



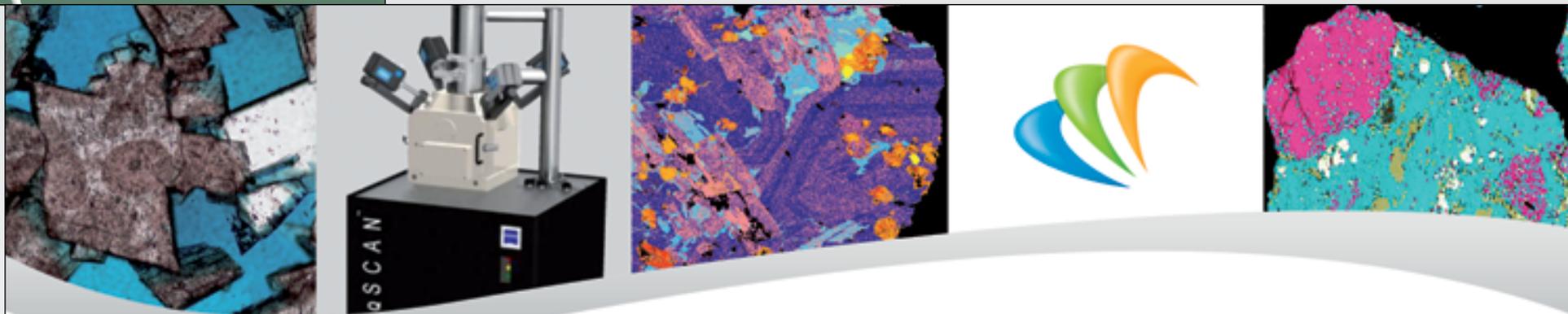
AAPG

# EXPLORER

JULY 2013

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See page 12



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PRESIDENT'S COLUMN

# AAPG: Doing What We Say We Do

BY LEE F. KRYSSTINIK

During my formative years I was raised with a consistent and simple theme: Do what I say I will do and do it to the very best of my ability.

Much as I may have wished it wasn't so true on some occasions, this policy seems to work in virtually all aspects of life and business.

I have the great honor to follow Ted Beaumont as president of AAPG. During his term as president, Ted did exactly what he said he would do: He put the spotlight on getting good geoscience out to our membership and to our society at large.

He often reminded us, "If we deliver good geoscience, most of our other problems will take care of themselves."

Ted delivered the goods during his watch, and it is my intent to follow his lead as we aim toward our start on a second century of AAPG as the premier petroleum geoscience organization in the world.

AAPG's primary missions are:

- ▶ Foster scientific research.
- ▶ Advance the science of geology.
- ▶ Promote technology.
- ▶ Inspire high professional conduct.

AAPG has done a great job delivering on these missions, ever since our inception in 1917 – but there always is room to improve.

We have seen radical changes in the ways we gather, analyze and interpret geoscience data; the ways this information is transferred and consumed; and in the ways our profession may be viewed by governmental agencies and by our society.

The exponential technology explosion has made the globe very small indeed – and in order to survive and, we hope, thrive, AAPG must respond to ever more



KRYSSTINIK

**AAPG must respond to ever more rapidly accelerating changes throughout the world.**

rapidly accelerating changes throughout the world.

This requires focus and efficiency.

\* \* \*

Our primary focus will continue to be advancing petroleum geoscience – and in order to achieve optimal efficiency, we will be linking each activity within AAPG to what we say we do.

▶ We will call upon each Region and Section to examine the linkage between their respective missions and what they are actually doing; to determine whether our money spent is directly aimed at these goals, or perhaps toward worthy, but diffusive efforts.

▶ We will call upon each committee within the AAPG governance structure to align its efforts with our strategic goals, and to focus on expenditures, activities

and products that link directly to what we say we do.

▶ We will ask each director within AAPG to look at their tasks within the context of our strategic objectives, and to work with their teams toward an ever-better job of proactively capturing and delivering excellent geoscience.

▶ To further enhance our efficiency in delivering our science – and to assure our Association's future as the baby boomers enter retirement – we have to touch new members.

We will continue looking for ways to extend our outreach to young professionals – many of whom may have been student members but perhaps fell away from AAPG as they graduated and moved into our profession. Whatever their "era" – whether Gen X, Gen Y/ Millennials, Gen Z/Plurals or those yet to be named – our intent is to make AAPG their geoscience home.

We must find a way to successfully communicate our "value proposition" to them and to other potential members worldwide.

▶ My international colleagues tell me that our membership application and approval process is a huge deterrent to geoscientists from their countries joining AAPG. To be more efficient at doing what we say we do, we need to be more inclusive.

The AAPG membership is a remarkable group of geoscientists, of excellent professional character, but I would hope that few would call us an exclusionary club.

[See President, page 4](#)

## AAPG Officer Candidates Announced

AAPG officer candidates have been announced for the 2014-15 term.

Biographies and individual information for all candidates will be available online starting in July.

The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2015-16. The terms for vice president and treasurer are two years.

Ballots will be mailed in spring 2014. The slate is:

### President-Elect

☐ Alfredo E. Guzmán, consultant, Veracruz, Mexico.

☐ John R. Hogg, MGM Energy Corp., Alberta, Canada.

### Vice President-Sections

☐ Steven H. Brachman, Petro-Hunt LLC, Houston.

☐ Hannes E. Leetaru, Illinois State Geological Survey, Urbana, Ill.

### Treasurer

☐ Vlastimila Dvorakova, Czech Geological Survey, Brno, Czech Republic.

☐ James W. Tucker, consultant, Houston.

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

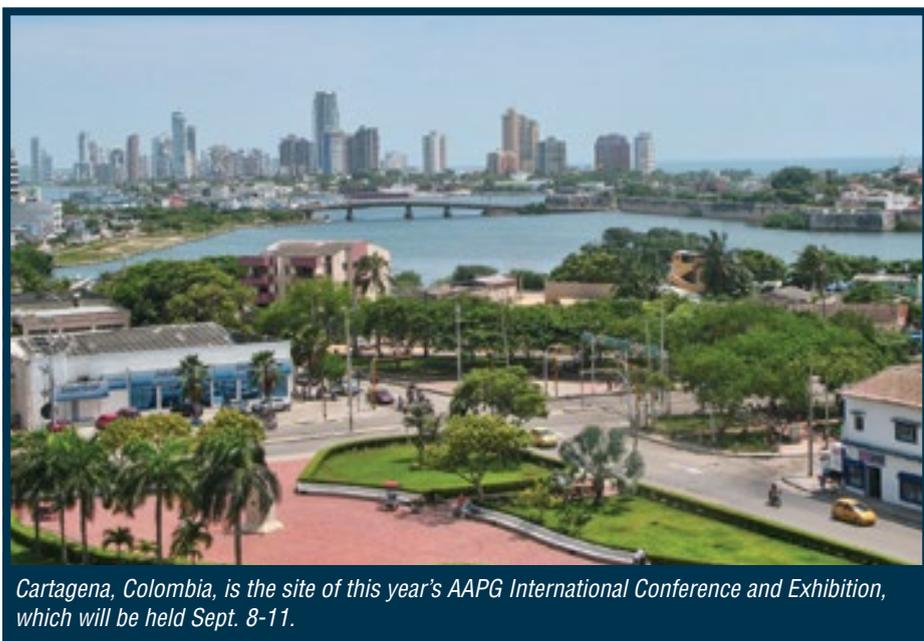


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## ON THE COVER:

Outcrops of the unconventional and highly productive Cretaceous Eagle Ford in west Texas' Lozier Canyon are providing geoscientists with a terrific exploration tool. Here, a digital image shows the facies change that occurs at the Langtry and Austin contact at Lozier Canyon, with the Eagle Ford providing the base. Grainstones interbeds in the upper Langtry give way to thickening-upward wackestones in the basal Austin. See story, page 12. To the right, another view of Lozier Canyon, looking northwest at Antonio Creek. Photos courtesy of Art Donovan.



Cartagena, Colombia, is the site of this year's AAPG International Conference and Exhibition, which will be held Sept. 8-11.

# Diverse Technical Program Planned for Cartagena ICE

Online registration continues for this year's AAPG International Conference and Exhibition, which will be held Sept. 8-11 in Cartagena, Colombia.

Members can save up to \$200 if they register for the meeting by Aug. 8.

This year's ICE marks the first time the event will be held in Colombia. The theme is "Energy for Integration and Prosperity."

The ICE diverse technical program covers a far-reaching range of topics and areas, grouped around six main themes: Latin American Basins and Petroleum Systems; Unconventional Resources;

Challenges in Heavy Oil; Mature Fields; Deepwater Exploration and Production; and Environmental Geology.

Added highlights, however, include 11 "special sessions," which include:

- ▶ Two plenary sessions on Monday, Sept. 9: the "National Oil Company Forum," featuring top level officers of Latin America's largest and most influential NOCs; and "Global Trends – Independent Oil Company (IOC) Perspective."
- ▶ The Discovery Thinking Forum.
- ▶ A History of Petroleum Geology forum.
- ▶ A DEG special session.
- ▶ A new "Regulators" forum.
- ▶ Specific "country sessions" that will focus on Brazil, Mexico, Trinidad and Tobago, Argentina and Peru.

Past AAPG president Scott Tinker, director of the Bureau of Economic Geology, state geologist of Texas and holder of the Allday Endowed Chair at the University of Texas at Austin, will be in the spotlight at this year's featured speaker luncheon, talking on "FraKs, NuKes and Koal: What Latin America Can Learn From the Global Ks."

Another luncheon will deal with "Strategic Alliances: Key Mechanism to Doing Business," featuring Maria Victoria Riaño, president of Equion Energia.

The information also is online, at [aapg.org/cartagena2013](http://aapg.org/cartagena2013).

Most important: Register before Aug. 8 to take advantage of the reduced fees.

## President from page 3

We will look for ways to make it simpler for new members to join, while still holding to rigorous technical/professional standards.

▶ Finally, the linkage to doing what we say we do will carry through to our budgetary planning process, with three-year business plans that will be directly linked to the strategic goals of AAPG.

Survival is a useful first step in meeting our long-term objectives. We will be working to establish a better financial buffer for AAPG in the event of an industry downturn (we currently have about a nine-month cushion and will be aiming for 12-18 months).

\* \* \*

I am looking forward to a great year, and would like to call upon you, the members of AAPG, to please provide your suggestions on how you believe AAPG could better serve you, your Section/Region, our science and society.

Feel free to "ping" me at [lkrystinik@aapg.org](mailto:lkrystinik@aapg.org).

We need your input, wisdom, creativity, energy, scientific contributions, passion, professionalism and volunteerism to help us to do what we say we do!



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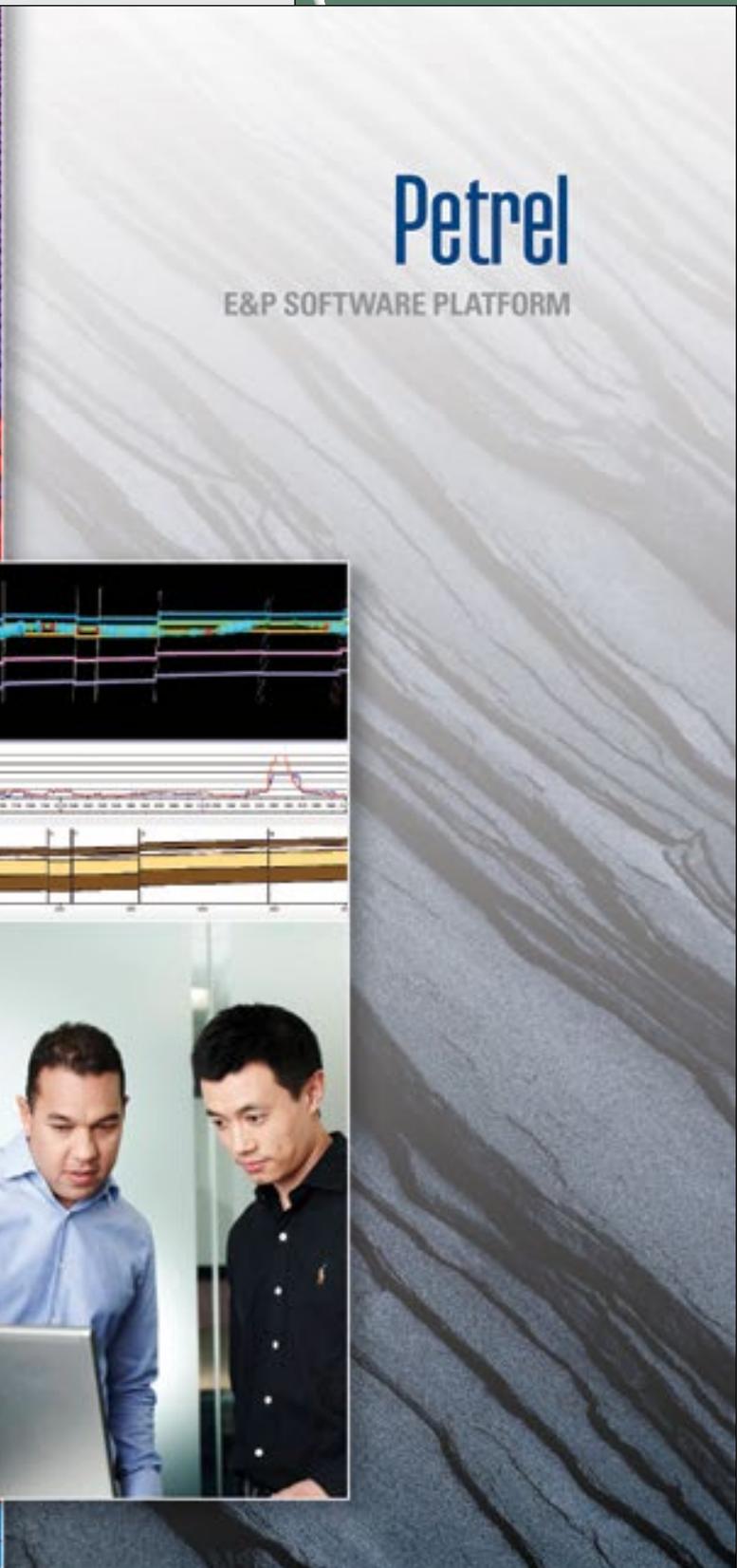
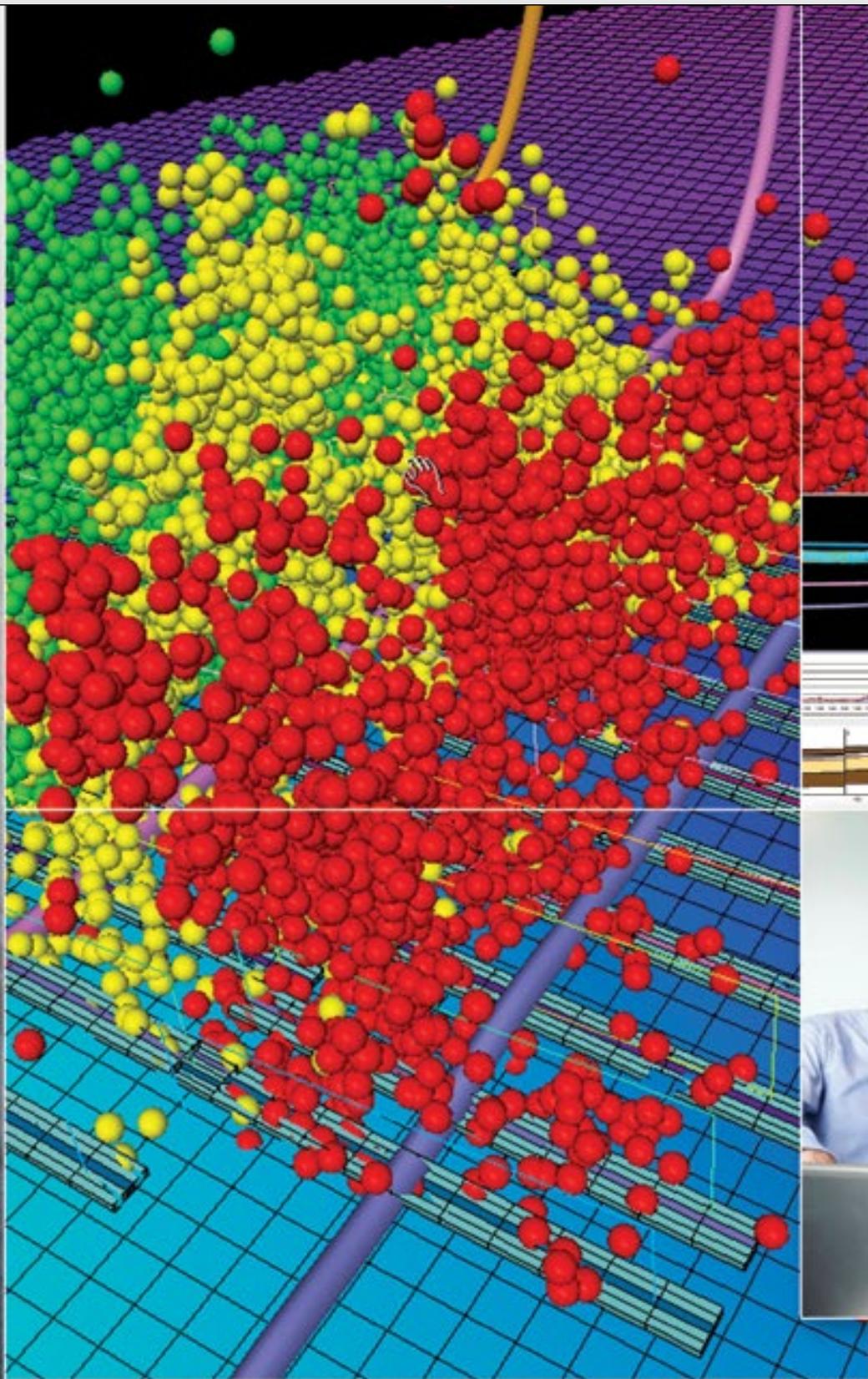
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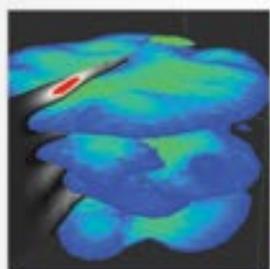


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A full azimuth angle gather from the Barnett Shale visualized in 3D



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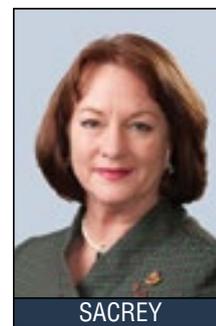
BALL



SWEET



EWING



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# Krystinik, EC Officers Seated for New Term

**L**ee Krystinik, principal with Fossil Creek Resources, Arlington, Texas, assumed the presidency of AAPG on July 1. Krystinik, a native of Dallas, received his bachelor's degree in geology from the University of Texas at Arlington, and master's and doctorate in geology from Princeton University.

He started his career as a research geologist with the U.S. Geological Survey, and then was regional projects leader for Reservoirs Inc. In 1982 he was named manager of geology for Union Pacific Resources (formerly Champlin Petroleum). In 2000 he became a consultant (Krystinik Litho-Logic), and in 2005 was named global chief geologist for ConocoPhillips. He founded Fossil Creek Resources in 2006.

A former president (1998-99) of SEPM, Krystinik has won the A.I. Levorsen Award and the EMD Loyd Carlson Memorial Award, has been an associate editor of the BULLETIN, twice was named an AAPG Distinguished Lecturer and chaired the DL Committee.

Joining Krystinik on the Executive Committee is **Randi Martinsen**, senior lecturer-petroleum geology at the University of Wyoming, Laramie, who recently was voted president-elect and will serve as AAPG president in 2014-15.

Martinsen holds a bachelor's in earth and space science from the State University of New York, Stony Brook, and a master's in geology from Northern Arizona University in

Flagstaff, Ariz.

She started her career as an exploration geologist with Cities Service Co., becoming a Laramie-based consultant in 1979. She's been with the University of Wyoming's Department of Geology and Geophysics since 1981, and has been a visiting geoscientist to both Norsk-Hydro, in Bergen, Norway (1985, 2001), and Exxon Exploration (1999).

Others recently elected to the 2013-14 AAPG Executive Committee are:

▣ Vice President-Regions – **John Kaldi**, Australian School of Petroleum, University of Adelaide, Adelaide, Australia.

▣ Secretary – **Richard W. Ball**, Chevron Upstream, Southern Africa SBU, Houston.

▣ Elected Editor – **Michael Sweet**, ExxonMobil Production, Houston.

Both the vice president-Regions and secretary will serve two-year terms. The editor serves a three-year term.

Others on the 2013-14 committee – and serving the final year of their term of service – are:

▣ Vice President-Sections – **Thomas E. Ewing**, geoscientist and partner, Yegua Energy Associates, and geoscientist, Frontera Exploration Consultants, San Antonio.

▣ Treasurer – **Deborah K. Sacrey**, owner, Auburn Energy, Houston.

Also on the new committee will be **Larry H. Wickstrom**, with Wickstrom Geoscience, Worthington, Ohio, who has assumed the chair of the House of Delegates. ■

**T**ed Beaumont has been seated as chairman of the 2013-14 AAPG Advisory Council.

Council members include past AAPG presidents Paul Weimer and David G. Rensink; Jeremy Boak, president-EMD; Douglas E. Wyatt, president-DEG; Valary L. Schulz, president-DPA; and R. Randy Ray, immediate past chair-House of Delegates.

Section representatives are:

- ▶ Jon Schwalbach Jr., Pacific Section.
- ▶ John Robinson, Rocky Mountain Section.
- ▶ David C. Harris, Eastern Section.
- ▶ William M. Whiting, Gulf Coast Section.
- ▶ Debra P. Osborne, Southwest Section.

▶ Robert D. Cowdery, Mid-Continent Section.

▶ Martha Lou Broussard, Gulf Coast Section.

International Regions/voting representatives (750 members or more) are:

- ▶ Andrea Moscariello, Europe Region.
- ▶ Paul J. English, Canada Region.
- ▶ Peter W. Baillie, Asia/Pacific Region.

International Regions/non-voting representatives (fewer than 750 members):

- ▶ Nosa Omorodion, Africa Region.

The representatives for the Latin America and Middle East Region are yet to be announced.



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URTeC spotlights integrated efforts

# Needed: Team-Approach to Today's Demands

By DAVID BROWN, EXPLORER Correspondents

For anyone wondering about the upcoming, inaugural Unconventional Resources Technology Conference (URTeC), a good one-word answer would be "Bakken."

The concept of integrated teamwork, essential to cracking open the Bakken unconventional oil play, lies at the core of URTeC.

AAPG, the Society of Petroleum Engineers and the Society of Exploration Geophysicists joined together to create the conference, a hybrid event drawing together knowledge from geology, geochemistry, geophysics, petroleum engineering and other professional specialties.

Scheduled Aug. 12-14 in Denver, URTeC's very existence speaks to the importance of unconventional resource plays and the integrated, multidisciplinary approach that makes them work.

"One of the first tight oil plays that came around was the Bakken. It was developed by people who used vertical drilling," said AAPG Honorary member Steve Sonnenberg, professor and Charles Boettcher Distinguished Chair in petroleum geology at the Colorado School of Mines in Golden, Colo.

Sonnenberg, a past AAPG president, serves as co-chair of URTeC, along with Luis Baez, exploration manager for BG Group in Houston, and AAPG member Ken Beeney, a Humble, Texas



SONNENBERG

**"I've been working unconventional for over 10 years, and the key is this integrated approach."**



BAEZ

## The 'Integrated Approach'

Baez has seen the same path to success in his experience with resource plays.

"I've been working unconventional for over 10 years," he said, "and the key is this integrated approach."

His two-word answer for questions about URTeC might be "Eagle Ford."

"It's been a radical shift. Five years ago everyone was looking for Barnett-type shales. No one was looking too much outside the box," Baez said.

By comparison, the Eagle Ford was overpressured, deep and difficult to characterize, and appeared to have the "wrong lithology," he noted. But by using a multidisciplinary approach, companies were able to begin tapping into the Eagle Ford's potential.

Baez hopes URTeC attendees will be able to discover answers to current resource-play challenges, in addition to broadening their horizons and sharpening their professional skills.

"There is just a huge learning curve to go through. Having everything in one place allows you to see what other people are doing," he said. "There's also the communication part. People don't necessarily know how these projects

geophysical consultant formerly with Devon Energy Corp.

Without the combined input of geoscientists, engineers and other industry professionals, the Bakken play would not have developed into a significant, unconventional, oil-producing resource, Sonnenberg said.

"The Bakken is a key example of an integrated approach combining geology with petroleum engineering," he observed. "The geophysical add to that was not only 3-D seismic, but also the microseismic – the microseismic arrays that were put out sometimes on a permanent basis."

## All Disciplines Must Contribute

The inaugural Unconventional Resources Technology Conference (URTeC) will feature numerous interactive panels and special-topic breakfast and luncheon opportunities, in addition to a wide-ranging technical program covering all aspects of unconventional resource development.

Program themes range from unconventional project development to well performance prediction, from unconventional reservoir characterization and formation

evaluation to reservoir monitoring.

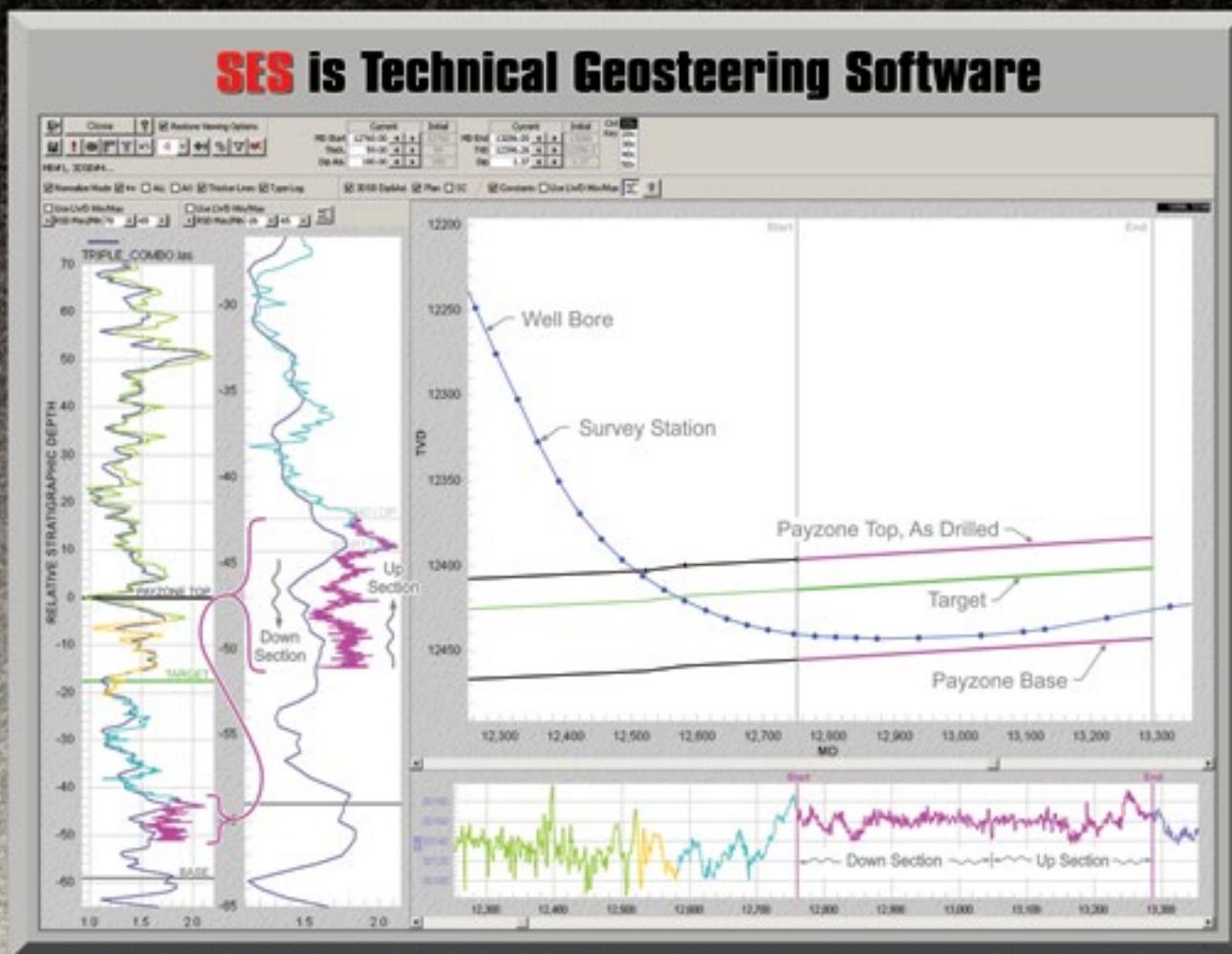
Attendees will hear much about play economics, and also about modeling for unconventional resources. That's a critically important step, co-chair Steve Sonnenberg noted.

