

AAPG

# EXPLORER

FEBRUARY 2014



## Polar Express

*Low temperatures, high stakes*

*See page 8*





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PRESIDENT'S COLUMN

Being what we say we are:  
AAPG as a Scientific and Professional Organization

BY LEE F. KRYSTINIK

In Shakespeare's play "The Tragedy of Hamlet, Prince of Denmark," we hear Polonius tell his son, Laertes:

"This above all: To thine own self be true, and it must follow, as the night the day, thou canst not then be false to any man."

Scholars of the Bard tell us that in this context to be "false" is to act in a way that is detrimental to your image or your goal.

Boiled down to basics, professionalism is the image of petroleum geoscientists and AAPG's goal is to promote good geoscience to the world.

So, if AAPG wouldst be true unto itself, what wouldst it be?

\* \* \*

I have heard many of our faithful members distinguish AAPG from other groups because we are a premier scientific and technical organization – and so we are. I also have heard equally strident voices within AAPG passionately declare that we are a professional organization – and so we are.

Yet others, looking in from the outside and observing our presence in Washington, D.C., for example, and not understanding our purpose there or our engagement in policy issues, have suggested we are, heavens above forbid, a "trade organization."

We are, in fact and practice, a group of professionals whose organization delivers premier petroleum geoscience by many modes. We are a group of diverse and talented individuals who mostly identify ourselves as professional petroleum



KRYSTINIK

geoscientists. Some faithful members pull for more "professionalism" while others pull for more science.

Our purpose, as defined in AAPG's constitution, is to further the science as well as promote professionalism.

Unfortunately, some in AAPG have chosen to polarize to one side or the other of this philosophical discussion and have made it into a debate, or an outright

In my experience, AAPG is at its strongest when we all work together toward a common goal.

fight. In my experience, AAPG is at its strongest when we all work together toward a common goal. The phrase, "United we stand, divided we fall," with a literary nod to Aesop, comes to mind.

So, if we are to be true to ourselves at AAPG, then my job and my honor as president of AAPG for this short year is to work in concert with the Executive Committee, the Advisory Council, the House

of Delegates, the AAPG staff and you, dear members, to further our scientific progress AND to promote professionalism, hoping to maintain a balance along the way.

\* \* \*

A distinct opportunity to both serve science AND promote professionalism has arisen in the form of the resolution to remove sponsorship as a requirement to become a member of AAPG.

Some might worry that we are damaging our professionalism by removing sponsorship, even though sponsorship is considered an affront by many experienced professionals both in the United States and abroad.

I will be quick to say that I am

See President, next page

Get to Know the Executive Committee Candidates

Videos of all six AAPG officer candidates for the 2013-15 Executive Committee – featuring a new question-answer format – continue to be available online, where they will remain through the election season.

Also available on the website are biographies and individual information for the candidates.

The candidate videos are presented in a new format that shows them responding to six specific questions, intended to allow members around the world to have a better introduction to those running for office.

Printed information on the candidates

also will be included in the March EXPLORER. Ballots will be mailed and online voting will begin in spring 2014.

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

To view the videos, go online to [www.aapg.org/business/candidates/](http://www.aapg.org/business/candidates/).

The slate is:

President-Elect

Alfredo E. Guzmán, consultant, Veracruz, Mexico.

John R. Hogg, MGM Energy Corp., Calgary, Canada.

Vice President-Sections

Steven H. Brachman, Wapiti Energy, Houston.

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

Treasurer

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

James W. Tucker, consultant, Houston.

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Sophia Ford

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20	Icebreaking vessels are the key to navigating the Arctic, and so are in high demand as oil producers set their sights on the vast oil reserves at the top of the world.
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Scan this for the mobile version of the current web Explorer.



Photo courtesy of Lee Krystinik

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ON THE COVER:

The resource-rich, challenging – and typically hostile – environments of the Arctic have become attractive exploration areas for major companies around the world. And that development is the theme of this EXPLORER – our first Arctic Exploration issue. Depicted on the cover are members of an Arctic consortium that are preparing now for the exploration activity of tomorrow. Photo courtesy of the OGP Oil Spill Response Technology JIP. On this page, something a bit warmer: The Sheyba field in Saudi Arabia. Why this photo? See page 46.



## Hartman, Weiner Get Foundation Top Honors

Two longtime valuable supporters of the AAPG Foundation have been named recipients of the Foundation's top awards for 2014.

The awards, announced by the Foundation's board of trustees, go to **James A. Hartman**, this year's winner of the L. Austin Weeks Memorial Medal, and **Charles "Chuck" Weiner**, the winner of the Foundation Chairman's Award.

The Weeks Medal, the Foundation's highest award, is given in recognition for extraordinary philanthropy and service directed to advance the mission of the AAPG Foundation. The award honors the late L. Austin Weeks, whose philanthropic legacy set an exemplary standard.

Hartman is the award's seventh recipient.

Past awardees were Marta Weeks-Wulf, T. Boone Pickens, Larry Funkhouser, Jack Threet, Bill Barrett and Robert Gunn.

He will receive the award during the opening session of this year's AAPG Annual Convention and Exhibition, set April 6-9 in Houston.

Hartman, an AAPG Honorary member, has been a Trustee Associate since 1992 and always has been a strong supporter of university students.

His most recent passion was establishing the James A. Hartman Student



HARTMAN



WEINER

Chapter Leadership Summit, a popular and successful initiative that enables, through Hartman's generosity, 12 students in leadership positions the chance to attend AAPG's annual Leadership Days event.

The students there benefit from networking, training and development – and make an impact on AAPG policies and plans.

Hartman is a retired independent dividing his residence between Des Moines, Iowa, and Venice, Fla. He served as AAPG secretary in 1981-83, and received AAPG's Distinguished Service Award in 1985.

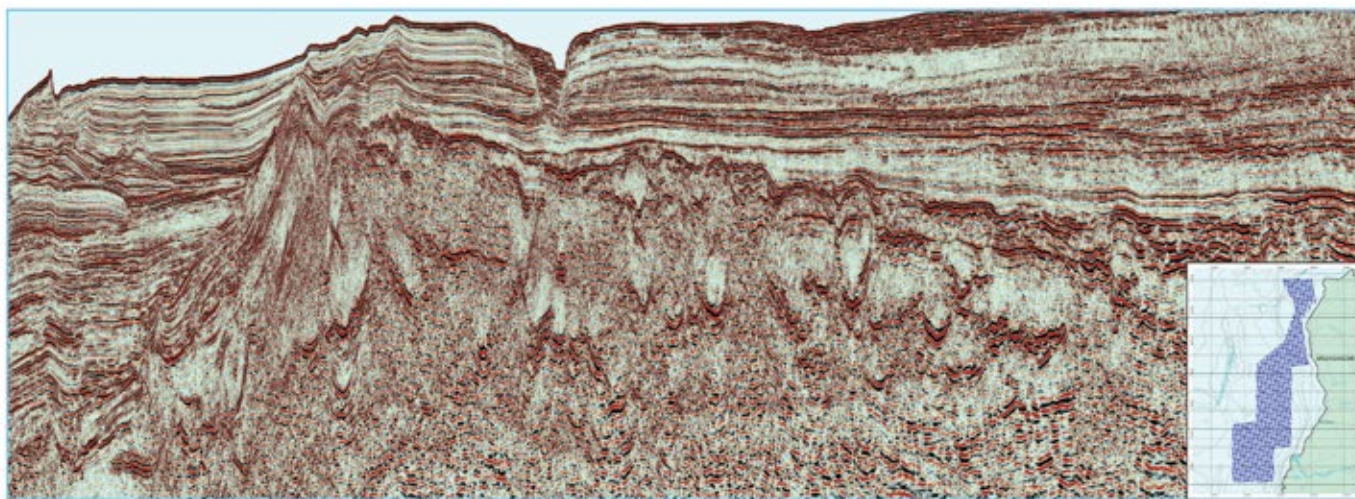
The Chairman's Award recognizes those who have made extraordinary contributions (monetary or service) to the AAPG Foundation, and also call attention to the role and value of the Foundation. Weiner is the award's 16th recipient; last year's honoree was Richard Baile.

Weiner, chairman of Westerly Exploration in Houston, has been active in exploration since the 1960s, operating not only in the United States but also in Canada, Australia, China, North Africa, the Middle East and Asia-Pacific.

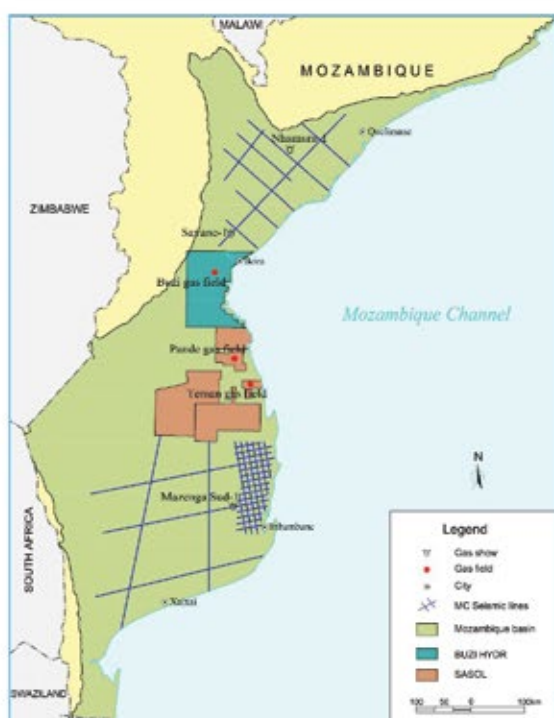
A Trustee Associate since 1979, he has actively supported a variety of Foundation programs over the past five decades, including K-12 Education, Grants-in-Aid and the General Fund.



### BGP Multi-Client Surveys in Offshore Madagascar & Onshore Mozambique



**Representative PSTM section from Morondava Basin, offshore Madagascar (In association with TGS)**



#### Onshore Mozambique

**Location:** Onshore Mozambique Basin.

**Survey size:** 4,160 km.

**The program includes three surveys:** Onshore Zambezi, South Mozambique and Mazenga Block.

**Three surveys will be planned and implemented separately.**

**First project is planned to start in Q3 2014 depending on the EIA progress and prefunding.**

**INP will launch a bid round after the program.**

### President from previous page

exceptionally proud to have the good names of my sponsors, each an oil finder of note in his own right, in support of my becoming a member, in keeping with the long-standing traditions of AAPG – but one might ask, did this make me one drop more a professional?

I would submit that what makes me a professional is my education, experience, personal dedication to continuous self-improvement in our profession and my personal ethics, to which no other person can truly attest.

If my signature acknowledging that I will abide by the AAPG Code of Ethics is insufficient, having 50 sponsors' signatures will not inhibit me from dastardly deeds befitting the darkest of villains in Shakespeare's plays.

At the same time, we serve our science *AND* professionalism by not building barriers to qualified geoscientists who otherwise might become members.

By taking down this barrier, we serve the highest tradition of AAPG by including our fellow professionals in what I do consider to be THE premier scientific and technical petroleum geoscience organization.

I must emphasize that increasing our membership is NOT the goal; the goal is to include professionals who are technically qualified and who, through their accomplishments, will enhance our science and the professional image of petroleum geoscientists.

This is why all of the presidents of our Regions, our Young Professional community, the DPA leadership, the AC, the EC and many thoughtful and dedicated professional members endorse this measure.

I hope the AAPG House of Delegates, after due deliberation and careful consideration as a united body of professional geoscientists, also will agree.

\* \* \*

And now, as Laertes responded to his father, "Most humbly I do take my leave."

Please feel free to "ping" me at lee.krystinik@aapg.org and let me know how I can best serve you as members of AAPG by continuing to do what we say we will do.

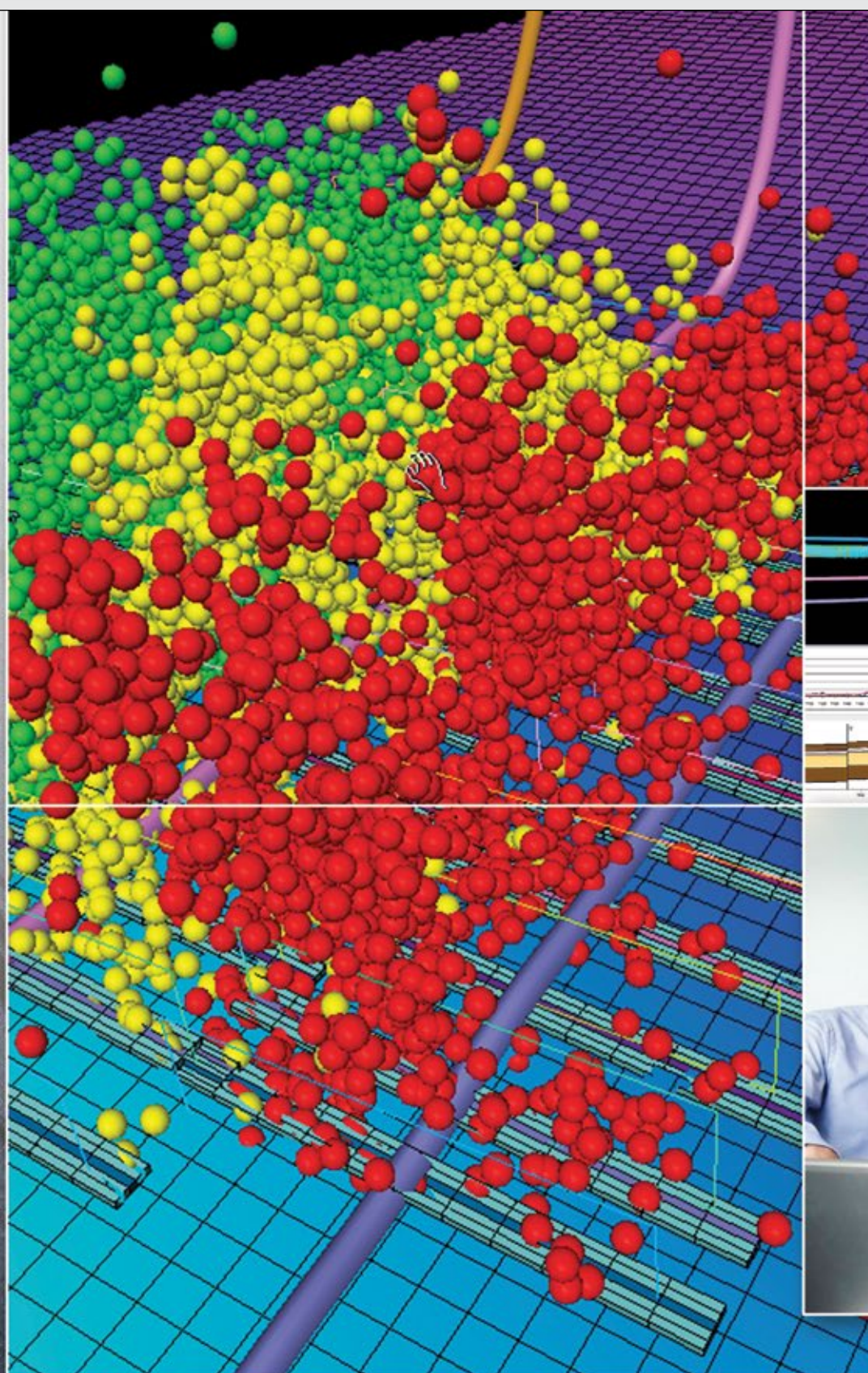
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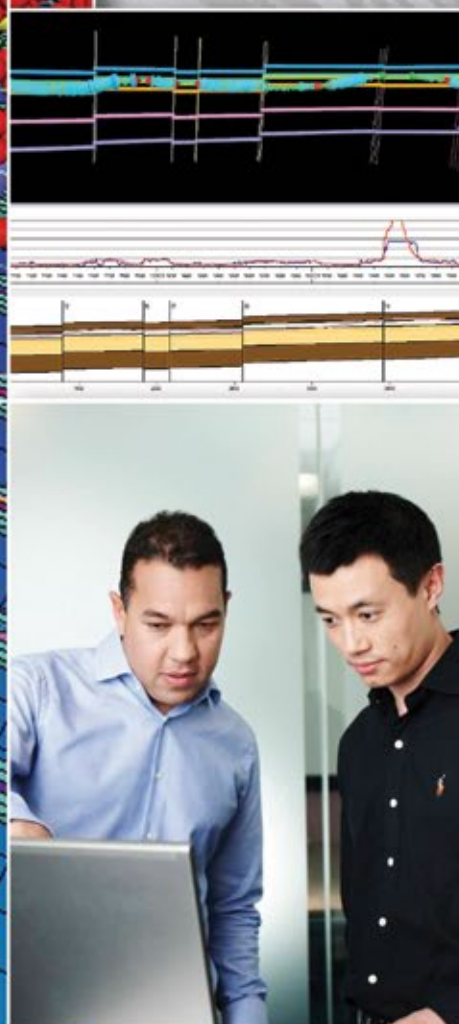






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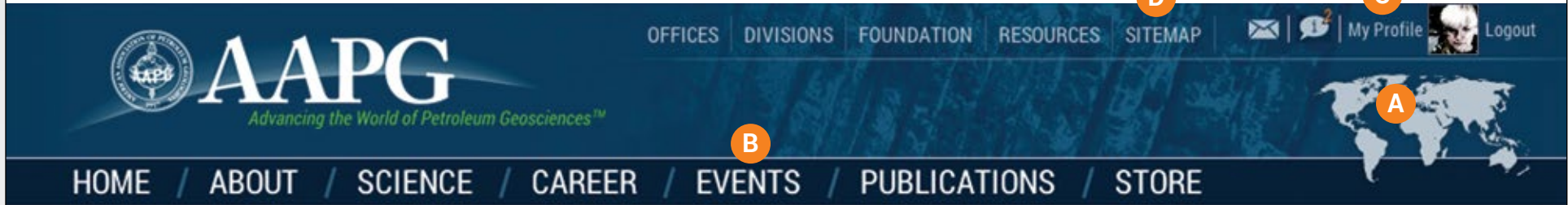
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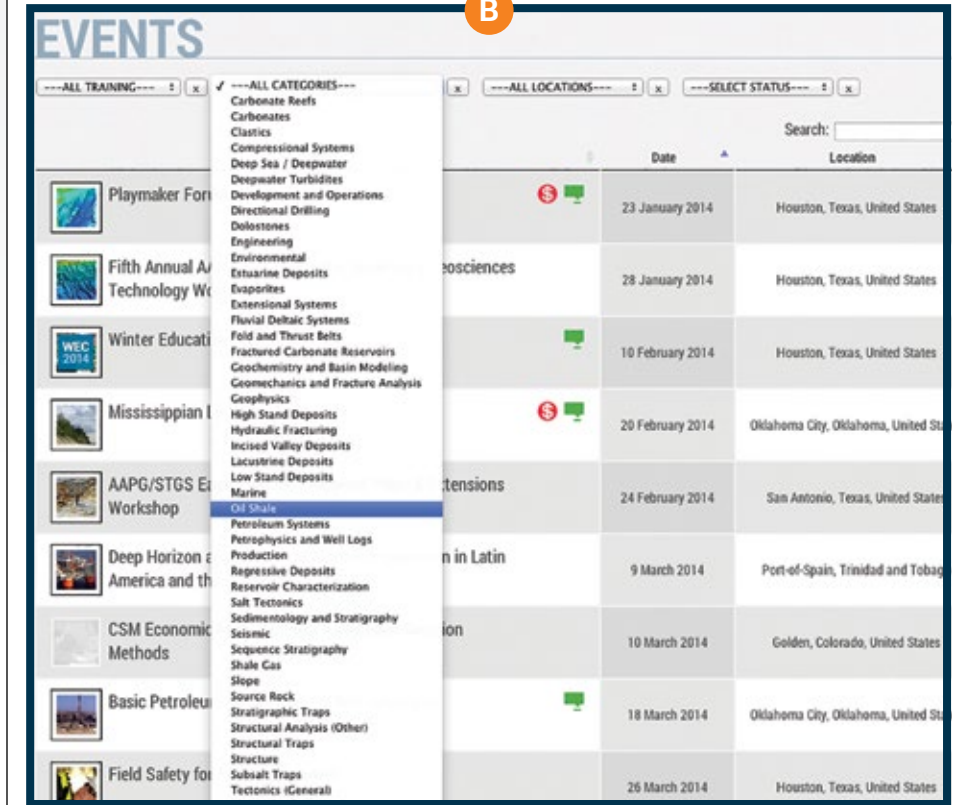


# Something *Very* New: AAPG Website Debuts

By JANET BRISTER, AAPG Website Editor



This month you'll have the opportunity to visit our new AAPG website – a radically new experience designed to improve your connection to AAPG. To help you prepare for this we'd like to introduce all of you to some of the features of our new site, which literally has been years in the making. So much to share and so little space – but here's a glimpse of what you will experience when the AAPG website launches. Please note these screenshots are from our development server, so there could be some minor variations in the final experience. The primary features, however, will be the same.



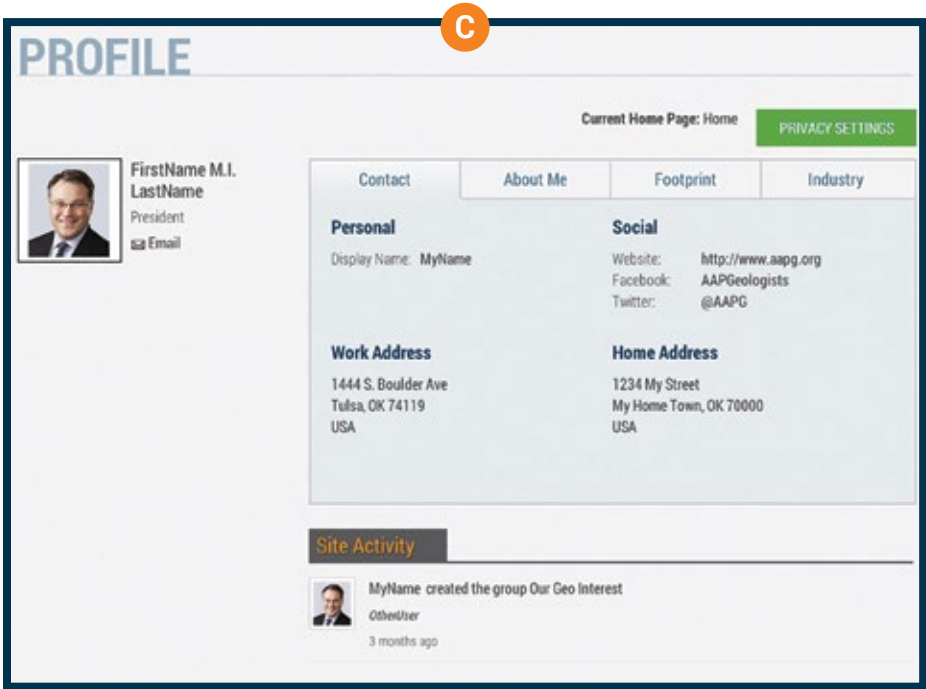
**Improved Event Listing:** The “master” events table lets you look through all events in chronological order – or sorted by location or type of event. You may select the type of content you desire to view, too, such as “Training” on “Oil Shale” to hone a list to your needs. Identifying icons allow you to see quickly the status of each meeting: call for papers, registration open, exhibits or sponsorships available.



**Convenient site** map is located from the mini-nav. When clicked it expands the footer to reveal a site map. **Enhanced site search** (not shown here) will be found just under the navigation bar and on the right. This tool auto-suggests as you type your search criteria. (Ranking your results will provide feedback and shape the information for other visitors to the site.) Best of all, the search tool not only will search AAPG's information domain, it also will search the scientific sites as well – including AAPG Datapages' Search and Discovery, several external meeting microsites and the Divisions, AAPG Foundation and all Section and Region pages. The final result is a much more comprehensive result to your search criteria.



**Geographic Map:** Look for meetings, events and even content in news articles or published papers by their location. Layers toggle on and off to display the content – and you may choose from six backgrounds for display.



**Profile set up** empowers you to customize the information you want shared about yourself. You'll also be able to retrieve important information for your own personal use, as the records maintained in the Association's database are now displaying just about every piece of information we have about you: activity records as to your participation (committee service, events attended and even purchases made); your contact information; and a personal bio about yourself where you can tell your associates information about you that matters. The expanded profile is vital to the AAPG N.E.T., where members may network, engage and talk. (The N.E.T. refers to most of the AAPG website as members make comments and offer reviews or participate in discussion groups either about scientific or technological information.) The more AAPG members participate, the stronger the N.E.T. will become. Everyone will be encouraged to register to use the site – registration opens up content and/or the ability to participate in information provided. As people use the site, it will grow in its value to the industry and to the members of the AAPG.





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# Challenges – and Rewards – Lure Arctic Efforts

By LOUISE S. DURHAM, EXPLORER Correspondent

Technological advances and industry know-how have enabled the oil industry to venture into a number of frontier areas – the deepwater Gulf of Mexico, for example – and attain success.

The foreboding Arctic region now looms as the last frontier for explorationists.

Experts peg it to be a treasure trove of untapped Black Gold – but it won't be recovered easily or inexpensively.

The resources are conventional, but the environment is highly unconventional.

In the past three decades, more than 200 billion barrels of oil have been discovered there, according to Alastair Fraser, EGI Chair in Petroleum Geoscience at Imperial College of London.

