

# AAPG EXPLORER

SEPTEMBER 2010



## Onshore, Offshore

The Gulf Coast region  
has some other news, too

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**PRESIDENT'S COLUMN**

# The Real Cost of Water – Going Up

By DAVID G. RENSINK

As geoscientists we have a good understanding of many of the factors that can affect our industry – but one factor that we may understand the least is water.

We know about water saturation and irreducible water calculations. We know that the cost for disposal of produced water is a line item on lease operating expense statements – and in some fields it is a very significant cost.



RENSINK

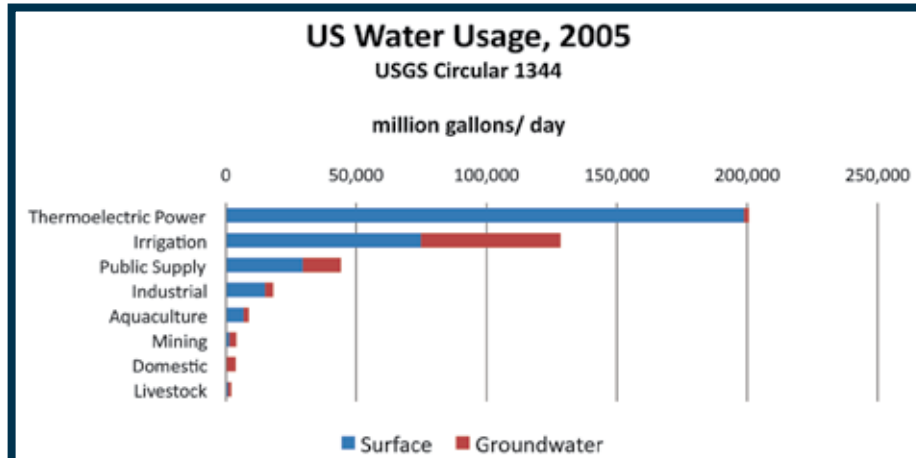
We know that when oil prices decline, the first wells that are shut in are those with the highest water cut. Water injection is one of the primary methods of reservoir pressure maintenance and secondary recovery. Water handling is a cost of doing business that increases with the age of the field.

However, most of us do not have a good understanding of how the oil industry fits into the total U.S. usage, or even the magnitude of U.S. water consumption.

Two studies published in 2009 by the U.S. Geological Survey and Argonne National Laboratory help put our industry in perspective with all other water usage in the United States:

▶ The USGS reports the U.S. water usage in 2005, as it has every five years since 1950.

▶ The Argonne National Laboratory



Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344 (Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, 52 p.); Consumptive Water Use in the Production of Ethanol and Petroleum Gasoline, Argonne National Laboratory ANL/ESD/09-1 (Wu, M., Mintz, M., Wang, M., and Arora, S., 2009).

report attempts to quantify the amount of water used in ethanol and gasoline production.

\* \* \*

The USGS study estimates that in 2005 the United States used an average of 410 billion gallons of water per day – 9.8 billion barrels per day. That is down slightly from the 413 billion gallons per day in 2000, and happens to be equivalent to the average daily usage over the past 30 years.

A summary of how the 410 billion gallons per day were used is shown in the attached table. Nearly half of it was used for thermoelectric power generation. Eighty percent of all water usage was allocated to power generation and irrigation. Sixty percent of the 410 billion gallons is groundwater and 40 percent is surface water. Freshwater withdrawals represent 85 percent of the total usage.

With total U.S. water usage in the range of 10 billion barrels per day, you would assume that the oil industry's contribution would be modest, and it is. The Argonne National Laboratory study concluded that U.S. oil production operations use between 2.1 and 5.4 net gallons of water per gallon of oil produced, depending on the location and age of the field. Net gallons of water usage means that the produced water re-injected for pressure maintenance is not included in water usage calculations.

See President, next page

## ESW Will Be 'Exploring Energy'

"Exploring Energy" is the theme of Earth Science Week 2010, which promotes scientific understanding of our planet – and this year the event will engage young people and the public in learning about Earth's energy resources.

A poster promoting activities being held Oct. 10-16 is inserted in U.S. addresses of this issue of the EXPLORER at pages 32-33.

Since 1998 the American Geological Institute annually organizes a "grass roots" effort for the geosciences community and publicizes the event, distributes materials and provides

guidance to those interested in participating in ESW.

In 2009, AGI said people in all 50 states and in more than 18 countries participated in events and activities, and nearly 80,000 people visited the Earth Science Week website. In addition, more than 1,100 people nationwide actively participated in the program's visual arts, essay and photography contests.

The program is supported by the AAPG Foundation, ESRI, ExxonMobil, the National Park Service and the U.S. Geological Survey.

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Looking for algae? Field trip participants study the Marcellus Shale.

Photo courtesy: Greg Wrightstone

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### ON THE COVER:

Since the devastating Deepwater Horizon oil spill in April, America's Gulf of Mexico has dominated the news – but that tragic story is not the only news to come from the region. Prolific plays onshore and offshore have helped the Gulf Coast to remain America's top source of energy – a topic covered in this month's EXPLORER. Cover shots depict activities in the successful Haynesville Shale (left) and shallow shelf plays. Photos courtesy of Petrohawk Energy, McMoRan Exploration and Murray Roth.

## Candidates' Videos Coming Online

**B**iographies and individual information for AAPG officer candidates for the 2011-12 term are now available online at [www.aapg.org](http://www.aapg.org).

Also, for the first time, video comments by the candidates will be available online in mid-September.

The videos show the Executive Committee candidates talking about why they accepted the invitation to stand for an AAPG office.

Ballots will be mailed in spring 2011.

The president-elect will serve in that capacity for one year and will be AAPG president in 2012-13. The vice president-Regions and secretary serve two-year terms.

Complete election campaign rules also are available online.

The slate is:

### President-Elect

- ☐ Edward A. "Ted" Beaumont, independent consultant, Tulsa.
- ☐ John C. Dolson, DSP Geosciences and Associates, Coconut Grove, Fla.

### Vice President-Regions

- ☐ David C. Blanchard, El Paso Egypt Production, Lasilky, Maadi, Egypt.
- ☐ Stuart D. Harker, Circle Oil Plc, Finchampstead, U.K.

### Secretary

- ☐ Charles A. "Chuck" Caughey, ConocoPhillips, Houston.
- ☐ Denise M. Cox, Storm Energy, Panama City, Fla.

## President from previous page

This study also estimates that oil refining uses approximately 1.5 gallons of water per gallon of oil refined.

Based on 2009 U.S. oil production and refining statistics, the U.S. oil industry's aggregate water usage is approximately 1.9 billion gallons of water per day, or approximately 0.5 percent of the United States' total water usage.

This study did not address water associated with natural gas production; therefore, the figure is somewhat conservative. A half-of-a-percent does not sound like much, but it represents 44 million barrels of water usage per day.

The unanswered question is – what is the real cost of handling that much water?

It may be relatively small in comparison to the average U.S. oil price of \$53.48/barrel in 2009, and even less so in comparison to \$91.48/ barrel in 2008. However, it was much more significant in 1998, when the average U.S. oil price was \$11.91/ barrel.

In 2005, Americans used an average of 1,367 gallons of water per day per person (410 billion gallons and 300 million people). Depending on location, we currently pay approximately \$0.002 to \$0.004/gallon for domestic supply. If we assume that \$0.002/ gallon approximates the real cost of water, applying that to the total U.S. usage yields a cost of \$2.73/ day per person.

In the same year, the United States used an average of approximately three gallons of crude oil per day per person (21.1 million barrels/day). The average cost of crude oil in 2005 was \$50.04/ barrel or \$1.19/gallon. That represents a daily cost of \$3.52/person.

It is not difficult to envision a time in the near future when the real cost of water will have a greater impact on the world economy than the cost of a barrel of crude oil.



## Eastern Section Spotlights Shales

**T**he onshore shale petroleum systems of eastern North America will be in the spotlight during the AAPG Eastern Section's annual meeting, set Sept. 25-29 in Kalamazoo, Mich.

The meeting's theme is "Perseverance – The Pipeline to Prosperity," and four of the technical program's sessions – comprising 22 papers and eight posters – will be devoted to the much-publicized eastern shale systems.

Several presentations will deal with exploration and development in the Marcellus Shale.

Specific talks will include:

- ▶ Regional Sequence Stratigraphic Interpretation of the Marcellus Shale.
- ▶ Characteristics of the Utica Black Shale in New York and Pennsylvania.
- ▶ Applying 3-D Seismic in Marcellus Shale Development.
- ▶ What's New With the New Albany Play in Illinois in 2010?
- ▶ Bloomin' Algae! How Paleogeography and Algal Blooms May Have Significantly Impacted Deposition and Preservation of the Marcellus Shale (see page 26).

Other technical sessions will deal with:

- ▶ Reservoir Characterization.
- ▶ Geological Sequestration of CO<sub>2</sub> and CO<sub>2</sub>/EOR.
- ▶ Trenton and Black River Exploration and Production.
- ▶ Responsible Development of Energy Resources in an Environment of Climate Change.
- ▶ Structural Analysis and Basin Modeling.
- ▶ Quantitative Applications for Reservoir Characterization and Production.
- ▶ GIS and Computer Applications.

For more information go online to [aapgesmeeting2010.mbg.org](http://aapgesmeeting2010.mbg.org).

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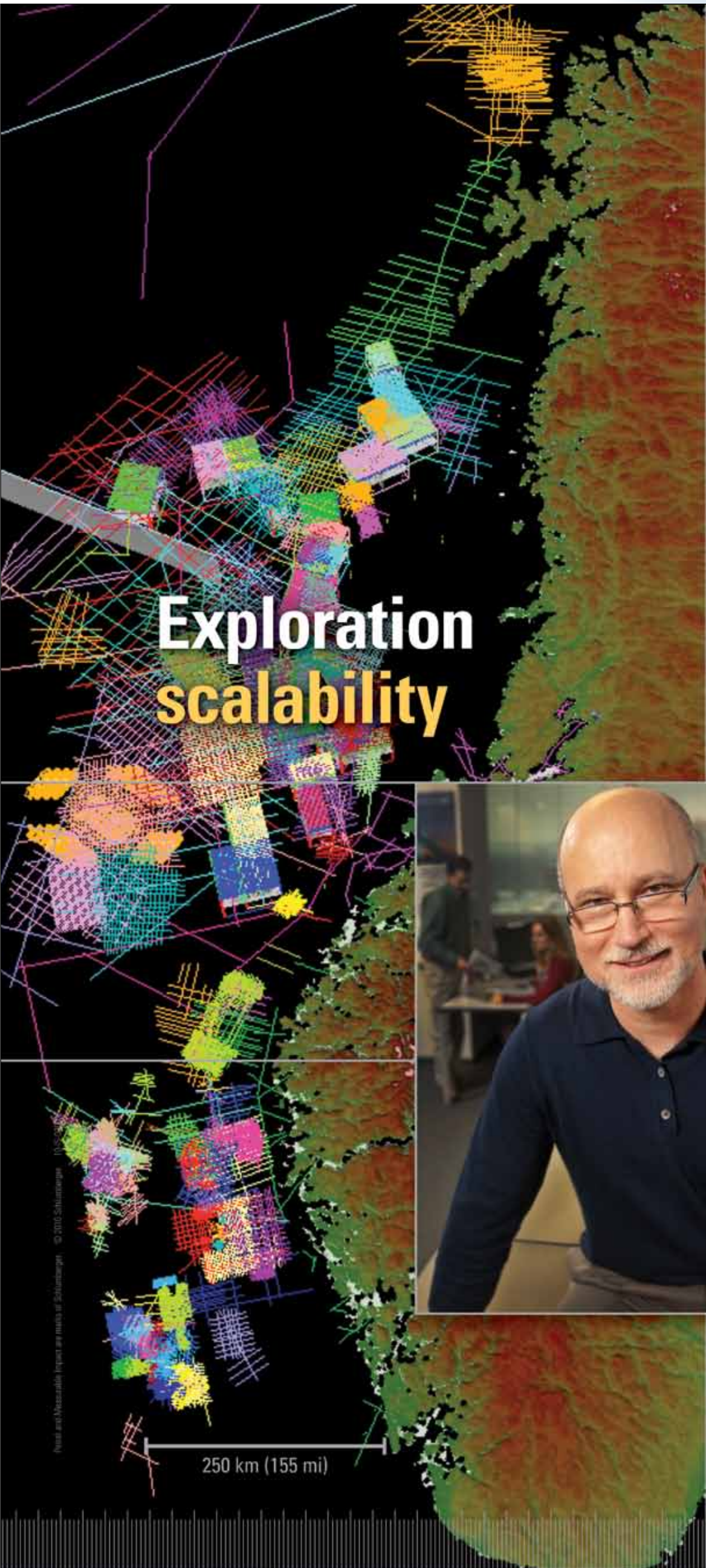
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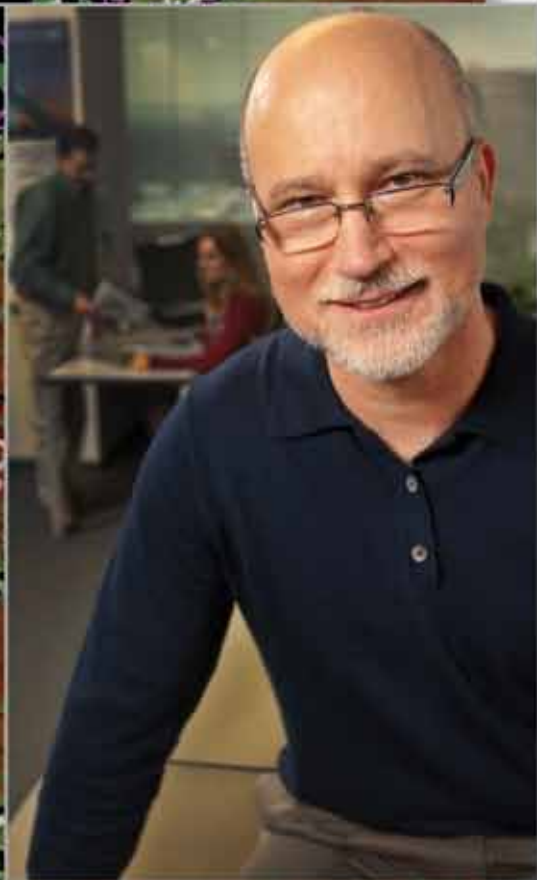


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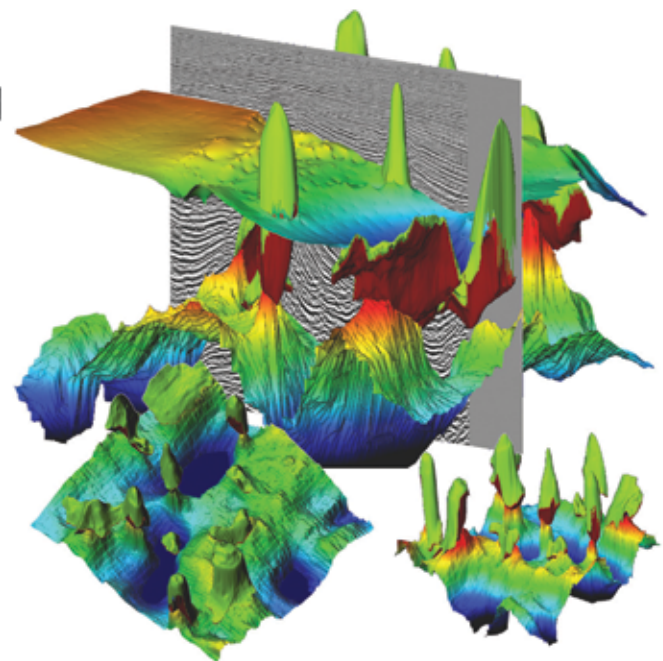
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*Moratorium creates dilemma*

# GOM Plans Redefined After Macondo

By DAVID BROWN, EXPLORER Correspondent

The extended duration of the oil spill from BP's Macondo well completely floored operators and service companies working the deepwater Gulf of Mexico.

Maybe that's why so many of them said the subsequent moratorium on deepwater exploration felt like being kicked while you're down.

Four major players scrambled to put together a \$1 billion spill-containment response system for the deepwater Gulf, and some companies issued dire predictions of an aftermath from the spill.

Those affected by the event expressed themselves from different perspectives:

❖ "The potential for removal of the liability cap for claims of damages from oil spills, and/or the enactment of onerous rules and regulations regarding activities in the deepwater Gulf of Mexico could significantly alter our industry," Noble Energy Corp. reported. "Such rules could effectively limit which companies can operate in the deepwater Gulf."

❖ T. Paul Bulmahn, chairman and CEO of ATP Oil & Gas Corp. – a significant explorer in Gulf waters – talked about the seriousness of an accident in which 11 lives were lost.

"As nothing compares to the tragedy of loss of life, we also ask that no one forget the estimated 45,000 workers and the families of those workers that will find

**Companies active in the deepwater quickly emphasized their own safety records and downplayed the potential effect of the moratorium on their financial results.**

themselves unemployed as a result of the imposed deepwater work stoppage," he said.

❖ Offshore crews hoped their unemployment would be temporary, limited to the extent of the drilling moratorium.

And for the most part, oil companies continued to push forward their Gulf of Mexico exploration plans in the face of the delay.

❖ "The drilling moratorium has impacted our offshore Gulf of Mexico operations in several ways. We expect some lost production in 2010 due to permitting delays on the shelf and a slower ramp-up at Perdido," said George Kirkland, executive vice president, global upstream and gas for Chevron Corp., in discussing the company's second-quarter results.

"Although the longer-term impact of the moratorium remains unknown, we are focused on progressing our projects in

the deepwater Gulf of Mexico," he added. "The Tahiti 2, Jack-St. Malo and Big Foot projects remain on track to reach FID (final investment decision) later this year, assuming the moratorium is lifted."

❖ Anadarko Petroleum Corp., a 25 percent partner in the Macondo well, reported it had \$3.3 billion of unproved property acquisition costs and \$377 million in exploratory drilling costs that were affected by the Gulf moratorium.

The company said no impairment of those properties had been recognized and its "intent to continue exploration and development of these properties is unchanged at this time."

Reacting to the moratorium created something of a dilemma for Gulf players.

Companies active in the deepwater quickly emphasized their own safety records – except for BP – and downplayed the potential effect of the moratorium on their financial results.

At the same time, they warned that the suspension of activity and imposition of stricter regulations could have a materially negative impact on their future.

### Collateral Damage

Financial effects of the spill quickly spread through the industry.

❖ Halliburton estimated that the deepwater suspension would lower its earnings by 5 to 8 cents per share for each quarter for the remainder of 2010.

❖ Baker Hughes said the drilling moratorium reduced its earnings by 3 cents per share during the second quarter and had a potential negative impact of 8 to 11 cents a share per quarter in the second half of the year.

❖ Noble Energy announced, "As a result of the moratorium, we entered into an agreement to terminate our contract for the Noble Clyde Boudreaux drilling rig and recognized rig contract termination expense of \$26 million during second quarter 2010."

The company suspended operations on an exploration well at the Santiago prospect (Galapagos project) in the Gulf and a sidetrack to an exploration well at the Deep Blue prospect, and temporarily abandoned both locations.

One of the early casualties of the Gulf spill was the U.S. Minerals Management

See What's Next, page 10

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## What's Next from page 8

Service. In May, the Interior Department announced that the service would be restructured. It was renamed the Bureau of Ocean Energy Management, Regulation and Enforcement.

Initial plans called for breaking up the agency into three departments, the Bureau of Ocean Energy Management, the Bureau of Safety and Environmental Enforcement and the Office of Natural Resources Revenue.

Key to those plans was the idea of separating the environmental and safety arm of the new bureau from the leasing and revenue operations. Michael Bromwich, a former inspector general of the Justice Department, became head of the new

**The newly created nonprofit Marine Well Containment Co. will operate and maintain a spill response system for the Gulf of Mexico.**

bureau and leader of the reorganization effort in June.

By August, industry developments resulting from the oil spill and the deepwater moratorium included three major elements, in addition to spill containment and clean-up efforts:

- ▶ Plans for a rapid-response, deepwater spill-prevention system.
- ▶ BP's program of planned asset sales, targeted at \$30 billion.

▶ Talk of a cooperative insurance plan for Gulf deepwater exploration.

ExxonMobil, Shell, Chevron and ConocoPhillips announced in July they would each commit \$250 million toward creation of the nonprofit Marine Well Containment Co., to operate and maintain a spill response system for the Gulf of Mexico.

The planned system would be capable of containing up to 100,000 barrels of oil per day, functional in up to 10,000 feet of water

depth and deployable within 24 hours.

It would capture all flowing oil and feed it to one or more capture vessels through a system of jumpers, manifolds and risers, and include capture caisson assemblies to enclose a damaged connector or leak outside the well casing.

ExxonMobil was named project leader on behalf of the sponsor companies. Plans called for existing equipment to be secured for the response system within six months, with specially made equipment finished and the system operational within 18 months.

BP said in July it would sell up to \$30 billion of assets during the following year and a half, primarily from its upstream business. The company took a charge of \$32.2 billion to reflect costs related to the Macondo spill.

Apache Corp. agreed to pay \$7 billion to acquire all of BP's oil and gas operations, acreage and infrastructure in the Permian Basin of west Texas and New Mexico and Egypt's Western Desert, plus most of BP's upstream natural gas business in western Alberta and British Columbia. The deal included estimated proved reserves of 385 million barrels of oil equivalent.

BP could offer a stake in its Prudhoe Bay operations in Alaska, reportedly part of but then excluded from the Apache acquisition. It also may offer assets in Vietnam, Pakistan and Colombia for sale.

### Cooperative Insurance?

In addition to negative public opinion and the possibility of operating restrictions in the Gulf, deepwater explorers expressed concern about the higher perceived risks of drilling.

"The ability to insure such risks is limited by the capacity of the applicable insurance markets, which may not be sufficient to cover the likely cost of a major adverse operating event such as a deepwater well blowout," ExxonMobil said.

"Small and medium-sized oil and gas companies might not be able to obtain insurance coverage at economically appropriate levels or meet financial responsibility requirements and would have to exit the deepwater Gulf of Mexico," Noble Energy warned.

One proposed solution would have companies acquiring their own liability coverage up to \$1 billion, then paying into a cooperative insurance pool for additional coverage. That money would be available to a contributing operator that experienced a catastrophic accident, blowout or spill.

Jim Mulva, chairman and CEO of ConocoPhillips, was asked about the possibility of a changed liability cap and a cooperative insurance approach during a discussion with industry analysts.

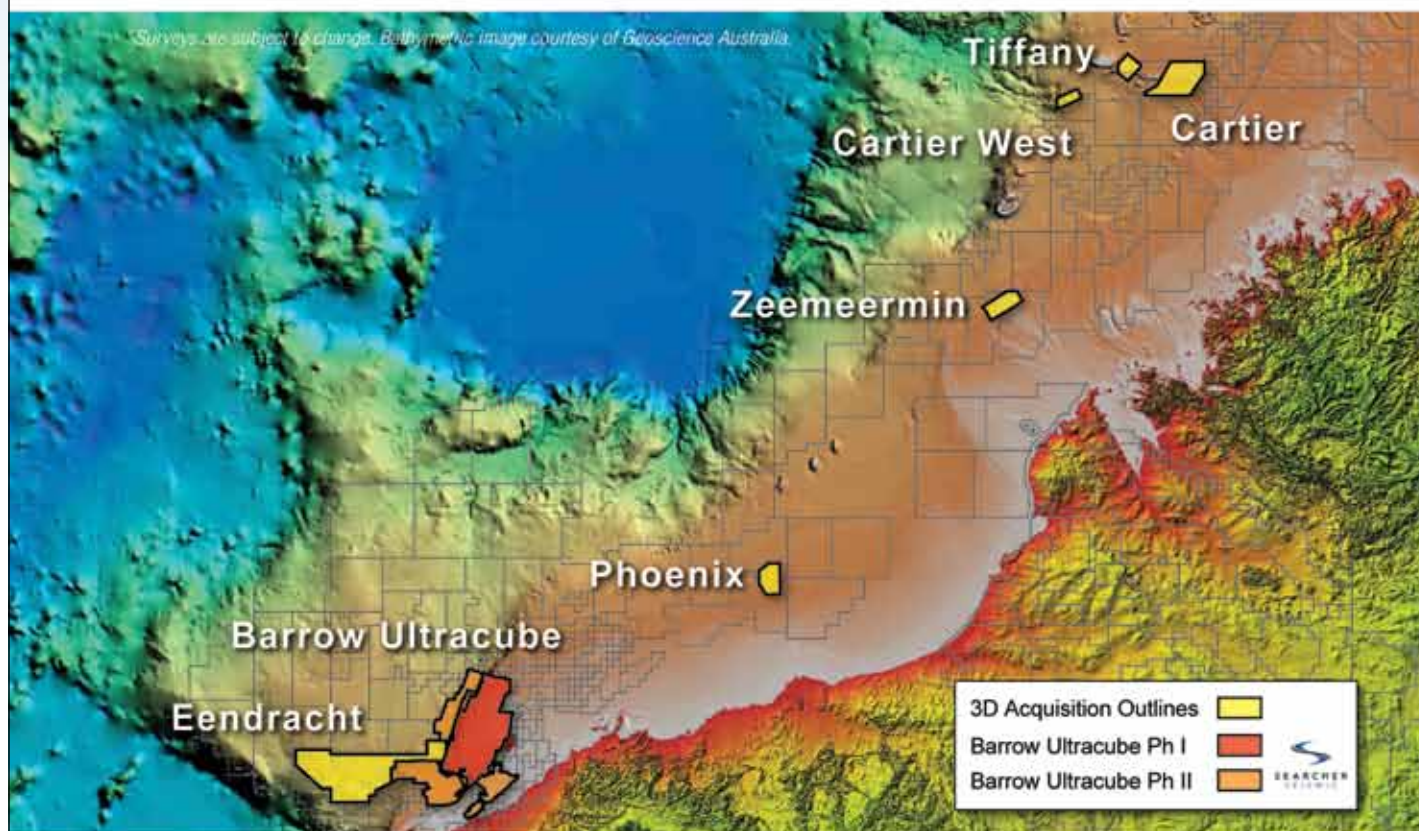
"The oil spill insurance fund, we have to make sure that whatever we do, if there are changes to it, it's done in a way that those funds if collected are really used in the case of a very unfortunate, tragic incident," Mulva responded.

