



AAAPG **EXPLORER**

July 2018

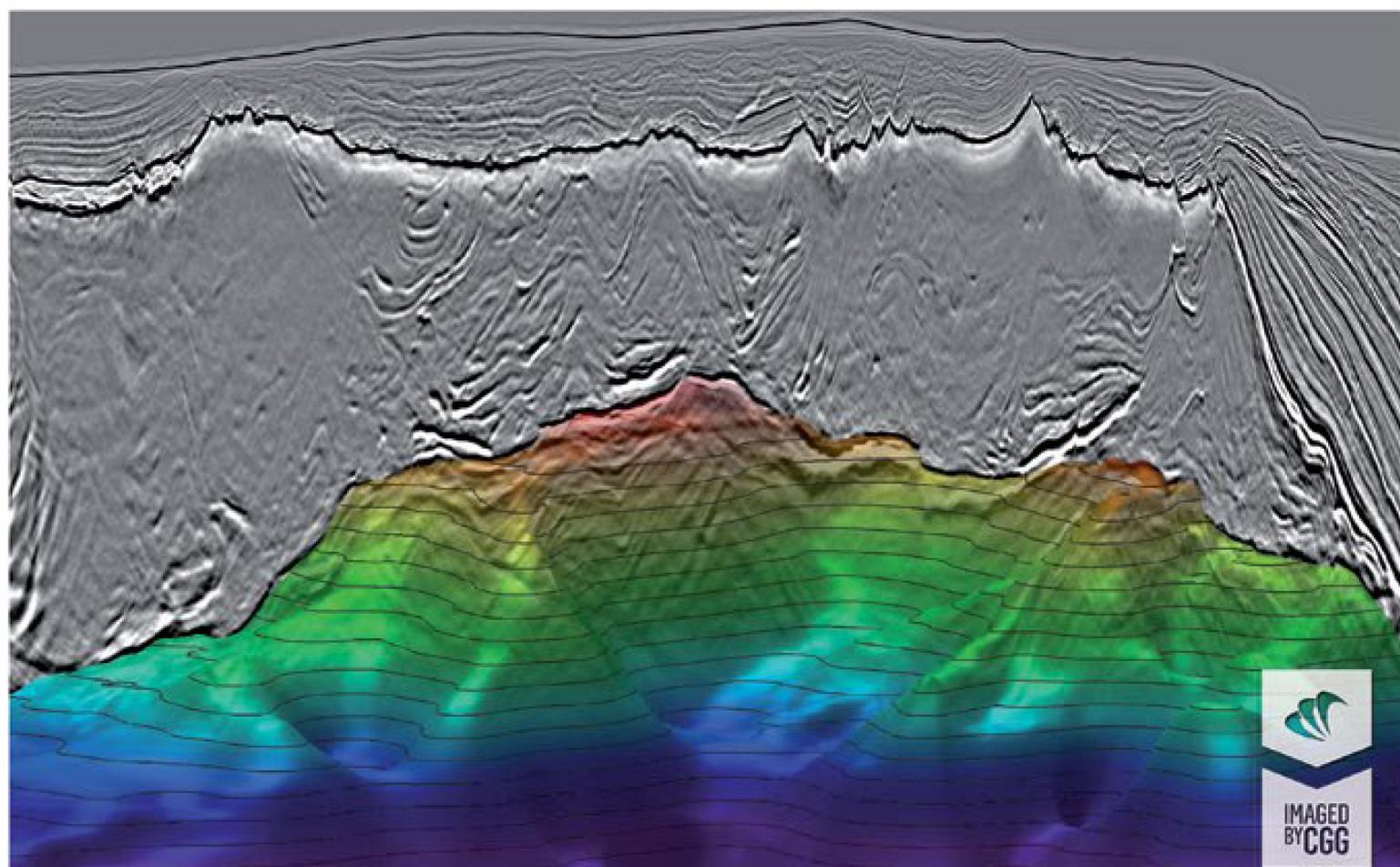
Solving the Riddle of Shale

See page 8



Santos VII 3D BroadSeis Survey Outstanding Images for Round 5

PRIME PROSPECT

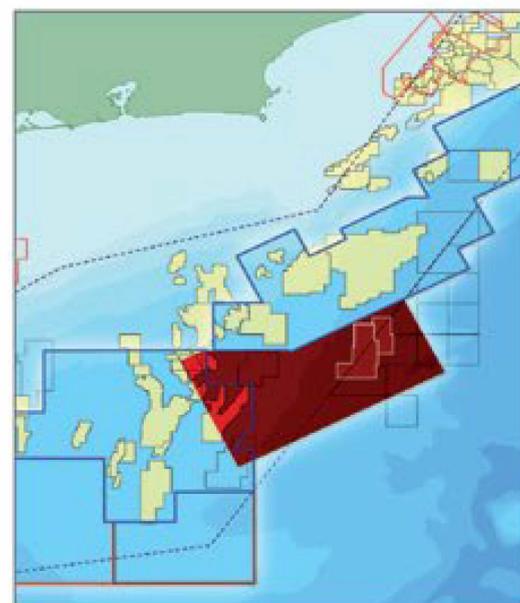


CGG began acquiring new surveys and reprocessing its legacy data well in advance of upcoming licensing rounds in the Santos and Campos Basins offshore Brazil. These data sets now cover the best exploration opportunities in these prolific basins.

Covering approximately 13,900 sq km, the Santos VII survey includes both the Saturno and Titã blocks which will be available for bidding in September's lease round. Processing is ongoing and ultramodern data will be available in July to evaluate these pre-salt areas.

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Sustainable Development in Energy and AAPG

It has been an educational and productive year serving on the 2017-18 Executive Committee. Your Association has benefited greatly under the leadership of Charles Sternbach and with the strategic input from outgoing members Marty Hewitt, Dan Swartz and Dave Entzminger and continuing members Dave Cook, Laura Johnson and Barry Katz. We welcome the leadership and insights of the 2018-19 EC members Mike Party, Jeff Aldrich, Richard Ball and Bill Houston.

Each AAPG Executive Committee has a distinct identity defined by external factors – the state of the global energy industry, and internal factors – state of the Association, and the personal goals of those elected to serve in leadership roles. The dedicated AAPG staff, under the leadership of our Executive Director David Curtiss, maintain continuity through this annual transition. Together, we strive to fulfill AAPG's mission to advance the science of geology, promote research and technology to find and produce energy, and inspire high standards of professional conduct.

We do this for you – to advance your well-being as members.

Sustainable Energy Development

The 2018 British Petroleum report, "Peak oil demand and long-run oil prices," highlights the uncertainty of future world oil demand with the prospect of a lower carbon future.

This is a strategic issue facing the petroleum industry, the geoscience profession and AAPG, and it provides the context for AAPG's continuing objectives to develop scientific content, engage and reengage members, prioritize operations and manage the budget.

The upward pressure on demand

The purposes of this Association are to:

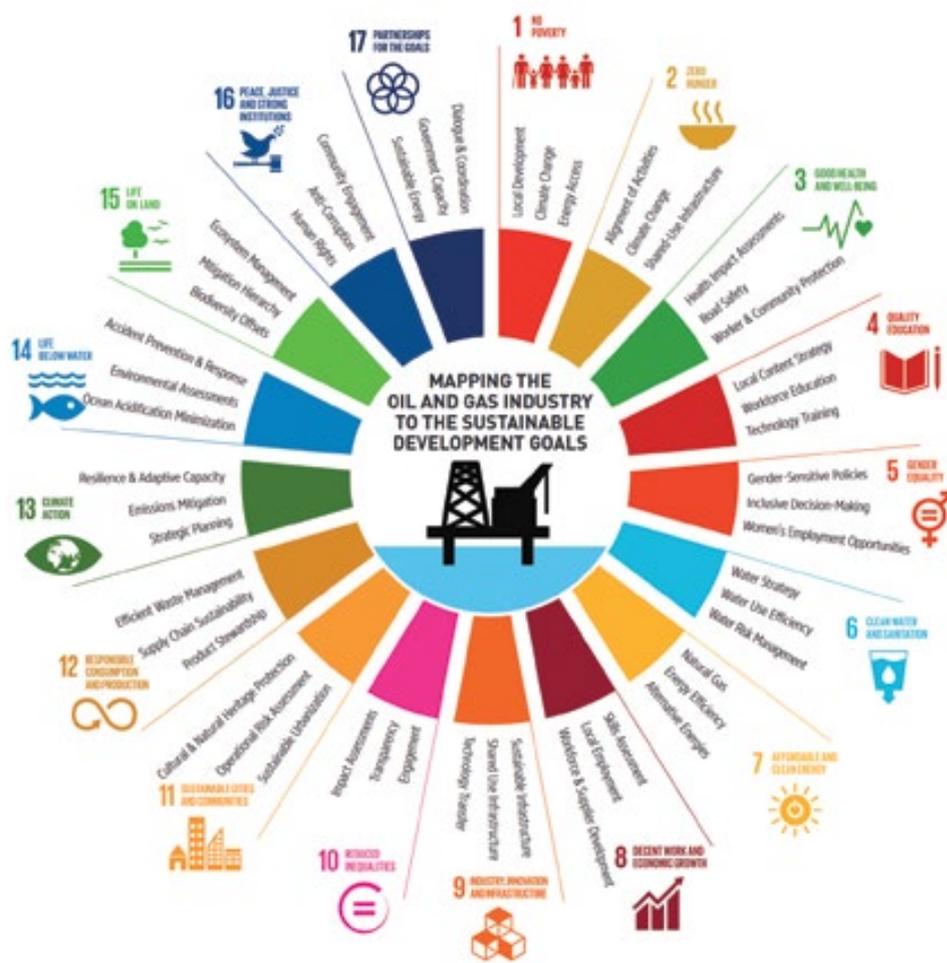
- Advance the science of geology, especially as it relates to petroleum, natural gas, other subsurface fluids, and mineral resources;
- To promote the technology of exploring for, finding, and producing these materials in an economically and environmentally sound manner;
- To foster the spirit of scientific research throughout its membership;
- To disseminate information relating to the geology and the associated technology of petroleum, natural gas, other subsurface fluids, and mineral resources;
- To inspire and maintain a high standard of professional conduct on the part of its members;
- To provide the public with means to recognize adequately trained and professionally responsible geologists; and
- To advance the professional well-being of its members.

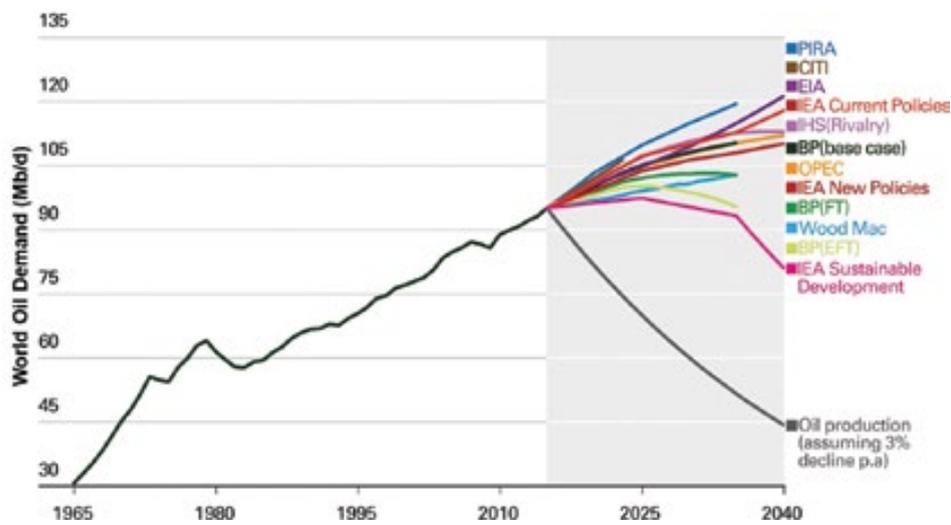
www.aapg.org/about/aapg/overview#2474264-mission-statement

is based in part on a global shift from energy scarcity to energy abundance and the availability of low-cost energy for economic growth. The flattening and downward pressure on demand illustrates the uncertainty the petroleum industry faces with sustainable energy development.

The range of world oil demand scenarios supports the need for continued petroleum development, but with attention to sustainable development.

The concept of "sustainable development" derives from the 1987 report, "Our Common Future," also known as the Brundtland Report.





World oil demand projections. Courtesy of BP.

Agenda 21 from page 3

of Agenda 21. The report defined three pillars of sustainable development: economic development, environmental responsibility and social progress, and their effects on the world. A common 2-D representation of the three pillars illustrates an equal contribution of the parameters that overlap to define "sustainable development." The parameters will vary globally in their contribution to sustainable development based on geography (i.e., resources), industrialization, culture and political conditions.

In 2015, the United Nations General Assembly adopted the resolution, "Transforming our world: the 2030 Agenda for Sustainable Development," and

expanded the three pillars to 17 sustainable development goals.

The concept of sustainable development has become widely adopted and now defines the way global leadership and the general public view energy solutions.

Work by IPIECA (originally the "International Petroleum Industry Environmental Conservation Association"), the global oil and gas industry association for environmental and social issues, illustrates that the petroleum industry can and does make significant contributions to all 17 of the UN sustainable development goals. The petroleum industry provides access to abundant and affordable oil and natural gas, which creates employment and generates revenue for economic growth that fosters social progress.

