Box 955 Yaoundé, Tel.: (00) 237 22 20 98 64, Fax: (00) 237 22 20 98 69, latest on the 1<sup>st</sup> of December 2014 at 12:00 am prompt local time.

# Trustees Gather for Wine, Rocks, Southern Charm

By APRIL HASTINGS, AAPG Foundation Program Coordinator

Sometimes, it IS a good idea to mix business with pleasure. Members of the AAPG Foundation Trustee Associates met for the group's annual meeting recently at the Barton Creek resort in the foothills of Texas Hill Country in Austin, Texas.

The group has gathered annually since the early 1970s, offering members a chance to enjoy the special kind of camaraderie inspired by their shared love of giving back while providing a chance to explore various areas of the United States.

This year, Chairman Jay Henthorne and his wife, Mary Beth, invited not only the AAPG Foundation Trustees but also members of the SEG Trustee Associates to join the fun.

Highlights this year, in addition to the business matters that are routinely discussed, included:

- ▶ A talk given by AAPG member Bob Esser, formerly with Cambridge Energy Research, titled "U.S. Gas and Oil Markets: The Winter Polar Vortex Alters the Landscape."

- ▶ A day-long geologic field trip led by AAPG Honorary member Pete Rose and his colleague, Chock Woodruf, titled "Geology, Frontier History and Wineries of the Hill Country Appellation, Central Texas."

The tour included stops at three lovely vineyards throughout the Hill Country area for tour-goers to sample the best varietals in the state. The stops focused

on the vintner sharing history of the vineyard, as well as information about the geology behind their grape production.

Those along for the ride could track their path with a road-log detailing the geology and historical events along the route.

- ▶ Several outings exploring historic neighborhoods, the state Capitol Building and the beautiful Umlauf Sculpture Garden.

Barton Creek is quaintly described as a place where "southern charm meets Texas style." The Trustee Associates and their guests enjoyed catching up with old friends, meeting new ones.

The group's next meeting will be Sept. 9-12 at the Broadmoor Hotel in Colorado Springs, Colo. [E](#)



Trustee Associates pause at the Hoover Point Overlook and gaze across Lake Lyndon B. Johnson toward exhumed Precambrian erosion surface, Llano Uplift.



Trustee Associates gathered at the Barton Creek resort in Austin.

## MILITARY VETERANS SCHOLARSHIP PROGRAM

Helping Veterans Enter the Geosciences



### The Military Veteran's Scholarship Program will provide financial aid to veterans returning to school.

This program will aid veterans who are seeking undergraduate and graduate degrees in the geosciences – specifically those whose studies and/or research has application to the search for and development of petroleum. Their real world experiences, leadership skills and motivation are a perfect match for today's demanding geoscience world – including the potential to be positive role-models and nurturers for their younger student peers.

### Contribute Today

Your donation will leave a lasting impact on veterans who share your passion for the geosciences.

*"As a veteran, I know firsthand the challenges associated with transitioning from the military to a career as a petroleum geoscientist. The AAPG Foundation's Military Veterans Scholarship seeks to make the transition a little easier, and to help meet our industry's future challenges by bringing these outstanding young men and women into our ranks."*

**Earl Wells**, Deepwater GOM/JI, ExxonMobil US Production

*"Military veterans have performed a priceless service to our country. The AAPG Foundation's Military Veterans Scholarship Program will help give them the support they need as they pursue their education in the geosciences. We will count ourselves fortunate as these talented men and women earn their degrees, enter our profession and contribute to finding, developing and producing the energy our world needs."*

**Dave Lawrence**, AAPG Foundation MVSP supporter



## GeoCare Open Enrollment Available

A new open enrollment opportunity, available for a limited time, will be offered starting this month by AAPG's GeoCare Benefits Private Medical Insurance Exchange.

Those looking for insurance or hoping to research alternative coverage can use the service to help them navigate the healthcare exchange waters.

Starting Nov. 15 and continuing through Feb. 15, 2015, you can enroll in a new plan – or make changes to your existing coverage – without exclusions for any pre-existing conditions.

Coverage will be effective Jan. 1.

GeoCare officials suggest this is a good time to examine your current coverage or healthcare needs.

Have you been paying more out of pocket than you expected?

Are you unsure of what level of benefits you really need?


The GeoCare Private Medical Exchange provides a marketplace where members can choose from multiple plan designs, options and premium rates available in your state from a variety of insurance companies. The Exchange employs fully licensed agents, readily available to chat with online or over the phone, to answer any questions or help walk you through the enrollment process.

To ensure that members are assisted in any way necessary without a hitch during open enrollment, the Exchange will have additional agents available and as last year, hours will be extended to accommodate late in the day and weekend enrollment or questions.

Go to [geocarebenefits.com/aapg](http://geocarebenefits.com/aapg) and click on "Members' Private Medical Insurance Exchange" to start researching plans, or call 877-739-7845 to talk to an agent and get your profile started over the phone.

Once you've logged onto the Exchange and established your profile, any plans researched can be saved so you can come back any time without feeling as though you are starting over.

Individuals also may qualify for special enrollment periods outside of open enrollment if they experience certain qualifying events, such as moving to a new state, certain changes in your income and changes in your family size (for example, if you marry, divorce or have a baby). If you are in the need of new healthcare coverage today, visit the Members' Private Exchange for an easy, hassle-free way to get your new healthcare insurance.

For more information on the program, go to [geocarebenefits.com/aapg](http://geocarebenefits.com/aapg). 

### Foundation Contributions for September 2014

#### General Fund

Alireza Akbarzadeh  
Robert J. Ardell  
*In memory of Ted Ashford*  
Alexander E. Booth  
Ritesh K. Chauhan  
Susan C. Cochran  
Peter U. Diebold  
Gordon E. Duffy  
Maher M. Elasmir  
Ursula Hammes  
Lee Higgins  
Bill and Carolyn Holland  
*In memory of Crandall Jones, Hank Hill and James Dean*  
Curtis C. Humphris Jr.  
Elizabeth Johnson  
Robert R. Jordan  
John L. Kamm  
Christopher J. LaFonte  
Thomas J. Liner  
Carlos E. Macellari  
Pierre A.A.H. Masson  
Andrew J. McCarthy  
Michael N. Michaelides  
James C. Musgrove  
J. David Overton  
Richard E. Paige  
Robert J. Raulston  
Frank Ryan  
Patrick J. Ryan  
Thomas J. Schull  
Jayne L. Sieverding  
Shell Oil Co. Foundation  
*Matching gifts/Hilary J. Brook and C. Scott Cameron*  
Bernard Smith  
Gary T. Tautkus  
Jennifer D. Taylor  
Emilio Jose Torres Parada  
Qingming Yang

Bashir M. Zakari

#### Digital Products Fund

W. Richard Moore  
*In memory of W. Dow Hamm*

#### Texas Christian University

Maher M. Elasmir

#### Universidad Industrial de Santander

Emilio J. Torres Parada  
University Subscriptions

#### Distinguished Lecture Fund

Jon P. Herber  
Richard D. Nehring  
*In memory of Amos Salvador and Bill Stanton*  
Education Fund  
Robert J. Ardell  
*In memory of Ken Masters*  
Thomas M. Parris

#### Grants-in-Aid Fund Grants-in-Aid Committee Named Grant

Kevin J. Keogh  
Rhonda A. Welch  
Dhreama R. Burford  
Paul H. Dudley Jr.  
*In memory of Kenneth Masters*