"You cannot only history match what you've already done, but also predict what resource you're going to have," he said. "Quite honestly, the only effective way to do a model is to have all of these disciplines contributing."

– DAVID BROWN

See URTeC, page 10

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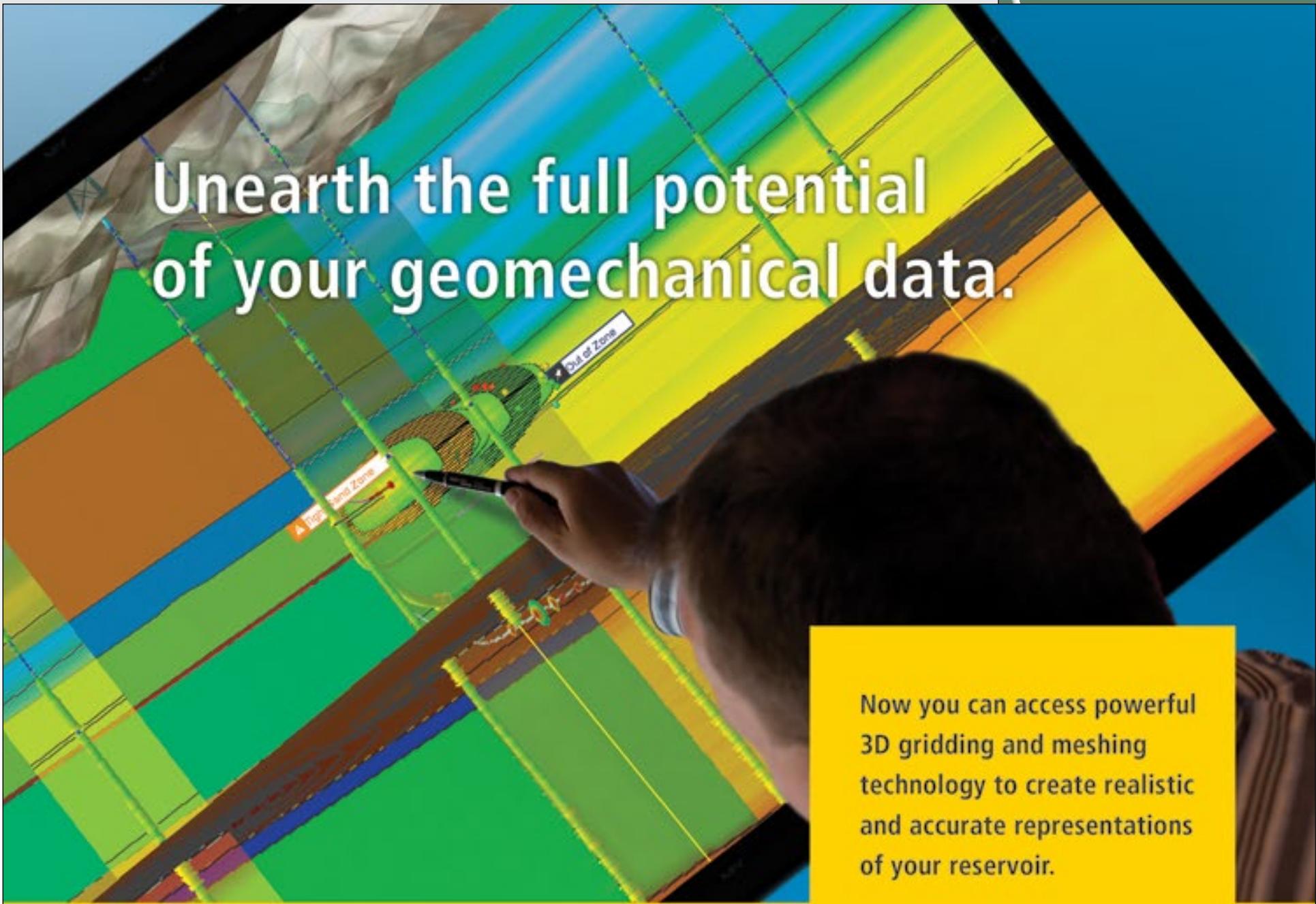
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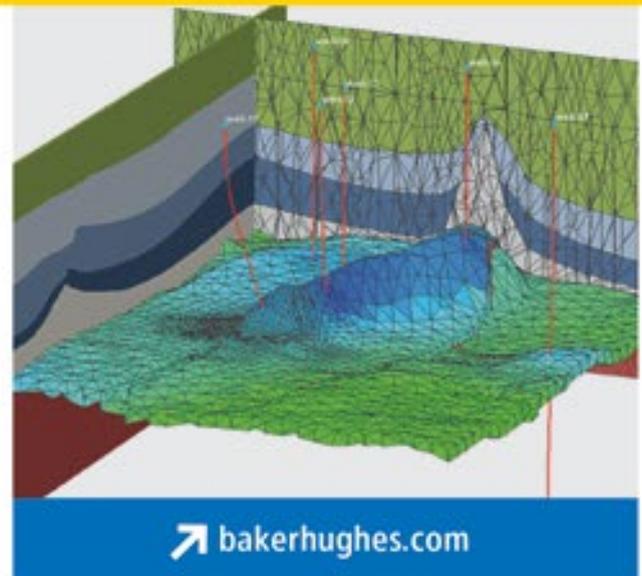
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## Online Registration Open for Inaugural URTeC

Online registration continues for the inaugural Unconventional Resources Technology Conference (URTeC), a joint venture that will bring together for the first time the key disciplines and technologies engaged in the development of North American unconventional resource plays.

URTeC, sponsored by AAPG, the Society of Petroleum Engineers and the Society of Exploration Geophysicists, will be held Aug. 12-14 in Denver.

AAPG, SPE and SEG members who register on or before July 17 can save \$100 on registration fees.

The URTeC technical program, also available online, boasts papers

from petroleum engineers, geologists, geophysicists and other professionals dealing with innovations, best practices and experiences in integrated approaches for North American unconventional resource plays.

The event has been designed to fill the unique need for a peer-reviewed, science-based unconventional resources conference that will take an asset team approach to development of unconventional resource plays – similar to how oil and gas professionals work in today's market.

URTeC also is designed to:

- ✓ Create a premier forum for technical exchange between vendors and users.

- ✓ Identify and solve E&P problems.
- ✓ Raise the competency of all petroleum professionals.
- ✓ Elevate the image of petroleum professionals and the societies in all communities

The technical program includes 20 themes applicable to unconventional resources and appeals to engineers, geologists and geophysicists.

The three technical program co-chairs are AAPG Honorary member and past president Steve Sonnenberg, with the Colorado School of Mines; AAPG member Ken Beeney, with Devon Energy; and Luis Baez, with BG Group.

For more information, visit the URTeC website at [www.urtec.org](http://www.urtec.org).

## URTeC from page 8

prove out."

Even if someone sticks close to his or her own specialty when attending URTeC, the importance of the multidisciplinary approach should show through, according to Sonnenberg.

"We have tried to stress to the authors to make their presentations integrated," Sonnenberg said. "No matter what session people sit in, they should see this integrated approach."

Just reviewing the submissions for URTeC presentations was an eye-opener for Baez.

"There are things in there I hadn't thought of before. I was saying to myself, 'Wow, that's a really good idea!'" he recalled.

**"The one conference you can go to and see ALL your colleagues there."**

### A Never-Ending Story

Slipping the word "technology" into the name of an unconventional resource conference might seem to emphasize one aspect of resource play development above others.

Actually, it's recognition of technology's central importance in exploiting unconventional prospects, Sonnenberg said.

"If it weren't for the technology, people wouldn't be drilling these wells," he acknowledged. "You could nickname these reservoirs 'high-technology reservoirs.'"

While mainstream media often portray resource play development as a perfected art, the oil and gas industry sees it as a set of still-evolving techniques. URTeC will address the industry's ongoing research into unconventional, Sonnenberg said.

"For instance, is the frac fluid of the future going to be a water-based frac fluid? People right now are experimenting with frac design," he observed.

The industry still has significant work to do, Sonnenberg said, both in understanding and opening new resource areas and in optimizing the approach to existing unconventional plays.

"We're determining right now with these studies that are going on what the optimal well designs can be, what the optimal well spacing is, that sort of thing," he said. "I think we have a ways to go in developing our science in these things."

Sonnenberg called URTeC a state-of-the-art science meeting and "the one conference you can go to and see ALL your colleagues there."

To Baez, it reflects the excitement and opportunity created by unconventional resources.

"It's a great time to be a scientist in this profession. We're looking for a lot of different skill sets right now," he said.

By design, URTeC will give industry professionals an understanding of the multidisciplinary approach to resource development techniques that continue to emerge, evolve, develop, grow and change.

"I have a feeling," Baez said, "everything I know will be wrong 10 years from now." ■

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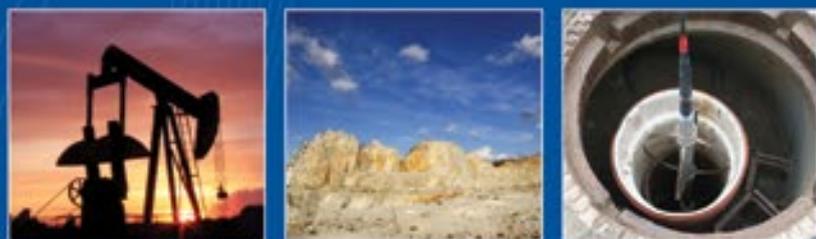
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Photos Courtesy of Art Donovan

West Texas' Lozier Canyon offers an opportunity to examine Eagle Ford shale outcrops at various scales across a sizeable area – including the chance to view the entire succession.

# Eagle Ford Outcrops: Taking a New (3-D) Look

By LOUISE S. DURHAM, EXPLORER Correspondent

When unconventional shale plays were in their infancy, there were a lot of individuals who believed all shales were alike – that is, homogeneous source rocks feeding nearby conventional reservoirs.

The thinking in general was that you could crack into a shale wherever and, *voila*, the hydrocarbons would spew forth.

But after a number of disappointing wells and other problems, the shale players came to realize this ain't necessarily so.

Unconventional reservoirs are typically poorly exposed at the surface. The lack of outcrops is a major hindrance to studying and understanding the actual puzzle presented by shale beds.

The unconventional and highly productive Cretaceous Eagle Ford in south Texas is a unique exception.

In addition to the ordinary roadside outcrops, which are affected by weathering and limited scale compared to the subsurface, there are other exposures that are beauts.

Outcrops in Lozier Canyon in western Val Verde and eastern Terrell counties in west Texas offer an opportunity to examine this unconventional carbonate mudstone reservoir at various scales across a sizeable area.

Natural occurring Eagle Ford outcrops appear in various canyon systems where the entire succession can be viewed.

Lozier is said to be the most famous.

"Lozier had been talked about in publications in the 1950s, but it was kind of off limits," said AAPG member Art Donovan, senior geoscience adviser for unconventional resources at BP in

Houston.

"The outcrops are on private property, and we started to have contact with the landowners early in 2010," he said. "We got access in the fall and began doing studies with various graduate students on those outcrops."

This is nirvana for any field geologist. "We found not just the one outcrop



DONOVAN

**"I think it's a good analog for a lot of similar type of reservoirs."**

that you could see from the highway but many outcrops over about a 50-square-mile area," Donovan said.

"Tens of cutbank outcrops provide panoramic views of the entire Eagle Ford in exposures hundreds of feet high and thousands of feet long."

### Seeing Is Believing

The methodology that the study team used for the Lozier Canyon outcrops was to describe and document the vertical and lateral variability of the Eagle Ford.

"Some localities display laterally extensive exposures of individual bedding planes and key stratal surfaces to allow for the three-dimensional view of sedimentary structures, biogenic debris beds and trace fossils," Donovan noted.

"Our work to date reveals a vertically heterogeneous facies and TOC succession with variability at the bed-

See Eagle Ford, page 14

AAPG member Art Donovan will present the paper "A 3-D Outcrop Perspective of an Unconventional Carbonate Mudstone Reservoir" at 1:30 p.m. Tuesday, Aug. 13, as part of the Unconventional Resources Technology Conference in Denver.

The inaugural URTEC will be held Aug. 12-14.

Donovan's talk will be part of a session titled "Core Evaluation and Depositional Environment."

His co-authors are T. Scott Staerker and Aris Pramudito, both with BP in Houston, and Rand Gardner and Michael Pope, both with Texas A&M University, College Station, Texas. All are AAPG members.

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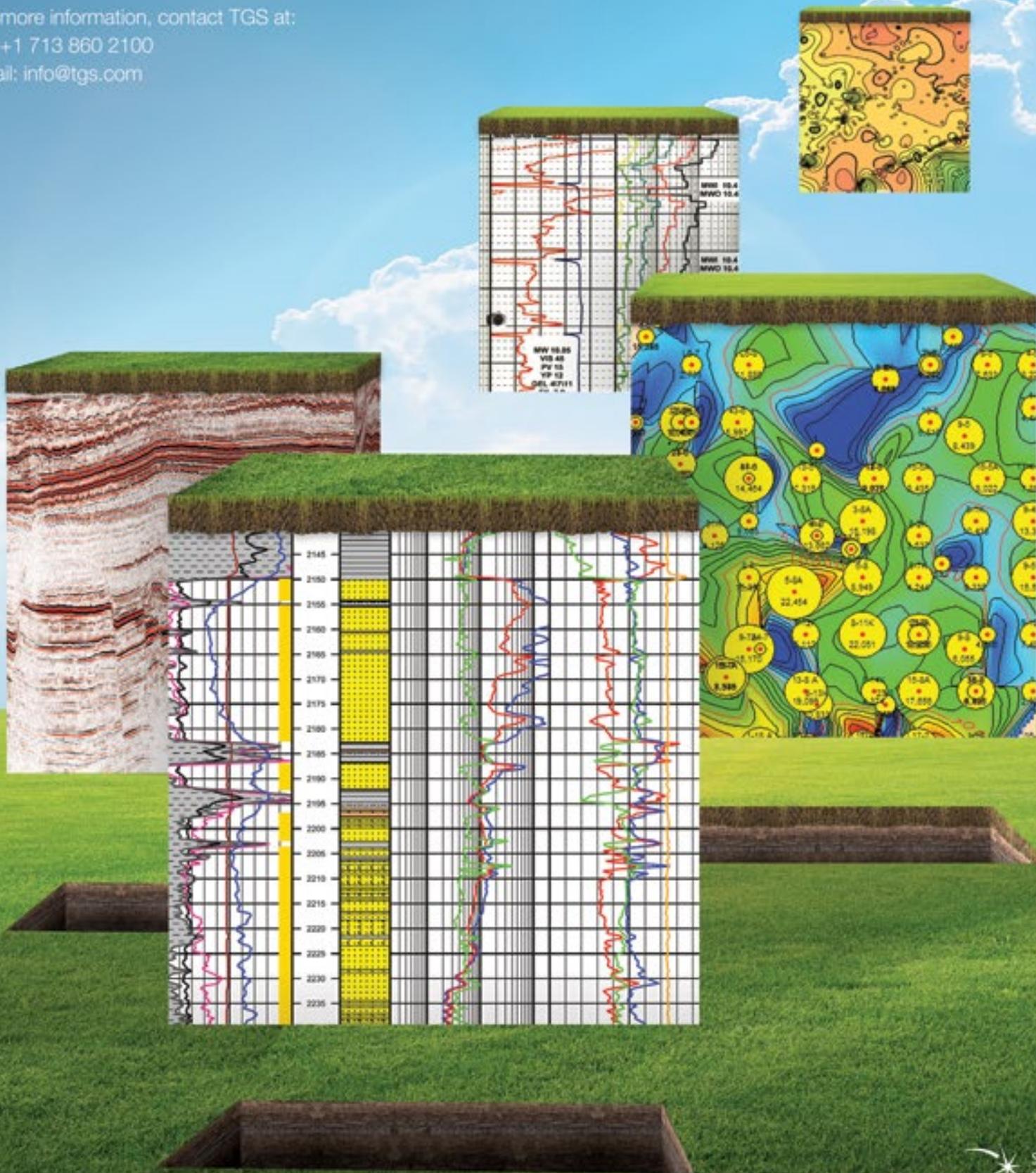
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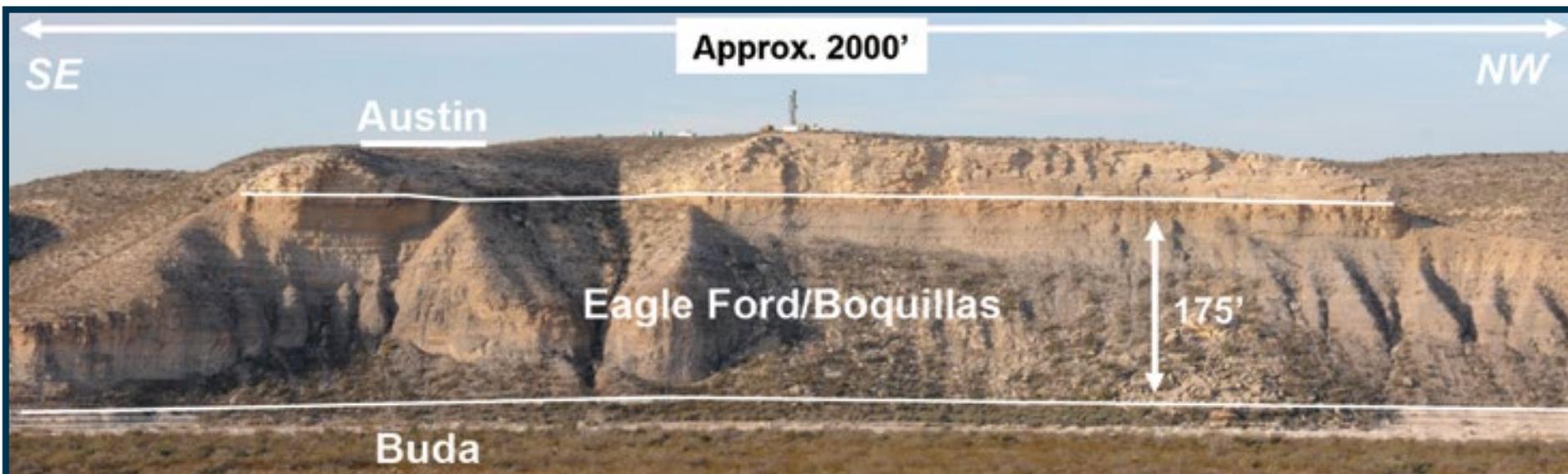
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Eagle Ford outcrops along and/or adjacent to U.S. Highway 90 at Comstock West, Osman Canyon East and Lozier Canyon. Along the highway, the Eagle Ford exposures tend to weather reddish brown and only toward the central core does the original black color remain. Here in Lozier Canyon, however, the bulk of the Eagle Ford is black to gray in color.

**Eagle Ford**  
from page 12

bedset-, parasequence-, sequence- and sequence-set scale," he said. "Lateral variations in the thickness, lithofacies and bedding continuity within the various defined members and sequences (can be) observed."

The Eagle Ford outcrops show vertical heterogeneities and zonation aplenty – and Donovan pointed out that there seems to be more continuity laterally.

"The trick is you gotta stay in zone and realize how much the vertical variability is," he emphasized.

"There's actually only one specific part of the Eagle Ford – and that's the lower member – that's the primary unconventional reservoir," he said.

"There's been a lot of trial and error in the subsurface, and people had to learn the hard ways of where they wanted to be in the Eagle Ford.

"The lower member (Lozier Canyon member) is where people usually land the laterals, and it's that lower member of the lower Eagle Ford that works real well.

"The upper member of the lower Eagle Ford is loaded with bentonite," Donovan said, "and if you land a fresh water frac in that, it's not pretty.

"With the gamma ray profile we put there, I think our management was pleasantly surprised with how similar the outcrops were to the subsurface," he noted. "Clearly, the Eagle Ford was thinner, but a lot of the basic stratigraphy in the subsurface is present in the outcrop."

**Analog Treasure Trove**

While this was a unique opportunity to study an organic rich mudstone, there was a real bonus in that it was the Eagle Ford, which currently is one of the hottest plays in the United States.

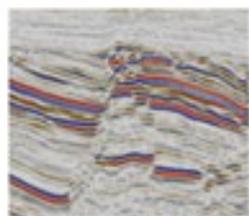
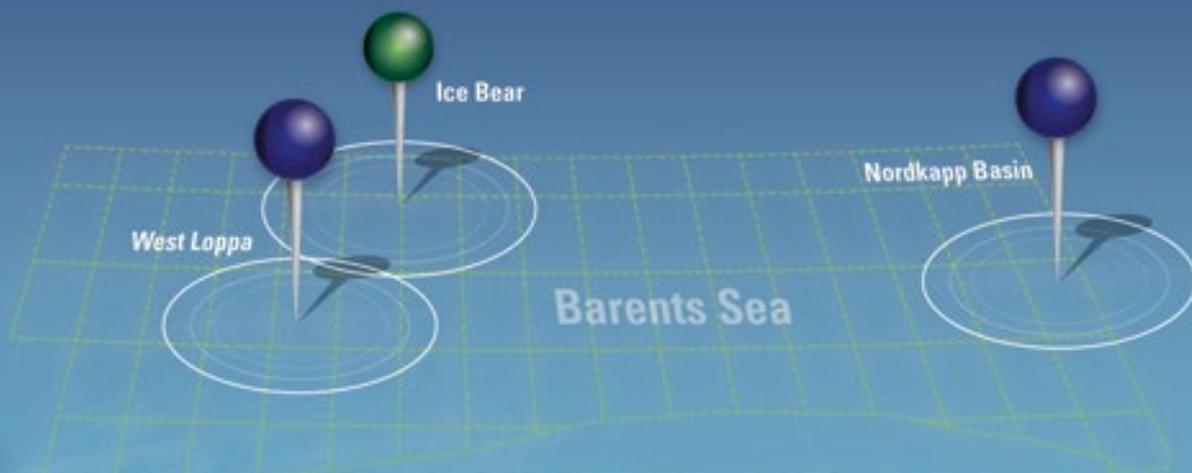
The study's impact likely will extend much further.

"I think it's a good analog for a lot of similar type of reservoirs, like the basal parts of the Utica and the Haynesville," Donovan emphasized. "So this has implications far beyond the Eagle Ford."

At the end of the day, these outcrops provide a rare three-dimensional perspective to document, understand and predict vertical and lateral heterogeneities that exist at a variety of scales within unconventional mudstones.

"They're some of the best outcrops of mudrocks in the world," Donovan emphasized. "We go out and teach unconventional reservoir courses there."

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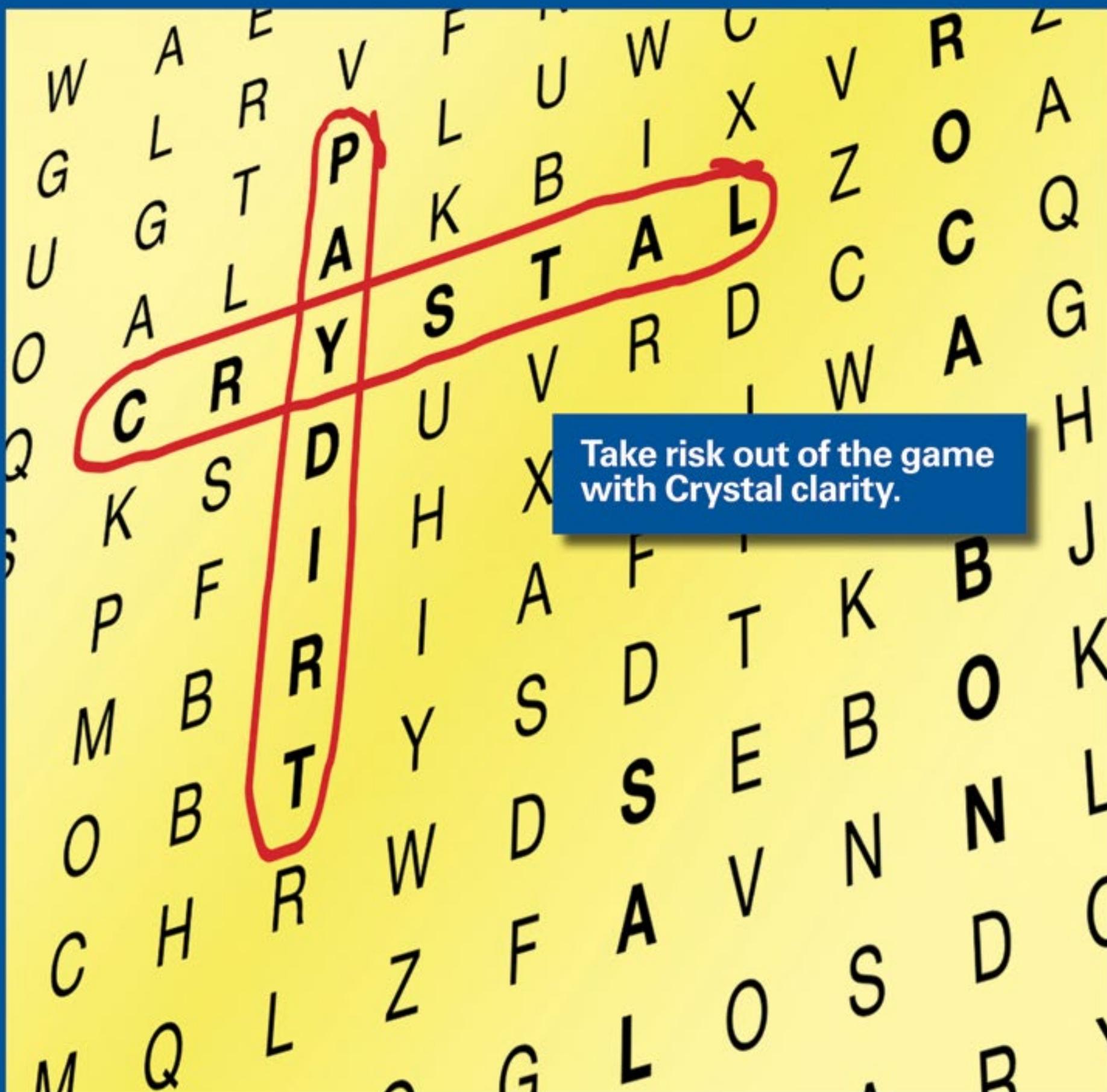
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Once overlooked, now spotlight-grabbing

# Geologists Excited About TMS Potential

By LOUISE S. DURHAM, EXPLORER Correspondent

Drill bits en route to deep targets often cut through zones with minimal hydrocarbon shows.

Sometimes that might be a nuisance. But sometimes it's best not to write off these shallower, unexpected teasers as trash zones.

They may have great promise – if not now then in the future, using advanced technology that has yet to be developed.

This appears to be the story of the Cretaceous-age Tuscaloosa Marine Shale (TMS), which occurs across central Louisiana and into southwestern Mississippi. It's age equivalent to the highly productive Eagle Ford in Texas.

The TMS occurs between the upper and lower units of the Tuscaloosa formation, which has produced enormous volumes of hydrocarbons over the years from giant fields in the famed Tuscaloosa Trend. Production is from the lower Tuscaloosa Massive Sand facies.

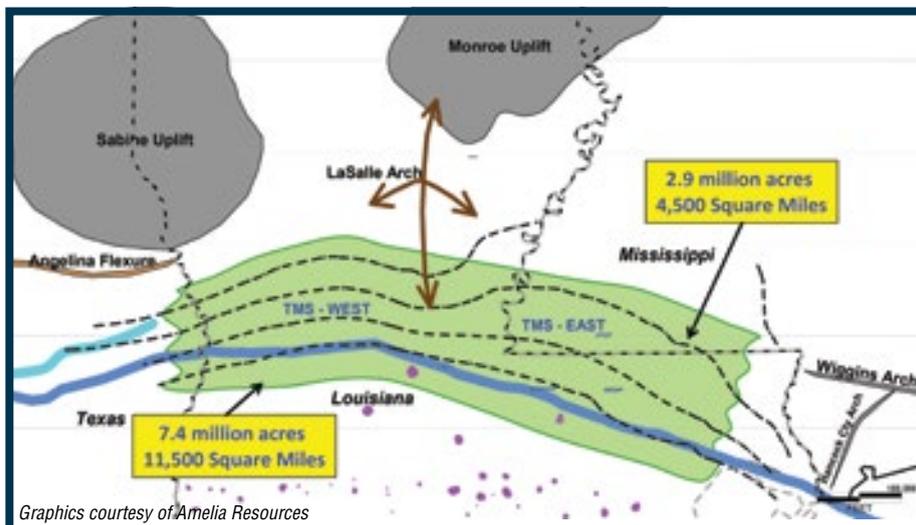
The deep high-pressure TMS is generally thought to have sourced the highly productive sands in the Tuscaloosa Trend.