The petroleum industry specifically makes contributions to SDG 7, which is

Interpretation[®] upcoming submission deadlines

FEBRUARY 2019

► Distributed acoustic sensing and its oilfield potential

Submission deadline: 1 May 2018

Special-section editors: Ge Zhan, Yingping Li, Ali Tura, Mark Willis, and Eileen Martin

► Permian Basin challenges and opportunities

Submission deadline: 1 June 2018

Special-section editors: Sumit Verma, Olga Nedorub, Ron Bianco, Richard Pagel, Fangyu Li, Tao Zhao, Mohamed Zoba, Robert Trentham, Joon Heo, and Vikram Jayaram

MAY 2019

► Interpretable seismic velocity

Submission deadline: 1 August 2018

Special-section editors: Jianxiong Chen, Alfred Liaw, Xianhui Zhu, Xin Wang, Tao Li, Priyank Jaiswal, Yafei Wu, and Xin Cheng

► Near-surface impact on seismic exploration

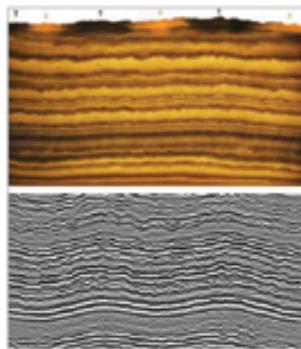
Submission deadline: 1 August 2018

Special-section editors: Claudio Strobbia, Daniele Colombo, Rick Miller, Andreas Laake, and Cedric Schmelzbach

► Seismic geometric attributes

Submission deadline: 1 October 2018

Special-section editors: Xinming Wu, Hongliu Zeng, Haibin Di, Dengliang Gao, Jinghui Gao, Kurt Marfurt, Saleh al Dossary, and Geoffrey Dorn



AUGUST 2019

► Insights into digital oil field data using artificial intelligence and big data analytics

Submission deadline: 1 October 2018

Special-section editors: Vikram Jayaram, Andrea Cortis, Bill Barna, Atish Roy, Deepak Devegowda, Jacqueline S. Floyd, Pradeepkumar Ashok, Satyam Priyadarshy, Aria Abubakar, Chiranth Hegde, and Emmanuel Schnetzler

► Geologic and geophysical characterization of ultra-deep reservoirs

Submission deadline: 1 October 2018

Special-section editors: Rui Zhang, Shu Jiang, Yongsheng Ma, Zhiwen Deng, Jijia Sun, and Xinming Wu

► Machine learning in seismic data analysis

Submission deadline: 1 November 2018

Special-section editors: Haibin Di, Lei Huang, Mauricio Araya-Polo, Youzuo Lin, Anne Solberg, Tao Zhao, Xinming Wu, Vikram Jayaram, Jun Cao, Satinder Chopra, Erwan Gloaguen, Saleh Al-Dossary, Ghassan AlRegib, and Hongliu Zeng

► Brazil

Submission deadline: 1 November 2018

Special-section editors: Vsevolod Egorov, Marcilio Matos, Roberto Fainstein, Ricardo A. Rosa Fernandes, Wences Gouveia, Paulo Johann, Luiz Loures, Webster Mohriak, João Paulo P. Nunes, and Jonathan Stewart

► Near-field exploration and development: Concepts, methodologies, challenges, and case studies

Submission deadline: 1 November 2018

Special-section editors: Huyen Bui, Vivian (Lee) Cathey, Phil Christian, Wenceslau Gouveia, Michael Putnam, Conor Ryan, Mark Smith, Steven Tobias, and Rune Wold

► Petrophysical analysis for shale reservoir evaluation: Methods, progress, and case studies

Submission deadline: 1 December 2018

Special-section editors: Guochang Wang, Shu Jiang, Timothy R. Carr, and Matthew Boyce

► Working with 2D seismic data

Submission deadline: 1 December 2018

Special-section editors: Don Herron, Brian Horn, Rachel Newrick, Cian O'Reilly, and Tim Smith

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SCHEDULED TOPICS

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The three pillars of sustainable development. A "fair world" is one in which economic development supports social progress. When economic development recognizes environmental responsibility, it is a "viable world." Social progress and environmental responsibility combine to make a "liveable world."

to "ensure access to affordable, reliable, sustainable and modern energy for all." In support of SDG 7, the industry can increase the proportion of clean burning natural gas in the energy market and work collaboratively with alternative energies to provide back-up power. The industry can continue to work to lessen environmental impacts through energy efficiency in operations and production and with carbon capture, utilization, and storage projects.

The petroleum industry's contributions to sustainable development are included in corporate annual reports and are used by financial institutions to assign sustainability ratings. The petroleum industry's sustainable development programs are recognized by financial institutions with several companies currently included in sustainable investment funds.

The industry's historical practices have always included a degree of environmental and social awareness with development programs. Now, environmental and social development programs are part of core business strategies and addressed with local and global resources.

Sustainable AAPG Development

While there is a diversity of views about the topics and terms of sustainable energy development, these are the trends that are shaping our industry, and because we're a global industry it affects every one of us. AAPG must recognize these trends and engage its current and future members in the discussion.

Accordingly, three strategic goals for AAPG in the next year are to:

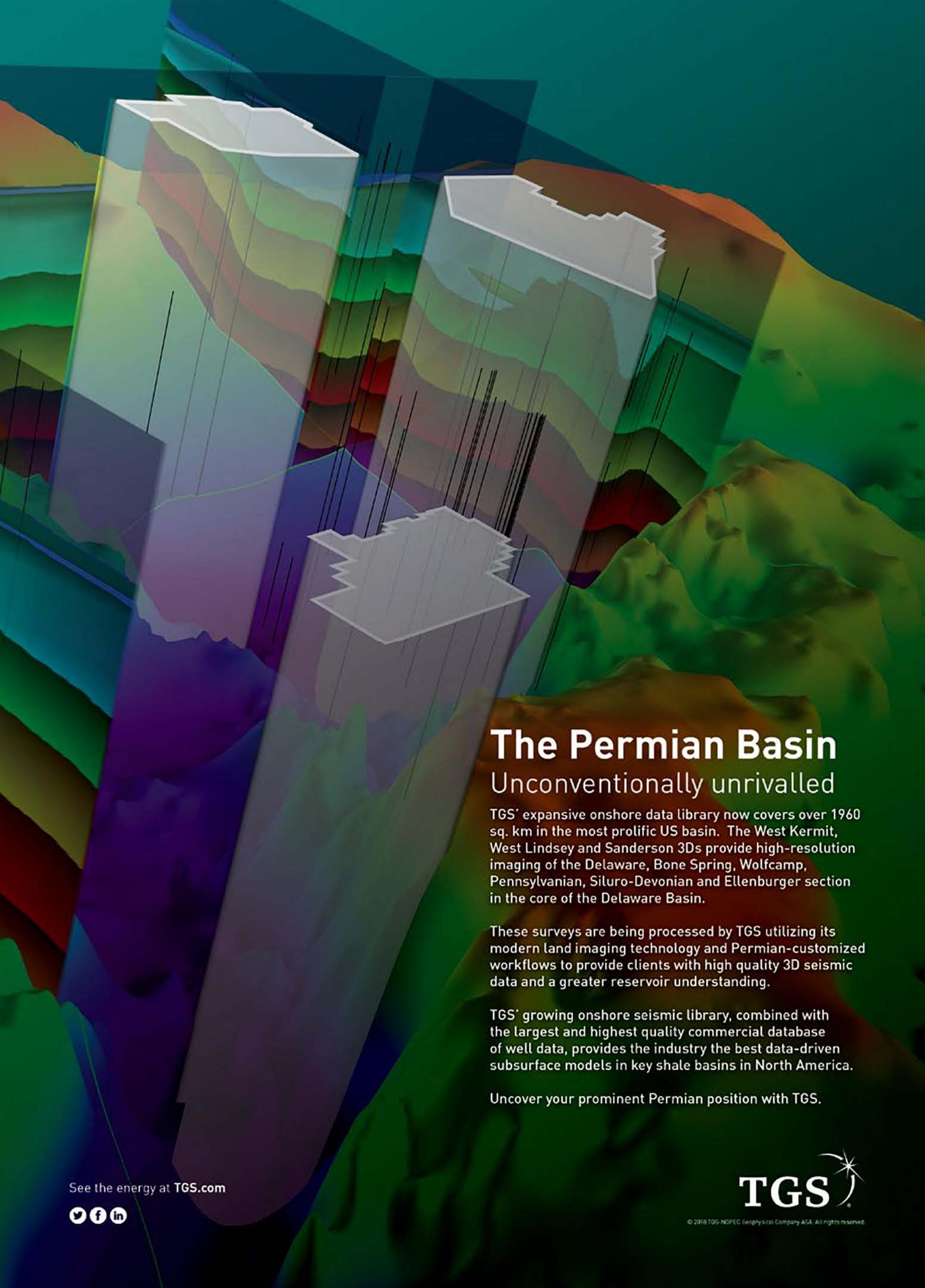
- Define the role of geoscience in sustainable petroleum development
- Promote the diversity of AAPG's science and technology to engage new and renewing members

See [Transition page 13](#) ►

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Geomechanics Dominates in Unconventional Resource Development

As unconventional resources have grown in importance, geomechanics has emerged as a major discipline in the field.

This month's Unconventional Resources Technology Conference in Houston July 23-25 provides a good example.

The inaugural conference in 2013 had a lone session in geomechanics.

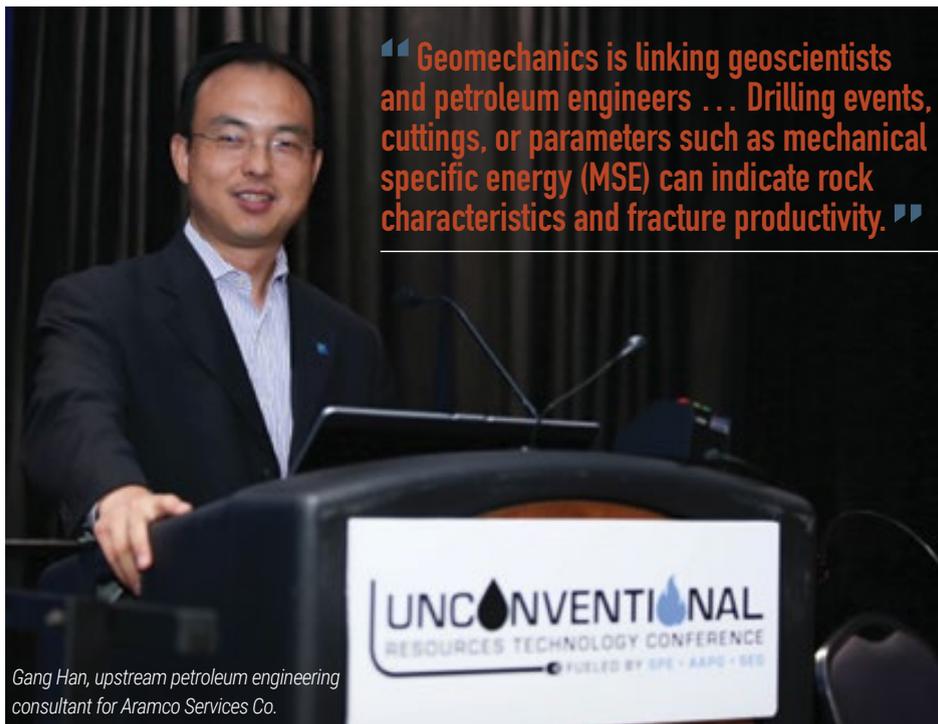
This year, it is one of the largest programs, explained Gang Han, upstream petroleum engineering consultant for Aramco Services Co. He has been involved with URTEC since its inception in various roles: theme chair, session chair, keynote speaker and technical presenter.

"Nearly 140 geomechanical technical abstracts were submitted. Of those, 45 were selected for seven sessions. In addition, American Rock Mechanics Association will present a special geomechanics session for a second year in a row," Han said.

"These sessions reflect the growing importance and multidisciplinary nature of geomechanics: from geoscience such as rock characterization, structural and tectonics presented by AAPG PSGD (Petroleum Structure and Geomechanics Division), pore pressure and in-situ stresses, to engineering such as fracture modeling, monitoring, diagnostics and performance," he said.

"Essentially, geomechanics is the study of the behavior of soil and rocks. So, when you consider that the success of the unconventional revolution is based primarily on two technologies – horizontal drilling and hydraulic fracturing – you can understand why geomechanics is so important," Han said.

Geomechanics threads through various



Gang Han, upstream petroleum engineering consultant for Aramco Services Co.

“Geomechanics is linking geoscientists and petroleum engineers . . . Drilling events, cuttings, or parameters such as mechanical specific energy (MSE) can indicate rock characteristics and fracture productivity.”

disciplines in all stages of exploration and production, he noted.

"Really, unconventional teams are all integrated now: geomechanics, geology, geophysics, drilling, completion and stimulation, production and reservoir engineering," he said.

"It is applied in geology – where to find the 'sweet spot.' We need to understand the best rock, not just the oil," he added.

"Successful rock drilling, keeping boreholes open and stimulating, such as hydraulic

fracturing, rely on inputs from geomechanics," Han also said.

The Bottom Line

"All this affects how much money we're spending – it's truly multidisciplinary," said Keith Rappold, technology coordination chief with Aramco.

"Drilling and producing from unconventional, shale, carbonate or tight sandstone reservoirs is

different. Unconventional rocks have their own unique characteristics and behaviors. As industry increases production of oil and gas from unconventional reservoirs, geomechanics experts are essential members of the development and operations teams. URTEC was created because there was a need for a conference that was an integrated event for unconventional resource teams," said Han.

The shale revolution has spurred rapid advances in the evolution of geomechanics.

"In the early years or 'gold rush' stage, unconventional operators focused largely on obtaining land leases. Conventional or traditional geomechanical approaches and technologies, such as planning horizontal well trajectories or designing well stimulations, were applied. Geomechanics supported operations but it quickly became clear that shale drilling for oil and gas would be different – different from both a business model and a technical model," Han said.

"Operators needed large numbers of wells to develop the land. Improving efficiency and reducing cost became the focus. Innovations came about with pad drilling, microseismic, zipper fracturing, and slick water to name a few. New technologies propelled geomechanics specialists into a key role in pad design, well planning, drilling, completion, stimulation, production, reservoir and environmental protection," Han said.

The search for new approaches is a continuing effort, said Theo Mallinson, also a petroleum engineering consultant with

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Solving the Riddle of Shale



In his documentary "Switch," Scott Tinker, Texas state geologist and director of the Bureau of Economic Geology at the University of Texas, along with filmmaker Harry Lynch, set out to make a film about energy's inexorable transition into the 21st century. The year was 2009. His goal, Tinker said at the time, was not to pick one form of "new" energy over any other, but to talk, in fact, about the inevitability (and predicted benefits) of all that was out there.

It was an unapologetically upbeat look at the future.

Before you can change an industry, though, you need to change the conversation – a conversation that continues today.

At this year's Unconventional Resources Technology Conference July 23-25, in Houston specifically during the opening plenary session, "The Shale Revolution – Getting Down to Business," Tinker will continue the dialogue, discussing, specifically, the elephant in the unconventional resources room, in a session called "Enigmatic Shale."

Vast Potential

So if production from shale reservoirs has changed the economy and energy landscape of the United States – which it has – is it really still an enigma?

In shale's case, yes, because time hasn't always meant understanding.

"Shale has been drilled since drilling began, with oil and gas shows well known in shale cores and cuttings. But it is just in the last two decades that natural gas production from shale began, and the last decade for shale oil. Understanding of shale reservoir rock fluid systems is thus in the early stages," he said.

This much, however, is known: largely because of shale, the United States is poised

"It is just in the last two decades that natural gas production from shale began, and the last decade for shale oil. Understanding of shale reservoir rock fluid systems is thus in the early stages."

to dethrone Russia and Saudi Arabia as the world's lead oil producer.

The potential is literally and figuratively enormous.

"Conventional oil and gas production is the oil and gas that has leaked off from the source rocks," said Tinker. "Where you have conventional oil and gas production, you have mature source rocks. Thus, global shale gas and shale oil resources are vast."

How vast?

Studies show that ultimately recoverable resources of shale are massive, yet ultimate production from shale given current technology represents less than 10 percent of the resource in place.

A Many-sided Riddle

No doubt that has changed the country's energy future, but converting those resources to reserves and production is where the challenge lies.

And one such challenge – surprising no one – is environmental.

"Environmental impacts from all oil and gas activities are real, shale or otherwise. Unconventional shale reservoir impacts are broader than conventional reservoirs because of the extensive nature of shale deposits, and the volume of injected, produced and disposed fluids that have to be handled in hydraulic fracturing operations," said Tinker.

Those disposed fluids are, in many cases,

the third rail of hydraulic fracturing and Tinker, while aware of the problems, sees progress.