#### Nancy Setzer Murray Memorial Grant

Donald L. Hansen  
Raphael A.J. Wust

#### Robert K. Goldhammer Memorial Grant

Peter A. Emmet  
Ursula Hammes

#### Weimer Family Named Grant

Gretchen M. Gillis  
*In honor of the Weimer family*

#### William E. and Jean Crain Named Grant

Donald W. Downey  
*In memory of Bryan R. Bracken*

#### James A. Hartman Student Leadership Summit Fund

Chevron Humankind  
*Matching gifts/Richard Ball and Douglas Hill*

#### Military Veterans Scholarship Fund

Heather S. Anderson  
David W. Burge  
ConocoPhillips Corporate Contributions  
*Matching a gift given by Charles Feazel*  
Bill and Carolyn Holland  
*In memory of Crandall Jones, Hank Hill and James Dean*  
Ernest and Dorothy LaFlure  
Philip M. Mobbs  
Thomas C. Neal  
Walter C. Riese  
Wolfgang E. Schollinger  
Shell Oil Co. Foundation  
*Matching gifts/Hilary J. Brook and C. Scott Cameron; In honor of Elle Marie Schollinger*  
Robert C. Strauss

*The monthly list of AAPG Foundation contributions is based on information provided by the AAPG Foundation office.*

# GRANTS-IN-AID

## Helping students like Jenna

Jenna Shelton has her eyes on the future – and her future includes a career in enhanced energy recovery.

Jenna is currently pursuing her Ph.D. in Environmental Engineering Science at Colorado School of Mines, and one aspect of her research uses produced gas isotopes to track how carbon dioxide is stored in a CO<sub>2</sub>-miscible enhanced oil recovery project at Whiting's North Ward Estes Field in Wickett, Texas.

And what's making this research possible?

Jenna is one of four recipients of a John and Erika Lockridge Named Grant this year.

Receiving this grant is the fuel she needs to complete her dissertation. Thanks to the AAPG Foundation, Jenna's foundation for a future as a geoscience professional is off to a solid start.

That's good news for Jenna, who plans to complete her Ph.D. in 2016, and continue her R & D work, seeking novel ways to extract oil from spent reservoirs while also reducing CO<sub>2</sub> emissions.

And that could be good news for the world's energy future, too.



Visit the AAPG Foundation website for more information on how to donate or apply for Grants-in-Aid or support other students like Jenna.

[foundation.aapg.org](http://foundation.aapg.org)

## AAPG Geosciences Technology Workshops 2015 Asia Pacific Region

### Modern Depositional Systems as Analogues for Petroleum Reservoirs

21-23 April 2015 | Wellington, New Zealand

Make plans to attend AAPG's first GTW in New Zealand.

**Preliminary program outline:**

1. Terrestrial settings and systems
2. Coastal and shallow marine settings and systems
3. Deep marine settings and systems
4. Application of modern depositional system analogues to petroleum exploration, appraisal and production

**Confirmed Keynote and Technical speakers include:**

Bruce Ainsworth (Chevron); Charles Paull (Monterey Bay Aquarium Research Institute); John McPherson (SED & RQ Pty Ltd), Joe Lambiasi (Chulalongkorn University), Philip Barnes (NIWA), Greg Browne (GNS Science).

Optional Field Trip to Wairarapa and Optional Core Workshop set for 23 April (Day 3).

**Who should attend?**

Geoscience professionals engaged in exploration, appraisal, development and production of clastic oil and gas reservoirs; researchers and academics interested in sedimentary and petroleum geology; reservoir modellers.

**For more information please email:**

Adrienne Pereira, Programs Manager, AAPG Asia Pacific (apereira@aapg.org)

For more information on AAPG Asia Pacific Region events, visit our website:

**asiapacific.aapg.org**

### INMEMORY

**Teddy R. Ashford, 84**  
Dallas, Sept. 1, 2014  
**Robert J. Bourrouilh, 76**  
Talence, France  
July 16, 2014  
**Bryan R. Bracken, 57**  
San Ramon, Calif.  
Aug. 10, 2014  
**Richard C. Dalton, 71**  
Houston, Sept. 25, 2014  
**Rene P. Kuijper, 64**  
Leiden, Netherlands  
Sept. 2, 2014

**Scott B. McDaniel, 62**  
Leawood, Kan.  
June 11, 2014  
**Emil Onuschak Jr., 78**  
Wilmington, Del.  
June 24, 2014  
**Arthur J. Pyron, 60**  
Pottstown, Pa.  
July 30, 2014  
**Carroll D. Shearer, 65**  
Las Vegas, June 26, 2014

### Energy Choice from page 66

re-considering their option for politically and environmentally safe and economically sensible sources of energy. There are 44 reactors under construction in China.

Russia and India also are gearing up to begin new construction, and five new plants are under construction in the United States. More than 40 other sites are either under consideration or in design stages, all amounting to over 600 planned to be operational worldwide within the next 30 years, and earlier if the new standard design reactors are adopted.

With the anticipated demand for uranium fuel, the uranium prices have begun to rise, which naturally sparks uranium company exploration, mergers and acquisitions, and new mining and processing plants coming on-line in the United States, Australia, Canada, Kazakhstan and an increasing number of locations throughout the world, with early activities beginning to explore off world on the moon and Mars by China and India – and just recently the United States.

Coal may even become useful in time for more than burning to produce electricity. A new Carbon Age is dawning using "clean coal," after all, and is no longer just an oxymoron, but many industrial and academic researchers have visions of coal becoming germane economically and environmentally sound. Products of carbon will become widespread in the foreseeable future, both on Earth and off world.

\* \* \*

In our function to monitor what is going on these days in the energy arena, the EMD Uranium Committee has concluded that natural gas and nuclear power will dominate energy sources for decades to come, both of which likely will replace


coal, while wind and solar will continue to be tested to determine if they can have a significant place in the energy picture (after government subsidies are removed), and whether they can be scaled up to meet the needs in other than remote areas away from national power grids and to meet the operation and maintenance demands of their moving parts.

Climate change issues will re-enforce the domination of the two energy sources; however, there is some recent evidence that with increasing temperatures come increasing methane releases from the deep sediments offshore, which may even have a more serious impact on the climate than CO<sub>2</sub> releases.

But by moving away from burning coal, the transition to additional nuclear power systems in the form of either large-scale plants or in the form of small modular reactors that will soon be coming down the road on a trailer truck or railroad car, will finally come into their own, driven by the merits of their economy and outstanding safety record. The transition from burning coal to other reliable energy sources (like natural gas and nuclear power) will likely be slow because industry cannot change quickly unless companies are placed on an emergency footing.

However, a large number of coal-fired plants are still in the planning stage for construction in the United States. Such changes in our energy usage may not become widespread in this decade, but they certainly will be apparent in the decades beyond.

Competition between energy sources is a good thing as long as it is based on economics and environmental factors.

We must not let biases scare us, stampede us and turn us toward one extreme or another in making our decision on energy sources. 

(Editor's note: Michael Campbell is chair of the EMD Uranium (Nuclear and Rare Earth) Minerals Committee.)

## SAVE THE DATES

AN AAPG GEOSCIENCES TECHNOLOGY WORKSHOP

### International Shale Plays

28-29 April 2015 – Houston, TX

All shale plays are different, and all shale plays shed light on other shale plays. Join experts to discuss world shale plays and share the "lessons learned" in dealing with a wide variety of lithologies, reservoir conditions, and degrees of heterogeneity. Find out the "must have" technologies and the emerging ones that are helping identify sweet spots, improve drilling and completion, and to return to the laterals and optimize the reservoir by launching a strategy of stacked pays and "stranded pay capture." Join experts who will share their experience and research findings in plays in Argentina, Colombia, China, Australia, Mexico, and other countries. We will compare them to analogues in North America with the goal of improving success rates in exploration, and optimizing production from existing and new reservoirs.



