

# EXPLORER



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*Taking the love of geoscience to new heights.*

*See page 14.*



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**PRESIDENT'S COLUMN**

# A Year in the Life of the AAPG President

BY PAUL BRITT

**“**It is not the strongest that survives, nor the most intelligent. It is the one that is most adaptable to change.”

This quote is frequently attributed to Charles Darwin, for understandable reasons, but it was actually coined in 1963 by a Louisiana State University business professor named Leon C. Megginson.



BRITT

It's been on my mind this year because being president of AAPG has been an exercise in adapting to change.

One of the hardest parts of this job is writing this column every month. It's just like I've always said: monthly deadlines come two weeks apart. So, I thought this might be a good month to talk about all of the tasks that keep your president busy in any given year.

At the beginning of the year are committee chair assignments. Ideally, that's accomplished early in the year, but there have been some changes to stretch the process out a bit. We have the new Technical Interest Groups (TIG) and Special Interest Groups (SIG) that we started last year, which are affecting some of the committees in the process. The TIG/SIG model is intended to serve as an “open ended” committee, making it easier for members to join without the formal structure of a committee. The process of forming TIGs and SIGs and incorporating them into the existing structure of committees is ongoing.

**Interacting with Members**

Then there are the events, many of which happen in the fall, like this year's AAPG/SEG



International Conference and Exhibition (ICE) in London in October, as well as four consecutive Section meetings. And, there are international meetings throughout the year in a variety of venues. Through all of them, as I interact with Members, I am always amazed at how excited they are to see the president of AAPG; it reinforces how involved the Association is in what Members around the United States and the world are doing.

But, my interaction with Members isn't limited to meetings and conferences, but is an ongoing, day-to-day activity through a multitude of emails and telephone calls about various Member interests. Members will reach out to me with new ideas or to address various problems or to ask about their paper's selection for an upcoming technical session, among a host of other issues. Lately, there have been a number of problems with non-U.S. Members who can't get a visa to attend the upcoming Annual Convention and Exhibition (ACE) in

Houston, as well as Imperial Barrel Award (IBA) contestants who are declined for visas.

The ongoing interaction with Members, and the opportunity to help resolve some of these problems is rewarding... but exhausting. One of the advantages the president has, though, is that the responsibility ends after a year, unlike the executive director's job, which continues after the current president's term.

The AAPG has a lot of moving parts. At the present time, ACE and the 100th anniversary celebration in Houston is under way and will be highlighted in next month's column. Clearly, last year was a challenging year, and this year has continued to be so as the price of oil and gas has begun its tenuous climb.

**Tomorrow's AAPG**

One observation I've made in meeting so many students around the world

has been their true love of geology and geoscience. That's one reason I'm optimistic about what lies ahead for the industry and the Association. And, I have written in a previous column about the technological changes I think will come about in the near future.

A part of that future has, in my talks, led to an analysis of the AAPG membership and consequently, the industry's. I was surprised to see a high interest in a few slides illustrating that trend, and I think while we all know it, there is some value to seeing it graphically, so I have included it here.

The accompanying slides show Membership by age across time. The arrow represents when I joined AAPG in 1980 and follows my career through to the present.

As you can see, there are a great many Members moving into retirement or joining independents and in a few years, the workforce is going to have a shortage of geoscientists. Technology may alleviate some of that, but not all of it. As the demographics change, the opportunities will abound.

Lastly, the Executive Committee has asked the Advisory Committee to prepare a new strategic plan. Some of it was presented at the mid-year leadership meeting, and the rest is being presented now at the annual House of Delegates meeting in Houston. The upshot is, changes will be needed in a changing world, and your leadership is addressing those changes in the many facets of our Association. The goal of these changes is to make sure AAPG continues into the next 100 years. Every Member needs to be aware of these issues, and I plan to address the details of the strategic plan in next month's column.

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**REGULAR DEPARTMENTS**

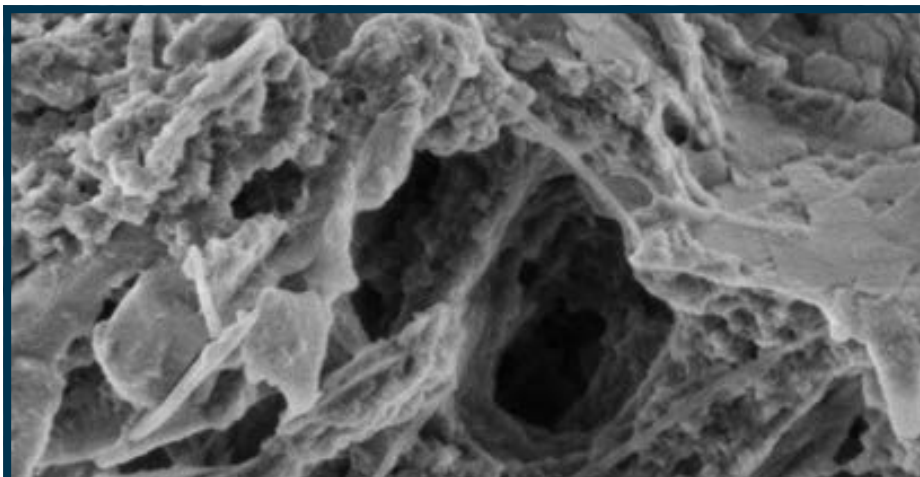
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**ON THE COVER:**

This photo of a potash mine landscape by this year's Geosciences in the Media Award recipient Michael Collier was featured as part of his photography exhibit, "Dispassionate Landscapes."

Left: Collier is a pilot as well as a photographer (among several other vocations), which enables him to take aerial photographs like this image of Red Rock Canyon near Las Vegas.





This image of pores in an unconventional reservoir in South America shows mineral surfaces interpreted as clay (on right) and calcite (on lower left) surrounded by porous organic matter with variable pore sizes. The mineral surfaces are largely uncoated in asphaltenes and water-wet, while the organic pore network at this level of maturity (oil window) is hydrophobic and considered oil-wet. This is a secondary electron image of a freshly broken surface, courtesy of Andrew Fogden.

## Imaging Unconventional Reservoir Pore Systems

For anyone interested in the methods of observing and quantifying the pore systems that control hydrocarbon and flow in unconventional reservoirs, AAPG's new volume is what you've been waiting for.

AAPG recently released Memoir 112: "Imaging Unconventional Reservoir Pore Systems."

The new volume covers recent advances in the acquisition and application of high-resolution image data to unconventional reservoirs, consistently



OLSON

demonstrating the value of integrating multiple techniques throughout its chapters.

The volume addresses imaging methods, recognition of artifacts and case studies that explore nanopore systems within particular depositional settings.

"Technology used to examine solid materials at the nanometer scale has existed for

decades, but the interest in applying these methods to reservoir rocks has increased dramatically in recent years," said the volume's editor Terri Olson. "Shale gas and shale oil reservoirs require this level of imaging to resolve the pore space, and other tight rocks benefit as well, particularly when clay-hosted porosity is common or wettability is difficult to characterize. A significant aspect of organic-rich reservoirs that is unique to them is the common occurrence of organic-hosted pores, which are portrayed in several chapters of this memoir."

Olson is a geologist and petrophysicist with 33 years of experience in the oil industry. She has spent most of her career at oil and gas companies, large and small, focusing on unconventional reservoirs, including tight sands, siltstones, mudstones/shales, and chinks. She's worked for Amoco, having attended the Amoco Petrophysics School at Amoco Research in Tulsa. She was the petrophysicist for Valhall Field in the North Sea in Norway, and later joined EOG Resources as a petrophysical adviser. After nearly seven years at EOG, Olson left to join FEI, a technology company that performs digital rock services in addition to providing image analysis software and making electron microscopes and helical CT scanners. In the spring of 2016, she formed Digital Rock Petrophysics, where she consults for FEI and other companies to design imaging projects and bring petrophysical insight to image data.

After publishing her first major paper, on Hugoton Field reservoir characterization in the AAPG Bulletin, Olson became active on the RMAG and AAPG publications committees, eventually chairing both. She co-edited a special publication on the Piceance Basin, for which she authored a paper on White River Dome Field. She has been an associate editor of the AAPG Bulletin for more than 15 years, most recently serving for three years as senior associate editor for unconvensionals. She received the Distinguished Service Award from AAPG in 2016 in recognition of these efforts.

AAPG's Memoir 112 is her latest effort, which includes the Bakken, Barnett, Bossier, Eagle Ford, Genesee, Marcellus, Niobrara, Wolfcamp and Woodford formations among the unconventional reservoirs studied.

Olson said contributors to Memoir 112 come from a range of backgrounds, including operating companies, technology and service companies, "universities in roughly equal proportions," with some contributions co-authored by a mix of these sources.

"Thanks go to them for the hard work of transforming their studies into publishable form," she said.

For more information about the volume, visit [store.aapg.org](http://store.aapg.org) and type Memoir 112 in the search bar.

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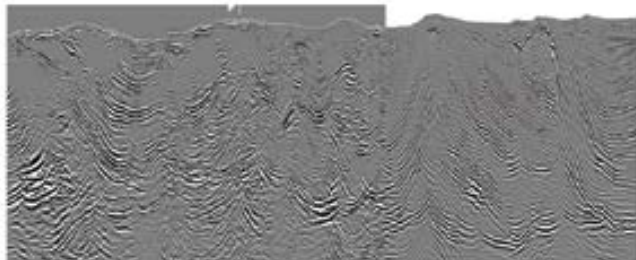
Picanha leverages ION's extensive local experience in combination with new accelerated workflows that enabled reimagining 42,000 km<sup>2</sup> of data across 9 surveys offshore Mexico in 4.5 months – from field data through RTM depth migration.

To learn more, visit [iongeo.com/Picanha](http://iongeo.com/Picanha).

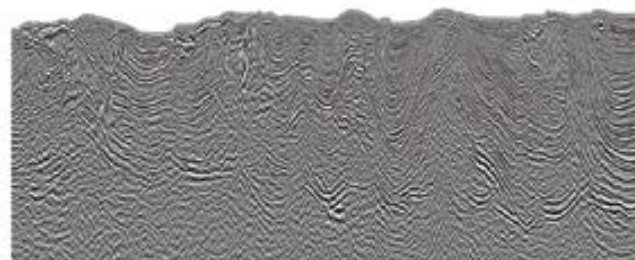
- BasinSPAN
- ION's Imaging Experience
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# The Oil Industry's Big Hurdle for Big Data

By DAVID BROWN, EXPLORER Correspondent

People who think about data in the upstream oil and gas industry are surprisingly in agreement about the future.

Looking at the decades ahead, will the industry struggle with a need for greater computing power to process and analyze rapidly growing amounts of data? Or will the challenge come from capturing enough data to understand complex exploration and production operations?

Experts in seismic and other industry data seem to agree the answer will be:

C) None of the above.

Kristian Johansen is chief executive officer of TGS in Houston, a worldwide focus in capturing and processing geophysical data.

"Cloud computing is the future trend of computation," Johansen said.

"The seismic industry's challenge is how to get the data in and out from the cloud effectively, because we are dealing with thousands of times more data than the other industries," he noted.

Ricardo Bertocco, partner with management consulting group Bain & Company in Dallas, served as a principal author on the company's report "Big Data Analytics in Oil and Gas."

"Right now the bottleneck is transmitting data. The cloud can help," Bertocco said.

Instead of problems with collecting or processing data, the oil and gas industry of the future will face its biggest challenges in combining data types, in storing data, in accessing, moving, managing and manipulating data.



JOHANSEN

**"The seismic industry's challenge is how to get the data in and out from the cloud effectively."**

## Better Machines, Better Integration

Not that the industry doesn't want bigger and better computers. Input and output (I/O) of data can be a serious hurdle, but even today, huge data collections are demanding improved computational abilities.

"Our industry demand for computing has been and will be always ahead of the IT industry. Algorithms exist today that would require thousands of times more powerful computers than today's supercomputers," Johansen said.

"And yes, as we said earlier, data I/O is a very big challenge when we are moving into cloud computing," he added.

Moore's Law states that computer processing power will double every two years. That isn't a scientific law, but an observation by Intel co-founder Gordon Moore about the steady increase in the number of transistors per square inch in integrated circuits.

A continuing debate questions whether that kind of computing advance can go on indefinitely, but Moore's Law has held up for more than 50 years. Whatever the future pace of growth, no one doubts an ongoing

increase in computing power.

"In a general sense computational power – the hardware – continues to grow. Some types of challenges may be simply waiting for the hardware to catch up," said Richard Gibson Jr., a professor in the Department of Geology & Geophysics at Texas A&M University in College Station, Texas, and an expert in seismic and microseismic applications.

"One of the main challenges will be integrating the larger and larger amounts of data and different types of data," he noted. "It becomes more and more challenging for one human being or even a team of human beings to understand what that data is telling you."

Gibson said he defines Big Data in oil and gas not only by the quantity of data, but by the extent of types of data being captured, combined and processed.

"What might be fundamentally different here is combining the types of data we have, like seismic, with other types of data. As we take these kinds of data and try to combine them, it becomes different," Gibson noted.

"One example might be looking at

unconventional reservoirs," he said.

In that example, microseismic data might be combined with data about geology, logs, rock mechanics, reservoir characteristics and other input, and engineering data like pressures and fluid composition.

"In a bottom-line sense, the goal is to tell engineers how to come up with optimal reservoir-management strategies to produce hydrocarbons from unconventional resources," Gibson said.

Geophysical companies already combine seismic data with some other types of field data for a better understanding of a reservoir, so a movement toward more data integration in the future seems like a good bet.

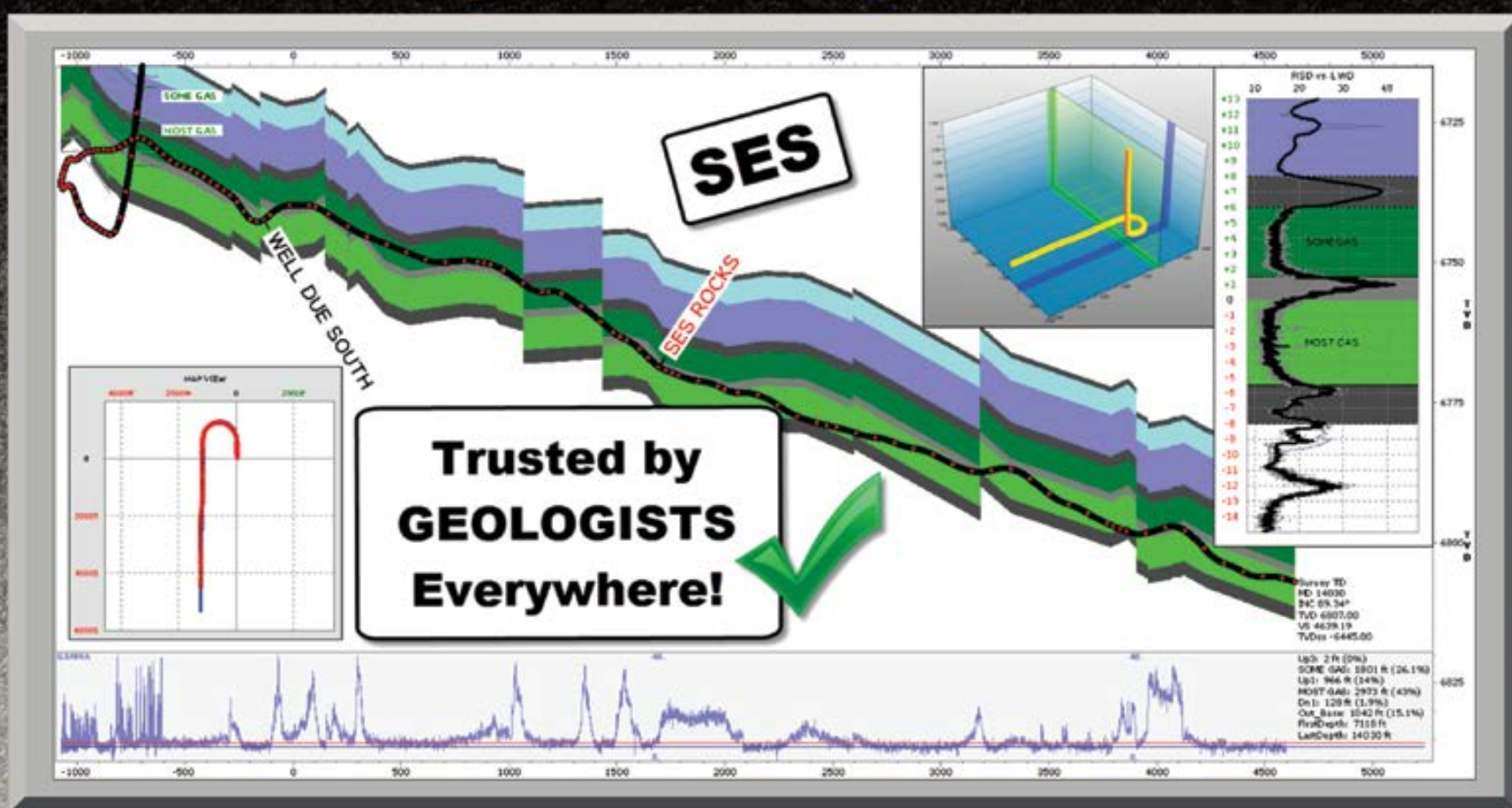
"Integrating geological interpretation and well logs into seismic data processing enables TGS to provide clients with high-quality seismic attributes that are correlated better to reservoir properties," Johansen said.

