AAPG EXPLORER

June 2018

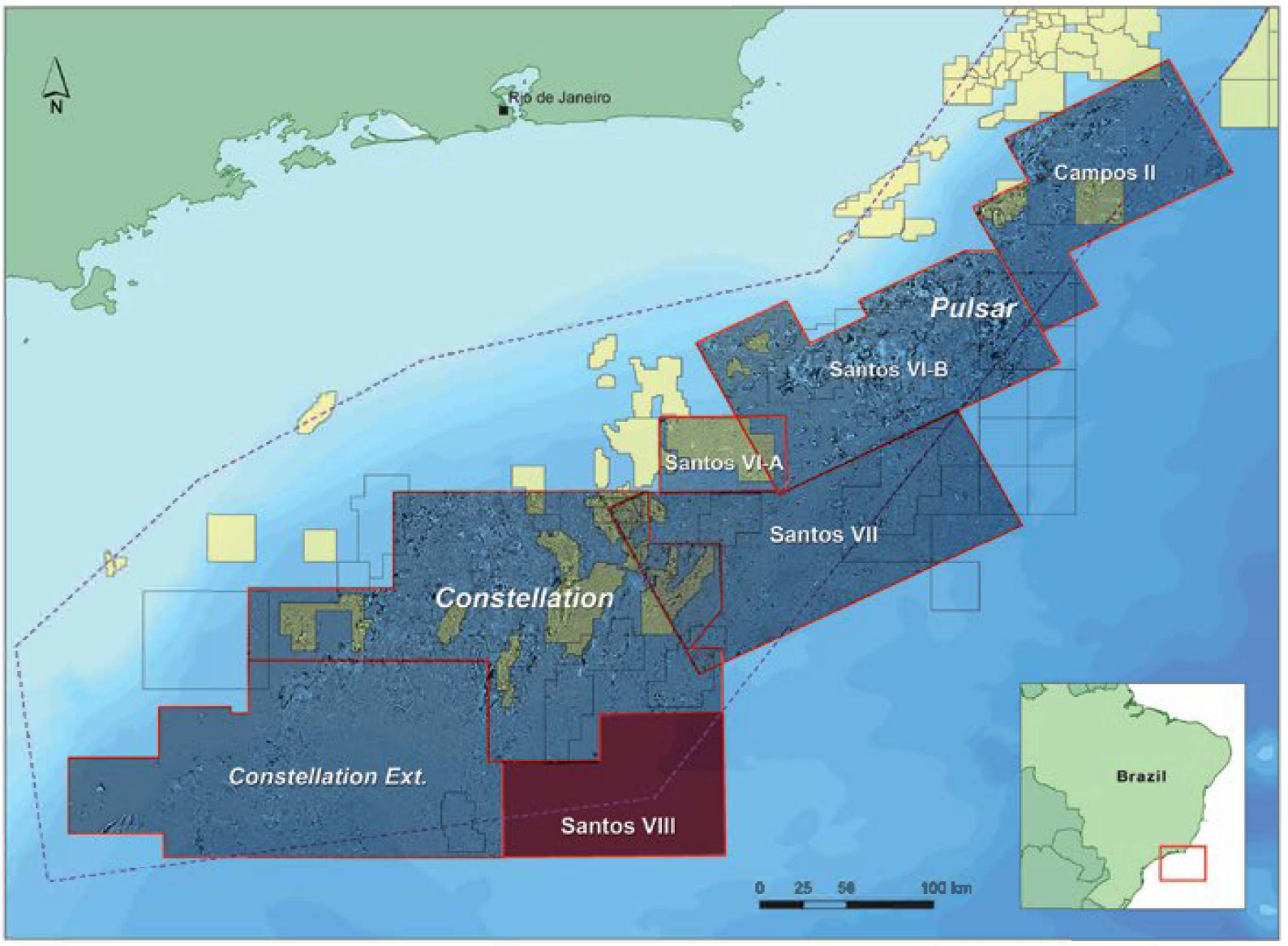
Hidden Gem

Guyana's exploration potential could be a 'winning lottery ticket.'

See page 12

PRIME PROSPECT

Santos VIII 3D BroadSeis Survey
For a Competitive Edge in Brazil



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

Acquisition of the new **BroadSeis**™ Santos VIII survey, covering approximately 8,060 sq km, is now complete. In anticipation of Round 16, a fast-track data set will be available in October, and the final volumes in August 2019.

Future plans include Campos III and Nebula, our most ambitious project to date. Contact us to find out more.

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Passion for Geoscience

Everything is Possible

During my presidential address at the AAPG Annual convention in Salt Lake City, Utah about two weeks ago, I asked about 1,000 attendees to recall an AAPG moment that positively impacted their life.

Perhaps you were there? I asked everyone to recall a memorable AAPG mentor, conversation, paper, book, field trip, short course, poster or presentation. AAPG creates magic moments, many of which occurred at our recent ACE, recapped in this and future issues of the EXPLORER.

I heard from courageous explorers like Paul Basinski. Paul was a pioneer for Conoco in the Eagle Ford Shale. A decade ago, doubters were all around. Paul told me that John Masters' memoir on Elmsworth field gave him the courage he needed at a critical time. Past AAPG President Eddie David told me that he wrestled with fluid levels in one of his fields. The light bulb went on when he read a paper by Bob Berg on hydrodynamic traps.

Do you have an AAPG magical moment? I would like to hear from you (carbodude@gmail.com).

A magic moment for me happened last year at the Division of Professional Affairs Heritage Luncheon at ACE in Houston. An actor portraying Wallace Pratt read from Pratt's writing and told a large packed room that "Everything is possible, anything is possible." In that time and place we believed. We showcased 101 incredible men and women featured in the Heritage Publication. That moment was special.

The single greatest AAPG event that changed my life happened in April 1997 in Dallas at a convention much like the one that just occurred in Salt Lake City. I sat in the front row and took ten pages of notes. The Legendary Tale, a program organized by Jim Gibbs, featured exploration greats telling how they found oil in far off places, made business contracts previously thought impossible, or went back to old fields and made breathtaking discoveries in bypassed zones.

Young Professionals, listen up! The Legends panelists that day recounted discoveries they made when they were young professionals! I was a young professional then and I wanted to be like them. I created events like the HGS Legends dinners, ACE and ICE Discovery Thinking Forums, Playmakers forums, and now the super basins conference so we could celebrate successful pioneers to better realize our own potential.

Michel T. Halbouty, looking over my shoulder (smiling, I hope).

On the AAPG website, you can listen to my presidential address and stories about George Mitchell, Robbie Gries and others who remind us every day that everything is possible (aapg.to/ace2018prezvid).

Young leaders who believe everything is possible are stepping forward for AAPG. They were abundant at ACE in Salt Lake City (see my May column). They are standing forward to lead in AAPG sections, regions, divisions, committees and our Executive Committee.

To our young leaders, I say thank you! Be a part of our energy solution, be a lifelong learner, engage AAPG with your passion. Say yes to AAPG!

Super Basins: A New Way of Thinking

The paradigm of "super basins" is just beginning to take hold. This year, my first column in the EXPLORER talked about the possibility of a new content theme based on the largest petroleum provinces in the world. Just 11 months ago, super basins programs didn't exist at AAPG. They were a vision of what might come to be. The concept of super basins – a new way of thinking – combines geoscience architecture, commerciality, infrastructure and above-ground issues.

AAPG's focus on how geoscience matters enables us to make the case to CEOs and industry leaders that geoscientists are the foundation of any successful energy company. Super basins are relevant for our times and I believe for many decades to come.

AAPG hosted the Global Super Basin Leadership Conference Mar. 27-29 in Houston. More than half of the 260 attendees of this quick to market conference were global high-level decision makers (managers, CEO's). Mike Party (president-elect-elect) and I are planning another GSBLC in early 2019 in Houston to feature a "deep dive" on the Permian Basin, a prototype for super basin success.

Other past and planned super basin forums include:

- We held an inaugural Super Basin Forum at ACE in Salt Lake City on May 21. This program had more than 600 attendees – the largest attended session – with standing room only.
- The European Association of Geoscientists and Engineers invited session on June 13, 2018, featuring Europe and North Africa super basins (Copenhagen). This will allow AAPG to showcase super basins and reach out to a non AAPG audience.
- I will chair a session with Nosa Omorodion on African and Middle East super basins at the International Conference and Exhibition (ICE) in South Africa in Nov. this year.
- I will chair a session on North American super basins at ACE in San Antonio in May 2019. I will also chair a poster session by students on global super basins.
- I will chair a session with Chandler Wilhelm on Latin American super basins at ICE in Buenos Aires, Argentina in Nov. 2019

Bulletin Articles

In March 2018, the AAPG Bulletin launched the Global Super Basin initiative. Global experts on the world's richest basins have been recruited to submit articles to the AAPG Bulletin. We have 10-15 papers committed. These should appear in the months and years ahead. Thank you to AAPG Editor Barry Katz and the Bulletin staff for supporting this initiative.

The Work That Awaits

While many super basins are experiencing an energy renaissance, others are in "standby" mode. Technical commonalities, actionable intelligence of basins that look like other basins and the ability to spot opportunities will be the focus of future effort.

See **Results** page 4 ▶

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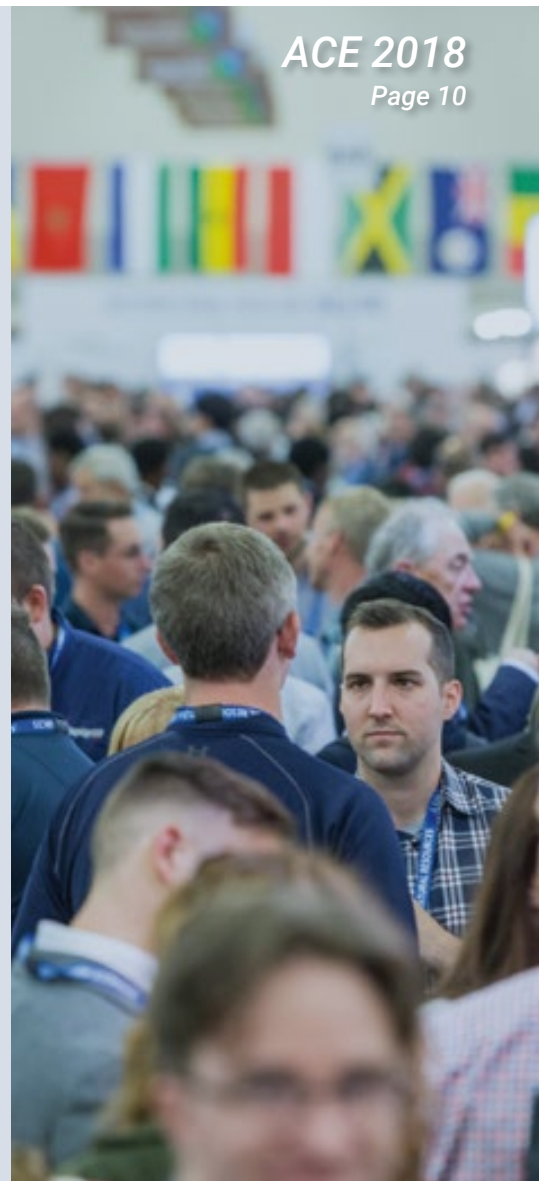
REGULAR DEPARTMENTS

ON THE COVER: Kaieteur Falls in Guyana is hopefully as emblematic of the country's coming oil fortunes as it is of the country itself. Photo by Emily Smith Llinás.