[aapg.org/career/training/in-person/workshops](http://aapg.org/career/training/in-person/workshops)

A JOINT AAPG-STGS GEOSCIENCE TECHNOLOGY WORKSHOP

### Fourth Annual Eagle Ford Shale

9-11 March 2015 - San Antonio, TX

The Eagle Ford is by no means uniform, and understanding just why, where, and how it produces is of critical importance as we enter new phases of the exploration and development. Join us to learn how to best identify areas of differential enrichment and accessible porosity, and exactly how to use new technologies to detect fracture networks, sweet spots, ideal pressure, to develop effective drilling and completion programs within existing plays, and to push the frontier in the Mexican equivalents of the Eagle Ford. Learn how new drilling and completion techniques are being used to reduce costs and to optimize production. Key words: fractures, pressure, geochemistry, whipstocking, proppant and fluid program design, stimulation.



[aapg.to/eagleFord2015](http://aapg.to/eagleFord2015)



## MEXICO Geological Framework and Petroleum Resources

Ten Multi-Client Reports are Available to the Industry that Cover:

- Geology and Basin Framework per a Synthesis of >5500 Publications
- Reservoirs, Traps, Source Rocks, and Development History of Trends
- Compiled Information on 640 Fields and 1600 Exploration Wells
- Digital Maps of Topography, Geology, Fields, Wells, and Data Sites
- Published Regional Seismic Data • Outcrop Locations and Analyses
- Rock Petrographic, Biostratigraphic, and Organic Geochemical Studies
- Richness, Burial History, and Maturation Modeling of Source Rocks
- Cross Sections • Paleogeographic and Plate Tectonic Summaries

Presented in 76 Volumes and in Digital and GIS formats

Tap into 35 Years of Experience from the Rio Grande to Guatemala

Blair & Associates LLC Boulder CO 303-499-6005 [tblair@aol.com](mailto:tblair@aol.com)



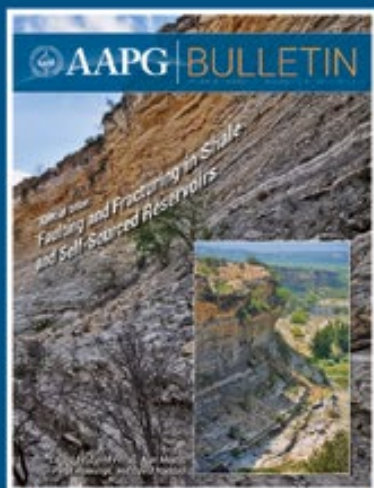
## Faulting and Fracturing in Shale and Self-Sourced Reservoirs

Editors: David A. Ferrill, Alan P. Morris, Peter H. Hennings and David E. Haddad

Production from self-sourced reservoirs relies on natural and induced fracturing for permeability and conductance of hydrocarbons to the producing wellbores, thus natural or induced fracturing is often a key to success in unconventional reservoir plays. On the other hand, fractures may compromise seals and large or well-connected fractures or faults may cause undesirable complications for unconventional reservoirs.

Understanding the occurrence and controls on natural and induced faulting and fracturing in self-sourced reservoirs is a key component for developing effective approaches for exploiting self-sourced reservoirs. As has commonly happened in the past, the role of faulting and fracturing has either been ignored or unrecognized until problems arise – often during production.

The contributions in this special issue of the AAPG Bulletin are valuable in providing the impetus to recognize, quantitatively characterize, and implement reservoir development and management practices that take these important reservoir elements into account.



Product Code: 1260  
 Publisher: AAPG  
 Release Date: November 20, 2014  
 Member Price: \$35.00  
 Non-member Price: \$45.00  
 (plus shipping/handling)

Purchase at [store.aapg.org](http://store.aapg.org)

To see complete list of papers in this issue, visit [aapg.org/publications/journals/bulletin](http://aapg.org/publications/journals/bulletin)



The AAPG Bulletin is a technical journal that is recognized in the industry as the leading peer-reviewed publication for information on geoscience and the associated technology of the energy industry.

# IRESS 2015

## Industry-Rice Earth Science Symposia



### New Geological Targets, Technologies, and Challenges: Our Continuing Dialogue with Industry

**March 11-12, 2015**

**Grand Hall • Rice University  
Houston, TX USA**

#### Technical topics include

- New plays in Mexico, Columbia, and Venezuela
- Seismic Imaging and Interpretation
- Petrophysics
- Carbonates
- Gas Hydrates

#### Also will include

Energy Vision Discussion with Industry Leaders, Rice EEI, and Rice Baker Institute

#### EVENING SPEAKER

**John B. Anderson, Ph.D.**

W. Maurice Ewing Professor of Oceanography  
Rice University



Wiess School of Natural Sciences  
Energy and Environment Initiative

**Register online now [iress.rice.edu](http://iress.rice.edu)**



CORPORATE SPONSORS

#### CLASSIFIED ADS

##### POSITION AVAILABLE

##### Tenure-Track Faculty Position Sedimentology The University of Alabama Department of Geological Sciences

The Department of Geological Sciences at The University of Alabama invites applications for an Assistant Professor tenure-track faculty position in sedimentology beginning August 2015. Candidates must have a strong record of research and teaching, and must have received their Ph.D. in Geosciences at the time of appointment. The successful candidate will be expected to establish an externally-funded research program, attract and supervise graduate students, and teach undergraduate and graduate courses in sedimentology/stratigraphy, and introductory geology. The department has a broad range of isotopic, geochemical and modeling research facilities available, in addition to University-shared instrumentation at the Central Analytical Facility ([www.caf.ua.edu](http://www.caf.ua.edu)). Details regarding existing research programs, equipment, facilities, and departmental activities are at [www.geo.ua.edu](http://www.geo.ua.edu).

Questions should be directed to Dr. Delores Robinson ([dmr@ua.edu](mailto:dmr@ua.edu)). Go to: <http://facultyjobs.ua.edu/postings/35994> to electronically apply. When submitting an application, candidates must provide a cover letter, CV, research and teaching statements, and a list with the contact information for at least three referees. Review of applications will begin November 17, 2014.

The University of Alabama is an Equal Opportunity Affirmative Action Employer and actively seeks diversity in its employees.

##### Tenure-Track Faculty Position Seismic Stratigraphy The University of Alabama Department of Geological Sciences

The Department of Geological Sciences at The University of Alabama invites applications for a tenure-track faculty position in seismic stratigraphy, beginning August 2015. The position will be filled at the Assistant Professor level. Candidates are invited to apply who have specialties within the broad field of seismic stratigraphy. Energy industry experience is a plus. It is expected that this position will enhance our existing faculty research areas in geophysics, sedimentology, basin analysis, and petroleum geology. Candidates must have a strong record of research and teaching, and must have received a Ph.D. in geology, geophysics, or a related field, at the time of appointment. The successful candidate will be expected to establish a vigorous, externally funded research program and attract and advise high-quality graduate students. Teaching responsibilities will include undergraduate and graduate courses in her/his specialty and introductory geology. The department has a broad range of geophysical, geochemical, and computational facilities, in addition to University shared facilities, including the Dauphin Island Sea Lab. Departmental software includes industry standards such as ProMAX, Petrel, IHS Kingdom, Geosoft, ArcGIS, and Matlab. Details regarding existing research programs, equipment and facilities, and departmental activities can be found at <http://www.geo.ua.edu>.