"Better sampling of the subsurface structures – finer grids and full azimuth acquisition – in data acquisition and improved analytical correlation of seismic data to rock properties in processing will be the key factors in the future to reduce E&P risks," he predicted.

And Johansen said the seismic industry is now seeing more applications of artificial intelligence, especially in "classifying new data according to known clarifications of lithology and hydrocarbon indicators," and he expects even more AI "in the near future, especially with more and more powerful computers coming."

See **Enormous Data**, page 15

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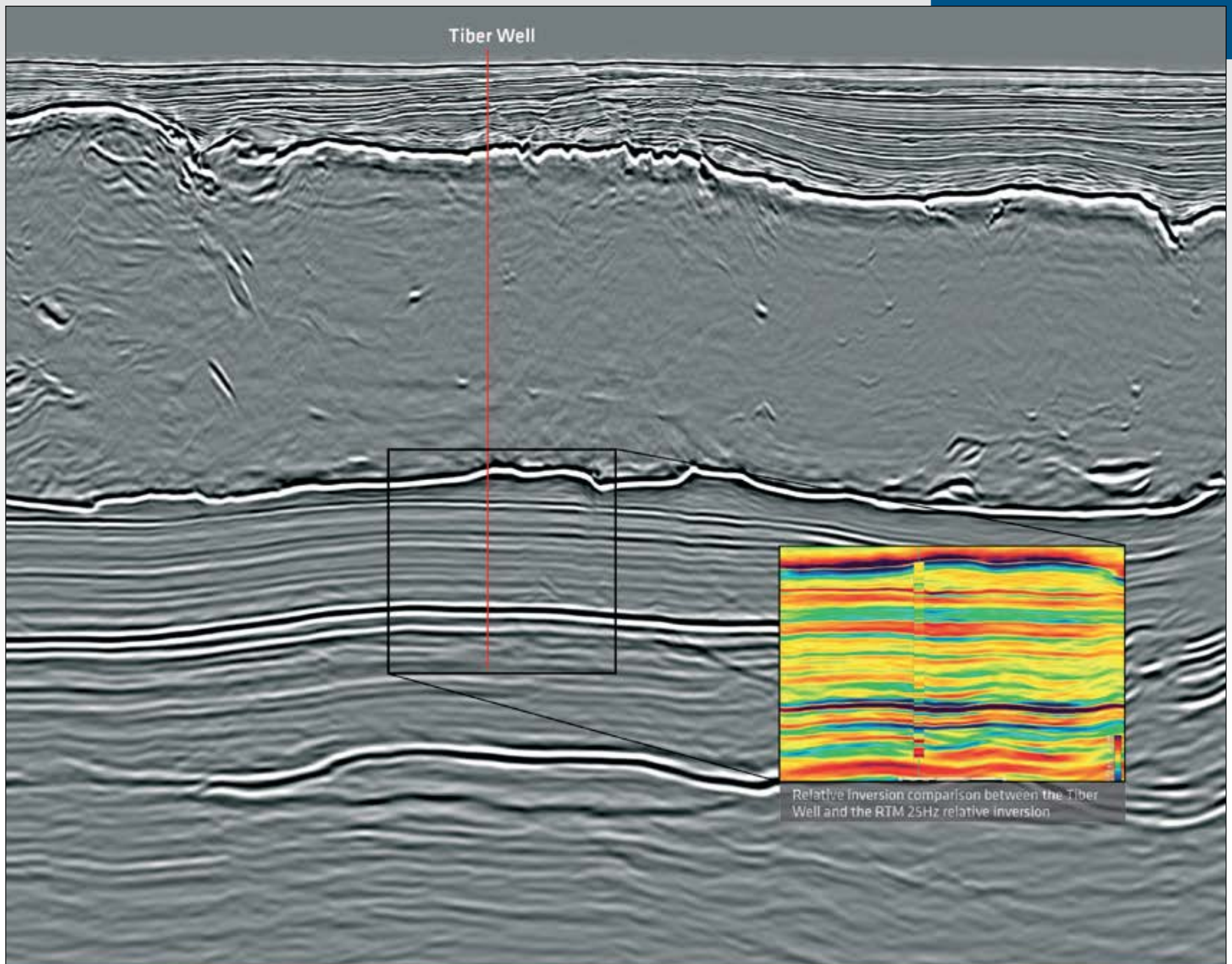


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# Mitigating the New Risks of the 21st Century Oil Field

By HEATHER SAUCIER, EXPLORER Correspondent

**R**isk has always been a factor in the oil and gas industry. Before the development of 3-D seismic and more advanced petroleum modeling, it was not uncommon for operators to drill numerous dry holes before making a discovery.

Yet, as the latest petroleum technology continues to reduce exploration risks, new risks in the industry are surfacing with the proliferation of another kind of technology. Cell phones, the Internet

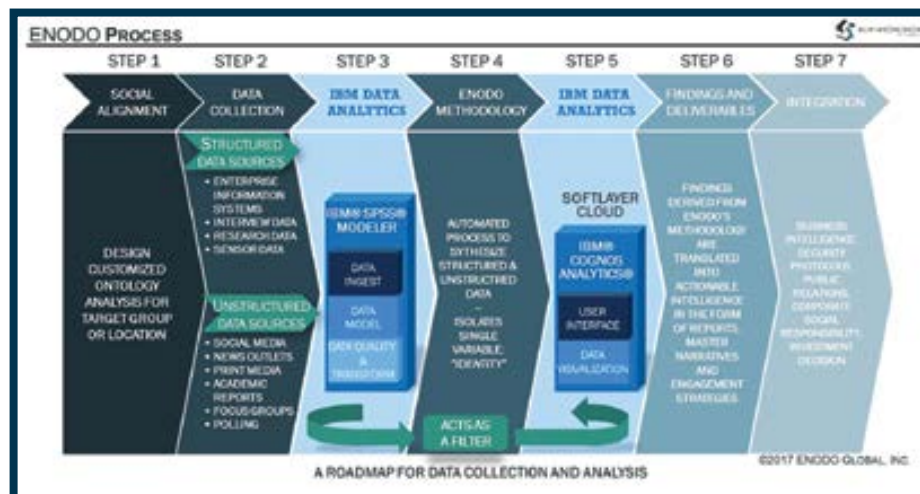


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and social media are now a global standard, having expanded into practically every country on the planet. As a result, communication among people, families, tribes and societies has become nearly instantaneous.

For the oil and gas industry, this has created a relatively new and serious vulnerability to social risks in both developed countries and Third World nations that can be more costly than a dry hole and stop a project dead in its tracks.

A case study performed by ENODO Global, a consulting firm specializing in risk analysis and population-centric engagement, took a hard look at the Dakota Access Pipeline project, initially expected to cost \$3.7 billion. After 87 percent of the pipeline was completed in 2016, protests began when it was revealed that part of the pipeline would be rerouted near a Native American burial site.



What began as a handful of concerned messages on YouTube turned into thousands of people permanently camped near the site and, later, a worldwide social media opposition campaign – ultimately costing \$100 million in project delays and \$10 million in security costs, said Jim Sisco, president and founder of ENODO Global.

"Today, extreme losses and multi-year project delays often are the result of unidentified or unmitigated social risks," he said.

Unprecedented social risks have left many operators – even the mighty majors – simply unprepared for the consequences, Sisco said. Having witnessed a number of costly project interruptions on the exploration, development and production fronts, Sisco insisted that the "we got this" mentality combined with "outdated"

business models, which fail to account for social risks, no longer work.

## Africa: The New Frontier

The Dakota Access Pipeline project is a close-to-home example of how communication technology can increase costs and stall a project, which is now moving forward after presidential intervention. Yet, similar situations are popping up all over the planet – particularly in developing countries where people are quickly gaining access to technology and social media platforms.

As operators advance into unexplored and underexplored territory for viable discoveries in the sub-\$50 a barrel climate, many are headed to resource-rich Africa, said Eric Hathon, AAPG Member and director of Conventional Exploration for

Marathon Oil. "Africa is a frontier," Hathon said. "That's where a lot of the potential is."

In fact, Africa has had unprecedented success in the past decade, claiming more than 50 percent of major worldwide discoveries, said David Blanchard, past president of the AAPG Africa Region and 2015-17 board chairman of the International Petroleum Technology Conference. "There is a real interest in exploring in the rift basins in east Africa and the interior of Africa," he said.

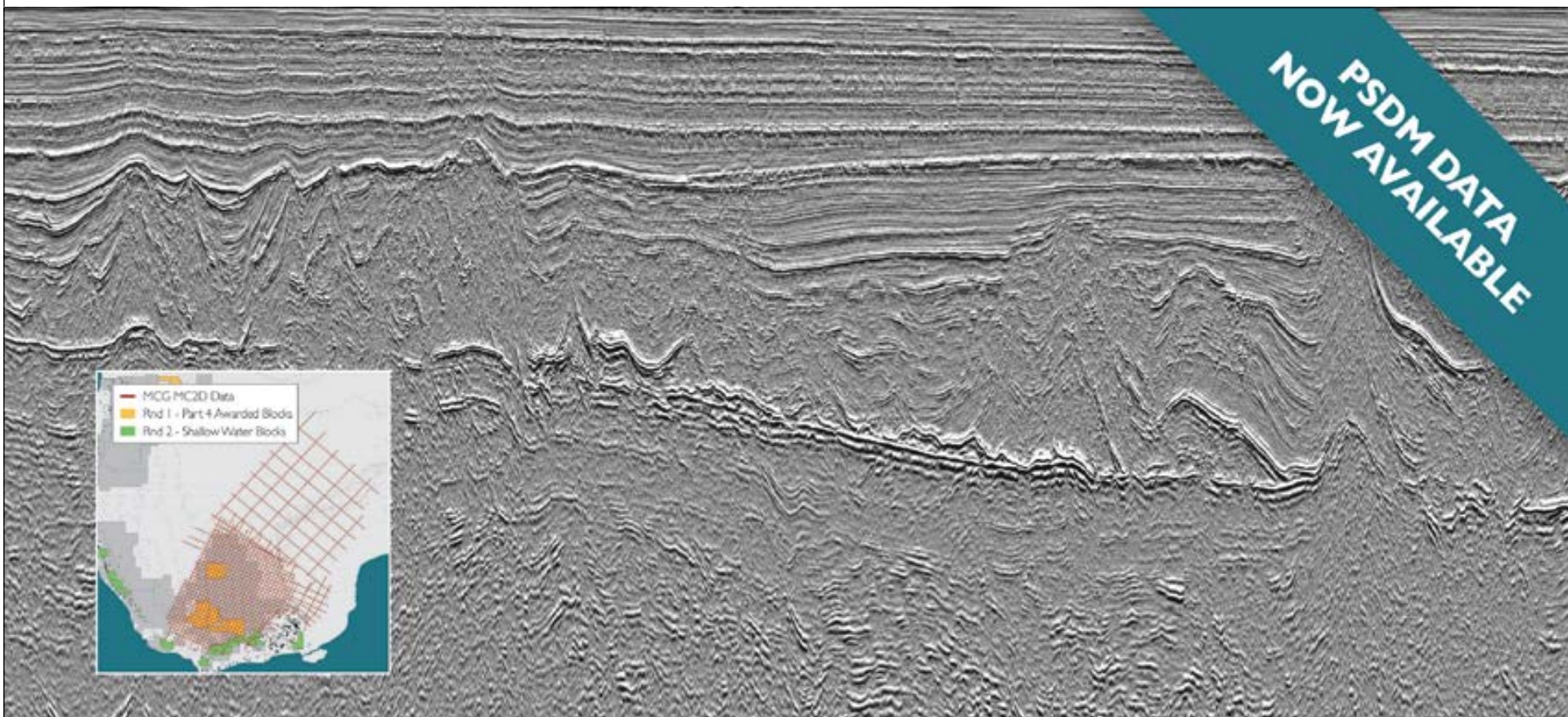
Exploration in Africa has always involved multiple levels of risk. Transparency, contract sanctity and government regulations have always been issues between some African governments and third-party investors. Yet, realizing that resource exploitation is essential for their nations' growth, countries such as Egypt, Ghana, Kenya and Gabon are stepping up to the plate and playing by the rules, Blanchard said.

Operators are doing their part as well.

"The private sector industry in general is taking a more proactive approach to closing the expectation gaps between governments and private sector investors," he said.

Yet in countries where people's needs are great, savvy citizens are no longer tolerating their governments to solely benefit from their nations' resources. With cell phones in-hand and Facebook and Twitter accounts active, many are forging digital connections, banding together and demanding their share. And, as seen by Sisco, many outside operators are unprepared for this new social climate.

See *New Breed*, page 10



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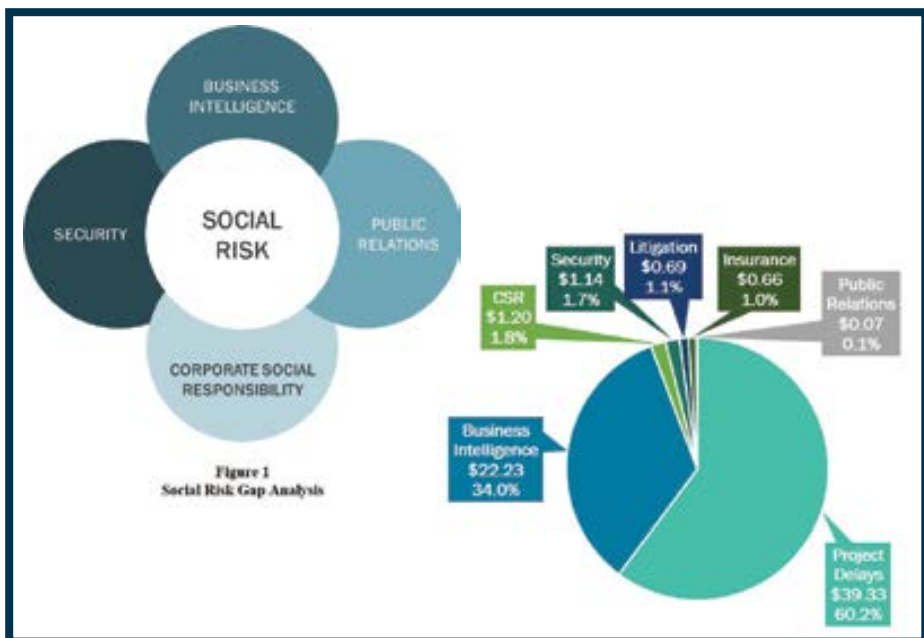
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## New Breed from page 8

### A New Breed of Social Risks

While social risks have always existed in both Third World and developed countries, as evidenced by the Dakota Access Pipeline project, they are becoming more difficult to wrangle, Sisco said.

He referenced an incident in Kwale, Kenya, where citizens mobilized in 2014 to petition the national government to allow local communities to excise a tax on a mining company (Base Resources headquartered in Australia), believing they would not otherwise directly benefit from the project. Unified through social media, they were successful and increased annual project costs by \$11,220 in business

permits for all mid-sized mining companies, as reported by Reuters Africa.

"If that mining company had properly engaged with those Kenyan communities and came to a fair agreement to meet their needs, the communities likely would not have asked for that tax," Sisco said.

Improved communication tools have given people more power and influence than ever before.

"As we flatten the world through globalization, information is spread so quickly. Governments can no longer be the sole regulators and make decisions that remain under the radar. People are demanding more from government. Where is my share of this reward? When people have more access to information, they become empowered," Sisco said.

For operators, it is no longer enough to adopt textbook methods to tackle social risks. Along the same lines, giving \$100,000 to a country's minister of the interior or minister of petroleum and paying large public relations firms to iron the wrinkles in community relations no longer cuts the cake.

"More and more companies are recognizing that they can't just enter a country with thousands of dollars for social programs and call it good," Blanchard said. "You have to be engaged and proactive with the local communities."

### Social Risk Analysis

Today's environment requires operators to employ detailed social risk analysis that ultimately allows an operator to come in, explore and produce with community support, rather than dissent, Sisco said. The method goes far beyond a cursory discussion with government officials and money spent on a hospital, school or water wells.

Rather, social risk analysis is a multi-step process that digs deeply into the identity of a community to understand the actual needs of a people, receive their buy-in on a project and regularly monitor and stamp out the potential for social unrest. The needed model is complex and must deliver real-time business intelligence operators can use to quell any kind of community distress that might be brewing.

Sisco is not an oil and gas man. Yet his expertise in risk management, which he developed while working as an intelligence officer in the U.S. Navy, has brought many operators to his door.

During Operation Enduring Freedom, Sisco was charged in 2009 with the daunting task of peacefully integrating U.S. Special Forces into Afghan communities. Through trial and error, he developed a process by which he could determine a community's identity and needs, craft a near seamless integration process and ultimately deliver a service to the community that was met with welcoming arms.