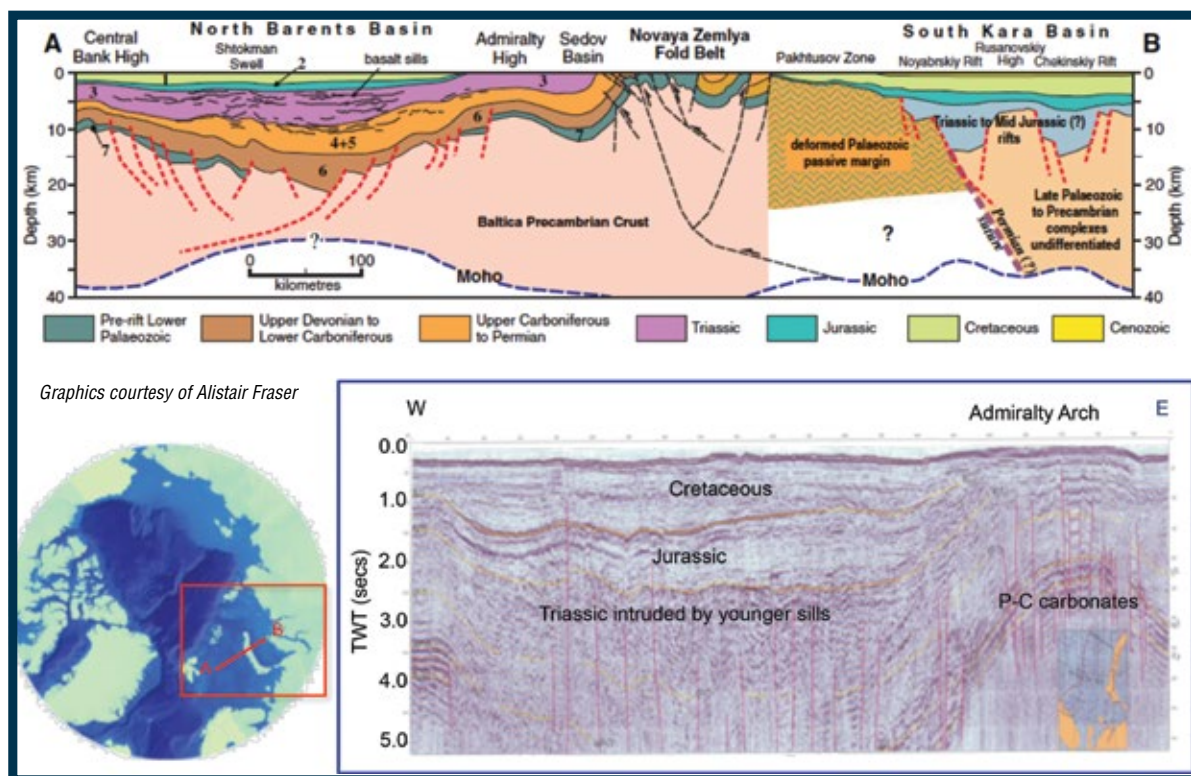
"Ultimate resources are estimated at 114 billion barrels of undiscovered oil and 2,000 trillion cubic feet of natural gas," Fraser said. "If these estimates are correct, these hydrocarbons would amount for more than a fifth of the world's undiscovered reserves."

Fraser is a former exploration manager at BP where he began working on the North Slope in 1979 and was involved in BP's circum-Arctic project beginning in 2002.

He also was one of the speakers for



FRASER



Graphics courtesy of Alistair Fraser

The West Siberian Basin and its offshore portions in the south Kara Sea are among earth's most prolific petroleum basins, with greater than 400 billion bbls(OE). It is an intracratonic basin that has evolved from Triassic to Tertiary. Note the progressive deepening of the late Jurassic source rock from south to north (Urengoy) and shallowing again into the south Kara Sea, which is likely to become a major oil and gas province over the next few decades.

the current AAPG-AAPG Foundation's Distinguished Lecture program, recently completing two tours of eastern and western Canada as this year's Shell Distinguished Lecturer.

Fraser offered two topics during his tour: One dealt with Angola exploration, but the other took advantage of his BP professional

experience on the North Slope: "Oil and Gas Exploration in the Arctic."

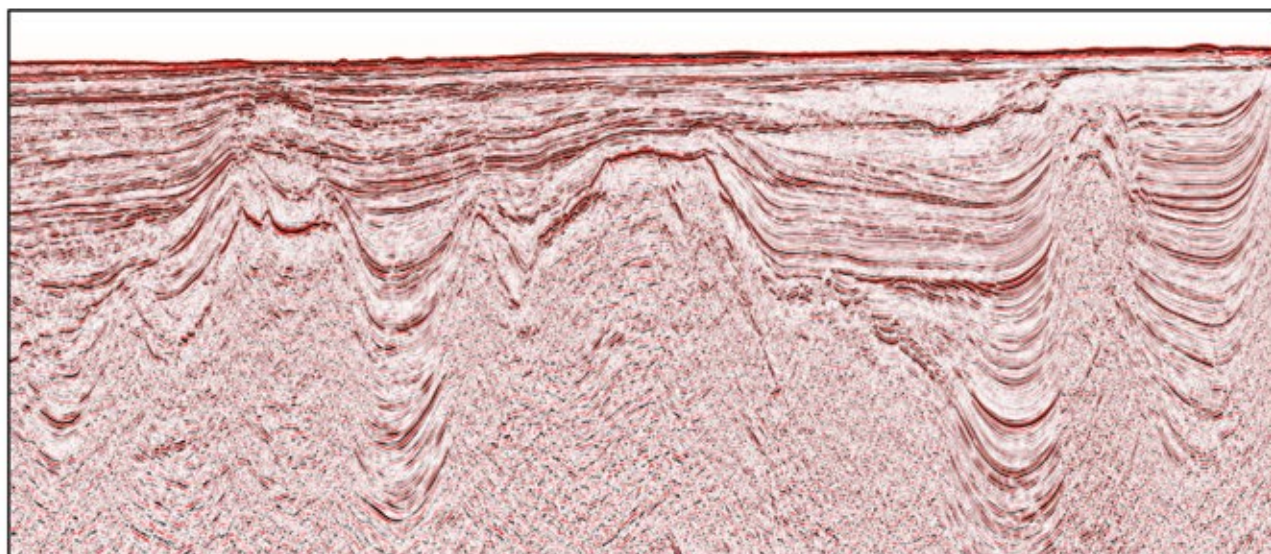
"Harnessing the considerable resources of the 'Final Frontier,'" he added, "will be fraught with many technical, political and environmental challenges that will engage many minds – both scientific and political – over the next half century."

## Challenges and Concerns

Besides the technical challenges of recovering hydrocarbons in this generally ice-covered part of the world, the concern

See Arctic, page 10

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- Well-tie survey tying 70 exploration wells

Seismic example from the newly acquired survey in the Tromsø Basin

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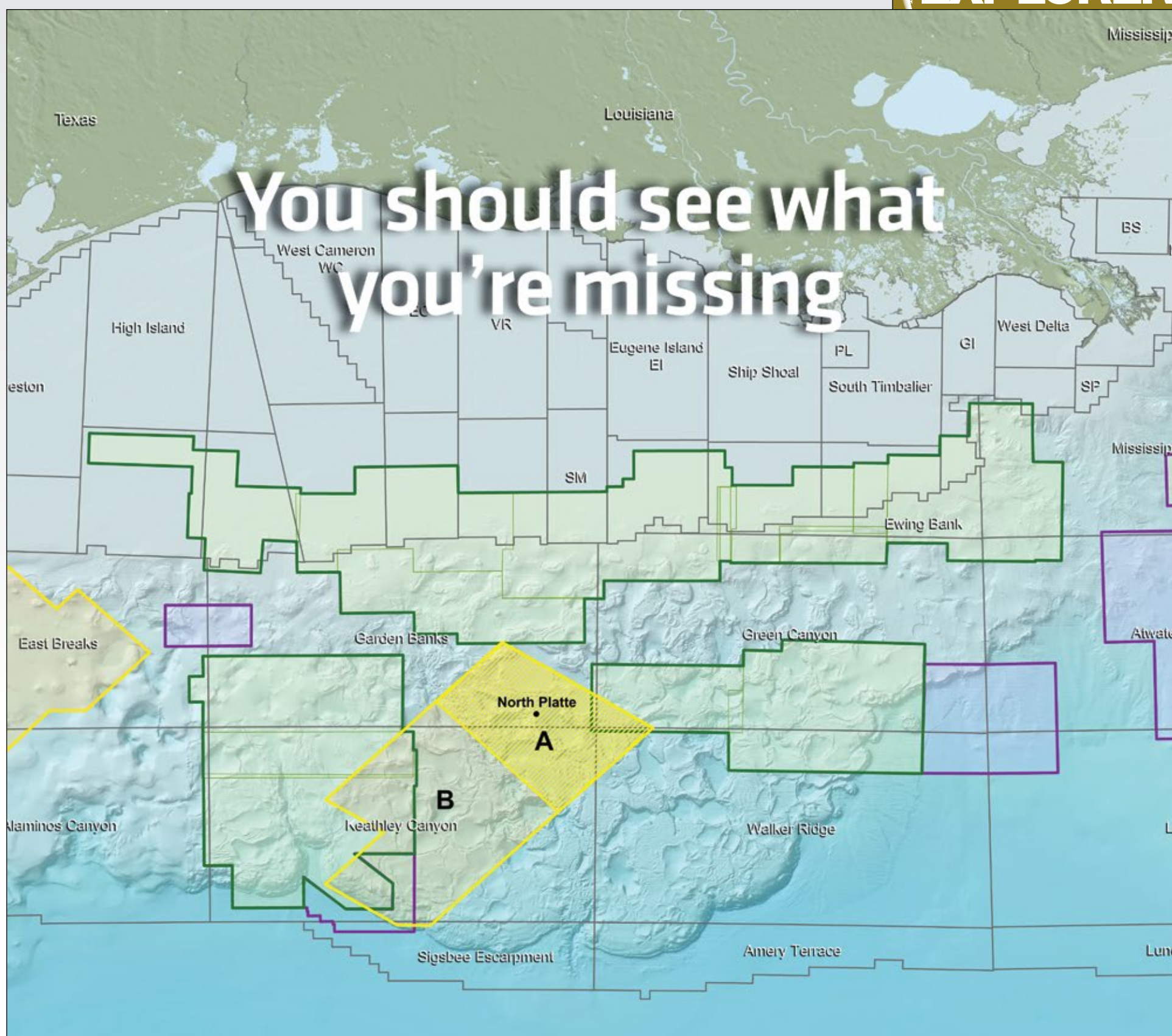
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## Arctic? You Must Remember This ...

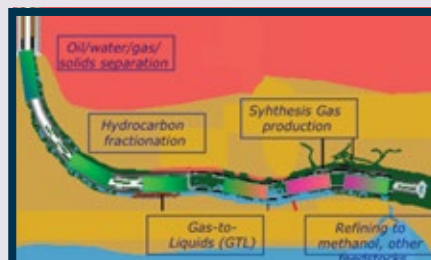
When it comes to exploring the Arctic, aka the Last Frontier for oil exploration, AAPG-AAPG Foundation Shell Distinguished Lecturer Alastair Fraser summarized some of the salient points to consider:

- ▶ There are vast unexplored areas within a proven petroleum province.
- ▶ The database is weak, particularly regional seismic and wells in the high Arctic.
- ▶ The key to success will be prediction of world-class regional source rocks.
- ▶ Future interest may focus on unexplored passive margins and associated delta systems.
- ▶ Sustainable development will require real partnerships between governments,

industry and, most importantly, indigenous peoples – a consistent approach required across all political boundaries.

▶ Is it all happening too fast? Are too many dollars being spent ahead of enabling technologies?

– LOUISE S. DURHAM



The Russian program for oil production in the Arctic includes plans to use a nuclear-powered drilling submarine.

## Arctic from page 8

for protecting the unspoiled environment looms large.

Not surprisingly, the humongous jackpot awaiting the explorers has stimulated both government and industry interest in an array of areas, including the U.S. and Canadian Beaufort Sea, east and west Greenland, and the Kara Sea on the Siberian shelf.

If you want to know just how big a challenge the Arctic region presents, check out Royal Dutch Shell's experience thus far.

The company has labored diligently for eight years and spent close to \$5 billion working the Beaufort and Chukchi seas offshore Alaska, where it encountered a slew of problems.

The highest profile setbacks in its planned drilling program included significant issues in 2012 involving two drillships. The company ultimately was limited only to top-hole drilling the upper 1,500 feet of its Arctic wells in 2012.

The drillship debacles and other problems placed the company under a virtual high-powered magnifying glass, ultimately triggering widespread concern among various anti-drilling groups, government agencies and others.

Speculation is rife that Shell will return to the Arctic sometime this year, but speculation is just that.

Russia, the United States, Canada, Norway and Greenland hold major interests in the Arctic, where some areas, such as Alaska, have been explored for a number of years. Certain others only now are digesting results of their first deep seismic surveys.

In fact, lack of a meaningful database is one of the issues looming large within the E&P offices.

Fraser noted this dearth of data holds particularly true for regional seismic and wells in the high Arctic, with drilling concentrated in a few regions and large areas of the Arctic being rather poorly understood.

### Don't Walk Away

Still, it would be folly to walk away from the awaiting prize.

"Four main factors are always required for a good working petroleum system," Fraser said, "and I believe that these are all present in an array of formats throughout the Arctic."

They are:

- ▶ World class source rocks.
- ▶ Sufficient heat flow for oil generation and migration.
- ▶ Excellent reservoirs – for example, thick, permeable sandstones, major deltas and carbonate platforms.
- ▶ Giant structures sealed by mudstones or salt.

Fraser emphasized that although there is significant ice in the Arctic, it is mobile – and its distribution varies from year to year.

Regardless, a seasonal approach to exploration is essential.

"The clockwise-rotating ice exits the Arctic into the North Atlantic through Baffin Bay and between Greenland and Iceland," he said. "This produces hazardous icebergs, which will impede (seismic) data acquisition and prospective drilling."

"The moving ice is a hindrance to economic exploration, drilling and development."

"Still, so many parts of the Arctic are accessible," Fraser added. "The Barents Sea (to the north of Norway and Russia) is ice-free year-round."

Then there's the current state of the historically ice-bound Northwest Passage, which is the Arctic sea route linking the Atlantic and Pacific Oceans. Today, one can navigate this now-open stretch in only a few days.

This bodes well for seismic data acquisition, exploration drilling and eventual development of production facilities.

The Arctic shelf is quite broad and shallow. For instance, the water depths of the Chukchi Sea range between 200 meters at most, down to less than 20 meters.

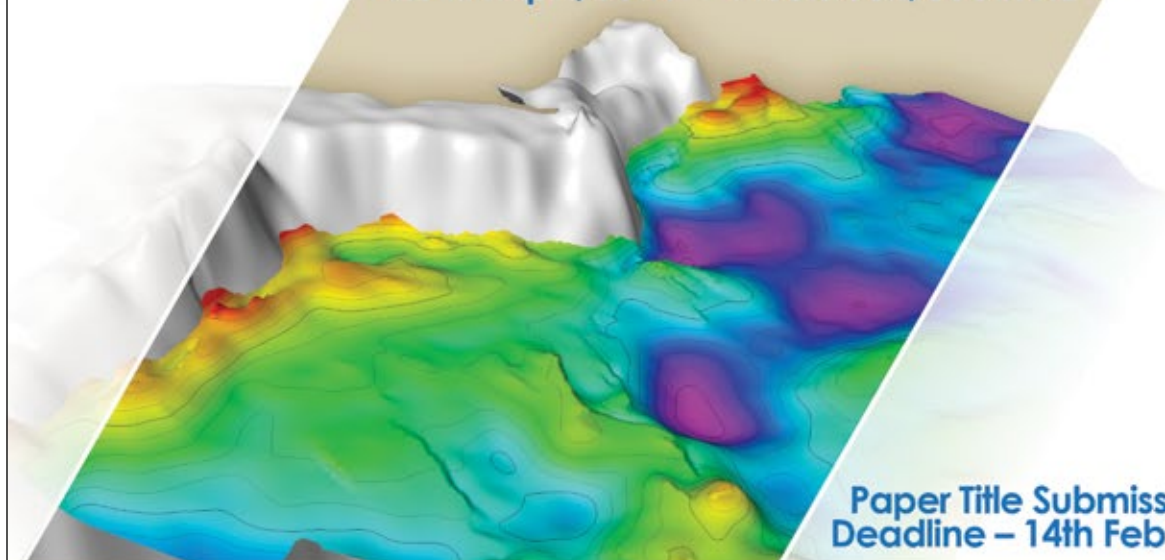
The vast areas of unexplored acreage in the Arctic include a 5,000-kilometer stretch

## Call for Papers and Registration

### The 'Brae Play,' South Viking Graben:

Jurassic coarse-grained clastic reservoirs, structural development and hydrocarbon systems

23–24 April, 2014 • Aberdeen, Scotland



Paper Title Submission  
Deadline – 14th February, 2014

This **2-day meeting** aims to bring together workers from industry and academia, resulting in a compilation of papers, which will form a comprehensive account of this important area.

#### Themes will range from

- mechanisms and geometries of deposition of conglomeratic, proximal submarine fan deposits and sand-rich basin floor fans
- sediment supply systems on the graben footwalls
- structural controls on deposition and the structural evolution of the graben
- development of the hydrocarbon systems within the graben

Although primarily focused on the South Viking Graben, contributions on relevant processes or analogs from the North Sea or elsewhere may also be included. Hopefully the results may stimulate further exploration activity in this region and also provide analogs for the exploration and development of other rift systems.

A **Core Workshop** is planned for 22nd April (p.m.) 2014 along with a **Field Trip** to the Helmsdale area, Northeast Scotland, to view Brae-like sequences for a limited number of participants on 25-26 April 2014.

Registration Details at:  
[www.braeplay.com](http://www.braeplay.com)  
Twitter @BraePlay

Those interested in providing a paper or poster for this meeting are requested to contact the following:  
Colin Turner – [ccturner@marathonoil.com](mailto:ccturner@marathonoil.com) or +44 (0)1224 803880  
Bryan Cronin – [bryan@deep-marine.com](mailto:bryan@deep-marine.com)

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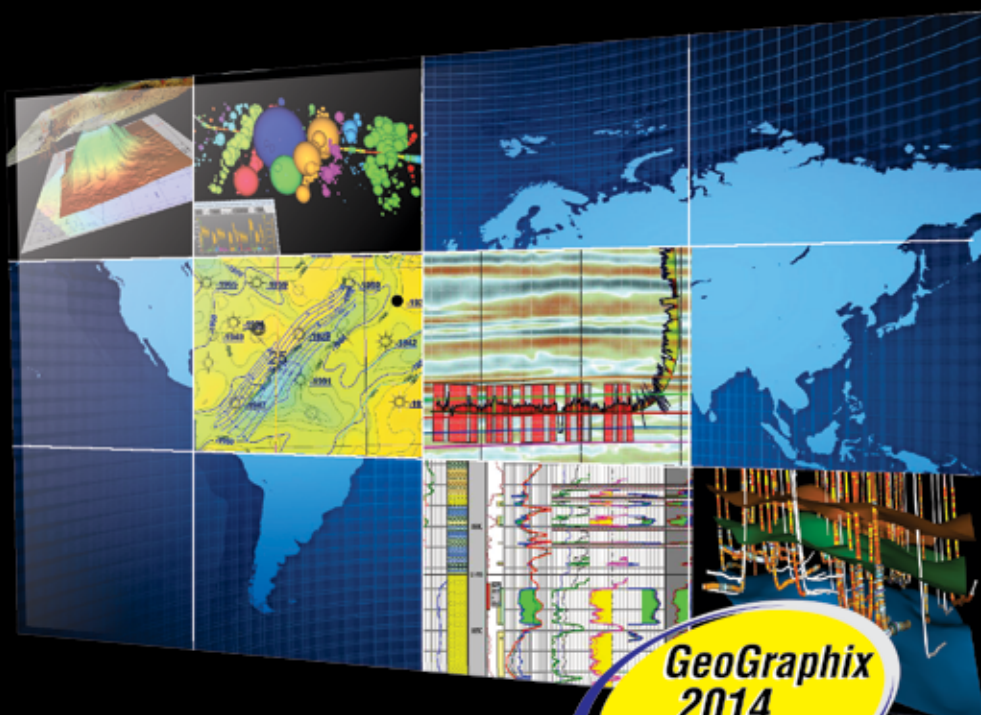


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## Exploration for Unconventional Reservoirs

The development of commercial production from unconventional reservoirs in North America over the past decade has generated a tremendous shift in exploration activity globally. Operators are taking what they have learned and are applying these methods to explore for and delineate potential unconventional reservoirs around the globe.

The editors of INTERPRETATION ([www.seg.org/interpretation](http://www.seg.org/interpretation)) invite papers on the topic "Exploration for Unconventional Reservoirs" for publication in a November 2014 special section to supplement the journal's regular sections of technical papers on various subject areas. Contributions are invited on interpretation across the broad spectrum of

- case studies describing exploration efforts for unconventional reservoirs outside of North America
- workflows and new methods to evaluate unconventional reservoirs
- seismic evaluation of source rock: estimating TOC, mineralogy, hydrocarbon richness, productivity, etc.
- techniques developed in North America with direct application to prospective plays outside North America (specific examples)

Interested authors should submit their manuscripts for review no later than **1 March 2014**. In addition, the special section editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for INTERPRETATION (<https://mc.manuscriptcentral.com/interpretation>) and select this topic in the manuscript type dropdown option. The submitted papers will be subject to the regular peer-review process, and the contributing authors also are expected to participate in the review process as reviewers.

The submissions will be processed according to the following timeline:

Submission deadline  
1 March 2014

Peer review complete  
1 August 2014

All files submitted for production  
15 August 2014

Publication of issue  
November 2014

Special section editors:

Karen Sullivan Glaser  
[glaser2@slb.com](mailto:glaser2@slb.com)

Yaping Zhu  
[yzhu2011@yahoo.com](mailto:yzhu2011@yahoo.com)

INTERPRETATION special section

# CALL FOR PAPERS



Photos courtesy of Chevron Arctic Center

Today's Arctic exploration efforts are possible in part because of the hard work of geoscientists in the past – stories that will be shared at the upcoming Arctic Technology Conference.

*The good, the bad ...*

# Lessons From the North

By DAVID BROWN, EXPLORER Correspondent

**B**een there, done that? Not many have in the Arctic.

Pioneers in Arctic exploration and development will discuss their experiences during the Arctic Trailblazers panel discussion at the upcoming Arctic Technology Conference, Feb. 11-14 in Houston.

"Our panel will be concentrating on learnings from Arctic pioneers, so you should expect some unique and personal perspectives on what a handful of seasoned Arctic veterans have to say on some key issues," said Gus Cammaert, who will serve as moderator for the panel session.

Cammaert is associate professor of Arctic engineering at Delft University in the Netherlands.

"The emphasis will be on lessons learned rather than specific technical issues, and how we can best move forward with this information," he noted.

Panelists scheduled to participate are:

► **Richard Glenn**, executive vice president-Lands and Natural Resources, Arctic Slope Regional Corporation, Barrow, Alaska.

► **David Dickins**, ice/oil spill expert, Chevron Arctic Center, Calgary, Canada.

► **Brian Wright**, senior ice/concepts adviser, Chevron Arctic Center.

► **Kevin Hewitt**, geotechnical/ice, Chevron Arctic Center.

► **R.J. Brown**, director, R.J. Brown Deepwater, Houston.



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### Way Up North

Brown had formed his company, R.J. Brown & Associates, when he got a contract from Panarctic Oils to design and install a gas pipeline from the Drake Field on Melville Island in the Canadian Arctic.

Panarctic was a Canadian government-sponsored exploration company created for Arctic drilling. It conducted an exploratory program and discovered the Drake Point gas field in 1969-70.

By 1976 it had drilled a number of good wells in the area and estimated marketable gas at as much as six trillion cubic feet (Tcf). The company put total gas reserves in Canada's Arctic Islands at 17 Tcf and oil in place at 1.6 billion barrels.

But no one had any idea if production could ever leave the area – if a pipeline was economically feasible or even possible.

Brown and John Bomba, senior principal engineer for R.J. Brown Deepwater, discussed the pipeline project, which took place in 1976-77.

(Bomba will serve as co-chair for the "Pipelines and Export" technical session at this year's ATC.)

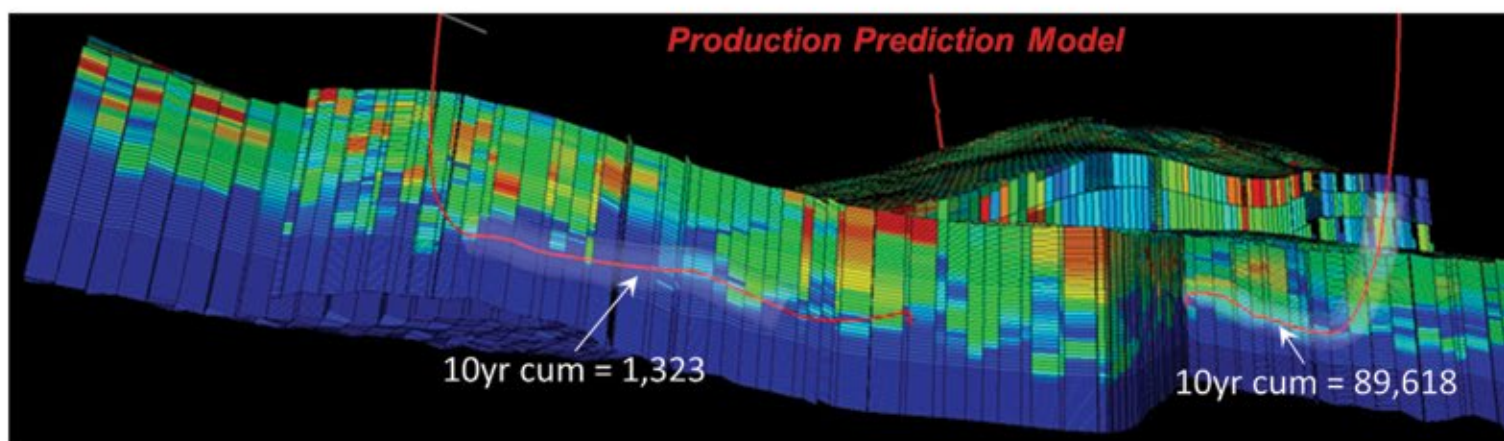
The Drake Point project "was a totally interesting job," Brown recalled.