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AAPG Officers Elected

Independent geologist **J. Michael Party**, president of Midland, Texas-based Beryl Oil and Gas LP, has been voted president-elect of AAPG for the 2018-19 term.

Party, an AAPG member since 1978, will begin his duties on July 1. He will serve as the Association's president in 2019-20.

Also elected to the incoming AAPG Executive Committee were:

❒ Vice president-Sections – **Jeffrey B. Aldrich**, vice president and partner of MHA Petroleum Consultants in Denver, Colo.

❒ Treasurer – **Richard Ball**, vice president of Detring Energy Advisors in Houston.


PARTY


ALDRICH


BALL

Both the vice president-Sections and treasurer serve two-year terms.

The newly elected officers will begin their duties July 1, serving on an Executive Committee headed by **Denise Cox**, independent geologist and president of Florida-based Storm Energy, who assumes the AAPG presidency on that date.

All will be joining continuing EC members **David R. Cook**, retired from ExxonMobil, Maldon, Essex, England, vice-president-Regions; **Laura Johnson**, senior geologist for Anschutz Exploration Corp., Denver, AAPG secretary; and **Barry Katz**, senior research consultant, Chevron, as editor.

Also on the committee will be **Bill Houston**, assistant professor of geology at Lake Superior State University, Sault Ste. Marie, Michigan, as chair of the AAPG House of Delegates.

Voting results indicated that nearly 22 percent of AAPG's 12,315 eligible voters cast ballots in this year's election, with all but 136 votes being cast online.

Results
from page 3

And, perfecting techniques in rejuvenated basins is still in the early phases and far from over!

Programs like Legends are look backs. Discovery Thinking and Playmaker forums are contemporary discoveries by those who know them well. Super basin programs are real-time assessments with an anticipatory, forward-looking nature. During the inaugural GSBLC, I took 35 pages of notes and wrote down at least 10 actionable geoscience and business opportunities.

With so many possible plays awaiting investment and talent, I believe the world will need AAPG geoscientists to pave the way!

Results Matter

Our FY 2018 goals are increased energy-relevant content, member engagement and financial strength (details in the upcoming AAPG Annual Report).

Remember the Permian Basin miracle production curve in the May EXPLORER? Analogous to the production curve turnaround, I believe AAPG finances are in the "Pratt Inflection" phase of an AAPG renaissance. What this means is that by 2020 or sooner, AAPG will not only be sustainable but have surplus as a result of far-reaching actions we have taken this year and because of the work of others before us.

AAPG finances are a big ship, but a turn is happening. We have made hard decisions reducing expenses by more than $700,000 this year. We are paying it forward by implementing a dues raise, retiring long-term obligations (staff pension), working to increase the profitability of ACE meetings and successfully launching efforts to grow revenue on AAPG intellectual property.

What Next?

My Executive Committee is used to hearing my mantra, "What next?"

I say this many times at each of our EC meetings. So here is what is next for me and AAPG:

- As incoming chair of AAPG's Advisory Council, we will be looking for deserving candidates for honors and awards. We are looking for A-team officer candidates for FY 2019 for secretary, vice president of regions, and president elect. Nominate! And most importantly, say yes!
- Based on the popularity of Memoir 113, Bob Merrill and I are working on the next volume on giant fields. Please contact us if you would like to write about a giant field (2010-20)!
- I will be teaching graduate-level classes on North American and global super basins. I look forward to traveling around the world to encourage students, teach classes, consult and to give presentations on super basins.

101+ Thanks For Our 101st Year, and Beyond!

You may have noticed that throughout my columns this year, I have mentioned many volunteers by name and shown many photos. That is by design! I have always believed that if you are given a spotlight, shine it on the good deeds of others! By my count, this year has recognized well over 100 incredible men and women geoscientists and leaders. So, let's just call it 101-plus in recognition of AAPG beginning our second century.

Thanks to the Executive Committee, AAPG volunteers, headquarters staff, and to all of you for allowing me the opportunity to serve our membership and profession. Congratulations to new incoming EC members: President-elect Michael Party, Vice President of Sections Jeff Aldrich and Treasurer Richard Ball.

Charles A. Sternbach

Long Range 3D

Long Range 3D comprises approximately 9,838 km² of PGS' GeoStreamer® data in the Eastern Newfoundland region. The survey covers open acreage which will be included during Newfoundland and Labrador's scheduled November 2018 licensing round.

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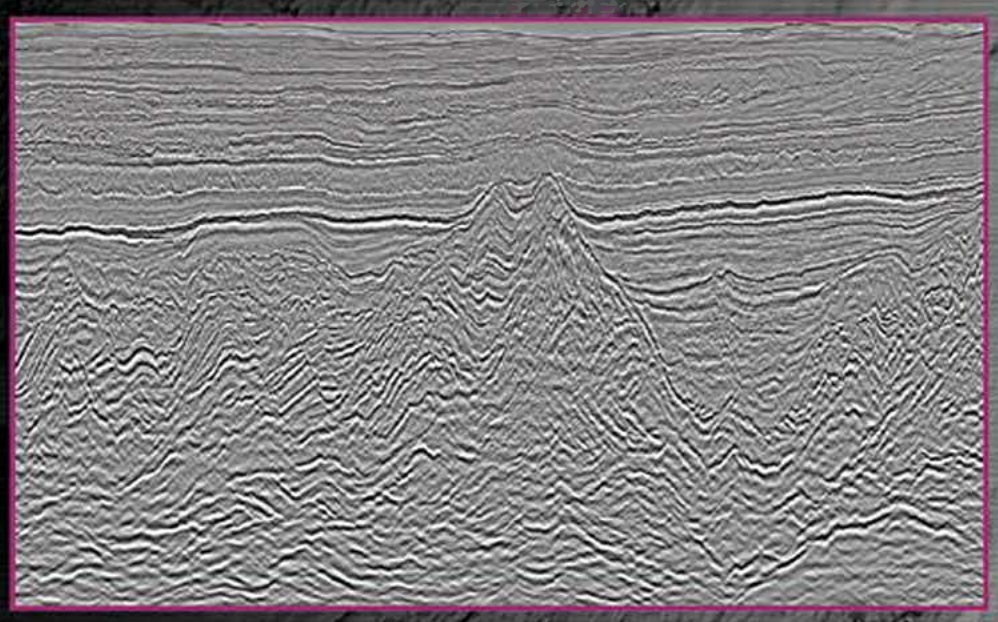

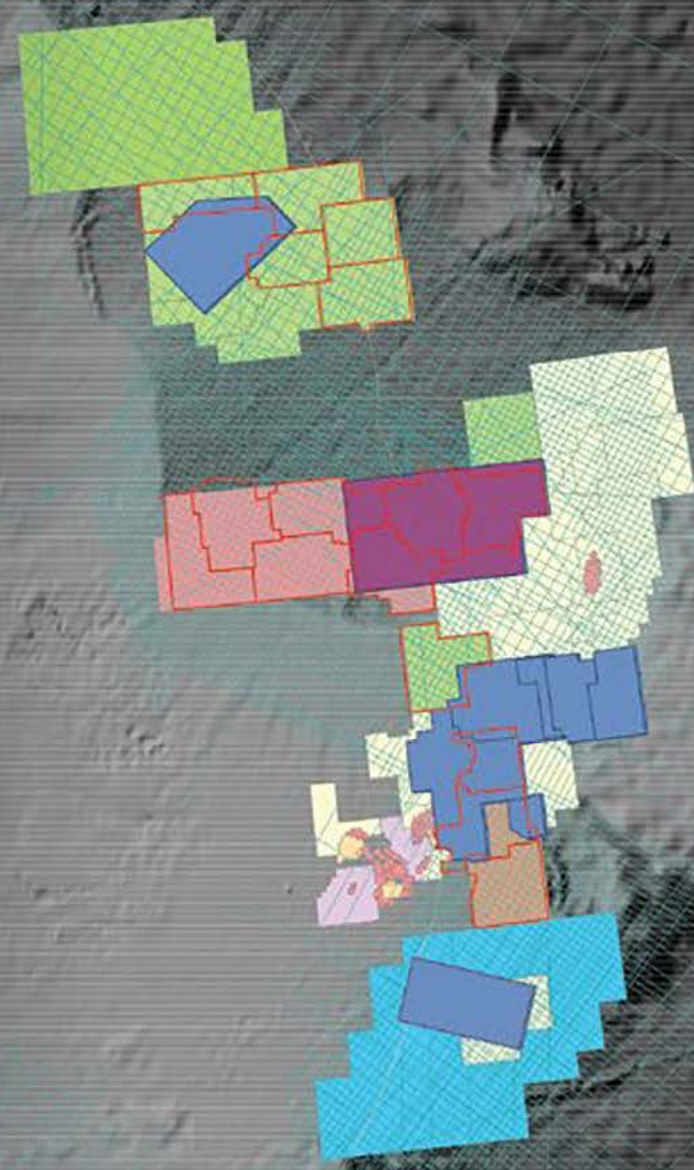

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'Depressed' Offshore Sector Seems Pretty Upbeat

If offshore drilling is depressed right now, why is so much of it going on?

The offshore sector took a serious hit during the industry downturn as spending cuts limited project sanctions. But international research and consulting firm Wood Mackenzie expects 30 major offshore projects to win approval in 2018, and that's only part of the story.

Altogether, 100 new offshore proposals could be headed for approval this year, according to business-intelligence data company Rystad Energy.

When Wood Mackenzie put together a list of conventional wells to watch in 2018, most of them were located offshore and a number of them in deepwater.

"The role of exploration is changing within companies. Many of the larger companies are looking to these deepwater opportunities to give them future legacy resources," said Julie Wilson, global exploration research director for Wood Mackenzie in Houston.