Despite the differences in ethnicities and tribes that Sisco encountered in Afghanistan, he ascertained that most people identified themselves as farmers who struggled with failing crops. In response, the U.S. government, working with agricultural development specialists, introduced a low-cost agrarian program that increased agricultural yields by 350 percent, he said. As word of the program's success spread to remote villages, the troops were embraced by the people who allowed them to carry out their mission without discord.

In fact, there was a 10-fold reduction in roadside bombs in some of the most insecure districts of the restrictive Kandahar province, Sisco noted, alluding to an article

See **New Model**, page 15

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Francis Bacon

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# Permian Basin: The Center of Black Gold Activity

By DAVID BROWN, EXPLORER Correspondent

The Permian Basin has been known for black gold and clear methane for almost 100 years. Today, it's just as closely associated with little green pieces of paper.

Those dollars are flowing into the area as fast as oil and gas are flowing out. Companies and investors dropped almost \$30 billion into Permian deals last year.

"Basically, we have 80 to 90 private equity teams working the Permian Basin along with all the publicly traded companies," said AAPG Honorary Member Mike Party, CEO and president of Beryl Oil and Gas LP in Midland, Texas.

The greater Permian area spreads across northwest Texas and southeast New Mexico. It includes the Midland Basin to the north, the Delaware Basin to the southwest, a northwestern shelf and an eastern shelf, a central platform and, to the southeast, the Ozona Arch area.

The Midland and Delaware sub-basins make up most of the heart of current activity and have attracted most of the recent investment.

"In the Midland Basin, the Delaware Basin, we've got 4,000 to 5,000 feet of reservoir rock, so there's a lot of opportunity, a lot of ways to get it out. The technology is developing very fast," Party noted.

"The basin is profitable at or below \$40 a barrel. We don't need \$50 oil to make it profitable" he said.

### Billions, Not Millions

At a time when some \$10 million deals have made the industry excited and



SM Energy recently acquired assets in Howard and Martin counties in Texas for \$1.6 billion. Photo courtesy of SM Energy.



PARTY

**"The basin is profitable at or below \$40 a barrel. We don't need \$50 oil to make it profitable."**

\$100 million deals have made it swoon, investments in the Permian are often measured in billions of dollars.

In January, ExxonMobil announced it would pay up to \$6.6 billion in stock

and cash to acquire companies owned by the Bass family of Fort Worth, with an estimated resource of 3.4 billion barrels of oil equivalent (boe) in the Delaware Basin in New Mexico.

That more than doubled its Permian Basin resource to 6 billion boe. The company agreed to pay \$5.6 billion in ExxonMobil shares upfront, with a series of additional contingent cash payments totaling up to \$1 billion no later than 2032, commensurate with development.

Noble Energy Inc. earlier announced it would buy Clayton Williams Energy Inc. for \$2.7 billion in stock and cash, adding 2,400 gross drilling locations on 71,000 contiguous net acres in the core of the southern Delaware Basin in Texas, plus an additional 100,000 net acres in other areas of the Permian.

The deal included unrisks resource potential of over 1 billion boe in Wolfcamp zones plus midstream assets with more than 300 miles of oil, natural gas and produced water-gathering pipelines.

In December, SM Energy closed a previously announced acquisition of Permian oil and gas assets in Howard and Martin counties, Texas, from QStar LLC for \$1.6 billion. That included about 2,400 boe per day net production and expanded the company's footprint in the area to around 82,450 net acres.

In October, RSP Permian Inc. of Dallas said it was acquiring Silver Hill Energy Partners LLC and Silver Hill E&P for \$1.25 billion in cash and 31 million shares of RSP common stock in a deal valued at a total of \$2.4 billion.

It gained current production of about 15,000 boe per day in the Permian and over 100,000 surface acres including 41,000 net

**Continued on next page**

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## Continued from previous page

acres in Loving and Winkler counties, Texas. Also in October, Occidental Petroleum Corp. acquired several Permian Basin interests from private sellers, including enhanced oil recovery and CO<sub>2</sub> properties and related infrastructure in the southern Delaware Basin in Texas. Oxy agreed to pay \$2 billion funded from cash on hand.

The acquisition included about 35,000 net acres in Reeves and Pecos counties, approximately 7,000 boe per day of net production from 68 horizontal wells and a minimum of 700 gross horizontal drilling locations targeting the Wolfcamp A, Wolfcamp B and Bone Spring.

Party said the hot Wolfcamp play is spreading rapidly to the west in the basin, but the Permian is known for multiple opportunities and numerous producing formations.

"We've got some operators starting to test multiple zones in the Spraberry. We also have some other new things like the Clear Fork. Up in New Mexico, you're starting to see more activity in the Bone Spring," Party said.

"The other thing going on kind of under the radar is the residual oil zone play, the ROZ play, in the San Andres. That's in Yukum County," he added.

Investment interest in the Permian is high now, but it tends to be focused in a small number of counties, Party said.

"If you look at the Midland Basin here, you've got eight or nine counties that are the heart of the basin action. That seems to be where all the activity is concentrated," he observed.

Leasing prices have gotten so high that Bloomberg News issued a story in February wondering if the expense of getting into



Apache Corp's operation in the Ketchum Mountain area of the Permian Basin. Photo courtesy of Apache Corp.

the Permian Basin would start to cool off investments.

"There's been a sale in the Midland Basin that was up at \$60,000 (per acre)," Party said. "We're just now getting up into the 40s in the Delaware."

But he hasn't seen a slowdown in activity in the Permian hot spots, just a dwindling of available lease acreage. They aren't making much new land nowadays, he commented.

"A lot of these core areas are leased up, tied up. You're really talking now about going to somebody and making a deal with them," Party said.

## Downturn Defiance

Remarkably, investment money began pouring into Permian opportunities well before the industry began to recover from a

prolonged slump.

Last July, Silver Run Acquisition Corp. said it would acquire an 89-percent controlling interest in Centennial Resource Production LLC, creating a combined company valued at an estimated \$1.7 billion and gaining 42,500 acres in the Delaware Basin with large, contiguous acreage blocks in Reeves, Ward and Pecos counties in West Texas.

And in August, the investment firm The Blackstone Group agreed to invest \$1 billion in Jetta Permian LP to acquire properties in the West Texas and New Mexico Permian area and pledged another \$500 million to Guidon Energy, which had already scooped up 16,000 net acres in the Midland Basin.

Then came the stunner – not an investment deal, but an announcement

by Apache Corp. in September. The company said its Alpine High prospect in the southern Delaware Basin likely holds 75 trillion cubic feet of rich gas and 3 billion barrels of oil in the Barnett and Woodford formations alone.

Apache also projected significant oil potential in the shallower Pennsylvanian, Bone Spring and Wolfcamp formations. It estimated 2,000 to more than 3,000 future drill sites in the Woodford and Barnett on 307,000 contiguous acres, primarily in Reeves County, Texas.

The promising outlook for the Permian Basin area has left the local industry giddy with anticipation.

"In Midland the feeling is it's picking up again," Party said. "Always a gauge is how busy the streets are, and the Loop has a lot of traffic on it." ■



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# 'Seduced by the Beauty of Geology'

By BARRY FRIEDMAN, EXPLORER Correspondent

**M**ichael Collier, this year's AAPG Geosciences in the Media Award recipient, is a man who takes his work seriously.

Very seriously, actually.

Which is noteworthy in itself, when you consider how long a list of accomplishments falls under the category of "his work."

But himself?

Well, not so much.

He is self-deprecating, modest and charming, and when asked which of his 19 books he was most proud, he said, as you might expect, "Hard to choose a favorite, of course, but 'The Mountains Know Arizona' quickly rises to the top."

His wife wrote the book and he photographed it, and in 2004, they won the National Outdoor Book Award for Design and Artistic Merit for it.

But then added:

"I always thought that the title (imposed by the editor) was pretty dorky."

It was a book written, he said, during a two-year period from his home state of Arizona and from – get this – "the imagined perspective of ten mountain tops."

Collier's others books include examinations on the Grand Canyon, Death Valley, Denali and Capitol Reef National Parks, including "The Melting Edge," about Alaska and climate change, which won the National Outdoor Book Award in 2012. He's also won Outstanding Science Trade Book awards from the National Science Teachers



Association in 2007, 2008, and 2009.

And, of course, the latest addition to that list is the 2017 AAPG Geosciences in the Media Award, to honor Collier's "life's work as an ambassador for the geosciences through his photography, books, exhibits and other projects."

## Renaissance Man

But, being an author is only part of his story. He's also a physician, a teacher, a pilot, a photographer and, of course, a geologist, which was the basis for something else he's done: produce

informative science programming.

"The radio geology vignettes were in a series that Rose (his wife) and I did for KNAU, the local NPR station. We'd highlight a geologically significant (but relatively unknown) location somewhere on the Colorado Plateau, often within a few hours' drive of Flagstaff," he explained.

It was made from love and knowledge – it's always been about that.

"In order to know something about the landscapes I was photographing, I got a couple of degrees in geology," said Collier.

*A couple of degrees?*

What makes a man like this tick?

"I have always been seduced by the beauty of geology and landscape. As a photographer and writer," he said, speaking directly about the award, "I have tried to share and preserve that beauty through my work within science outreach."

A voracious reader and a man who has rowed boats commercially in the Grand Canyon, Collier has won both the USGS Shoemaker Communication Award and AGI's Public Contribution to Geosciences Award, and said he learned the world is "a big place full of fascinating people."

Photography seemed the natural outlet to chronicle that, but when you hear the progression – his progression, and you can almost plot the journey on a graph and see why he moved on.

"I started shooting pictures at the age of 16, and first published them (in Westways Magazine) at 20. In order to publish photographs, I pushed myself into writing accompanying texts. In order to have a captive audience for my geology stories, I started to row passengers down rivers (the San Juan, Green, and ultimately the Colorado through the Grand Canyon). In order to expand my perspective on landscapes, I learned to fly."

And on and on.

But a doctor?

"Freelance photography is a

See Professor, page 16

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## Enormous Data

from page 6

At some point in the future, the challenge of Big Data in oil and gas may grow into an "Enormous Data" challenge. Bertocco foresees a huge increase in the amount of data being captured.

"There's going to be more and more data coming out of equipment," he said.

Right now only about 15 percent of oil and gas equipment generates captured data, but "going forward, we have to believe that almost 100 percent of the equipment will produce data," he said.

Bertocco thinks the industry will be dealing with terabytes of data per well and several hundred terabytes per field. Today, "it's impossible for anybody to have the kind of computing capability" that will be needed in the future, he said.

### Future Development

Because it already deals with very large quantities of seismic data and other data, the oil and gas industry probably sees itself as a leader in data use. According to Bertocco, it's just the opposite.

"Oil and gas is still lagging every other industry, barring construction, in capturing and using data. Which is amazing," he said.

It's also ironic, because 20 years ago oil and gas was a pioneer in Big Data capture and analysis, Bertocco said. Since then it has been surpassed by most other industries, from finance to airlines.

In part that isn't surprising, since the E&P sector is just now coming out of a miserable downturn with not enough money to spend on anything, including IT. But Bertocco thinks the industry has

already started a major five-year push in developing data capabilities.

He said three areas of development will be crucial:

#### ► People

This involves creating more collaborative work structures as well as building internal knowledge capacity and adding expertise, Bertocco said.

"There aren't that many (cyber) scientists available today, and most of them are employed by other industries," he observed.

#### ► Information Technology

Beyond the need to upgrade and add computing capacity, oil and gas companies have to deal with legacy systems that hinder progress, he said.

"A lot of companies have been struggling with very complicated and cumbersome IT systems," Bertocco

said. "We want to be sure information flows across the organization. Those systems can be, and are as of today, a big impediment."

#### ► Change Management

In computing-related change management, less than 15 percent of companies rate themselves as satisfied and 30 percent fail, Bertocco said. An effective digital roadmap is essential, he noted.

"Unless you're clear on how you're going to drive the transformation, it just won't happen," he said.

The puzzle facing oil and gas in future decades is how to make enormous quantities of data both usable and useful. Maybe by the year 2100, the industry can look back and see how all the pieces fit together. [E](#)

## New Model

from page 10

titled, "The Changing Role of Armies in the Age of Democracy," published by Business Day in 2013.

"We made a point to see the world through their eyes," he said, "and talk in a way that resonated with them."

### New World, New Model

Insisting that textbook strategies that involve business intelligence, security, public relations and corporate social responsibility (CSR) programs are no longer enough to keep projects out of the fires of conflict, Sisco said that social risk analysis is crucial in the age of social media and the empowerment it has brought to people.

Business intelligence is typically driven by broad geopolitical factors with an emphasis on formal institutions and business elites, he explained. "Standard business intelligence tools are not equipped to analyze large amounts of information that is continuously generated by news outlets and social media," Sisco said.

He added that security measures focus on protecting a company's assets and personnel, and can therefore create physical and psychological barriers that can impede efforts to establish stakeholder relations.

Public relations campaigns tend to be reactive in nature and often rely on strategies that fail to shape opinions and resonate with local populations. In that vein, CSR initiatives often overlook local grievances and basic needs when designing and implementing social development projects, Sisco said.

The right social risk analysis can fill the void where the above strategies intersect. "It is a new approach that can synthesize large amounts of data to help businesses proactively prevent social risks from becoming events that interrupt projects and up their costs," he said. "It empowers leaders to make better decisions, identifies mispriced investments, reduces unexpected operating expenses and prevents lower productivity, project delays and even violence, which are all real-world manifestations of social risk."

While social risks can never be completely removed, they can and must be mitigated for a successful operation, Hathon explained. "I'm more of a believer in risk management than risk reduction," he said. "A critical mistake is overlooking your risk factors. In fact, the most dangerous risks are the ones you don't think of." [E](#)

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Special-section editors: Per Pedersen and David Eaton

### NOVEMBER 2017

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**Submission deadline 1 March 2017**

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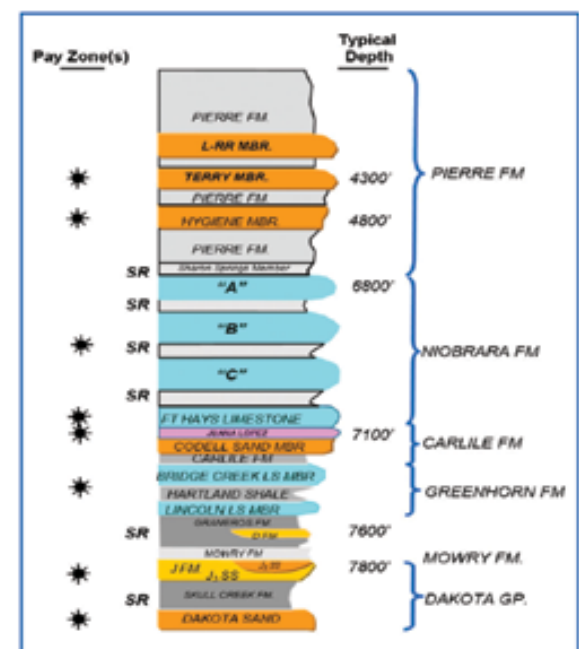


Image from: The Niobrara Petroleum System, a multi-basin resource play in the Rockies

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





This aerial photograph is of the Ivanpah Solar Electric Generating System in California's Mojave Desert, at the base of Clark Mountain. Photo courtesy of Michael Collier.

## Professor from page 14

wonderful, ethereal life, but I decided as I turned 30 that I needed an additional practical skill. So at 35, I added an MD to the back of my name," he said.

He said medicine – and it's going on 25 years now – is a way to look at someone and say, "How can I help you?"

### 'Disjunct' Professor

It is that same sense of immediacy he brings to the classroom.

"I enjoy teaching," he said, "but not in conventional ways."

To that end, he has created websites about unconventional oil in Alberta and Utah, as well as an app about seeing landscapes from the sky. It is the same unique pedagogy he has used in other disciplines, as well.

"As a physician, I often had third-year med students up from my alma mater, the University of Arizona. They certainly had access to fancy specialists down in Tucson, so I always concentrated instead on their interpersonal skills – how to talk, touch and empathize with patients," he said.

At Northern Arizona University, where he teaches, he wants a new title.

"They say I am an 'adjunct professor' within something called the School of Earth Sciences and Environmental Sustainability (whatever that's supposed to mean), but I just call myself a 'disjunct professor,'" he quipped.

On a serious note – almost, anyway – he talks about his work and future generations.

"I currently work occasionally with a few NAU graduate students in the biology department, focusing on science outreach projects. And I am about to start working with an undergraduate geography intern, cataloging photographs I've taken throughout the western hemisphere before they are all donated, after I kick the bucket, to the NAU Special Collections library," he said.

In that collection will be his 14-picture exhibit of vistas that he said have "experienced significant human impact, called "Dispassionate Landscape," of which of he said, "For years, as a pilot and photographer on my way to some assignment, I'd cruise past and dispassionately look down on industrial sites with a landscape."


"With no dog in the fight, I could see both the natural setting and the unnatural development," Collier added.