"We were way up there – we were five degrees north of the Arctic Circle, about 300 nautical miles," he said.

To begin the project, Brown created a full-model simulation of the staging area and worked out how to install the

See Arctic Pioneers, page 14

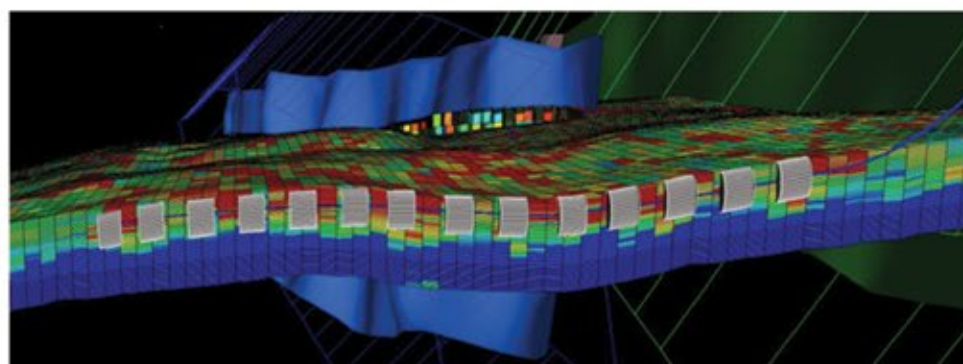




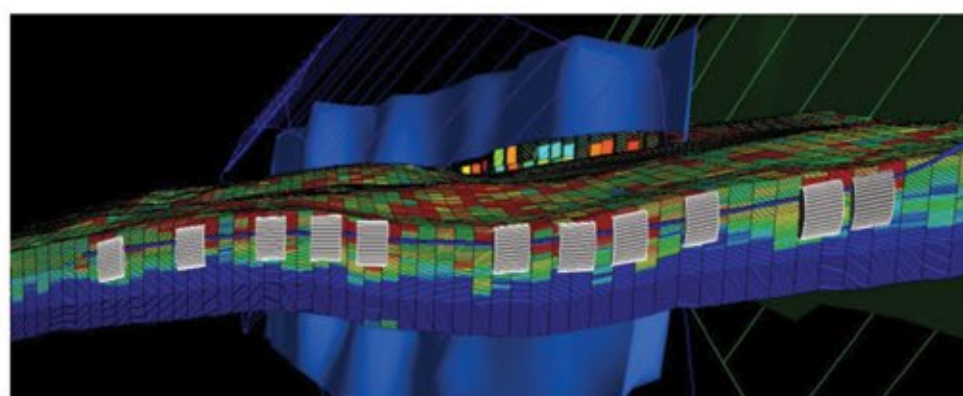
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*Technological advances have helped make the Arctic more accessible today than it was for the "pioneers" – but it still presents enormous challenges for today's explorationists.*

## Arctic Pioneers from page 12

pipeline. Although natural gas eventually was pipelined, this was as much of a demonstration project as an operational one.

"This was a test pipeline to prove that a well could be drilled and produced," Bomba said.

"That was actually the first installation under the ice," Brown recalled.

"Everything had to be airlifted from Point Rea to Point Drake.

"It was an area that was never totally clear," he added. "There was always ice cover."

### A Lot of Hot Air

In their description, Brown and Bomba made ice sound like concrete. Water was poured or injected to make a base for drilling rigs, to create a working surface, to establish support. Work was conducted in fall and winter months.

To create a landing strip for planes and airlifts, "they had to make a combination on-the-island, on-the-ice runway," Brown said.

"Now they're using these ice roads. Maybe they've figured out how to get up there with trucks," Bomba added.

A special tractor vehicle was used to get and move flown-in materials and equipment. Leaving a tractor out too long could result in worse problems than freezing.

"If you left it there too long, it would start to sink. The ice would start to deform," Brown explained.

Flowlines were made up and bundled in a tent onshore then pulled to the Drake 76 well site on an ice island. From there connections were made in what Brown described as a remote, driverless, "deflect to connect" process.

Installation took place in the winter, when air temperatures could reach -50 degrees Celsius.

The pipeline bundle consisted of two six-inch insulated and heat-treated lines, additional control and hydrate suppressant lines and an annulus access, all in an 18-inch casing. That casing was put into a 24-inch casing with a three-inch methanol line for growing a protective permafrost bulb.

A trench was opened in the ice for the pipeline installation. Naturally, it would

freeze over.

"We would have to cover the ditch with plywood," Brown said, "and blow hot air in under that to keep the channel open."

### Unique Expertise

The pipeline project included many industry firsts and established practices and approaches that are still used today, according to Brown. However, every project in the Arctic will present its own unique challenges, he noted.

"All of it is very site specific. This was a spot, luckily, that had shelter. It didn't have icebergs coming through," he said.

Cammaert agreed that conditions and challenges will vary for Arctic resource development, depending on where and when the work takes place.

"The considerations of remoteness, terrain, lack of infrastructure, et cetera, are unique to each Arctic project," he acknowledged.

"Through reference to specific projects by slides and films, there should be some interesting discussions on these topics" during the Arctic Trailblazers panel session, he said.

The number of specialists needed for Arctic exploration indicates how different it will be from oil and gas work in other frontier areas.

Cammaert said the discussion will feature "a fascinating mix of expertise on our panel," including:

- ▶ Native traditional Arctic experience.
- ▶ Escape, evacuation and rescue operations.
- ▶ Floating structures in ice.
- ▶ Technology for artificial islands.
- ▶ Execution of Arctic pipeline projects.

"Each expert will no doubt give his view on the skills that have been needed in the past," Cammaert said, with a look toward future requirements. In addition, questions from audience members and audience interaction will be encouraged.

"I hope the panel session will be provocative, and provide some new perspectives on issues such as new risks that should be anticipated, what new solutions should be applied to past problems, and how the environment and remoteness should impact the design of future projects," Cammaert said.

"One especially interesting topic that we hope to bring up," he added, "is how can we best cultivate the next generation of Arctic pioneers." ■



# SEE THE ENERGY

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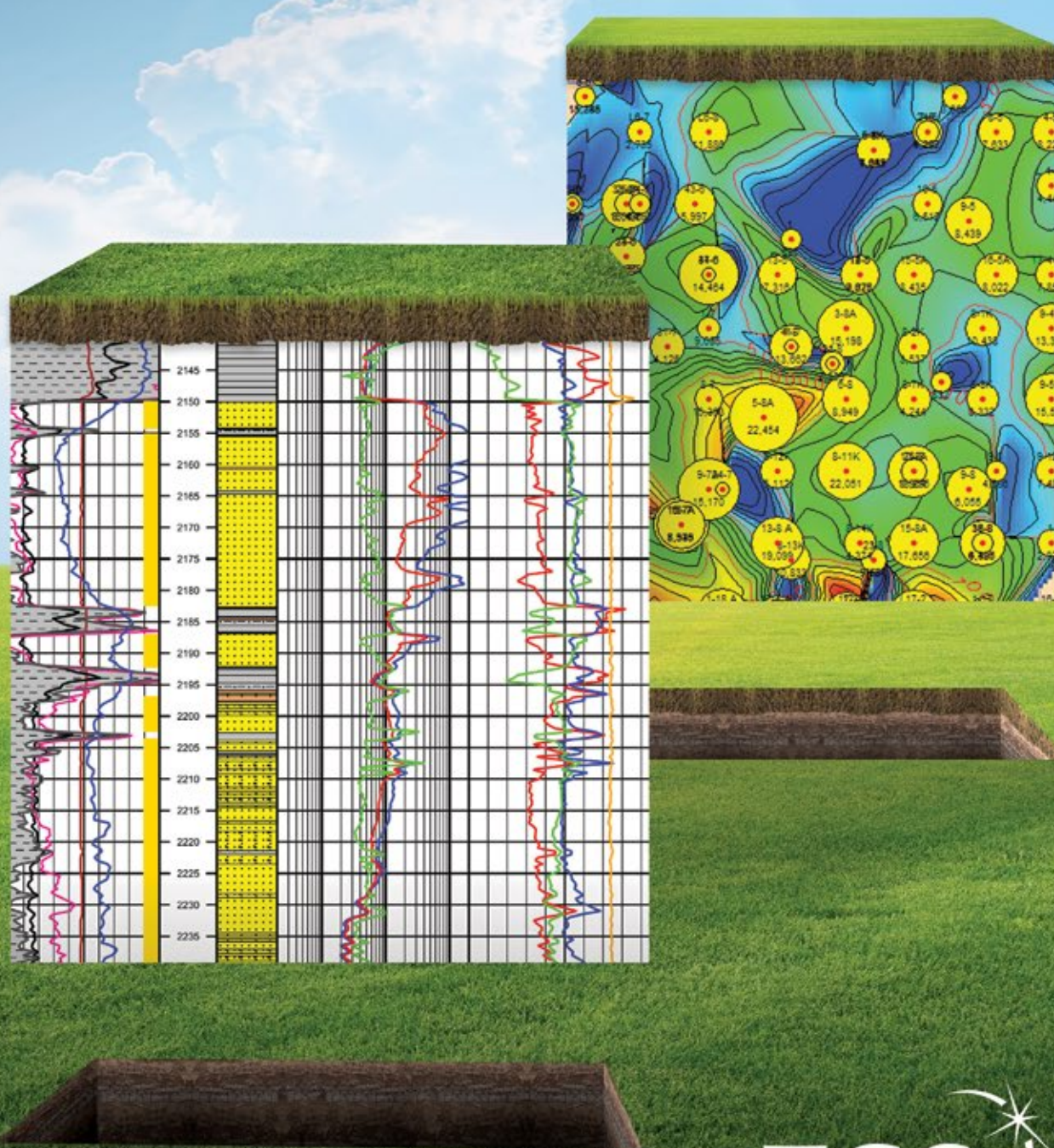
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Experts join together

## Teams Prep for Crises

By LOUISE S. DURHAM, EXPLORER Correspondent

**O**il spills happen. Typically without warning, whether on land or at sea.

How fast and effectively the involved parties and others respond to these sometimes potentially disastrous events can make all the difference.

Should such an event occur in the challenging Arctic region with its ordinarily frigid temperatures and widely pervasive, mobile ice sheets, it's essential to be prepared with the right technology and adequately trained response teams.

Yes, operators could pass this one by and focus their E&P efforts in friendlier, less risky environments.

But explorationists are not easily put off, and the Arctic is considered to be the last frontier in the big oil hunt. It's said to hold a magnificent prize of billions of barrels of technically recoverable oil and great quantities of natural gas.

Frontiers, however, represent the unknown – and the hostile Arctic likely more so than any other.

Significant preparation with regard to oil spills is crucial to harvesting hydrocarbons there in this pristine region.

The Arctic Oil Spill Technology-Joint Industry Program (JIP) is an endeavor focused on the need to be at the ready, when and if a spill occurs.

The JIP was established in January 2012, with the goal to raise awareness of



MULLIN

existing industry oil spill response capabilities in the Arctic and to further enhance industry knowledge and capabilities in the realm of oil spill response.

"This JIP has brought together the world's foremost experts on oilfield response research, development and operations from across industry, academia and independent research centers to undertake the technical work and scientific studies," said AAPG member Joseph Mullin, JIP program manager.

"This (program) is conducting oil spill response research projects over a four-year period," he noted – and for a good reason.

"This," he said, "is to advance the application and understanding of dispersant effectiveness, environmental effects, trajectory modeling, remote sensing, mechanical recovery and in-situ burning (ISB) in Arctic and ice-prone

### See Spills, page 18

Nine international oil and gas companies support the Arctic Oil Spill Technology-Joint Industry Program. They are:

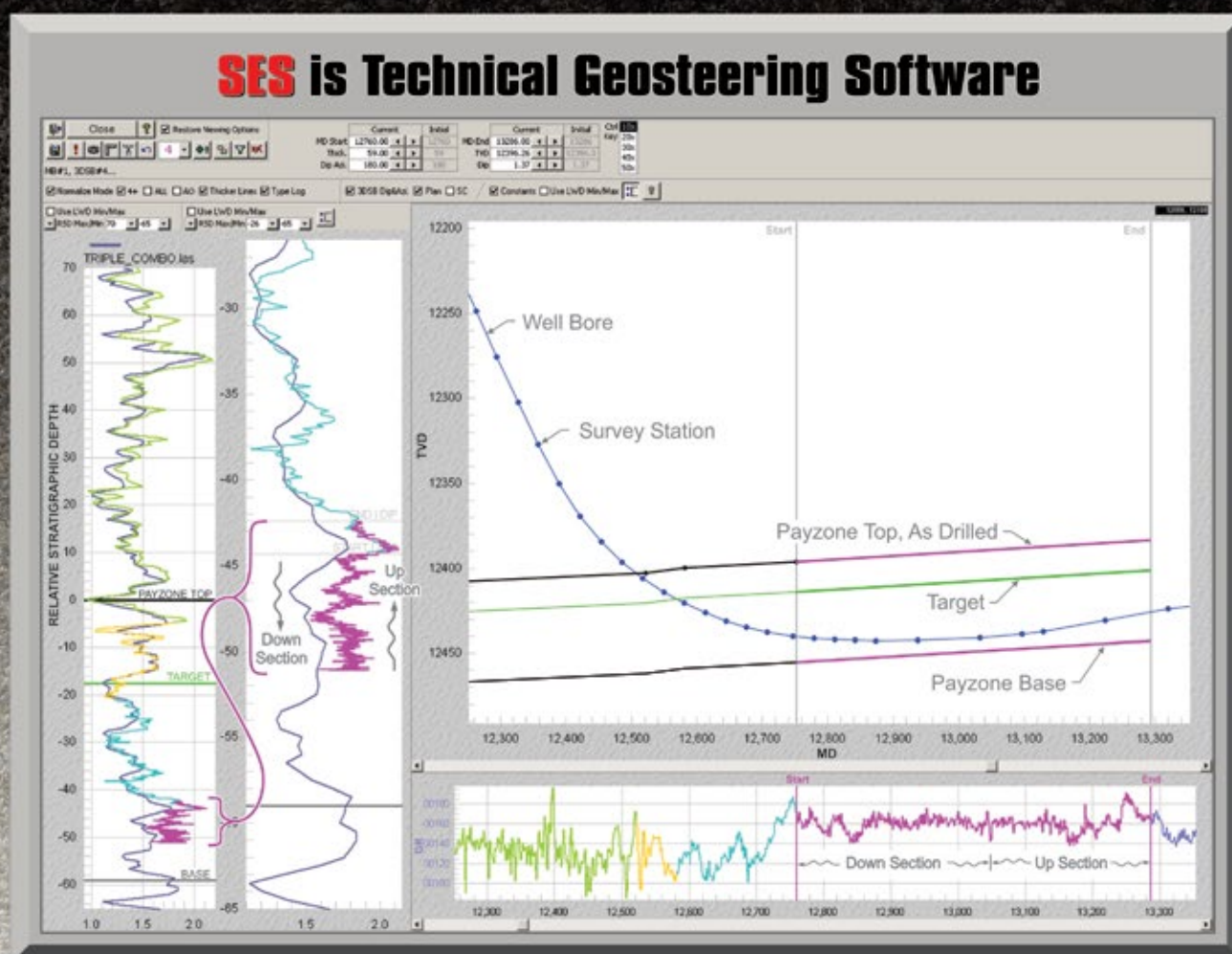
- |                  |                               |
|------------------|-------------------------------|
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Photos courtesy of the OGP Oil Spill Response Technology JIP

Crews with the Arctic Oil Spill Technology-Joint Industry Program train for emergencies.

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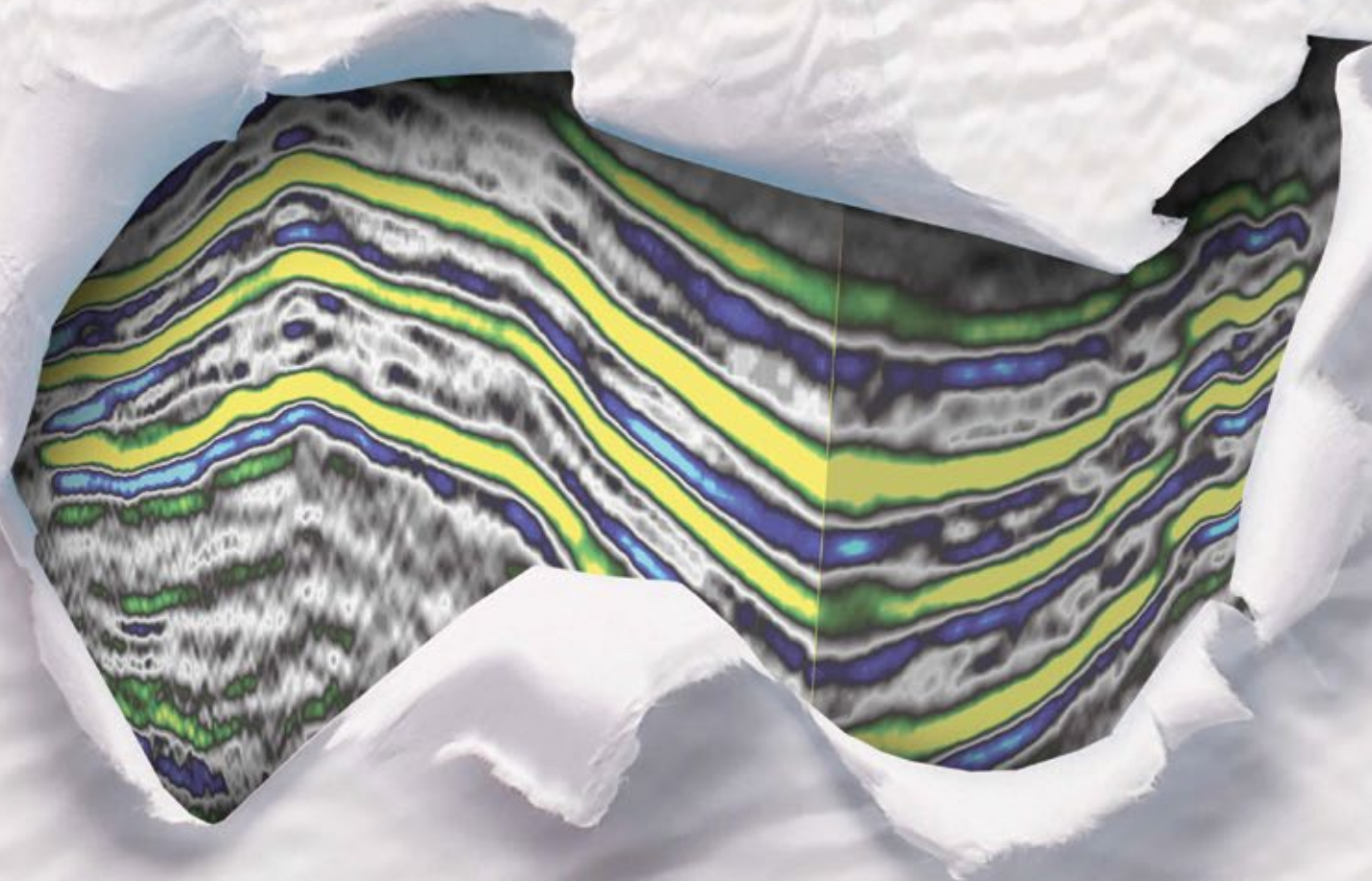
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Practice makes perfect: Research and training efforts currently under way include finding better ways to deal with oil spills in the Arctic both offshore and on.

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## Spills from page 16

and remote sensing have been completed. Mullin outlined the key findings to date:

► Dispersants can work in the Arctic and, under certain circumstances, will be more effective with ice present than in open water.

► Besides increased effectiveness, the presence of ice can increase the time window in which dispersants can be used effectively.

► Technology exists to conduct controlled ISB of oil spilled in a wide variety of ice conditions, and ISB is one of the response techniques with the highest potential for oil spill removal in Arctic conditions.


► There is significant scientific and engineering knowledge on ISB to ensure safe and effective response in open water, broken pack ice and complete ice cover. This knowledge was acquired from more than 40 years of research, including large-scale field experiments.

► Most of the perceived risks associated with burning oil are mitigated easily by following approved procedures, using trained personnel and maintaining appropriate separation distances.

► The current state of technology in remote sensing confirms the industry has a range of airborne and surface imaging systems utilized via helicopters, fixed-wing aircraft, vessels and drilling platforms that have been developed and tested for the "oil on open water scenario" that can be used for ice conditions.

Mullin noted that research efforts currently under way include oil spill trajectory modeling and technology feasibility studies, laboratory and meso-scale dispersant effectiveness tank testing, assessments of surface/subsea remote sensing technologies, and field research with chemical herders to improve ISB.

He emphasized the JIP builds on the progress the industry has made during many decades of R&D in the realm of oil spill response in the Arctic and cold weather conditions.

"Through (our) initial research," Mullin said, "we have reaffirmed our confidence in the techniques that the industry and its partners have developed during that long span of research and development to respond to oil spills in ice." 



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## Icebreaker technology

# Arctic Projects: If You Clear It, They Will Come

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

As this month's Arctic-themed issue of the EXPLORER was coming together, an instructive drama unfolded at the other end of the earth that illustrates a mounting obstacle to Arctic exploration and production.

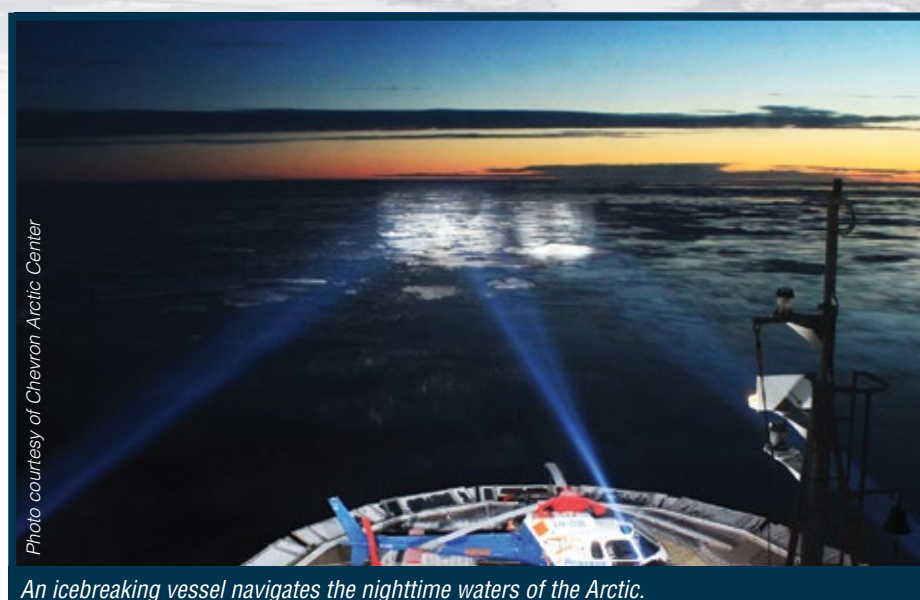
The Russian research vessel the *Akademic Shokalsky* was overtaken by a blizzard in late December and stranded in the icy waters offshore Antarctica. In the days immediately following, a series of icebreaking ships from Russia, China and Australia tried and failed to clear a channel through the thick barrier of ice to free the stranded vessel.

The latest would-be rescuer is the U.S. Coast Guard icebreaker the *Polar Star*, which was en route from its port in Sydney, Australia, at the time of this writing.

The *Polar Star* is, to date, the most powerful vessel to attempt a rescue of the *Shokalsky*, but it was built 38 years ago with an anticipated life span of 30 years. It was all but decommissioned in 2006, until engine failure took its sister ship, the *Polar Sea*, out of active use in 2010, necessitating a refurbishing of the *Star*.

It had been back in service only mere weeks before the *Shokalsky's* troubles began.

And that's somewhat typical for icebreaking vessels. With a limited number of newer icebreaking ships in existence, older vessels like the *Polar Star* tend to be relied upon long past their intended operating lives.



An icebreaking vessel navigates the nighttime waters of the Arctic.

### Finding the Way

Along with an aging, limited and increasingly thin supply, the demand for icebreaking vessels is expected to swell considerably in the decade to come.

With the U.S. Geological Survey estimating almost 90 billion barrels in recoverable oil in the frozen earth of the Arctic Circle, icebreakers will be vital to finding, drilling and transporting it.

"Whatever you do out in the seas, out in the Arctic, you cannot operate without icebreakers. In general, they are essential to anything you do where there's ice," said Arto Uuskallio, a naval architect with Aker

Arctic Technology, a Finnish engineering company that designs icebreaking ships.

Uuskallio's company and its predecessors boast of having designed and built roughly 60 percent of the world's existing icebreaking vessels.

The company's most recent creation is the NB 508, christened the *Baltika* – the first of what principals at Aker Arctic Technology hope will be the next generation of icebreaking ships: the oblique icebreaker.

Uuskallio explained the ship design was born out of Russia's need for a more expedient and economical way to transport crude oil to western Europe

Arto Uuskallio will present the paper "Next Generation to Break the Ice – The Oblique Icebreaker," during the upcoming Arctic Technology Conference, set Feb. 10-12 at the George R. Brown Convention Center in Houston.