Back in time, the TMS was viewed as a kind of nuisance bed, throwing a tad of oil when penetrated by the downward-moving drillbit.

Attempts to produce from the shale in



BARRELL



Graphics courtesy of Amelia Resources

TMS regional geology and potential play boundaries: Tectonic features (gray); Base TMS structure (black dashed lines); TMS high resistivity (blue dashed lines); salt domes (purple); and Lower Cretaceous shelf edge (blue line).

the 1970s were non-commercial. Even so, a well drilled in 1977 in northern Tangipahoa Parish is kicking out a few bopd even now.

A publication in 1997 based on a study

conducted by Louisiana State University's Basin Research Institute (now the Basin Research Energy Section of the Louisiana Geological Survey) revealed the TMS

**A**APG member Kirk Barrell will present the paper "Tuscaloosa Marine Shale – An Emerging Play," at 9:45 a.m. Tuesday, Aug. 13, as part of the Unconventional Resources Technology Conference in Denver.

The inaugural URTeC will be held

Aug. 12-14.

Barrell's talk will be part of a session titled "Unconventional Tight Oil and Tight Gas."

Barrell is president of Amelia Resources, The Woodlands, Texas.

According to Amelia Resources, Tuscaloosa Marine Shale play benchmarks are:

- ✓ 20 completion results.
- ✓ Long laterals: Encana, 8,932 feet.
- ✓ Drilling time: EOG 604 feet/day; 16,907 feet in 28 days.
- ✓ EOG: DHC/CC <\$11.5 million.
- ✓ IP: Goodrich Crosby well 1,300 boepd; 15/64.
- ✓ 30-day IP: Goodrich Crosby 1,137 boepd.
- ✓ Frac stages: 30 – Encana Anderson 17H.
- ✓ Frac proppant: Encana – up to 700,000#-1,000,000# per stage.
- ✓ Encana Anderson 18 H-1: 110,000 bo in nine months.
- ✓ EUR and decline: 450-800 mboe, 78-83 percent first year decline.

harbors an estimated seven billion barrels of oil awaiting recovery.

Such a number is guaranteed to grab the attention of the E&P crowd.

This potential, combined with ongoing advances in horizontal drilling technology and hydraulic fracturing, meant a play was inevitable.

Problem is, it's taking a long time to prove commercial.

See Tuscaloosa, page 18

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## Tuscaloosa from page 16

### Getting Started

The TMS play essentially kicked off in 2008 when the former Encore Acquisition drilled four horizontal wells, which met with various problems.

Thus far, 35 permits have been acquired in the play, and 23 wells have been drilled. Twenty completions are on record, with 13 wells currently producing.

The focus is on the updip oil window rather than the much deeper gas window, and true vertical depth for the wells average about 12,500 feet.

Three wells were drilling at the end of May, according to AAPG member Kirk Barrell, president of prospect generator

Amelia Resources, based in The Woodlands, Texas.

"Recent results have been very encouraging, but we just wish they happened faster," said Barrell, who has 23 years' experience in the Tuscaloosa Trend and is an avid TMS blogger. "I don't think there's any question it will work – the geology hasn't changed.

"What we see now is a fracture design that's been proven to work," he noted. "The final piece of the puzzle is to get costs down a little more, ideally in the

**"It's an expensive play compared to some others, but the rates and EURs make the economics still look good, even at current costs."**

\$11 million range.

"It's an expensive play compared to some others," Barrell added, "but the rates and EURs make the economics still look good, even at current costs."

### Accentuating the Positive

Barrell emphasized that early negative perceptions about the play, such as too much clay and being too close to sand, have been proven wrong.

Each step forward, whether big or

small, gets this all-out effort closer to commerciality.

For instance, EOG drilled three wells over a time period ranging between 28 and 34 days. Taking into account the day rate and the fracture design, well costs reportedly tallied about \$11.5 million or less, making it a benchmark in the play.

Early on, some of the players referred to the TMS in the western area of this new play as the Louisiana Eagle Ford.

Hopes were high. Alas, that kind of went the way of the Dodo bird when Halcon condemned the western segment via drilling. The core area now is considered to begin in Avoyelles Parish and continue eastward.

Today, chances are you can only be a bystander, as Barrell noted the currently prospective 2.8 million acres are pretty much all leased up. Once the boundaries of the play are defined, he estimates as much as 7.4 million acres eventually could be prospective.

At press time, four operators had a combined total of 13 wells producing:

- ▶ Devon.
- ▶ Encana.
- ▶ EOG.
- ▶ Goodrich Petroleum.

The most recent of the 20 completions in the TMS was the Goodrich Petroleum Crosby 12-H-1 well in Wilkinson County, Mississippi.

It's an attention-getter. "They used 475,000 pounds of proppants per stage and about 70 percent slickwater and laid in the bottom 60 feet of the shale," he noted. "Those three criteria appear to be the formula for success.

"The initial test on that well was 1,300 boe per day," he said. "I think it will be like that Jake well in the Niobrara."

This would be huge, given that EOG's #2-01 H Jake well in Colorado's DJ Basin startled the industry when it tapped into a copious amount of oil in the Cretaceous-age Niobrara formation. It essentially ignited the now-famous Niobrara play.

Barrell noted that the Crosby well had already produced approximately 85,000 boe in about 100 days.

"There's no question it's the star thus far," he said.

### Pay It Forward

Barrell emphasized that accurate prediction of estimated ultimate recoveries will occur after approximately 10 to 20 wells have produced for more than a year and decline rates, hydrocarbon mix and pressures are confirmed. This will enable generation of meaningful economic scenarios and type curves.

The hundreds of wells drilled to the deeper Tuscaloosa sands provide prodigious volumes of data for the TMS operators.

Some much-welcome 3-D data soon may be added to this trove.

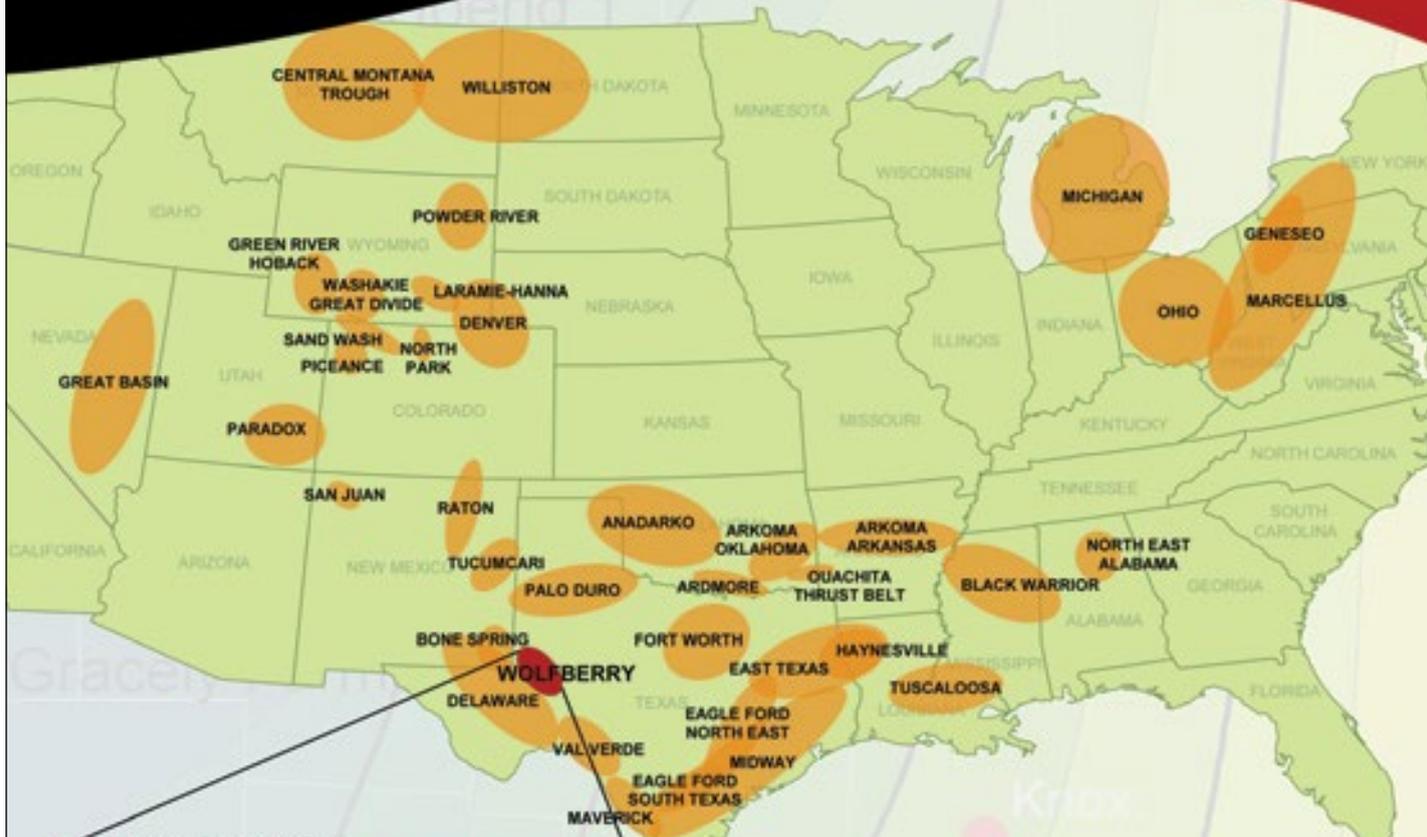
Once commerciality of the play is confirmed – which Barrell predicts is close – watch for the 3-D action to kick off. Several vendors are said to have expressed interest in acquiring a large 3-D data set.

Besides the TMS, there's lagniappe to be had in the form of other production potential. This also will benefit from 3-D analysis.

"There's still a lot of shallow potential in the area," Barrell noted. "There's the Austin Chalk, the Wilcox and a significant amount of deep Lower Cretaceous and Jurassic potential that would greatly benefit from 3-D." ■

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2	Weatherford	Wolfberry 2	2	Waller	TX	30.444444	-94.444444
3	Weatherford	Wolfberry 3	3	Waller	TX	30.444444	-94.444444
4	Weatherford	Wolfberry 4	4	Waller	TX	30.444444	-94.444444
5	Weatherford	Wolfberry 5	5	Waller	TX	30.444444	-94.444444
6	Weatherford	Wolfberry 6	6	Waller	TX	30.444444	-94.444444
7	Weatherford	Wolfberry 7	7	Waller	TX	30.444444	-94.444444
8	Weatherford	Wolfberry 8	8	Waller	TX	30.444444	-94.444444
9	Weatherford	Wolfberry 9	9	Waller	TX	30.444444	-94.444444
10	Weatherford	Wolfberry 10	10	Waller	TX	30.444444	-94.444444
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13	Weatherford	Wolfberry 13	13	Waller	TX	30.444444	-94.444444
14	Weatherford	Wolfberry 14	14	Waller	TX	30.444444	-94.444444
15	Weatherford	Wolfberry 15	15	Waller	TX	30.444444	-94.444444
16	Weatherford	Wolfberry 16	16	Waller	TX	30.444444	-94.444444
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18	Weatherford	Wolfberry 18	18	Waller	TX	30.444444	-94.444444
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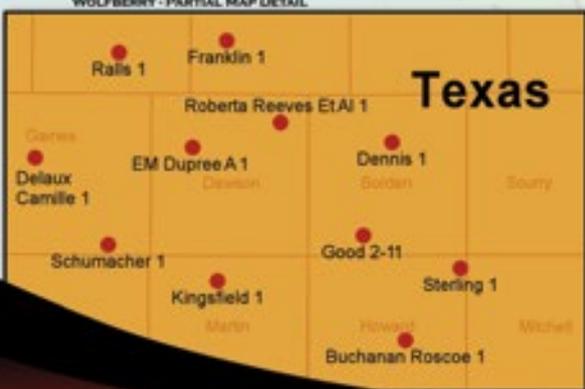
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*Karst*

The term *karst* derives from the name of an area of Slovenia and generally refers to the result of weathering or dissolution of limestone, dolomite, anhydrite, or other soluble rocks. Paleokarst is one of the most complex and least predictable styles of carbonate reservoir heterogeneity. Wells that intersect karst-modified fractures frequently have high initial production rates followed by rapid decline. Karst collapse features locally increase depositional accommodation space, and their bounding faults may propagate into shallower reservoirs in response to differential compaction. Rugose karst horizons can cause significant diffraction of downgoing reflection-seismic energy thereby limiting the resolution of deeper targets. Shallow karst systems are important components of freshwater aquifers and form sufficient hazards for highway and other infrastructure, and they can be a drilling hazard in hydrocarbon exploration and production.

The editors of INTERPRETATION invite papers on the topic *Karst* for publication in the August 2014 special section or supplement. Contributions are invited in the areas of seismic geomorphology, the appearance of karst on seismic attributes and impedance inversion, as well as tutorials on geologic processes involved in meteoric dissolution, hydrothermal alteration, evaporite dissolution, and sedimentary infill of karst features. We anticipate contributions related to:

- Geomorphology and architecture of karst in seismic data
- Seismic attribute analysis for paleokarst characterization
- Formation evaluation of karst-modified reservoirs including image log interpretation
- Seismic-aided field development and completion design strategies
- Outcrop analogs for subsurface karst
- Differentiating karst styles: meteoric, hydrothermal, and evaporitic
- Karst petroleum reservoirs
- Karst petroleum seals
- Karst drilling hazards
- Karst influence on shallow unconventional
- Seismic imaging of karst for geothermal production
- Karst influence on seismic data quality
- Karst associated with anhydrite and salt dissolution
- Mapping of shallow karst for engineering and groundwater applications
- Acquisition, processing, and imaging workflows to improve subsurface karst imaging.

Interested authors should submit manuscripts for review no later than **15 November 2013**. In addition, the special section or supplement editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for INTERPRETATION (<https://mc.manuscriptcentral.com/interpretation>) and select the *Karst* option in the manuscript type dropdown box. The submitted papers will be subject to the regular peer-review process, and the contributing authors are also expected to participate in the review process as reviewers.

The submissions will be processed according to the following timeline:	Special section editors:
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Peer review complete 1 May 2014	Jason Rush rush@ksg.ku.edu
All files submitted for production 15 May 2014	Charlotte Sullivan charlotte.sullivan@pnnl.gov
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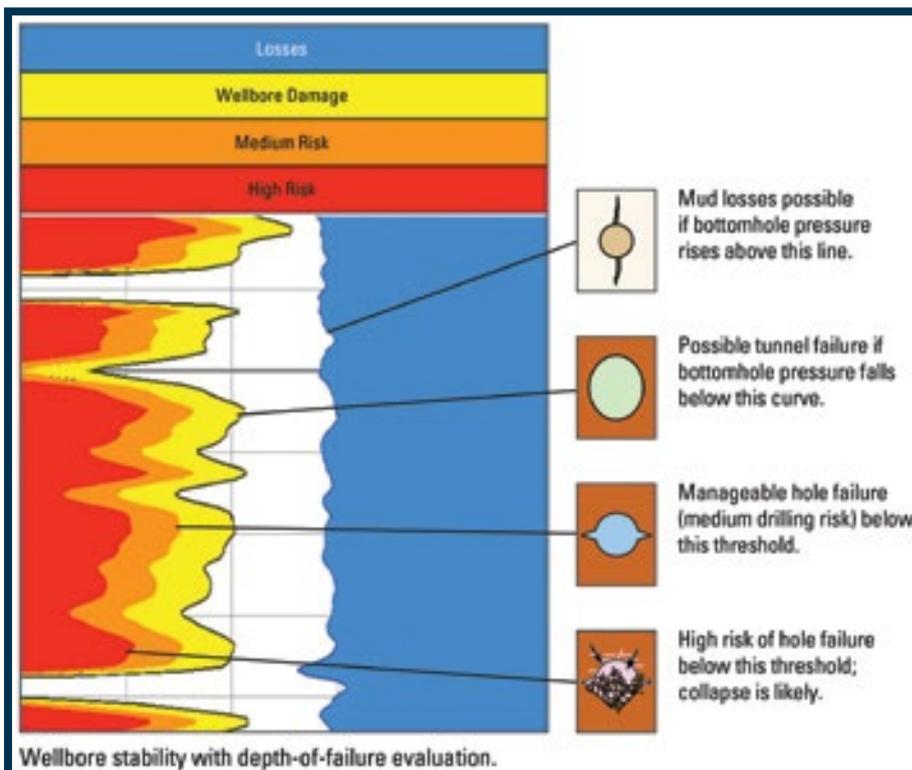


Figure 1 – The depth of failure wellbore stability approach provides a risk assessment for drillers. The yellow wellbore damage line shows the bottomhole pressure required to avoid formation damage initiation. The orange-shaded line provides the driller with a “medium risk” threshold where failure is manageable, and the red line shows a high risk, where wellbore collapse is likely.

# Geomechanics Helps Solve Horizontal Woes

By LOUISE S. DURHAM, EXPLORER Correspondent

**D**rill down vertically to a shale zone, take a turn and head into the bed laterally and, presto, completion is a slam-dunk. Right? Not necessarily. These unconventional formations can, and usually do, create a host of problems for the drillers and others.



SITCHLER

In fact, stuck bottom hole assemblies and lost wells occur with more frequency than you would think.

It's been commonplace to consider only reservoir quality and completion quality in deciding where to land a lateral in these type reservoirs – but drilling quality is now becoming a key part of the mix.

And that entails integration of the disciplines and incorporation of geomechanics.

“By integrating geomechanics and drilling engineering disciplines, operators have been able to understand recent failures, allowing them to plan and manage risks moving forward,” said AAPG member Jason Stichler, senior geoscientist for Schlumberger Petrotechnical Services in Denver.

Unmanageable reservoir instability problems are not unusual when drilling unconventional shale wells. To deal with this challenge, Stichler and his fellow technical whizzes developed a new rapid mechanical earth model (rapid MEM) workflow to enable operators to quickly make the big decisions for drilling the laterals after acquiring the needed geological info in the vertical pilot hole.

With the rapid MEM, there's no lost rig time given that this process is finalized prior to drilling the lateral or sidetrack.

**Direct Communication**

As part of the rapid MEM, Stichler and his team are employing a whole new risk-based approach to geomechanics dubbed “depth of failure” – and seeing some impressive results.

“In the past, the black and white answer from a geomechanics perspective would say you're either going to be drilling with the safe mud weight needed to cause the borehole to be stable – or not,” he said.

“For the driller, that's not a useful answer. “What we've done with ‘depth of failure’ is look beyond the initiation of failure at the borehole,” Stichler noted. “Now we predict where failure might occur at some depth

See **Geomechanics**, page 24

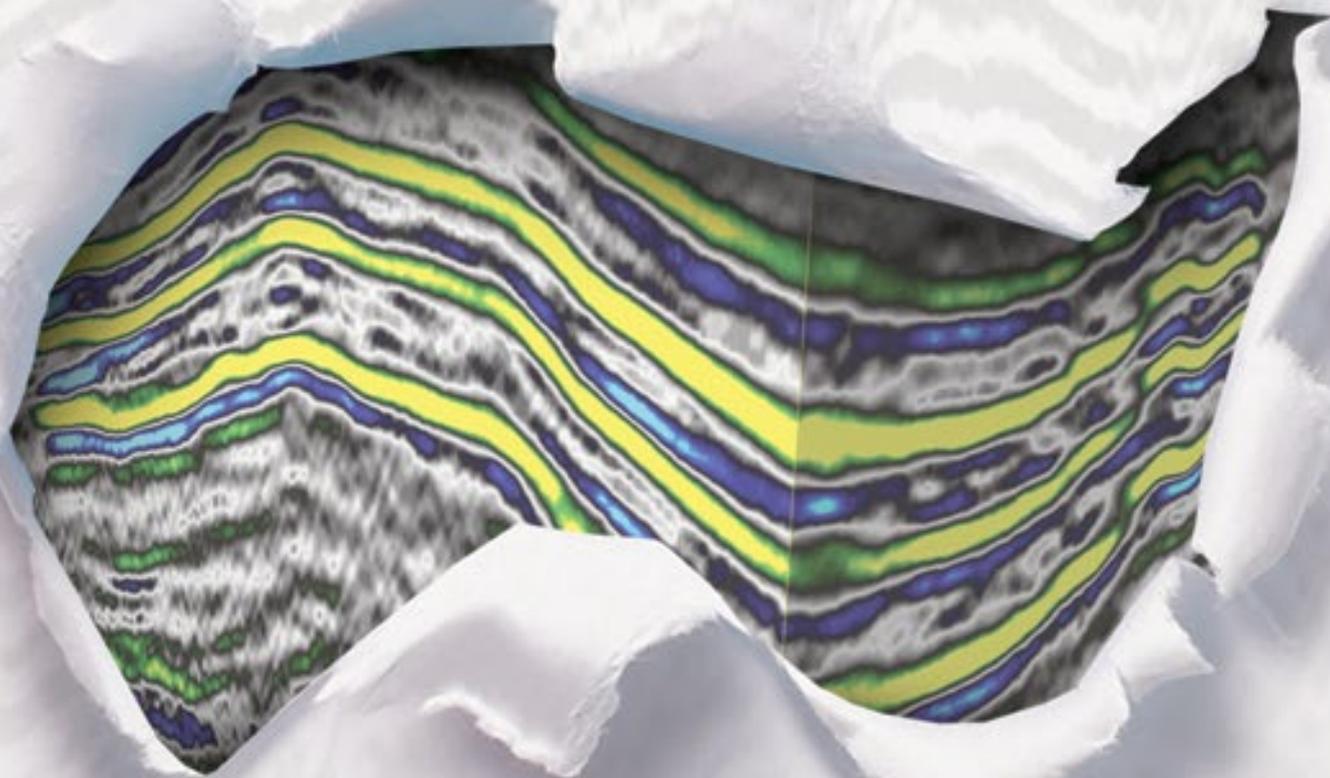
**A**APG member Jason Stichler is co-author of the paper “New Approach to Geomechanics Solves Serious Horizontal Drilling Problems in Challenging Unconventional Plays,” which will be presented at 1:55 p.m. Monday, Aug. 12, as part of the inaugural Unconventional Resources Technology Conference.

URTeC will be held Aug. 12-14 in Denver. The paper is part of a session titled “Unconventional Geomechanics.” The paper will be presented by

Shannon Higgins-Borchardt, a geoscientist engineer for Schlumberger PetroTechnical Services based in Denver.

Other co-authors are the late Anthony Krepp, who was with the K&M Technology Group for Schlumberger, The Woodlands, prior to his recent death, and Marcelo Frydman, a geomechanics program manager in the geomechanics group of Schlumberger Brazil Research and Geoengineering Center, Rio de Janeiro, Brazil.

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# Flowback Water Provides 'Unique Messages'

By LOUISE S. DURHAM, EXPLORER Correspondent

**H**ydraulic fracture stimulation in combo with horizontal drilling might well be called the heart of the ongoing production success of the numerous shale plays scattered across the United States – and elsewhere.

There's still work to do and much to learn. Plenty of aspects of these unconventional reservoirs continue to be poorly characterized.

One of the thorny problems that must be dealt with using hydraulic stimulation is the complex interaction with natural discontinuities in the rock, as shown by mineback and coring studies.

AAPG member Doug Bearinger, geology adviser for shale gas at Nexen, has been working with a team at the company to get a better handle on what happens in these reservoirs and why.

Nexen is a major player in the Devonian Horn River gas shale in Canada's northeast British Columbia, where it has been drilling wells for more than five years.

"The extent of the stimulated reservoir volume can be reasonably determined from the application of microseismic monitoring, proppant tracers, offset pressure changers and fluid hits of offset wells," Bearinger said. "But the extent and geometry of the producing fracture network is poorly understood.

"Low recoveries of slickwater fracturing fluid and chemical fluid tracers suggest that much of the stimulated fracture network doesn't clean-up," he said. "Plus, production analysis techniques and reservoir simulations indicate that the effective producing fracture network is significantly



BEARINGER

**A** APG member Doug Bearinger will present the paper "Message In A Bottle" at 2:20 p.m. Wednesday, Aug. 14, as part of the Unconventional Resources Technology Conference in Denver.

The inaugural URTeC will be held Aug. 12-14. Bearinger is geology adviser for shale gas at Nexen, Calgary, Canada.

Bearinger's talk will be part of a session titled "Stimulated Volume and Fracture Prediction."

smaller than the stimulated fracture network."

To decipher many of the complexities resulting from stimulation, the team soon recognized that they needed to study the water coming out of the reservoir.

There are messages in this water. "We just have to figure out how to decode them because it's all in the chemistry of the flowback, which contains unique messages," Bearinger emphasized.

### Measure for Measure

A key issue for the evaluation is the rate of sampling.

"It takes high frequency sampling to see some of the things we're looking for," he said. "A typical sample schedule may not catch it; it may not figure out there's more than one distinct trend with time."

He noted that James Pyecroft, a veteran reservoir engineer on the Nexen team, worked with a vendor who did chemical tracing and suggested that in addition to the tracers, they should measure the characteristics of the water.

They began measuring ions.

It was determined that the chemistry from the water that comes back from a new break in the rock from hydraulic fracturing looks different than the chemistry of that out of the natural fractures that have been stimulated. This is attributed to the difference in the process that adds ions to the water that was introduced.

"A number of processes are in play, and I think we have a pretty good indication of what is going at this point," Bearinger said.

"The simple one is water mixing," he noted. "If water is already there, you can mix with it – and that is a straight linear mixing exercise.

"The natural fractures are gas-filled, but there is some water in these," he said. "We'll see a higher degree of mixing in natural fractures than induced.

"A fresh break in the rock won't have water on those surfaces, just only a little in the matrix pores, because the matrix porosity is so low in these rock types," he noted. "By the time you have gas-filled porosity, there's not much water left."

"Fluid from a new break makes its way into natural fractures and will encounter more connate water because there will be

water on the surface of natural fractures. "That's kind of the model," he said.

### A Stimulating Subject

An added observation is that even though water doesn't flow out of the matrix, ions can move out in an osmosis-like manner – with some moving faster than others.

In the model the research team formulated, sodium chloride or potassium are readily observed in the fresh break because they move most easily during diffusion – and they are the most soluble.

With more water available in natural fractures to afford some mixing, other ions begin to show up in bigger quantities.

Bearinger emphasized that reservoirs are hydrocarbon – bearing because water has largely been pushed away by hydrocarbons. The remaining water is not free flowing, so one of the difficulties in looking at mixing is that you can't get an actual sample of formation water.

"We would like to know the composition of the water sitting in the pore space," he said. "One of the challenges in figuring out this story is that we actually don't have all of the pieces to figure it out."

Ultimately, this effort is slated to improve characterization of the reservoir post-fracturing, giving the operator a better idea of how much of the production comes from the hydraulic fractures and how much from stimulated natural fractures.