It has been a long, fulfilling life, but when asked what was most memorable, he laughed and said, "I forget." What he hasn't forgotten, though, are those who helped him get here.

"I was lucky enough to get to know Bruce Appelbaum and Ray Thomasson (both AAPG Members) through the American Geosciences Institute and I was blessed to have Chuck Barnes (as an undergraduate) and Arvid Johnson (as a graduate student) as geology mentors."

There's someone else, too, who has helped him share and preserve the beauty of it all – his co-author, his partner.

"Thanks go first," he said, "to Rose, my wife of 36 years. She, more than anyone else I know, knows how to smile at the world."

One gets the sense it's his favorite photograph. 

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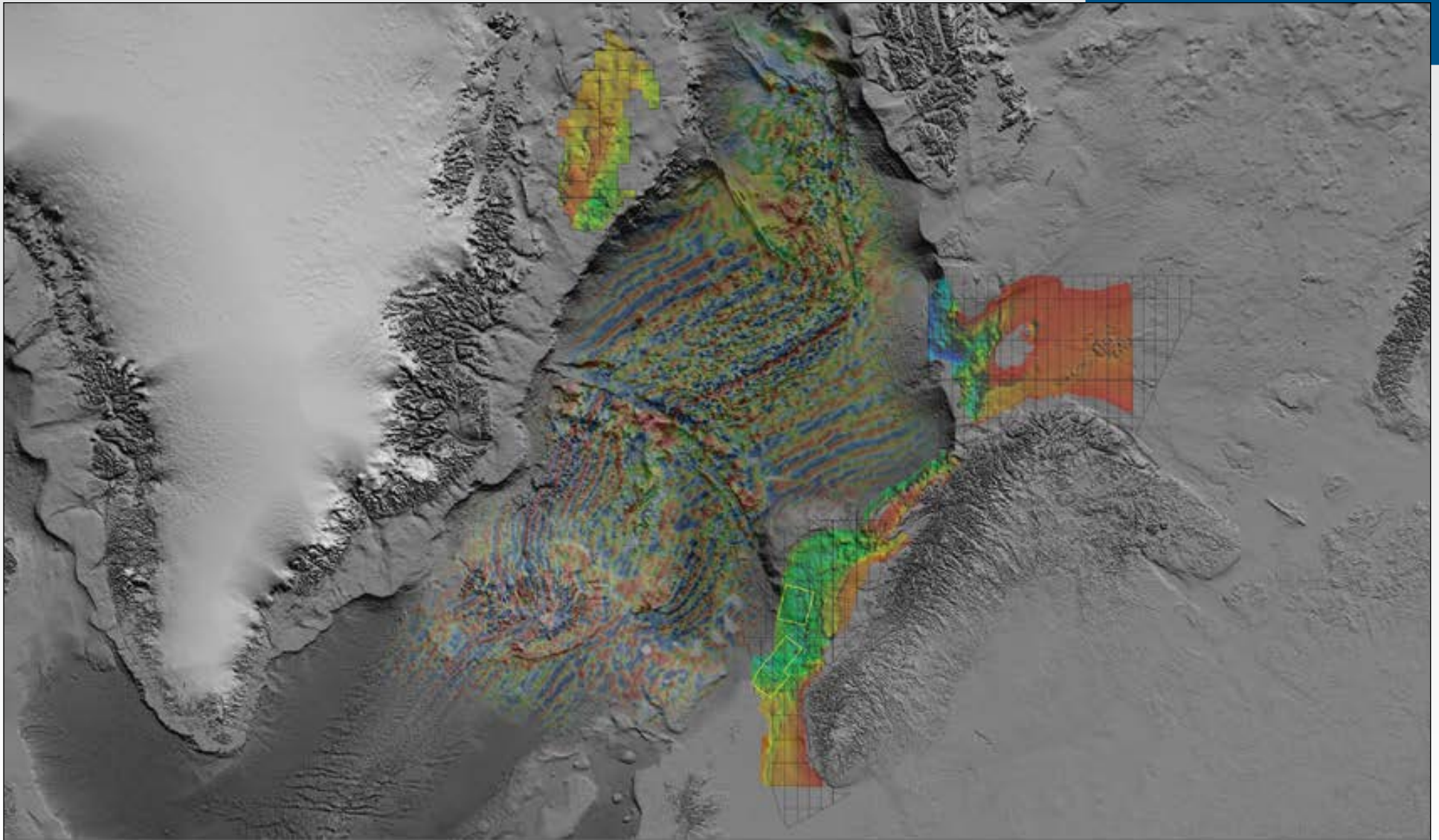


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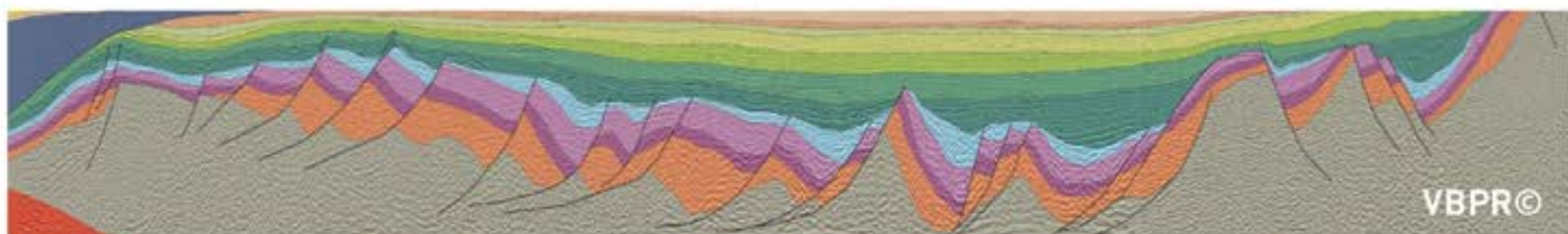
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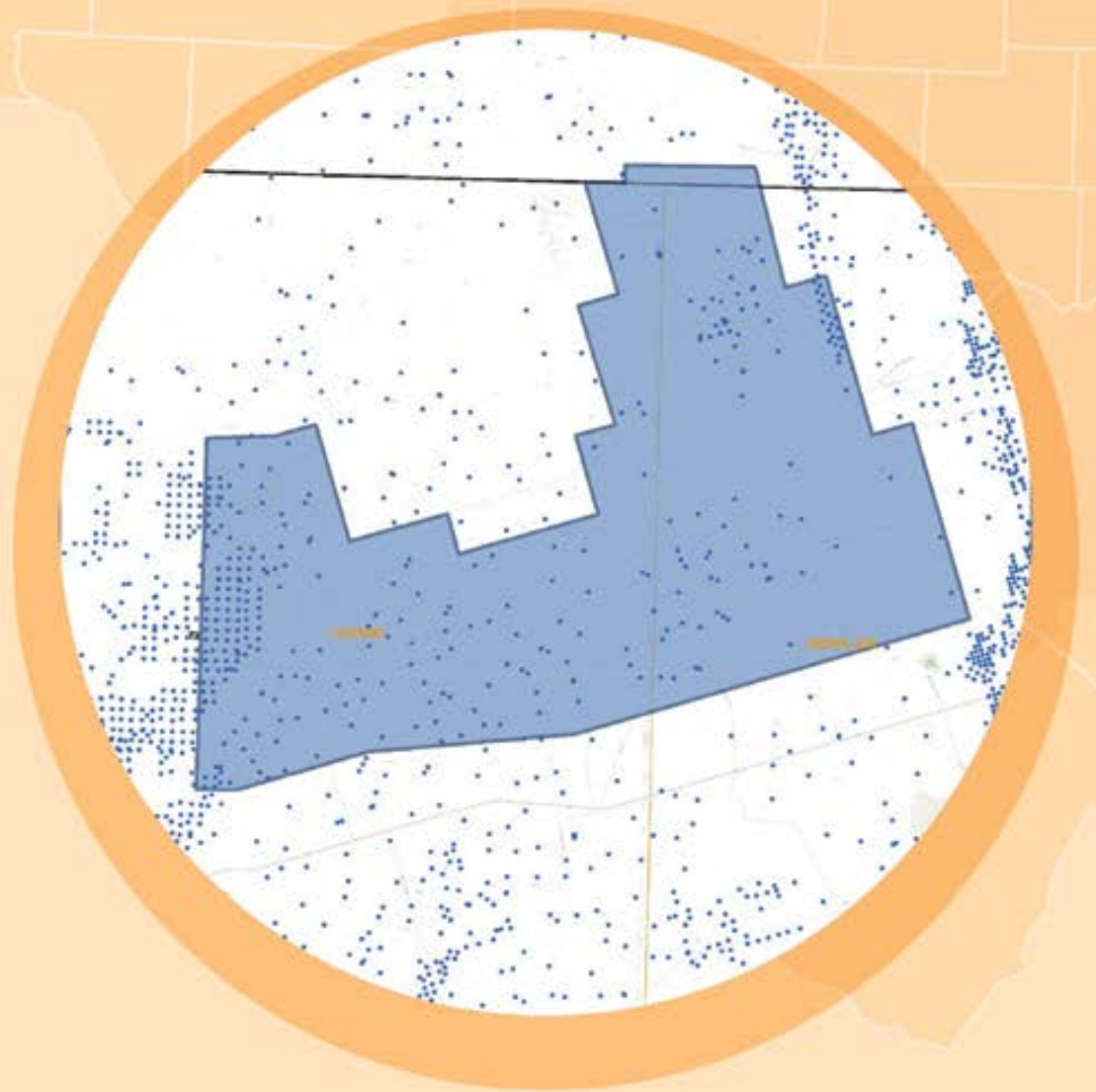
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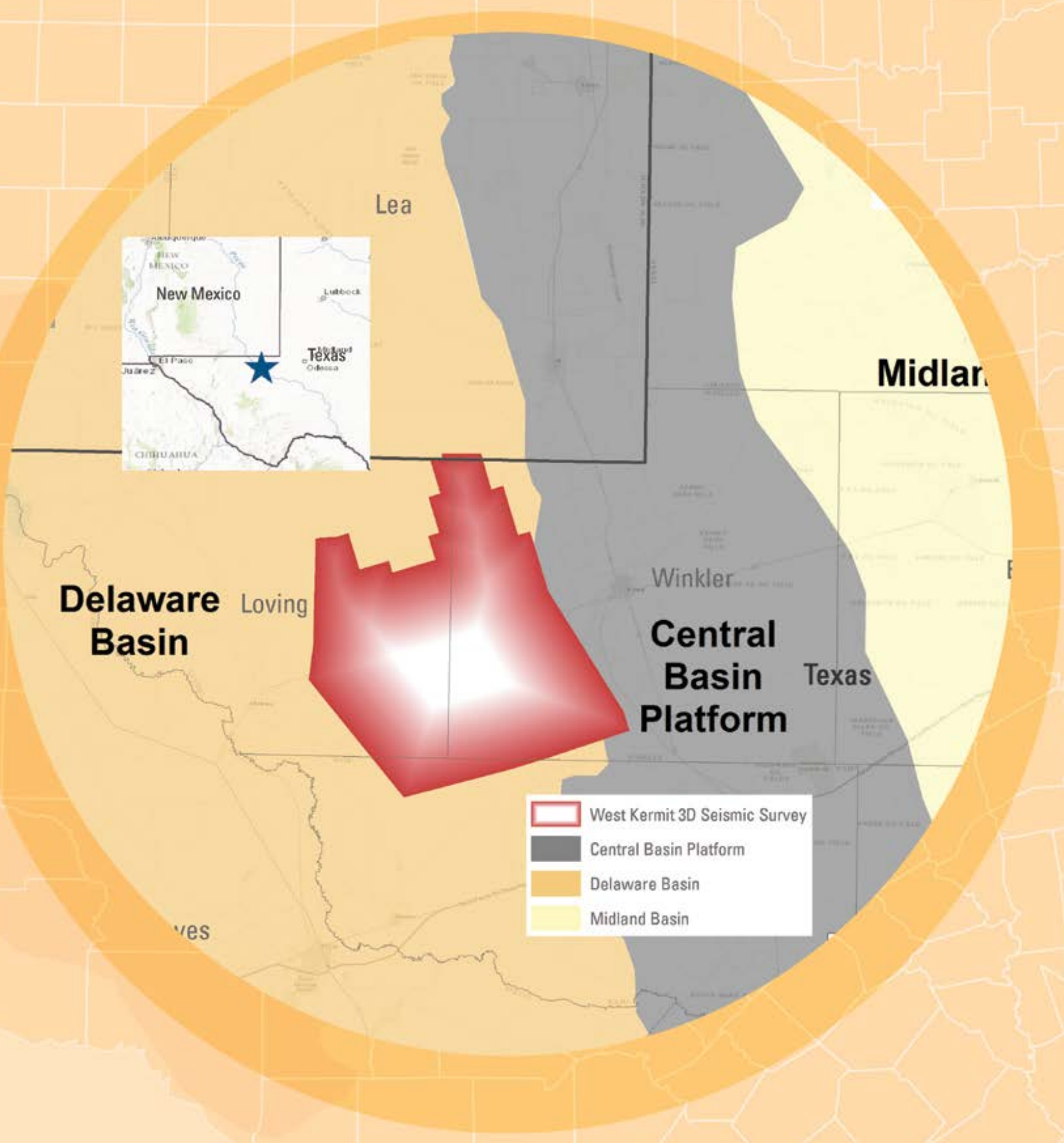


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# Centennial of the Wolfcamp Formation

By RICHARD BAIN

This year marks a centennial celebration for petroleum geologists in more ways than one. A few months after the founding of AAPG in early 1917, the first description of the Wolfcamp Formation was published in the University of Texas Bulletin No. 1753 titled "Notes on the Geology of the Glass Mountains" by J. A. Udden, on Sept. 20, 1917.

Johan August Udden described a series of outcrops in the Wolf Camp Hills that lie at the southern end of the Glass Mountains, approximately 12 miles northeast of the town of Marathon in Brewster County, Texas.

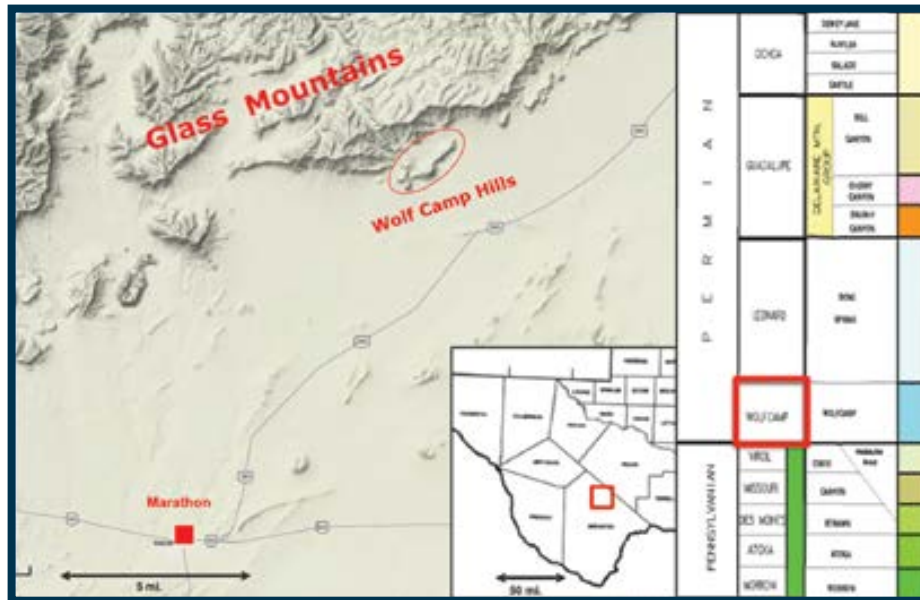


UDDEN

"Overlying the Gaptank there are some beds which I have called the Wolfcamp," stated Udden. "Observations on this formation have been made chiefly at Wolfcamp, from which it takes its name. Wolfcamp is the site of an old dwelling-place, not now inhabited. 'Lobo' wolves are said to frequent the place."

"The Wolfcamp consists mostly of shales which vary in color from almost black to gray and greenish-gray. Interbedded with this shale are several layers of limestones which are cemented shell breccia, in places conglomeratic," he continued.

Two months later, in the University of



Texas Bulletin 1762 titled "The Permo-Carboniferous Ammonoids of the Glass Mountains, West Texas, and their Stratigraphic Significance," by Emil Böse, Udden clarified his involvement in the naming of the Wolfcamp. In an editor's footnote he credited Böse and fellow researcher Charles L. Baker as co-discoverers of the Wolfcamp Formation.

### Continued Research

Starting from that description of a single locality in 1917, subsequent researchers identified and described

the Wolfcamp in numerous surface and subsurface locations over a large extent of west Texas. Today the lowermost series of the Permian system in North America is called the "Wolfcampian" as defined on the Correlation of Stratigraphic Units of North America (COSUNA) charts. It is equivalent to the Asselin and Sakmarian Series on the International Commission on Stratigraphy International Chronostratigraphic Chart.