"The industry is improving every year," he said.

Tinker references lower surface impacts at multi-well pads, to lower water use per unit of production, to use of brackish instead of fresh water for fracturing, to produced fluid recycle and reuse, to improved disposal of fluids and earthquake mitigation, and much more.

But it remains a large-scale industrial operation.

Tinker – who is chairman of the Switch Energy Alliance, which creates free, non-partisan, film-based resources to help students learn about energy – said there is a two-way street on which shale, the country's energy prospects, its economic outlook and politics all travel.

"Politics, especially regulation and trade agreements, play a role for sure," he said, especially because the United States has led the world in shale.

"Too much regulation and heavy tariffs drive costs up. Too little regulation risks environmental impacts," Tinker added.

That story is well known. This one perhaps not as much.

"But the shale story is global, and other major oil and gas regions – the Middle East, Russia, South America – are now beginning to quietly examine their unconventional reservoirs," he said.

Benefits of Shale

Tinker is convinced, as one might expect, that the benefits of shale – perhaps the most conventional of the unconventional – outweigh the negatives.

"Natural gas from fracking is replacing coal for power generation, thus lowering CO₂, sulphur, nitrogen, particulate and mercury emissions. It is also used in the power plants to backup intermittent wind and solar power generation," he noted.

He said the data on fracturing – economic, security and environmental – of oil and natural gas are all generally positive.

"Affordable, available and reliable oil and natural gas underpin healthy economies allowing for environmental investment; are needed to lift emerging economies from poverty; and provide energy security to many developed and developing nations," he said.

That topic – energy poverty – is the subject of Tinker's next film, "Switch On."

There's no panacea out there, Tinker reminds us. There never has been. In the industry, there have always been trade-offs on environmental, energy and economic matters, depending, in part, on whether you're talking about governments, NGOs or industries.

Who's in? Who's out?

"As with all things, those that have the resource are mostly in, and those who aren't, don't. But on top of that we layer politics. Development of oil and gas, and coal, tends to be resisted more by 'progressives,'" (and he said that politicians have to follow the wishes of their voter base), "and by non-oil and gas industries who compete for market share, like electric vehicles, biofuels, geothermal, solar and wind," Tinker explained.

It is a resistance he said that has many layers.

"This resistance is often couched in environmental terms, mostly climate change, but runs deeper philosophically for some," he added.

The dynamic going forward is, in a sense, as its always been.

"The future for oil and gas is mostly a technology and demand story. Will technology keep the cost of oil down so that gasoline, diesel and jet fuel can compete in the transportation markets? And keep the price of natural gas down so that it can compete in the power generation, and potentially transportation (CNG, LNG, fuel cells) markets?" Tinker pondered.

As exciting as the time is for unconventional energy sources, including shale, there is still the reality.

Let's call it maturity.

"And a little told story is the coming environmental impacts of large scale wind, solar and battery development: from mining, to manufacturing, to transmission, to disposal. Nothing in energy, at scale, comes without environmental cost," he added. [E](#)



Photo courtesy of Switch Energy Project.



Water tanks preparing for a hydraulic fracturing job. Photo by Joshua Doubek.

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Constant Technological Advances Drive Unconventionals Development

'Moore's Law in action'

The effect of technology on unconventional resource development might be the biggest story in the oil and gas industry ever. And that story is still being written.

In the United States, unconventionals will help push crude oil production to a record average of 10.8 million barrels a day in 2018, according to the U.S. Energy Information Administration.

This huge increase in U.S. crude production, driven by technology, began in 2009 and has persisted despite one of the most significant industry downturns in history.

At the upcoming Unconventional Resources Technology Conference in Houston, a panel of industry experts will discuss the most important current and emerging technologies in unconventionals.

The July 23 session, "Technologies That Will Make a Difference in Unconventional Reservoir E&P," will examine the state of traditional unconventional reservoir technologies and explore what new technologies could become game-changers for the industry.

'Marginal' Differences

Chris Spies, vice president of geoscience and technology for Concho Resources in Midland, Tex., will participate on the panel.

Spies said the most important emerging technologies in unconventionals are "those that help us learn about short- and long-term



SPIES

"The pure size of the prize is incredible. It's big enough to displace everything else in the U.S. and to compete with conventional resources globally."

production of oil, gas and water, and those that help with efficiency. I think a lot of them are small, at-the-margin things that add up to a much bigger thing."

He noted the cumulative effect of many advances in technology as unconventional resource development has progressed in the United States over the past decade.

"I truly believe the whole adds up to so much more than the sum of the parts – the gestalt of unconventionals. And I believe that there's a lot more ahead. The initial exploration phase is over and we're finding out there is so much more to be learned," Spies said.

Others scheduled to participate on the URTEC panel are:

▶ Yanni Charalambous, vice president and chief information officer of Occidental Petroleum

▶ Hege Kverneland, corporate vice president and chief technology officer of National Oilwell Varco

▶ Chris Cheatwood, executive vice president and chief technology officer of

Pioneer Natural Resources

Five years ago, the industry was interested in quantifying the hydrocarbons-in-place stored in shales for unconventional production, Spies said.

"This meant we had to solve for the mineral constituents of the entire rock, including the organic matter/TOC, clay, even pyrite," he noted

Other pursuits at that time included imaging nanopores or pores that were previously unaccounted for, using core analysis of organic mudstones and finding ways of better measuring permeability – one thing the industry still isn't very good at, Spies observed.

Today the industry is asking, he said, "How much of the hydrocarbons-in-place are movable?"

"It turns out some of the core and log analysis is fooled by solid or immobile hydrocarbons. Advancements in NMR (nuclear magnetic resonance spectroscopy) and geochemistry are helping solve this problem," Spies noted.

Beyond 'Pump and Pray'

In unconventionals now, the industry is putting increased emphasis on geomechanical measurements – core, log, seismic, etc. – to analyze how the rock breaks, he said.

Also, the industry is developing techniques to better understand the role of natural fracture systems and bedding boundaries/barriers, he observed.

For the geoscientist, technology innovations that contribute to a knowledge of the subsurface in unconventional resources are always meaningful, explained Spies.

"Any technology that is able to be incorporated back into your digital model of the subsurface is very important," he said. "The biggest thing for me – and it's not really a geoscience thing – the fiber optic sensors have been really interesting," he added.

In addition to advances in petrophysics, the industry has gained an improved understanding of geomechanical modeling in unconventionals and has seen important, new contributions from geochemistry, Spies noted.

"In the early days geochemistry was more set on maturities, and today it's more about oil typing to better understand spacing," he said

Horizontal drilling and hydraulic fracturing

See **Technology** page 17 ▶

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API Launches 'Explore Offshore' Coalition Amid Political Opposition



Photo courtesy of Bureau of Safety and Environmental Enforcement.

It's strange to think about ground truths determining the future of offshore exploration, but that's exactly what is happening in the southeastern United States.

In June, the American Petroleum Institute announced its new Explore Offshore initiative, a coalition of more than 100 community organizations, associations, businesses and local leaders in Virginia, North Carolina, South Carolina, Georgia and Florida.

Attitudes about offshore drilling in those states grow out of a push-pull mélange

of increasing energy needs, recreational opportunities, beach life, environmentalism and a heavy reliance on gasoline and jet fuel to bring in tourists and their dollars.

API describes Explore Offshore as a bipartisan effort "representing a diverse group of community organizations, businesses, and local associations across the Southeast that support safe and responsible expanded U.S. access to oil and natural gas through advanced technologies."

Florida, with its extensive tourism industry,

could be the archetype for a state struggling to balance energy needs with other local concerns.

Former Florida Lieutenant Governor Jeff Kottkamp, now a practicing attorney in Tallahassee, serves as co-chair for Explore Offshore in the state. He noted that Florida gets about 110 million visitors a year.

"Affordable energy, oil and gas, it's so closely tied to our economy down here. When we see these increases in gas price we take a huge hit in the number of people who can drive down here to Disney World, for example," Kottkamp said.

Solidifying Support

Last year, Florida was among the fastest growing U.S. states in population. For the period July 2016 to July 2017, it was second only to Texas in population expansion.

"We will have a significant population growth in Florida, another 3 million, 4 million people," Kottkamp said. "We will have additional energy needs."

Erik Milito, API's director of upstream and industry operations, said the Explore Offshore coalition was founded to solidify support for "expanded access to U.S. natural gas and oil resources and the National Offshore Leasing Plan, which will play a critical role in America's long-term energy and economic future." That plan, officially called the National Outer Continental Shelf (OCS) Oil and Gas Leasing Program, is developed by the Bureau of Ocean Energy Management under the U.S. Department of the Interior. It saw a

significant potential increase in scope in January of this year.

Interior Secretary Ryan Zinke proposed making more than 90 percent of the total OCS acreage available to consider for future exploration and development. The proposal would have included three lease sales each for the Mid- and South Atlantic regions, two for the North Atlantic region and one for the Straits of Florida.

But a week after that announcement, following negative public response, Zinke said drilling in the Atlantic Ocean off Florida and in the eastern Gulf of Mexico would be "off the table" for the time being.

Then in April, Florida's Constitution Revision Commission approved a constitutional amendment question for the state's November 2018 ballot that would prohibit oil and gas exploration in Florida's state waters while also banning electronic-cigarette vaping in indoor workspaces.

Asked about that unusual combination, the commission said it was trying to cut down on the number of proposed amendments by consolidating different concerns into one question, in this case under a "clean-water, clean-air" umbrella.

Resistance

API's Explore Offshore announcement drew opposition almost immediately. The day following its news release, Florida's Democrat

Continued on next page ►



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“The first step is really going out there and talking about this, having a meaningful conversation. We’ve got to get into the weeds on this. Let’s not take anything off the table.”

KOTTKAMP

◀ Continued from previous page

U.S. Senator Bill Nelson filed an amendment to the annual national defense bill that would keep exploration and production out of the eastern Gulf of Mexico for an additional five years.

“Like us, Big Oil doesn’t believe Florida is really off the table to new drilling – despite what (Florida Gov. Rick) Scott and the Trump administration keep saying – and now they are making a new push to drill closer to Florida’s shores. We can’t let that happen!” Nelson said in a tweet.

Soon after the API announcement, Oceana, an international advocacy organization focused on ocean conservation, held a meeting in Chincoteague, Va., in opposition to offshore drilling and seismic work.

In South Carolina, Peg Howell, co-founder of the group Stop Oil Drilling in the Atlantic, and Frank Knapp Jr., president and CEO of the state’s Small Business Chamber of Commerce, derided the initiative.

“Big Oil is creating this fake coalition made up primarily of former elected officials who have no responsibility to represent the public and businesses that will be harmed,” Knapp was quoted as saying.

Kottkamp commented, “Tourism is obviously a large part of our economy. Some people who don’t want offshore exploration just assume that people in the oil and gas industry don’t care. And nothing could be farther from the truth.”

Raising Awareness

The other co-chairs for Explore Offshore Florida are Miriam Ramirez, a former Puerto Rico state senator, and Wayne Harris, former Okaloosa County commissioner.

“The Department of the Interior took a step in the right direction by proposing to open up additional areas of the eastern Gulf of Mexico to new exploration for oil and natural gas,” Ramirez stated.

“Our neighbors in the Gulf of Mexico support thriving tourism industries all while developing offshore energy resources that create high-paying jobs to those states, provide much needed state revenue and economic investment, and deliver greater energy security to America,” she said.

Harris said the United States and Florida need to use recent advances in technology and science “to find out exactly what energy resources lay in our waters, and how we can produce that energy in a responsible manner in the years ahead.”

Kottkamp said future offshore oil and gas activity should take place “only in a way that preserves Florida’s natural beauty,” and also noted that development is restricted in a significant area of Florida for military training and testing activities.

This restriction includes the 180,000-square-mile Joint Gulf Range Complex as well as 17 miles of adjacent dedicated shoreline and 724 square miles of onshore area.

“We have a very significant part of the Gulf set aside for that range,” Kottkamp said. “We have an important balancing act here.”

API said the national Explore Offshore effort will be co-chaired by Jim Webb, former U.S. Secretary of the Navy and a former Democratic U.S. senator from Virginia, and Jim Nicholson, former Secretary of Veterans Affairs in the George W. Bush administration.

Among its activities, Explore Offshore will host local events and try to engage and educate local communities on safe and responsible access to U.S. resources and the related positive economic and energy benefits, API announced. Kottkamp said public education and awareness are essential.

“You have to really educate people. This has already happened offshore Florida, but so far offshore you don’t see it,” he noted.

“The first step is really going out there and talking about this, having a meaningful conversation. We’ve got to get into the weeds on this,” Kottkamp said. “Let’s not take anything off the table.”

Transition from page 4

► Communicate broadly the economic, environmental and social benefits of the petroleum industry and its collective efforts to address the challenges of sustainable development

To begin to address the first goal, AAPG is partnering with Shell for a conference, “Geoscience in a New Era - Energy Transition,” to be held Sept. 5-6, 2018 in Amsterdam (visit EnergyTransition.AAPG.org, and see related article on page 20).

AAPG will also convene a session at the American Geophysical Union annual meeting, Dec. 10-14, 2018 in Washington, D.C., “Geoscience and Sustainable Energy Solutions” to reach new members through the science of AAPG and its divisions. Your abstract submissions are encouraged before the Aug. 1 deadline (FallMeeting.AGU.org).

An ad hoc committee on sustainable development with representation from majors, independents, NOCs, service companies and consultants will focus on the third goal. The committee will collect information from companies and academic

consortia for a coordinated message from AAPG on the petroleum industry’s contributions to sustainable development.

AAPG’s divisions, regions, sections, committees, YPs and student chapters will also be working to capture and communicate the science and technology of the petroleum industry and how it is contributing to sustainable energy development. Watch the EXPLORER and the AAPG website to learn more!

What’s Sustaining You This Month?

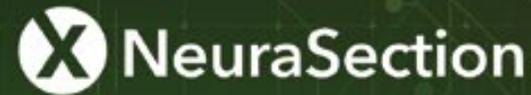
What’s sustaining me this month is outcrop photos from summer field trips posted on social media from friends and connections. Our best understanding of the subsurface geology comes from understanding the rocks!

Post your photos of field work, cores, maps, cross sections, short courses, projects, networking or comments and let us know what sustains you. #AAPGSustainsMe

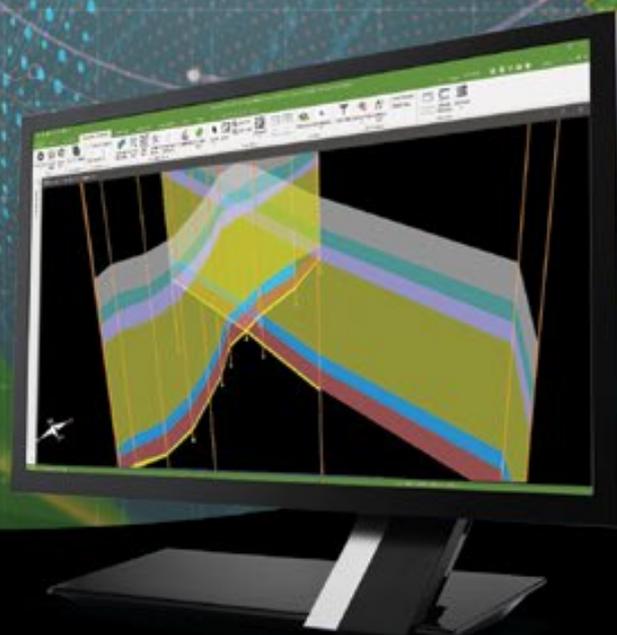
Onward!