Questions should be directed to Dr. Ibrahim Çemen ([icemen@as.ua.edu](mailto:icemen@as.ua.edu)). Applicants should go to <http://facultyjobs.ua.edu/postings/36000> to electronically apply for this position. When submitting an application, candidates must provide a cover letter, CV, research and teaching statements, and a list with the contact information for at least three referees. Applications will be reviewed beginning November 17, 2014.

The University of Alabama is an Equal Opportunity Affirmative Action Employer and actively seeks diversity in its employees.

##### Assistant Professor – Sedimentary Geoscience – Weber State University

The Department of Geosciences at Weber State University invites applications for a tenure-track position at the Assistant Professor level starting August 2015. We seek

a person with expertise in applied/emerging areas of sedimentary geoscience (e.g. basin analysis, depositional systems, sedimentary geochemistry, carbon sequestration, energy resources).

For a more detailed position description and to apply, please go to <http://jobs.weber.edu>. All applicants must complete the online application, which includes uploading a cover letter, statement of teaching philosophy and research plans, CV, and unofficial transcripts. In addition, three letters of reference addressing the candidate's qualifications for this position must be mailed to Dr. Rick Ford, Search Committee Chair, Department of Geosciences, Weber State University, 1415 Edvalson St. Dept 2507, Ogden, UT 84408-2507. Applications received by December 5, 2014 are guaranteed full consideration, although screening will continue until the position is filled.

Weber State University is an affirmative action, equal opportunity employer. Women and minorities are encouraged to apply. EOE/M/F/Vet/Disability. A criminal background check is required as a condition of employment.

\*\*\*\*\*

##### Associate Sedimentologist or Sedimentologist (depending on qualifications)

**Illinois State Geological Survey  
Prairie Research Institute  
University of Illinois at Urbana-Champaign**

The Illinois State Geological Survey (ISGS) is part of the Prairie Research Institute (PRI) at the University of Illinois at Urbana-Champaign which is centrally located between Chicago, St. Louis, and Indianapolis. PRI houses five large scientific surveys covering a wide range of expertise including biology, water resources, climate, geology, sustainable technology and archaeology. The ISGS is a premier state geological survey, with over 200 scientists and technical support staff, serving the needs of the public, government, and industry with earth science information and research relevant to natural resources, environmental quality, economic vitality, and public safety. The University is a land-grant institution that provides access to world-class laboratory and academic facilities, Big Ten athletic events, and internationally acclaimed cultural opportunities.

We are seeking an individual to fill one position to plan, coordinate, and conduct basic and applied research related to bedrock geology and industrial minerals. Characterize sedimentary rocks with a focus on the lithostratigraphy and sequence stratigraphy utilizing sedimentology, biostratigraphy, chemostratigraphy, and bedrock geologic mapping. Serve as principal investigator, lead research and projects, and perform tasks in that capacity, including management and production of projects, grants, contract reports and other deliverables. Master's degree in sedimentology-stratigraphy or related discipline. Ph.D. is highly preferred. A minimum of 5 years related industry and/or research experience post master's degree. Research experience in sedimentology-stratigraphy (both carbonates and silicilastics) including lithostratigraphy, sequence stratigraphy, chemostratigraphy, and other related field as applied to stratigraphic correlation and basin analysis. The successful individual's qualifications will determine the level to which he/she is appointed.

Applications must be received by January 9, 2015. To apply, please visit <https://jobs.illinois.edu/academic-job-board> to complete an online profile and to upload a 1) cover letter, 2) résumé/CV, 3) the names and contact information (including e-mail addresses) of three professional references. All requested information must be submitted for your application to be considered. Incomplete information will not be reviewed.

For further information please contact Lori Walston-Vonderharr, Human Resources, Illinois State Geological Survey, at [lwalston@illinois.edu](mailto:lwalston@illinois.edu) or 217-244-2401.

The University of Illinois is an EEO Employer/Vet/Disabled <http://inclusiveillinois.illinois.edu/>.

See Classified Ads, page 64

12<sup>TH</sup> ANNUAL  
**World-Class Education Conference** HOUSTON, TEXAS  
 MARCH 2-6, 2015



**Courses Include:**

- ▶ Deepwater Reservoir Connectivity
- ▶ Exploration for Deep-water Sands Using Seismic Sequence Methodology
- ▶ Carbonate Reservoir Geology: Understanding Depositional and Diagenetic Factors Controlling Porosity
- ▶ Carbonate Depositional Systems
- ▶ Microbial Carbonate Reservoir Characterization
- ▶ Basic Seismic Interpretation
- ▶ Seismic Amplitude Interpretation
- ▶ 3D Seismic Attributes for Unconventional Resources
- ▶ Discovery and Recovery Thinking in Shales
- ▶ Introductory Geochemistry for Condensate-rich Shales and Tight Oil
- ▶ Log Analysis of Shaly Sand Reservoirs
- ▶ Log Analysis of Hydrocarbon-Bearing "Shale" Reservoirs

Hosted by:

**Norris Conference Center**

816 Town & Country Lane, Suite 210  
 Houston, TX 77024

Phone: 713-590-0950  
 Fax: 713-590-0961

*(Special AAPG Group Rates at Nearby Hotels)*

**Registration and Information**

Call AAPG toll free in the U.S. and Canada at 888.338.3387 or 918.560.2650  
 F: 918.560.2678 • E: educate@aapg.org  
 W: [www.aapg.org/career/training/in-person/education-conference](http://www.aapg.org/career/training/in-person/education-conference)

# Upcoming Education Courses

**SHORT COURSES**

- Last Chance!** **Nov. 10-13, 2014**  
Houston, TX  
 Fall Education Conference
- Practical Salt Tectonics **Dec. 8-11, 2014**  
Houston, TX
- Unconventionals Update (with IPTC meeting) **Dec. 8-9, 2014**  
Kuala Lumpur, Malaysia

**E-SYMPOSIA**

- Multiscale Modeling of Gas Transport and Storage in Shale Resources **Dec. 2, 2014**  
2 pm, CDT

**ONLINE CERTIFICATE COURSES**

- Biomass Energy Basics: A Renewable Energy Certificate Course  
*(self-paced – course begins on the first day of each month)*
- Geothermal Energy Basics: A Renewable Energy Certificate Course  
*(self-paced – course begins on the first day of each month)*
- Renewable & Non-Renewable Resources – Overview & Integration  
*(self-paced – course begins on the first day of each month)*
- Solar Energy Basics: A Renewable Energy Certificate Course  
*(self-paced – course begins on the first day of each month)*
- Wind Energy Basics: A Renewable Energy Certificate Course  
*(self-paced – course begins on the first day of each month)*
- Five-course set – Online Renewable Energy Certificate Courses  
*Save when you sign up for all five of the above courses at the same time!*
- Giant Oil & Gas Fields  
*(self-paced – course begins on the first day of each month)*
- Introduction to Shale Gas  
*(self-paced – course begins on the first day of each month)*
- Unconventional Resources  
*(self-paced – course begins on the first day of each month)*

[www.aapg.org/career/training/](http://www.aapg.org/career/training/)



**AAPG**

World-Class Education Conference 2015

March 2-6, 2015 - Houston, Texas



**AAPG**

Education



**Marshall-Heape Chair, Solid-Earth Geophysics**

The Department of Earth and Environmental Sciences at Tulane University invites applications for the newly established Marshall-Heape Chair in Geology, in the Department of Earth and Environmental Sciences at Tulane University. We seek a scholar with an outstanding international reputation who will be appointed at the Full Professor level with tenure. We particularly seek a broad-based geoscientist with a research focus in Solid-Earth Geophysics, who complements current faculty expertise and offers potential for collaborative research. The Marshall-Heape Chair is expected to lead a widely recognized, externally funded research program that will attract PhD-level graduate students and postdoctoral scholars of the highest caliber. Teaching duties are both at the graduate and undergraduate levels. For full consideration, applications should be received by January 15, 2015, but the position will remain open until filled. Applications should include a curriculum vitae, research and teaching statements that articulate how the mission of the department would be enhanced, and the names and contact information of at least three references. Applications must be submitted electronically via the following link: [apply.interfolio.com/27240](http://apply.interfolio.com/27240). Any inquiries may be directed to Dr. Torbjörn Törnqvist, Department of Earth and Environmental Sciences, Tulane University, 6823 St. Charles Ave., New Orleans, LA 70118-5698 ([tor@tulane.edu](mailto:tor@tulane.edu)). Further information about the department and university can be obtained at <http://tulane.edu/sse/eens>. Tulane University is an EEO/ADA/AA employer.



