AAPG EXPLORER

APRIL 2016

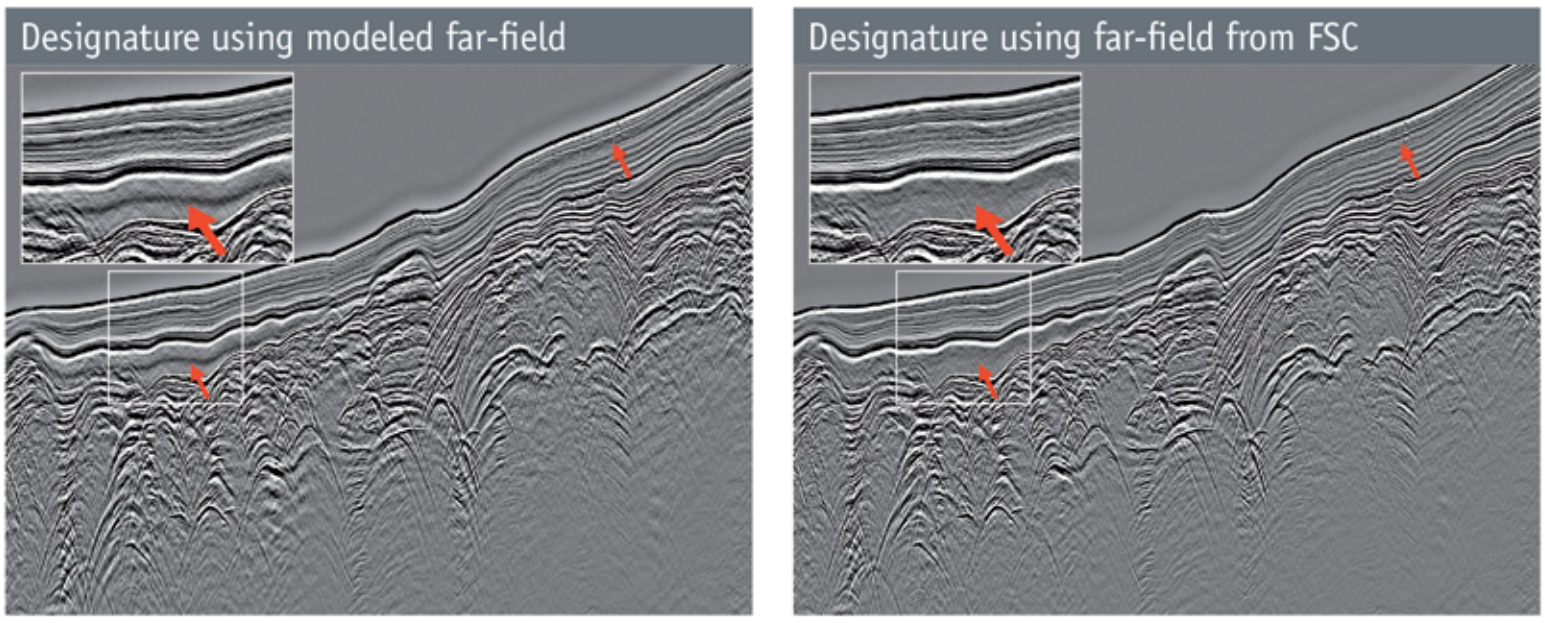
The Best of Both Worlds

Energy, environment find common cause offshore.

See page 10

Full Source Characterization

Better QC, better data, better results



Far-field signatures derived using Full Source Characterization deliver superior debubbling and more stable low frequencies. Data courtesy of CGG multi-client data library, Gabon.

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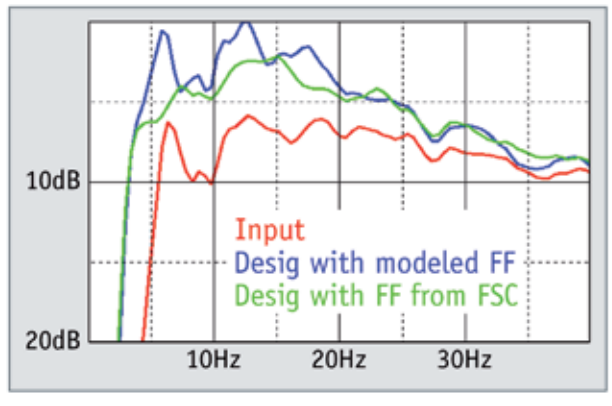

Designature using FF derived from modeling boosts the bubble, designature with FF estimated from FSC attenuates the bubble.

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Vol. 37, No. 4
April 2016

AAPG EXPLORER

PRESIDENT'S COLUMN

The New Face of AAPG

BY JOHN HOGG

As I have written in a number of columns, this has been a difficult year for all of the scientific associations with whom we closely work. AAPG has, like them, made a difficult choice to further reduce our staff size, for the second time this fiscal year, and once again great folks who have been with us for many years are now looking for new employment.

The No. 1 challenge for us is our greatly reduced revenue stream from conferences – from delegates and exhibitors who generously attend our meetings, meet with clients and exhibit their products to our conference delegates. With significant declines in their own revenues and consequent downsizing of employee bases, they are now in survival mode and are not in a position to exhibit at many shows.

In his column on the back page, David Curtiss describes the new organization at headquarters in greater detail. But the guidance we, as the Executive Committee, have provided to David and the Directors emphasized the following themes:

- **Focus on optimizing AAPG's business operations.** AAPG is a business, as I've written before, and though we are a non-profit, we must run efficiently.
- **Focus on our members and customers.** AAPG has a strong constituent base of Members, Associates, and Students. We also have many customers, such as the sponsors and exhibitors and a significant number of non-member geoscientists who support our activities. Better serving our members and customers is our primary goal.
- **Focus on relevance.** We must evaluate everything AAPG is doing, both from a business standpoint and programmatically to ensure that what we are offering our members and customers is relevant to them during this industry downturn.


HOGG

We all need to hold on and be persistent through these difficult times. The world needs energy and we will continue to be the ones who find it.

Our members are the lifeblood of this Association and that remains true even under this new organizational structure. AAPG's staff work in a dynamic partnership with our volunteers to create and provide this value to our members and to support the profession of petroleum geology. We're looking to do that even better than before.

In March, I visited the Middle East Region and attended their Imperial Barrel Award competition and the GEO 2016 Conference we hold jointly every two years with SEG and EAGE in Manama, Bahrain. The students in this Region, like everywhere, are concerned about their future and finding jobs in the energy industry. I spoke to students in Abu Dhabi, Saudi Arabia and in Bahrain about the long-term future for the industry and the need for geoscientists to provide energy to the world for the next 50 years.

I also had a wonderful visit to Saudi Aramco and they shared views on training and technology with me and SEG President John Bradford, and we were also treated to wonderful hospitality over the three days spent in the Kingdom.

The highlight of the visit was the offer by Mr. Ibraheem Assa'ada, vice president of exploration for Saudi Aramco, of a trip to the Shaybah oilfield, located in the Rub' al Khali Desert in the Empty Quarter of the Kingdom. The giant field has recoverable resources of at least 15 million barrels and 25 trillion cubic feet of gas. The Rub' al Khali Desert is a fascinating place of magnificent reddish quartz sand dunes up to 80 meters tall, interspersed with glass-like sabkahs.

An ocean of sand, a harsh environment and a challenge for early explorers and, with persistence, the discovery of a giant oilfield: We all need to hold on and be persistent through these difficult times.

The world needs energy and we will continue to be the ones who find it.

Candidate Videos Online

AAPG officer candidates for the 2016-17 AAPG Executive Committee have been announced, and videos that allow the membership to become more familiar with them, their careers and their thoughts are available online, on the Officer Candidates page of AAPG.org.

This year's slate includes contests for four offices. The person elected president-elect will serve in that capacity for one year and will then be AAPG president for 2017-18. The terms for the vice president-Sections and treasurer posts are 2016-18, and the term for elected editor is 2016-19.

The candidates are:

President-Elect

❒ **W.C. "Rusty" Riese**, retired, adjunct professor and lecturer, Houston.

❒ **Charles A. Sternbach**, Star Creek Energy Co., Houston.

Vice President-Sections

❒ **Terence G. "Terry" O'Hare**, Emerald Energy, Dallas.

❒ **Daniel E. Schwartz**, Aera Energy, Bakersfield, Calif.

Treasurer

❒ **Anwar M. Al-Beaiji**, Saudi Aramco, Houston.

❒ **Martin D. Hewitt**, retired, Calgary, Canada.

Editor

❒ **Barry J. Katz**, Chevron, Houston.

❒ **Claudio Bartolini**, Repsol USA, Tomball, Texas.

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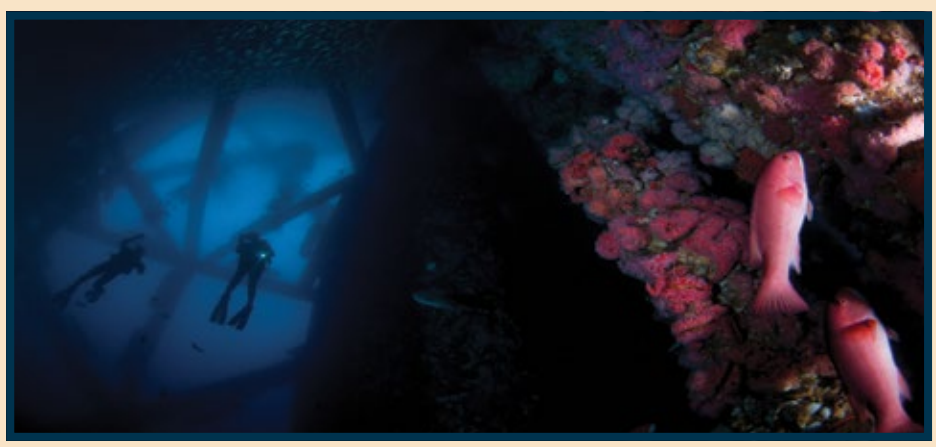

REGULAR DEPARTMENTS

ON THE COVER:

Platforms Ellen and Elly are unique because they are a double platform, connected by an above-water bridge. Platform Ellen is a drilling platform while Platform Elly houses equipment for separating the oil, natural gas and produced water. The image below is of Platform Eureka, but has been included to illustrate the transition from oil rig to reef. See story on page 10.

Left: The original image of the waters beneath Platform Eureka, where two female sheephead find shelter on the crossbeam-turned-reef. Photos by of Caine Delacy.

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Oil industry financing

Low Oil Prices Bring Tighter Credit

By DAVID BROWN, EXPLORER Correspondent

Just like Santa Claus, commercial banks have a list. That list tells them which companies they will lend to and how much each company can borrow.

Oil and gas companies usually need loans to operate and survive, so these lending determinations can be crucial. If banks cut back on lending to the industry, drilling can grind to a halt, companies can fail, jobs will be lost.

Now there are signs that banks might be ready to do just that.

Dramatically lower oil and gas prices and tighter credit have already started to bring change to the oil and gas industry, said Ron Meisler, corporate restructuring partner for Skadden LLP in Chicago.


BAYOUTH

> **"You don't want to get three months further along the path and regret that there were things you really should have done, and it's too late."**

"You're seeing the transformation already because there must have been at least a dozen bankruptcies filed so far," Meisler said. "Those companies were highly levered and they didn't have room to kick the can further down the road."

Skadden – once known to just about everybody as Skadden Arps – employs nearly 2,000 attorneys and has been called Wall Street's most powerful law firm. Its specialties include advising companies on financing, restructuring, and acquisitions and mergers.

If the banks' lending determinations limit a company's access to capital, that company can find itself in a serious financial squeeze, noted Frank Bayouth, corporate partner for Skadden and head of the firm's Houston office.

"As you go further down the path of distress, you have fewer options. And it may be that acting today is not the best decision," Bayouth said.

But, Bayouth added, executives need to be aware of all their options and act decisively when necessary.

"You don't want to get three months further along the path and regret that there were things you really should have done, and it's too late," he noted.

A Few Challenges

To make a lending determination, a bank looks at a company's reserves and production together with a "price deck," a table combining past, current and forecast oil and gas prices. Future prices will help determine whether or not a company is able to make interest payments on its loans.

"In a nutshell, what they're doing is taking a look at the price decks they have. Each bank has its own price deck," said Meisler.

To evaluate a company's assets and operations, a bank can look at the company's published reports, outside engineering reports and often its own estimates of reserves and production.

"Banks often have their own engineers who determine the validity of the estimates," Meisler said. "They also are looking at their own books."

All those pieces of information help guide banks in determining how much money will be loaned to oil and gas companies.

Today, Meisler and Bayouth see three problems facing the industry.

- **Low oil and gas price levels.**

Late-2015 production prices weren't just low, they were about 50 percent less than prices a little over a year earlier.

Nobody knows where oil and gas prices will be two or three years from now. So far, banks don't appear to be too pessimistic about future oil and gas prices.

But you can bet that banks won't be super-optimistic in their price projections, either, and those projections affect how much money the industry can borrow.

- **Expiring price hedges.**

By using hedges that lock in production prices over a long period of time, a company can avoid some of the pain of falling prices. Banks consider price hedges in evaluating a company, but eventually those hedges will expire.

"Hedges will figure into a borrowing base consideration," Meisler said. "The hedges worked great for 2015, but as we enter 2016 the hedges are rolling off."

See **Pressures**, page 6

"Knowledge has TO BE improved, CHALLENGED, AND INCREASED constantly, OR IT vanishes."
Peter Drucker

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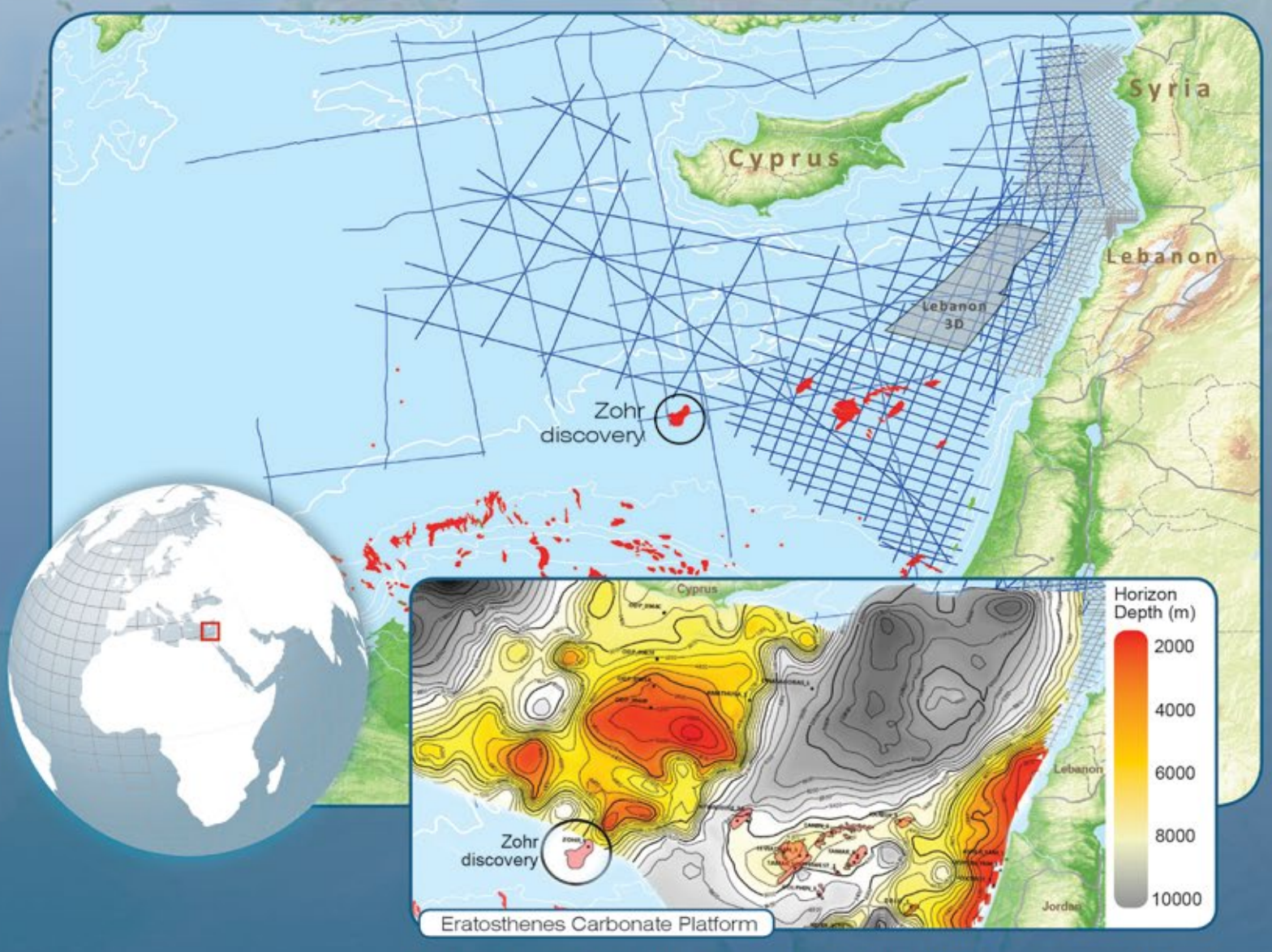
Zohr Opens the Door...

...to a Newborn Carbonate Play in the Mediterranean



The gas discovery in the Zohr-1 well (ENI 2015) has created a step change in the understanding of carbonate plays offshore Egypt and throughout the Eastern Mediterranean.

The new discovery was encountered in shallow water deposited limestone, dating from the Miocene. It is thought to represent part of a much more expansive carbonate platform extending northward and comprising several phases of carbonate build-up around the edges of the Levant Basin.

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Pressures

from page 4

Regulatory pressures.

Even before the oil-price downturn in late 2014, government agencies in the United States were warning banks to reduce their exposure to the oil and gas sector.

The Office of the Comptroller of the Currency, the Federal Reserve and the Federal Deposit Insurance Corp. reportedly have warned commercial banks to limit their loan exposure to highly leveraged, risky oil and gas companies, Meisler and Bayouth noted.

"They are putting pressure on banks because they are concerned the banks may have a lot of exposure to risk," Meisler said.

But at the same time, "the banks don't want to be seen as the reason that liquidity is being sucked out of the industry," he added.

MEISLER

> "When borrowing from alternative lenders, the risk profile of a company materially increases."

Redetermination Looms

Banks review their lending determinations and go through a redetermination period twice a year, once in the spring and once in the fall.

It looked like the banks were going to treat the oil and gas industry with a fairly light hand and not yank away credit in fall 2015, but it was too early to judge final results, Meisler said.

"We don't know how the fall (2015) redetermination is going to turn out. That chapter has yet to be written," he said.

The important spring redetermination period will come in March to mid-May 2016, and the industry will be watching the banks' lending decisions closely.

"In the secondary market, funds have deployed capital in the first nine months of this year and a lot of money has been lost. The amount of capital that's going to be available going forward is uncertain," Meisler said.

"The capital market constraint is going to be very important," he noted.

Banks using a company's reserves as a basis for extending loans don't lend against 100 percent of the reserves, as a safeguard against lower future prices.

"Once the bank comes up with a reserve amount, it will loan against 65 percent of that," Meisler said. "If you think about it, banks want to be well over-collateralized for protection against any steep drops in commodity prices."

When a bank makes a loan based on a company's oil and gas reserves, it's known as a "reserve-based loan."

"A reserve-based loan is extending credit based upon the production itself, based on the producing wells," Meisler explained.

"And we're talking about revolving credit, which is different from your typical home mortgage," he continued. "This revolving line of credit has a maximum limit you can borrow. As a company does development, as it drills, the limit can and should increase if the new wells you develop are successful."

For example, if a company has a maximum revolving credit limit of $1 billion and a borrowing limit of $450,000, the company can ask for an increase in the borrowing limit – if it has done more drilling, put more wells on production and established more proved reserves, he said.

There's a catch, though, because companies have to obtain capital to drill and establish new reserves.

"For the companies, they are in a bit of a bind," Meisler said.

A company needs liquidity – money – to drill and turn prospects into proved reserves and production. The banks lend money based on the estimated reserves and production the company already has.

It's a conundrum: An oil company has to have money to develop more reserves and production, but needs more reserves and production to establish a higher borrowing base.

Complicated Questions

When a company finds itself with limited access to liquidity, or possibly cut off from traditional commercial bank lending completely, it can face unattractive options even if alternative lenders are available.

"You're looking at alternative lenders who might have alternative motives," Meisler said. "When borrowing from alternative lenders, the risk profile of a company materially increases."

Higher interest rates and other less favorable terms are just two of the problems. A lender might extend credit hoping it can gain equity if a company fails to meet repayment obligations, a tactic called "loan to own," according to Meisler.

"Another way a company can raise cash is to sell assets," he noted. "The problem is, the companies want to hold on to their assets that are most valuable. The assets that aren't as valuable won't bring in as much liquidity."

What should a company do if it finds itself with a serious liquidity problem?

How can a company best protect its investors, directors, executives, stakeholders and employees?

"A company in that position should be hiring advisers," Meisler said. "These questions are very complicated."

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'Old Reliable'

Production On the Rise in GOM

By LOUISE S. DURHAM, EXPLORER Correspondent

The U.S. Gulf of Mexico might best be dubbed 'Old Reliable'.

It's been churning out hydrocarbons since 1947 when the first well drilled from a fixed platform out of sight of land marked the debut of the offshore oil and gas industry.

Derided as the "Dead Sea" a number of years ago during one of the industry's infamous bleak periods, diminished activity at the time eventually did a "180" and just keeps on going even today.

The region's crude oil production is estimated to increase to record high levels in 2017 despite record low prices, according to the U.S. Energy Information Administration's Short-Term Energy Outlook, February 2016.

