

# The Frozen Ground?

*The Arctic holds promise even  
in a slow oil market*

See page 14





# PASSION FOR THE ARCTIC

Work with the industry's recognized leader for Arctic geosolutions.

CGG is the preferred provider of integrated geological, geophysical and petrophysical solutions across the E&P lifecycle from asset evaluation and exploration to production and field development.

Learn more about our extensive portfolio of Arctic geosolutions including:

- Multi-disciplinary data library coverage of Alaska's North Slope and the Barents, Kara and Bering Seas including geology, satellite mapping, seismic, gravity and magnetic
- Offshore and onshore seismic acquisition operations including **BroadSeis™** and **EmphaSeis™** broadband and **HPVA™** high-productivity vibroseis technology
- Multi-Physics solutions
- Advanced subsurface imaging and reservoir characterization technology and services
- Economic valuations and consulting services

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



PRESIDENT'S COLUMN

Doing what we do better ...

# YPs Add Passion, Talent to AAPG

By RANDI MARTINSEN

It should come as no surprise to learn that Young Professional AAPG members are not only growing in numbers within our Association, but also in influence.

YP groups are increasing all around the AAPG world – and as any who read the monthly “ProTracks” column in the EXPLORER already know, the groups’ monthly activities are becoming “must-attend” activities wherever they’re held.

YPs have held their own Leadership Summits, typically in conjunction with AAPG Leadership Days, and their Meet-n-Greets – which allow them a chance to not only meet others in their demographic, but to network and bond with more veteran AAPG members – are important parts of all annual conventions and international conferences.

The growth of this group has been notable; in March 2007 we had 2,381 members who were between the ages of 25-35; as of last month we had 8,459 (the classification is now age 36 and under).

But it's not just the numbers that matter when it comes to considering YPs and AAPG. Something else that is equally impressive is the way their passion for their profession, industry and careers are infusing our Association.

Passionate people have always made AAPG a great association, right from the start. And it's wonderful to see that same quality alive in so many of our younger members.

Two Young Professionals who I have worked with this year are Richard Ball, who is completing his two-year term on the AAPG Executive Committee as secretary, and Flover Rodriguez, the Latin America



MARTINSEN

Passionate people have always made AAPG a great association, right from the start.

Region Student Chapters liaison.

Both of these talented people have impressed me with their drive and vision for the AAPG – yes, and their passion for what they do. And because of their involvement in many key roles over the past few years I asked each of them a question or two about their experiences.

*What is something you learned from your involvement with the Student Chapter Leadership Conference?*

FLOVER: Being involved with the AAPG has been an incredible experience, and I've learned firsthand that being successful is *not* an impossible goal that is limited to only the lucky few – success is something that exists in all of us.

However, there is no shortcut to success.

When I attended the Global SCLS in 2009, Richard (Ball) shared advice from one of his mentors (Bobby Ryan), which was this: Never work your next job until you

have accomplished and surpassed your current expectations.

It took hard work to plan the Latin American SCLS. Our plan was to teach students how rewarding it is to share their passion for geology and the geosciences with others – and that is something every member should strive to attain.

And eventually we realized, our team had indeed designed an event that will continue to make a difference in the lives of young geoscience students for years to come.

*Flover, you are a student and very active in the Association. What advice do you find most valuable?*

FLOVER: Practice makes perfect – there is no easy way around being successful. No matter how talented you are, if you don't work harder and dedicate yourself toward being better every single day, you'll fall behind in your profession to someone else who is working harder.

Also, if you focus your energy on making a difference, you are going to make it. You have to believe in you. You have to believe that you can create the organization you want.

*Richard, what advice do you focus on passing on to students?*

RICHARD: Have a vision – I try to impart how a solid vision of whatever it is you're trying to accomplish makes the difference between success and failure.

*What would both of you like to see*

See President, next page

## Candidates Announced for 2015-16

**A**APG officer candidates have been announced for the 2015-16 term. The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2016-17. The terms for vice president-Regions and

secretary are two years.

Biographies and responses from all candidates are available online.

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

### President-Elect

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

### Vice President-Regions

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

### Secretary

- Heather L. LaReau, Noble Energy Inc., Denver.
- Nicole S. Morris, Atlas Resource Partners, L.P., Fort Worth.

## STAFF

### Managing Editor

Vern Stefanic  
email: vstefan@aapg.org

### Assistant Managing Editor

Brian Ervin  
email: bervin@aapg.org

### Communications Project Specialist

Susie Moore  
email: smoore@aapg.org

### Graphics/Production

Matt Randolph  
email: mrandolph@aapg.org

### Advertising Coordinator

Steve Praytor  
P.O. Box 979, Tulsa, Okla. 74101  
Phone: (918) 560-2647 – fax: (918) 560-2636  
(U.S. and Canada only: 1-800-288-7636)

(Note: The above number is for advertising purposes only.)  
email: spraytor@aapg.org

## CORRESPONDENTS

- |                  |                 |
|------------------|-----------------|
| David Brown      | Barry Friedman  |
| Courtney Chadney | Ken Milam       |
| Louise S. Durham | Heather Saucier |
| Kristi Eaton     | Peri Sasnett    |

## TABLE of CONTENTS

**6 A Lean Year:** The years of plenty afforded by the shale boom have given way to **plummeting oil prices and layoffs**, but lower break-even points are softening the blow.

**12 The Arctic Has You:** Simulated reality can help **lower costs and risk** in the **hunt for oil and gas** in the **Arctic Circle**.

**14 Shale Adventure** in the Arctic: Despite a bear oil market, three oil companies might be about to make history on **Alaska's North Slope**.

**22 Marshall's Folly:** **AAPG member Tom Marshall** suggested looking for **oil in Alaska** before it was cool.

**30 Treasure Trove:** The award-winning **Chukchi Sea Environmental Studies Program (CSESP)** is releasing vast quantities of **precious geologic data** to the public.

**46 Optimism Deferred:** The recent **price plunge** represents a major setback for the promising but troubled **Tuscaloosa Marine Shale** play.



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



## REGULAR DEPARTMENTS

- Historical Highlights ..... 38
- Policy Watch ..... 42
- Geophysical Corner ..... 44
- ProTracks ..... 47
- Professional News Briefs ..... 47
- In Memory ..... 47
- Foundation Update ..... 50
- Reader's Forum ..... 52
- Classified Ads ..... 53
- Director's Corner ..... 54
- Divisions Report (EMD) ..... 54

## ON THE COVER:

Brooks Range at Ivishak River, a tributary of the Sagavanirktok River on Alaska's North Slope. The Ivishak enters the Sagavanirktok on the coastal plain south of the famous Prudhoe Bay. That's Gilead sandstone in the foreground.

Left: Great Bear Alcor well, July 2012. Sagavanirktok River in background, underground portion of TAPS on this side of drilling rig, and Dalton Highway in foreground.

Photos courtesy of David Houseknecht.

**President**  
from previous page

*becoming the focus for AAPG members?*  
FLOVER: Learn from your own experiences – don't wait until someone tells you how to solve a problem, try to find the solution.

Randi, you told us how important it is to be responsible for the next generation, and it's true. If every generation in the AAPG continues to heed that advice, and works toward making the organization better prepared for the *next* generation, the AAPG will be around for the next 100-plus years.

RICHARD: Keep it simple. We are a large organization, and occasionally we get bogged down in

the belief we need all-encompassing, complex ways to improve the AAPG, when in fact, some of the most beneficial changes come from simple ideas executed in small pilot programs (like the SCLS program).

All we need is an idea, an effective way to communicate that idea and people who believe in that idea.

I often try to inspire my daughters using words from Amelia Earhart: "Never interrupt someone doing what you said couldn't be done."

I think Flover and Richard are giving us a good message. When we listen to and carefully consider the needs of members, and then act in good faith to find solutions, great things can happen.

Visions can begin. Of course, doing that means we first

need members to come up with some good ideas about how AAPG can help maintain the integrity of our science and the growth of our profession for future energy needs.

And, importantly, we need people who are willing to *share* those ideas with us, so we can all work together to make those good ideas useful for our Association, valuable for our membership and integral to our capabilities to provide energy for our planet.

That's a tall order, and it will require everyone – students, YPs and veteran geologists alike – to participate.

Are you ready to be part of the team? I'd love to hear from you.



**Catch the Next Wave At ATC**



By BRIAN ERVIN, EXPLORER  
Assistant Managing Editor

New technology, new science, new possibilities – all in a new location. There's a lot that's new waiting to be introduced at this year's Arctic Technology Conference (ATC), a multi-disciplinary meeting that offers the latest in Arctic exploration, development and production.

That includes a new setting: For the first time, the event will be held somewhere other than Houston. The fourth annual ATC will be held March 23-25 at the Bella Center in Copenhagen, Denmark.

"There are two new and exciting events this year at ATC 2015," said program chair Brian Miller.

The first is the "Arctic Next Wave," which, as described by Miller, will be "a session centered on what you need to know if you are just starting out in the Arctic."

The Arctic Next Wave will be on Tuesday, the second day of the three-day event. It's designed to serve as a focused orientation and networking event for both seasoned energy veterans and YPs who have been recently assigned to the Arctic or who might be assigned responsibility for an Arctic project in the future.

Along with a roundtable session and networking reception, the Arctic Next Wave will include a presentation by AAPG member Nathan Meehan, senior executive adviser to Baker Hughes and president-elect of the Society of Petroleum Engineers, on "Arctic Skill Demands and How People Gain Those Skills."

Another talk in the session will be a keynote address by Shell's Arctic Vice President Don Jacobsen, titled "What Makes the Arctic Unique?"

The second new event will be the ATC Distinguished Achievement Awards, which are modeled after the prestigious Offshore Technology Conference awards of the same name (See story on page 32).

Also to be held on Tuesday, the awards will recognize significant technological, humanitarian, environmental and leadership contributions to the industry.

The conference also will include, of course, all of the features that have made it so successful over the past four years:

- ▶ Plenary Session.
- ▶ Five panels.
- ▶ More than 150 technical presentations (some of which are covered in this issue of the EXPLORER).
- ▶ Topical breakfasts and luncheons.

ATC also includes a bustling exhibition, which typically attracts more than 1,500 industry professionals from at least 26 different countries and about 80 exhibiting countries.

An offshoot of the Offshore Technology Conference, ATC is supported and endorsed by AAPG and 13 of the world's top scientific and engineering organizations.

This year's venue was chosen for its ease of access for European and Asian operators in the Arctic, while still providing easy access for participants from North America.

"Copenhagen's central location and broad accessibility make it a strategic choice to host ATC 2015 and attract these international professionals who wouldn't normally attend in Houston," said Han Tiebout, who was the technical program chair for last year's event. **E**

**Compare Options.**  
**FAST.**



PetroDE IP Heat Map based on 4.6 million IHS wells



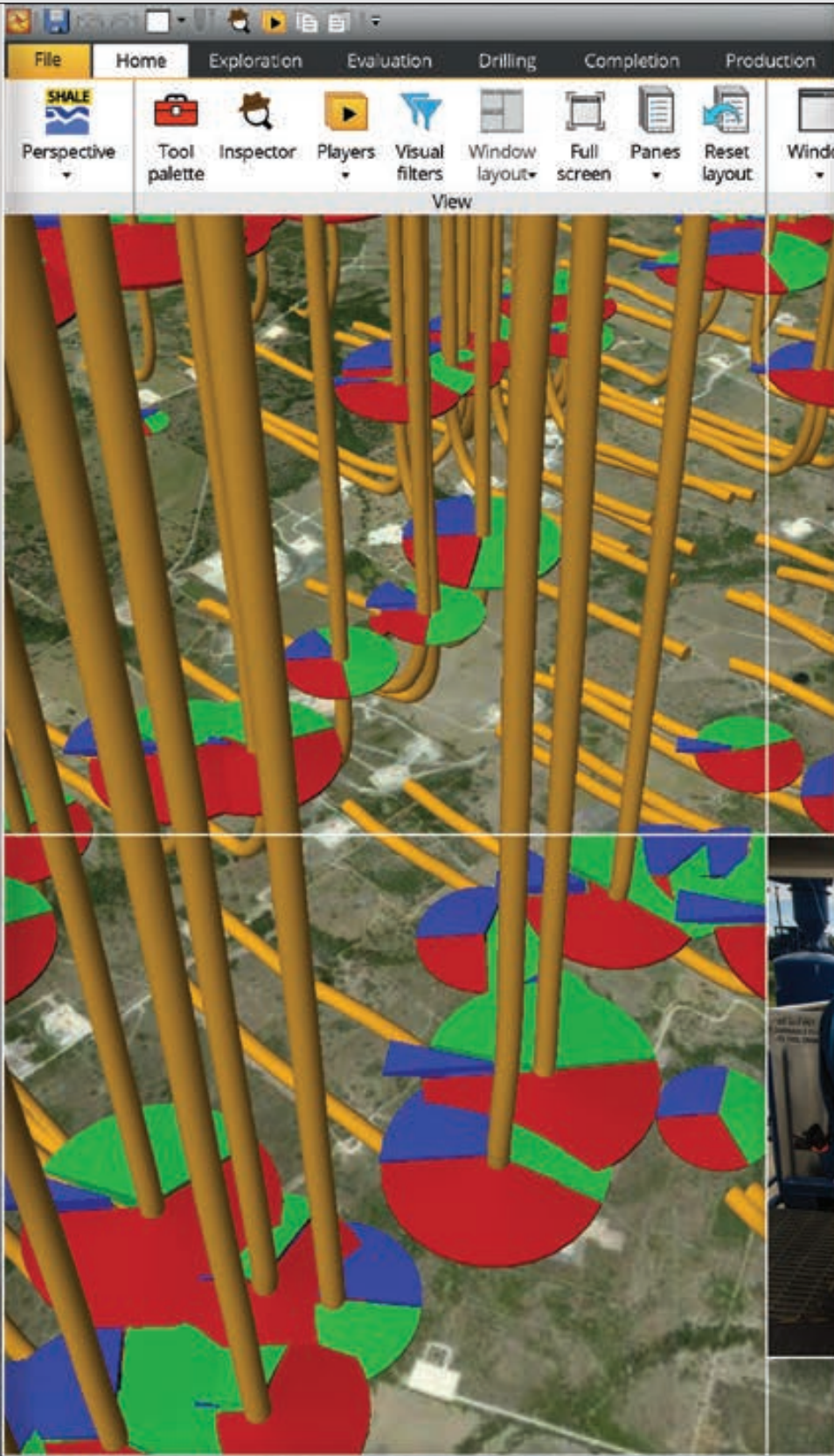
**The World's First Petroleum Decision Engine.**

All the data your team needs at your fingertips  
Make real-time, collaborative, data-informed decisions  
Mine and analyze your data in seconds

See us at NAPE Summit, Feb 12-13, 2015, Booth 3118

email: sales@petrode.com | phone: 303-919-3770





**Petrel**

E&P SOFTWARE PLATFORM

## Petrel Shale—A fit-for-shale solution from exploration to production

Leveraging the Petrel\* E&P software platform, Petrel Shale offers the industry's first end-to-end workflow specifically designed for shale resources.

The customized interface and toolset allows geoscientists to integrate multidisciplinary data to define sweet spots, plan well locations, and analyze production trends to maximize capital efficiency.

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

**Schlumberger**

\*Mark of Schlumberger. © 2014 Schlumberger. 14-D-0918

2015 North America outlook

# No Certainty, But Not All Is Doom and Gloom

By DAVID BROWN, EXPLORER Correspondent

**O**il prices ... barreling downward. Natural gas prices ... up in flames. Gasoline prices ... tanking.

The year got off to a scary start for the oil and gas industry.

Recent company announcements make it clear that 2015 will bring a smaller North American energy industry, spending less money. Talk of layoffs and reduced capital budgets began as early as last November.

In January, commercial intelligence and consulting firm Wood Mackenzie issued a list of "15 Things to Watch in North America Upstream in 2015." It predicted efficiency improvements, asset high-grading and cost relief for the industry.

Also, no big decline in production.

"What we're seeing right now is a lot of uncertainty. We are seeing the thesis play out where costs are coming down. And we are seeing production chugging along," said Delia Morris, senior North American upstream analyst for Wood Mackenzie in Houston.

"We think producers are going to keep producing until cash flow dries up for them to fund it," she added.

Overall, most industry observers expect economic pressures almost across the board, with only a few positive trends for North America, in these key areas:

**Budgets and Finances**

In November, Apache Corp. announced it would take more than \$2 billion in non-



MORRIS

**"What we're seeing right now is a lot of uncertainty. We are seeing the thesis play out where costs are coming down."**

cash charges and reduce its 2015 North American onshore capital budget by \$1.4 billion. Unconventionals player Continental Resources Inc. cut its non-acquisition capital expenditure budget from \$5.2 billion to \$4.6 billion, and later slashed it to \$2.7 billion.

Range Resources Corp. in January reduced its 2015 capital budget for the year from \$1.3 billion – already down 18 percent from 2014 – to \$870 million. A number of companies announced initial rounds of layoffs last month, led by Schlumberger's plan to trim its workforce by 9,000.

Similar moves were expected from other companies in a general pullback, resulting in one small solace for operators: Experts predicted a lower-cost service and supply environment for the industry, with downward pressure on the price of everything from rig rates to rub rags.

Wood Mackenzie called upstream costs "the silver lining for operators." It said if oil prices average around \$50 per barrel in

2015, the U.S. horizontal rig count could decline by 40 percent and rig day rates could fall by 30 percent or more.

While production-oriented "master limited partnerships" have come under considerable pressure, the company said there still is room for growth in North American MLPs related to the storage or transport of oil and gas.

**Unconventional Resources**

Lower costs and operating efficiencies could be the salvation for North American resource plays as breakeven points begin to drop, sometimes dramatically.

The Eagle Ford looks like a best bet, Wood Mackenzie said. Its supply-chain analysis predicted Eagle Ford costs will come down an average of 20 percent for drilling and 10 percent for completions, leading to lower WTI break-evens in the play's core and economic drilling below \$50/barrel for many operators.

In the Haynesville, lower service costs

should improve the return on dry-gas investment. Wood Mackenzie projected gas-price break-evens for the Greenwood-Waskom, Spider and Woodardville area sub-play at \$3.46/mcf, \$3.31/mcf and \$3.37/mcf, respectively.

"Concerning tight oil plays and unconventional gas plays, we are seeing reversion to the core areas, to the money-making areas. Operators are running away from high-cost fringe areas," Morris commented.

Look for more refrac work in U.S. unconventional plays. Because of low natural gas prices, some operators have already introduced refracturing, which can boost production at relatively low cost.

Successful refrac testing also has taken hold in gas-rich plays like the Haynesville and Barnett, Wood Mackenzie noted.

**Gulf of Mexico**

The biggest surprise of 2015 might be an uptick in Gulf of Mexico operations. It's hard to think of a deepwater lease being a hot topic, but industry observers expect lease expirations to drive activity in the U.S. Gulf.

Lower rig demand has mitigated that outlook, with utilization projected to fall below 50 percent and some contractors already bidding their largest jackups below \$100,000 per day.

See **Acquisitions**, page 8

As Mexico's oil, natural gas, and electricity businesses open to foreign investment in 2015, position yourself with data, knowledge, and tools to respond effectively to emerging opportunities.

Alconsult International announces a cross-disciplinary, multi-client Mexico study that will facilitate review and assessment of E&P investment opportunities and enhance understanding of Mexico's regulatory environment.

**ON THE GROUND MEXICO EXPERIENCE  
NEW COUNTRY-NEW BASIN ENTRY STRATEGIES  
E&P OPERATIONS EXPERTISE**

FOR MORE INFORMATION  
OR TO SCHEDULE AN INFO SESSION

[www.alconsult.net/mexico](http://www.alconsult.net/mexico)

**ALCONSULT**  
INTERNATIONAL

Worldwide Energy Business Consultants Since 1986.

*Any time. Any place.  
Any prospect.*



**Globe: The Complete New Ventures Solution**

The most comprehensive Earth Systems Models, controlled by Getech's world class data and exploration workflows. The cost-effective solution in Plate-to-Prospect exploration.

*For further information contact Getech:*

Getech, Leeds, UK +44 113 322 2200  
info@getech.com

Getech, Houston, US +1 713 979 9900  
www.getech.com



## The Silver Lining, Other Themes of 2015

International consulting-research firm Wood Mackenzie's mid-January report suggested that despite the North America upstream oil and gas sector's "unprecedented level of uncertainty going into 2015," some positive signs can be found.

"We are already seeing this play out as upstream operators announce drastically reduced capital budgets for 2015, yet forecast increased production growth (in aggregate)," said Delia Morris, senior North American upstream analyst for Wood Mackenzie.

Several of the themes can be found in the accompanying report. Other themes include:

▶ A slowdown in drilling activity already is having an impact on the demand and costs for rigs. If the oil price were to average around \$50/bbl in 2015, WM

anticipates a 40 percent decline in the horizontal rig count compared to 2014. Rig day rates could fall by 30 percent or more.


▶ As many as 16 Canadian oil sands project phases that have not received corporate sanctioning are at risk of being deferred if current low oil prices persist – but simultaneously, low prices could warm up a deal market that has been markedly quiet over the past two years. Large acreage holders like Sunshine Oilsands could turn into bargain investment opportunities for companies seeking long-term resource potential and betting on a long-term oil price recovery.

▶ North American LNG loses some luster, but maintains momentum.

▶ Ethane is maxed out. Maximum ethane rejection has resulted in many

natural gas pipelines reaching their maximum BTU limits as ethane is kept in the gas stream since it is more valuable as a fuel than as a chemical feedstock.

▶ U.S. crude export policy will be evolution rather than revolution: "Although we do not believe that the ban will be lifted wholesale for all classes of crude oils in 2015, expect to see an increase in condensate exports as the industry tests and clarifies the definition of distilled condensate," reads the report.

▶ The benefits of Mexico's opening will accrue mainly to larger players. Overall, interest will likely focus on discovered fields rather than exploratory blocks, with the exception of Perdido. Joint ventures will allow for cost and risk diversification in the current price environment. 

## Acquisitions from page 6

On the high end of estimates, Wood Mackenzie predicted drilling in the Gulf to increase by more than 30 percent compared to 2014, as rig contracting continues and development drilling ramps up.

### Canadian Outlook

Sharply lower production prices are widely expected to limit oil sands projects and curtail western Canada drilling operations. Wood Mackenzie said up to 16 oil sands project phases are at risk of being deferred by low oil prices.

The Duverney, Montney, Falher/Wilrich, Glauconite and other liquids-rich areas will see lower activity levels, but to a lesser extent than in other plays, it predicted. And activity in the Deep Basin and new niche plays like the Saskatchewan Torquay will continue, but at a reduced pace.

In mergers and acquisitions, a low oil price environment could warm up the Canadian deal market and generate bargain investment opportunities for companies wanting long-term resource potential, it said.

Repsol S.A. announced in December it had agreed to acquire Calgary-based Talisman Energy for \$8.3 billion, a possible sign of more deals to come.

Despite a great deal of talk – and posturing – by the Republican-majority Congress in the United States, surprisingly few experts see much love for the long-delayed Keystone XL pipeline proposal. Wood Mackenzie expected the project to remain in a holding pattern.

### Mexican Outlook

Mexico is in the process of reforming its energy sector to allow foreign investment. Last year the Mexican National Hydrocarbons Commission released an initial bid process for 14 shallow-water contract areas, one of five types of licenses to be offered in Round One.

Wood Mackenzie forecast a decline in speculative interest by smaller and newly established companies in Round One because of lower oil prices. It said most interest probably will focus on discovered fields rather than exploratory blocks, with the exception of the offshore Perdido area.

"This is pretty lousy timing for them to have Round One going on," Morris noted.


She said the offerings related to Mexican unconventional resource plays could be delayed or withdrawn, reflecting reduced interest in natural gas, unconvensionals and heavy oil blocks.

### North American Exploration

Morris said the exploration sector faces lower activity, reduced ambition and a flight to quality.

"For the shale players, companies are just not going to be drilling exploration wells in fringe plays," she said. "For deepwater, I'm pretty sure that's similar."

However, past price-hedging using futures contracts will provide some protection for operators through 2015. And cash flow will allow companies to maintain production levels in already-developed plays this year.

"You are not going to get the full effect until 2016," Morris said. "Then things are going to be more exposed, and you could see some of the small companies go under." 



## Bring Order to Your Data with Desktop

Unorganized data costs you time and money. Neuralog Desktop utilizes simple loaders and file association tools to load and organize well, log and related document data. With minimal turnaround time users can begin utilizing data and evaluating projects.

- ✔ Same-day Setup and Utilization
- ✔ SQL and Access Database Support
- ✔ Project and Corporate Level Data Organization
- ✔ Well, Log and Document Management
- ✔ Interactive GIS-based Interface

Organize Efficiently  
NAPE Summit 2015  
Booth 2225

**Neuralog**  
Turning Paper Into Petroleum

© Neuralog 2015 www.Neuralog.com 1.281.240.2525 sales@neuralog.com



CORING SERVICES



NO CHALLENGE TOO TOUGH,  
NO ROCK TOO HARD

FOR HALLIBURTON'S ROCKSTRONG™  
CORING SYSTEM.

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

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

**HALLIBURTON**

Solving challenges.™

© 2014 Halliburton. All rights reserved.

*A creative approach to Arctic research*

# Managing Complexity Through Collaboration

By LOUISE S. DURHAM, EXPLORER Correspondent

**A**rctic exploration and production is not for the timid.

Nor for those without deep pockets. Look at Royal Dutch Shell Plc, for example.

Long recognized for its considerable E&P expertise, this super major has labored for eight years to find and produce oil in the Beaufort and Chukchi seas.

Despite spending more than \$5 billion and counting, the fates have not been kind.

A drillship mishap in 2012 followed by damage to the company's unique spill containment barge during certification testing, along with other setbacks, led to a halt in drilling, with the exception of some top hole activity.

Early on, the company had become a favored target of lawsuits instigated by environmental groups seeking to block any and all Arctic exploration.

With its lease holdings still intact, Shell continues to press forward with plans to drill again, possibly this year.

The Big Story, however, tends to overshadow the considerable bustle already under way in the region.

Jocelyn Fenton, health and safety executive and regulatory coordinator at Statoil in Alaska, has considerable insight on the industry's Arctic activity overall. This comes from her hands-on experience working in the Alaska oil and exploration arena for 10 years, focusing on regulatory and permitting issues and sciences.

"There is a lot of activity in the Arctic

that is quite comprehensive, and I want to combat the lack of awareness of this," she said. "There are numerous completed, ongoing and planned projects characterizing this complex region, but getting the word out seems to be a struggle.

"Also, I want to emphasize that all this work should be coordinated with other groups in the area," she said.

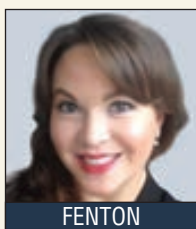
"The Arctic is a complex region with differing policies and protocols, so collaboration and communication are imperative for success," she added, "even when we're talking about competing companies."

### The Arctic Council

There's good news already in that the oil and gas industry currently collaborates with numerous diverse public and private partnerships to plan, explore, develop and sustain multiple regions within the Arctic.

Still, little is known outside of the energy or research milieu about the extensive research and data collection efforts in the region. Much of this is available for public review and use, according to Fenton.

She summarized the aspects of Arctic



FENTON

Jocelyn Fenton, health and safety executive and regulatory coordinator at Statoil in Alaska, will present the paper "Charting a Collaborative Course for Arctic Offshore Oil and Gas Development" at this year's annual Arctic Technology Conference, set March 23-25 at the Bella Center in Copenhagen, Denmark.

hydrocarbon exploration that present the greatest opportunities for cooperation:

- ▶ Baseline studies.
- ▶ Engineering.
- ▶ Oil spill prevention, detection and response.
- ▶ Data collection and modeling.
- ▶ Monitoring.

The Arctic Council is the leading international forum involving all of the Arctic nations.

"Through its formal working groups and task forces, the Arctic Council encourages collaborative research among governmental and non-governmental organizations laboring to explore and develop resources in this challenging environment," Fenton said.

She also emphasized that the Arctic Council is maturing into a science-based forum where multiple entities can share their findings and work toward sustainable development for the benefit of the Arctic states and other global communities as well.

Chairmanship of the group will be

handed over from Canada to the United States in May (see Policy Watch, page 42).

### Social License


Besides the operational and logistical headwinds posed by the locale itself, sociological challenges also must be considered.

Six organizations that represent Arctic indigenous peoples have been designated as permanent participants on the council.

The Arctic Oil Spill Response Technology-Joint Industry Program (JIP) has proven to be one of the region's successful collaborative endeavors to date. The JIP comprises 10 oil and gas companies, and the program's goal is to advance oil spill response logistic strategies and equipment sharing, and also to increase knowledge of the potential impacts that oil could have on the region's marine environment.

The Chukchi Sea Environmental Science Program (CSESP) was founded by Shell and Conoco-Phillips in 2008, incorporating Statoil as a partner from 2010 until 2014. CSESP was formed to characterize pre-exploration baseline information on the ecology of the region.

Fenton's take on collaboration in general is straightforward.

"A lot of great things have been achieved," she said, "when public-private partnerships work together to meet numerous interests." 

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



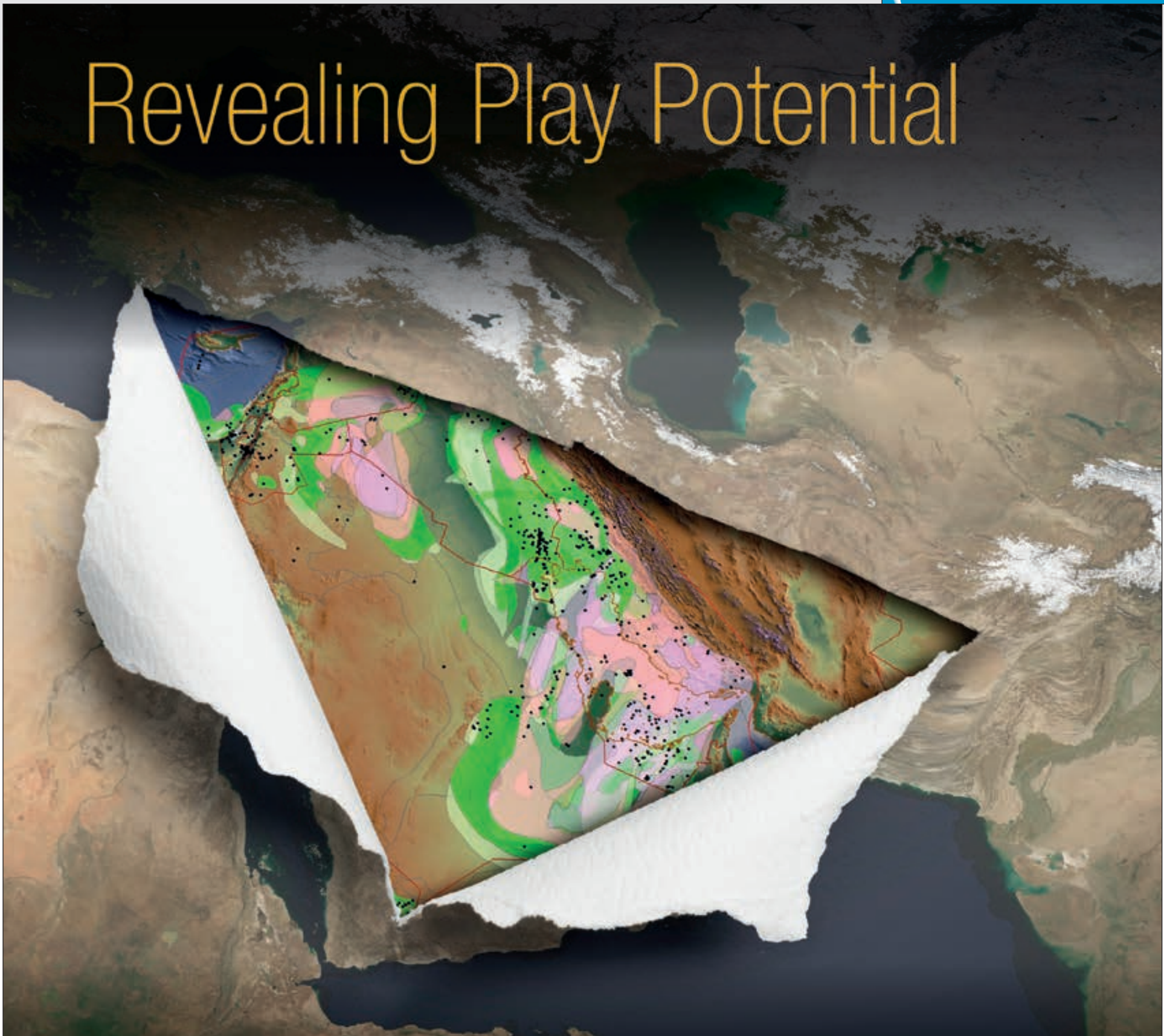
**The knowledge. The expertise. The relationships.**  
**No event gets you better connected with the heavy oil community. Register to attend!**

**March 24 - 26, 2015**  
 Edmonton, Alberta, Canada

Get \$300 off Until Feb. 12! Register with code **WH2F** at [worldheavyoilcongress.com](http://worldheavyoilcongress.com)

business conference | technical conference | short courses | exhibition | social events | poster sessions

# Revealing Play Potential



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

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

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

Contact us today:

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

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

Tel: +44 (0)1235 442699

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

Neftex • 97 Jubilee Avenue • OX14 4RW • UK

Now Explore



*Innovation remains the key*

# Simulated Environment, Real Gains in Arctic

By LOUISE S. DURHAM, EXPLORER Correspondent

**O**il and gas professionals have long been accustomed to working in hostile geographic environments. Think dense jungles, desert terrain, ultra deep water, for example. Then there's the unique Arctic region. Obviously, it's a daunting locale, with often-frigid temperatures, frequent ice floes and myriad other challenges to oil and gas operations and the stalwart workers who perform these tasks. The ongoing efforts to strike it big continue unabated, however, given that the potential for major production is huge.

In the past three decades, more than 200 billion barrels of oil have been discovered there, according to AAPG member and past AAPG Distinguished Lecturer Alastair Fraser, EGI chair in petroleum geoscience at Imperial College of London.