"People have not abandoned high-impact exploration, because they need those needle-movers within their portfolios," she noted.

Managing Expectations, and Efficiency

With industry spending still constrained, today's approved offshore projects are considerably smaller than in the past, the company said.

Last year the average capital expenditure committed to major offshore projects – those targeting at least 50 million barrels of oil equivalent in commercial reserves – fell to $2.7 billion, Wood Mackenzie calculated.

That compares to an average project capital expenditure of $5.5 billion for major projects sanctioned over the last decade, it said.

"The projects moving forward to final investment decision are much smaller than we've seen traditionally – a lot of brownfields instead of greenfields," Wilson observed.

Rystad Energy said the 100 offshore projects of all types that could be approved this year represent about $100 billion worth of total capital investment, or an average of about $1 billion per project. Five years ago, the average capex for offshore projects was $1.8 billion, they noted.

But in a positive development, more offshore projects are being funded through the industry's improved cash situation. Rystad estimated that 60 percent of companies looking to finance project development costs can now do so through their cash flow.

Wilson said Wood Mackenzie's wells-to-watch list isn't necessarily a collection of efforts likely to have the biggest production results.

"It's more about a selection of wells we think are interesting because they are possible play openers, or high-impact wells," she explained

They include Tullow Oil's Cormorant-1 offshore Namibia, Kosmos Energy's Anapai-1 off Suriname, ENI's deepwater wildcat Santola-1 offshore Portugal and Statoil's Gjokasen well in the Barents Sea.

In the longer term, the offshore sector of the industry knows it needs to become more efficient and competitive. It has to generate economic production to get projects sanctioned and budgets approved.

Wilson, whose background includes eight years working for BP, said offshore has some catching up to do in making use of data.

"Efficiency is a big deal. Digitalization is

See **Data** page 8 ▶

Statoil's operation in the Barents Sea. Photos courtesy of Statoil

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DATA
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really going to help efficiency," she noted. "We're a very high-tech industry and have been for a long time. Having worked at an oil company myself, I'm amazed by all the data sources around, for essentially the same information."

While offshore has thrived on advanced seismic, companies operating offshore generally have lagged behind in connectivity, data capture and data management.

"One of the things we talk about is that the industry very quickly needs to improve its data management," Wilson said. "You have to make sure that all your data is accurate and verified, and that people are using the same sources."

Automation also is helping companies reduce costs offshore, with remotely controlled platforms and robotic inspection and maintenance becoming realities.

"I think we've made a fantastic start, but the current focus for digitalization tends to be more on the production and integrity side rather than in exploration," Wilson said.

"Those places where innovation can be captured more quickly will be the sweet spots. In terms of reducing the cost of supply it definitely will have an effect. It's likely to be the onshore players who benefit first," she observed.

Longer lead times for offshore projects give onshore operators an edge in more quickly introducing innovations for efficiency. Offshore operations and facilities also tend to be more complex than their onshore counterparts.

But offshore might offer the biggest potential dollar savings from efficiency improvements because of the large capital commitment required, especially for deepwater projects.

"The impact could be greater offshore because you are investing billions of dollars. If you are building efficiencies into that whole project, there are potential savings that could even surpass onshore," Wilson said.

Some offshore operators today are talking about reducing per project capital expenditures by 30 percent through increased efficiency, she noted.

Here's another reason offshore drilling hasn't gone away: The oil and gas industry has stuck with it and gotten pretty darn good at it.

Offshore operations in the Gulf of Mexico date back to the 1940s. The Offshore Technology Conference in Houston, one of the world's major industry events, celebrated its 50th anniversary in May.

"You think about the Gulf of Mexico, which is a very open playing field. Companies that dominate, like BP and Shell, have continued to explore and to replenish their portfolios through three decades," Wilson said.

In the near term, cautious spending is mandating smaller offshore projects and in-field or infill development. For offshore exploration, highly prolific reservoirs are the focus today, according to Wilson.

Operators want to go after prospects that can result in large reserves, attractive post-exploration development opportunities and big production numbers, so investment dollars get spread out over more barrels or million cubic feet.

"Once you start developing, that's really going to help your development costs," Wilson explained.

Deepwater Potential

Major hydrocarbon discoveries over the past decade have mostly come offshore for the industry, and currently, almost all the frontier plays with the biggest exploration potential are in deepwater.

That's a big reason the industry looks at deepwater drilling and says, "I can't quit you."

"The scale of the discoveries you can make is why people explore deepwater," Wilson said. "Deepwater will usually give you the biggest bang for the buck in terms of discovery size."

ENI has been active offshore Portugal since 2014.

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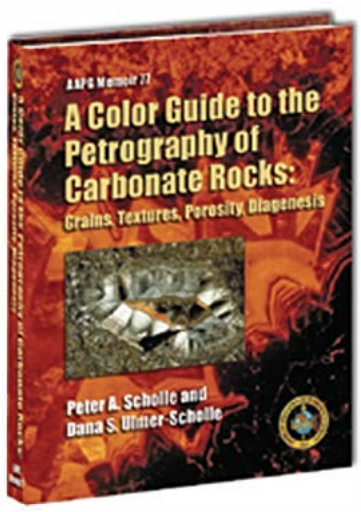
Time to Rock the Summer Sale!

Don't miss your chance to pick up some great titles at great prices from AAPG's Summer Bookstore Sale.



Memoir 77-Color Guide to Petrography of Carbonate Rocks

By Peter A. Scholle and Dana S. Ulmer-Scholle

Product #649
SALE Price: $24
(Regularly priced: Member $48 / List $68)
This volume expands and improves the AAPG 1978 classic, A Color Illustrated Guide to Carbonate Rock Constituents, Textures, Cements, and Porosities (AAPG Memoir 27). Carbonate petrography can be quite complicated. Changing assemblages of organisms through time, coupled with the randomness of thin-section cuts through complex shell forms, add to the difficulty of identifying skeletal grains. Furthermore, because many primary carbonate grains are composed of unstable minerals (especially aragonite and high-Mg calcite), diagenetic alteration commonly is quite extensive in carbonate rocks. The variability of inorganic and biogenic carbonate mineralogy through time, however, complicates prediction of patterns of diagenetic alteration.

This book is designed to help deal with such challenges. It includes a wide variety of examples of commonly encountered skeletal and nonskeletal grains, cements, fabrics, and porosity types. It includes extensive new tables of age distributions, mineralogy, morphologic characteristics, environmental implications and keys to grain identification. It also encompasses a number of noncarbonate grains, that occur as accessory minerals in carbonate rocks or that may provide important biostratigraphic or paleoenvironmental information in carbonate strata. With this guide, students and other workers with little formal petrographic training should be able to examine thin sections or acetate peels under the microscope and interpret the main rock constituents and their depositional and diagenetic history.

Hedberg Series 4: Basin Modeling—New Horizons in Research and Application

Edited by Kenneth E. Peters, David J. Curry, and Marek Kacewicz
Product #1106
SALE Price $122
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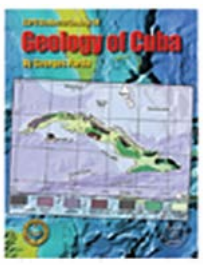
Containing 18 chapters, this volume provides an overview of the state of the science for basin and petroleum system modeling and will appeal to geochemists and BPSM modelers in industry, government, and academia.



Studies in Geology 58: Geology of Cuba

By Georges Pardo
Product #845
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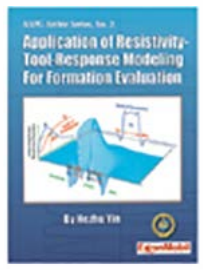
Providing a general description of the geology of Cuba, this volume also contains an updated description of the island's stratigraphy, and interpretation of its complex structures, some mechanism for its emergence from the Caribbean, and a description of its petroleum occurrences.

Studies in Geology 64: Heavy-oil and Oil-sand Petroleum Systems in Alberta and Beyond

Authors: Frances J. Hein, Dale Leckie, Steve Larter, and John Suter
Product #1187
SALE Price $109
(Regularly priced: Member $135 / List $209)
28 papers showcasing the geology of oil sands from around the world. It highlights the Athabasca Oil Sands of northern Alberta and the geochemistry of the associated bitumen resource, but points directionally to the development of other oil-sand deposits in the world.



Archie Series 2: Application of Resistivity-Tool-Response Modeling for Formation Evaluation

By Hezhu Yin
Product #831
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This volume introduces the fundamental concepts required for understanding resistivity-tool response and resistivity-log interpretation for formation evaluation, and has been written for geoscients, engineers, petrophysicists, reservoir engineers, and formation evaluation specialists.

Memoir 103: Critical Assessment of Shale Resource Plays

Edited by Jean-Yves Chatellier and Daniel M. Jarvie
Product #1200
SALE Price $69
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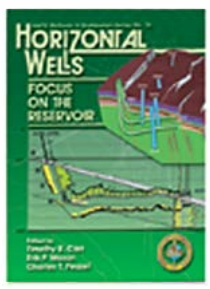
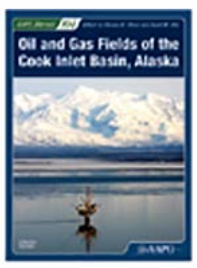
This volume consists of 10 chapters covering items from geochemistry, geology, basin analysis, diagenesis, geophysics, geomechanics, and engineering with a main emphasis on shale from North America and Europe.



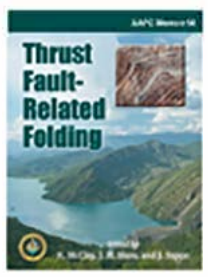
Methods in Exploration 14: Horizontal Wells—Focus on the Reservoirs

Edited by Timothy R. Carr, Erik P. Mason, and Charles T. Feazel
Product #525
SALE Price $24
(Regularly priced: Member $49 / List $74)
This book provides an overview of the technical approaches required for best use of horizontal and extended-reach technology in different reservoir situations.



Memoir 104: Oil and Gas Fields of the Cook Inlet Basin, Alaska

Edited by Denise M. Stone and David M. Hite
Product #1026
SALE Price $49
(Regularly priced: Member $79 / List $159)
Memoir 104 is designed to showcase the geo-technical elements of oil and gas fields of the Cook Inlet Basin in southcentral Alaska. It contains 10 chapters, and serves as a key reference to the petroleum geology of the basin.



Memoir 94: Thrust Fault-Related Folding

Edited by K. McClay, J. H. Shaw, and J. Suppe
Product #1065
SALE Price $58
(Regularly priced: Member $95 / List $144)
16 papers on new advances in the analysis and understanding of thrust-related fold systems including detachment folds, thrust-fault propagation folds, wedge thrust-related fold systems, and basement-involved fold systems.