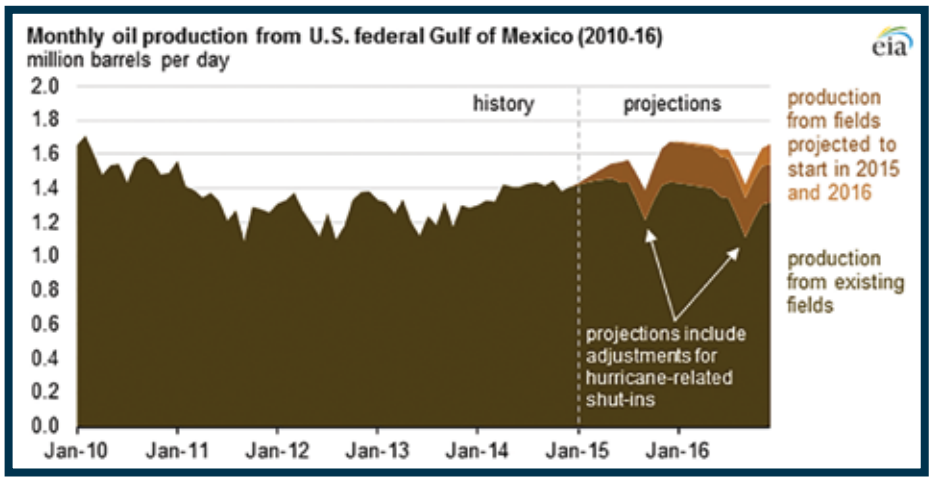
The numbers are impressive.

The government agency projects that federal GOM production will average 1.63 MMbpd in 2016 and 1.79 MMbpd in 2017, reaching 1.91 MMbpd in December 2017. In all, the area's production is expected to account for 18 percent and 21 percent of total forecast U.S. crude oil production in 2016 and 2017, respectively.

Offshore GOM production has little in common with its onshore counterpart.

In the Lower Tertiary deepwater activity, for example, both water and reservoir depths are a considerable challenge to drilling and production.

Look at Chevron's Jack/St. Malo program where the tension-leg platform is positioned in 7,000 feet of water with some target reservoirs sitting many thousands of feet beneath the seafloor.



This is a typical scenario for the region, a testament to why such projects move at a virtual snail's pace, often spanning several years between discovery and production.

Over the course of evaluating, planning and constructing these massive, high cost, long term projects, short term oil price gyrations are relegated to the back burner, as opposed to onshore, where producers must keep a wary eye on such price movements.

Increasing Uncertainty

Even so, the EIA noted that current decreasing profit margins and lowered expectations for a quick oil price recovery have convinced many GOM operators to scale back on future deepwater exploration spending, reduce their active rig fleet by scrapping and stacking older rigs, and either restructure or delay drilling rig contracts.

As a result of these actions, there is increased uncertainty relative to the timeliness of a number of GOM projects. Those in the early stages of development are at the greatest risk of delay or cancellation.

GOM Fields

The EIA noted that eight fields came online in the GOM during 2015. All except one was developed as a subsea well tied back to production facilities nearby. Using subsea tiebacks, producers can reduce project costs as well as start-up time.

The lone exception was Anadarko's Lucius field, which spans several blocks in the Keathley Canyon area in 7,168 feet of water about 180 miles off the Louisiana coast.

Lucius produces oil via a truss spar, which is a type of floating production platform that supports drilling, production and storage operations. Designed to provide increased stability in harsh offshore circumstances, this spar is the largest in the Anadarko fleet.

The company's Heidelberg field in 5,271 feet of water started production in January 2016, producing at a spar using the same design as the Lucius, according to the Environmental Protection Agency. Heidelberg is in the Green Canyon Block 159, about 140 miles offshore Louisiana.

In contrast to Lucius and Heidelberg, production at Shell Oil Co.'s Stones field in 9,556 feet of water in the Walker Ridge area about 250 miles southwest of New Orleans will utilize the first floating production, storage and offload (FPSO) vessel in the GOM, the EIA noted.

FPSOs enable development of complex fields with unique reservoir properties and no existing infrastructure.

Crude produced at the Stones complex will be transferred to tankers for transport to some of the myriad U.S. Gulf Coast refineries.

Two additional fields anticipated to begin producing in the deep waters of the GOM in 2016 are subsea tiebacks as well as a couple of fields slated to begin producing in 2017.

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A jack mackerel "bait ball" forms underneath the platform. This behavior is an instinctual defense mechanism, as a lone mackerel is more likely to be eaten than a large group. Photos by Caine Delacy.

Oil Rigs Become Haven For Sea Life

By BARRY FRIEDMAN, EXPLORER Correspondent

Oil companies and environmentalists are popularly – albeit inaccurately – perceived as natural enemies by the general public. But, the marine life dwelling offshore California and other oil-producing locales knows nothing of this supposed antagonism. All they know are the drilling rigs where they thrive.

"They're incredibly valuable ecologically."

That's Emily Callahan, a marine conservation biologist and oil and gas consultant and explorer. She, along with oceanographer and environmental scientist Amber Jackson, runs Blue Latitudes, a company of marine scientists, communication specialists, software developers and designers who specialize in ecological solutions for offshore structures, namely "Rigs-to-Reefs" (R2R).

One of their allies: the oil and gas industry itself.

But more on that in a moment.

Blue Latitudes offers opportunities and solutions to oil and gas operators to modify a platform to continue to support marine life as an artificial reef, rather than being ripped from the ocean floor, which can be dangerous and expensive.

"The research has shown that it's beneficial in California," said Callahan about R2R. "We've also spoken with other scientists in the North Sea and the Gulf of Mexico who have conducted similar studies on these platforms and they found similar results."

Benefits of R2R

Specifically, according to Jackson and Callahan, R2R:

- Presents a cost-savings compared to full removal and onshore disposal.
- Creates marine habitat with the potential to enhance depleted fish stocks in the regions.
- Provides socio-economic benefits through enhanced fishing and utilization by recreational user groups.

LOVE

> **"Some ... dislike the oil industry and dislike anything artificial in the ocean and thus don't care one way or another how these platforms are functioning as sea life habitat."**

Naturally, members of the oil and gas industry – for reasons both altruistic and economic – support such efforts.

"It's been very interesting, because we've done a lot of work in support of these platforms, but the oil companies are very aggressive and want the program to happen because it saves them money. They don't need, for instance, to invest in technology in having to pull them out of the water," said Callahan.

The cost of that technology can be substantial, because no two platforms are constructed identically – not to mention the potential damage to existing ecosystems in the area – so it is cheaper for the rigs to be left where they are.

Left – Amber Jackson is an oceanographer, environmental scientist and entrepreneur. Right – Emily Callahan is a marine conservation biologist, oil and gas consultant and explorer.

Loyal Opposition

The pushback, at the moment, is from the public.

"The law doesn't say the rigs have to stay there. The companies have the option to remove them, but the status quo is not something the public sees in the same way," said Callahan.

She believes the criticism, though, comes from a lack of understanding among the public.

"And why would they see the value of these reefs, why should they? The work is being done below the platforms," she added.

While Callahan and Jackson are convinced of the benefits of leaving the rigs where they are, there is plenty of debate on the subject among scientists and academia as well as among the public.

To that point, Milton Love, a research biologist at the Marine Science Institute of the University of California, Santa Barbara, who has done much research on the topic, said there isn't just one issue at stake.

"That's a hard one to answer. Ultimately, the question is what roles do the platforms off California play as habitats for sea life? Right now, there is substantial evidence that these structures often harbor large numbers of both adult and juvenile fishes and that they are more productive as fish habitats than many, if not most, natural structures," he said.

Another issue is what to do with the platforms during decommissioning, he added.

"Some folks would view my results as suggesting that platforms are just great big reefs and thus should be left

See **Money**, page 15

AAPG Education Upcoming Education Events 2016

LAST CHANCE!
AAPG HEDBERG RESEARCH CONFERENCE CENTER

The Future of Basin and Petroleum Systems Modeling
April 3-8, 2016, Santa Barbara, California, USA

The conference aims to bring together professionals from academia, government agencies and industry who are actively involved in pushing the technical limits and application of basin modeling. New ideas are welcomed from R&D scientists (whether they have an academic or industry background), the hardware/software computing industry, exploration business units of the oil and gas industry, or any closely related disciplines, e.g., geochemistry or geothermal industry. Students are also welcome as long as they are able to actively contribute.

The four main goals of this conference are:
1. To share knowledge, experience and opinions across different affiliations in BPSM
2. To identify limitations of concepts, workflows and technologies and to explore new solutions and potential improvements in BPSM
3. To promote awareness that integration is key to solving complex E&P challenges
4. To better understand the subsurface processes for specific areas of interest through case studies

Mudstone Diagenesis: Implications for Exploration and Development of Unconventional Reservoirs
16-19 October 2016, Santa Fe, New Mexico

The purpose of this conference is to foster the free exchange of new ideas among leading experts from industry, academia, and government on the controls and impacts of inorganic and organic diagenesis on mudstone hydrocarbon generation, reservoir properties and seal quality.

FORUMS

LAST CHANCE!
Pittsburgh Playmaker Forum
April 13, 2016, Pittsburgh

This forum is a one-day event preceded with a PAPG monthly dinner meeting on the evening of 12 April 2016; providing an opportunity to come to Pittsburgh the day prior to the forum, network with local geoscientists and enjoy an Appalachian Basin technical talk.
The workshop will provide insight to the strategy and tactics used to propel a company from start-up into a successful player and ultimately through an initial public offering, in an area of the Marcellus and Utica Shale plays dominated by large independent exploration and production companies. Networking opportunities will be available during the morning and afternoon breaks, before and after the luncheon and during a planned mixer after the forum. Register Today.

GTW

New Thinking and Value Propositions: ProActive Steps Now
May 17-18, 2016, Houston

The goal of this two-day workshop is to proactively create opportunities for yourself and your company in a low price environment. You will learn how to bring value propositions to operators. Revitalize reservoirs for less than the cost of plugging and abandoning, paid for by increased production. Rethink reservoirs and push paradigm shifts that will result in breakthroughs. We will discuss how to use these times to pilot new products and technologies and thus position innovative companies to boom when conditions improve. This event is for engineers, geologists, geophysicists, land professionals, and entrepreneurs. Register Today.

SCHOOLS AND SHORT COURSES

LAST CHANCE!
Basic Well Log Analysis — April 25–29, Austin, TX; July 11–15, Golden, CO

LAST CHANCE!
How to Find Bypassed Pay in Old Wells Using DST Data — April 26–28, Austin, TX

Petroleum Geology for Engineers — May 1, Houston, TX (with OTC)

Modern Terrigenous Clastic Depositional Systems — May 31–June 7, 2106, South Carolina; September 11–18, 2016, South Carolina

PROFESSIONAL DEVELOPMENT AT ICE BARCELONA 2016

AAPG|SEG International Conference & Exhibition 2016
April 3-6 2016, Barcelona, Spain

ICE BARCELONA SHORT COURSE

Advanced Sequence Stratigraphic Applications for Exploration (SEPM Course)
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Instructor: Vitor Abreu
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How To Turn a Dry Hole Into a Success Story

By DAVID BROWN, EXPLORER Correspondent

Dry hole.

Two of the worst words in offshore exploration.

When per-well costs offshore can reach into the hundreds of millions of dollars, no one wants to drill a duster.

So are dry holes nothing but failures?

"Not if they provide information that sets up the next discovery," said AAPG member John Snedden, senior research scientist and director of the Gulf Basin Depositional Synthesis Project at the University of Texas-Austin.

Snedden gave the example of Texaco Inc., Royal Dutch Shell PLC, Amoco Corp. and Mobil Corp. coming together in the late 1990s to drill an exploration well in the deepwater Gulf of Mexico.

They held leases on a large and promising undrilled structure, but little was known about it. It was far offshore in the Alaminos Canyon area. And it was in deeper water than anyone was used to drilling.

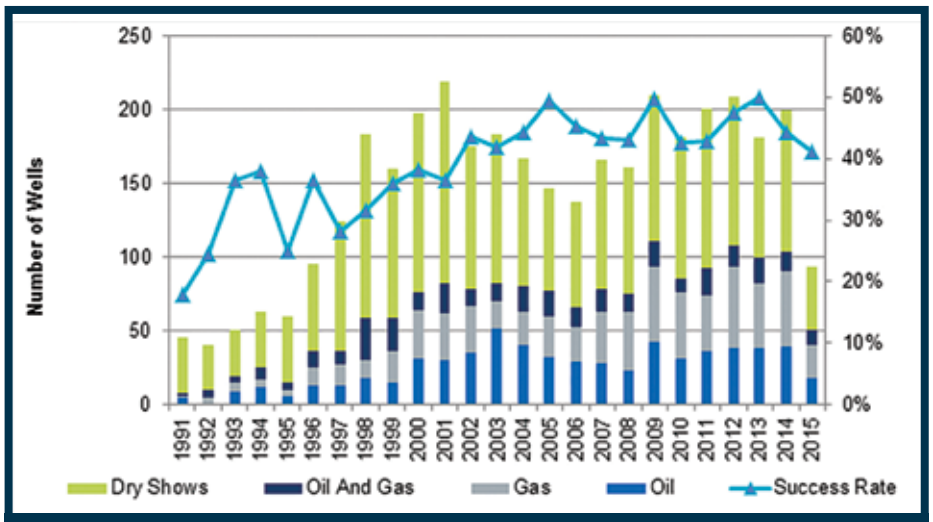
Plus, they didn't know what to call the prospect.

Each company had its own prospect name, leading to a combination of Brachiosaurus, Alpha Centauri, HI-C and Anaconda.

In the end, they compromised and called it BAHA.

"It took a while to drill the well, and BAHA 1 didn't reach its objective. Then BAHA 2 finally reached objective," Snedden said.

At that point, the exploration consortium had one failed attempt and one costly dry hole on its hands. But it also had gained compelling evidence of a thick column of sandstone that no one knew existed.



Graphic courtesy of IHS.

"Everybody was astounded. Where did all this sand come from?" Snedden recalled.

"Most people consider that to be the play opener for the Paleocene play in the Gulf of Mexico, the Lower Tertiary play. Now we're up to billions and billions of barrels of oil from that play," he said.

Snatching Production From The Jaws of Dry Holes

Experts say dry holes can be labeled successes when they uncover information that leads to discoveries, or when they have sufficient impact on future exploration.

"To most people, a 'dry hole' is one that doesn't result in economic production. It can still be a technical success," said AAPG member Bob Fryklund, chief upstream strategist for IHS in Houston.

Since the 1990s, explorers have greatly increased their odds of success in drilling deepwater offshore prospects. But based on the industry's overall success rate today, a truly exploratory offshore well is more likely to be a dry hole than not.

"On a global basis, we're still running around 40 percent. The high-impact wells are somewhat less," Fryklund said. "A high-impact well is one that opens a new play in a new basin, or the same thing in a producing basin."

The threshold for labeling a well "high-impact" has come down over time, he noted.

At one time, a well was considered high-impact if it found at least 250 million barrels of oil equivalent (boe), he said. Now, a well that discovers a 100 million boe accumulation could be called high-impact.

The type of prospect also matters. A frontier play-opener well or a well in an unconventional reservoir might not have to meet even that standard, Fryklund said.

"What's advanced that further is the tight rock convention. We've learned to look more closely at the rock in the reservoir," he explained.

Snedden said wells that discover hydrocarbons in less-than-economic amounts are not true dry holes when they've been evaluated as potential producers.

"If it's not commercial, it's a dry hole. Essentially you're walking away. You're plugging and abandoning the well," he said.

"Anything that's even considered for development I would consider 'discovered undeveloped.' That's not a dry hole. Those are different categories, especially if you keep the lease," he added.

Those undiscovered undeveloped wells can provide crucial information, especially for independents who follow up with further work and their own evaluations, and sometimes drill meaningful discoveries on the same prospects.

"The inventory of discovered undeveloped is pretty large. That's how

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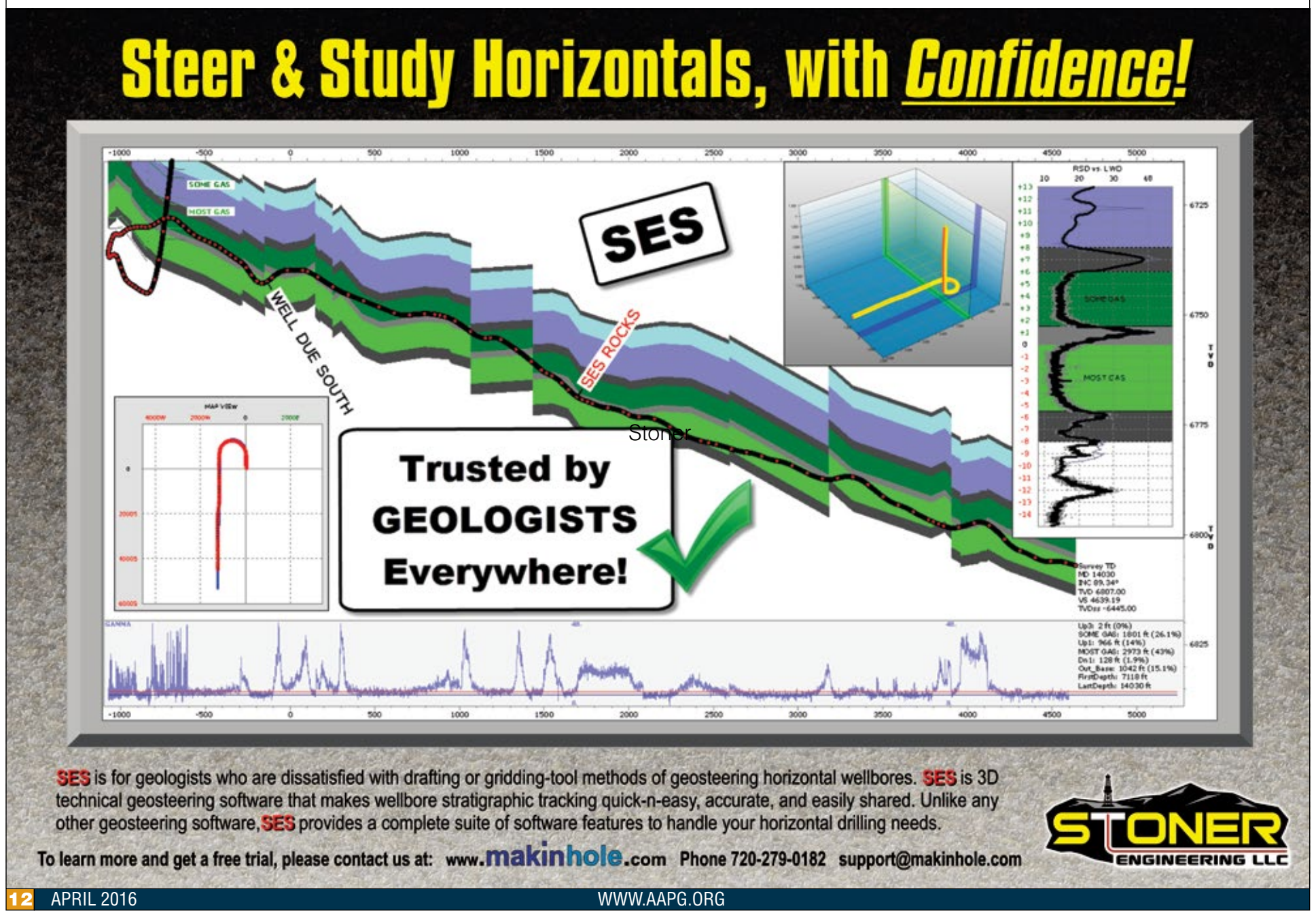

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a lot of these independents get started," Fryklund noted.

In today's price environment, the oil and gas industry faces a challenge in making large investments offshore. Drilling too many dry holes is no doubt a bad thing. Drilling too few might be a bad thing, also.

"Going forward the question is, 'How much damage will the price reset do?' Exploration is the first thing to get whacked," Fryklund said. "It's going to take a couple of years for things to get reset."

Notable Dry Holes

One dry hole that led to major production more than 20 years later was the Baccalieu 1-78 offshore Canada, Snedden said.

Esso PAREX and partners drilled the North Atlantic exploratory well in 1985 in the Flemish Pass Basin, about 300 miles northeast of St. John's, Newfoundland.

"It was a dry hole but it discovered a really high-quality Kimmeridgian age source rock, up to about 4 percent (total organic carbon)," Snedden noted.

"Baccalieu set up the big Bay du Nord discovery more than 20 years later. That's the Statoil discovery. With its partner Husky Oil it had drilled the Harpoon and Mizzen wells in the Flemish Pass," he said.

Snedden himself took part in a groundbreaking dry hole effort in what became the Makassar Strait Production Sharing Contract in the Mahakam Delta area, offshore East Kalimantan, Indonesia.

"One that I know very well, because I worked on the well, was the Perintis," he recalled.

"Mobil drilled a well called Perintis-1 back in the '90s. It was the first well drilled in the deepwater Kutei Basin. And it found a source rock," he said.

Although the well encountered a noncommercial accumulation of natural gas, it uncovered both a source rock and a viable petroleum system.

"With this Type III petroleum system, our big question was, 'Could you get source rock into the slope and basin?'" Snedden said.

The One Thing Dry Holes Should Always Produce

Dry holes have been around about as long as oil production.

Edwin Drake drilled the first commercial oil well in the United States near Titusville, Pa., hitting total depth at 69.5 feet on Aug. 27, 1859. According to the American Oil and Gas Historical Society, the first dry hole happened just four days later.