Matthew Hamilton will present his paper "Virtual Arctic Simulation Environment" at this year's Arctic Technology Conference, which will be held March 23-25 at the Bella Center in Copenhagen, Denmark.

"Ultimate resources are estimated at 114 billion barrels of undiscovered oil and 2,000 trillion cubic feet of natural gas," Fraser noted to the EXPLORER last year. "If these estimates are correct, these hydrocarbons would amount to more than a fifth of the world's undiscovered reserves."

### Digital Arctic

So, you ask, what will it take to recover a sizeable amount of these hydrocarbons? For starters, it will require innovation – and lots of it, particularly in the realm of subsea operations. Newfoundland-based GRI Simulations, which specializes in subsea simulation and visualization, has logged innumerable hours working on its Virtual Arctic Simulation Environment to enable scientists to evaluate the perilous area from the comfort of their offices.

The evolving VASE technology has been under development at GRI for more than 15 years, explained company research scientist Matthew Hamilton. He noted that while parts of it are finished, it is still being developed, and much of it is still experimental.

"It's close to being commercial," he said. "We need more testing, more studies with real data."

When designing subsea infrastructure and executing operations, issues of safety and economic and engineering success are challenged by the risky conditions characteristic of deeper waters and harsh, cold environments.

"A software-based virtual environment presents the option to alleviate these risks, providing the capability to design, train and plan design and operations virtually before proceeding in the physical realm," Hamilton said.

No one said it would be easy, though. "Virtual environments pose steep technical challenges," Hamilton said, "in that they must be realistic enough so that training in the simulation environment transfers into the corresponding real world scenario, and design simulations are accurate enough to serve as reliable predictive tools."

### The Right Stuff

Remotely operated vehicles (ROVs) are increasingly used where conditions for subsea operations pose danger or obstacles for divers charged with operating and maintaining infrastructure.

Significant skill is needed to operate these vehicles at all times – and certain missions require even more specialized skills than usual, meaning the ROV pilots need considerable time to learn the specifics of what any given assignment requires.

In fact, ROV training simulation has emerged as an indispensable tool to help train pilots in performing basic piloting skills and practicing complex missions.

"In the harsh northwest Atlantic, the threat of iceberg scour has created a requirement that subsea pipelines be buried in deep trenches in order to mitigate against the risk of damage," Hamilton said. "Successful trenching of pipelines requires complex ROV piloting but also strategic choice of trench routes based on seafloor geometry, soil properties and geotechnical considerations."

"We present a virtual software simulation environment centered around ROVs, with particular focus on supporting trenching vehicle operations," he noted. "The system can now simulate trenching and dredging

## WELLSITE GEOSCIENCE SERVICES



## When time is money, Wellsite Geoscience is money well spent.

Whether you're exploring a basin, producing a well or completing a shale play, time is money. That's why Weatherford Laboratories brings a suite of formation evaluation technologies right to the wellsite. Utilizing mud gas and cuttings, these technologies provide detailed data on gas composition, organic richness, mineralogy and chemostratigraphy in near real time. As a result, operators now have an invaluable tool to assist with sweet spot identification, wellbore positioning, completion design and hydraulic fracturing. We call it Science At the Wellsite. You'll call it money well spent.

### SCIENCE AT THE WELLSITE™

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

Formation Evaluation | Well Construction | Completion | Production

©2013 Weatherford. All rights reserved.



See Training, page 20

# DEEP. INTEL.

THE INDUSTRY'S FIRST DYNAMIC LAND, GEOLOGY,  
AND ENGINEERING INTELLIGENCE ON DEMAND.

When was the last time you could take immediate action from an analysis? Only Drillinginfo puts comprehensive, play-specific data and deep insights at your fingertips. We'll tell you what rock properties contribute to production, and which drilling, completion, and stimulation efforts contribute (including how much and where).

- Tens of thousands of petrophysical, analytics-grade, digitized well logs per play, plus detailed wellbore and completion/stimulation information
- Dozens of sequence stratigraphic correlations, fault picks, and attendant properties maps per play
- Detailed multivariate analysis of emerging best practices for each quality of rock
- Easy integration with your seismic and internal data to better quantify optimization techniques
- The cleanest, highest-quality, pre-scrubbed, analytics-grade data in the industry
- See the evolution of a play unfold day by day, week by week, month by month, and year by year
- Each play area maintained and updated frequently and expanded geographically into adjacent areas

Add to your expertise in the plays you are in, and stay up to date with the plays you aren't, at a cost that doesn't break the bank.

[Drillinginfo.com/DIG-Niobrara](http://Drillinginfo.com/DIG-Niobrara)



**drillinginfo**  
better, faster decisions

View to the north through Tiglukpuk anticline along Tiglukpuk Creek near Brooks Range mountain front, 2011.

'Big deal' in the Arctic

# 'Shale Adventure' on Alaska's North Slope

By HEATHER SAUCIER, EXPLORER Correspondent



At a time when some operators are slowing production of unconventional resources, and as oil and gas prices continue to fall, three companies have high hopes for producing shale oil north of the Arctic Circle for the first time in petroleum history.

Great Bear Petroleum of Anchorage, Alaska, Royale Energy of San Diego and Burgundy Xploration of Houston hold a total of nearly 800,000 acres in leases on the North Slope of Alaska.

The leases are located south of Prudhoe Bay and stretch about 100 miles from the Colville River on the west to the Sagavanirktok River on the east.

Great Bear has drilled two stratigraphic test wells with its partner, Halliburton Energy Services, and is evaluating three source rocks estimated to contain hydrocarbons by the U.S. Geological Survey (USGS).

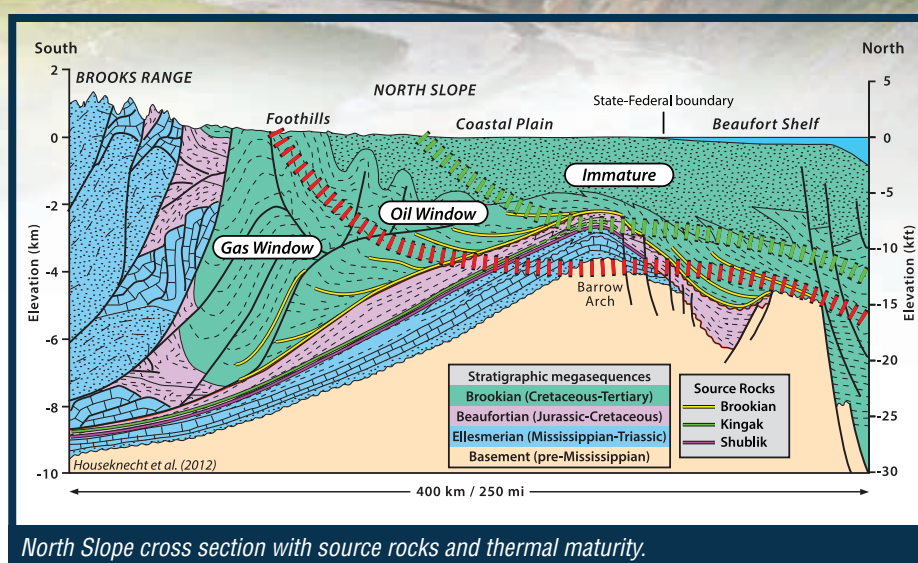
"Everyone is watching because this is the first time that shale oil is being tested in the Arctic environment," said AAPG member David Houseknecht, supervisory research geologist and project chief for the USGS' Energy Resources Program in Alaska.

"It is a big deal," he said. "It will be interesting to see what the outcome is."

### Three Rocks

Geologists at Great Bear, Royale and Burgundy are eyeing three source rocks: the Triassic Shublik, the Jurassic Lower Kingak and the Cretaceous-Lower Tertiary Brookian (which includes the pebble shale unit and Hue shale).

All have sourced conventional reservoirs



North Slope cross section with source rocks and thermal maturity.

on the North Slope, primarily Prudhoe Bay. Broad estimates of oil generated in these source rocks range from 100 billion to one trillion barrels of oil.

Combined, the mean estimate for all three source rocks ranks among the top source-rock systems in the country, placing them just above the Eagle Ford in terms of technically recoverable oil, Houseknecht said.

Specifically, they have the potential to produce up to two billion barrels of retained oil and up to 80 trillion cubic feet of retained gas, according to Houseknecht's report released by the USGS in 2012.

Houseknecht began gathering data on shale oil and gas potential in 2009.

"I decided that considering the level of shale oil and gas development in the Lower 48, we really needed to establish

a quantitative perspective on the shale resources on the North Slope," Houseknecht said. "The reaction I got was, 'Why are you doing this?'"

Then, a year later, Great Bear appeared out of nowhere and leased 99 tracts totaling approximately 499,000 acres south of the Prudhoe Bay and Kuparuk fields.

"My phone began ringing off the hook," Houseknecht said. "The state wanted to accelerate the assessment. It's the only time in my life that I anticipated a demand appropriately."

In 2011, Great Bear acquired an additional 45,700 acres and Royale entered the scene and leased 100,000 acres. Burgundy, now in partnership with Tangiers Petroleum, recently popped up acquiring nearly 100,000 acres as well.

Based on Houseknecht's estimates, the Shublik Formation – the oldest of the three – contains the greatest potential per unit area, with a mean of 463 million barrels of

technically recoverable oil for the entire play. It is trailed by the Brookian formation with a mean of 449 million barrels, and the Kingak with a mean of 28 million barrels.

The Shublik has diverse rock types – including shale, impure shale, mudstone, siltstone and limestone – and overall is very brittle and ideal for hydraulic fracturing.

It also spans an entire range of thermal maturities across both the oil and gas windows.

"There is a wide range of suitable geological conditions that exist," Houseknecht said.

The USGS estimates the likelihood of technically

recovering oil as:

- ▶ Shublik oil and gas: 95 percent.
- ▶ Brookian oil and gas: 90 percent.
- ▶ Kingak oil: 40 percent.

### From Texas to Alaska

While working as an oil and gas consultant in Houston five years ago, AAPG member Ed Duncan, a petroleum geoscientist and CEO and president of Great Bear, wanted to combine the global basin knowledge he acquired earlier in his career working for BP and his experience with shale plays in Texas, Oklahoma and California to find the next emerging unconventional resource play.

His research serendipitously took him back to Alaska, where he worked in regional exploration plays on the North Slope more than 30 years ago.

Continued on next page



HOUSEKNECHT



Photos courtesy of David Houseknecht

Coal-bearing Upper Cretaceous strata along Sagavanirktok River, south of Prudhoe Bay.

**Continued from previous page**

"I was stunned to find myself focused pretty quickly on a basin I worked on early in my career," he said. "I dug deeper and realized that not only are there really great source rocks, but some are naturally fractured. Oil that was flow-tested from the Shublik source rock in Prudhoe Bay

Eager to get started, Duncan and his wife, Karen Bryan Duncan, who serves as the company's vice president and general counsel, formed Great Bear in 2010 and moved to Anchorage the following year. Although Great Bear operates with just six employees, Duncan describes it as "the world's largest small oil company," touting the expertise of his technical staff – including North Slope consulting geologists Ken Bird, Les Magoon and Allegra Hosford Scheirer, all AAPG members.

"No one has done the amount and quality of work we have done," Duncan said. "We are much more heavy on the petroleum systems science from what I have read."

In 2012, Great Bear completed drilling the Alcor No. 1 and Merak No. 1 test wells off the Dalton Highway, with good results.

"The thermal maturity of the rocks were exactly spot on with our pre-drill predictions, and the geo-mechanics of the Shublik exceeded our expectations," Duncan said.

Combining his findings with data on source rocks his team gathered from existing wells on the North Slope, Duncan found that the Shublik Formation is carbonate rich, contains high silica content and has little clay – ideal for a hydraulic fracturing operation.

He believes both the Shublik and lower Kingak formations contain "world class" source rocks with the potential to produce light oil and condensate.

"We have proven that with the results of our own wells," Duncan said, adding that all three source rocks are present in the oil window.

Great Bear had hoped to drill several lateral wells off of the Alcor and Merak wells in 2012 to test oil production from the shale. However, it was forced to delay those plans, primarily because of the pending expiration of its rig contract.

**Possible Bumps in the Road**

Despite the Shublik's potential for an unconventional play, finding sweet spots may be difficult, Houseknecht said. In a basin like the North Slope, thermal maturities do not always reflect the current temperature, as the entire North Slope has been uplifted, and rocks on the top have eroded.

The maximum temperature in the Shublik most likely occurred 40 million years ago, he said, and since then the rocks have cooled.

"One of the uncertainties is whether or not there would have been pressure reduction in the formation over those millions of years that would be detrimental to the drive mechanics," he said. "When you go from one unconventional play to another, some are currently at maximum temperature but many have decreased in temperature since the time the kinetic reactions occurred that generated the oil and gas."

Houseknecht noted that the Shublik overall generates heavier oil, so ideal geomechanics must be present for the oil to move through the rocks.

While the Kingak and Brookian generate lighter oil, Paul Decker, AAPG member and petroleum geologist at the Alaska Division of Oil and Gas, remains uncertain of their ability to produce. He says:

- ▶ The Kingak Formation may not be brittle enough to hydraulically fracture.
- ▶ In the Brookian Formation, which



*Fortress Mountain Formation near Brooks Range mountain front.*

contains very thin volcanic ash beds that could alter mechanical properties in the rocks, it is unclear whether it will be possible to create fractures and keep them open.

"The Shublik Formation is likely to be the most exploitable, at least initially," Decker said. "It has created most of the oil on the North Slope. And the USGS has made a tentative interpretation for one high gravity field sourced from the Shublik."

If that is correct, parts of the Shublik could produce light oil.

**Three More Wells**

Great Bear's permitted well sites sit in a 15-mile strip just west of the Dalton Highway near the Trans-Alaska Pipeline. This area is between Deadhorse and the Franklin Bluffs pad.

Having mapped all three source rocks with a "retained phase fairway approach," targeting areas likely to contain lighter oil and condensate saturated reservoirs, Great Bear will begin drilling the Alkaid No. 1, the



first of three additional wells planned this winter season, weather permitting.

Duncan's eyes are on the Talitha No. 2 well, however, which he expects to drill in March on a tract Great Bear picked up just two months

ago. Located at the southern end of Great Bear's leasehold roughly three miles west of the Dalton Highway, Talitha, because of its location, will be key in further delineating retained phase fairways of the Shublik Formation, Duncan said.

The third planned well is the Phecda No. 1.

All three are specifically targeting conventional reservoir zones with plans to obtain data relevant to unconventional plays in each stage of drilling.

"We are focusing 100 percent of our source rock evaluation time on predicting or understanding how much oil is retained in the source rocks and what is remaining in place," Duncan said.

The conventional reservoirs on Great Bear's leasehold have been regionally proven through 3-D seismic data the

company acquired over the last few years covering 420 square miles, Duncan said. In addition, Great Bear will be shooting an additional 170 square miles of seismic this winter.

To date, Great Bear is the only company to have systematically used modern method 3-D seismic south of the Prudhoe Bay and Kuparuk fields, Duncan said, adding that the seismic data, which has identified both conventional traps, small displacement fault patterns and natural fractures in the shale, has been key in pinpointing well locations.

"We have the benefit of being able to image details in the subsurface with our 3-D that our predecessors did not have," Duncan said. "We have this great collection of interwoven strata that have a lot of conventional and unconventional potential to the south of Prudhoe Bay and Kuparuk that is basically untested."

During its current winter exploration program, Great Bear is allowing for the possibility of drilling lateral wells and hydraulic fracturing to test oil production if targeted zones of interest exhibit ideal properties.

"We are letting the rocks determine our next step," he said.

Great Bear will continue to collect data as it drills, targeting the deepest wells to 150 feet below the base of the Shublik Formation.

Its exploration program now covers 375,000 acres.

Royale has plans to begin drilling in 2016 with four well locations currently in the permitting process. It already has acquired and processed 3-D seismic data over 80 square miles of its acreage and has identified two locations for wells east of the big bend in the Colville River known as Ocean Point.

Calling his work the "shale adventure on the North Slope," AAPG member Mohamed Abdel-Rahman, senior vice president of exploration and production at Royale, said his company is targeting light oil in its conventional plays and relying on core samples to lead them to



*TAPS at Slope Mountain, upper Torok and lower Nanushuk formations in background.*

**See Brookian Formation, next page**



Upper Cretaceous Seabee Formation, comprising organic rich shale with tephra (volcanic ash) interbeds, near Umiat along Colville River. This is part of the Brookian source-rock system.

## Brookian Formation from previous page

the right source rocks.

"With the shale, we are going to take anything we can get. We will find which formation has the best characteristics to determine where to drill," he said. "It's a matter of putting the technical story together ourselves."

Burgundy and Tangiers are targeting the Brookian Formation, a choice most likely dictated by the thermal maturities of the rocks on its leasehold.

### Making It Economical

As all three companies move full steam ahead, no doubt they are aware of others in the industry quietly asking the – literally – million dollar question:

*How can they pull this off?*

"Regardless of what shale analog you use in terms of productivity per well, the cost of drilling a single well, especially if it's a horizontal well with massive fracs on the North Slope, will make it a very challenging situation for a pure shale play to be economically viable," Houseknecht said.

With oil and gas hitting their lowest prices since 2009, Decker said, "I can't see that helping. I think there's already a significant challenge in making a source rock play on the North Slope."

Decker said much potential still exists in many conventional plays in Alaska – both onshore and in the federal waters, namely the central North Slope, state lands and onshore in the National Petroleum Reserve-Alaska.

The area where Royale and partner Rampart Energy plans to drill is just a few miles east of the Spark-Rendezvous conventional field (also known as the Greater Moose's Tooth) targeted for development by Conoco-Phillips – an important fact considering that Royale, like Great Bear, is relying on profits from conventional discoveries to fund unconventional plays, Abdel-Rahman said.

The Spark-Rendezvous field will be peaking at 30,000 barrels per day, Rahman said, reiterating reports from Petroleum News.

"In this market, we must devise a way in which we can still explore for the shale while we are producing from conventional accumulations," Abdel-Rahman said. "We hope that the oil found in conventional plays will be lucrative enough to help us finance a costly shale development."

The company plans to drill its first well to the Shublik Formation and take side wall cores, which are smaller than traditional cores and cost less to acquire. They also are more beneficial in calibrating and sampling the variations in petrophysical properties of the shales, Abdel-Rahman said.

Just as the earlier Eagle Ford and Bakken conventional plays led to the development of much-needed infrastructure to support shale development, Duncan said the same needs to happen in Alaska. Aside from the Dalton Highway and Trans-Alaska Pipeline, no other infrastructure exists in the Great Bear project area. If more infrastructure were in place from conventional production, it would help to reduce costs for a North Slope shale play, he said.

Great Bear is currently constructing approximately six-seven miles of ice roads for exploration drilling purposes. To date the company has spent more than \$150 million on leasing, exploration and drilling.

"The market right now is a bear for everybody," Duncan said. "The fact that we have the will to crawl out of bed every morning is pretty good."

In the eyes of Duncan, it is reasonable for a company with Great Bear's potential to build eight development pads a year, with up to 24 wells per pad. If Great Bear's shale play proves successful, and the state supports drilling activities, 200 wells a year is a reasonable expectation, he added.

In such a scenario, Great Bear could produce 200,000 barrels of crude per day by 2020 and peak in 2056 at 600,000 barrels per day, he said.

An uptick in production could give a tremendous boost to the North Slope and the Trans-Alaska Pipeline, whose operations have been threatened by a throughput decline averaging 5.1 percent a year since 1988, Houseknecht said.

If Duncan is correct, Houseknecht said, "This is going to be significant not only here but globally."

# Register now for the world's most focused and comprehensive Arctic event: ATC 2015



**COPENHAGEN DENMARK**  
23-25 MARCH 2015  
CONWELL CONVENTION CENTER COPENHAGEN

If your job is to safely and effectively discover and produce the vast energy resources in the Arctic, you need to participate in the only event that has the industry and society credibility to bring it all under one roof.

- More than 150 technical presentations on topics under Geology and Geophysics, Exploration and Production, Physical Environment, Logistics and Regulatory Environment and Social Responsibility themes
- Panel Sessions focusing on Global Arctic Market Outlook – Regional Influences; Arctic Technology: Leveraging Capability, Targeted Development and Collaboration Efforts; Regulatory Governance: Attaining Stakeholder Confidence; Arctic Metocean and Ice Forecasting and Routing Optimization
- The combined reach and credibility of 14 of the world's top engineering and scientific organizations and OTC's 45 year history

Register today at [ArcticTechnologyConference.org](http://ArcticTechnologyConference.org)



SPONSORING ORGANIZATIONS

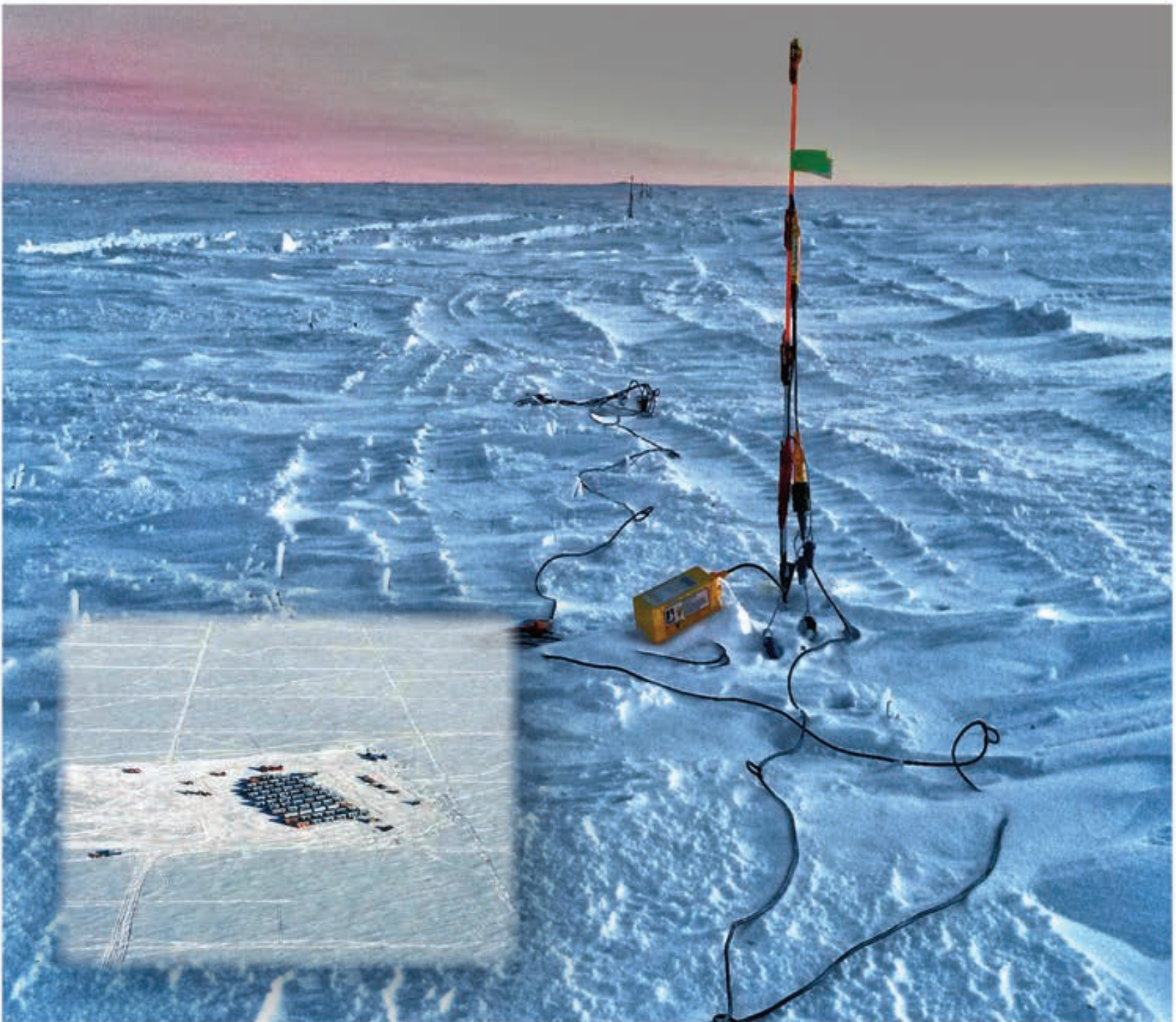


ENDORING ORGANIZATIONS





# EXTREME ARCTIC ACQUISITION



## EXPERTS IN NORTH AMERICA SEISMIC

Global Geophysical Services is a leader in arctic acquisition. Our people have the know-how and capacity to get it done, no matter the job.

The proven efficiency and reliability of our crews are matched only by that of our technology. Seismic equipment that works well elsewhere often fails in extreme arctic conditions – not the case for our AutoSeis® autonomous nodal recording system. With AutoSeis® we are able to achieve record-setting production levels, with minimal environmental impact, in the arctic climate of the North Slope. The 32-bit technology also captures the faintest seismic emissions (ambient seismic) that, when processed using our patented method, directly map fracture networks with incredible detail.

For more information about our arctic expertise contact us at [arcticnodal@globalgeophysical.com](mailto:arcticnodal@globalgeophysical.com).

Download the Case Study at  
[www.globalgeophysical.com/NAM](http://www.globalgeophysical.com/NAM) or  
 Contact us at [ARTICNODAL@globalgeophysical.com](mailto:ARTICNODAL@globalgeophysical.com)

tel +1 713-972-9200  
[www.globalgeophysical.com](http://www.globalgeophysical.com)

**Global**  
 Geophysical Services

# Remote Sensing for Cost-Effective Mapping

By KEN MILAM, EXPLORER Correspondent

Remote Arctic coasts are among the most fragile and least understood environments.

Natural events like tsunamis, storms and climate changes can threaten life and infrastructure. These events also can spur major pollution concerns when they impact petrochemical or mining operations.

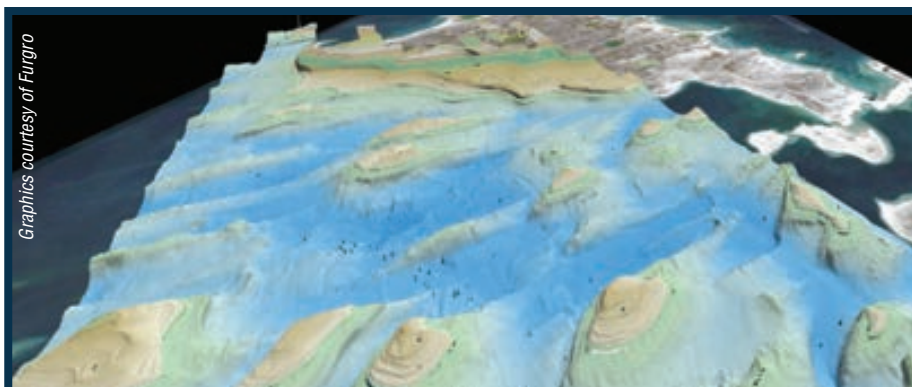
In a paper to be presented at the upcoming Arctic Technology Conference, Fugro remote sensing manager Todd Mitchell discusses ways to better characterize these sensitive areas to help prepare for better disaster responses.

In "The Remote Coast: Baseline Mapping in Preparation for Arctic Coast Disasters," Mitchell discusses some of the lessons learned and suggests a mechanism for a cost-effective, tiered approach to coastal baseline mapping.

With offices in 60 countries and projects in many more, Fugro employs remote sensing methods from satellites, aircraft, ground vehicles, marine vessels and underwater submersibles, Mitchell said.

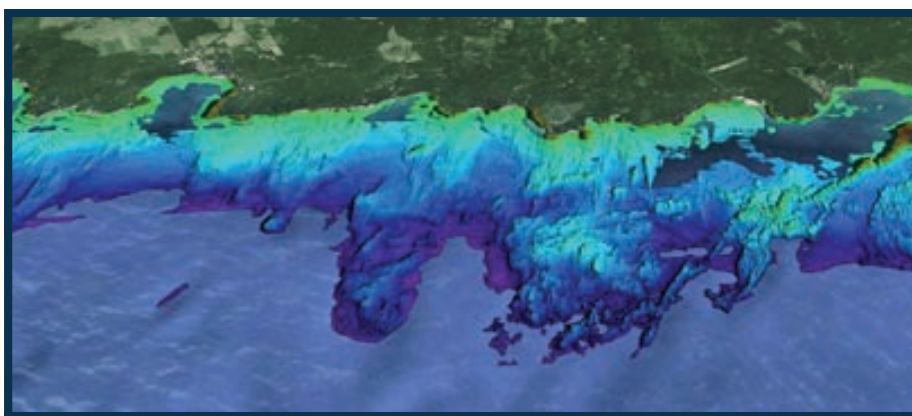
"Our clients include government agencies at all levels and the private sector," he said. "Although the largest share of our business comes from the energy market, we support a very diverse portfolio of project types and clients."

For example, he said one of the company's notable projects is the ongoing search for Malaysian Airline Flight MH 370, which disappeared en route from Kuala Lumpur to Beijing in March 2014.



Graphics courtesy of Fugro

The importance of baseline data. Baseline data is essential for knowledge of existing (pre-event) conditions, improved hazard mitigation, change detection and disaster response.



Complex, shallow coastline is challenging to survey efficiently and safely.

### Needed: Reliability

Remote sensing is "a huge topic and the paper really focuses principally on imagery and LiDAR (laser ranging)

techniques for capturing information about the coastline's topography and bathymetry in remote areas as rapidly as possible, because there's a lot of coastline that is not very well mapped in the Arctic,"

Mitchell said.

Reliable maps are needed to navigate safely near the shore in response to disasters – petrochemical spill cleanup, shipwrecks, tsunamis and the like, he said.

"The risk is that more people may be placed in harm's way during emergency response operations, and the impacts of a disaster on the environment are not characterized accurately," he said. "As activity increases in remote locations, we need a better understanding of the conditions in these remote areas."

Satellite imagery provides coarse, low-resolution imagery, which is cheap or free. Significant energy development, however, may justify more detailed and costly techniques like airborne LiDAR bathymetry, he said.

Remote, sparsely populated areas often lack tax or other economic support to pay for building the baseline, "but shipping passes through areas that are not being developed as well," Mitchell said.

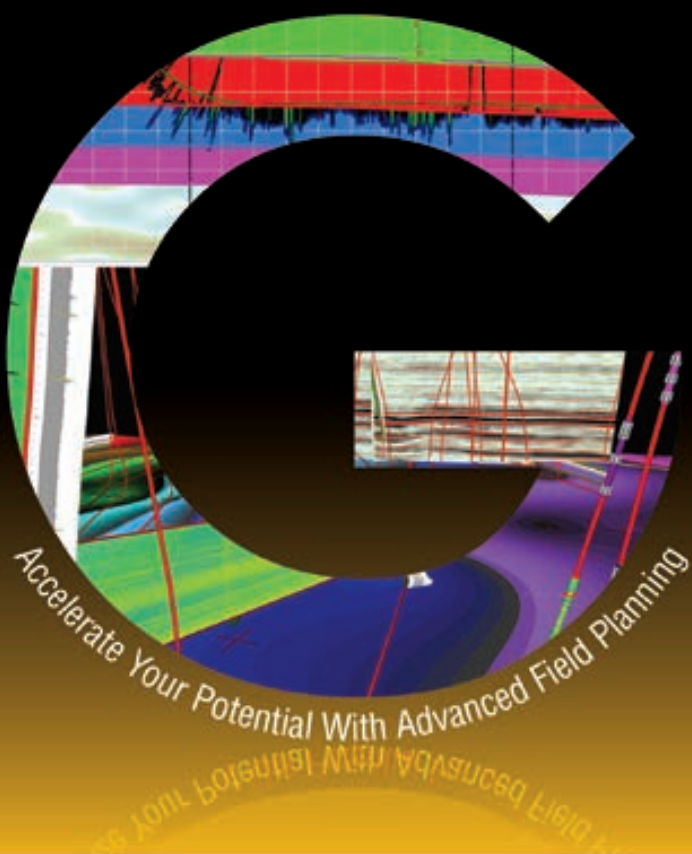
While vessel-mounted sensors may be best for smaller surveys, they can be hazardous in shallow waters, he said.

In his paper, Mitchell discusses use of multispectral imagery from satellites and aircraft to gather data about the land and seafloor, such as soils, potential habitat and vegetation above and below the water surface.