"This starts to tell us something about

[See Water, page 24](#)

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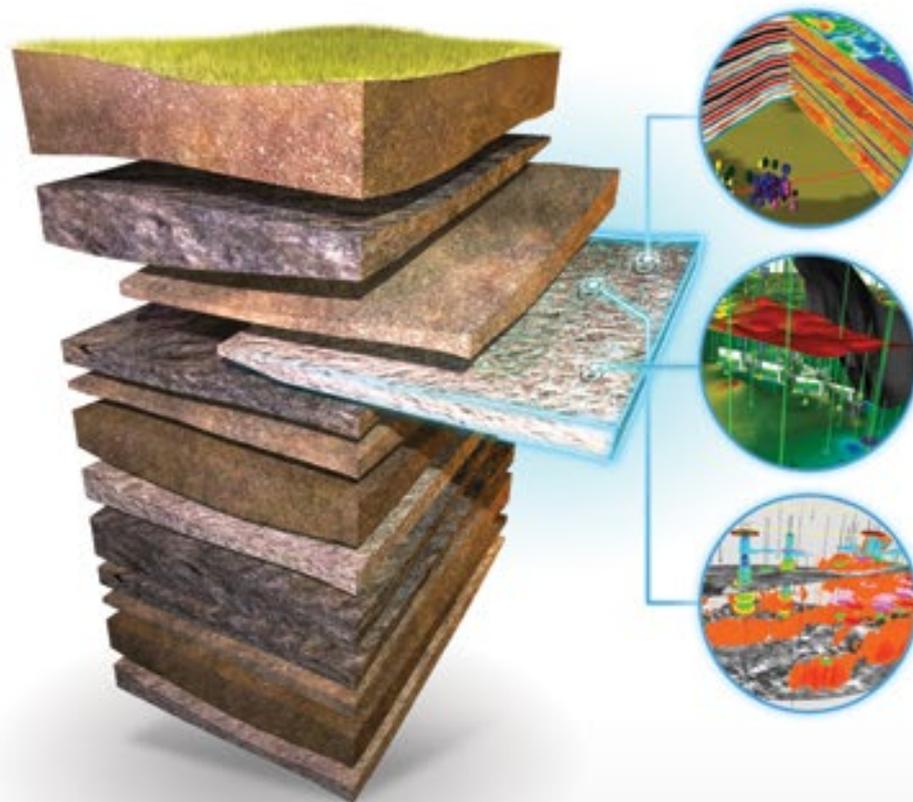
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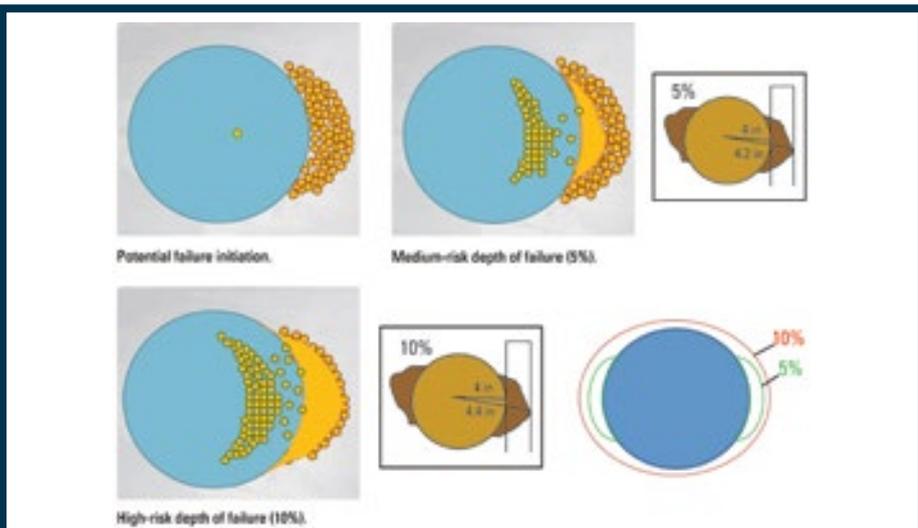


Figure 2 – Depth of failure explanation. The upper-left diagram shows when there is potential failure initiation. The upper-right diagram shows the wellbore, with a potential consequence of a 5 percent larger borehole. The lower left figure shows a wellbore with a radius increase of 10 percent.

## Geomechanics from page 20

beyond the borehole wall and how much material would cave in because of drilling conditions.

“The way stresses are oriented in a lot of basins, borehole breakouts will concentrate on the sides of the wellbore in a horizontal,” he said. “Because the well is not caving from the top, this is not necessarily disastrous for the well.

“Once these breakouts along the sides start getting worse and you’re getting further from stability, then the roof of the horizontal wellbore starts collapsing, and you get a runaway situation leading to wellbore failure.

“There’s a small cushion where you can keep the bottomhole pressure above to manage instability, and you should be ok.”

The geomechanics team members tailor

the rapid MEM so that they communicate directly with the drilling engineers, who have models and software that allow them to take results from the geomechanics and determine the key drilling parameters affecting the pressure downhole.

Sitchler described a project where the mud properties and drilling practices had caused instability in the borehole.

“In two attempts to drill a horizontal well, this operator lowered the equivalent bottomhole pressure by swabbing when they pulled the drillstring out of the hole,” Sitchler said, “causing the borehole to cave in and collapse. This root cause was determined through the rapid MEM process incorporating the depth of failure concept.

“To avoid this,” he said, “they pumped out a portion of the borehole to keep the bottomhole pressure high enough to prevent collapse.”

### Other Concerns

Before you rush in to raise the mud weight when you see the borehole beginning to cave, be aware that other things can go wrong.

Sitchler mentioned another well where the operator had increased the mud weight to try to stabilize the hole. The process created fractures, and the well began relinquishing mud into the formation and ultimately was lost.

In this case the solution determined through drilling engineering was to alter the mud properties to manage ECD (equivalent circulating density) loads.

Depending on the project, Sitchler said the outcome of geomechanics analysis has determined:

- ▶ Where and how to land the well.
- ▶ Safest mud weight to use.
- ▶ Changes necessary to manage swab and ECD (equivalent circulating density) loads for both drilling and casing operations.

“Our goal from the combined geomechanics and drilling engineering is to find the stability window you can work with,” Sitchler said, “to successfully drill the well.

“In the past, with a single well geomechanics model, we had the mindset of monitoring mud weight in and out of the borehole, rather than combining geomechanics with sound drilling engineering principles.

“The difference with this approach is that we’re merging these disciplines through open communication, accounting for depth of failure, he said, “and doing so a lot faster than we used to, using a rapid MEM.

“I can’t overstate the need for good communication,” Sitchler emphasized, “between all parties involved.”

“I can’t overstate the need for good communication,” Sitchler emphasized, “between all parties involved.”

## Water from page 22

the architecture of the producing fracture network,” Beasinger said. “We’re stimulating rocks two-and-a-half kilometers below the surface of the earth, and it’s challenging to know what it actually looks like.

“You can core and run image logs in wells and get an idea of what the natural fracture system looks like before you stimulate it.

“We can use microseismic and other techniques to see how far the fracturing fluid reaches,” he said, “but we don’t know how much of that we actually produce from.

“There are a lot of suggestions that we produce from a lot less fracturing than we create.”

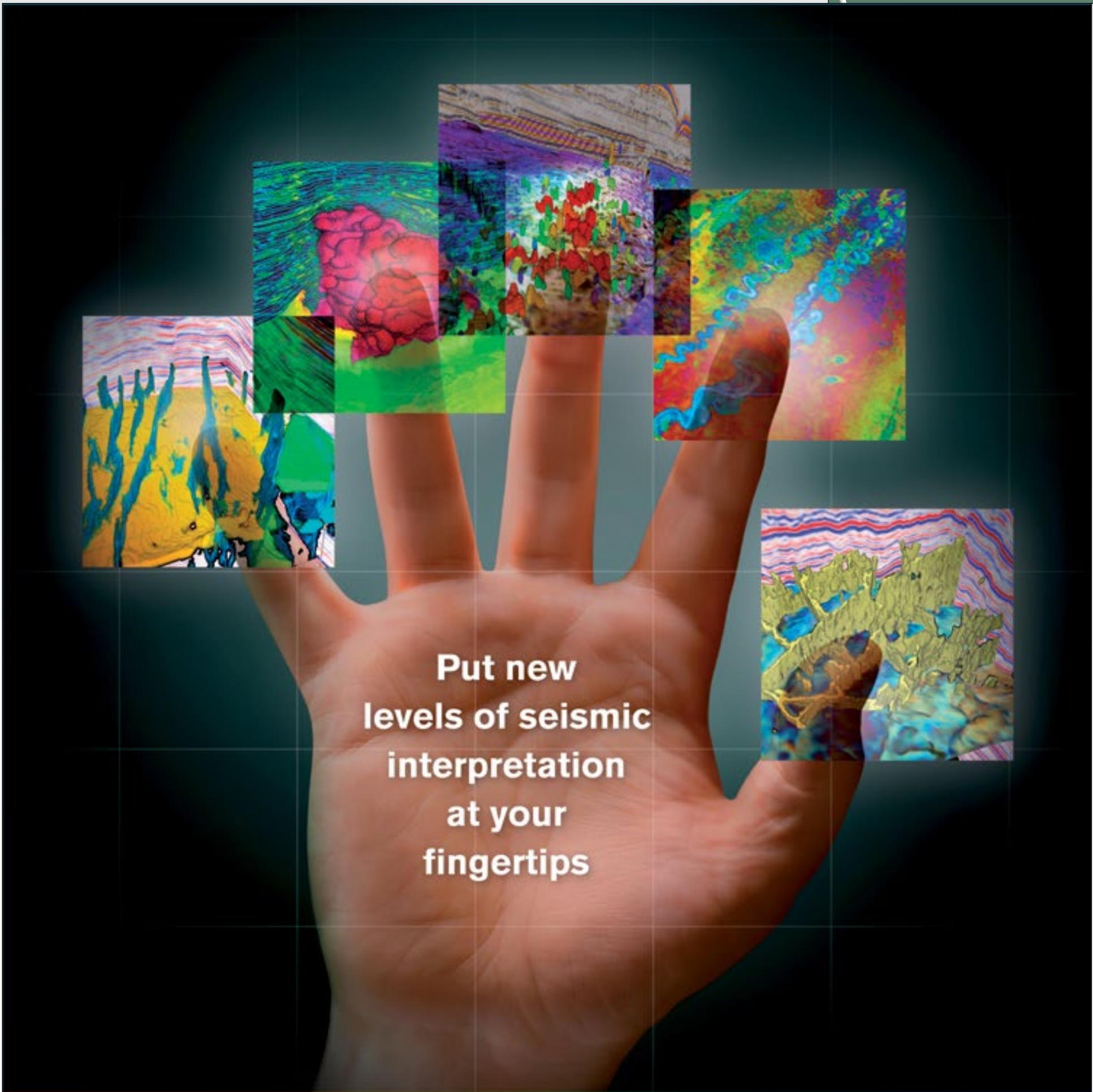


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Several U.S. states show increases

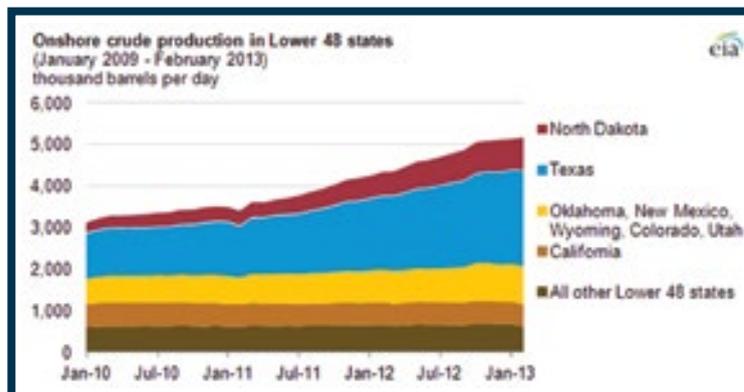
# Rising Production Not Limited to the Big Two

By KEN MILAM, EXPLORER Correspondent

Texas and North Dakota may get a lot of the headlines, but they clearly aren't the only boom states defining today's energy dynamics, according to the U.S. Energy Information Administration.

Estimates in EIA's Petroleum Supply Monthly report released in late May show onshore oil production in the lower 48 states, including crude oil and lease condensate, rose more than two million barrels per day, or 64 percent, from February 2010 to February 2013.

In those years, production more than



Source for the attached graphics: U.S. Energy Information Administration, Petroleum Supply Monthly.

doubled in Texas and nearly tripled in North Dakota, spurring a lot of industry and media attention, the report noted.

"There are other states where increases are noteworthy," the report said. "Five western states in particular – Oklahoma, New Mexico, Wyoming, Colorado and Utah – account for 15 percent of the increase. Production in each of these states increased between 23 percent and 64 percent over the same three years."

The EIA, which is part of the U.S. Department of Energy, attributed the rise in onshore production to increased productivity from oil-bearing, low-permeability rocks.

Horizontal drilling and hydraulic fracturing of low-permeability rocks were fueling the new productivity, the EIA said.

The report excluded production from federal Gulf of Mexico and federal Pacific from its Lower 48 figures.

While the Eagle Ford formation and Permian Basin in Texas and Williston Basin in North Dakota outpaced other regions, "gains in the other Lower 48 states add up to roughly 320,000 bbl/d of production over the past three years," the report stated. Of that, 290,000 bbl/d was produced in the five states mentioned above.

Oklahoma and New Mexico's combined crude oil production averaged more than 530,000 bbl/d in February, about the same as California, the fourth-largest producing state after Texas, North Dakota and Alaska.

"Oklahoma and New Mexico's gains in production, up 51 percent and 46 percent, respectively, compared with February 2010, are primarily from the Anadarko and Permian Basins," the report said.

In Colorado, production increased 64 percent during the three-year period. Wyoming saw a 23 percent increase.

Busy basins in those states are the Powder River, Greater Green River and Denver.

The recently discovered Covenant Field in the central Utah thrust belt – plus continued production from the Uinta and Paradox basins – boosted Utah's output by 45 percent, the EIA said.

"In many fields, in basins such as the Permian, Uinta and Powder River, enhanced oil recovery techniques such as CO<sub>2</sub> injection are also boosting production from conventional reservoirs," the report said.

In its short-term energy outlook, published in April, the EIA report said U.S. crude oil production is expected to "grow rapidly" through 2016. The EIA said it expects U.S. crude oil production to go from an average of 6.5 million barrels per day in 2011 to 7.9 million bpd next year.

EIA collects, analyzes and disseminates energy information to aid policymaking, markets and public understanding of energy and its interaction with the economy and the environment. Its programs cover data on petroleum, natural gas, coal, electric, renewable and nuclear energy.

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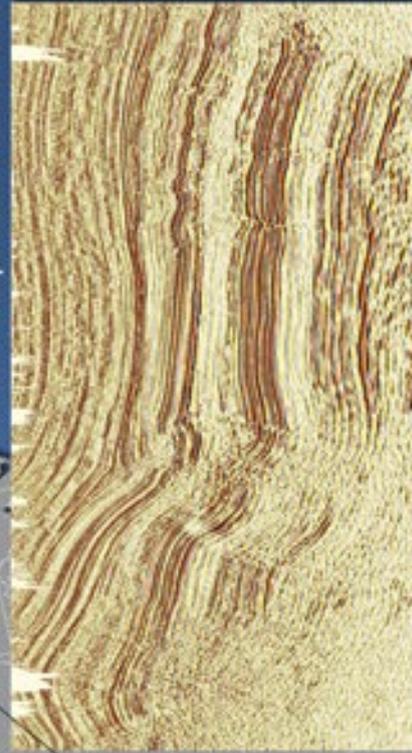


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# Cyber Security a Concern

By **KEN MILAM**, EXPLORER Correspondent

The oil and gas industry is waking up to an invisible threat – the risk of cyber-terrorist attacks and other information technology – according to Ernst and Young’s periodic survey of industry experts and executives.

For the first time, IT risks appear in the top 10 listing in the company’s Business Pulse Oil and Gas Report. IT issues are ranked ninth in the newest survey and are expected to remain in the top 10 through 2015, according to the report.

Previous surveys were released in 2011 and 2010. The survey included more than 100 executives from 90 companies in 21 countries.

“The increasing sophistication of control systems used by oil and gas companies across the world has delivered immense benefit to both the industry and the consumer,” the report read. “Yet ... the risks associated with having a physical network controlled digitally are significant.”

Infrastructure controls are a likely target for cyberattacks.

“At the same time, the amount of sensitive proprietary information circulating within and between oil and gas companies and their counterparties means that information security needs to remain watertight to prevent both industrial espionage and breaches by ‘hacktivists’ – those who hack into computer networks to promote a political or social ideology,” the report said.

One company told the advisory firm, “When we go to particular countries we go with clean cell phones and clean

computers. We don’t store any information, we don’t transmit any information back home and we don’t go on any networks.”

Information risks can include intellectual property and commercial espionage – the untimely leaking of business information like bids and proposals, according to the report.

In past years, the biggest IT concern used to be the effectiveness of the system.

### Changes in Attitudes

The industry’s top concern remains unchanged from past surveys – health, safety and environment.

It can be a dangerous business, and “any perceived negligence in this area (may be) penalized heavily by both regulators, who hand out enormous fines, and the wider public, whose perception of the organization responsible can be irreparably damaged,” the report stated.

While poor public perception can damage a company’s bottom line, the issue has a flip side, the survey indicated.

Listed at number nine on the “Opportunities” list is “additional corporate social responsibility and corporate sustainability measures and transparency.”

And number 6 on the positive side is “safety and risk management used as a partnership enabler.”

The report quoted the CFO of a U.S.-based company: “When we look for partners we look at their safety record as well as their financial ability to handle an accident in case something happens, particularly if the partnership involves

Risk ranking	2013	2015	Opportunity ranking	2013	2015
The risk of a health, safety or environmental incident, and in ensuring regulatory compliance	1	1	Rising emerging market demand	1	1
Price volatility; managing long-term investment with the potential for extreme price volatility	2	2	Investing in innovation and R&D	2	2
Access to reserves or markets	3	3	Frontier acreage	3	3
Cost escalation and inflation	4	6	Focused recruitment, training and retention programs	4	4
Uncertain energy policy	5	5	New infrastructure to gain access to, or to connect, resources and markets	5	5
Worsening fiscal terms	6	4	Safety and risk management used as a partnership enabler	6	7
Human capital deficit (e.g., skills shortages, aging workforce)	7	7	New or expanded markets for natural gas	7	6
Competition from new technologies and new sources (e.g., alternative fuels)	8	8	Acquisitions or alliances to gain new capabilities or access to resources or markets	8	8
IT security	9	10	Additional corporate social responsibility (CSR) and corporate sustainability measures and transparency	9	9
Increasing project scale and complexity	10	9	Strategic divestitures	10	10

Data courtesy of Ernst & Young Business Pulse Oil and Gas Report.

deepwater drilling. The oil spill in the Gulf of Mexico has changed how we evaluate partners.”

While failure to adhere to HSE regulation is the number one risk for oil and gas executives worldwide, this breeds compliance, which enhances partnership opportunities, the report stated.

Other top 10 risks in the industry include price volatility, access to reserves and markets, cost escalation, uncertain energy policy, worsening fiscal terms, human capital deficit (skills shortages, aging workforce, etc.), competition from new technologies and source like alternative fuels, and increasing project scale and complexity.

The report also noted changes in attitudes about the top opportunities.

Rising emerging market demand moved to the number 1 ranking from number 4 two years ago.

“Rapid-growth markets (i.e., developing countries and emerging economies) are thirsty for fossil fuels,” the report stated.

“The breadth and scale of the risks highlighted in this report paint a picture of the oil and gas industry as a perilous place in which to operate. Yet the strength of rapid-growth markets, even amid the backdrop of the recent global economic downturn, has provided ample reward for those able to thrive in this environment.”

Other top 10 opportunities in the report include investing in innovation and R&D; frontier acreage; focused recruitment, training and retention programs; new infrastructure to gain access to – or to connect to – resources and markets; new or expanded markets for natural gas; acquisitions or alliances to gain new capabilities or access to resources or markets; and strategic divestitures. 

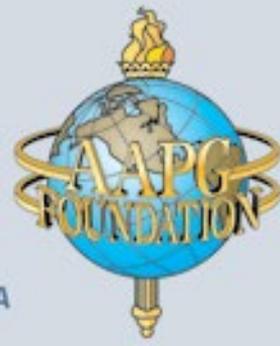
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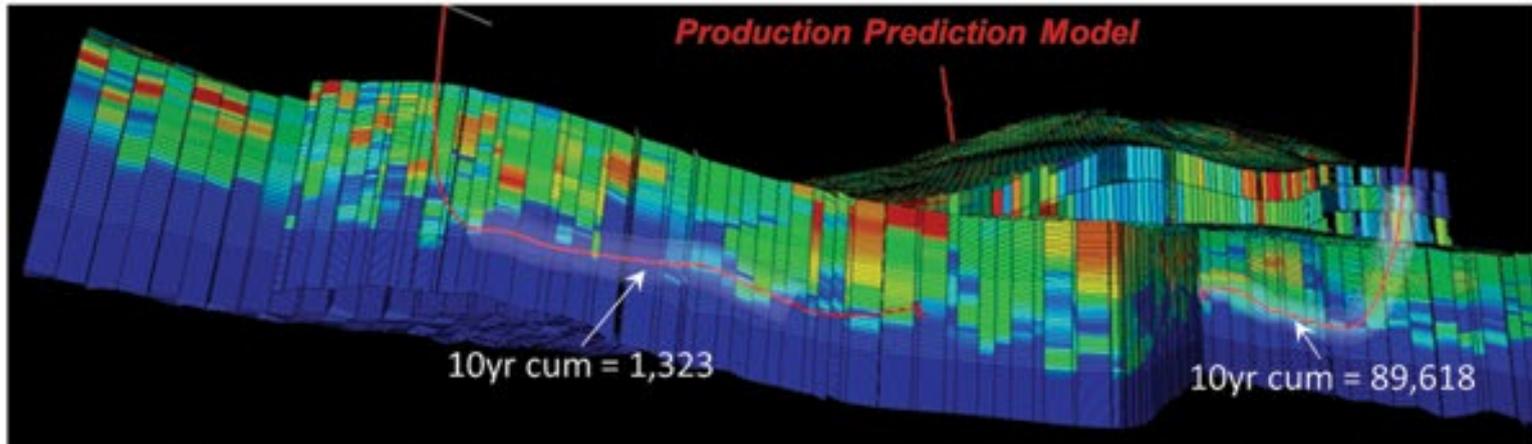
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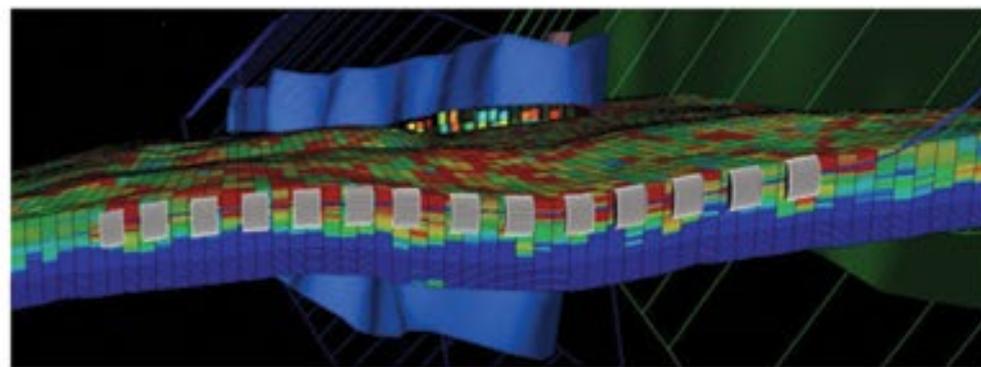
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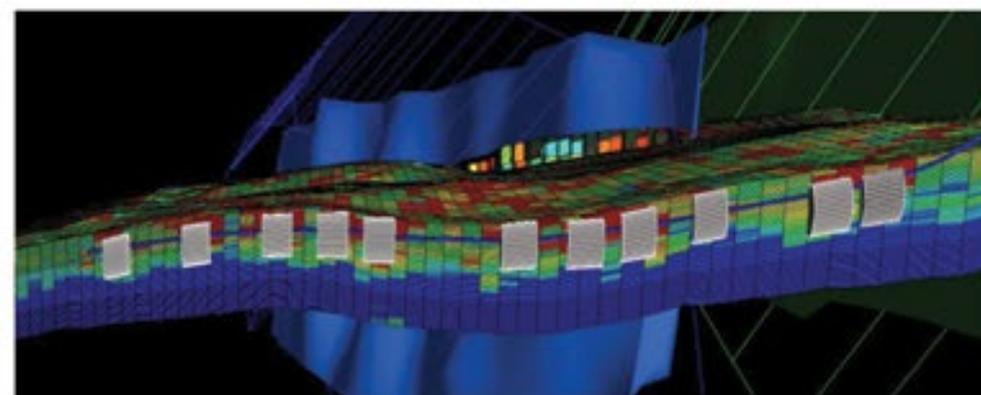


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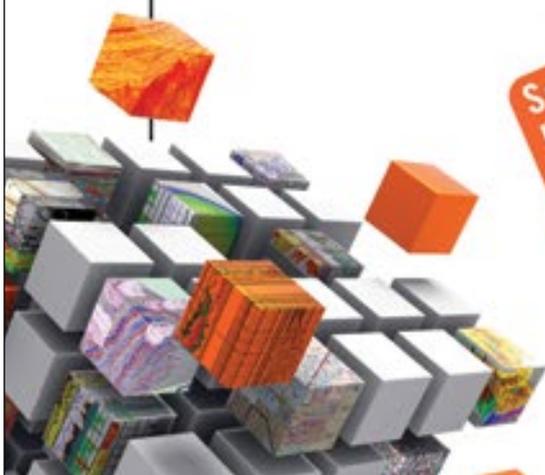


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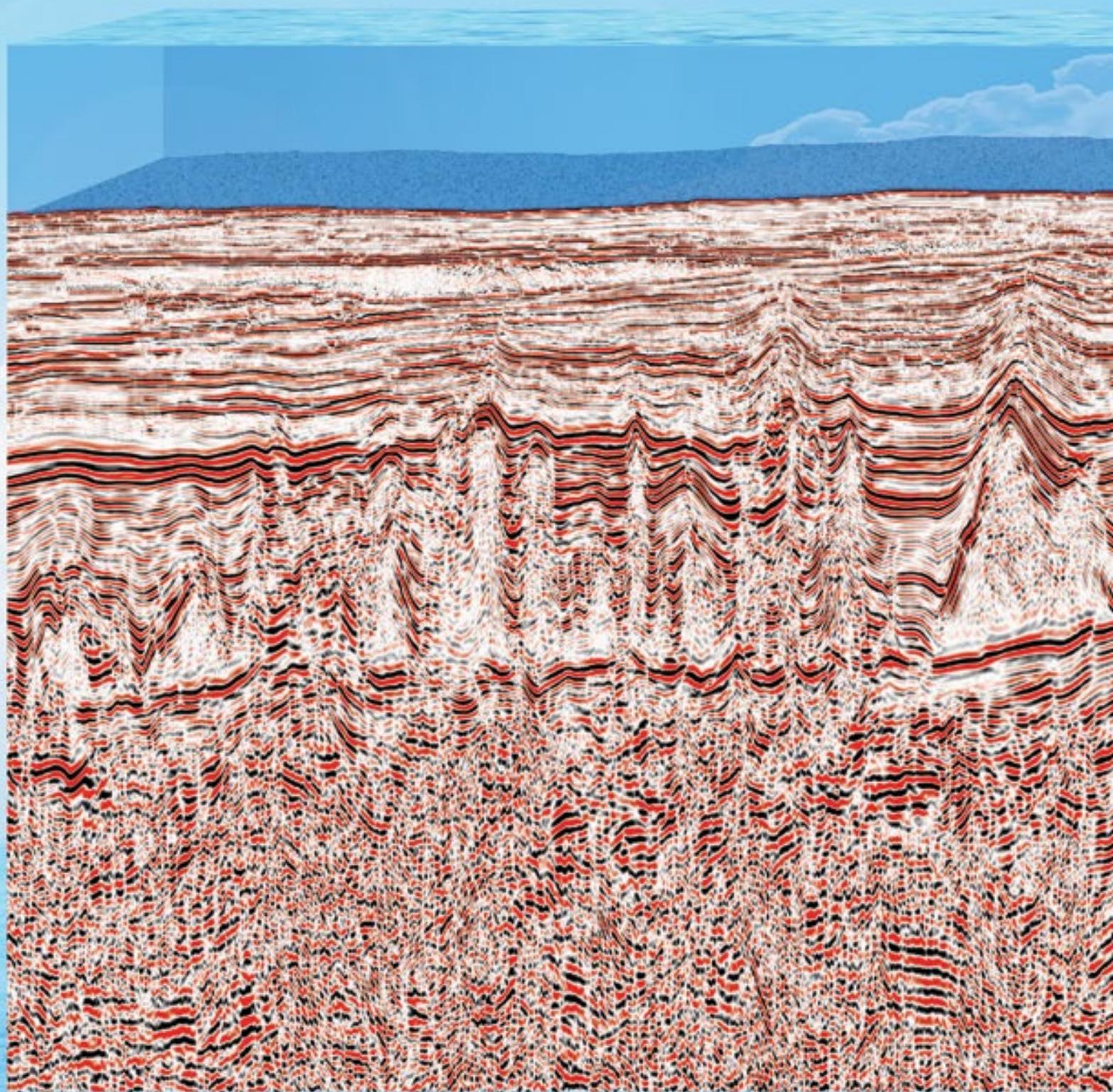


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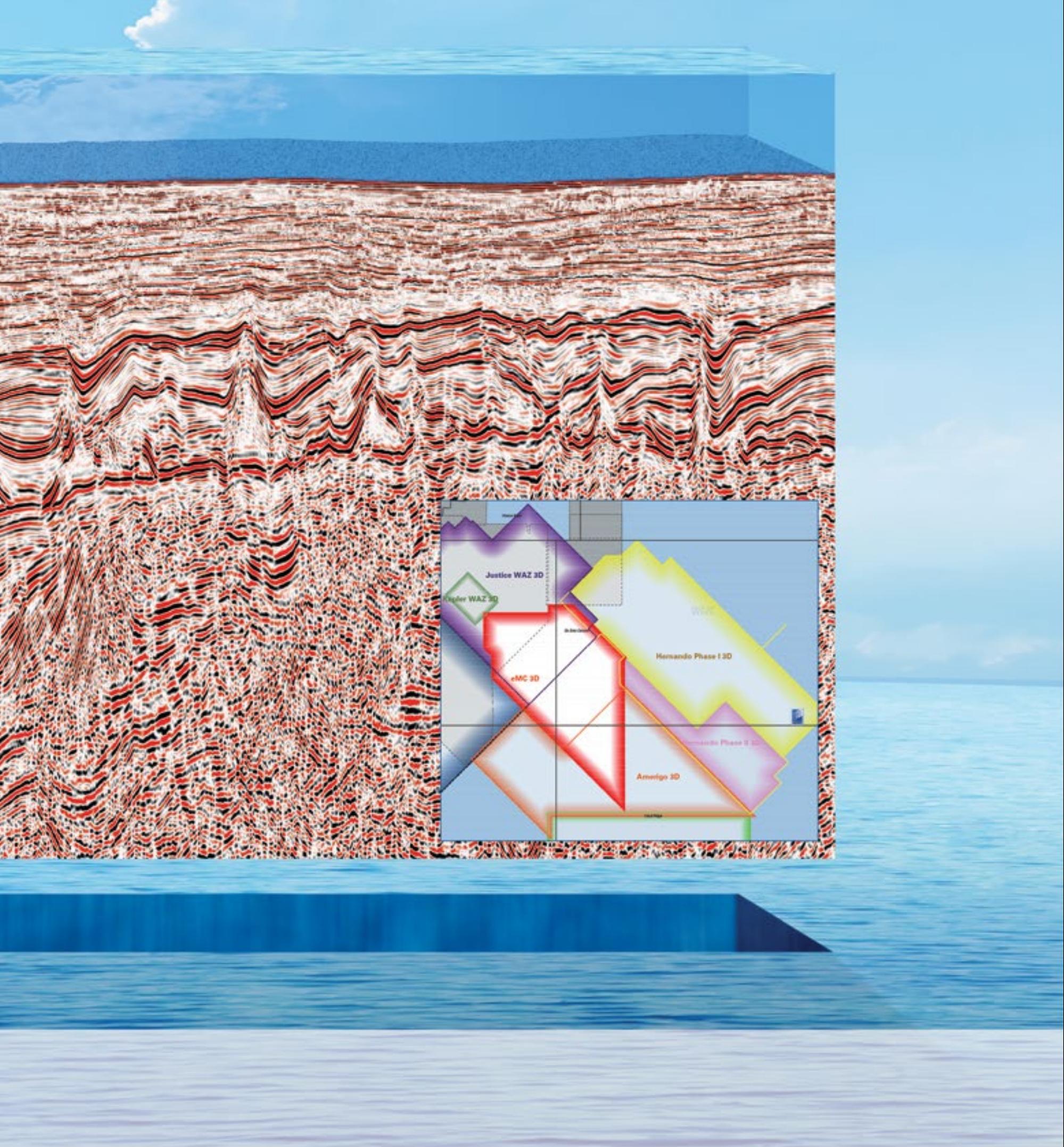


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# Pittsburgh Provided a Unique ACE Location

By VERN STEFANIC, EXPLORER Managing Editor

A new location that sat square in the heart of an active and internationally significant play brought a fresh and exciting feel to this year's AAPG Annual Convention and Exhibition in Pittsburgh. About 5,000 people attended the meeting, which for the first time ever was held in Pittsburgh, and not surprisingly, much of the technical program and several of the activities were defined by the city's proximity to the celebrated Marcellus Shale play.