Uuskallio's talk will be at 2:50 p.m. Wednesday, Feb. 10, as part of the session titled "Ice Breakers."

Also part of that session will be Bill Scott's paper on "Increasing the Role of Marine Support in the Arctic Offshore Exploration Drilling," which will be presented at 2:25 p.m., immediately preceding Uuskallio's paper.

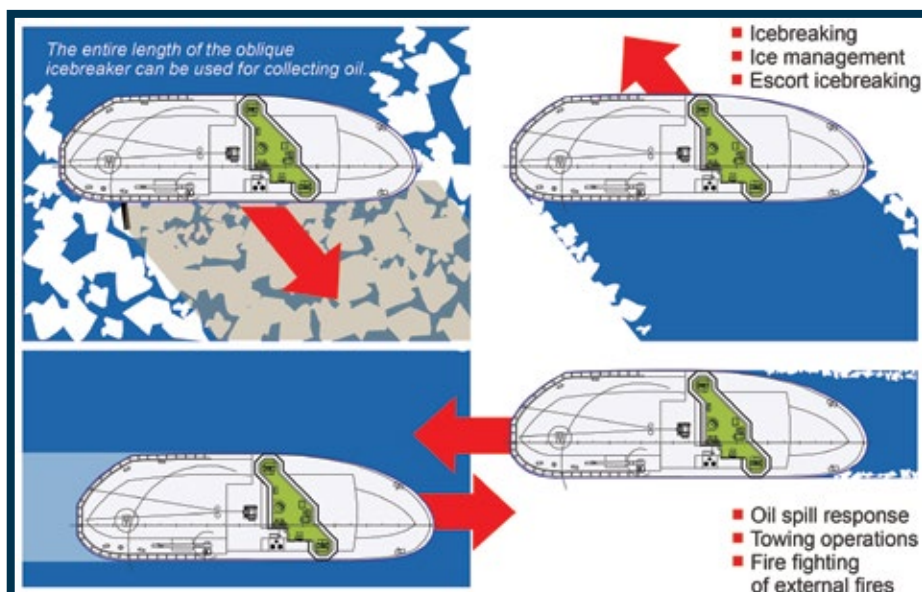
through the icy Baltic Sea. Typically, this requires two icebreaking ships, because a single icebreaker cannot cut a wide enough channel on its own to accommodate the massive girth of the Aframax oil tankers.

Naturally, two icebreakers cost more than one, so to reduce operating costs, the Russian Ministry of Transport requested proposals for a single ship design that could accomplish the work of two.

Aker Arctic Technology's predecessor, Kvaerner Masa Yards Arctic Technology Centre, won the contract with its oblique icebreaker concept.

The ship sports an asymmetrical hub with three "azimuthing propulsors" (that's

**Continued on next page**



AHTS - Icebreaker Vidar Viking



Continued from previous page

engineer-speak for propellers that can turn), which enable the ship to traverse at an oblique sideways angle, thereby cutting a swathe through the ice almost as wide as the ship is long.

The concept was introduced to the public in May of last year, and the *Baltika* is expected to be operational early this year.

The oblique icebreaker is expected to meet the needs of Russian oil exporters in the Baltic, but it won't help to meet the growing demand for icebreakers in the Arctic Circle.

Uuskallio explained the qualities that make it useful in the particular niche for which it was designed make it ill-suited for service where more conventional icebreakers would be used.

"The sea-keeping properties are not the same. The movements are different in heavier seas," he said. "There is always a compromise between different sea-keeping parameters."

### Wanted: A Better Swiss Army Knife

In that regard, the oblique icebreaker is somewhat representative of the economic difficulty of Arctic oil exploration. It's that variance between different sea-keeping parameters and different operational needs that prevents any single mass-market solution to meet the growing demand for icebreakers.

"Everybody's got a Swiss army knife, but the more pieces it has, the less useable it's going to be," said Bill Scott, general manager for the Chevron Arctic Center.

Scott and his colleagues also are presenting a paper at this year's ATC, titled "Increasing Role of Marine Support in the Arctic Offshore Exploration Drilling."

As Scott explained, the ship (or ships) used to manage the ice is among the most significant logistical considerations for Arctic operations.

"It used to be that icebreakers were used mainly to support drilling," he said, "but they're being used now to support seismic operations and exploration, and logistical operations."

The problem, however, is that most existing icebreaking vessels weren't designed to perform in all of the capacities needed for Arctic exploration and drilling, which means an operator will sometimes have to add multiple vessels to a support fleet, which drives up operating costs.

This likely will force operators to design and build new, multi-function icebreaking vessels, which presents its own difficulties – namely, the aforementioned "Swiss Army knife" conundrum in which, by trying to make it do too much, the vessel turns out to be a jack of all trades but a master of none.

But, Scott explained, operators in the Arctic need vessels to perform masterfully at multiple tasks.

Consequently, new ships have to be customized to the specific environments for which they will be used, which raises multiple considerations for the front and back ends of the operation.

First, building a new ship-to-order requires a long lead time, which forces oil and gas companies to speed up their decision-making process of whether to drill or not.

Second, companies must determine whether the new support vessels will still be useful and economical – and therefore worth the investment – after the operation is finished. 

## Third Annual ATC Opens This Month in Houston

The third annual Arctic Technology Conference (ATC), the world's foremost event for the development of offshore resources in the fields of drilling, exploration, production and environmental protection, returns to the George R. Brown Convention Center in Houston, Feb. 10-12.

Developed with the support of the Offshore Technology Conference's multidisciplinary sponsoring organizations, ATC's program offers more than 130 technical presentations for energy professionals working in the ever-changing Arctic region.

ATC 2014 is expected to build upon the success of the previous ATC events with international scientists and engineers sharing their ongoing research and

development and execution experiences in the five key areas: Geology and Geophysics; Exploration and Production; Physical Environment; Logistics and Marine Transport; and Regulatory, Environment and Social Responsibility.

All focus will be applications in the circum-Arctic, while paying respect to the people, the land and the sea of the circumpolar areas.

The three-day program includes panel sessions devoted to Arctic core capabilities, past Arctic projects, the global Arctic market outlook and worthwhile experiences from Arctic trailblazers. In addition, topical luncheons will offer insights into Arctic themes, both from a technical as well as a socio-economic

point of view.


A continuing highlight is the Spotlight on Arctic Technology awards program, which recognizes innovative new products and technologies displayed in the exhibition.

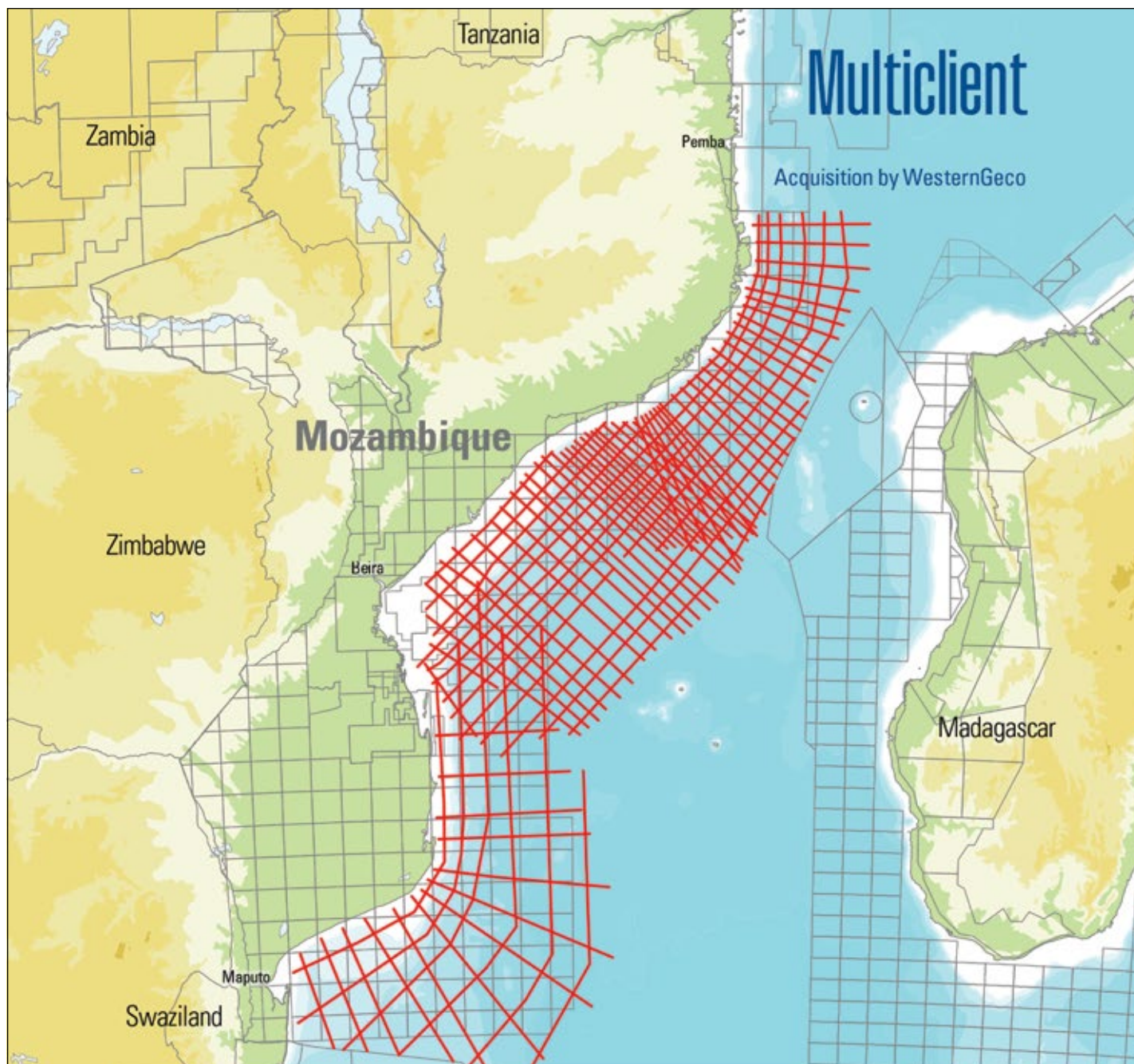
This year's award winners to be honored Feb. 10 in the exhibition hall are:

► **ION Geophysical**, for its Narwhal™ for Ice Management.

► **Fugro**, for GeoSAR Sea Ice Mapping.

► **Fugro** (again), for Integrated 3D Iceberg Imaging.

Online registration and additional information are available at [www.arctictechnologyconference.org](http://www.arctictechnologyconference.org). 






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## Fraser from page 10

of shallow continental shelf extending from the North Chukchi Basin to the North Kara Sea, according to Fraser. He noted there is not a single well in this sizeable area.

"Fifty percent of the Arctic is continental shelf – the largest tracts of undrilled continental shelf on the planet," he declared. "We like continental shelves as they have basins, (and) basins have source rocks and oil and gas."

"The USGS (U.S. Geological Survey) has done a lot of wonderful work (in the Arctic), saying the Arctic is going to be quite gassy," Fraser said. "I think it will be quite oily, because we're looking at world class oil prone source rocks that will be in the oil window."

"A lot of gas has been found in the Arctic so far, mostly in western Siberia in Russia," he said. "As you go farther north, the source rocks producing the gas come back into the oil window."

### The Only Place

Look for politics to play a significant role in Arctic E&P as the various countries jockey for the prime acreage.

"Some wonderful battles have taken place over acreage such as the south Kara Sea," Fraser noted jocularly, "which is my favorite piece of exploration acreage on the planet."

To date, two structures have been drilled there, resulting in large gas discoveries. For now, they sit under ice, taunting the experts who must determine how to produce them.


It behooves all industry participants to be aware of just how major the issues are relative to the environment and the people in this region.

"The Arctic is a wonderful pristine wilderness," Fraser emphasized. "As an industry we have to be very careful, be better than we've ever been before."

"Four million people live and work north of the Arctic Circle," he noted. "Twenty percent of these are indigenous, and it's very important they have a say in this. But the oil companies have worked with local populations all over the world, so they know how to do this."

Well, you ask, if it's all so tedious, why not go elsewhere?

Fraser's answer:

"The Arctic is the only place where we can really replace production from a conventional resource." 

## ACE Registration Opens – Reduced Fees Available

Online registration for this year's AAPG Annual Convention and Exhibition is now available – and the first deadline for reduced fees arrives this month.

Specifically, that deadline arrives Feb. 10.

The 2014 ACE will be held April 6-9 at the George R. Brown Convention Center in Houston – the 13th time the city has played host for the AAPG annual meeting.

This year's theme is "Ideas and Innovation: Fuel for the Energy Capital," and the comprehensive technical program will include more than 800 oral and full-day poster presentations.

Highlights include:

- Sunday's opening session, featuring an address by AAPG President Lee Krystinik and the bestowing of honors to the Association's and profession's best, led by Sidney Powers Memorial Award winner Ernest A. Mancini and Michel T. Halbouty Outstanding Leadership Award winner Peter R. Rose.

- Not just one but two Discovery Thinking Forums – the ninth and tenth in the AAPG 100th Anniversary Committee's series honoring "100 Who Made a Difference." The sessions will be held in the morning and afternoon Monday, April 7.

- Kirk Johnson, Sant Director of the Smithsonian's National Museum of Natural History, will be the All-Convention Luncheon speaker, talking on "Evolution, Time, Tectonics, Asteroids, Climate and the Trajectory of Earth Science."

- Carlos A. Dengo, director of the Berg-Hughes Center for petroleum and Sedimentary Systems at Texas A&M University, will present this year's AAPG Foundation-sponsored Michel T. Halbouty Lecture, at 5:10 p.m. Monday, April 7.


- A special forum on "Communicating Our Science" also held Monday, April 7, exploring ways to communicate sensitive topics in energy and science to the media and public.

- A forum that takes an in-depth look at "U.S. Shale Gas Reserves and Production: Accelerators and Inhibitors," set at 8 a.m. Tuesday, April 8.

- The AAPG Imperial Barrel Awards ceremony once again will be presented in a colorful, exciting setting immediately preceding the opening session, open to all attendees.

- As always, the exhibition hall will be filled with the latest technology, information and energy services – and will be the site for the annual Icebreaker reception, daily refreshments, the Cyber C@fé and the AAPG International Pavilion.

As in past years, a discounted fee schedule will be offered to those who register early – those who register on or before Feb. 10 can save up to \$210 on the cost of registration.

Meeting details can be found in the official ACE announcement that accompanied the January EXPLORER, or online at [www.aapg.org/houston2014](http://www.aapg.org/houston2014). 

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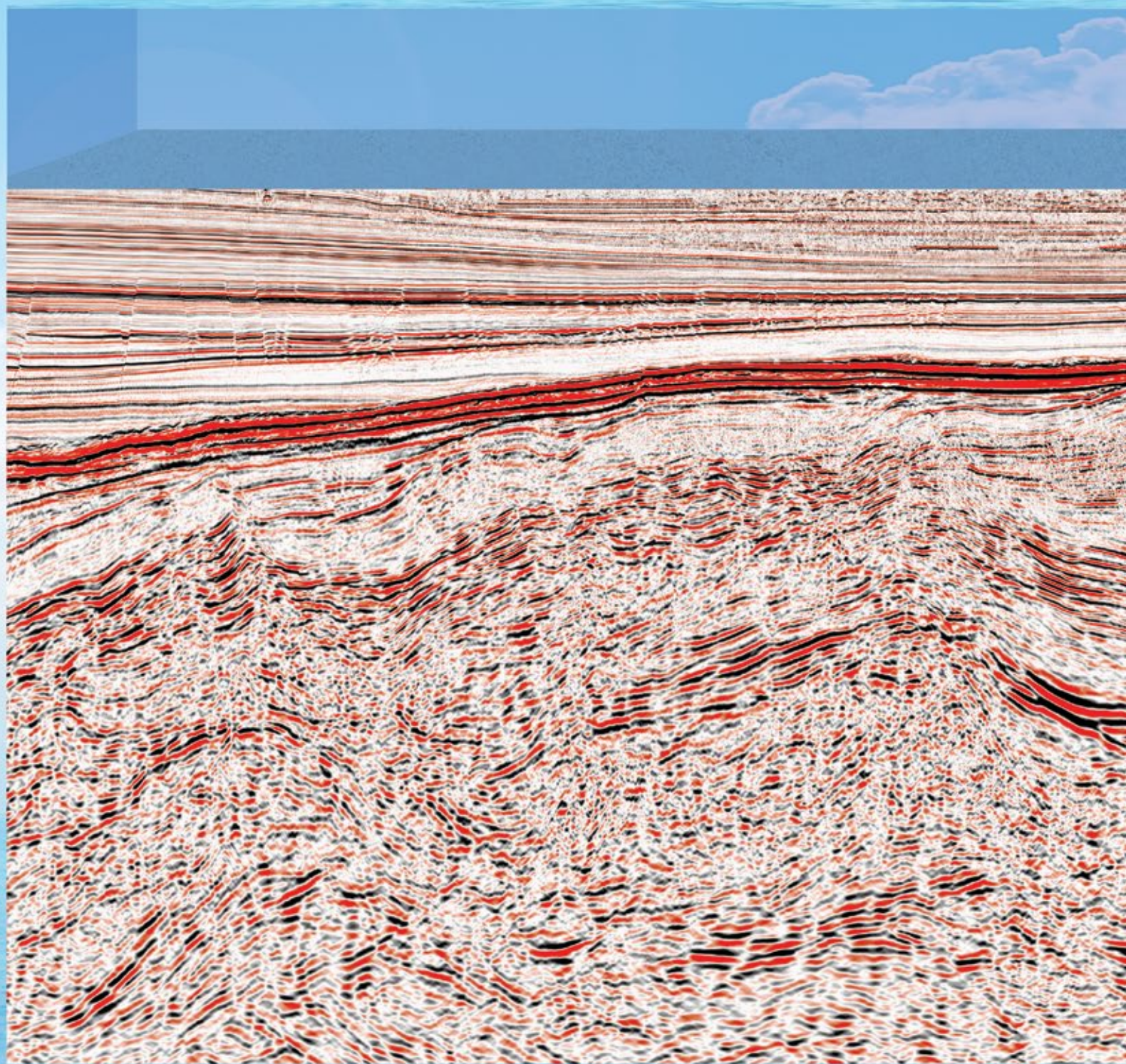
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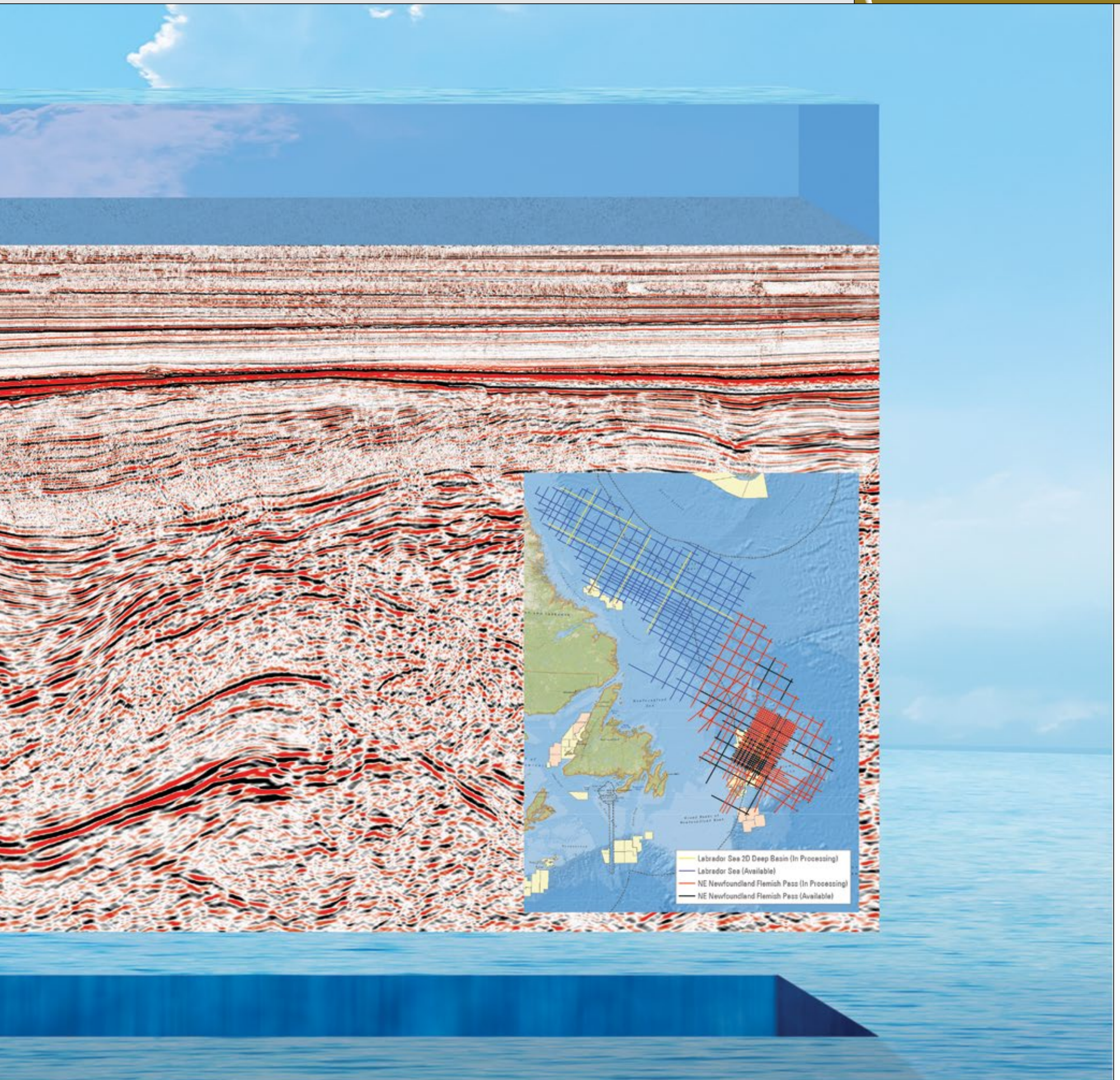
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## Asking the right question

## Conventional Reservoirs Hold Keys to the 'Un's

By JEFF OTTMANN and KEVIN BOHACS

Last November, the AAPG Geosciences Technology Workshop (GTW) on Unconventional Reservoir Quality was held in Austin, Texas, and many of the presentations given during the session focused on porosity development, a key element of reservoir quality.

Given that reservoir quality (or storage) is one of the fundamentals of any reservoir – and since what we really want to do is get hydrocarbons out of the ground – we might consider turning the phrase around. Rather than discussing “reservoir quality,” we should consider what makes a “quality reservoir.”

Placed in a quality reservoir context, we need then consider all of the elements required to make a reservoir successful. All successful reservoirs, whether conventional or unconventional, must have the same fundamentals: **storage**, **conductivity** and **drive**. When these basic elements come together in appropriate combination, a rock unit then can be considered a quality reservoir (figure 1).

Storage in an unconventional reservoir often is associated with organic material – however, storage can commonly be associated with inorganic grains (primary and secondary) and with fractures. The primary difference between an unconventional and conventional reservoir is that the conductivity of an unconventional reservoir usually requires enhancement via hydraulic fracturing to be commercial.

Successful reservoir stimulation requires an additional subset of rock properties – the ability of the rock to fracture complexly (brittleness) and to maintain the induced fractures (stiffness). Natural internal reservoir fracturing can provide enhanced conductivity and some storage, although extensive tectonic fracturing may breach seals and rob a reservoir of the energy required to be successful.

The third fundamental, sufficient reservoir energy, also is required, and it must be retained over geologic time by sealing



OTTMANN



BOHACS

lithologies. Most mudstone successions contain clay-rich and clay-poor intervals. Both are needed to act as reservoir (mudstones) and seal (claystones) for pressure retention.

Each element of a quality reservoir has some forgiveness. For example, slightly lower conductivity can be compensated by increased storage or reservoir energy.

However, there are limits – beyond which the elements in a rock unit will fail to become a quality reservoir.

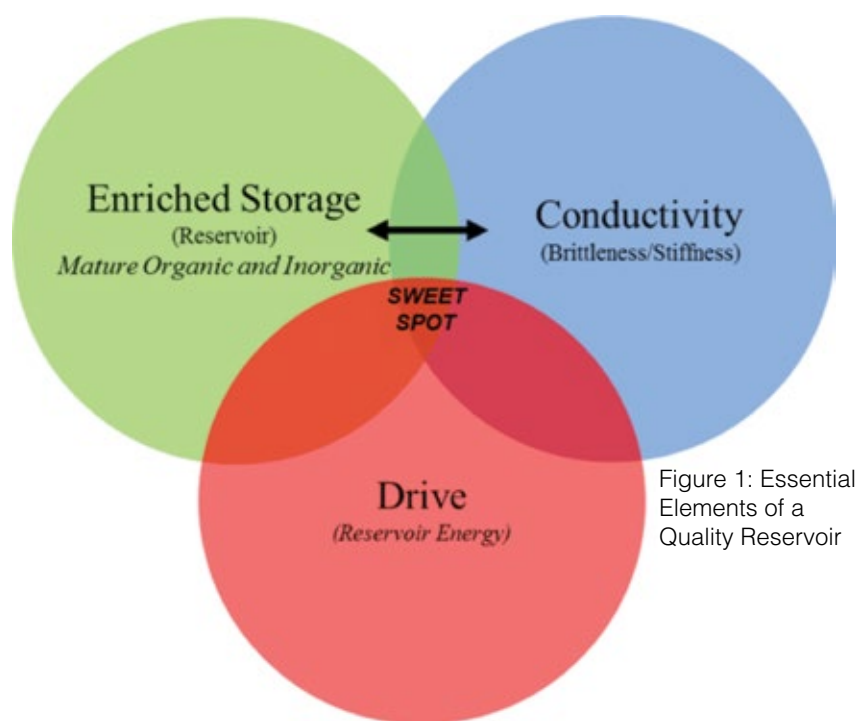


Figure 1: Essential Elements of a Quality Reservoir

The horizontal axis is the hard component percentage, which is the volume percent of the hard/brittle elements (minerals) minus the soft/ductile elements (clay, TOC and porosity). Since clay is most often the element contributing to ductility, the triangle is divided vertically by whether a rock is primarily clay dominated or mud dominated.