Airborne LiDAR bathymetry can capture information about the sea

See Airborne LiDAR, page 20

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



Quick and easy Field Planning tools

Analyze multiple field plan scenarios quickly

Create proposed surveys for all wells on a pad\*

Visualize in one 3D scene

\*Requires LMKR Well Planner



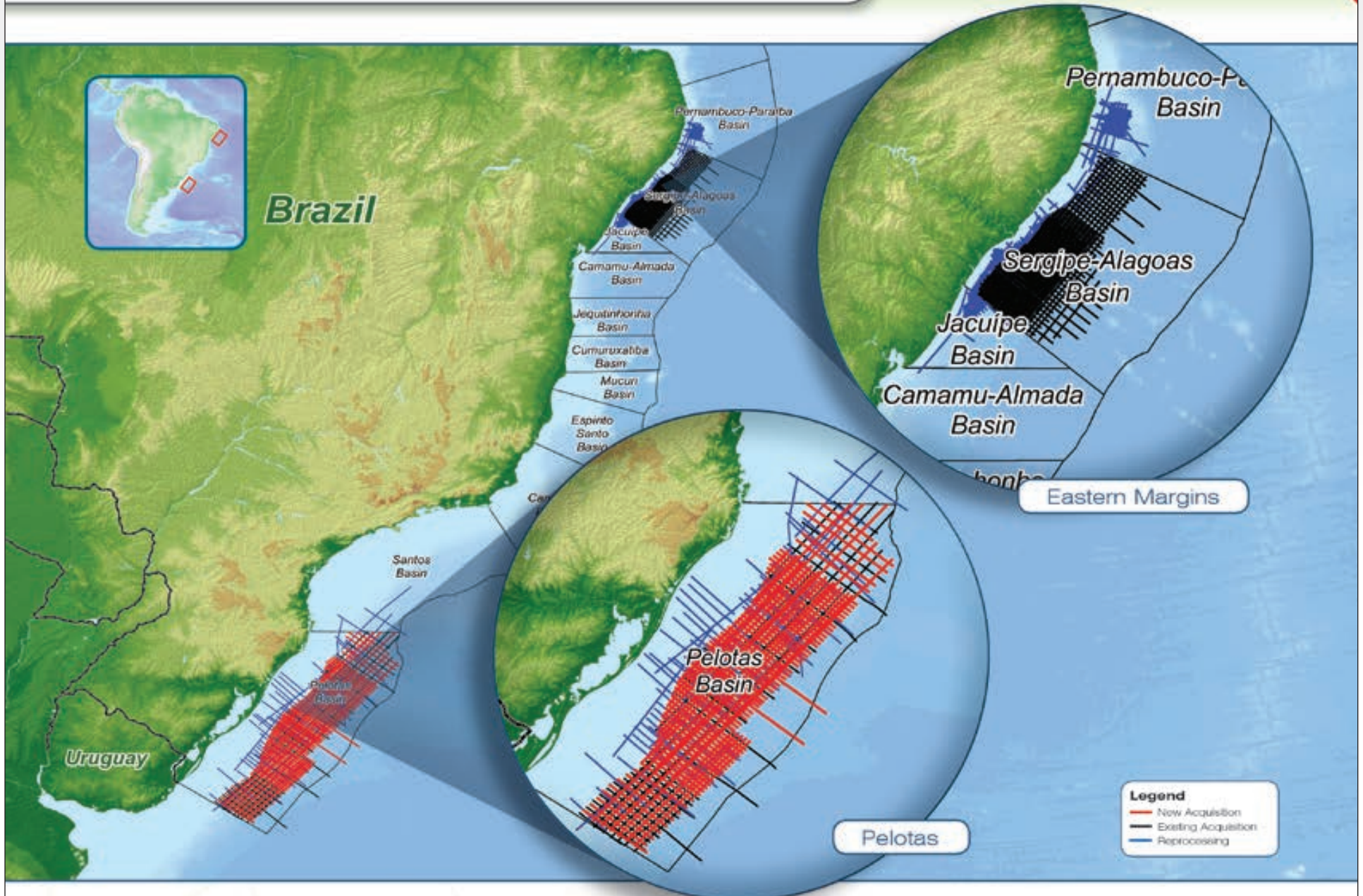
GeoGraphix® is a registered trademark of Landmark Graphics Corporation. The LMKR Logo is a trademark of LMKR Holdings. LMKR Holdings is the exclusive world-wide licensor and distributor of GeoGraphix® software. LMKR Well Planner is an LMKR product with integrates seamlessly with LMKR GeoGraphix.



Anticipated  
**2015**  
License Round

# Brazil: Eastern Margins & Pelotas

Extensive 2D Multi-Client Seismic Data

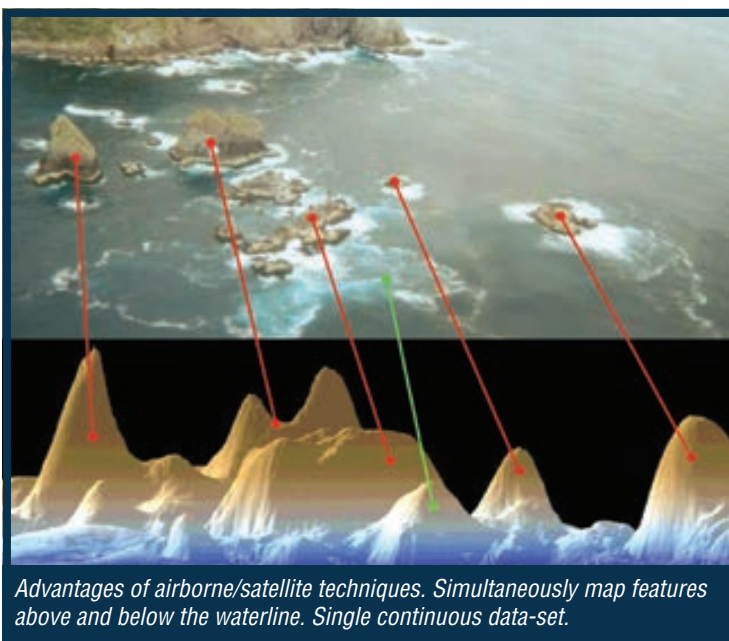


In anticipation of the 2015 bid round in Brazil, Spectrum offers 45,000 km of seismic data from the Pelotas Basin in the south and the Jacuípe, Sergipe-Alagoas and Pernambuco Basins along the eastern margin of Brazil. Of the 45,000 km, approximately 23,000 km of long offset data was acquired in 2013/2014 and approximately 22,000 km was reprocessed during the same time period. All lines will have both time and depth products, and the Sergipe 2014 new acquisition will have additional broadband and AVO products available.

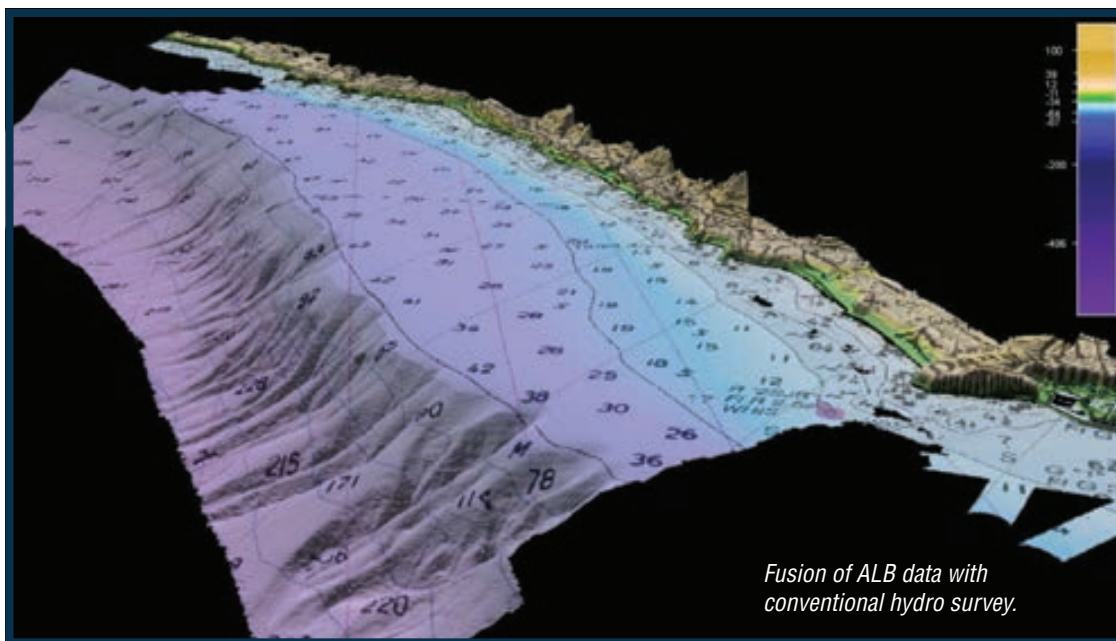
An infill seismic survey for the Pelotas Basin is expected to commence in Q1 2015.

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





Advantages of airborne/satellite techniques. Simultaneously map features above and below the waterline. Single continuous data-set.



Fusion of ALB data with conventional hydro survey.

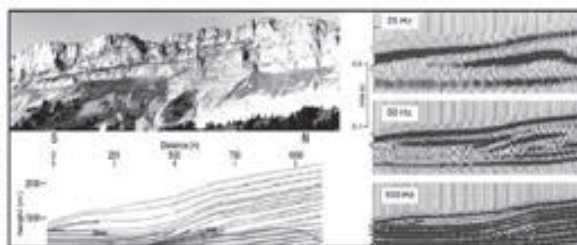
# CALL FOR PAPERS

Submission deadline:  
**1 March 2015**  
<https://mc.manuscriptcentral.com/interpretation>



## Geophysical modeling for interpreters

The editors of *Interpretation* invite papers on the topic of Geophysical modeling for interpreters for publication in the November 2015 special section of *Interpretation*. Many geoscientists make use of geophysical modeling during the interpretation workflow, and models of the subsurface are used by interpreters in many different ways. Sometimes models can embody a simplified version of the interpreter's concepts. This can help communicate to others what the interpreter sees in their field observations. Models also can serve as a testing ground for measuring how changes in earth parameters match or affect geophysical observations.



Modeling of carbonates from outcrop to geophysical cross section. This illustrates the reflection pattern an interpreter will observe at different frequencies. Image adapted from Schlager, 2005, SEPM.

This special section calls for papers regarding the use of models by geoscientists during the interpretation process (this is different from models used primarily for seismic processing). The purpose of this special section is to help interpreters understand why models are important, how they are constructed for interpretation purposes, how they are used in the interpretation process, and a measure of their impact on an interpretation. Examples might include: 1) case histories of modeling for interpretation, 2) describing modeling approaches for specific geological problems, 3) descriptions of modeling tools and techniques with their assumptions, shortfalls and pitfalls.

Categories of building and applying models for interpretation that should be considered include:

- seismic well ties
- gravity, magnetic, and electromagnetic models (used for mining, basement tectonics, oil and gas fluids)
- seismic modeling for structural and stratigraphic analysis (faulting, resolution, facies, mud volcanoes)
- seismic modeling for determining earth properties (DHI/ AVO, pressure, fractures, fluid substitution)
- seismic modeling of noise to help geoscientists from mistaking it for signal in their interpretation
- dynamic interpretation models (fracking, oil and gas production, CO<sub>2</sub> injection)

Key questions: How do geophysical models help interpretation geoscientists to better understand and communicate about the subsurface? What tools and techniques are employed and how do they fit into a workflow? How important is multi-data integration? What assumptions, complications, and issues are important to interpreters (e.g. scale, uncertainty, degree of parameterization)?

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

The submissions will be processed according to the following timeline:

Submission deadline:  
**1 March 2015**  
Publication of issue:  
**November 2015**

Special section editors:

**Bill Abriel**  
billabriel@yahoo.com

**Andreas Lake**  
laake1@exchange.slb.com

**Vincent Artus**  
artus@kappaeng.com

**Carlos Calderon**  
carlos.calderon@iongeo.com

**Yaoguo Li**  
ygli@mines.edu

**Steve Danbom**  
steved@rice.edu

**Jamie Rector**  
jwrector@lbl.gov

**Feng Chen**  
Feng.chen@cgg.com

**Rolf Ackermann**  
rolf.ackermann@

rocksolidimages.com

**Joe Mongan**  
Joe.mongan@tulloil.com

**Isabelle Lecomte**  
Isabelle.Lecomte@norsar.com

## Airborne LiDAR from page 18

bottom as well as topographic data on shore. Potential obstacles to its use, he writes, include insufficient water clarity, precipitation, ice cover and lack of facilities to stage the aircraft.

Mitchell suggests that a mix of both technologies might be most effective. Satellite data is relatively inexpensive and the steps needed to calculate bathymetric measures are highly automated. It can be a valuable tool in deciding when to use more expensive, detailed techniques.

It also might identify areas where the best option is a surface vessel.

"There's no silver bullet answer," Mitchell said. "There's no quick fix. These remote areas are lacking in population (and thus fiscal support) and the cost for undertaking a quality job can be significant. Naturally As some industries (such as energy and mineral development) benefit from activity in many of these remote locations, it may not be unreasonable to expect developers to share some of the burden."

## Training from page 12

vehicles, such as jetties, ploughs and mechanical cutters."

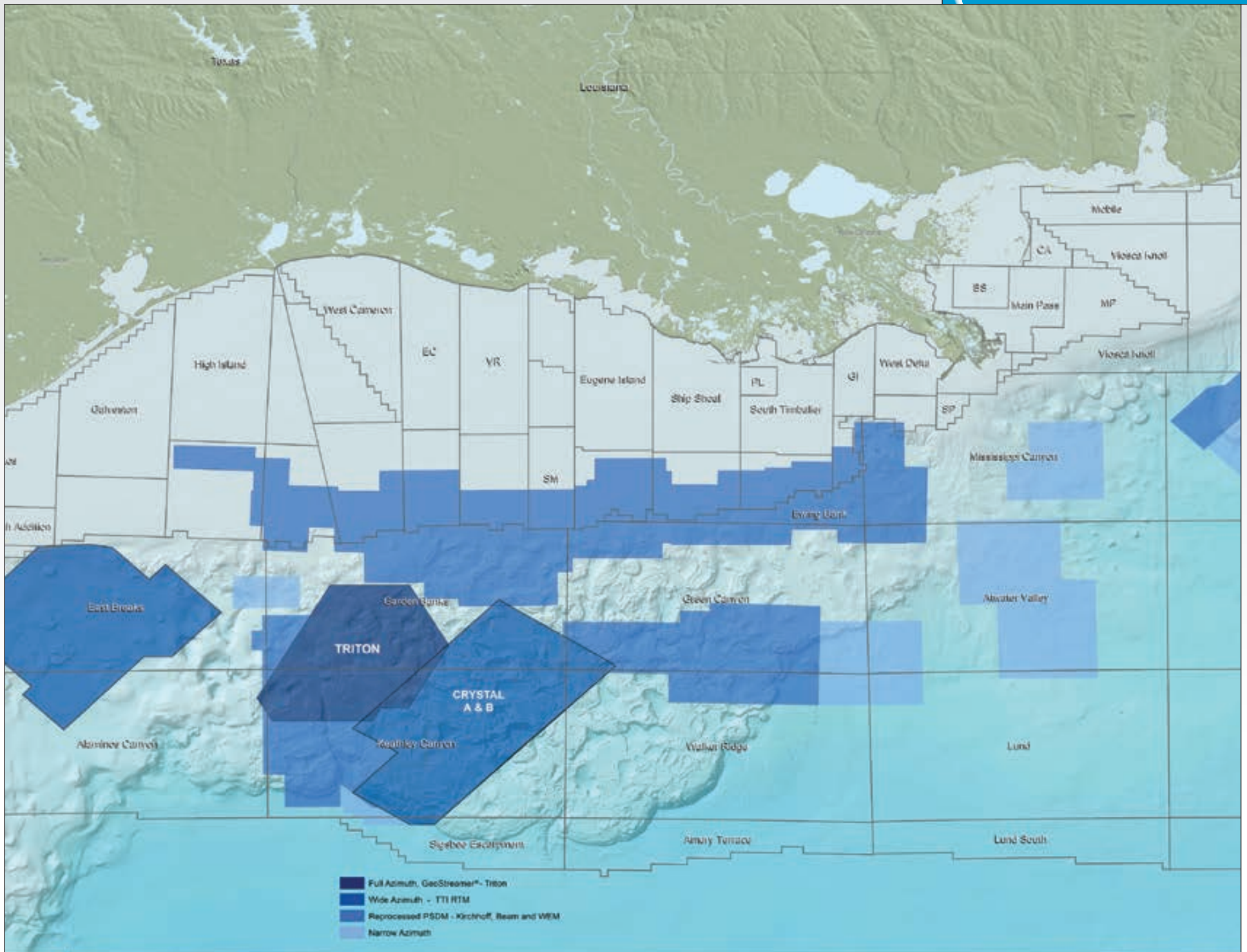
The key property for a virtual environment used for training is realism, in that it must create the sense of presence for the user. In other words, the sense of "being there" in a virtual environment, according to Hamilton.

When piloting an ROV, the sometimes reduced visibility caused by not-so-clear water can be a considerable issue. This can be made worse if the vehicle makes contact with the seafloor – the ensuing "dust-up" will impair visibility for the pilot who must compensate by relying more on sonar and other sensors.

Hamilton emphasized that the dirt kick-up effect is simulated effectively in the VASE.

"GPU-based dust plumes have been tested and appear to allow much larger, more realistic plumes to be modeled in real time," he said, "allowing simulation of what would occur in deep, arctic trenching scenarios."

As GRI continues to refine its VASE, he noted they receive feedback from ROV companies using the system, telling them what works and what doesn't.



## Keathley Canyon and Garden Banks:

- **MC3D GeoStreamer® Triton survey;**
  - Covering 390 OCS blocks with large open acreage access
  - Full Azimuth (FAZ), long-offset, Broadband data
  - Acquisition completed in August 2014
  - Opportunity for input into data processing and imaging; early access to the data
- **26,000 sq km new MC3D data, Crystal A&B RTM Wide Azimuth (WAZ) survey**
  - Covering 580 deepwater OCS blocks
  - Sub-salt imaging greatly enhanced utilizing:  
High Resolution geologically-constrained PGS hyperTomo and TTI RTM

Please contact your PGS Account Manager today +1 281 509 8000 or [gominfo@pgs.com](mailto:gominfo@pgs.com)

A Clearer Image

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

MultiClient  
Marine Contract  
Imaging & Engineering  
Operations



*Discovery of Prudhoe Bay*

# 'Marshall's Folly' Changes Course of Alaska History

By HEATHER SAUCIER, EXPLORER Correspondent

It wasn't easy, that's for sure. But AAPG member Tom Marshall – a geologist who moved to Alaska in his early 30s, enamored by the idea of homesteading in the Matanuska-Susitna Valley – managed to change the future of the entire state with a suggestion that sounded as promising as a dry hole.



MARSHALL (THEN)

**"Every time an Alaskan resident cashes or deposits a Permanent Fund dividend check, he or she should stop for just a moment and say a short word of thanks to Tom Marshall."**



MARSHALL (NOW)

Company (Arco) and Humble Oil (now ExxonMobil), tapped into the largest oil field in North America. The well was located on state lands officially selected by Marshall and leased to Richfield Oil and Humble in a 1965 auction.

A confidential report confirming oil at Prudhoe Bay slid across Marshall's desk before the news hit the public.

Marshall's homesteading, which he funded by random consulting jobs for investors in minerals and petroleum, led him down a path that culminated in a series of discussions with the Alaska governor and ultimately opened the door to the Prudhoe Bay discovery.

It all took place in the late 1950s and early '60s, against a backdrop of tremendous controversy. The public at large, the oil and gas industry and the newly formed state government put Marshall's theory about a large oil field on the North Slope farther left than left field.

Voicing a common belief at the time that oil could not be produced from icy ground, the late Gov. William Egan once asked, "Don't you know the North Slope is frozen?"

**So Wrong, So Right**

Hired on the spot as an assistant land selection officer in 1960, Marshall's

experience in geology piqued the interest of the director of the newly created Division of Lands in the Department of Natural Resources after Alaska became a state in 1959. Marshall was tasked with making recommendations for the selection of state lands that the federal government would deed to Alaska under the 1958 Statehood Act.

The Division of Lands was permitted to select 102 million acres over a 25-year period of time, and it focused on multi-purpose acreage that would bring the state revenue via the timber industry, parks and recreation, agriculture, and oil and gas activity – particularly in Cook Inlet.

Marshall's idea to select 1.59 million coastal acres on the North Slope – believing that oil might lay beneath the Barrow Arch – drew laughs and even disdain, as little was known about North Slope geology at the time.

On Marshall's application to the Bureau of Land Management requesting

acreage that included Prudhoe Bay, a colleague had written "Marshall's Folly," and it was buried at the bottom of the stack.

"I wish I had pulled that sheet out and kept it as a souvenir," said Marshall, now 89 and living in Anchorage. "No one wanted to believe it could be a huge oil field. Maybe it was too good to be true. I don't know."

But Marshall stuck to his guns. If he was wrong, Alaska would own useless land that yielded no revenue. The state would have spent roughly \$40,000 in federal filing fees for naught and significantly reduced its federal funding for infrastructure and fire protection, explained Herb Lang, a retired lands officer for the Division of Lands.

However, if Marshall was right ...

**Discovery of the Century**

In 1968, the Prudhoe Bay State No. 1 well, drilled by Atlantic Richfield

Working as the state geologist for Alaska's Division of Mines and Minerals at the time, Marshall read the report before walking outside to his next appointment.

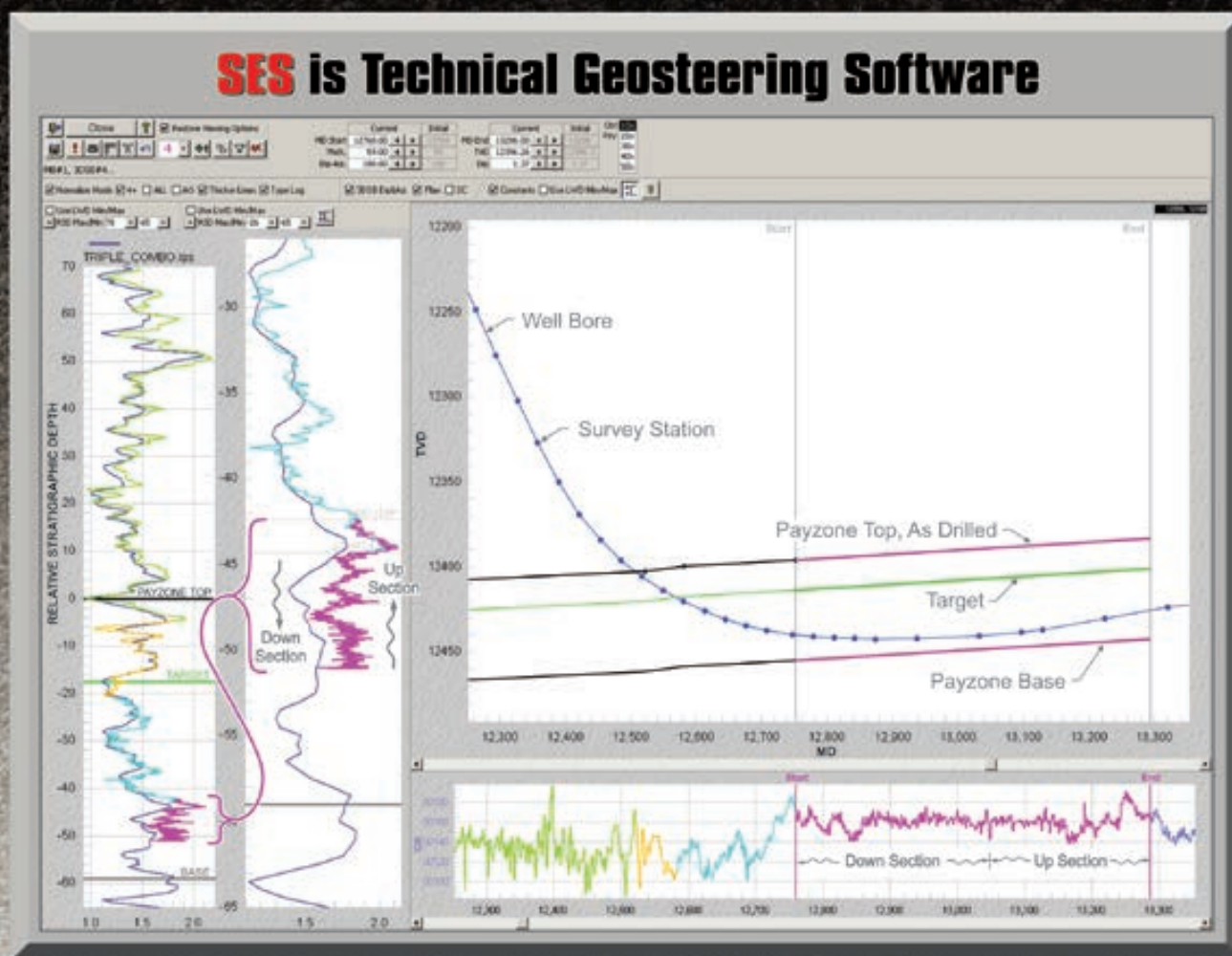
"I'll never forget that day," he said. "I was walking toward the Westward Hotel in Anchorage. It was a seven-story building, and I thought, 'Holy Moses! That pay section is as thick as this hotel is tall.'"

The discovery made headlines around the world. Its success drew countless explorers to the North Slope in the late 1960s and '70s – all paying millions to lease state lands in search of another Prudhoe Bay.

Initially estimated to contain 25 billion barrels of oil in place, Prudhoe Bay has produced an excess of 13 billion barrels to date and brought billions of dollars in revenue to Alaska – transforming it from

See **Permanent Fund**, page 24

## Land your horizontal with *confidence!*



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

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

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

Phone 720-279-0182  
support@makinhole.com

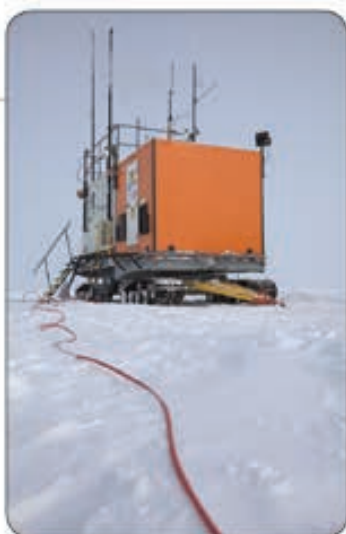


- ★ Drill more horizontal pay!
- ★ Reduce pilot holes!
- ★ 85+ clients and growing!
- ★ Free trial software and video!



## BroadLand®

Announcing the World's First True  
**Broadband Seismic Solution**  
 for Land, Transition Zone, and Ocean Bottom



Offering volumes of seismic experience. Contact us today and we'll help you explore the solution that's right for you.

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

[sales@geokinetics.com](mailto:sales@geokinetics.com)

RESERVOIR DRIVEN



Marshall (left) and AAPG member (and Alaska expert) Gil Mull, 2009.

## Permanent Fund from page 22

a poor mining state into an oil and gas Mecca of sorts. The state's Permanent Fund, established by its constitution and worth \$52 billion today, pays yearly dividends to all Alaska residents.

"It has long seemed to me that every time an Alaskan resident cashes or deposits a Permanent Fund dividend check, he or she should stop for just a moment and say a short word of thanks to Tom Marshall," said Gil Mull, an AAPG member who mapped extensively on the North Slope for Richfield and Humble and served as a wellsite geologist when the Prudhoe Bay State No. 1 well struck oil.

"Of course, the Permanent Fund is

just a fraction of the other state services that have been paid for over the years by revenue the state has received as a result of Tom's foresight," added Mull, who also worked for the Alaska Division of Geological and Geophysical Surveys, Division of Oil and Gas, and the U.S. Geological Survey.

"The problem has been that only a few have ever heard his name."

### Common Name, Uncommon Man

"Tom Marshall" may be a common name, but the Tom Marshall who was born in Nebraska, went to college in Colorado, accepted his first geology job in Wyoming and then headed to the 49th state is no common man.

While working in Casper, Wyo., Marshall crossed paths with AAPG member John Wold, a well-known geologist and businessman (and AAPG Pioneer Award winner) who opened up coal exploration in the Powder River Basin in the 1950s. Wold hired a young Marshall to evaluate properties he owned in the Lower 48 for uranium potential.

Marshall often talked of a mysterious Alaska. He shared stories about the U.S. territory told by his grandfather, who worked as a mounted policeman in Canada and often crossed the border to take in Alaska's majestic landscape. Marshall wanted to see the land for himself, and Wold hired him on a retainer to scope properties with investment potential.

Aware of the U.S. Navy's efforts to find oil reserves on the North Slope with assistance from the USGS, Marshall studied "the dickens" out of the USGS's reports, accumulating a library of papers and maps.

Running out of money as a homesteader, Marshall applied for a job at the state's Department of Natural Resources and was hired by the director, Roscoe Bell, to help select lands that might enable the nascent state to support itself.

### Arctic Wasteland

While other land selection officers worked to identify tracts suitable for agriculture, the timber trade and other means of revenue, Marshall put his petroleum geology background to use. He was the first to suggest land for single-use purposes, and the first to suggest land on what many had dubbed the "Arctic Wasteland."

The state polled the oil and gas industry, and the six operators exploring in Alaska at the time all expressed interest in leasing land much farther south of the North Slope – on the same latitudinal line as the small, non-commercial discoveries made by the Navy near Umiat in the National Petroleum Reserve No. 4 (NPR-4).

Although the conservative way to explore was near known accumulations, Marshall insisted that to bring oil to market, a huge field would be needed to pay for a very long pipeline to tidewater.

The "little wrinkles" in Cretaceous rocks in NPR-4 would not cut it. The large structural high Marshall studied near Prudhoe Bay had much better potential – and oil seeps near Cape Simpson added interest to his claim.

"I was very appreciative of the fact that the North Slope would be a place to commit financial suicide if you tried to develop small fields like Umiat," Marshall

See North Slope, page 26



## DISABILITIES CAN OCCUR IN THE BLINK OF AN EYE

Disabilities affect more of us than we realize. Statistics show that just over 1 in 4 of today's 20 year-olds will become disabled before they retire.\* It is important to protect your most valuable asset from this possibility – your ability to earn an income. Disability income insurance can do just that.

AAPG's GeoCare Benefits Group Insurance Program offers three Disability Income Plans so you can choose the benefits most fitting for your needs. One of the most appealing aspects of the Plans offered by AAPG's sponsored disability plan is that, unlike disability benefits offered through your employer, the coverage is portable so you can take it with you if you change jobs.

Help protect your family's finances from falling victim to the unexpected with AAPG's GeoCare Benefits Group Disability Income Plan. Visit us online for more information at [www.geocarebenefits.com/aapg](http://www.geocarebenefits.com/aapg) or call us at 800-337-3140.

\*U.S. Social Security Administration, Fact Sheet February 7, 2013



Online Enrollment and Downloadable Paper Applications are available.

GeoCare Benefits Group Disability Income Insurance Plans, P.O. Box 9159, Phoenix, AZ 85068-9159, E-mail: [geocarebenefits@agia.com](mailto:geocarebenefits@agia.com). The GeoCare Benefits Group Disability Income Plan is underwritten by New York Life Insurance Company, 51 Madison Ave., New York, NY 10010 under Policy Form GMR-G29066/FACE. All coverage is subject to approval by New York Life.



# DO MORE WITH LESS

## Uncertainty.

With today's prices, there is no margin for error. Dry wells and expensive investments with limited value must be avoided at all costs. It's more important than ever to accurately determine probabilities of success and the economic potential of a project before decisions are made on investing, drilling or divesting.

Do more with EMGS' exclusive integration of seismic attributes and 3D EM data. We will work with you to de-risk and polarize your portfolio, drill higher impact discoveries quicker, and more effectively place wells.

Bring more value to your portfolio and existing seismic data by spotting the difference with EMGS.



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

Spot the difference.

## Upcoming AAPG/SEG Student Spring Break Expo Is Canceled

The 2015 AAPG/SEG Spring Break Expo in Norman, Okla., has been canceled.

"With the substantial negative impact that the drop in oil prices has had on the industry, the ConocoPhillips School of Geology and Geophysics feels that it is in the best interest of all involved to suspend the event this year," said event organizers when the announcement was made in mid-January. "With word of companies tightening budgets, thus not participating in the Expo, and the real possibility that new jobs and

internships are to be limited, we have made this difficult decision with the best intentions for everyone."

The event was to be held March 12-13 at the University of Oklahoma.

Those who have already registered should see an "Expo refund" in their bank accounts by now.

If it has not appeared, however, or to get more information about the Student Spring Expo, contact Devon Harr, special events and donor relations at OU's ConocoPhillips School of Geology and Geophysics (devonharr@ou.edu).

## North Slope from page 24

recalled. "Size meant everything."

While many may have regarded Marshall as a pariah – or perhaps a tad insane – his opinions caught the attention of the late Phil Holdsworth, a fellow homesteader and the first commissioner of the Department of Natural Resources.

Holdsworth was aware that Marshall was the first to use aerial photographs to piece together a map to evaluate mining properties in Alaska – particularly in the Cashe Creek area.

"I could show the difference in the gradients of that stream and where the gradient changed rapidly. That's where you could expect to find gold to accumulate," Marshall explained.

His map made many rounds through the geological community and eventually landed in front of Holdsworth.

### Whistling a Different Tune

Intrigued by Marshall's map and geological savvy, Holdsworth conferred with Bell of the Division of Lands and took a closer look at Marshall's recommendations for state land selection. Soon after, several meetings were held with the governor to sell Marshall's controversial idea.

"We did not have enough money in our budget to do what Tom recommended," Lang recalled, explaining that the new state had little means to pay for the federal filing fees for a land selection that large. "The governor was very cautious. It was a whole new game for us."

Using a plethora of maps and reports, Holdsworth and Bell translated Marshall's technical analysis into words that resonated with the governor, who then dug deep into the state's pockets to fund the selection – keeping his fingers crossed.

"We took chances in the early days," Lang said, "and sometimes we even won."

After the discovery at Prudhoe Bay, operators were bidding in the millions – hitting a record \$900 million in 1969 – for state leases on the North Slope.

"It was a shock to people that this oil and gas was really worth something," Marshall recalled. "Oil and gas just didn't have the stature that it has now. Alaska was a mining state."

### Lost in the Wrinkles of Time

As with many political successes, the governor received credit for the billions of dollars that flowed alongside the oil at Prudhoe Bay. Marshall has been honored from time to time for his insights, but he mostly remained out of the limelight for the remainder of his career – becoming state petroleum supervisor in 1965 before retiring in 1978.

After all this time, however, Marshall's contributions have again reached radar level.

In May, he will receive an honorary doctor of science degree from the University of Alaska Fairbanks, said Marmian Grimes, a spokeswoman for the university. He will be joined by his son, Charlie, at the commencement ceremony.

As rich in modesty as Prudhoe Bay is in oil, Marshall credits his success to simply being "in the right place at the right time with the right knowledge."

Others see him quite differently.

"Many people in public service in Alaska have made important contributions that make Alaska what it is today," Mull said. "But in my estimation, the decision that Tom Marshall made as an Alaska state employee stands at the top of the list as the single most important decision ever made by anyone in service to the state of Alaska."

"It all started with Tom," Lang added. "He is the man who came up with the idea."

For Marshall, he's simply glad that some people are willing to entertain seemingly outlandish ideas.

"If they aren't going to be tested, then people are going to continue believing that these are just crazy, crazy, crazy ideas," Marshall said.

Discovering Prudhoe Bay "blew everyone's mind," he added. "Including mine." ■

## Two Great Years and Growing Stronger

**95%**

would recommend URTeC to a colleague\*

*"Best conference I have attended in many years"\**

*"A successful, informative and enjoyable event"\**

**97%**

overall satisfaction with URTeC\*

URTeC 2014 attracted more than 5,000 petroleum engineers, geoscientists and other energy professionals collaborating on all things unconventional under one roof.