And yet the ACE organizers also made sure that the meeting also offered a comprehensive scope that made it both attractive and valuable to an international audience as well.

"The technical sessions had appeal to both a domestic and an international attendee," said ACE general chair Michael Canich – one of the factors that he said made the meeting a success.

Certainly, several of the "standing room only" sessions – including the Discovery Thinking Forum – featured talks that shared the science and successful exploration experiences from areas around the world.

But in a perfect blend of local versus global, organizers definitely took advantage of the world's growing interest in shale plays.

"The Halbouty Lecture (Jeff Ventura, president and CEO of Marcellus pioneer Range Resources) and All-Convention luncheon (James Palm, CEO of Gulfport Energy) speakers covered the two major, currently active shale plays in the eastern United States," Canich said. "Both of these speakers provided details of their company's approaches to their respective plays that can be applied by domestic and

international companies pursuing shale plays.

"Shale outcrops of these formations were within driving distance of Pittsburgh, and there were field trips to these sites," Canich added.

"I think the opportunity to take field trips to outcrops and formations currently being drilled within miles of the convention center was a great opportunity," added ACE general vice chair Dan Billman, "and one you often don't have in (other) locations.

"Having a meeting in an area of significant and recent unconventional activity was a great aspect of the meeting," he said. "Having rigs running in the area, and incorporating that into a field trip, was a great opportunity."

The meeting officially started with a fast-paced, colorful opening session that



CANICH

featured a greeting from Canich that offered an entertaining look at the region's historical roots – going back to the 19th century Drake well – and recent developments that have given the region "a second bite of the oil and gas apple."

AAPG President Ted Beaumont's address next explored the potential AAPG and

its members have in making an impact in the world – often through anticipation of and responding effectively to "black swan events," which he described as being surprising, "highly improbable" occurrences.

While we don't know what challenges are going to occur, Beaumont said, we can effectively respond if we stay open to new possibilities. He cited legendary geologist's Parke Dickey's advice:

*"We usually find oil in a new place with old ideas. Sometimes we find oil in an old place with a new idea; but we seldom find much oil in an oil place with an old idea. Several times in the past we have thought that we were running out of oil, when actually we were running out of ideas."*

Also during the opening ceremony was the honoring of AAPG's top award winners for the year, led by Sidney Powers medalist Dietrich H. Welte and Michel T. Halbouty Outstanding Leadership Award winner Stephen A. Sonnenberg.

Daily video recaps of the meeting featuring AAPG Executive Director David Curtiss remain available on the AAPG website, and online videos showing various talks and activities of the meeting will be made available in the coming weeks, at [www.0aapg.org](http://www.0aapg.org).

## Student Winners Announced for Best ACE Presentations

Student award winners have been announced for best oral poster presentations at the recent AAPG Annual Convention and Exhibition in Pittsburgh.

For the best oral presentations, the winners are:

- ▶ First place – **Stephen Holtkamp**, Miami University, Oxford, Ohio, for the paper, "A More Complete Catalog of the 2011 Youngstown, Ohio, Earthquake Sequence From Template Matching Reveals a Strong Correlation to Pumping at a Wastewater Injection Well."

Holtkamp also won the George C. Matson Award, presented for the best paper presented at an ACE. It is the first time in AAPG history that a student member won both awards in the same year (related story on page 36).

- ▶ Second place – **Michael Zeller**, University of Miami, Fla.
- ▶ Third place – **Courtney Kolesar**, University of Pittsburgh.
- ▶ Fourth place – **Robert Heller**, Stanford University.

The best student poster awards for the Pittsburgh ACE went to:

- ▶ First place – **Bryan Ott**, University of Houston.
- ▶ Second place – **Luis Carlos Carvajal Arenas**, University of Houston.
- ▶ Third place – **Lucia Torrado**, University of Houston.
- ▶ Fourth place – **Oluwatobi Olobayo**, University of Manchester, England.

All awardees are AAPG members. Shell has supported student technical awards since 1989, this year providing \$22,500 in prize money that is split between the winning students and their respective universities.

# Exploration Never Takes a Holiday.

AAPG is advancing the world of petroleum geosciences year-round, with innovative educational events that cover the latest discoveries, trends and techniques for exploration and recovery. Our Geosciences Technology Workshops (GTWs) are among the most renowned educational forums anywhere, where experts from across the world share their knowledge and expertise to inspire, enlighten and release your inner explorer.

## Hydrocarbon Charge Considerations in Liquid-Rich Unconventional Petroleum Systems

3 - 5 November 2013 • Vancouver, B.C.

Hosted by: **AAPG Canada Region**

Renaissance Vancouver Harbourside Hotel  
[www.aapg.org/gtw/2013/vancouver/index.cfm](http://www.aapg.org/gtw/2013/vancouver/index.cfm)

## Deep Horizon and Deepwater Frontier Exploration in Latin America and the Caribbean

8 - 10 December 2013 • Trinidad & Tobago

Co-Hosted by: **AAPG Latin America Region and Geological Society of Trinidad & Tobago (GSTT)**

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[www.aapg.org/gtw/2013\\_tobago/index.cfm](http://www.aapg.org/gtw/2013_tobago/index.cfm)

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16th Annual AAPG/SEG

# Fall Student Expo



**When:** 16–17 September 2013

Monday & Tuesday

**Where:** George R. Brown Convention Center, Houston, Texas



Industry Exhibition | Poster Session | Field Trips  
Résumé Building and Review | Networking | Interviews  
Ice Breaker | Interviewing Tips | Short Courses

[www.studentexpo.info](http://www.studentexpo.info)



Emcees David Cook (left) and Chuck Caughey.



Second place: University of Oklahoma.



Third place: Sultan Qaboos University.

## Global competition

# Utah Team Wins IBA

**G**eoscience students from the **University of Utah** took the top prize in this year's AAPG/AAPG Foundation Imperial Barrel Award competition, beating out 10 other teams from geoscience departments from around the world.

The finals were held in Pittsburgh right before the start of the AAPG Annual Convention and Exhibition – and for the second year, the awards ceremony itself was held immediately before the convention's opening session.

That session, emceed by IBA co-chairs David Cook and Chuck Caughey, and featuring swirling lights, rollicking music and a celebratory atmosphere, attracted a crowd estimated at more than 500.

Members of the winning Utah team are AAPG members Mason Edwards, Morgan Rosenberg, Tyler Szwarc and Alexandre Turner, plus Marko Gorenc.

The winning team, representing the Rocky Mountain Section, received the actual 2013 Imperial Barrel Award, individual medals and a \$20,000 prize for their school's geoscience department.

Finishing second (Selley Cup winners) was the team from the **University of Oklahoma**, representing the Mid-Continent Section, which earned individual medals and \$10,000 in scholarship funds for the department.

Finishing third (Stoneley Medal winners) was the team from **Sultan Qaboos University** in Oman, representing the Middle East Region, which earned individual medals and \$5,000 in scholarship funds for their department.

The remaining eight finalists, all winners in Region or Section competitions, each earned \$1,000 in scholarship funds for their schools plus individual medals for themselves as IBA finals participants.

The final teams were (in alphabetical order):

- ▶ Africa Region – Nnamdi Azikiwe University, Nigeria.
- ▶ Asia-Pacific Region – Institut Teknologi Bandung (ITB), Indonesia.
- ▶ Canada Region – Dalhousie University.
- ▶ Europe Region – Manchester University, England.
- ▶ Latin America Region – Universidade do Estado do Rio de Janeiro, Brazil.
- ▶ Eastern Section – University of Wisconsin-Madison.
- ▶ Gulf Coast Section – Texas A&M University.
- ▶ Pacific Section – University of Alaska-Fairbanks.

The IBA program gives teams of students the chance to evaluate the petroleum potential of a sedimentary basin and to test their creative geological interpretations. Their work must be completed in a six-to-eight week period, with results presented to – and judged by – an independent panel of petroleum industry experts.

A total of 107 teams from 30 countries, involving at least 535 students, competed in this year's IBA program.

Past IBA winners were teams from:

- ▶ 2012 – University of Louisiana at Lafayette.
- ▶ 2011 – University of Texas at Austin.
- ▶ 2010 – Institut Francais du Petrole, Rueil-Malmaison, France.
- ▶ 2009 – Lomonosov Moscow State University, Moscow, Russia.
- ▶ 2008 – The University of Oklahoma, Norman, Okla.
- ▶ 2007 – The University of Aberdeen, Scotland.

For more information on the IBA program go online to [www.aapg.org/iba](http://www.aapg.org/iba).

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Houston: Sept 23 – 27      Aberdeen: October 7 – 11  
Calgary: Sept 16 – 20

### Risk, Uncertainty & Economic Analysis for Resource Assessment & Production Forecasting in Shale and Tight Reservoirs

Denver: Aug 5 – 8      Houston: Oct 28 – 31  
Calgary: Oct 7 – 10

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

Houston: Nov 18 – 20

<http://www.roseassoc.com/instruction>

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- Founded by Charles Gould in 1900, OU's geology and geophysics program granted the world's first degree of Petroleum Geology in 1904.
- OU was the site of the American Association of Petroleum Geologists' inaugural meeting in 1916.
- OU alum J. Clarence Karcher conducted the first reflection seismograph survey in 1921 in Oklahoma City and partnered with OU alum Everett Lee DeGolyer to form Geophysical Research Corporation, America's first seismic company.
- OU has graduated more petroleum geologists than any program in the world—over 5,000 and counting.

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## Chopra gets Braunstein Student Wins Matson

**W**inners have been announced for the best technical presentations at the AAPG Annual Convention and Exhibition in Pittsburgh – and one of the awardees represents a first in AAPG history.

This year's winner of the Matson Award for best oral paper at an AAPG ACE and the winner of the top student paper is the same person, for the same paper.

AAPG Student/YP member **Stephen Holtkamp**, of Miami University in Oxford, Ohio, won both awards for his paper, "A More Complete Catalog of the 2011 Youngstown, Ohio, Earthquake Sequence from Template Matching Reveals a Strong Correlation to Pumping at a Wastewater

Injection Well."

His co-authors are AAPG member Brian Currie and Michael R. Brudzinski, both professors at the school.

The Braunstein Award, presented for the best poster presented at the ACE, goes to AAPG member **Satinder Chopra** and **Ritesh Sharma**, for the poster "New Seismic Attribute for Determination of Lithology and Brittleness."

Both are with Arcis Seismic Solutions, Calgary, Canada. Chopra also is the current editor of the EXPLORER's popular Geophysical Corner.

All awardees will be honored at the opening session of the 2014 AAPG Annual Convention and Exhibition in Houston. 





# A Penchant For Pittsburgh

By STUART HARKER

There's many famous firsts that come from Pittsburgh Pennsylvania  
The Ferris Wheel and Polio Vaccine  
Heinz Ketchup and the Big Mac all come from Pittsburgh Pennsylvania  
Plus Drake's well of '59 you scream

Entertainers, Bobby Vinton, then there's Michael Keaton,  
Christina Aguilera, Gene Kelly and Lena Horne  
Movies for all, Lorenzo's Oil, Silence of the Lambs  
Football Joes Namath and Montana borne  
But the Steelers supreme six times Super Bowl winners  
Hockey's Penguins three Stanley Cups  
Artist Andy Warhol had Campbell's Soup for dinner  
Pittsburgh Salad – with French fries-whoops

These are firsts that come from Pittsburgh Pennsylvania  
Now ACE is here, Awards to celebrate  
Marcellus shale exposés in Pittsburgh Pennsylvania  
Let's all make this conference great

*(Delivered at the opening session by AAPG Vice President-Regions Stuart Harker.)*



A joint publication of SEG and AAPG  
**Interpretation**  
 A journal of subsurface characterization



*Karst*

The term *karst* derives from the name of an area of Slovenia and generally refers to the result of weathering or dissolution of limestone, dolomite, anhydrite, or other soluble rocks. Paleokarst is one of the most complex and least predictable styles of carbonate reservoir heterogeneity. Wells that intersect karst-modified fractures frequently have high initial production rates followed by rapid decline. Karst collapse features locally increase depositional accommodation space, and their bounding faults may propagate into shallower reservoirs in response to differential compaction. Rugose karst horizons can cause significant diffraction of downgoing reflection-seismic energy thereby limiting the resolution of deeper targets. Shallow karst systems are important components of freshwater aquifers and form sufficient hazards for highway and other infrastructure, and they can be a drilling hazard in hydrocarbon exploration and production.

The editors of INTERPRETATION invite papers on the topic *Karst* for publication in the August 2014 special section or supplement. Contributions are invited in the areas of seismic geomorphology, the appearance of karst on seismic attributes and impedance inversion, as well as tutorials on geologic processes involved in meteoric dissolution, hydrothermal alteration, evaporite dissolution, and sedimentary infill of karst features. We anticipate contributions related to:

- Geomorphology and architecture of karst in seismic data
- Seismic attribute analysis for paleokarst characterization
- Formation evaluation of karst-modified reservoirs including image log interpretation
- Seismic-aided field development and completion design strategies
- Outcrop analogs for subsurface karst
- Differentiating karst styles: meteoric, hydrothermal, and evaporitic
- Karst petroleum reservoirs
- Karst petroleum seals
- Karst drilling hazards
- Karst influence on shallow unconventional
- Seismic imaging of karst for geothermal production
- Karst influence on seismic data quality
- Karst associated with anhydrite and salt dissolution
- Mapping of shallow karst for engineering and groundwater applications
- Acquisition, processing, and imaging workflows to improve subsurface karst imaging.

Interested authors should submit manuscripts for review no later than **15 November 2013**. In addition, the special section or supplement editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for INTERPRETATION (<https://mc.manuscriptcentral.com/interpretation>) and select the *Karst* option in the manuscript type dropdown box. The submitted papers will be subject to the regular peer-review process, and the contributing authors are also expected to participate in the review process as reviewers.

The submissions will be processed according to the following timeline:	Special section editors:
Submission deadline 15 November 2013	Jerome Bellian jerry.bellian@whiting.com
Peer review complete 1 May 2014	Jason Rush rush@ksg.ku.edu
All files submitted for production 15 May 2014	Charlotte Sullivan charlotte.sullivan@pnnl.gov
Publication of issue August 2014	Hengliu Zeng zengh@beg.utexas.edu
	Kurt Marfurt kmarfurt@ou.edu

INTERPRETATION special section  
**CALL FOR PAPERS**



Members of the IBA-winning University of Utah team – flexing, just a bit. From left: Alexandre Turner, Morgan Rosenberg, Tyler Szwarc, Mason Edwards and Marko Gorenc.

Department-wide effort  
**Utah Won as a Team**

By BARRY FRIEDMAN, EXPLORER Correspondent

**B**y all rights, perhaps, the school may not have been eyed as a factor, much less potential champions, in this year's AAPG/AAPG Foundation Imperial Barrel Award competition.

Still, the University of Utah took home the IBA trophy at the recent AAPG Annual Convention and Exhibition in Pittsburgh.

Of course, no one but the judges know exactly what happens inside the room once the competition begins, and even hardcore IBA observers find it impossible to predict a winner.

Still, when the Utah winners were announced, a number of people may have been surprised.

The Utah students who participated, though – not so much.

AAPG member Alexandre Turner, one of those on the team, even flexed a little.

"Our level of work dominated the competition," Turner said, still in the flush of victory, "and this fact was confirmed again and again by judges at the regional and global level."

All-righty then.

The Utah team members are AAPG members Mason Edwards, Morgan Rosenberg, Tyler Szwarc and Alexandre Turner, plus Marko Gorenc. And yes, they are proud. And with good cause.

This year's international competition involved 535 students from 107 colleges and universities.

In the IBA competition, each school is given the same task: To work up and present a detailed assessment of a parcel's potential for hydrocarbon production using real seismic-imaging and well data.

Here's AAPG member Lauren Birgenheier, faculty adviser for the Utah students and assistant professor of geology and geophysics at the university.

"The Utah Barrelmen (a team name they have given themselves) were given a dataset from the Cooper-Eromanga Basin in Australia," she said. "They made a 25-minute presentation to a panel of judges regarding their technical recommendations, followed by a question and answer session."

Getting to the finals, and then winning finals, was the last step of a difficult journey. To get to Pittsburgh, the Utes had to first compete in Denver, at the Rocky Mountain Section competition, against Brigham Young University, Idaho; Colorado School of Mines; Montana State University-Bozeman; Northern Arizona University; and the

University of Nevada-Las Vegas. It was an intense few months, one in which Rosenberg said condenses time and strengthens friendships.

"When our group of graduate students arrived at the University of Utah, we quickly became a very close group," he noted, "to the point where it's still hard to believe that we have only known each other for a few years."

**Career Path Curriculum**

The Imperial Barrel Award comes with a \$20,000 prize check, which AAPG member Cari Johnson, an associate professor and chair of geology and geophysics at the school, said comes with "bragging rights."

But more importantly, Birgenheier says, "the money will go toward petroleum-related curriculum and student scholarships, either directly or as a seed for a new endowed fund."

It's what the students wanted.

"We asked them," she said.

These students were advised by not only Birgenheier, but also by AAPG member Lisa Stright, an assistant professor of geology and geophysics. Aksel Quintus-Bosz of Chevron and AAPG member Matt Heumann of ConocoPhillips served as the team's industry consultants.

Specifically, as it relates to the university, team member Gorenc gives the credit for the win to the school's focus on its students, faculty and program.

"Our victory is a direct reflection of our department's commitment to developing excellent geoscientists, and our strong connection to industry," he said.

Before the five students could compete on Utah's IBA team, they had to first complete the university's rigorous Petroleum Industry Career Path course series, in which the focus is geology and geophysics with industry applications, and also had summer internships in 2012.

"That helped us build a wide range of skills that were utilized for this project," Gorenc said.

**It 'Makes a Difference'**

Birgenheier says the award is a confirmation of sorts.

"The contest doesn't really change

See IBA Winners, page 48

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AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AND SEPM WISH TO EXPRESS THEIR APPRECIATION TO THE SPONSORS WHO HAVE GENEROUSLY SUPPORTED THE PETROLEUM GEOLOGY COMMUNITY AND THE 2013 ANNUAL CONVENTION & EXHIBITION.

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# Questions Continue to Center on Gas Potential

By EDITH ALLISON, GEO-DC Director

Natural gas production has mushroomed over the past five years. At the same time, natural gas prices have declined.

An important question for individuals involved in natural gas exploration and production is whether demand is likely to grow enough to raise prices and stimulate drilling and production.

But consumers are asking a different question: Will demand expansion raise natural gas prices to punishing levels?

Natural gas demand for electric power has grown 60 percent in the past decade and now represents about one-quarter of natural gas consumption. However, electric power generators can rapidly switch between coal and natural gas, so this area of consumption is not the subject of debate as are other uses of natural gas, and is not discussed in this article.

In May, two different groups looked at natural gas demand:

► The Senate Energy and Natural Resources Committee, chaired by U.S. Sen. Ron Wyden (D-Ore.), held three forums on natural gas, looking at issues including infrastructure needs, the impact of LNG exports and environmental concerns for shale gas development. U.S. Sen. Lisa Murkowski (R-Alaska) is the committee's ranking member.

► The AAPG GEO-DC office hosted an energy policy forum on May 21, at the AAPG Annual Convention and Exhibition in Pittsburgh, to look at the impact of increasing demand for natural gas in the form of LNG exports, natural gas vehicles



ALLISON

The potential for natural gas exports is a hot topic in Washington, D.C., as the Energy Department considers whether to allow LNG exports.

and natural gas for manufacturing. Panelists included Howard Gruenspecht, deputy administrator, Energy Information Administration (EIA); Paul Kerkhoven, government affairs director, Natural Gas Vehicles for America (NGVAmerica); James R. Cooper, vice president-petrochemicals, American Fuel & Petrochemical Manufactures (AFPM); and David Sweet, executive director, World Alliance for Decentralized Energy.

### By the Numbers

U.S. natural gas production has grown a spectacular 20 percent in five years, from 24.4 trillion cubic feet (tcf) in 2007 to 27.2 tcf in 2012, driven by shale gas production.

At the same time, natural gas wellhead prices plummeted from an average annual price of almost \$8 per thousand cubic feet (mcf) in 2008 to less than \$3/mcf in 2012. The price fall was precipitated by increased supply combined with decreased demand caused by the recession.

### LNG Export Growth

The potential for natural gas exports is a hot topic in Washington, D.C., as the Energy Department (DOE) considers whether to allow LNG exports. Natural gas exports to non-free trade countries are allowed unless the DOE determines that the exports "will not be consistent with the public interest."

Two non-free trade LNG export applications were approved in 2012-13, but the facilities will not be completed for several years.

In 2012, the United States imported three tcf of natural gas, primarily from Canada, and exported 1.6 tcf, primarily to Canada and Mexico. This modest export volume is a radical turnaround from 2004, when over 50 import terminals were planned for the United States as the country was expected to become a major importer of LNG. Now the EIA expects the United States to become a net exporter of natural gas by 2020.

U.S. LNG export terminals are expected to rapidly multiply – a small terminal has operated at Kenai in the Cook Inlet, Alaska, since 1969. In the past three years, 26

LNG export applications have been made to the DOE. The total export volume if all the proposed plants were approved and developed as planned would be almost 11 tcf/year.

No one expects all these export facilities to be approved or constructed, but the potential export volume is enough to worry domestic consumers.

EIA projections are relatively benign. The EIA projects that natural gas production will expand 11 percent, or almost three trillion cubic feet (tcf) per year, by 2020. EIA also projects that natural gas exports will expand from 1.6 tcf/year in 2012 to 2.2 to 2.9 tcf per year in 2020, with little impact on prices.

Senator Wyden's concern that the actual price impacts of LNG exports could be more severe prompted his committee's hearings. Several of the invited speakers concluded that LNG exports would have a positive economic benefit for the United States.

For example, Cal Dooley, president/CEO of the American Chemistry Council (ACC), opined that increased natural gas use for electricity generation, transportation, industrial use and LNG exports will benefit the U.S. economy and consumers. He also called for increased access to federal lands as a way to assure growth in natural gas exploration and production.

Deborah Rogers, executive director of Energy Policy Forum, offered an opposing view – that the rapid production declines seen in most shale gas wells suggests the

Continued on next page

## Exploration Never Takes a Holiday.

### Geomechanics and Reservoir Characterization of Shales and Carbonates

16-17 July 2013 • Baltimore, Maryland USA

Join us for lively, multi-disciplinary discussion of new findings, lessons learned, and emerging ("young") technologies related to shale play geomechanics and reservoir characterization. We will discuss how they relate to finding optimal zones, mapping fractures and fracture behavior, optimizing hydraulic fracturing, understanding fracturing fluid behavior, selecting proppants, as well as optimizing horizontal drilling and staged completions.

#### Session Titles:

- Session 1: Geomechanics: What We've Learned about Shales and Carbonates
- Session 2: Fractures: Natural and Induced
- Session 3: Reservoir Characterization and Fluids
- Session 4: Geophysics, Analytics, and Big Data

[www.aapg.org/gtw/2013/baltimore/index.cfm](http://www.aapg.org/gtw/2013/baltimore/index.cfm)

### Sweet Spots, Reservoir Compartmentalization and Connectivity

6-7 August 2013 • Houston, TX

We will focus on defining and identifying "sweet spots," along with understanding compartmentalization and connectivity of the reservoirs, which are increasingly important in all fields, ranging from new shale and carbonates plays to mature conventional fields, both onshore and offshore.

- Porosity development
- Fractures
- Microseismic
- Sequence Stratigraphy
- Imaging
- Workflows

[www.aapg.org/gtw/2013/houston/index.cfm](http://www.aapg.org/gtw/2013/houston/index.cfm)

### Reservoir Quality in Unconventionals

12-13 November 2013 • Austin, Texas

As the industry gains experience in developing shales, carbonates, and other unconventional reservoirs, optimization becomes critical. It is important to understand the key determinants of producibility, and the reservoir characteristics that allow pinpointing productive zones and determining the best completion, stimulation, and developmental strategies.

- Critical Attributes of High-Quality Unconventional Reservoirs
- Petrophysics and Reservoir Quality
- Seismic and Reservoir Quality
- Reservoir Fluids and Reservoir Quality

[www.aapg.org/gtw/2013/austin/index.cfm](http://www.aapg.org/gtw/2013/austin/index.cfm)



**AAPG**

Geosciences Technology Workshops 2013

## GCVD Event Set Sept. 17-18

**P**lan to join members of AAPG and other geoscience organizations in Washington, D.C., Sept. 17-18, for Geoscience Congressional Visits Day.