"That is what they need to be used for, and more of a collective mutual insurance by the industry to the extent you pay in, than to be a vehicle by which the government collects money from the industry and then uses it for things other than its intended purpose," he said.

An obstacle to cooperative insurance coverage may be the industry's attitude about responsibility for serious accidents in deepwater. BP was widely criticized by other operators and accused of lax operations leading to the Gulf oil spill.

"We believe the investigations of this tragedy," Kirkland said, "will show that it was preventable." ■

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**Zeemeermin** - recent acquisition of ~1160 km<sup>2</sup> in the Browse Basin.

**Phoenix** - ~1100 km<sup>2</sup> to be acquired in the Canning Basin.

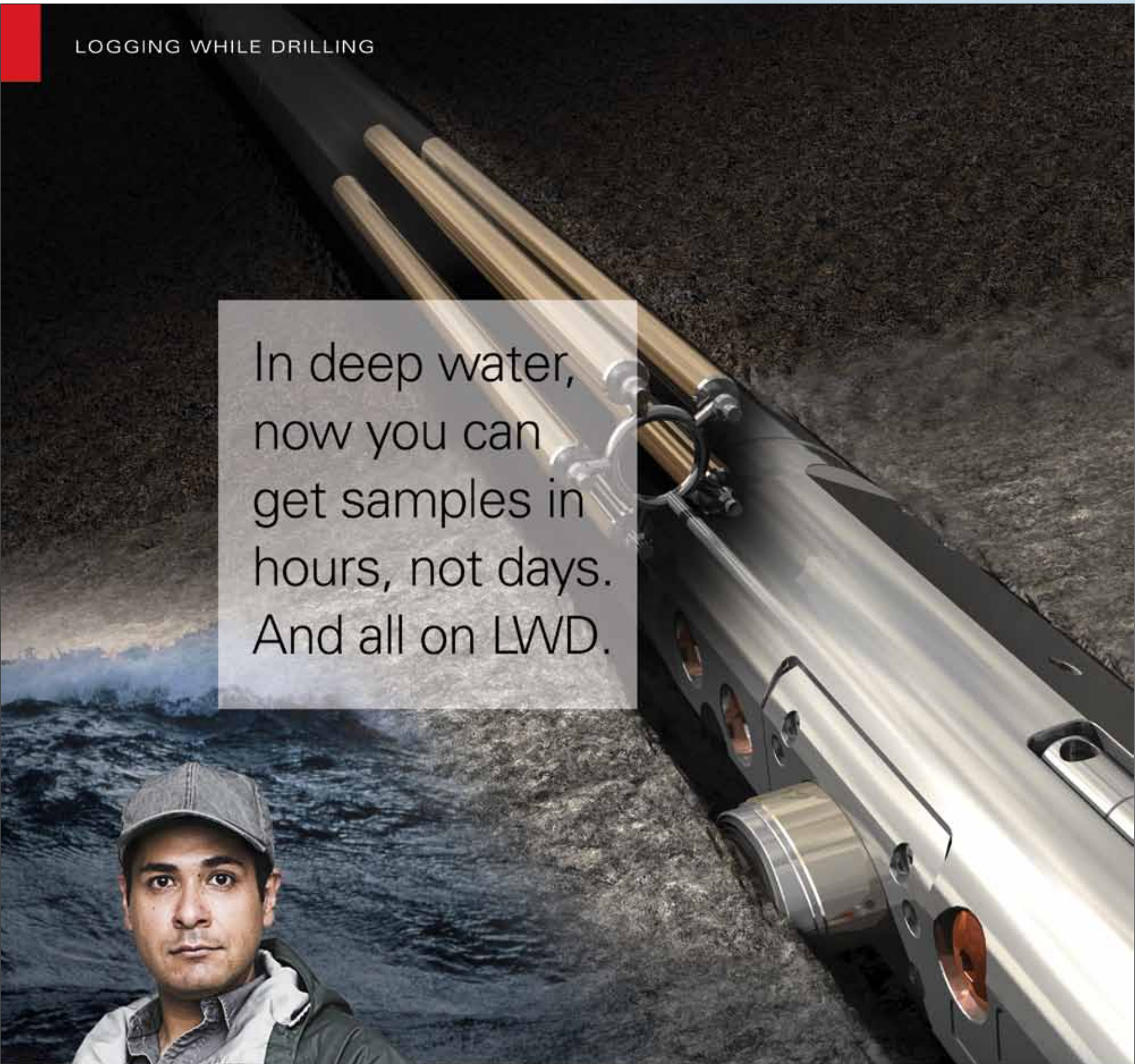
**Tiffany** - ~730 km<sup>2</sup> to be acquired in the Timor Sea.

**Barrow Ultracube** - together with Searcher Seismic have reprocessed Phase I consisting of ~8770 km<sup>2</sup> in the Carnarvon Basin. Phase II extension consists of ~7000 km<sup>2</sup> and is currently underway.

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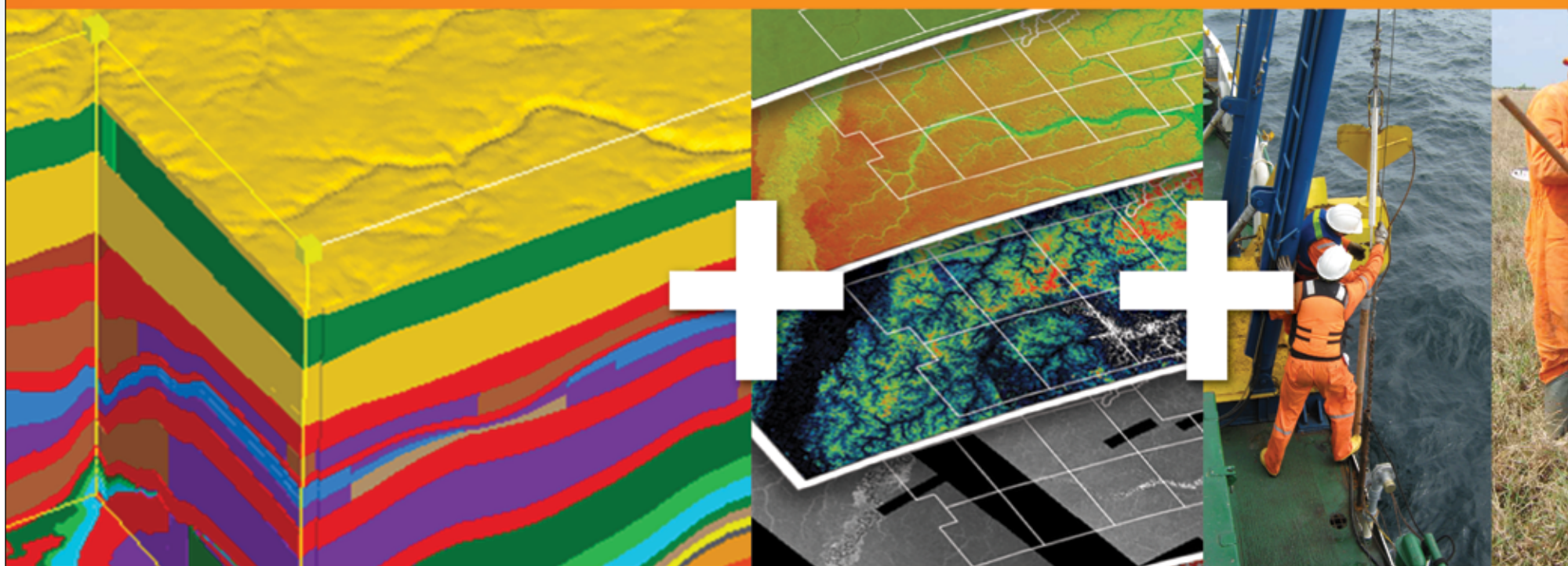
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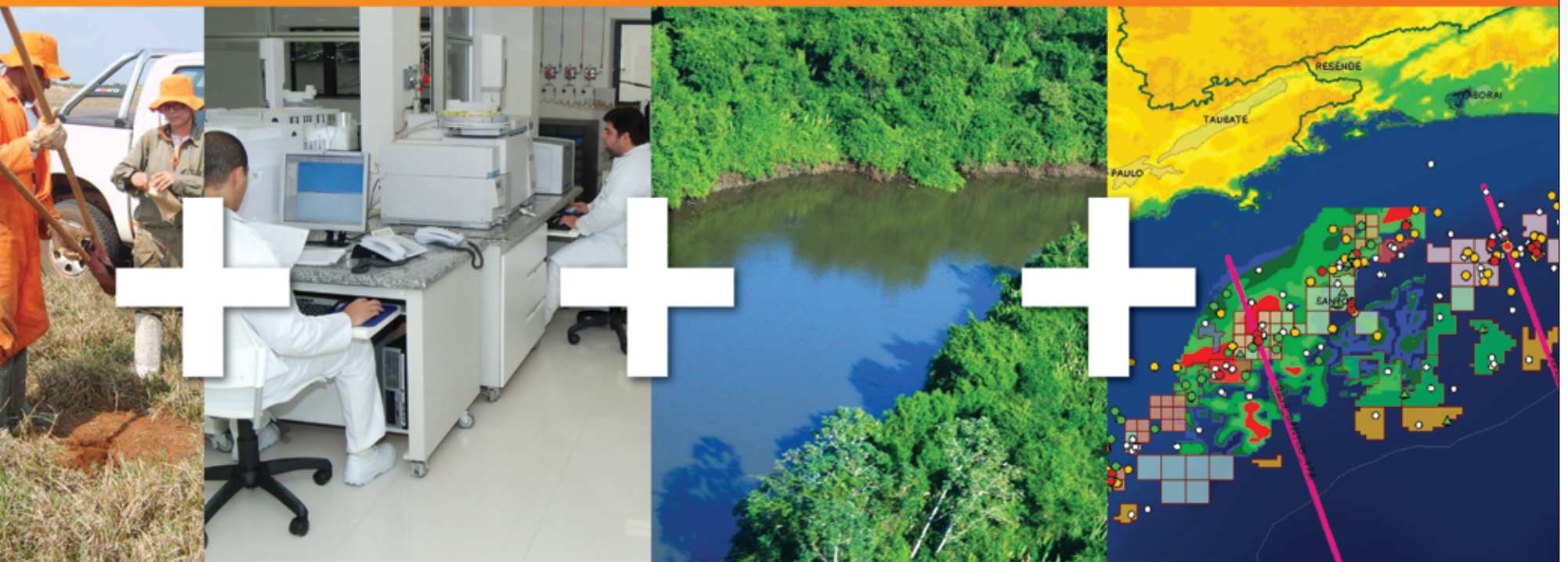
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*Lessons being learned*

# 'This Isn't Going to Happen Again'

By LOUISE S. DURHAM, EXPLORER Correspondent

The well that sourced the Big Spill in the deepwater Gulf of Mexico was reported to have ceased flowing early in August owing to success of a static kill.

At press time, the permanent kill was imminent.

Early on, continuing video of the ghastly months-long spill reached a worldwide audience, and the political powers-that-be quickly slapped a six-month moratorium on deepwater Gulf drilling, which they defined as water depths greater than 500 feet. Even shallow water permits were stalled while safety standards were reviewed.

A let-up is in sight.

Michael Bromwich, director of the Bureau of Ocean Energy Management, which is the federal offshore regulator, reportedly has said the moratorium possibly can be lifted "significantly" in advance of its planned Nov. 30 expiration.

McMoRan Exploration Co. has a long history of working both the onshore Gulf Coast area and the offshore Gulf – and has become adept at drilling successful deep wells in shallow water.

A shining example is the company's relatively recent and widely acclaimed Davy Jones discovery well, which reached almost 30,000 feet in depth while positioned in only 20 feet of water.

## Being Prepared

But while shallow water may be its milieu, McMoRan co-chairman and veteran



MOFFETT

**"We can contain a spill around these wells on the shelf immediately, because the equipment is there."**

geologist Jim Bob Moffett has earned more than enough stripes in the business to comment with authority on the recent deepwater Gulf disaster.

"Some people are calling it the Chernobyl of the oil and gas business," Moffett noted during the company's recent Q2 2010 earnings conference call. "That's an interesting comparison since you haven't had an accident in the nuclear business similar to that in 34 years."

"We've been operating on the shelf for 40 years," he noted. "As to the containment of a spill – whether because of a production facility, hurricane damage, a well out of control – we do fire drills around here all the time that the MMS basically conducts on the shelf."

"We can contain a spill around these wells on the shelf immediately," he emphasized, "because the equipment is there."

"We've done some additional actual tests on the blowout preventers, even on new rigs, demonstrating that the rams can

actually sever a five-inch or 6 5/8-inch drill pipe if needed."

It's a pointless exercise to speculate what might have happened had a well cap been sitting "on the shelf" at the ready when the recent Gulf well blowout and explosion occurred, or even a design in place to handle a damaged tree subsea.

"That's spilt milk," Moffett said. "I can assure you, at least in my opinion, those caps will be designed, because it's not like every one of those subsea completions is unique."

"The stacks may have some different dimensions," he commented, "but since we're not deepwater experts, I won't try to be a deepwater expert."

"But I can tell you that what's been learned from this incident is that the equipment that's been experimented with over the last three months, that won't ever happen again because they're going to have the stuff "on the shelf" before anybody goes back to work," Moffett emphasized. "So if you have a problem,

you go out there and put the right cap on the first time instead of experimenting."

Moffett emphasized the answers will ultimately get sorted out.

After all, billions of dollars flow into the federal coffers annually from royalty payments on Gulf of Mexico production. On top of this humongous income stream, the government has collected probably billions in revenue from lease bonuses just since deepwater plays were discovered, according to Moffett.

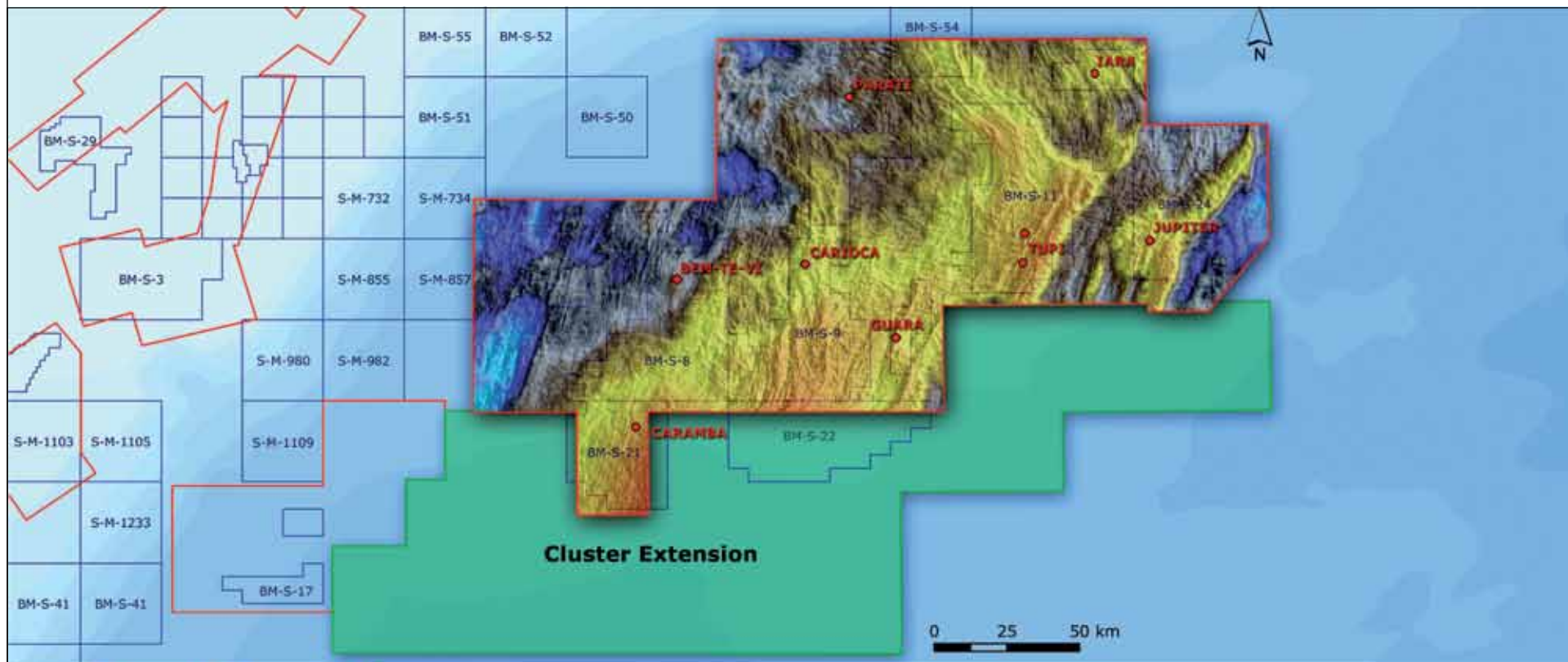
Clearly the spill will have a number of ramifications. Moffett believes there will have to be an insurance pool – a high risk pool.

He emphasized this event is not like an earthquake or hurricane that likely will continue to occur over time.

"This isn't going to happen again," he reiterated. There won't be experimental stuff as things have gone in the last months – at least in my opinion.

"You're going to have to have that," Moffett noted. "Nobody is going to operate in an environment where you have to factor into your goal whether or not to bid on a lease or drill a prospect if you've got a liability that's totally unlimited."

"I don't want to become a soothsayer here," he said, "but those are kind of my impressions of what's going to follow as people start to become rational and deal with the real economics and realities of how you keep the Gulf of Mexico as a resource for the United States." ■



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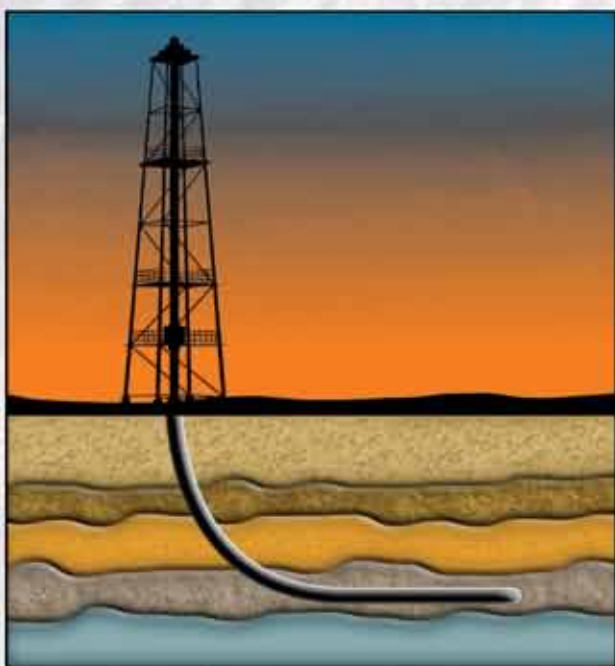
- Estimated completion: October 2010
- PSTM Fast-Track over the entire area available January 2011 (10,000 sq km available today)
- 8,000 sq km of final Kirchhoff PSDM, CBM and RTM available in December 2010

Contact:  
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Sept. 23 deadline looms

# Last Call Sounded for 2010 ACE Abstracts

**A**bstracts continue to be accepted for the 2011 AAPG Annual Convention and Exhibition – but the deadline is coming fast.

Abstracts must be submitted by Sept. 23.

The 2011 ACE will be held April 10-13 at the George R. Brown Convention Center in Houston. The general theme is “Making the Next Giant Leap in Geosciences,” and abstracts for papers and posters are being sought for 11 areas:

▶ **Molecules to Marketplace: The**

**Business of Energy** – Business energy experts from domestic and international companies who can discuss active oil and gas trends, price, demand and advice on what might happen in the future. Specific emphases include global business perspectives and discovery thinking.

▶ **Global Deepwater Reservoirs:**

**Giant Leaps in E&P** – State-of-the-art geoscience deepwater reservoir studies and deepwater depositional environments in fields located in the Gulf of Mexico, deepwater South



America, offshore Africa and emerging deepwater plays around the world.

▶ **Worldwide E&P: Opportunities in the New Decade** – Exploration

and production onshore or offshore, focused on significant new plays and studies of geological trends from around the world, including the Americas, Brazil, Middle East, Asia and Arctic exploration.

▶ **Challenged Resource Frontiers** – Multidisciplinary aspects related to the characterization, assessment and understanding of gas and oil resources from less-than-conventional reservoir systems in both the U.S. and international arenas. Specific emphases include tight oil sands, fractured reservoirs, heavy oil plays and gas hydrates.

▶ **Mudstones and Shales: Unlocking the Promise** – A comprehensive look at U.S. and international gas- and oil-productive mudstone case studies, systems geology and geochemistry, exploration, assessment and ranking techniques, reservoir characterization and evaluation, and drilling and completion technologies.

▶ **Siliciclastics: Advancing Research to Resource** – All aspects of siliciclastic research and reservoir characterization, including fluvial, shallow marine and deepwater settings, diagenesis, reservoir modeling comparing modern and ancient siliciclastic systems, and marine biostratigraphy and paleontology.

▶ **Insight Into Carbonates and Evaporites** – A look at carbonate and evaporite research (ancient and modern), carbonate reservoirs, reservoir modeling, seismic interpretation and oil and gas studies of carbonates.

▶ **Breakthroughs: Tectonics, Salt and Basin Analysis** – Basin analysis, petroleum systems and studies of structure and tectonics worldwide, including faulting styles, salt tectonics, subsalt and pre-salt modeling and exploration, and thrust and strike slip faulting and plate tectonics.

▶ **Integrating New Technology, Geophysics and Subsurface Data** – Geology integrated with geophysics, applied to exploration and production – including surface and subsurface GIS mapping technology. Specific emphases include case studies in integrated geology and geophysics, seismic visualization and mapping and GIS technology.

▶ **Energy and Environmental Horizons** – Topics important to today's natural resource and environmental geologists. Papers coordinated by the AAPG's Energy Minerals Division (EMD) will address alternative energy resources; the Division of Environmental Geologists (DEG) will coordinate papers on environmental geology.

▶ **The Next Geo-Generation: Who, What and Where** – The trends and dynamics of young professionals in the energy industry, including career development, attracting and retaining geoscience staff and forecasting new career pathways.

Abstracts for all sessions should be submitted online at [www.aapg.org/Houston2011](http://www.aapg.org/Houston2011).

Remember, the abstract submission deadline is Sept. 23.

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## Looking for Haynesville Sweet Spots

# Data Boom Boosts Stratigraphy Understanding

By LOUISE S. DURHAM, EXPLORER Correspondent

The Gulf Coast region's Upper Jurassic Haynesville play in northern Louisiana and East Texas continues to be a real happening.

The play is defined by an organic shale interval approximately 200 feet thick stretching across approximately 6,000 square miles, according to AAPG member John Rhodes, manager at MXD Energy Partners LP, which is a prospect-generating company with working interest ownership in several areas of the play.