Horizontally, the triangle is subdivided into segments of mature enrichment, when vitrinite reflectance (Ro) is greater than 1 percent.

Note that the organic content is displayed as a volume percent and not weight percent.

Most of the successful plays group together with similar properties in a class we call “Organically Rich Mudstones.” This area is where the hard elements exceed the soft ones and the enrichment of organic material is sufficient to provide storage and hydrocarbons, but not so much to soften the rock enough to diminish induced reservoir conductivity.

These characteristics of hardness and enrichment are primary elements of quality reservoirs.

For any given well or wells in a play, the range of the points on figure 2 could spread across the chart. However, those points that are quality reservoir will almost always plot as organically rich mudstones. The geologic conditions that come together to serve as the fundamental elements for quality reservoirs can be mapped to identify sweet spot areas:

- ▶ Storage and conductivity through regional geology, sedimentology and sequence stratigraphy.
- ▶ Drive through pressure data, burial history and basin modeling.

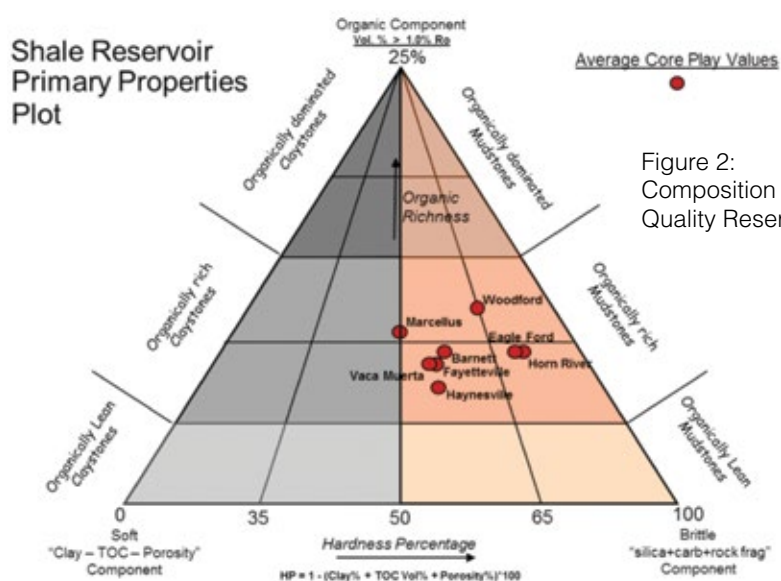


Figure 2: Composition of Quality Reservoirs

In summary, all successful reservoirs share the same fundamental attributes in appropriate combinations, and there are various ways to arrive at an appropriate combination.

Thus, we can use our understanding of conventional reservoirs – along with an appreciation of additional factors (organic-associated pores, ductile vs. brittle components, fractures, etc.) – for insights into what makes a quality unconventional reservoir.

## GTW ‘Breakthrough’ Presentation Offered Complicated Material Simply

Susan Nash is still excited about the material that was presented at a November GTW in Austin, Texas.

“This presentation was really a breakthrough,” said Nash, AAPG’s director of education and professional development. “It was a very elegant presentation.

“The beauty of it was that the material is extremely complicated,” she noted, “but it was expressed very simply.”

The GTW, “Unconventional Reservoir Quality,” was presented by AAPG members Jeff Ottmann and Kevin Bohacs, both with ExxonMobil in Houston. It was convened by AAPG member Richard Chuchla, new opportunities vice president at ExxonMobil.

Bohacs, a past AAPG Distinguished

Instructor, also is a recipient of this year’s AAPG Robert R. Berg Outstanding Research Award, which he’ll receive at the AAPG Annual Convention and Exhibition, set April 6-9 in Houston.

The GTW audience comprised working geologists and core AAPG membership who, Nash said, found the material to be “very intensive” – for veteran geologists and students alike.

Nash said the pyramid diagram (figure 2) was particularly fascinating because of the novel approach it represents.

“It’s really unique because it really puts together and explains the relationship between the mineralogy, the lithology and whether or not a shale is producible,” she said.

“What’s so fascinating is, you have

on this side mudstones and you have claystones – these are different types of rocks, fine-grained rocks. And the big question has been, ‘Where are the cutoffs and what makes one better than the other, and what are the thresholds?’ And this diagrammatically demonstrates thresholds. It’s essentially a producibility/prospectivity index or indicator, and you can understand it at a glance,” she explained.

“There are so many different kinds of shale reservoirs or shale plays, and it’s hard to compare them. You can have this list of properties and all that, but how can you visualize and really understand how they compare to each other? And this is a really elegant way to make that work,” she elaborated.

Nash also noted that the Ottmann-Bohacs guide should be of interest at the Eagle Ford GTW, which will be held Feb. 24-26 in San Antonio. Figure 1 is particularly relevant, she said, because the workshop will include material on determining ideal well spacing, hydraulic fracturing spacing and completion techniques.

“This is a diagram for trying to find sweet spots ... It helps people save a lot of money by not drilling in barren areas,” she said. “This analytical tool can really be a breakthrough, in terms of optimizing the reservoir, and being cost effective.”

“I absolutely love the work that Jeff Ottmann and Kevin Bohacs did,” Nash added.

– BRIAN ERVIN



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# YP Activities Provided Asia-Pacific Highlights

By REETU RAGINI, Asia-Pacific Region YP Leader

Young Professional activities in the Asia-Pacific region are growing by leaps and bounds – and as the regional coordinator for YP activities, I am pleased to announce that new chapters have been formed in Malaysia, Indonesia, China and India.

More is being done, and we hope to soon see chapters in Thailand, Brunei and Pakistan.

This report is a summary of many of the YP activities that happened in our Region over the past year.

As you can see, there were a lot of reasons to smile.



RAGINI



Top: Lansing Taylor giving a talk on Structural Geology to YP's.

Bottom: Speaker, Kim Kiat "KK" Liaw giving talk on Mulu caves field trip to participants.

In 2013, the Kuala Lumpur chapter proved to be the most dynamic, offering platforms for technical talks by eminent speakers, together with an unprecedented number of activities to strengthen Student-YP liaisons, thus enhancing involvement in AAPG activities.

► With very strong efforts from Tan Chun Hock, Low Wan Ching, Evon Leong and their committee, the Malaysian chapter ran the first YP talk by Bob Shoup, veteran petroleum geologist and longtime AAPG member, who spoke on the "10 Habits of Highly Effective Oil Finders" in July.

This first effort offered many benefits to attendees and was well appreciated. AAPG members who attended welcomed peers who had not yet joined AAPG – the first steps toward increasing our membership.

Feedback of the event indicated that more than 90 percent of attendees were willing to support the YP chapter.

► A second talk for YPs was presented in August by KK Liaw, a geoscientist from Saudi Aramco, on "Sarawak Carbonates Field Trip and Geology," and almost 30 professionals from 11 oil companies attended.

We are thankful to INPEX for hosting and sponsoring this event. Liaw's field experience on outcrops of limestone, carbonate heterogeneity and key facts of different carbonate projects was a wonderful way for the audience to augment their technical skills in the field of carbonates.

► In October, AAPG member Herman Darman from Shell gave a talk on "Caspian Exploration and Challenges" – another warmly welcomed experience.

As past president of the AAPG Asia-Pacific Region, Darman holds student chapters and YPs close to his heart and can

always be counted upon for support.

► November saw a talk on "Carbon Capture and Storage," by AAPG Vice President-Regions John Kaldi, a professor at the Australian School of Petroleum, University of Adelaide. The audience learned a lot from him.

► In December, Lansing Taylor, a structural geologist in Talisman, gave a technical lecture on "Geomechanics: From Mantle Plume to Molecular Cohesion, What is the scale of the Problem."

\* \* \*

The YPs were active in Indonesia, too.

► In May, AAPG member Ronald Atasi of Total E&P actively volunteered to showcase the YP activities at the Indonesia Petroleum Association event. Students attending the event were given information on what to expect from a career in the petroleum sector.

► In November, 20 ITB students went on a field trip to the Mahakam Delta, sponsored by Total.

Finally, we are attempting to revive the interest and participation of inactive members in Brunei, China, Pakistan and Thailand.

For more information on the YP initiative and specific activities, visit our page at <http://www.aapg.org/youngpros> – and feel free to contact me for any queries, at [reeturagini@gmail.com](mailto:reeturagini@gmail.com).



**AAPG**  
Middle East Region

**GTWs**

## Geosciences Workforce: Attraction & Retention

14 - 16 April, 2014 • Abu Dhabi, UAE

Increasingly oil and natural gas production is associated with more challenging regions or more complex difficult fields, such as maturing reservoirs, complicated and highly fractured traps, ultra-deep water, unconventional and extended reach drilling, and technological innovation to enhance oil recovery.

This workshop will focus on industry best practices for attracting and retaining Generation Z, how to attract mid-career hires in a highly competitive recruitment environment, how to retain your current geosciences workforce and capitalize on your training investment, and finally how social media can work for or against you in attracting and retaining your geoscience workforce.

### The workshop sessions are:

- PR of the Industry
- Attraction and Retention of Generation "Z"
- Attraction of Mid-Career Hires
- Bridging the Knowledge Gap
- Retention of Geosciences Workforce

## Producing the Last Drop: Bridging the Gap between Production and Demand

28 - 30 April, 2014 • Muscat, Oman

With the advent of new technologies in exploration and production, not only do the ultimate recoveries increase, but also, exploration for hydrocarbons in deep targets and frontier areas along with unconventional resources become feasible for production. Furthermore, finding bypassed oil and gas in mature fields using new techniques help sustain the production levels. New developments in seismic acquisition, processing, and interpretation provided a better evaluation of exploration prospects which resulted in new discoveries and determination of bypassed hydrocarbons in mature fields. Determination of overlooked pay zones in wells using formation evaluation tools provided a new life to many brown fields. In addition, unconventional resources are now becoming more attractive by the application of new technologies, and high prices provide an incentive for development. Economics and risk assessment are critical factors in the identification of new opportunities. With special attention on the environmental impact of its activities, oil industry utilizes all available tools to produce the last drop and continues to improve the current technologies to support the economic development.

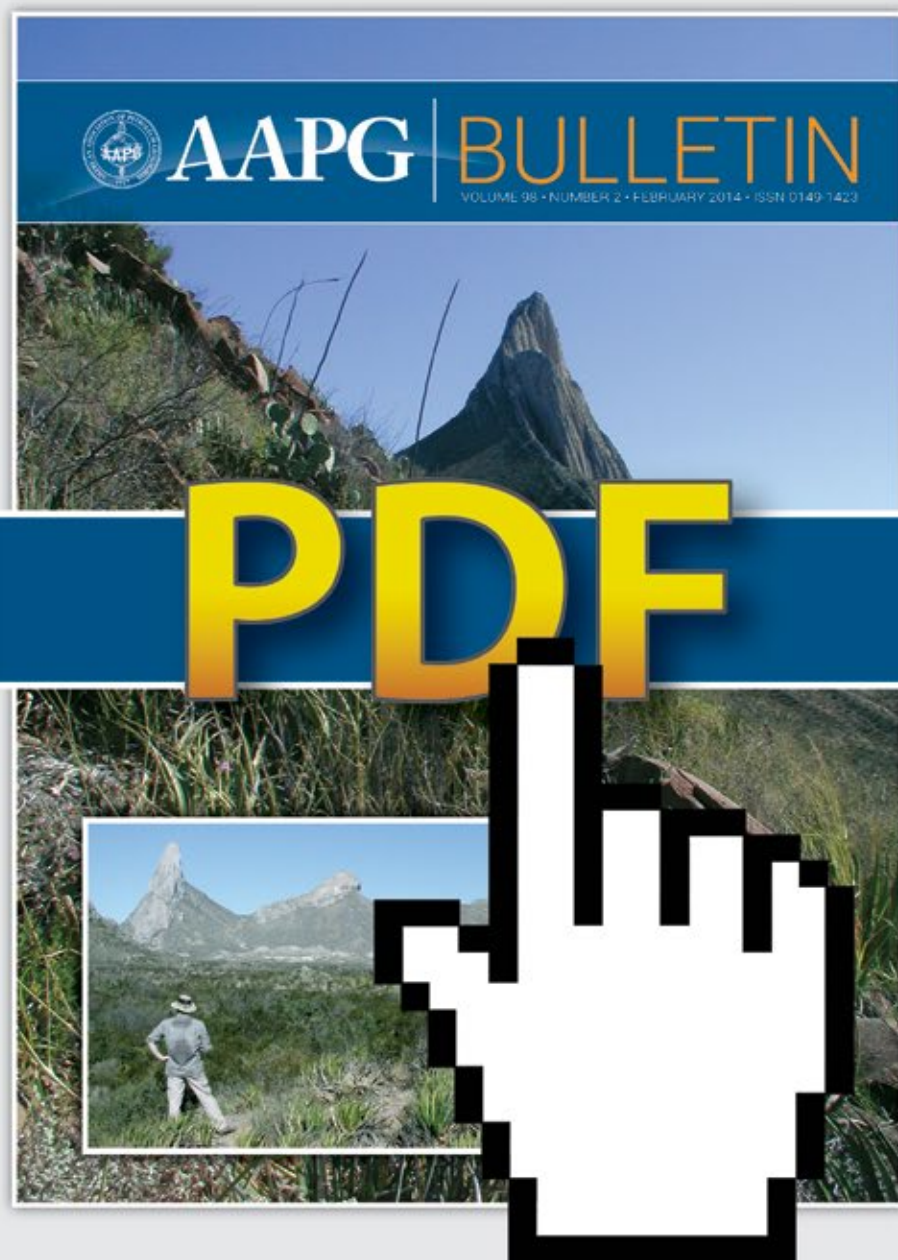
### The workshop sessions are:

- Advances in Geophysical Technologies
- In Depth Geological and Petrophysical Evaluation
- Advanced Reservoir Engineering
- Integrated Subsurface Studies
- New Technologies and Applications



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## A BETTER UNDERSTANDING OF THE MOLASSE

*Juergen Gusterhuber, Ralph Hinsch, and Reinhard F. Sachsenhofer*

To better understand the geologic evolution and hydrocarbon potential of the western part of the Austrian Molasse Basin, structural and petroleum systems models are integrated to explore the hydrocarbon potential of the imbricated zone. A kinematic model is used to provide realistic input.



## DEEP-WATER EOCENE TURBIDITIES

*André De Gasperi and Octavian Catuneanu*

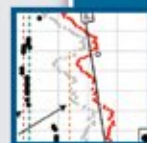
This paper describes and interprets a late Eocene deep-water clastic succession, offshore Brazil. This work illustrates the application of sequence stratigraphy to a deep-water system and provides a case study for a third-order exploration scale depositional sequence.



## PORE PRESSURE PREDICTION

*Michael P. Merrell, Peter B. Flemings, and Glenn L. Bowers*

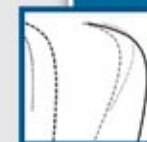
A pore pressure analysis of the Mad Dog field, deep-water Gulf of Mexico, shows that sandstone pressures follow the hydrostatic gradient while pore pressures in adjacent mudstones can be approximated by the total vertical stress gradient. Thus, pore pressure can be predicted at new locations.



## SORPTION CAPACITY OF COALS

*Yves Gensterblum, Alexej Merkel, Andreas Busch, Bernhard M. Krooss, and Ralf Littke*

Fundamental concepts on how sorption capacity and gas saturation change with depth and coal maturity are presented. Observations that may be useful to improve sweet-spot identification related to coalbed methane and CO<sub>2</sub>-enhanced coalbed methane production are also discussed.



Members may access the AAPG Bulletin online at:  
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## Hedberg tackles 3-D interpretation

# Geologists Get a Closer 'Look' at Complexity

By BOB KRANTZ, CAROL ORMAND and BRETT FREEMAN

**G**eologists use above-average spatial thinking skills to interpret and communicate complex geologic structures. Interpretation challenges, especially with industry subsurface targets, come from abundant but still ambiguous data volumes, challenging geologic forms, powerful but difficult-to-learn software and under-prepared staff.

Last June, 70 participants met in Reno to discuss these and related issues, and to explore how spatial cognitive science can help us better understand and develop geologic interpretation skills, software



KRANTZ



ORMAND



FREEMAN

tools and education strategies. Industry interpreters and trainers, academic structural geologists, software developers

and cognitive scientists brought complementary perspectives to three days of presentations, posters and discussions, plus a field day with interactive interpretation modules.

This Hedberg conference provided new, shared insights to the interpretation process,

ideas for improving skill development and abundant opportunities for further collaboration.

### Multidisciplinary Perspectives

Academic geologists have long sought and continue to seek the best methods to educate future geologists. In recent decades, these efforts have included rigorous, quantitative classroom-based research on effective pedagogies. The development of students' spatial thinking skills is an emerging focus of this research, as educators have articulated its vital importance throughout the geoscience workforce – including the petroleum industry.

Cognitive scientists explore how people develop and apply spatial thinking skills to accurately perceive, understand and communicate 3-D (and 4-D) relationships, and how these skills impact success in tasks ranging from navigation to laparoscopic surgery.

It is clear from this research that spatial skills are malleable, though how best to train these skills remains an area of active research. Some academic geologists are engaged in investigating the application of spatial cognitive concepts to improve teaching and student performance.

Petroleum industry professionals, particularly those with significant interpretation experience, are uniquely qualified to describe the spatial cognition challenges inherent in 3-D (and 4-D) interpretation. Collaboration with academic geologists allows industry to inform educators about the kinds of tasks new hires face.

Collaborating with cognitive scientists provides industry professionals an opportunity to better understand the cognitive challenges of subsurface interpretation – and to develop training strategies and tools informed by cognitive science. Conversely, working with professional geologists provides cognitive scientists a window into the minds of spatial thinking experts.

Software (and hardware) developers and users strive for effective 3-D visualization and interpretation software, which is widely used in the petroleum industry. Beyond the notion of a software product being used solely to achieve a technical outcome, software routinely represents the subsurface in a 3-D viewer or 3-D interpretation environment.

To a large degree, subsurface geology is an obvious application for 3-D visualization, where the benefits of cognitive off-loading (the geologist is freed from the mental process of imagining in 3-D because it's manifest on the screen) are implicit.

However, toolkits and visualization systems can actually overload the interpreter with the enormous amount of information that is available.

Techniques for interactive visual culling and intuitive object hiding and retrieval are seen as a way forward to simplify both user experience and productivity.

### A Productive Exchange of Ideas

Given the diverse backgrounds of the conference participants, the opening keynote panel provided an overview of key concepts and perspectives.

► **George Davis** (University of Arizona) described structural geology as the

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## Continued from previous page

study of the architecture of the earth. He emphasized the need to visualize rocks in both deformed and undeformed states, and to consider how 3-D and 4-D processes must relate the two.

► **Steve Davis** (ExxonMobil) related structural form and complexity to the exploration and production mission, emphasizing that current and future E&P targets exist in settings with extreme complexity, requiring more accurate and complete interpretation than in the past.

► **Mary Hegarty** (UC-Santa Barbara) reviewed the cognitive science of spatial thinking, especially as expressed in the physical sciences, with insights into the importance of scale, visualization and representation.

► **Steve Reynolds** (Arizona State University) shared his experiences with trying to help students develop and apply spatial thinking to geology, including challenges such as recognizing key elements, being able to see "inside" a 3-D volume, spatial vs. verbal mental processing, and dealing with cognitive load.

► **Colin Dunlap** (Midland Valley Exploration) described software innovations as disruptive, including both the first generation of 3-D visualization tools and projecting what the next generation might bring.

► **Doug Goff** (Chevron) addressed the industry-training mission in which diverse staff with variable backgrounds must build both experience and expertise, and might benefit from understanding concepts before learning software.

## Conference Highlights

Following the Monday morning panel, the group heard more about the science of spatial cognition – including basic concepts and areas of research – plus methods for assessment of spatial skills.

In addition to presentations on how these skills impact field geologic interpretation, the group completed a standard skills assessment test.

Monday afternoon sessions provided examples and discussions of typical subsurface interpretation projects, demonstrating the geologic complexity and interpretive challenges that arise from integrated data sets (seismic, well logs, production performance, for example) and desired end goals, ranging from complete structural frameworks to dynamic modeling. Presentations addressed workflow and thought processes across a range of geologic settings and practical problems, especially where the 3-D nature of the structure, and its evolution through time, pose significant risk to economic success.

On Tuesday, the group traveled to Hat Creek, Calif., where a complex zone of normal faults offsets Quaternary volcanic flows. The fault zone, with throws up to 500 meters, provided a laboratory for real-time interpretation exercises.

While most of the participants completed and discussed their maps, sketches and thinking, the cognitive scientists made observations and recordings to capture insights about processes employed and implications for 3-D interpretation.

Wednesday began with an introduction to software tools, including subsurface interpretations based on the Hat Creek fault zone. Presenters described how design can address the technical challenges while facilitating or inhibiting the cognitive process.

The focus then switched to a review of how academic teaching strategies have incorporated understanding of spatial skills,

and their impact on geoscience education. Pedagogic methods suggest how industry might improve subsurface training through awareness of critical skill needs and levels.

Wednesday closed with a poster session, including digital presentations and demonstrations showing current research (such as eye-tracking studies) and seismic interpretation methods.

Discussions around the posters continued during a series of breakout sessions, with focus themes including the critical role of 3-D thought and process, the differences between interpretation novices and experts, ideas for next generation software and hardware, and opportunities for further learning and collaboration.

As one outcome of the Hedberg conference, the new AAPG Petroleum Structure and Geomechanics Division has sponsored a new Committee for Structural Interpretation. Initial enrollment includes many of the conference participants. For more information, or to join the committee, see the Division website at [www.aapg.org/committees/research/psgg/index.cfm](http://www.aapg.org/committees/research/psgg/index.cfm).

An AAPG Hedberg Special Volume is now in preparation, to capture most of the key presentations and discussions from the meeting. In addition, we expect the special volume to contain reports on the analysis of the observations and data collected during the field exercises and other interactive sessions.

Planning also has begun for a repeat Hedberg conference on 3-D interpretation. Target timing is set for later this year.

On Thursday, the final set of presentations addressed how to improve interpretation. Speakers offered suggestions for strategies and practices with current tools, but also posed questions for how to better develop skills – especially in the context of collaboration.

The conference closed with a general review and discussion of the week's experiences, and plans for future meetings.

## Key Findings

In the end, many participants expressed significant new insights. These included:

► A new appreciation for the complexity of the interpretation mission, both geologically and cognitively.

► A deeper understanding of the distance between novice and expert geoscientists, exemplified by the complexity of 3-D interpretation.

► A developing understanding of the benefits of comprehending the cognitive processes and cognitive challenges of our work.

► A desire to learn and apply research-proven strategies to help move people from novice to expert more efficiently.

Most academic geologists were impressed with the complexity and intellectually stimulating geology in typical industry subsurface projects, and by the power of industry software to display and manipulate 3-D data.

Geologists, both in academia and industry, also recognized the key difference between traditional surface geologic mapping and interpreting subsurface 3-D structural frameworks. This difference emerged when academic and industry participants compared interpretations during the field exercises, and highlights contrasting strategies for spatial thinking.

The cognitive scientists, while struggling to follow the nuances of geological

See Hedberg, page 33

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



# Detection of Hydrocarbons

Hydrocarbon reservoirs may be detected in seismic data in a number of ways, and the successfully used bright spot is the most reliable. Today we must exploit other indications to find more oil and gas of the future. Dim spots are very difficult, but they represent a major opportunity. How many hydrocarbon reservoirs in production today have been discovered by the direct identification of a hydrocarbon dim spot? Because of compaction trends in the earth, we must expect more of these subtle indications as we look for hydrocarbons deeper in the earth. We also must exploit multiple characteristics to increase confidence.

The editors of INTERPRETATION ([www.seg.org/interpretation](http://www.seg.org/interpretation)) invite papers on the topic "Detection of Hydrocarbons" for publication in a November 2014 special section to supplement the journal's regular technical papers on various subject areas.

Here are some topics we would like to see addressed in this issue:

- examples of hydrocarbon polarity reversals
- examples of hydrocarbon dim spots
- using multiple geophysical characteristics to increase identification confidence
- examples of hydrocarbon indicators at greater depths
- examples of hydrocarbon indicators in non-Tertiary (Mesozoic and Paleozoic) rocks
- insights from observation of gas chimneys

Interested authors should submit for review no later than **1 March 2014** via the normal online submission system for INTERPRETATION (<https://mc.manuscriptcentral.com/interpretation>) and select the Detection of Hydrocarbons special section in the dropdown menu.

The special section editors would like to receive a provisional title and list of authors as soon as possible. The submitted papers will be subjected to the regular peer-review process, and the contributing authors also are expected to participate in the peer-review process.

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

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INTERPRETATION special section

# CALL FOR PAPERS



# YPs Offer Valuable Tips For Rookie Geologists

By SEAN KIMIAGAR, Gulf Coast Section YP

Interviewing for that first internship or full-time position can be a daunting process – but the AAPG YPs are here to help.

If you're joining the job hunt next year and/or considering attending one of the many job expos offered by AAPG, then this short guide is for you.