\*based on URTeC 2014 attendee and exhibitor survey results

The integrated event for unconventional resource teams

**UNCONVENTIONAL<sup>®</sup>**  
**RESOURCES TECHNOLOGY CONFERENCE**  
 FUELED BY SPE • AAPG • SEG **URTeC.org**

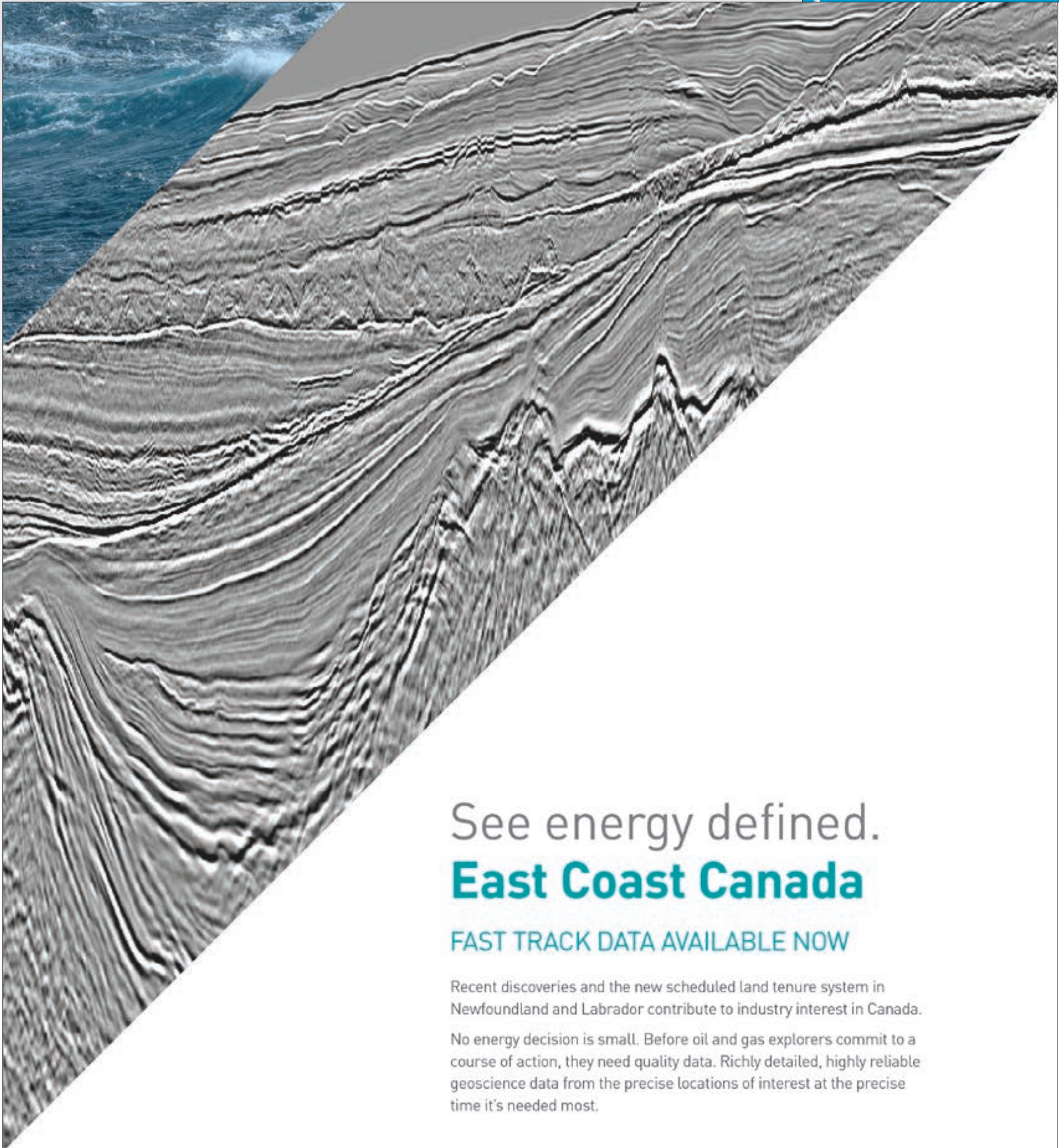
20-22 JULY 2015 • SAN ANTONIO, TEXAS • HENRY B. GONZALEZ CONVENTION CENTER

- A superior quality, multidisciplinary science and technology event
- An integrated conference developed by an interdisciplinary program committee comprising engineers, geophysicists and geologists
- One of the industry's most interactive networking forums for companies and individuals across all segments of the unconventional market

Registration opens in March

URTeC.org





See energy defined.  
**East Coast Canada**

**FAST TRACK DATA AVAILABLE NOW**

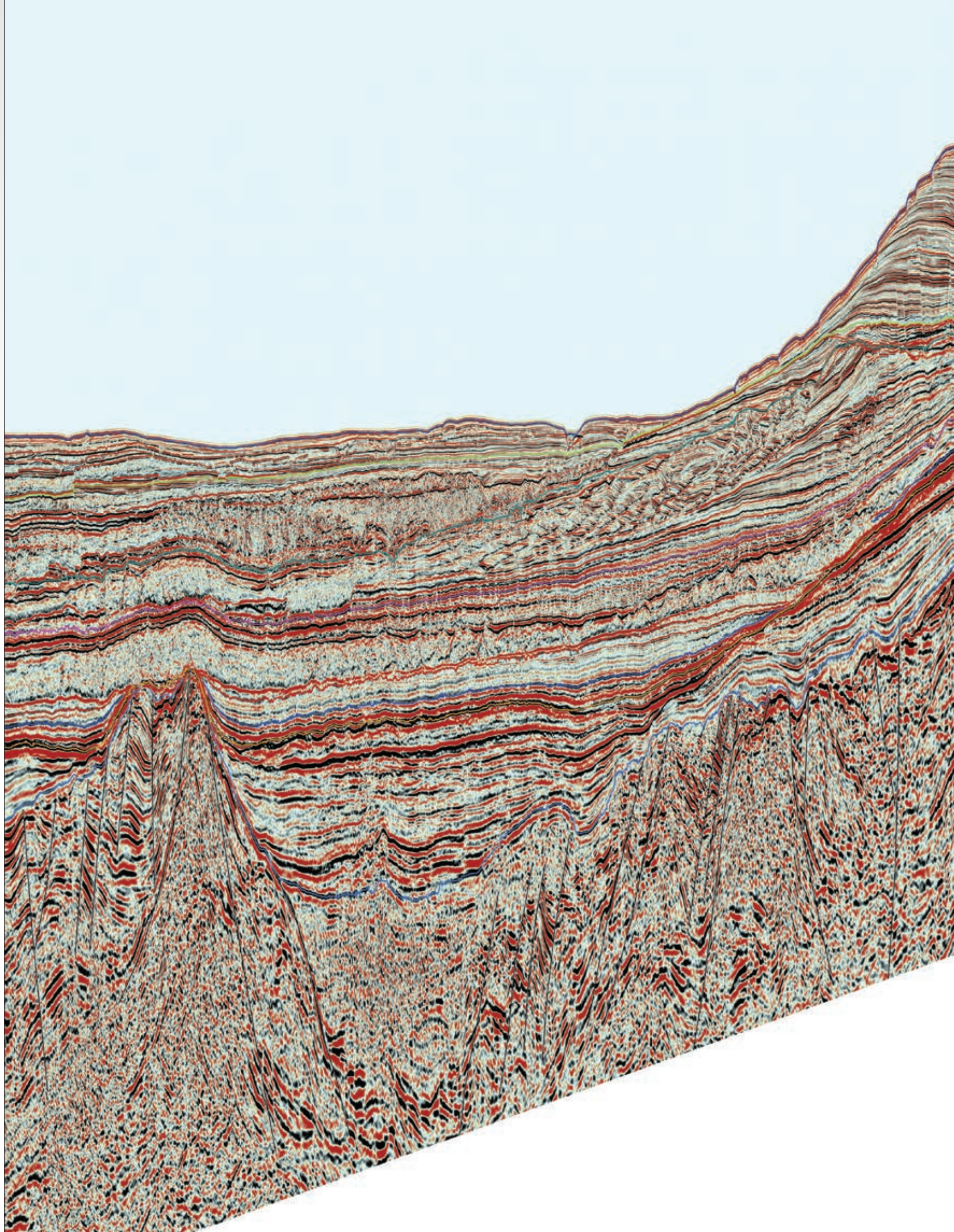
Recent discoveries and the new scheduled land tenure system in Newfoundland and Labrador contribute to industry interest in Canada.

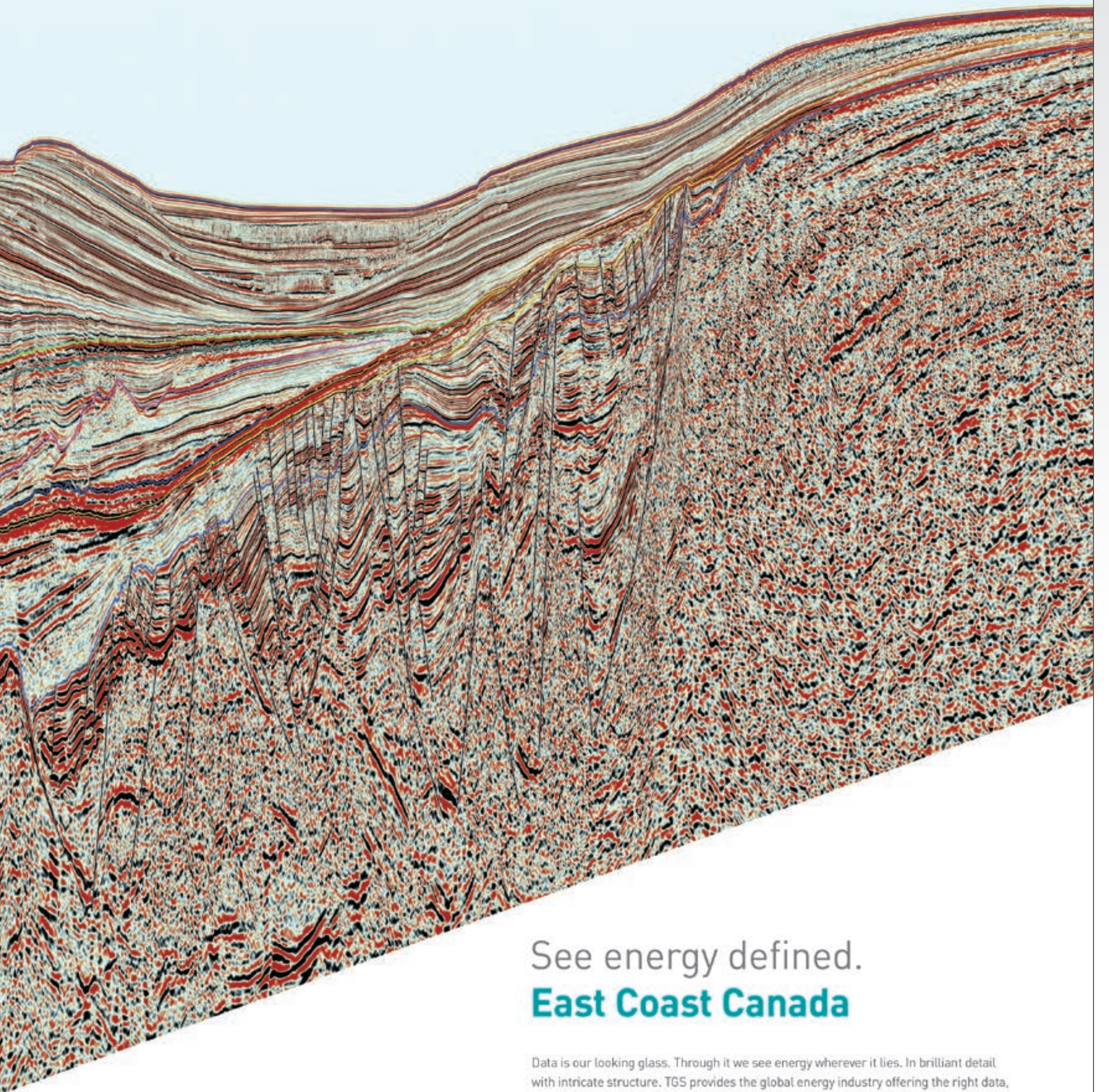
No energy decision is small. Before oil and gas explorers commit to a course of action, they need quality data. Richly detailed, highly reliable geoscience data from the precise locations of interest at the precise time it's needed most.

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



© 2015 TGS-NOPEC Geophysical Company ASA. All rights reserved.





## See energy defined. **East Coast Canada**

Data is our looking glass. Through it we see energy wherever it lies. In brilliant detail with intricate structure. TGS provides the global energy industry offering the right data, in the right place at the right time. We create value by making geoscience driven investment decisions to anticipate and satisfy energy industry needs.

TGS' Newfoundland Flemish data includes over 44,000 km of high quality 2D seismic data which provides unsurpassed images of potential reservoirs offshore Newfoundland. Data will be available in preparation for both the Eastern Newfoundland Sector Area NL01-EN, which is scheduled for a Call for Nomination in Q4 2015, and the soon-to-be-announced new sector area.

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



© 2015 TGS-NOPEC Geophysical Company ASA. All rights reserved.



The seven-year hitch

# Treasure Trove of Data Released on Chukchi Sea

By KEN MILAM, EXPLORER Correspondent

A massive environmental data trove from Alaska's Chukchi Sea gathered by three large oil companies is available at an Internet near you.

The Chukchi Sea Environmental Studies Program was begun by ConocoPhillips and Shell in 2008, including Statoil in 2012-13.

Through the years, the project collected terabytes of data from meteorological-ocean to chemical to biological information to photos, according to Christie Cowee and Cindy Eick, both of Resource Data Inc. in Anchorage.

The scope and detail of the project is the subject of two papers by Cowee and Eick, which they will present at the upcoming Arctic Technology Conference.

Initially begun for exploration permitting purposes, the project represents tens of millions of dollars of investment and can benefit research in numerous disciplines, said Eick, GIS project manager and senior analyst.

The meticulously cataloged collection is being released through an agreement with the National Oceanic and Atmospheric Administration.

"It's been a pretty great project to be a small part of," Eick said.

"What's truly unique, from my point of view, anyway, is that getting through seven years and making the data public required the ongoing partnership of three big petroleum companies, a very large investment from all of them and a willingness and eagerness that's unusual in this industry to make the project completely transparent and available to the public through the data sharing agreement with NOAA," she added.

**Data Within Data**

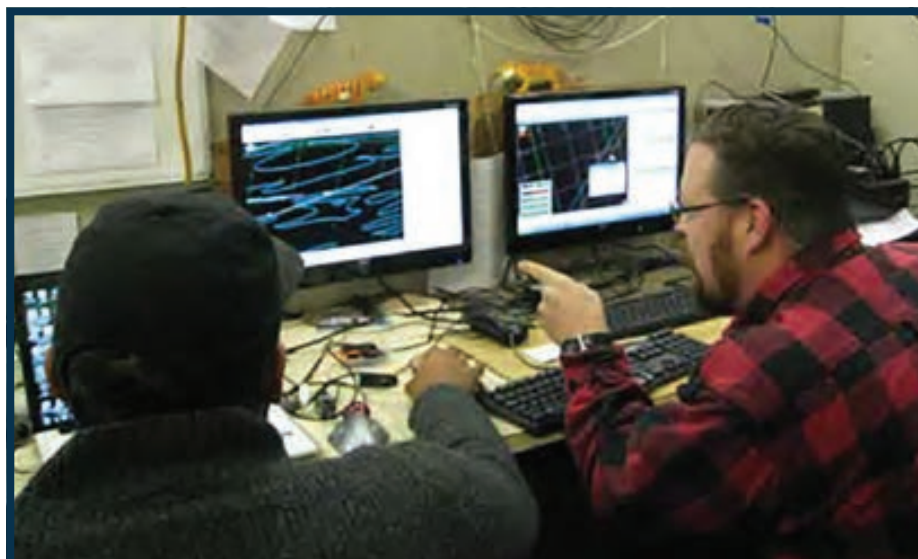
From the beginning, a major focus was standardization of data and metadata – data about data – to make sure the information would be accessible and usable now and well into the future.

"This was especially challenging over the course of seven years with turnover among the field teams, generally grad students," Eick said. "Oversight was constant to ensure standards were maintained."

Collecting data on boats in the Arctic can be daunting.



Visiting officials pause for a photo during the 2011 cruise. Pictured from left are: Jane Lubchenco, Robert Day, Caryn Rea, Amy Holman, Kristin Carden and Jason Mansour.



Onboard data managers ensure each day's data are processed to the highest level of quality, provenance, standardization and documentation.

ranged from computer networking and connectivity issues on the vessels, and between vessels and land to ensure that all data was accounted for at the end of each cruise and the end of each season," she said.

"Once all the data was accounted for the next biggest challenge as a data manager was communicating the importance of standardized data year in and year out," she added.

paramount. Any inaccurate or missing data could affect permitting, forcing a company to delay or halt drilling during open water season, potentially costing millions.

The study initially took place in two 900 nm<sup>2</sup> study boxes, including ConocoPhillips' and Shell prospect areas. It grew to include Statoil's study area of the same size and at some points took on a regional focus as needed,

Cowee and Eick wrote.

Disciplines in the study included sea birds, marine mammals, plankton, physical oceanography, sediments, benthic studies, acoustic monitoring, chemical oceanography and fish studies.

The result is a product "perfect for any scientific studies that support natural resources development, including petroleum and mining," she said.

"A key point is that strict management, storage and documentation of large or small datasets enables that data to be accessible, usable and defensible into the future. This is a good justification for the extra expense.

"When a company shuts down a project only to resurrect it five or 10 years in the future, which happens a lot, the company doesn't have to start from scratch with baseline studies if all the previous data exists, is well-documented and is locatable within a corporate network infrastructure," Eick said.

"Arctic data, whether offshore or terrestrial, can be incredibly expensive to collect," she continued. "These methods protect the results of multimillion dollar data collection efforts."

Eick offered three general examples of how CSESP collections have potential impact of exploration efforts:

- ▶ Whale migration – Knowing when and where the whales will be is critical during the operations planning phase to mitigate potential disturbance of migration patterns.
- ▶ Metocean buoys and vessel instruments provide seven years of detailed (every few minutes) weather and sea state information during the open water season in the potential drilling operations areas.
- ▶ Sediment sampling each year has built a history of baseline sediment chemistry that can be compared with post-drilling sediment samples.

**Not As Easy As It Sounds**

Constantly verifying data and bringing it up to the necessary standards required for release took intensive efforts.

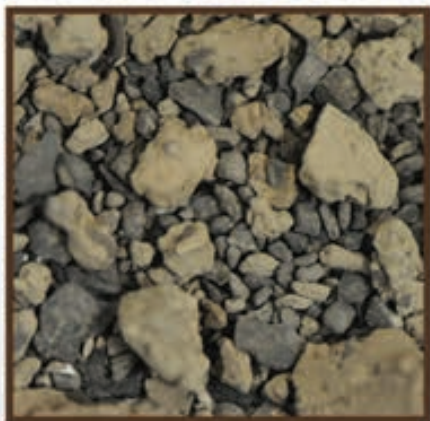
"Data managers gathered annual reports, program documentation and annual metadata files submitted by

[See Data Collection, page 32](#)



# Applied Geoscience Conference

FEBRUARY 16-17, 2015

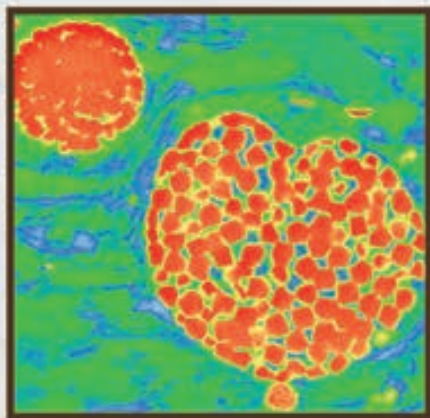


## Integrated Approaches of Unconventional Reservoir Assessment and Optimization

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

Our 2015 program includes:

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



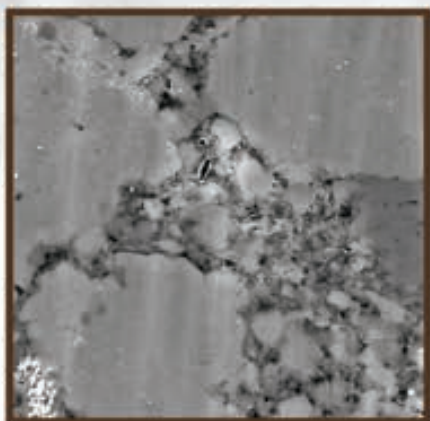
### Day 1:

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



### Day 2:

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



## Registration Now Open!

Sponsored By

**Schlumberger**

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

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

## Distinguished Achievement Award Recipients Named For ATC 2015

The winners of the 2015 Arctic Technology Conference's inaugural Distinguished Achievement Awards have been named for the Individual and the Company/Organization/Institution categories.

Recently retired ice scientist and ice engineer Dan Masterson will take home the award for Individual Achievement.

He will be honored for his significant advancements to the ice sciences and also for advances to the design and construction of pioneering Arctic projects.

His professional achievements began in the 1970's with pioneering engineering work for Panarctic Oils through the design and construction of floating ice platforms to support both drilling operations and floating airstrips for large aircraft.


In more recent years, he also has played a lead role in the development of ice load criteria for Arctic standards including the Canadian Offshore Standard S-471, API RP2N and the new ISO Standard 19906 for Arctic Offshore Structures

The Chukchi Sea Environmental Studies Program (CSESP) and its supporting entities – Olgoonik-Fairweather, ConocoPhillips, Shell and Statoil – will be honored with the Companies' Achievement Award.

The award is to recognize the CSESP as one of the largest, most robust

multidisciplinary science programs in the world. Going on its seventh year in 2015, the CSESP aims to characterize pre-exploration baseline information on the ecology of the region and, despite innumerable potential logistical and natural hazards, has operated with zero recordable injuries with over 395,000 man-exposure hours and across 13,000 vessel miles. The CSESP covers 37,000 square kilometers of the northeastern Chukchi Sea and the program focuses on nine main science disciplines including: seabirds, marine mammals, plankton, physical oceanography, sediments, benthic studies, acoustic monitoring, chemical oceanography and fisheries.

The recipients will be honored at the ATC 2015 Distinguished Achievement Awards Luncheon scheduled for Tuesday during the conference being held March 23-25 in Copenhagen, Denmark.

This will be the first time ATC incorporates the Distinguished Achievement Awards into its program. Modeled after the prestigious OTC Awards of the same name, these awards honor an individual and a company/organization or institution for their major technological, humanitarian, environmental and leadership contributions to the Arctic industry. 



The vessel crew deploys a metocean buoy from the westward wind.

### Data Collection from page 30

CSESP scientists to mine these for the required information to meet the Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata," Eick said.


"Many follow-up calls with principal investigators and the vessel crews were needed to double-check details like the makes and models of scientific equipment, sampling methodology and even the error tolerance of the fathometer used to collect depth information," she said.

Attaining and maintaining the

standards ensures that data is usable to future users, she said.

The CSESP began in 2008 during the open water summer months. The initial agreement with NOAA for release of the data was approved in 2011.

Eick said data collection concluded after its seventh open water season in October 2014, although it will take scientists several months to analyze their data and write final reports. The 2014 data should be available to the public sometime during summer and fall 2015.

To help spread word about the project and its availability, a 66-page book telling the story of CSESP is being prepared for distribution to agencies and other interested parties. 

## Currently Acquiring Oil & Natural Gas Assets!

Contact: [Prospects@usedc.com](mailto:Prospects@usedc.com)

We are currently looking to acquire oil and natural gas assets in the following areas:

- Anadarko Basin
- Fort Worth Basin
- Appalachian Basin
- Permian Basin
- Williston Basin

We are also seeking additional leasing opportunities in Texas and Oklahoma (ground floor or targeted acquisitions).

Looking for an exciting career opportunity at U.S. Energy?

Submit your resume to [careers@usedc.com](mailto:careers@usedc.com)

**U.S. ENERGY** Development Corporation

We Will Work With You! Call Us Today:

800.636.7606 x 238

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



**TRUSTED OPERATOR  
& CAPITAL PROVIDER  
FOR OVER 30 YEARS**



# Upcoming Education Courses

2015 Courses now available:

## SHORT COURSES

- Sequence Stratigraphy: Principles & Applications (with AAPG Annual Meeting) **May 30-31, 2015**  
Denver, CO
- Exploration in the Bakken Petroleum System (with AAPG Annual Meeting) **May 30, 2015**  
Denver, CO
- Integrating Data from Nano- to Macro-Scale (with AAPG Annual Meeting) **May 31, 2015**  
Denver, CO
- Practical Aspects of Petroleum Geochemistry (with AAPG Annual Meeting) **May 31, 2015**  
Denver, CO

## FIELD SEMINARS

- Geological Mechanics on the Rocks: Stress, Deformation and Rock Properties with Application to Reservoir Stimulation and Management (with AAPG Annual Meeting) **May 28-31, 2015**  
Casper, WY
- Deep-Water Siliciclastic Reservoirs **June 5-10, 2015**  
California
- Utica, Marcellus and Black Shales in the Northern Appalachian Basin **June 15-19, 2015**  
New York
- The Lodgepole-Bakken-Three Forks Petroleum System **June 24-26, 2015**  
Montana

## HEDBERG CONFERENCE

The Future of Basin and Petroleum Systems Modeling **August 9-14, 2014**  
Santa Barbara, CA  
*Call for Abstracts now open!* **Deadline: April 1, 2015**

## ONLINE COURSES

- Technical Writing  
(Self-paced course – begins the first of each month)
- Professional English  
(Self-paced course – begins the first of each month)
- Introduction to Shale Gas  
(Self-paced course – begins the first of each month)
- Unconventional Resources  
(Self-paced course – begins the first of each month)

[www.aapg.org/career/training/](http://www.aapg.org/career/training/)



# 12<sup>TH</sup> ANNUAL World-Class Education Conference

HOUSTON, TEXAS  
MARCH 2-6, 2015



## Courses Include:

- ▶ Deepwater Reservoir Connectivity
- ▶ Exploration for Deep-water Sands Using Seismic Sequence Methodology
- ▶ Carbonate Reservoir Geology: Understanding Depositional and Diagenetic Factors Controlling Porosity
- ▶ Carbonate Depositional Systems
- ▶ Microbial Carbonate Reservoir Characterization
- ▶ Basic Seismic Interpretation
- ▶ Seismic Amplitude Interpretation
- ▶ 3D Seismic Attributes for Unconventional Resources
- ▶ Discovery and Recovery Thinking in Shales
- ▶ Introductory Geochemistry for Condensate-rich Shales and Tight Oil
- ▶ Log Analysis of Shaly Sand Reservoirs
- ▶ Log Analysis of Hydrocarbon-Bearing "Shale" Reservoirs

Hosted by:

### Norris Conference Center

816 Town & Country Lane, Suite 210  
Houston, TX 77024

Phone: 713-590-0950  
Fax: 713-590-0961

(Special AAPG Group Rates at Nearby Hotels)

### Registration and Information

Call AAPG toll free in the U.S. and Canada at 888.338.3387 or 918.560.2650  
F: 918.560.2678 • E: [educate@AAPG.org](mailto:educate@AAPG.org) • W: [www.aapg.org/career/training/in-person/education-conference](http://www.aapg.org/career/training/in-person/education-conference)



**AAPG**

World-Class Education Conference 2015

March 2-6, 2015 - Houston, Texas

# Collaboration is Key With Native Communities

By KRISTI EATON, EXPLORER Correspondent

There are more than just technical challenges facing those who would explore the Arctic for oil and gas.

Navigating the governance structure and deep cultural systems of Canada's aboriginal communities can be a complex and confusing task, too, especially for oil companies looking to do business in the country.

That's where Jennifer Young comes in. Young, a certified management consultant and a certified aboriginal financial manager who runs Nestu'et Management Consulting, St. John's, has built a career on helping facilitate economic development deals by working closely with aboriginal communities to develop systems that will foster understanding between the two parties.

According to Canadian government statistics, there are 1.4 million aboriginal people in the country, accounting for 4.3 percent of the population.

There are two types of aboriginal people in Canada: First Nations and Inuit, Young explained. Under the Canadian Indian Act, indigenous people of the First Nations were put into bands and moved on to reserves.

"Basically they were given small pockets of land vaguely in the area of their traditional territory, often miniscule sizes, and they were told they had to live there," Young said.

Today, those First Nations have elected chiefs and councils and have a duty to deliver services like housing, public works, education and health.

The Inuit communities do not live on reserves but in villages and have two kinds of governmental structures: a mayor and



YOUNG

**"The 'moccasin telegram' is a very strong and powerful tool. If you do something wrong, everybody knows."**

council, and traditional Inuit elders who are looked to for informal non-legal fiduciary responsibility. There also is the provincial or territorial government, which administers the education and health services.

Not interacting or coordinating with all of the correct leaders and community members can be detrimental to any project, Young said.

For instance, there are five different aboriginal communities in Labrador, part of the province of Newfoundland and Labrador.

"If you want to dig a mine, you have to talk to all five of them," Young said. "Even though, physically, the mine may be overlapping in only two direct areas. The others have responsibility to be consulted with, so it becomes really complex."

**Personal Best**

When the oil industry shows an interest in aboriginal lands, all five aboriginal-level governments must be consulted – as well as the local municipal government, the territorial government and Canada's federal government.

Many of the aboriginal governments have extremely small staffs but might get an average of 200 to 500 business proposals a year. Young's job is to help the chiefs and councils structure the government so they can respond to all the requests.

The key, Young said, is that business and oil industry leaders need to understand the importance of creating trust and building a leader-to-leader relationship early on.

That means the CEO, COO or another major player at the company needs to make flying to the community, drinking tea and listening to stories with the community leaders a priority.

"The CEO that sits in his office in downtown Houston or wherever it is and never gets on a plane and never does anything other than expect to go up and do a ribbon cutting maybe – those are the companies that don't get it," she said.

But it's also important to recognize that just sitting down and building a relationship with a chief is not always enough, either. Chiefs in some communities are only elected for two years – and then someone else takes over.

"Some companies have done

Jennifer Young of the St. John-based Nestu'et Management Consulting will share her expertise in successfully navigating the sometimes labyrinthine terrain of local and aboriginal governments in a poster session scheduled at this year's Arctic Technology Conference, "Why Understanding Both the Political Governance and Traditional Governance Structures Are Critical in Working With Remote Aboriginal Communities."

The fourth annual Arctic Technology Conference will be March 23-25 at the Bella Center in Copenhagen, Denmark.

tremendous damage in these communities," she said. "They've gone in, talked to one person, thought they got permission and then gone out and caused a complete nightmare because they may have only spoken with the chief," she said. "Well, that chief just got elected and he's only in office for two years, and he's going to get booted out in two years because he didn't consult with the rest of his community."

A mistake like that can have lasting repercussions for an oil and gas company, because many communities rely heavily on word of mouth from other First Nation or Inuit communities.

"The 'moccasin telegram' is a very strong and powerful tool," Young said. "Everybody laughs at me when I say that, but if you do something wrong, everybody knows."

**Continued on next page**

## Two New 2015 GTWs



**AAPG**

A JOINT AAPG-STGS GEOSCIENCE TECHNOLOGY WORKSHOP

### 4th Annual Eagle Ford Shale

9-11 March 2015 - San Antonio, TX

The Eagle Ford is by no means uniform, and understanding just why, where, and how it produces is of critical importance as we enter new phases of the exploration and development. Join us to learn how to best identify areas of differential enrichment and accessible porosity, and exactly how to use new technologies to detect fracture networks, sweet spots, ideal pressure, to develop effective drilling and completion programs within existing plays, and to push the frontier in the Mexican equivalents of the Eagle Ford. Learn how new drilling and completion techniques are being used to reduce costs and to optimize production. Key words: fractures, pressure, geochemistry, whipstocking, proppant and fluid program design, stimulation.



[aapg.to/eagleFord2015](http://aapg.to/eagleFord2015)

AN AAPG GEOSCIENCES TECHNOLOGY WORKSHOP

### International Shale Plays

28-29 April 2015 - Houston, TX

All shale plays are different, and all shale plays shed light on other shale plays. Join experts to discuss world shale plays and share the "lessons learned" in dealing with a wide variety of lithologies, reservoir conditions, and degrees of heterogeneity. Find out the "must have" technologies and the emerging ones that are helping identify sweet spots, improve drilling and completion, and to return to the laterals and optimize the reservoir by launching a strategy of stacked pays and "stranded pay capture." Join experts who will share their experience and research findings in plays in Argentina, Colombia, China, Australia, Mexico, and other countries. We will compare them to analogues in North America with the goal of improving success rates in exploration, and optimizing production from existing and new reservoirs.



[aapg.to/GTW2015IntlShalePlays](http://aapg.to/GTW2015IntlShalePlays)



# Q and A with MHA Nation Chairman

By KRISTI EATON, EXPLORER Correspondent

The Bakken formation has helped North Dakota become the second-highest oil-producing state in the United States. With nearly 1.2 million barrels produced each day, the state trails only Texas in U.S. production.



FOX

About one-third of North Dakota's production comes from the Fort Berthold Indian Reservation, home to the Mandan, Hidatsa and Arikara Nation, or the Three Affiliated Tribes.

In November, Mark Fox, who was the tax director for the Three Affiliated Tribes, became the tribe's new leader, succeeding longtime chairman Tex Hall, who lost in the primary after a report detailing alleged improper business practices relating to the oil and gas industry.

Fox now will lead the tribe of more than 10,000 people, more than 4,000 of who live on the nearly million-acre reservation.

By one estimate, oil and gas exploration has infused more than \$1 billion into the tribal economy over the past six years, helping to build new infrastructure and provide payments to tribal members to cover costs associated with education, household expenses and other needs on the once impoverished reservation.

But the drilling also has raised concerns among tribe members, primarily over the lasting environmental effects of oil and gas development on the land and the societal issues that come with large influxes of cash – including from illegal drugs, human trafficking and other crime.

Fox, who previously was a tribal councilman, campaigned on a platform of prioritizing self-sufficiency and sovereignty. He's a supporter of exploration and development, but he says it needs to be done responsibly and with all parties sitting at the table.