John Livingston Grandin was so inspired by the Drake success that he decided to drill in an area of oil seeps near Tidioute, Pa., about 20 miles away. Grandin and a partner leased 30 acres at $10 an acre, built a 20-foot derrick and used a discarded tram axle to make a reamer.

The well reached an astonishing 134 feet of depth before the axle drill got stuck. Blasting powder failed to dislodge the equipment. Thus the first failed well following the Drake discovery was on the books.

One thing all dry holes produce is information. Any time a company drills a well "you should leave that well with lessons learned. Every company does a post-mortem on a dry hole," Snedden noted.

"The logs themselves are the most important piece because they give you information about lithologies, the seals,

SNEDDEN

> **"If you spend $100 million drilling a well and what you have is the logs, you can trade that for other information. It has trade value."**

the source rock. There may be pressure information," he said.

Because companies are able to keep well data and other information proprietary for a time, they are in a position to trade with other operators for information that can de-risk future drilling, according to Snedden.

"If you spend $100 million drilling a well and what you have is the logs, you can trade that for other information. It has trade value," he said. "That's why companies endeavor to keep that information private for 18 months."

The ability to de-risk an exploration project is often the difference between proceeding or backing away.

"Based on my experience as an exploration manager, in most companies the rule of thumb is you only buy something where additional information can reduce risk," Fryklund said.

Earlier this year, Faroe Petroleum PLC announced that the Wintershall-operated Kvalross exploration well in the Norwegian sector of the Barents Sea was a dry hole. Faroe and Wintershall Norge each held 40 percent of the 9,570-foot test.

Graham Stewart, Faroe chief executive, sounded almost chipper in commenting on the well.

"Whilst the results for the Barents Sea Kvalross well are disappointing, we are pleased that the well has been drilled significantly below budget and to have encountered hydrocarbon shows which will add to the large data bank we now hold over this prospective frontier area," he said.

That type of discovered data is what can make a dry hole more than just a dry hole.

"It's a data point. In the project I lead here, we use well data," Snedden said. "Most of the data points are dry holes."

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'Long-lasting benefits'

OTC Houston Promotes Efficiency, Resiliency

By EMILY SMITH LLINÁS, EXPLORER Correspondent

In a time of low energy prices and market volatility, it is more important than ever for energy professionals to develop the tools to stay competitive and efficient.

The Offshore Technology Conference (OTC), set for May 2-5 in Houston, provides the perfect opportunity.

The annual event, organized by 14 sponsor societies, including AAPG, offers training courses, technical sessions, networking activities, a research showcase and a nearly 700 square-foot exhibition.

In 2015, OTC drew more than 90,000 professionals from more than 120 countries.

AAPG member Buford Pollett, chairperson of OTC's AAPG Committee and assistant professor at The University of Tulsa, said the current industry environment makes sharing new techniques and best practices more important than ever.

"Due to improvements that the industry has made in productivity, some projects that were barely commercial two years ago at $50 per barrel are commercial now in the 30s," Pollett said. "They aren't making a lot of money, but they are making some. It's survivable."

Last year's OTC drew in excess of 90,000 people from 120 different countries. A similar turnout is expected this year.

Competing in Lean Times

The partner societies work together to bring their topics to the table – and as a result of the current environment, a recurring subject this year will be making companies efficient and competitive during the current low price environment.

For example, the panel session "Coping with local oil prices: perspectives from energy leaders" will feature perspectives from top energy managers who explain how they're coping with the crisis. The d5 innovation session following OTC is entitled "Thriving on Volatility: Opportunities Challenges, and Solutions."

Pollett said the OTC Organizing Committee's balance of seeking papers for specific topics and receiving ideas organically through abstract submissions results in a program that is diverse, relevant and global.

"Oil and gas does predominate, but even those industries that are not carbon-based have room at the table at OTC," he said, noting that this year's program includes sessions on mining and offshore wind.

Global Perspective

OTC 2016 also dedicates an entire day to Mexico's energy reform, which has opened new markets to investors and operators in the Gulf Coast Section.

"Even though Mexico has been around for years, the market opening up makes it like a new market," Pollett said. "It's a key driver to keep Houston developing projects close to home."

Pollett said international participation at OTC is one of the biggest changes he has seen since he started volunteering eight years ago.

"On the OTC exhibit floor, you are just as likely to see companies from Russia and southeast Asia as you are from Humble, Texas," he said. He noted that international participation not only increases participation and exhibition space, it enhances the event's resilience and technical quality.

"The beauty of the technical program is the opportunity to read abstracts from authors from around the world," he added.

OTC participants will get a global perspective at AAPG's recommended session, "Geotechnics for Well Design," which includes presentations from the United States, Brazil, China, Norway and Ireland.

The session, chaired by Eric Cauquil of Total and Robert Little of Chevron, will present advances in geotechnical approaches for top hole risk assessment, with particular attention to well conductor fatigue analysis, wellbore stability, surface casing design and overburden pore pressure prediction.

Cauquil, offshore site investigation and geohazard expert, said successful frontier exploration activities in deep water depends on geotechnics, which examines shallow sediments located in the first 200 meters below sea level.

"As exploration is moving in always deeper frontier areas, very shallow geology may have an impact on the design of the well and its integrity in terms of HSE and non-productive time, and as we all know, time is money," he said.

Cauquil noted that 10 percent of the overall oil and gas industry costs for drilling are related to shallow geology and geotechnical problems such as stuck pipe, lost circulation, wellbore instability, and shallow overpressure.

He insisted that properly designed wells not only save money, but also help operators avoid accidents and environmental disasters.

Cauquil said he expects the geotechnics session to be informative and timely, particularly during an industry downturn.

A major focus will be gathering knowledge from different companies, and to review their developments and methodology.

"We want companies to share their experience, provide feedback and propose new ideas and best practices," he elaborated. "We also want to be sure that all operators have access to the proceedings from the session so they can use this information to make operations better and safer."

Cauquil said the geotechnics session will help professionals working in the Gulf of Mexico, offshore Brazil, West Africa and other deep water areas.

Personal Touch

Pollett said OTC sessions provide long-lasting benefits both to event participants and their employers, noting that the personal interaction with presenters greatly enhances their ability to understand concepts and to apply them in their own jobs.

"You can go to a database and do research and find articles, but you're much more likely to understand, appreciate and utilize technical aspects of a paper if you listen to a person talk about his or her work," he said. "You know that person, you've met them, you've talked to them after the speech and you can call and ask questions. You can't get that searching a database for the paper. I see that over and over again at OTC."

Another benefit OTC provides is the opportunity to interact with professionals from different disciplines. He described OTC as a "large-scale partner meeting."

"When you're in the industry working on a project, you have partner meetings where you bring together engineers, geoscientists and technical people," he said. "What you're doing at OTC is seeing projects on a global scale instead of one project at a time. At OTC you have the opportunity to see top-notch projects from around the world. Where else are you going to get this, except at OTC?"

Return on Investment

Cauquil, who conducts well-site investigations worldwide, said he travels less during the industry downturn, but he would not think twice about flying from Paris to Houston the first week of May.

"OTC has the perfect stage for networking and meeting with counterparts from other operators. It's the biggest event of the year for networking and exchanging information regarding problems and opportunities in our industry," he said.

Pollett said OTC also provides benefits for those who are not currently employed.

"In these times we need to ask what you can do to increase your skill set, not just O&G but your ability to do other things. You've got to make sure you maximize your toolbox," he said.

In his position at The University of Tulsa, Pollett sees firsthand the effects of low oil prices on students and colleagues.

"I had one student; he and his wife worked for the same company and got cut on the same day. I feel a moral obligation to make sure he and his wife and kids make it through," he said.

"During bad times, the companies and individuals who make it through will be more productive. But there is a human impact. We need to make the transition easier. This is real, and it's not going to be easy. Those of us who still have jobs should reach out and do what we can do to help others along so it's not a situation where they're frowned upon," Pollett added.

Regardless of current status, industry professionals can be a part of the OTC network. The event offers both one-day and four-day rates, as well as discounts for students. The OTC Committee continues to seek new volunteers to plan events in the United States and worldwide.

For information about OTC and serving on the committee, visit 2016.otcnet.org.

Money
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at least partially in place after they are decommissioned. Some dislike the oil industry and dislike anything artificial in the ocean and thus don't care one way or another how these platforms are functioning as sea life habitat," Love continued.

This last point is one backed up by Callahan.

"People are very scared of oil and they associate oil platforms with oil spills and want to see them gone," she said.

There are oil platforms and then there are oil platforms.

"In the Gulf of Mexico, there are thousands of them there, there's a revenue flow, lots of jobs associated with them, but in California, there are only 27," said Jackson. "Not a lot of jobs, people don't have access to the platforms and when you talk to most people opposed, they bring up the 1969 Santa Monica oil spill."

And, of course, there's the issue of money.

"The law, as it stands, says that oil companies have to donate 55 percent of their cost savings to the state in an endowment for marine preservation," she said.

This figure, according to present law, goes up as the years go on. After 2017, it increases to 65 percent, then five years later, it goes to 85 percent of costs determined by a third-party that comes in to validate the cost of leaving the rigs in place.

If 23 of the deeper platforms were decommissioned and left, Jackson said it would mean around $700 million to the state.

"The public reception views this as 'the oil companies are winning,'" she said.

The value is placed on the rigs by third parties, she said, to ensure objectivity before payments are scheduled. The companies, for their part, don't want to be seen going against public perception, and don't want to get involved in "green washing" by pushing too hard, Jackson said, so they're going slowly.

As for the environmental concerns about the actual rigs once they're left, Callahan said the outlook is favorable.

"The truth is we don't know if these platforms are going to last a thousand years or what they're going to look like. We do know they were engineered to stand and to stay standing, versus other forms of artificial reefs. I mean, they have run subway cars off the coast of New York, toilets off the coast of Florida, trying to cultivate life. And those things were not designed to be put in the ocean," she said.

Aside from some members of the public, the biggest detractors are trawl fisherman – those who use fishing nets and pull them along the bottom of the sea or in mid-water at a specified depth.

"These trawl permits pass on from generation to generation, so those who have had their area interrupted by these oil platforms want to see these platforms completely being taken out so they can have their historic fishing grounds restored," said Callahan.

Changes and Expansion

There are legislative changes, both in the air and underwater, in the California Legislature that will clarify many of these concerns, including:

- Confirmation that liability would go to the state or a wildlife agency after decommission, while the petroleum company would forever retain liability on the well itself.
- Changing the cost savings to a set fee from the outset.

If the research continues to validate it, both Callahan and Jackson hope to expand R2R to places like the North Sea, Australia, the Indian Ocean and Malaysia.

They also want to emphasize they are not in favor of more offshore drilling, but support the drilling already completed being put to good use.

"We see this as a win-win," said Jackson. "Emily and I both drive cars, we both use plastics, so this is just a positive use of the oil platform structure that actually helps the environment and is sort of a silver lining to offshore oil and gas development."

Union Oil's Platform A was the source of the 1969 oil spill offshore Santa Barbara.

Alleviating Impacts from Drought in California

By DANIELLE WOODRING, American Geosciences Institute Intern

Pervasive drought conditions still dominate the western United States from the Pacific Northwest to the Colorado Basin, resulting in significant negative agricultural, hydrological and economic impacts. California has been hit the hardest: it is only recently seeing some relief from its fourth consecutive year of drought, but it remains to be seen if that relief will have any lasting impact.

According to the Congressional Research Service, as of Oct. 1, 2014, almost 60 percent of California had experienced "exceptional" drought conditions. Recharge rates for snowpack, aquifers, lakes and streams have been at an all-time low, and groundwater basins have been overdrawn to compensate for the lack of fresh water, resulting in large reductions in water deliveries across California's agricultural sector.

The severity of the drought is illustrated in these images of Folsom Lake, a reservoir formed by Folsom Dam, located 25 miles northeast of Sacramento. In the July 20, 2011 view, the lake was at 97 percent of total capacity and 130 percent of its historical average for that date. In the Jan. 16, 2014 shot, the lake was at 17 percent of capacity and 35 percent of its historical average. Photos by the California Department of Water Resources.

State and Local Water Conservation

In April 2015, Gov. Edmund Brown Jr. became the first governor in California's history to issue an executive order mandating statewide water reductions in response to the increasing drought conditions.

The measures also included programs to develop water efficiency technology, replace old appliances with newer water-efficient models, and swap 50 million feet of grass lawns for more drought-tolerant landscaping.

These efforts, as well as federal partnerships with state and local lawmakers, are intended to help California expand water management programs for water storage facilities and water recycling and conservation initiatives.

At the state level, the California Water Action Plan and the Water Quality, Supply and Infrastructure Improvement Act have helped local communities adapt to drought conditions and achieve a more sustainable water management environment.

The Water Action Plan makes investments in water conservation and recycling and expands water storage, safe drinking water, and watershed and wetland restoration.

Under the plan, increased collaboration among state agencies has accelerated emergency relief efforts to supply water to drought-stricken communities.

Furthermore, the State Water Board (SWB) was able to streamline its recycling permitting processes for landscape irrigation, dust control and community supplies.

The Water Quality, Supply and Infrastructure Improvement Act provides an additional $7.5 billion dollars to the state's water conservation effort.

This funding will go toward water supply infrastructure projects and restoration efforts for ecosystems and watersheds as well as drought mitigation efforts within the California Department of Water Resources (CDWR).

California's water districts and local agencies are also incentivizing water conservation programs by rewarding good behavior and penalizing waste.

For example, the Newhall County water district in southern California offers rebates and incentives for turf replacement and water-smart irrigation controllers.

Other water districts have implemented restrictions on outdoor watering budgets and employed water waste patrols.

To get the message out about water conservation efforts, water districts in California have developed complex outreach and education plans, including social media campaigns, festivals, drought-friendly gardening classes and community partnerships. These campaigns have focused on simple measures such as prohibiting the use of potable water to wash hard surfaces, requiring leaks to be repaired, and shutting off hose nozzles.

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Federal Partnerships

Water districts in California have also entered into federal-level partnerships with the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration's (NASA) Earth Science Division to help local communities monitor, mitigate and adapt to the intense drought.

Satellite imagery and remote sensing technologies from NASA have proven particularly vital in assisting California's struggling agricultural sector.

For example, NASA is currently working with the CDWR to provide high-resolution satellite data to local water managers throughout California from its Moderate Resolution Imaging Spectroradiometer (MODIS) system, Satellite Irrigation Management Support (SIMS) system, and Gravity Recovery and Climate Experiment (GRACE) satellite.

MODIS is an instrument mounted on two of NASA's satellites that transmits daily observations of vegetation coverage at a resolution of 15 to 16 acres. MODIS provides the data behind California's Vegetation Index as well as much of USGS's Landsat imagery.

CDWR uses these data to provide communities with nearly real-time assessments of land idling and significant vegetative change during the times of drought.

Data collected from SIMS provides local water managers with information on crop conditions and canopy development over time. This, in turn, allows farmers to adjust the amount of water to give their crops. These partnerships allow for accurate drought monitoring and mapping of fallowed agricultural areas.

NASA Earth Science's GRACE satellite also provides key data to communities suffering from drought in California. Data from GRACE generate groundwater and soil moisture drought indicators on a weekly basis.

Maps of these indicators help California residents understand the drought as it relates to natural climatic variability versus drought conditions which could be human-induced.

CDWR has also joined with USGS California Water Science Center and universities to provide decision makers with drought maps for fallowed agricultural land in California's Central Valley.

The Water Science Center works directly with drought-stricken communities to monitor drought impacts on streamflow, surface water, and groundwater quality and availability.

The Science Center then conducts projects ranging from groundwater basin water quality assessments for drinking water supplies to assessing land subsidence using global positioning systems (GPS) and Interferometric Synthetic Aperture Radar (IfSAR) technology.

The city of Santa Barbara, Calif., for example, is working with the Water Science Center to update its groundwater information.

Other programs that provide helpful information to state and regional water resources offices throughout the nation include the Cooperative Water Program, the National Streamflow Information Program and the State Water Resources Institute Program.

Drought Mitigation Measures in Congress

Members of Congress have responded to the drought in California with two main bills: the Western Water and American Food Security Act (H.R. 2898) in the House, and the California Emergency Drought Relief Act (S. 1894) in the Senate.

The House bill, introduced by Rep. David Valadao (R-CA), contains several titles that focus on maximizing water deliveries to farmers. The key challenge legislators face is how to increase the amount of water supplies to water users without further threatening or endangering fish species or degrading water quality.

The Senate bill, introduced by Sen. Dianne Feinstein (D-CA), would ensure federal support for water recycling and desalination projects in California and also authorizes funding for water storage projects such as enlarging dams and reservoirs.

The bill calls for collaborations between federal agencies such as the USGS and the Environmental Protection Agency in order to promote the alleviation efforts. H.R. 2898 passed the House of Representatives on July 16, 2015 and is up for consideration by the Senate. S. 1894 has yet to be taken up by the Senate.

Other bills have been introduced in the 114th Congress, including H.R. 291, S. 176, H.R. 2983 and S.1837, which support research and development on desalination plants and water storage facilities.

Scientists, engineers and policymakers at the state, local and federal level are developing and implementing innovative measures to alleviate the impacts of the current drought. They are also collecting and analyzing data from multiple sources to support decision making based on accurate, up-to-date information and to support long-term planning for a variable water supply in the western United States.

Danielle Woodring, AGI intern.

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Natural fracture interpretation: What to look for

Interpretation of petroleum geomechanics and fracture data is increasingly central in many exploration and development situations. This issue will investigate petroleum geomechanics interpretations, encompassing examples from structural geology, rock mechanics, petroleum engineering, and geophysics to address a wide range of geomechanical problems that arise during the exploitation of oil and gas reservoirs. Topics to be covered include the exploration, assessment, and production phases of petroleum reservoir development.

The editors of *Interpretation* (www.seg.org/interpretation) invite papers on the topic **Natural fracture interpretation: What to look for** for publication in a February 2017 special section to supplement the journal's regular technical papers on various subject areas.

We are seeking submissions on related topics including:

- What are the key interpretation challenges for petroleum geomechanics?
- How have geomechanics interpretations been applied throughout the asset life-cycle?
- What information can geophysics provide about determining the impact of critically stressed fractures on drilling and production?
- How can geophysics help to define different modes of rock failure and deformation?
- How do we identify the causes of fault slip and the extent of aseismic fluid flow in existing fractures?

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

The submissions will be processed according to the following timeline:
Submission deadline:
1 May 2016
Publication of issue:
February 2017

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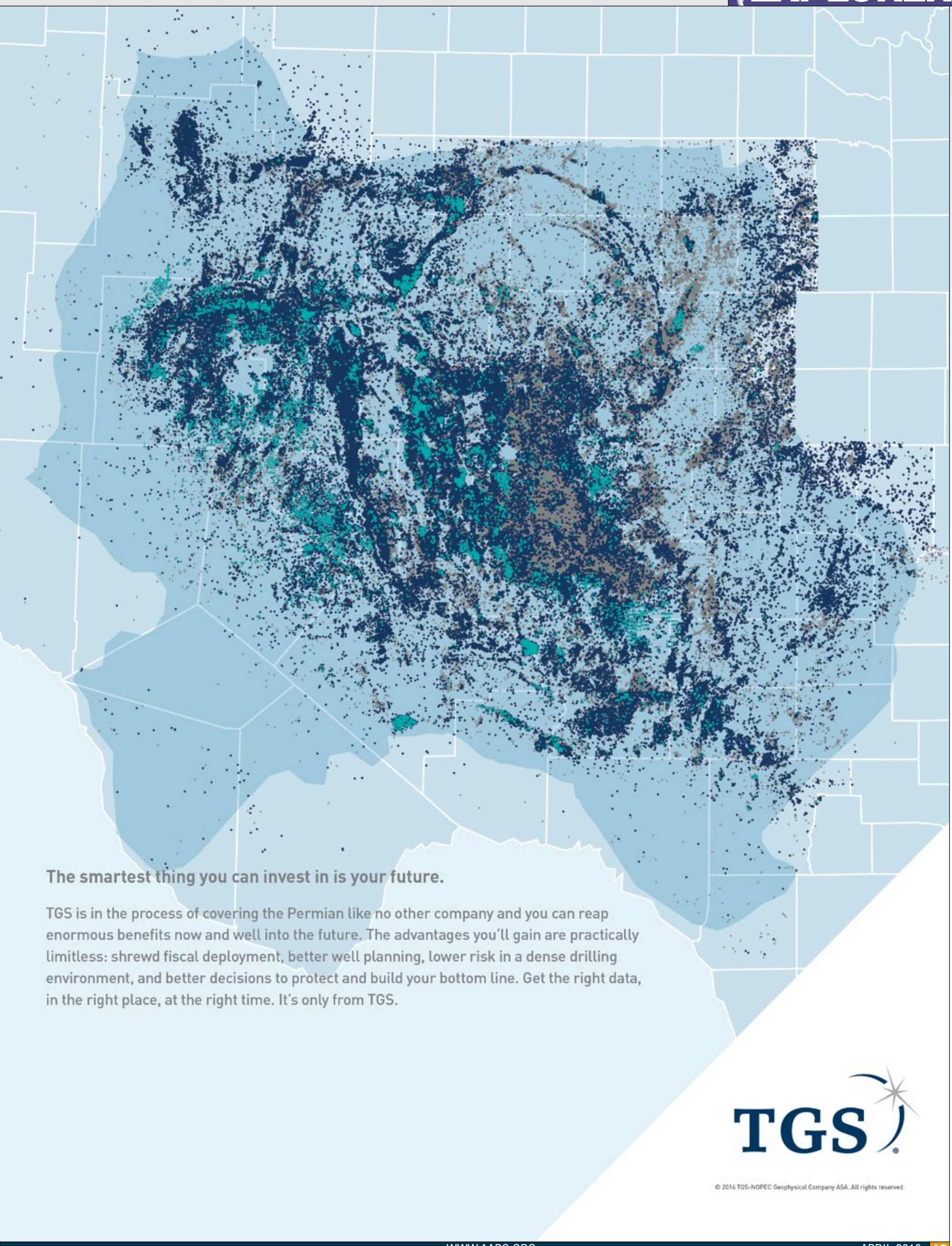