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A Look Back at ACE 2018

This year's AAPG Annual Convention and Exhibition in Salt Lake City, Utah, has come and gone, and it was another yearly gathering packed with cutting-edge geoscience content, educational and professional development, reunions between old friends and colleagues for industry veterans, as well as networking opportunities for students and young professionals.

Dinosaurs roamed the Exhibition Hall and standing-room-only crowds packed into auditoriums for the opening ceremony and several of the technical presentations, and there were field trips to the stunning geology surrounding the venue in Salt Lake City, including one to the iconic Delicate Arch, depicted artfully below with some of the highlights from this year's Annual Convention.

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GTW Guyana convened 167 participants from 17 countries, 72 companies and seven universities. Photos by Emily Smith Llinás.

Guyana Exploration Opportunities Draw Industry-wide Interest

The International Pavilion buzzed with excitement at the Annual Conference and Exhibition in Salt Lake City, where the new addition IP Theatre featured presentations highlighting exploration opportunities and bid rounds from dozens of countries throughout the world.

One of the most popular presentations was "Guyana Undiscovered", prepared by Guyana's Ministry of Natural Resources and the Guyana Geology and Mines Commission.

The Ministry is responsible for implementing policy and regulating the extractive factor in Guyana, while GGMC serves as technical regulator for the country's mining and petroleum activities. The agencies work together to oversee regulation, exploration and future production of all oil and gas resources.

Marissa Foster, AAPG Member and petroleum geologist at the Ministry, provided a brief history of exploration in Guyana, from early work by Conoco and Tenneco in the 1960s through 2017 discoveries on the Stabroek Block made by Esso Exploration and Production in partnership with Hess and CNOOC Nexen.

> **"Guyana has won a lottery. Evidence from other countries is that this type of windfall is usually squandered and does not benefit the people. This industry can only benefit the people of Guyana if they become informed of the risks, if they insist on full transparency and hold their representatives accountable, and if they get independent expert advice."**

Foster described Guyana as a "hidden gem," with two primary petroleum provinces: the Guyana Basin, including the coastal onshore basin fringe and offshore basin, and the Takutu Basin, located in the southwestern section bordering Brazil.

She cited United States Geological Society studies identifying the Guyana/Suriname Regional Basin as the second most attractive under-explored basin in the world and Wood MacKenzie reports noting that the production peak in the offshore Guyana-Suriname region could reach 350,000 barrels per day by 2025.

Foster described how Guyana, traditionally focused on mining, underwent a major shift following ExxonMobil's Liza discovery in May 2015.

"Guyana has been strengthening its preparedness for large scale exploration activities, environmental monitoring and overall industry regulation," she said.

She described several factors making Guyana attractive for petroleum ventures: a stable political climate; a hard-working, English-speaking population; and nearby service industry support in Trinidad, Suriname and the Gulf of Mexico. She also noted how the country's geographical location facilitates shipping and rig movement.

Working with AAPG

Foster explained how their attendance at AAPG ACE for the first time provided the Ministry and GGMC an opportunity to showcase what Guyana has to offer, to

See **Deepwater** page 14 ▶

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* *Cancer, Facts & Figures*, 2018

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*** Members and Dependents who have been medically treated for or advised of Cancer within the 5 years (3 years in LA, 2 years in VT; 1 year in NC & TX; 6 months in ID, NV & UT) prior to the Effective Date of Coverage are not eligible for this Cancer insurance.

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Kaieteur Falls in central Guyana

Deepwater
from page 12

learn from others and to seek new partners.

"It was great being able to attend the technical presentations to see research being done on the different play types and components of the petroleum system," she said. "We also have been able to forge relationships with our counterparts in neighboring countries through the IP. Lastly, we have been able to meet with companies who provide technical and scientific services we as regulators may be interested in."

The Ministry's partnership with AAPG started in November 2011, when the Association held its first-ever event in Guyana.

More recently, in late 2017, the Geosciences Technology Workshop, "Deepwater Exploration of the Columbus and Guiana Basins," convened 167 of the oil and gas industry's top business leaders, academics and technical professionals hailing from 17 countries throughout the Americas and Europe.

The GTW featured two days of presentations and discussions related to deepwater exploration stretching from offshore Barbados and Trinidad to Guyana, Suriname and French Guiana.

Making History

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The GTW featured two days of presentations and discussions related to deep water exploration stretching from offshore Barbados and Trinidad to Guyana, Suriname and French Guiana. Guyana's Minister of Natural Resources, Raphael Trotman and ExxonMobil Country Manager Rod Henson inaugurated the event at an opening reception held the evening before the workshop.

Trotman recognized the significance of having an AAPG event in Georgetown.

"Guyana stands at the cusp of great transformation as we usher in this signal chapter in our history, one that has already begun to transform the shape and texture of our society," he said. "We therefore do not make light of this first ever gathering of AAPG members on Guyanese soil; and upon this good and fertile soil, I make the first step in declaring that it shall not be the last of its kind."

Trotman encouraged GTW participants to seek both geological and economic success through continual learning, risk reduction and prudent investment.

"Just as the super-continents once connected us, it is also imperative that we stay connected in the scientific community and among governments so that we can fully harness the full potential of our geological basins. Forums such as this enable us to see the bigger, regional picture," he said.

Seeing the Bigger Picture

GTW Guyana included four technical sessions and the poster session featured 12 presentations covering Demerara Plateau geology, tools and technologies to enhance E&P activities in the region and strategies for engaging local communities.

The fourth session, "Beyond the Wells: Working with Regulators and Communities," featured a panel discussion covering corporate social responsibility, local content and community outreach in Guyana, Suriname, Trinidad and Tobago and Barbados.

Panelist Jan Mangal, petroleum adviser to the president of Guyana, spoke candidly about how the developing oil and gas industry can affect all aspects of the country's socio-economic landscape, both positively and negatively.

"Guyana has won a lottery," he said. "Evidence from other countries is that this type of windfall is usually squandered and does not benefit the people. This industry can only benefit the people of Guyana if they become informed of the risks, if they insist on full transparency and hold their representatives accountable, and if they get independent expert advice."

Mangal urged companies seeking to do business in Guyana to understand the country and its people.

"The challenges are rather daunting. There are vast sums of money at stake, and there are numerous very savvy external players," he said. "Guyanese people (as opposed to Guyanese politicians) can be quite skeptical of foreign investors. If they feel Guyana is being taken for a ride in comparison to other countries, they will react."

He invited his colleagues to help the country grow sustainably so that all stakeholders benefit.

"You have an opportunity to influence the direction of the industry in Guyana, and thereby Guyana's future," he said. "Guyana can become a little Switzerland in the region or can be another disappointing oil state."

Other panelists shared strategies for ensuring a positive way forward including a

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commitment to local content development and promoting Corporate Social Responsibility among operators.

Anthony Paul, AAPG member and part of an independent advisory team to Guyana's Ministry of Natural Resources, presented the Ministry's policy framework for local content and participation. The policy includes hiring Guyanese nationals as employees or contractors as well as building capacity that enhances their ability to participate.

Key tenets of this policy include creating avenues and opportunities for local participation, knowledge transfer and using opportunities initiated within the petroleum sector for the benefit and growth of other sector industries.

Giving Back and Looking Forward

Event organizers and supporters sought to create an event that would benefit not only those who attended, but also those who live and work in Guyana.

AAPG provided two-for-one workshop and short course registrations to employees from the Guyana Geology and Mines Commission and free registration to staff from the Ministry of Natural Resources.

ExxonMobil sponsored registration for three Guyanese students, and Chevron sponsored registration for a University of Guyana faculty member.

AAPG also organized a book drive and encouraged GTW participants to pack a textbook in their suitcase. At the closing ceremony, general chairs presented the books to the University of Guyana's geology department head and dean of technology.

AAPG will continue to support future leaders through establishing a Student Chapter at the University of Guyana and Young Professionals Chapter for recent graduates. The Association also plans to provide guidance to technical professionals seeking to form a geoscience society in Guyana.

A Dream Come True

General Chair Xavier Moonan, AAPG Latin America and Caribbean Region education director and University of the West Indies in St. Augustine professor, described GTW Guyana as a dream come true.

"I have been very interested in the Guiana Basin since my undergrad years, where I followed CGX's activity very closely. An AAPG GTW held Trinidad in 2014 reaffirmed the potential of this basin with the very positive signs from Repsol's Jaguar well," he said.

Moonan shared his interest with Clyde Griffith, AAPG Latin America and Caribbean Region delegate and team coordinator of the geoscience group at Staatsolie in Suriname. Griffith attended the GTW along with 10 colleagues, who took a 12-hour bus and ferry ride from Paramaribo to Georgetown.

"We came to gain knowledge and exposure that we are lacking at Staatsolie to understand the architecture of the Guiana Basin," Griffith said, "We also wanted to give the staff the opportunity to network with other peers."

Jim Pindell, director at Tectonic Analysis and workshop speaker, said he was impressed at how participants collaborated throughout the event.

"What struck me was the feeling of a collective need to understand the basins, rather than a bunch of competitive companies trying to glean whatever they could," he said. "And it is interesting how the basic tectonic evolution of the region has been known for 35 years, yet the economic potential has only been exposed recently."

Future Plans

Moonan and Griffith expect both industry and AAPG activity to increase in future years, and they are planning to hold another regional GTW in Suriname in late 2019.

Foster described how recent finds and partnerships have catapulted Guyana into a time of critical changes that bring both opportunities and responsibilities.

"We must manage our natural resources from a generational standpoint – honoring the natural patrimony of the country by not just thinking of today's and tomorrow's generations but more to come," she said. "We welcome new partnerships with our well-known Guyanese hospitality to those who hold these values at heart to share in this journey with us."

If IP and GTW attendance are any indication, the Ministry should have no problem finding partners on that journey.