**WESTERN STATE  
COLORADO UNIVERSITY**  
PETROLEUM GEOLOGY

**Rady Chair in Petroleum Geology**

Western State Colorado University invites applications for the Rady Chair in Petroleum Geology. The Rady Chair is made possible by a generous endowment from the Paul M. Rady Family Foundation. The successful candidate will work with the department to recruit students into the petroleum geology program, place students in professional jobs and internships, and develop industry support for the program. Teaching responsibilities include undergraduate courses in petroleum geology with an emphasis on subsurface mapping, log analysis, seismic interpretation and workstation techniques. The successful candidate will also teach courses in the geology core curriculum that support the petroleum emphasis.

Significant experience in the oil and gas industry is required. The ideal candidate should have a broad range of experience within the oil and gas industry, including significant time spent at a major oil company and experience working in the independent sector. Candidates must possess a strong commitment to undergraduate education as well as demonstrable teaching excellence. The successful candidate will demonstrate the ability to serve as the chief liaison between the program and industry partners.

Screening begins November 15. To view details of the position and to apply, visit [western.edu/jobs](http://western.edu/jobs). Please direct questions regarding the position to Dr. Allen Stork: [astork@western.edu](mailto:astork@western.edu).

[western.edu/petroleumgeology](http://western.edu/petroleumgeology)

**Classified Ads**  
from page 62

**Department of Geosciences  
Western Michigan University**

**Tenure-Track Faculty Position  
Sedimentary Geology: Sedimentary Basin  
Analysis, Sedimentology and Stratigraphy**

The Department of Geosciences at Western Michigan University is a growing center for geologic and environmental research, and invites applications for a tenure-track faculty position in Sedimentary Geology; with emphasis in sedimentary basin analysis, sedimentology, and/or stratigraphy/sequence stratigraphy beginning August 2015. The position will be filled at the Junior Faculty level (Assistant/Associate Professor). Candidates should have a strong record of research and teaching, and must have received their Ph.D. in Geology, or a related field, at the time of appointment. The successful candidate will assist in enhancing the diversity on campus through demonstrated commitment to diversity and inclusion.

The successful candidate expected to establish a vigorous externally-funded research program in the field of Sedimentary Geology is central to the successful applicant's professional responsibilities. Professional responsibilities also comprise teaching undergraduate and graduate classes including, but not limited to: Historical Geology, undergraduate and graduate courses in sedimentology and stratigraphy. Industry experience related to subsurface geology is advantageous since this experience has been important in attracting and supervising graduate students.

The Department has a strong tradition of both applied and basic Geosciences research highlighted by work in the areas of Environmental Geology/Hydrogeology, Geochemistry/Isotope Geochemistry, Tectonics, Remote Sensing, and Sedimentary Geology/ Sedimentary Basin Analysis. Research with a focus on applied geosciences through the years in Michigan has resulted in the development of the Michigan Geological Repository for Research and Education (MGRRE), the premier subsurface geological research and data repository for studies related to the Michigan basin, and the recent transfer (through legislative initiative) of the Michigan Geological Survey to Western Michigan University.

The Department of Geosciences at Western Michigan University (one of the top-100 public universities in the United States) is fully committed to the priorities of a "discovery driven, learner centered, and globally engaged" university. The department is one of the most research active units at WMU, has a substantial student population, confers BS, Masters and PhD degrees, and supports the general education mission of the College of Arts and Sciences and the University.

The Carnegie Foundation for the Advancement of Teaching has placed WMU among the 76 public institutions in the nation designated as research universities with high research activities.

Please visit [www.wmujobs.org](http://www.wmujobs.org). The appointment process at Western Michigan University requires that each applicant submit a comprehensive vita or set of placement credentials and arrange for the transmittal of at least three recent letters of recommendation. Expected start date is Fall 2015. Open until filled.

WMU is an Affirmative Action/Equal Opportunity Employer consistent with applicable Federal and State Law. All qualified applicants are encouraged to apply.

\*\*\*\*\*

**CLIMATOLOGY AND ENERGY  
GEOPHYSICS POSITIONS AT BINGHAMTON  
UNIVERSITY**

Binghamton University will make two tenure-track appointments in the broad area of geophysics starting Fall, 2015. We seek outstanding candidates with research and

teaching interests in climatology and energy geophysics. Appointments are planned at the assistant professor level, however exceptionally qualified applicants may be considered for a higher level appointment.

Position 1: Climatology (Geophysical Fluid Dynamics)

We anticipate hiring a climatologist who employs geophysical fluid dynamics to study global scale energy exchange within the Earth System. Possible research areas might include: (1) past, present and future climate change; (2) understanding modern climate systems to interpret paleoclimate archives preserved in ice and sediments, and to predict future climate changes; (3) the dynamics of sea-level changes as ice sheets respond to changing energy levels in the atmosphere and oceans; (4) impact of climate variations on renewable energy resources; and (5) impacts of climate change on ecosystems and human health. Geophysicists with other research areas in the broad field of climatology are also encouraged to apply.

Position 2: Energy Geophysicist

We anticipate hiring an energy geophysicist, with expertise in the exploration of Earth's shallow subsurface structure and composition. We are particularly interested in geophysicists familiar with the acquisition and processing of seismic data and other geophysical tools for the interpretation of rock structures and sequences in sedimentary basins. This hire will likely collaborate with current faculty working on basin analysis, tectonics, and sedimentary processes. Possible research areas might include: (1) advanced seismic imaging; (2) attribute analysis to differentiate lithologic and fluid variability in sedimentary sequences to better understand processes leading to hydrocarbon or ore accumulation; (3) documenting the sequence of events and rates of tectonic and sedimentological processes; and (4) 3D analysis of sedimentary sequences.

The successful candidates must develop and sustain nationally recognized, externally funded research programs in their areas. We also expect the candidates to develop a strong record of teaching and mentoring students and to teach undergraduate courses in geophysics and advanced undergraduate/graduate level courses in their areas of expertise. We are seeking candidates who will strengthen our existing research programs in geochemistry, sedimentary geology, or Earth surface processes, and who will seek to interact with geologists, environmental scientists, chemists, physicists and engineers on the Binghamton University campus. Candidates must have a Ph.D. with a focus in these fields, at the time of appointment. Interested candidates should submit a letter of application, curriculum vitae, statements of research and teaching interests, and names and contact information of at least three references to the Binghamton University Interview Exchange site at <http://binghamton.interviewexchange.com>. For further information about the department, visit the Geological Sciences and Environmental Studies website ([www.geology.binghamton.edu](http://www.geology.binghamton.edu)). For questions about the Climatology position, contact Professor Steve Dickman ([dickman@binghamton.edu](mailto:dickman@binghamton.edu)); for questions about the energy geophysics position, contact Professor Bob Demicco ([demicco@binghamton.edu](mailto:demicco@binghamton.edu)).