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Canada Region YPs Prepare for ACE 2016, Ramp Up Activities

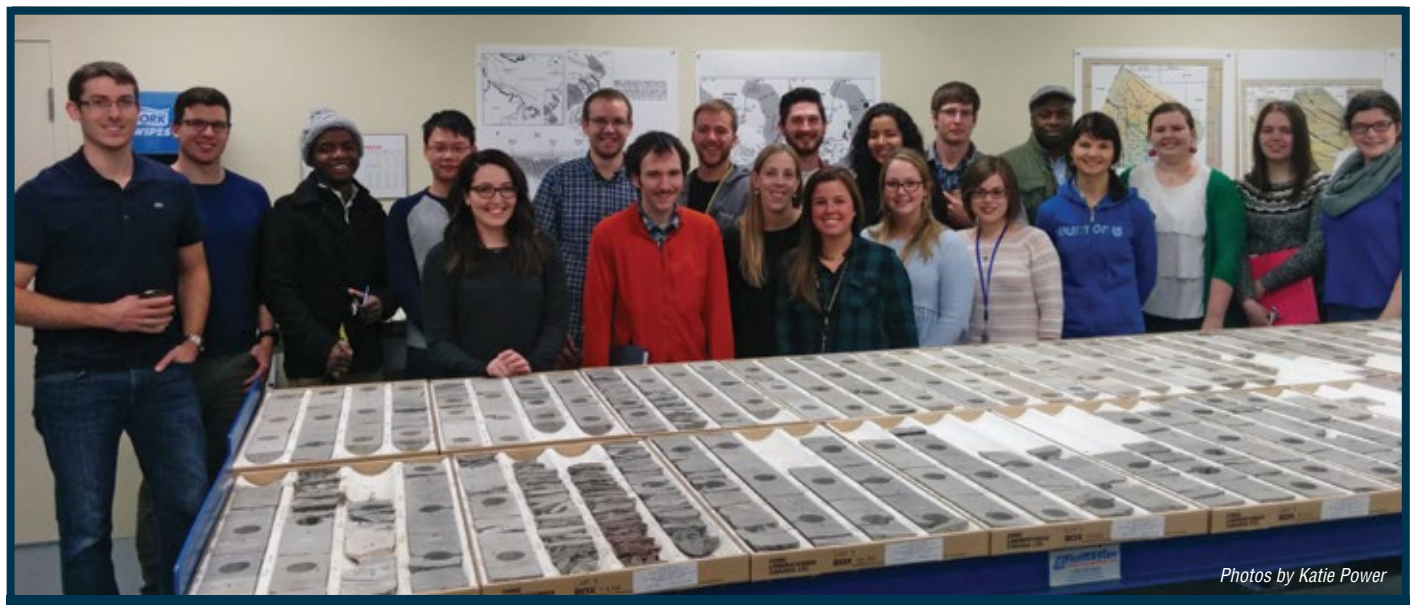
By ROBYN PAUL, KATIE POWER and MERIEM GRIFI

The Canada Region Young Professional (YP) Committee (Meriem Grifi, Robyn Paul, Katie Power, Leanne Tingley and Zen Weleschuk) has been making great strides to increase awareness and activities for YP members in the Region. Our current initiatives include improving the student-to-YP transition, collaborating with other societies and expanding knowledge of the YP program beyond Calgary, Canada's central oil patch.

The group is excited to bring more opportunities to YPs across the country.

We are planning a couple of volunteering events this spring, as well as a Skype series to connect Student Chapters across the country with working YPs. Follow us on Twitter @aapg_canada_yp for updates on these projects.

One of the group's biggest accomplishments this year was putting together a proposal for the first-ever YP field trip. The trip, which the team has been working on since last June, will precede the AAPG Annual Convention and Exhibition 2016 in Calgary this summer. All YPs attending this year's ACE are encouraged to register for the Young Professionals Guided Hike to Stanley Glacier and Marble Canyon, Kootenay National Park. Participants will have the chance to learn about and see some Burgess Shale fossils. Dr. Jean-Bernard Caron, a world-renowned leader in research on the Burgess Shale, will be one of the field trip guides along with Dr. Robert Gaines. Along the trail, our guides will provide interesting facts and history on the formation and paleontology of the area, making this a trip you won't want to miss.



Photos by Katie Power

The Inter Society Young Professionals Holiday Social in Calgary and was co-hosted by AAPG, SPE, CSPG, SEG and CSEG.

PAUL

POWER

GRIFI

The field trip takes place Saturday, June 18. There are only 24 spots available so registration will fill up fast.

The committee is actively working on a coast-to-coast YP program within the Region and has had great success with recent events in Newfoundland and Alberta.

AAPG Canada Region YP Events and Updates

On Monday, Dec. 21, a mix of East Coast AAPG student and YP members visited a local core facility for an afternoon short course on the history and geology of the Jeanne d'Arc Basin.

Frank Ryan and Harry Fowlow led the discussion and participants had the opportunity to examine some sample logs and to ask questions, which led to a number of thoughtful group discussions. And, some holiday chocolates were up for grabs for correct answers, which spurred some healthy competition.

The rest of the afternoon focused heavily on the geology of the main reservoir units at Hibernia, including the Ben Nevis/Avalon and Hibernia sandstones. Thanks to posters provided

Continued on next page

The American Association of Petroleum Geologists (AAPG) and the Society of Petroleum Engineers (SPE) have partnered to host the inaugural Africa Energy and Technology Conference (AETC) to be held 5-7 December 2016, at the Safari Park Hotel in Nairobi, Kenya. The conference will bring together the leading professionals in the oil, gas, and renewable energy sectors and experts in engineering and technology. The target attendance will be upstream industry and renewable energy professionals, executives, practitioners, researchers, regulators and academia.

Africa ENERGY AND TECHNOLOGY CONFERENCE

Call for Papers Coming Soon

The call for papers topics are;
- Exploration and Production
- Drilling and Completion Technology
- Project Commercialisation
- Health, Safety and Environment
- Social Responsibility
- Transitioning to a Sustainable Energy Mix
- Emerging Natural Gas/LNG Markets
- Managing Water Resources
- Business and Infrastructure Development

Conference website www.africaetc.org coming soon.
The call for papers will open on the 21 March.

SPE International Society of Petroleum Engineers

AAPG Africa Region

The Inter Society Young Professionals Holiday Social was developed jointly to bring YPs more opportunity to network and bridge the gap between engineering and earth science.

The all-night bowling, scavenger hunt style bingo game and appetizers helped keep the event rolling.

Continued from previous page

by Niall Toomey, there were a number of visual aids to help describe the environment of deposition of these sandstones.

Attendance for this event was double that of the inaugural event held the year before.

It would not have been possible without the generosity of Steve Finney, Edgars Rudzitis and the people at Geotech Services Core facility in St. John's, Newfoundland and Labrador.

Additionally, many thanks to Frank Ryan and Harry Fowlow for volunteering their time and knowledge for this event.

Western Canada Update

In western Canada, the Inter Society Young Professionals Holiday Social commenced on Dec. 15 in Calgary, co-hosted by SPE, CSPG, SEG, CSEG and AAPG. This event was developed jointly to bring YPs more opportunity to network and bridge the gap between engineering and earth science. The appetizers, all-night bowling and scavenger hunt-style bingo game helped keep the event moving at a high pace. Also, AAPG supplied t-shirts to promote the Sundown Science Series, which were in high enough demand that none were left over by the end of the event.

Overall, it was a huge success with 231 people in attendance, of whom at least 34 were AAPG members, 44 were CSEG members, 68 from SPE and 85 non-members.

Together, we raised a whopping $545 at the door for the Calgary Food Bank.

Thanks to everyone who came out and helped make this year's social a success, and a special thanks to Michael Hauer and the SPE team for giving us the opportunity to collaborate with them on this event.

How To Get Involved

Want to get involved with YP activities in your area? Connect with us! Like the AAPG Young Professionals Special Interest Group Page on Facebook, follow us on Twitter and Instagram (@aapgypsig) or visit us online at www.aapg.org/youngpros to contact your Region/Section YP Committee representative.

Editor's Note: Robyn Paul is the West Coast Canada YP lead and a recent graduate of the University of Calgary. Katie Power is the East Coast Canada YP lead and a student and research assistant at the Memorial University of Newfoundland. Meriem Grifi is the Canada Region YP lead and works at Husky Energy.

Future Looks Bright For U.S. LNG Exports

By EDITH ALLISON, Geoscience and Energy Policy Office Director

In late February, the first liquefied natural gas (LNG) shipment left the United States. It sailed into an economically difficult global market with excess supplies of LNG, sluggish growth in energy demand, and exceptionally low oil prices against which global LNG prices are often set.

However, many analysts and policymakers see reasons to expect growing demand for U.S. LNG.

A July 2015 report by the Task Force on the U.S. Energy Boom and National Security chaired by Senators Lisa Murkowski and Mark Warner, "Empowering America: How Energy Abundance Can Strengthen U.S. Global Leadership," enumerated some of the LNG demand drivers.

A January 2016 Atlantic Council report, "Surging Liquefied Natural Gas Trade: How U.S. Exports Will Benefit European and Global Gas Supply Diversity, Competition, and Security" authored by Bud Coote considered similar encouraging signs for U.S. LNG exports:

- European states want to diversify their oil and gas supply away from Russia, even as their need for imports increases because of declining domestic production.
- Asian demand will continue to grow faster than other regions, and Asian consumers want to diversify their supply from the Middle East. In addition, China may limit the volumes of gas it imports from Russia.
- Latin America and the Caribbean need a cost-competitive energy supply given the decline in Venezuela's subsidized oil. The International Energy Agency (IEA) projects that these regions' natural gas demand will outpace their production.
- Africa and India need low-cost fuels to generate electricity while reducing air pollution, especially in expanding urban areas.


ALLISON

The United States and Australia dominate the development of new large-scale LNG export facilities.

Challenges to Growth Demand

However, growth in demand for U.S. LNG faces major headwinds: competition from coal and renewables, and a growing number of LNG suppliers and new liquefaction terminals. The United States and Australia dominate the development of new large-scale LNG export facilities.

Australia's LNG export infrastructure is more developed than that of the United States – Australia's first cargoes were shipped in 1989. In addition, the country is expected to add six new export terminals between 2015 and 2020 with a total capacity of over 70 billion cubic meters per year.

Australia and the United States will probably not be in direct competition, however:

- Most U.S. export facilities will come online later than those in Australia.
- Australian exporters are expected to ship exclusively to Asia.
- Most U.S. exports will originate on the Atlantic or Gulf coasts and will probably target Europe and the Americas, as long as global oil and gas prices are low.

Less Dependence on Russia

The opportunities for exporting LNG to Europe are looking up. In February, the European Commission (the executive body of the European Union) proposed new natural gas and LNG rules in its Security of Gas Supply strategy. The proposal should encourage U.S. exports in the interest of reducing dependence on Russian gas.

By way of background, natural gas is one quarter of EU energy consumption. Less than half of the EU's gas needs are currently met by domestic production; the rest is imported, mainly by pipeline from Norway (30 percent), Russia (39 percent) and Algeria (13 percent). In recent years LNG has accounted for around 10 percent of natural gas imports, with most of that coming from Qatar, Algeria and Nigeria. In the future, EU gas consumption is expected to decline due to improvements in energy efficiency, but domestic production will also decline. One concern is that many EU states depend on a single gas supplier.

Currently, the EU has LNG import capacity to meet 43 percent of total 2015 natural gas demand, which is much more than it is using, but its LNG imports are not accessible to Baltic and eastern European member states.

The EC natural gas strategy aims to ensure energy markets function properly and there is a secure supply of natural gas within the EU. Pertinent elements that could affect LNG include:

- Infrastructure improvements to allow all states to access international LNG. Generally the Baltic central-eastern

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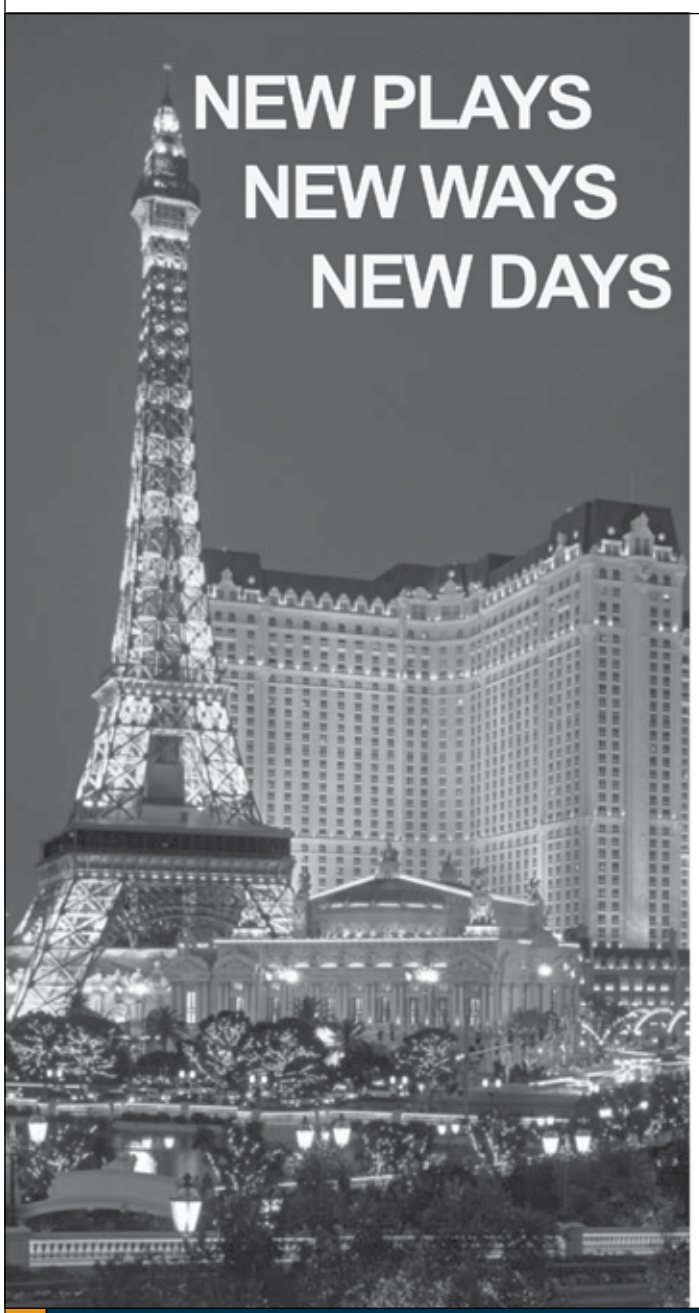

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Extended Submission Deadline 1 June 2016

Abstract Limit 250 words | Find more submission instructions at Section websites

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EOR Method Creates Market For Carbon Emissions

By LOUISE S. DURHAM, EXPLORER Correspondent

Oil storage facilities are virtually overflowing, commodity prices continue to languish in the doldrums with occasional upward blips, and angst permeates the industry.

Many take what comfort they can from the fact that the world runs on oil, and past extreme price gyrations have aptly demonstrated that high prices tend to peak and ultimately crater at some point, only to rise again.


McCONNELL

Today, the industry at large is waiting to see history repeat itself.

A positive aspect to price downturns is that they provide the gift of time to develop new, more efficient technologies to enhance anticipated upswings through economies of scale, for example.

To this end, improvements in the realm of already existing technologies, such as enhanced oil recovery (EOR) applications, are underway given the anticipation for higher demand and prices in the future.

EOR technology and its potential to increase production garnered significant attention in the late 1970s. It continued to attract interest and enthusiasm until the Big Crash in commodity prices in the early 1980s sent the industry into a tailspin.

The more expensive 'exotic' oil recovery applications quickly faded from the headlines – that is, until prices improved.

Much of the future oil supply in the United States is expected to come from existing wells, where producing conventional reservoirs frequently retain about two-thirds of the crude therein, leaving about 400 billion barrels stranded in place, according to the U.S Department of Energy's National Energy Technology Laboratory. Some portion of this will be a ready-made target for EOR applications.

CO_2, Among Other Methods

EOR programs using thermal, chemical, CO_2 and other methods have proven to be commercial on land in the United States and elsewhere.

Offshore EOR is a bit of a laggard given its more challenging logistics and economics.

Even so, various technologies are being studied, improved and evaluated for use there, including biological, surfactants and secondary polymers, among others.

CO_2 injection appears to be the leader of the pack.

A relatively straightforward description of this EOR process belies its complexity.

The CO_2 is injected into the reservoir under high pressure and the vaporization of the hydrocarbons alters the system composition at the invading gas front to the extent that the two otherwise immiscible fluids become miscible.

Simply put, the CO_2 decreases the viscosity of the oil it reaches and allows it to flow more readily to the wellbore. A portion of the injected CO_2 remains sequestered in the pores of the reservoir rock.

> **This more efficient CO_2 performance ... means that many additional offshore oil fields may become economically viable.**

But, you say, carbon is a dangerous waste product – a threatening greenhouse gas at the epicenter of climate change.

That's only part of the story.

There's an upside here, if you listen to 35-year energy industry veteran Charles McConnell, executive director at Rice University's Energy and Environment Initiative and former assistant secretary at the DOE. McConnell is a designated

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and southwestern regions lack diverse gas sources, large storage facilities and access to LNG. This goal will be helped by stronger regional coordination proposed in the draft regulations.

- Encouraging renewables and energy efficiency.
- Emphasizing LNG for diversification and competition.

The EC strategy notes that the 2015 Paris Climate Conference, COP21, favors renewables, but the EC recognizes the need for natural gas as bridge fuel, and the necessity to increase imports of natural gas as European production declines.

A few interesting questions that arise from the EC strategy is how Nord Stream II, a Russia-to-Germany pipeline through the Baltic Sea that could potentially come online in 2019, would contribute to EU diversification objectives.

One other area of interest is the 2016 Atlantic Council report's observation that the fastest growing sector of natural gas use is transportation, including ships. This is only unexpected because low diesel prices have slowed the U.S. transportation sector's adoption of natural gas. The International Association for Natural Gas, Cedigaz, projects that LNG use in heavy-duty vehicles will grow significantly in the United States, Europe and Asia. In addition, the International Convention for the Prevention of Pollution from Ships, (MARPOL), stimulates marine use of LNG, a cheaper alternative to low-sulfur oil-based fuels to meet new emissions limits.

Eastern Section AAPG
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For a full list of proposed topics visit our website
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For more information about abstract submission requirements:
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The planning committee would like to thank Appalachian Geological Society for this ad space

Abstract deadline is Friday, May 20, 2016
John Hickman - jhickman@uky.edu
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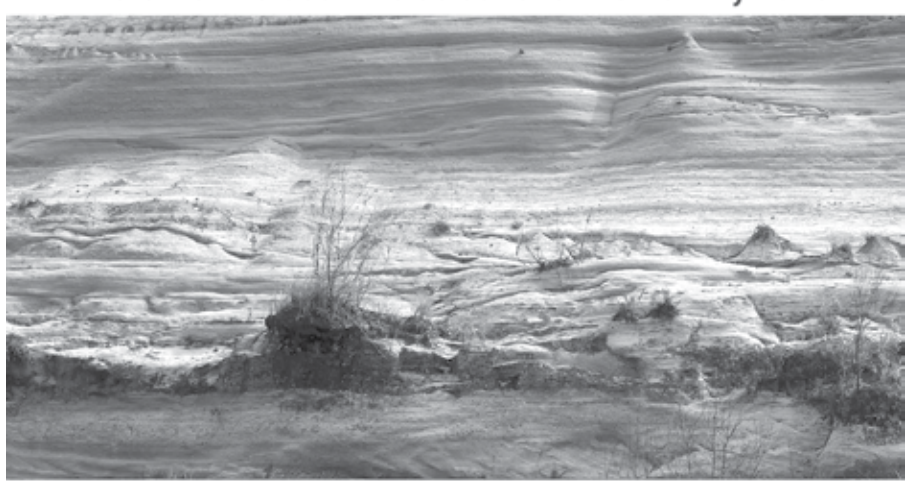

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Historical Highlights is an ongoing EXPLORER series that celebrates the "eureka" moments of petroleum geology, the rise of key concepts, the discoveries that made a difference, the perseverance and ingenuity of our colleagues – and/or their luck! – through stories that emphasize the anecdotes, the good yarns and the human interest side of our E&P profession. If you have such a story – and who doesn't? – and you'd like to share it with your fellow AAPG members, contact Hans Krause at historical.highlights@yahoo.com.