Participants in the GTW Guyana's "Beyond the Wells: Working with Regulators and Communities" session

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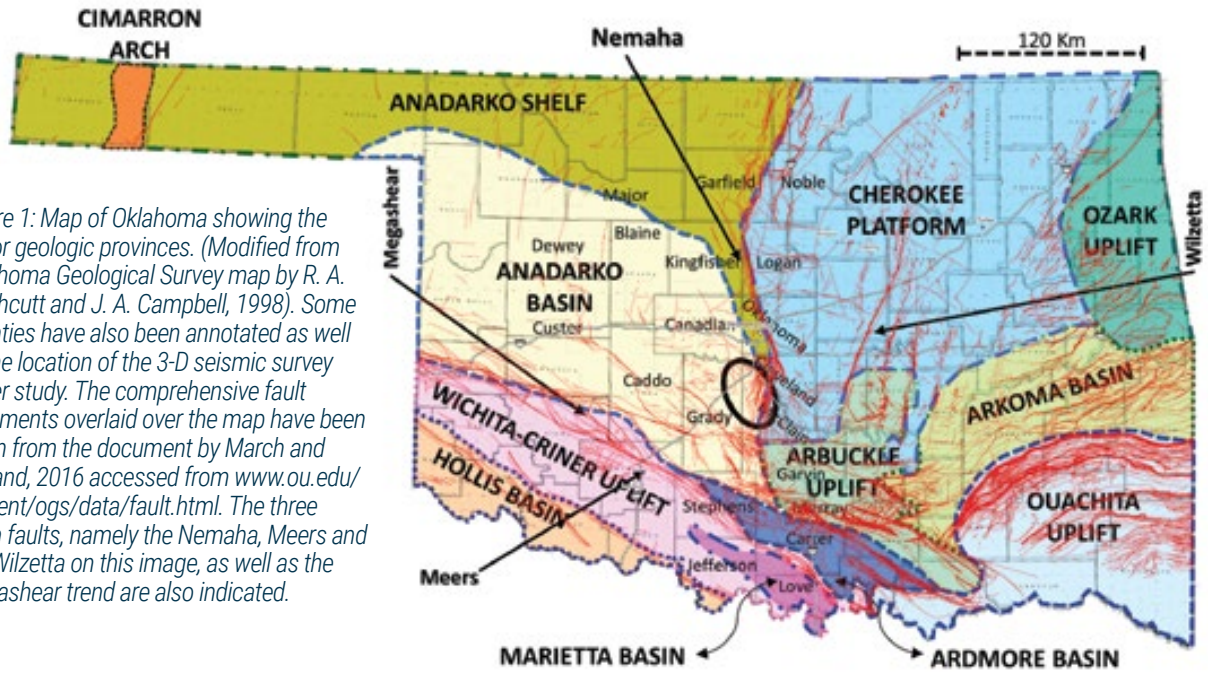
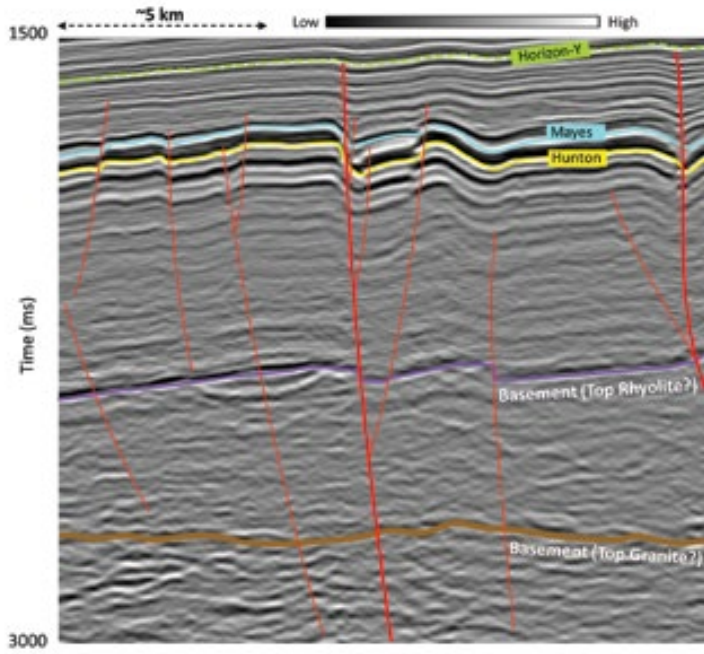


Figure 1: Map of Oklahoma showing the major geologic provinces. (Modified from Oklahoma Geological Survey map by R. A. Northcutt and J. A. Campbell, 1998). Some counties have also been annotated as well as the location of the 3-D seismic survey under study. The comprehensive fault lineaments overlaid over the map have been taken from the document by March and Holland, 2016 accessed from www.ou.edu/content/ogs/data/fault.html. The three main faults, namely the Nemaha, Meers and the Wilzetta on this image, as well as the megashear trend are also indicated.



Nemaha Strike-Slip Fault Expression on 3-D Seismic Data in SCOOP Trend

Fault interpretation is an important step in seismic structural interpretation and has a bearing on the quantitative interpretation that may eventually be carried out. This requires the meaningful recognition of the faults within the proper geological context of the area. In Oklahoma, we see wrench faulting with strike-slip faults and other associated features.

In the case of a strike-slip fault, the maximum and minimum principal stress directions are horizontal, and the intermediate stress is vertical. Large strike-slip faults are also called "wrench faults." In many cases, branches and step overs might form with two or more through-going faults instead of one, and offset one another. This results in complicated fault patterns.

Wrench faults are usually characterized by near vertical fault planes, along which the strike-slip motion takes place, and might produce positive and negative flower structures, in response to compressional and extensional driving forces respectively. Evidence of strike-slip movement along the fault plane usually manifests in additional fault and fracture patterns. A continental-scale zone of deformation produced by strike-slip movement is sometimes referred to as a megashear fault.

In the central and eastern United States, such faults typically root into igneous basement (about 1.5 billion years ago in Oklahoma). Displacement within the basement produces characteristic fault structures in the sediments above. Strike-slip movement and relatively low


CHOPRA

strains result in Riedel (R) faults as well as faults in the R' and, P orientations. Riedel fault segments will commonly get linked to P fault segments. Such combinations can give rise to en echelon fault patterns in the direct vicinity of the main fault or a zone of intense strike-slip deformation with complicated vertical offsets, i.e. positive and negative flower-type structures. Three prominent faults in Oklahoma are marked in figure 1. The Nemaha Fault, striking nearly north-south through the state is a wrench fault rooted in the deep crust (past the basement).

There are two thoughts on its formation, one is that it is related to the deep-rooted tip of the mid-continent rift; the other is that it could have formed due to a gentle counter-clockwise rotation of an intra-continental block lying between two bounding, left-lateral megashears, namely the Oklahoma megashear to the south (figure 1) and the Central Plains Megashear in Nebraska. It is perpendicular to the regional maximum horizontal principal stress (S_{Hmax}) orientation, which is a consistent 80-degree north/90-degree east orientation through much of Oklahoma, except in the southern part, where it deviates to approximately 50 degrees northeast. The Meers Fault is steeply dipping oblique-slip fault, which formed as

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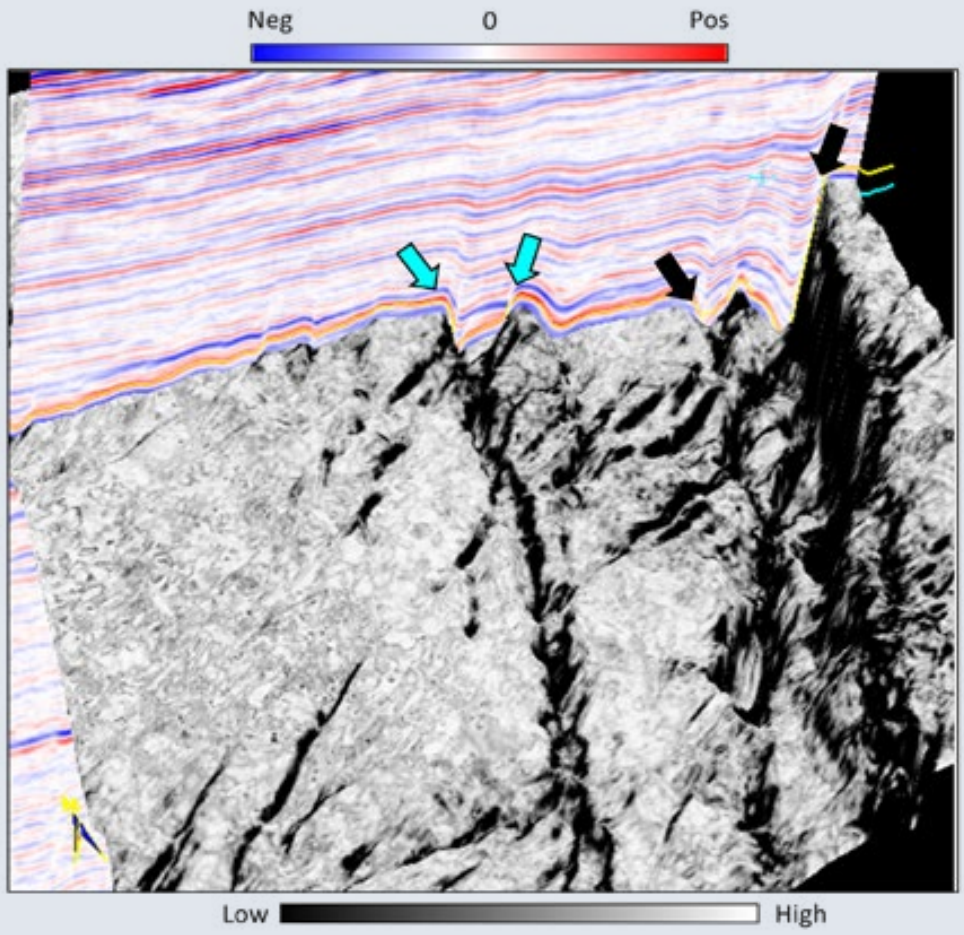

Figure 4: A chair display showing the energy ratio coherence stratal slice shown in figure 2 as the horizontal display and an inline from the seismic volume as the vertical display. Data courtesy of TGS, Houston.