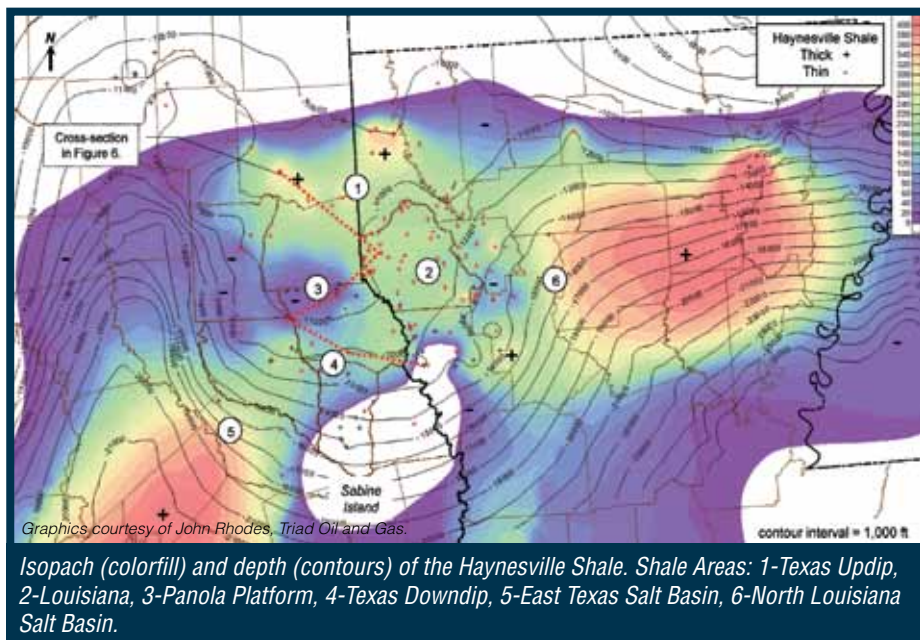
Anyone would be hard-pressed to pinpoint an onshore hydrocarbon play in Louisiana that has triggered the level of excitement attributed to the Haynesville. The play virtually up-ended the oil and gas business in this hydrocarbon-rich state where the coastal region activity has long held the spotlight while the many old fields in the north chugged along slowly as if on life support.

Once the Upper Jurassic Haynesville shale discovery well was announced by Chesapeake Energy in 2008, the land rush was on.

Leases quickly skyrocketed to the \$25,000/acre range before the companies managed to take a collective deep breath and worked to promote a semblance of calm amidst the near-chaos that enveloped this largely rural region.

Given the big bucks and production potential, calm is relative.

Petrohawk Energy plunged into the action early on and acquired substantial



Isopach (colorfill) and depth (contours) of the Haynesville Shale. Shale Areas: 1-Texas Updip, 2-Louisiana, 3-Panola Platform, 4-Texas Downdip, 5-East Texas Salt Basin, 6-North Louisiana Salt Basin.

holdings.

"We have a program here that's got decades worth of development," said AAPG member Dick Stoneburner, COO at Petrohawk. "We think it's prudent to learn as much as we can about this field – if you compromise data gathering and operational expertise, then you get behind."

Initial production in the 20 MMcf/d range was announced for some wells relatively early in the play. However, first-year decline rates as much as 80 percent were a part of the rumor mill early on.

### Data Treasure Trove

Given the number of uncertainties from the get-go, there's good news for all in that the near lightning-fast development of the play has yielded a treasure trove of pertinent info to analyze.

Indeed, the rapid development of this play has resulted in a virtual explosion of new data that significantly contribute to understanding Jurassic stratigraphy and tectonics in the region, Rhodes said.

He commented that the productivity

of the play is much less consistent than the structure and stratigraphy originally indicated, and noted that the fundamental determinants of Haynesville productivity are:

- ▶ Pre-Jurassic, tectonic influence on Haynesville stratigraphy.

- ▶ Variation of the Haynesville stress state caused by late Cretaceous volcanic and halokinetic tectonics and differential subsidence of the Gulf Coast passive margin.

"Additionally, the pressure and consequently the natural fracturing and energy within the Haynesville are impacted by stratigraphic variation of the juxtaposed Smackover, Cotton Valley lime and Cotton Valley Bossier intervals," Rhodes said.

"These intervals can act as conduits, baffles or seals to gas generated in the Haynesville.

"Where the Haynesville is isolated and can't leak into anything else and there's no faulting to let it leak, that's where you have the highest and best productivity," he noted.

Unlike many shale plays where completions target silty or carbonate zones within the shale that enhance porosity, permeability and brittleness, Rhodes commented that the Haynesville play is generally a homogeneous shale.

Productivity variation is difficult to discriminate based on log character, thickness or depth alone, but there have been observations that productivity may be enhanced as the interval becomes thinner.

See Haynesville, page 20

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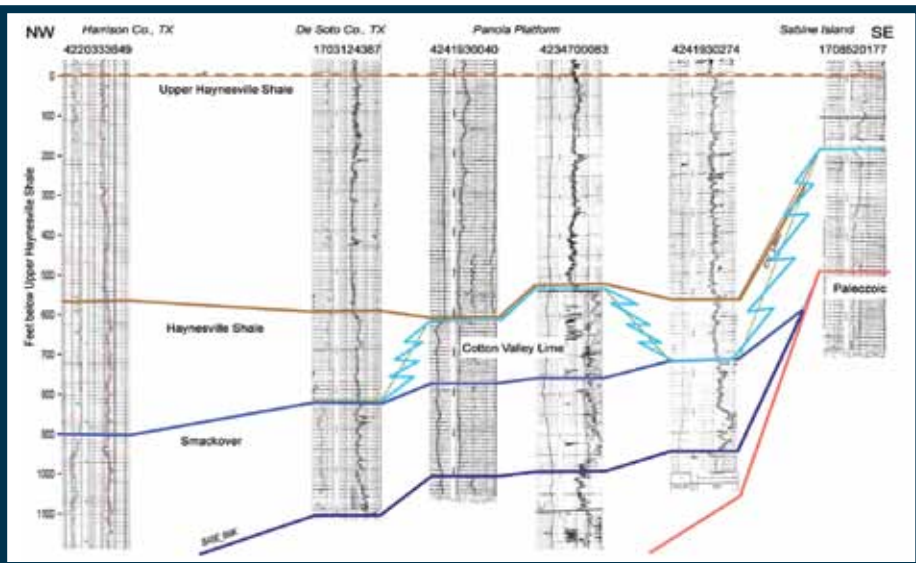
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Cross-section across the Panola Platform to Sabine Island. Datum is the Upper Haynesville (aka Mid or Lower Bossier) Shale.

## Haynesville from page 18

Suggested causes for this are:  
 ▶ Productivity decreases as shale thickens because of proximity to a deltaic source and a greater percentage of more ductile clays that impede effective fracturing.

▶ Thin areas are further removed from a deltaic source, leading to clearer water and more carbonate material in the shale, which makes the shale more brittle thereby enhancing fracturing.

The Haynesville shale is thickest in the salt basins, controlled by accommodation space and the proximity to the depocenters of clastic input, Rhodes noted.

Regarding the importance of pre-Jurassic structure, he said it's important to differentiate between the well-known Sabine

Uplift in this region and the Sabine Island. "These two are frequently confused," he said. "The Sabine Island is an old pre-Jurassic feature, whereas the Sabine Uplift is a younger Cretaceous feature – they have a separate genesis yet they're frequently misrepresented as being synonymous.

"The most important feature relative to impact on the Haynesville is the island and not the uplift," Rhodes emphasized. "Part of Sabine Island was emergent during the Upper Jurassic including Haynesville deposition, but most of the wells are located on the north flank and have Cotton Valley limestone or Smackover overlying Paleozoic sediments."

Stress caused by the Sabine Uplift during the Upper Cretaceous tended to decrease total stress on the north flank of the Sabine and increase total stress on the south flank, Rhodes said. The current hingeline of the Haynesville structure is a likely focus of stress and correlates with the highest rate wells in the Haynesville shale.

"Pore pressure is increased by gas generation, which facilitates fracturing," he added. "Pore pressure reduction by migration out of the Haynesville shale tends to impede natural fracturing."

### Emerging Sweet Spots

Owing to the relative newness of this play, it may be a tad early to tabulate an array of conclusions for the Haynesville play. However, Rhodes said sweet spots are emerging based on initial production rates, flowing pressure and decline rates.

He noted that production and log characteristics allow the play to be grouped into a few specific areas:

▶ **Texas and Louisiana updip** area includes southern Harrison and northern Panola counties in Texas along with southern Caddo, Bossier and northern De Soto parishes in Louisiana. The best wells are in southern Bossier Parish at the inflection into the North Louisiana salt basin and near a major regional fault.

▶ **Louisiana downdip** trend includes Louisiana's southern De Soto, Red River and northern Sabine parishes. This area has some of the best wells with nearly all being above average. Pore pressure is generally high, and most of the area is at the hingeline into the salt basin.

▶ **Panola platform** in southern Panola, northern Shelby, northern Nacogdoches and Rusk counties in Texas has relatively poor production as the Haynesville Shale can be thin or even absent. Also the gas can migrate out of the system via the Cotton Valley limestone.

▶ **Texas downdip** area includes southern Nacogdoches, southern Shelby, northern San Augustine and northern Sabine counties; it's contiguous with the Louisiana downdip area in Sabine Parish. Pore pressure is high here, and the wells are among the best in the play.

▶ **North Louisiana and East Texas** salt basin areas share the same characteristics, and correlation is difficult as the Bossier and Haynesville shales look similar with the latter missing its characteristic high resistivity. The shale is thicker than average and pore pressure is high, suggesting the potential may be greater than indicated by the few wells that already penetrate the interval.

It's all still new and exciting, but certain aspects of the play were always evident.

"There were some old wells from Smackover exploration in the region," Rhodes noted. "The pressure based on just mud weights from those early wells pretty much mimics what we're seeing in productivity now.

"You could see the trends in the old drilling."

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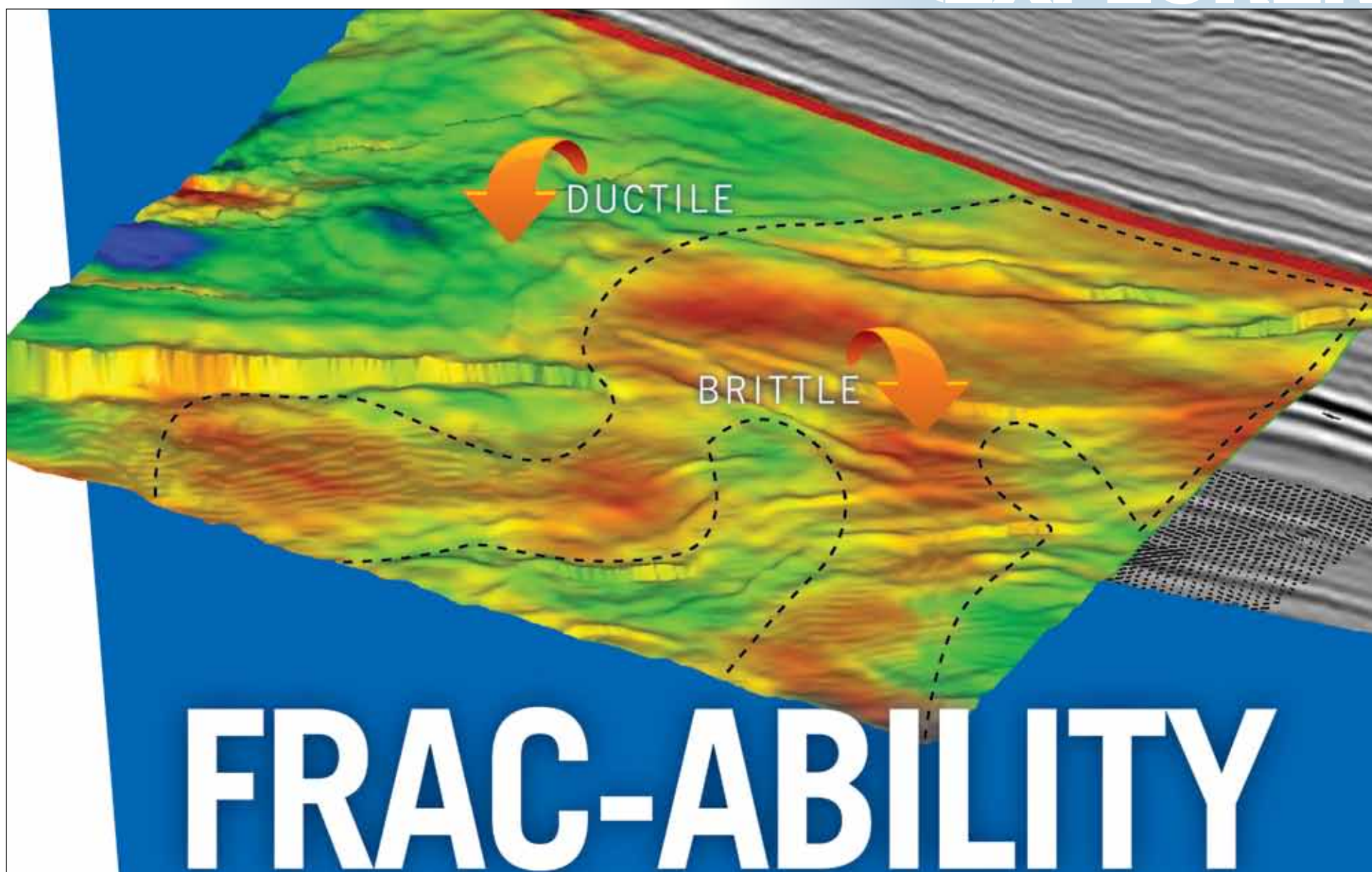
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## Texas Miocene targeted

# Offshore CO<sub>2</sub> Repository Potential Studied

By LOUISE S. DURHAM, EXPLORER Correspondent

Carbon sequestration – or long-term storage, of anthropogenic carbon dioxide in subsurface geologic formations – has long been on the radar screen of scientists, politicians and others as a potentially viable means to reduce greenhouse gas emissions into the atmosphere.

In the United States, consideration of this type storage ordinarily is associated with onshore regions.

No more.

The first study in the United States to investigate the potential for permanent

underground storage of CO<sub>2</sub> in offshore geologic formations has been launched by the University of Texas at Austin via its Bureau of Economic Geology (BEG).

The three-year project is being funded by \$6 million in grants from the U.S. Department of Energy (DOE) via the National Energy Technology Laboratory and the Texas General Land Office. It's designated to identify state-owned areas underlying the Gulf where CO<sub>2</sub> can be stored safely and economically.

Dubbed Gulf of Mexico Miocene CO<sub>2</sub> Site Characterization Mega Transect,

the effort is focused specifically on the geologic potential of Miocene age rocks of Texas State Submerged Lands to store CO<sub>2</sub> for geologically significant periods of time.

The effort is designed to help meet the DOE goal of characterizing geologically representative formations that may be used to economically store anthropogenic CO<sub>2</sub> emissions.

Program principal investigators are AAPG members Timothy "Tip" Meckel and Ramon Treviño, research associates at the BEG.

"This is a dramatic shift in thinking about carbon storage in the United States," Meckel said. "Until the funding of this proposal, most people thought of carbon storage as an onshore exercise."

"Owing to decades of oil and gas exploration, the Texas state lands of the northern Gulf of Mexico make up one of the most geologically studied areas in the world," Meckel said. "That makes us very comfortable with the idea of starting new activities in this area."

"Preliminary estimates of carbon storage capacity suggest many billions of metric tons of carbon dioxide could be stored in offshore geologic formations in Texas," he said, "making offshore storage an extremely promising resource for mitigating greenhouse gas emissions for Texas as well as other parts of the U.S. with more limited storage potential."

### Project Objectives

Treviño noted an array of advantages that Texas brings to the table for this type project:

- ▶ State lands ownership extends 12 nautical miles offshore, compared to three miles for all other states except Florida.
- ▶ Available sources of carbon dioxide from industry and power generation.
- ▶ Existing infrastructure from the decades-old oil and gas activity.
- ▶ Reduced environmental risks to underground sources of drinking water compared to sequestration beneath land onshore.

Scott Tinker, director of the BEG and a past AAPG president, originally proposed the idea to the Texas House of Representatives Carbon Dioxide Caucus in 2008.

"Because Texas produces copious quantities of energy and industrial products for the U.S., which in turn results in large output of carbon dioxide, Texas has a strong interest in developing effective CO<sub>2</sub> management options," Tinker emphasized.


Meckel summarized the objectives of the project:

- ▶ Assess and analyze the existing data from historical hydrocarbon industry activities in a regional transect of the Texas Gulf Coast.
- ▶ Verify the ability of the Miocene age rocks of the region to safely and permanently store large amounts of anthropogenic CO<sub>2</sub>.
- ▶ Identify at least one specific site that can accept at least 30 million tons of CO<sub>2</sub> from future commercial carbon capture and storage operations.

Among the many efforts planned to help meet the objectives, the study participants will investigate reservoir and seal quality of the target units and generate datasets of geologic information needed to assess geologic storage viability.


Additionally the study will evaluate the possible risks involved with geologic carbon storage. To help with the objective of defining risks, the Environmental Defense Fund, the Environmental Defense Fund, Los Alamos National Laboratory and Sandia Technologies are partners in the project.

Various methodologies will be utilized by the project team to achieve the project objectives. These include geophysical



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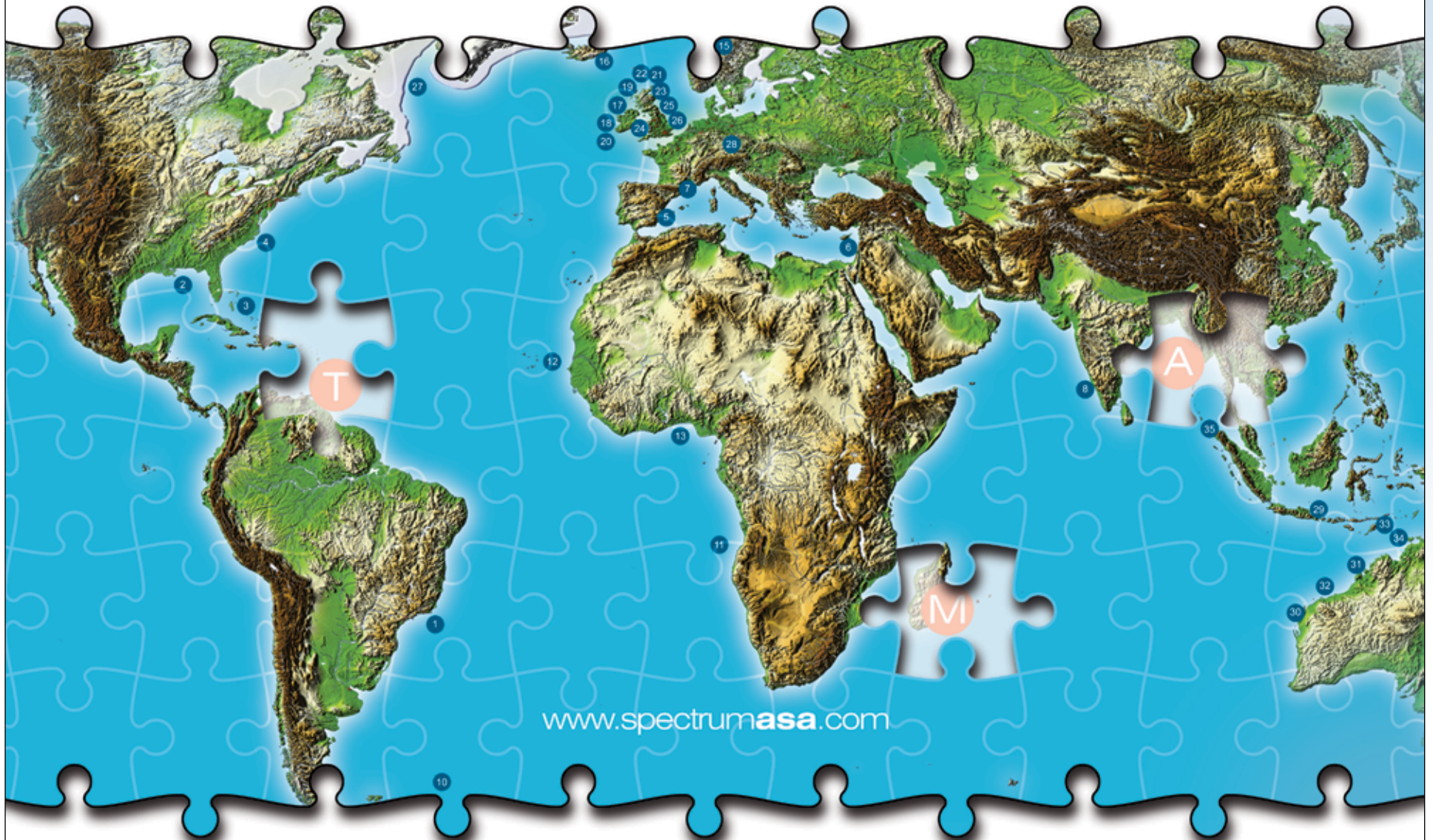
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42018004000	HAMBILL OIL & REFINING	BRUSHMORE, WELLS C	1 W	ATASCOSA	1636	2113
42018005000	COOKHEARTY, DAVID E	HEWITT, B W	1	ATASCOSA	1636	2113
42018006000	TRIN AM PETRO CORP	R K BIRDWELL	4	ATASCOSA	4323	7822
42018007000	SHELL OIL CO	WYHLER, GERTHA H	1	ATASCOSA	1636	1636
42018008000	SHELL OIL CO	WYHLER, GERTHA H	1	SEE	1636	1636
42018009000	SHELL OIL	WYHLER, GERTHA H	1	SEE	1636	1636
42122001000	TEXAS EASTERN TRANS CORP	BARNE, SMO UNIT	1	DE WITT	1000	1470
42122002000	SHELL OIL	BROWN, CORA S	1	DE WITT	1000	1470
42122003000	ARCO OIL & GAS	ARCO HOBBS	1	DE WITT	1000	1470
42122004000	MSF OIL Corp	BECKER	1	FRED	1540	1640
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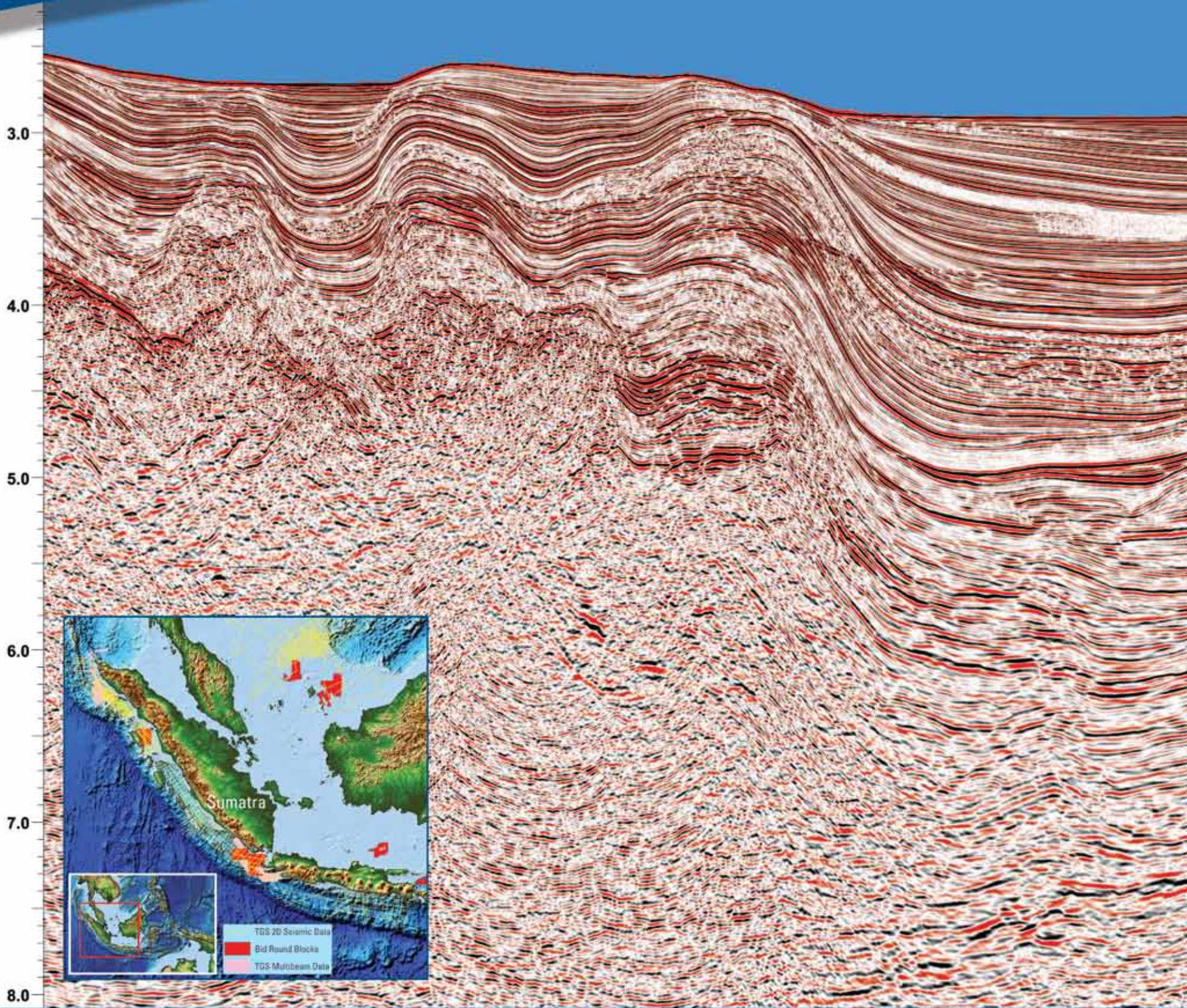
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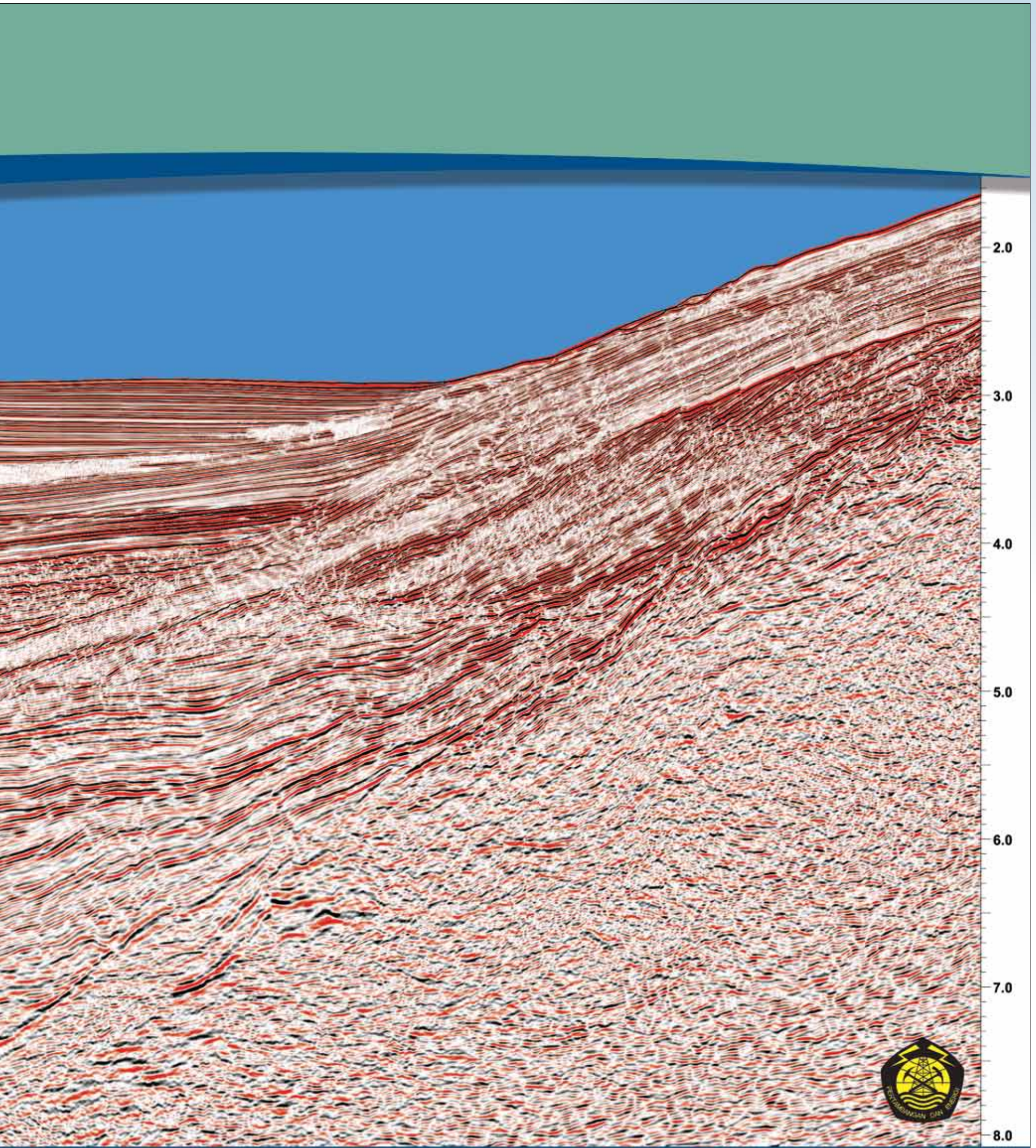