Rather than relying solely on oil royalties and taxes, Fox wants the tribe to become an active player in the industry, and he recently met with North Dakota Gov. Jack Dalrymple to discuss how the two can partner on oil-related issues.

Fox recently spoke with the EXPLORER about his plans for oil and gas exploration on the reservation.

**EXPLORER:** *What are your plans as chairman for production and exploration?*

**FOX:** It's two-fold.

One is to continue to support development and do things necessary to support development. For example, making sure water is available for drilling and looking into what we can do about flaring and being more efficient and things of that nature.

The second thing I want to indicate – the other part of the fold – is getting assurances that we get to what I refer to as "responsible development." That we get assurances that the way we do and the way we conduct our oil and gas development is done in such a way that we are protecting our environment and assuring that our children have a place to live 25 to 30 years from now. Those are the two focuses.

**EXPLORER:** *What do you envision with regard to environmental regulations?*

**FOX:** The regulations all depend on what is necessary to protect our environment and reduce contamination and spills and negative effects. We will look at what we may have to do to strengthen – you can call it tightening, but I'd rather call it strengthening – and that comes as a result of sitting down with industry and partnering up and saying, "How is this going to impact you?"

No, I'm not trying to deter development or impede it. I just want us to sit down and partner and figure out better ways to get it done.

**EXPLORER:** *Can you tell me where negotiations stand on the ONEOK pipeline on the reservation?*

**FOX:** I'm just now getting into it myself. It's the first couple of weeks on the job ...

I do intend to sit down with them to continue negotiations – some negotiations have occurred with our previous chair and administration – but we're going to go ahead and sit down with them and see where we need to go to see how we complete it.

Right now, we're really assessing the whole situation and we'll move forward.

**EXPLORER:** *You've spoken elsewhere about the economic benefit to natural gas. Can you elaborate on that?*

**FOX:** We all know that gas has got value, but we have the situation where we're

**See Refinery, page 37**

## Continued from previous page

### R-E-S-P-E-C-T

As the oil and gas deals continue, once all the appropriate people have been consulted, both sides agree on who will be the primary contact. Companies sometimes give grants to the communities to help increase local staff size on large-scale projects.

Court cases over the years have primarily sided with the aboriginal communities, which, Young said, serves to reiterate that the indigenous peoples did not give up their rights to their resources and land even if they were put on reserves.

Because of that, there is a duty to

create accommodations when those resources are used. Accommodations can come in a variety of forms, including a minimal number of jobs created or a stake in the company, she said.

Most of all, as in any business arrangement with any group, it's important to recognize that respect is paramount when it comes to working with aboriginal communities.

Young illustrated that point by recalling a conversation she once had with a chief about business leaders hoping to create a partnership:

"If your leader doesn't have the respect to come and talk to me as the leader of my people, we have no respect for you," she recalls the chief saying. "That concept of 'leader to leader' is really important."

Introducing the 2015 Southwest Section of the AAPG Annual Convention



## ROCK THE FALLS

*Evaluating the Past, Exploring the Future*



April 11–14, 2015

Wichita Falls, Texas

### ❖ Field Trip – Saturday, April 11<sup>th</sup>

The Wichita Mountains, Oklahoma. A tour of Eocambrian rifting and Permian erosion

- Led by Dr. Jonathan Price – Midwestern State University
- Exploring the intense magmatism and subsequent deformation associated with the Southern Oklahoma Aulacogen
- Lunch at the famous Meers Store

*\*Field Trip limited to 50 attendees and requires member registration*

### ❖ Annual SWS-AAPG Short Course – Sunday, April 12<sup>th</sup>

Borehole Imaging: From Acquisition to Interpretation

- Presented by Valentina Vallega – Senior Borehole Geologist, Schlumberger
- Open to geologists, reservoir engineers, team managers, or those who work with borehole imaging data through open hole logging programs

*\*Short Course requires member registration*

### ❖ Icebreaker – Sunday Evening, April 12<sup>th</sup>

The traditional icebreaker kicks off the convention!

- Hear the smooth sounds of Wichita Falls blues legends The Mike O'Neill Band
- Visit with our exhibitors while reconnecting with old friends and making new contacts
- Feast on shrimp, tenderloins, and heavy hors d'oeuvres

*\*Admission with name badge; cash bar*

### ❖ Technical and Poster Presentations – April 13<sup>th</sup> & 14<sup>th</sup>

- Unconventional resource plays in Texas and the U.S.
- Papers and posters covering frontier exploration areas and alternative exploration techniques
- Presenters interested in participating may contact Scott Meddaugh at [scott.meddaugh@mwsu.edu](mailto:scott.meddaugh@mwsu.edu)

### ❖ "Southern Hospitality" – Monday Evening, April 13<sup>th</sup>

Bob and Ann Osborne open their locally-famous estate for an evening of socializing and southern hospitality. Their home, built in 1935 by local drilling legend Red Dillard, was originally landscaped in 1949 by international architect James Fry of Paris, France. Most recently, Georgia landscape architect Phillip Watson refined the rose gardens to accentuate the sprawling lawns.

- Enjoy a rib dinner prepared by the Wichita Falls Mavericks
- Afterwards, board the trolley for a tour of the Country Club Estates presented by a local historian
- Complete your evening listening to the cowboy crooners Prairie Moon perform

*\*Shuttle service will be provided to and from local hotels*

For more information on the convention, go to:

<http://www.ntgeologicalsociety.org/2015-southwest-section-of-aapg-convention/>

# Changing the Game in Arctic Remote Health Care

By COURTNEY CHADNEY, EXPLORER Correspondent

**E**xploration and production in the Arctic is a proven difficult task – companies active there are all too familiar with its harsh conditions of ice, extreme low temperatures, long periods of winter darkness and remoteness.

Consequently, providing safety to workers has become a major concern for companies braving this harsh territory, and a hot-topic that will be addressed at the upcoming Arctic Technology Conference in March by bringing in remote health care expert, Hans Berg.

Berg is a member of Shell's Health Global Leadership Team, and personnel and training lead for Shell's Global Business Health, UIX and New Business. In his presentation, "Remote Health Care: A Game Changer for the Arctic," Berg will share case studies, recent developments in telemedicine technology, and how Shell ensures safety and enriches communities in remote areas all over the world, including the Arctic.

Talking to the EXPLORER, Berg described Shell's benefits since deployment of a strong remote health care (RHC) model, including:

- ▶ Safer and healthier operations.
- ▶ Providing care quickly that otherwise would not be available for days or even weeks.
- ▶ Minimized costs.
- ▶ Meeting medical emergency requirements, while ...
- ▶ Providing support and assurance to staff.

His technical session will also explain



BERG

**"For local communities this would open the door to improved health care and so much more."**



Photo courtesy of Shell

The Noble Globetrotter II has been in use by Shell to implement its RHC strategy to use satellite communication to connect the ship's medical team with several hospital departments.

how RHC strategy and telemedicine technology have prevented unnecessary and urgent medical evacuations – and already saved numerous lives.

"We believe this a game changer,"

Berg said. "The entire traditional way of providing health care in the seismic, drilling and offshore industry always has relied on the premise that rotator wing capacity and local health infrastructure

availability would ensure adequate and timely hospital care.

"In the Arctic, however, weather conditions, lack of rotator wing support, the lack of local hospital infrastructure, the costs of logistics and short operational time windows all conspire against the traditional method of providing timely hospital care," he added.

Berg believes his company's desire "to explore in extremely remote areas, but not at the expense of its health, safety, security, environment and social performance standards" is something they share with many other companies with a presence in the Arctic.

"The remote health care strategy ensures safer and healthier operations and allows for virtual hospital expertise and advice to be instantaneously available on a 24/7 basis," he said.

### Bringing the Hospital to the Field

Similar to other companies, Shell has a responsibility to guarantee the safety of employees, ensuring they can be transported to a hospital within four hours of an incident. In the Arctic, as Berg explained, the only way to ensure this medical emergency requirement is met is by utilizing a remote health care strategy.

Remote health care that includes telemedicine allows the company to bring the hospital to the patient, virtually, through the use of modern technology

**Continued on next page**

# EPSON®

## LOG PRINTING SOLUTIONS



See us at NAPE EXPO  
Houston, Texas  
February 11-13 2015

sales@wellgreentech.com  
www.wellgreentech.com  
403.800.5290

EPSON reliability  
LOW acquisition cost  
EPSON warranty  
LOW cost per page  
EPSON ease of use

**Refinery**  
from page 35

burning it off right now with all the flaring and things of that nature. I think, number one, we facilitate getting it into midstream so it can go to market. And number two, we can also look at situations of working with the industry and working with technology to reduce flaring by finding ways to utilize that gas as power at the wellhead ... and compressing it and getting it to market. So we can show the industry they'll make money instead of burning it and not have to worry about getting everyone into midstream. We can go right to the wellhead and take advantage of that.

**EXPLORER:** *The tribe is building its own refinery, Thunder Butte Petroleum*

*Services Refinery. Can you tell me about that? Has construction begun?*

**FOX:** We've done some preliminary construction on site development, site work and things of that nature, but those things would have to be done regardless.

What we're doing right now is, we're sitting down with the Thunder Butte management and the developers and trying to figure out if we're going to make some changes.

It's apparent that we are going to do some modifications to the plans over the last few years, and how we approach it and exactly what products we're going to do. We're looking at machine lining and maybe cutting a little bit of the cost of development a little bit. Also, focusing on transload as well, so we're still moving forward.

**EXPLORER:** *Why do you think it's*

*important for the tribe to have its own refinery?*

**FOX:** Because No. 1, it's the value. Instead of just sitting back, with our oil that's underneath our land – our own oil – instead of just getting royalties and a few taxes, we're going to take the product from out of the ground, we're going to add value, develop it and create a product, send it to market.

The overall benefit of that is the value of that oil coming from out of the ground is going to get tenfold, because we're actually going to develop it and take it to market as a developed product rather than just getting royalties. It's a way of bringing in more revenue.

**EXPLORER:** *Any idea on when the refinery will be complete?*

**FOX:** I couldn't exactly say that, but

I'm hopeful we will be in stage one full operation within two years. I sure hope so.

**EXPLORER:** *Are you concerned about the ongoing slowdown in shale production? How is the ongoing price war with OPEC going to affect your plans and the future of the tribe?*

**FOX:** Very much concerned. What's happening to the world market, primarily because of OPEC influence, is very concerning to us. We are being directly affected, and we are anticipating losses to tax and royalty revenue of at least 30 percent from what we expected to see this fiscal year, if the price does not rebound soon.

We are currently working hard to revise our tribal budget and planned expenditures and investments on behalf of our people. **E**

**Continued from previous page**

and communication.

"We have a particular duty of care to our employees who will be exposed to a remote and harsh environment while working in the Arctic," Berg said. "(Our RHC strategy) sends a strong message that we care about our employees and are doing everything we can to safeguard their health and safety."

Also, he added, "it provides medical staff with critical access to expertise and advice in many areas and boosts confidence of staff members who may feel anxious about working conditions."

Berg and his team have learned this from other successful operations, like the Noble Globetrotter II, which is a deepwater drilling ship currently operating for Shell off the African West Coast.

The ship has been using Shell's RHC strategy to connect via satellite with 12 different hospital departments at the University of Haukeland in Norway. Since Shell implemented this technology, two lives have been saved and three unnecessary evacuations have been avoided. By utilizing telemedicine, the ship's medical team can be connected in just ten minutes by mobile and tablet devices to doctors ashore ensuring that patients and medical staff get the help they need.

**Social Investment**

Berg's ATC session aims to demonstrate how an RHC model like Shell's can not only improve health outcomes and save money for companies, but also can be adapted and scaled to support community health in these regions, allowing companies to be a better neighbor and contribute to the areas in which they work.

"With increased interest in the Arctic from governments, oil and gas, shipping and the leisure industry, we all share the need for telecommunication," he said. "With investment in highly elliptical orbital satellites, the entire region could be provided with bandwidth at even the highest northern latitudes.

"For local communities," he added, "this would open the door to improved health care and so much more."

Berg and his team see the future of the Arctic as one in which remote health care will provide:

- ▶ Opportunities to the local community.
- ▶ The industry with necessary skilled workers.
- ▶ Opportunities for social investment associated with health care to improve the health and well-being of many remote communities. **E**

**AAPG Annual Convention & Exhibition 2015**  
with SEPM (Society for Sedimentary Geology)  
31 May–3 June » Colorado Convention Center » Denver

**REGISTRATION NOW OPEN**

**250+** Exhibitors

**900+** Technical Presentations

**8,500+** Geosciences Professionals

**18** Short Courses

**13** Field Trips

**Engage**  
with a focused audience of geologists, geophysicists, engineers and energy leaders

**Exchange**  
ideas and research new products and services

**Experience**  
an exceptionally strong, peer-selected technical program

Register by 6 April to save up to \$210  
**ACE.AAPG.org**

# Going Deeper: Blue H-28 Was a Whale of a Tale

By TAKO KONING

The 1970s were tumultuous years for the oil industry.

In October 1973, impacts of the Arab-Israeli War caused the price of oil to jump from \$3 to \$12 a barrel. The Arab Oil Embargo prevented the export of oil to countries like the United States and Netherlands and caused enormous difficulties – including long lines at U.S. gas stations due to gasoline shortages.



KONING

In 1979, the price of oil increased to \$14 per barrel due to oil production cutbacks related to continued political instability in the Middle East, including the departure of the Shah from Iran.

By 1980, oil prices were up to \$35 per barrel, and the public became obsessed with the issue of oil supply. Indeed, many people believed that the world was running out of oil.

The relationship between these events and the drilling of the Texaco Shell et al Blue H-28 well in Newfoundland will become apparent later in this article.

## The Opportunity

In 1975, Calgary-based Texaco Canada was contacted by Shell Canada, which owned a massive deepwater exploration permit in offshore



The drillship Discoverer Seven Seas entered St. John's harbor in May 1979 for provisions and stocking up on fuel before going out to sea to drill Blue H-28.

Newfoundland. Shell wanted to farm-out its permit to other oil companies.

The permit's location was in the Orphan Basin, approximately 350 kilometers northeast of St. John's, the capital city of Newfoundland.

The permit was called the Gander Block – it consisted of 5.6 million acres, and late 1960s vintage seismic showed weak evidence of some huge structures within the block.

A team was formed to evaluate this farm-in opportunity, which included chief geologist John Williams, senior geologist

Peter Bower, exploration geologist Dave Vander Lee, chief geophysicist Trevor Bell and senior landman Ray Howells.

The team was entirely Canadian except for Al Hanners, an American who was Texaco Canada's division manager. Hanners had worked most of his career with Texaco Inc. in New York and Trinidad, and also had worked on many of the big oil plays in the Middle East, including Saudi Arabia.

The closest control well at that time was the BP Bonavista C-99 well, located 90 miles southwest of the block – and due to



Bathymetry (contour interval 1000m). Dots mark exploration wells. Graphic courtesy of Grant (1987).

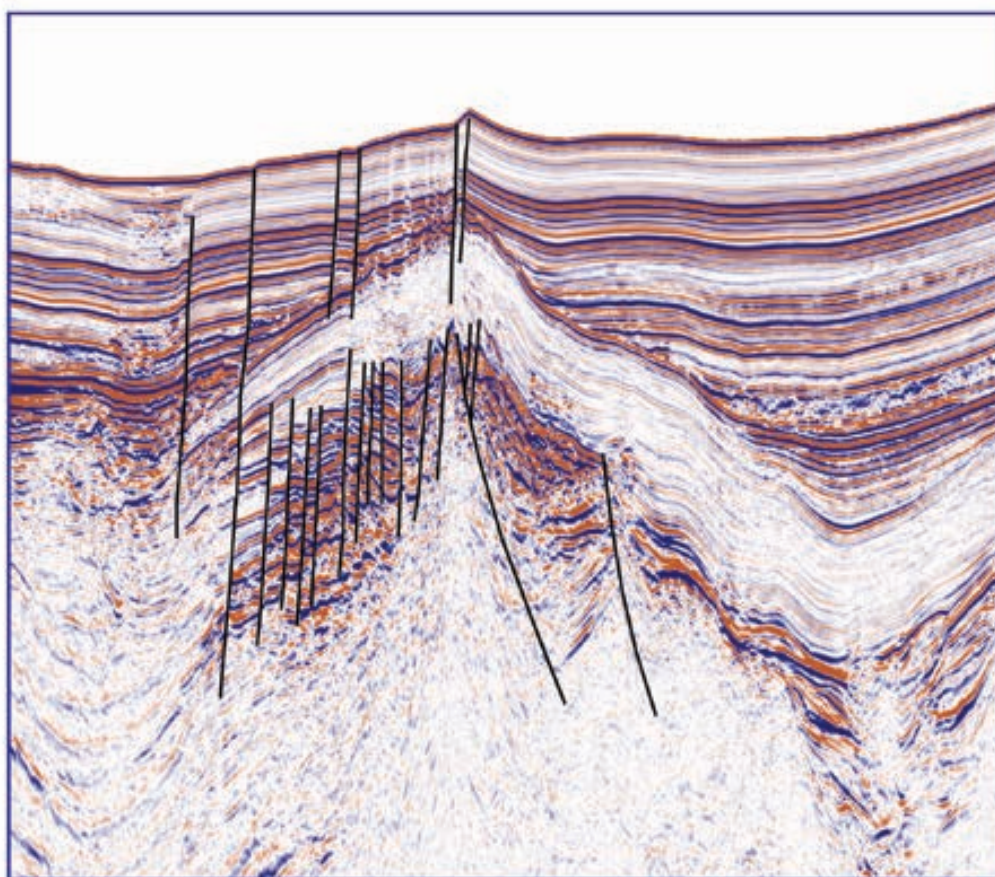
the lack of well control, exploration of this block would truly be rank exploration.

Texaco Canada's geoscientists studied the seismic and concluded the structures were possible massive reef buildups similar to the prolific Golden Lane-Reforma Lower Cretaceous reefs of Mexico.

An encouraging closer piece of supporting evidence came from a Joides DSDP core hole drilled on Orphan Knoll, which penetrated 180 feet of Lower Cretaceous carbonate sands and shaley

**Continued on next page**

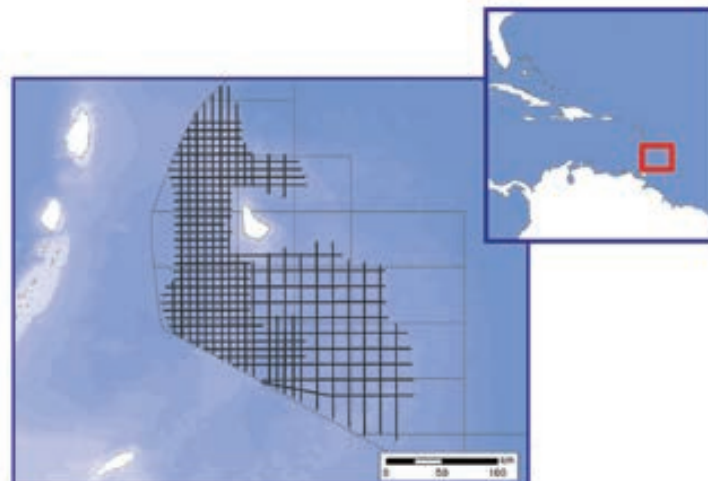
## MultiClient Geophysical



### Offshore Barbados

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

The data covers all 26 blocks open for bidding



For further information please contact:

Kenneth Mohn  
+1 713 485-9696

Tom Wolden  
+47 66 98 41 18

John Whitcomb  
+65 63 27 97 44

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

**Continued from previous page**

limestones. Also, dredge samples from Flemish Cap contained Lower Cretaceous foraminifera, *Orbitolina Conoides*, which was believed to be indicative of warm temperature, reefal environments.

On the basis of this very minimal data and regional geology, the Texaco Canada team postulated that reefs similar to Golden Lane could extend northward from Mexico into Newfoundland – including the Gander Block.

**Selling the Opportunity**

Once the team had finished its technical assessment of the Gander Block, Hanners traveled to the headquarters of Texaco Canada's parent company, Texaco Inc., in White Plains, N.Y., to "sell" the project to Texaco's executive management.

This would be highly challenging. He was trying to convince Texaco to drill a rank exploration well in almost a mile of water, to a possible depth of over 20,000 feet, in Newfoundland's ice-infested "Iceberg Alley" – one of the world's most hostile environments. During the summer months this area had extensive pack ice and frequent thick fog; occasional storms had waves of up to 60 feet.

When Hanners presented his recommendation to farm into the block, the deepest water depth drilled at that time was by Shell Oil in 1974 in Gabon, in 2,097 feet of water. Texaco was a conservative company more focused on oil production, refining and marketing rather than exploration, so it was quite audacious for this drilling project to be proposed to the company.

In his presentation, Al pitched the prospects as possible reefs – but he also said that the structures, in a way, looked similar to the Ghawar oil field in Saudi Arabia, the world's biggest conventional oil field.

Since Texaco was a partner in Saudi Aramco, mentioning Ghawar made the ears of the Texaco executives perk up. The possibility of finding another Ghawar basically sold the farm-in to Texaco's execs.

However, another highly compelling reason to explore the Gander Block was a financial incentive known as the Canadian government's PIP program, which stood for Petroleum Incentive Program. Due to the concerns about world oil supply, the federal government in Ottawa believed it was crucially important for Canada to have an understanding of the possible oil resources in its minimally explored frontiers, which were East Coast Canada and the Arctic.

The PIP program came into effect in 1975. Under it, frontier drilling programs were subsidized by the federal government with what was informally called "PIPs grants," whereby Ottawa paid 95 cents on the dollar and the oil companies paid only five cents.

Accordingly, Texaco Canada drilled the Blue well almost cost-free.

Despite the minimal cost, the company did take on a lot of risk in terms of operational and safety risk in drilling in unprecedented water depths in such an extreme environment.

**Exploring the Opportunity**

Texaco's management approved the farm-in into the block on condition that other companies would join the program to share the risk and make it a multi-company campaign. In the next year, Calgary-based Home Oil, Dome Petroleum, Hudson's

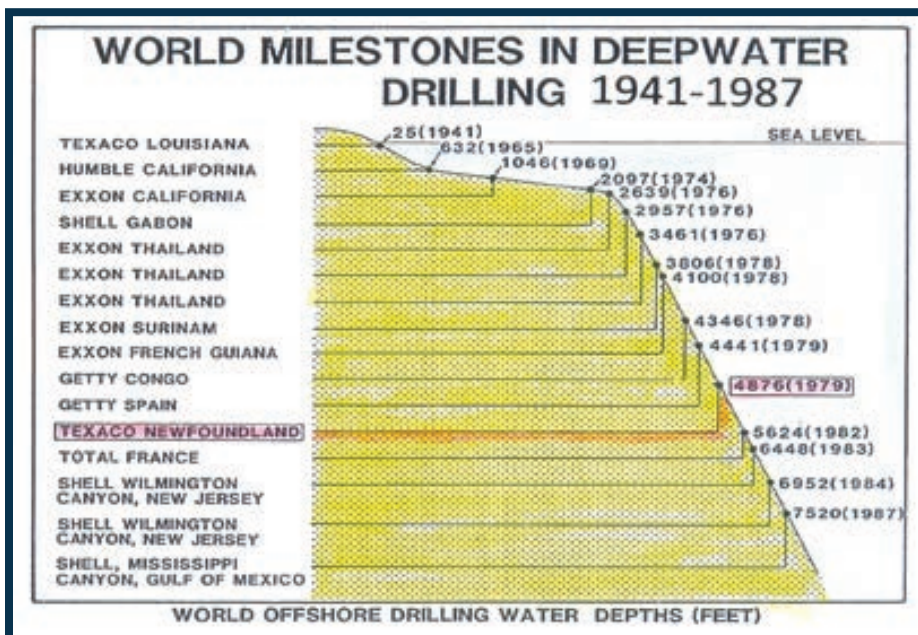
Bay Oil & Gas and Petro Canada become partners with Texaco Canada in the block along with Shell Canada, which retained an interest in the block.

The partnership was committed to drilling at least one well in the block.

In 1976 the partnership shot new seismic in the block; approximately 1,760 kilometers of 2400 CDP data was recorded. Noteworthy was that Texaco Canada's senior geophysicist Rennie Reghenas spent six weeks non-stop as the company rep on the seismic boat in often storm-tossed seas.

The new seismic data showed that the structures were not reefs, so the reef play was terminated. But the seismic did show a number of huge structural closures overlaying interpreted basement, so those became the primary targets.

See **Grand Banks**, page 41



**CALL FOR PAPERS**

Submission deadline:  
**1 April 2015**  
<https://mc.manuscriptcentral.com/interpretation>



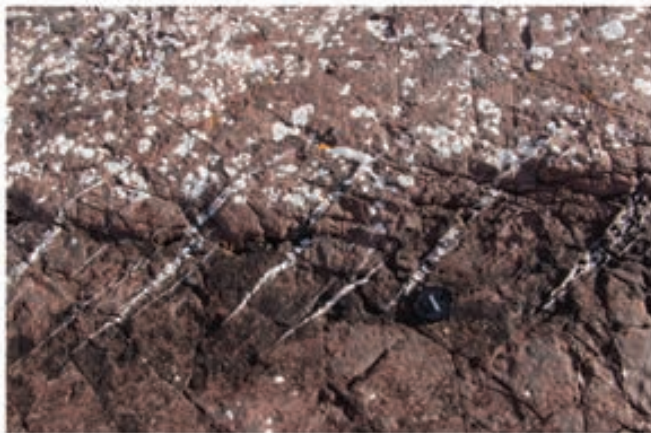
**Petroleum geomechanics and fracture interpretation**

Interpretation of petroleum geomechanics and fracture data is increasingly central in many exploration and development situations. This issue will investigate petroleum geomechanics interpretations, encompassing examples from structural geology, rock mechanics, petroleum engineering, and geophysics to address a wide range of geomechanical problems that arise during the ex-

ploration of oil and gas reservoirs. Topics to be covered include the exploration, assessment and production phases of petroleum reservoir development.

We are seeking submissions on related topics including:

- What are the key interpretation challenges for petroleum geomechanics?
- How have geomechanics interpretations been applied in exploration and development?
- What information can geophysics provide on determining the impact of critically-stressed fractures on drilling and production?
- How can geophysics help define different modes of rock failure and deformation?
- Identify the causes of fault slip and the extent of aseismic fluid flow in existing fractures?



Fracture array, Torridonian sandstone near Red Point Lighthouse, NW Scotland. Photo Courtesy Ann Laubach.

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

The submissions will be processed according to the following timeline:

Submission deadline:  
**1 April 2015**  
Publication of issue:  
**November 2015**

Special section editors:

**Stephen E. Laubach**  
steve.laubach@beg.utexas.edu

**Randall Marrett**  
marrett@jsg.utexas.edu

**Jon E. Olson**  
jolson@mail.utexas.edu

**Sergey Fomel**  
sergey.fomel@beg.utexas.edu

# Register today!

## DEVELOP YOUR ASSETS



Short Course #3 – Organized by AAPG PROWESS and AWG

### The Integral Role of Petroleum Economics In Oil And Gas Field Development

Course instructor: Jenny Spalding, Ph.D., Aramco Services Company

**The course will cover the following topics:**

- Decision-making under uncertainty in exploration and value creation by geoscientists.
- Reserves and resources.
- Field development and cash flow modeling.
- Profitability indicators.
- Production portfolio ranking and investment selection.
- Production and reservoir management.
- International contract arrangements and trends.

**Date:** Saturday, 30 May 2015 (pre-convention)  
**Time:** 8:00a.m. – 5:00p.m.  
**Venue:** Colorado Convention Center  
**Registration:** \$250 USD (Includes course notes on USB drive, lunch, luncheon speaker, coffee breaks)



Dr. Spalding has 35 years of experience in petroleum engineering, energy economics, and project economics at Saudi Aramco, Aramco Services Company, the World Bank, Shell, and CERA.



Includes Luncheon talk:

### The Impact of Women on Structural Geology – A 200-Year Perspective

Presented By: Terry Engelder, Ph.D., Penn State University

Short Course sponsored by



### Kiddie Corp Child Care offered onsite at AAPG ACE

Parents with small children – Don't leave your children "Home Alone". Sign up now for professional childcare onsite. With over 25 years' experience providing high-quality childcare at conventions, KiddieCorp offers licensed, professional childcare for children aged 6 months through 12 years. Since 2012, childcare service has been organized by AAPG's Professional Women in Earth Sciences (PROWESS) Committee to promote family-friendly geoscience careers.

Childcare service at AAPG Denver ACE is available during the following hours:  
 Sunday 2:30 p.m. – 8:30 p.m.  
 Monday 7:30 a.m. – 10:00 p.m.  
 Tuesday 7:30 a.m. – 9:30 p.m.  
 Wednesday 7:30 a.m. – 6:00 p.m.



Kiddie Corp Child Care sponsored by



Register at [ACE.AAPG.org](http://ACE.AAPG.org)

# Feds, States Wrestle On Land Management

By PERI SASNETT, AAPG/AGI Intern

Recent debates have flared in the western United States over federal versus state ownership of public lands. Bills concerning the transfer of some public lands to states have been introduced in the U.S. Congress and many western state legislatures, though none have become law.

At the heart of the issue is a dispute over:

- ▶ Who has the best knowledge and perspective to manage these lands?
- ▶ Who should benefit from them?
- ▶ Who can pay for it?

Local interests argue they are better suited to make land management decisions in their states, while federal proponents argue that they can better manage resources with long-term and national interests in mind.

Federally owned land accounts for 47 percent of the combined area of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. These lands are managed through several agencies, most notably the Bureau of Land Management and the U.S. Forest Service.

The National Park Service, the U.S. Fish and Wildlife Service, and the Department of Defense also control substantial land holdings. Each of these agencies has different management directives, but their goals include conservation, recreation, ecosystem health, timber harvesting, grazing access and energy production.

According to the U.S. Energy Information Administration, 12 percent of the nation's natural gas supplies and 7 percent of its oil came from onshore federal lands in fiscal year 2013.

#### Both Sides Now

Proponents of federal management argue that larger federal budgets provide the capacity to make long-term resource management – a higher priority. They contend that the federal government is not incentivized by revenue in their land management policy, whereas states' more limited budgets encourage managing for short-term gain, selling land and harvesting resources like timber or minerals to make ends meet.

The federal government also has the ability to fund major expenditures such as wildfire management, which costs taxpayers \$3.5 billion per year on average, according to the Congressional Research Service.

Some states' advocates argue that state managers could allocate complex wildfire funds more flexibly without federal mandates. However, those types of expenditures often rely heavily on resources like aircraft and highly trained crews, which currently are made available through federal infrastructure.

Advocates for state ownership argue that states are best equipped to make management decisions because local residents are the most directly impacted.

In such instances, states point to uncertainty over federal management as a particular source of frustration; for example, it is difficult for companies to invest in mines or drilling sites when currently available land could be protected as a national monument at the president's discretion.

State ownership would allow state and local governments to make these decisions, collect any energy and mineral royalties or logging and grazing fees, and distribute that revenue to benefit their communities as they see fit.

Editor's note:

AAPG/AGI intern Peri Sasnett earned her bachelor's degree in earth science from Columbia University, with a minor in American history. She completed her



SASNETT

master's in geology at the University of Canterbury, focusing on active tectonics, while on a Fulbright fellowship to New Zealand. Since then she has been an interpretive geologist for the U.S. National Park Service in the Grand Canyon and Grand Canyon National Parks through the GeoCorps program. She currently is a guest scientist in Yosemite National Park, and she hopes to continue to combine her interests in science policy and natural hazards.

State advocates also argue that federal ownership of land prevents them from collecting the property taxes they would receive if the land were privately owned, which they assert would be a major revenue source. Currently, the government awards funds to compensate for this through the Payment in Lieu of Taxes (PILT) program. However, even if states took over these lands and proposed to sell a majority of them, there is no guarantee that they would find buyers, thus leaving states without PILT funds and with less tax revenue than expected.

Diverse stakeholders of public lands further complicate this issue. For example, both local and out-of-state hunting and outdoor organizations typically favor federal ownership; they have expressed concerns about losing access to land through privatization and increased fees that could occur with state-owned land.

Likewise, conservation advocates question states' ability and incentive to maintain wilderness and wildlife protections.

Conversely, energy, mining and logging interests would likely benefit from easier access to resources and expedited permitting associated with state ownership, which could bring jobs and revenue to local communities.

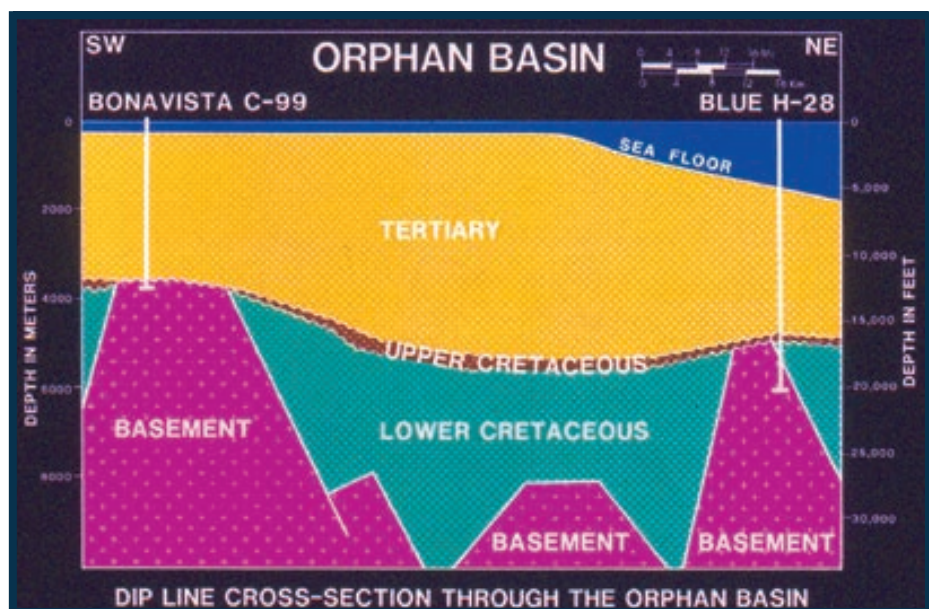
#### Compromising Positions

Instead of the sweeping takeovers proposed by several state legislatures, more nuanced compromises have been recently proposed.