Jenica M. Cox

Neuralog



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New KU Geoscience Facility 'a Dream Decades in the Making'

A new facility at the University of Kansas – and the philosophy behind it – are already generating new ideas and programs.

The \$78.5 million, 140,000-square-foot Earth Energy and Environment Center opened for classes in January and was formally dedicated in April.

The state-of-the-art facility continues the university's embrace of a philosophy of integration in education, industry outreach and research in energy and environment, said Robert Goldstein, provost's special adviser on campus development and Haas distinguished professor in the Department of Geology.

The design of the complex is open and transparent, bringing students and instructors closer together on a regular basis. Petroleum engineering and geoscience faculty and students in energy-related studies work together in the new facility.

In addition to fostering interdisciplinary classwork, the university engages with industry to further prepare students for their careers, Goldstein said.

Industry-standard software is incorporated, including a full suite of Schlumberger software, such as Petrel. Students also use Petra, SMT-Kingdom Suite, DionisosFlow and CMG, Goldstein said.

"We have recently signed a memorandum of understanding with Schlumberger-NEXt to design and jointly offer a one-year non-thesis interdisciplinary master's degree focused on petrophysics. Development is happening rapidly and we expect this degree program to go live within the next year. This degree program represents a new interdisciplinary partnership between industry, and the KU departments of geology and chemical and petroleum engineering," he said.

Interdisciplinary Approach

Goldstein said the plans for the degree program were hatched from interactions between engineers and geoscientists which were facilitated by the EEEEC. Other emerging plans include joint summer internship programs.

"Classroom spaces all use the engaged learning design, so there are no spaces that look like standard lecture rooms," Goldstein said.

"One of the classrooms has 162 seats, and two have 63 seats. All use round tables with technology that allows students to work in groups on projects and then share results with the class and faculty. This engaged learning model promotes higher levels of learning among students and promotes development of reasoning, integration and communication skills. There are also class laboratories in the building used for teaching, including computational labs and reservoirs labs. Once fully booked, these classrooms will handle about 1,500 students per day," he said.

The interdisciplinary approach works, he said.

"Our past experiences with interdisciplinary courses indicate that the students find them highly challenging, but in a positive sense. Students with diverse backgrounds must first find a common language and framework for problem solving and interacting as team members. This is interesting, as it sometimes results in a little resolvable conflict that really help the students to work hard and learn. Once

they get out in the workforce and find themselves working in similar integrated teams, it is familiar territory, and they are well prepared to contribute successfully," Goldstein said.

Faculty members use a "flipped classroom" approach, which had already proven effective, and have found additional benefits.

"The flipped classroom strategy is most commonly applied in the large introductory classes but has also worked its way into much of the geology curriculum. Professors Jen Roberts, Alison Olcott-Marshall and other faculty made a major revision of the approach to teaching our intro students and turned the class meeting time into one where students did group work and solved problems," Goldstein said.

"Interestingly, they turned this course transformation into an experiment to evaluate the impact on student learning, and particularly, the impact of the new approach on student success by gender and minority group.

"They found that this new approach made a significant impact on success of students in general, but in particular, it improved performance of women and students from historically minoritized populations. The result of this teaching

innovation was recently presented at the Earth Educators Rendezvous annual meeting, along with co-authors N. McClean, G. Baker and A. Moeller. To highlight the widespread approach to these teaching innovations in EEEEC, we will host the Earth Educators' Rendezvous there this summer," he said.

The center's two buildings are connected through walkways and tunnels. A large atrium provides visibility into the offices and labs. Everything is connected through transparent walkways and many meeting rooms are fully transparent.

The center is designed to serve as a crossroads for people and ideas.

"If you are a professor, you can see your graduate students and see into the labs. If you are a graduate student, your professor has to walk through your space to get to the office, you can see into their office, and that promotes interaction," Goldstein said.

An Expansive Project

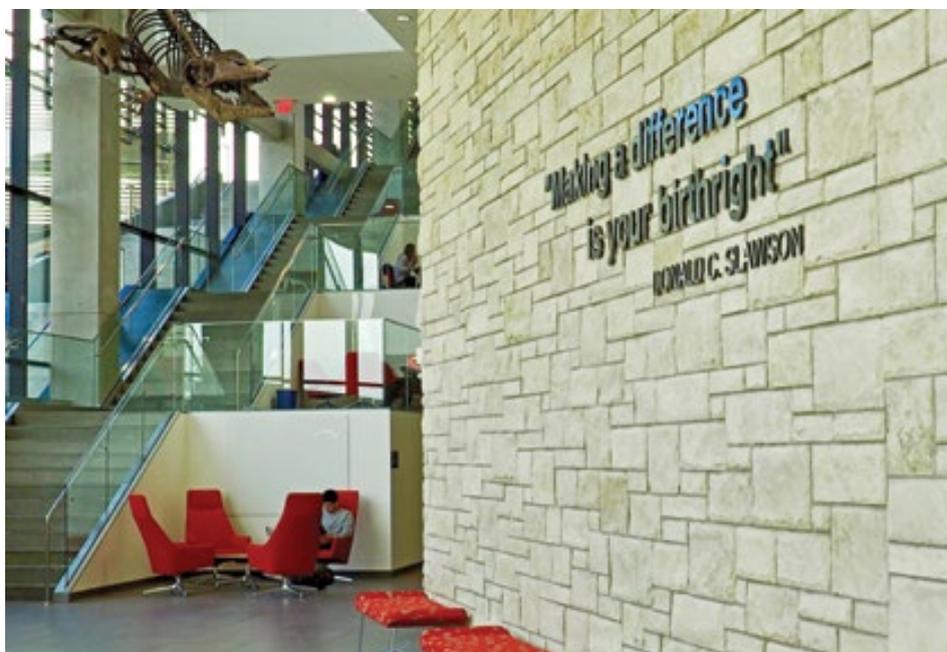
The EEEEC is something of a dream, decades in the making, Goldstein said.

He said the need to upgrade the Department of Geology's historic home in Lindley Hall was first noted in 1971, while the discipline of geology continued to evolve over the years, requiring sophisticated analytical, geophysical and computational resources.

"At a planning retreat that started my term as chairperson of the Department of Geology in 2004, the faculty gave me my marching orders: Find the funds, plan and build an addition to Lindley Hall with modern facilities capable of housing the department," Goldstein said.

The project grew from a relatively modest \$12 million addition into the ambitious and innovative new center with the construction of Ritchie Hall and Slawson Hall. Both new buildings are still connected to historic Lindley Hall, where many of the great figures of petroleum geology once roamed the halls, Goldstein said.

"The project evolved through synergy and support. Scott and Carol Ritchie and



Continued on next page ►



Kansas Geological Survey outreach geologist and a staff member focused on industry outreach and tech transfer. Those faculty and staff members have their laboratories in EEEEC and those with offices in adjacent buildings also have labs in EEEEC. There is permanent office space for approximately 100 graduate students and post docs, and desk space for collaborators and drop-ins. There is additional meeting and office space for industry visitors and collaborators. They can be assigned office, desk and meeting space in the building.

The new facility is meant to engage the public as well as students.

The Kansas Geological Survey has a geologist-in-residence at the EEEEC available to answer questions from the general public. KGS's mission includes training courses useful to industry, legislators and regulators.

The Tertiary Oil Recovery Program has a major component of outreach and tech transfer as part of its mission. The program works with the petroleum industry at large to provide workshops on relevant topics, technical assistance, field tests and demonstration projects.

The building hosts multiple workshops and events during the year focused on the STEM disciplines. These range from events such as a "Girls in STEM" workshop for secondary school students to a "Digital Rock Physics" workshop for professionals.

The exterior is as inviting as the interior is open, Goldstein said.

"The building is designed for outreach with educational exhibits to invite the public in to learn about geology. The façade of the building is inspired by the geologic cross section of Kansas; there is a dynamic display of vertebrate fossils from the Niobrara western interior seaway; there is a geologic park, with large boulders telling the geologic history of the U.S., and there is a rock garden, where visitors can harvest specimens to take home with them," he said. 

◀ Continued from previous page

their family business, Ritchie Exploration, first stepped forward as committed donors and proved that the project was feasible. They encouraged us to think big, reflect the historic legacy of KU and the Department of Geology, and to be as inclusive as possible of diverse disciplines at the intersection of geoscience, energy, environment and engineering," Goldstein said.

"Our university got a new provost who began a strategic planning initiative focused on interdisciplinary research

collaboration. Out of that came a major strategic theme for the university, 'Sustaining the Planet – Powering the World,' and our goal for EEEEC became fully aligned with university strategic goals," he said.

"The family of Donald C. Slawson (of Slawson Exploration Co.) then stepped forward and encouraged us to make EEEEC the most highly-integrated university facility of its type in the nation. Thanks to their help, we were able to greatly expand the project and were fully able to integrate the geosciences, petroleum engineering, energy and environment. Robert M. Beren (of Berexco) helped in a

major way by allowing us to incorporate a training, education and outreach center that encouraged integration of our faculty and students with industry and others from outside of KU through educational programs. Finally, our Geology Associates Advisory Board chair, Steve Dixon (of Tapstone Energy), was a tireless proponent for the project."

Ongoing Uses

The EEEEC is designed to house the offices of 22 faculty members, the Department of Geology support staff, building support staff, staff of the Tertiary Oil Recovery Program, a



energy transition

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Geophysical Corner

Multispectral Coherence Attribute Applications

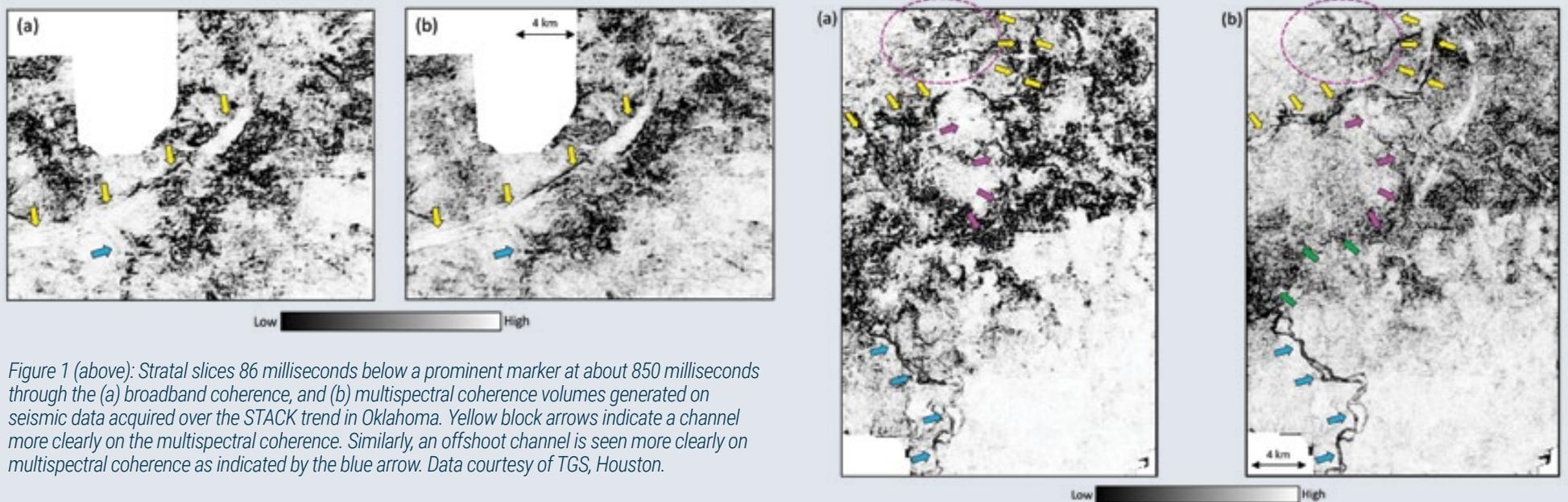


Figure 1 (above): Stratal slices 86 milliseconds below a prominent marker at about 850 milliseconds through the (a) broadband coherence, and (b) multispectral coherence volumes generated on seismic data acquired over the STACK trend in Oklahoma. Yellow block arrows indicate a channel more clearly on the multispectral coherence. Similarly, an offshoot channel is seen more clearly on multispectral coherence as indicated by the blue arrow. Data courtesy of TGS, Houston.

Figure 2 (right): Stratal slices 160 milliseconds below a prominent marker at about 850 milliseconds through the (a) broadband coherence, (b) multispectral coherence volumes generated on seismic data acquired over the STACK trend in Oklahoma. Notice the better definition of the channel features as indicated by the yellow and magenta arrows as well as in the highlighted area. There is at least one channel feature running north-south as indicated by the blue, green, magenta arrows as well as the highlighted portion on top. Data courtesy of TGS, Houston.

Coherence is an iconic attribute that finds its place in most workstation interpretation software packages. Much has been written about this attribute and the usefulness of its applications. The geologic feature imaging in three-dimensional seismic data volumes is done well by the coherence attribute as three-dimensionality is an essential ingredient of its computation. Ever since the first cross-correlation-based coherence algorithm was introduced way back in 1995, other algorithms have also been developed, including semblance-based, eigenstructure-based, prediction error filter-based, gradient structure tensor-based and energy ratio-based. These algorithms vary in how they handle lateral variations in amplitude, phase and waveform, and thus have different sensitivities to geology, spectral bandwidth and seismic noise.

For coherence computation, first an analysis window consisting of a fixed number of samples in the inline, crossline and time directions is constructed along structural dip. In the eigenstructure-based coherence computation, a covariance matrix is then constructed from the selected samples and solved, i.e. the eigenvalues and eigenvectors are determined. The ratio of the first eigenvalue (by definition the largest) to the sum of all the eigenvalues is the value of the eigenstructure coherence at the sample at the center of the unit cube. The analysis window is then shifted by one sample at a time in the inline, crossline and time directions, and the above process repeated. The result is a coherence volume, which is ready for

interpretation.

The energy ratio-based coherence algorithm is a slightly more general computation in that the energy of the coherent component of the seismic traces is divided by the total energy of those traces within the analysis, and the process is repeated for all the samples in the broadband three-dimensional seismic volume. We have shown in an earlier Geophysical Corner article (March 2015) that coherence run on spectrally decomposed seismic volumes, or the derived voice components, often delineate edges that are best analyzed at or near the tuning frequency of a given formation. In general, shorter, more vertically-limited faults and channel edges are often better delineated at higher frequencies, while through-going faults are often better delineated at lower frequencies.

Recent Advance

With such observations in mind, an advancement has been made recently in energy ratio-based coherence computation. Instead of computing covariance matrices from the input seismic volume, covariance matrices are computed on voice components at different frequencies (see the March 2015 Geophysical Corner) derived from the input broadband seismic data volume and oriented



CHOPRA

along structural dip, summing them and computing eigenvectors of the summed matrix. We denote such a computation as "multispectral coherence."