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A mid-Devonian 'perfect storm'

# Marcellus Owes Its 'Beauty' to Algal Blooms

By LOUISE S. DURHAM, EXPLORER Correspondent

**T**oday, the Marcellus shale gas play in the Appalachian Basin of the northeastern United States appears to hold the lead position on the hype scale for the many domestic shale gas plays.

It's a big 'un, for sure.

The Marcellus trends northeastward from West Virginia into Pennsylvania and New York and has a potentially prospective area of 44,000 square miles, according to AAPG member Bill Zagorski, vice president of geology for the Marcellus shale division at Range Resources, which pioneered this relatively new play.

Zagorski, who in 2009 was officially given the title "Father of the Marcellus" by the Pittsburgh Association of Petroleum Geologists, talked about the play in the Discovery Thinking forum at the recent AAPG Annual Convention and Exhibition in New Orleans.

According to him, reserve potential over this vast acreage is humongous. Current-day estimates range from 50 Tcf to more than 500 Tcf.

The large natural gas reserve projections for individual wells and the play as a whole are directly tied to some darn good geological rock properties. These include high total organic carbon, high porosity and high permeability.

Credit this in large part to blooming algae.

Really.

"The superior rock properties may be partly explained by the paleogeography



Fold is in Union Springs member of Marcellus Shale at Oriskany Falls quarry.

and the depositional framework of the Marcellus, and the significant role that algal blooms may have had in the development of this resource," said AAPG member Gregory Wrightstone, director of geology at Texas Keystone Inc. in Pittsburgh.

He noted that algal blooms in the Middle Devonian Marcellus depositional basin are proposed to have played a key role in the creation, accumulation and preservation of the Marcellus.

"Algal blooms are suggested to have greatly increased the production of organics," Wrightstone said, "and also enhanced preservation by creation of both local and basin-wide anoxia."

### Bloom Town

During mid-Devonian time, organic-rich deposition took place in a large, nearly enclosed sea – the Marcellus Basin. Marine phytoplankton was the

main contributor to organic material in the organic-rich facies.

The phytoplankton growth no doubt was enhanced by the subtropical warmth and solar radiation indigenous to the basin's paleogeographic location in the subtropics.

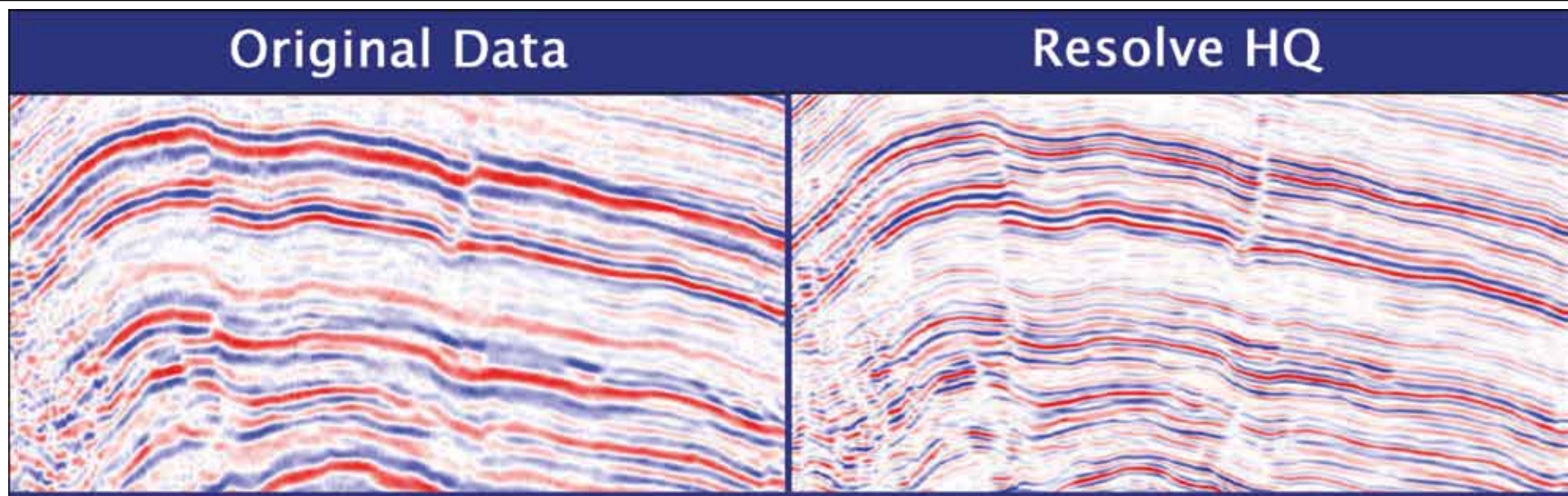
The Marcellus Basin was bounded on the east by the Acadian Highlands. The likely arid conditions on the Highlands' west flank contributed significantly to the quality of organics deposited in this environment owing to probable non-aolian sediment starvation.

"Several recent investigators have identified aeolian silts as the major contributor of quartz within the organic-rich black facies of the Marcellus," Wrightstone said. "It's probable that large dust storms may have been a recurring phenomenon during the deposition of the Marcellus."

The dust blown into the nearly landlocked basin most likely came from Middle Devonian soils containing naturally occurring nitrates, sulfates and iron. Upon entering the sub-tropical basin, these nutrients would have triggered formation of algal blooms.

This sudden increase in growth, or blooms, of the basin's omnipresent phytoplankton population would have significantly increased the amount of organic material available for deposition

**See Marcellus Shale, page 33**



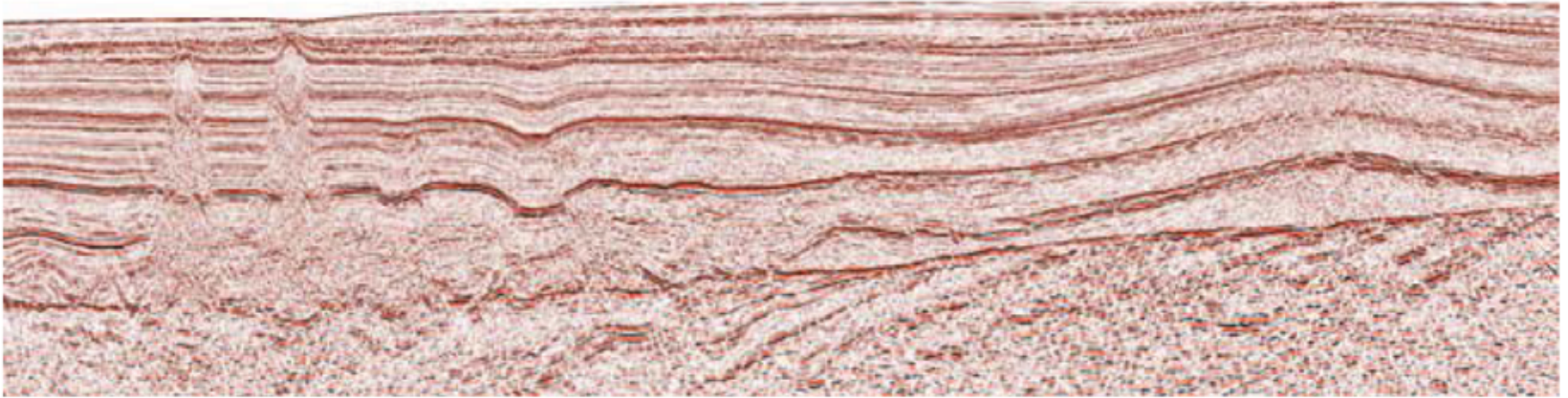
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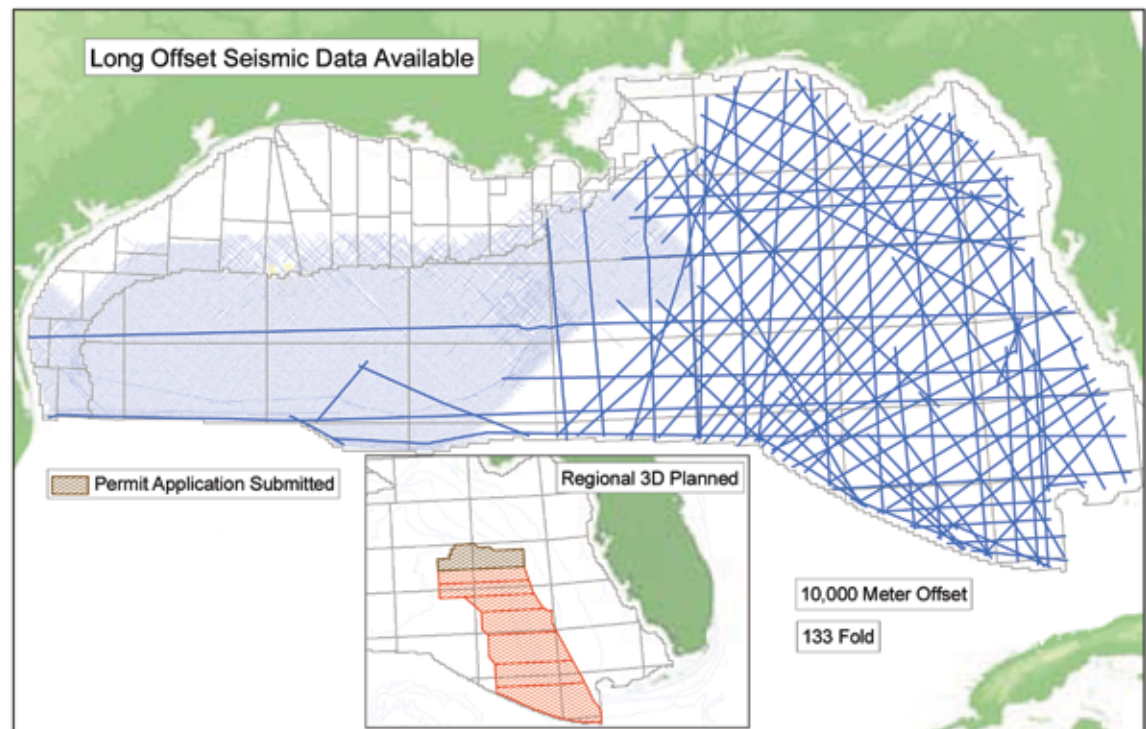
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Data indicate sweet spots, dead zones

# Shales – Similar, Yet So Different

By LOUISE S. DURHAM, EXPLORER Correspondent

Shale gas plays in North America have rapidly become so numerous – and productive – there's a tendency to think of them as being conventional rather than unconventional.

Despite the well-publicized public concern about the safety of hydraulic fracturing involved in shales production, the already hot action in shale plays appears to be heating up further.

This reportedly is being spurred in part by BP's now-infamous Big Spill in the Gulf of Mexico and the ensuing government-imposed moratorium on leasing, deepwater drilling, etc.



ROTH

Even before this near-unfathomable mess occurred, newcomers to the shale were latching onto opportunities to stake out claims in the high-flying plays via

acquisitions or joint ventures. These included some of the larger companies based in the United States as well as international firms.

**"Well-to-well production can often vary by a factor of two or more if you haven't used seismic data to determine where the fairways are."**

Many industry participants anticipate this trend to intensify given the iffy situation in the Gulf, which has long held forth as the backbone of domestic energy production.

Under the circumstances, few would argue that the timing of the shale gas "boom" has turned out to be fortuitous.

Recent estimates of recoverable gas from unconventional shale reservoirs in the United States exceed 500 Tcf (USGS/EIA 2009), with potential for another 200 Tcf in Canada, according to AAPG member Murray Roth, president of Transform Software and Services in Littleton, Colo.

The EIA Annual Energy Outlook 2010 reports that shale plays make up 2.75 Tcf of current U.S. natural gas production, with this number expected to reach 6 Tcf in 2035.

Roth noted that North American shale gas reservoirs currently account for six of the 22 largest gas fields worldwide based on estimated recoverable reserves, with average recovery factors about 20 percent.

## Head Scratchin'

Since the now-legendary George Mitchell and his dedicated Mitchell Energy team of experts succeeded in devising the particular fracturing technique needed to spur economic production from the original big daddy of shale gas plays – the Barnett – shale-focused technology has evolved considerably.

This includes horizontal drilling and completions, supported by 3-D seismic, microseismic and FMI (Fullbore Formation MicroImager), FMS (Formation Micro Scanner) among other measurements.

Sounds like the operators have mastered the shales, huh?

How naïve.

Nothing is simple in this industry, and even some of the most experienced shale players often have to step back and do a bit (a lot?) of head scratchin'.

There are shales, and there are shales.

North American shale gas basins generally follow a trend of thrust belts and a Mississippian/Devonian shale fairway from western Canada and into the western, southern and eastern United States, according to Roth.

Serving as source, trap and seal, shale beds have characteristics that vary not only from region to region but also within specific plays and fields. In fact, there often are significant well-to-well variations in gas production within a single field.

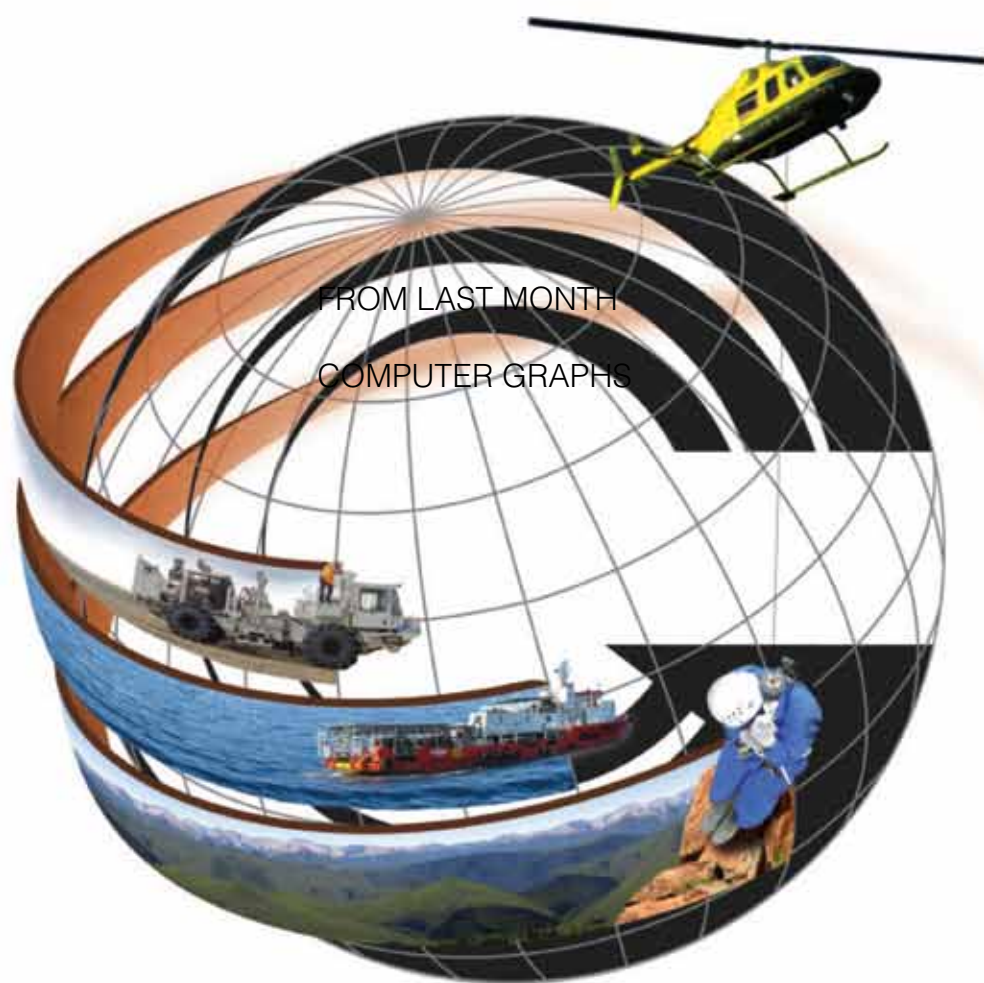
"Part of this variability in production performance is related to evolutionary and company-to-company differences in best practices fracturing," Roth said. "Surprisingly, after nearly 30 years of development and over 14,000 wells, wellbore lengths and completions parameters in the Barnett Shale of Texas can vary by factors of two or more, pointing to the challenge and non-uniqueness of production optimization."

Where there is large variability in production from well to well, it clearly tends to challenge any assumption that shales and their indigenous hydrocarbons are simple and consistent.

## Meeting the Challenge

Transform is throwing the book at the challenge.

See *Shale Gas*, page 33



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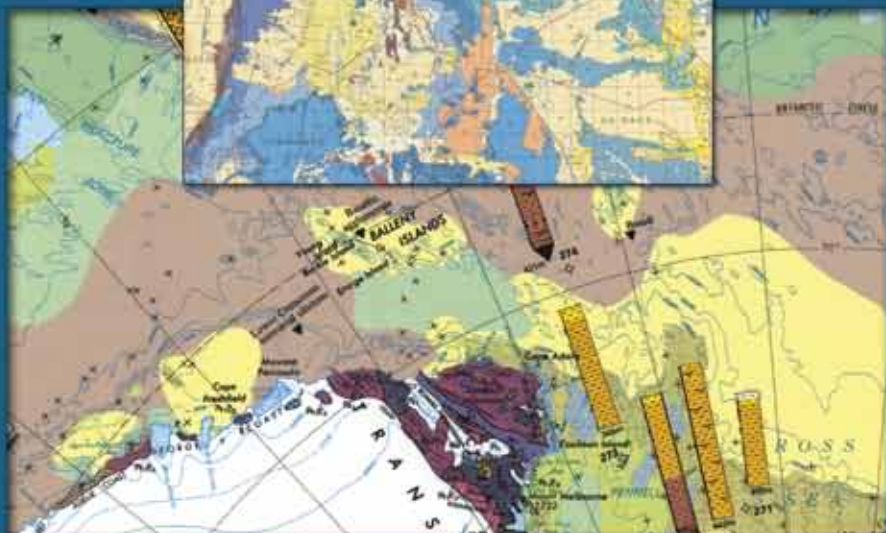


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# First of a Series: 3-D Design Philosophy

By BOB HARDAGE

The geometry of onshore 3-D seismic recording grids is based on five parameters: source-station spacing, receiver-station spacing, source-line spacing, receiver-line spacing and recording swath size.

At each prospect, these design parameters can be specified by answering four simple questions:

- ▶ What is the narrowest lateral dimension of the geologic target that is to be imaged?
- ▶ What is the depth of the shallowest target?
- ▶ What is the depth of the deepest target?
- ▶ What stacking fold is required to create an acceptable image at the depth of the principal target?

The first three questions can be answered if the geology of the prospect is known. The fourth question can be answered by examining local seismic data or by guessing.

Once these four questions are answered, the methodology described in this four-article series allows many onshore 3-D seismic surveys to be designed without having to use commercial design software.

About this series:

Some of the more technical aspects of 3-D seismic design, such as ensuring that there are proper azimuth and offset distributions between source-receiver pairs, are not considered in this simple treatise on first principles of 3-D survey design. The intent is to describe a method that allows non-geophysicists to plan simple 3-D surveys – and to recognize flaws in proposed 3-D programs.

The design procedure is diagrammed on figure 1.

## Narrow Targets and Stacking Bins

The horizontal resolution provided by a 3-D seismic image is a function of the trace spacing within the 3-D data volume. As the separation between adjacent traces decreases, horizontal resolution increases.

At the conclusion of 3-D data processing, each trace in a migrated 3-D seismic data volume is positioned so that it passes vertically through the midpoint of a small area called a stacking bin or image bin (figure 2). These stacking bins can be square or rectangular, depending on an interpreter's preferences.