The first tip: A little bit of research and preparation can go a long way toward landing the summer internship or job of your dreams. And who better to show you the way than former expo attendees who are now sitting on the other side of the interview table as YPs?

\* \* \*

AAPG, in collaboration with other geoscience societies around the world, organizes student expos throughout the year, which provide geoscience students and recruiters from oil and gas companies a great opportunity to meet and network with one another.

Most companies pre-select the students they'd like to interview before the expo begins – but do not be discouraged if you arrive at the expo without any scheduled interviews. Some companies will interview



KIMIAGAR

candidates they meet at the event (just be prepared to stand in line for a chance to speak with a recruiter).

To make your meeting efficient, students are advised to register for the expo and submit a resumé early, submit a poster to showcase their achievements and research the companies in attendance in advance.

The expos are held throughout the year, across the United States and around the world. More information can be found at [seg.org/web/aapg-seg-student-expo/other-expos](http://seg.org/web/aapg-seg-student-expo/other-expos).

\* \* \*

Each expo is unique in the benefits it offers.

One difference: The job offerings often are related to the time of year, coinciding with different "recruitment cycles," and with the geographic location.

Also, not all companies attend every expo. It is important to note that while some companies may hire interns and full-time employees based on the recruitment cycles, others hire throughout the year, depending on the immediate needs of the company.

**Continued on next page**

## PROFESSIONAL news BRIEFS

**James "Jim" Corthay** has retired from ExxonMobil after 29 years of service. He resides in San Marcos, Calif.

**Jerry Gips**, to consulting geologist, Fayetteville, Texas. Previously vice president, Macquarie Capital (USA), Houston.

**Alan Hart**, to geoscience manager, Xodus DMCC, Dubai, UAE. Previously distinguished geological adviser, Petrotel Inc., Plano, Texas.

**David Henderson** was inducted into the 2013 Virginia Tech College of Science Hall of Distinction, presented to those who embody the college goals of enhancing the well-being and development of their community, the commonwealth, the nation or the world. Henderson is president, WBH Energy Partners, Austin, Texas.

**Richard Herbert**, to chief operating officer-exploration, BP, London, England. Previously executive vice president-exploration, Talisman Energy, Calgary, Canada.

**Mohit Khanna**, to chief geoscientist, Petrofac-Integrated Energy Services, London, England. Previously head of subsurface development, Petrofac-Integrated Energy Services, Mumbai, India.

**Henry Lieberman**, to senior geologist-overseas offshore projects, Lukoil, Houston. Previously senior geoscience consultant, Canadian International Oil (USA), Houston.

**John McCarter** has received an honorary doctorate from University of Louisiana at Monroe. McCarter taught at both ULM and Louisiana Tech University and was founder and head ULM's geology department. He resides in Monroe, La.

**Anthony "Tony" Moherek**, to vice president-geology, EDF Trading Resources, Austin, Texas. Previously senior geoscience adviser, Apache Corp., Houston.

**Ross Saunders**, to chief geophysicist, Energy XXI, Houston. Previously lead geophysicist, Energy XXI, Houston.

**Tom C. Shackleton**, to operations manager-new ventures, Apache Corp., Houston. Previously operations geology adviser, Apache Corp., Houston.

**Braden Thompson**, to Rockies exploration manager, Chesapeake Energy, Oklahoma City. Previously senior geologist, Chesapeake Energy, Oklahoma City.

**Gregory Wrightstone**, to independent consulting geologist, Wrightstone Consulting, Pittsburgh. Previously vice president geology, Mountaineer Keystone, Pittsburgh.

*"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).*

# AAPG Middle East Calendar of Events: 2014

## Imperial Barrel Awards

8 March 2014 • Manama, Bahrain

## GEO 2014 - 11th Middle East Geosciences Conference & Exhibition

9 - 12 March 2014 • Manama, Bahrain

## Geosciences Workforce:

### Attraction & Retention

14 - 16 April 2014 • Abu Dhabi, United Arab Emirates

## Producing the Last Drop: Bridging the Gap between Production & Demand

28 - 30 April 2014 • Muscat, Oman

## Estimating Petroleum Resources and Reserves: Geoscience Aspects

12 - 14 May 2014 • Dead Sea, Jordan

## 2014 LIPE & AAPG Northern Arabia Geoscience Conference and Exhibition

27 - 29 May 2014 • Beirut, Lebanon

## AAPG/SPE E&P Data Management

9 - 11 June 2014 • Istanbul, Turkey

## Effective Training for the Young Exploration Generation

16 - 18 June 2014 • Manama, Bahrain

## EAGE/SPE/AAPG Shale Gas Workshop

21 - 24 September 2014 • Dubai, UAE

## Stratigraphic Traps of the Middle East

20 - 22 October 2014 • Muscat, Oman

## Unlocking the Potential of Low Yielding Reservoirs

3 - 5 November 2014 • Manama, Bahrain

## Siliciclastic Reservoirs of the Middle East

2 - 4 December 2014 • Abu Dhabi, United Arab Emirates



# AAPG

Middle East Region



## Continued from previous page

A suggestion: Students should speak with colleagues who have previously attended the expos in order to assess which expo might be right for them.

Still unsure? Ask a YP, because many YPs had their start in the industry by attending a student expo.


The Houston expo, given its location in the oil and gas capital of the world, hosts one of the largest groups of companies and students each year, offering opportunities not just in that city but around the world.

In fact, the number of people and competition for positions may overwhelm students attending for the first time. However, it is important to remember the companies are seeking individuals that fit their requirements, both in terms of technical expertise and their corporate culture.

One of the events that received a warm welcome during the 2013 Houston expo was the Recruitment Panel. This forum provided an opportunity for YPs and seasoned professionals to share their expo experiences as both students and recruiters and to answer students' questions.

There is no single formula for success, but learning how to promote yourself and your abilities in a professional context will be a key part of launching your career. The expos are excellent venues for perfecting this skill.

\* \* \*

If you would like to know more about what it is like to work in the industry, visit the YP website at [aapg.org/youngpros](http://aapg.org/youngpros) and contact the YP representative in your area. 

## Opportunities and Actions

Several key opportunities emerged during the conference, with strong support and commitments from participants. These include:

► Increase awareness of the subsurface interpretation mission and methods across the academic geologic world.

► Encourage industry interpreters to use 3-D interpretation environments as their default tools.

► Apply spatial cognitive science and informed pedagogy for interpretation tools, strategies and training methods.


► Pursue further interdisciplinary and cross industry-academic collaborations, including:

✓ Software developers and cognitive scientists (intuitively oriented hardware and software).

✓ Industry and academic interpreters (industry data, tools and objectives).

✓ Industry trainers and academic educators (teaching and assessment methods).

✓ Industry interpreters and cognitive scientists (applied spatial thinking).

✓ Academic geologists and cognitive scientists (teaching and measuring spatial thinking skills). 

## Hedberg 3-D from page 31

interpretations, were quite impressed by the speed and facility with which geologists developed and discussed mental models of complex stratigraphic and structural systems.

Novices and experts clearly interpret structures with different skills and strategies. Novices can be overwhelmed with information (and software), and struggle to build a 3-D mental model. Experts are more likely to rely on mental representations, but may be misled by experience bias. Training methods must account for novice versus expert abilities.

For most participants, the cognitive science perspective on what we do, how we do it and how we can teach/train people to do what we do was completely new.

A few key ideas generated a high level of interest.

First among them was that spatial cognition improves with practice, and also degenerates with disuse. Furthermore, whatever we can do to reduce the cognitive demands of visualizing spatially complex datasets frees our minds to analyze and interpret the data. Strategies that are known to help with cognitive off-loading include gesturing, sketching and, of course, working with computerized visualizations of the data.

There are obvious implications in this for teaching and training the next generation of interpreters.



# AAPG

## Imperial Barrel Award 2014

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	October 13 – 16, 2014	Ok City:	August 4 – 7, 2014

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Houston:	November 3 – 5, 2014
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<http://www.roseassoc.com/instruction>



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## Pitfalls in the structural interpretation of seismic data

The editors of *Interpretation* invite papers on the topic of **Pitfalls in the structural interpretation of seismic data** for publication in a February 2015 special section of *Interpretation*.

Reflection seismic data images the earth's acoustic impedance contrasts in continuous 2D sections or 3D volumes. Structural geology is obtained by interpreting the continuity and discontinuities of the reflections caused by impedance contrasts. But the art of interpretation requires special knowledge in underlying principles in order to avoid false interpretations.

P. Tucker and H. Yorston in 1971 published the SEG monograph *Pitfalls in Seismic Interpretation* illustrating how to avoid false seismic interpretations. A classic example they present is the incorrect seismic structural interpretation of an anticline only to discover the seismic data are not migrated and the structure is actually a syncline. Since this publication, there have been additional papers and presentations on seismic interpretation pitfalls, but the literature is far from complete. There exists a legacy of interpreters who have personal and practical experience in the art of avoiding interpretation pitfalls, and *Interpretation* invites all to share these with the interpretation community.

Seismic interpretation consists of much more than rendering structural geology. Other uses of seismic data are seismic stratigraphy, lithology prediction, rock property prediction, fluid and pressure prediction, and reservoir dynamics. Future calls for interpretation pitfalls also will be made for those topics. The February 2015 special section will focus on structure.

Related topics for pitfalls in the structural interpretation of seismic data might include:

- Problems from inadequate migration
- Complications from depth conversion and depth imaging
- False structure from fault shadow and other velocity lenses
- Mapping signal in noisy data
- Interpretation in the presence of multiples

Authors are encouraged to submit papers that are brief and explanatory. A suitable format would be to explain the process that could lead to a false interpretation (the pitfall) and then use live or model data as an illustration.

Interested authors should submit their manuscripts for review no later than **1 June 2014**. In addition, the special section editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for *Interpretation* (<https://mc.manuscriptcentral.com/interpretation>) and indicate that it is a contribution for this special section. The submitted papers will be subject to the regular peer-review process, and the contributing authors also are expected to participate in the review process as reviewers.

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*Interpretation* special section

# CALL FOR PAPERS

## HISTORICAL HIGHLIGHTS



Photo courtesy of IPC

*The famous gusher at Baba Gurgur, with oil running down the wadi "like a trout stream in the Highlands."*

## Nightmare, or vindication?

# A Gusher at Baba Gurgur

By MICHAEL QUENTIN MORTON

*"One man was at the head waters of the River Amazon among the headshrinkers when he was recalled to come to Iraq; another came from Argentina, another from Mexico, still another had been in Romania, one in Indo-China, several in Venezuela and the East Indies."*

So wrote T.F. "Jock" Williamson, a British geologist seconded to the Turkish Petroleum Company (TPC) from the Anglo-Persian Oil Company (APOC), describing the eclectic mix of geologists that made up the expedition to Iraq during the 1925-26 season.

The Turkish Petroleum Company, the forerunner of the Iraq Petroleum Company, was an international consortium. In 1925 the company had agreed to a convention with the Iraqi government that had opened the way for a comprehensive geological survey of Iraq.

Although U.S. oil companies were not officially part of the company at that time, they were invited to participate.

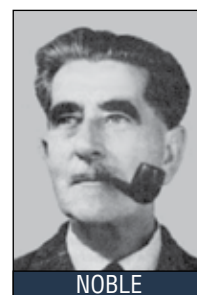
The team that was assembled numbered 18 geologists with a wide range of knowledge and experience, but this came at a price: There was considerable scope for profound disagreement among them.

### Hammers at Dawn

The geologists brought with them diverse theories about the formation of oil in the region. Those from APOC had been schooled in Persian geology and in a particular theory about the region known as the "lagoon theory of oil." Its chief proponent was Professor Hugo de Bockh, a



SHAW



NOBLE

Hungarian geologist who had arrived in Persia in 1923 as a geological adviser to APOC.

His theory proposed that large quantities of oil might exist in certain rock formations that derived from ancient lagoons.

Geologists E. Wesley Shaw and Arthur Noble were soon at loggerheads with de Bockh.

At the end of the survey, Noble and Shaw joined de Bockh and others in Mosul for a final meeting to rate the best sites for drilling. It soon became clear that de Bockh had reached his own conclusions about the location of the oil reservoir. On the basis of his theory, he did not recommend drilling the Kirkuk structure.

But Noble and Shaw considered it the most important prospect of all, rating it as "of

**Continued on next page**



MORTON

Quentin Morton grew up in Qatar, Bahrain and Abu Dhabi in the 1950s and 1960s. A barrister, he has written a number of books and articles on the history of oil exploration in the Middle East. His latest book, "Buraimi: The Struggle for Power and Oil in Arabia," tells the story of the battle over energy resources in the region during the 1950s. His father, D.M. "Mike" Morton, was an exploration geologist with the Iraq Petroleum Co. and presented "The Geology of Oman," to the fifth World Petroleum Congress, New York, in 1959.





*Hugo de Böckh  
(1874–1931)  
in Persia,  
November  
1924.*

Photo courtesy of BP Archive

## Continued from previous page

outstanding merit" and "first-class." Having disagreed with de Böckh in the final report, they were shocked to find themselves dismissed a month later.

A senior member of the TPC board flew out from London to smooth things over.

"It was not a happy expedition," Noble wrote, "(but) in spite of that a lot of fine work was done."

## The Long Hot Summer

The TPC board decided to drill a number of wells in northern Iraq, based on the geologists' final recommendations. The objective of these wildcat wells was to reach the "Main" Asmari-equivalent limestone underlying the Lower Fars (Middle Miocene) Formation.

On April 5, 1927, the first well at Pulkhana was spudded in, followed by others at Injana and Khashm al-Ahmar.

Nearly four weeks later, on June 30, another well followed at a location near Kirkuk. This was Baba Gurgur, the "Father of Fires," that took its name from the oil and gas seepages that burned nearby.

Baba Gurgur No. 1 well soon produced evidence of oil at comparatively shallow depths in the Lower Fars. Since the well was only a short distance from the famous seepages, this was not entirely unexpected. Drilling continued at a slow rate – about 20 feet per day.

Over that long hot summer, the dust on the tents of TPC field headquarters at Tuz Khurmatu grew thicker, merging the camp with the dun-colored hills. The staff received daily reports on the wells by telephone or telegram. Nothing of great importance happened and the camp gradually settled into a steady routine.

On Sept. 23, the company's chief geologist, Louis "Chick" Fowle, suddenly noticed that Baba Gurgur No. 1 was making rapid progress. He examined a sample of rock from the well and was shocked to discover that the drill bit had already penetrated the "Main" limestone at a far shallower depth than expected – 1,521 feet.

As the drillers had only cased the well to a depth of 590 feet, it was necessary to suspend the drilling and run casing over the remaining 1,000 feet of open hole. While the cement was setting, the crew changed from rotary to percussion drilling.

Shortly after midnight on Oct. 14, the crew resumed work on the well. They cleared out the residual mud and left 500 feet at the bottom of the well as a precaution against any upward surge of gas and oil. Then they ran their drilling tools into the well.

"The stillness of the night was disturbed only by the familiar hiss of locomotive-type boilers and the breathless chugging of the steam engine," one account recorded.

## Black Rain

At 3 a.m., the drillers pulled up the

drilling bit to clean out the well hole. Gas and oil, escaping from the punctured limestone below, rushed up the hole and spurted over the crown of the derrick to a height of 140 feet, drenching everything in a torrent of black rain.

In one sense, it was a driller's dream, but reality soon dawned – It was a nightmare.

The gusher roared up in a black fountain and sprayed oil in billowy clouds across the terrain and threatened to flood the region with crude, drenching the land and poisoning the rivers.

By the time the men had capped the well 10 days later, over 95,000 barrels of oil a day had spilled out into the desert – but a major disaster had been averted, and a massive oilfield found.

No doubt Noble and Shaw felt vindicated after de Böckh's earlier conclusion:


"I do not ... recommend a borehole here." 



Photo courtesy of IPC

*Louis Fowle (center) with Kurdish guards at Chamchamal in 1927.*

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# Effective Ways to Eliminate Side-Lobe Effects

By RONGFENG ZHANG

It is no secret that geologists do not fully trust all the events shown in pretty seismic pictures.

Even deeper concerns may arise when the images are composed from algorithmic manipulation and transformation of seismic signals, such as seismic attributes – especially spectral decomposition.

Last month in this column I reviewed how spectral decomposition is used in seismic interpretation, and pointed out that even though this technique has become a popular interpretation tool in the industry, it does have some issues – including a significant problem called the side-lobe effect.

In spectral decomposition, when there is one event (the main lobe) that corresponds to a particular geological feature – like the top or bottom of a formation – there often are several relatively smaller adjacent events, called side-lobes. These are closely related to the main lobe, but have nothing to do with sub-surface geology.

For example, many of the strong events shown in warm colors in figure 1 are self-related and do not correspond to actual geology. The risk of interpreting spectral decomposition results with strong side-lobe effects without good well control is obvious and sometimes very large.

\* \* \*

The side-lobe effect in spectral decomposition results from the use of a mathematical function with closed form expressions – such as a mathematical wavelet, a sine/cosine and a Gaussian function, for example – as the basic elements in the algorithm used to compute results. These basic elements are squeezed and stretched analytically and then convolved with the seismic trace to calculate spectral decomposition at different frequencies.

Unfortunately, these mathematical expression-based elements rarely resemble the actual seismic data. The Morlet wavelet – the basic element used in continuous wavelet transform (CWT) spectral decomposition – probably is the closest among many other functions to resemble a real seismic wavelet, but is still far from matching real data.

Here, we have proposed a new spectral decomposition method that is similar to CWT; however, instead of using a wavelet derived from a mathematical expression, an actual wavelet extracted from the seismic data is used (an example is shown on the top right of figure 1).

Since the real wavelet does not have a simple mathematical expression, we may not be able to transform back from the spectral decomposition. This, however, is regarded as a limited deficiency, since inversion to the original data may not be required in many or most cases.

The direct benefit, comparing to CWT and other methods, is that there are fewer side-lobe effects and therefore less ambiguity. The proposed method uses an algorithm similar to CWT, wherein the seismic data is convolved with groups of dilated, squeezed and stretched seismic wavelets.

If the closed form expression of a wavelet is known, squeezing and stretching can be easily done – but doing this with a discrete seismic wavelet is challenging and special care is required.

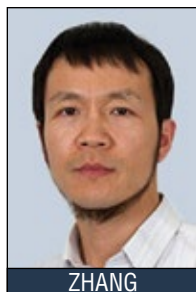
Figure 2 shows the spectral decomposition results calculated by CWT and the new method at the same frequency (72Hz) on a cross line in Blackfoot (Canada) P-wave seismic data. From shallow to deep, there are roughly three groups of events (corresponding to warm colours) where the reservoir is located in the middle group.

Comparing the results in figure 2, it is clear that the new method displays a clear advantage over the CWT method. Fewer side-lobe effects are observed, especially in the first and the third event groups, where some individual events hardly can be distinguished in the results from CWT.

In the map view, the results (right) from the new method show the north-south incised valley more clearly. There are the upper channel and the lower channel located in the valley, and they are partially sand-filled and partially shale-filled. Due to this, the sand and shale deposits within the channels in this data set cannot be fully distinguished solely by spectral decomposition results.

Some wells penetrate the channels; some do not, and are the regional wells as reference.

The CWT method shows high amplitudes within the channel, which could be misleading.



ZHANG

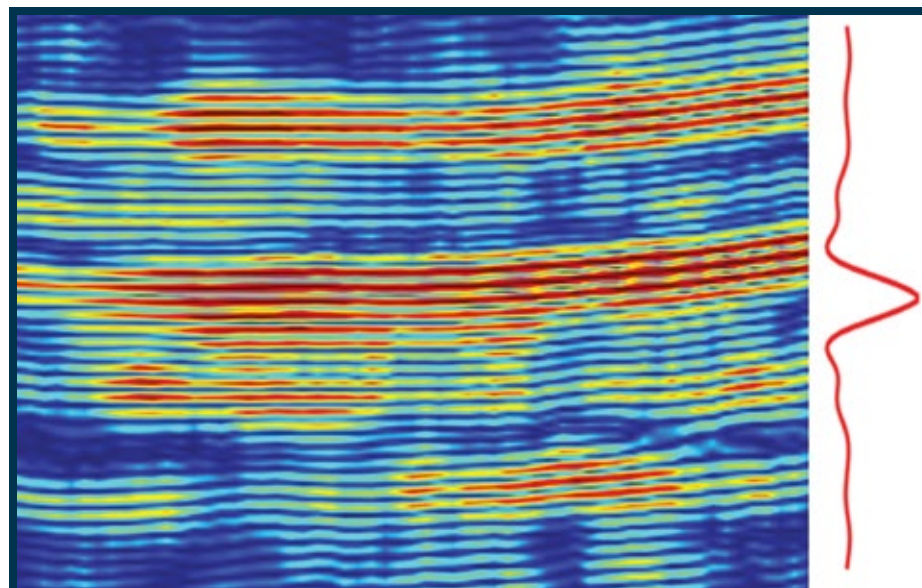


Figure 1 – Portion of profile view of spectral decomposition results showing side-lobe effect.

\* \* \*

Spectral decomposition is a powerful interpretation tool, and each method has its advantages and disadvantages. The new method introduced here tries to reduce the side-lobe effects that come with the other methods.

The severity of these effects varies across geologic regimes, data sets and frequencies.

The new method provides a very attractive option when spectral decomposition side-lobe effects appear

to be masking key geologic features.

I would like to thank John Sherman for his help in this article. I also would like to thank Geomodeling Technology Corp. for its support.

(Editor's note: Rongfeng Zhang is a senior geoscientist with Geomodeling Technology Corp.)

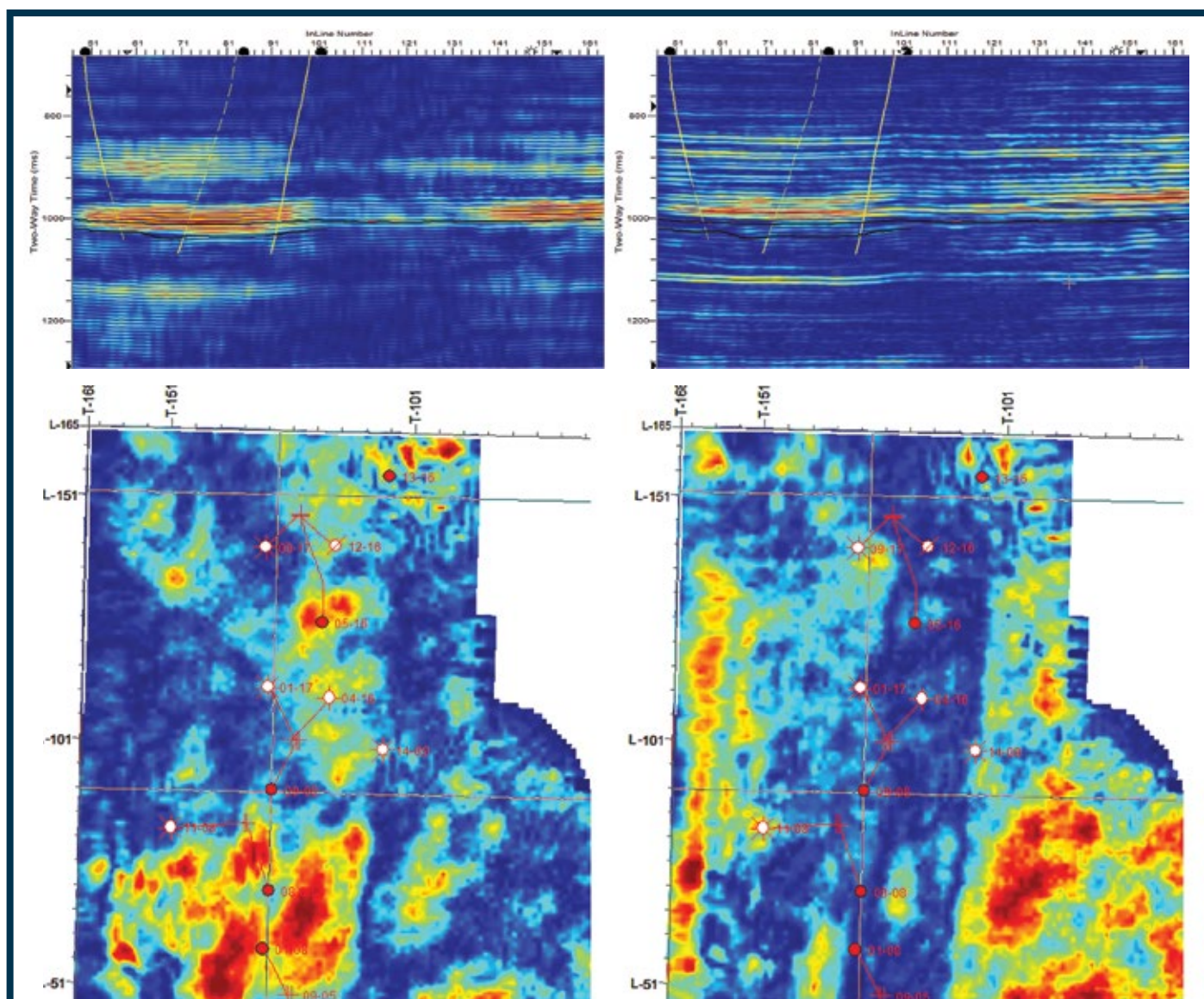
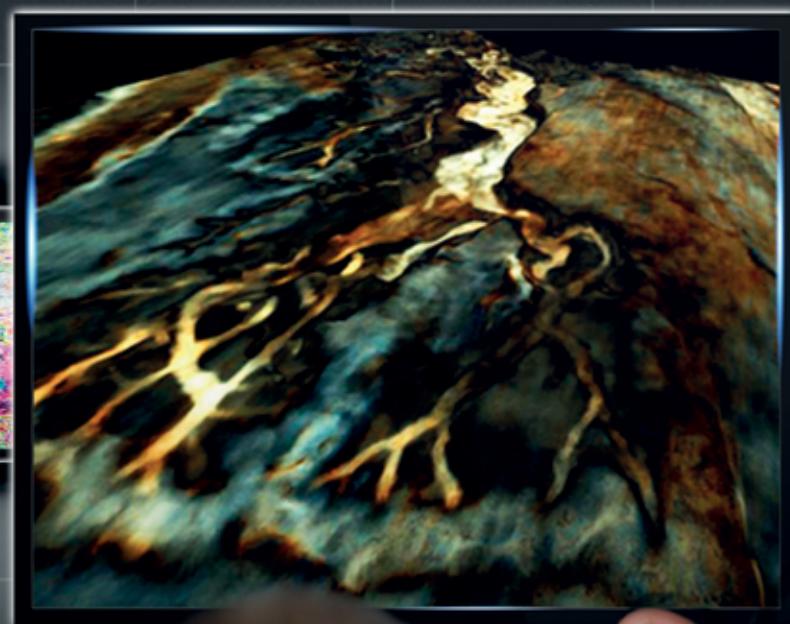


Figure 2 – Spectral decomposition results (72Hz) comparison, with profile view at top row and mapview at bottom row (the horizon slices around 0.98 seconds along the middle group of the profile).