Geo-CVD, similar to the AAPG CVD, is an opportunity for members to help raise visibility and support for the geosciences – and discuss with congressional offices the science behind the energy issues important to you and other AAPG members.

A constructive visit from citizen geoscientists centered on the importance of geoscience, and the science behind energy issues such as hydraulic fracturing is the most effective way to inform and influence federal policy.

Here's how it works:

▶ Participants spend the first afternoon at a workshop learning how Congress works; how to conduct congressional visits; about relevant legislation; and federal programs.

▶ The second day consists of visits with members of Congress or congressional staff on Capitol Hill.

Fact sheets and talking points for shared geoscience concerns will be provided. Plan to bring examples from your experience and impacts to your congressional district.

All of the scheduling and logistics for the workshop and visits will be arranged by AAPG and its sister societies.

To participate, contact Edith Allison, AAPG's GEO-DC director, at [eallison@aapg.org](mailto:eallison@aapg.org).

For more information, see <http://www.agiweb.org/gap/events/geocvd/index.html>.

### Continued from previous page

resource is small and therefore should not be exported.

Rogers also proposed that encouraging production levels sufficient for exports would be irresponsible given the negative environmental impacts of shale gas development.

### Other Demand Growth Areas

Speakers at the AAPG energy policy forum discussed the potential demand for natural gas in the vehicle, chemical and export markets.

▶ **Paul Kerkhoven** described the benefits of natural gas use in vehicles, which include:

- ✓ Reduced air emissions.
- ✓ Current availability of vehicle and fueling technology.
- ✓ Natural gas is essentially the only abundant replacement for diesel in heavy-duty trucks.

Working against natural gas use in vehicles are the high initial costs of the vehicles and refueling infrastructure.

However, the infrastructure is rapidly developing for compressed natural gas and LNG refueling for vehicles such as buses that return to a base station and for long-haul trucks that operate along the interstate highways.

Kerkhoven quoted a PIRA Consulting study that projected that vehicles would use 5.1 tcf of natural gas by 2030.

▶ **James Cooper** described a potential

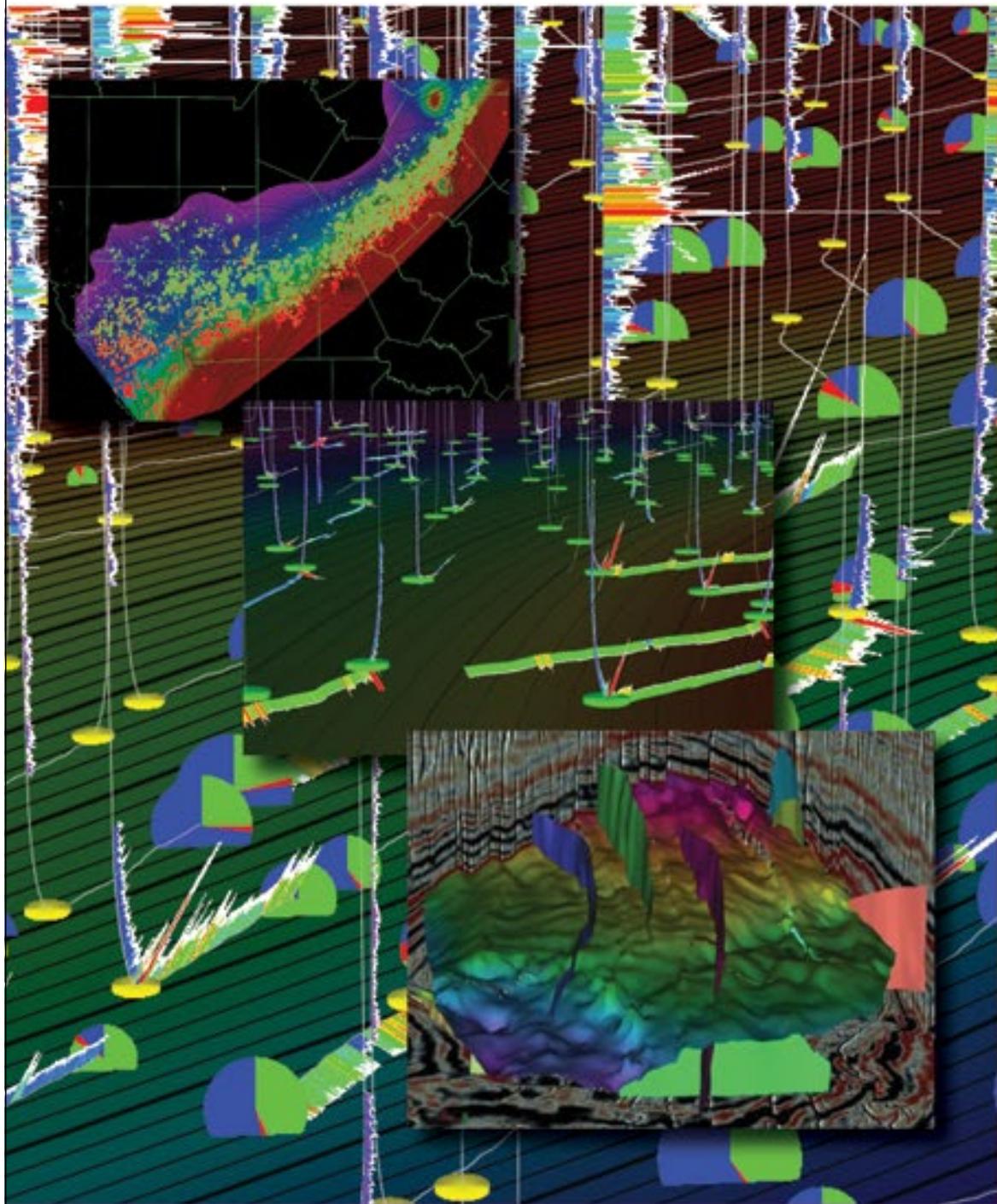
See **Policy Watch**, page 48

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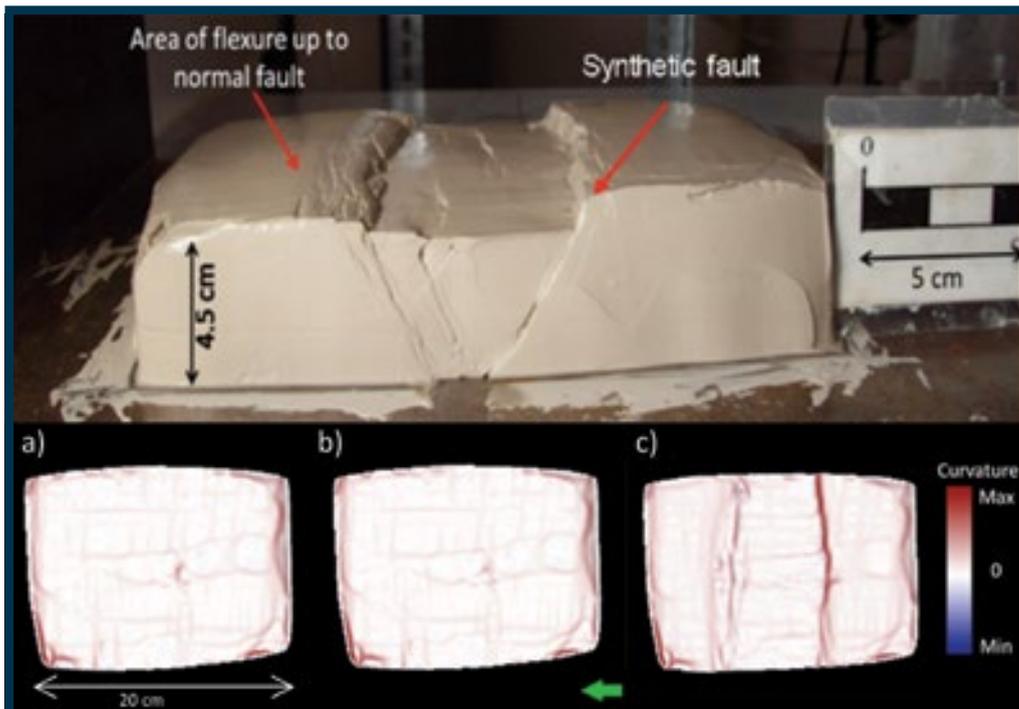


Figure 1 – (Top) Side view of clay cake deformed during extensional experiment. (Bottom) Most-positive curvature computed from the undeformed to final stage of extension experiment a-c. Subtle curvature anomalies parallel and perpendicular to the fault correlate to tool marks made in the initial clay model construction. Fracture intensity calculations occurred on the left side of the central graben. The top of the model is to the left as indicated by the green arrow.

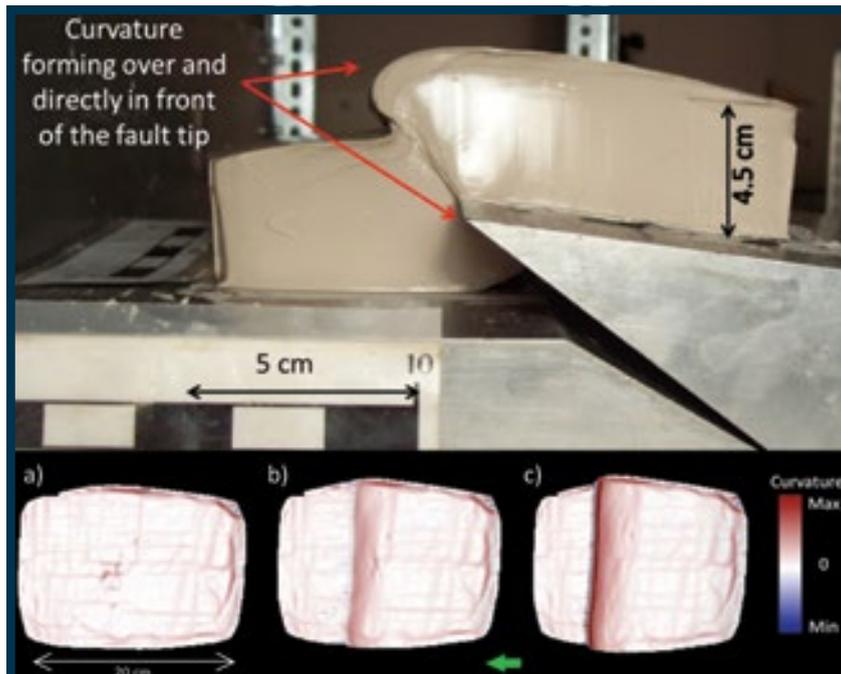


Figure 2 – (Top) Side view of anticline generated during compressional 30-degree ramp experiment. (Bottom) Most-positive curvature computed from undeformed to final of compressional 30-degree ramp experiment a-c. Subtle curvature anomalies parallel and perpendicular to the fault correlate to tool marks made in the initial clay model construction. Fracture intensity calculations occurred on the top of the anticline. The top of the model is to the left as indicated by the green arrow.

A primary factor in controlled lab work

# Testing Curvature's Impact on Fractures

By EVAN STAPLES and KURT MARFURT

Fracture zones can be critical to improving or creating sufficient porosity and permeability in hydrocarbon reservoirs – with strain, along with lithology and thickness being the major controls.

In this article we will use layer curvature as a proxy for strain induced by layer bending.

We test our hypothesis using small-scale clay models, which provide a time history of folding and fracturing, and are commonly considered analogs for large-scale field structures. The experimental apparatus consisted of a horizontal table with one moveable sidewall, one stationary sidewall and a deforming base.

We present four experiments – one extensional and three compressional.

► In the extensional experiment, the clay cake was placed on top of two rigid, thin metal plates that were moved away from each other.

► In the compressional experiments, the clay cake was placed on two metal wedges with inclinations 45 degrees, 30 degrees and 15 degrees, that moved toward each other to generate reverse basement faulting.

We use wet clay with dimensions of 20 centimeters long, 15 centimeters wide and five centimeters thick. A laser scanner positioned above the clay cakes captured 3-D surface images.

A typical experiment lasted approximately 30 minutes with a laser scan occurring every two minutes; this short duration eliminated clay drying as a variable.

The curvature of the clay surface was calculated from the laser scans using commercial software, and the fractures were mapped on digital photographs of the clay surface. Curvature over the deformation area was calculated in each stage by placing three polygons at fixed locations and averaging the curvature within each polygon.



The fracture intensity (FI) was calculated for these polygons by dividing total measured fracture length in each polygon by its area.

\* \* \*

In the **extensional experiment**, a basin formed above the moving plates with a synthetic normal fault on one side, and a system of antithetic-normal faults, fractures and a flexure on the other side (top of figure 1). Curvature and fracture intensity measurements were conducted on the later side of the basin.

The bottom of figure 1 displays a suite of positive curvature images from initial through final stages.

Fractures were first visible on the clay

surface with a measured curvature of  $2.53 \times 10^{-3} \text{ cm}^{-1}$ . We observed that curvature and fracture intensity increased with time, but was dependent on fault movement. Normal faults started as individual segments and eventually joined up to form faults that spanned the entire clay model.

At a critical point, fractures no longer accommodated the displacement; rather, normal faults accommodated displacement in the model.

At this point, we ended the experiment.

\* \* \*

In the three **compressional experiments**, an anticline developed with fractures on the crest sub-parallel to the axial plane (top of figure 2). Fractures were first visible

on the clay surface with curvature ranging between  $1.40 \times 10^{-2} \text{ cm}^{-1}$  to  $2.13 \times 10^{-2} \text{ cm}^{-1}$ .

The bottom of figure 2 shows a suite of positive curvature images initial to final stages for the 30-degree ramp.

During the experiments we observed that curvature and fracture intensity qualitatively increased with time as initially hypothesized. Fractures initially accommodated the extensional displacement on the top of the anticline in individual segments; as the experiments progressed, the fracture segments began to connect and eventually generated faults to accommodate the increased displacement.

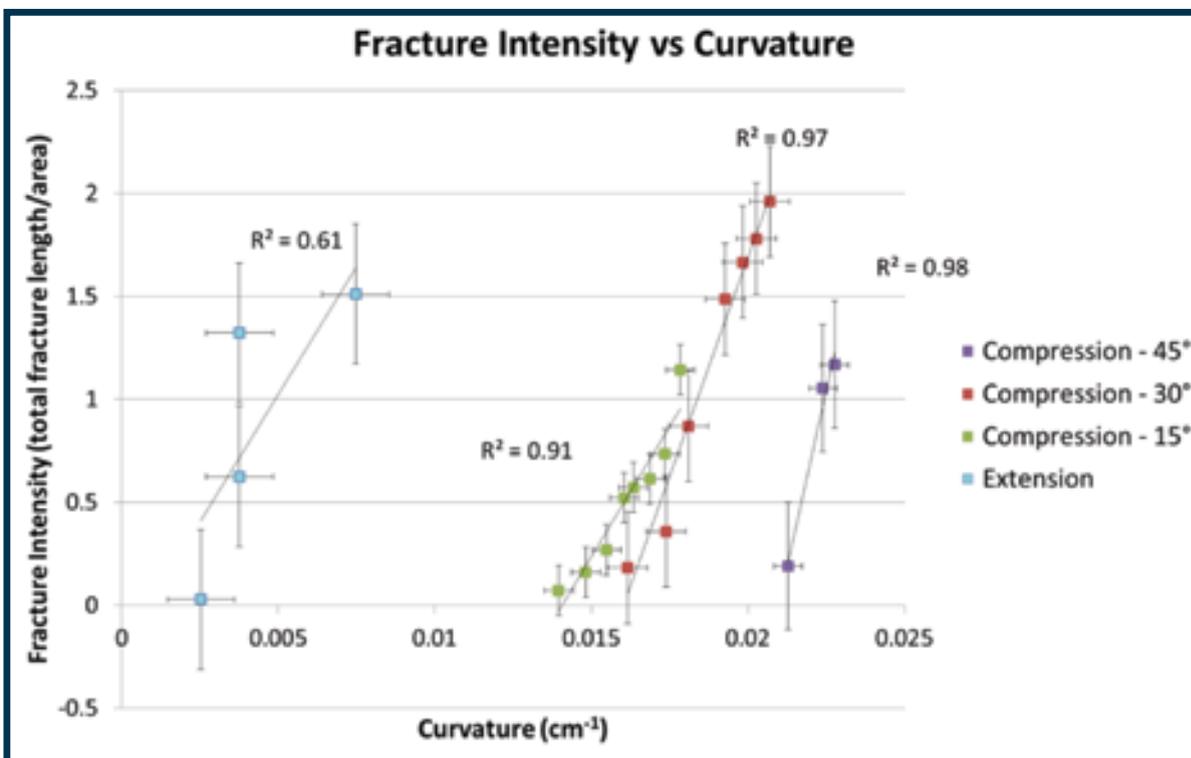


Figure 3 – Linear relationship observed between fracture intensity and curvature, with standard error bars for all four experiments.

Continued on next page

Continued from previous page

At this point, fractures and curvature were no longer the principle features that accommodated displacement, and we stopped the experiments.

\* \* \*

Curvature increased over time with systematic deformation occurring in the extensional, 15-degree compressional ramp and 30-degree compressional ramp experiments. Deformation in the 45-degree compressional ramp was non-systematic, but followed a similar trend as that seen in the other two ramp experiments.

Maximum curvature values varied based on the experimental setting, with the extensional value ( $7.5 \times 10^{-3} \text{ cm}^{-1}$ ) being one order of magnitude lower than the compressional settings ( $2.28 \times 10^{-2} \text{ cm}^{-2}$  to  $1.78 \times 10^{-2} \text{ cm}^{-1}$ ).

Calculated FI increased with curvature and correlations show a strong-positive-linear relationship (figure 3) – however, fracturing did not occur at the same curvature value in each experiment. The extensional experiments showed fracturing initiation at a significantly lower curvature value ( $2.53 \times 10^{-3} \text{ cm}^{-1}$ ) than compressional experiments, where fracturing initiated at values one order of magnitude higher than extensional experiments. ( $2.13 \times 10^{-2} \text{ cm}^{-1}$ ,  $1.62 \times 10^{-2} \text{ cm}^{-1}$ , and  $1.40 \times 10^{-2} \text{ cm}^{-1}$  for 45-degree, 30-degree and 15-degree ramps, respectively).

We interpret differences in horizontal strain as the main reason there is such a disparity in fracturing and curvature values at fracture initiation. In the extensional experiment, we assume that horizontal strain occurred throughout the experiment, since the basement plates were constantly moving apart – though we only measured vertical displacement.

In the compressional settings, however, an anticline had to develop and grow before horizontal strain was great enough on its crest to induce fracturing.

\* \* \*

The clay model experiment results suggest that curvature was the primary factor in fracture generation in controlled, laboratory settings.

Assuming results from clay models show fracture patterns similar to real rocks, then clay-model results imply that curvature and fracture intensity follow a 3-phase curve of elastic deformation (no fractures), through linear correlation (Figure 3), to fracture saturation (movement along faults) when subsurface deformation involves basement reverse faulting or layer extension.

In a future article we will show the correlation of curvature computed from 3-D seismic data to fractures seen in horizontal image logs.

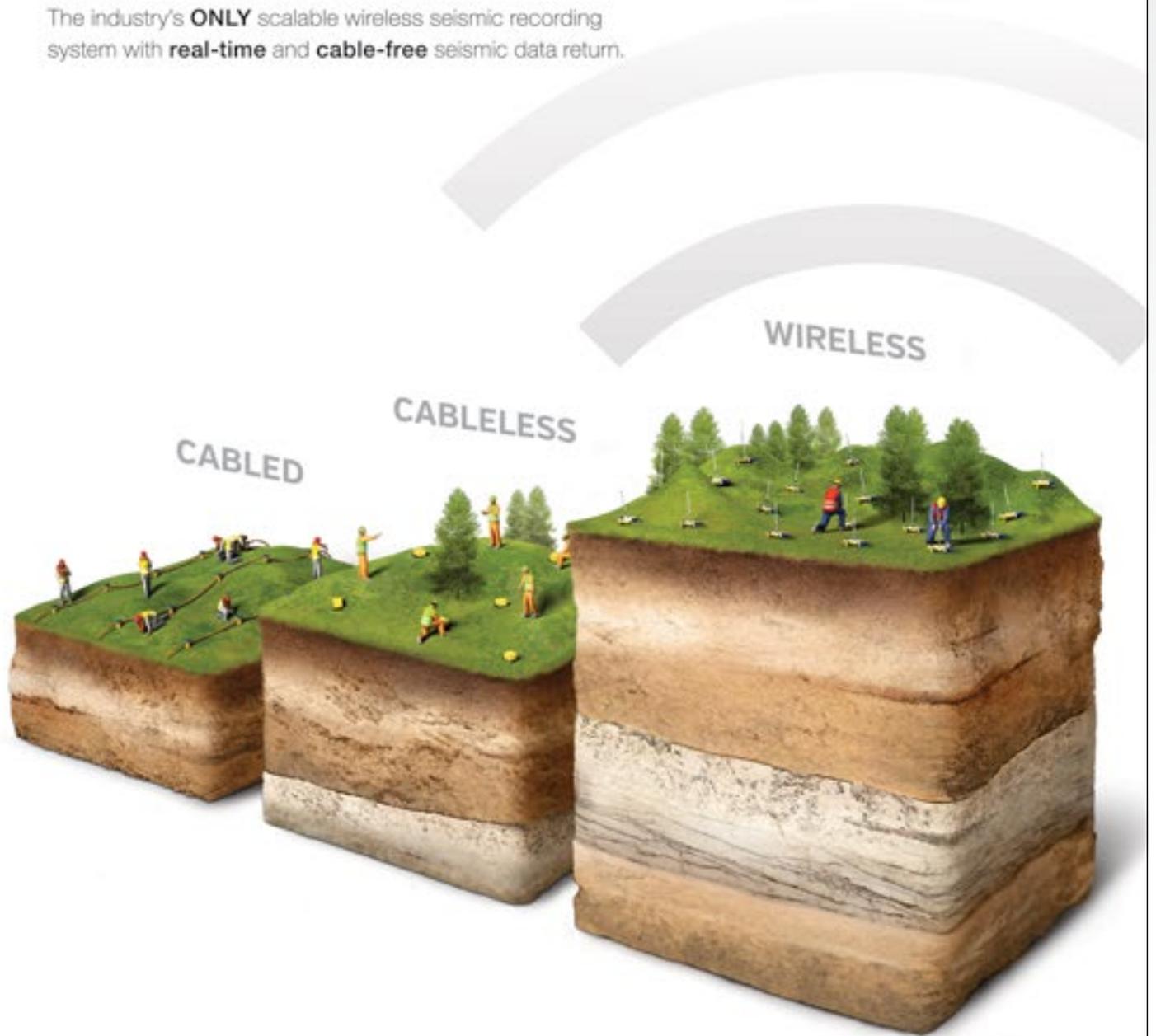
**Acknowledgements:** We would like to thank AAPG member Ze'ev Rechtes from the University of Oklahoma for help with this project and guidance in clay model setup and analysis. Additionally, we would like to thank Schlumberger for providing software for this research at the University of Oklahoma.

*(Editor's note: Evan Staples is with ConocoPhillips in Houston, and Kurt Marfurt is with the University of Oklahoma in Norman, Okla. Both are AAPG members.)*

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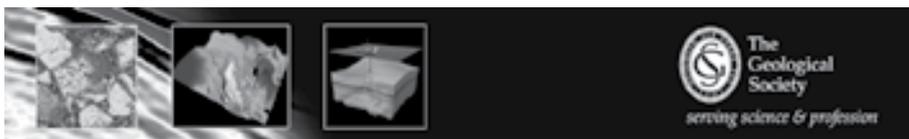
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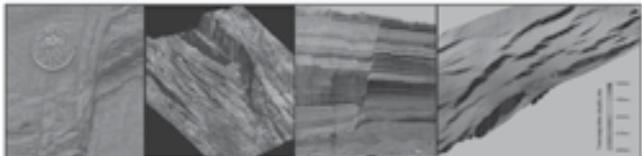
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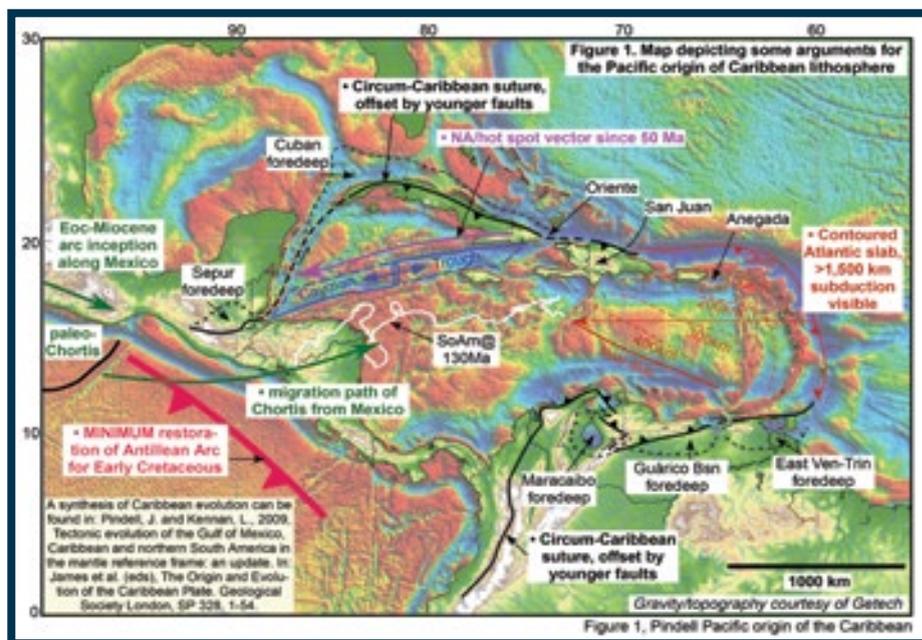
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## HISTORICAL HIGHLIGHTS



# Origin of the Caribbean? Look Toward the Pacific

By JAMES PINDELL

As a Ph.D. candidate in Durham, England, back in 1983, assessing Caribbean evolution with John Dewey, I had a far-reaching decision to make:

*Were there enough arguments to champion a firm stand for a Pacific origin of the Caribbean lithosphere, as Kevin Burke, Bruce Malfait and others had suggested?*



PINDELL

At that time I had just quantified for the first time the American relative plate motion histories with respect to Africa using Seasat/Geosat data – with Steve Cande and Walter Pitman at Lamont, in 1981-82 – so I was in a good position to test hypotheses concerning Caribbean origin.

Through the course of compiling information for my thesis – and guided by the plate kinematics – the answer to the question, even back then, was an overwhelming “yes.”

Drift between North and South America created Jurassic-Cretaceous “Proto-Caribbean” passive margins, which were subsequently overrun by allochthonous Caribbean oceanic/arc terranes. I was able to show, by evaluating the circum-Caribbean foredeep basins, the eastward-younging history of oblique arc-continent collision from the Pacific since the Campanian, when Caribbean lithosphere first arrived along southern Mexico/Chortis and western Colombia from even farther west.

It also was apparent that the Caribbean lithosphere has rested very nearly in the hot spot or mantle reference frame since before the Cenozoic, such that the American plates, and not the Caribbean, have caused the relative plate motion as the Americas have drifted west from Africa to form the Atlantic.

\* \* \*

Today, arguments for this story are more numerous and better documented than in 1985, and none contest it.

▶ A conspicuous aspect of Caribbean geology explained only by an allochthonous Caribbean origin is the paucity of arc-related tuffs in the Cretaceous Proto-Caribbean passive margin sections of Yucatán, Bahamas, northern Colombia, Venezuela and Trinidad.

In contrast, the Caribbean arcs were constantly eruptive, and deposition across the Caribbean Plate was dominated by arc tuffs. Clearly, there was significant spatial separation between the arcs and the passive margins in the Cretaceous, unlike more recent times.

Further, Proto-Caribbean passive margin sections are separated today from Cretaceous-Paleogene mobile belts of arc magmatism, tectonic deformation and subduction-related HPLT metamorphic rocks and mélanges, by the circum-Caribbean suture (figure 1, black).

These abrupt juxtapositions are clearly incompatible for Cretaceous-Early Paleogene time, and the respective associations could not have formed near each other.

▶ East-west opening of the Cayman Trough, a hyper-extended pull-apart basin along the northern Caribbean boundary, is at least 700 kilometers – and more likely about 1,000 kilometers – judging from the basement's oceanic spreading fabric and trough-flanking structure. This has occurred since at least the Oligocene (dredged basin floor sediments) or the Eocene (magnetic anomaly interpretation).