The trace spacing in a given direction across a 3-D image is the same as the horizontal dimension of the stacking bin in that direction. As a result, horizontal resolution is controlled by the areal size of stacking bins.

The imaging objective dictates how small a stacking bin should be. Smaller bins are required if the resolution of small stratigraphic features is the primary imaging objective.

As a general rule, there should be a minimum of three stacking bins – and preferably four bins – across the narrowest feature that needs to be resolved in a 3-D data volume so that the targeted anomaly is expressed on three

or four adjacent seismic traces.

A variation in seismic reflection character on three to four adjacent traces is usually noticed by interpreters; anomalous reflection behavior on fewer traces tends to be ignored, or may not even be seen when viewing a 3-D data volume.

For example, if the interpretation objective is to image meandering channels that are as narrow as 100 meters, then stacking bins should have lateral dimensions of approximately 25 meters or less (figure 3), which would cause a 100-meter channel to affect at least four adjacent traces.

One of the first 3-D design parameters to define is the physical size of the stacking bin that should be created. That bin size, in turn, can be determined by first developing a stratigraphic model of the target that is to be imaged and using that model to define the narrowest feature that needs to be seen.

Once this minimum target dimension is defined, stacking bins having lengths and widths that are about one-fourth of this minimum target width should be created if the target is to be recognized in a 3-D data volume.

## Source and Receiver Station Spacings

Geophysical texts show that the dimension of a 3-D stacking bin in the direction that receiver lines are deployed is one-half of the receiver-station spacing along the receiver lines, and the dimension of a stacking bin in the direction that source lines are oriented is one-half of the source-station spacing along the source lines.

Thus, when a choice is made about the narrowest target that must be imaged, not only have the dimensions of stacking bins been determined, but source-station and receiver-station spacings also are defined.


Because of the 2-to-1 ratio between station spacings and stacking-bin dimensions, source-station and receiver-station spacings should be one-half (or less) of the narrowest horizontal dimension that needs to be interpreted from 3-D data.

Referring to figure 1, we have now defined parameters – source-station and receiver-station spacings – required for the first calculation step of the 3-D design process.

\* \* \*

One appeal of the 3-D seismic design philosophy described here is that the design procedure uses geological concepts to guide the selection of geometrical parameters – the first concept being the physical size of the smallest stratigraphic feature that the seismic data must image.

This non-mathematical approach to 3-D seismic design is intended for non-geophysicists – and it produces good 3-D images for most geologic problems that do not involve severe structural dip.

Where rock units have steep dips or where large changes in rock velocity across fixed horizontal planes, a more rigorous calculation of station spacing should be made using commercial 3-D design software. 

Geophysical Corner editor Bob Hardage has been voted president-elect of the Society of Exploration Geophysicists, and will serve a one-year term as SEG president in 2011-12.

Hardage has been editor of the EXPLORER's popular Geophysical Corner since January 2006.

Hardage won an A.I. Levorsen Award in 2004 and received AAPG's Distinguished Service Award at this year's AAPG Annual Convention and Exhibition in New Orleans.

He and the other new SEG Executive Committee members will assume their duties Oct. 21 at the conclusion of SEG's annual meeting in Denver.

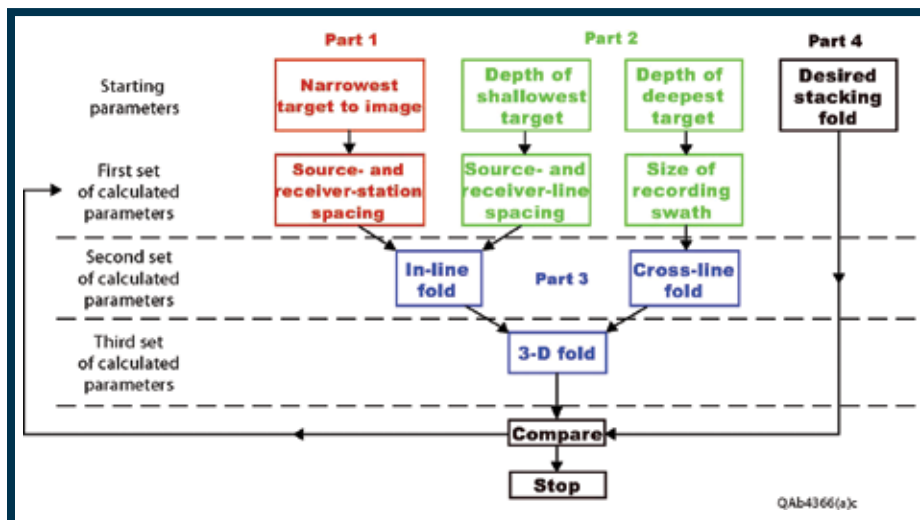


Figure 1 – Planning steps that can be followed to design 3-D seismic acquisition geometry. There is no single procedure for designing a land-based 3-D survey. Each prospect offers different design challenges, and 3-D designers follow various preferred computational steps. The method discussed here is logical, easy for non-geophysicists to understand and can be used for many 3-D seismic prospects. The method will be presented as a four-article series, with the topic of each article color coded on the chart. This paper deals with part 1 of the methodology.

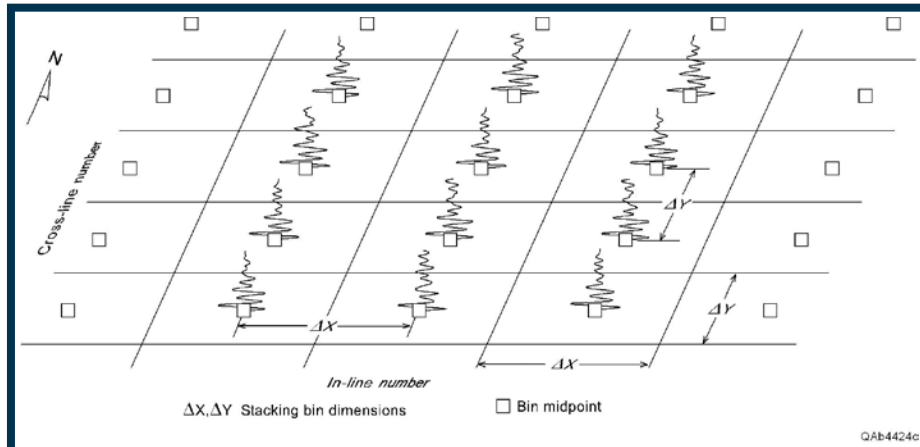


Figure 2 – The area spanned by a 3-D seismic image is divided into a grid of small, abutted subareas called stacking bins. In this illustration, each stacking bin has lateral dimensions  $\Delta x$  and  $\Delta y$ . At the conclusion of 3-D data processing, a single seismic trace passes vertically through the midpoint of each stacking bin. The horizontal separations between adjacent processed traces in a 3-D data volume are  $\Delta x$  and  $\Delta y$ , the same distances as the dimensions of the stacking bins. The term in-line used here is defined as the direction that receiver cables are deployed, which is north-south in this example. In-line coordinates thus increase from west to east. Cross-line refers to the direction that is perpendicular to the orientation of receiver cables; thus cross-line coordinates increase from south to north.

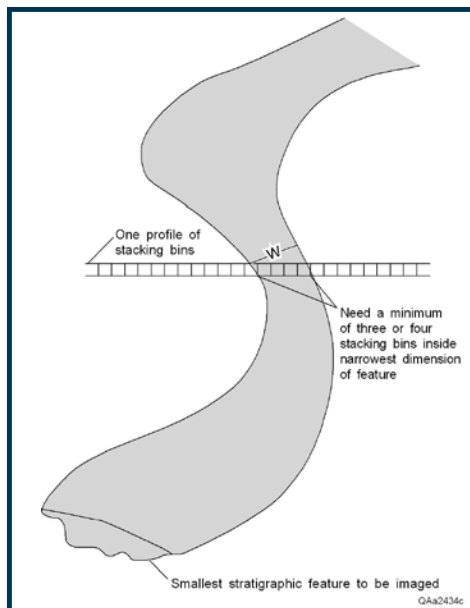


Figure 3 – Example of a narrow feature that needs to be seen in a 3-D image. The first parameter that has to be defined in this 3-D seismic design method is the smallest (narrowest) horizontal dimension of a feature that must be seen in the 3-D data volume. For purposes of illustration, it is assumed the narrowest feature that is to be interpreted is a meander channel. At least three, and ideally four, stacking bins (seismic traces) must lie within the narrowest dimension  $W$  of this channel if the channel is to be reliably seen in the seismic image during workstation interpretation. Once this minimum channel width  $W$  is defined, the dimensions of the stacking bins are also defined, those bin dimensions being no wider than  $W/3$ , and ideally, they should be  $W/4$  or less.



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**WASHINGTON WATCH**

# Canada/U.S. Pipeline Scrutinized

By DAVID CURTISS

Ask the average U.S. citizen where the country gets its oil, and their likely response is the Middle East.

It's common knowledge, and it's wrong. The top suppliers of crude oil to the United States are Canada and Mexico.

In fact, the top five oil suppliers to the United States in May were, in descending order, Canada, Mexico, Venezuela, Saudi Arabia and Nigeria, according to the U.S. Energy Information Administration. They represented 59 percent of U.S. crude oil imports. Canada alone contributed 21 percent, almost double Mexico's 12 percent.

Now, these numbers fluctuate monthly – and for the United States, every barrel of oil, whether imported or produced domestically, is important to ensuring available supply to meet consumer demand. But stable, predictable crude oil imports from Canada are vital to U.S. energy security.

It's a fact that seems lost in the political wrangling over a proposed pipeline to bring more Canadian oil to this country.

In September 2008 pipeline operator TransCanada filed an application to construct the Keystone XL pipeline, an expansion of the company's existing Keystone pipeline project, to bring crude oil from western Canada to Gulf coast refineries in Texas.

The roughly \$7 billion project would involve construction of more than 1,700 miles of new pipeline in Canada and the United States. The 36-inch diameter pipeline would have capacity to transport 900,000 barrels of oil per day. And, according to an



CURTISS

assessment funded by TransCanada and conducted by The Perryman Group, the project would deliver significant economic benefits, both from pipeline construction and subsequent operation.

Because the proposed pipeline crosses from Canada into the United States it requires a presidential permit issued by the U.S. Department of State.

As part of the permit process the State Department conducts an environmental review in accordance with the National Environmental Policy Act to assess the project's environmental impacts and consider possible alternatives.

In April the State Department released a draft environmental impact statement (EIS), inviting designated federal agencies to provide feedback.

The U.S. Environmental Protection Agency (EPA) responded in a letter from Cynthia Giles, its assistant administrator for Enforcement and Compliance Assurance, criticizing the draft EIS's narrow scope, saying it focused too narrowly on the pipeline to be permitted and did not "provide the scope of detail of analysis necessary to fully inform decision makers and the public."

EPA's concern, among others, is that the crude oil to fill the Keystone XL pipeline is from Canada's oil sands. And while the agency acknowledged the strategic

importance of dealing with a reliable trading partner like Canada, it said, "the national security implications of expanding the nation's long-term commitment to a relatively high carbon source of oil should also be considered."

EPA also suggested the analysis of GHG emissions in the EIS should be broadened to include emissions generated by oil sands extraction "to fully disclose the reasonably foreseeable environmental impacts on the U.S. of the Keystone XL project."

House Energy and Commerce Committee chair Henry Waxman (D-Calif.), in a letter to Secretary of State Hillary Clinton, expressed "concern that this project would have a major adverse impact on the carbon intensity of U.S. transportation fuel." He also faulted the draft EIS for not considering the project's global warming impacts.

Supporters of the Keystone XL project have not been silent.

In a June 28 op-ed in the Washington Examiner, Consumer Energy Alliance president David Holt reminded the State Department that "working to expand America's access to secure, reliable and affordable energy supplies from friends in the hemisphere makes a lot [of] sense. And it just might make a lot of jobs as well ..."

Jobs also were on the mind of Russ Breckenridge of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, who said the construction industry "is currently facing on average 20 percent unemployment, and

in some areas our members are facing 40 percent," Breckenridge said. The pipeline "will begin to put our members back to work with high-quality jobs, with full benefits and worker protection."

Ed Stelmach, Alberta's premier, vigorously defended oil sands development in an op-ed in Politico saying, "[T]hese oil sands have been developed because there is continuing demand for petroleum. We can all agree that alternative energy sources are part of the supply equation to power our future. But until those alternatives are developed commercially – and at a price that consumers can afford – we still require oil and gas to power our lives."

So where does all this leave the Keystone XL project?

The State Department is currently reviewing the input it received and is preparing a final EIS. Federal agencies will have 90 days after completion of the final EIS to review and provide additional input, before the department makes a final decision on the presidential permit application.

The Keystone XL pipeline, if approved, has to be built, operated and maintained in an environmentally responsible and safe manner. There is no question about that. But an equally obvious point that regulators and politicians must remember is that U.S. consumers need these oil supplies. And Canadian oil sands are a good source.

As Premier Stelmach observed: "A good neighbor lends you a cup of sugar. A great neighbor supplies you with 1.4 million barrels of oil per day."

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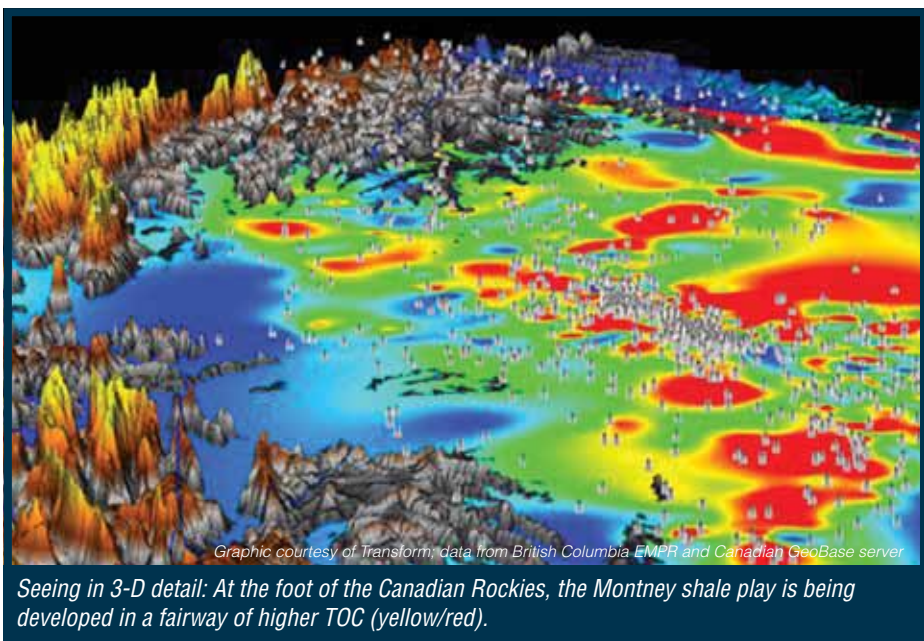
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*Graphic courtesy of Transform; data from British Columbia EMPR and Canadian GeoBase server*

Seeing in 3-D detail: At the foot of the Canadian Rockies, the Montney shale play is being developed in a fairway of higher TOC (yellow/red).

## Shale Gas from page 28

“Our approach is to integrate all of the geophysical, geological and engineering data,” Roth said. “Engineers tend to want to treat the shales as ‘gas factories,’ laying down a well every 10 or 20 acres and developing the fields in a very methodical mode.”

“This works in some cases, but an integrated approach is needed for optimization in most plays,” he noted. “For instance, well-to-well production can often vary by a factor of two or more if you haven’t used seismic data to determine where the fairways are.”

To try to understand the variances in gas shales, Transform has conducted a study that integrates published data, type logs, accessible seismic and microseismic data along with five years experience across most significant North American shale gas basins, according to Roth.

The tabulation of shale gas reservoir characteristics and well log analysis highlights key production differentiators including clay content, pressure and total

organic carbon.


“It’s our work with 3-D seismic and microseismic that clearly supports the concept of shale gas ‘sweet spot’ fairways and converse ‘dead zones,’” Roth said.

“Whether it’s faulting in the Woodford, karst collapse chimneys in the Barnett, natural fracturing in the Marcellus or relative clay content across many plays, seismic and microseismic data provide valuable calibration and prediction tools for mapping productive and/or non-productive fairways,” he noted.

There’s motivation aplenty for folks to perform some scientific detective work on the slew of shale deposits.

Roth noted that 60 potentially economic shale gas plays have been identified in North America, and shale “fever” is spreading quickly overseas in Poland, Germany, Austria and other countries.

And it’s not all about gas, owing to the relatively high price for crude oil.

For example, activity is full-speed-ahead in the highly productive Bakken shale oil play in North Dakota, and also in gas-liquids-rich shale plays such as the Eagle Ford in Texas. 

## Marcellus Shale from page 26

and accumulation.

“Far reaching anoxic events such as those associated with modern blooms may have occurred as basin-wide events during the Marcellus deposition, leading to enhanced preservation of the organics,” Wrightstone said.

“Just as with modern algal blooms, large anoxic ‘dead zones’ are created with explosive algae population,” he said. “The algae consume the available nutrients and die off, stimulating a bacterial process that breaks down the dead algae.”

“The process uses a huge amount of oxygen, creating a ‘dead zone’ that then kills off the area surrounding the ‘bloom,’ making it uninhabitable,” Wrightstone said. “Since the Marcellus sea was nearly enclosed, repopulation of the basin would have occurred exceedingly slowly.”

“Phytoplankton growth within the basin would have continued, with enhanced preservation of the organics owing to lack of a developed marine ecosystem,” he added. “Additionally, the nearly enclosed basin would have likely led to a much shallower wave base than in an open marine setting, allowing for reduced oxygenation and preservation on the basin floor.”

### A Lesson For All?

Organic rock quality varies across relatively small areas of the basin, and some larger regions have superior capabilities for production. These local variations may be partly explained by localized algal blooms, according to Wrightstone.


He succinctly summarized some of the salient points relative to deposition and preservation of the Marcellus:

- ▶ The excellent rock properties of high TOC, porosity and permeability found in the Marcellus Shale likely are related in large part to the depositional processes in place during the Middle Devonian.

- ▶ Controls on the depositional processes of the Marcellus Shale may include paleogeography, nutrient sourcing of algal blooms by frequent dust storms and preservation of the organics by basin-wide bloom-related anoxic events.

- ▶ The Marcellus organic-rich units were deposited and accumulated in a “perfect storm” scenario of maximum organic production, maximum preservation and minimum non-aeolian sediment influx.

Even if you’re not playing the high-profile Marcellus, you may want to file this info away in your shale folder.

“The important role of algal blooms,” Wrightstone said, “is likely to be applicable to many of the other shale plays around the world.” 

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# Asia Pacific Region Busy on Many Fronts

By ADRIENNE PEREIRA, Asia/Pacific Programs Manager

**B**y the time you read this I will have completed my first year immersed in AAPG activities in the Asia Pacific region.

Having enjoyed studying geography in school, I'm excited to be representing AAPG in the Asia Pacific, the largest AAPG region. As you would expect, there are many opportunities for AAPG to serve the geosciences community in this vast area. I'm fortunate to have the insights and expertise of the AP Region Council, led by Joseph Lambiase, with support from Peter Baillie, Mick McWalter and Abul (Shams) Shamsuddin to help me prioritize projects

and deliver value to our members and other professionals here.

Of course, I also work closely with the AAPG staff in Tulsa and have learned so much during this period; personal thanks to everyone concerned.

\* \* \*

Here are some of the highlights of our first year of operation – and projects that currently are under way.

▶ AAPG Executive Director Rick Fritz visited Japan, Malaysia and Singapore in



PEREIRA

January this year. In Tokyo, Rick met with executives from JAPEX and several major E&P companies and gave a talk to students at the University of Tokyo; in Malaysia, he visited our student chapter at the University of

Malaysia, Malaya, met with representatives from our affiliate, the Geological Society of Malaysia, spent time visiting with Petronas officials and also met House of Delegates

representative Askury Abdul Kadir.

▶ A one-day AP Region strategy meeting was held in Singapore.

One priority is to develop and offer Geosciences Technology Workshops (GTW) and education courses in the Region. I opened a line of communication with our House of Delegates' members who have come through with suggestions for courses that can be done.

My networking also is renewing and creating new contacts with the Region's various industry players and local and regional societies. The South East Asia Petroleum Exploration Society and Petroleum Exploration Society of Australia have given me a warm welcome and are providing strong assistance.

A few ideas were generated through a "wish list" e-mail to members; suggestions for a couple of courses and potential speakers came in but we can do with more. Your suggestions help me build a contacts base for an Asia Pacific Speakers Bureau, which allows us to draw on the expertise in the region, thereby bringing to members access to reputable speakers.

▶ The Asia Pacific Region will present its inaugural GTW in Singapore Oct. 27-29, on "Pore Pressure and Related Issues – Special Focus: Asia Pacific," chaired by AAPG member Mark Tingay of the University of Adelaide. Running alongside will be two short courses taught by Tingay and Richard Swarbrick, GeoPressure Technology, U.K.

▶ Another active AAPG program is the Publications Pipeline Project. Gerrit Wind and his committee members in Houston work tirelessly to source books for donation to universities. What a wonderful idea!

Here in the AP, other individuals work tirelessly to help students – and we hope to get libraries for at least five universities by year's end.

▶ I came onboard with AAPG in the thick of planning for the Region's semi-finals competition for the Imperial Barrel Awards. With student teams hailing from countries traversing the region, it took some innovating and technology to complete the presentations and judging without the expense of participants all coming together. We deployed the online WEBEX system – and despite a few bandwidth problems we were able to successfully connect teams and judges and complete the competition.

The team from the China University of Petroleum won and represented the Region at the AAPG Annual Convention and Exhibition in New Orleans. While they finished outside the top three, the AP team received a \$1,000 award – plus an incomparable experience.

\* \* \*

With my presence in this region, plus strong support from the AP Region Council, headquarters staff and, not least, our fantastic volunteer members, I hope to tighten the links and scientific exchange between professionals here and the AAPG community worldwide.

I'd love to hear from you on how AAPG can grow and better serve you in the Asia Pacific. Please send your comments to [apereira@aapg.org](mailto:apereira@aapg.org).



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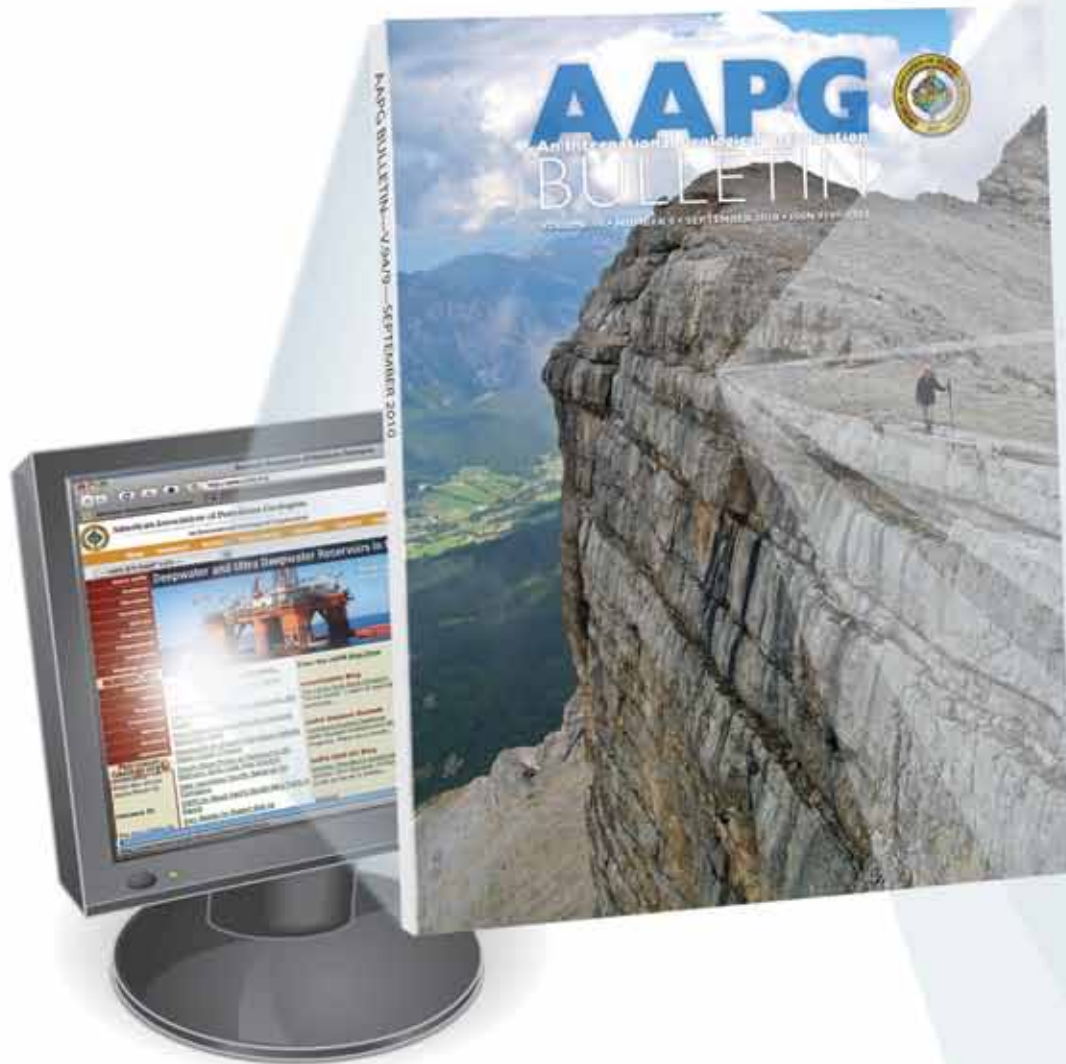
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The AAPG Bulletin is a technical journal that is recognized in the industry as the leading peer-reviewed publication for information on geoscience and the associated technology of the energy industry.