The Wolfcamp Formation has received a great deal of press lately. A recent assessment by the U.S. Geological Survey resulted in the largest estimate of

technically recoverable continuous oil and gas reserves ever assessed by the USGS in the United States: 20 billion barrels of oil, 16 trillion cubic feet of associated natural gas, and 1.6 billion barrels of natural gas liquids. And that is just in the Midland Basin portion of the Permian Basin; the Delaware Basin could contain a similar volume.

### A Man of Many Accomplishments

Johan August Udden was born at Lekasa, Sweden on March 19, 1859 and two years later came to America with his parents, who settled in Minnesota. Udden earned his bachelor and master's degrees from Augustana College in Rock Island, Ill., and taught natural science and civics at Bethany College, Lindsborg, Kan. from 1881 to 1888, then returned to Augustana College as a professor of natural history and geology from 1888 to 1911. During his tenure at Augustana, Udden taught various courses in botany, zoology, physiology, meteorology, and geology and at times he helped out in fields such as history.

In 1911, he became a geologist in the Bureau of Economic Geology and Technology of the University of Texas, and was named director of the Bureau in 1915.

In 1914, from a study of cuttings from a deep well in West Texas, he demonstrated

**Continued on next page**



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## Continued from previous page

the occurrence of extensive deposits of potash salts in the Permian basin. Today, potash mines in the northern Delaware Basin near Carlsbad, N.M. provide 75 percent of the domestic production of potash salts, which are used in the production of agricultural fertilizers.

In 1916, Udden advised the regents of the University of Texas of the probable occurrence of oil and gas in the University lands of west Texas. It wasn't until seven years later that the Santa Rita No. 1, regarded as the first producing oil well in the Permian Basin, began production.


Today the University Lands System administers the surface and mineral interests of 2.1 million acres of land across nineteen counties in West Texas for the benefit of the Permanent University Fund (PUF). The PUF is one of the largest university endowments in the United States and benefits more than twenty educational and health institutions across both The University of Texas System and Texas A&M University System.

In 1894, Udden first published on sedimentary processes of the atmosphere, a line of investigation that culminated in an important publication on the mechanical composition of loess and other wind deposits. As an outgrowth of this work he established, with C. K. Wentworth in 1922, a geometric grain-size scale that became the norm in the geological sciences. The grain size classification scale that is commonly called the Wentworth Scale is more properly known as the Wentworth-Udden Scale.

Udden received four honorary degrees: a PhD from Augustana College in 1900, a doctorate of science from Bethany College in 1921, a doctorate of science from Texas Christian University in 1923 and Doctor of Laws from Augustana College in 1929. He held membership in several scientific societies including the American Association for the Advancement of Science, (Fellow, 1906) Geological Society of America, American Association of Petroleum Geologists, Sigma Xi, and the Illinois, Iowa, Oklahoma, and Texas (Fellow) Academies of Science. In 1929 he was elected honorary member of the Society of Economic Paleontologists and Mineralogists.

In recognition of his distinguished service in sciences, Udden was knighted in 1911 by King Gustaf V of Sweden.

## Future of the Wolfcamp

For most of the 20th century, the Wolfcamp was a secondary target in the Permian Basin, greatly overshadowed by formations such as the San Andres and Ellenburger. Going forward in the 21st century, it is likely that the Wolfcamp will be the premier reservoir for development of oil and gas in the Permian Basin. 



BAIN

**Richard Bain** recently retired after 37 years with Chevron during which time he worked exploration and development projects in South Louisiana, South Texas, and the Permian Basin. His

most recent area of focus was a regional characterization of the Wolfcamp Formation in the Delaware Basin.

## Bridging the Petroleum and Geothermal Industries

The Geothermal Cross Over Technology Workshop will be held April 25-26 in Durham, United Kingdom.

The event will explore the potential for cross over technology and cross over experience in the petroleum and geothermal industries. It will also discuss opportunities to improve the efficiency and effectiveness of the industries.

Speakers from the petroleum and geothermal industries will present information centered on a variety of themes throughout the workshop.

Themes will include the prospectivity of fluid systems; modeling and measuring fluid flow; the impact of geothermal fluids; combined petroleum and geothermal mineral systems; adding value with geothermal energy; hydraulic fracturing




enhanced oil recovery; geothermal petroleum systems; enhanced geothermal systems; hot rock drilling, logging and completion; and monitoring performance.

In addition to the presentations, attendees will have the opportunity to network with one another and to make valuable connections to further bridge

the industries.

The event will be hosted by the AAPG Europe Region and will take place at the historic Durham University.

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# Interpreting Seismic Amplitude Volume Technique Attributes

By LUIS VERNENGO, EDUARDO TRINCHERO, MAXIMILIANO GARCIA TORREJON and IGNACIO ROVIRA of Pan American Energy LLC

The main challenge for a seismic interpreter is to extract the maximum amount of information from seismic data and integrate that with other relevant data so an accurate reservoir model of the subsurface prospect can be conceived. This implies evaluating and comprehending seismic events, their spatial behavior and interrelation and understanding the subsurface geo-architecture in the area of interest. To achieve such objectives, the seismic interpreter makes use of high-end interpretation workstations, where the seismic data are analyzed, integrated with well and other geological data and visualized in a practical and realistic way that other members of the team can understand.

But this represents only one part of the modern seismic interpreter's job.

The other challenge for the seismic interpreter is to devise creative and convincing workflows for analyzing the seismic data and its integration as mentioned above. Significant progress has been made in the search for and advancement of such new approaches.

## A New Approach For Using Seismic Amplitudes

A seismic interpreter's routine task must include comprehending and analyzing novel and non-traditional ideas, which tap into the individual interpreter's creativity. This is our motivation in pursuing such advancements. A couple of years ago, the first two authors described an amplitude volume technique (AVT) workflow that calculates the root-mean-square (rms) of the amplitudes by choosing a definite analysis window, and then rotates the phase of the data by negative 90 degrees using the mathematical operation of Hilbert transform. This calculation of the input seismic data yields somewhat higher amplitudes of frequencies in the bandwidth of the input data. A variation of this approach called high-frequency AVT was also described, wherein the workflow is applied to input seismic data after its bandwidth is broadened, i.e. includes frequencies at the lower and higher end of the spectrum also. Interpretation carried out on the resulting data (AVT or AVT<sub>HF</sub>) or attributes generated on these data exhibit more detail and are suggestive of other points of view that have a positive impact on the comprehension of the structural and stratigraphic elements in the subsurface architecture.

In figure 1a we show the visual impact

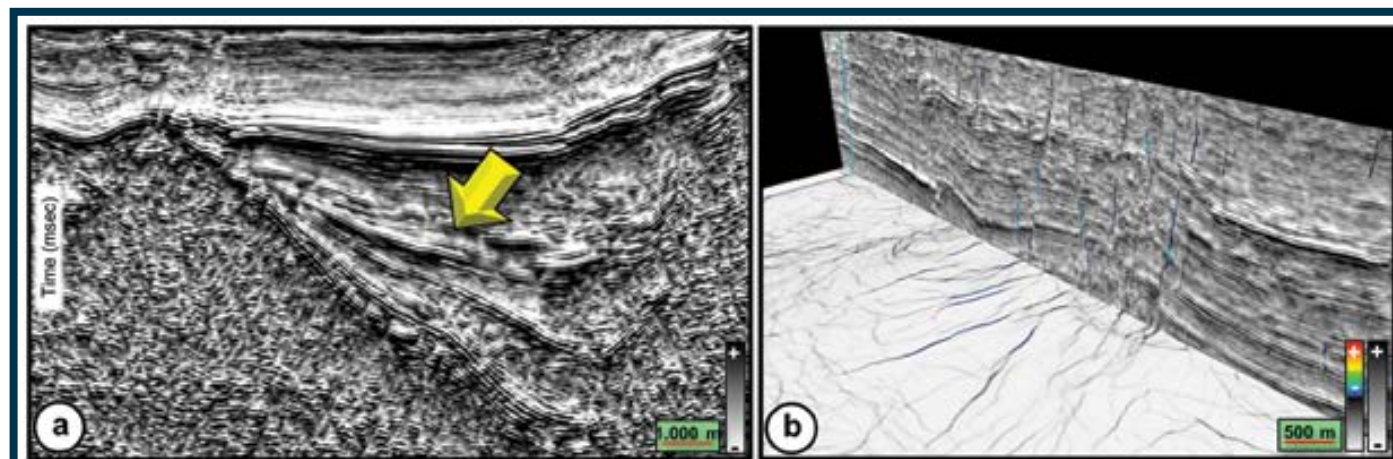


Figure 1. Examples of visual impact of AVT<sub>HF</sub> sections from Golfo San Jorge Basin, Argentina. (a) Segments of sections showing deep Neocomian deposits (yellow arrow). (b) Chair display with a time slice from coherence and the vertical section from AVT<sub>HF</sub> co-visualized with coherence using transparency. Notice the clear correlation of the discontinuities on the horizontal and the vertical sections that exhibit the ease with which interpretation can be carried out.

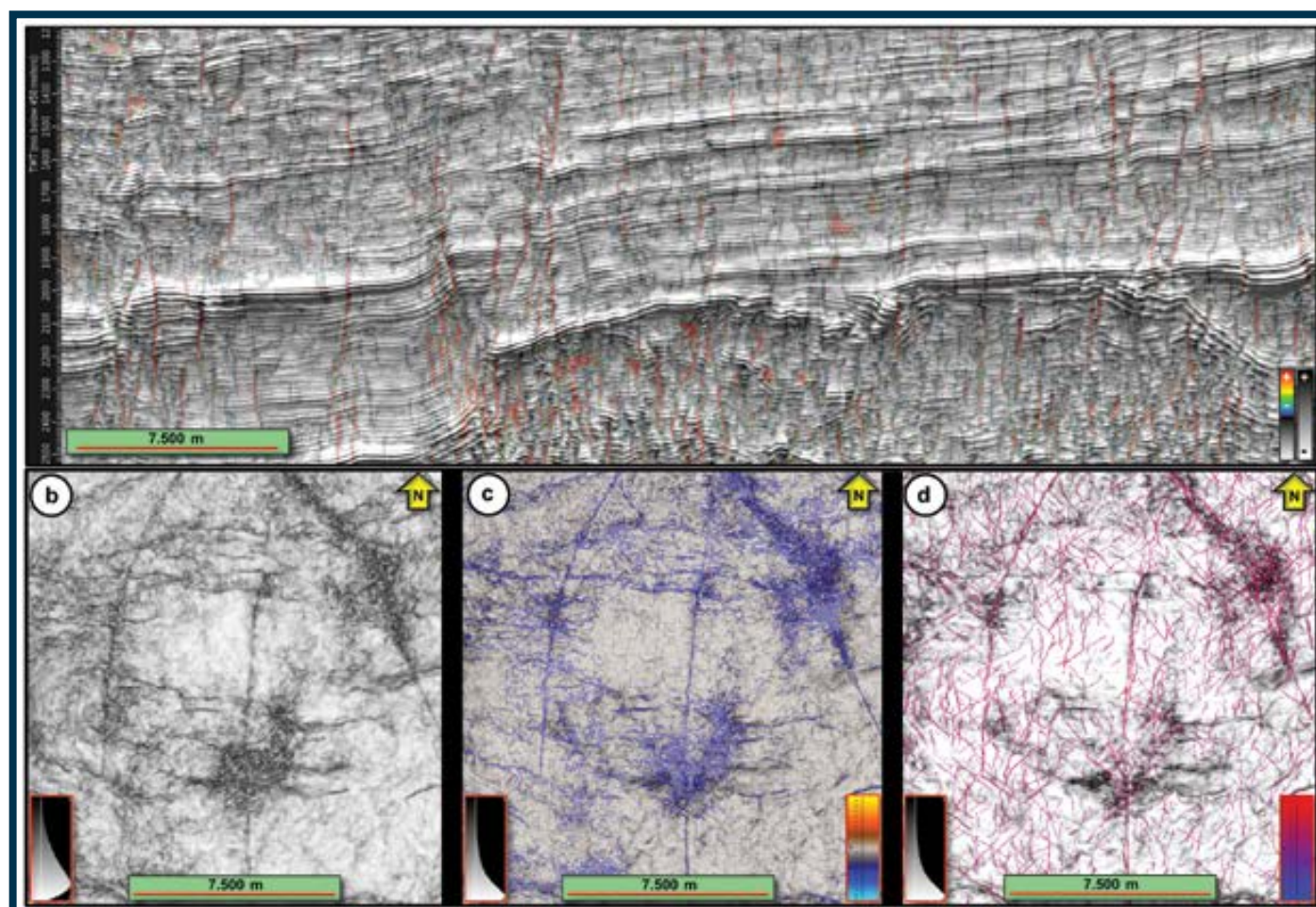


Figure 2. Co-visualization shown in different forms. a) AVT<sub>HF</sub> section co-visualized with an equivalent section from ant-tracking attribute. Equivalent time slices (at 700 ms) from b) coherence attribute run on full stacked data (Coh(AVT<sub>HF</sub>)), c) coherence run on AVT<sub>HF</sub> data (Coh(AVT<sub>HF</sub>)) and co-visualized with most-negative curvature attribute run on AVT<sub>HF</sub> (Curv(AVT<sub>HF</sub>)), and d) both attributes run on AVT<sub>HF</sub> data derived from far angle stack data, 30-45 degrees.

of the AVT<sub>HF</sub> sections from Golfo San Jorge Basin in Argentina, where the Deep Neocomian deposits stand out clearly as indicated with the yellow arrow. In figure

1b we show a chair display with a time slice from a coherence volume generated using commercial software and the vertical section has been co-visualized with the

coherence attribute using transparency. The display facilitates the correlation of

**Continued on next page**

**Luis Vernengo** is the head of geophysics at Pan American Energy LLC, an independent oil company of Argentina. He worked for this company 20 of the 29 years of his career in the industry. He has a degree in geophysics from the University of La Plata (Argentina) in Facultad de Ciencias Astronómicas y Geofísicas. Vernengo has experience mainly in development geophysics: seismic interpretation, attributes and seismic inversion. He has worked in different basins around the world, especially in Latin America, in various geological structural and stratigraphic scenarios.

**Eduardo Trinchero** is a staff senior geophysicist at Pan American Energy LLC. He received a specialization



VERNENGO



TRINCHERO



TORREJON



ROVIRA

degree in geophysics at the Universidad de Buenos Aires and a specialization degree in seismic interpretation at the Universidad Nacional de Cuyo. Trinchero has more than 30 years of experience in different aspects of seismic exploration and exploitation issues. He has a strong

background in development geophysics, reservoir seismic interpretation, attributes, seismic stratigraphic interpretation, seismic acquisition and processing.

**Maximiliano Garcia Torrejon** is a staff semi-senior geophysicist at Pan American Energy LLC. He has a degree in

geophysics at the Universidad Nacional de San Juan, Argentina. Garcia has nine years of experience in development geophysics, reservoir seismic interpretation, attributes, stratigraphic and structural interpretation and seismic inversion.

**Ignacio Rovira** is a staff geophysicist at Pan American Energy LLC. He received a degree in geology with an orientation in geophysics at the Universidad de Buenos Aires (Argentina). His background includes both onshore and offshore seismic interpretation as well as other geophysical methods. As a reservoir seismic interpreter he achieved strong skills in structural and stratigraphic interpretation and diverse seismic attributes application for both gas and oil field development.



## Continued from previous page

the fault lineaments as seen on the time slice with those through different sediment sequence patterns. Notice the clear correlation of the discontinuities with the AVT data and the ease with which they can be interpreted.

**A seismic interpreter's routine task must include comprehending and analyzing novel and non-traditional ideas, which tap into the individual interpreter's creativity.**

Next we demonstrate through examples how different attributes can be visualized together and result in a value-addition exercise. In figure 2a we show a vertical section from the AVT<sub>HF</sub> volume that has been co-visualized with the ant-tracking volume using transparency. Notice how the many visible discontinuities line up with the ant-tracking volume lineaments in red. Ant-tracking is an image processing procedure that can be run on discontinuity attributes for gaining higher resolution in terms of lineaments, and is available in a commercial interpretation package. We further illustrate that the lineaments in the data can not only be effectively defined by using coherence and curvature attribute data on full stacked data, but by running these attributes on far angle data also.