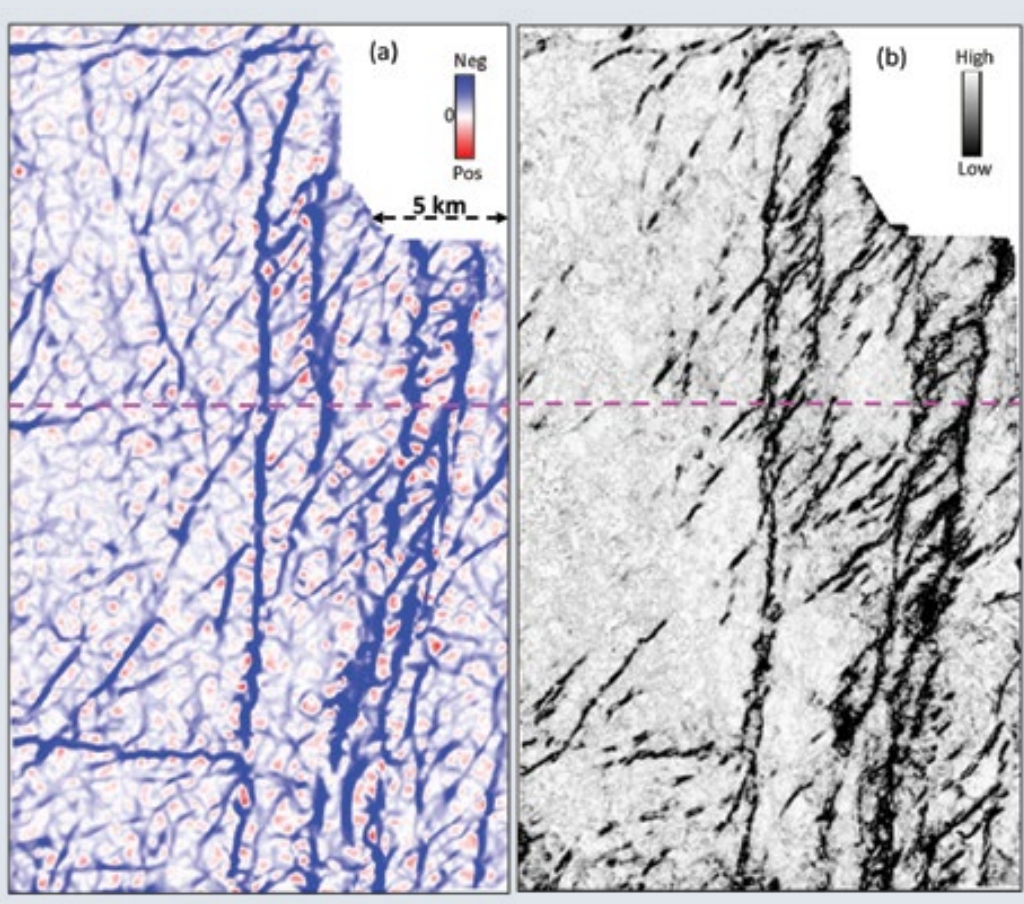

Figure 3: Stratal slice midway between the 'Mayes' and the 'Hunton' markers from the (a) energy ratio coherence volume, and (b) most-negative curvature (long-wavelength) volume. Interpretation of different types of faults (as described in the text) carried out on the stratal displays in (a) and (b) is shown in (c). Data courtesy of TGS, Houston.

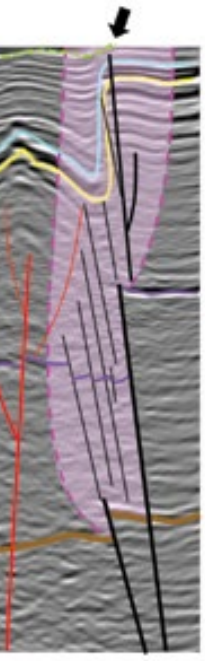

Figure 2: Segment of a seismic section from the 3-D seismic volume from the SCOOP area. The main Nemaha fault is seen to the right (black arrow), and its large throw is prominent. It goes down all the way to the basement (in purple) and beyond. The prominent horizons and the fault interpretation have been marked on the section. The legend to the right explains the different colored fault segments. Data courtesy of TGS, Houston.

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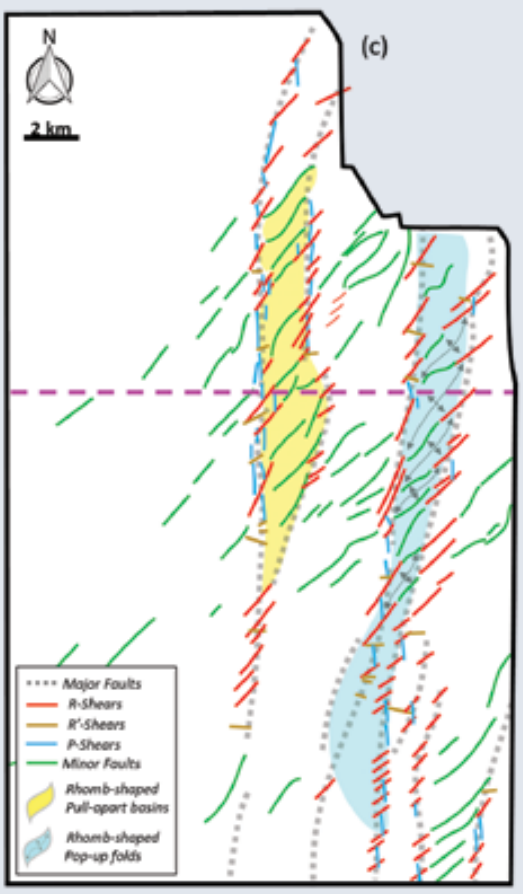
part of the Wichita Uplift system. Finally, there is the Wilzetta fault, a long north-northeast trending strike-slip fault.

Nemaha Fault Zone

The 400-mile-long Nemaha fault zone extends from southeastern Nebraska through northeastern Kansas and across Kansas and Oklahoma and terminates in central Oklahoma.

As wrench faults form because of a horizontal shear couple, which in this case is likely basement rooted, compressional and tensional forces are generated in the overlying sediments. Such forces may

See **Nemaha** page 23 ▶



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.

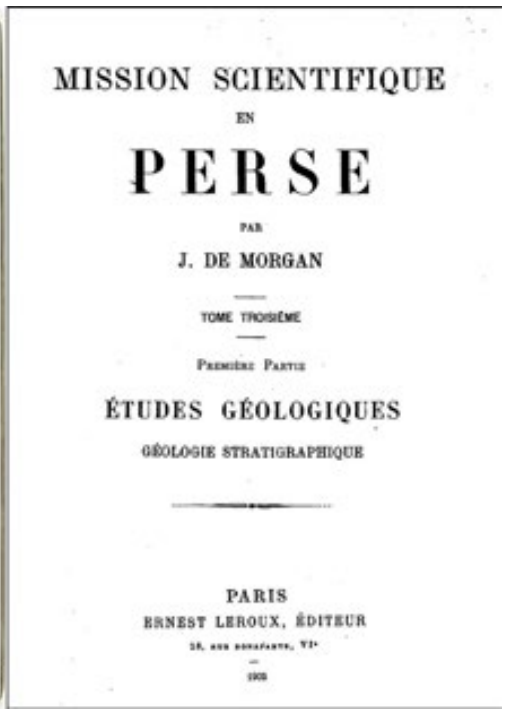
Folarin Kolawole received a bachelor's in Geology from the Federal University of Technology Akure, Nigeria, then worked as a geophysicist for three years with the Bureau of Geophysical Prospecting at Chinese National Petroleum Corporation in Nigeria. He later proceeded to Oklahoma State University

to obtain a master's in geology with a focus on structural geophysics and is currently a doctoral student at the University of Oklahoma where he is working on research related to structural geology, geomechanics and geophysics.

Brett Carpenter received his bachelor's degree in earth and space science education and physics education from Mansfield University of Pennsylvania. He then received his master's and doctoral degrees in geosciences from the Pennsylvania State

University. He then proceeded to complete a four-year post-doctoral position at the Istituto Nazionale di Geofisica e Vulcanologia, which was followed by two years of additional post-doctoral research at the University of Oklahoma. He is currently an assistant professor of structural geology at the University of Oklahoma focusing on how fault/crustal structure and small-scale processes affect large scale fault and crustal behavior, particularly the behavior of earth materials at shallow to central crustal conditions, where destructive earthquakes originate and propagate.

Historical Highlights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Far left: Jacques Jean Marie de Morgan (1857-1924), French archeologist and geologist, who worked extensively in western Iran and whose work drew the attention of European entrepreneurs to the oil resources in Iran. He is best known for this five-volume report "Mission scientifique en Perse" (1894-1905 in five volumes). Photo is from 1890, courtesy of Bibliothèque nationale de France (gallica.bnf.fr).

Left: William Knox D'Arcy (1849-1917) whose investment in the 1901 D'Arcy Concession in Persia led to the first oil discovery in the Middle East. Yet, he never visited the region and did not know much about the oil industry. Photo taken 1900.

The First Oil Field in the Middle East

The 1908 discovery of Masjid Suleiman in southwest Iran

This year marks the 110th anniversary of the discovery of the Masjid Suleiman oil field in southwest Persia (Iran), which ushered in a new era in the history of the Middle East. This is the story of the men whose vision, interests and perseverance made it happen.

Oil from seeps in Iran and Mesopotamia were used by the native people for millennia for illumination, waterproofing, medicine and other applications. In the 1890s, the French scientist Jacques de Morgan published his maps and reports of oil seeps from western Persia. His 1892 article in the "Annales de Mines" was of particular interest to Edourad Cotte, a French business agent and geologist who had spent time with de Morgan in Persia. At the Paris Expo in 1900, Cotte together with Antoine Kitabchi Khan, a high-ranking Iranian officer representing his country at the world fair, and Sir Henry Drummond Wolff, who had served as a British special envoy in Tehran from 1888-91, discussed the possibility of a modern oil industry in Iran. Wolff introduced Kitabchi Khan to William Knox D'Arcy, an Englishman who had made huge wealth from investing in the Mount Morgan gold mine in Australia, and from his base in London was on the lookout for new business ventures.

Left: A map of Iran (Persia) and George Reynold's drilling sites in the Zagros foreland basin which lead to the 1908 discovery.

The D'Arcy Concession

D'Arcy used the consulting services of Sir Thomas Redwood, a leading petroleum engineer in London. In March 1901, D'Arcy sent his representative, Alfred L. Marriott, together with Cotte and Kitabchi Khan to Tehran to negotiate for a concession from the Iranian government. He also separately dispatched H.T. Burls, a geologist working for Redwood's firm, to Iran to verify the oil seeps in the areas mapped by de Morgan. It was all good news to D'Arcy: Burls' report was favorable ("the territory as a whole is one of rich promise") and the Persian King Muzaffar al-Din Shah Qajar needed money to finance his expensive trip to Europe.

On May 28, 1901, the oil concession was signed by the king. It granted D'Arcy permission to explore, drill, produce and export petroleum in Iran (except for five provinces in the north close to Russia) for a period of 60 years. D'Arcy was required to form a company within two years for this purpose. The Persian government was to receive £20,000 in cash, £20,000 in shares from the company, and 16

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Gusher: Oil discovery well at Masjid Suleiman, 1908. Source: British Petroleum Archive No. 178498.


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Masjid i Suleiman 26/5/08 to 1 more Depth 1180 feet. Oil struck in flow

Telegram sent by George Reynolds to his company, 1908. Source: British Petroleum Archive No. 78680.