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# Production Grows – As Do Areas of Concern

By EDITH ALLISON, GEO-DC Director

**O**il and natural gas production continued to grow in the United States in 2013 even as progress on new federal laws and regulations stalled – but local opposition to shale gas and oil development increased.

Canadian shale gas also ballooned – to 2.8 billion cubic feet per day in May 2013 – but still lagged behind its southern neighbor. Canadian shale gas represented only 15 percent of the country's 2012 production, but jumped to 20 percent in 2013, as per the Canada National Energy Board and U.S. Energy Information Administration (EIA).

Outside North America, a dozen countries conducted exploratory shale gas drilling – but only China reported commercially viable production, according to EIA. China's shale gas represented only one percent of the country's total gas production.

## U.S. Production Grew

U.S. oil and natural gas production grew substantially in 2013, but low gas prices continued to shift drilling activities away from natural gas. Below are just a few statistics (EIA data) to document these patterns:

- ▶ In 2012 shale gas was 39 percent of U.S. dry gas production, and Marcellus production was 18 percent of U.S. production. By comparison, shale gas was 28 percent of production in 2011.

- ▶ Natural gas marketed production is



ALLISON

**No legislation that would affect hydraulic fracturing has passed either the House or the Senate, let alone both.**

projected to have increased from 69.2 Bcf/d in 2012 to 70.4 Bcf/d in 2013.

- ▶ The Henry Hub 2013 average price (\$3.69 per thousand cubic feet, mcf, est.) was significantly above 2012 (\$2.65/mcf), but nowhere close to the 2008 price of

almost \$8/mcf.

- ▶ The Bakken Shale produced approximately one million barrels per day in December 2013, and increased oil production from the formation contributed to September 2013 domestic oil

production being almost 20 percent over September 2012.

- ▶ Oil well completions increased 18 percent while natural gas completions declined 30 percent, and total well completions increased 6 percent (American Petroleum Institute, third quarter 2013 compared to the third quarter 2012).

## Federal Regulations

President Obama stated his intent to reduce greenhouse gas emissions,

**Continued on next page**

## D.C. Bound: Congressional Visits Days Slated for March 10-12

**W**ant to participate in this year's AAPG Congressional Visits Days (CVD)?

If so, the deadline to register is looming.

This year's AAPG CVD event will be held March 10-12, but the registration deadline is Feb. 10.

AAPG Congressional Visits Days event annually provides an opportunity for AAPG members to discuss petroleum science and energy issues with decision makers in the legislative and executive branches of the federal government.

It also is an exciting introduction to

the world of politics that will provide the tools to use at the local and state levels once you return home. AAPG staff will provide training and briefing materials, and schedule the meetings.

This year's CVD:

- ▶ Starts with an afternoon briefing on how Congress works; the legislative process; ways to make your visits successful; and issues that are of concern to Washington.

- ▶ On the second day, gives participants the chance to visit the executive branch and congressional committee offices.

- ▶ The third day is devoted to small-group visits to senators' and representatives' offices.

To register or get additional information contact Edith Allison, GEO-DC's Energy and Geoscience policy director, at [eallison@aapg.org](mailto:eallison@aapg.org); or (202) 643-6533.

To reserve lodging, contact the Army and Navy Club by Feb. 10, at (202) 628-8400; or email to [FrontDeskPOS1@armynavyclub.org](mailto:FrontDeskPOS1@armynavyclub.org).

– EDITH ALLISON

# REGISTRATION IS NOW OPEN

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# AAPG





## Continued from previous page

including reducing methane emissions from oil and gas operations, through executive branch actions because of congressional inaction, and many expected a rush of new regulations.

The early focus of this activity has been on coal-fired power plants, and almost no federal hydraulic fracturing regulations were finalized in 2013. The inaction may reflect longer times for the White House review process, plus the difficulty in dealing with the large number of comments received when draft rules and regulations were released.

The most recent White House regulatory agenda includes:

- The Bureau of Land Management plans to release its new hydraulic fracturing rules in May 2014.

- EPA's draft guidance for hydraulic fracturing using diesel is not yet scheduled for release.

- The U.S. Coast Guard has sent a draft regulatory proposal on barge transport of flow-back fluids from hydraulic fracturing to the Office of Management and Budget (OMB).

Preliminary ideas evidently include requiring barge operators to have certification of no hazardous materials in wastewater shipments – a potentially expensive and time-consuming requirement given that the fluid comes from multiple well sites.

### State, Local Bans and Regulations

Local bans on hydraulic fracturing appeared around the country in 2013; the tally is about 400 state and local bans.

State bans or moratoria have been enacted in Maryland, New Jersey, New York and Vermont.

Most of the numerous local bans have not yet taken effect, and many are currently being fought in the courts. A few examples:

- In Pennsylvania, the state Supreme Court ruled in December that the Marcellus Shale drilling law, Act 13, which allowed companies to drill anywhere in the state without regard to local zoning laws, is unconstitutional.


- In Colorado, four municipalities have recently banned or suspended hydraulic fracturing. Governor (and past AAPG member) John Hickenlooper has expressed the position that the municipalities lack the authority to determine the use of the state's natural resources.


Six states have strengthened their regulation of hydraulic fracturing: California, Colorado, Ohio, Pennsylvania, Utah and Wyoming; simultaneously, the governors

of energy-producing states have reiterated their opposition to federal regulation of hydraulic fracturing. In late December the governors of 12 energy-producing states sent an open letter to Washington regulators and policy makers asking that regulation be left to the states.

### Federal Legislation

Many Senate and House bills have been introduced on both sides of the safety debate, to either strengthen or weaken federal regulation of hydraulic fracturing – but no legislation that would affect hydraulic fracturing has passed either the House or the Senate, let alone both.

Both last year and this year the proposed bills focused on requiring disclosure of chemicals used in hydraulic fracturing fluid, or giving states the authority to regulate hydraulic fracturing on federal lands. 



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### 2014 Field Seminar

- Tabernas Basin, Spain
- October, 2014
- 5 days, \$2950.00

## GCAGS Abstract Deadline Looms

The call for papers for this year's annual meeting of the Gulf Coast Association of Geological Societies (GCAGS) has been extended to Feb. 12.

The GCAGS meeting will be held Oct. 5-7 in Lafayette, La. The theme is "Survivor – The Gulf Coast," and there are 13 specific themes, including a special symposium honoring the late Sidney Powers medalist Arnold Bouma, "A Half-Century of the Turbidite."

Other themes include conventional plays; deepwater plays; resource plays; renewable energy; and politics, ethics and security.

For details go to [www.gcags.org](http://www.gcags.org).



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# Energy-Water Nexus Demands Fast Action

By SOPHIA FORD

**E**nergy and water are inextricably linked, both at the crux of the U.S. economy and way of life.

Energy is required to secure, treat and distribute water; conversely, energy production depends on an abundant and reliable source of water.

This intersection is commonly called the “energy-water nexus,” a phrase that has reached buzzword status and is the focus of current policy decisions and scientific research.

As population increase and climate change put additional stress on the environment, the nexus acknowledges that any solution for one problem must equally consider the other.

## Energy-Water Legislation

The energy-water nexus is not new to political agendas – but it is rapidly gaining popularity:

► In 2004, the House and Senate Appropriations Subcommittees on Energy and Water Development requested a report from the Department of Energy on “the interdependency of energy and water focusing on threats to national energy production resulting from limited water supplies ...”

► The Department of Energy’s Sandia National Laboratory has taken the lead in energy-water nexus research. Sandia National Laboratory (2005) estimated that electricity production requires about



FORD

Sophia Ford just ended her stint as AAPG/AGI intern at the American Geosciences Institute. She earned a bachelor’s degree in geology from Kansas State University, and her undergraduate research focused on arsenic contamination of groundwater in West Bengal, India. She became passionate about Earth’s dwindling natural resources as she grew up in the drought-stricken plains of central Kansas. Her plans to serve as a Peace Corps volunteer and later attend graduate school in hydrogeology. Her research interests include biogeochemistry, environmental contamination and remedial design, and water resources management and policy.

136,000 million gallons of freshwater per day, or approximately 40 percent of all daily freshwater withdrawals in the nation.

► Bipartisan legislation in the Senate supports increased energy-water efficiency; the Energy Savings and Industrial Competitiveness Act, co-sponsored by Sen. Jeanne Shaheen (D-N.H.) and Sen. Rob Portman (R-Ohio), was introduced to the Senate in July 2013 in an attempt to update and replace the Energy Independence and Security Act of 2007.

The Shaheen-Portman bill would be the most comprehensive energy bill passed since 2007, with its purpose to reduce energy and water waste by increasing efficiency technologies across the nation.

Sen. Tom Udall (D-N.M.) proposed amendments in the bill to promote water efficiency. One of his amendments included authorizing the EPA WaterSense program, similar to that of the Energy Star program, to improve labeling systems for efficient water appliances, plumbing and landscaping.

He also proposed establishing a “Blue Bank” to provide grants to help water and sewer utilities invest in water efficiency and reuse.

The Shaheen-Portman bill is expected to pass both houses of Congress – it has been delayed, however, due to more pressing budgetary matters.

## Federal Agency Support

It is important to recognize that not all low-carbon technologies benefit water resources. According to a 2008 report (Webber), to produce one megawatt-hour of electricity:

► Gas and steam combined cycle plants must use 7,400 to 20,000 gallons of water.

► Coal- and oil-fired power plants require 21,000 to 50,000 gallons.

► Nuclear power plants require 25,000 to 60,000 gallons (Webber, 2008) – nuclear power is one of the most water-demanding forms of energy creation, with consumption approximately three times that of gas.

► Carbon capture and storage technology and biofuels also are very water intensive. For example, in some parts of the world people may use as much water powering their homes as they use taking showers and watering their lawns (Sandia, 2005).

Consequently, there is urgency in further research to quantify total national water resources as well as each energy sectors water use.

Through the Omnibus Public Land Management Act of 2009, Congress called for a national assessment of water availability and use. The U.S. Geological Survey (USGS) launched the National Water Census, a comprehensive look at national water availability, the first since 1978.

To start, the agency is focusing on the Colorado River Basin, Apalachicola-Chattahoochee-Flint River Basin and Delaware River Basin due to water competition from surrounding dense populations. The USGS is working with the U.S. Energy Information Administration to improve the quality and usefulness of data from power plants’ water use.

To aid in the water census, the USGS recently announced it would reinstate the rule to report the amount of water consumed in the production of thermoelectric power.

This reinstatement will significantly benefit the progress in the national census of water.

According to the USGS, thermoelectric energy water withdrawals accounted for

**Continued on next page**



## AAPG | FORUM

### Mississippian Lime Forum 2014 – Learn Insights for Effective Mississippian Lime Exploration and Production.

*February 20, 2014 – Oklahoma City, Oklahoma*

The Mississippian Lime Forum will seek to help develop a deeper, more integrated understanding of the reasons for productivity in the play, and will feature presentations by experts, and group discussions that will tie the development of secondary porosity, fractures, and diagenesis to basement structural reactivation, and the syn-depositional tectonism of the Mississippian shelf margin.

#### Comments from attendees of the 2013 Mississippian Lime Forum:

- “I really appreciated the opportunity to be involved in the great AAPG Forum. It was unquestionably the best one of these in which I have either been a presenter or attendee.”
- “Just wanted to Thank You for your work on the forum I attended yesterday. Thought it was well thought out and the diversity of talks was very good.”
- “The recent Mississippi Lime forum in Oklahoma City was an excellent opportunity for operators to come together and learn about the play that the industry is just starting to understand and to develop.”

\* Presentations

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[www.aapg.org/forum/2014/MississippianLime](http://www.aapg.org/forum/2014/MississippianLime)



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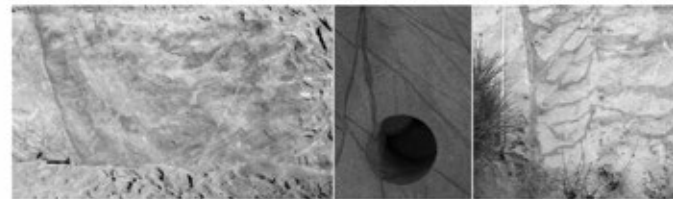
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Call for Abstracts Deadline: 25 April 2014

## Small to Subseismic Scale Reservoir Deformation

29-31 October 2014

The Geological Society, Burlington House, Piccadilly, London



Small to subseismic deformation features can negatively impact reservoir performance and/or be stimulated to enhance field recovery. In many cases such features are controlled by, or interact with, similarly scaled sedimentological features, complicating conventional views of intra-reservoir connectivity and flow unit definition. Whilst the intra-reservoir distribution of these small-scale features has traditionally been ‘modelled’ in the subsurface by applying data from analogue outcrop studies, the recent advances in the acquisition and processing of both seismic and imaging techniques, such as helical CTscans, have provided greater resolution of the ‘subsurface’ than ever before.

This 2-day international conference will bring academic and industry geoscientists and engineers together, to examine: (i) how much extra geological detail modern seismic and imaging techniques are now able to provide; (ii) how that expansion of detailed information is being approached and captured by interpreters - and tied back to real reservoir geology; (iii) what ‘new questions’ are now being asked of outcrop and well based studies in order to address the ‘unseen challenges’ of subseismic deformation; (iv) how this is influencing the level of detail that should be captured to define better subsurface flow characteristics within flow simulation models; and (v) how depletion and injection impact upon formation and reactivation of reservoir scale deformation features.

#### Call for abstracts:

Please email paper and poster contributions to [laura.griffiths@geolsoc.org.uk](mailto:laura.griffiths@geolsoc.org.uk) and copy to [mikeashton@badleyashton-america.com](mailto:mikeashton@badleyashton-america.com) by 25 April 2013.

For further information please contact:  
Laura Griffiths, The Geological Society, Burlington House, Piccadilly, London W1J 0BG.  
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## A life-changing experience

# Water Crisis in Bengal

By SOPHIA FORD

The Indian state of West Bengal, located in eastern India and stretching from the Himalayas to the Bay of Bengal, is a cultural hub where art and literacy flourished. This landscape is dominated by winding rivers and luscious fields of spices, rice and other crops.

The Bengal Basin region, however, is confronted with some of the highest levels of naturally occurring arsenic (As) in drinking water, which poses a major health-related environmental threat to the 70-100 million people living in the area.

The arsenic released from sediment to groundwater is dependent on biogeochemical processes and sediment mineralogy. Rapid population growth and a lack of sanitation infrastructure have accentuated the problem.

### A Health Calamity

The exposure to As-contaminated drinking water is relatively new to this region. Until the 1960s, inhabitants of the Bengal Basin utilized surface water.

Surface water availability is dependent on the season, with monsoon season completely or intermittently inundating the area. It was recognized that the surface water was causing morbidity and mortality from gastrointestinal disease due to lack of sanitation infrastructure. UNICEF, World

Bank and other international agencies installed millions of tubewells to provide what was presumed to be safe groundwater.

Instead, the shallow tubewells drilled into another health calamity.


The World Health Organization guideline for arsenic in drinking water is 10 ppb. Some wells we identified had As concentrations as high as 4,000 ppb (Neal, 2010).

The source of arsenic is geogenic, with it restricted to Holocene sedimentary aquifers. In this region, Holocene sediments originated from igneous and metamorphic rocks weathered in Himalayan mountains just to the north. The sediments contain adsorbed As and oxide minerals. Arsenic is mobilized through reductive dissolution of iron oxyhydroxides within the sediments, which is controlled by microbial action.

Despite the widespread acceptance of this process, much about it remains unclear.

Continuing to educate villagers in low As areas may identify wells in the area of high As simply because they're not aware of the issue.

Further work is needed in planning long-term intervention measures. Education is a critical factor.

The experience left me eager to pursue graduate work in hydrogeology to help alleviate global water quality and quantity misfortunes. 

### Continued from previous page

41 percent of total freshwater withdrawals and 50 percent of total fresh plus saline withdrawals for the nation.

Without a national assessment of water supply it is difficult to gauge and understand the interdependencies of water and energy.

### Conclusions


The energy-water nexus catchphrase taps the potential for policy makers, scientists and industry leaders to better understand the interdependencies of energy and water.

Current legislation to increase water and energy efficiency, the National Water Census and the reinstatement of the rule to report water use in thermoelectric plants are

federal initiatives to address the interlocking nature of the two. Understanding the linkage of water and energy is key in determining efficient use of these critical resources, both for economic benefit and environmental resilience.

Wastewater reuse has a strong potential to boost water supply and lessen energy consumption. Wastewater treatment plants discharge approximately 32 billion gallons per day in the United States, with approximately 12 billion gallons of that going to an ocean or estuary.

Reusing this treated water, rather than discharging in coastal areas, would increase the U.S. total water supply by about 6 percent.

With population increasing and water becoming scarcer, water reuse and increased water efficiency prove to be a cost-effective means to provide water. 

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**University of Tulsa - [cese.utulsa.edu](mailto:cese.utulsa.edu)**

## Optimizing Shales: New Lessons Learned

### Third Annual AAPG/STGS GTW: Eagle Ford + Adjacent Plays and Extensions

February 24-26, 2014 • San Antonio, TX

This workshop focuses on prospectivity and producibility, with an emphasis on the conditions and characteristics of successful wells, and the technologies and techniques used in achieving success.

The productive extent of the Eagle Ford has expanded, thanks to new information and understanding of the factors that make the formation producible in a particular prospect or location. The same is true of adjacent formations such as the Buda and the Austin Chalk, along with Cretaceous extensions of the Eagle Ford, which extend from the Eaglebine to the Tuscaloosa Marine Shale.

#### Topics:

- Geophysics, regional geology, and Eagle Ford Extensions
- Sweet spots, reservoir quality, and the Eagle Ford
- Petrophysics
- Geomechanical considerations
- Drilling the "new" zones: Lessons learned and "Must-Know" facts
- Completions: Hydraulic fracturing, proppant selection, understanding reservoir behaviors
- The right kind of frac: How can geologists help? What can engineers explain?
- Decline curves: Seeking and finding answers

[www.aapg.org/gtw/2014/houston/index.cfm](http://www.aapg.org/gtw/2014/houston/index.cfm)



**AAPG**

Geosciences Technology  
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# Keeping Busy: Foundation Spreads Its Support

By NATALIE ADAMS, AAPG Foundation Administrative Manager

**A**wards, appointments and determining new ways to help support geoscience education dominated AAPG Foundation activities in January.

Leading the list was the announcement that James A. Hartman and Charles "Chuck" Weiner have been named recipients of the Foundation's top honors, the L. Austin Weeks Memorial Medal and the Chairman's Award, respectively (see related story, page 4).

But that wasn't the only Foundation news.

## Trustee Associates Service Awards

The AAPG Foundation Trustees have named Robert J. Ardell and Mike Wisda, both of Houston, as the 2014 Trustee Associates Service Award recipients.

The award is presented annually to those who have "distinguished themselves in beneficial long-term service to the AAPG Foundation."

Awards will be presented at the 2014 Trustee Associates annual meeting in Austin, Texas, in September.

## Halbouty Lecturer

Dr. Carlos Dengo has been selected by the AAPG Foundation Trustees to be the 2014 Michel T. Halbouty Lecturer, a special event presented annually at the AAPG Annual Convention and Exhibition.

Dengo, director of the Berg-Hughes Center for Petroleum and Sedimentary Systems at Texas A&M University in College Station, Texas, will present "Transcending Geoscience Paradigms for Exploration



ARDELL



WISDA



DENGO

Opportunity Growth," Monday, April 7, at the George R. Brown Convention Center in Houston.

Dengo's abstract can be found at [http://foundation.aapg.org/programs/halbouty\\_lecture.cfm](http://foundation.aapg.org/programs/halbouty_lecture.cfm).

## Foundation Award Support

AAPG's honors and awards program annually provides a means for recognizing outstanding achievements and contributions by professional geologists, especially in the area of exploration for petroleum and energy mineral resources, and by other professionals who further the goals and objectives of the geosciences.

The following awards, all of which will be presented at the ACE opening session in Houston, are funded by the AAPG Foundation:

- ▶ Grover E. Murray Distinguished Educator Award – to Joseph A. Cartwright, Gregor P. Eberli, Charles Kerans and Donald R. Lowe.
- ▶ Wallace E. Pratt Memorial Award – to Sonja Spasojevic and Michael Gurnis.
- ▶ Robert H. Dott Sr. Memorial Award – to

John A. Breyer.

▶ John W. Shelton Search and Discovery Award – to Neil K. Basu, Gervasio J. Barzola, Hector Bello, Paul R. Clarke and Oswaldo E. Vilorio.

▶ George C. Matson Award – to Stephen G. Holtkamp.

▶ Jules Braunstein Memorial Award – to Satinder Chopra and

Ritesh Kumar Sharma.

▶ Gabriel Dengo Memorial Award – to Irene Arango.

▶ Ziad Beydoun Memorial Award – to Jaime Castillo, Victor Castro, Alfredo Ramirez, Carlos Mora, Paola Blanco and Claudia Ceballos.

▶ Geosciences in the Media Award – to Scott D. Sampson, and The Switch Energy Project (Scott Tinker and Harry Lynch).

## Support for AGI's Geoscience Center

The Foundation, continuing its mission to promote K-12 geoscience education through programs for science teachers, students and the general public, has awarded \$50,000 to the American Geosciences Institute's (AGI) new Center for Geoscience Education and Public Understanding, in Alexandria, Va.

The Center acts as a clearinghouse for information on exemplary earth science curricula and non-curricular resources; professional development programs for teachers; geoscience career information; educational ancillary materials; the status of earth science education at the state and

national levels; and geoscience outreach programs to schools.

The Center also houses the Critical Issues Program, which will provide the most current scientific understanding on geoscience topics of interest to the general public and decision makers.

## Support for Datapages' Digital Efforts

The Foundation also supports projects that assist in capturing publications into online searchable archives.

In fulfilling that mission, the Foundation recently approved \$50,000 to AAPG Datapages for its continuing efforts to digitize publications and data.

Local organizations can join the AAPG Datapages Archives program, spreading the latest science even farther.

This grant specifically will fund the digitization of data for the North Texas, South Texas, Alaska, Grand Junction, Asociación Mexicana de Geólogos Petroleros and Mississippi geological societies.

## Shell: New Matching Gift Procedures

Shell Oil Co., through its Royal Dutch Shell's "Heroes (Helping Employees Reach Out) Program," matches employee contributions to the AAPG Foundation, from \$25 to \$5,500 at a one-to-one ratio.

Full-time employees, spouses, part-time employees and even retirees are eligible.

Donors can register their matching gift requests electronically at [www.easymatch.com/shell/](http://www.easymatch.com/shell/).

# MEET EMILIO JOSE TORRES PARADA

Emilio Parada, a student at the University of Oklahoma, received a 2013 Grants-in-Aid award thanks to the Jon R. Withrow Named Grant. Because of his tremendous success with his research on unconventional gas shale assessment of the La Luna Formation in South America, Emilio was awarded the John R. Withrow Named Grant two years in a row.

Emilio recently spent a summer interning with Halliburton, and was involved in tasks such as generating the reservoir characterization and modeling of the Anadarko Basin's Woodford shale; developing 3-D seismic interpretations with calculations of volumetric seismic attributes; velocity model analysis; seismic time-to-depth conversion; and creating sequence stratigraphy characterization and correlations. He also worked on sequence boundaries and system tracts for 3-D mapping; generated a geological/structural geology 3-D mapping and geomechanical characterization of reservoir intervals for possible geosteering and hydraulic fracturing projects; and worked on prospect development.



Donors Jon and Cathryn Withrow

It's projects like these that excite donors like Jon R. Withrow. Withrow, a longtime geologist and dedicated AAPG Foundation Trustee Associate, is a consistent supporter of the grant that bears his name. Withrow fondly remembers what it was like to work and study as a young petroleum geology student – and now he and his wife, Cathryn, enjoy being able to offer assistance to dedicated students who excel in their fields.

To read more about Jon and Emilio, visit

[foundation.aapg.org/students/graduate/current.cfm](http://foundation.aapg.org/students/graduate/current.cfm).

Join geologists like Jon Withrow in providing college geoscience scholarships through the AAPG Foundation's Grants-in-Aid program.





# Heather McArdle Wins TOTY Honors

Heather McArdle, an award-winning geosciences teacher at Mahopac High School in Mahopac, N.Y., has been named 2014 AAPG Foundation Earth Science Teacher of the Year.