Figures 2b and c show time slice (700

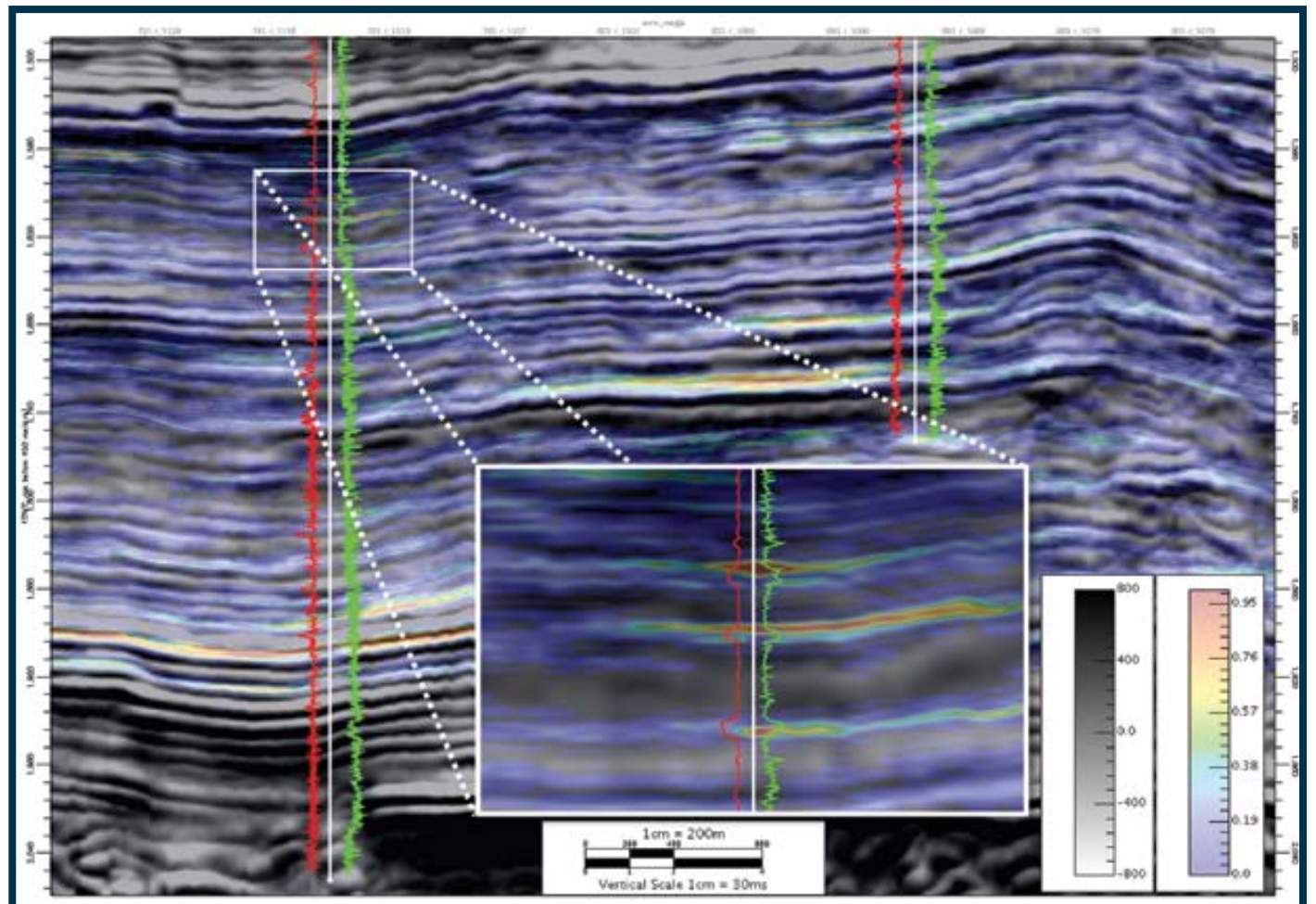


Figure 3. Covisualization of equivalent sections from the AVT<sub>HF</sub> volume (in grey) and the probability of pay (reservoir) volume computed using geostatistical inversion in color. The zoom of a small section seen in the foreground exhibits the correlation detail between the covisualized data and the two well log curves, the spontaneous potential curve in red and the resistivity curve in green.

milliseconds) comparison of Coh (AVT<sub>HF</sub>) and Curv (AVT<sub>HF</sub>) attributes. The sharpness of the lineaments is crisper on the curvature attribute display as expected. It is possible to run directional filters on the input data so as to rule out the discontinuities in a

certain direction so that the orientation of discontinuities in other directions can be visualized better. We show the results of this exercise in figure 2d.

In the last two examples, we have shown the co-visualization of the

discontinuity attributes such as coherence and curvature with seismic amplitudes. For achieving certain objectives, the discontinuity attributes may be co-

[See Co-visualization, page 25](#)



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# Decoding the Permian

By LOUISE S. DURHAM, EXPLORER Correspondent

The initial commercial oil well in the Permian Basin was completed in 1921, the first of thousands of wells that would ultimately be drilled in this oil-rich region.

Despite its ups and downs over time, the Permian today is hot, and haute.

Long the domain of smaller independents for the most part, the region now is also attracting the big, big players. Among others, super major ExxonMobil recently staked an ownership claim there, which is forecast to pump oil for a couple of decades (see related story on page 12).

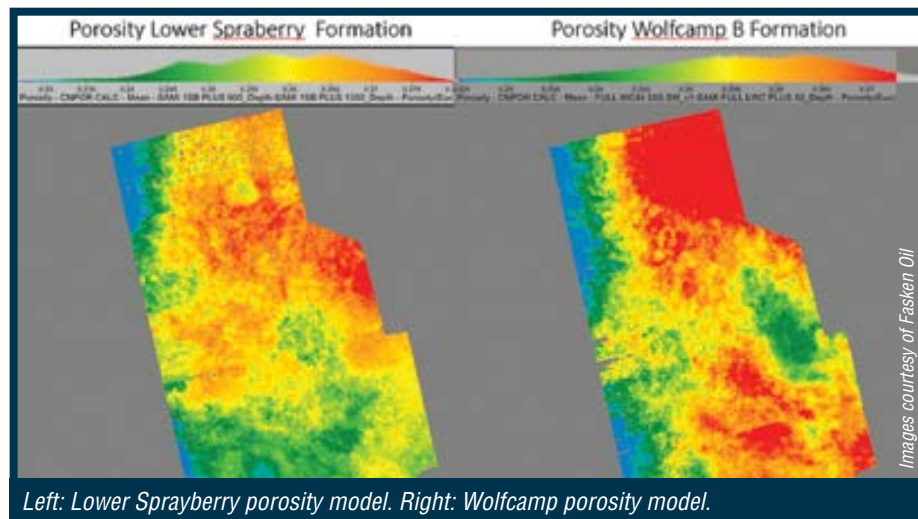
The Greater Permian sprawls across a wide expanse of west Texas, reaching into southeastern New Mexico. Within the Basin, the two sub basins Midland and Delaware are perhaps the most high profile. The Central Basin platform lies between the two.

With its innumerable hydrocarbon-bearing targets, including shale zones aplenty, this part of the oil patch really came into its own with the proliferation of horizontal drilling. The practice of commingling production from two or more zones became the rage soon thereafter.

## Incorporating Seismic Data

Even so, complexity rules and operators continue to investigate how to up their game with lower costs and more efficient production.

The geology poses some daunting challenges for the lateral wellbores, often changing significantly with no warning and thereby negating production at certain



Left: Lower Sprayberry porosity model. Right: Wolfcamp porosity model.

stages of the procedure, among other complications.

Midland-based Fasken Oil and Ranch Ltd. has long been drilling in the Permian – the Midland Basin in particular. Today, the company is working diligently to determine the best practices to optimize the lower Permian-age Wolfberry Play here where it has a wrap on 165,000 acres.

Fasken has hundreds of successful vertical wells to its credit and soon will kick off its first horizontal wellbore in the play.

The Wolfberry moniker originates from the initial commingling of oil from the long producing Spraberry sandstone and the deeper packed-limestone Wolfcamp formation. The Wolfberry interval in the area of interest includes several Pennsylvanian to Guadalupian-age formations.

Working in conjunction with Drilling Info, principally Samantha Siegel, the method of the ongoing program entails incorporation of seismic data into a multivariate data analysis of the play, according to Fasken chief geophysicist Glenn Winters.

The engineering, seismic and geological information comprising the robust data set the two entities are working with includes open and cased hole logs, completion information, core data, four years of production history data and recently acquired 3-D seismic data.

The data set encompasses more than 1,900 wells with production history of more than 50 horizontal wells, according to Winters. The company has over 600 square miles of contiguous merged and reprocessed seismic data, which has been

subjected to both pre- and post stack inversion.

Winters noted that topics to be investigated during the next couple of years include:

- ▶ Vertical versus horizontal wellbores
- ▶ Well spacing and landing targets
- ▶ Conventional versus unconventional landing targets
- ▶ Completion practices

Fasken owns the 3-D survey outright, which positioned the company in a good spot early on.

“Basically, we organized this big 3-D group shoot and let other people in it,” Winters said. “Now, because we have that good chemistry, we’ve been getting production from some of the other companies.”

“Since we own all of the seismic data and the majority of the land, we can share information because we’re not competing with anyone,” he emphasized.

Even though Fasken has more than 500 vertical wells on production in the Wolfberry, horizontal wells in the area are just outside the limits of its acreage and are owned by others. Without the sharing agreement, all of the available production history it uses would originate from verticals.

Note to anyone unfamiliar with Texas oilfields: the state doesn’t calculate production per well, but by lease, so it’s hard to find out well quality by state records. So

**Continued on next page**

AAPG Memoir 111 & 112

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This Memoir covers recent advances in the acquisition and application of high-resolution image data to unconventional reservoirs. The value of integrating multiple techniques is a common theme. Chapters address imaging methods, recognition of artifacts, and case studies that explore nanopore systems within particular depositional settings. The importance of mineralogy, organic matter content, and fabric to reservoir quality issues such as wettability, porosity, and formation damage are addressed.

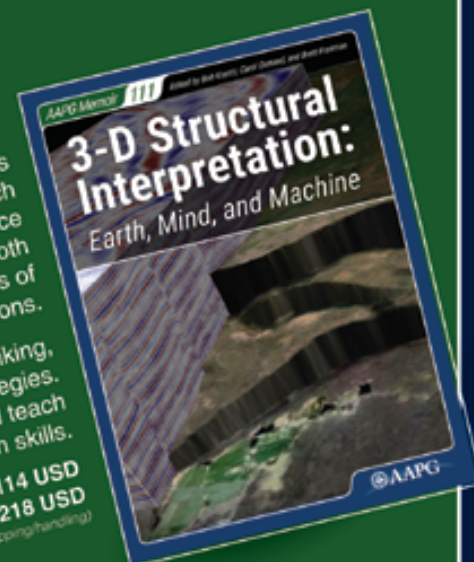
This volume will prove useful to anyone interested in the methods for observing and quantifying the pore systems that control hydrocarbon storage and flow in unconventional reservoirs. Unconventional reservoirs studied include Bakken, Barnett, Bossier, Eagle Ford, Genesee, Green River, Horn River, Marcellus, Mississippi Lime, Monterey, Niobrara, Wolfcamp, and Woodford formations.

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Three-dimensional geologic interpretation of surface and subsurface data requires integration and application of both geologic knowledge and spatial cognitive skills. Much surface geologic mapping still employs pen and paper techniques, but subsurface interpretation is usually accomplished using sophisticated visualization software. In both cases, successful interpreters use mental models that bridge internal and external forms of 3-D visualization to construct 3-D geologic interpretations.

This volume sets out to understand more about the convergence of geology, 3-D thinking, and software, which collectively provide the basis for truly effective interpretation strategies. It should appeal to all geologic interpreters, and especially those who investigate and teach interpretation skills.

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### Wolfberry Horizontals - Landing Zones 933 Horizontals in Map Area

- Upper Leonard Shale – 9 Wells
- Middle Spraberry Shale – 42 Wells
- Spraberry Sandstones – 11 Wells
- Lower Spraberry Shale – 357 Wells
- Wolfcamp A – 100 Wells
- Wolfcamp B – 340 Wells
- L. Wolfcamp - 'Cline' – 30 Wells
- Strawn – 7 Wells
- Atoka – Upper Barnett – 10 Wells
- Moonlight – 9 Wells
- Lower Barnett – 1 Well
- Permitted Wells = 820**



Left: The number of horizontal wells at each producing formation. Right: Fasken's C-Ranch area.

### Co-visualization from page 23

visualized with lithology or fluid attributes derived from impedance inversion, or even the attributes that come out of their probabilistic analysis. This may be seen as an extension of the co-visualization described earlier, which can lead to a multidimensional interpretation of data. Figure 3 demonstrates the co-visualization of a vertical AVT<sub>HF</sub> section with an equivalent section through probability reservoir pay derived from geostatistical inversion. Such displays are particularly useful as discontinuity features are easily interpreted and the anomalous zones exhibiting high values of reservoir pay are seen popping up and correlated with the appropriate well log curves.

### Conclusions

The visualization workflows described in this paper are useful for comprehending the overall architecture of the subsurface events. Of course individual projects and their challenges will decide the level of creativity, innovation and length that the seismic interpreters are expected to go to using the available tools in their arsenal.

### Acknowledgements

We sincerely acknowledge the help rendered by Satinder Chopra of Arcis Seismic Solutions, TGS, Calgary, for rewriting several parts of an earlier version of this paper. We also thank Pan American Energy LLC for permission to publish this paper.

### Continued from previous page

if you need to model your reservoir and not break the bank while doing so, the Fasken/Drilling Info project is tailor made.

"The two software packages we're using – SeisWare and Transform – are significantly less expensive tools that easily communicate with any other software packages," Winters emphasized.

"We are coming up with a workflow that uses this great data set (we've assembled) to then use as a procedure in how to go ahead and do this yourself," he noted. "You then can continually update your models."

Winters said they used SeisWare for their seismic interpretation.

### Integrating the Data

Having so much well control including the information from neighboring producers, the Fasken team was able to use its vertical wells to create a porosity model. Then they integrated that with production information to arrive at a probability production model.

"Once you have the procedure and a sequence, then it's just a matter of keeping on adding wells to it, and you can continually update the model using software that a small company can afford to use with only a little training," Winters exclaimed.

It helps that the software is becoming so much easier to use, meaning the field scientists can actually do the work independently.

"Using Transform software, we're able to use multivariate statistics to find relationships not easily observed in conventional crossplots. We then use non-linear regressions as a predictive analysis tool to investigate these relationships.

"The ability to calibrate seismic to well logs and then calculate additional volumes from multivariate statistics proves to be a valuable tool," he added.

"Ultimately, the goal for the geoscientist and reservoir engineer is to create a dynamic model that integrates how production on a lease fluctuates over time with the increase in density of vertical wells," Winters said, "and how the completion activities and perforations when combined with geology and geophysics helps to identify the best way to harvest the reservoir."

The current program involving the Fasken holdings will yield an unexpected bonus for future petroleum industry professionals in particular.

Winters noted that Fasken intends to allow Drilling Info to use this part of their data for instructional purposes in several universities in the oil patch.

"Fasken is going to provide this data as a great training set," he exclaimed.

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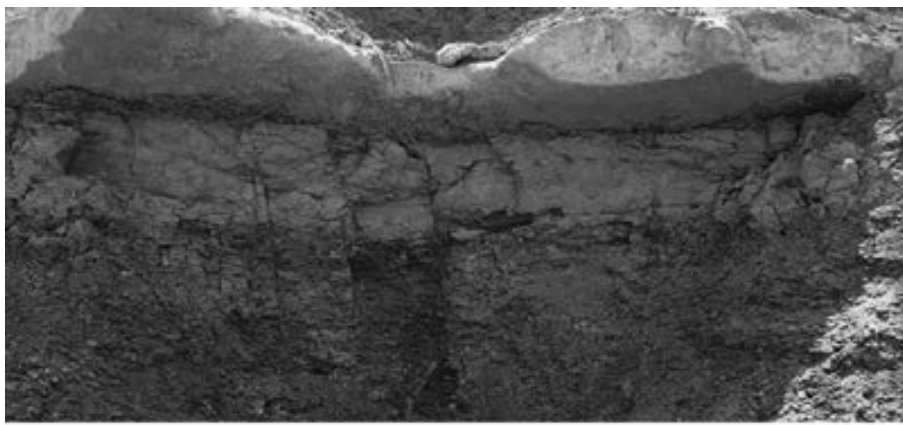
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## Mid-Continent Playmakers Forum in OKC in May

Geologists, engineers, geophysicists and entrepreneurs are invited to the Mid-Continent Playmakers Forum on May 11 in Oklahoma City at the headquarters of the Oklahoma Geological Society.

The Playmakers forums are just one of the ways AAPG's Division of Professional Affairs (DPA) offers new opportunities for professional development and networking.

The primary purpose of these forums is to bring leaders from industry to present their ideas, successes and even failures in developing new plays. A secondary purpose is to provide training for professionals in prospect generation and presentations. The key to the success of Playmaker's is most of the speakers are predominantly invited, technical experts on active plays.

Discussions will include:

- ▶ Majors to mid-size independents

to small private equities – Roles in the unconventional development of the Anadarko Basin.

- ▶ The private equity explosion – How to raise and make money during a long period of stressed commodity prices.

- ▶ Keys to extending mature resource plays and exploring new unconventional opportunities.

- ▶ Science wells—How to make efficient use of all that data.

The forum will also include a Discovery Thinking presentation by AAPG President-Elect Charles Sternbach, "The AAPG Century – Giant Fields through the Decades," as well as presentations from representatives of Devon Energy, Tecolote Energy, Council Oak Resources, Panther II, BlueJacket Energy and others.

For more information, contact Susan Nash, AAPG's director of innovation and emerging science and technology at [snash@aapg.org](mailto:snash@aapg.org).