U.S. Rep. Rob Bishop (R-Utah), who will chair the House Natural Resources Committee in the 114th Congress, has been working with stakeholders to design the Utah Public Lands Initiative. After decades of gridlock – with conservatives blocking

See *Land*, page 43





## Grand Banks from page 39

A personal note: I graduated from the University of Alberta in 1971 and at the young age of 21 worked for two years as a mudlogger ("gas sniffer") for Continental Laboratories, which had a contract with Amoco Canada, operator of a multi-well exploration drilling program on the Grand Banks of Newfoundland.

All of Amoco's wells turned out to be dry holes – but mud-logging was excellent experience and taught me a lot about wellsite geology and offshore drilling operations.

I joined Texaco Canada in 1973. In 1978 I was area geologist for northern Alberta and the East Coast Canada was added to my area. I became the project geologist for Blue H-28 and was much involved with the upcoming Newfoundland drilling program.

So I started my career in the oil industry in 1971 on the Grand Banks of Newfoundland and seven years later I returned there to coordinate an incredible deepwater drilling project.

### Drilling Blue H-28

The well drilled in the Gander Block was called "Blue" after the world's largest mammal, the blue whale, since it was going to be drilled on one of the world's largest prospects – Ghawar was the world's biggest oil field, and Blue was one of the world's biggest oil prospects.

In mid-1979 Blue H-28 spudded in 4,876 feet (1,486 meters) of water and was drilled problem-free to a drill depth of 20,023 feet (6,103 meters). The well was drilled by an almost new dynamically positioned drillship, the Discoverer Seven Seas, which was built in 1976.

Blue H-28 found very close to prognosis the objective Lower Cretaceous section – approximately 180 feet of clean, medium to coarse-grained sandstones were intersected. The electric logs indicated 19 percent porosity, but the logs also showed the sands to be water-bearing.

The well was plugged and abandoned. Still, the following records were achieved with the drilling of Blue H-28:

- ▶ The world water depth record for drilling had been held by a well drilled in early 1979 in 4,441 feet (1,354 meters) of water by Getty Oil in offshore Spain. Blue H-28 extended the world record by 435 feet (133 meters).

- ▶ Blue H-28 also extended the Canadian water depth record by 2,034 feet (620 meters), since the previous

record was held by a well drilled in 1978 by Chevron in offshore Nova Scotia in a water depth of 2,842 feet (866 meters).

- ▶ The Canadian drill depth record was held by a well drilled in 1973 by Union Oil, to a depth of 18,677 feet (5,692 meters), but this record was extended by 1,346 feet (410 meters) with the drilling of Blue H-28.

Several connections to Blue H-28 remain, both industry wide and on a personal note.

First, Blue H-28 remains a very important control well in the minimally explored Orphan Basin.

Second, the Discoverer Seven Seas is now 39 years old, but it remains an important deepwater drilling rig. It was rebuilt in 1997 and is still drilling deepwater wells worldwide, most recently in Indonesia.

Third, after 44 years in the oil patch and at the age of 65 years, I remain active in the oil industry, currently as a consultant for Gaffney, Cline & Associates in Luanda, Angola.

### Epilogue

When the Blue H-28 project was completed I accepted a transfer with Texaco to Sumatra, Indonesia, where I worked for seven years. In 1986 I transferred back to Calgary with Texaco Canada.

In 1987 I was invited by the Offshore Technology Conference (OTC) in Houston to present a paper on Blue H-28 at its 20th annual event, in a special session devoted to "Milestones in Deepwater Drilling."

The paper contained as much technical information as I could possibly squeeze into it, and it was published in the OTC Proceedings.

In 2005 and 2006 I gave presentations on the Blue H-28 project in Calgary to the Canadian Society of Petroleum Geologists (CSPG), and portions of the OTC paper were re-published in the CSPG's Reservoir magazine in January 2007.

With the passage of time, the significance of deepwater wells like Blue H-28 seem to pale in comparison to recent exploratory drilling in water depths exceeding 10,000 feet (3,050 meters).

Indeed, the current water depth record is held by a well drilled in offshore India in 2013 by India's ONGC, in 10,414 feet (3,174 meters) of water.

I believe it is important that historic geological, geophysical and drilling data, such as was obtained from Blue H-28, be preserved and not fade into oblivion as the years pass – and that's what inspired me to write this story for the EXPLORER's Historical Highlights.



**Geosciences Technology Workshops 2015**

# Siliciclastic Reservoirs of the Middle East

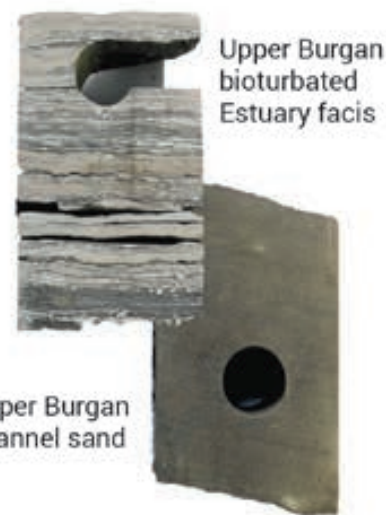
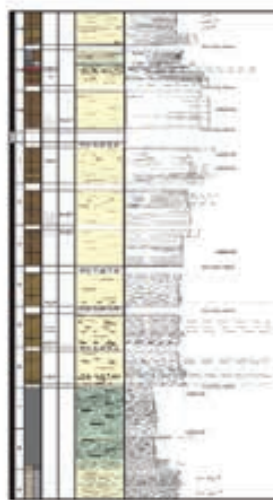
23-25 March, 2015 • Kuwait City, Kuwait

This exciting workshop will focus on disseminating the latest ideas, information and processes pertaining to exploration and development of hydrocarbon bearing clastic reservoirs in the Middle East. The workshop will feature a number of case studies involving field and outcrop scale reservoir characterization as well as regional depositional models and their sequence stratigraphic framework. A Core Workshop will be included throughout the duration of the workshop.

*Ahmed Al-Eidan, Manager Exploration Group for KOC (Kuwait Oil Company) as inaugural keynote speaker*

### Core Display

Core from several Middle East reservoirs will be on display throughout the workshop. These cores have been selected to compliment the presentations in the oral and poster sessions. There will be plenty of time between sessions and during coffee breaks for speakers to review the core with participants and generate discussions.



### Core representing the following formations will be on display

AGE	FORMATION	FIELD
Permian	Unayzah	Midrikah, Nujayman and Tinat
Permian	Unayzah	Exploration well in Kuwait
Cretaceous	Burgan & Wara	Greater Burgan Field
Cretaceous	Upper Burgan	Raudhatain and Sabriya
Cretaceous	Middle Burgan	Raudhatain and Sabriya
Cretaceous	Zubair	Raudhatain



For more information please visit:  
[middleeast.aapg.org](http://middleeast.aapg.org)  
 Or our AAPG Middle East Group in LinkedIn



LinkedIn

AAPG

# Policymakers Mull Increased Arctic Interest

By EDITH ALLISON, Geoscience and Energy Policy Office Director

Commercial interest in the Arctic has grown with declines in summer sea ice cover – since 2007 the extent of Arctic sea ice has been significantly less than it was in the decade after satellite measurements started in 1978.

For example, commercial and tourist ships – following the Northern Sea route north of Russia – have transited the arctic many times in the past four years, and exploration drilling efforts in the U.S. offshore, Norwegian and Russian arctic regions are regularly in the news.

Washington, D.C., policymakers expect that commercial activity will continue to grow – and with increasing activity come increased risks to national security and greater risks of oil spills, which drive interest in improved technology and regulations.

Other important areas of concern for policymakers include the potential impacts on the economies and cultures of native peoples.

Increased interest by Washington, D.C., policymakers will be driven, in part, by the United States assuming the leadership of the Arctic Council in May, and by Republicans gaining a majority in the Senate, with Sen. Lisa Murkowski (R-Alaska) assuming the chair of the Senate Energy and Natural Resources Committee in the 114th Congress.

The newly formed House Arctic Working Group, chaired by congressmen Don Young (R-Alaska) and Rick Larsen (D-Wash.), also will draw attention to the economic, strategic and environmental interests of the United



ALLISON

North of the Arctic Circle are more than 400 oil and gas fields potentially containing approximately 240 billion barrels of oil and natural gas equivalent.

States in the Arctic.

(Author's note: This article does not consider current or proposed regulations for oil and gas operations, a complex topic for a future column – in early 2015, the Department of the Interior is expected to release proposed regulations for drilling in the Arctic Outer Continental Shelf.)

## Arctic Council

In May the United States will take over the leadership of the Arctic Council, an intergovernmental forum created to address the concerns to Arctic nations and the region's indigenous peoples.

Canada has chaired the council for the past two years. Council members include eight countries – Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States – and six Arctic indigenous groups. Many European and Asian nations are observers.

The Council began organizing in 1991 and held its first ministerial level meeting in 1998.

Retired Adm. Robert Papp Jr. is the U.S. special representative for the Arctic and will represent Secretary of State John Kerry as chair of the council. The U.S. presentation on plans for the U.S. chairmanship of the council (Dec. 2, 2014 Virtual Stakeholder Outreach Forum) defines three focus areas:

- ▶ Addressing the impacts of climate change.
- ▶ Stewardship of the Arctic Ocean.
- ▶ Improving economic and living conditions.

An outgrowth of the Arctic Council is the Arctic Economic Council, which formed last September. The Economic Council will focus on economic growth, environmental protection and social development. It includes three business representatives of each Arctic state and the indigenous-participant organizations.

The U.S. tenure as chair of the Arctic Council will reflect long-standing executive branch policy:

▶ In January 2009, President Bush signed a National Security Presidential Directive on Arctic Region Policy, which focused

on assuring environmentally sustainable resource and economic development, increased scientific research and monitoring, greater involvement of indigenous communities in decision making, and greater coordination among the Arctic nations.

▶ In May 2013, the Obama administration released the National Strategy for the Arctic Region, which aims to increase U.S. security interests with improved transportation and communication infrastructure, and environmentally responsible development of oil, natural gas and other resources.

The strategy also calls for improved hazardous spill containment and response, increased research and increased international cooperation to protect the environment and enhance security.

The Obama administration, as the Bush administration before it, supports U.S. accession to the United Nations (U.N.) Convention on the Law of the Sea, a 1984 treaty signed by 166 countries. The U.S. Navy and many oil companies support the treaty as a guarantee of rights of marine transit and of title to minerals under continental slopes that extend more than 200 nautical miles from shore.

Some Senate Republicans do not support the treaty, arguing that the treaty would cede American sovereignty to the U.N.

Under the treaty, Denmark, Canada and Russia have filed claims to large areas of the Arctic including the North Pole based on the extent of their continental shelves.

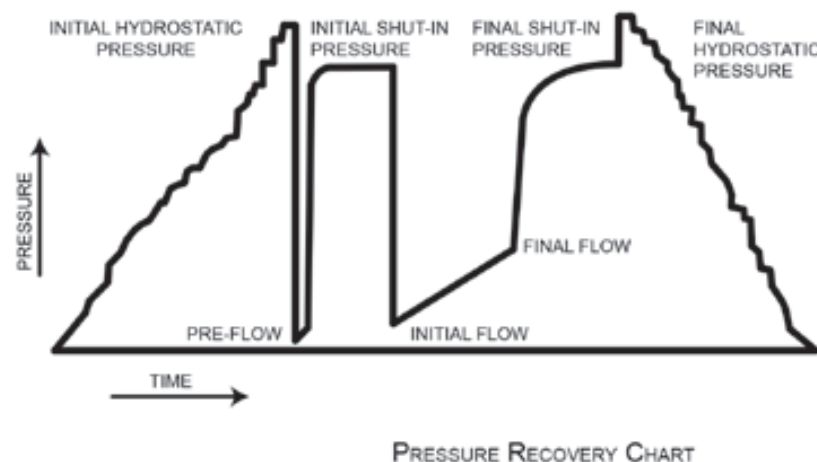
**Continued on next page**

## AIFE, American Institute of Formation Evaluation LLC ANALYZED DST DATA

Data for over 170,000 Analyzed Drill Stem Tests in the Continental U.S., covering 1948 onward. Each test has been analyzed from the original DST report by AIFE's expert personnel, not transcribed from field or scout data.

### Individual Test

- Indication of near wellbore reservoir characteristics
- Detailed assessment of Quality of test
- Drill Pipe & Drill collar data
- Horner extrapolation and slopes
- Permeability assessment
- Damage assessment
- Detailed recoveries and blow description
- Horner plot and build up curve charts
- Data for detailed reservoir calculations
- Incremental Detail on Shut-in Build-ups



### Regional Utilization

- Permeability maps to highlight potential stratigraphic traps
- Temperature Maps
- Potentiometric surface maps to indicate flow potentials, directions for preferential migration of hydrocarbons
- Pressure/Elevation Charts to determine continuity of reservoirs, estimate gas/oil/water contacts
- Pressure/Depth Charts
- Pressure/Depth ratio maps to locate abnormal and subnormal pressured reservoirs
- Locate potential Resource play areas by searching for Low Perm zones with high pressure & minor hydrocarbon shows

### Accessing AIFE DST Data

AIFE DST Data can be accessed by individual or regional data requests. Clients who license data sets receive online access and a copy of the data for in-house loading in MS Access format. For further information please see AIFE's powerpoint presentation at [www.aifeonline.com](http://www.aifeonline.com) or contact us directly at [aifedstdata@gmail.com](mailto:aifedstdata@gmail.com).

### DST Interpretation and Hydrodynamics Courses/Mentoring

Mr. Hugh W. Reid, of Calgary has had a lifetime passion for DST's and Hydrodynamics. Mr. Reid is an independent consultant not affiliated with AIFE and can be reached at [hugh@hughwreid.com](mailto:hugh@hughwreid.com) or at [www.hughwreid.com](http://www.hughwreid.com) for additional information and course schedules.

## Land from page 40

any bill designating wilderness land, and federal or environmental protections that might complicate access to resource development getting blocked – the stakeholders involved are ready for a compromise.

Bishop's office has reached out to dozens of diverse interest groups and is working on a plan to swap state and federal lands in several eastern Utah counties, allowing drilling and mining in certain areas to generate revenue for local schools, while also protecting large wilderness tracts and designating areas for tourism development.

Despite the concessions required by all sides, the initiative has won praise from conservation groups, industry interests and

local residents.

The bill is still in development, but Daggett County recently became the first participating county to contribute its finalized plan to the project. Bishop plans to introduce the multi-county bill in Congress in early 2015.

It remains to be seen where this management and ownership debate will go from here – full state takeovers of federal lands are unlikely to come to fruition; the legality of states' claims is debatable, and recent studies, including one from the University of Idaho, have suggested that it could be economically difficult for states to profit from these lands.

However, the process of negotiation and compromise between diverse stakeholders, as exemplified by the Utah Public Lands Initiative, may provide a road map forward that could be replicated in other western states. **E**

## Continued from previous page

### Congress

On July 23, 2014, the House Subcommittee on Coast Guard and Maritime Transportation of the Committee on Transportation and Infrastructure held a hearing to discuss implementing U.S. policy in the Arctic.

Much of the hearing focused on the shortage of U.S. icebreakers: The Coast Guard has two operational icebreakers, while Russia has nearly 40, and other nations have about 40 more.

The size and ice-thickness capability of these vessels varies greatly, so the numbers are not directly equivalent, but the U.S. fleet is probably inadequate – the NSF charters a privately owned ice-capable research vessel for its Arctic and Antarctic research.

The Congressional Research Service estimated in 2012 that a new heavy icebreaker (equivalent to our largest) would cost \$1 billion.

Many Republican legislators support opening the coastal plain (1002 Area) of the Arctic National Wildlife Refuge to oil and gas development, and accelerating oil and gas development in the National Petroleum Reserve-Alaska. Legislation on these topics may pass the new Senate, and pro-drilling legislation frequently passes the House.

Congress, however, is unlikely to be able to overcome a presidential veto.

### Advanced Technology For Energy Development

North of the Arctic Circle are more than 400 oil and gas fields potentially

containing approximately 240 billion barrels of oil and natural gas equivalent. In addition, the U.S. Geological Survey estimates that the Arctic holds 13 percent of the world's undiscovered oil resources and 30 percent of its undiscovered conventional natural gas resources.

The Implementation Plan for The National Strategy for the Arctic Region, which the White House released in January 2014, directs the U.S. Department of the Interior with the Department of Energy (DOE) and the Department of Commerce (National Oceanic and Atmospheric Administration) to take the lead in advancing technology for non-renewable energy, focusing on technologies to reduce the risk and consequences of an oil spill from ships transiting the region or from oil and gas operations.

In support of the DOE effort, the National Petroleum Council, a federally chartered and privately funded committee that advises the secretary of energy, will send the report of its Arctic research study to the secretary in March. The study's key findings were released in December 2014.

These include:

- ▶ Arctic oil and gas resources can contribute significantly to global energy needs over the next several decades.
- ▶ Most of the U.S. Arctic offshore conventional oil resources can be developed using existing field-proven technology.
- ▶ There have been substantial recent technology and regulatory advancements to reduce the risk and consequences of a spill.
- ▶ Development of the Arctic resources requires securing public confidence and using local knowledge. **E**

## McGinley Wins Southwest Section's A.I. Levorsen Award

**T**imothy R. McGinley is the winner of the Southwest Section's A.I. Levorsen Memorial Award, given to the best paper presentation at the Section's annual meeting.

McGinley will be honored at this year's Southwest Section's annual meeting, set April 11-14 in Wichita Falls, Texas.

His award-winning paper was titled "Utilizing Petrophysical Attributes to Optimize Performance of a Horizontal

Drilling Program."

McGinley is a senior petrophysical adviser for Laredo Petroleum.

The A.I. Levorsen Memorial Award was established as a lasting memorial to Sidney Powers Award-winner Arville Irving Levorsen. A plaque is given to the best paper winner at all AAPG Section meetings, with particular emphasis placed on creative thinking toward new ideas in exploration. **E**

# REGISTRATION NOW OPEN



**AAPG**  
Latin America Region

Geosciences Technology  
Workshops 2015

Co-hosted with Asociación Argentina  
de Geólogos y Geofísicos Petroleros



## GTW Argentina

### Extending Mature Fields' Life Cycles: The Role of New Technologies and Integrated Strategies

11-12 May 2015  
Buenos Aires, Argentina

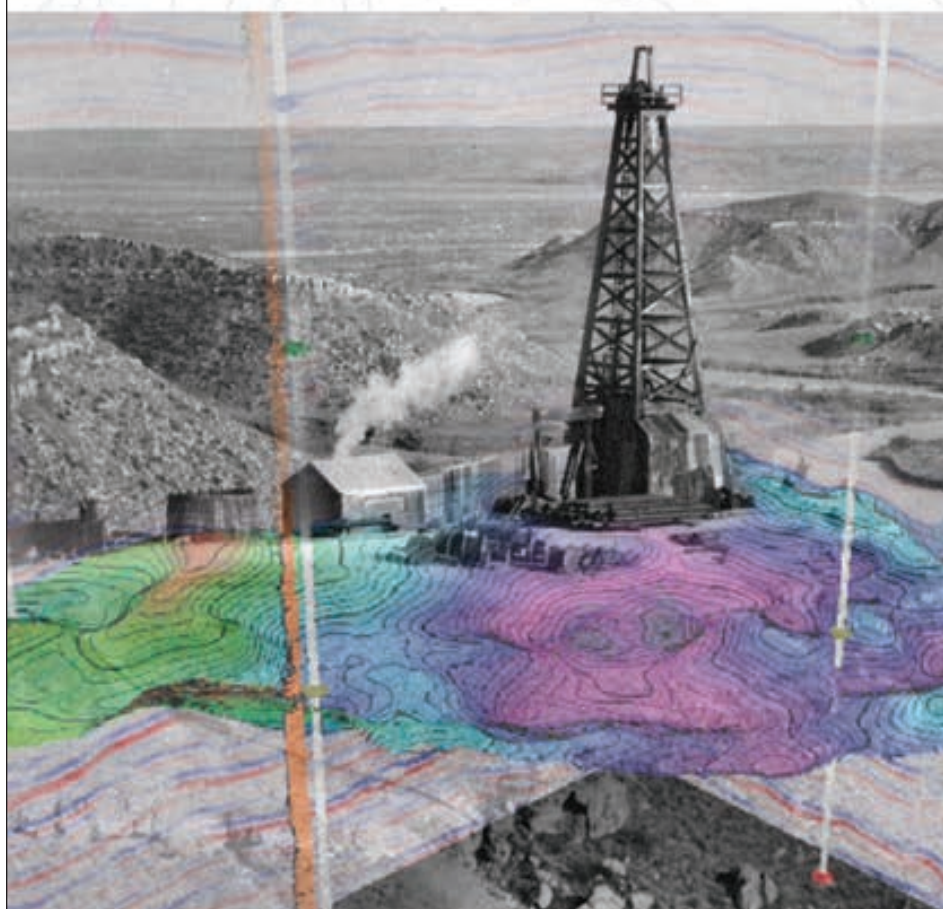
Sheraton Buenos Aires Hotel and Convention Center

#### Preliminary Session Themes:

- Integrated Field Management
- Optimizing Operations and Maintenance
- New Technologies for Secondary Recovery
- New Technologies for Enhanced Oil Recovery

#### Sponsorship opportunities available!

For more information, contact:  
[latinamerica@aapg.org](mailto:latinamerica@aapg.org)



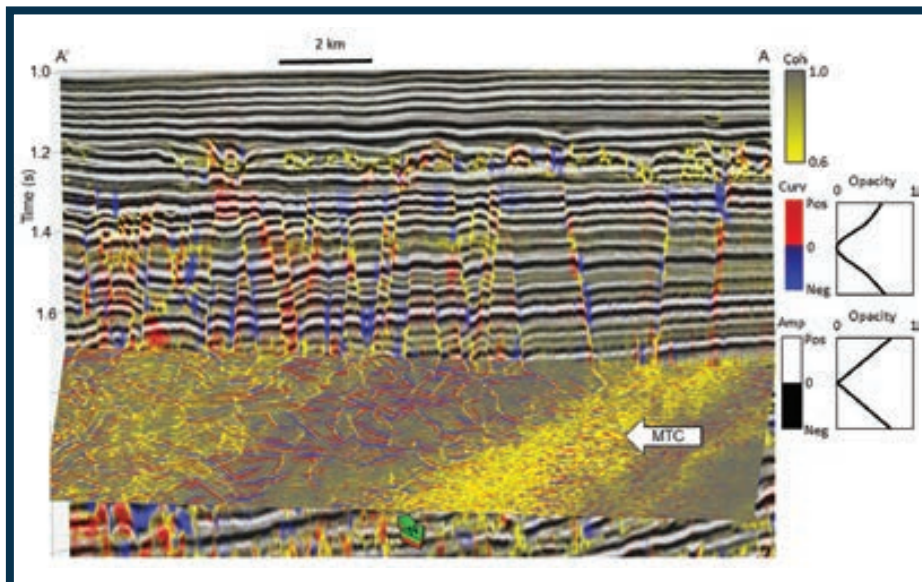


Figure 1 – View from the north of vertical slice AA' and time slice at  $t=1.650$  s through coherence (as the background attribute), co-rendered with most-positive and most-negative principal curvatures,  $k_1$  and  $k_2$ . Seismic amplitude is further co-rendered on the vertical axis. Note that in some areas, the faults are clearly delineated as a discrete discontinuity, and appear as yellow. A blue most-negative curvature anomaly often occurs on the hanging wall, juxtaposed to a red most-positive curvature anomaly on the footwall, indicating conjugate faulting about the main fault. Note the bracketed red-yellow-blue pattern about many of the faults. The low coherence zone in yellow indicates a mass transport complex (MTC). Data courtesy of NZPM.

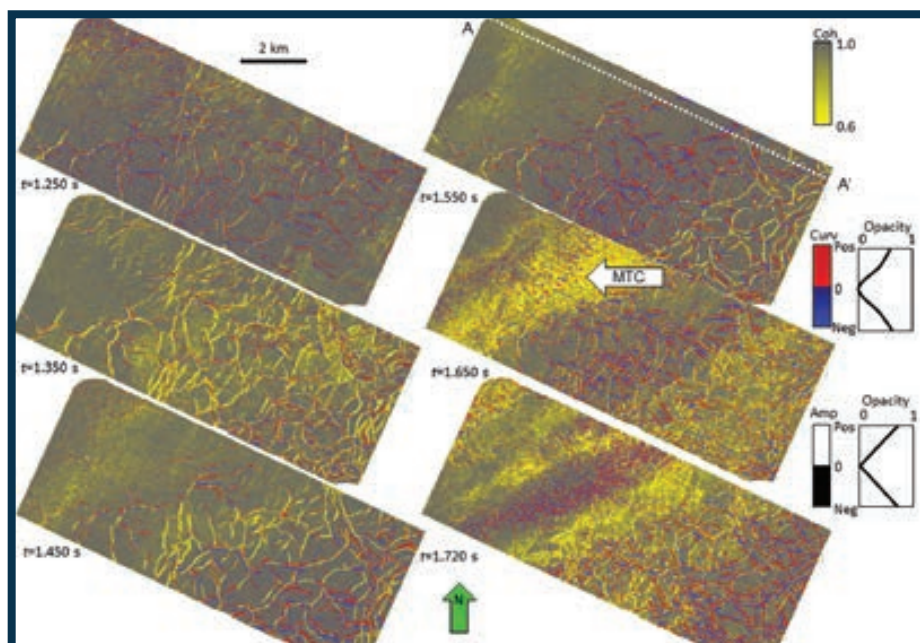


Figure 2 – Time slice at approximately equal intervals through coherence, co-rendered with most-positive and most-negative principal curvatures,  $k_1$  and  $k_2$ . Note how the appearance of the polygonal faults changes as we cut through different lithologies. At  $t=1.350$  s, the faults are best delineated using coherence, while at  $t=1.550$  s they are better delineated by curvature in the central part of the survey. We hypothesize – but without well control, do not at present know – that this variation is a function of the lithology, with faults through brittle rocks being seen better on coherence and more ductile rocks on curvature.

# Fault Finding? Access to 3-D Data Always Helps

By ESTHER ALI, EMMA GIBBONS, JUAN MARTINEZ-MUNOZ, KARL SCHLEICHER, DENNIS COOKE and KURT MARFURT

Access to modern 3-D seismic data is critical to educating the next generation of sedimentologists, stratigraphers, structural geologists and geophysicists who envision a career in the petroleum industry. While suffering from limits to vertical and lateral resolution, 3-D seismic volumes generate a more complete image of the subsurface than 2-D outcrops of limited vertical and lateral extent.

At the graduate level, geoscience students are calibrating seismic data with outcrop analogues, putting them within a depositional, diagenetic or tectonic framework and developing new workflows based on new seismic attributes, clustering and 3-D visualization.

Until recently, there have been very few seismic data volumes available for student education and research. There are several small data volumes acquired with U.S. government funding (Stratton Field, Teapot Dome, Waha) and few larger data volumes that have been released from the Netherlands (F3) and Norway (Gulfaks).

Working with individual operators and service companies, students at the University of Oklahoma have had access to a fairly rich assortment of proprietary 3-D land seismic surveys licensed for a specific project. Other universities without such relationships face a greater challenge.

For all of us, data licenses to deepwater surveys are even more problematic, with the data being owned either by multiple partners or acquired as a spec survey where the goal is to sell the data as often as possible.

Access to petroleum exploration data, however, is more open in Australia and New Zealand, where seismic and well



ALI



GIBBONS



MARTINEZ-MUNOZ



SCHLEICHER



COOKE



MARFURT

data are released to the public after a few years. New Zealand Petroleum and Minerals (NZPM) is the governmental agency in New Zealand responsible for data compilation and release.

Karl Schleicher and AAPG member Dennis Cooke have worked with NZPM and the SEG to place some 3-D seismic volumes from the Taranaki, Great South and Canterbury basins in an SEG-sponsored public repository for use by

universities and the research community at large. These volumes contain spectacular images of turbidites, mass transport complexes, syneresis and volcanic intrusives.

In this article we focus on the seismic expression of polygonal faulting seen in NZPM's Waka 3-D Great South Basin survey, used by the first three authors as a final project in a 3-D seismic interpretation class.

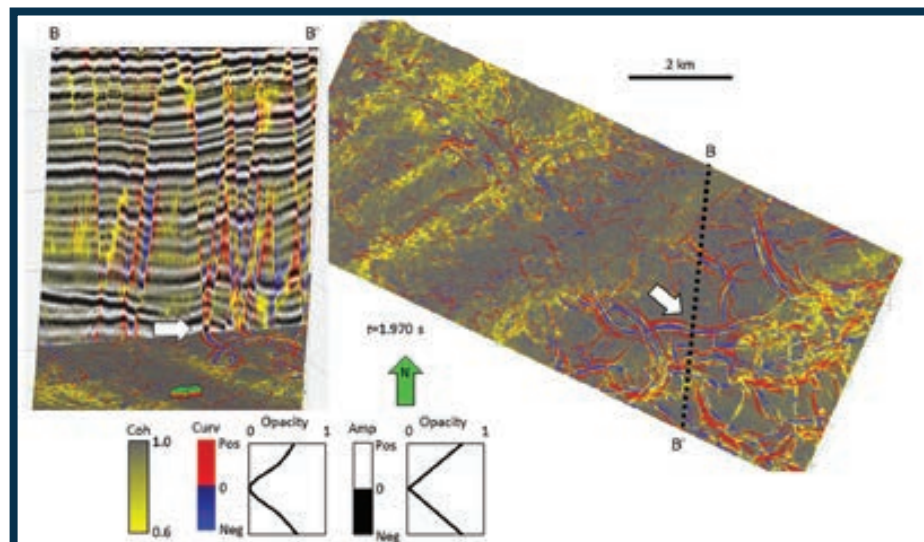


Figure 3 – (Left) View from the north of vertical slice AA' and time slice at  $t=1.970$  s through coherence co-rendered with most-positive and most-negative principal curvatures,  $k_1$  and  $k_2$ . (Right) Same time slice shown in 2-D perspective. White arrows indicate a thin graben (in blue) that is separated by two faults (in yellow), which separate it from adjoining horsts (in red). The curvature-coherence relationship seen in the shallower images allows one to interpret less well-resolved features at this level with confidence.

Polygonal faulting is common in many surveys and has been well documented in a recent AAPG BULLETIN paper by Jackson et al. on a deepwater North Sea survey.

In general, tectonically generated polygonal faulting will be through-going, while syneresis (less accurately called "shale dewatering") shows similar patterns that are constrained to fall within discrete shale formations.

Interpreters routinely use coherence to map faults on time slices and seismic amplitude on vertical slices. Here, we show the value of using multi-attribute display to better quantify the seismic expression of such faults.

Edges are best seen using a monochromatic color bar, with a simple gray scale being the most popular means to display coherence. While a gray scale works well when displayed on top of seismic amplitude using a red-white-blue color bar, it works poorly when displayed on top of seismic amplitude using black-gray-white color bar.

For this reason, we've chosen the monochrome yellow-to-gray color bar shown in figure 1 to display coherence as the "background" attribute.

Next we co-render most-positive and most-negative curvature using the binary red and blue color bar, and show the amplitude of the anomaly through the use of opacity, with a curvature value of zero (planar features) being rendered as transparent.

Finally, on the vertical slice we display seismic amplitude using a binary black and white color bar. Again, using opacity, we set zero values of amplitude to be transparent, and high positive (white) and high negative (black) values of amplitude

Continued on next page

Continued from previous page

to be more opaque.

In general, synclinal features in figure 1 appear as blue and anticlinal features as red, though we need to remember that curvature is a 3-D measure, and a synclinal expression in this vertical slice may be anticlinal in the perpendicular direction.

For this reason, on the footwall side of many of the faults we observe a red positive curvature anomaly, while on the hanging wall side we observe a blue negative curvature anomaly.

The faults in this vertical slice have a distinct offset, giving rise to a yellow coherence anomaly – suggesting the rock is relatively brittle. A very common pattern then is red-yellow-blue, with the curvature anomalies bracketing the coherence anomaly.

Qualitatively, curvature provides a measure of the width of the damage zone. The broad yellow low coherence anomaly seen on the time slice corresponds to a mass transport complex (MTC), which are quite common in the NZPM surveys.

\* \* \*

Given this mental calibration, we turn to figure 2, which shows a suite of time slices, beginning relatively shallow at  $t=1.250$  s and increasing at 0.5 s intervals, with the exception of the last image at  $t=1.720$  s.

The time slice of figure 1 at  $t=1.650$  with the MTC is repeated in these images, but now oriented from south to north. The water bottom is at about  $t=0.800$  s.

Note the change is fault expression at the different time slices. At  $t=1.250$  s, we note the red-yellow-blue pattern seen on the previous vertical slices. However, at  $t=1.350$  s, most of the faults give rise to a strong coherence anomaly, with little curvature expression.

We suspect the lithology at this level is more brittle.

In contrast, near the center of the slice at  $t=1.550$  s, we see primarily curvature anomalies in red and blue, with fewer coherence anomalies, suggesting the lithology may be more ductile.

As we progress further down section to  $t=1.720$  s, we see a change in the size of the polygonal faulting, with smaller polygons seen in the west-central part of the survey and larger polygons in the southeast part of the survey.

At present, we do not know why this change occurs.

\* \* \*

As in most surveys, we lose spectral resolution as we go deeper.

In figure 3, we show a time slice at  $t=1.970$  s. The somewhat “wormy” pattern seen on the time slice indicated by the white block arrow of red-yellow-blue-yellow-red appears “artificial.” However, closer inspection of the vertical slice cutting it (left image in figure 3) shows that it is a small graben, separated by adjacent horst blocks by (yellow) faults.

The worminess of the fault pattern may be real; however, one must also consider the cumulative effects of fault-shadow velocity pull up and push down in the overburden.


\* \* \*

This work is highly preliminary, with the exercises done as a class project by first-time seismic interpreters.

Our interpretation may be full of faults

– however, we think the reader will agree that we have no fault with NZMP for providing us at OU and other universities around the world, access to their data.

We thank the New Zealand Petroleum and Minerals (NZPM) for providing data.