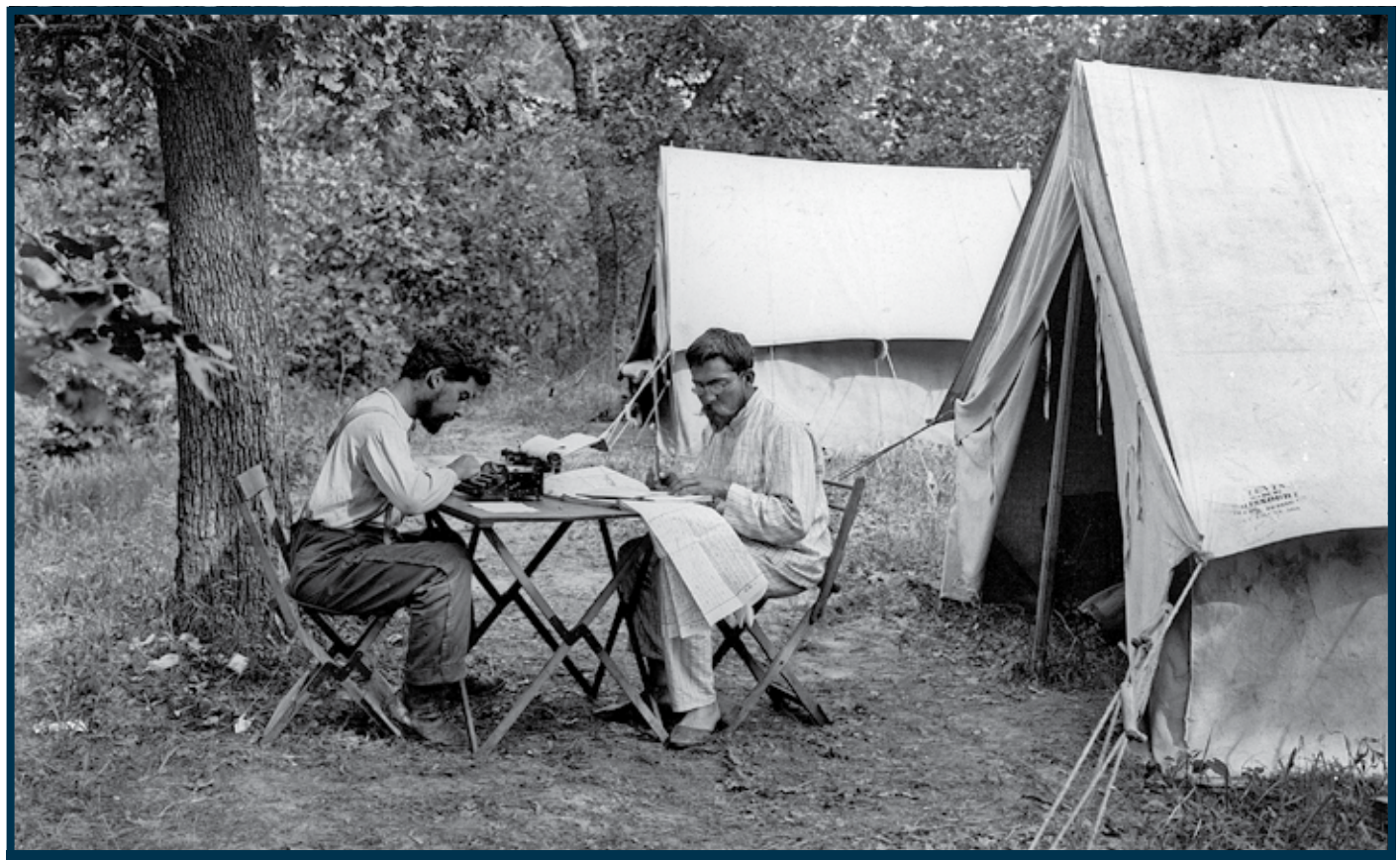
The Rise of the 'Swiss Mafia'

By MONIKA GISLER and DANIEL M. TRUEMPY

When one of us joined Royal Dutch Shell in 1980, seven out of 27 young professionals in the basic training course were Swiss, or at least had studied in Switzerland – a remarkable number of students from a tiny country that does not produce oil or gas (with the exception of an occasional puff of gas in the Finsterwald "field").

Significant numbers of managers and senior technical specialists at that time were also Swiss.

The term "Swiss mafia" was coined by our Dutch colleagues, and it wasn't meant in a complimentary sense.



Arnold Heim and Eduard Blösch. Photo courtesy of ETH Zürich, Bildarchiv.

Why the Swiss?

The reasons for the initial employment of Swiss geologists in the early years of the 20th century were threefold:

- Having the Alps in their backyard, Swiss geologists enjoyed a particularly good training ground for geology, including structural geology, stratigraphy in complex tectonic contexts and "sedimentology" (yet to be defined then), under splendid outcrop conditions.
- Because Switzerland was a neutral country, and in addition not one perceived as burdened by a colonial past, Swiss geologists could travel relatively easily into the world at difficult times during World War I, between both wars and during World War II.
- Easily forgotten today now that Switzerland is a "rich" country, Switzerland was in the early years of the 20th century, a very poor emigration country, and the opportunity to gain a good salary by working "in the oil" was eagerly grasped by a great number of Swiss geologists.

Today, the situation has changed. There is still a trickle of young Swiss geologists and engineers joining the petroleum industry, but their numbers are much more in proportion to the size of the country. This also reflects the fact that jobs in geology in Switzerland are easier to find and well remunerated.

In 2013, Monika Gisler published the book, "Swiss Gang – Pioniere der Erdölexploration," issued (in German) as part of the series "Schweizer Pioniere der Wirtschaft und Technik." The book gives an overview of the origins of what was later to become the "Swiss mafia." The present article is mostly extracted from this book.

Warda Bleser-Bircher

Petroleum geology was in the early days a job for men. Rare were the women who ventured into this domain; rarer still were those who took upon themselves the then arduous task to travel to remote and difficult countries.

In that context, it is remarkable that a Swiss geologist was one of the first (if not the first) women geologists to work in the petroleum industry. Warda Bleser-Bircher (1905-2006) studied geology in Zurich and, jointly with her later spouse Paul Bleser, looked for work in difficult times after graduation in 1935. In 1937, she worked in Turkey as a paleontologist while her husband moved to Colombia with a contract for Shell. In 1941, she found employment with Shell Egypt (in her parents' country of residence), before moving to Tehran in 1941 as an employee of the National Department of Mines, eight years before the Iranian government called in a Swiss group of geologists to systematically review those parts of the country not operated by the Anglo-Iranian (BP) group.

Josef Theodor Erb. Photo courtesy of Photographic Services, Shell International Ltd.

Josef Theodor Erb

The first geologists out of Switzerland left mostly for Indonesia, where Royal Dutch and its precursor companies had found huge reserves. Perhaps the most famous among them was Josef Theodor Erb (1874-1934), who, jointly with Englishman Charles Hose, is credited with the discovery of the Miri field in Sarawak (Malaysian Borneo).

Erb worked for the Royal Dutch company and traveled to Sumatra (Palembang), which was the center of Indonesian oil activities at the time, in the year 1900. There, where oil had been discovered as early as 1885, he met with several other Swiss geologists (among them Arnold Heim, son of the legendary guru of alpine geology Albert Heim) and applied new drilling methods, not only concentrating on seeps but also on the structural geology where these seeps were found (Miri was actually one of the first structures to be drilled solely based on geology, not on seeps). Erb was, during his successful years in Indonesia and Malaysia, one of the first Swiss to systematically recruit other Swiss geologists for work in Indonesia – perhaps the original "Godfather" of what was later to become the "Swiss mafia."

Erb remained in Europe for a few years upon returning, working on Romanian fields and beginning a successful managerial career with Royal Dutch.

Max Mühlberg

Max Mühlberg (1873-1947) is another important name linked to oil exploration in the Far East. He was one of the first geologists to systematically use geophysical tools in oil exploration. Gravity and magnetic, as well as logging of wells, were not yet systematically used. But, as Erb had already done, Mühlberg also used reflection seismic long before this became standard practice for oil exploration. One has to remember that at that time, the use of dowsing rods was considered acceptable practice in the search for oil deposits.

Swiss geologists also left their marks in Latin America, specifically and initially in Argentina and Mexico. The previously mentioned Arnold Heim (acting more as a scientist there than as an oil man), and Mühlberg passed through.

Daniel Truempy

Daniel Truempy (1893-1971) was also there, and after a stint in Argentina moved to Mexico, where he was highly successful, namely in the 1932 discovery of the Poza Rica field.

Also in the Chicontepec area discoveries were made. At that time however, they were not considered to be of significant interest. But it was later, in Colombia, where Truempy had his most significant successes in South America. The discovery and subsequent development of the Casabe field, under difficult topographic conditions in the Middle Magdalena Valley, laid the base of Royal Dutch's successful exploration and production efforts in Colombia.

Held back in Colombia by the outbreak of World War II, Truempy was able to contribute significantly to the general geological understanding of this country. His publication on the Palaeozoic sediments and stratigraphy of Colombia remains still in use today.

Hans Gottfried Kugler

Venezuela and the Caribbean Island of Trinidad also were active hydrocarbon development areas since the early years of the 20th century. The name of one Swiss geologist is intrinsically linked to the petroleum geology of Trinidad, offset from Venezuela's Oriente Basin by the Gulf of Paria. As a student, Hans Gottfried Kugler (1893-1986) met with the petroleum geologist August Tobler, who was contracted by Trinidad Leaseholds Ltd. to carry out investigations in Trinidad. Tobler was one of the first geologists to realize the value of micropaleontology for age-dating in the oil industry.

Immediately after graduating in 1921, Kugler returned to Trinidad, eventually working as chief geologist for both Trinidad and Venezuela with Trinidad Leaseholds Ltd. His initial tasks were the systematic topographic and geologic mapping of the central ranges of Trinidad, a series of low-lying hills separating the prolific southern basin from the far less productive northern basin. At the time, these hills were still covered by dense tropical vegetation and fieldwork consisted in systematically following and mapping creeks, which in the dry season provided the only outcrop successions, and in digging stratigraphic control holes between the existing sections. This detailed work led eventually to the discovery of several oil fields in the southern basin, such as the Apex and the Palo Seco fields around 1926.

Kugler's work also was fundamental in mapping out stratigraphic traps on the flanks of the Forest Reserve field (originally discovered 1914), at a time when stratigraphic traps were nearly unheard of. His work resulted in issuing the first geological map of Trinidad and its sister island Tobago.

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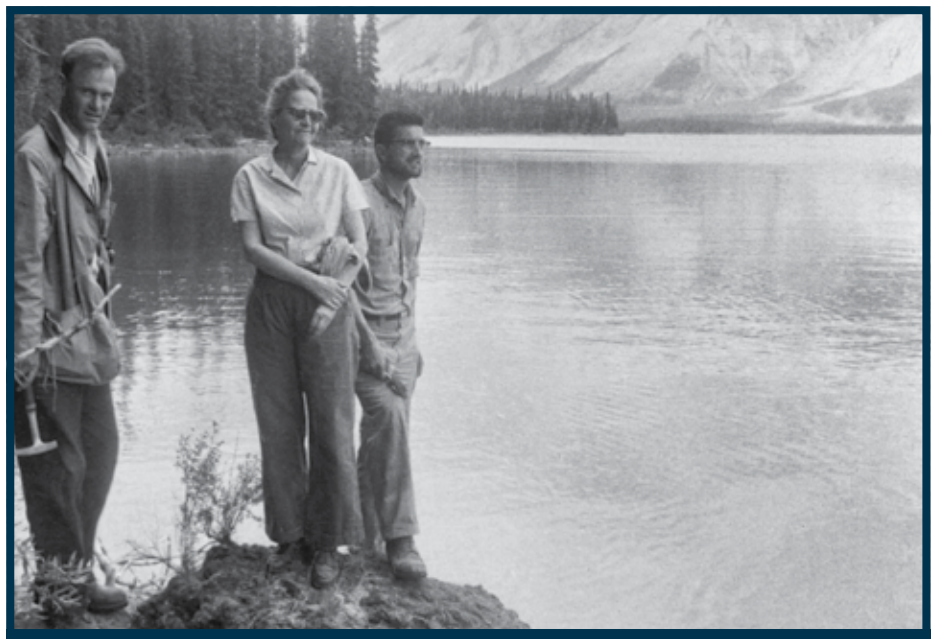
In Venezuela, his mapping and micropaleontological efforts were fundamental for the discovery of the Cumarebo field.

In 1929, Kugler took up residence in Pointe-a-Pierre near San Fernando in Trinidad, where Trinidad Leaseholds Ltd. had built the country's refinery, later expanded by Texaco and today operated by the state oil company Petrotrin. In 1933, he established the paleontological laboratory there, which was soon to become a global hotspot for foraminiferal paleontology, and where many of the leading micropalaeontologists of the world spent many years establishing the zonations for the Late Cretaceous-Paleocene to Middle Miocene stratigraphy. Swiss, American and British stratigraphers passed through this institution, which also served as training ground for Trinidadian geologists who now play key roles in Petrotrin or in other oil companies in Trinidad.

Hans Hirschi

Swiss geologists also were active in the United States. In 1911, the "Union des Pétroles d' Oklahoma" contracted Swiss geologist Hans Hirschi (1876-1964) as chief geologist for their licenses in Oklahoma, where so far little or no exploration had been carried out.

Hirschi came with significant experience from fieldwork with Erb in Sumatra and Borneo. His main task was to evaluate reports sent to him by field parties. As his collaborator and later successor, Swiss geologist Eduard Blösch (1884-1980) comments, this was a complex task, since Blösch had to send his reports to Switzerland where Hirschi resided eight months per year, who sent the reports with his comments to the general management, who sent instruction and orders to the local management.



Warda Bleser-Bircher. Photo courtesy of ETH Zürich, Archiv für Zeitgeschichte.

TRUEMPY

AAPG member Daniel M. Truempy worked for more than 30 years for the Royal Dutch Shell Company in various technical, managerial and advisory roles in the Middle and Far East, Europe, West Africa and in the Americas. He retired in 2010 and now consults for various small companies and hydrocarbon agencies. He has his own consulting firm specializing in teaching field and classroom courses, both in South America and in Europe.

Blösch was highly successful in his search for oil in Oklahoma. However, his relations with management were not always smooth. In 1913, he mapped the anticlines of what was to become the Cushing field, where wildcatter Thomas Baker Slick Sr. had made a successful discovery the previous year. Excited by his work, he presented it directly to management, only to be told that the company was not ready to spend $80-100 per acre solely on the advice of a single geologist. (It's worth noting that in May 1917, the Cushing field produced 310,000 BOPD, two-thirds of the entire production of the western hemisphere.)

When Blösch continued his work on the Cushing anticline in an area of the field later to produce impressive quantities of gas, he was told by his employer that his job was to find oil, not gas. Frustrated, Blösch resigned in 1915, stating that when he went to Oklahoma he was of the opinion that geology would be the key tool to find oil and gas, as was customary in other countries. However, he went on to realize that there, with few exceptions, managers cracked jokes about geologists and considered geology irrelevant – a short-lived flavor-of-the day soon to fall out of use.

Arnold Heim

Meanwhile, in the Middle East, Swiss geologists had little impact on the Arabian Peninsula, but were very successful in Iran. Discovery and development of the huge fields of the territories now known as Saudi Arabia, Qatar, the Emirates, Kuwait or even Iraq were done without significant Swiss involvement – partly because these desert areas were very much in the British sphere of interest, and partly because the Royal Dutch Shell Company, employer of many Swiss geologists at that time, did not have significant footholds there.

However, Arnold Heim (1882-1965), whose name was to become directly tied to many of the Iranian discoveries, was invited in 1924 to lead an expedition to look for oil, ore and water in the Persian Gulf. The last because improving the water supply to the areas of the northern Persian Gulf (northeast Saudi Arabia, Kuwait and Bahrain) was a condition of being granted future licences.

Heim, suffering from bad health during the two months he spent almost entirely

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Canada's Energy Geoscientists

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Bryan Turner, Oklahoma
The Use of Chemostratigraphy to Refine Ambiguous Sequence Stratigraphic Correlations in Marine Mudrocks. An Example from the Woodford Shale, Oklahoma

Carlos Molinares-Blanco, Oklahoma
Woodford Shale (Unconventional Resource) Core from the Arkoma Basin, Oklahoma: Litho/Sequence Stratigraphy, Palynology, Chemostratigraphy, Hardness, and Organic Geochemistry

Steve Sonnenberg, North Dakota
The Giant Continuous Oil Accumulation in the Bakken Petroleum System, U.S. Williston Basin

Riley Brinkerhoff, Montana
The Bakken-Three Forks Petroleum System in the Northern Williston Basin as Displayed by the Douts 4-7 Core, Burke County, North Dakota, USA

Cornelius Rott, Germany
Reservoir Quality of a Diagenetically Altered Shallow Marine Carbonate Interval in the Permian Zechstein (Ca2), East Germany – Implications for Porosity Prediction Using Seismic Inversion Data

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Registration Open For URTeC 2016

Registration is now open for the 4th annual Unconventional Resources Technology Conference (URTeC) to be held Aug. 1-3 at the Henry B. Gonzalez Convention Center in San Antonio, Texas.

Sponsored by AAPG, the Society of Petroleum Engineers (SPE) and the Society of Exploration Geophysicists (SEG), the multidisciplinary conference and exhibition has become one of the leading events for unconventional exploration, drilling and production.

The technical program will be announced soon and will include presentations and posters from industry professionals that will share new concepts, case studies, characterizations, forecasting and more.

Short courses will also be held during the event, presented by the industry's top experts from a range of fields.

Two field trips have also been planned for URTeC. One will showcase outcrops of the Woodford Shale in southern Oklahoma. The second will examine examples of tight-oil reservoirs in Colorado.

URTeC also serves as a helpful platform for interacting with fellow professionals from a wide gamut of companies. A variety of networking opportunities are in the works including breakfasts, breaks and receptions in addition to an exhibition hall.

The exhibition area will boast more than 175 companies showcasing their ideas, products and solutions.

On average, 3,500 attendees from 40 countries attend URTeC.

This year, eight new supporting organizations have joined URTeC, significantly expanding the event's reach and audience and intensifying its multidisciplinary focus.

They are:

- American Institute of Chemical Engineers.
- Association for Iran & Steel Technology.
- American Society of Civil Engineers.
- American Society of Mechanical Engineers.
- Society for Mining, Metallurgy and Exploration.
- Society of Petroleum Evaluation Engineers.
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- The Minerals, Metals and Materials Society.

For more information, visit URTeC.org.

CALL FOR PAPERS

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1 July 2016

https://mc.manuscriptcentral.com/interpretation

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

Facies classification and interpretation: Integrating multi-scale and multi-discipline data

Facies characterization and classification play critical roles in reservoir description and modeling, facilitating the prediction of 3D reservoir extent and rock properties distribution. The term facies originates from early sedimentologic work and describes rock types with shared traits. The concept of facies has been extended to multiple disciplines at various scales within the broad field of petroleum geosciences including seismic facies, petrophysical facies, geomechanical facies, and geochemical facies. Fit-for-purpose facies classification using diverse data types can add value to all phases of reservoir work including exploration, appraisal, and development. Although quantitative estimates of facies can drive business decisions, the integration of multi-scale and multi-discipline data toward consistent facies classification remains one of the most challenging tasks in the geoscience community. This special section will highlight novel concepts, state-of-the-art algorithms, and field applications that characterize and classify facies from multiple disciplines at a variety of scales.

The editors of Interpretation (http://www.seg.org/interpretation) invite papers on the topic **Facies classification and interpretation: Integrating multi-scale and multi-discipline data** for publication in a May 2017 special section. We are seeking submissions on related topics including but not limited to the following:

- data integration at multiple scales
- data integration from diverse disciplines
- new classification concepts and algorithms
- facies classification of fluvial-deltaic systems
- facies classification of deep-water systems
- facies classification of carbonate systems
- facies classification of mudrock systems

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

The submissions will be processed according to the following timeline:
Submission deadline:
1 July 2016
Publication of issue:
May 2017

Special section editors:

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Sources
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co-chair for the "Advances in EOR in Offshore Environment" session at the upcoming Offshore Technology Conference in Houston.

Upon joining DOE, McConnell swept away a bit of the bad vibe associated with this gas. Rather than focusing on carbon capture and sequestration (CCS), he shifted the emphasis by adding utilization to the mix to make it "CCUS." In short, he recognized the need to focus on this carbon gas as a path to energy security and profit generation rather than just as an environmental menace.

It's actually a kind of Catch-22 in that what might be viewed as "too much" by some might not be enough for others – for now.

CO_2 Supply Sources

U.S. onshore naturally occurring CO_2 supplies are limited and are all, for the most part, already spoken for. So, McConnell zeroed-in on anthropogenic CO_2, which can be captured at fossil fuel power plants.

Stripping out the CO_2 requires energy, so the process can be pricey. But its use as an application for EOR – in addition to increasing oil production – provides a market for CO_2 emissions.

These anthropogenic sources abound in various parts of the world, often along coastlines.

Look at the hydrocarbon-rich U.S. Gulf of Mexico, for example. The abutting U.S. coastal region is near chock-a-block with power plants, refineries, chemical plants and the like, particularly in south Louisiana and south Texas.

NETL contractor Bill Pike has noted that with application of current moderate performance CO_2 EOR technology in the offshore GOM, economically viable oil recovery and CO_2 demand are modest.

Substituting higher performing "next generation" technologies, the projection is for a tenfold increase in recovery – think 15 bbl of incremental oil. This entails 3,910 million metric tons (mt) of CO_2 demand.

This more efficient CO_2 performance, along with higher recovery per well, means that many additional offshore oil fields may become economically viable.

Besides the performance level of these technologies, Pike commented on two additional governing factors for CO_2 potential in this offshore region:

- Price of CO_2 with delivery cost to field factored in: a NETL study used $50/mt ($CO_2$ purchase price = $30/mt + $20 for CO_2 transportation).
- World oil price: the agency studied the CO_2 EOR and CO_2 storage potential using an oil price of $90/bbl and a future oil price of $135/bbl.

Besides increasing Outer Continental Shelf oil production and providing a significant market for CO_2 emissions, there are other benefits to be gained from CO_2 use in the offshore environment.

Storage potential ranks high among these.

As opposed to land storage, there is diminished risk to subsurface sources for drinking water. Additionally, existing corridors and oil and gas infrastructure can be utilized by offshore CO_2 pipelines, thereby reducing upfront capital costs.