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Also, submit your next paper for consideration via [www.aapg.org/bulletin](http://www.aapg.org/bulletin).

**Article highlights include:**

**Understanding reservoir property distribution E&P**

*Paola Ranchi, Andrea Orteni, Ornella Borromeo, Michele Claps, and William G.Zempolich*

**E&P Note**



The Kashagan field structure is a huge isolated carbonate platform in the Pre-Caspian Basin. Reservoir Unit 1 displays a complex distribution of reservoir properties, due to the interplay between depositional characteristics and early and late diagenetic imprints.

**Characterizing clastic wedges**

*Caroline Gomez-Verdiza and Ronald J. Steel*



Sediment partitioning analysis along the Iles clastic wedge in Wyoming and Colorado uses a source-to-sink correlation method that allows high-resolution correlation across long distances. It can be applied to other basins of similarly low depositional gradient.

**Hydrocarbon migration in fault openings**

*Likuan Zhang, Xiaorong Luo, Qianjin Liao, Wan Yang, Guy Vasseur, Changhua Yu, Junqing Su, Shuqin Yuan, Dunqing Xiao, and Zhaoming Wang*



The authors introduce an empirical method to assess hydraulic connecting capacity of a fault for hydrocarbon migration over geological time. It is based on the recognition that hydrocarbon in reservoirs should depend on the behavior of the fault during hydrocarbon migration.

**Reduced reservoir performance**

*John G. Solum, J. P. Brandenburg, Stephen J. Naruk, Olga V. Kostenko, Scott J. Wilkins, and Richard A. Schlutz*



Deformation bands from extensional settings may be indicative of discrete damage zones associated with normal faults, while deformation bands from contractional settings may indicate much more areally extensive deformation band networks and, thus, be a greater risk of reservoir degradation of substantial dolomite bodies.

Lecture season begins in October

# DL Speakers Announced for N.A. Tours

By VERN STEFANIC, EXPLORER Managing Editor

Seven speakers, representing the latest in geoscience research, geologic understanding and practical applications, have been named for the North American tours of this year's AAPG Distinguished Lecture program.

The lecture season will begin with two tours in October and continue through next spring. International Distinguished Lecturers are yet to be announced.

AAPG's Distinguished Lecture program, funded largely by the AAPG Foundation, is the Association's flagship

initiative for spreading the latest in science, technology and professional information.

North American speakers take two tours during the season, one going to eastern locales and one to western locales. Each tour lasts about two weeks.

Last year's tours (North American and international) attracted 11,077 attendees to a total of 169 lectures.

This year's roster once again will talks that vary widely in subject content, from the Marcellus Shale to tight-gas

sandstone reservoirs to coastal facies models to mud volcanoes in offshore Eastern Trinidad.

The speaker list to date includes experts from both industry and academia – and features the delayed tour of speaker **Steve Cumella**, this year's Haas-Pratt Distinguished Lecturer.

Cumella, geologist with Bill Barrett Corp., in Denver, was unable to complete his tour last year due to various conflicts.

The Haas-Pratt lecture is a domestic tour provided by contributions from the

late Merrill W. Haas, in honor of famed geologist (and Haas' mentor) Wallace Pratt. The funding is granted for a lecture of an applied nature dealing with the exploration and discovery history of a field, or a subject having economic implications.

Cumella will offer two lectures:

▶ "Geology of the Giant Continuous Gas Accumulation in the Mesaverde Group, Piceance Basin, Colorado."

▶ "Important Characteristics of Rocky Mountain Tight Gas Accumulations."

He will tour eastern North American sites Dec. 6-17, and western North American sites Feb. 28-11.

There are two other specially funded speakers:

□ **Matthew D. Jackson**, senior lecturer in geological fluid mechanics and reservoir engineering, Imperial College, London, England, is this year's Allan P. Bennison lecturer.

The Bennison DL is an international lecturer who makes a U.S. tour, funded by contributions from the late Allan Bennison, a long-time Tulsa geologist.

He is offering two lectures:

▶ "From Outcrop Analog to Flow Simulation: Understanding the Impact of Geologic Heterogeneity on Hydrocarbon Production."

▶ "Integrating Production Geoscience and Engineering: Can Smart Wells Mitigate Uncertain Reservoir Behavior?"

His tour dates are Nov. 8-19 and March 14-25.

□ **Joann E. Welton**, senior research associate at ExxonMobil's Upstream Research Lab in Houston, is this year's J. Ben Carsey lecturer.

The Carsey lecture is an annual domestic tour provided by contributions from J. Ben Carsey Jr. of Houston, to establish a named lecturer in memory of his father, who served as AAPG president in 1967-68.

Welton will offer two talks:

▶ "Evaluating Siliciclastic Reservoir Quality in a Changing World."

▶ "Grain Coats on the Brazos: Using Modern Studies to Understand the Origin of Porosity-Preserving Early Clay Grain Coats."

She will tour western North American sites Nov. 8-19, and eastern North American sites Jan. 31-Feb. 11.

Other North America lecturers this season include:

□ **Scott A. Barboza**, research scientist and team leader, ExxonMobil Upstream Research Co., Houston. He will offer two lectures:

▶ "Mud Volcanoes: A Dynamic Model Motivated by Observations Offshore Eastern Trinidad."

▶ "Consequences of Multiple Phases of Tertiary Uplift and Erosion on the Thermal Evolution of Mesozoic Source Rocks, North Slope – Chukchi Sea, Alaska."

His tours are Oct. 25-Nov. 5 (eastern North America) and Jan. 31-Feb. 11



# AAPG

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17-19 OCTOBER 2010  
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Continued from previous page

(western North America).

□ **Ron Boyd**, principal geologist for the stratigraphy and quantitative modeling group, ConocoPhillips Subsurface Technology, Houston. He will offer two lectures:

▶ "A One-Way Ticket From Antarctica to the Tasman Abyssal Plain via the Great Barrier Reef – Sediment Dispersal on the Eastern Australian Margin."

▶ "Coastal Facies Models."

His tours are Nov. 1-12 (western North America) and Feb. 7-18 (eastern North America).

□ **James L. Coleman Jr.**, director of the Eastern Energy Resources Science Center, U.S. Geological Survey, Reston, Va. He will offer three lectures:

▶ "Tight-Gas Sandstone Reservoirs: The 200-Year Path From Unconventional to Conventional Gas Resource and Beyond."

▶ "Examination of Potential Factors Affecting Successful Exploration and Production of Devonian Marcellus Shale Gas, Eastern United States."

▶ "Tight-Gas Sandstone Reservoirs: 25 Years of Searching for 'The Answer.'"

His tours are Jan. 10-21 (eastern North America) and Feb. 14-25 (western North America).

□ **Donald Arthur Medwedeff**, consulting research scientist, Chevron Energy Technology Co., San Ramon, Calif.

Medwedeff's lecture is titled "Insight



BOYD



COLMAN



CUMELLA



JACKSON



MEDWEDEFF



WELTON

in Lieu of Truth: An Approach to Probabilistic Fault Seal Analysis."

His tours are Oct. 11-22 (western North America) and March 7-18 (eastern North America).

For more information on the speakers, their tours or the DL program go online to [www.aapg.org](http://www.aapg.org).

## 60<sup>th</sup> Annual GCAGS/GCSSEPM Convention

Presents

### The Stricklin Symposium: Forming and Filling of the Gulf of Mexico Basin: Triassic, Jurassic, and Cretaceous Tectonics, Source Rocks, and Petroleum Systems

Oct. 12, 2010 • 8:20 am – 4:10 pm  
San Antonio, Texas

#### Symposium Conveners:

**T. E. Ewing**, Frontera Exploration Consultants, San Antonio, Texas  
**E. A. Mancini**, Texas A&M University, College Station, Texas

- 8:20 **Thomas Ewing**: Introduction to the Stricklin Symposium
- 8:30 **James Pindell**: History of Tectonic Modeling and Implications for Depositional Architecture in the Gulf of Mexico (GOM): Where we Should Go from Here
- 9:00 **Jim Harris, Rob Crossley, Nick Stronach, Paul Valdes, and Roger Proctor**: The Plate Tectonic, Paleogeographic, and Paleoclimatic Context for the Development of the Mesozoic Gulf of Mexico
- 9:30 **Steve Creaney**: A View of the Genetic Development of Gulf of Mexico Petroleum Systems
- 10:00 **Break**
- 10:30 **Ernest Mancini and Wayne Ahr**: Jurassic Depositional Systems, Facies, and Reservoirs of the Northern Gulf of Mexico
- 11:00 **Thomas Lovell and Amy Weislogel**: Detrital Zircon U-Pb Age Constraints on the Provenance of the Late Jurassic Norphlet Formation, Eastern Gulf of Mexico: Implications for Paleogeography
- 11:30 – 1:00 **GCSSEPM and Stricklin Symposium Luncheon (ticketed event)**: **Roger Sassen**: Preservation of Methane in Deep, Hot Reservoir Rocks
- 1:10 **Robert Scott**: Cretaceous Stratigraphy, Depositional Systems, and Reservoir Facies of the Northern Gulf of Mexico
- 1:40 **Thomas Ewing**: Pre-Pearsall Geology and Exploration Plays in South Texas
- 2:10 **Marco Flores Flores, Jorge Lavín, Noemí Aguilera, and Marco Peña**: The Kimmeridgian Oolitic Banks and their Exploration Potential in the Marina de Campeche Zone, Southeastern Mexico: Biostratigraphical and Sedimentological Implications
- 2:40 **Roger Sassen**: Laminated Lime Mudstone of the Upper Jurassic Smackover Formation: Source of High-Sulfur Oil and Gas
- 3:10 **Andrew Petty**: Stratigraphy and Petroleum Exploration History of the Smackover Formation (Oxfordian), Northeastern Gulf of Mexico
- 3:40 **Russell Dubiel, Peter Warwick, Lauri Burke, James Coleman, Kristin Dennen, Colin Doolan, Catherine Enomoto, Paul Hackley, Alexander Karlsen, Matthew Merrill, Krystal Pearson, Ofori Pearson, Janet Pitman, Richard Pollastro, Elisabeth Rowan, Sharon Swanson, and Brett Valentine**: Geology and Assessment of Undiscovered Oil and Gas Resources in Mesozoic (Jurassic and Cretaceous) Rocks of the Onshore and State Waters of the U.S. Gulf of Mexico Region

To register for, sponsor, or exhibit at the GCAGS 2010 Convention, please go to [www.gcags2010.com](http://www.gcags2010.com)

Image courtesy of Ron Blakey, [ronald.blakey@nau.edu](mailto:ronald.blakey@nau.edu)

## AAPG GEOSCIENCES TECHNOLOGY WORKSHOP



INFORM DISCUSS LEARN SHARE: THE AAPG GTW EXPERIENCE

### Pore Pressure and Related Issues Special Focus: Asia Pacific

Questions? E-mail [apereira@aapg.org](mailto:apereira@aapg.org)

28-29 October 2010, Singapore

The Asia Pacific contains some of the world's deepest and most rapidly formed basins and associated high magnitude overpressures. Join us at the region's inaugural GTW to discuss the challenges in finding and developing the significant resources of the region. Sharing their expertise will be 18 noted professionals, including Richard Swarbrick and Nader Dutta, who will present Keynote Addresses.

#### Highlights include:

- Asia Pacific Case Studies
- Geomechanics
- Fractured & Unconventional Reservoirs
- Understanding Overpressures
- Frontiers in Pore Pressure Prediction
- Basin Modeling

#### Workshop Registration

Before	Members US\$795
15 September	Non Members US\$845
After	Members US\$845
15 September	Non Members US\$895

#### Plus Pre- and Post-Workshop Courses



**Pore Pressure Prediction: Principles and Pitfalls**, Dr. Richard Swarbrick, GeoPressure Technology, UK • Wednesday, 27 Oct.

Designed for all but experienced predictors, the focus will be on understanding where and why pressure prediction works well in certain areas and how to recognize where this is not the case.



**Petroleum Geomechanics**, Dr. Mark Tingay, University of Adelaide • Saturday, 30 Oct.

An introduction to the fundamentals of petroleum geomechanics with particular emphasis on how present-day stress information is applied to exploration and production issues.

#### Short Course Registration

With GTW Registration	Members: US\$445	Non Members: US\$545
Short Course Only	Members: US\$545	Non Members: US\$595

Courses priced individually

Register online at [www.aapg.org/gtw](http://www.aapg.org/gtw)

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**AAPG Website Goes Mobile**

By JANET BRISTER, Website Editor

**R**ead any good sites lately – on your MOBILE DEVICE? About three years ago I bought the first iPhone the day it was released. Within 24 hours I wondered how I had managed my day-to-day life without it. I enjoyed it that much and found it that handy.

Today I now have an iPhone 4 and many of my friends and family have smart phones or mobile devices.

The teens and young adults use the text feature a lot but most of my peers use their phones for their schedule and for reading websites and books while traveling.

Today, “there’s an App for that” is quoted

almost as much as “where’s the beef?” once was.

**Two Questions, Two Answers**

When at the annual meeting in New Orleans two questions were often asked of the AAPG Web team: When will you have a mobile version of the AAPG website and will there be an App developed by AAPG?

The mobile site is now available and optimized for iPhones and Android-based phones. When you type [www.aapg.org](http://www.aapg.org) into your phone’s browser you will be given the option of viewing the full site or mobile version. We suggest you save a bookmark of the mobile version to your device’s desktop.

We took a survey to learn that deadlines, news, EXPLORER and BULLETIN articles, and meeting information were the top sought-after information.

So that’s what we’ve featured first on the AAPG Mobile site.



*iPhone users may bookmark this site with “Add to Home Screen” and have an App-like experience with AAPG Mobile.*

The blogs have been updated, too, to be more readable on your mobile device. In fact, you’ll see this little block that looks like a piece of decorative tile just to the right of each blog.

This tile is the new QR code for that blog. Ever seen those before? Well, they will start cropping up on business cards, advertisements, brochures, possibly letterhead.

“QR” stands for “quick response.”

According to Wikipedia the codes originated in 1994 out of Japan where these two-dimensional codes were designed to be quickly interpreted by scanners.

There are many Apps that are scanners that any smart phone can use to access a QR code.

Businesses and individuals are able to create these QR codes, publish them and send you to websites or specific URLs within their websites for more information.

You simply launch your QR scanner on your phone; point the phone’s camera at the code; and the next thing you know the phone is launching a web page in its browser.

It’s pretty cool.

**Where’s the App?**

The AAPG web team discussed developing an App for AAPG and discovered that the best experience we can provide to all smart phone and mobile device users will be browser-based.

There will be no App developed but an App-like experience is provided (see graphic). But we do encourage a QR scanner App. You can find a list of those in the Blogzone – [blog.aapg.org/web/](http://blog.aapg.org/web/).

*Good browsing!*

**CHALLENGES FOR TODAY**      **OPPORTUNITIES FOR TOMORROW**

## Registration opens in September!

Make plans to attend the OTC’s new event focusing on the cutting-edge technologies and innovative practices needed for exploration and production in the Arctic. Senior explorationists and technical experts will share their knowledge, vision and ideas on the exploration and geology of the U.S., Canadian, Russian, Norwegian, and Greenlandic (Danish) onshore and offshore arctic basins. There will also be networking activities and an exhibition with leading companies focused on the Arctic.

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7–9 February 2011 • George R. Brown Convention Center  
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An OTC event, managed by AAPG

**PROFESSIONAL NEWS BRIEFS**

**P. Jeffrey Brown**, to senior associate (play based exploration), Rose & Associates, Houston. Previously engagement leader, Decision Strategies, Houston.

**Peter Carragher**, to senior associate, Rose & Associates, Houston. Previously vice president-geoscience and exploration, BP Exploration, Houston.

**Bill M. Francis**, to vice president-geology, Silver Oak Energy Partners, Fort Worth, Texas. Previously vice president-operations, Encore Acquisition Co., Fort Worth.

**Stu Hirsch**, to geological adviser, Hess Corp., Houston. Previously senior geologist, Chesapeake Appalachia, Charleston, W.Va.

**Michael Langeler**, to geologist, EnCana O&G, Dallas. Previously exploration manager, Cornerstone E&P, Irving, Texas.

**Dave Muller**, to senior geological adviser, Apache, Tulsa. Previously senior district geologist, Samson, Tulsa.

**Emily Oatney**, to country manager, Chevron Denmark, Copenhagen, Denmark. Previously exploration adviser, Chevron Europe, Eurasia and Middle East operating company, London, England.

**Chet Paris**, to Rocky Mountains exploration manager, Newfield Exploration, Denver. Previously geological adviser, Noble Energy, Denver.

**Mark Schneider**, to senior associate, Rose & Associates, Jakarta, Indonesia. Previously manager-technical coordination, CNOOC Southeast Asia, Jakarta, Indonesia.

**Artur Stankiewicz**, to global fluids domain head, Schlumberger, Clamart, France. Previously subsurface and planning manager, Shell Abu Dhabi, Abu Dhabi, U.A.E.

**Kurt Stropoli** has retired as senior applications geoscientist with Paradigm in Houston. Stropoli resides in Alpine, Texas.

**Garven Paper Wins Pacific Levorsen Award**

Grant Garven, with the Tufts University department of geology in Medford, Mass., has been named winner of the Pacific Section's A.I. Levorsen Award for the best paper at the recent annual Section meeting in Anaheim, Calif.

Garven's paper was "A Geohydrodynamic Study of the Role of Faults on Petroleum Migration in the California Borderland Basins."

His co-authors were Byeongju Jung, also of the Tufts University geology department, and James R. Boles, department of earth science, University of California-Santa Barbara.

Garven will receive his award at the next Pacific Section annual meeting, to be held in Anchorage, Alaska, on a date to be determined.

**GCAGS Sets 60th Annual Meeting in San Antonio**

A varied technical program that examines both the onshore and offshore activity – and potential – of one of the world's most prolific regions has been planned for this year's AAPG Gulf Coast Association of Geological Societies annual meeting, which will be held Oct. 10-12 at the Henry B. Gonzalez Convention Center in San Antonio.

The theme for the meeting – GCAGS' 60th annual – is "Weathering the Cycles." Also meeting will be the Gulf Coast Section of SEPM.

The technical program will include a special daylong Stricklin Symposium on Tuesday, Oct. 12, titled "Forming and Filling the Gulf of Mexico Basin:

Triassic, Jurassic and Cretaceous Tectonics, Source Rocks and Petroleum Systems."

Other technical sessions include:

- ▶ Organic Shales of the Gulf Coast – Controls On Reservoir Quality and Producibility.
  - ▶ Carbon Sequestration – Risks, Opportunities and Implications for EOR.
  - ▶ Water for A Growing Region – Geology, Water Quality and Resource Management.
  - ▶ Integrated Answers in Subsurface Exploration for Shelf-to-Ultradeep Opportunities.
  - ▶ Preparing for the Crew Change in the Geoscience Work Force.
- The program also includes a

opening session featuring AAPG President Dave Rensink and a keynote address by past AAPG president Scott Tinker, plus two luncheons:

- ▶ Monday's All-Convention Luncheon will feature John Hofmeister, founder and chief executive for Citizens for Affordable Energy, talking about "Why We Hate the Oil Companies: Straight Talk From an Energy Insider."
  - ▶ Tuesday's Divisions Luncheon will feature Lee Shephard, direction of the Institute for Conventional, Alternative and Renewable Energy at the University of Texas at San Antonio, talking about "Realizing America's Energy Future."
- For more information go online to [www.gcags2010.com/index.html](http://www.gcags2010.com/index.html).

Frontiers of Unconventional Thinking...Saddle Up for the Ride



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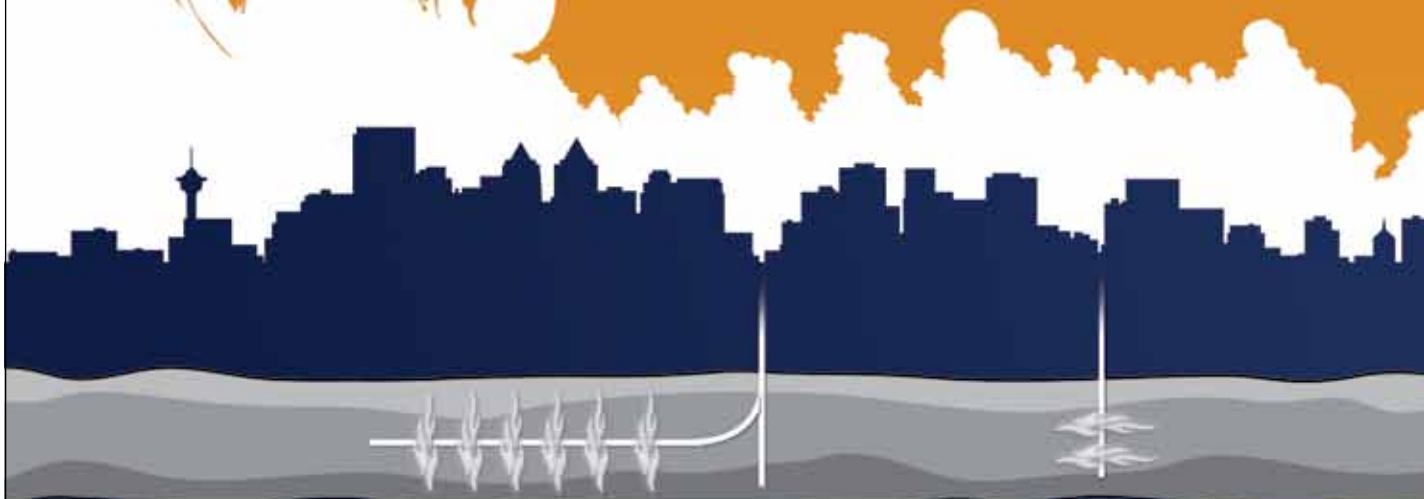
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For fastest service, register online at [www.AAPG.org/Calgary](http://www.AAPG.org/Calgary)



**2010 Open Enrollment Course Schedule**

**Risk Analysis, Prospect Evaluation & Expl. Economics**

Calgary, Alberta	October 4 – 8, 2010
Aberdeen, Scotland	October 4 – 8, 2010
Houston, Texas	October 18 – 22, 2010

Register at: [www.roseassoc.com/instruction](http://www.roseassoc.com/instruction)  
 Questions: [allisondunn@roseassoc.com](mailto:allisondunn@roseassoc.com) Ph: 713/528-8422

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# TGS Offers \$upport

The Tulsa Geological Society has thrown down a financial gauntlet to help raise money for one of the AAPG Foundation's most popular programs.

TGS Council members recently voted to offer a challenge grant of \$6,250 to alumni and friends of the University of Tulsa and the University of Arkansas to help fund a subscription at each of those schools to the Foundation's Digital Products university program.

A \$12,500 AAPG Datapages online subscription provides students, faculty and visitors of the university complete access to the entire Datapages digital library in perpetuity.

The online digital archival library currently consists of over a million pages of geological information consisting of numerous society collections, AAPG publications and other regional publications – a substantial and continually expanding petroleum geology library.

TGS members as well as alumni and friends of the universities of Tulsa and Arkansas can make donations to the challenge grant online at [foundation.aapg.org/donate.cfm](http://foundation.aapg.org/donate.cfm); just select "Digital Products Fund," and then select the university of your choice.