*(Editor's note: Esther Ali and Emma Gibbon, are geology graduate students and Juan Martinez-Munoz is an undergraduate geology student, all at the University of Oklahoma; Karl Schleicher is with the University of Texas at Austin, John A. and Katherine G. Jackson School of Geosciences, Bureau of Economic Geology; Dennis Cooke is with the University of Adelaide and ZDAC Geophysical Technologies, Glen Osmond, Australia; and Kurt Marfurt is with the University of Oklahoma, Norman, Okla. Ali, Cooke and Marfurt are AAPG members.)* 

## Securing Well Data From New Zealand

The New Zealand government collects seismic and well data and releases it to the public after a data confidentiality period of a few years. The purpose of releasing these data to the public is to promote development of New Zealand's petroleum and mineral resources.

These data can be used by students, academics and industry – provided publications and presentations acknowledge New Zealand Petroleum and Minerals for providing data.

▶ The New Zealand GNS website, <http://www.gns.cri.nz/>, provides excellent regional geologic studies and maps.

▶ Seismic and well data acquired

by petroleum explorers and producers is released to the public at <https://data.nzpam.govt.nz/GOLD/system/mainframe.asp>.


Both websites require that users create a login ID. One can download reports and well data directly from these sites – however, there is a cost associated with obtaining large 3-D seismic volumes, which are shipped by post.

The SEG's online committee is experimenting with free distribution of several surveys from [http://wiki.seg.org/wiki/Open\\_data#New\\_Zealand\\_3D](http://wiki.seg.org/wiki/Open_data#New_Zealand_3D).

Send questions and comments to [open.source.geoscience@gmail.com](mailto:open.source.geoscience@gmail.com).

– The Authors

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




Tim has cabin fever.

EXCELLENCE FROM THE GROUND UP™

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

SURFACE LOGGING SYSTEMS  
[www.weatherford.com/surfacelogging](http://www.weatherford.com/surfacelogging)  
[mudlogging.services@weatherford.com](mailto:mudlogging.services@weatherford.com)



*Optimism deferred*

# Oil Price Slams Beleaguered TMS Play

By LOUISE S. DURHAM, EXPLORER Correspondent

Following many years of on again/off again activity, the Tuscaloosa Marine Shale (TMS) was, at long last, being proven in recent months to be a viable commercial play.

The Cretaceous-age TMS, which occurs across central Louisiana and into southwestern Mississippi, is age-equivalent to the Eagle Ford formation in Texas.

While the Eagle Ford play has been a kind of bonanza for the shale operators, the TMS has presented more than its share of issues to overcome with regard to cost, drilling and production. In turn, this impacts the bottom line for operators, who recently have incurred about \$100,000 well-per-day drilling cost.

AAPG member Kirk Barrell, president of prospect-generator Amelia Resources in The Woodlands, Texas, has 24 years of experience in the famed Tuscaloosa natural gas trend.

"I'm as optimistic as I've ever been," he noted in August last year about the TMS.

That was then.

Since that time, the operators' world has done a 180-degree spin owing to the unanticipated, near-devastating drop in oil prices.

### Arrested Development

Among other altered plans, new activity has been squelched in some plays, particularly shales, where break-even oil



BARRELL

**"We were getting progress in the play, but this price will have a severe impact."**

prices vary widely.

The TMS requires hefty budgets.

"From a philosophical, but not economical, standpoint, I'd say \$90 is the threshold that many feel the play needs to continue the activity it was getting," Barrell said.

"This was such bad timing because we were seeing great results, like 1,100 to 1,500 barrel-per-day wells," he noted. "Operators were drilling faster, and we were seeing some consistencies.

"We were getting progress in the play, but this price will have a severe impact," he said.

Given that seven billion barrels have been estimated to await recovery from the TMS via the drill bit, this is a bad day, indeed.

Among other operators, Halcon Resources has moved its rigs out.

Barrell noted in mid-January that Goodrich Petroleum still had two rigs running in the play. Even without new drills

he doesn't see operators abandoning the area despite the exodus of rigs.

For now, the action is focused in part on planning and implementing fracturing operations.

A key variable as to the near future centers on the acreage that will be up for extension, according to Barrell. The companies that paid \$250 to \$300 (per acre) to get in will have to pay the same for a two-year extension.

"Most operators we see are paying those fees," he said. "The cards will lay down this year to see who is really committed long term."

When asked whether an upcoming TMS confab in New Orleans where he was scheduled to speak was still a go, he replied: "No better place to sulk than New Orleans."

Among the companies assuming a lower profile in the play, Comstock Resources announced recently that it had released its rig in the TMS and will

postpone its drilling activity there until oil prices improve.

### Greener Pastures?

The announcement revealed an unexpected twist coming on the heels of the TMS activity downturn.

Comstock stated that it would move two rigs from its Eagle Ford oil-rich shale properties to north Louisiana to begin a drilling program on its Haynesville shale natural gas properties.

This likely shocked many industry shale players.

The Haynesville play rose to prominence around 2008 and quickly became an industry darling.

Typical of the cyclic nature of this business, natural gas prices eventually cratered and gas soon became so yesterday.

The Haynesville morphed into a has-been of sorts as the players scurried to other locales to latch onto shale oil acreage, which harbored the potential to bring in the big bucks as oil prices began their ascent into the stratosphere.

According to Comstock, improved completion technology, including longer laterals, will provide strong returns on drilling projects in the Haynesville at current natural gas prices.

Remember, the industry has suffered whiplash before – and survived.



## THE ART OF DISCOVERY

October 4-6, 2015  
Hyatt Regency Downtown Tulsa

Abstracts for MCS-AAPG 2015 may be submitted for either oral or poster presentation on any of the topics listed below, in keeping with the Meeting's theme:

**MID-CONTINENT RESOURCE PLAYS:  
GEOLOGIC CONTROLS & PRODUCTION**

**CLASTIC RESERVOIRS OF  
THE MID-CONTINENT**

**GEOPHYSICAL METHODS IN  
EXPLORATION & PRODUCTION**

**DRILLING & PRODUCTION  
TECHNOLOGY IMPLEMENTATION**

**PRE-MISSISSIPPIAN PETROLEUM  
POTENTIAL IN THE MID-CONTINENT**

**EXPLORATION & PRODUCTION  
IN MISSISSIPPIAN RESERVOIRS**

Abstracts must be limited to 250 words. All papers and posters will be judged, with awards given in four categories: best professional paper and poster, and best student paper and poster. Go to <http://aapgmc.org/section-meetings/2015> to begin the submission process. NEW DEADLINE : FEB. 27.

**HYDROCARBON GENERATION  
& MIGRATION IN THE MID-CONTINENT**

**MID-CONTINENT EARTHQUAKES:  
INDUCED OR NATURALLY OCCURRING?**

**GEOSTEERING OF HORIZONTAL WELLS**

**THE BUSINESS OF OIL & GAS  
EXPLORATION & PRODUCTION**

**PETROLEUM PRODUCTION IN THE  
SOUTHERN MID-CONTINENT**

Questions? Contact Technical Program Co-Chairs Chris Carson ([ccarson@casillaspetra.com](mailto:ccarson@casillaspetra.com)) or John Mitchell ([mtgeologist@yahoo.com](mailto:mtgeologist@yahoo.com)).

*'For over 110 years explorers of the Mid-Continent Oil Province have continued to pioneer the discoveries that have shaped our industry worldwide. From plane table alidade surveys to pore volume images defining shale as reservoir, today's geoscientist must integrate cutting-edge technology with historical data and continue to innovate. It is through visualization, communication and collaboration that today's geoscientist can open industry's mind and lead to the next big thing. The 2015 AAPG-MCS aspires to inspire the modern geoscientist to pursue THE ART OF DISCOVERY.'*

– Shane Matson, General Chair & Chris Carson, Technical Program Co-Chair

**CALL FOR PAPERS AND POSTERS**  
AAPG Mid-Continent Meeting 2015

**SUBMISSION DEADLINE EXTENDED TO  
FEBRUARY 27, 2015!**

**PROTRACKS**

# Eastern Section annual meeting YPs: Resolve to Get Involved

By MEREDITH FABER, Young Professionals Committee Co-Chair

After sponsoring several successful networking events over the years, the Young Professionals (YP) Committee has a pretty good idea of what draws a crowd.

Now, thanks to AAPG Eastern Section YP Lead Merril Stypula, we can add bowling to that list.

It happened at the Eastern Section's annual meeting last fall in London, Canada, when about 35 meeting participants representing a combination of students, YPs and experienced professionals gathered at Palasad, an ultra-chic bowling alley, for the YP Meet and Greet.

Attendees enjoyed refreshments, played pool and tried their luck out on the lanes. A highlight of the evening was the gift card raffle where five lucky winners were selected.

Importantly, participants also had the opportunity to mingle and talk with a number of geoscientists in various stages of their careers, including AAPG President-Elect John Hogg.

"He was very impressed with our effort," Stypula said. "It was great for him to see how the AAPG YPs are trying to evolve and grow. He really appreciated being included in our event, and I think he was a great addition to the overall mix of attendees."

Following the success of the London Meet and Greet, Stypula shared the YP perspective on the future of AAPG with the Eastern Section Council. Like many groups within AAPG, the council is

eager to see increased YP involvement at both the Section-level and within the Association globally.

Council suggestions like recruiting YP members to co-chair Eastern Section committees already align with the goal of the YP Committee to see more YPs in AAPG leadership roles.

However, critical to achieving this goal is establishing a community of engaged YPs.

"Simply agreeing to show up to an event is not enough,"

Stypula said. "We need people to commit to taking on responsibility."

While Stypula and her colleagues in Pittsburgh have begun brainstorming ideas for future events in the Eastern Section, the YP Committee urges everyone to "Resolve to Get Involved" in 2015. The committee is looking for enthusiastic individuals to help grow YP communities, encourage AAPG involvement and support the future of AAPG in the Regions and Sections.

It's easy to become part of the team – just contact your Region or Section YP lead. You can learn about them on the Young Professionals Committee's Web page on [aapg.org](http://aapg.org), and their contact information is in the online AAPG membership directory.

(Don't forget to indicate your city or geographic area.)

With your help, we can bring YP events to major cities, meetings and conferences around the world. Join the community today and be a part of something great.

"Resolve to get involved!" 



FABER

**PROFESSIONAL news BRIEFS**

**Michael T. Gibson**, to vice president-geophysics, Dunn Exploration Company, Houston. Previously geophysical adviser, Fieldwood Energy, Houston.

**Matthew Koehler**, to exploration and development manager, BlackBrush Oil & Gas, San Antonio. Previously senior geologist, BlackBrush Oil & Gas, San Antonio.

**Thomas B. Layman**, to vice president-geoscience, Parsley Energy, Austin, Texas. Previously vice president exploration-southern division, Chesapeake Energy, Oklahoma City.

**Joe McGovern**, to directional drilling manager, BlackBrush Oil & Gas, San Antonio. Previously geologist, BlackBrush Oil & Gas, San Antonio.

**Alexei Milkov**, to exploration manager-new ventures, Murphy Oil, Houston. Previously senior

manager-exploration technical, Sasol, Johannesburg, South Africa.

**Mark A. Norville**, to chief operating officer, BlackBrush Oil & Gas, San Antonio. Previously vice president exploration and development, BlackBrush Oil & Gas, San Antonio.

**Matt Williams**, to director of exploration-western United States, Southwestern Energy, Houston. Previously geoscience manager-Appalachia, Southwestern Energy, Houston.

*(Editor's note: "Professional News Briefs" includes items about members' career moves and the honors they receive. To be included, please send information in the above format to Professional News Briefs, c/o AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101; or fax, 918-560-2636; or e-mail, [smoore@aapg.org](mailto:smoore@aapg.org); or submit directly from the AAPG website, [www.aapg.org/explorer/pnb\\_forms.cfm](http://www.aapg.org/explorer/pnb_forms.cfm).)*

**IN MEMORY**

**Paulo de Tarso Araripe**, 75  
Rio de Janeiro, Brazil  
Nov. 27, 2014

**Ross E. Brannian**, 89  
Irving, Texas, Nov. 28, 2014

**Donald Dodge Jr.**, 89  
Bozeman, Mont., Oct. 17, 2012

**Gordon L. Dolton**, 85  
Grand Rapids, Mich.  
Sept. 16, 2014

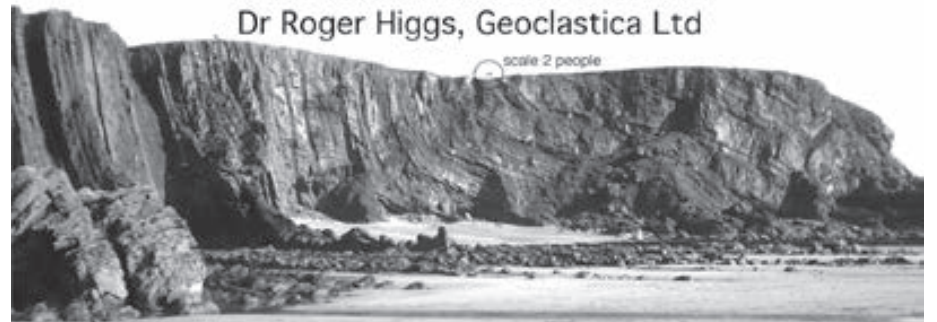
**Charles O. Frederick**, 58  
New York City, June 20, 2014

**Joseph A. Rayzor**, 84  
Brenham, Texas, Sept. 19, 2014

**Robert Womack Jr.**, 97  
Madison, Miss., Dec. 23, 2014

*(Editor's note: "In Memory" listings are based on information received from the AAPG membership department.)*

## CLASTIC PETROLEUM SEDIMENTOLOGY COURSES BUDE, CORNWALL, UK 2015 Dr Roger Higgs, Geoclastica Ltd



Course dates: Apr 20-24, Jun 1-5, Sep 21-25, Nov 16-20, Mon-Fri, Tuition £500  
Lectures on clastic environments & facies. Practical sessions involving walks to cliffs exposing Bude Formation Carboniferous turbidites in exquisite wave-polished detail  
Lecture venue: Brendon Arms [www.brendonarms.co.uk](http://www.brendonarms.co.uk)  
Book early to secure a room (9 available; preferred rates)  
Details: [www.geoclastica.com](http://www.geoclastica.com) [rogerhiggs@geoclastica.com](mailto:rogerhiggs@geoclastica.com) tel 44 (0)7880 515748



### Need Deepwater Databases?

<b>Fields/Reservoirs DB</b>	<b>Outcrops DB</b>
• Over 1240 Deepwater fields and reservoirs from 87 basins in 46 countries	• Over 3140 Architectural Elements from 137 outcrops in 22 countries
• Fully Searchable • Monthly, Single or Corporate Licenses	
<p>Details: <a href="http://www.cosseygeo.com">www.cosseygeo.com</a> or email: <a href="mailto:cosseygeo@aol.com">cosseygeo@aol.com</a> or call +1 (970) 385 4800</p>	
• We can also perform analogue searches for you!!	

## COMPARTMENTS, SATURATIONS, AND PERMEABILITY



### GEO2FLOW WORKSHOP USING YOUR DATA

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

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

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

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

*'Recruit, recruit, then retain, retain ...'*

# Community Colleges Should Recruit Geo Majors

By BARRY FRIEDMAN, EXPLORER Correspondent

**R**obert Gray is a man on a mission. Gray, an AAPG Grover E. Murray Distinguished Geology Educator Award winner in 2014, said he is tired of lower-level geologic study at community and city college levels being treated like the Rodney Dangerfield of academia.

"We're all well aware," this professor of earth science at Santa Barbara City College said, "that large major 'research' universities require the tenured geologic professors to focus on research with the aid of graduate geo-majors (who get financial assistance from the research work)."

What they miss, he wants you to know, is often the student.

"Without the threat of Publish or Perish," Gray said of SBCC – but he includes other city and community colleges as well – "we can focus more on the freshman and sophomore students. We have time to counsel them more thoroughly and to push them out to the university of their choice."

"Our whole geology program is centered around 'geology in the field.'"

## Ahead of the Curve

It's a case of quality and quantity – and it works not only for students, but also, ultimately, for the industry.

"Over the years I have received emails and, in the past, letters from our geo-majors who have gone on to universities extolling their achievements at the junior and senior



GRAY

**"There is more flexibility to mix and match classes at a community college than at the university in this early-going stage."**

level, because they were way ahead of their classmates who had taken the freshman and sophomore courses at the university."

And here Gray makes a bold claim.

"I'm not sure that the universities really care about the freshman/sophomore classes."

An overstatement, maybe, but in those letters and emails, Gray said, his graduates are thankful for not only the kind of courses they took at SBCC, but the environment at the school as well.

"They feel that they are better equipped and more focused than their similar geo-majors who came up through the university program."

This nurturing process, though, begins even before the student gets to college – any college.

Gray said that very few geology majors are born that way and the courses that might excite them have much to be desired.

"Many earth sciences courses at the high school level are perceived as 'easy' natural sciences courses for the non-natural

scientists majors," he said.

This continues in what he calls the "rocks for jocks" courses in high schools, which are an easy-out for students who need to take a natural science course.

"Unfortunately, high school counselors often promote the earth sciences courses for less-academically inclined students," he said.

The problem is exacerbated once the student enters college.

"The geoscience programs at some of the most prestigious major universities focus almost entirely on the graduate geology programs," he said. "Little interest is shown in recruiting freshman geology students."

## Fixing the Pipeline

Which is where, he believes, the community college can excel, where this recruitment and encouragement can take form. He believes the success of a community college program should

be measured in attracting geo-majors. This way, there will be a link to either an upper-division geology program at a four-year university or to a geo-technician program leading to work in industry.

"In our case (at Santa Barbara Community College), we had both going from 1975 to 1987 until the petroleum industry in Ventura, California collapsed."

He feels it behooves a) community college geology professors to focus on such recruitment, and b) the industry and associations like AAPG to recognize and encourage those efforts.

"So I'm only asking that AAPG or any other geology organization occasionally include the community colleges for their role in recruiting geology majors," he said.

"I really think that many major universities never explain that some or perhaps many of their geo-majors came through the community colleges."

In conclusion, he said, community colleges that have good geo-majors programs are a better place to get early training for students than bigger schools.

"There is more flexibility to mix and match classes at a community college than at the university in this early-going stage."

His goal, he reiterates, is not to knock what's going on at the bigger schools, especially when it comes to research,

**See Flexibility, page 52**

## Third Annual Mississippian Lime Forum

February 19, 2015 – Oklahoma City, Oklahoma

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

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

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

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

Don't miss this "must attend" event!  
[aapg.to/mississippianLime2015](http://aapg.to/mississippianLime2015)



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

## Reserves Forum: Reserve and Resource Assessment Challenges

26-27 February 2015 - Houston, Texas

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

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

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

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

Reserve your seat today!  
[aapg.to/reservesForum2015](http://aapg.to/reservesForum2015)





## Call for abstracts

# IPTC Set For Qatar

By DAVID BLANCHARD, President-AAPG Africa Region

Abstracts are now being sought for the ninth annual International Petroleum Technology Conference (IPTC), to be held Dec. 6-9 in Doha, Qatar.

And if you want to participate, the time to act is now: The deadline for submitting abstracts is Feb. 28.

IPTC, co-hosted and sponsored by AAPG, EAGE, SEG and SPE, is a unique collaboration that provides an exceptional balance of technical talks, poster sessions, exhibitors and, significantly, panel sessions that provide real-time dialogue with delegate participation.

We all know that disseminating and sharing geoscience and technology information is critical to advancing our knowledge – and conferences and exhibitions play a major role in that process.

Conferences, by providing a forum for geoscientists to share their work and interact directly with colleagues, peers and mentors, are critical for advancing and encouraging the spread of innovative research and ideas.

That's the intent of the still-relatively new IPTC.

In existence since 2005, IPTC's intent always has been to provide a forum for the international oil and gas community to share a broad range of technical advances and topics that are not always discussed and debated at regional meetings or even annual conventions.

IPTC is registered and incorporated as a company in Hong Kong to facilitate operating and governance of the four societies and provides a focused business approach to managing the events.

It has evolved from a bi-annual event to an annual one, with the venues that have included the Malaysian capital, Kuala Lumpur; Beijing, China; Dubai, UAE; Bangkok, Thailand; and the first venue, Doha, Qatar.

As an international event, the four societies wanted to keep the focus and momentum in the Middle East, Africa, Asia and Eurasia tectonic plates and provide diverse locations for delegates to share information and ideas and to network with the global energy community.

### The Gathering in Qatar

Qatar once again will provide the setting this December for this year's ninth annual conference, selected largely for its prominent role in gas production and advanced technology, for its location in the heart of the world's most prolific hydrocarbon region and, in no small measure, for the hospitality of the Qatari people.

Doha, the nation's capital, boasts 165 hotels – many located on the warm blue waters of the Gulf, where white sandy beaches provide a haven for weary travelers and jet-lagged conference participants.

Qatar enjoys an enviable, if not unique, position in the energy world: Imagine a single gas field some 900-plus TCF in size – and then picture a country the size of Connecticut, or three times smaller than Belgium, perched in the middle of a vast blue lagoon fast becoming a 21st century global player not only in energy but in commerce, banking, tourism, art and the fast paced world of sports.

That's Qatar, where 15 percent of the

world's gas reserves meet a people with a heritage stretching back more than 5,000 years.

Qatar's gas reserves are the second largest in the world, and the Al Shamal (North Dome) field is the world's largest natural gas accumulation. Massive undertakings such as Shell's LNG and 150,000 barrel per day GTL projects are thrusting this kingdom into the forefront of energy technology.

In addition, Qatar is totally committed to

See IPTC, page 53



Last year's opening ceremony in Doha

# CALL FOR PAPERS

➤ Submission deadline:  
**1 June 2015**

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



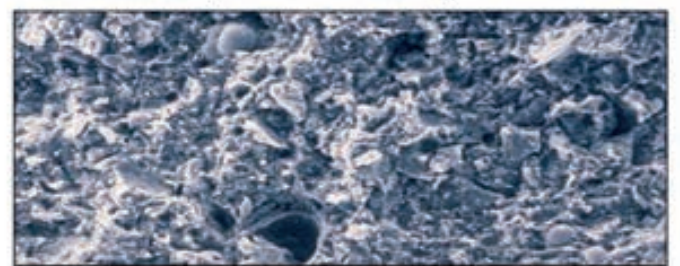
## Pore pressure

The editors of *Interpretation* invite papers on the topic of **Pore pressure** for publication in the February 2016 special section of *Interpretation*. Knowledge of pore pressure informs both tactical and strategic aspects of the exploration process. Tactically, pre-drill prediction of pore pressure allows for more effective, less expensive drilling operations by identifying critical risks, and real-time detection of pore pressure allows for safer well management. Strategically, the value of pore pressure lies in the ability to predict reasonable ranges of column heights and to infer likely hydrocarbon seals. In addition, the uncertainty in pore pressure prediction depends on the input data quality and the manner in which geological information is incorporated into the pre-drill prediction and real-time monitoring workflow. Increasingly, pore pressure estimates are high-visibility efforts which require the latest and greatest in multi-disciplinary interpretative tools.

Contributions are invited on interpretation across the broad spectrum of "pore pressure-applicable geosciences" – geology, geophysics, geomechanics, clay mineralogy, sequence stratigraphy, petrophysics, core analysis, geochemistry, real-time wellbore, and drilling monitoring, etc. – as these are applied in the analysis of overpressure for informing drilling practices and hydrocarbon seal analysis.

We are seeking submissions on related topics, including:

- case histories of challenging well pore pressure interpretations and lessons learnt
- best practices for pre-drill pressure prediction and real-time pressure monitoring
- impact of pre-drill and post-drill pressure prediction/detection on recognition of regional or local hydrocarbon seals
- new approaches for quantitative pressure prediction, either from novel input (e.g. acoustic impedance, Vs, Vc, Vp/Vs, seismic or resistivity anisotropy parameters, etc.) or new transforms or processing (e.g. attributes, inversions, etc.)
- reduce uncertainty on pore pressure: pre-drill and ahead of the bit during real-time monitoring



Scanning electron micrograph of clays in the Gulf of Mexico. Image courtesy Daniel Ebrom.

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

The submissions will be processed according to the following timeline:

Submission deadline:

**1 June 2015**

Publication of issue:

**February 2016**

Special section editors:

**Dan Ebrom**  
daeb@statoil.com

**Huyen Bui**  
buileanhjp2@yahoo.com

**Fernando Ziegler**  
fernando.ziegler@gmail.com

# Foundation Library Brings 21st Century Value

By KAREN PIQUNE, AAPG Foundation Energy Library

If you feel the world of information is going faster and faster these days, you're absolutely correct. There is no doubt that knowledge is increasing at breakneck speed.

Many of you may recall that neo-futuristic thinker Buckminster Fuller created the "Knowledge Doubling Curve" in the early 1980s, which basically states that until 1900 human knowledge doubled every century – but by the end of World War II it was doubling every 25 years.



PIQUNE

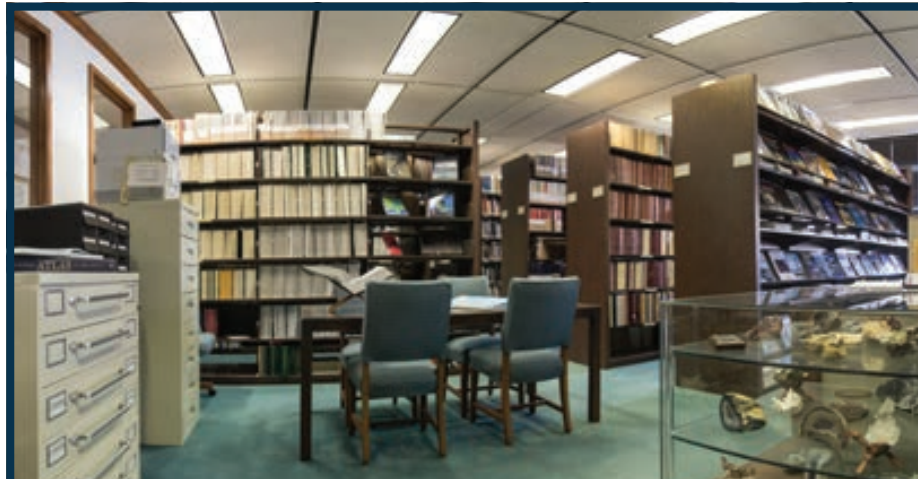
Today, information increase is on an exponential curve and it is thought to be doubling every 13 months.

And if you think that's fast, consider this: According to IBM, if you factor in faster computing and storage, combined with the Internet, human knowledge will soon double every 12 hours.

Granted, not all avenues of knowledge are growing at the same rate, and geology may be a bit slower than say, nanotechnology. And geological literature has archival value – its great staying power is much greater than in some other sciences.

In fact, it is not unusual for a request to come to our library for articles from the 1920s, '30s, '40s and so on.

The point is, there is no way the AAPG



The Foundation Library at AAPG headquarters.

library can store physically on its shelves all the potential literature that a petroleum geologist might need – we have to be selective about actual materials.

And yet that helps prove the point: the AAPG Foundation Energy Resource Library, even in an age of accelerating knowledge and limited square footage, remains a treasure trove of geoscience data and information.

### Data to Share

Don't think that we undervalue our hardcopy collection. This is truly of great use and backup to the digital realm; but one of the fastest growing areas of the library is its media cabinet, which houses

CD-ROMs and DVDs. Some of these have no hardcopy equivalent.

Indeed, digital databases and journal archives are the saving grace of today's libraries.

Many of you certainly are acquainted with and are using AAPG Datapages Archives, which we routinely search to handle many requests.

But beyond the AAPG Archives are many databases of related societies and trade publishers – many geologists simply do not have the time or desire to search out these databases, and this is where the AAPG library can help.

Just give us an idea of what you need and let us do the rest.

Be aware: Most databases offer free

Karen Piqune (pronounced pic-a-new) has a bachelor's degree in geology from the University of Tulsa and master's in library and information studies from the University of Oklahoma. She worked as an exploration geologist for four years before being hired by AAPG in 1985.

"So with my geological background, I speak our members' language," she said.

"I'm married to a longtime petroleum geologist and many of our vacations center around visiting geological sites and collecting rocks," she added.

searching, but once documents are located you may need to use a pay-per-view option to purchase the document. Some fees may be involved.

For other requests we may direct you to a different, perhaps more appropriate place – or send them links to documents.

In short, don't hesitate to call when you need some hard-to-find data or other information. We have the resources, and we're ready to help.

The library is open from 12:30-5 p.m. Monday -Thursday, and 12:30-4:30 p.m. on Friday (CST).

For more information, take a moment to explore the library's website at <http://foundation.aapg.org/library/>.

Feel free to fill out Ask the Librarian with your request.

## Need information? Need it now?

Don't let search engines frustrate you – the AAPG Foundation's Energy Resources Library can help you find the articles and data you need about a field, play, producing formation, basin or region.

Get fast access to all AAPG publications since 1917 – plus expert guidance to a variety of valuable web links.

Explore our website to get a full flavor of information available; or even better, use the "Ask a Librarian" feature to directly contact geoscience librarian Karen Piqune.

Yes, information is just a click away.  
Get what you need – now!



Using the AAPG-F Library will save you time in gathering information needed for your projects. For more information, visit the library's website at <http://foundation.aapg.org/library> or call toll free 1 (855) 302-2743 ext. 2644.



**Foundation Contributions for December 2014**

**General Fund**

Anonymous  
John A. Abeid  
Agile Libre  
James K. Anderson  
Lee B. Backsen  
Robert E. Bierley  
R.J. Bottjer and Sara L. Peyton  
Janet Brister  
William C. Burkett  
John R. Carson  
Jack C. Cartwright  
Paul A. Catacosinos  
Mr. and Mrs. Kenneth W. Ciriacks  
Chevron Matching Gift Program  
*Matching gifts/Layne Sieverding and Stanley Roe*  
Tom S. Deen  
Rodger E. Denison  
*In memory of William E. Ham*  
Eric K. Ericson  
Roger A. Freidline  
Leon H. Gerlich  
John E. Gilcrease  
Kenneth L. Harkins Jr.  
Jeanne E. Harris and Robert J. Groth  
*In memory of Andy Alpha*  
John O. Hastings Jr.  
James H. Henderson  
Robert E. and Betty K. Hilty  
Paul F. Hoffman  
Eric H. Johnson  
Charles Kerans  
*In honor of William Fisher*  
Carl W. Kuhnen Jr.  
Loren M. Leiker  
Michael P. Lewis  
Steven R. Lockwood  
Nazim F. Louni  
Jeffrey W. Lund  
Terry J. Mather  
*In memory of Rufus LeBlanc*  
Joshua A. McBride  
Richard F. Meyer  
Thomas and Betty Miller  
Leslie O. Niemi  
Lola and Phil Pitzer  
*In memory of I.C. Scott*  
Craig D. Pollard  
Eddie W. Rhea  
Peggy J. Rice  
Nataasha M. Rigg  
Hector F. San Martin  
Bill and Blanche Scheidecker  
Martin and Arlyn Shields  
George M. Simmons  
Elliott M. Simonberg  
Mr. and Mrs. Dan L. Smith  
Dallas B. Spear  
Gordon G. Start  
William and Pamela Stephens  
H. Leighton Steward  
Stephen M. Strachan  
Mark A. Sutcliffe  
Paul J. Szatkowski  
Anna Thorson  
Don and Nancy Todd  
Thomas James Tourek  
Michael D. Van Horn  
Bruce H. Wiley

**Amoruso Special Publications Fund**

John J. Amoruso

**Awards Fund**

**Robert R. Berg**  
*Outstanding Research Award*  
Josephine F. Berg  
*In memory of Robert R. Berg*

**Teacher of the Year Award**  
Gerald E. Harrington

**Digital Products Fund**

**Baylor University**  
John W. Shelton

**San Diego State University**  
John A. Abeid

**University of Colorado**  
Frederic A. Tietz  
*In honor of Paul Weimer*

**University of Illinois**  
Frederic A. Tietz  
*In honor of J.W. Soderman*

**University of Kansas**  
Nazim F. Louni

**University of Missouri, Columbia**  
Mark A. Sutcliffe

**West Virginia University**  
Dan A. Billman

**Distinguished Lecture Fund**  
Willis R. Brown  
David R. Feineman  
*In memory of Parke A. Dickey*  
John R. Kerns  
Camille and Francis King  
Richard A. Kopp  
Thomas R. Marshall Jr.  
*In honor of Greer Streetman*  
John T. Palmer  
Edward B. Picou Jr.  
David and Susie Work

**Education Fund**

Mia S. Alexander  
*In memory of Roger G. Alexander Jr.*  
Claude E. Bolze  
Donald D. Clarke  
Marshall C. Crouch III  
Larry P. Friend  
Gerald E. Harrington  
Julie L. Hill  
Wayne P. Johnson  
Mark W. Longman  
John E. and Mary T. Lucken

Paula L. MacRae  
Jack P. Martin  
Sandy Meyer  
Robert C. Milici  
Anthony J. Moherek  
Rita Monahan  
Sally M. Murray  
Susan S. Nash  
Jack Dale and Audrey Nations  
Ronald W. Pritchett  
Gene E. Richards  
*In memory of John M. Sweet*  
Joe and Jean Siegmund  
*In memory of Clyde Metz*  
Gordon K. Yahney  
William V. York  
William A. Zagorski

**Grants-in-Aid Fund**

**Donald A. and Mary O'Nesky Named Grant**  
Don and Mary O'Nesky  
*In memory of Ken Masters*

**Eastern Section Named Grant**  
James McDonald  
*In memory of Wallace de Witt*

**Fred A. and Jean C. Dix Named Grant**  
James E. Briggs

**Grants-in-Aid Committee Named Grant**  
Andre C. Klein  
Donald W. Boyd  
John S. Isby  
Jeffrey A. May and Karen A. Crossen  
David G. Morse  
April L. Parsons  
Bill and Blanche Scheidecker  
Martin and Arlyn Shields  
William M. and Jean L. Smith

**Gustavus E. Archie Memorial International Grant**  
John G. Kaldi

**Harry and Joy Jamison Named Grant**  
Harrison C. Jamison  
*In honor of Paul and Lydia Dudley*

**Ike Crumbly Minorities in Energy Named Grant**  
Isaac J. Crumbly

**John E. Kilkenny Memorial Grant**  
Bob and Arlene Lindblom  
*In memory of John and Virginia Jacobson*

**John H. and Colleen Silcox Named Grant**  
John and Colleen Silcox  
*In memory of William R. Barlow*

**Jon R. Withrow Named Grant**  
Jon R. Withrow  
*In memory of William Dale Trumbly*

**Lawrence W. Funkhouser Named Grant**  
Jean K. Funkhouser  
*In honor of L.W. Funkhouser*  
Susan and Charlie Hollis  
*In honor of Larry Funkhouser*