GISLER

Monika Gisler is an historian, covering the fields of the history of science and technology as well as economic history. She currently specializes in the history of energy and has published on the cultural history of oil in Switzerland, the Swiss pioneers in the oil industry as well as the history of nuclear energy. She has her own research institute and is a scientific adviser to the Swiss Federal Office of Energy.

Heim
from page 25

on camel back, was convinced that oil exploration efforts in these areas were bound to fail (though he specified that the last word remained to be spoken on the issue). His focus on the search for water, however, was highly successful, and shortly after his departure, the first springs produced fresh water based on the recommendations of Heim.

Swiss geologists were, however, to play a dominant role in the oil exploration and production of Iran after the creation of the Iranian National Oil Company in 1949, and the departure of the Anglo-Iranian Oil Company, which had produced oil in the south of the country since 1933. The Swiss geologists were specifically called in by Iran because they were looking for citizens from neutral countries to join their newly-formed state oil company.

The first to be invited was again Arnold Heim, who as chief geologist was asked to form a top-quality team made up almost entirely of Swiss geologists, amongst whom were Jovan Stöcklin (1921-2008) and Augusto Gansser (1910-2012). It was the latter who was, as Heim's successor, chief geologist for INOC at the time of the spectacular Qom wildcat blowout (Alborz-5 well), the largest ever recorded blowout at rates of 120,000 BOPD, after the drill string had, for the first time ever, been able to penetrate the Miocene salt to reach the objective marine Qom limestones.

At the time, Heim had already returned to Switzerland, weakened by sickness and age. However, there too he remained active, insisting on the hydrocarbon potential in his native Switzerland. Based on the relative abundance of oil seepages (both in the Molasse basin and in the Jura Mountains), many Swiss geologists in the early days of oil exploration rated the chance of finding hydrocarbons in Switzerland in commercial quantities as good. Arnold Heim was the first, however, to map Switzerland systematically for its oil potential, and he remained throughout his life convinced that Switzerland had the potential to at least become self-sufficient in terms of hydrocarbon supply.

Indeed, both Germany and Austria have encountered success in the Molasse basin adjacent north of the Alps, but in Switzerland success has somehow been elusive. This notwithstanding, many geologists today, like Heim, think that the last word on the hydrocarbon potential of Switzerland may not have been spoken. New insights have come through modern seismic carried out in the context of searching for safe storage sites for nuclear waste, and there is new interest in the potential for shale gas or even shale oil from the Toarcian Posidonia shale.

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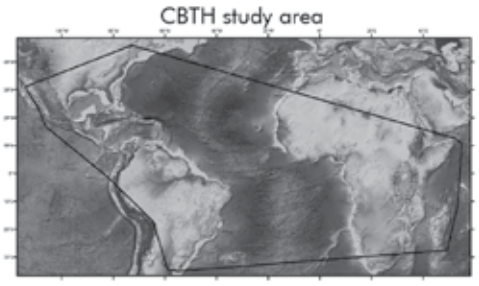
GIS data available from CBTH Project consortium at the University of Houston

3TB of georefrenced seismic lines, geologic maps and cross sections, wells, regionally-mapped surfaces, source rocks, reservoir trends, faults divided by age, seeps, earthquakes, gravity, magnetics, stress indicators, paleogeography, and plate reconstructions.

Data concentrations in Mexico, all sectors of GOM, Nicaraguan Rise, Colombian onshore and Caribbean margin, Venezuela onland and margins, Trinidad and Barbados onland and margins, Guyana margin, Brazil margin, and west African conjugates.

CBTH study area



Data is based on original mapping, thesis research, and over 15,000 published references that are listed as searchable database. All data are georeferenced and displayed using ArcGIS Online.

Inquiries: cbthproject@gmail.com http:/cbth.uh.edu

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Pittsburgh Playmaker Forum
13 April 2016, Pittsburgh (Coraopolis), Pennsylvania

The Pittsburgh Playmaker Forum is a one-day event sponsored by DPA in conjunction with two local societies, the Pittsburgh Geological Society (PGS) and the Pittsburgh Association of Petroleum Geologists (PAPG)

2016 Pacific Section AAPG Playmaker Forum: Finding Value in Mature Basins
13 May 2016, Bakersfield, California, United States

The Playmaker Forum will be a great way to learn more about our fascinating Pacific Section petroleum provinces, facilitate industry networking, and visit with friends and colleagues.

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Introduction to Oil Sands Thin Section Analysis
Saturday, 18 June 2016, 8:00 a.m.-5:00 p.m.

This course offers a unique opportunity to have a retrospective look at the reservoir characteristics of oil sands. It will be taught from 'Guide to Oil Sands Fabric Analysis for Reservoir Characterization', written by the instructor, in e-book format.

Advanced Geochemical Technologies: Methods That Reveal the Rest of Your Petroleum System
Sunday, 19 June 2016, 8:00 a.m.-5:00 p.m.

The technologies and methods to be presented in this course have been underutilized compared to the wealth of new understanding they can bring forth when applied to petroleum system analysis and modeling.

Integration of Petroleum Geochemistry and Reservoir PVT Analysis for Evaluation of Hydrocarbon Resource Plays
Sunday, 19 June 2016, 8:00 a.m.-5:00 p.m.

This course will address integration of source rock, produced oil and gas, mud gas and reservoir engineering data to better understand and exploit 3-dimensional details of petroleum systems.

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The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, TGS, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer.

Synthetic Seismograms for PS Seismic Data

By SATINDER CHOPRA and RITESH KUMAR SHARMA

Over the last few years, several articles on multicomponent seismic data have appeared in Geophysical Corner by Bob Hardage and his co-authors (January, February, April and August 2011, and February 2012), describing various aspects of processing and interpretation of such data.

In this article, we address an important question about correlation of synthetic seismograms with converted wave PS seismic data.

When a seismic wave (compressional or P-wave) impinges on a rock interface at oblique incidence, the contrast in the elastic parameters it encounters results in compressive and shear stresses. As a result, partitioning of energy takes place at the interface. This means that besides the reflection and refraction of the incident P-wave, there is P to S energy conversion. Thus an incoming P-wave gives rise to a reflected P-wave, a transmitted P-wave, a reflected S-wave and a transmitted S-wave as we show in figure 1.

The partitioning of energy of the incident wave that takes place at the interface into different components is dependent on the angle of incidence as well as the elastic parameters, which can all be derived from the P-velocity, S-velocity and density of the two media defining the interface. The angular relationships between the different wave components are governed by Snell's law (which we all studied in high school) and the amplitude relationships between the incident wave and the reflected, transmitted and converted-wave components are described by Zoeppritz equations (which we have referred to in our earlier articles from October 2012 and June 2015).

Synthetic Seismogram Generation

What we have stated above is that conversion of energy (P to S) takes place at oblique incidence of the incident waves. We may emphasize this aspect as normal for the incident wave – there will be no conversion of energy, and for angles of incidence less than 10 or 12 degrees, there is no detectable conversion. This PS data, when acquired and processed, may not show any visible amplitudes corresponding to such small angles of incidence. This is a consequence of the fact that PS waves follow asymmetric illumination ray paths at the reflecting surface, compared with the symmetric ray paths for the PP waves as seen in the conventional survey geometry (common mid-point reflection).

Synthetic seismograms are usually generated from well log data for identifying reflection events on stacked seismic data corresponding to different subsurface rock interfaces. The sonic and density log curves are used for generating an impedance log and the reflectivity derived therefrom is convolved with a wavelet to produce a synthetic trace at the location of the well. The wavelet used can be a mathematical wavelet of an appropriate frequency such as a Ricker wavelet, or it could be extracted from seismic data in the broad zone of interest using a statistical process, or it could be extracted by making use of well log data and seismic data.

Whatever method is used for generating the wavelet, it generates the synthetic trace, which is compared with the seismic data and interpretation made thereof. Such a simplistic process for synthetic seismogram generation assumes normal incidence of the seismic waves, which is what is implied for stacked seismic data as well as the well log data.

For PP seismic data interpretation this works well. This is not to say that every time we correlate a synthetic seismogram with real seismic data, we end up getting a good match. This could serve as a topic of discussion for another article, wherein reasons for commonly observed mismatch of well ties could be enunciated.

For PP stacked seismic data, the synthetic seismogram generation described earlier will serve well. But for PS stacked converted wave data, the above process may not be accurate, as the reflectivity is zero for normal

Continued on next page


CHOPRA


SHARMA

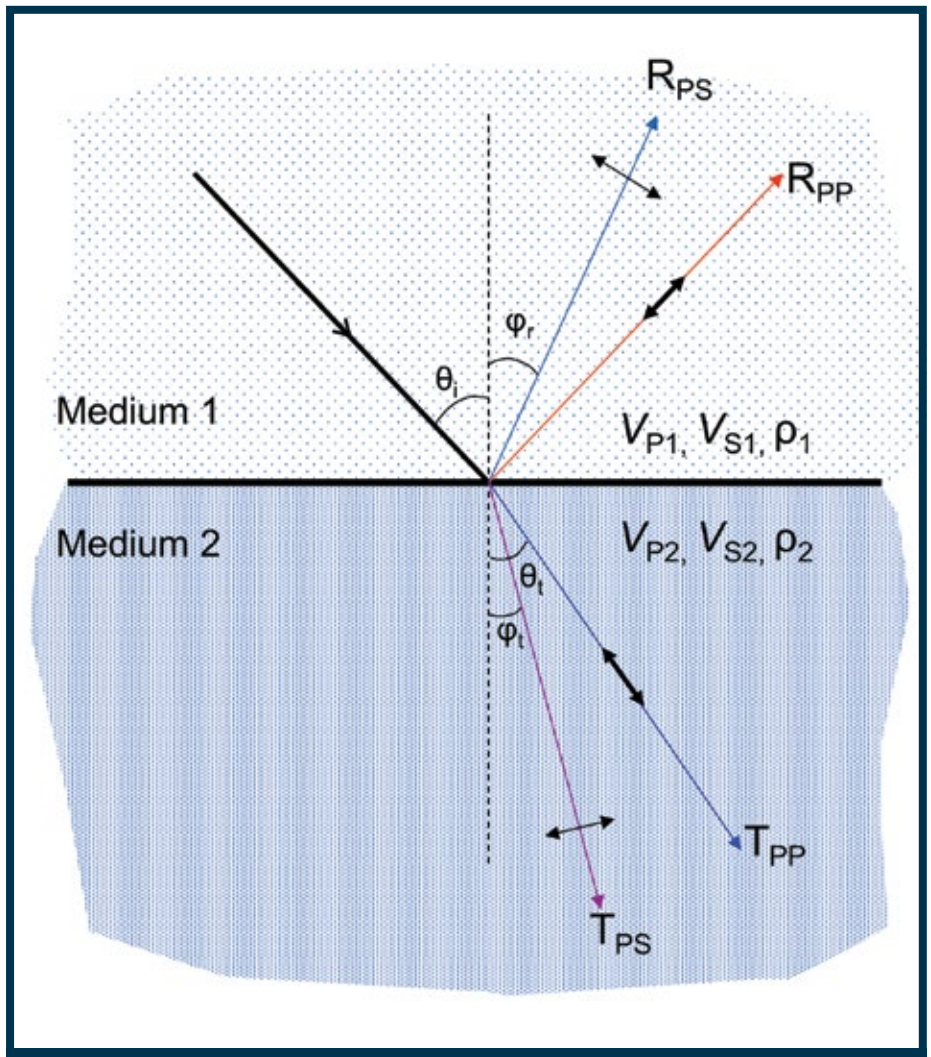

Figure 1: Ray paths for a seismic wave that is incident on an interface and splits up into four separate components. The particle motions are shown schematically for the individual waves.

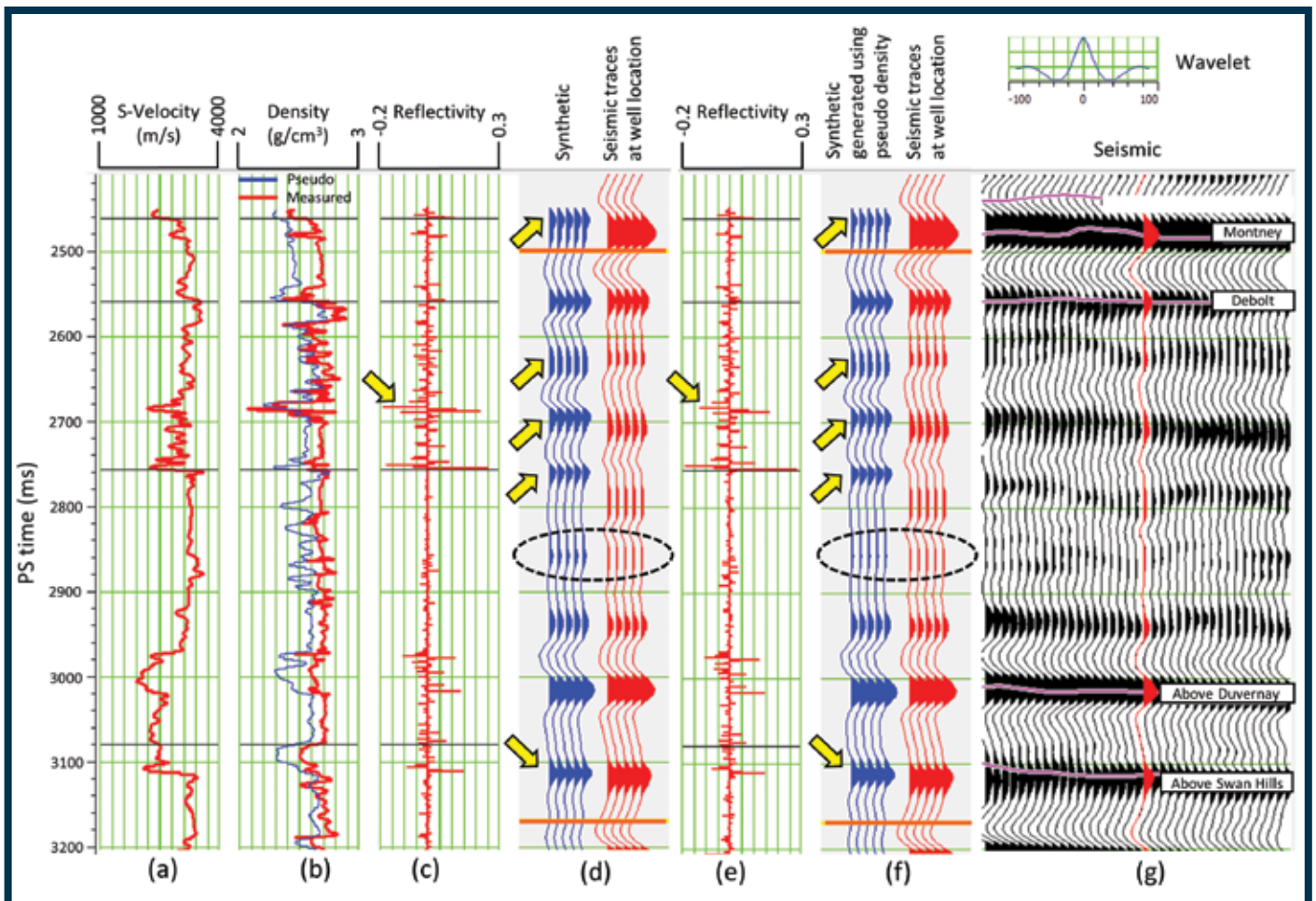

Figure 2: Well to seismic tie for PS data. (a) S-velocity well log curve, (b) the measured density curve in red, the estimated pseudo density curve in blue, (c) reflectivity derived from these two curves. (d) The blue traces are the synthetic traces derived from the reflectivity and using the wavelet shown on the top right. The red seismic traces are the PS data at the location of the well. Most of the reflection events seem to correlate well on the blue and the red traces, except at the locations marked with yellow arrows. (e) Reflectivity calculated from the pseudo density and S-velocity, which in turn is used for generating the blue synthetic traces in (f). The PS seismic data is shown in (g). Notice the differences between the reflection amplitudes indicated with the yellow arrows. The correlation with pseudo density reflectivity seems to be better as indicated by the correlation coefficient increase from 76 percent with (d) and 78 percent in (f). Data courtesy: Arcis Seismic Solutions, TGS, Calgary.

Continued from previous page

incidence and thus the convolution of a normal incidence reflectivity with a wavelet makes no sense.

Pseudo Density

So, how do we correlate PS stacked seismic data with well log data?

There are a couple of ways to address this question. One way to compute the PS-reflectivity is to use an approximation to the Zoeppritz equations (Aki and Richards) with use of P-velocity, S-velocity and density information. Once the PS-reflectivity is computed, it can be convolved with a statistical wavelet extracted from the PS seismic data to obtain a PS synthetic seismogram. As PS reflectivity is a function of the angle of incidence, and the amplitude information on the near-offset traces is not optimum, in practice PS synthetic seismograms are computed over a range of angles (usually 10 to 25 degrees), with each correlated with the PS stack data. The PS synthetic seismogram that gives maximum correlation with PS stack data is then selected. This works well.

In this article, we describe another approach that was first described by Valenciano and Michelena, and presented at the 2000 SEG Meeting. They demonstrated that PS normal incidence reflectivity can be approximated by introducing a quantity called "pseudo density," which is a function of the medium density and ratio of P- and S-velocities.

Using the dipole sonic and density curves, we derived the pseudo density curve, in blue, as shown in figure 2. The measured density curve is shown in red.

The synthetic seismogram generated in figure 2 using reflectivity derived with S-velocity and measured density is shown in figure 2d. The equivalent synthetic seismogram derived using the reflectivity from pseudo density is shown in figure 2f.

Notice, as indicated with yellow arrows and in the highlighted zone, there are differences in the reflection coefficients and hence the amplitudes. In each case the same wavelet derived within the time zone marked with orange bars was used and shown on the top right. Such differences may appear small, but can make appreciable differences going forward when reservoir properties are derived with the use of the PP and PS seismic data, or the confidence imposes in zones with mismatches.

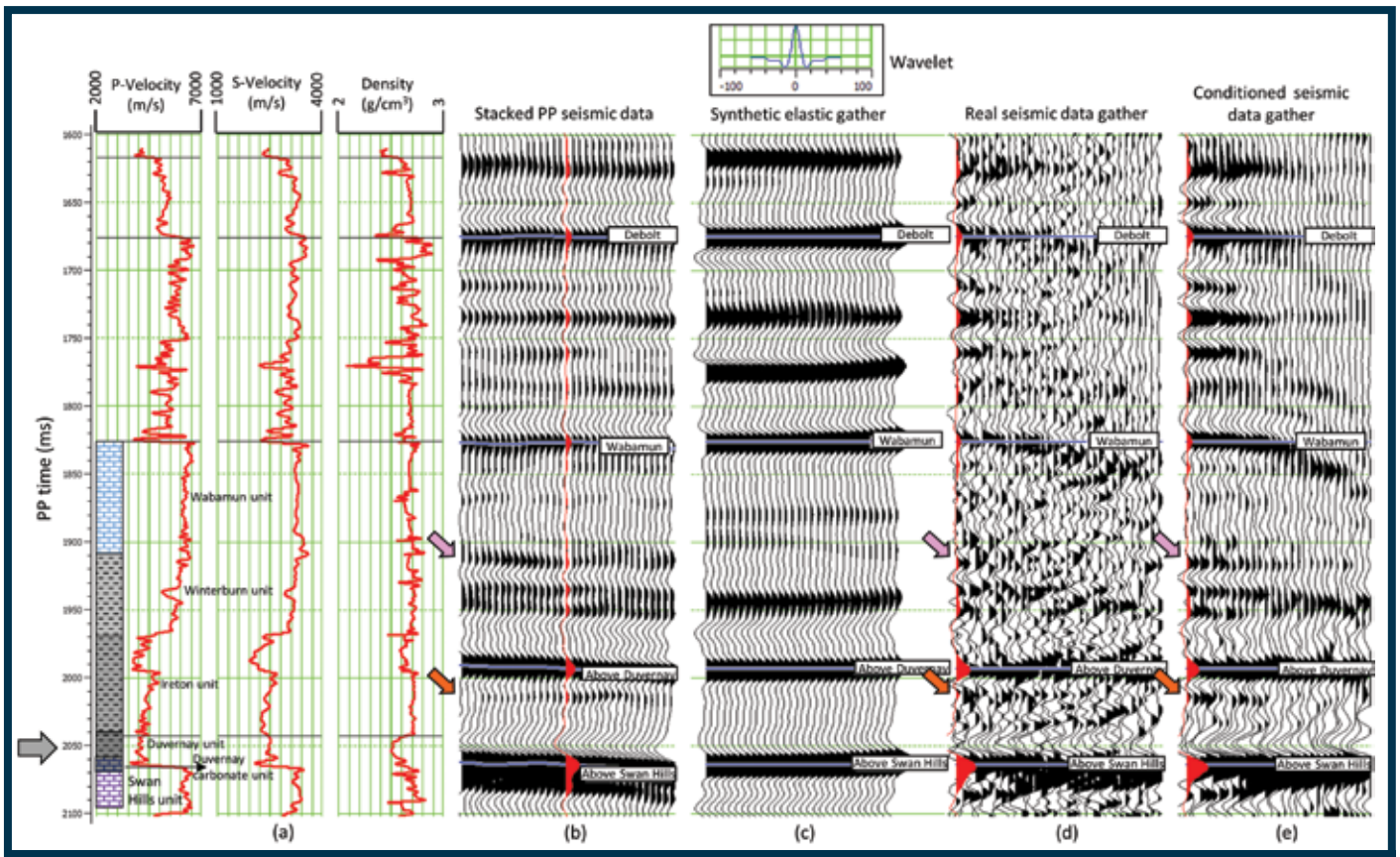

Figure 3: The P-velocity, S-velocity and density curves measured in a well are shown in (a), and are seen correlated with PP seismic data in (b). A synthetic elastic gather generated from the three curves is shown in (c). A real seismic PP gather at the location of the well is shown in (d). This data has not been conditioned for any amplitude analysis. The conditioned version of the gather in (d) is shown in (e). It is interesting to note the differences as indicated with the pink and orange arrows. Also, the stacked data and the prestack data correlation shows the similarities and differences that are open to interpretation.