Left: George Bernard Reynolds (left) with two colleagues Crush (center) and Willans (right) in Persia ca. 1909. Source: British Petroleum Archive No. 178509-08. Above: Work at the oil well, probably Masjid Suleiman. Source: www.abadan.wiki

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percent of profits made by the concessionaire. D'Arcy formed the First Exploration Company in May 1903 with a capital of £600,000. He owned half of it.

The First Drills

For field operations in Persia, D'Arcy hired George Bernard Reynolds, an English engineer who had had worked for the Indian railways and in the Dutch oil fields in Sumatra. Working conditions in western Iran, as Reynolds soon learned, were hard: the climate was hot, the drill sites remote and the local tribesmen were suspicious of foreigners in their territories. Reynolds had to hire local laborers and security guards and pay the tribal chiefs for their cooperation. He also put together a technical team of Polish and Canadian drillers, an Indian doctor and a tough American engineer, C. B. Rosenplaenter, as his deputy. Rosenplaenter had worked in oil fields in Texas, Mexico, Baku and Assam.

In November 1902, Reynolds started drilling at the seepage area of Chiah Surkh (one of the key areas mapped by de Morgan) in the Kermanshah province close to the border with Iraq. In the summer of 1903 a slight show of gas and oil was encountered at 1,665 feet. In January 1904, a second well hit oil at a shallow depth of 765 feet. However, D'Arcy's excitement was short lived – the daily oil flow rapidly reduced to a few barrels.

D'Arcy, now disappointed after having spent more than £200,000 of his money, was willing to sell the concession, and some non-British companies were interested in a deal.

Redwood was alarmed. He did not want the D'Arcy concession to slip out of British hands.

The timing was right: Sir John Fisher, who had become first lord of the admiralty in October 1904, was planning to convert the Royal Navy from coal to oil fueling. Moreover, the Scottish Burmah Oil Company, for which Redwood had long worked as a consultant, was in need of new oil reserves. Orchestrated by Redwood and Fisher, a new company, the Concessions Syndicate Ltd., formed in 1905 in Glasgow to take over D'Arcy's interests in Persia. It was financed by the Burmah Oil Company and a retired wealthy Englishman Lord Strathcona. D'Arcy remained the director of the new company.

Southwest Zagros

In 1905, under instructions by his new bosses, Reynolds abandoned Chiah Surkh and moved the drilling rig to the southern Khuzistan province. Two years earlier, D'Arcy had sent W.H. Dalton, another geologist from Redwood's firm, to investigate oil prospects in that province. Dalton had singled out Shardin (Marmatin), some 55 miles east of Ahavaz City, as "by far the best." Based on his report, Reynolds drilled two wells at Shardin: one in

See **Gusher** page 28 ►

Finding Oil in the Unconscious Mind

Norman H. Foster Outstanding Explorer Award

You cannot, at least not for very long, talk about this year's Norman H. Foster Outstanding Explorer Award recipient Susan Morrice without mentioning the Central American country of Belize. There's a symbiosis. Without her doggedness, many an AAPG member night never have heard of the place, but decades ago, Morrice saw something in the country – more to the point, decided to take the time to look for it.

"There were 50 dry holes and everyone said, 'There is no oil in Belize!' and most people thought I was nuts," she said.

But she wasn't, there was, and she found it.

Susan Morrice and Josh Steward, her fellow director at BNE and founder of Xjet, their private aviation company.

Bettering Belize

In the 1980s, she was asked by an old friend, noted inventor Sir Ian Rankin, if, in fact, there was any oil in Belize, and she took it as a challenge. She researched many old papers on British Honduras and concluded Belize was part of the greater Mexican Basin.

But that research was just one part of her motivation for her pursuit.

"I fell in love with the people of Belize and that gave me an extra passion and purpose. I also had great fun exploring in the jungles and getting to know the entire country and its people," she said.

Morrice and her Belizian partner, Mike Usher, shot seismic and caused a deep offshore well to be drilled, but to no avail. She credits her attendance of an Educo Seminar with her getting their "ducks clearly in a row" before they returned to Belize to set up Belize Natural Energy in 2003.

Less than two years later, in June of 2005, she found what her her heart told her was always there: oil.

"When everyone told me there was no oil in Belize and no oil company would join us to drill, we went to Ireland where 76 small Irish investors joined us on that Mike Usher No. 1 well."

Many of these Irish investors didn't even know where Belize was. Usher had died unexpectedly in 2004, and BNE decided to name the first drill site in his honor.

"We commenced preparations to drill in May 2005 and on the exact day, the anniversary of Mike's death, we struck the first discovery in the first well on 24 June, 2005!" Morrice related.

Even the geologists said, "This is about something bigger than us!"

Since then, BNE has discovered and developed Belize's only two commercial oil fields, as well as developed ancillary and related oil and gas infrastructures, drilled over 62 wells, which have produced 11 million barrels of crude oil.

It has also – and this is dear to Morrice's heart – sold 20 percent of crude production to local industries, thereby lowering local production costs.

The country is better for her being there.

Accessing the Unconscious

The Norman H. Foster Outstanding Explorer Award is about honoring those with great exploration histories, but Morrice said her life is more than the sum total of her finds. She said it has been about the people who are positively affected by her work and empowered to follow their dreams, as well as the environment that must be protected. In Belize, she sees a microcosm and case study for the rest of the world, and something that must always be considered alongside exploration.

"Humanity lives united in goodness, one world, in partnership with life the way we were all born to be," Morrice said.

That, she added, takes more than just technical know-how, an innate sense of where to drill, and a ledger sheet.

"Science and art are said to be differing parts of our brain or mind. When we learn how to use our whole mind, it brings these different areas together and we can fully utilize our innate potential," she said, adding that both the conscious and unconscious mind must be utilized. "Accessing this deeper area connects us with our passion, imagination, creativity and energy. Everyone has this dormant potential and can access it when they know how," said Morrice.

Keep in mind, this is a geologist talking, not a self-help guru, but it's how she overcame her own doubts in tackling the challenges of Belize.

Morrice reiterated that she credits the Educo Seminar she attended more than 15 years ago for awakening her understanding and encouraging her passion and developing her full potential. When the seminar was over, it was clear to her what she was going to do.

Continued on next page ▶

◀ Continued from previous page

"I immediately went to Belize and set up Belize Natural Energy," she said.

That challenge from Ian Rankin, apparently, never left her. A decade and a half later, she still sees the Educo Seminar's impact on her life and career and the need to keep pushing out those boundaries.

"I researched the globe for an educational system that understood the mind. I wanted a course that had studied back through time to Socrates and Plato, had tight PhD requirements and excellent practical results," she said.

It is something she now makes part of her corporate business model.

"So not only did I attend the Educo Seminar 15 years ago, but I send all the people from BNE so they too can follow their dreams and be all they can be," she added.

Morrice said the Educo business model that is at the core of BNE and is what enabled them to win the prestigious Getenergy Global Education and Training Award in 2017, beating out companies from 50 other countries, such the United States, United Kingdom, Canada and Oman.

Finding Oil in the Minds of Women

As for those who helped bring her to this point of winning the Foster Award, she mentioned her parents in Ireland, her family, including her cousin Josh Stewart, who is a director in BNE.

But,she seems particularly touched by a more personal (and immediate) connection to the award's namesake.

"I recently met Norman's wife and daughter who became very emotional when I told them what we had done in Belize. They told me how glad they were I had received Norman's award," she said.

Morrice noted that success is also about paying knowledge, expertise and passion forward. During economic downtimes, she still mentors students and talks of the possibilities and successes. It is why she was so instrumental in founding AAPG's International Pavilion, for which she was recognized by AAPG with its Distinguished Service Award.

"I am now bringing this understanding and educational model to other countries who took part in the International Pavilion and companies who want the same empowerment that BNE/Belize is now well known for," she said.

That model carries the ability, when necessary, to change direction, change outlook and channel passion.

"Developing the full capacity of all in BNE means we have diversified into building a gas plant to convert our natural gas into cooking gas and electricity. Meanwhile, the employee group 'Energy for Life' continued to mentor young people from the villages all over Belize," said Morrice.

Like many in the industry, she is fond of Wallace Pratt's famous line, "Oil is found in the Minds of Men."

"I wondered," she said, for the longest time, "about the women and the mind as well."

She found an answer by sending a young Mayan girl, Elsia Pop, to the same Educo Seminar,who was not only mentored in entrepreneurship by the BNE employees but won the Princess Diana Legacy Award.

"Pop was on a plane for her first time to London," Morrice said, "as a guest of the Royal Family."

Susan Morrice is the first female winner of the Norman H. Foster Outstanding Explorer Award, but she wants you to know that it's not just about the gender.

"I would say once people understand themselves and drop their mindsets they can achieve all they want to, especially if it includes making a difference in the lives of others. Then the energy that propels you forward is phenomenal. So, I see many more females coming forward and indeed a greater diversity in leadership," said Morrice.

Nemaha
from page 19

provide additional signatures, such as en echelon faults and fractures that could be utilized as a means of interpreting them.

We study the seismic expressions of such faults and fractures and try to interpret them on a 3-D seismic volume from the SCOOP area of Oklahoma, and its location is shown in figure 1. The quality of the seismic data seems to be very good as seen on a segment of a seismic section from the 3-D seismic volume shown in figure 2. Notice the basement reflection tracked in purple.

The Nemaha fault marked on the section penetrates beyond the top of the basement. In fact, it is the Nemaha fault zone that can be seen there, and its spatial disposition is seen clearly on the stratal slices in figure 3 between the Mayes and the Hunton markers from the coherence and most-negative curvature attribute volumes. The fault lineaments are seen better defined on the curvature than the coherence. The Nemaha fault appears to be in the form of a zone rather than a single fault, as indicated by the two black arrows. Another fault zone is also seen to the left of the Nemaha fault zone as indicated with the cyan arrows.

In addition to these two fault zones, there is another fault lineament pattern in the northeast-southwest orientation that seems overlaid on the display. The observed basement fault patterns are consistent with the tectonic history of the mid-continent and may provide explanations for deformation observed in the shallower sediments. As the Precambrian basement of the mid-continent is only exposed in a few places and limited in aerial extent, studies using seismic attributes on robust 3-D volumes provide a critical tool for understanding how deep structures and deformation may influence the overlying sediments.

(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.)

Foundation Update

AAPG Foundation's Excellence in Teaching Award Recipients Announced

Lauren Birgenheier receiving the 2018 Inspirational Geoscience Educator Award from AAPG Foundation Trustee Chairman Jim Gibbs.

Geoscience education initiatives are an important part of the AAPG Foundation's mission. Each year the Foundation offers two prestigious Excellence in Teaching awards that recognize educators who demonstrate outstanding leadership in the field of geoscience education.