We demonstrate the application of multispectral coherence on two different 3-D seismic volumes, one from the STACK trend in Oklahoma in the United States, and the other from the Montney Dawson area in British Columbia, Canada.

Figure 1 shows stratal slices 86 milliseconds below a prominent marker tracked at close to 850 milliseconds from the broadband coherence (figure 1a), and multispectral coherence (figure 1b), generated from voice components derived from the input seismic data at 20 to 60 Hertz at increments of 5 Hertz. Notice the channel feature indicated with yellow block arrows is much better defined on multispectral coherence than the broadband coherence. Similarly, a small offshoot channel indicated with the blue block arrow is seen better-defined on the multispectral coherence.

Figure 2 shows stratal slices 160 milliseconds below a marker at close to $t=850$ milliseconds on the same data volume shown in figure 1. The channel features seen lower down on the displays (blue arrows) are very clearly seen on the multispectral coherence. The channel feature indicated with magenta arrows, and then the channels in the highlighted area of the magenta ellipse are all better defined on multispectral coherence. Another channel feature indicated with yellow arrows is more clearly noticeable on multispectral coherence. In fact, there is

at least one channel that runs almost north to south from the highlighted area, through by the side of the magenta arrows, green arrows and to the blue arrows that can now be interpreted.

In figure 3 we show a similar comparison of coherence stratal slices 36 milliseconds above a marker at roughly $t=1,700$ milliseconds on a 3-D seismic volume from the Montney-Dawson area in British Columbia in Canada. The multispectral coherence was generated by using 12 selected voice component volumes from 20 Hertz to 75 Hz at increments of 5 Hertz. Notice the definition of faults running almost north-south and indicated by the yellow blue and green arrows to be well-defined on multispectral coherence.

One observation that is common in all the above figures is that a better signal-to-noise ratio is seen on multispectral displays than the broadband coherence displays. Multispectral coherence enhances discontinuities seen across multiple frequencies and suppresses discontinuities (such as noise) seen on only one or two spectral components.

Conclusions

Multispectral coherence computation from input seismic data volumes yield more accurately-defined geologic features, which would help with their interpretation. Overall, the displays exhibit better signal-to-noise ratio than the broad band coherence. The computation of multispectral coherence is more time consuming than broadband coherence, and hence would be somewhat more expensive. In general, the added value in terms of interpretation would be well worth the extra time and expense. [E](#)

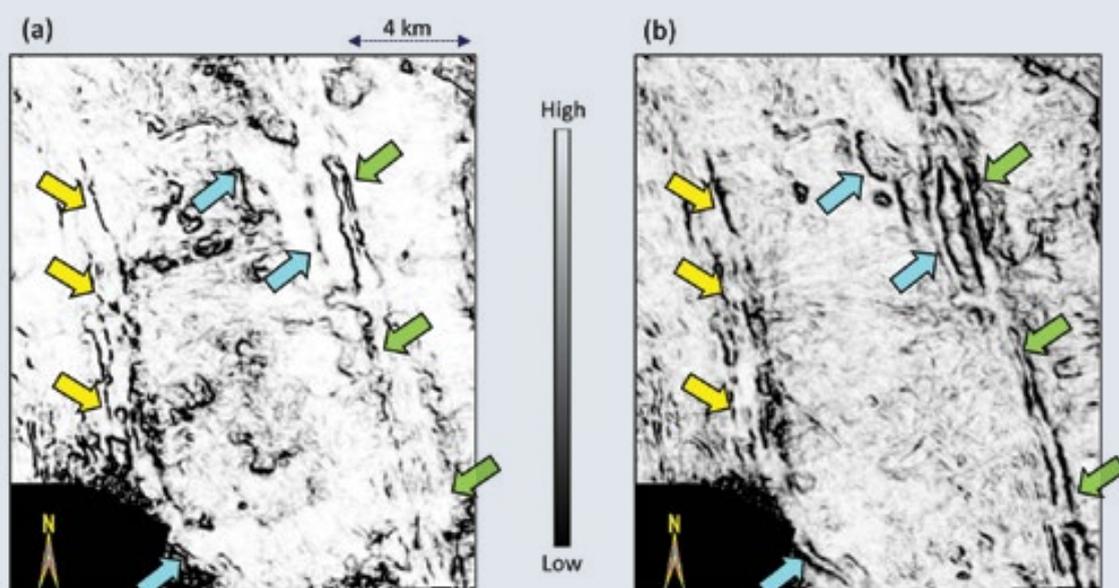


Figure 3: Stratal slices 36 milliseconds above a marker at roughly 1,700 milliseconds through the (a) broadband coherence and (b) multispectral coherence volumes. Notice, the overall better definition of faults indicated with yellow, cyan and green arrows. The seismic data are from the Montney-Dawson area in British Columbia, Canada. Data courtesy of TGS, Calgary.

(Editors Note: The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for TGS, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer.)



AAPG Member Kurt J. Marfurt serves as the Frank and Henrietta Schultz professor of geophysics within the ConocoPhillips School of Geology and Geophysics at the University of Oklahoma in Norman, Okla.

Injection from page 6

Aramco.

"Two (URTeC) sessions look at applying gas injection in a relatively novel way," he said.

"They are mostly lab papers – trying to discover underlying principles, but there are a couple of field tests. It's a quite interesting area to keep an eye on," Mallinson explained. "Gas injection has been used in the Permian for decades, but its application in unconventional areas involves many differences."

"The question is whether it will be economical," he added.

"With vast amount of data from thousands of wells, integration of multi-disciplines is the key to making good business decisions," said Han.

"For instance, as refracturing becomes popular and more prevalent, understanding stress changes with production and depletion is critical for operators to select successful candidates," he said.

Bridging Geologists and Engineers

"Geomechanics is linking geoscientists and petroleum engineers ... Drilling events, cuttings, or parameters such as mechanical specific energy (MSE) can indicate rock characteristics and fracture productivity," explained Han. "Stimulation efficiency is evaluated with microseismic events, fracture diagnostics and well testing. Down spacing of clusters, stages, or wells can benefit from geomechanical modeling to

minimize fracture interference and avoid fracturing hits. The technical insights from geomechanics on these topics and others are contributing to the decision-making and defining the discipline as an essential part of operations teams."

"At this stage, most engineers and scientists are either intimately involved, or familiar, with the field," he added.

Han said the URTeC sessions should be worthwhile for any professionals at the conference.

"From conversations among the people in different areas, decision-makers are all wanting these inputs. It's a good bridge," said Susan V. Gonzalez, a spokesperson for Aramco.

The influence and importance of geomechanics is being recognized in geoscience and engineering education as well.

Most major universities have strong geomechanics programs, noted Han.

Introducing even younger students to science is also important, said Gonzalez.

For that reason, Aramco sponsors G-Camp, a geology camp designed for fifth-through 12th-grade STEM teachers, who take their newly acquired ideas and insights back to the classroom.

Han is a member of this year's URTeC Technical Committee and chair for Theme 4: "Geomechanics in Unconventionals: From Mechanical Properties to Hydraulic Fracturing and Session Chair for Hydraulic Fracturing Simulation." He is a board member of the American Rock Mechanics Association and the organizer for this year's ARMA special session, "Principles, Simulation, and Practice." 

Technology from page 10

kicked off the resource-play boom, and Spies thinks continuing technological development in both areas has been the main contributor to the continued success of unconventional development.

"I would say (innovation in) drilling and completion technology is the biggest needle-mover, because without that none of this could have happened," Spies said. "And understanding the subsurface context makes it or breaks it."

In hydraulic fracturing, the innovation of "having isolation between each of your fracs was a huge step," he noted.

That helped the industry move away from what Spies called "pump-and-pray" stimulation to a much better understanding of fluids and proppants "and tighter cluster spacing, all of which resulted in higher fracture density and improved recovery factors," he said.

Constant Tinkering

Concho Resources works in a variety of unconventional resource settings in west Texas and southeastern New Mexico. The company is organized into asset groups and emphasizes innovation, Spies said.

"Primarily the way we come at it is to democratize the technology," he explained.

"First you have to find the right tool. Then you have to purchase and implement the tool – and that can be an expensive proposition. Then you have to provide access for a whole group of people," he said.

Spies hesitated when asked to identify new technologies on the horizon that will affect resource development.

"We've been pretty poor predictors of that, so we believe in constantly tinkering. We say, 'Technology begets more technology,'" he said.

Remarkably, a collapsing oil price and serious industry downturn did not

impair technology advancements for unconventional. Instead, companies tried harder to achieve production improvements and operational efficiencies.

In the downturn "a lot of innovation happened, and the mindset changed, too," Spies said.

"Another thing that was happening at the same time was that the scale of the development projects got larger. Now we're looking at 20 wells in the same one-mile or two-mile area," he added.

In the unconventional arena today, "on balance, the mode is switching to pretty intensive full-field development," Spies observed.

He compared the pace of technology development in unconventional to Moore's Law in computing. Moore's original observation applied to the growth of processing capacity; it is now often cited as a general comment on the continued doubling of technological capability.

"Unconventionals is a great place to see Moore's Law in action," he said.

Spies predicted that future advances in technology will have the most effect in "areas that have the largest scale – areas where you can invest a lot of money. I think they'll be most advantaged," he said.

As the oil and gas industry continues to identify and develop unconventional resources "the pure size of the prize is incredible. It's big enough to displace everything else in the U.S. and to compete with conventional resources globally," Spies observed.

That makes URTeC an especially important gathering for the industry, he noted.

"I think URTeC is a great environment to see multidisciplinary teams of people talking, in real time, about what's happening," he said.

Advancements in technology go on improving the outlook for resource plays. At times in recent years, the whirlwind of technological innovation for unconventional has neared cyclone strength.

"It's been the most exciting time in the industry, I feel," Spies said. 

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Historical Highlights

Darkening Skies: The Qatar Well Fires of the 1950s

The blazing well site of DK20, Dec. 1956. Photos are from the BP Archives.

In 1953, the Qatar Petroleum Company had been developing the Dukhan oilfield for 13 years. However, the area was still remote from the main centers of industrial production and so presented certain challenges to setting up and operating the drill sites. Most of the heavy equipment was shipped by dhow via Bahrain to Zekrit, where the company had built a jetty. There were no cranes to unload the cargoes, which had to be lifted by local workers onto lorries waiting on the quayside, then taken to the oilfield. A basic landing strip provided more immediate access, but this was only for company flights. Otherwise, Qatar remained a mystery to the outside world.

Fire in the Desert

In March 1953, well DK35 was coring the Arab-D reservoir when it showed signs of blowing out and was shut in by the blow-out preventers. Heavy mud was prepared to block the well, but the preventer rubbers began to leak. On the 28th, the well blew out and caught fire spontaneously.

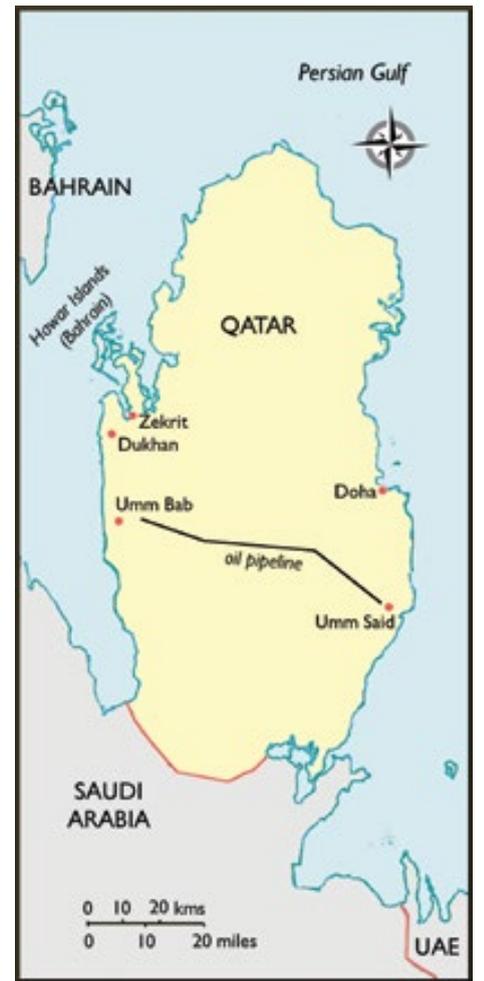
In a film about the disaster, "Fire at Dukhan," the narrator breezily announces: "She went up at midday on Saturday, all 3,200 pounds to the square inch of her, and it wasn't long before the derrick and the upper works collapsed in the heat into a pile of melted junk!"

Although water pumped from the sea helped to cool the ground, wreckage and firefighters, this was not enough to extinguish the flames and it was clear that a different approach was required.

Two years before, the Anglo-Iranian Oil Company – a shareholder in QPC – had used the services of American firefighter Myron M. Kinley to fight an oil well fire at Naft Safid in Iran. A call now went out for Kinley, who had just completed work on a well fire in Louisiana. Upon arriving in Dukhan, he carried out an immediate inspection of the site. The first stage was to clear the tangled mass of structural steel wreckage from around the burning well. The task was complicated by the fact that no one could get closer to the fire than 60 feet because of its intense heat. He ordered an Athey hook be built in the Dukhan workshop. This was a 60-foot boom assembled on a bulldozer with a large hook on its end, designed to clear away the junk. The bulldozer was clad with galvanized sheets to protect the driver



Left: Paul 'Red' Adair (centre) at the site of DK 20, Dec. 1956. Right: Map of Qatar in the 1950s.



from the blaze. Each day, it crawled back and forth, sometimes hooking mangled parts but more often catching nothing. On the tenth day, the wind changed direction, forcing Kinley to go "fishing" for wreckage from another direction.

The next stage was to put out the fire. Once the debris had been removed, a water-cooled tank containing 450 pounds of gelignite was pushed toward the fire and detonated with an electrical charge. The explosion blew out the well head fittings but extinguished the fire only briefly. A second explosive charge in a drum did the trick, snuffing out the flame like a candle. At this juncture, the sound of escaping gas resembled the thunder and scream of several jet engines; the ground reverberated with the vibration and the danger of the oil and gas catching light was always present.

The final stage was to cap the well. After

a nine-foot collar had been lowered onto the well, the flange and collar were removed, and the capping head lowered into place and bolted down against the immense pressure coming up from the hole. This was the most dangerous part of the operation, since the well could have reignited at any moment. However, 15 days after the fire had started, the well was capped and DK 35 was secured.

Afterward, there was an investigation into the causes. It was found that there had been a failure to keep the hole filled with mud while pulling out the drill pipe, and the blow-out preventer equipment had been incorrectly operated by closing a control gate on a collar instead of on the drill pipe itself.

Within two weeks, DK35 was connected to the field production system.

By the end of 1953, output from the

Dukhan field was 4.5 million tons a year.

The Athey hook was kept on – the wisdom of that decision would become apparent two years later when another well, DK20, caught light.