But this 700-1,000-kilometer estimate of American-Caribbean relative motion (figure 1, blue) comprises only part of the estimate derived from seismic tomography, which images the Atlantic slab dipping westward some 1,500 kilometers beneath the eastern Caribbean Plate (figure 1, red).

Fifteen-hundred kilometers is a measurable minimum Caribbean-American Tertiary displacement.

▶ Caribbean lithosphere has rested nearly in the hot spot reference frame since subduction and arc magmatism began along the western, Costa Rica-Panama Caribbean margin in the Campanian, such

See Caribbean, page 46

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## Caribbean from page 44

that the plate has been locked between opposing subduction zone "anchors" that have moved laterally very little through the mantle.

Unlike North and South America, with their Cretaceous-present histories of compressive orogenesis along their western subduction systems, the Caribbean does not drive westward over the mantle, because subduction at the Lesser Antilles matches American westward drift. The Costa Rica-Panama Arc is not being thrust over the trace of its own trench, and thus there has been no Cenozoic Andes-type orogenesis in Costa Rica-Panama.

Further, migration paths of North

America relative to the hot spots closely scribe the Cayman Trough in both azimuth and length, especially if we accept an Eocene time of initial Cayman Trough opening (figure 1, pink). This is strong evidence that the Cayman Trough does indeed record American-Caribbean relative motion.

An implication of 1,000 kilometers of Cayman Trough opening is that Jamaica restores to a position near the southeastern Yucatán Block in the Eocene. Jamaica's Richmond Fm conglomerates bear metamorphic clasts that appear to derive from Central America rather than Jamaica itself.

Simon Mitchell, Uwe Martens and I are currently examining this material for lithologic and chronologic ties to the Chuacus and other metamorphic units of Central America.

Another implication of 1,000 kilometers

of Cayman Trough opening is that the displacement also must occur obliquely through the Greater Antilles Arc. Sinistral segmentation of Antillean rock units on the order of 300, 400 and 300 kilometers at the Oriente, San Juan-Muertos and Anegada fault zones, respectively, are apparent and consistent with Cayman displacement (figure 1).

► The Greater Antilles Arc collided with the Bahamas above a southwest-dipping subduction zone in the Eocene. The same subduction zone was responsible for the Neocomian to Eocene history of arc magmatism and HPLT subduction-related metamorphism, some 80 million years.

Following the tenet that arcs need subduction rates of >20 mm/year to evolve robustly, the Antilles Arc likely migrated from the southwest by at least 1,600 kilometers prior to the Eocene collision

(figure 1, strawberry). This pre-dates Cayman Trough opening and places the arc, with the Caribbean Plate southwest of it, west of Colombia and south of Yucatán, in the Pacific.

But 1,600 kilometers is only a minimum, because the arc did not begin to collide with Yucatán until 80 Ma.

Further, in the Neocomian when Greater Antillean arc magmatism and subduction began, the gap between the Americas was trivial (figure 1, white), with no "room" (or reason) for Antillean subduction to begin within this entirely extensional passive margin setting.

► Recent and ongoing field and lab studies by Tectonic Analysis and others are strengthening the long-held suspicion that rocks of the Chortis Block (nuclear Central America) are equivalent to and originated from a position along the Acatlán/Oaxaca complexes of southern Mexico. This implies about 1,600 kilometers of Chortis displacement (figure 1, green), larger than the width of onshore central Guatemala, such that there can be no strike-slip offset marker there.

It also is greater than the length of Cayman Trough, suggesting that Chortis began to move east before the Cayman began to open.

In concert with the migration of Chortis, initiation of Tertiary arc magmatism in southwest Mexico has migrated east as well (figure 1, green), because the migration of Chortis has allowed the 150-kilometer depth contour of the Farallon-Cocos Benioff Zone to advance eastward beneath southern Mexico.

► Finally, Cretaceous passive margin sections of Yucatán, the Bahamas, Colombia, Venezuela and Trinidad transform upward with east-younging diachroneity into tectonically active foreland basins with "arc-bearing" turbiditic flysch (figure 1, ticked basin outlines).

✓ In southern Yucatán, Cobán carbonates deepen upward into Maastrichtian Sepur flysch.

✓ In western Cuba, a paralochothonous portion of eastern Yucatán, shelf carbonates are overlain by Paleocene-Lower Eocene Cacarajicara-Pica Pica foredeep mélange/flysch.

✓ In northern Cuba/Bahamas, shelf carbonate (Card Sound/Cedar Keys/Lake City) is overlain by Early to Middle Eocene Amaro and Lutgado flysch.

✓ In Colombia's Cesar Basin, Umir platform strata give way to Paleocene Molino turbidites.

✓ In Maracaibo, the Cretaceous-Paleocene (Guasare) platform is buried by Early to early Late Misoa-Trujillo-Pauji foredeep section.

✓ In central Venezuela's Guárico Basin, the Oligocene La Pascua-Roblecito foredeep section overlies the Cretaceous platform. In its Maturín Basin, the Cretaceous-Oligocene platform is drowned by Early and Middle Miocene upper Areo/Carapita and Oficina foredeep units.

✓ In Trinidad, the foredeep section comprises the Upper Cipero, with its Middle Miocene Retrench and Herrera sandstone fairways.

These transformations from passive to active margin (recording first Caribbean collision and subsequent advance) young from west to east at about 20 mm/year, which is, appropriately, the average rate of Atlantic seafloor spreading through time.

GPS measurements confirm the continuation of the 20mm/year rate today.

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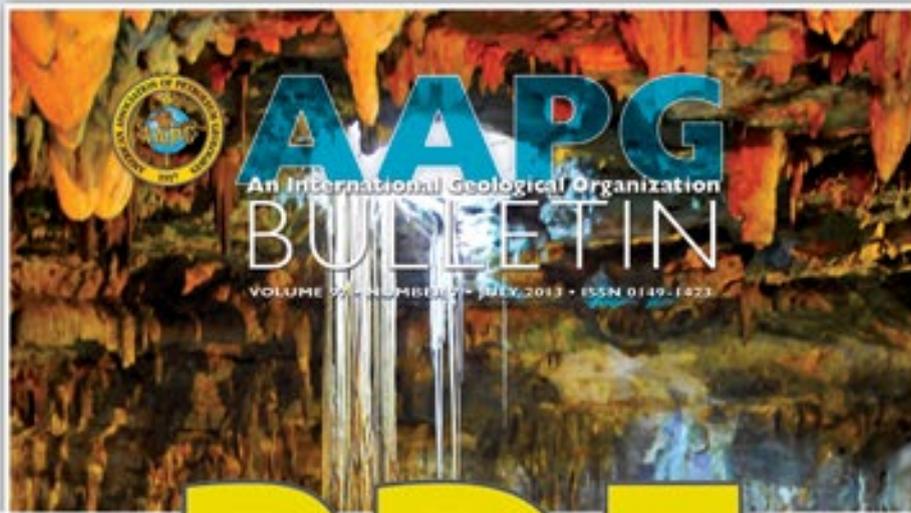
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See Origins, page 48

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### AN ONGOING CHALLENGE

*Peter M. Burgess, Peter Winefield, Marelio Minzoni, and Chris Elders*

Isolated carbonate buildups are important exploration targets but difficult to identify on seismic data. Identification criteria have been developed which include regional constraints, analysis of basic seismic geometries, analysis of geophysical details, and finer-scale seismic geometries.



### INTRODUCING A NEW CLASSIFICATION SYSTEM

*Boyan K. Vakarelov and R. Bruce Answorth*

A new architectural classification for clastic marginal marine depositional systems addresses subparasequence scales of stratigraphy that often control fluid flow in these reservoirs. This system is a powerful tool for dealing with uncertainty in marginal marine interpretation.



### RESERVOIR CHARACTERIZATION OF HUNTON GROUP

*Stephanie B. Gaswirth and Debra K. Higley*

There are multiple carbonate facies and pore types in the upper Hunton Group of West Edmond field, Anadarko Basin. The heterogenous nature of the carbonate facies and their porosity conditions have had a significant effect on reservoir properties.



### DOLOMITIZATION AND GEOMETRY

*Veerle Vandeginste, Cédric M. John, Tina van de Fliedrt, and John W. Cosgrove*

Dolomitization styles in an outcrop of Jurassic host rocks from northern Oman have an impact on the dimension, texture, and geochemistry of different dolomite geobodies. A modified classification scheme to incorporate diagenetic geobodies in future reservoir modeling is proposed.



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## Policy Watch from page 41

manufacturing renaissance built on the availability of petrochemicals such as ethylene, which is derived from natural gas liquids. Ethylene is used for the production of a myriad of products, including plastic films, detergents and food packaging.

Cooper suggested that the abundance of this natural resource coupled with a strong manufacturing and transportation infrastructure, skilled workforce and large consumer population make the United States perhaps the best-endowed country for a resurgence in manufacturing.

EIA statistics show that U.S. ethylene production has grown about 50 percent from 2005 to 2012. AFPM recently announced that an unprecedented wave of construction of ethylene-production facilities could boost

production another 37 percent by 2020.

► **David Sweet** identified two additional new market opportunities for natural gas – distributed power generation and marine transport.

✓ Distributed power generation, primarily industrial combined heat and power (CHP) using natural gas, is cheaper, more efficient and less polluting.

President Obama issued an Executive Order calling for the deployment of 40 gigawatts of new, cost-effective industrial CHP capacity in the United States by 2020.

✓ Driven by recent Environmental Protection Administration emissions restrictions in the 200-mile-wide Exclusive Economic Zone along the U.S. coast, marine vessels such as ferries, cruise ships and container ships may choose to switch to natural gas engines.

Marine vessels could be a huge new

market for natural gas: Sweet quoted statistics showing that a container ship uses 200 times as much fuel each year as a train locomotive.

Forum speakers clearly documented areas for significant growth in natural gas demand. However, most of these technologies have high initial capital costs that will slow their expansion should natural gas prices increase. Thus, the speakers agreed that natural gas demand and prices should not rise significantly.

However, Sen. Wyden's concern about potential increases in natural gas prices due to LNG exports continues to have impacts.

On May 21, new Energy Secretary Ernest Moniz announced that, upholding a commitment he made to Wyden, he would not issue additional LNG export authorizations until after a new analysis of the potential impacts of exports on domestic natural gas prices. ☐

## Origins from page 46

\*\*\*

In summary, the Caribbean's Pacific origin is perfectly clear. It also is the simplest model, with the Caribbean being fixed in the hot spot reference frame; surely no one can doubt the westward drift of the Americas.

We can constrain Caribbean-American interactions quite well since Santonian, just before the Caribbean Arc collided with the passive margins of northern Colombia and southern Yucatán. Central Caribbean Coniacian abyssal shales, with up to 5 percent TOC, may be time-equivalent to Villeta-La Luna-Querecual-Naparima Hill shelf sections of northern South America, but the relatively thin Caribbean source rock layers pertain to regional or global oceanic anoxic events, partly controlled by mid-Cretaceous Caribbean plume volcanism, and are not strictly correlative.

There remains no hint of continental crust or salt in the deep Caribbean interior, and any Jurassic section, if present, will comprise Pacific pelagics, as in Puerto Rico.

Among the true paleogeographic questions today is not IF the Caribbean is Pacific derived, but HOW and WHEN west-dipping subduction of Proto-Caribbean crust began such that an isolated swath of Pacific lithosphere became engulfed between the westward-drifting Americas. ☐

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## IBA Winners from page 38

how I approach teaching geology," she said, adding, the IBA win speaks to:

► "The creativity, drive and intellect of the students of these five gentlemen, as well as the many other high-caliber students that we are fortunate to have at University of Utah."

► "The level of preparation that these students had throughout their curriculum (and research) at University of Utah and a previous institutions."

► "The experience each student has had with major petroleum companies."

She is referring to the participation (for both graduate and undergraduate students) in a Petroleum Industry Career Path (PICP) curriculum. This program consists of four half-semester courses in sequence on various aspects of petroleum geology, including:

► Basic petroleum elements (field and classroom).

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► Geologic seismic interpretation.

► Electives such as reservoir characterization and modeling, basin analysis, petroleum systems modeling, sequence stratigraphy and depositional environments.

"We often see the students come back to their research and classes in the fall much stronger after their internship, with new skills – technical, professional and personal," Birgenheier said.

Beyond the money, then, beyond the trophy, she says of the university – and of the students themselves – "This really makes a difference." ☐

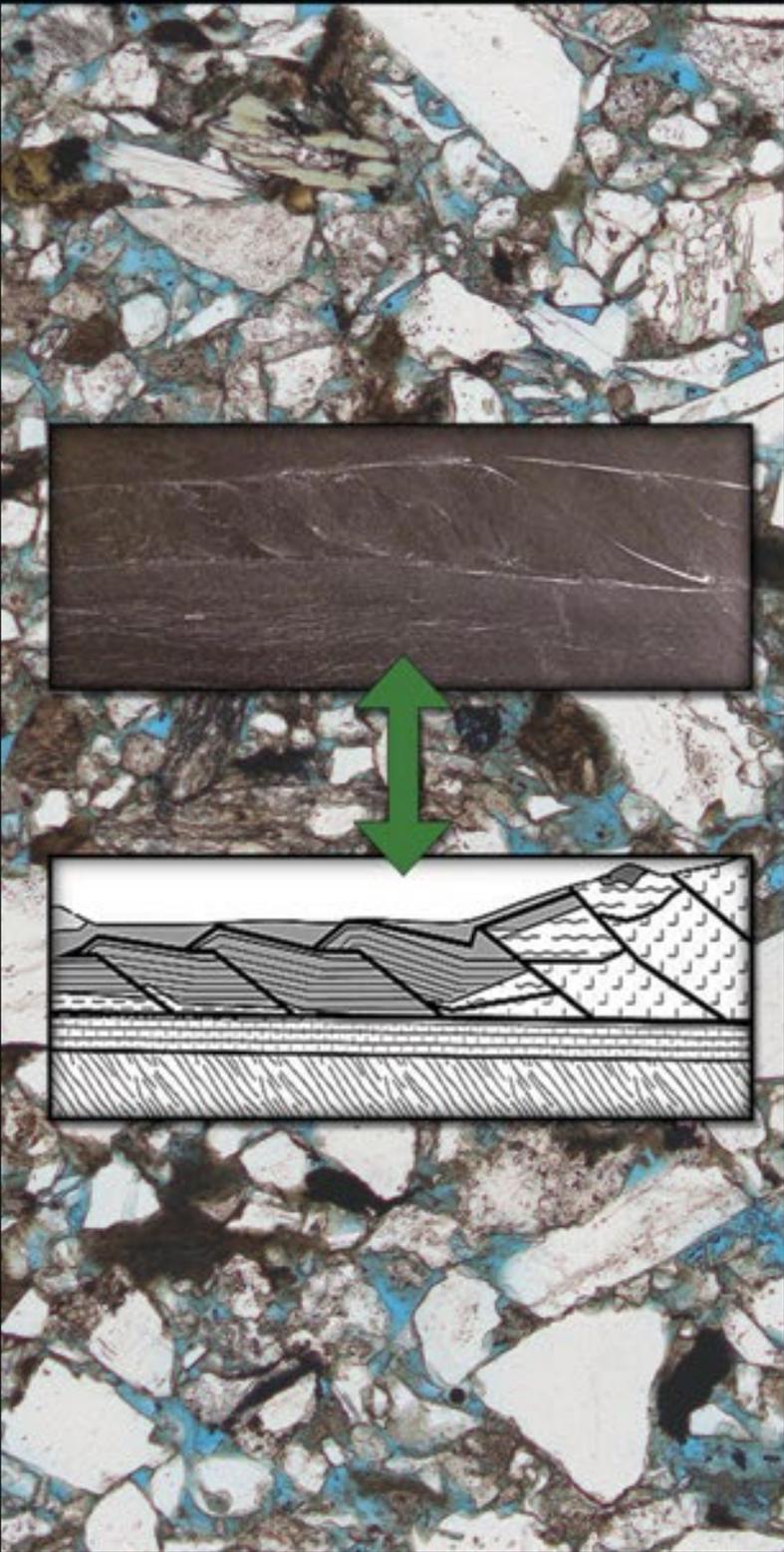


# Applied Geoscience Conference

Interdisciplinary Micro to Macroscale Geomechanics

November 4-5, 2013

WESTIN MEMORIAL CITY 945 Gessner Road Houston, TX 77024



## Geomechanical Approaches for Optimization of Unconventional Reservoirs

Presenters and attendees will represent a broad spectrum of industry professionals, including those in the disciplines of geology, geophysics, and engineering. The integrated topics will cover advantages of using geomechanical characterization to reduce difficulties in de-risking unconventional reservoirs.

### Day 1 sessions will focus on:

- Seismic Shale
- Petrophysical & Geochemical Integration

### Day 2 sessions will focus on:

- Microseismic & Geomechanics
- Engineering & Geochemical Integration

Speakers include technical experts from industry, government and university.

### 2013 Geomechanics AGC Technical Program Committee

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More information on registration, sponsorship, and the speaker line-up can be found at [www.hgs.org](http://www.hgs.org)

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# Latin America Region Experiences Prosperity

By MIGUEL RAMIREZ, AAPG Latin America Region President

The last decade has been good for Latin America. All countries in the Region, with the exception of Cuba, are now ruled by democratically elected governments. In addition, better economic performance, buoyed partly by the growing worldwide appetite for commodities, has enlarged the middle class and brought prosperity to the average Latin American.

The oil industry is no exception to this trend. Higher oil prices and additional demand for petroleum products have resulted in significant increases in exploration and production activities – and higher oil and natural gas production throughout the region.

Countries from the Rio Grande to the tip of Tierra del Fuego are producing oil and gas at record levels. Total oil production in the region stands at around nine million barrels of oil per day.

There also is significant undiscovered potential in the region, both in conventional and unconventional resources.

The pre-salt discoveries in Brazil and the heavy oil activities in Peru, Ecuador, Colombia and Venezuela exemplify the potential of conventional resources in the region.

Prime examples of the unconventional potential are the Vaca Muerta formations in Argentina and La Luna formations in Colombia and Venezuela.

If the extraordinary unconventional revolution experienced in the United States – increased oil and gas volumes,



RAMIREZ

**This oil and gas boom is demanding more and better-educated engineers and geoscientists.**

high employment, more and higher fiscal revenues – is replicated in Latin America, the Region will be able to maintain or even increase its current production levels, thus helping to alleviate the poverty of many of its citizens.

This oil and gas boom is demanding more and better-educated engineers and geoscientists.

Here is where AAPG comes into the picture.

\* \* \*

In the summer of 2008, the AAPG Latin America Region recognized these tendencies, and with the help of countless volunteers in several countries designed an ambitious set of business plans to better serve AAPG members in the Region and to advance the science of geology.

Initiatives developed to meet these objectives included:

- ▶ Secure 2013 ICE for Colombia. After spirited competition between

Bogotá and Cartagena, the latter won and received approval from AAPG's Executive Committee, and the ICE Organizing Committee committed to make the Cartagena ICE the best ever event of its kind in AAPG history.

The ICE 2013 motto, "Energy for Integration and Prosperity," fits well with the Region's aspirations. (Related story, page 4.)

- ▶ Organize Geoscience Technology Workshops in Latin America.

The Region's first GTW was held in Veracruz, Mexico, in 2010. Since then, GTWs have taken place in Colombia, Argentina (twice), Brazil and Peru – and Trinidad & Tobago will host a workshop later this year.

The GTWs have been very well received by local geoscience communities as well as by the 750 people who have attended the events.

- ▶ Support students throughout the Region.

AAPG has increased outreach to universities, and the Region now has seven active student chapters: Brazil, Colombia (3), Peru (2) and Trinidad & Tobago.

The first Latin American Geoscience Student Conference (LAGSC) took place in Medellín, Colombia, earlier this year. The event, sponsored by AAPG, EAGE and SEG, encouraged participants to create new student chapters, energize existing chapters and to be a part of Young Professional committees after graduation.

- ▶ Develop Young Professionals.

The Region has three active YP Committees comprising representatives from Lima, Buenos Aires, Maracaibo and Bogotá. Young Professionals across the region are working to promote AAPG's benefits throughout Latin America.

- ▶ Establish a Regional office.

AAPG opened an office in Bogotá and hired Emily Smith Llinás as Latin America Region programs manager. Having AAPG staff working in Latin America provides enhanced synergy between Regional leadership and the AAPG headquarters, and facilitates additional opportunities for educational sessions and conferences.

Primary tasks for the Latin America Region office include enhancing AAPG's science and technology offerings, expanding the membership base and

**Continued on next page**



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Call for Abstracts – Deadline 30 September 2013

## Reducing Subsurface Uncertainty & Risk Through Field-Based Studies

*The Value of Outcrops and Analogues in Hydrocarbon Exploration, Development and Production Implications for Global Exploration and Production*

4-8 March 2014 (Field Trip 7-8 March)  
The Geological Society, Burlington House, Piccadilly, London

- Convenors:
- Helen Smyth, CASP
  - Mike Bowman, University of Manchester
  - Tim Good, ExxonMobil
  - Simon Passy, CASP
  - Philip Hirst, BP
  - Colin Jordan, BGS



This meeting will provide a timely revisit and reappraisal of the value and impact of outcrop based fieldwork in hydrocarbon exploration, appraisal, development and production. In recent years we have seen a refreshed focus on frontier exploration, in increasingly difficult settings, and the challenges of new developments such as deepwater clastics and carbonates. This has led to the resurgence in the appreciation, use and need for outcrop based studies as analogues and benchmarks for the subsurface. This applies both to the overburden and the reservoirs. Digital technologies such as remote sensing and digital data capture have revolutionised field-studies, however traditional methods (e.g. mapping, logging and sampling) remain at the very core of any field study.

This meeting offers an exciting opportunity for key researchers and users of these datasets to come together, learn from recent advances and look forward to future directions and needs. A key objective is to engage industry groups and academia in a dialogue and knowledge sharing that reflects the current status and future potential of this important area.

**Themes:**

- Exploration: Reconnaissance-scale fieldwork
- Structural Analogues – regional to reservoir scale
- Applications to Reservoir and Field Appraisal, Development and Production: Outcrop-scale fieldwork
  - Clastics
  - Carbonates
- Unconventional Hydrocarbon Resources
- Health, Safety & the Environment and field studies
- Looking to the future

There will also be an optional field trip to BGS Core Store and relevant N England and Pennine outcrops taking place on the 7-8 March. Further details will be made available during registration for the conference. For more information or to submit an abstract please contact: Steve Whalley, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. T:020 7434 9544 F:020 7494 0579



**AAPG - Rocky Mountain Section Annual Meeting**  
Salt Lake City, Utah  
September 22-24, 2013

[rmsaapg2013.com](http://rmsaapg2013.com)

## Registration Now Open

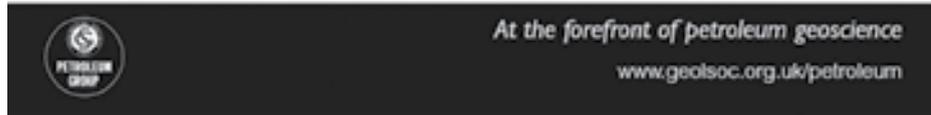
### Technical Program Highlights

- Lacustrine Basins
- Microbial Carbonates: Modern and Ancient
- Great Oil/Gas Fields of the Rocky Mtns.: A Historical Perspective
- Unconventional Resource Plays
- Carbon Capture, Utilization, and Storage
- New Resource Plays
- Geothermal Resources of the Rocky Mountains



### Other Convention Events

- 5 Utah-based field trips and 4 short courses
- ACL: Roving the Red Planet: A Field Geologist Explores Gale Crater  
*Dr. Rebecca Williams, Mars Scientist, Planetary Science Institute*
- Night at the new Natural History Museum of Utah
- Guest hospitality suite and 3 days of special activities



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# Europe YPs Growing

By **RUAIRI McDONALD**, YP Committee Chair, Europe Region

**N**orth Sea rejuvenation, onshore unconventional exploration and Eastern Mediterranean exploration have resulted in a growing Young Professional (YP) demographic in Europe.

In fact, the European YPs have undergone continued growth since 2010, fueled by active YP groups and a buoyant industry.

From starting new groups to restructuring the Europe Region council's structure, AAPG's European YP branch is slowly but surely becoming an integral part of the organization.

Not coincidentally, over the past two years, YP activities in the Region have really taken off – there currently are four active groups in the major cities of London, England; Aberdeen, Scotland; The Hague, Netherlands; and Copenhagen, Denmark; plus one new group in Stavanger, Norway.

► The **London** YP group has seen its share of bad and good times, but over the last two years, the London committee has been very successful in running both educational and networking events.

Since 2011, the committee has organized and carried out MSc Career Talks at major UK petroleum-focused universities, including Imperial College London, Royal Holloway, the University of Manchester and the University of Southampton.

These talks aim to highlight the day-to-day tasks expected of a YP within the industry and examine how geoscience roles vary within majors, independents and service companies.

► The **Aberdeen** group also has carried out Career Talks at Aberdeen University, with equal success.

The Aberdeen YP group has seen an amazing transformation since disbanding in 2012. Through the much-appreciated enthusiasm and hard work of the current committee, and the support of other AAPG YP groups in Europe, the Aberdeen group is stronger than ever.

Both UK-based groups also have established a close relationship with the Petroleum Exploration Society of Great Britain (PESGB). Through this collaboration, both organizations have facilitated community growth in the YP arena and benefited from increased attendance at networking events.

► More European YP activities can be found in Netherlands. The **Hague** group has been busy hosting seminars from experienced geoscientists, "Lunch-and-Learn" afternoons and touring AAPG Distinguished Lecturers.

The group also has established a



McDONALD

positive relationship with the Petroleum Geologisch Krig (the Dutch network of commercial and academic professionals for petroleum exploration), creating more opportunities for co-hosted lectures and field trips.

► In Denmark, the **Copenhagen** YP group also has been very successful. Mainly established and operated alongside Copenhagen University and GEUS (Geological Survey of Denmark and Greenland), this group's monthly events cover a range of geological topics. In 2012, for example, Total gave an insightful, and controversial, seminar on unconventional exploration in northern Denmark.

Additional highlights there include hosting speakers from the Geological Society of America (GSA) and numerous industry-led workshops.

So, into the future: Where do we go now?

A motion was made following the 2012 Young Professional and Student Leadership Summit to reshape the current YP structure within the Europe Region's hierarchy. This improved structure was based on the Canada and Africa regions' incorporation of a YP Region chair.

This proposal, which was designed to facilitate communication and access to leadership, was accepted in early 2013.

Another sign of continued progress is the formation of a new group in Stavanger, Norway. It is hoped that Stavanger, like other oil and gas hubs in Europe, will flourish as an AAPG YP group as early as late 2013/early 2014.

The significant growth of YP participation in AAPG events in Europe – and elsewhere around the globe – has required AAPG to evolve as an organization. By supporting the next generation of geoscientists and facilitating the transition from student to YP to experienced professional, AAPG will continue to grow as a global geoscience community, provide a platform for scientific discussion and assist retention of members.

For more information on how to become involved in YP events in your area, visit [aapg.org/youngpros/](http://aapg.org/youngpros/) and contact your Section or Region representative. ☰

partner society conferences in Colombia and Mexico; and showings of the movie "Switch," including panel discussions, in eight countries.

Regional staff and leadership also plan to visit countries throughout the Region, enhancing collaboration with affiliated societies, creating student chapters and helping companies, members and potential members understand the value of being a part of AAPG.

The Region is finalizing preparations for ICE 2013, and we hope you will join us in Cartagena in September. ☰

**Continued from previous page**

increasing engagement from diverse companies and individuals throughout the region.

\* \* \*

Clearly, the future looks bright for AAPG in Latin America. Activities planned for the coming year include "Education Week" events in Argentina, Brazil, Mexico and Colombia; AAPG representation at

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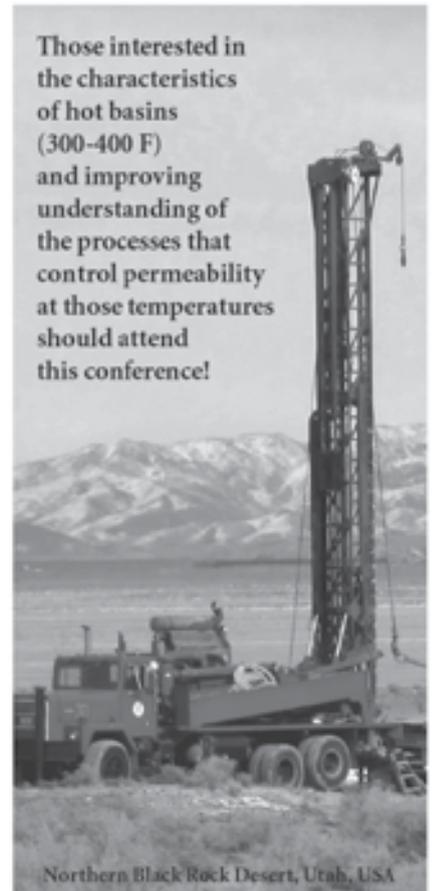
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# Evans Wins Foundation's Professorial Award

By NATALIE ADAMS, AAPG Foundation Manager

A few months ago the AAPG Foundation emailed AAPG student members, asking for their nominations for the 2013 Professorial Award.