These positions are affiliated with the Smart Energy Area, one of five Transdisciplinary Areas of Excellence (TAEs) that Binghamton University has identified for growth under the auspices of the SUNY2020 plan. The successful candidate will contribute to the development of this TAE as an area of intensive research and teaching. The search committee will include members of the Smart Energy TAE steering committee. For more information on the TAEs [and SUNY2020], go to <http://www.binghamton.edu/tae/>. Women and minorities are encouraged to apply.

Binghamton University is an equal opportunity/affirmative action employer. The position will remain open until filled. The review of applications will begin on November 30, 2014.

**Continued on next page**



**Continued from previous page**

**Stephen F. Austin State University:  
Chair, Department of Geology**

The Department of Geology at Stephen F. Austin State University invites applications for the department chair position. We seek an individual with strong management, communication, and interpersonal skills to provide innovative and energetic leadership. Duties include managing curricula, budgets, student enrollment, personnel, program assessment, and developing strong, mutually beneficial relationships with industry and alumni. The incumbent will teach a reduced load of courses and develop a research program in his/her area of expertise. Applicants must have credentials for appointment at the associate or professor rank in geology.

Submit a letter of application, CV, and contact information for three references to <https://careers.sfasu.edu> (posting 0603046). Also mail official transcripts to:

Dr. Kenneth Farrish, Search Committee  
Chair Stephen F. Austin State University  
Department of Geology  
PO Box 13011 SFA Station  
Nacogdoches, TX 75962-3011  
(936) 468-3701

Review of applications will begin on Jan. 9 and will continue until the position is filled. Equal Opportunity Employer; Security-sensitive position; this position will be subject to a criminal history check.

See more at: <http://www.aapg.org/career/jobs/classifieds/ad/articleid/10656/stephen-f-austin-state-university-chair-department-of-geology#sthash.A35MrGe8.dpuf>

\*\*\*\*\*

**Director, Enhanced and Improved  
Oil Recovery Institute**

The Wyoming Enhanced and Improved Oil Recovery Commission and the School of Energy Resources at the University of Wyoming invite nominations and applications for the position of Director, Enhanced and Improved Oil Recovery Institute (EORI). The EORI is a well-established organization, which is currently undergoing a re-examination of the organization's focus in carrying out its statutory duties to the State of Wyoming. The Director, with the guidance of the Wyoming Enhanced and Improved Oil Recovery Commission (Commission) and the School of Energy Resources (SER) will collaboratively develop the new focus for EORI, develop an implementation plan and subsequently manage its deployment. The Director will report administratively to the Director of SER and interact directly with the Commission for guidance. Compensation will be commensurate with experience.

Required qualifications include a science or engineering degree and at least 10 years of experience in the oil and gas industry. The complete position announcement and desired qualifications can be viewed on the EORI website: <http://www.uwyo.edu/eori/>.

To apply, please email cover letter, resume and a minimum of three professional references to Rob Hurlless, at [rhurlless@uwyo.edu](mailto:rhurlless@uwyo.edu). Position is open until filled.

The University of Wyoming is an Equal Employment/Affirmative Action employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, disability or protected veteran status or any other characteristic protected by law and University policy. Please see: [www.uwyo.edu/diversity/fairness](http://www.uwyo.edu/diversity/fairness). We conduct background investigations for all final candidates being considered for employment. Offers of employment are contingent upon the completion of the background check.

**MISCELLANEOUS**

**SAMPLES TO RENT**

International Sample Library @ Midland – Formerly Midland Sample Library. Established in 1947. Have 164,000 wells with 1,183,000,000 well samples and cores

stored in 17 buildings from 26 states, Mexico, Canada and offshore Australia. We also have a geological supply inventory.

Phone: (432) 682-2682  
Fax: (432) 682-2718

\*\*\*\*\*

Strengthen the confidence in your horizontal well geologic interpretation with SES! SES is technical GEOSTEERING SOFTWARE trusted by geologists everywhere. Free trial, online training, and class training available.

[www.makinhole.com](http://www.makinhole.com)  
Stoner Engineering LLC.

\*\*\*\*\*

StarSteer – the Premier Geosteering Software Solution for the Oil & Gas Industry. Scientific, Modern and Interactive. Integrates all your data for ideal well placement.

[www.rogii.com](http://www.rogii.com)

**GEOLOGICAL & OIL INDUSTRY IMAGES**

Custom Photography by an  
**Experienced Geologist & Photographer**  
Landscapes - Rock Formations - Nature Scenery

**Local and International Assignments**

[cbartolini@internationalshot.com](mailto:cbartolini@internationalshot.com)  
Sample images at: [www.internationalshot.com](http://www.internationalshot.com)



**The University of Oklahoma**

**The University of Oklahoma invites applications for the position of  
Dean, Mewbourne College of Earth & Energy who will also hold the Lester A. Day Chair.**

**DUTIES AND RESPONSIBILITIES:** The Dean of the College and Lester A. Day Chair is the chief academic officer of the Mewbourne College of Earth & Energy with an ongoing commitment to energy education and research. This individual provides leadership for all academic and research programs and has responsibility for the growth and success of the college. The Dean reports directly to the Senior Vice President & Provost of the Norman Campus. He/she is expected to work collaboratively with colleges across the University to deliver world-class general education for students, to foster and grow exemplary research programs within the college's academic departments, schools and programs, to develop innovative curricula, and to provide outstanding service to the State of Oklahoma.

The college includes the Mewbourne School of Petroleum & Geological Engineering (ABET accredited), the ConocoPhillips School of Geology & Geophysics, and the Oklahoma Geology Survey (<http://www.ou.edu/mcee>). The Dean oversees the budgets of all these units and oversees the academic degree programs and curriculum within the college. The Dean leads meetings of the faculty, college executive committee, and the college's Board of Visitors. The Dean will hold a tenured academic appointment within an appropriate division in the college.

**QUALIFICATIONS:**

- An earned doctorate in a relevant field or equivalent experience, including proven leadership
- A distinguished record of scholarly and/or professional accomplishments
- Demonstrated record of strong, visionary leadership and sound fiscal management with the ability to grow the prominence and performance of the college
- Ability to work collaboratively with diverse groups of students, faculty, staff, and alumni, as well as local, state, national, and international stakeholders
- Ability to engage the oil and gas industry and federal agencies to support research and educational programs

**OTHER INFORMATION:**

**College:** Established in January 1, 2006, the Mewbourne College of Earth & Energy is committed to energy education and research. The college provides an academic environment for the development of tomorrow's academic and industry leaders that includes the University's robust general education curriculum while providing close ties to engineering fundamentals and the scientific base in geology and geophysics. The college focuses on laboratory "hands-on" instruction and is an academic leader for end-to-end energy education and research. Distinguished faculty, exceptional students, and state-of-the-art research and instructional laboratories are the bedrock of the college.

The college is home to the first schools of Petroleum Geology and Petroleum Engineering and has more graduates from these programs than any other in the world. Record gifts from alumni have fueled remarkable achievements that include petroleum engineering, petrophysics, reservoir geomechanics, and frontier shale laboratories; an interactive drilling and well-control simulator; and the Bartell Geology and Geophysics Field Camp in Colorado.

The college is housed within Sarkeys Energy Center, which comprises a seven acre, 340,000 square foot teaching and energy research complex located in the northeast corner of the Norman Campus. The building includes more than 200 laboratories, thirty classrooms, faculty, and administrative offices. The building also includes the Lawrence S. Youngblood Energy Library which holds over 200,000 references, books, and maps related to geological topics. It is the largest geological reference library in the world.