A Whodunnit – Persian Gulf-style

Despite Qatar's physical isolation and scant population, it was by no means immune from events elsewhere. In 1951, nationalization of the Iranian oil industry had caused QPC to increase oil production to make up for the shortfall from Anglo-Iranian and then, when Iranian oil exports returned in 1953, to cut it back again.

But, all this paled when the Suez Crisis broke out.

Continued on next page ►



Left: The Athey hook on a dummy run with a drum of explosives, Dec. 1956. Right: The Athey hook used in the two well fires at the site of DK 20, pictured in 2007. Photo by Peter Little.

◀ Continued from previous page

A slow fuse had been burning for some time. The ruler of Qatar, Sheikh Ali bin Abdullah Al Thani, had established an education system that relied on teachers from abroad, many of whom were Egyptians who were enthralled by the nationalism of newly-elected Egyptian President Gamal Abdel Nasser. On Aug. 16, 1956, 2,000 people demonstrated in Doha, carrying Egyptian flags and chanting anti-British slogans. As the Suez Crisis escalated in October, there was another demonstration. In early November, saboteurs blew up the two oil pipelines between Umm Bab and Umm Said, which blazed until work gangs were able to fix them. There was a general strike in Dukhan and Umm Said, and sporadic strikes in Doha.

A British warship arrived off the coast. This undercurrent of discontent erupted spectacularly on Dec. 20, 1956 when the DK20 well was set alight. Witnesses reported fire billowing through a one-inch hole in the well assembly. Petroleum Week reported that it was “A Whodunnit – Persian Gulf-style,” and the oilmen had no doubt that sabotage was the cause: “No worm ate that hole through the metal except the two-legged variety,” remarked one.

Soon, up to 7,000 barrels of oil a day were gushing out at a 45-degree angle. The well fire at DK35 was still fresh in the collective memory and now it seemed that history was repeating itself.

Myron Kinley was busy putting out sabotaged wells in Kuwait, so the company engaged his former deputy, Paul “Red” Adair, who had visited Qatar for the well fire of 1953 and was well acquainted with operations at Dukhan. Meanwhile, QPC managers took certain precautions as they awaited Adair’s arrival. The cellar – a pit in the ground beneath the wellhead for blowout preventers and other equipment – was filled with water in order to keep the rest of the wellhead cool and intact. They retrieved the Athey hook, the relic of the DK35 fire, from storage. With the hook attached to its boom, the bulldozer advanced on the fire and pulled away the remaining fence to allow clear access to the wellhead.

Adair arrived and worked on the fire for the next few days. He ordered the workmen to get more fire pumps working, all pumping seawater into a big tank. From there, more pumps sent the water at high pressure to six jets that cooled people and equipment working close to the fire. He then used



Michael Quentin Morton grew up in Qatar, Bahrain and Abu Dhabi in the 1950s and ‘60s. A barrister, he has written a number of books and articles on the history of oil exploration in the Middle East. His new book, “Empires and Anarchies: A History of Oil in the Middle East,” is available from Reaktion Books (UK), University of Chicago Press (USA) and all good book sellers.

explosives to blow up any obstacles at the top of the well so that oil, gas and flames could shoot vertically into the air.

On closer inspection, Adair decided to remove what remained of the well tree and make up a new cap in the Dukhan workshop. They prepared an explosive drum with 500 pounds of Geophex. After soaking the ground around the well with water for another 24 hours, they set off the charge just below the base of the flame. It blew out the fire, but the men kept the water hoses going for another 24 hours as a precaution. As with DK35, they had to be very careful of naked lights and sparks, since large quantities of oil and gas were still spurting out. Fortunately, on most afternoons there

was an onshore breeze that gently blew the oil column to one side, keeping the oil away from the well site.

Adair and his three assistants advanced cautiously on the wellhead and unbolted the wrecked top of the tree. Then, using a crane, they slowly swung the replacement cap through the shooting column of oil and gas to place it astride the flow. A tragicomic scene ensued: the men, soaked in oil, slipped and slithered in a desperate attempt to secure the cap with a single bolt to the flange. Finally, they turned the valve handle to shut off the well, and a great cheer went up. The well site – once filled with a hissing, grumbling cacophony of escaping oil and gas – fell into an eerie silence.

It was New Year’s Eve. Geologist Peter Walmsley recalls that a seasonal party was in full swing at the club when Red Adair and his team, covered in oil, arrived to announce that they had capped the well. A cry went up for free refreshments all around, and the celebrations flowed into the night.

Conclusion

These well fires are an important part of the oil history of Qatar, as a major part of a wider narrative of fire fighting in the Middle East. From the early days of development to the devastation left in the wake of Saddam Hussein’s retreating army, well fires were a rare but dangerous feature of life in the oil industry, matched only by the bravery and ingenuity of those who helped to put them out. Today, in Dukhan, the site of DK 20 and the Athey hook stand as solitary reminders of the torrid events of the 1950s.

Acknowledgements: The author would like to thank Peter Morton and Peter Walmsley for their kind assistance. 



What is the Role of Geoscience in the Age of Renewables?

AAPG Energy Transition Forum

You see the headlines in energy publications all across the globe: "Central Asia's green horizons," "Is the Middle East's solar market breakthrough finally happening?," "Going Green in South East Asia," "Portugal breaks 100 percent mark but remains isolated" ...

The world's transition from high-carbon to lower-carbon energy technologies, clearly, is afoot, as is the industry paradigm that will accompany it.

So, the challenge is – how will the industry embrace and steer this new reality?

It will, among other adjustments, have to address personnel issues of attracting new and better-trained workers, while making the most of the talent already employed. Industry leaders must articulate the often multifaceted goals of the new exploration as well as prepare for the frequency and severity of catastrophic climatic, political and economic events.

Charting that landscape of the future of the oil and gas industry is the purpose behind the AAPG "Energy Transition Forum – A New Era for Geoscience," in the Netherlands later this year.

The forum, the roster of which includes professionals from Shell, Statoil, The Hague Centre for Strategic Studies, University of Plymouth, Schlumberger, K-U-TEC IBM, International Geothermal Association and Google, will target not only current decision makers and existing professionals, but also – perhaps most importantly – the young professionals and students in this new era in geoscience.

The past, present and future of the industry will have to get along.



STEWART

“ What does (the transition) look like? What does that mean for the oil and gas industry? What does it mean for things like wind turbines and solar farms? What does it mean for nuclear? ”

Conversations We Need to Have

Max Brouwers, Shell's vice president of exploration for Europe, Russia and CIS, who is chairing the committee, believes

the answers to the future of energy will come from a conversation on sustainability, digitalization, talent and skills, and collaboration between a broad range of technology, geoscience, renewable and oil

and gas industry contributors. Specifically:

► **The Future of Energy:** This is the big issue, because almost everyone agrees that oil and gas, whatever its efficacy, profitability and sustainability, will be around for a while; thus, still in the mix. The question is: will it continue to be pursued and drilled as before or will the industry need to work differently? Clearly, it will require a change in attitude and approach, but how much and how difficult that will be is up for discussion. More collaboration between all parts of the geoscience family will be needed for new revenue streams.

► **Sustainability:** Balancing the need for "clean" energy with macroeconomic issues, as well as understanding and reacting to the politics of the day, is a discussion that will also have to be monitored closely. Geoscientists will have to find the sweet spot in the midst of energy, environmental and political concerns.

► **Digitalization:** The forum, according to organizers, will focus not just on machine learning, but also applying digitalization to improving the efficiency of data management, interpretation and other aspects of exploration. The hope is to share ambitions for applied digitalization, which improve ongoing businesses and open up vast realms of new knowledge. On this point, Darryl Willis, Google's vice president of oil, gas and energy, and also an organizer of the forum, was quoted recently as saying, "In our industry, we have an opportunity to use data to win. We only use about 5 percent of the data we have at our disposal – we can do better."

► **Skills:** New technologies and vistas

See **Relevance** page 29 ►

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Ranney on the rim of Grand Canyon.



Working with a Japanese film crew on the geology of Grand Canyon.

Coming to Terms with Time and Mystery

Geosciences in the Media Award

This might be the first story in the history of the EXPLORER where you'll see mention of Dr. Seuss, Thomas Paine and longtime Los Angeles Dodgers Manager Tommy Lasorda.

But Wayne Ranney, this year's AAPG Geosciences in Media Award winner, is motivated and moved by more than just those in and around the profession. There's a vast world beyond, literally and figuratively, and he knows some them are Dodgers fans. His proficiency in contributing to the public understanding of the profession, which he sees as filled with magic and metaphor, begins with knowing to whom he's speaking.

"I make people feel comfortable about time," said Ranney, who signed off one of his

"To me, that is the point of science – that we know very little about our world and even though we chip away at that inexplicableness, it is the stuff still residing on the other side that makes the journey compelling."

emails with a Paine quote ("The world is my country, all mankind are my brethren and to do good is my religion."), another with one from Theodor Seuss Geisel ("Be who you are and say what you feel, because those who mind don't matter and those who matter don't mind."), and one from Lasorda ("My responsibility is to get my twenty-five guys

playing for the name on the front of their uniform and not the one on the back.")

Before he makes them comfortable about time, however, he deconstructs why they're not.

Ranney, an award-winning author, lecturer and host of outdoor adventures and worldwide expeditions, said about the movement of time

through the ages, "I have found that for most people, time can be divided in only two parts: 'now and 'then.' The entire past to them is just one big thing."

It is the geoscientist, apparently, who makes time complicated.

"To a geologist however, there are millions of 'thens,'" said Ranney.

Ranney's strength, and why, in large measure, he received the award, is his work over the years recognizing the different worldviews of those who read his books, attend his lectures and hike up and down trails with him.

"I have had a lot of success in helping people overcome the daunting nature of deep time by just pointing out to them that there are literally unlimited 'thens' to know about and enjoy," he said.

The Place with the Most Magic

For Ranney, even though he's visited Antarctica 34 times, the grail, the wellspring of his work, can be found in the Grand Canyon. Three of his books are dedicated to it: "Carving Grand Canyon: Evidence, Theories, Mysteries," "Canyon Country," and "The Grand Canyon. Monument to an Ancient Earth. Can Noah's Flood Explain the Grand Canyon" (spoiler alert: No, it cannot.) – and he said it is where the questions of earth's mysteries, while perhaps not revealed, are most easily posed.

It is also place that holds the most magic.

"The Grand Canyon has to rank at the very top for me because it reveals the most earth history in a single sweep and it is where my passion first came to fruition," said Ranney.

His love affair with the place began pretty much how you'd expect it to, and he's never lost the connection.

"In the mid-1970s, I wandered into the Grand Canyon and never came out!" he said. "It was just so huge! It was 1973 and I was traveling on my first adventure away from home. I was like a kid in a candy store."

He remembers one day in particular.

"At the North Rim of the Grand Canyon, while enjoying a sunny vista, we watched as a huge thunderstorm moved through the canyon, seemingly below me in the canyon. The sky turned suddenly into a violent and



With geologists on the Colorado River, September, 2013. Left to right: Ron Blakey, Ed Spenser, Howard Capito, Wayne Ranney and John Warme.

See [Accessibility](#) page 25 ►

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Shell Makes Large Discovery in Deepwater GoM



Transocean's Deepwater Poseidon, a new-build ultra-deepwater drillship. Photo courtesy of Shell.

Chalk up another victory for Shell in the deepwater Gulf of Mexico.

This one is the Dover discovery announced late in May.

Sitting in about 7,500 feet of water 170 miles southeast of New Orleans in the Mississippi Canyon locale, Shell reported that the discovery well encountered more than 800 net feet of pay.

It was drilled by Transocean's Deepwater

Poseidon, a new-build ultra-deepwater drillship.

This is the company's sixth discovery in the Jurassic-age Norphlet geologic play in the Gulf. It joins such high-profile finds as Appomattox, approximately 13 miles away. The Appomattox host, which is now on location in the Gulf, is viewed as a potential tieback for Dover, among other discoveries.

Geological Factors

The Norphlet formation ranks as the first extensive post-salt deposit in the central Gulf Coast. Salt plays a key role in the Gulf region by providing a mobile underpinning for overlying sediments. As such, it is a major force for local structure and stratigraphy, with the salt-related structures frequently providing traps for hydrocarbons.

The geographically widespread Norphlet sandstone is a buried aeolian deposit, which is a windblown accumulation of sand particles for the most part and indicative of arid conditions. Despite high porosity and other advantages that render them to be alluring reservoirs, aeolian deposits can be confounding for explorers. Internally, they are prone to rapid change both horizontally and vertically.

Initially discovered far inland in Norphlet, Arkansas, this formation has an aerial extent of several hundred thousand square kilometers across Louisiana, Mississippi and Alabama and outward into the deepwater Gulf.

Hydrocarbon accumulation in the Norphlet is attributed to the overlying Jurassic Smackover Formation, which itself is a prized producing horizon in many Gulf Coast areas. The Smackover is considered to be both source and seal for the Norphlet, with the play characterized by a combination of high pressures and well temperatures, hosting good quality oil in high grade reservoirs.

Economic Considerations

The deepwater Gulf has long been an alluring but very high-dollar undertaking for operators. Yet costs are changing as demonstrated by Dover, which aptly showcases the new way forward embraced by many operators. It entails an increasingly common focus on new finds that will benefit from proximity to available hubs for faster and less expensive production.

Andy Brown, upstream director for Royal Dutch Shell, noted that Dover exemplifies the company's talent for discovering new,

Continued on next page ►



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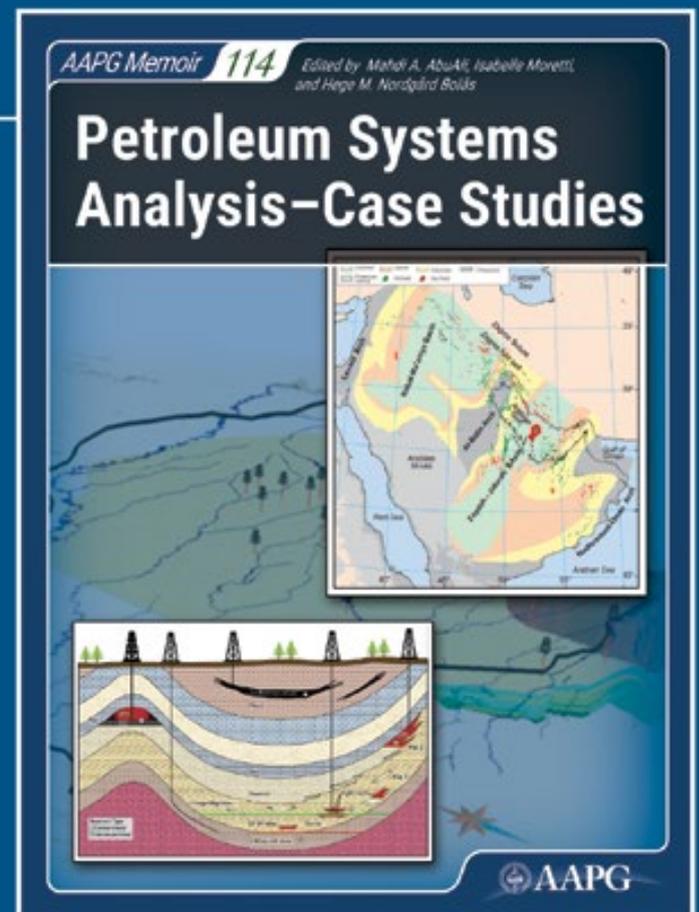
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Ranney with a geologic map on the Colorado River.