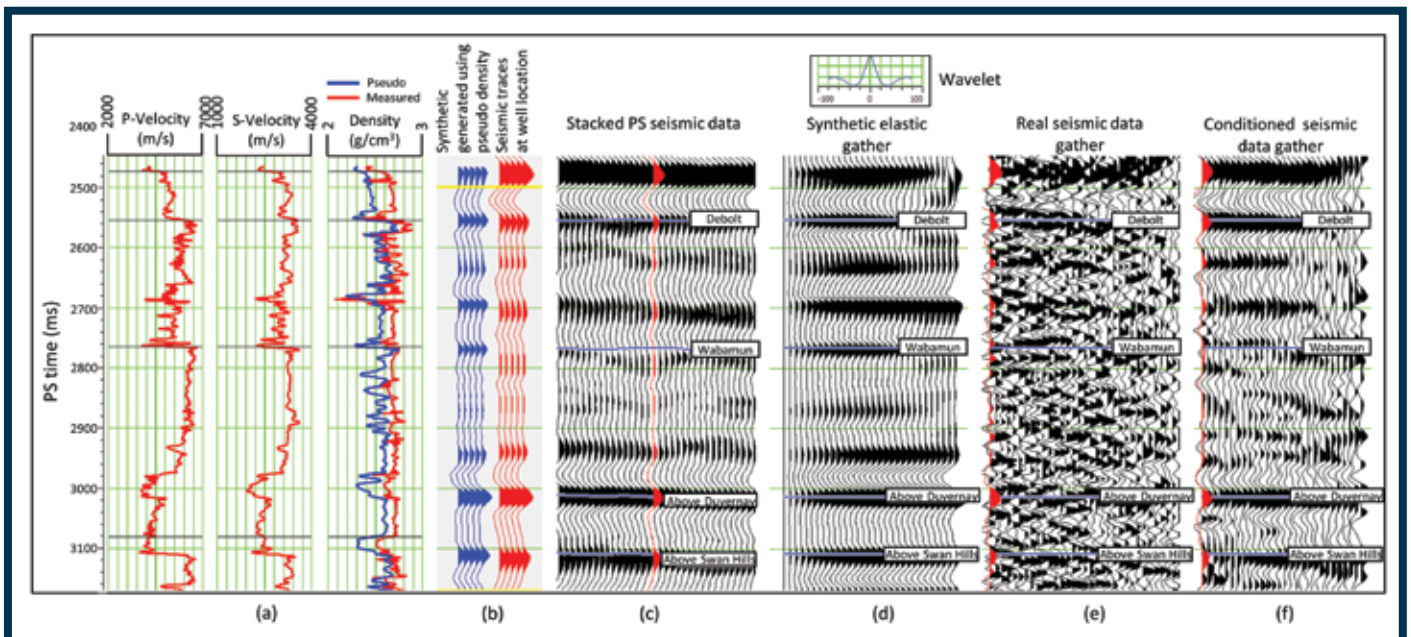

Figure 4: (a) The P-velocity, S-velocity and pseudo-density curves measured in the same well as shown in figure 3. The PS synthetic seismogram (blue) generated from the S-velocity and the pseudo density curves is shown in (b) and with PS seismic data in (c). A PS synthetic elastic gather generated from the P-velocity, S-velocity and density curves is shown in (d). A real seismic gather at the location of the well is shown in (e). This data has not been conditioned for any amplitude analysis. The conditioned version of the gather is shown in (f). It is interesting to note the difference between the gathers in (e) and (f). Also, the stacked data and the prestack data correlation shows the similarities and differences that are open to interpretation.

Registration Process

For making use of PP and PS seismic data, one of the first steps to follow is to correlate the seismic reflections on the two sections, a process called "registration." This is usually done manually, though some other existing methods could also be adopted with varied degrees of success.

As the travel times of the reflection events on the two datasets are different (P-waves travel faster than S-waves), PP and PS synthetic seismograms are generated for correlation with the respective stacked datasets. Besides the stacked datasets, prestack PP and PS data are also used for deriving elastic reservoir properties such as with the use of prestack joint inversion. This necessitates the careful processing of PS prestack data and the subsequent correlation with modeled PS gathers.

For modeling prestack seismic data, usually the travel time as a function of offset is calculated using a ray-tracing technique, and Zoeppritz equations are used for generating amplitude information. Together, the composite information defines the prestack gather for a given geometry, which is chosen similarly to the geometry of the real seismic data for which the gather is being modeled. This way gathers are modeled for both PP and PS seismic data.

The data example shown is from northwest Alberta, Canada, where the Devonian Duvernay shale has been the source rock for many of the large Devonian oil and gas pools in Alberta, including the early discoveries of conventional hydrocarbons near Leduc. This fine-grained and silica-rich shale unit is overlaid by the Ireton (calcareous) and Winterburn shale units, and over which lays the Wabamun limestone unit. The Duvernay unit is underlain by a thin carbonate-rich shale layer that overlies the Swan Hills reefal unit.

The stratigraphic column shown to the left of figure 3 illustrates these units. In the same figure we show the correlation of P-velocity, S-velocity and density curves (seen in figure 3a) with stacked data (figure 3b). Also shown in the figures are the equivalent correlation of PP modeled elastic gather (figure 3c) with the real PP raw processed gather (figure 3d), and its conditioned version (figure 3e). Notice the differences in the gathers and the stacked data at the locations indicated with pink and purple arrows. The reasons for such mismatches need to be explored. In our exercise these points of mismatch lie outside of our zone of interest and thus were left alone.

For comparison, in figure 4 we show the equivalent PS seismic data correlation. Notice the following prominent differences, apart from some others:

- The difference in the travel times of the PP and PS data.
- The first two traces on the PS gather showing very weak amplitudes as mentioned earlier.
- The difference in quality of the PP and PS prestack seismic data. PS data is usually noisier.

We thus conclude that the PS synthetic seismograms should be calculated accurately using one of the available methods. We have described a method wherein pseudo density is first calculated to approximate the normal incidence PS reflectivity, which is then used for generating a PS synthetic seismogram.

We thank Arcis Seismic Solutions, TGS, Calgary for permission to present this work.

Foundation's Highest Honor Goes to William E. Gipson

By TAMRA CAMPBELL, AAPG Administration Team

William E. Gipson, longtime supporter of the AAPG Foundation and former chair of the AAPG Foundation Trustees, has been named recipient of this year's L. Austin Weeks Memorial Medal.

Gipson, an AAPG Honorary member and Foundation Trustee Emeritus, will receive the award during the opening session of this year's AAPG Annual Convention and Exhibition, set June 19-22 in Calgary, Canada.

The award, presented annually for extraordinary philanthropy and service to the AAPG Foundation, honors the late L. Austin Weeks, whose philanthropic legacy sets an exemplary standard.

It is the Foundation's highest award.

Gipson's philanthropy and service to the Foundation began in 1974, with his first gift to the Foundation.

In 1977, Gipson joined a small group of donors who became the Founding Members of the Trustee Associates, the Foundation's major donor group. They formed:

- To raise money to permit the Foundation to pursue its goals and objectives.
- To recognize individuals who provide substantial financial support.
- To serve as an advisory body offering advice and counsel to the Foundation Board of Trustees.

Gipson, a Texas A&M graduate, served as the group's vice chair in 1988 and chair in 1990.

William E. Gipson with Foundation Chair Jim Gibbs.

In 1996, Gipson was appointed a Member of the Corporation, and in 2006 was elected as a Trustee – a position he held for 16 years. As a Trustee he served as treasurer and as chairman to the Foundation Audit Committee.

Gipson also played a key role as team leader in the Foundation's 2006 "Meeting Challenges … Assuring Success" capital campaign, which over a six-year period raised more than $35 million.

Gipson's philanthropic legacy has provided support for a variety of Foundation programs over the years, including the Treatise Petroleum Geology and Tectonic Map programs; support for building funds for the Weeks and Pratt Towers; and the Distinguished Lecture and Grants-in-Aid programs.

In 2008, Gipson established the William E. Gipson Named Grant as part of the Foundations Grants-in-Aid program – a lasting tribute to his character that will provide annual grants to graduate students for years to come.

* * *

WEEKS

L. Austin Weeks is the namesake for the Foundation's highest honor, as well as one of the Foundation's most vital programs for geoscience education.

Long heralded as a pioneer of petroleum geology, Weeks made a name for himself not only in the field, but as a generous benefactor who paid his success forward.

Weeks and his wife Marta made a significant contribution to the Foundation in the late '90s that would go on to support thousands of students in their pursuit of geoscience education.

The gift paved the way for aspiring geologists to take field trips, attend geology conferences, and apply funds toward tuition costs and the purchase of rock hammers, compasses and more.

The L. Austin Weeks Undergraduate Grant program, initially earmarked for student chapters, expanded in 2014 to provide aid to more individual students

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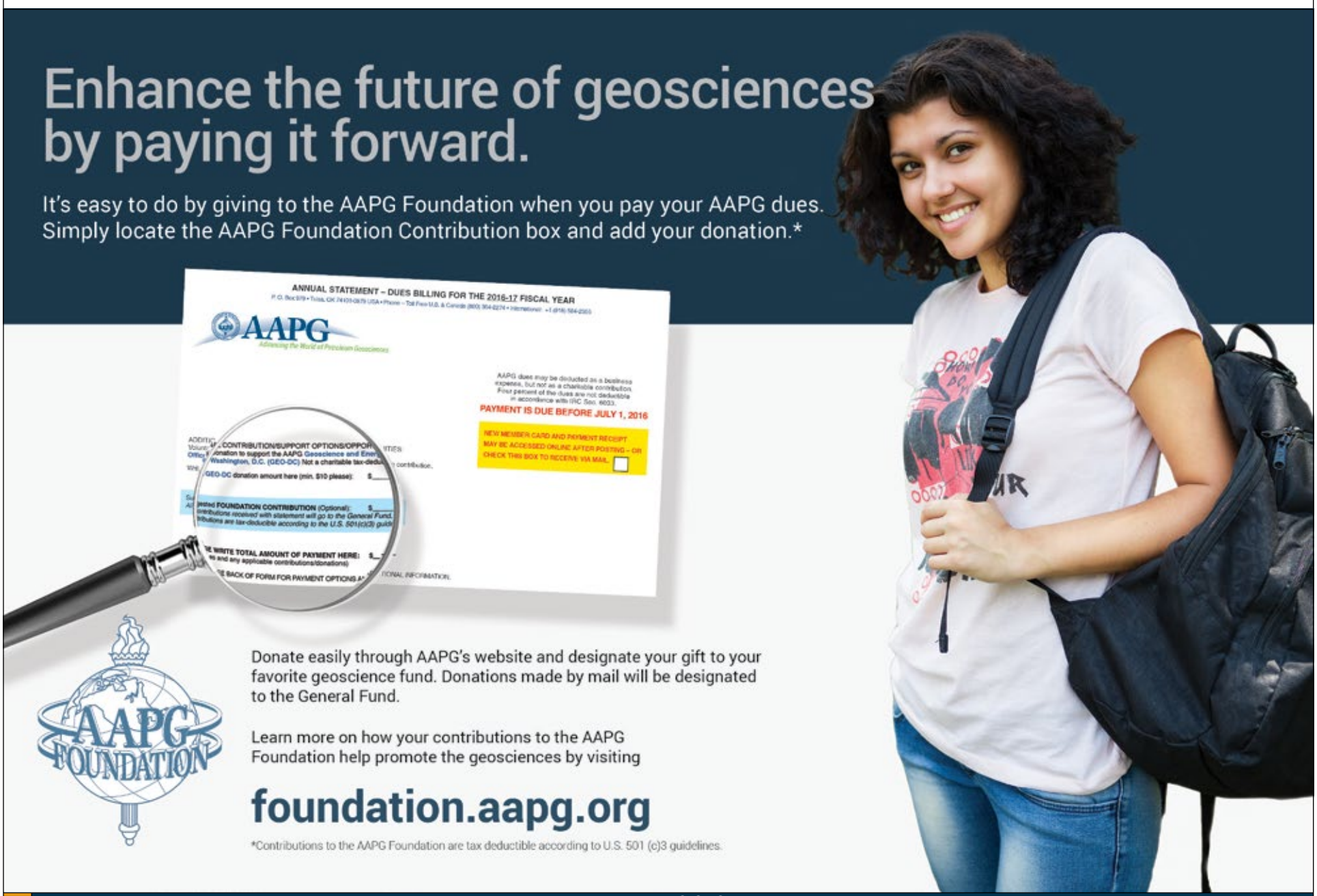

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and their student-led geoscience associations.

This expansion has drummed up a significant amount of interest over the past couple of years, and has opened a new channel for students who had not previously been exposed to AAPG to learn about the benefits the Association can provide.

It generated so much interest, in fact, that the Foundation went on to form an official committee of judges who would be able to take on the tasks and lengthy process associated with reviewing, scoring and selecting top applicants each year.

Be sure to read next month's Foundation Update for a full report on that committee and on the grant program itself.

Foundation Contributions for February 2015

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In memory of Alfred T. "Toby" Carleton Jr.

Digital Products Fund
Stephen F. Austin State University
William L. Scott

Distinguished Lecture Fund
Robert J. Ardell
In memory of Alfred T. "Toby" Carleton Jr.

Education Fund
Martha L. Broussard
In memory of Alfred T. "Toby" Carleton Jr.
William L. Scott
Stuart and Barbara Strife
Grant from Strife Family Charitable Fund at Fidelity Charitable
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Grants-in-Aid Fund
David W. Worthington Named Grant
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Andre C. Klein
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Harry and Joy Jamison Named Grant
Paul H. Dudley Jr.
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Ohio Geological Society Named Grant
SM Energy Company
Matching a gift given by Steven Zody

James A. Hartman Student Leadership Summit Fund
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Military Veterans Scholarship Program
John F. Bookout Jr.
Marlan and Marea Downey
In memory of Larry Gordon, Alfred T. "Toby" Carleton Jr. and Chuck Noll

Military Veterans Scholarship Fund
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Ronald E. Tepley
In memory of Ruth M. Tepley

Named Public Service Fund
The Gibbs Family Endowment Fund
James A. Gibbs
In memory of Alfred T. "Toby" Carleton Jr. and Walter J. "Jack" Sleeper Jr.

Newly Released Publications Fund
Frederick L. Stead

Visiting Geoscientist Fund
B.C. Schreiber

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

IN MEMORY


CARLETON

AAPG Honorary member Alfred Townes "Toby" Carleton Jr. has passed away at the age of 86.

Carleton was AAPG president in 1994-95 and was also chairman of the House of Delegates. He also served in leadership roles in other professional societies throughout this career, including the West Texas Geological Society and the Midland chapter of the Independent Professional Earth Scientists.

Most of his career was as an independent geologist, but he also worked for Ohio Oil Company (now Marathon), Zapata Petroleum Corporation (merged into Pennzoil Company) and others.

He passed away on Feb. 6, 2016.

Richard Eugene Church, 81
Denver, Colo., Dec. 25, 2015

Lawrence Gordon, 83
Houston, Texas, Feb. 14, 2016

Leslie Robert Honeyman, 68
Midland, Texas, Dec. 30, 2014

Martin Russo, 101
Dallas, Texas, June 15, 2015

Howard Samsel, 89
Brandon, Miss., Jan. 18, 2016

Walter Jackson Sleeper Jr., 86
Dallas, Texas, Feb. 18, 2016

Dan Ray Frantzen, 82
Lafayette, La. Sept. 8, 2015

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

Climate Debate 'More Political Than Scientific'

BY LEE GERHARD and BOB SHOUP

In the January issue of the EXPLORER, Robert Yeats called on AAPG to be part of the conversation on climate change. He concludes his commentary by stating, "AAPG members are scientists. Let's take a leadership position so that the argument is based on science and not politics."


GERHARD

Before there can be meaningful political discussion about the impact of global climate change and the cause of that change, the debate must first be scientifically resolved.


SHOUP

The human role in climate change has split the science community into two camps: those who believe in a human cause for climate change, and those who see climate change as a result of largely natural processes.

Adherents to either human-caused or naturally-caused climate change have politicized the discussion, all too often engaging in a battle of invective and *ad hominem* attacks.

AAPG is a scientific organization. We advocate that the sole way to resolve the scientific climate debate is through the use of the scientific method by rigorous and open testing of competing hypotheses. As Popper stated in 1963, "the scientific status of a theory is its falsifiability, or refutability, or testability."

Dr. Yeats does not seem to be aware that AAPG has been heavily involved in attempting to bring clinical science and the scientific method to the debate for almost 20 years. Lee Gerhard initiated the Association's effort in a 1996 paper in AAPG's Environmental Geosciences.

AAPG consequently held a series of panel discussions, debates and technical sessions on the subject of climate change, and in 1998 established an ad hoc committee, chaired by Bruno Hanson to look at the issue of global climate change.

The AAPG Bulletin continued to publish debating summary papers through 2006, although the capstone of AAPG efforts to bring data and science to the debate was the 2001 publication of Studies in Geology #47, "Geologic Perspectives of Global Climate Change." That book went into second printing.

In 2007, AAPG formed the "Global Climate Change Committee." The goal of the committee was to seek scientific balance on climate change.

As with the previous committee, this committee hosted several forums and a discussion board. However, the meetings and discussions of this committee were politicized early on and it took an almost herculean effort from the committee chair and co-chair to achieve what balance the committee did achieve. The political conflict within the committee contributed to the committee being sunset in 2010.

What we scientists face today is a serious conflict with the digital models and the measured data. Resolving this conflict should be a major goal of the scientific community.

Unfortunately for us, this debate – unlike the plate tectonics debate – is now more political than scientific, tied up with agendas that have no business being thrust on a scientific issue.

Plate tectonics was a scientific debate based on data. Climate change is a political debate based on digital models.

The political nature of the debate has given rise to data manipulation, alarmism, appeals to consensus, and *ad hominem* attacks. These have no role in the scientific process, and should be condemned by all scientists.

AAPG members have always believed that the debate should be resolved by careful application of the scientific method, specifically rigorous testing of competing hypotheses.

Before there can be meaningful political discussion about the impact of global climate change and the cause of that change, the debate must first be scientifically resolved.

For the scientific debate to be resolved, scientists on both sides of the issue must be allowed to seek to falsify the work of the others with equal access to funding and without fear of *ad hominem* attack or loss of funding and or their jobs.

CLASSIFIEDADS

POSITIONS WANTED

Michel T. Halbouty
'30 Visiting Chair in Geology and Geophysics

The Department of Geology and Geophysics at Texas A&M University is pleased to announce the Michel T. Halbouty '30 Visiting Chair in Geology and Geophysics. The purpose of Mr. Halbouty's generous gift is to "Promote excellence in the teaching and research of the Department of Geology and Geophysics." We expect to appoint 4 to 5 distinguished scholars to the Visiting Chair over the next few years and provide them the opportunity to visit our campus and interact with department faculty and students for six to twelve months duration. The appointment provides partial salary support and additional funds to cover lodging and travel, as well as proposed engagement activities.

Applications should be submitted by June 1, 2016, to be considered for awards in 2016 and 2017; consideration of applications will begin as soon as April 18, 2016. Interested persons are encouraged to contact faculty members in the Department of Geology and Geophysics (http://geoweb.tamu.edu/). Applications should identify potential faculty proponents, include a CV, a 2-page proposal identifying engagement activities in teaching and research as a Visiting Chair holder, availability for visiting the department in the upcoming academic year, and tabulation of desired funds needed for salary and other expenses.

Texas A&M University is an Affirmative Action/Equal Opportunity Employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. The University is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment. We strongly encourage applications from women, underrepresented ethnic groups, veterans, and individuals with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners (hr.tamu.edu/employment/dual-career.html).

Please send your application materials to F.M. Chester, chair of the Halbouty Visiting Chair Committee (chesterf@tamu.edu). For further information, contact F.M. Chester or other faculty members of the department (http://geoweb.tamu.edu/).

MISCELLANEOUS

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DPA
from page 34

Section Annual Convention on April 12, then on June 21 at ACE in Calgary.

In late 2014, the DPA sponsored an event called "Pass the Baton" in Tulsa. The event provided early-career geoscientists the opportunity to hear from late-career geoscientists about their experiences in the oil and gas industry. Several events of this kind are in the planning stages for various venues throughout the United States. Final preparations are being made for one such event in Pittsburgh, Pa. in May 2016. The event will be sponsored by the AAPG Eastern Section Young Professionals Committee and the DPA and will consist of a panel of three to five experienced professionals. The panelists will address the current environment that our industry is experiencing and will share a brief history of their careers. Time will be scheduled before and after the panel discussion for networking.

Being Your Own Career Manager

With regard to attitude, the DPA and AAPG are putting the final touches on the publication "Becoming an Independent."

The first paragraph of the preface to this publication is:

Before reading this booklet, there are two important concepts that you need to understand. The first is that the oil and gas industry is a business. The second is that you are your own career manager.

It is your career and nobody but you can manage it. This publication will give you tips on how to manage your career and keep a positive attitude. The publication will be distributed soon.