Students stepped up to the task and nominated their best and brightest. We then notified the nominees and the applications began to come in.

It was quite an involved process, as professors were required to submit their philosophy and methods of teaching, a description of the unit and a letter of recommendation from an administrator. Their classes must include content that applies to the formation and geological history of natural resources; the scientific study of these resources; their origin, discovery and extraction, as well as their historical and present use.

Class content also should include the preservation of the environment; reclamation and the conservation of resources; and the use of earth science knowledge in decision-making.

The AAPG Academic Liaison Committee, chaired by John Holbrook, evaluated the applications and ultimately chose **Jim Evans**, professor of structural geology at Utah State University. His award check already has been mailed to him, and he will receive his plaque at the Rocky Mountain Section annual meeting in September.

Last year's recipient was Grant Wach, professor of petroleum geoscience at Dalhousie University in Nova Scotia, Canada. Wach was recognized at the Foundation "Chairman's Reception" and at the Foundation exhibition booth at the AAPG

Annual Convention and Exhibition in Long Beach, Calif.

The cash award given for the Professorial Award is a mere \$1,000 – and although the money is for their personal use, we're finding that professors are putting it right back into their students' activities.

One of our goals at the AAPG Foundation is to increase this award.

Please thoughtfully consider a gift today designated to the Foundation's Professorial Award program. We'll be delighted to share



EVANS

with you how the money is used to build a better foundation for the geosciences.

\*\*\*

The 36th annual AAPG Foundation Trustee Associates meeting will be held Sept. 22-26 at the Suncadia Resort in Cle Elum, Wash. – and, of course, all

280 of the Trustee Associates are invited, along with a spouse/guest.

The TAs are among the Foundation's largest supporters, contributing 66 percent

of the Foundation's total contributions.

Activities at the meeting will include three field trips, golf, fly fishing, hiking, a tour of the town of Roslyn (which provided the setting for the television program "Northern Exposure"), complete with lunch and beer tasting at the brewery, special dinners and of course, a business meeting or two with special speakers.

Waterfalls and wine are the key words for this year's event.

For more information on the AAPG Foundation Trustee Associates, visit <http://foundation.aapg.org/TrusteeAssociates/index.cfm>.

## Sallers Completes Inaugural Shell DL Tour

Art Saller, the inaugural Shell Distinguished Lecturer, completed a successful, nearly four-week-long lecture tour of Asia and Australia this spring.

Saller, a stratigrapher and exploration geologist for Cobalt International Energy in Houston, presented 15 talks at 12 different locations in six different countries.

The Shell Distinguished Lectureship, made possible through a generous contribution by Shell to the AAPG Foundation, annually endows a speaker who this year focused on petroleum geology topics related to



Southeast Asia.

Geoscientists attending Saller's lectures varied from young college students in blue jeans to experienced professionals in suits.

His tour started with talks to the

Petroleum Exploration Society of Australia in Melbourne, Sydney and Brisbane.

Following those were talks at the Shell Technology Center in Bangalore, India, and at the University of Papua New Guinea in Port Moresby – with a gathering of students, teachers and other geologists sponsored by the university and the PNG Chamber of Mines and Petroleum.

The tour then shifted to Tokyo, with Japex as the host for geoscientists from local petroleum companies, universities

[See Saller, page 54](#)



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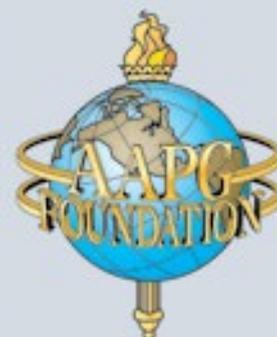
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## Foundation Contributions May 2013

The names that appear here are of those who have made donations to the AAPG Foundation in the past month – predominately through adding some additional monies on their annual dues statement.

To these people, and to those who have

generously made donations in the past, we sincerely thank you.

With your gifts, the AAPG Foundation will continue its stewardship for the betterment of the science and the profession of petroleum geology.

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The monthly list of AAPG Foundation contributions is based on information provided by the AAPG Foundation office.



## Exploration Opportunities in Southeast Asia

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## PROFESSIONAL news BRIEFS

**Edward J. Bucher**, to asset development geologist, Chevron N.A. Exploration and Production, Houston. Previously senior staff geologist, Anadarko Petroleum, The Woodlands, Texas.

**Edward K. "Eddie" David** was recently honored by Eastern New Mexico University in Roswell, N.M., with the President's Distinguished Service Award. Earlier this year David was presented the Margie Boles Lifetime Achievement Award by the United Way of Chaves County, N.M., for his community involvement. David is president of David Petroleum Corp. in Roswell, N.M.

**Simon Haynes**, to principal geologist, Statoil Canada, Calgary, Canada. Previously senior geologist, Statoil Canada, Calgary, Canada.

**Greg Hummel**, to senior geologist-Los Angeles Basin, E&B Natural Resources, Bakersfield, Calif. Previously senior geologist-Cat Canyon field, ERG Resources, Bakersfield, Calif.

**Michael Kuykendall**, to geoscience manager, Felix Energy, Denver. Previously exploration new venture lead, Newfield Exploration, Tulsa.

**Vince Matthews** received an award for "Exceptional Service to the Colorado Emergency Management Community" from Colorado Gov. John Hickenlooper. Matthews recently retired as state geologist of Colorado and director of the Colorado Geological Survey is now the principal at Leadville Geology, Leadville, Colo.

**Chris Oglesby**, to development geoscience manager, Mubadala Petroleum, Bangkok, Thailand. Previously chief geologist, Mubadala Petroleum, Bangkok, Thailand.

**Matthew Pranter**, to professor of geology and geophysics and Lew and Myra Ward Chair in Reservoir Characterization, ConocoPhillips School of Geology and Geophysics, University of Oklahoma, Norman, Okla. Previously associate professor of geological sciences, University of Colorado, Boulder, Colo.

**Daniel C. Steward**, to director of exploration, Lukoil Overseas, Houston. Previously exploration manager-West Africa, Noble Energy, Houston.

## Saller from page 52

and research labs, and then to Kuala Lumpur, where Petronas sponsored presentations at the Universiti Teknologi Petronas and the Twin Towers.

The tour's final stops were in Jakarta and Bogor, Indonesia, sponsored by Pertamina; after a talk at Pertamina Upstream in Jakarta, Saller addressed AAPG student chapters at the University of Pakuan (Bogor), Trisakti University (Jakarta) and the University of Indonesia (Jakarta).

- Saller offered four talks:
- ▶ Diagenetic Evolution of Porosity in Carbonates During Burial.
  - ▶ Pleistocene Shelf-to-Basin Depositional Systems, Offshore East Kalimantan, Indonesia: Insights Into Deepwater Slope Channels and Fans.
  - ▶ Controls on Hydrothermal Dolomites and Their Reservoir Properties.
  - ▶ Sequence Stratigraphy of Classic Carbonate Outcrops in West Texas and Southeast New Mexico with Subsurface Analogs.

Travel included planes, trains and automobiles – but mostly planes; the itinerary included 17 plane flights with 87 hours in the air covering approximately 40,000 miles.

Many helped make this trip safe and successful. Guruh Ferdianto, volunteer with AAPG Asia Pacific Region, and Lorry Richardson of AAPG DL coordinator, organized the trip and schedule, with help from Adrienne Pereira of AAPG Asia Pacific Region office in Singapore.

Others helping with arrangements along the way included Louise Goldie-Divko, Phillip and Marina Cooney, Sue Slater, Ankush Singh, Bitan Munshi, Ankush Ghosh, Mick McWalter, Kazuyoshi Hoshi, Bahari Md Nasib, Ummy Farah Binti Mohamad Rosli, Noor Alyani Bt Ishak, Rick Major, Tavip Setiawan, Heribertus Satrio Wibowo, Zulkha Arfat, Dewi Syavitri, Rendra, Fakhmi, Renky Apriliani, Mill Sartika Indah and Andi Mardianza.

Saller said thanks go to all of them, as well as the AAPG Foundation and his employer, Cobalt International Energy, for allowing him to go on this three-week tour. 

## ACE Issues Call for Papers

The call for abstracts is open for the 2014 AAPG Annual Convention and Exhibition, to be held April 6-9 in Houston at the George R. Brown Convention Center.

The technical program will include 11 themes, plus a special session on the "History of Petroleum Geology."

Proposed themes are:

- ▶ Emerging Frontiers and New Technology: Ideas and Innovations That Revolutionize the E&P Industry.
- ▶ Unconventional Resources: What Have We Learned So Far and Where Are We Going?
- ▶ Producing Oil and Gas Fields and New Conventional Plays: How Do We Maximize Recovery by Applying New Science and Multidisciplinary Approaches



**AAPG** Annual Convention & Exhibition 2014

to Mature Fields and Plays?

- ▶ Siliciclastics.
- ▶ Carbonates and Evaporites.
- ▶ Energy and the Environment.
- ▶ Geochemistry and Petroleum Systems Analysis.
- ▶ Structure, Tectonics and Geomechanics.
- ▶ Geophysical Methods for Exploration and Production.
- ▶ AAPG and SEPM Student Poster Sessions.

Complete guidelines can be found on the ACE website.

The abstract deadline is Sept. 13. For more information go online to [www.aapg.org/houston2014](http://www.aapg.org/houston2014).

**READERS' FORUM**

**Ethical Question**

Oil companies conduct large numbers of studies and interpretations internally and through paid services. It could be a special seismic processing or a high-resolution 3-D model; a detailed sequence stratigraphic framework, high-resolution petrophysical interpretation, fault architecture, petroleum system models, seismic reservoir characterization are all some examples of such internal work.

Most such studies are not published in any open forum.

Frequently, academic or open research is conducted in collaboration with external agencies on specific topics. These could be on depositional models, laboratory studies on core or regional constructions. Such studies are exposed to voluminous unpublished internal study material for the purpose of correct and complete assimilation of available data and information.

Publications are normally encouraged from these research pursuits. In such publications, the authors are limited to the team that conducted the open study – however, they can and often do use high value data, interpretations and inferences that came from earlier unpublished material of the company.

Situations where the results of open-study are directly impacted by and dependent on the internal material is quite normal. The portions of unpublished data (from the various internal studies) per se are screened and approved for disclosure by the company. There is no issue of confidentiality.

The question is about intellectual ownership of the disclosed material.

Papers that use and disclose earlier unpublished work of noteworthy scientific value – in a substantive, technical sense in their work – are refraining from referring formally to the internal reports. Most journals (even AAPG) do not want such references.

However, once in print, the same material will be automatically assigned the ownership of the paper's authors.

Any number of examples can be conceived with such situations, where someone working on creating new organic geochemistry data gets credited for sequence stratigraphy!

My questions:

- ▶ What is the ethical and correct way of using unpublished study in a publication?
- ▶ How does one give ownership to original unpublished work?
- ▶ How should research paper's authors rightfully limit their credits to their original work?

Any answers out there? I need help and guidance!

Guruswamy Srikanth  
Mumbai, India

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AAPG is accepting abstracts for the Annual Convention and Exhibition 6-9 April, 2014 in Houston, Texas. Striving to provide the geoscience community opportunities for professional growth and development, we are creating and hosting innovative and educational opportunities that are pertinent to geoscience careers worldwide. This convention serves as an important vehicle for participants to strengthen their roles through learning, sharing and networking with professionals throughout the many facets of petroleum geology.

**Submit your abstracts online under any of these themes:**

- Theme 1:** Emerging Frontiers and New Technology: Ideas and Innovations that Revolutionize the E&P Industry
- Theme 2:** Unconventional Resources: What Have We Learned So Far and Where Are We Going?
- Theme 3:** Producing Oil and Gas Fields and New Conventional Plays: How Do We Maximize Recovery by Applying New Science and Multidisciplinary Approaches to Mature Fields and Plays?
- Theme 4:** Siliciclastics
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- Theme 6:** Energy and the Environment
- Theme 7:** Geochemistry and Petroleum Systems Analysis
- Theme 8:** Structure, Tectonics, and Geomechanics
- Theme 9:** Geophysical Methods for Exploration and Production

**AAPG and SEPM Student Poster Sessions**  
**Special Session: History of Petroleum Geology**



**IN MEMORY**

- M. "Mo" E. Arnold, 90  
Tulsa, April 26, 2013
- Frederick Michael Black, 61  
Oklahoma City, May 7, 2013
- Robert Lee Cash, 88  
Fairview, Texas, April 23, 2013
- Lester David Collier, 86  
Covington, La., April 7, 2013
- James Horton Frizell, 85  
Midland, Texas, March 3, 2013
- William W. Hambleton, 91  
Lawrence, Kan., Oct. 4, 2012
- Val Edward Kotrous, 66  
Houston, March 12, 2013
- Ross Miller (Member '57)  
West Paducah, Ky., May 16, 2013
- Max W. Prescott, 83  
Lakewood, Colo., Jan. 11, 2013
- Frederick Howard Reiter, 88  
Littleton, Colo., April 1, 2013
- Earl E. Rossman Jr., 80  
Houston, Nov. 30, 2012
- Bernard Douglas Sheffer, 88  
Atascadero, Calif., April 12, 2013
- Arthur J. Tschoepe, 84  
Corpus Christi, Texas  
April 24, 2013
- Robert K. Williams, 88  
Midland, Texas, Nov. 1, 2012

*(Editor's note: "In Memory" listings are based on information received from the AAPG membership department. Age at time of death, when known, is listed. When that is unavailable, the person's membership classification and anniversary date are listed.)*



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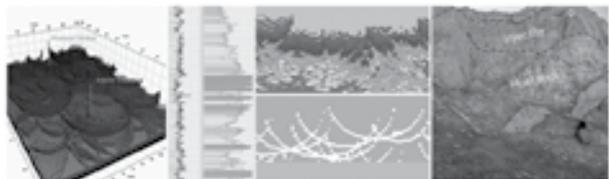
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Call for Abstracts – 16 September 2013

## Capturing uncertainty in geomodels: Best practices and pitfalls

11-12 December, 2013

Elphinstone Hall, University of Aberdeen



Over recent years, the static description of hydrocarbon fields has increasingly been undertaken via construction of 3D cellular geomodels. The model builder's toolkit is now extensive, incorporating sophisticated structural framework building capabilities, numerous gridding technologies and an ever-expanding, complex geostatistical data modelling resource. However, as we develop hydrocarbon fields and not the geomodels that are built to describe them, we must ask whether the modelling paradigm is robust and whether the models illuminate or hide uncertainty.

This two-day conference will explore how geomodelling tools should be used to best effect, and when such tools mislead or do not add value. The focus will be on methods and workflows for capturing uncertainty throughout the geomodelling process, and on how to carry this uncertainty into the dynamic modelling realm. Keynote presentations and discussion sessions are planned. We invite contributions covering all aspects of uncertainty management in geomodelling, from the philosophical "why" to the detailed "how". Examples of best practice and, particularly, on how to avoid pitfalls are particularly welcome.

**Call for Papers:**

Please email paper and poster contributions to [steve.whalley@geosoc.org.uk](mailto:steve.whalley@geosoc.org.uk) and [Andy\\_Sims@merlinenergy.co.uk](mailto:Andy_Sims@merlinenergy.co.uk) by 16 September 2013

For further information please visit [www.geosoc.org.uk/geomodelling13](http://www.geosoc.org.uk/geomodelling13) or contact: Steve Whalley, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. T:020 7434 9544 F:020 7494 0579



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## DPA from page 58

Watch for us soon at a meeting near you.

\* \* \*

What's on your night table/Kindle/iPad?

I'm working my way through "Switch," by Chris Heath and Dan Heath, subtitled "How to Change Things When Change is Hard."

It's a slow read – not because of the writing, which is clear and concise, but because there are so many thoughtful

gems of insight.

The authors have synthesized and cite research in psychology, sociology, socioeconomics and behavioral science to illustrate that reason alone is insufficient to achieve change. Clarity of purpose is essential, since resistance is often a response to the lack of crystal clear direction.

Through utilization of the "school of appreciative inquiry" one can recognize bright spots in systems that can be emulated for continued success.

Sounds esoteric, but I know I'll be able to integrate these precepts to my next prospect.

Let me know what you're reading.

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Faculty of Arts and Science and Faculty of Engineering and Applied Science  
Queen's University, Kingston, Ontario, Canada



One of Canada's leading universities, Queen's has a long-standing reputation for academic excellence, research, and a diverse and vibrant learning environment. With its strong tradition of public service, the University has helped to shape Canadian values and policies, educating notable political and cultural figures.

Queen's University is located in the heart of the community in historic Kingston, midpoint between Montreal, Toronto, and the nation's capital.

Queen's is seeking an outstanding individual to become the Executive Director of the new professional program in Earth and Energy Resources Leadership. Funded for the first three years by a generous alumni donation, this program will provide students with a comprehensive professional program, integrating courses taught by faculty and experts in the fields of Geological Sciences and Geological Engineering, Chemical Engineering, Policy, Law, Finance and Business.

The position will be based in Kingston, Ontario and the Executive Director will report to the Dean of the Faculty of Arts and Science and to the Dean of the Faculty of Engineering and Applied Science. During an initial three-year appointment, the Executive Director's mandate will be to build and lead all aspects of an interdisciplinary and collaborative professional Master's degree program in Earth and Energy Resources Leadership that has both national and international scope and impact. The program will be designed to meet the emerging needs of industry. The Executive Director will be responsible for the creation, development, growth, success and reputation of the program, in the context of the strategic plan and priorities of the University and the faculties.

We are seeking a well-known and respected industry expert from the resource sector. The ideal candidate will have:

A university degree in geological engineering or geology, chemical engineering, business, law, finance, public policy or other relevant field; a graduate degree is considered an asset.

Minimum 10 to 15 years of progressive experience in the Earth and Energy Resources sector, including several years at a senior executive level.

Demonstrated genuine interest and knowledge of and/or experience in a post-secondary educational environment.

Additional details can be found in the Position Profile posted at: [www.geol.ca](http://www.geol.ca)

Applicants should send their curriculum vitae, contact information, and the names of three references including their contact information to:

Robert P. Lemieux, Ph.D.  
Associate Dean (Research), Faculty of Arts and Science  
F300, Mackintosh-Corry Hall  
Queen's University  
Kingston, Ontario, CANADA  
K7L 3N6  
email: [rpl@queensu.ca](mailto:rpl@queensu.ca)

Review of applications will begin on July 15th, 2013. Applications will be accepted until the position is filled, preferably by September 1st, 2013.

*The University invites applications from all qualified individuals. Queen's is committed to employment equity and diversity in the workplace and welcomes applications from women, visible minorities, aboriginal people, persons with disabilities, and persons of any sexual orientation or gender identity.*

*All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents of Canada will be given priority.*

[www.queensu.ca](http://www.queensu.ca)

# A Scenario of Hope for Natural Gas Challenges

By DAVID K. CURTISS, AAPG Executive Director

Global demand for natural gas continues to grow and the search is on to meet that demand in both the eastern and western hemispheres.

The development of both shale gas and conventional natural gas resources has turned the U.S. natural gas supply picture on its head.

✓ China is seeking every available energy source to fuel economic growth.

✓ Saudi Arabia has made a strategic decision to shift its energy consumption from (mostly) crude oil to natural gas, in order to free that crude for sale on world markets.

✓ Massive natural gas discoveries in the eastern Mediterranean and eastern Africa are in development to supply world markets.

The challenge, of course, is that unlike with crude oil, the physical and economic challenges of transporting natural gas have thus far restrained the development of a truly global natural gas market in favor of regional markets – some more connected than others.

But large price differentials for natural gas prices across the globe, for example between North America and Asia, are shifting the economics in favor of natural gas exports and toward a more global market.

This shift is attracting its share of critics.

\* \* \*

In the United States, policy makers and industry leaders are debating whether the nation should permit these natural gas exports.

One element of the debate is simply the rehashed argument between free traders and those who prefer more controlled markets.

But another element is a more serious



CURTISS

Large price differentials for natural gas prices across the globe are shifting the economics in favor of natural gas exports and toward a more global market.

policy question about when and how a nation should export a commodity product – such as crude oil or natural gas – and gain immediate economic benefit, and when should it use that commodity as an input to create, for example, a petrochemical product that yields greater economic benefit.

In an efficient market, the oil and natural gas producer is a price taker, with the price set by the last barrel of oil or MCF of gas sold. If demand for the commodity increases, say by expanding U.S. LNG export capacity, you can expect that the next increment will be sold at a higher price. Demand is the commodity producer's friend.

But if you are purchasing this commodity as an input into your manufacturing process, such as a chemical plant, you want that price to be as low as possible. Supply is your friend and excess supply is even better, because, for a time at least, it further depresses prices and improves your margins.

That's the heart of the debate we're having in the United States, and there is no simple answer, because notwithstanding economic theory, there are myriad variables at work in the energy markets and no one knows precisely how they would respond to expanded natural gas exports.

\* \* \*

In May the Bipartisan Policy Center (BPC), a Washington, D.C., based think-tank, issued "New Dynamics of the U.S. Natural Gas Market," its assessment of this debate.

BPC evaluated several different scenarios and modeled their impacts using the National Energy Modeling System (NEMS), a system used by the U.S. Energy Information Agency in its forecasts. It also assembled a group of energy policy experts and stakeholders to analyze the model input selections and scenario development, and evaluate the results.

The purpose of the study as BPC defined it was "to develop realistic scenarios that usefully bound the range of plausible outcomes for natural gas supplies and demand over the next few decades, as well as potential impacts in terms of fuel mix, energy prices, and opportunities to expand natural gas use in ways that improve the environmental performance of the U.S. energy system."

Their study resulted in eight key findings:

▶ The United States has ample domestic natural gas supplies to meet future demand without significant price increases.

▶ LNG exports are unlikely to have a large impact on natural gas prices.

▶ Increased natural gas consumption in the future will be driven primarily by overall economic growth and increased demand in the electric power and industrial sectors.

▶ The industrial sector could be a major source of new demand for natural gas if projected growth in the U.S. manufacturing base is realized.

▶ Natural gas vehicles stand to make significant gains in market share and vehicle miles traveled by 2030.

▶ In the electric power sector, natural gas leads – but renewables also play a significant role.

▶ Energy-related carbon dioxide emissions are driven primarily by overall economic growth.

▶ Pricing carbon results in greater emissions reductions.

Given the inputs, assumptions and scenarios considered in its analysis, BPC's conclusions suggest that natural gas exports and a price environment that attracts investment and expands the manufacturing base and promotes additional economic activity can coexist, all while delivering an environmental dividend from switching to clean burning natural gas.

These are modeled results. But they offer a plausible and hopeful scenario.

## DIVISIONS REPORT

# New DPA Leadership Ready for a Big Year



By VALARY SCHULZ, DPA President

What a great privilege it is for me to serve as your president of the Division of Professional Affairs this coming year. As understudy (president-elect) over the past 12 months I've had the opportunity to observe now-past president Charles Sternbach as he developed new initiatives and marvelously successful programs with his characteristic enthusiasm and verve.

Many thanks to Charles, who will be staying on the board as past president, and to the outgoing board members for their service to the DPA during the 2012-13 term: Marty Hewitt, past president, and Paul Pause, vice president.

Mark Gallagher has excelled as DPA secretary for the past two years and he will be returning to the Executive Committee as vice president. Debbie Osborn will continue in the second year of her term as treasurer, trying to keep us aware that we have a budget.

Terry O'Hare will join the board for the next two years as secretary, and our well-renowned friend from the Mid-Continent Section, Rick Fritz, will be serving as president-elect.

We also welcome the newly elected



SCHULZ

Committee work is the foundation of any volunteer organization, and we will be looking for help in a number of categories.

councilors to the team and look forward to serving with them and their alternates. We will be continuing a full schedule of events, so their support will be critical to our success. Welcome to:

▶ Justin Bellamy and Don Burdick as representatives of the Mid-Continent Section.

▶ Margo Liss, who joins Mark Rainer to represent the Southwest Section.

▶ Larry Jones and Connie Mongold, who join Ralph Baird, James Grubb and Greg Hebertson in the Gulf Coast Section.

Get to know your councilors – all 19 of them as well as the alternates are listed on our website – and then join us in thanking those retiring councilors for their service as well.

\* \* \*

Committee work is the foundation of any volunteer organization, and we will be looking for help in a number of categories.

I hope you'll contact me with your expressions of interest – or be receptive when I call, so we can continue to deliver content to further our goals of professionalism, ethics, training, certification and policy communication.

\* \* \*

Young Professionals often are not yet qualified for membership in the DPA when they've not been in the industry for

eight years – however, we greatly value their input and energies.

With that in mind, we passed a change to the Bylaws at the recent AAPG Annual Convention and Exhibition in Pittsburgh to allow for appointment to our board of a non-voting AAPG member, which will provide for a YP seat at our table.

We intend to proactively recruit this important demographic into the DPA community.

\* \* \*

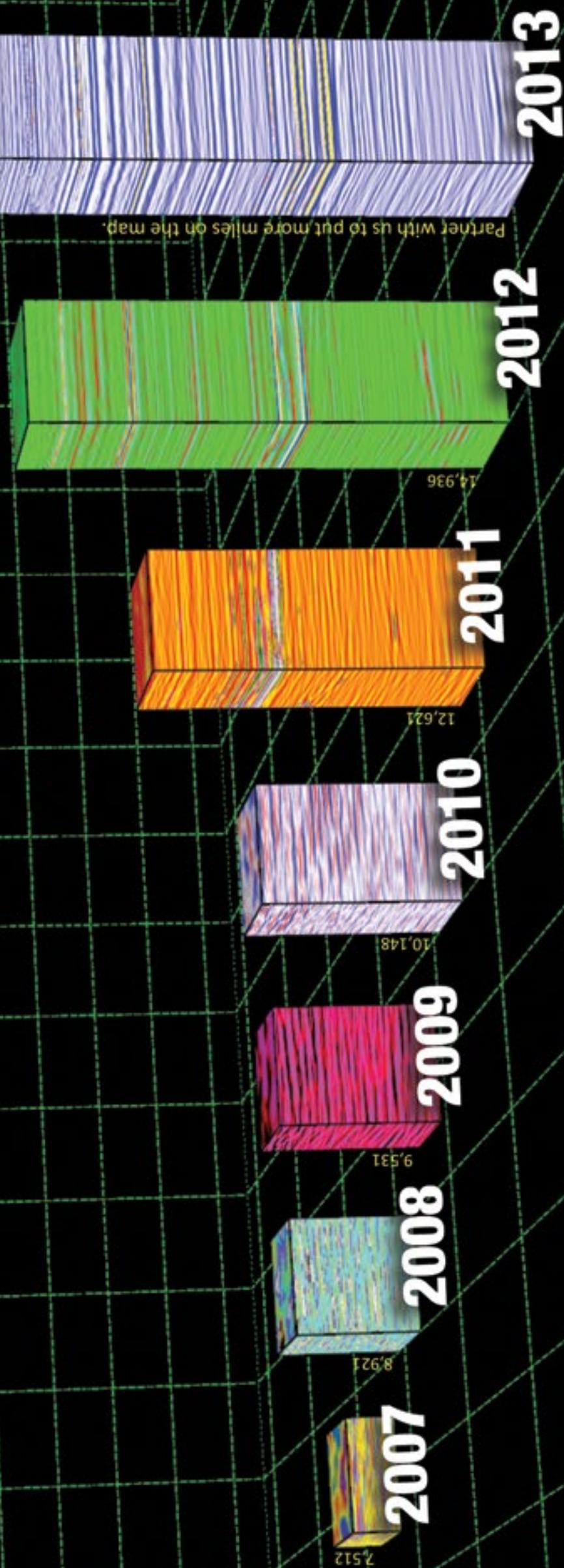
I'm filled with gratitude for this opportunity to serve you, the members of the DPA, but I'm particularly fortunate that my employer, Cinco Resources Inc., in Dallas, has been supportive of my efforts.

Throughout the coming year we want to make the DPA more relevant to you and your business, and we intend to continue to increase our visibility at societal, regional, Section and annual meetings.

See DPA, page 56

## Unconventional 3D data Library Growth

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