## Big Data, Deep Learning Workshop Coming in May

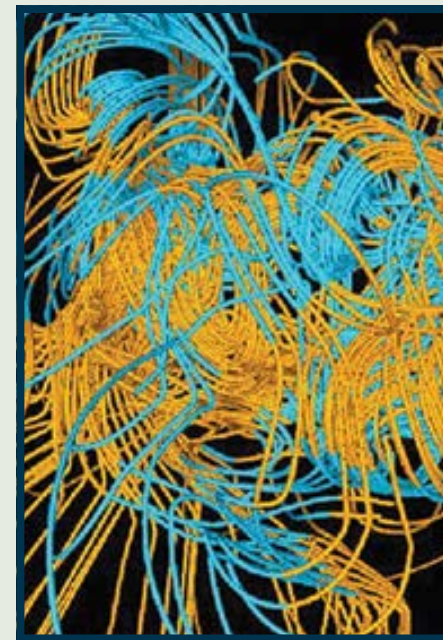
New analytics involving Big Data, deep learning and machine learning are transforming all aspects of the oil and gas industry.

This will be the focus of "Big Data and Deep Learning in the Oil Industry: Basics and Applications," a Geosciences Technology Workshop to be held in Houston on May 22 at the CityCentre Norris Conference Center.

This workshop will familiarize attendees with the latest techniques and workflows used in deep learning, Big Data and advanced analytics, and will also describe how the cloud is accessed and managed in order to provide real-time monitoring and decision-making. The afternoon session will relate the theory to upstream oil industry examples. Students will apply the concepts using hands-on examples (software) as well as case studies.

Susan Nash, AAPG's director of innovation, emerging science and technology, said the workshop will cover how companies are exploring new ways to develop intelligent analytics and machine learning to optimize geosteering and to determine how to design the fracturing jobs.

"Analytics are now being used to revisit data from older operations to see where things could be done differently today, with better results than in the past. One example: revisiting failed shale plays. Are they really not producible? Or, were they simply botched? Analytics – Big Data and



using unstructured data to create neural networks – could help us answer that question," she added.

This workshop is for geoscientists, engineers, entrepreneurs, infrastructure construction companies and anyone else whose work entails integrating various databases (geophysics, fracture networks, regional faults, methane seeps, surface geochemistry for sweet spot identification / pinpointing).

For more information, contact Nash at [snash@aapg.org](mailto:snash@aapg.org).



# OTC 2017 in Houston Next Month

The 2017 Offshore Technology Conference is set for Houston next month. It will be held May 1-4 at NRG Park (formerly Reliant Park).

OTC is where energy professionals meet to exchange ideas and opinions to advance scientific and technical knowledge for offshore resources and environmental matters, and it is the largest event in the world for the oil and gas industry, featuring more than 2,300 exhibitors and attendees representing 100 countries.

This year's technical program features a few key highlights:

- ▶ Updates on world-class projects: Low oil prices create the demand for game-changing, lower cost methods, resulting in an environment rich for breakthrough technologies.

- ▶ Strategies for adapting to a lower priced environment: Addressing the effective use of technology and standardization to reduce costs.

- ▶ New developments in major offshore basins: Major changes are underway in Mexico and Brazil concerning regulation

and development of offshore resources.


- ▶ Safety and risk management: While the transition to a lower cost is critical to the industry, safety and environmental responsibility remain the cornerstones of success.

- ▶ Offshore renewable energy: Designing and developing offshore renewable energy structures and infrastructure.

- ▶ Digital revolution: Looking closely at big data and the growing importance of cybersecurity.

Founded in 1969, OTC's flagship conference is held annually in Houston. OTC has expanded and globally with the Arctic Technology Conference, OTC Brasil, OTC Asia, and d5.

OTC is sponsored by AAPG along with a dozen other nonprofit organizations in the energy industry who work cooperatively to develop the technical program. Revenue from OTC directly benefits the membership of these societies.

To register or for more information, visit [2017.otcnet.org](http://2017.otcnet.org). 

## Drones and UAV Workshop in Houston

AAPG will hold its "Drones and UAVs: Solving Problems, Finding Resources" Geoscience Technology Workshop in Houston next month.

The two-day event will be held at Houston's CityCentre Norris Conference Center, May 23-24.

The goal of the workshop is to identify and describe how drones and UAVs using new sensors and analytics may help optimize the exploration and production of oil and gas, and to reduce costs and find innovative cost-saving solutions for problems.

The presentations will demonstrate the capability of the new technologies to solve existing problems in less expensive and more efficient ways that current solutions. They will also demonstrate the use of new technologies for discovering new reserves of oil and gas.


The workshop will consist of

45-minute presentations by experts and operators on case studies, technical solutions, and emerging new practices.

One of the presentations will be "Geiger-mode LiDAR: Efficient collection for digital terrain mapping and feature classification" by Conse Vecchio of Harris Corporation, which is a Platinum sponsor for the workshop.

"They are developing an amazing set of new sensors that can potentially revolutionize the oil industry, both in exploration and production – exploration through detecting anomalies and production through helping monitor and protect the environment," said Susan Nash, AAPG's director of innovation emerging science and technology.

There will also be presentations by representatives of Drone View Services, Bama Consulting Services, Aeroscan Solutions, Weatherford and others.

For more information, contact Nash at [snash@aapg.org](mailto:snash@aapg.org). 



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# Geopolitics Working Group Educates Policymakers for 2017 Budget

By DAVID CURTISS, AAPG Executive Director

In the middle of last month, U.S. President Donald Trump unveiled his fiscal year 2017 budget. As expected, and in keeping with his campaign promises, the president asked for significant increases to military spending as well as border protection and immigration enforcement. The increased spending was partially offset with proposed spending cuts to federal agencies and programs.

The U.S. government's fiscal year runs from Oct. 1 to Sept. 30. So, we are already six months into the FY2017 budget, with the government operating under a continuing resolution, a deal struck last year to continue funding government operations at FY2016 levels through April 28, 2017.

Without further action by Congress to provide spending authorization and appropriations ahead of the expiration of the continuing resolution later this month, the U.S. government will shut down. It doesn't happen often – though the threat of a shutdown emerges annually, it seems – and is unlikely to happen this year. But to avoid this outcome, Congress must decide how and how much the federal government will spend through Sept. 30, and the president has to sign the bill into law.

And it is in this environment that everyone with an interest in how the federal government spends its money becomes very active on Capitol Hill, letting representatives and senators know about their proposals for how the government



CURTISS

**Our policy work here at AAPG is focused on helping policymakers understand the importance of various federal programs and why they should be funded.**

should spend these tax dollars.

Legislators, too, have their own ideas of how to prioritize federal spending, so over the next several weeks we'll be treated to furious jockeying and posturing to come up with a spending plan.

Our policy work here at AAPG is focused on helping policymakers understand the importance of various federal programs and why they should be funded.

The Association itself does not seek federal grants and contracts, but many of our Members, particularly in academia, do. And this is particularly true of graduate students, many of whom have their thesis and dissertation research funded through federal grants. These folks are the next-generation geoscience workforce, and federal spending supports the nation's educational and research infrastructure.

#### **An Association of Associations**

We don't take on the responsibility of educating policymakers alone.

Instead, we cooperate with other geoscience societies and organizations through the Geopolitics Working Group (GWG). And AAPG has joined with the American Association of State Geologists, American Geosciences Institute (AGI), American Geophysical Union, American Institute of Professional Geologists, Consortium for Ocean Leadership, the Geological Society of America, the National Groundwater Association, and the Soil Science Society of America to create "Geoscience Policy Recommendations for the New Administration and the 115th Congress."


The document is being delivered to policymakers across Washington, D.C., and outlines the vital roles geoscientists play throughout society, focusing on five themes:

- ▶ Enhancing national and homeland security
- ▶ Increasing economic prosperity
- ▶ Securing resources and strengthening national infrastructure
- ▶ Supporting strong and resilient communities

- ▶ Growing a dynamic workforce
- Each of these themes has specific policy proposals to meet the stated goals and links those to federal programs that support these endeavors. The list of programs is wide-ranging, including:
- ▶ Earth systems observation, data collection, and analysis
  - ▶ Investments in the U.S. icebreaker fleet
  - ▶ Natural hazards and water usage research
  - ▶ Energy research and development programs, including minimizing environmental impacts of energy development
  - ▶ Ocean planning initiatives
  - ▶ Agricultural and soil science
  - ▶ Mineral commodities information from discovery to disposal to maintain economically vital mineral supply chains
  - ▶ Geoscience research funding to train and develop the next generation geoscience workforce

You can download the document from the AGI Critical Issues website.

And, I should say that not every association or society engaged with GWG explicitly supports each of the policy proposals made in this document, or even has a particular position on each. But collectively, they represent the shared priorities of the broader geoscience community, representing more than 250,000 geoscientists.

We're stronger when we combine our efforts and speak with a common voice. 



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## PROTRACKS



The Canada Region YPs volunteered at the Calgary Food Bank.

## Canada Region YPs Continue Momentum

By MERIEM GRIFI, Canada Region YP Leader

The Canada Region young professionals (YPs) had a great finish to 2016, including welcoming some new members to the organizing committee. Incoming Canada Region YP Lead Marcelina Labaj is joined by Daniel Wennerstrom, Jillian Berling-MacKenzie and Zennon Weleschuk, who is returning from the previous year.

There are many members actively seeking work, but the unfortunate reality is that there are slim pickings out there. But, the Canada Region YP leadership is striving to keep everyone positive. The focus in the final months of 2016 was to get members access to motivational talks and continue to build relationships with other professional societies by collaborating on more events. This allowed all societies involved to consolidate resources and work more efficiently towards shared common goals.



GRIFI

### Year-end Roundup

The Region had three events in Calgary late last year. In a joint effort with the Canadian Society of Exploration Geophysicists, the group hosted about 45 YPs and students for its first speaker series in November. Two speakers were invited to give their personal perspectives on the industry: retired professional geologist Wayne Dwyer and junior geophysicist Matthew Lennon. Wayne talked us through his more than 35-year career, covering the great downturn of the '80s and the 20-percent mortgage interest rates incurred at the time. Matthew shared his enthusiasm for volunteering and how he's always trying to learn something new. Both speakers, while at opposite ends of their careers, gave a similar message to the audience:

► Get out there and start networking! Whether it's for a coffee once a week with a different connection, or simply sending out a check-in note to someone in your network, maintaining your presence in the industry is critical.

► Stay busy through volunteering. This

ensures little to no gaps on your résumé and, helps to develop your professional skills and builds your network.

► Never burn your bridges. Keep that network as large as you can, and always leave a position on a positive note, no matter the circumstances.

In early December, several YP volunteers assisted the Calgary Food Bank with food collection and sorting. This is the second time the group has volunteered with the Food Bank. The event was a great way to help the local community while having a bit of fun.

To end 2016, AAPG teamed up with the Society of Petroleum Engineers, the Canadian Society of Exploration Geophysicists and Young Professionals in Energy for the SPE's Annual Holiday Social. This event was a huge success, drawing 135 attendees for a night of fun involving ugly sweaters and bowling. This is the second year in a row members of the above societies made a point of getting together to discuss ways of maximizing our resources. The partnership was formed to bridge the gap between disciplines and create networking and exposure opportunities for all young professionals involved.

### Looking Ahead

The Canada Region YP organizing committee is busy planning activities for 2017. Follow @aapg\_canada\_yp on Twitter for all the latest information on upcoming events. Looking for additional information on AAPG YP events worldwide? Visit the YP SIG online at [aapg.org/youngpros](http://aapg.org/youngpros), like us on Facebook at AAPG Young Professionals Special Interest Group, follow us on Twitter and Instagram @aapgyppsig or join us on LinkedIn at AAPG Young Professionals.

On a more personal note, I would like to thank AAPG for all the opportunities I have received over the last few years. Richard Ball, Denise Cox, Bill Houston and Carol McGowen were all instrumental in motivating and inspiring me to get more involved with AAPG at Leadership Days in Tulsa in 2010. A big thank you to the headquarters staff as well. They contribute greatly to our Region's planning and support.

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- Students will apply the concepts using hands-on examples (software) as well as case studies.

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



# Foundation Announces TOTY, IGEA Winners

By AUDREY CORTE, Programs Coordinator

**J**ulie Mitchell, a geology teacher from Erie High School in Erie, Colo., has been named the AAPG Foundation's 2017 Teacher of the Year.

The Teacher of the Year (TOTY) award, funded and presented annually by the AAPG Foundation, is intended to honor and encourage excellence in geoscience education. Mitchell, who has taught high school earth science for more than 20 years, was chosen as the top teacher by a panel of national judges.

Upon being notified of the honor, Mitchell said she is "incredibly honored and humbled to be receiving the prestigious AAPG 2017 TOTY award."

"I'm excited beyond words to be part of the energy and knowledge at the ACE convention," she said. "And, to be part of the 100-year celebration ... is a once in a lifetime opportunity."

She is passionate about teaching geology and environmental science to her students in a balanced classroom that allows them to "discover and do science, not just take notes."

Mitchell's award includes a \$6,000 prize, half allocated to Mitchell for her own personal use and the other designated to Erie High School for educational use under Mitchell's supervision. She will also receive an all-expense paid trip for two to the 2017 AAPG Annual Convention and Exhibition (ACE) in Houston early this month, where she will be presented her award at the All-Convention Luncheon.



Mitchell snapped this shot of her students engaging in some hands' on geologic study.



MICHELL

**"I'm excited beyond words to be part of the energy and knowledge at the ACE convention."**

"Julie has been a strong leader and champion for the promotion of geology and earth science education," said Erie

High School Principal Matt Buchler. "She has led numerous district level teams in reviewing curriculum, adopting

textbooks, and educating other science teachers and administrators about the importance of geology in the high school curriculum."

Mitchell was one of four finalists for the annual TOTY award – each selected as the top geoscience educator in their respective geographic regions. Mitchell was nominated by AAPG's Rocky Mountain Section. The remaining semi-finalists each receive honorable mentions and \$500 awards from the AAPG Foundation. They are Dylan Canavan of Hinsdale Central High School in Hinsdale, Ill. (Eastern Section); Leigh Marsh of Marvin Baker Middle School in Corpus Christi, Texas (Gulf Coast Section); and Martha "Molly" (Deich) Shaw of New Brighton Middle School in Capitola, Calif. (Pacific Section).

## Inspirational Geoscience Educator Award Winner

Hendratta Ali, associate professor of geosciences at the Fort Hays State University (FHSU) in Hays, Kan., has been named this year's Inspirational Geoscience Educator Award (IGEA) winner.

The honor, determined by the AAPG's IGEA Committee and led by chair Carol Wicks, is presented annually to a "college or university professor who

**Continued on next page**

## Some people make a difference ...

The AAPG Foundation provides the support that helps make these programs possible.



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Ohio University



## Continued from previous page

has shown outstanding academic leadership and works to inspire the future of geoscience." The honor comes with a \$1,000 prize from the AAPG Foundation.

"I am very humbled and honored to be selected as this year's AAPG Inspirational Geoscience Educator Award recipient," said Ali. "This is a testament to the phenomenal group of students that I have the privilege to work with, the fantastic mentors I have in my life and my supportive family.

"I have learned a lot from people I work for, my students and truly believe that we have all grown together to be better professionals. I thank the AAPG



ALI

Foundation and all organizations and societies that offer opportunities and support geoscience education."

Ali has been teaching geoscience courses at FHSU since 2010 and is an active Member of AAPG.

In addition to teaching a wide range of geoscience courses at FHSU, Ali

**"This is a testament to the phenomenal group of students that I have the privilege to work with."**

spends time mentoring her students outside of the classroom and encourages active participation in the geoscience community. Her students have earned eight research awards at professional conferences under her guidance. Additionally, she was awarded "FHSU Phenomenal Woman" in 2015 for

"breaking gender stereotypes, taking action on campus and leading by example."

"I can say that as an early career geoscientist, she has achieved more with her students in the last seven years than many more established geoscientists have in a lifetime," said Estella Atekwana, colleague and regents professor of geology at Oklahoma State University. "She is passionate about her students, the integration of science and education, and transfer of knowledge to the younger generation – AAPG's future, including high school students in the United States and in several countries in Africa."

Ali will also receive her award at ACE in Houston this month. [E](#)

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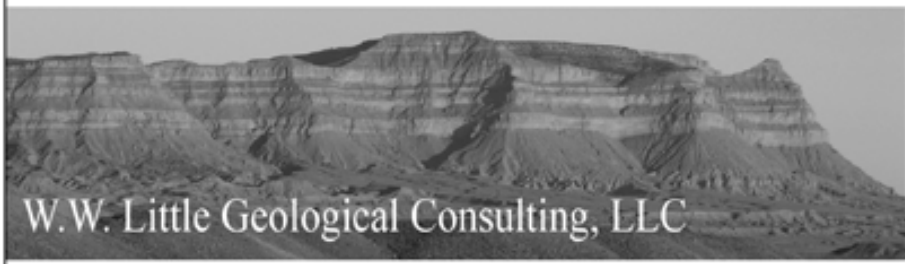
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The Myanmar Oil and Gas Conference drew 240 attendees from 22 countries.