As you can see from all the scheduled events, DPA is working to provide assistance to DPA members as well as the entire AAPG membership. If you are already a member, please become more involved. If you are an AAPG member but not a DPA member, but have the requisite years to become a certified petroleum geologist and a member of DPA, please do so online at dpa.aapg.org. If you are an AAPG member and do not have the requisite years to become a member, I encourage you to contact me and we will find positions in our organization where you can have contact with DPA members. Become involved, it is your career.

As always, please help me *Spread the Word about DPA*!

EXECUTIVE DIRECTOR AMERICAN GEOSCIENCES INSTITUTE

The Search Committee invites applications for the position of Executive Director for the American Geosciences Institute (AGI).

The Executive Director conducts the affairs of the Institute, with direction from the Executive Committee, including administering all planning and policies, supervising AGI staff and coordinating the various activities, projects and programs of the Institute. The Executive Director maintains and fosters relationships with the officers and administrators of the 51 AGI member societies, international and regional associates, and with other geosciences and science-related organizations in addition to academia, government agencies, and industry representatives.

The ideal candidate will be an established scientist who has demonstrated leadership and vision in their field; possesses proven senior management and budgetary experience and excellent interpersonal skills; and has a record of success as a fundraiser for not-for-profits. The successful applicant must have the ability to communicate effectively across the scientific community, academia, industry, government and the public.

An earth sciences background is highly desirable. An advanced degree is preferred. The successful candidate must be willing to relocate to the Washington, DC, area and to fulfill the demands of frequent travel.

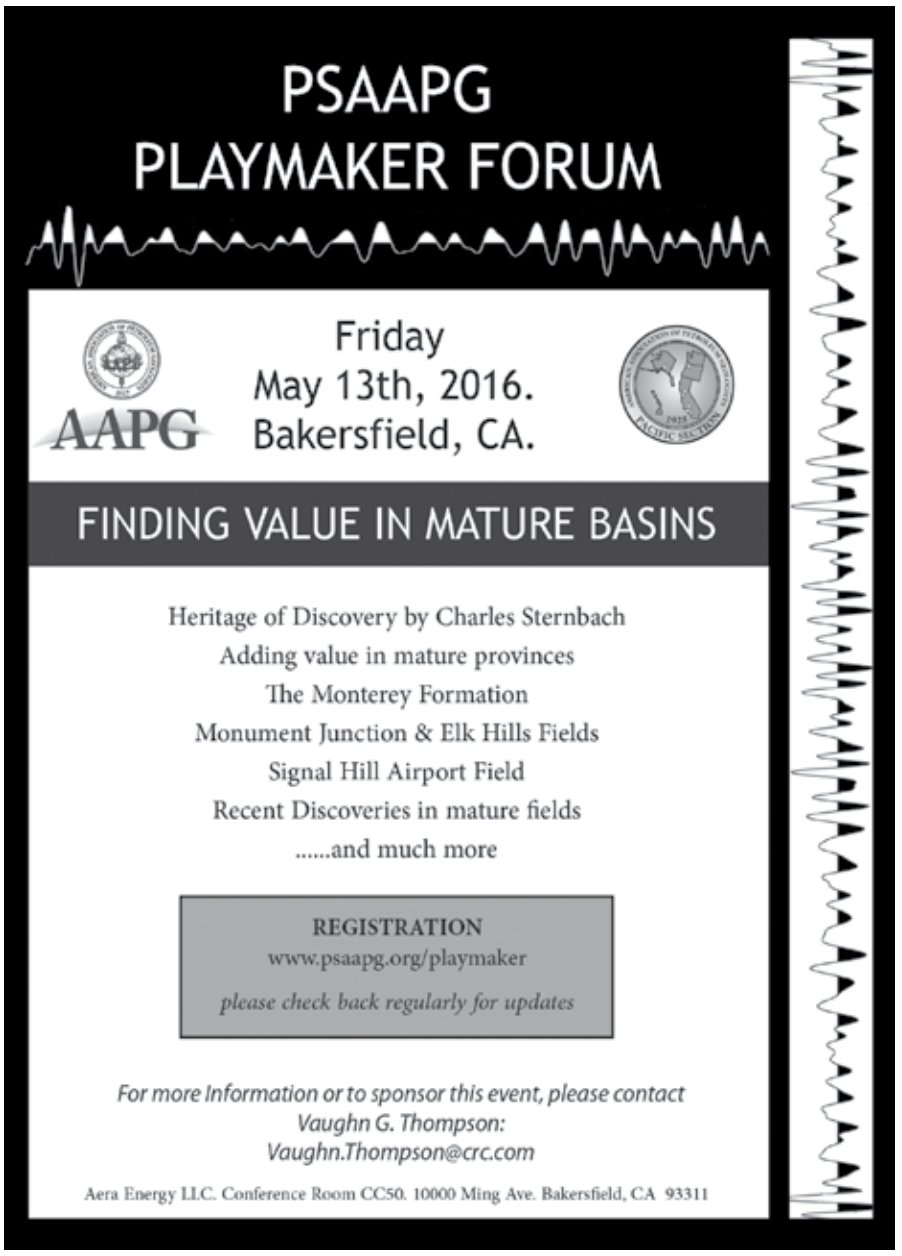
AGI american geosciences institute
connecting earth, science, and people

A Position Description is available at **http://www.americangeosciences.org/executive-director-search/position-description**.

Interested persons are invited to submit a resume, an expression of interest, and a list of five references. Submission may be made via email to **executive-director-search@americangeosciences.org** or by mail to the address below. Review of applications will begin April 2016.

Chair, Search Committee
American Geosciences Institute
4220 King Street
Alexandria, VA 22302

Applications and inquiries will receive confidential consideration. AGI is an equal-opportunity employer.



DIRECTOR'S CORNER

AAPG's New Structure: 'Necessary, Not Easy'

By DAVID CURTISS

We are busily restructuring the way AAPG conducts business here in Tulsa and around the globe.

It's a project forced upon us by the extended downturn in oil and natural gas prices and the impact the decline is having on our members and on the petroleum industry. Like you, we feel this impact directly, as the Association has had to reduce its staff levels in response to lower revenues.

It's not easy, but it's necessary.

But as difficult as the downturn is, it also represents an opportunity to look at how we do things, evaluate what programs and activities are still effective and assess what our current and prospective members need in order to be successful in their careers.

That, after all, is why we exist as an Association: to advance science and the professional well-being of our members. These are the times when we can best demonstrate our relevance to you and your career.


CURTISS

> A restructuring as extensive as we're pursuing is not a simple task. But we believe this structure will enable AAPG to best serve its members and customers in the years ahead.

The Fourfold Plan

There are four elements to our restructuring plan:

- Controlling our costs and searching for more efficient ways to operate are at the heart of our current activities. How do we take a limited amount of resources – both human and financial – and derive the greatest value for our members and customers?
- Program focus is an area the Executive Committee is actively assessing. Does our current portfolio of products, services and volunteer activities still meet the needs of our current members? How about the needs of the next generation? As we look at these activities, how can we reimagine them to be even more effective?
- Strategic investment is important, because no organization has cost-cut its way to success. And, while we have limited financial resources for investing in new programs and services, we are evaluating opportunities to position AAPG for future success.
- Innovation is essential to positioning AAPG for its second century. Our goal is to build a process that generates good ideas, evaluates them, then selects the most promising among them for further investment and development. This has historically been an ad-hoc process. Our goal is to systematize it and extend it throughout the organization.

Seven Themes of Our New Direction

In terms of how this affects our operations here in Tulsa, we've reshaped the organization along seven different themes:

- Grouping similar job functions and developing teams to enable cross-training and backup that will enhance the resilience of our staff organization.
- Enhancing communication and alignment between teams and product lines.
- Establishing a member and customer experience center – a centralized communications hub for our members and customers – to provide better service when they contact the Association.
- Focusing on marketing our products and services to support our members' engagement with non-members.
- Creating an innovation engine for AAPG that allows us to make these products and services more relevant to the professional development of our members.
- Developing and focusing on performance metrics for our products and services.
- Providing AAPG's leaders with more effective data and analysis to assess how and where the Association should channel its resources for maximum benefit to its members.

AAPG's New Groups

As a result of these goals, we have housed all of AAPG's revenue-generating products in a business group under the direction of Alan Wegener. This includes all of AAPG's events and experiences, such as ACE, GTWs, Hedberg conferences and field seminars. It includes all of AAPG's market development organizations – our foreign offices – in the regions. It also includes all of AAPG's technical publications, the EXPLORER and Datapages. And, this group contains a dedicated sales and marketing unit to serve these product lines.

We've created a new group focused on AAPG's administration and programs under the leadership of Vern Stefanic. On the administration side, this group will be the principal liaison to AAPG's governance units: Executive Committee, Advisory Council and House of Delegates, as well as the Divisions' leadership groups, Sections and Regions leaders. They are responsible for all elections, honors and awards organization-wide. In addition, this group will handle the application process for voting Members.

The program side of this group is focused on all of AAPG's programs such as the Imperial Barrel Award, Distinguished Lecturers, Visiting Geoscientists, Student Chapters, the Publications Pipeline, the new Young Professionals Special Interest Group and the 100th Anniversary Committee. Several of these are also joint programs with the AAPG Foundation.

Vern will also be the first point of contact for our office in Washington, D.C. focused on energy and geoscience policy issues, with my continued involvement.

The new corporate shared services group, which Bryan Haws will be directing, includes the new Member and Customer Experience Center (which will handle Associate and Student membership processing), along with our accounting, information technology, office services teams and building management activities.

Finally, a new science group, led by Jim Blankenship and Susan Nash, will be focused on keeping AAPG's products and service offerings at the front edge of new science understanding, technology trends and innovative ideas. They will be the principal liaisons with our new Technical Interest Groups, technical committees and Divisions to identify relevant themes and concepts, which are then developed into products and services, such as events, groups and publications, and delivered through the business group.

A restructuring as extensive as we're pursuing is not a simple task. But we believe this structure will enable AAPG to best serve its members and customers in the years ahead – moving us closer to becoming indispensable to you.

DIVISIONS REPORT: DPA

What You Can Control In the Downturn

By MICHAEL CANICH

My term as president of the Division of Professional Affairs is whizzing by and will end just after the Annual Convention and Exhibition in Calgary in June.

In the past eight months, our industry has continued to be challenged by low commodity prices resulting in difficult times for many geoscientists in our industry. I retired in October after 39 very fulfilling years in the oil and gas industry, even though I had to weather numerous downturns along the way.

To everyone who has been affected and to those of you who are concerned that you will be, remember to stay focused and be optimistic about your future. During my career, which spanned some very difficult times during the 1980s and '90s, I tried to follow that advice. Even with those difficult times, I can't imagine having worked in any other business.

I read an article in a newsletter published by a longtime friend here in the Appalachian Basin addressing the current downturn. His main point was that there are things you can control and others you cannot. You cannot control the commodity price or decisions made by an upper-level manager, but you can control the quality of your skill sets, your network and your attitude, and DPA is here to help.


CANICH

> To everyone who has been affected and to those of you who are concerned that you will be, remember to stay focused and be optimistic about your future.

DPA Forums

With regard to skill sets and networking, DPA will provide a number of forums in the next four months.

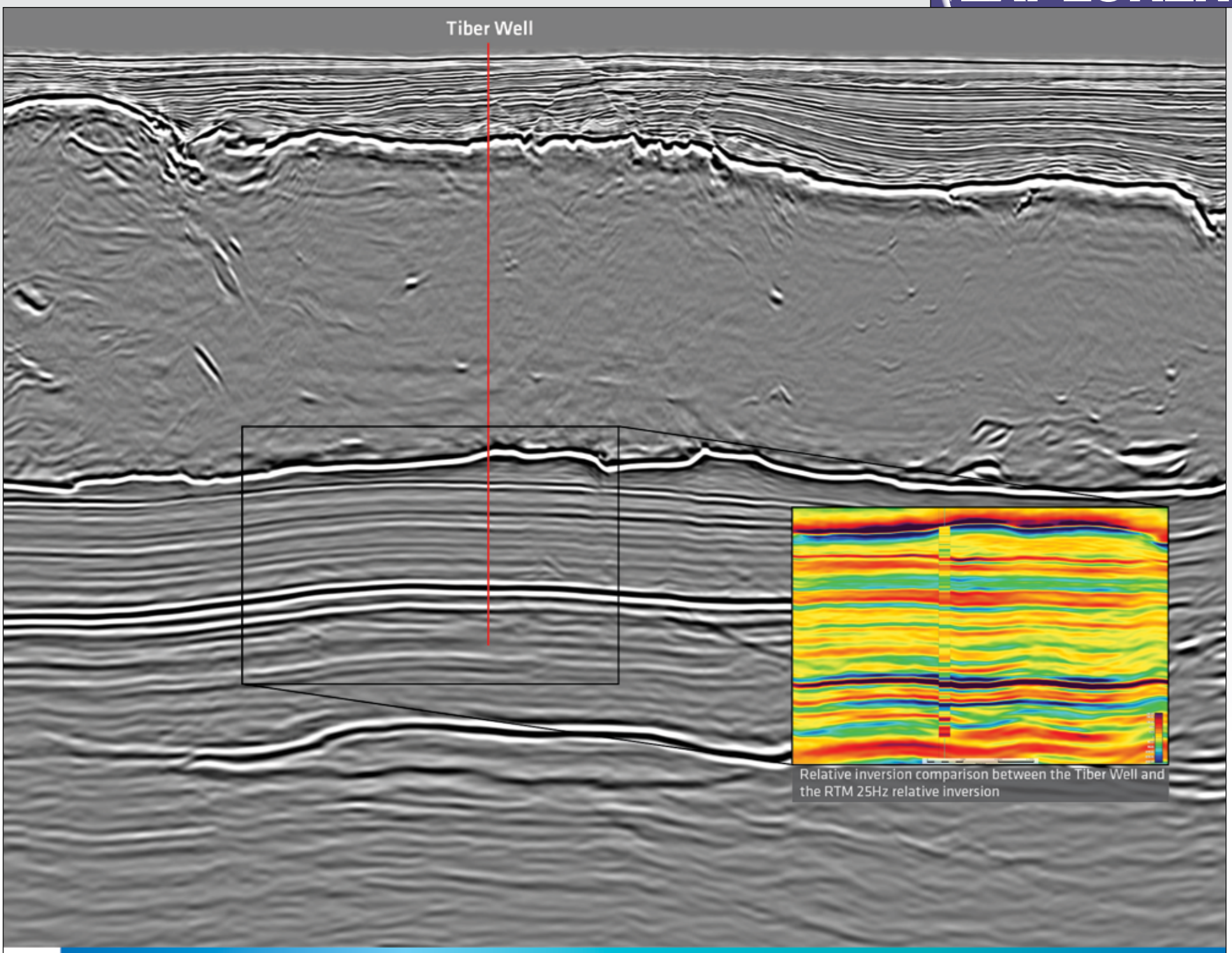
Playmaker forums are scheduled for Denver, Pittsburgh and Bakersfield, respectively on March 31, April 13 and May 13. These forums are a great opportunity to hear case studies of current plays delivered by geoscientists and engineers who applied creative and entrepreneurial thinking to discover or extend plays. Ample time is scheduled for networking with the speakers as well as the attendees during and after the full day of presentations.

At ACE in Calgary the DPA will sponsor the Discovery Thinking forum on Monday, June 20, which features geoscientists who are leaders in their sections and regions on various conventional and non-conventional plays. This forum has been a well-attended session at ACE since 2008 and at the International Conference and Exhibition since 2012.

Also at ACE this year, the DPA and the AAPG Career Services Committee are co-sponsoring a career development panel session on Tuesday, June 21 from 5:30 to 7 p.m., to discuss the managerial versus technical path taken by geoscientists in the past and available to geoscientists in the future. The panel will consist of four geoscientists, two of whom are DPA members.

Another signature event, the DPA Luncheon, has been held at ACE as well as AAPG section meetings for over 20 years. The luncheons feature a well-known keynote speaker and provide opportunities to meet old friends and make new contacts. Luncheons are scheduled in Abilene at the Southwestern

See DPA, page 33



Relative inversion comparison between the Tiber Well and the RTM 25Hz relative inversion

TRITON RESERVOIR IMAGING

PGS is pleased to announce that the first datasets from its industry-leading full-azimuth (FAZ) ultra-long-offset Triton survey in the deepwater Gulf of Mexico are available.

Combining a state-of-the-art survey design and GeoStreamer technology, PGS has imaged targets where shallow and complex salt and steeply-dipping structure have hampered previous exploration efforts. In addition to greatly enhanced definition of the shallow section, the sub-salt Lower Tertiary Wilcox reservoir interval is now being seen as never before.

The Tiber, Gila, and Guadalupe discoveries have revealed the potential of the Wilcox reservoirs within the Triton survey area. Sub-salt inversion of the Triton data closely matches the Tiber log data, and clearly demonstrates the improvement in data quality brought about by the full-azimuth depth imaging and the broader bandwidth and increased signal/noise of GeoStreamer.

The latest results are proving the uplift possible with Triton FAZ acquisition and imaging, with the potential to significantly reduce exploration-production risk for the Wilcox play in the deepwater Gulf of Mexico.

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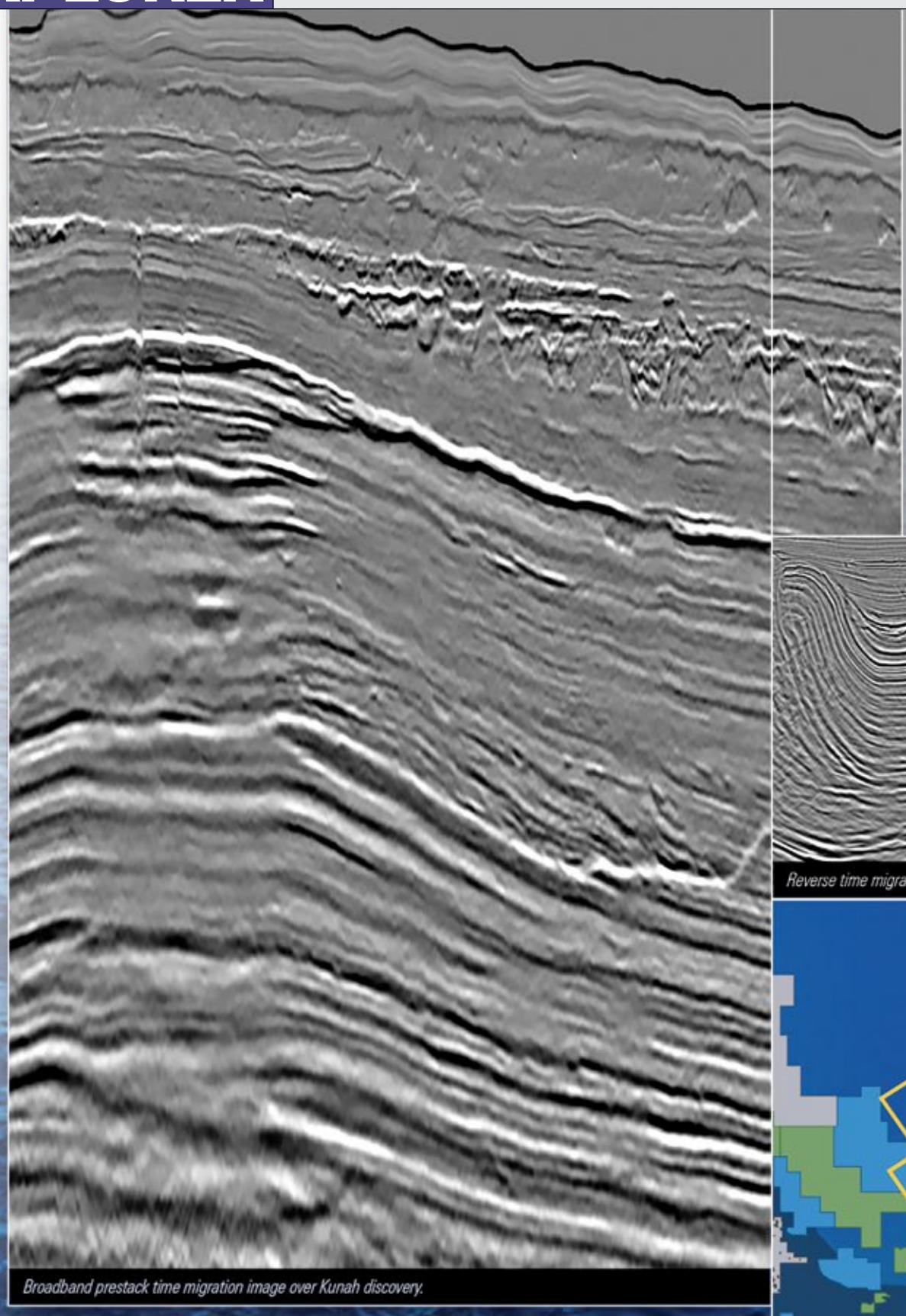
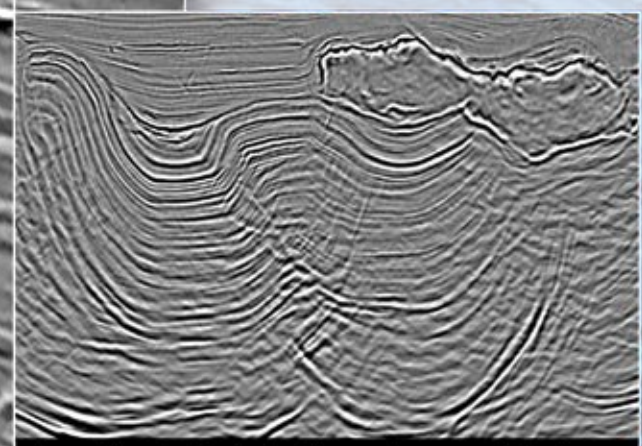


Broadband prestack time migration image over Kunah discovery.



Reverse time migration showing three- and four-way salt body closures.

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