The college's name honors Curtis W. Mewbourne, a Shreveport, Louisiana native who obtained his degree in petroleum engineering from OU. After serving as an officer in the U.S. Army and working as a petroleum engineer, he founded Mewbourne Oil Company in 1965. In recognition of his longtime support, the University named the Mewbourne School of Petroleum & Geological Engineering in his honor in 2000, granted him the Doctor of Humane Letters in 2002, and in 2007 named the newly formed college the Mewbourne College of Earth & Energy. He was presented the Oklahoma Trailblazer Award for his professional achievement and lifetime commitment to the University.

Since the establishment of the college, student enrollment has increased from about 450 to approximately 1,300 in the fall of 2014. While the majority of this increase has been in undergraduate petroleum engineering students, geosciences has also experienced notable increases in both undergraduate and graduate students. The college has responded by continuing to upgrade and expand key instructional facilities, in particular classrooms and teaching labs.

The faculty of the Mewbourne College of Earth and Energy also maintains a robust research program, with a good mix of more basic research combined with applied research targeting energy. This includes government-sponsored research such as NSF and DOE grants, along with industry specific programs, included several long-standing and successful industry consortia in various areas of geoscience and petroleum engineering. During the past five years, the Mewbourne College of Earth and Energy has consistently ranked among the top five colleges at OU in research expenditures.

**University:** Founded in 1890 before Oklahoma Statehood, The University of Oklahoma (<http://www.ou.edu>) is the state's flagship university, with its main campus in Norman, its Health Sciences Center campus in Oklahoma City, and the Schusterman Center in Tulsa. The University is comprised of fifteen colleges and enrolls 27,000 students, including approximately 3,800 graduate students. OU is in the midst of unprecedented growth with a total endowment exceeding \$1 billion. OU is classified as a Very High Research University by the Carnegie Foundation and generated over \$174 million in research expenditures across all campuses in 2013. OU received the Association of University Research Parks (AURP) 2013 Outstanding Research Park Award. OU ranks first in the nation among public universities in National Merit Scholars enrolled. In the past 12 years OU has more than quadrupled the number of endowed faculty chairs and professorships.

**Nominations and Applications:** The University of Oklahoma invites letters of nomination, applications (letter of interest, complete Curriculum Vitae, list of references), or expressions of interest to be submitted in electronic or paper form to the Chair of the Search Committee, Joseph Harroz, Jr., Dean, OU College of Law. Review of the materials will begin immediately and continue until the appointment is made. Applicants will be notified prior to the search committee soliciting letters of reference.

Nominations, applications and inquiries should be directed to: **Joseph Harroz, Dean, OU College of Law or Lisa T. Ross, Executive Assistant to the Dean, 300 Timberdell Road, University of Oklahoma, Norman, OK 73019-4004. Email: [jharroz@ou.edu](mailto:jharroz@ou.edu) and [lross@ou.edu](mailto:lross@ou.edu)**

*The University of Oklahoma is an equal opportunity institution. [www.ou.edu/eoo](http://www.ou.edu/eoo)*

# Introducing the AAPG Research Showcase

By DAVID CURTISS

Innovation, according to Merriam-Webster's definition, is "the introduction of something new, a new idea, method or device." It sounds simple enough. And in retrospect it often looks simple, too.

But the reality is the process of innovation is full of uncertainty, false starts and failure. It demands a level of determination and faith that balances on a knife's edge between genius and foolishness.

It sounds an awful lot like exploration. And as we've shown throughout this issue of the EXPLORER, innovation is at the heart of the process of finding and producing oil and natural gas.

Here at AAPG we've also been talking about innovation, and how we as an Association can best achieve our principal purpose of advancing the science of geology – particularly as it relates to petroleum, natural gas and other subsurface fluids and mineral resources.

We already provide many outlets for geoscientists to share their knowledge and experiences. That happens at conferences and symposia, in journal articles and special publications.

Our Geosciences Technology Workshops typically include plenty of time for interactive discussion on a given topic. And our invitation-only Hedberg conferences are specifically designed to bring together groups of experts to help facilitate deeper understanding and breakthroughs on a particular theme.

But we've been looking for ways to expand this activity and to breathe new life into geoscience research by broadening the conversation, cutting across the traditional industry/academic divide and facilitating the pursuit and development of new geological insights and understanding that help our community of professionals find more oil and natural gas.

Enter the AAPG Research Showcase, a brand new program we're unveiling at the



CURTISS

It's my belief that we need a new model for funding geoscience research.

upcoming 2015 Annual Convention and Exhibition in Denver.

Located in a dedicated area in the exhibition hall, the AAPG Research Showcase will feature current or proposed research projects from scientists from around the world. We're planning to have hard-wall panels for them to post information about their projects and a small theater where they will have an assigned time to present their proposals.

We're hoping researchers from universities, institutes, industry, consultancies, research consortia, government laboratories and "think tanks" all will choose to participate.

But the purpose of their presentations is not to talk about what research they've already done – that work is presented in the technical talks and poster sessions.

Instead, they'll be talking about the research they are planning to do, and how the listener can get involved.

\* \* \*

There are a few criteria for the kinds of projects we're looking for:

► First, the proposed research should be seeking to provide answers that will help geoscientists find and produce oil and natural gas.

This could, for example, include development of a new way to model

hydrocarbon generation in source rocks, better predict reservoir behavior during development or a region-scale prospectivity assessment or basin evaluation in a frontier area.

There's a lot of room to be creative, but the bottom-line is the research you propose should have an application to E&P.

► Second, the research project you're presenting should have a specific proposal.

What are you trying to accomplish? Who is planning to do the study? Have you scoped a budget for this project? What do you need to be successful?

Perhaps you're looking for scientific collaborators – other researchers whose expertise complements your own – to conduct this study. Alternately, you may have already assembled a research dream team and are still seeking financial support necessary to do the study.

We're looking to create a forum where you can find other people interested in your project.

► Finally, you should be willing to engage in a market place of ideas to promote the best in geoscience research.

Are you willing to present this proposal and take feedback on how to improve it and perhaps modify your approach so that it can proceed?

It's my belief that we need a new model

for funding geoscience research.

In many countries, the government funding available to support academic research, and particularly the research for masters and doctoral students, is drying up. And yet without this research ecosystem and infrastructure how can we train and equip the oil and gas industry's next generation workforce?

Industry has a strong track record of supporting academic research that is useful and relevant to its needs. In the AAPG Research Showcase we're hoping to stimulate the conversations between academic scientists and industry practitioners to dramatically expand this cooperation.

\* \* \*

As we try to innovate here at AAPG, I'm reminded of the 19th century investor and businessman Thomas Alva Edison. The legend has it that Mr. Edison suffered many, many failures on his path to developing a stable, long-lasting incandescent light bulb, an invention that transformed the modern world.

So, please provide us feedback as we launch this new initiative.

How can we ensure that it is valuable both for the presenter and the audience?

How can we help you expand your network, find collaborators and perhaps get your project funded – all in the pursuit of advancing our science?

Be a part of the new AAPG Research Showcase. Because when it comes to geoscience research funding, we need a better light bulb.

## DIVISIONS REPORT: EMD

# Notoriety Notwithstanding, Nuclear Revival is Under Way

By MICHAEL D. CAMPBELL

Nuclear power, because of its use for both peaceful and military purposes, causes angst among some people – and produces fuel for those with other purposes, albeit competing energy sources, religion or politically belligerent politics.

As nuclear power was being developed in the 1970s in the United States, the Three Mile Island incident occurred (in March 1979; no one was killed or irradiated outside the plant, although two workers were burned with hot water). Accidents happen occasionally with any industrial activities, but media reports of the incident panicked us all into retreating from nuclear power because of the fear of radioactivity.