**Ohio Geological Society Named Grant**  
James McDonald

**Raymond C. Moore Memorial Grant**  
Teresa M. O'Neill  
*In memory of Brian J. O'Neill*

**Robert K. Goldhammer Memorial Grant**  
Kerry F. Inman

**Roger W. Stoneburner Memorial Grant**  
Jean K. Funkhouser  
*In memory of R.W. Stoneburner*

**Weimer Family Named Grant**  
John G. Kaldi  
Robert J. Weimer

**William E. and Jean Crain Named Grant**  
Chevron Matching Gift Program  
*Matching gift/Donald Downey*  
Bob and Arlene Lindblom  
*In memory of John and Virginia Jacobson*

**James A. Hartman Student Leadership Summit**  
Chevron Matching Employee Fund  
*Matching gift/Richard Ball*  
William O. Williams  
*In memory of Sarah Johanna Stolle, Maxwell Clinton Cater and Maurice Francis Kennedy*

**Imperial Barrel Award Fund**  
Jane E. Estes-Jackson  
*In memory of Vincent Jon Hamilton*  
Gretchen M. Gillis  
Mike and Ginger Mathy  
Scott L. Stockton  
Karla E. Tucker

**Military Veterans Scholarship Fund**  
Anonymous  
John J. Amoruso  
Lee B. Backsen  
Peter E. Blau  
Jerry W. Box  
Patricia K. Boyd  
*In honor of Paul and Deana Strunk*  
Dan J. Breaux  
*In honor of Murray J. Breaux*  
William T. Brown Jr.  
*In memory of David Roten*  
Walter P. Buckthal  
*In memory of Natalie Buckthal*

David W. Burge  
David G. Campbell  
Curtis D. Conley  
Louis J. Conti  
William T. Cook  
Robert L. Countryman  
*In memory of Garold L. Countryman*  
M.A. Custer  
*In honor of Crandall Jones*  
Norbert E. Cygan  
*In honor of David Glenn*  
Henry C. Dean Jr.  
James J. Emme  
Franklyn R. Engler  
Michael C. Fauquier  
Richard D. Finken  
Michael C. Forrest  
Helen L. Foster  
Larry P. Friend  
Pat and Jack Frizzell  
*In memory of Arden E. Kersey*  
Mark J. Gallagher  
*In memory of Dave Heinlin*  
Christine B. Gaynor  
Stephen J. Gillotti  
William E. Gipson  
*In honor of Charles Weiner; In memory of Harry A. Miller Jr.*  
Patrick T. Gordon  
Willard R. Green  
Paul M. Guerino  
William Roy Guffey  
Edward and Elizabeth Heath  
Edward W. Heath  
Tim and Brenda Hellman  
Donald E. Hibbard  
*In memory of Norm Foster*  
David M. Hite  
Michael and Linda Hoffman  
*In memory of James Samson Dean*  
Frank C. Horacek III  
Dan and Dottie Hudson  
*In memory of Ken Masters*  
Curtis C. Humphris Jr.  
Kenneth E. Jackson  
Curtis L. Johnson  
Joseph J. Kato  
Camille and Francis King  
Merlin Dean and Nancy E. Kleinkopf  
David E. Lange  
Walter A. Laufer  
*In memory of Mick Denny and Orbon Tice*  
Gene and JoAnn Lipstate  
John E. and Mary T. Lucken  
Curtis L. Lundy  
Paula L. MacRae  
Maryann L. Malinconico  
Jim and Carolyn McGhay  
*In memory of Donald L. McGhay*  
Douglas and Danna Middleton  
*In memory of Charles F. Dodge*  
John V. Miesse  
Steven D. Mitchell  
Jerome Nicholas Namy  
Jack Dale and Audrey Nations  
Brian E. O'Brien  
Josh W. Oden  
April L. Parsons  
H.W. "Dub" Peace II and Norma J. Peace  
James L. Pear  
Henry S. Pettingill  
*In honor of Murray S. Breaux*  
Sanford Ingels Phillips  
Paul E. Potter  
Walter C.J. Pusey III  
Gayle A. Reising  
Sarah Springer and Rusty Riese  
*In memory of David Roten*  
Karen and Cecil Rives  
*In memory of Robert S. Moehlman*  
Sigmund J. Rosenfeld  
*In memory of Beverly E. McMahon, Jack Century and John Buckley*  
Jennifer L. Rothfuss  
*In memory of Frederick C. Rothfuss Jr.*  
Edward M. Rothman  
Charles and Janet Rubins  
William D. Simmons  
Christopher E. Slagle  
Darrell E. Smith  
Marlis E. Smith  
Richard K. Sparkman  
Lawrence W. Staub  
David and Virginia Thetford  
Patrick M. Tolson  
Glen E. Vague Jr.  
La Verne L. Vigoren  
Robert E. Webster  
Robert J. Weimer  
William M. Whiting  
*In memory of Clinton, Charles, Georgy and Walter Whiting*  
Lawrence H. Wickstrom  
William O. Williams  
*In memory of Robert S. Williams*

**E.F. Reid Scouting Fund**  
Terri Duncan  
Ronald L. Hart  
Bryan Haws

**L. Austin Weeks Undergraduate Grant Fund**  
Lee and Joanne Billingsley  
*In honor of Pete Rose*  
Willis Reider Brown  
Paul A. Bryden  
*In memory of Elmer Bryden*  
Larry P. Friend  
Michael R. Gross  
John E. and Mary T. Lucken  
Christopher E. Slagle  
Timothy L. Smith  
Edwin L. Trice III  
Marta S. Weeks-Wulf  
*In memory of Austin Weeks*

**Publication Pipeline Fund**  
Martin M. Cassidy

# Grants-in-Aid Deadline Approaching



## Applications, Transcripts and Endorsements Due 15 February

Are you a graduate or Ph.D. candidate? The time to apply is NOW. Application period closes at midnight (PST), Sunday, 15 February.

# Undergrad Scholarships and Grants Available – Apply Now!



## L. Austin Weeks Undergraduate Grant Program

\$500 grants are available for geoscience-focused undergraduate students, chapters, associations and clubs.



## U.S. Military Veterans Scholarship Program

Scholarships ranging from \$2,000-\$4,000 are available for veteran undergraduate students earning degrees in fields of geoscience.

**Deadline is 15 May!**



Visit AAPG Foundation's website today to complete an application. [foundation.aapg.org](http://foundation.aapg.org)

## READERS' FORUM

### The Anthropocene

Since proposed in 2000, the concept of the "Anthropocene" has filtered through the geological literature (see Zalasiewicz, J., et al, In Press, for a brief summary review), including reports in the September 2008 and November 2011 EXPLORER.

Inevitably, it attracted the attention of the geo-bureaucrats at the IUGS, which formed a subcommittee of the International Commission on Stratigraphy (ICS) to examine it. Although the base of the "Anthropocene" is diachronous (Edgeworth et al, 2014), the ICS has proposed it should be defined by the isotopic signature of the world's first nuclear explosion, which occurred July 16, 1945, at Alamogorda, N.M.

Other work (Corcoran et al, 2014) shows that the advent of plastic garbage makes an anthropogenic global marker as well.

The real question is, does the "Anthropocene" even have utility? Granted, human reworking is observable at the surface or near surface, but is it geologically regional in scale?

How would one map the proposed isotopic marker in the field? Will it mean repeated trips to the field to collect samples, analyze them isotopically in the laboratory and then go back to the field to place the boundary thus increasing a field geologist's carbon footprint especially if an SUV or a four-wheel-drive vehicle is used?

Or will geologists now be required to carry a Geiger counter or portable Gamma Ray tool to be sure not to miss the critical basal boundary? (I see a business opportunity here to develop miniaturized versions for field use).

Where will the type section be? Alamogorda, N.M., where the original atomic bomb test took place, is a military restricted area requiring extensive security clearances to even visit, much less do field work – if it will even be allowed.

Has the isotopic signature representing the base of the "Anthropocene" ever been identified and correlated in deep sea piston cores recovered by oceanographic institutions? (SDP, IPOD and ODP cores have disturbed tops, so they are unusable). Has anyone even checked?

(Looks like a potential Ph.D. thesis for someone.)

What is the long-term preservation potential of any identifying criteria for the so-called "Anthropocene?" Likely it will be small because most of the studies describing evidence of human alterations occur in geomorphic areas that are dominantly erosional. Few examples have been reported from areas of sediment deposition that have larger preservation potential.

A working limestone quarry operates near my residence. Is the changing vertical cut and quarry floor an

"excavation surface?"

Is the "excavation surface" in a quarry 10 miles away and abandoned 50 years ago coeval? Perhaps the IGC should form a subcommittee to evaluate that surface for its utility in "Anthropocene" sequence stratigraphy.

If the reader is offended by my questions and bemusement, please consider this quote:

*"A boundary at this time need not have a Global Boundary Stratotype Section and Point (GSSP or 'golden spike') but can be defined by a Global Standard Stratigraphic Age (GSSA), i.e. a point in time of the human calendar"* (Zalasiewicz et al, In Press).

That statement above appears to undermine the standards of the revised Stratigraphic Code, which has served us well in various forms since the 1930s.

It also raises substantive questions as to whether geology is well served by "Anthropocene," and whether it has any utility at all.

Various isotopes are used to determine rates of surficial, sedimentological and geomorphic change, and a new stratigraphic term really doesn't improve our understanding of the associated processes.

Having completed and published research on modern and ancient sediments, "Anthropocene" adds nothing to my findings and interpretations. However, it may make for longer and "snazzier" titles of these publications.

Expressed in another way, Desnoyers, Lyell and Gervais, the founders of Quaternary epochs, must be spinning in their graves.

More than 60 years ago Paul D. Krynine, the eminent sedimentary petrologist at Penn State University, defined stratigraphy as "the triumph of nomenclature over common sense." Although "Anthropocene" may have utility as a period of human history, using it in geology and the associated ICS pontifications and scholarly papers proves Krynine to be correct.

George Devries Klein  
Barrigada, Guam

*(Editor's note: Klein completed and published research in sedimentology and stratigraphy, and taught both topics at the University of Pittsburgh, the University of Pennsylvania and the University of Illinois, where he is Professor Emeritus of Geology.)*

### One More Credit?

Regarding the January Historical Highlights article, "Oil for Life – Russian Pioneers Chose Wisely": It looks like you've missed one important name, Nikolay Kudryavtsev (1893-1971), who did much for the Timan-Pechora petroleum province development.

Alexander Kitchka  
Kiev, Ukraine

## Flexibility from page 48


which admittedly and obviously is something at which the smaller schools cannot compete. What he wants from industry – and this is important to him – is for the profession to remember and acknowledge how vital the role of community college geology department

and their geo-majors are.

"Our motto is to recruit, recruit, then retain, retain and foster a collegiate approach to all of our geo-majors," he said.

In fact, at Santa Barbara, over its 48-year history, more than 800 geologists have gone into industry.

It works.

"We're proud of that accomplishment." 

## MEXICO

### Geological Framework and Petroleum Resources

Ten Multi-Client Reports are Available to the Industry that Cover:

- Geology and Basin Framework per a Synthesis of >5500 Publications
- Reservoirs, Traps, Source Rocks, and Development History of Trends
- Compiled Information on 640 Fields and 1600 Exploration Wells
- Digital Maps of Topography, Geology, Fields, Wells, and Data Sites
- Published Regional Seismic Data • Outcrop Locations and Analyses
- Rock Petrographic, Biostratigraphic, and Organic Geochemical Studies
- Richness, Burial History, and Maturation Modeling of Source Rocks
- Cross Sections • Paleogeographic and Plate Tectonic Summaries

Presented in 76 Volumes and in Digital and GIS formats

Tap into 35 Years of Experience from the Rio Grande to Guatemala

Blair & Associates LLC Boulder CO 303-499-6005 tcbclair@aol.com

## Rose & Associates

Courses Consulting Software

### Risk Analysis, Prospect Evaluation & Exploration Economics

Houston:	April 20 – 24	Calgary:	April 13 – 17
	Sept 14 – 18		Sept 21 – 25
Perth:	March 9 – 13	Bali:	June 8 – 12

### Unconventional Resource Assessment and Valuation

Houston:	May 11 – 15	Calgary:	May 11 – 15
	Oct 26 – 30		Oct 5 – 9
OK City:	Aug 10 – 14	Denver:	June 15 – 19
Pittsburgh:	Oct 5 – 9		

### Evaluating Tight Oil and Gas Reservoirs

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

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

Aberdeen:	Sept 14 – 16	Houston:	Nov 16 – 18
-----------	--------------	----------	-------------

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

## AAPG Geosciences Technology Workshops 2015

Asia Pacific Region

### Modern Depositional Systems as Analogues for Petroleum Reservoirs

21-23 April 2015 | Wellington, New Zealand

Make plans to attend AAPG's first GTW in New Zealand.

#### Preliminary program outline:

1. Terrestrial Systems
2. Coastal and Marginal Marine Systems
3. Deep Water Systems
4. Integration and Applications

#### Confirmed Keynote and Technical speakers include:

Bruce Ainsworth (Chevron); Charles Paul (Monterey Bay Aquarium Research Institute); John McPherson (SED & RQ Pty Ltd); Dale Leckie (Canadian Society of Petroleum Geologists); Joe Lambiasi (Chulalongkorn University); Philip Barnes (NIWA); Greg Browne (GNS Science).

#### Optional Field Trip to Wairarapa and Optional Core Workshop set for 23 April (Day 3).

#### Who should attend?

Geoscience professionals engaged in exploration, appraisal, development and production of clastic oil and gas reservoirs; researchers and academics interested in sedimentary and petroleum geology; reservoir modellers.

#### For more information please email:

Adrienne Pereira, Programs Manager, AAPG Asia Pacific (apereira@aapg.org)

For more information on AAPG Asia Pacific Region events, visit our website:

[aapg.org/events/event-listings](http://aapg.org/events/event-listings)

**CLASSIFIED ADS**

You can reach about 37,000 petroleum geologists at the lowest per-reader cost in the world with a classified ad in the EXPLORER. Ads are at the rate of \$2.90 per word, minimum charge of \$60. And, for an additional \$50, your ad can appear on the classified section on the AAPG web site. Your ad can reach more people than ever before. Just write out your ad and send it to us. We will call you with the word count and cost. You can then arrange prepayment. Ads received by the first of the month will appear in the subsequent edition.

**CLASSIFIED ADS**

**POSITION AVAILABLE**

**DIRECTOR  
NEW MEXICO BUREAU OF  
GEOLOGY & MINERAL RESOURCES**

The New Mexico Bureau of Geology and Mineral Resources, Socorro, NM, is seeking a new director and state geologist. The bureau, with ~60 employees, is a prominent research and service division of New Mexico Tech and serves as the state geological survey, with a long-standing reputation for excellence in research, service, and outreach. Our mission includes research on the geologic framework of the state, with an emphasis on applied geoscience evaluation of water and energy resources. The bureau works closely with the university academic divisions as well as many state agencies. Full details of the position and information regarding application procedures may be found at <http://geoinfo.nmt.edu/DirectorSearch> and at [www.nmt.edu/hr-jobs-at-nmt](http://www.nmt.edu/hr-jobs-at-nmt). For more information about the application process, contact JoAnn Salome in Human Resources at 575-835-5955 (JSalome@admin.nmt.edu). For more information about the position itself, contact Warren Ostergren, search committee chair, at 575-835-5363 (warreno@nmt.edu)

**MISCELLANEOUS**

**SAMPLES TO RENT**

International Sample Library @ Midland – Formerly Midland Sample Library.

Established in 1947. Have 164,000 wells with 1,183,000,000 well samples and cores stored in 17 buildings from 26 states, Mexico, Canada and offshore Australia. We also have a geological supply inventory.

Phone: (432) 682-2682  
Fax: (432) 682-2718

\*\*\*\*\*

SES — more companies CHOOSE SES v5 over the other 15+ commercial geosteering software options on the USA market; browse its features/pricing/evolution online to see why. SES is niche 3D technical geosteering software TRUSTED by geologists everywhere. Free trial, online training, and class training available.

[www.makinhole.com](http://www.makinhole.com)  
Stoner Engineering LLC.

\*\*\*\*\*

StarSteer – the Premier Geosteering Software Solution for the Oil & Gas Industry. Scientific, Modern and Interactive. Integrates all your data for ideal well placement.

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

**Heavy Oil  
from page 54**

bopd of average 8.5 degrees API extra-heavy oil using cold production methods, augmented by solvent-injection.

Currently, the United States is producing commercial quantities of heavy oil from sand deposits in two principal areas, the San Joaquin Basin of central California and the North Slope of Alaska.

California's oil fields, of which 52 each have reserves exceeding 100 million barrels (15.9 million m<sup>3</sup>), are located in the state's central and southern parts. As of 2012, the proved reserves were 2,976 million barrels (473.2 million m<sup>3</sup>), nearly 65 percent of which is heavy oil in the southern San Joaquin Basin.

In addition to the heavy oil accumulations that are being produced, California has numerous undeveloped shallow bitumen deposits and seeps, a resource estimated to be as large as 4.7 billion barrels (0.74 billion m<sup>3</sup>).

Alaska's heavy oil and bitumen

deposits on the North Slope are very large (24 to 33 billion barrels, or 3.8 to 5.2 billion m<sup>3</sup>) and they hold promise for sustained commercially successful development.

\*\*\*

In virtually all regions of sustained production, the industry is steadily improving in situ recovery methods and reducing environmental impacts of bitumen and heavy oil production, especially those associated with surface mining.

For additional information on current and developing recovery technologies and efforts at environmental mitigation, see the full commodity report from the EMD Heavy Oil and Bitumen Committee at [emd.aapg.org/technical\\_areas/oil\\_sands/oil-sands-commodity-report-midyear-2014nov.pdf](http://emd.aapg.org/technical_areas/oil_sands/oil-sands-commodity-report-midyear-2014nov.pdf).

*(Editor's note: Steven Schamel is with GeoX Consulting Inc., Salt Lake City; Sharleen Overland is with Alberta Energy Regulator, Calgary, Canada.)*

**IPTC  
from page 49**

the education of its people and has built an "Education City" in Doha, anchored by the Science and Technology Park including companies like Microsoft and others.

U.S. universities such as Texas A&M, Cornell and Virginia Commonwealth already have a presence – and more schools are slated to follow.

Qatar is in the process of building several new museums to house a world-class collection of Islamic art – probably the most distinguished and comprehensive such collection ever assembled. Also due for completion this year is a huge library in Education City that will include a conference center to host a flood of researchers and scientists for seminars and meetings.

This year's conference program is expected to include more than 65 technical sessions, covering themes from exploration to drilling to production and reservoir as well as mid-stream gas, integrated development and case studies.

Other highlights will include:

▶ An opening ceremony featuring top government officials.

▶ A keynote distinguished panel discussion on global energy issues, featuring CEOs and senior executives from both international and national oil companies, and technical service providers.

▶ Industry-focused sessions, including an insightful look into the future of global energy.

▶ Special sessions on HSE and human resources.

More information is available at the website, [www.iptcnet.org/2015/doha](http://www.iptcnet.org/2015/doha).

The IPTC is a crossroads for the major societies to gather and share the past, present and future of our international energy world.

As the world's energy-consuming nations realize that hydrocarbons are indeed a precious resource, it will be up to us, the members of the four sponsoring societies, to find, develop and prudently manage new resources in an increasingly fragile global environment.

IPTC is a great place to start.



**Power Plays: Geothermal Energy in Oil and Gas Fields**

Conference - May 19-20, 2015    Workshop - May 18    SMU Campus, Dallas, TX

- Desalination
- Induced seismicity
- Play Fairway Analysis
- Waste-heat technology
- Onshore and offshore thermal maturation
- Power generation from flare gas and well water
- Eastern North American Margin Community Seismic Experiment (ENAM CSE)

Contact Maria Richards  
214-768-1975  
<http://www.smu.edu/geothermal>



**2015 Field Seminars**

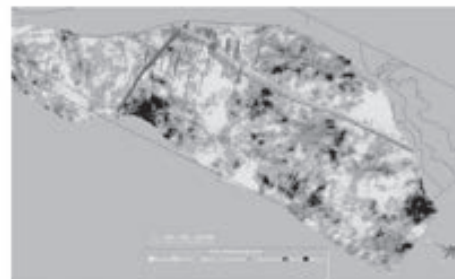
- |   |   |
|---|---|
| <p><b><u>Tabernas, SE Spain</u></b></p> <ul style="list-style-type: none"> <li>• Integrated Seminar</li> <li>• Classic Outcrops</li> <li>• October 12-16, 2015</li> <li>• 5-days, \$3,300.00</li> </ul> | <p><b><u>Chicontepec, Mexico</u></b></p> <ul style="list-style-type: none"> <li>• On Demand, Customized Trip</li> <li>• Eocene and Paleocene</li> <li>• Canyon-fills, Channels, Lobes, Slumps</li> <li>• Near Poza Rica, Mexico</li> <li>• Basin History</li> <li>• 5-days</li> </ul> |
|---|---|

*Details:*  
[www.cosseygeo.com](http://www.cosseygeo.com)  
or email: [cosseygeo@aol.com](mailto:cosseygeo@aol.com)  
or call +1 (970) 385 4800



**Opportunities and Advancements in Coalbed Methane in the Asia-Pacific**    12-13 February 2015  
Brisbane, Australia

**Make plans to attend this first AAPG GTW in Australia**



**Preliminary program outline:**

1. Introduction and Regional Overviews
2. Understanding the Complexity of CBM plays
3. Characterising Complex Coal and Coal Inter-burden Geology
4. Advances in Well, Completion and Stimulation Technologies
5. Characterising, Predicting and Managing Produced Water
6. CBM Grand Challenges

Over 25 technical papers from across the Asia-Pacific region, covering fundamentals of CBM-related play and reservoir geology, completion/stimulation engineering and water management will be presented by representatives of over 11 companies and six research institutions. Members also will participate in a session defining and discussing CBM-specific "Grand Challenges."

For more information, contact Adrienne Pereira ([apereira@sapg.org](mailto:apereira@sapg.org))

**Who should attend?**

Geoscientists, petroleum and well engineering professionals engaged in CBM/CSG exploration, appraisal, development and production for coalbed methane; researchers and academicians in coal geology and hydro-geology, production technologists and reservoir modelers.

One-day course on Wednesday, 11 February 2015 by Ray Johnson (UQ Honorary Fellow and Principal at Unconventional Reservoir Solutions), on "CBM Stimulation: What Every Geoscientist Should Know about Fracturing Design, Execution and Evaluation for CBM Reservoirs!" Interested parties should contact Ms Julijana Rajkovic ([j.rajkovic@uq.edu.au](mailto:j.rajkovic@uq.edu.au)).

For more information on AAPG Asia-Pacific Region events, visit our website:

[www.aapg.org/events/event-listings](http://www.aapg.org/events/event-listings)

# World-Class Knowledge, Experience, Community on Offer

By DAVID CURTISS

Equipping you to be a world-class geoscientist is our goal here at AAPG. It's why we exist as a scientific and professional association: To assist you throughout your career to stay at the top of your game.

Knowledge is a key element of honing your competitive edge. You've got to invest the time to understand both how your particular field and discipline are evolving and how what you know fits into the big picture.

But book learning isn't enough. It's the successful application of this knowledge that creates value. It's accumulated experience that makes you good at your job, so gaining that experience and doing it as quickly as possible accelerates your ability to deliver value to your employer or clients.

And here's some good news: You can leverage the experience of others to boost your own by learning from great teachers and mentors.

And where do you find teachers and mentors who will let you learn from their failures, successes, and share their insights?

You find these people by being connected to a community of professionals.

That's what we do at AAPG – teach each other, and thereby improve ourselves and our profession.

\* \* \*

Knowledge, experience and community are three essential ingredients to being at the top of your game. And we're serving up a big dose of all three at the upcoming 2015 World-Class Education Conference, scheduled for March 2-6 in Houston.

Now I realize that eyebrows likely popped as you read that last sentence.

World class? Really?

But take a look at what's available to you at this education conference: 12 courses in four tracks over five days, and the quality of the courses and instructors is truly world class.



CURTISS

You can leverage the experience of others to boost your own by learning from great teachers and mentors.

▶ AAPG member **Lesli Wood**, who holds the Robert Weimer Endowed Chair for Sedimentology and Petroleum Geology at the Colorado School of Mines, will be teaching a brand-new course titled Deepwater Reservoir Connectivity.

▶ Exploration for Deepwater Sands Using Seismic Sequence Methodology will be taught by AAPG Honorary member **John Armentrout**, consultant and past AAPG secretary, who has a distinguished international exploration and research career in stratigraphy, deepwater depositional systems and exploration geochemistry.

▶ AAPG members **Dana Ulmer-Scholle** and **Peter Scholle**, renowned carbonate experts who have both authored or edited several books and together co-edited AAPG Memoir 77, the Color Guide to Petrography of Carbonate Rocks, return to the education conference with their course on Carbonate Reservoir Geology: Understanding Depositional and Diagenetic Factors Controlling Porosity.

It's intended for exploration and development geologists as well as the geophysicists and engineers working with them to develop carbonate fields.

▶ Carbonate Depositional Systems is the title of noted carbonate stratigrapher (and AAPG member) **Art Saller's** one-day course. It's an introductory course, but will be helpful even to experienced

geoscientists working in carbonate systems.

▶ The final carbonate course offered will be taught by AAPG Sidney Powers medalist **Ernest Mancini** – it's a brand-new course titled Microbial Carbonate Reservoir Characterization, and will benefit both geoscientists exploration for microbial carbonate reservoirs as well as geoscientists and engineers developing these reservoirs.

▶ AAPG member **Donald Herron**, an independent geophysical consultant, and Rice University professor Robert Wegner are teaching an introductory course on Basic Seismic Interpretation that is suitable for all new hires, experienced geoscientists or geo-techs who would like to increase their seismic interpretation abilities.

▶ Seismic Amplitude Analysis to validate reservoir composition is the second geophysics course on offer and taught by **Fred Hilterman**, a past AAPG and SEG Distinguished Lecturer. This course is designed for any geoscientist or engineer who is using seismic data to characterize a reservoir.

▶ AAPG member **Kurt Marfurt** (a frequent contributor to the EXPLORER's Geophysical Corner), the Frank and Henrietta Schultz Professor of Geophysics at the University of Oklahoma, teaches 3-D Seismic Attributes for Unconventional Reservoirs to equip

geoscientists to map reservoir quality and evaluate completion quality in these reservoirs.

▶ Helping attendees better understand the critical factors and risks needed to explore, appraise and develop unconventional shale plays is the focus of past EMD president **Creties Jenkins'** Discovery and Recovery Thinking in Shales. This is the third brand-new course offered at this education conference, and will help you understand what rock and fluid properties you need to identify and how to quantify the uncertainties of those properties to characterize shale reservoirs.

▶ Introductory Geochemistry for Condensate-Rich Shales and Tight Oil will be being taught by **Christopher Laughrey** and is a practical and applied course focused on the geochemical tools and techniques used in assessing shale gas/condensate and tight-oil systems.

▶ Two one-day courses by professor **George Asquith** of Texas Tech University (and a best-selling AAPG author) close out the conference. The first is Log Analysis of Shaly Sand Reservoirs and the second is Log Analysis of Hydrocarbon-Bearing "Shale" Reservoirs.

While these courses are grouped into tracks, you also can customize your training program by mixing and matching courses to suit your development needs and interests.

There's a lot here to choose from. Go online for more details on each course and to design your curriculum.

World-class knowledge, experience and community – we've got it for you in Houston next month.

## DIVISIONS REPORT: EMD

# Heavy Oil Recovery Methods Are Improving

By STEVEN SCHAMEL and SHARLEEN OVERLAND

Heavy oil and bitumen are denser than conventional crude oil and considerably more viscous, making them more difficult to recover, transport and refine.

Heavy oil is just slightly less dense than water, with specific gravity in the 1.000 to 0.920 g/cc range, equivalent to API gravity of 10 degrees to 22.3 degrees. Bitumen and extra-heavy oil are denser than water, with API gravity less than 10 degrees.

Extra-heavy oil is generally mobile in the reservoir, whereas bitumen is not. At ambient reservoir conditions, heavy and extra-heavy oils have viscosities greater than 100 centipoise (cP), the consistency of maple syrup. Bitumen has a gas-free viscosity greater than 10,000 cP, equivalent to molasses.

The International Energy Agency estimates the total world oil resources are between nine and 13 trillion barrels, of which just 30 percent is conventional crude oil. The remaining 70 percent is unconventional crude divided:

- ▶ 30 percent bitumen.
- ▶ 25 percent extra-heavy oil.



SCHAMEL

In virtually all regions of sustained production, the industry is steadily improving in situ recovery methods.

▶ 15 percent heavy oil.

Bitumen and heavy oil deposits occur in more than 70 countries across the world. The global in-place resources of bitumen and heavy oil are estimated to be 5.9 trillion barrels (938 billion m<sup>3</sup>), with more than 80 percent of these resources found in Canada, Venezuela and the United States.

Western Canada has several separate accumulations of bitumen and heavy oil that together comprise 1.7 trillion barrels (270 billion m<sup>3</sup>). The Orinoco heavy oil belt is a single extensive deposit containing 1.2 trillion barrels (190 billion m<sup>3</sup>) of extra-heavy oil. Both regions have extensive world-class source rocks and host substantial conventional oil

pools in addition to the considerably larger resources within shallow oil sands.

Other countries producing significant quantities of heavy oil and/or bitumen include Russia, China, Iran, Iraq, Azerbaijan, Mexico, Colombia, Ecuador and Brazil.

Globally there are just over one trillion barrels of technically recoverable unconventional oil: 434.3 billion barrels of heavy oil, including extra-heavy crude, and 650.7 billion barrels of bitumen.

\* \* \*

Virtually all of the bitumen being commercially produced in North America is

from Alberta, Canada, making it a strategic source of bitumen and of the synthetic crude oil obtained by upgrading bitumen.

Estimated remaining established reserves of in-situ and mineable crude bitumen is 167 billion bbls (26.6 billion m<sup>3</sup>).

To date, just 5.4 percent of Canada's initial established crude bitumen resource has been recovered since commercial production began in 1967. In-situ production using steam-injection overtook mined production for the first time in 2012 and continued to exceed mined production in 2013.

The Faja Petrolifera del Orinoco (Orinoco heavy oil belt) in eastern Venezuela is the world's single largest extra-heavy oil accumulation. The total estimated oil in-place is 1.2 trillion barrels (190 billion m<sup>3</sup>), of which 310 billion barrels (49.3 billion m<sup>3</sup>) is considered technically recoverable.

Four active heavy oil recovery projects operating in the Faja, each begun in successive years between 1998 and 2001, produce collectively about 640,000

See **Heavy Oil**, page 53



# power play

Adjust to low oil prices by making a power play using our conventional seismic data.

Visit us at NAPE Summit Booth #3011

## call Seitel. drill Smart.

Looking to make a power move while unconventional players are stuck in a holding pattern? As the largest onshore seismic data library in North America, we have your area of interest covered. Select from over 20,000 sq. miles of Conventional 3D data and 2D lines to equip your exploration team with the tools they need to deliver a productive drilling plan in 2015. Partner with Seitel on your next power play!

- Quality 2D and 3D seismic
- Acquisition management
- Fast-track processing
- Pre-stack depth migration
- Azimuthal analysis
- EarthStudy 360
- Multi-Component Processing
- 5D Interpolation



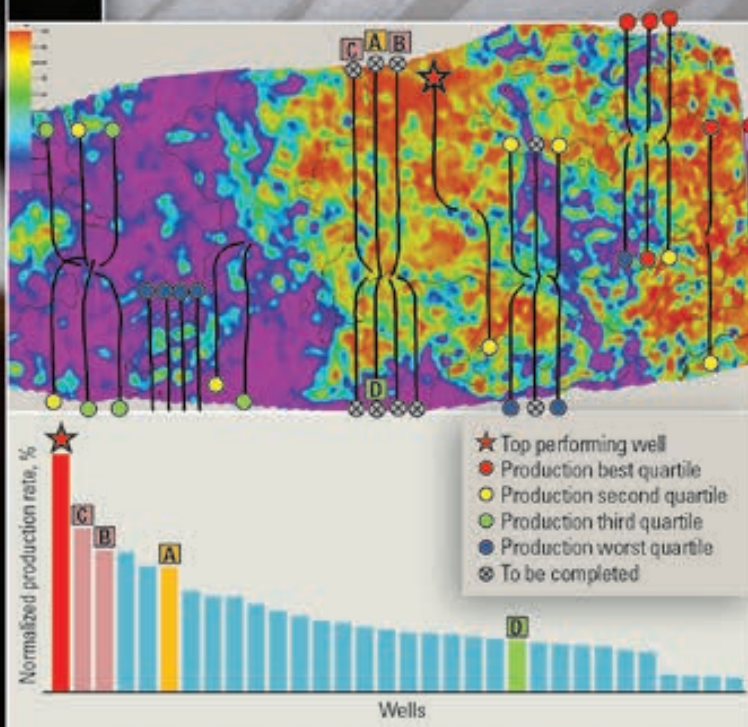
seitel.com

Visit seitel.com often to see our acquisitions in progress, and seize the competitive edge by being the first to license our latest data.





# Seismic for Unconventional Resources



Wells ranked by normalized first-year production rates. Wells A, B, C, and D were completed after the study and confirmed production rates predicted by Schlumberger.

## Make top-performing wells the only ones you drill.

Schlumberger proprietary workflows combine seismic data with well measurements to determine fracture, geomechanical, and fluid properties. This combination reduces uncertainty in field development planning by pinpointing the highest-quality areas of unconventional reserves.

An operator in the Marcellus Shale was prepared to abandon completion activities after several wells did not produce as expected. After integrating 3D seismic data with production metrics and LWD and logging measurements, Schlumberger delivered a predictive map of sweet spots that prompted the completion of three additional high-rate producers, guiding the decision to continue developing the acreage.

Read the case study at [slb.com/SUR](http://slb.com/SUR)