\* \* \*

The 2011 AAPG Grants-in-Aid Program is currently accepting applications from qualified master's or Ph.D. candidate geosciences students who may require funding for their research.

With over \$200,000 available – and grants awarded up to a maximum of \$3,000 – applicants are encouraged to review the procedures and begin the online submission process early.

This year's application deadline is Jan. 31.

\* \* \*

Additional funding for the Named Grants-in-Aid Program has been provided by Rosann Hooks, who generously donated in memory of her late husband, James E. Hooks, a Chevron vice president and Foundation Trustee Associate who passed away in September 2002.

The James E. Hooks Memorial Grant is restricted to Hook's two alma mater's, Florida State University and Texas A&M.

For additional details of this or any Foundation program, or to donate by phone, contact Foundation manager Rebecca Griffin, at 918-560-2644.

**Foundation (General)**

- Seymour R. Baker
- Gerald R. Baum
- Michael William Bennett
- Douglas Charles Bleakly
- BP Foundation
- Matching gift for Jacek M. Jaminski*
- Janet Sue Brister
- Alex S. Broun
- Michael C. Burkard
- Dean Lynn Callender
- Susanna Sofia Calvo
- Martin Macdermott Cassidy
- Robert Randall Chanpong
- Richard Eugene Church
- David Kingsley Curtiss
- Donald William Davis
- Edward Louis Davis
- James Harrison Davis
- In memory of Merrill Haas*
- Giancarlo Davoli
- Tim Paul Dooley
- Edwin Harris East
- James William Eberhardt
- EOG Resources
- Matching gift from Stephen Burke*
- Parrish Erwin Jr.
- ExxonMobil Foundation
- Matching gift for Wayne Schild*
- John Sturges Eyres
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- Dennis J. Fischer
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- Enoch Amakiri George
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- Thomas Edgar Green Jr.
- George A. Hall
- Neil Wallace Hamilton
- Stuart D. Harker
- Philippe Eric Heer
- W. Daniel Heinze
- Dave Hixon
- In memory of Keith Young*
- William J. Hlavin
- Michael Frances Hoffmann
- John D. Humphrey
- Robert Bruce Hunter
- Tony Jolly
- Suhattaya Kaewla-lad
- Wayne Russell Kemp
- Robert Winfield Koch
- Max Allen Krey
- Kurt Matthew Ley
- Sitian Li
- James Warren Lovekin
- Roy Burvil Luck
- Alberto R. Luna
- George M. Markey Jr.
- Robert L.W. Martin
- Terry Wayne Massoth
- Michael Thomas May

## CALL FOR ABSTRACTS

Submit your abstract online before 23 September 2010

**MAKING THE NEXT GIANT LEAP IN GEOSCIENCES**



**AAPG 2011 Annual Convention & Exhibition**  
 American Association of Petroleum Geologists  
 with SEPM (Society for Sedimentary Geology)

10–13 April 2011 | George R. Brown Convention Center | Houston, Texas, USA

Industry professionals and students are invited to submit abstracts to the AAPG 2011 Annual Convention & Exhibition. The technical program committee encourages abstracts that relate to any of the topics listed below. Planned sessions and formats (oral or poster) may be modified depending on actual submittals.

**THEME 1: Molecules to Marketplace: The Business of Energy**

This theme will include business energy experts from domestic and international companies who will discuss active oil and gas trends, price, demand and advice on what might happen in the future.

**THEME 2: Global Deepwater Reservoirs: Giant Leaps in E&P**

This theme will present state-of-the-art geoscience investigating deepwater reservoir studies and deepwater depositional environments in fields located offshore of the Gulf of Mexico and Africa.

**THEME 3: Worldwide E&P: Opportunities in the New Decade**

This theme will cover exploration and production onshore or offshore. It will include significant new plays and studies of geological trends from countries of the world including Americas, Brazil, Middle East and Asia.

**THEME 4: Challenged Resource Frontiers**

Challenged Reservoirs will cover multidisciplinary aspects related to the characterization, assessment and understanding of gas and oil resources from less-than-conventional reservoir systems in both the U.S. and international arena. We encourage contributions ranging in scale from 'pore-throat to basin'.

**THEME 5: Mudstones and Shales: Unlocking the Promise**

This comprehensive theme will include U.S. and international gas- and oil-productive mudstone case studies, systems geology and geochemistry, exploration, assessment and ranking techniques, reservoir characterization and evaluation, and drilling and completion technologies.

**THEME 6: Siliciclastics: Advancing Research to Resource**

This theme covers all aspects of siliciclastic research and reservoir characterization including, fluvial, shallow marine and deepwater settings, diagenesis and reservoir modeling.

**THEME 7: Insight Into Carbonates and Evaporites**

This theme will include oral and poster sessions about carbonate and evaporite research (ancient and modern), carbonate reservoirs, reservoir modeling, seismic interpretation and oil and gas studies of carbonates.

**THEME 8: Breakthroughs: Tectonics, Salt and Basin Analysis**

This theme will hold sessions concentrating on basin analysis, petroleum systems and studies of structure and tectonics worldwide, including faulting styles and salt tectonics.

**THEME 9: Integrating New Technology, Geophysics and Subsurface Data**

This theme will have abstracts and sessions relating to geology integrated with geophysics and applied to exploration and production, including surface and subsurface GIS mapping technology.

**THEME 10: Energy and Environmental Horizons**

This theme will have energy and environmental sessions important to today's natural resource and environmental geologists. Papers coordinated by the AAPG's Energy Minerals Division (EMD) will address alternative energy resources. The Division of Environmental Geologists (DEG) will coordinate papers on environmental geology.

**THEME 11: The Next Geo-Generation: Who, What and Where**

This theme will explore the trends and dynamics of young professionals (1-10 years) in the energy industry through an exciting speaker program and poster sessions. Covered topics will include managing career development, attracting and retaining geoscience staff and forecasting new career pathways.



[www.AAPG.org/Houston2011](http://www.AAPG.org/Houston2011)

Continued on next page



**Continued from previous page**

Barry C. McBride  
James S. McGhay  
Larry Richard Moyer  
Larry Nation  
Alexey Nechayuk  
Ellen West Nodwell  
Robin L. Petrusak  
Hayat A. Qidwai  
Victor O. Ramirez  
Barry Joseph Rava  
Betty May Robertson  
*In memory of Clifford G. Flittie*  
Kweku-Mensah O. Sagoe  
Daniel William Sellers  
Daniel R. Shaughnessy  
Peter Edwin Sikorski  
David John Sivils  
George C. Soronen  
John Stanfield Spaid  
Edward Anthony Steiner  
Charles Edward Stelling  
Cynthia G. Suek  
Gregory Scott Thomas  
Natalia Aleksandrovna Tkacheva  
Jerry Edward Tochterman Sr.  
Harshad Trivedi  
*In memory of R.C. Slocum*  
Ravi T. Venkateswaran  
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Keith R. Whaley  
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**Awards Fund**

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Ellen West Nodwell

**Teacher of the Year Award**

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Ellen West Nodwell

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*Virginia Tech University*  
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**Grants-in-Aid Fund**

BHP Billiton  
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Michael R. Wisda  
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**Fred A. and Jean C. Dix Named Grant**

James E. Briggs

**Robert K. Goldhammer Memorial Grant**

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**Grants-in-Aid Committee Named Grant**  
Rebecca L. Griffin

**James E. Hooks Memorial Grant**

Rosann F. Hooks  
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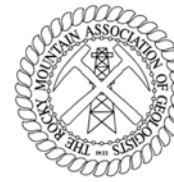
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**CALL FOR PAPERS**

The Rocky Mountain Association of Geologists and the American Association of Petroleum Geologists will produce a special publication for release in 2011. The publication theme is

**The Application of Structural Methods to Rocky Mountain Hydrocarbon Exploration and Development**

We are seeking submittals from authors involved with recent investigations.

Our publication objective is to provide a venue for authors to share new ideas, methods, and applications relating structural geology to hydrocarbon exploration and development. We are seeking papers that discuss regional aspects of structural geology as well as papers that focus on smaller scale issues, such as defining field parameters and optimizing production. The format for this publication will be digital.

Possible topics include:

- Regional structural framework concepts
- Application of structural methods to Rocky Mountain resource plays
- The role of faulting and fracturing
- Applications of geophysical techniques including: 3-D and 4-D seismic, multi-component seismic, and potential field data
- Utilization of borehole imagery
- Relevance of borehole seismic methods

Please submit your title and abstract by **October 15, 2010.**

**CONTACT INFORMATION:**

RMAG Office: 303-573-8621, [admin@rmag.org](mailto:admin@rmag.org)

**Editors**

Connie Knight: [cnknight@comcast.net](mailto:cnknight@comcast.net)  
Jerry Cuzella: [jerryc49@aol.com](mailto:jerryc49@aol.com)  
Chuck Kluth: [ckluth@mines.edu](mailto:ckluth@mines.edu)



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Details [www.rockymountainexpo.org](http://www.rockymountainexpo.org)

2009 Attendance: 1,000+ prospects total 1 billion bbl oil potential represented

## MEMBERSHIP & CERTIFICATION

The following candidates have submitted applications for membership in the Association and, below, certification by the Division of Professional Affairs. This does not constitute election nor certification, but places the names before the membership at large.

Any information bearing on the qualifications of these candidates should be sent promptly to the Executive Committee, P.O. Box 979, Tulsa, Okla. 74101.

Information included here comes from the AAPG membership department.

(Names of sponsors are placed in parentheses. Reinstatements indicated do not require sponsors.)

Membership applications are available at [www.aapg.org](http://www.aapg.org), or by contacting headquarters in Tulsa.

### For Active Membership

#### Colorado

Rhoades, Matthew J., consultant, Englewood (S.A. Sonnenberg, J.E. Wellborn, M.C. Carr); Stichter, Jason, Schlumberger Data & Consulting Services, Littleton (E. Gomez, S.D. Sturm, T. Numelin)

#### Indiana

Pigott, Robert Lee, Earthcad Consulting, Evansville (J.A. Rupp, T.H. Stark, D.L. Gelhausen)

#### Louisiana

Sloan, Robert F., Shell Oil, New Orleans (H.J. Brook, T.V. Wilson, R.J. Stancliffe)

#### Oklahoma

Chapman, James Benjamin, SandRidge Energy, Oklahoma City (R.S. McCarty, M.A. Thomas, S.D. Nath); Cruse, Anna M., Oklahoma State University, Stillwater (J.W. Higgins, J.O. Puckette, J.M. Gregg)

#### Texas

Abele, Stanley Thomas, Seismic Micro-Technology, Houston (reinstatement); Aular, Julio, Halliburton, Houston (N.G.K. Boyd, C.M. Gell, R.L. Chambers); Barker, Neville, OHM Rock Solid Images, Houston (R.C. Cooper, S.W. Singleton, G. Flanagan); Guu, Jeng-yih, Nexen Petroleum, Plano (reinstatement); Jung, Kyungtae, Samsung Oil & Gas USA, Houston (K. Hogenson, G.E. Stachura,

## Dues are Payable Online

**A** reminder: Pay your 2010-11 dues now online to avoid losing your membership benefits.

AAPG continues to offer the graduated dues structure – no member is denied participation based on their income.

Student dues will remain at the \$10 rate, and Chevron will continue its support as the corporate sponsor of the Student Sponsorship Program.

Payments are accepted online, or contact the membership department at 918-584-2555.

M. B. Anderson); Ofoma, Innocent C., Eni Petroleum, Richmond (J.O. Otiocha, J.D. Doyle, K. Yang); Suhrer, Michael E., Ingrain, Houston (E. Diaz, J.P. Dvorkin, J.M. Spaw)

#### Wyoming

Tomasso, Mark, Enhanced Oil Recovery Institute, Laramie (J.R. Steidtmann, E.C. Potter, J.R. Underhill)

#### Colombia

Cogollo, Magda Lucia, CTP Ltda., Piedecuesta (M. Garcia-Gonzalez, I.D. Olaya-Lopez, V.O. Ramirez)

#### Ecuador

Hidalgo, Juan Carlos, Schlumberger, Quito, Ecuador (M. Rivera, D. Burger, R.H. Vera)

#### Mongolia

Graham, Rodney William, Petro Matad, Ulaanbaatar (D. Janchiv, J.E. Warme, J.C. Coogan)

#### Nigeria

Awobadejo, Olanrewaju O., Total E&P Nigeria, Lagos (M.O. Odebode, O.O. Ogunkoya, K.A. Ojoh); Ayodele, Irewole John, ConOil Producing, Lagos (O.T. Odusote, M.L. Afe, S.O. Akande)

## Certification

The following are candidates for certification by the Division of Professional Affairs.

### Petroleum Geologist

#### Colorado

Arthur E. Rowley, Williams Production RMT, Denver (reinstatement)

#### Florida

Denise M. Cox, Storm Energy, Panama

City (C. Caughey, D. Sacrey, M. Party)

#### Texas

Steven A. Earle, Carrizo Oil & Gas, Houston (SIPES reciprocity); Janet M. Combes, consultant, Houston (SIPES reciprocity)

#### Washington

Paul T. Doughty, PRISEM Geoscience Consulting LLC, Spokane (L. Fairchild, B. Quartero, T. Andrews/J. Nurkowski)

## Carbon Storage from page 22

interpretation of seismic data (commercially available and perhaps acquired specifically for the study).


In fact, ION contributed its GulfSPAN seismic data library to the investigation, according to Bob Peebler, CEO at ION. Additionally, a 3-D seismic survey was provided by Formosa Plastics and its subsidiary, Neumin Production Co.

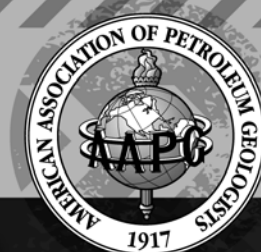
"The results of this study should provide the next step in making geostorage of CO<sub>2</sub> a commercial reality," Meckel said, "and may provide the impetus for the future creation of a georepository State of Texas Submerged Lands."

Contributing to the enthusiasm is the fact that sub-seafloor CO<sub>2</sub> storage has the potential to generate significant capital for public education in Texas.

The Texas General Land Office has a longstanding requirement to direct revenues generated from resource utilization on state lands into the Texas Permanent School Fund, Meckel said.

Texas Land Commissioner Jerry Patterson has said oil and gas exploration in the Gulf alone has brought more than \$6 billion to the fund. He emphasized that oil and gas are finite resources, noting that CO<sub>2</sub> storage may replace some of the revenue lost as those resources deplete.

"It's a new way to think about sequestration in terms of managing long-term liability while distributing benefits," Meckel noted. 



## Come Be Part Of The 'IN' Crowd!

Participate in AAPG's Geoscience Technology Workshops (GTW's)

### New Ways to Look at Old Data: New Pay Zones, Increased Production, Expanded Regional Plays

November 8-9, 2010 • Houston, TX

How are new ways to look at old data resulting in new pay zones, increased production, and even new regional plays? How can you find and determine the best way to produce oil that's been "left behind"?

This AAPG Geoscience Technology Workshop provides you with answers, ideas, and opportunities.

Sessions include using existing data for effective hydraulic fracturing for horizontal wells, ways to look at old well log data to find new fields and new productive zones, integrating core information and old seismic with new technologies for better imaging of reservoirs, combining old and new data for enhanced oil recovery, and bringing together old and new data to better understand shale reservoirs.

### Deepwater and Ultra Deepwater Reservoirs in the Gulf of Mexico

January 18-19, 2011 • Houston, TX

Practicing geologists, engineers, and geophysicists will make active, dynamic presentations on how to improve exploration and development, operations, and appraisal efforts in deepwater and ultra deepwater reservoirs.

Focus will be mainly on the the Gulf of Mexico, but we will discuss case studies in other areas. Change is occurring quickly, and keeping up to date with new regulations and operating procedures will receive special emphasis. Included are sessions on how new geological and geophysical data can help decision-making, and what new processing and interpretation methods can tell us.

Each session will include an IPOD discussion (in-depth discussion on issues, problems, opportunities, and directions).

### Success in the Marcellus: Reservoir and Field Studies, Cores, Geomechanics, Geochemistry

May 24-26, 2011 • Baltimore, Maryland

This workshop will feature presentations on case studies, reservoir and field studies, cores, geomechanics, geochemistry, 3D seismic, and imaging to optimize your Marcellus operations.

What makes this workshop special? Not only does it take an interdisciplinary approach, you'll have a chance to discuss the unique structural setting that gives the Marcellus its unusual qualities. If you have not had a chance to see the Marcellus in outcrop, and to look at its natural fractures and joints, you'll have the opportunity to go on a virtual field trip as Marcellus experts and professors discuss their work and show their high-quality photos.

Each session will include an IPOD discussion (in-depth discussion on issues, problems, opportunities, and directions). As a special added bonus, our goal is to have an informal core workshop during lunch and poster sessions.

**INFORM – DISCUSS – LEARN – SHARE • THE AAPG GTW EXPERIENCE**

For information on these AAPG GTW's, please log on to our website at <http://www.aapg.org/gtw>.

A A P G F O U N D A T I O N

# Meeting Challenges

## ASSURING SUCCESS

# Back to School!



## Support Earth Science K-12 Education

The AAPG Foundation K-12 Education Endowment will allow us to sponsor, train and support teachers in their efforts to bring more geology-related topics to the classroom, sparking the early interest of students and encouraging more of them to enter a geoscience field.

Currently, the AAPG Foundation provides support to successfully established programs, such as Earth Science Week, More! Rocks-in-your-Head workshops and the Bookout Initiative.

There is a need for additional outreach to students, teachers, parents and the general public, to educate them about the invaluable role of geosciences in major issues such as global climate change and world energy needs.

### How can YOU help?

You may direct your tax-deductible contribution toward the AAPG Foundation "K-12 Education Fund."

A gift may be made online at [foundation.aapg.org/donate.cfm](http://foundation.aapg.org/donate.cfm), through the mail or by phone.

Should you wish to receive a 5-year pledge commitment form or further details about the K-12 Education Fund, please contact Rebecca Griffin, 918-560-2644, [rgriffin@AAPG.org](mailto:rgriffin@AAPG.org)



## READERS' FORUM

## Rising to the Occasion

The outrage over the explosion and sinking of the Deepwater Horizon in the Gulf of Mexico is palpable, and justifiably so. The question the offshore industry must now face is: How do we as an industry respond to this disaster in such a way to preserve offshore drilling and restore confidence in what is clearly a vital component of our future domestic energy supply?

One possible approach is to re-evaluate every offshore project in terms of the probability of the occurrence of an undesirable risk event, and the consequence of such a risk event.

Reducing risk to effectively zero may not seem practical to many (and is theoretically impossible), but in light of recent events, that clearly must be our goal.

An article in the June EXPLORER outlined the top 10 worst oil spills in history.

Several conclusions can be drawn from that data:

▶ The worst oil spill in history was an intentional act that occurred as Saddam Hussein was retreating from Kuwait in 1991.

▶ Only one of the 10 worst oil spills occurred onshore, in Central Asia. Without minimizing the severity of such an accident, onshore spills are usually not as catastrophic in terms of environmental damage.

▶ Seven of the worst oil spills involved tankers.

Given the relatively high frequency of tanker spills (seven) between 1978 and 1991, it struck me as odd that there has not been a major tanker related spill since 1991. The probable explanation is the mandate, pursuant the Oil Pollution Act of 1990, to phase out single-hull tankers in favor of double-hull tankers.

My point is to recognize the dramatic re-engineering and re-design response that was taken in light of the high number of tanker related accidents.

The one remaining spill not yet discussed is the 1979 Ixtoc #1 well, which like the Deepwater Horizon exploded and sank in the Gulf of Mexico in such a way that made it very difficult to control the damage.

Although the well was in shallower water, the similarity of technical issues hindering efforts to control the damage in both wells cannot be ignored.

Times are different now than they were in the 1970s, 1980s and early 1990s. Industry's response to the Deepwater Horizon and Ixtoc spills must be faster than the response to the tanker spills. The opportunity to take control of this situation is now, and must be accepted by the entire industry working in concert with one another

on a common goal, or we will collectively lose control of this situation and pay the price for decades to come.

This is not just BP's problem; it is now the entire industry's issue to deal with. We can either rise to the occasion and lead this re-engineering and re-design effort, or for the foreseeable future react to well-intentioned but ill-informed knee-jerk reactions.

John M. Stafford  
Highlands Ranch, Colo.

## Ethanol? No!

I am disappointed over the big push to make ethanol. Ethanol is polluting, low energy and it raises the cost of food.

Why don't I hear a push to use natural gas to power our vehicles?

Natural gas is high energy, clean burning, cheap and plentiful. There are 200 drilling rigs drilling for natural gas in the United States today.

U.S. automakers already build cars that run on natural gas for the foreign market.

Another loan of \$30 million was made to a plant in Colwich, Kan., to build a cellulose ethanol plant. This \$30 million would have built dozens of natural gas filling stations.

Converting our vehicles would save the United States one-half billion dollars a day that we spend on foreign oil.

Marvin E. Frankamp  
Wichita, Kan.

## IN MEMORY

Past officer and AAPG award recipient Erik P. Mason died July 31 in Leiden, Netherlands, after a sudden illness. He was 56.

Mason was on assignment for Royal Dutch Shell working in Europe and Sub-Saharan Africa, after a distinguished career as a geologist, team leader and manager in exploration in the Americas. He had assignments for Shell in New Orleans, the Netherlands and Houston.



MASON

He received his bachelor's from Principia College and joined Exlog and later joined Phillips Petroleum in 1982 after earning a master's at Oklahoma State University. He joined Shell in 1988.

Co-editor of AAPG Methods in Exploration #14 on horizontal wells, Mason was the general chairman of the 2000 AAPG annual meeting in New Orleans. His latest duty for AAPG was chair of the Geoscience Events Oversight Committee.

He served as AAPG vice president in 2003-04 and received the AAPG Distinguished Service Award in 2007. He was an AAPG HoD delegate, served on many committees and was a member of the Division of Professional Affairs.

Family and friends have established the "Erik Mason Memorial" through The AAPG Foundation. Contributions will be designated to support the scholarship established at Oklahoma State University and are accepted by the AAPG Foundation.

Karl H. Arleth, 85

Houston, June 16, 2010

Donald Wallace Baird, 86

Sun City West, Ariz., 2010

Donald R. Baker, 83

Denver, July 19, 2010

Jaime Barcelo-Duarte, 56

Villahermosa, Mexico

June 29, 2010

Daniel A. Bradley, 87

St. Laurent, Canada

April 30, 2010

Jay T. Garske (AC '62)

Denver

Warren Wall Hagist, 82

Morrison, Colo., June 19, 2010

Gerhard Cyril J. Jansen, 79

San Clemente, Calif.

February 2010

Erik Paul Mason, 56

Leiden, Netherlands, July 31, 2010

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**CLASSIFIED ADS**

**POSITION AVAILABLE**

**TWO ENDOWED FULL PROFESSOR POSITIONS  
OSU BOONE PICKENS SCHOOL OF GEOLOGY**

The Boone Pickens School of Geology at Oklahoma State University (OSU) seeks applications for two endowed chairs: the Chesapeake Energy Corporation Chair of Petroleum Geoscience and the Devon Energy Corporation Chair of Basin Research. We are particularly interested in candidates with interests in one or more of the following: unconventional energy resources, petrophysics, reservoir characterization/modeling, tectonics of sedimentary basins, depositional and diagenetic systems, and basinal fluids. These chairs will be filled at the level of Professor, will carry tenure in the School of Geology, and will be effective August 2011. Applicants must have a Ph.D. degree in geology or related field and have an outstanding record of research. The applicant must be committed to excellence in teaching both undergraduate and graduate students, will be expected to supervise M.S. and Ph.D. level graduate students and develop courses in her or his specialty.

The successful candidates will join a faculty of eleven geoscientists and will take leadership roles in a department that has close ties to the petroleum industry. The School's teaching and research facilities include state of the art geophysical field and laboratory equipment and software, the Devon Visualization Laboratory, and a wide range of petrographic and geochemical instrumentation. The School also has a recently renovated field camp facility near Canon City, Colorado.

Candidates should submit a letter of application, including a discussion of research interests and approach to teaching, along with a curriculum vitae and contact information for three references to: Endowed Chair Search, Boone Pickens School of Geology, 105 Noble Research Center, Oklahoma State University, Stillwater, Oklahoma 74078-3031. Screening of candidates will begin on November 8, 2010 and continue until the position is filled. More information about the Boone Pickens School of Geology can be found on the web <http://geology.okstate.edu> along with additional information about these opportunities. Inquiries may be directed to Dr. Todd Halihan ([todd.halihan@okstate.edu](mailto:todd.halihan@okstate.edu)) or Dr. Jay Gregg ([jay.gregg@okstate.edu](mailto:jay.gregg@okstate.edu)). Committed to health and safety Oklahoma State University maintains a tobacco free work environment. Oklahoma State University is an Affirmative Action/Equal Opportunity/E-Verify employer committed to diversity.