# Myanmar Conference Highlights SE Asia Hotspot

By PETER GRANT, Asia-Pacific Region President

Based on the success of the previous conferences and the fact that Myanmar is the current focal point for exploration in Southeast Asia, another successful event was held in the former capital city of Yangon in February: the third annual Myanmar Oil and Gas Conference.

The conference was held jointly by AAPG, the European Association of Geoscientists and Engineers (EAGE) and the Myanmar Geoscience Society (MGS).

Deputy Minister Tun Naing opened the conference and MOGE presented numerous papers that were very well received.

Myanmar is enjoying unprecedented exploration activities at present ...

### Conference Highlights

The conference attracted great interest and 57 oral and poster papers were presented during the three-day event. A great success of the conference was that it attracted papers from local presenters, and more than 30 percent of attendees were from Myanmar, from both industry and academia.

The event drew 240 attendees from 22 countries to the conference facilities of the Sule Shangri La, where we had a compact and very effective exhibition area. The facilities were excellent, with everything in the same area, which allowed for a lot of interaction and networking by all delegates.

We enjoyed the full support on the Myanmar Ministry of Energy and Electricity and their national oil company Myanmar Oil and Gas Enterprise (MOGE).

Technical convenor Paul Thompson arranged the conference according to themes that included regional, onshore, offshore (in two areas), research and geophysics.

We also had, for the first time, a dedicated Q&A panel session. It provided the delegates an opportunity to ask in-depth questions of Myanmar experts from industry, government and academia, and it worked very well.

### Myanmar Exploration

Myanmar is located in a tectonically active area with large parts of their onshore and offshore without seismic

**Continued on next page**



From left: Peter Grant, AAPG Asia Pacific Region president and panel co-chair; U Ko Ko of MPRL; U Nyan Tun of MOGE; Terry Walker of Woodside Energy; Day Wa Aung of Yangon University; Michael Myint of Schlumberger; Jean Paul Thiriet of Total; Paul Thompson, conference technical co-ordinator and panel co-chair.

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## DPA from page 34

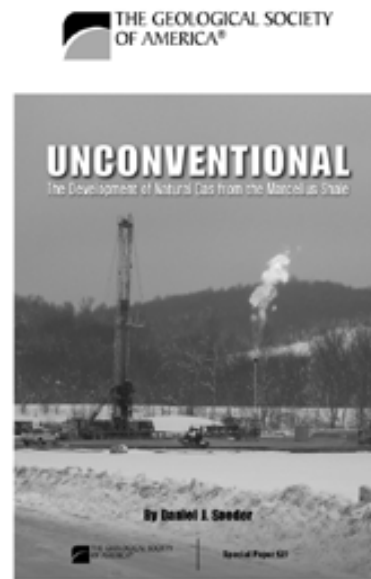
Thinking forums, as well as potentially new membership categories to attract Young Professionals.

For some current DPA members, the ongoing generational transition may offer exciting new opportunities for service to our profession through mentoring and geoscience education, as well as new tangible business opportunities such as consulting, new E&P startups, and nontraditional options such as private equity.

Geoscientists love what they do, and not all will want to retire. We have made careers out of spotting opportunities in a changing and uncertain landscape. The

future ahead will inevitably continue to be uncertain, but it will present opportunities for geoscientists of all generations. You can count on the DPA to help geoscientists to enhance their career development and support their leadership aspirations through its platform of programs and services. If you are a DPA member I thank you for your continued service to our profession. If you are not yet a DPA member, I encourage you to join as soon as you meet the minimum qualifications. The application can be found on the DPA website at [www.aapg.org/divisions/dpa/join](http://www.aapg.org/divisions/dpa/join).

Good hunting to you in the next upcycle, regardless of your generation, technical specialty, geographic location, or career goals. 



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AAPG Asia Pacific Region President Peter Grant (left of center) and Adrienne Pereira, programs manager for AAPG Asia Pacific Region (right of center).

### Continued from previous page


data – vintage or modern. As such, there were numerous debates and challenges to concepts expressed which carried on into most of the breaks. This is always an excellent experience at conferences, where people are not afraid to launch ideas and debate them with fellow geos.

Myanmar is enjoying unprecedented exploration activities at present, with more than 80,000 square kilometers of 3-D seismic obtained during an 18-month period from late 2015 to early 2017. These data will see potentially 10-13 wells in 2017 and 20 or more wells in the three years thereafter, should companies elect to move from their study period into their first three-year period of production-sharing contracts.

This activity level ensured success in securing excellent support from sponsors and exhibitors, and we thank them all and hope that they benefitted from the event.

So, we had a great conference with many great presentations, and we had a strong and dedicated committee and sponsors who I can't thank enough. We even had many people stay to the bitter end at 5 pm on a Friday afternoon!

I am looking forward to our next event there in 2018 (planned for the fourth quarter) and hearing of exploration success in the country.

If you are interested in participating in the next event (as presenter, or sponsor/exhibitor), please contact our Asia Pacific office at [apereira@aapg.org](mailto:apereira@aapg.org). 

## WHY I JOINED DPA:



Steve Sonnenberg

I joined DPA because of the title "certified petroleum geologist" and to further develop my professional network. DPA has very active, passionate, and enthusiastic members. It is an honor to be a member of this AAPG group.



To join AAPG's Division of Professional Affairs please visit [DPA.AAPG.org](http://DPA.AAPG.org).

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# Nothing New Under the Sun, Or in the Oil Patch

By DAVID CURTISS

Oil prices go up. Oil prices go down. This should perhaps be added to the list of sure things in life, alongside death and taxes.

Market observers look for patterns in these price fluctuations driven by supply and demand, attempting to identify turning points in the cycles. Some say they're 16 years long, others say 27. What is certain is that they occur, and that most petroleum geologists will see several of them throughout their careers.

Each cycle has its own subtle variations, but as the writer of Ecclesiastes explains, "What has been will be again, what has been done will be done again; there is nothing new under the sun."

And so it is with commodity cycles.

So as we navigate our paths through these cycles it can be helpful to understand how those who have gone before us did it. There is something to be learned, there is knowledge to be transferred from generation to generation. And AAPG is where this communication can best occur.

## Merits of Mentoring

I discussed this issue with Jim Gibbs over dinner a few months ago. Jim, as most of you know is a past-president of AAPG and the chairman of the Board of Trustees of the AAPG Foundation. He is founder and chairman of Five States



CURTISS

So as we navigate our paths through these cycles it can be helpful to understand how those who have gone before us did it.

Energy Capital, LLC, – his day job – after working both for an integrated oil and gas company and as an independent and consulting geologist for about 20 years.

Jim has seen his share of downturns, and one of his passions is talking about the opportunity and importance of mentoring.

Our industry is full of petroleum professionals who have successfully navigated multiple downturns and are now slowing down their pace of activity, transitioning to retirement or to a new phase of their own careers.

Many retiring baby boomers are in the midst of this shift with many wanting to stay engaged and involved in the science and profession. At the same time, the influx of early career petroleum geologists into the profession over the past decade is for the first time facing the reality of our cyclical business.

Both of these groups could benefit from the knowledge and experience –

the wisdom – of our more experienced colleagues. Whether it is baby boomers wanting to develop a company of their own, or new professionals looking for a toehold in the profession, there are many AAPG Members who have done these successfully.

You're never too old to have a mentor.

## The Necessity of Networking

As Jim told me, many professionals of his generation are eager to help, willing to share their knowledge and experience with others. But the requests are few and far between. And they need to be based on a relationship, not a cold call.

You cannot just send an email to someone you admire and ask to be mentored. That's not how it works. Instead, you need to find ways to get to know potential mentors.

The buzzword is "networking," but it's actually simply putting yourself in situations where you can engage with

like-minded people, get to know them and then ask questions. In other words – cultivate a professional relationship.

As this issue of EXPLORER drops into your mailbox you might be at the 100th anniversary Annual Convention and Exhibition. ACE is a great place to begin making these contacts. One of the reasons we schedule AAPG events and experiences throughout the year is to provide opportunities for community and relationship building. It's a principal reason professional associations exist.

Mentoring isn't magic. You still have to do the work, to find and develop a mentoring relationship, and to build and develop toward your career goals. And I can promise that progress on both fronts won't be as fast as you'd like or necessarily be a smooth ride.

Jim launched Five States Energy in 1985 and immediately had to navigate a downturn that left an indelible impression on a generation of petroleum geologists. But within every downturn hide many opportunities. Just remember the old saw that "opportunity is missed by most people because it's dressed in overalls and looks like hard work."

And when your time comes and you seize your opportunity, don't forget to thank your mentor.

## DIVISIONS REPORT: DPA

# Transitions: Preparing for the Next Business Cycle, Crew Change

By CHANDLER T. WILHELM, DPA President

For the first time since the oil price collapse in November of 2014 and the difficult restructuring of our industry that followed, there are some signs of life returning to the oil patch.

Some analysts suggest that 2016 will prove to be the low point of the investment cycle. The Baker Hughes North American rig count is up 87 percent from its nadir only one year ago. Capital spending surveys forecast increasing investment in 2017, led by U.S. independents emboldened by a change in the presidency to an administration committed to domestic resource development. The first quarter financial reports for many oil and gas companies show improvements year on year, and some analysts forecast that the industry will deliver positive free cash flow in 2017 if oil and gas prices hold firm.

Most investor presentations are notable for their representations of how companies are improving efficiencies and driving down break-even prices in order to be profitable in a "Lower for Longer" world. Some companies that went into Chapter 11 have successfully restructured their businesses and have emerged from the bankruptcy process as more competitive and sustainable enterprises. Strengthening profitability and economic resilience will remain the top priority for most management teams, but there are also signs that positioning portfolios for the long term is also starting to gain traction.

Deal flow in hot plays such as the Delaware Basin – where approximately \$25 billion in transactions have taken place over the past 12 months – stands out in particular



WILHELM

I do believe that industry is moving toward investment and activity levels that are more suitable for growing long term shareholder value than simply surviving.

and signals that companies have enough confidence in the long term to pay top dollar for top acreage. While I think that it is too early to say with certainty that we are in the early stages of the next industry upcycle, I do believe that industry is moving toward investment and activity levels that are more suitable for growing long term shareholder value than simply surviving.

## DPA Programs

The Division of Professional Affairs is working to prepare for this and future business cycles through its mission to help geoscientists become future leaders by delivering programs and services that advance their professional development goals and business networks.

We have had some notable successes in fiscal year 2017. The February Delaware Basin Playmaker's Forum saw more than 300 geoscientists in attendance, and the program did not disappoint. A dozen presentations were given by companies including majors, mid-sized independents, small independents and service companies, and showed the dynamism of this basin

that continually reinvents itself through the application of new technology and development of new geological insights.

Hats off to the Forum organizers Mike Party and David Entzminger for their hard work to coordinate this event.

Next in the queue is the Mid-Continent Playmaker's Forum, which will be held in Oklahoma City on May 11 and will focus on the many emerging plays within the Anadarko basin. It promises to be a fascinating and lively conference.

My thanks to Forum organizers Rick Fritz and Jason Hamilton for their efforts.

Registration details can be found on the DPA website at <http://aapg.to/mcplaymaker2017>.

I encourage all AAPG members who have an interest in emerging Unconventional plays in general and the Mid-Continent in particular to attend this event.

## Great Crew Change

The next upcycle will require skilled, motivated, and dedicated geoscience professionals. But the "Great Crew Change"

that has been written about for so many years may be coming to an end, as this latest downturn has been the catalyst for many of the remaining senior technical professionals in our industry to retire. Many of those with whom I talk are happily retired, and there is no certainty that their skills and experience will be available for the next upcycle. Increasingly, the future will be in the hands of the next generation of professionals, particularly the so-called millennials, that large demographic wave born between 1980 and 1995. By the end of this decade, they will occupy about 50 percent of the total U.S. workforce, and probably a larger percentage of our profession. They are well educated, socially concerned and incredibly adept at using information technology and social media. If Facebook were a country it would be the world's largest, and they are native to it. They are impatient with bureaucracy and desire responsibility. What they may lack in experience they more than make up for in capacity to learn and desire to make a difference.

Despite the downturn, DPA membership has been relatively stable, which is a testament to the dedication of DPA members to the division and its mission. But the DPA will need to evolve to provide a compelling value proposition to this next generation of geoscience professionals. This could include new content platforms to augment the current platform of programs and services such as Playmakers, convention short courses and Discovery

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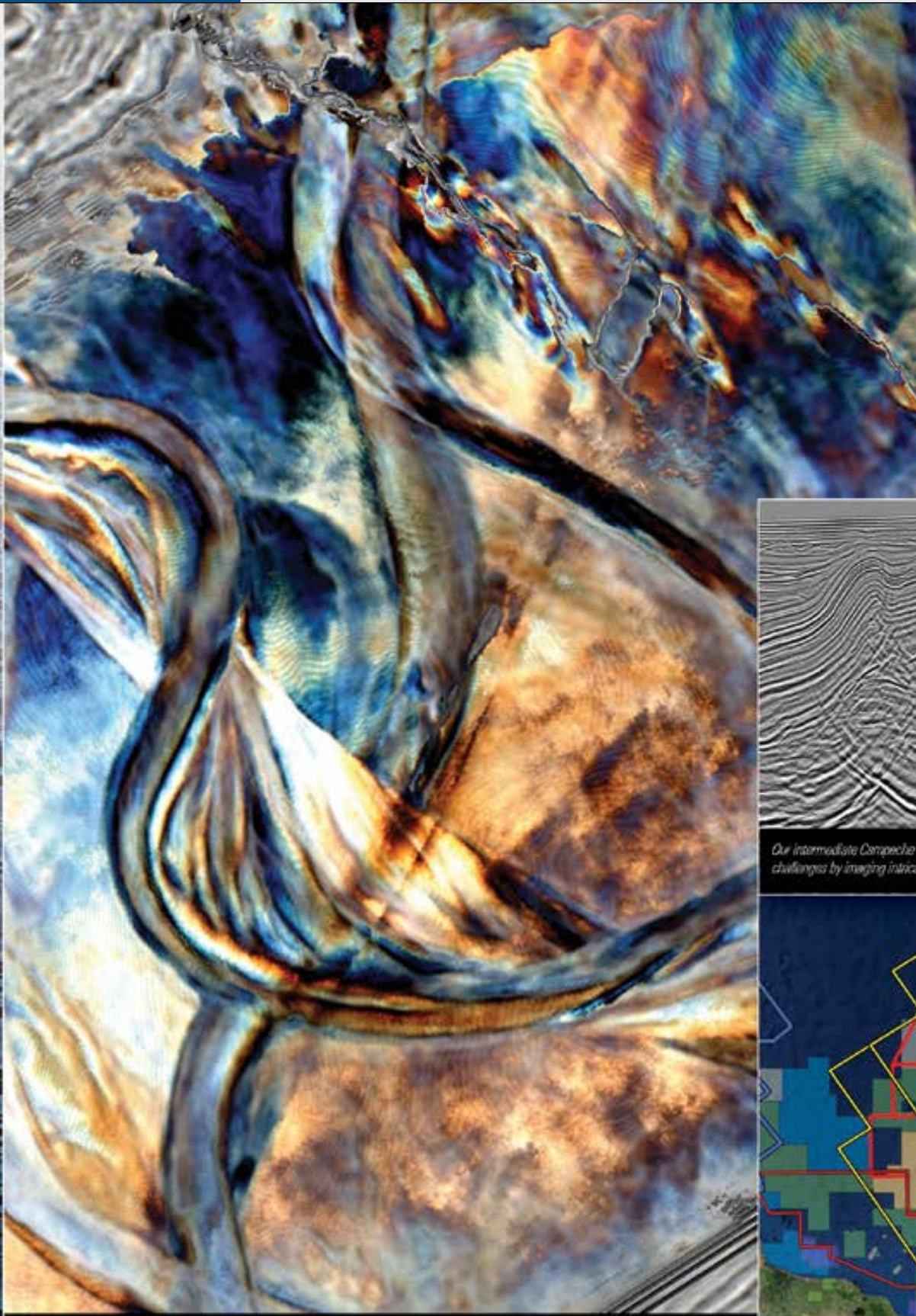


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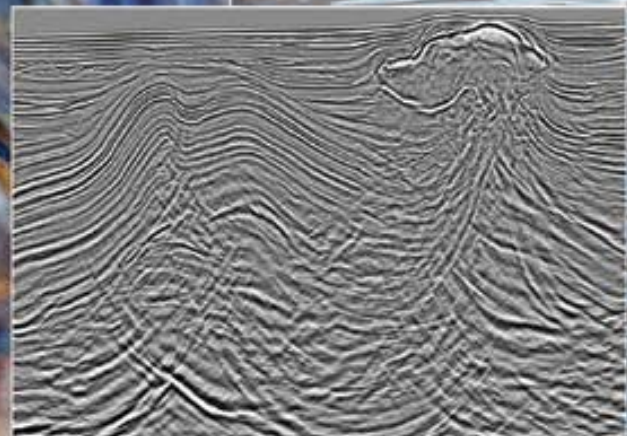
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