McArdle, from Ossining, N.Y., is author of three published geoscience lab manuals, creator of "Living the Earth Sciences" Web page and has taught high school and college-age students in fields of geoscience for more than 17 years.

The honor comes with a \$6,000 prize, funded annually from the AAPG Foundation, to be split between McArdle and Mahopac High School. She also will receive an expense-paid trip to the AAPG Annual Convention and Exhibition in Houston April 6-9, where she will be presented with her award at the All-Convention Luncheon.

A feature interview with McArdle will be published in the April convention issue of the AAPG EXPLORER.

A colleague at her school praised her teaching methods, saying her students "are taken into the field, taught to research and read primary resources and to write in the scientific style – and they are introduced to real world examples of careers in the geosciences."



McARDLE


McArdle has a bachelor of science dual degree in geology and secondary science education from SUNY Oneonta, and a master's degree with an emphasis in secondary science education from

Syracuse University.

Five other geoscience teachers received honorable mentions from the Foundation as having won teacher of the year awards from their respective Sections. They are:

- ▶ Sabrina Ewald, McKinney, Texas.
- ▶ Madelyn Percy, Austin, Texas.
- ▶ Chung Khong, San Jose, Calif..
- ▶ Debra Stiles, Helena, Mont.
- ▶ Alexandra Holter, Tulsa.

One of the AAPG Foundation's primary goals is to provide funding for educational, charitable and scientific objectives that benefit the geologic profession and the general public.

The Teacher of the Year initiative began in 1996 and has since honored 17 outstanding earth science teachers. 

## Foundation Contributions for December 2013

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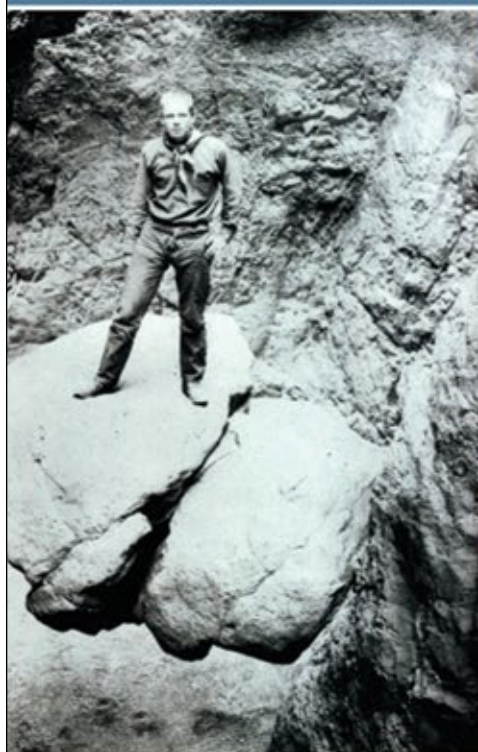
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## Ageing Petroleum Fields - Is there life after 50?

11-12 September 2014

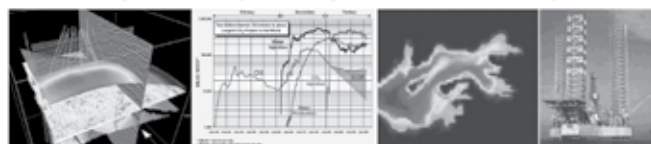
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Production of petroleum from the North Sea is fast approaching its 50th birthday (in 2015). Many of the early discovered large fields are still on production some in their second decade after the original plan for field abandonment. They still produce oil and gas at commercial rates. This picture is repeated around the globe. There are a lot of big old fields still in production. Life with these ageing assets is however not easy. As youngsters many produced oil in copious amounts with little need for understanding how the reservoir performed. As petroleum production rates have dropped and for oilfields at least, water rates have risen, optimising off-take of petroleum has become that much more difficult. The search for bypassed petroleum, untapped layers and segments has become the order of the day. Such activity demands that we better understand both the static properties and dynamic behaviour of the fields.

However, optimising the resource which is a field is not just about doing the same thing better. Old fields offer many more opportunities beyond primary and secondary recovery. Companies are looking to tertiary methods to wrest the remaining oil and possibly gas from fields. Additional value might also be created in novel ways. For example; can CO<sub>2</sub> disposal (carbon storage) be combined with EOR and EGR in areas other than Texas; can turning an ailing oilfield into a gas storage facility deliver additional value from the return of wet (oil bearing) gas; what value is there in the hot water being co-produced with the oil; what valuable species (solutes, gases) are also co-produced?

This two day meeting will explore the late life of oil and gas fields and ask the question; how can ageing oil and gas fields continue to deliver value decades after the initial planned abandonment date?

#### Themes

- Problems of late life fields
- Changing requirements in sub-surface skills
- Opportunities for EOR and EGR
- Co-produced fluids – any value?
- Subsurface value beyond last petroleum

#### CALL FOR ABSTRACTS:

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## READERS' FORUM

### Memories of the Great Sea

I greatly enjoyed the spectacular photos of the earth's surface, which appeared in the December 2013 issue of the AAPG EXPLORER.

An equally spectacular view can be found in the components of rocks, such as those accompanying this letter – four plates of Late Ordovician brachiopods.

The original plates measure 13.25 x 15.25 inches; all of the pictured brachiopods are deposited in the U.S. National Museum.

During my doctoral studies I came across a down faulted outlier of Late Ordovician rocks in the Franklin Mountains of west Texas. This unique outcrop changed my career from structural geologist to paleontologist.

It also changed the Journal of Paleontology. Tom Perry, editor of the journal, used my papers as models for other manuscripts, and he asked me to write a paper on my methods of plate preparation (Journal of Paleontology, Vol. 43, No. 3, 1969).

The following comments pertain to the plates:

"Imagine a sea so vast that it covered more than half the area of the United States. Such a sea happened during Late Ordovician time, 440 million years ago.

"Outcrops are found in west Texas, New Mexico, Nevada, Oklahoma, Colorado, Wyoming, Idaho, Minnesota, Wisconsin, Iowa, Illinois, Indiana, Ohio and several localities in Canada.

"Localities vary from below sea level to elevations of more than a mile. No comparable sea exists today even though water covers more than 70 percent of the



(See all 59 photos online at [www.aapg.org/explorer](http://www.aapg.org/explorer)).

earth's surface.

"Brachiopods are the main fossils found in Paleozoic rocks and are especially useful in correlating rocks over a wide area. The fossils displayed on the plates are beautifully preserved.

"Over time, the original shell was replaced by silica (a form of quartz). Dilute hydrochloric acid was used to extract them from the enclosing rock.

"Individuals can be assigned to a specific genus and species based on variations in size, shape, ornamentation and internal features. A mixture of hydrochloric acid and ammonia was used to prepare them for copy."

Herbert J. Howe  
Vancouver, Wash.

## EMD from page 46

(ROD) for the Oil Shale and Tar Sands Programmatic EIS, finalizing Proposed Land Use Plan Amendments for Allocation of Oil Shale and Tar Sands Resources on BLM administered lands in Colorado, Utah and Wyoming, and the Final Programmatic Environmental Impact Statement (OSTS PEIS), released in November 2012.

The ROD opens 130,000 Federal acres (52,609 ha) of tar sands in Utah for leasing and development.

► **Oil Shale** – Shell is withdrawing from oil shale development in Colorado, but continuing to work in Jordan using the same technology on a resource no richer, suggesting the barriers in Colorado were not technical.

On the other hand, Red Leaf Resources received its final permit for a large-scale test of its EcoShale™ in-capsule process, which may bring commercial production to the United States in 2014 for the first time since Union Oil stopped in the early 1990s. Planned production facilities would bring world production of shale oil from oil shale to about 400,000 BOPD by 2030.

Success will depend on companies successfully attracting capital to complex technical projects.

► **Coal** – Dramatic reductions in coal's share of U.S. energy production have paralleled the rise of natural gas production (and drop in price) over the last several years. EMD's Coal Committee report indicates that declines in U.S. coal production have been slowed due to increased exports of coal.

Carbon emissions also are part of the

conversation about coal's future.

Texas has two clean coal facilities being developed – the NRG Parish Plant near Houston and the TCEP Summit Plant near Odessa – with potential to reduce emissions by 4.65 million tons per year, and to support enhanced oil recovery.

► **Gas Hydrates** – A joint research expedition in April and May 2013 gathered high resolution seismic data and imagery that will help refine characterization of large methane hydrate resources at shallow subsea depths in the U.S. Outer Continental Shelf.

Japan has conducted a test of gas production from subsea hydrate deposits, and Korea plans one for 2014.

► **Uranium (nuclear minerals)** – 70 new reactors are under construction in 13 countries and 160 sites are under development, most in Asia.

U.S. production of uranium was the highest since 1996. Expenditures for land, exploration, drilling, production and reclamation were up 111 percent in 2012 over 2011, and 11 uranium mines are operating in Texas, Wyoming and Nebraska.

China is developing as a major customer for uranium to fuel 28 new nuclear reactors (and more than 120 are in development).

The U.S.-Russian agreement to downblend weapons-grade uranium from Russian warheads expired in November.

Greenland and Mongolia are moving toward development of rare-earth element resources.

(Are you interested in the details, but not yet an EMD member? Upgrade your membership today – at no additional cost to AAPG members – for online access to our research and reports.)



## 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.

## Curtiss from page 46

\* \* \*

The sabkha was getting wetter and wetter. I stopped to remove my shoes and socks and rolled up my pant legs above the ankle – I hadn't really packed for this type of field experience – and continued toward the sea.

Cyanobacteria mats form irregular polygons, just barely submerged under water. Think of a series of interlinked sand-colored lily pads with dark speckles and a greenish-black rim outlining the edges.

While the surface of the mat was a bit slippery, gingerly placing one foot in front of the other enabled slow progress. The mats held my weight – that is, until they didn't and I sank ankle deep into the tan and gray carbonate mud.

Slogging on, I was now sinking up to my knees with each footstep and scraping my feet and ankles against something sharp – probably shells – buried in the mud. Looking up, I could see the aqua blue of the Arabian Gulf, but there was still a fair distance to traverse.

As I pulled first one foot and then the other out of the mud the sun wasn't nearly as pleasant as it had felt earlier. I was hot and starting to sweat. And I felt a flash of fear: "What if I get stuck out here?"

\* \* \*

Some of us may feel this kind of fear while we review and assess which practices and beliefs to keep and which to change to equip the Association to succeed in the coming decades. This kind of organizational introspection can be uncomfortable, but it is a necessary part of growth and change. We must persist.

The Arabian Gulf was as beautifully blue up close as it looked from afar, the only sound a gentle breeze as warm water lapped at our feet. Well, OK, at my knees.

Back at the cars, as I was washing off



Up to his knees in a great experience.

the mud and the blood seeping from cuts on my legs and feet, Lee looked at me with pity in his eyes, "I'm so sorry, David."

But I wasn't sorry – not at all. I am sincerely grateful to our guides, Abdulla Al-Mansoori, Hesham Shebl and Ali Al-Shamry, for giving me this experience. Because spending a morning on Chris Kendall's sabkha gave me a glimpse of both the past and the future.

It was a great day and I was smiling.

\* \* \*

We can build a better AAPG. Together. Each of us contributing perspectives, voicing opinions and focusing on the future. It won't necessarily be easy or comfortable, but we can – and we must.

The lesson I was reminded of on the sabkha is the importance of persistence, cheerful persistence.

Onward, ever onward.

David H. Curtiss

## INMEMORY

Kenneth O. Seewald, a former chair of the AAPG House of Delegates, died Dec. 9 in Austin, Texas. He was 79.

Seewald had a long career working as a geologist for major and independent oil companies, and in his later years was a partner in Thomason Partner Associates. He was HoD chair – and part of the AAPG Executive Committee – in 1992-93.

He also was a former president of the West Texas Geological Society and South Texas Geology Society.



SEEWALD

Michael Goertz (Member 2000)  
Houston

Alvin August Kollaja, 90  
Midland, Texas, Oct. 17, 2013

Wade Lowery McCormick, 83  
Athens, Texas, Sept. 11, 2013

Kenneth St. Clair Meek Jr., 77  
Calgary, Canada, Sept. 13, 2013

Bernard Podolsky, 97  
Fairfield, Ill., March 4, 2013

Lee Roy Riley, 95  
Oklahoma City, Dec. 23, 2013

Kenneth Oscar Seewald, 79  
Austin, Texas, Dec. 9, 2013

James Arnold Seglund, 90  
Diamondhead, Miss., July 4, 2013

## CLASSIFIED ADS

### POSITION AVAILABLE

#### Assistant Professor of Geological Engineering University of Mississippi

The Department of Geology and Geological Engineering at The University of Mississippi is seeking an Assistant Professor. Details are available at [jobs.olemiss.edu/postings/4454](http://jobs.olemiss.edu/postings/4454). The University of Mississippi is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA employer.

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Bakersfield, California, April 27-30, 2014

Registration is open: <http://psaapg.org/2014-convention/>

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## ETGS 2014 TECH & PROSPECT EXPO

April 1, 2014 in Tyler, TX.



### Tech & Prospect Expo

- On display will be the best available prospects in the Ark-La-Tex region.
- Exhibitors will include software developers, lending institutions, data vendors, service companies displaying the latest in geophysical, geological, and exploration technology and research.

### Guest Speakers

10:00 AM • ARTHUR E. BERMAN - Director, Labyrinth Consulting Services, Inc. Associate Editor of the AAPG Bulletin; former Managing Editor & Contributor to theoilboom.com; Director of the Association for the Study of Peak Oil  
Will Speak on: "Reflections on a Decade of U. S. Shale Plays"

1:30 PM • DR. SCOTT W. TINKER, Ph.D. - Professor, Edwin Allday, Endowed Chair in Subsurface Geology, Jackson School of Geosciences, The University of Texas at Austin; in association with SVETLANA IKONNIKOVA - Research Associate - Bureau of Economic Geology

Will Speak on: "Reserve and Production Forecast for the Barnett, Fayetteville and Haynesville Shale Gas Systems"

Vendors/Exhibitors cost is \$350/booth  
Prospect Booth is \$250/booth  
Attendees pay \$30 in advance and \$40 at the door  
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# Building Our Association, One Step at a Time

By DAVID CURTISS

Last month I had the privilege of traveling to the Middle East with AAPG President Lee Krystinik.

Our packed itinerary, coordinated by AAPG Middle East Region President Sa'id Al-Hajri and Abeer Al-Zubaidi, director of the AAPG office in Dubai, allowed us to meet with a host of executives and professionals in the region.

Saudi Aramco graciously invited us on a field trip to the Sheyba field, located in the Rub' al Khali, the Empty Quarter, of the Kingdom of Saudi Arabia. Here, in the largest sand sea on earth, we stood on 300-meter sand dunes overlooking a field producing 750 million barrels of oil per day. It was an amazing experience.

We then visited our office in Dubai to discuss opportunities for AAPG to have an even greater impact in the Middle East, and we wrapped up our trip at the seventh International Petroleum Technology Conference (IPTC) in Doha, Qatar. IPTC is a joint venture of AAPG, EAGE, SEG and SPE.

Lee and Don Steeples, president of the Society of Exploration Geophysicists who also was touring the region, were invited to speak to the Dhahran Geoscience Society and Emirates Society of Geoscience. Both events were packed and we spent two very enjoyable evenings discussing our science and industry with fellow geoscientists.

We then had a second chance to go into the field in Abu Dhabi. And this trip turned out to have a personal connection for me.



CURTISS



For some, a walk in a lot of sand; for others, the thrill of a lifetime. David Curtiss (left) realizing a truth in Saudi Arabia's Rub' al Khali – we're always following in the steps of others.

\* \* \*

ADCO, the Abu Dhabi Company for Onshore Oil Operations, permitted us to access one of its fields to visit a sabkha.

But this wasn't any ordinary sabkha. As our hosts informed us, it was "Chris Kendall's sabkha."

Christopher G. St. C. Kendall, an AAPG member and professor emeritus of the University of South Carolina, did his doctorate work at this particular location, and much later he cheerfully and willingly agreed to serve on my master's thesis committee.

It was a thrill to walk in his footsteps with colleagues who knew him well, and it caused me to reflect intensely on how we as scientists build upon the work and understanding of those who go before us.

Simply thumb through the BULLETIN,

for example, and you'll see references in each journal article drawing on earlier published research. The authors take and develop new insights and viewpoints based on that previous work and their own new observations and findings.

This is an important way that we achieve our mission to advance the petroleum geosciences.

\* \* \*

The sun was warm overhead but a cool breeze kept things comfortable as we struck out across the sabkha, in the direction of the Arabian Gulf. Our footsteps crunched as we crossed a field of cone-shaped turritella shells, the remnants of sea snails, occasionally stopping to look at a particular specimen or to dig a small trench looking for

anhydrite and evidence of cyanobacteria.

As we continued seaward the sand underfoot began to change, sparkling flecks of gypsum catching the sun as far as the eye could see. It was beautiful.

And our footing changed yet again as we continued over rubbery dried mats of cyanobacteria that lay atop the sand. We were getting closer to the sea.

\* \* \*

Just as we advance our science by building upon the foundations laid by earlier generations, we continue to build our Association to best achieve its mission of advancing science and promoting professionalism. And just as our scientific understanding changes over time, so too must AAPG evolve to maintain its health and vibrancy in preparation for its second century.

Creating an organization that delivers our science to all who are interested in petroleum geoscience, and thereby demonstrating our relevance to society, is our challenge over the next several years. And this Association must be welcoming and attractive to new members, whose interests, desires and values may differ from those of past generations.

That does not mean throwing out everything that previous AAPG members have built over the last century. In fact, there is much to preserve for future generations.

But evolving AAPG does require an honest assessment of everything we do – even cherished organizational practices and beliefs – to determine if they continue to serve the needs of the Association today and its next generation of members.

See Curtiss, page 45

## DIVISIONS REPORT

# Report: A State of the EMD Union Update

By JEREMY BOAK, EMD President

Every six months, chairs of the Energy Minerals Division committees convene and report on developments in the areas they cover. In this column, we highlight important observations from these recent reports.

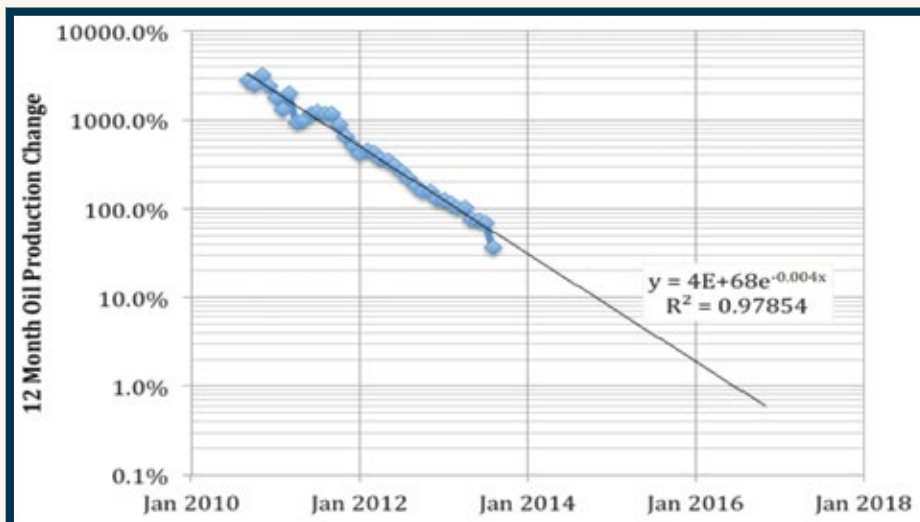
Detailed reports are on the EMD members website.

► **Shale Gas and Liquids** – Global interest in shale plays has grown this report to more than 150 pages summarizing 14 plays in the United States, developments in 11 Canadian provinces/territories, activity and potential in 12 European countries and plays in China, Australia, India, New Zealand, Japan and Indonesia.

The accompanying chart shows the growth of this report as another indicator of the "Shale Revolution."

Two details from the section on the Barnett, most venerable of these plays, serve as useful myth-busters for members:

✓ Daily production from the primary Barnett field is declining far less rapidly than might be expected, given the huge drop in rig count and the assumption that



continuous drilling is necessary to maintain high production levels.

✓ Degradation of air quality is often cited by opponents of shale gas development as a reason to halt or greatly restrict activities in these plays.

The chairman of Texas Commission on Environmental Quality (TCEQ) said air around the Barnett development is the most monitored in the United States. None of the millions (yes, millions) of tests performed by the Commission has shown concentrations of any of 46 chemicals monitored hourly that

have exceeded air quality standards.

► **Tight Gas Sands** – Much of the current investment in Alberta's Western Canada Sedimentary Basin is focused on the liquids-rich gas held in the fine-grained fringe deposits (or haloes) of the Cretaceous Cardium Formation. This new development is leading some to refer to hybrid plays, with elements of conventional and unconventional fields.

China appears to be testing tight gas sands, in partnership with international oil

companies like Shell.

EnCana has decided to stop using proppant sand in hydraulic fracturing operations in the Piceance Basin of Colorado, saving \$300,000 per well!

► **Oil Sands** – As of December 2012, Alberta bitumen reserves under development accounted for only 4.8 percent of the remaining established reserves (169 billion BBL / 2.68 billion m³) since commercial production began in 1967. If present production growth is maintained, in-situ production will overtake mined production by 2015.

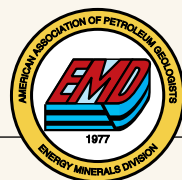
At Milne Point, BP Alaska is testing the CHOPS (cold heavy oil production with sand) recovery process in the Ugnu Sands. Initial production from horizontal wells reached peak rates of 500-550 bopd, exceeding model predictions.

BP announced in late 2012 that without tax relief, the company would be ending the pilot.

In Utah, two pilot projects announced to start in 2014 will produce liquids from surface-mined oil sand using a closed-loop solvent extraction process.

In March, the U.S. Bureau of Land Management signed the Record of Decision

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# It's good!

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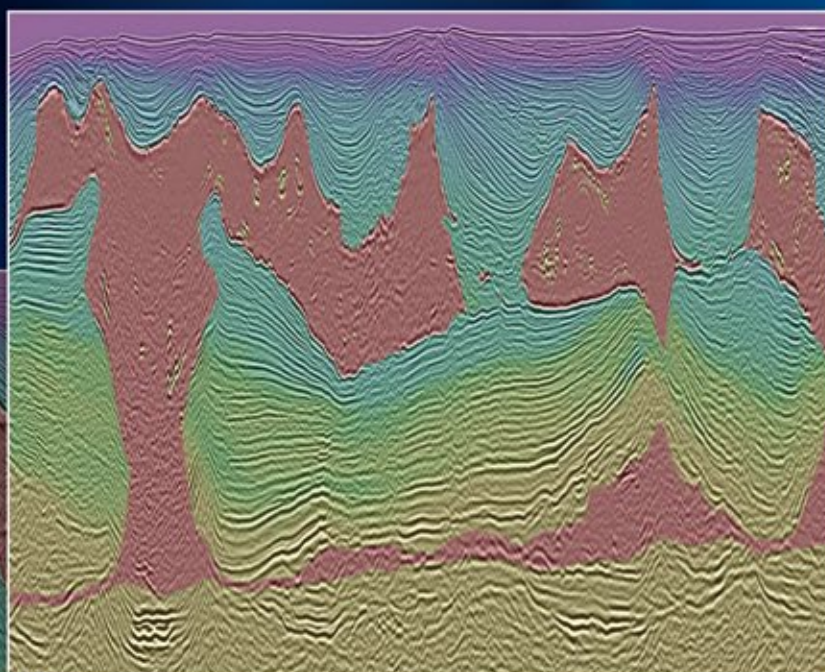
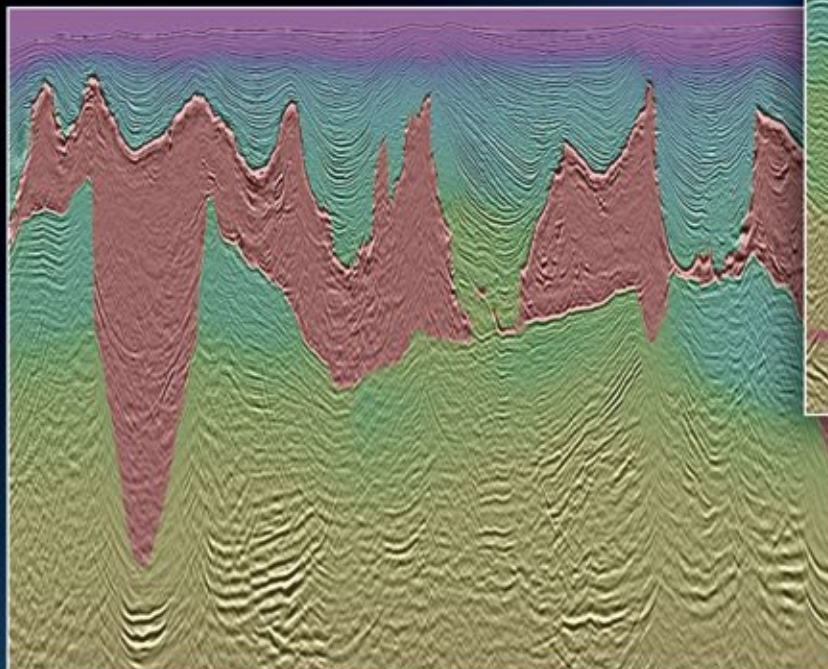
Acquisition by WesternGeco

**Revolution**

Model 2013

**Conventional**

Velocity Model E-Dog 2006



*A comparison of conventionally acquired narrow-azimuth data from 2006 (left) and full-azimuth data acquired and processed for the Revolution survey in 2013 (right). The new data allows better delineation of the subsalt structure and accurate reservoir definition to help mitigate drilling risk.*

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