Accessibility from page 22

very powerful crash of thunder and lightning. As soon as it had come, it was gone and the canyon walls sparkled in sunlight, appearing as millions of brilliant gems. In southern California where I grew up, we did not have storms like that. I was hooked!"

Don't Dumb It Down

So, imagine being in one of his seminars when he's retelling that story, hearing him explain the inexplicable. It's infectious to hear and see someone thread that kind of needle. It's how geosciences in the media get done.

And, maybe, the less you know, scientifically speaking, the better the experience.

"I love speaking to novices about geology, so I would have to say it is the scientists who are the most difficult for me," Ranney said.

Call it the law of accessibility.

"In giving public lectures I've developed the habit of not overusing geology jargon, and some geologists who hear me may assume I am not all that literate in it. I think that some geologists assume that if you have to give a public lecture, all you have to do is 'dumb it down' so the audience will understand," he explained.

Ranney, who said, "Education is my passion, Landscape is my home, and Earth is my playground," thinks nothing could be further from the truth.

"In fact, if you dumb it down, the audience will know that you're talking down to them and you may lose a bit of respect or credibility with them. Actually, what you have to do is work harder to understand what the audience can hear in assuring that they can walk away from

it having learned something tantalizing and useful," he added.

The Journey

The Geosciences in Media Award validates not only what Ranney does, but what he believes the industry must continue doing.

"It shows that we as a discipline are beginning to recognize the importance of sharing our passion for Earth history with a wider audience," he said.

In thanking his professors at Northern Arizona University, where he received both his bachelor's and master's degrees, as well as his many clients on the hikes, river trips and excursions for the award, he, admittedly, is surprised by it.

"I had no idea that anyone, let alone those at the AAPG, were paying attention to what I was doing with my career. It is so gratifying to know that someone out there recognizes what I do is beneficial to our science and worthy of respect," he said.

He knows the message, whether it's for a geoscientist or a weekend hiker, can be both simple and complex. He was quoted once as saying, "Life is good, if we'd take the time to understand that," but he knows there's no end-point in that discussion.

"I hardly ever give a lecture where I don't say at some point, 'We don't know.' And to me, that is the point of science - that we know very little about our world and even though we chip away at that inexplicableness, it is the stuff still residing on the other side that makes the journey compelling.

"No other animal that we know of thinks of the past or the future. To them, there is only now. We should honor and embrace our ability to see and experience time."

"Science," he reminds us, "is a journey, not a destination."

Continued from previous page

commercial resources in a heartland.

"By focusing on near-field exploration opportunities in the Norphlet, we are adding to our resource base in a prolific basin that will be anchored by the Appomattox development," he said.

It's an eye-opener, considering that as recently as the late 1990s, Shell geologists were working diligently simply to ascertain whether the noted onshore Norphlet play might possibly extend into the deepwater Gulf.

Fast-forward to today, and it has reason to tout its industry leadership in exploring this prized geologic accumulation offshore, after acquiring its first leasehold in the region in 2001.

There are neighbors.

In January, Chevron announced a Norphlet discovery at its Ballymore prospect in the Mississippi Canyon area in 6,536 feet of water.

The initial Ballymore well tallied 29,194 feet total measured depth and tapped into more than 670 feet net oil pay having excellent reservoir and fluid characteristics, according to Chevron. The company is operator here, holding a 60-percent working interest, with co-owner Total owning the remaining 40 percent.

A sidetrack is underway to further evaluate the discovery well and to formulate development options for the Ballymore find, which is located about three miles from Chevron's Blind Faith platform.

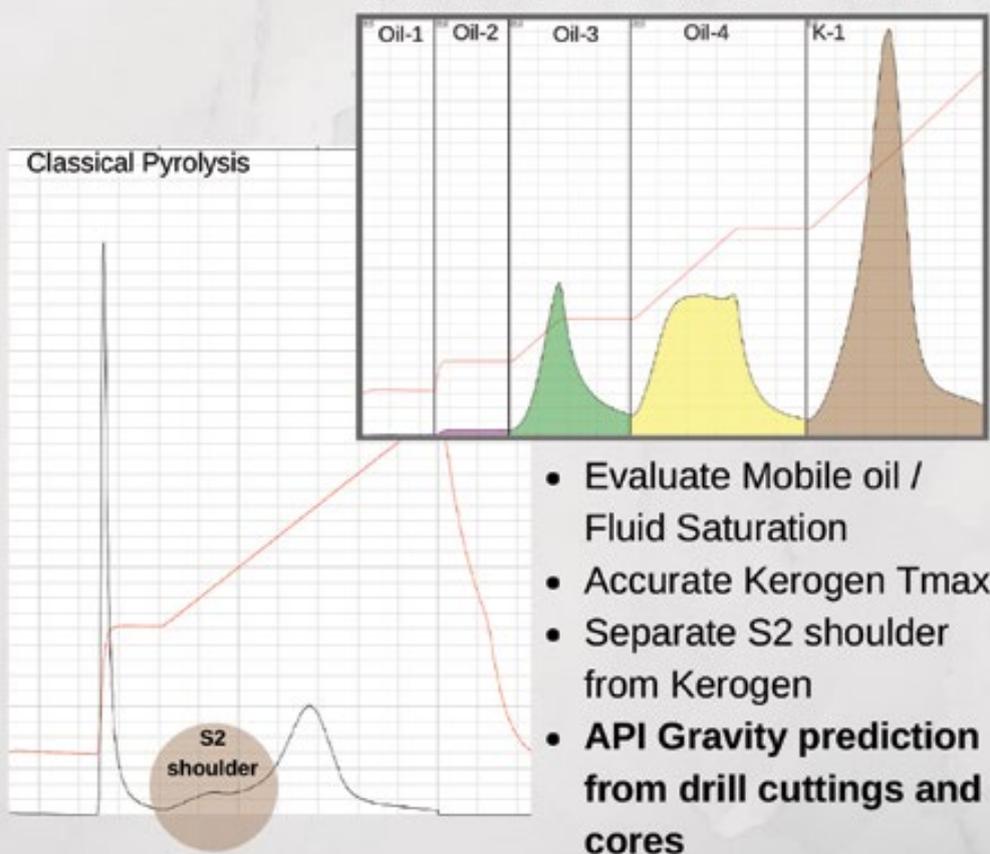
Comments from, Jeff Shellebarger, Chevron's president of North America exploration and production, are in sync with the industry's current fiscally conservative approach to deepwater.

"This discovery is an important addition to our portfolio, especially with its combination of size, quality and proximity to existing infrastructure," he said.

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Foundation Update

Military Veterans Scholarship Recipients Announced

The AAPG Foundation's Deana and Paul Strunk Military Veterans Scholarship Program recipients have been announced for 2018.

Eligible applicants include United States military service members and veterans who have been honorably discharged and who are pursuing undergraduate degrees in a geoscience program at an accredited college or university. The MVSP is designed to assist United States military service members and veterans as they transition into civilian careers in the geosciences from military service.

Eligible recipients can receive scholarship awards between \$2,000-4,000 to fund educational expenses and costs of attendance, such as tuition, fees and supplies. The MVSP has assisted service members and veterans from all branches of the military, including the National Guard and Reserve.

This year the MVSP distributed a total of \$20,000 to seven recipients:

- ▶ Cpl. Nicholas Ferry, United States Marine Corps, attending Northern Illinois University
- ▶ Chief Petty Officer Bonnie Flynn, United States Navy, attending San Diego State University
- ▶ Cpl. Cameron Gernant, United States Marine Corps, attending Louisiana State University
- ▶ Sgt. Clayton Hefner, United States Marine Corps, attending West Virginia University



“This fall I am ready to begin my final semester majoring in geology with hopes of eventually becoming a petroleum geologist, thanks to the generosity and support of the AAPG Foundation Military Veterans Scholarship Program.”

- ▶ Sgt. Carlton Mueller, United States Marine Corps, attending University of Colorado-Boulder
- ▶ Senior Airman Jahleel Stone, United States Air Force, attending University of South Carolina
- ▶ Sgt. Jose Zamora, United States Army, attending Missouri State University

The Yellow Ribbon Series

This year the “Yellow Ribbon” series of articles was introduced to give past MVSP recipients the opportunity to thank the Foundation and give readers a glimpse into the extent to which the scholarships have aided them in their pursuit of their new careers in the geosciences. The articles appeared on the Foundation

Update blog and serve as a reminder of the impact donations make to the students who receive them.

“After 29 years of combined active duty, reserve and Air National Guard service, I see the need to prepare for the inevitable military retirement,” said Roberta Thompson, a 2017 MVSP recipient. “I initially set my sights on a petroleum engineering major. However, after working on a project in the Williston Basin during a summer internship, my fascination with Earth’s varied strata was rekindled. This fall I am ready to begin my final semester majoring in geology with hopes of eventually becoming a petroleum geologist, thanks to the generosity and support of the AAPG Foundation Military Veterans Scholarship Program.”

“I would like to thank all those involved for the creation of programs such as this, and for the donors who support them,” said Matthew Brice, also a 2017 recipient. “Though many of us take advantage of our military educational benefits, those alone are not enough to accomplish what we wish. Without scholarship opportunities made available to veterans, reaching our post-military goals would be increasingly more difficult.”

The application process for next year’s MVSP opens on Feb. 15 and closes on May 1. Requirements and other application information can be found at: foundation.aapg.org/programs/military.cfm or by calling an AAPG Foundation programs coordinator at (918) 560-9426, or toll free at 1 (855) 302-2743. 



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 Arthur Craig Mullenax
 Stanley L. Obernyer
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In memory of James "Jim" A. Hartman
 Peggy Joyce Rice
In memory John J. Amoruso, William F. Bishop, and Matthew W. Daura
 Shojiro Seto
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In memory of David Hammes Whiting for his service in the War of 1812

Robert K. Goldhammer Memorial Grant

Karen Lyn Canter
 Mark Joseph Gallagher
 Arthur Craig Mullenax

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



MARK YOUR CALENDAR!

Important Award Deadlines 2018-19

GRANTS-IN-AID PROGRAM

OPENS: Aug. 31, 2018 | DEADLINE: Dec. 3, 2018

The Grants-in-Aid program provides financial aid to graduate students whose thesis research has applications in the search for and development of petroleum mineral resources, and/or related environmental geology issues. Grants range from \$500 to \$3,000.

TEACHER OF THE YEAR AWARD

OPENS: Aug. 31, 2018 | DEADLINE: Feb. 1, 2019

The AAPG Foundation awards \$6,000 to a K-12 teacher in the United States for Excellence in Teaching the geosciences. Nominate a teacher who has a tremendous impact on students' love of and understanding of the geosciences.

L. AUSTIN WEEKS UNDERGRADUATE GRANT PROGRAM

OPENS: Jan. 1, 2019 | DEADLINE: March 25, 2019

The L. Austin Weeks Undergraduate Grant program provides \$500 grants to undergraduate geoscience students and student-led associations (student chapters and clubs) worldwide to help with tuition, books, equipment, field trips and conferences.

INSPIRATIONAL GEOSCIENCE EDUCATOR AWARD

OPENS: Jan. 1, 2019 | DEADLINE: April 1, 2019

The AAPG Foundation awards \$6,000 to a college or university professor for Excellence in Teaching natural resources or the geosciences. Nominate a professor who impacted your career in the geosciences.

DEANA AND PAUL STRUNK MILITARY VETERANS SCHOLARSHIP PROGRAM

OPENS: Feb. 15, 2019 | DEADLINE: May 1, 2019

The Military Veterans Scholarship Program (MVSP) provides grants to veterans pursuing geoscience degrees at a four-year college or university in an effort to aid in their transition from military service to civilian career opportunities. Grants range from \$2,000 to \$4,000.

Learn more. Visit foundation.aapg.org



2018 L. Austin Weeks Undergraduate Grant recipients from University of Montana.

Structural Geologist

The Department of Geology at Stephen F. Austin State University invites applications for a tenure-track position at the assistant (or associate) professor level. Applicants must have a doctoral degree in geology or a related field with emphasis on structural geology and field camp, a strong commitment to excellence in teaching and a willingness to direct Master of Science geology students in research. Preference will be given to candidates with structural geology and field camp teaching and/or research experience. Teaching responsibilities for structural geology will include introductory courses, upper-level and graduate courses in the applicant's specialty, and occasional weekend field-trip courses. Teaching responsibilities for field camp will include teaching or co-teaching field methods in the spring semester and co-teaching summer field camp. Other expectations include research, university service and continuing professional development.

To apply and submit required documents, please visit: <http://careers.sfasu.edu/postings/2803>.

Review of applications will begin on September 3, 2018, and will continue until the position is filled. SFA is an equal opportunity employer. This is a security-sensitive position and will be subject to a criminal history check.

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By BRIAN ERVIN, EXPLORER Managing Editor

In Memory



Paul M. Strunk, Weeks Memorial Medalist, Passes Away

Paul M. Strunk, the 2017 recipient of the AAPG Foundation's highest honor, the L. Austin Weeks Memorial Medal, passed away on June 17 at the age of 84.

He is being remembered by family, colleagues and fellow AAPG and AAPG Foundation members for a long and illustrious career as a successful explorationist and an ardent supporter of the Association, the Foundation and geoscience education.

"It was with great sorrow that I learned of Paul's passing. We join his family and friends in remembering a remarkable man and a remarkable leader," said AAPG Executive Director David Curtiss.

"I had the great fortune of working with him when he served as a Trustee of the AAPG Foundation. Paul was always positive, and even when making a serious point, was quick with a smile," he added.

A Lifetime of Generosity

Paul and his wife Deana have been donors to the AAPG Foundation since 1994, when he joined the Trustee Associates, a distinguished group of donors who provide support for the Foundation's fundraising efforts, as well as providing counsel and leadership to the Trustees.

Curtiss noted that, when the Foundation Trustees launched the Military Veterans Scholarship Program four years ago, "It grabbed Paul's interest and attention, and he and his wife, Deana, provided the seed funds to launch this new endowment."

In recognition of their generosity and dedication to the program, the Trustees last year renamed it the Deana and Paul Strunk Military Veterans Scholarship Program.

Strunk was selected as a member of the Foundation's Members of the Corporation in 2000 and appointed as a Trustee to the AAPG Foundation in 2011. During his time as a Trustee, Strunk also served on the Foundation's Audit Committee.

Strunk stepped down from the Board of Trustees in 2016 and became a Trustee Emeritus.

Strunk the Explorationist

Strunk was CEO of American Shoreline in Corpus Christi, Texas.

He received his bachelor's degree from Kansas State University in 1956, and began his career as a geophysicist with Pan American Petroleum Corp. One year later he returned to KSU for his master's degree.