**Petroleum Exploration Geologist  
Newfield Exploration  
Tulsa, OK**

Seeking Geologist, responsible for conducting detailed prospect analysis and play fairway assessments within the Mid-Continent Region plus the generation and presentation of prospect ideas and leads to management. This position would be located in Tulsa, OK.

The successful applicant will generate and update maps, logs, cross-sections and corporate databases with new tops, correlations, shows and other pertinent geological data. Develop regional, multi-county stratigraphic framework and subsurface correlations.

Minimum qualifications, ten years of experience, knowledge of Mid-Continent upstream oil and gas, experience with conventional and un-conventional plays, experience doing play-fairway analysis assessments. Send resume to [kleffer@newfield.com](mailto:kleffer@newfield.com).

**Production Engineer (2)**

BS/MS Chemical or Petroleum Engineering 10+ yrs. O&G Production. Understand completions, multiphase fluid flow, wellbore hydraulics, etc. Located in Santa Barbara or Bakersfield CA \$150-200,000 + BONUS. Company pays relocation, US Citizens only - send resume to [Kathi@whalenbryan.com](mailto:Kathi@whalenbryan.com)

**Reservoir Engineer (2)**

PE degree 5+ yrs. E&P 5+ yrs. , US citizen only. Multiphase fluid flow, wellbore hydraulics, reservoir characterization and economic analysis. Know Gas life & ESP's. Located in Santa Barbara or Bakersfield CA \$150-200,000 + BONUS- Company pays relocation - send resume to [Kathi@whalenbryan.com](mailto:Kathi@whalenbryan.com)

**Pipeline Compliance Coordinator (2)**

5 yrs. Exp. Pipeline operation, maintenance or construction exp. Santa Barbara or Bakersfield \$60-80,000 +. Resume to [Kathi@whalenbryan.com](mailto:Kathi@whalenbryan.com)

Continued on next page



*Petroleum Technology Transfer Council  
September Workshops*

**Government Funding for Advanced Technology  
-A Guide to Winning Government Grants**  
9/21 Tulsa    9/23 Lafayette    9/30 Morgantown

**EASTERN REGION**  
**Trenton-Black River Core Workshop**  
9/25 Kalamazoo, MI

**ROCKY MOUNTAIN REGION (all workshops in Denver area)**  
9/24 **Bakken Petroleum System**  
9/28-29 **Completion & Stimulation(s) of Horizontal Wells in Tight & Unconventional Gas Reservoirs**  
9/30 **Overcoming Geologic Challenges with Advanced Drilling & Completion Techniques**

**WEST COAST REGION**  
**IOR Field Applications and Case Histories**  
9/29 Bakersfield  
**Drilling Engineering 101**  
9/30 Sacramento

Visit [www.pttc.org/national\\_calendar.htm](http://www.pttc.org/national_calendar.htm) for more detailed workshop information



13th Annual AAPG/SEG

# Fall Student Expo

**When:** 20-21 September 2010  
Monday-Tuesday

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

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- ✓ Interviews
- ✓ Field Trips
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- ✓ Interviewing Tips
- ✓ Resume Building and Review

More information and registration online at:  
**<http://studentexpo.info>**



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# AAPG-SEG West Coast Student Expo

**30 Sept. - 2 Oct. 2010**  
**California State University,  
Northridge**

**Company interviews,  
Student poster presentations,  
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**Interested Companies and Students see:  
[www.csun.edu/geology/aapg-seg.htm](http://www.csun.edu/geology/aapg-seg.htm)  
for registration information**



المعهد البترولي  
THE PETROLEUM INSTITUTE

Abu Dhabi, UAE

## FACULTY POSITIONS

### Petroleum Geosciences

**Petroleum Geosciences Department**  
is seeking applications for the following positions:

**Chair Professor, Distinguished Professor**  
**Professor, Associate Professor, Assistant Professor**  
**Senior Research/Teaching Associate**  
**Research/Teaching Associate**

Department faculty will be expected to teach undergraduate and graduate courses, develop an active research program, and to engage in professional and institutional service activities. Opportunities to interact with PI industrial stakeholders and other local industries will be a key feature in the development of a research program.

**Institution: The Petroleum Institute (PI)** was created in 2001 with the goal of establishing itself as a world-class institution in engineering education and research in areas of significance to the oil and gas and the broader energy industries. The PI's sponsors and affiliates include Abu Dhabi National Oil Company and several major international oil companies, namely Shell, BP, Jodco and Total. The campus has modern instructional laboratories and classroom facilities and is now in the planning phase of three major research centers on its campus. The PI is affiliated with the Colorado School of Mines, the University of Maryland (College Park), the University of Minnesota and Johannes Kepler University in Linz, Austria. Recent additions to collaborating institutions include Rice University and University of Texas, Austin. The growth of the PI is instrumental to meet the business and research needs of the fast growth of the UAE industry. For additional information, please refer to the PI website: [www.pi.ac.ae](http://www.pi.ac.ae).

For details on the positions and to submit your application, please go to:

<http://www.pi.ac.ae/jobs>

Review of applications will begin immediately  
and will continue until successful candidates are selected.  
Only shortlisted applicants will be notified.



## FACULTY POSITION IN PETROLEUM GEOSCIENCE

### CONOCOPHILLIPS SCHOOL OF GEOLOGY AND GEOPHYSICS

### MEWBOURNE COLLEGE OF EARTH AND ENERGY

### UNIVERSITY OF OKLAHOMA

The University of Oklahoma invites applications and nominations for a tenure-track or tenured faculty position in petroleum geology. The rank is open, from Assistant through Associate to Full Professor levels. Depending on experience and qualifications, the successful candidate may be appointed as a tenured Associate or Full Professor in an endowed professorship or chair. The applicant is expected to add significantly to the University's petroleum geology/geophysics education and research programs. Applications are being solicited from both academia and industry.

The successful candidate must have a demonstrated research record and the vision to establish and lead a strong multidisciplinary research program in petroleum geology, or a closely related discipline. This includes the opportunity to work closely with the Mewbourne School of Petroleum and Geological Engineering and the Oklahoma Geological Survey to investigate concepts, tools and methodologies to better define, characterize and manage oil and gas reservoirs. A qualified applicant should have demonstrated expertise in a range of geoscience technologies. The ideal candidate will also have experience in using these technologies to define and better understand geological features of economic interest, and should be an excellent educator with commitment to both undergraduate and graduate (M.S. and Ph.D.) education. A Ph.D. degree in geology or a closely related field is required. Salary and benefits will be competitive and commensurate with experience and anticipated potential.

The Mewbourne College of Earth and Energy possesses extensive industry-standard software, along with well-equipped and maintained computing labs for geological and geophysical mapping, analysis and interpretation, as well as rock properties/characterization laboratory facilities. Additional information about the College and the entities that it houses can be found at <http://mcee.ou.edu>.

Review of candidates will begin October 1, 2010 and continue until the position is filled. The anticipated starting date is August 15, 2011. Applicants are requested to submit a vita/resume, statement of research and teaching interests, and a list of five references who can be contacted, including names, phone numbers, email and complete mailing addresses. Questions or requests for additional information may be addressed Dean Larry R. Grillot, Chair of the Geosciences Search Committee, at (405) 325-3821, or [lgrillot@ou.edu](mailto:lgrillot@ou.edu). Applications and nominations should be addressed to Geosciences Search Committee, University of Oklahoma, Sarkeys Energy Center, 100 E. Boyd Street, Room 510, Norman, OK 73019-1008.

The University of Oklahoma is an Affirmative Action, Equal Opportunity Employer. Women and Minorities are encouraged to apply.

## Continued from previous page

### POSITION ANNOUNCEMENT

#### Assistant Professor in Energy Geoscience

The Department of Earth and Environmental Science of the New Mexico Institute of Mining and Technology invites applications for a tenure-track Assistant Professor position in the broad area of energy-related geoscience. The candidate's research should be original and address significant geophysical, geochemical or geological questions related to energy resources. While we will consider all outstanding candidates, we are particularly interested in those who complement existing strengths in the department, and will conduct research and teaching in one or more of the following areas: active-source seismology, seismic stratigraphy, geological sequestration of CO<sub>2</sub>, petroleum geology and basin analysis, and geothermal science.

Applicants must have a Ph.D. in Earth Sciences or a related field at the time of appointment, as well as a significant record of research productivity. Potential for excellence in research, teaching, and building energy industry and academic collaborations are the most important qualifications. Applications are solicited from both academic and industry.

Responsibilities include the development of a vigorous, independent, and externally funded research program supporting M.S. and Ph.D. students, teaching two to three courses per year (graduate and/or undergraduate), student advising, and service to the department, institute, state, national, and international Earth Science communities. The successful applicant will be expected to develop and maintain significant department faculty and student interactions with the energy industry.

Applicants should submit a statement of research and teaching interests and goals, a curriculum vitae, and the names of three or more references to: Energy Geoscience Search, New Mexico Tech, Human Resources Department, 801 Leroy Place, Socorro, New Mexico 87801. Official transcripts of pre-and post-graduate studies will be required if selected to interview. For full consideration, applications should be received by October 1, 2010 (email applications cannot be accepted). For further information, including the complete position announcement, visit [www.ees.nmt.edu/professional\\_ops.html](http://www.ees.nmt.edu/professional_ops.html), and/or contact search committee chair Peter Mozley ([mozley@nmt.edu](mailto:mozley@nmt.edu)). New Mexico Tech is an equal opportunity/affirmative action employer.

### Research Assistant Professor - Petroleum Systems.

#### University of Western Australia, Centre for Petroleum Geoscience & CO<sub>2</sub> Sequestration

We are seeking an early-career high-achieving geoscientist with expertise in petroleum geoscience and petroleum systems to participate in an integrated geoscientific study of the Canning Basin (on-shore Western Australia) to assess its potential for energy resources and CO<sub>2</sub> sequestration. The role requires a highly motivated geoscientist with a PhD (or equivalent experience) in basin-related geoscience.

The Centre for Petroleum Geoscience & CO<sub>2</sub> Sequestration is a dynamic research environment combining academic and industry-oriented research. The Centre is located in Perth; the centre of the Australian energy industry and an emerging focal point for the petroleum industry worldwide with the development of world-class offshore hydrocarbon resources and CO<sub>2</sub> sequestration sites on the Northwest shelf.

For further details see: <https://www.his.admin.uwa.edu.au/jobvacs/external/academic/doc/doc1766912.RTF>

**Niko Resources Ltd.** is seeking an experienced carbonate explorationist in our Jakarta, Indonesia office. Candidates should have industry experience and an expert level background in carbonate depositional

systems and reservoir facies. This role's primary focus is the ability to operate an exploration workstation for the identification of carbonate facies in 2D and 3D seismic data and be highly proficient in mapping drillable prospects. The candidate will be tasked with conducting field programs in remote areas to add to the geological knowledge of Niko's exploration activities. Candidates with the necessary experience are expected to be fully independent but be able to work in a team environment and mentor junior staff members. Niko Resources Ltd operates numerous exploration PSCs in Indonesia and this position would be a key leading member of the team tasked to identify drilling opportunities. For the candidates, this is a unique opportunity to work as part of an aggressive team of explorationists, to develop prospects, and to have their prospects drilled in a short time frame. Send resume to [lrothenberg@nikoindonesia.com](mailto:lrothenberg@nikoindonesia.com)

## INVESTMENT OPPORTUNITY

### Pin Money Investments, LLC

- Private Portfolio Management
- Investment Advice
- Equity Research

L.J. Bonnie Snyder  
Portfolio Manager  
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## MISCELLANEOUS

### Party Celebrating Dr. Wayne's World

Dr. Wayne Pettyjohn, professor emeritus, Oklahoma State University holds the record for most piezometers (43) at a residence. Aside from training graduate students and professionals, Wayne provided a course that retrooled approximately 1300 professionals from the petroleum industry to the water industry to provide employment from the oil bust during the 1980's. Due to the vagaries of federal rules, we do not have a list of these geologic professionals. However, we would like to have a party in honor of Wayne on Oct 1<sup>st</sup>, 2010 in Stillwater, Oklahoma. If you were a student or friend of Wayne's and would like to attend our celebrations of his career, please contact Todd Haihan at [todd.haihan@okstate.edu](mailto:todd.haihan@okstate.edu) or OSU School of Geology, 105 NRC, Stillwater, OK 74078 for more information.

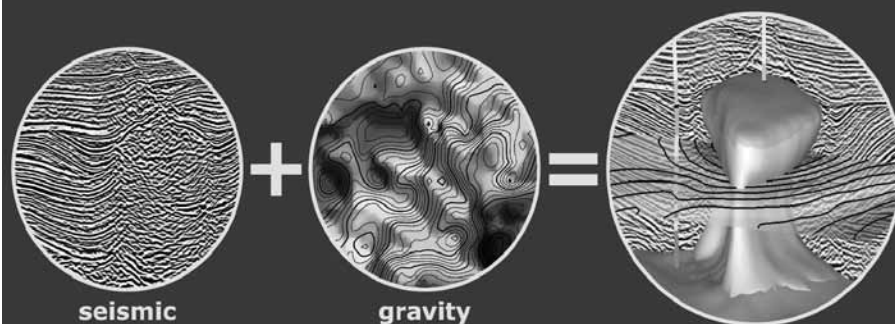
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DIRECTOR'S CORNER

# Defining and Parsing the 'Hiccup'

By RICK FRITZ, AAPG Executive Director

Membership numbers are an interesting barometer of an association's health. The general ups-and-downs of AAPG membership are clearly tied to the price of oil and gas.

The primary factor, of course, is the number of available jobs.

A secondary and perhaps more important driver for membership is most effectively stated as "program attractiveness." This is something that almost every association tries to define and develop for membership.

For AAPG, "science" is the key for "program attractiveness." That is why a good technical program drives attendees to a conference. You can walk in to your boss and say, "I need to go to this meeting, because it has an attractive program that will help me do my job better."

Other factors defining program attractiveness include networking opportunities and continuing education.

For the past five years AAPG membership has been steadily increasing. This is largely due to the number of new young people coming into our profession, but also due to growth of the non-U.S. membership. For the first time since the "boom" in the early 1980s AAPG's membership topped 38,000 total members, but then something happened – we had a hiccup.



FRITZ

Before I explain the "hiccup," please let me explain how AAPG's membership cycle works.

On July 1 of each year we drop all members who have not paid their dues the previous year. As a result the highest membership in any one year is on June 30, and the lowest is on July 1 (see chart).

Each year we send the dues statement in March, followed by several reminders. We also hire a service to contact all of the unpaid members once or twice a year.

This process has been very successful.

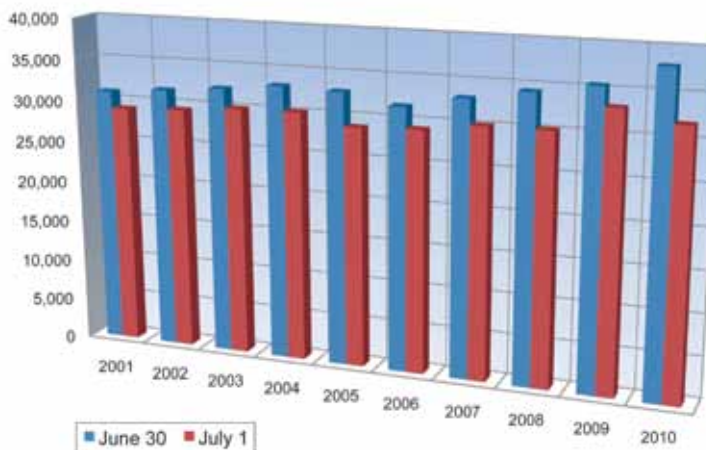
For example, for the fiscal year ending June 30, 2009, we had 35,530 members – but we dropped 2,301 of that number, so on July 1, 2009, we had a total membership of 33,229.

On June 30 of this year we had 38,044 members, but we had to drop 6,167. As a result, on July 1 we were down to 31,877 total members.

This is an unusually high number of drops.

For the past 10 years, the leadership's greatest concern was the decline in Active members within AAPG. Of course, this decline is primarily due to the aging of our membership. As a result we have activated various methods to attract more Active members. These methods include:

AAPG MEMBERSHIP TOTALS



- ▶ Emphasis on transfers to Active.
- ▶ Graduated dues.
- ▶ Corporate memberships.

As a result the decline is now around 1 percent, down from a decline at the beginning of the decade of nearly 5 percent. So Active membership is not a key part of last year's variance.

Based on our analysis, the dropped members contain a high number of students leaving university and a high number of new associates (young professionals).

This variance is tied to our significant increase in students over the past five years – from an average around 4,000 to more than 7,000 total students last year. Currently we have 211 student chapters – 92 U.S. and 119 non-U.S.

As a result of this "hiccup" we are

surveying students and young professionals to determine their employment status and plans for professional development. Economic conditions and lower natural gas prices have led to fewer jobs and more stress on staying employed. This always places negative pressure on professional development and activity in professional societies.

Another reason for the "hiccup" is many of the students like AAPG programs, stay with us for a while after graduation but then move on to other professions.

Nevertheless, we are not giving up. We are using all our resources to contact dropped members. As a result, many of them of renewing their membership. Often a simple factor like a change of address is the reason for a lapse in membership.

You can help. Look around you and just ask. Most members join because someone took the time to ask if they would like to be part of AAPG. With online applications, we have made it extremely easy to apply.

The good news is membership is still high and AAPG is still a very attractive program.

DIVISIONS' REPORT

# DEG Aims to Expand Focus, Membership

By MARY K. HARRIS, President, Division of Environmental Geosciences

As the newly elected Division of Environmental Geosciences (DEG) president for 2010-11, please let me introduce myself.

I became an AAPG member in 1984 while in graduate school at the University of Idaho, where I was actively involved in an AAPG student chapter. My affiliation with DEG began when the organization was formed in 1992; I served as an original member of the first Hydrogeology Committee.

I am excited about serving as DEG president and believe the next year offers many opportunities for the division.



HARRIS

- ▶ Environmental impacts of oil spills.

We plan to sponsor special editions on the above topics in our *Environmental Geosciences Journal* – our new editor-in-chief Kristin Carter has assembled an impressive editorial staff with a broad experience base, and is very interested in addressing issues that inherently link petroleum geology with the environment.

\* \* \*

As with AAPG's other divisions, international growth is a goal for the coming year. DEG has initiated a membership drive to attract new national, international and student members by implementing a "no dues" policy for AAPG members who join DEG.

Further, DEG is partnering with the Geological Society of London to arrange a series of semi-annual conferences on carbon sequestration topics (thanks to Peter Lloyd, DEG Advisory Board).

DEG also is working to have a more visible presence at international meetings while continuing to sponsor sessions and short courses at regional and annual meetings. DEG will continue to partner with both EMD and DPA on joint sessions and other interactions, as appropriate.

All of these are ambitious goals and require assistance and support from both



the DEG Executive Council and Advisory Board. My experience in working with DEG members on these groups over the past few years has been rewarding to say the least, as these individuals are clearly committed to both their professions and to the division.

As geoscientists and AAPG members, we should all be good stewards of our natural resources and support protection of our environment. This message has been amplified in the wake of the Gulf Coast oil spill. The spill has impacted the petroleum industry in the offshore gulf, and will eventually bring more regulation both offshore and onshore.

It is encouraging that several large players who routinely work in the Gulf of Mexico plan to invest in a more complete spill-response infrastructure. Perhaps this will encourage the government to engage with the petroleum industry more proactively on these matters.

While the spill is an environmental accident of unforeseen proportion, I agree with past DEG president Mike Jacobs' last column (June EXPLORER), where he recognized the need for a balanced approach to exploration and production while protecting the environment.

The industry also should step forward to address the engineering and safety issues associated with the spill, as well as promote

research of oil spill remediation. Tidal areas, beaches and coastal environments are important to all of us.

To quote Mike Jacobs, "I think it is fair to say the recent events taking place in the Gulf of Mexico highlight some of the purposes behind the existence of the DEG."

It is DEG's duty to communicate with the public regarding how AAPG responds – not only to the current Gulf Coast crisis but to all environmental issues affecting our industry.

As the DEG president I willingly take on this responsibility to promote education and communication between and among AAPG members and the public about these issues.

\* \* \*

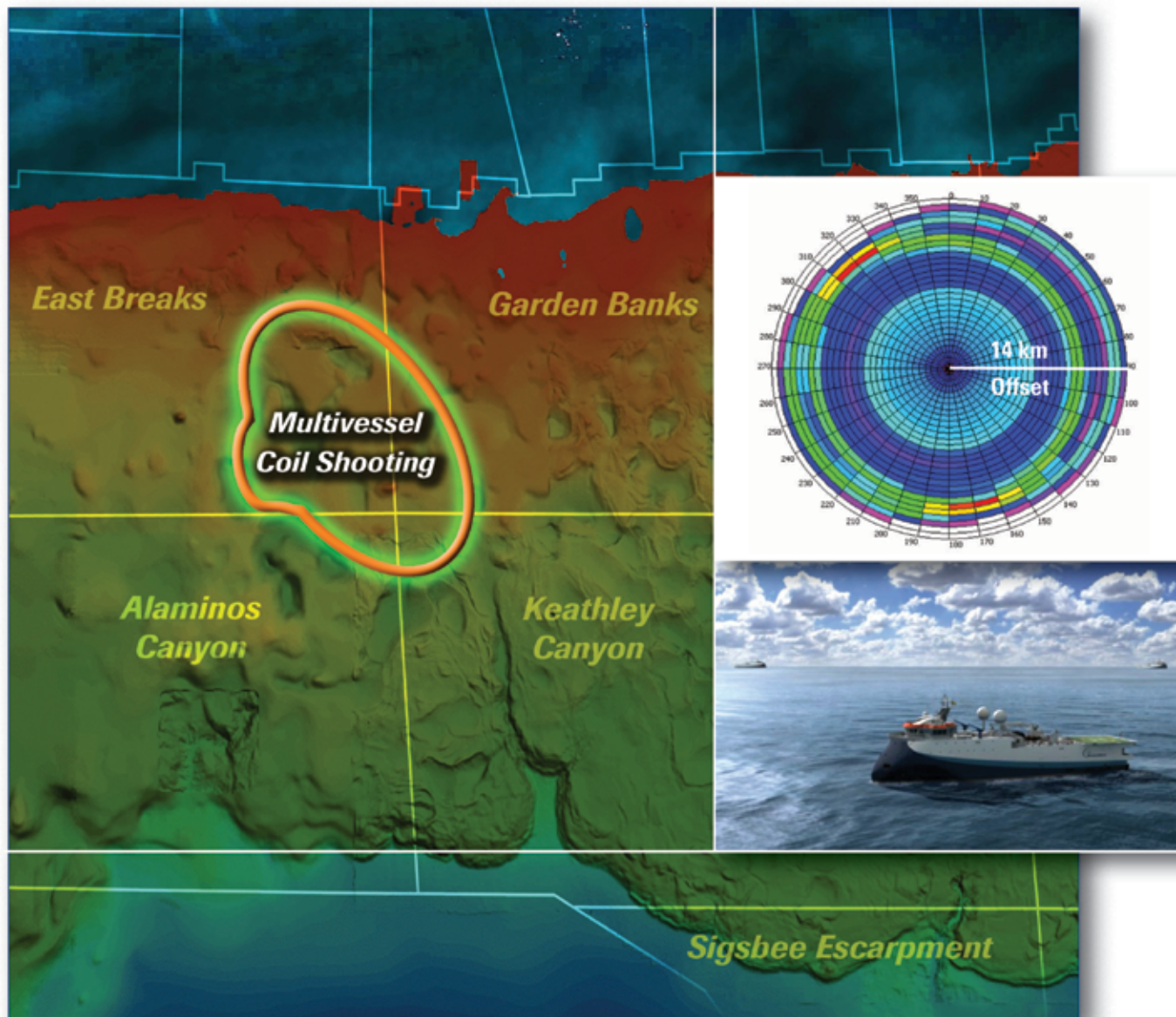
I challenge every AAPG member to become an active DEG member. By doing so, you will not only help us educate the public regarding energy and environmental matters, but you also will benefit by being kept abreast of the latest research, which offers value to both the petroleum industry and the environmental community at large.

Please consider joining DEG to promote these important messages involving the environmentally safe development of our natural resources.

Remember, good science makes for a healthy earth. ☒

# Multivessel Coil Shooting Survey

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