Then, the Chernobyl disaster (within a dual military-commercial reactor with serious design flaws) occurred a few years later, which caused us to retreat even further from using nuclear power to generate electricity. Heroic workers and fireman trying to control the fire lost their lives. And, nearly 4,000 children subsequently contracted thyroid cancer (almost 99 percent of them have recovered after treatment).

After years of debate and re-evaluation of the event's impact, the merits of nuclear power emerged again from the plethora



CAMPBELL

Competition between energy sources is a good thing as long as it is based on economics and environmental factors.

of emotional adversaries to demonstrate its usefulness on the basis of its economic viability and on its actual safety record. After decades passed, and because of economic necessity, nuclear plant construction began again, this time to replace older reactor models and to begin installing improved nuclear power plants.

But then again, in 2011, an earthquake off Japan's coast created tsunamis that created havoc and caused the death of thousands of people, and which also flooded and damaged the backup power supply system that was designed to run the water pumps to keep the fuel rods cool at the plant in Fukushima.

Absent the power to the pumps, the core

of fuel rods overheated and was exposed while the water boiled away, and hydrogen gas collected in the building. The gas was ignited by an electrical spark, creating the explosion that demolished the plant building and contributed to releasing radioactive material to the surrounding areas. But no one has been killed because of radiation.

After many months of sampling the region, the general conclusions have been reached by the scientific community that although radiation was released it was not widespread. More importantly, the level of radiation reportedly didn't reach dangerous levels except near the plant.

Also, the world revisited the safety features of the more than 435 reactors

(especially those built along coastlines), and have redesigned the back-up power systems to avoid such failures in the future. One design even included a small nuclear reactor installed underground onsite to provide emergency power, if needed.

\* \* \*

Over the past year or so we have observed strong evidence that nuclear power is into a new expansion period.

Japan has realized that it must re-start most of its existing nuclear power plants because they need economic power supplies (wind, solar and geothermal sources have not been shown to be economic or scalable). The existing plans are now being equipped with new systems to withstand earthquakes and any tsunamis of the magnitude anticipated in the future.

The United States, United Kingdom, Brazil, Bolivia, India, Vietnam, Poland, Jordan, Egypt and the UAE have begun to build, and Saudi Arabia and other Middle Eastern countries are considering nuclear as the energy of choice. Even Germany is

See Energy Choice, page 60



# clearer views.

See Seismic Data in your future projects  
to maximize productivity.

## call Seitel. drill Smart.

Make Seismic part of your vision for success by licensing data from the largest onshore library in North America. Our services will broaden your view and assist in providing the insight you need to ensure smart drilling decisions. Partner with us on your new venture and see the difference for yourself.

- Quality 2D and 3D seismic
- Acquisition management
- Fast-track processing
- Pre-stack depth migration
- Azimuthal analysis
- EarthStudy 360
- Multi-Component Processing
- 5D Interpolation

seitel.com



Visit seitel.com often to see our acquisitions in progress, and seize the competitive edge by being the first to license our latest data.

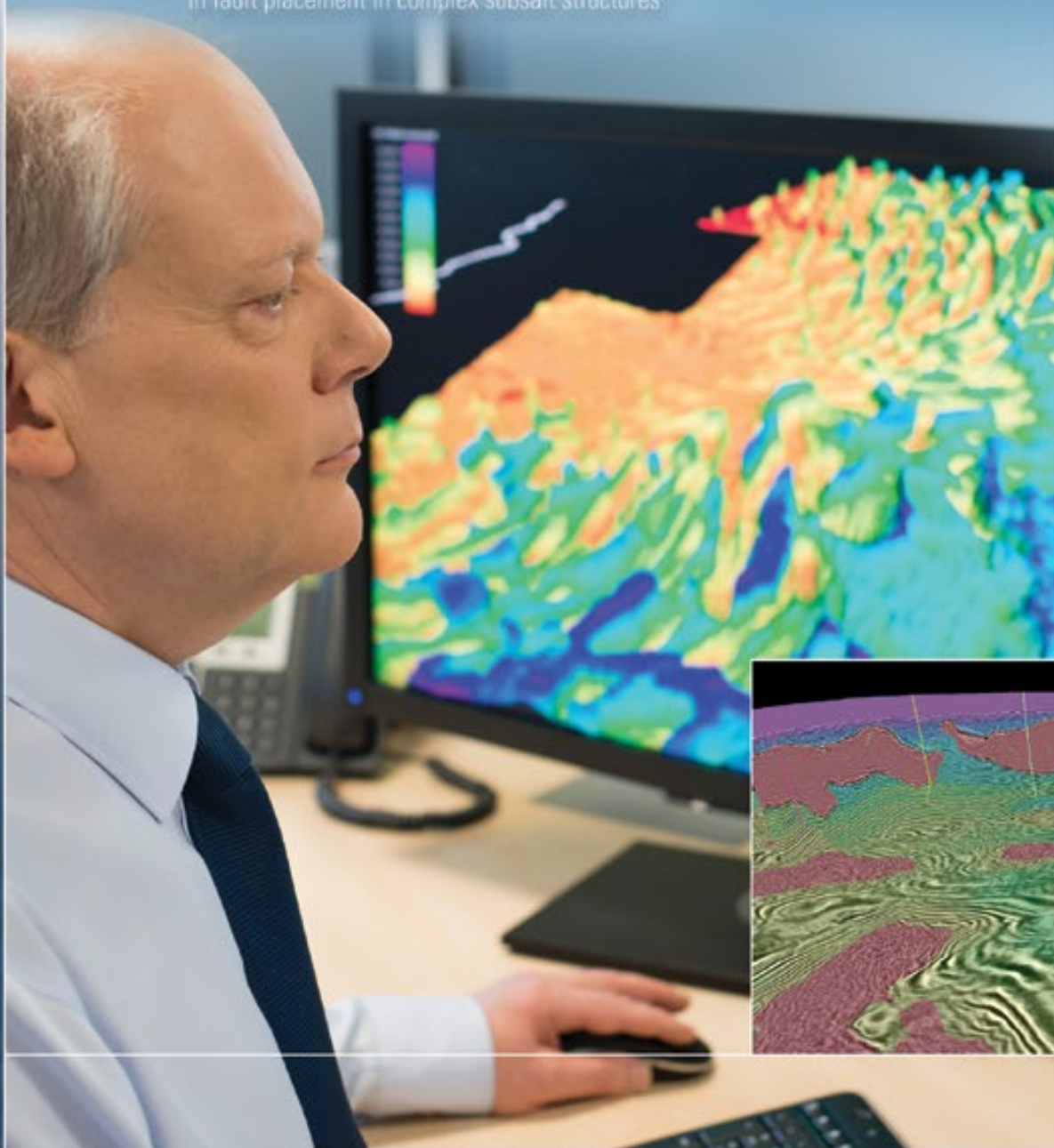


“IMPROVED IMAGING  
of Stampede field”

“ENHANCED DEFINITION  
of unseen reservoir sand delineation”

“INCREASED CONFIDENCE  
in fault placement in complex subsalt structures”

**Multicient**



## We make the data. You make the news.

Nobody knows where the next exploration success is going to be, but recent operational successes in the Gulf of Mexico, including the Stampede field and other complex subsalt structures, have Schlumberger multicient data at the heart of the story—from discovery to field development.

Decades of experience form the foundation of our multicient team’s petrotechnical knowledge. Together with the latest acquisition and processing technologies, our experts collaborate with you to identify the best opportunities in the most promising areas.

Write your own success story with our multicient data.  
[multicient.slb.com](http://multicient.slb.com)

**Schlumberger**