He was then transferred to Corpus Christi, where he worked as a geologist for Pan American. In 1960 he joined Skelly Oil Company as an exploration geologist, and in 1964 he became an independent geologist. He and an associate, J.B. Clark, formed Fontana Oil and Gas in 1974. Fontana merged with Centura Inc. in 1976, and Strunk continued as president.

In 1978, he left Centura to start American Shoreline Inc., a successful oil and gas exploration company, which now includes Amshore US Wind, a pioneering independent Texas wind energy development firm.

During his career in oil and gas exploration, Strunk was involved in the discovery and development of more 36 oil and gas fields, most of which were in the Gulf Coast area of south Texas.

Service to AAPG

He has been an active Member of AAPG since 1960, serving on numerous committees and engaging in several leadership roles, including:

- ▶ Served as a two-term delegate in the House of Delegates
- ▶ Served on the Advisory Council
- ▶ Served on the Insurance Committee, Twenty-First Century Committee, Committee on Committees, Environmental Geology Committee, Headquarters Management Committee and Committee on Investments (chair in 1993-97)
- ▶ Held the office of AAPG treasurer (1988-90) and was a candidate for president (1994-95)
- ▶ Was a founding member of the Division of Environmental Geosciences and a member of the Division of Professional Affairs
- ▶ Received the AAPG Certificate of Merit in 1991 and the Distinguished Service Award in 1993

Strunk also has held numerous

[Continued on next page ▶](#)

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Geosciences Technology Workshops 2018-2019

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26-27 September 2018 • Bangkok, Thailand

Gas Hydrates - From Potential Geohazard to Carbon-Efficient Fuel?

16-17 April 2019 • Auckland, New Zealand

Advancements and Challenges in Coal Seam Gas in the Asia-Pacific Region

19-21 November 2019 • Brisbane, Australia

Conferences

AAPG/EAGE/MGS

4th Oil & Gas Conference

13-15 November 2018 • Yangon, Myanmar

Find all these events and more at:

www.aapg.org/global/asiapacific/events

Paul Basinski, 64
Houston, Texas, April 5, 2018

William Brown, 83
Waco, Texas, Jan. 17, 2018

George Louise DeCoster, 96
Key West, Fla., March 5, 2018

Carl Allen Dimon, 81
Grand Prairie, Texas, April 29, 2018

Roy Robert Henry Dott, Jr., 88
Madison, Wisc., Feb. 27, 2018

Henry Dubitzky, 90
Highlands Ranch, Colo., April 24, 2018

Wallace F. Fawcett, 96
Dallas, Texas, Jan. 10, 2018

Curtis Lundy, 86
Troy, Mich., April 18, 2018

Roberto Jorge Merino, 73
Buenos Aires, Argentina, March 23, 2018

Marion Alan Rogers, 81
The Woodlands, Texas, May 9, 2018

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

Classified Ads

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Fellowship and other geology funds. He served on the KSU Advisory Council for the Department of Geology and was a member of the Presidents Club.

"He built a legacy in his professional life, and he built a legacy in his volunteer service, both for AAPG and the AAPG Foundation," said Curtiss.

Strunk chose not to have a funeral. In lieu of flowers, Deana and the rest of his family ask that donations be made in his memory to the Deana and Paul Strunk Military Veterans Scholarship Program. [E](#)

(Editor's note: Special thanks to Tamra Campbell for her contribution to this article.)

organizations and as it develops, we will keep you informed. We hope to have this finalized this year.

Expanding DPA Certification

This year the DPA Executive Committee will explore the potential of expanding our certification to other disciplines in the geosciences. As you know the DPA currently certifies: petroleum geologists, geophysicists and coal geologists. We should consider expanding certification to environmental geology, geochemistry and petrophysics. These are key disciplines in geology and important to the future of our Association. Additionally, I would like us to investigate a geosteering certificate. While geosteering is not a subdiscipline of geology, it is a tool many of use every day (and night). Horizontal wells are the future and many geosteering professionals come from other disciplines. We, AAPG, must take the lead and educate these professionals.

Playmakers 2019 – Oklahoma City

The DPA is planning a Playmakers for Oklahoma City in the Spring or Summer of 2019. The theme will be the business of geology. Rick Fritz will chair the event.

Again, I want to congratulate Jim Hill for a great presidency. I want to thank him for his advice and guidance this last year. Additionally, I want to thank Diane Keim, AAPG executive staff, for her ideas, support and recommendations. Diane is a key player in the success of the DPA. I look forward to working with the new Executive Committee and hope they know that I am always available for questions.

Last, to the membership, please consider getting involved in the AAPG and the DPA. It will be the best investment you ever make. [E](#)

International Certification

Our DPA certification is open to all AAPG members but we are now looking at a new level of certification that crosses section, regions and association boundaries. For the past two years, AAPG past President and DPA past President Paul Britt has been investigating an international certification process to help fill a need in the AAPG Europe Region. This certification will be in conjunction with other professional

Continued from previous page

committee positions and offices for the Corpus Christi Geological Society and the Gulf Coast Association of Geological Societies, American Institute of Professional Geologists and Society of Independent Professional Earth Sciences, and received the Don R. Boyd Medal for Excellence in Gulf Coast Geology in 2007.

Also, along with his generous support for the AAPG Foundation and its programs, Strunk also actively supported the geology program of his alma mater, KSU. Specifically, the Strunks contributed to the geoscience building program, the Strunk Geology

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provisional membership and inclusion of young professionals in all our events:

► The Gulf Coast Section Meeting will be in Shreveport, La. on Tuesday, Oct. 2. We will sponsor a luncheon and the speaker will be Jeff Jones of Quantum Energy Partners, presenting "Looking Forward into the 21st Century." Jeff is a geologist and technical director of Quantum. Tom Wyche is the DPA technical chair.

► The Eastern Section Meeting will be in Pittsburgh, Pa. The DPA will sponsor two ethics-based luncheons for geologists and engineers by AAPG Distinguished Lecturer David Abbott. On Monday, Oct. 8, he will present "Honesty: Avoiding the Misuse of Models," and on Oct. 10, "Geoscience Ethics: Public Protection Versus Confidentiality." This section meeting is held in conjunction with the Society of Petroleum Engineers. Jonathan Brady is the DPA technical chair.

► The Southwest Section meeting to be held in Irving, Texas, is in the planning stage.

► Plans are also taking shape for ACE in San Antonio, and the DPA technical chair will be Mark Norville.



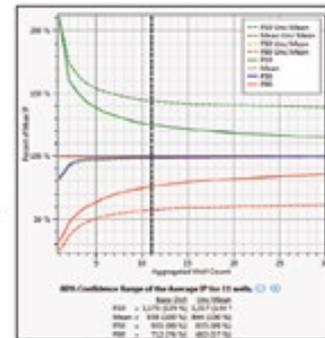
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Relevance from page 20

require new skills, so one of the topics the forum will explore is what skills geoscientists will need in the coming years – skills that may include a hybrid of competencies and polymorphic skillsets. It is also very likely that the geoscientists of tomorrow will need to be well-versed in the commercial side of the business and be willing to work beyond upstream and into the extended value chain, being mobile across a broader industry – from digital tech, to seismic operations, to oil and gas, to renewables and back. This will no doubt change the culture and hierarchy of organizations.

The Role of Geoscience?

The industry, as it considers these lower-carbon technologies and new

commercial models to meet a century's needs (meaning, more efficient means and reduced consumption), will be faced with nothing less than the relevance of geoscience itself.

Iain Stewart, a professor at the University of Plymouth, host of the BBC's "The Power of the Planet," and another member of the forum's organizing committee, has been thinking about the new industry makeup for years. He said last year from Scotland about the transition to a low-carbon future, "What does that look like? What does that mean for the oil and gas industry? What does it mean for things like wind turbines and solar farms? What does it mean for nuclear?"

The Forum is encouraging all those in the industry to join this debate, including young professionals, Generation X, industry decision makers and educators.

The new era in geoscience, as this forum will remind us, has already begun. [E](#)

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Director's Corner

Oil Markets in the Balance: The Role of Unconventional Resources

All eyes were glued on Vienna last month as the Organization of Petroleum Exporting Countries gathered to assess oil market conditions and set production targets for its member countries to ensure adequate supplies, but also to support oil prices.

On June 22, amid reports of significant differences between Saudi Arabia and Iran, OPEC arrived at a production agreement, but did not disclose the target levels. The following day, non-OPEC members, such as Russia, which have been coordinating production with OPEC to avoid oversupply, signed onto the pact.

Saudi energy minister Khalid al-Falih offered that OPEC and its non-OPEC partners would provide "measurable support," indicating that together the group would boost production by roughly 1 million barrels per day, or about 1 percent of total global supply.

But the statement of the group of OPEC and non-OPEC clarified that, after months of producing below their previously agreed quotas, this increased production was simply going to bring them back into compliance with those levels.

Crude oil prices had moved lower ahead of the meeting in Vienna, but popped higher after the announcement, as futures traders remain bullish on crude oil prices.

Earlier in the week, Richard Kaplan, president and CEO of the Federal Reserve bank of Dallas – one of twelve regional Federal Reserve banks that make up the Federal Reserve System, the U.S. central banking authority – issued an essay entitled, "A Perspective on Oil."

Economists of the Dallas Fed have been closely studying oil and energy markets as crude oil production becomes an increasingly important part of the U.S. economy. And, as they work to model and



CURTISS

Stability in the oil markets hinges . . . on the ability of U.S. shale producers to maintain and grow production. There are challenges to accomplishing this, but understanding the science, technology and commercial pressures on unconventional resources is what we'll be focused on this month with the return of URTeC.

forecast market cycles, understanding the impact of crude oil prices on both producers and consumers is an essential component of that analysis.

Kaplan and his economists "believe that global oil supply and demand are now in relative balance."

They also believe that even with the mooted production increases by OPEC and non-OPEC producers, total demand growth will accommodate this increased production.

Hurdles Ahead

But, looking into the future, Kaplan notes several issues and challenges facing the global oil market:

- ▶ Little investment is flowing into long-lived projects, such as the deepwater, the Arctic and Canadian oil sands. This is a trend that has been discussed repeatedly by energy ministers and CEOs, who fear that failure to invest now for future production will result in supply shortfalls in coming decades with potentially dramatic and economically disruptive price increases.

- ▶ Global demand for crude oil continues to grow. Kaplan says global oil demand is likely to increase from an average of 98.4 million barrels per day in Q1 2018 to 101.5 million barrels per day in 2020, much of this

growth coming from emerging economies.

- ▶ Notwithstanding the dramatic production growth from U.S. shale oil reserves – currently representing roughly 6 percent of global crude oil production – it too faces some challenges. These include rapid production declines, labor shortages, raw material availability, environmental concerns, infrastructure constraints – particularly pipeline constraints coming out of the Permian basin – and equity owners enforcing capital discipline on E&P companies.

- ▶ The markets are largely in balance and that makes them susceptible to geopolitical issues and supply disruptions – witness what has occurred in Venezuela and Libya in the past decade. Tensions in oil producing regions may produce similar events.

The Vital Role of Unconventionals

Over the next few years, the Dallas Fed economists see global oil markets balancing in a "fragile equilibrium," with demand growth being met by U.S. unconventional resources and assuming no serious disruptions to existing global production.

A final point they make is that the U.S. economy has experienced a multi-decade decline in oil intensity, which is the amount of oil required to generate \$1,000 of GDP.

In 1970, they note, the United States used 1.1 barrels of oil to generate every \$1,000 of GDP. In 2017, that number had dropped to 0.4 barrels of oil. As a result, they believe that modest price increases will not significantly dampen U.S. economic growth.

Stability in the oil markets hinges, according to Kaplan's analysis, on the ability of U.S. shale producers to maintain and grow production.

There are challenges to accomplishing this, but understanding the science, technology and commercial pressures on unconventional resources is what we'll be focused on this month with the return of URTeC, the Unconventional Resources Technology Conference, a collaboration of the Society of Petroleum Engineers, the Society of Exploration Geophysicists, and the AAPG together with nine endorsing organizations.

Heading to Houston for the first time in its history, URTeC will be at the George R. Brown center from July 23-25, and we're looking forward to an event that will advance the science and empower you to succeed in unconventional resources.

But it's not just unconventional resources. As the line between unconventional and conventional resources continues to blur, with science understanding and technology from resource plays now being used in more traditional plays, URTeC can help you succeed even if you aren't focused on producing from shales.

What happens when unconventional becomes conventional? Come to URTeC and find out.

By MARK GALLAGHER, DPA President

Divisions Report: DPA

Do You Have Skin in the Game?

For the past three years, I have worked with a startup oil and gas firm here in Dallas, Texas. Every time I meet with financial professionals I hear the same questions: "Do you have skin in the game or are you invested?" They are trying to determine my confidence level in my ideas and in my other team members. We as geologists love our profession and we take pride in our work, but we are also responsible for our professional career development and the future of the AAPG. The two are linked. Involvement in the AAPG and the Division of Professional Affairs shows our level of investment. So, I ask you: "Do you have skin in the game?" Involvement in the AAPG and DPA helps grow our careers through networking and educational opportunities. DPA Certification, shows we are committed both ethically and professionally to our science and careers as geologist. If you are interested, in taking the next step to certification, please go to our page on the AAPG website (AAPG.org/Divisions/DPA) or contact me through the AAPG. Remember, the DPA motto is, "From prospects to discoveries, professionalism leads the way."



GALLAGHER

While geosteering is not a subdiscipline of geology, it is a tool many of use every day . . . We, AAPG, must take the lead and educate these professionals.

Provisional Membership and ACE

I want to congratulate immediate past DPA President Jim Hill, the DPA Executive Committee, committee chairs and councilors for a year of great accomplishments.

Last year, emphasis was placed on implementation of our new DPA member status for young professionals: provisional membership. This new level of membership is for AAPG members who currently meet the requirements for DPA membership but do not have the years of experience required for certification. Provisional members, although non-voting and uncertified, will have all the benefits of full

DPA membership. This includes discounts to DPA events and access to the website content. Joining the DPA as a provisional member is an important step for young professionals to build their career network with the future goal of DPA certification when they reach the required years of professional experience.

Also, last year there was a series of luncheons and events at section meetings and at the Annual Convention and Exhibition. David Wavrek, DPA ACE technical chair, and the Salt Lake City team did a great job organizing our ACE DPA events:

- ▶ Turbinator II, the world's fastest wheel driven car and salt flat racer was the centerpiece of the AAPG ACE booth.

This was a great draw. It also educated us on the disappearance of the salt flats (savethesalt.org).

- ▶ On Tuesday, DPA Luncheon speaker Tim Rynott of Durango spoke on "Global Natural Gas Markets and the implications for the Southern Rockies."

- ▶ Laura Birgenheier and Lee Billingsley moderated the special forum, "Future Energy Geoscientist: What types of opportunities and career paths are available to current and future energy geoscientists?"

- ▶ DPA co-sponsored a special Wednesday luncheon: Dr. Carlee Beth Hawkins spoke on "Unconscious Bias in the Workplace."

These events took a great deal of time, planning and execution. We greatly appreciate the efforts of all those involved.

What's Next?

As we look forward to the next year, planning is already started on section meeting events and ACE. Additionally, we will continue to place emphasis on

See DPA, page 29 ▶



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