The Teacher of the Year Award is presented each year to a K-12 teacher within the United States who exemplifies outstanding achievement in teaching earth sciences. The Inspirational Geoscience Educator Award is awarded annually to a college or university educator who demonstrates professorial excellence in higher education geoscience courses. The IGEA award is intended to encourage geoscience professors to share current industry trends and the latest technological advances with students in their undergraduate and graduate courses, further enhancing the field of geoscience research.

The 2018 Teacher of the Year Award

This year's recipient of the AAPG Foundation's Teacher of the Year Award is Debbie Morgan, an Earth systems science teacher from South Sevier High School in Monroe, Utah.

Morgan said that science is "extremely critical to helping solve many of our 21st century problems (and) it is my job to contribute to that work by inspiring the next generation of geoscientists and ensuring that all students are earth science literate."

She does this by encouraging students to "start an educated and thoughtful discussion about the importance of our natural resources and the management of them."

Morgan has been teaching for 14 years and earned a bachelor's in geology from Utah State University and a master's in geosciences from Mississippi State University.

Morgan received her TOTY Award during the All-Convention Luncheon at the Annual Convention and Exhibition, held last month in Salt Lake City.

"I'm here today to offer my sincerest gratitude to the people and organizations without whom this experience wouldn't have been possible," she said.

Morgan has conducted student field trips "from wind-formed caves in the Bahamas to sea floor sediments off the Alaskan Coast" and the USGS Astrogeology Science Center in Flagstaff, Ariz. Three of her students won a national NASA competition to attend a summer workshop event at the NASA Goddard Space Center near Washington, D.C.

"None of these adventures would have been possible if it weren't for the support and interest of scientists like you," Morgan told the attendees at ACE. "Thank you for investing in my students' futures and the ability to provide opportunities that may very well change the world one day – one student at a time."

South Sevier High School Principal Randy Madsen described Morgan's innovative techniques in teaching as "keep(ing) students learning, on task and completely engaged."

"She had her students investigate new technologies relating to the study of the Earth, design their own inventions and share them with the class," he related.

The AAPG Foundation bestows the TOTY Award with a commemorative plaque and a cash prize of $6,000, comprised of $3,000 for Morgan's personal use and another $3,000 for educational purposes to South Sevier High School's use under Morgan's supervision. In addition, Morgan also received an expense-paid trip for herself and her husband to attend ACE to receive the award.

The 2018 Inspirational Geoscience Educator Award

Lauren Birgenheier, an assistant professor of geology and geophysics at the University of Utah in Salt Lake City, has been named the recipient of the 2018 Inspirational Geoscience Educator Award.

She received her award during the Chairman's Reception at ACE.

"I am honored to receive this Inspirational Educator Award," she said in her acceptance speech. "I am deeply grateful for the creative, bright and thoughtful graduate students I advise and mentor. It is truly the most rewarding part of my job. Most simply, I give talented students a place to thrive, a few tools and the time to work toward a career that I hope will be equally rewarding for them. Gratefully, they seem to rise to the occasion each time."

Birgenheier also recognized those who have supported her in her own career.

"I have been very fortunate to have had many advisers and mentors along my own

Continued on next page ▶

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path that showed me, by example, how to connect with, educate and train promising geoscience students. I feel a great deal of satisfaction in designing and helping graduate students carry out research to help answer how will we meet energy needs," she said.

Throughout her teaching career Birgenheier has led students on multidisciplinary research projects in the Mancos Shale (Uinta, Piceance and San Juan), Green River Formation (Uinta Basin), Wolfcamp Shale (Permian Basin) and Agrio Formation (Neuquén Basin, Argentina). As faculty adviser, she led her University of Utah student team to an AAPG Imperial Barrel Award win in 2013, as well as second place in the AAPG Rocky Mountain Section in 2015 and 2017.

Birgenheier holds a bachelor's in geology from Colorado College and a geosciences doctorate from the University of Nebraska–Lincoln. She has taught undergraduate and graduate level courses at the University of Utah for more than five years, including courses in petroleum systems, depositional environments, petroleum industry career path capstone and the Imperial Barrel Award Competition. She also served as technical program chair at this year's ACE.

Cari Johnson, professor of geology and geophysics at the University of Utah, said that Birgenheier's "record documents remarkable success in teaching, mentoring and advising a large and talented body of graduate and undergraduate students, particularly at this relatively early stage of her career. This is a diverse group on many levels, and I can personally attest to Lauren's strong advocacy on behalf of underrepresented groups in STEM and the spirit of inclusion in all aspects of her professional life."

The AAPG Foundation bestows the Inspirational Geoscience Educator Award with a commemorative plaque and a cash prize of $6,000.

The AAPG Foundation was established in 1967 with the primary goal of providing a source of funding for educational, charitable and scientific objectives, which directly and indirectly benefit the geoscience profession and the general public. The Teacher of the Year award honors that intention by giving this accolade to the heart of geoscience educational initiatives – grades K-12. The Teacher of the Year award began in 1996 and has since honored 21 outstanding earth science teachers across the country. The Inspirational Geoscience Educator Award (formerly known as the Professorial Award) also supports the AAPG Foundation's education initiative by bestowing honor and recognition to those dedicated to geoscience in higher education who inspire and motivate students in their pursuit of geological careers. The IGEA began in 2012 and has since honored seven outstanding geoscience professors.

Tomorrow's Energy Geoscientists and the Coming War for Talent

Who are the "future energy geoscientists" and in what kind of professional world will they work?

Veteran petroleum geologist and organizational leader Chandler Wilhelm envisions a changing industry that will require different skills and provide new and different opportunities for young professionals and students beginning to choose their career paths.

Wilhelm also suggests that the next generation is arriving with skills, goals and priorities that will require the industry to adapt to the employees' expectations if it hopes to recruit and retain them.

"I have worked for many years in both conventional and unconventional oil and gas, and as these businesses mature I see increasing divergence in the career opportunities for geoscience professionals. The rise of the unconventionals business in the past decade will fundamentally change the choices available to the future energy geoscientist," Wilhelm said.

"Geoscientists in these respective businesses will need different technical skills and will have different choices on where to live and work," he said.

The Old Skills and the New

As new technologies develop with new skills to be mastered, the basics still matter.

"Economically successful projects are still underpinned by good geoscience that is well integrated with engineering and commercial disciplines. Finally, geoscientists will continue to need to be good integrators, 'connecting the dots' to envision opportunity where data are ambiguous or incomplete," said Wilhelm.

"I believe that this is where our profession creates the most value, over and above bringing simple technical competence to a project. The classic statement by AAPG Founding Member Wallace Pratt that 'oil is first found in the minds of explorers' applies now more than ever, and in all parts of our industry, conventional and unconventional alike," he added

Digital skills will also be a basic requirement for success and advancement for the future energy geoscientist, he said.

"The relentless drive for efficiency that is required for businesses to sustain profitability will require that geoscientists be able to independently manage and analyze large data sets, regardless of whether that data set is a large offshore marine seismic survey or an onshore unconventional play with thousands of wells," he said.

"Particularly in the unconventionals, there is increasing drive to use 'analytics,' or what some call 'multivariate analysis,' to continue to optimize estimated ultimate recovery by finding the right combination of reservoir landing zone, wellbore azimuth, lateral length, well spacing, completion intensity, and reservoir drawdown," he added.

Wilhelm said some view this more as an engineering than geoscience challenge, these analyses must be map-based, relying "fundamentally on a sound understanding of regional geology in order to be able to separate the impact of geology from engineering and operating practice. This is why geoscientists play an essential role in the application of analytics to unconventional plays, and why they will need to have strong digital skills to be competitive."

In addition to a solid basis in geoscience, students entering the workforce will need need strong critical thinking skills and an aptitude to continuous learning, he said.

Cooperation between industry and academia is important to provide students with a taste of real-world challenges.

"I have seen some different approaches used to help meet this common goal. Some schools such as the Colorado School of Mines run research consortia on topics of relevance to industry, with industry funding of student projects that address fundamental questions with economic significance. These types of programs help to foster a sense of shared mission between industry and academia," Wilhelm said.

He said multidisciplinary knowledge is increasingly important for the future energy geoscientist.

Familiarity or basic competence in areas such as geographic information systems, petrophysics, geomechanics and economics will be needed to foster efficient teamwork and career advancement, he said.

Tight budgets might limit some geoscience departments from offering such broad choices, but Wilhelm said other options are available through professional societies, online learning and companies that specialize in professional training.

"I have also seen new multidisciplinary degree programs or certificates in energy management being offered by some leading universities that may fit the needs of some students," he said.

As the industry emerges from a severe downturn, "Those that have survived are leaner and generally committed to running their businesses to prosper in a future with low and volatile commodity prices.

"There is no way to sugarcoat the challenge this has created for early-career professionals who have been trying to start their careers during this difficult period,"

Continued on next page ▶


WILHELM

Chandler Wilhelm, Shell's vice president of portfolio and emerging basins and past president of AAPG's Division of Professional Affairs, was part of a special interactive forum hosted by the DPA on "The Future Energy Geoscientist" at last month's 2018 AAPG Annual Convention and Exhibition in Salt Lake City, Utah. Geared toward young professionals and students, the forum featured experts from various backgrounds who discussed the needs of tomorrow's workforce.

◀ Continued from previous page

Wilhelm said.

He said businesses have begun to rely more on digital media to help match jobs with candidates.

"Professional societies such as the AAPG and its Division of Professional Affairs have also responded by creating new membership categories to attract early-career professionals and provide a means to creating a deeper network to help identify opportunities," he added.

After the Great Crew Change

Preserving and passing on lessons learned through experience is also important.

"Many senior professionals enjoy the opportunity to help early-career professionals. It is a source of new relationships and helps remind people like myself what it was that attracted us to this great profession in the first place," said Wilhelm. "Again, professional societies such as the AAPG have expanded their use of digital media to help match early career professionals with experienced mentors. The AAPG Foundation also provides an array of programs to help students and early-career professionals, mainly with educational funding assistance, but also by sponsoring programs such as the Visiting Geoscientist Program to help connect senior professionals with students to share their experiences."

Many companies have mentoring programs, and Wilhelm said he has participated as a mentor at Shell for years.

"Digital tools will never substitute for quality time spent with another person," he noted.

Wilhelm said the future will bring not only a changing workplace, but a changing workforce.

"The "Great Crew Change" that has been written about for so many years is probably coming to an end, as this latest downturn has resulted in the retirement of many of the remaining senior technical professionals in our industry. Increasingly, the future will be in the hands of the next generation of professionals, particularly those so-called millennials – that large demographic wave born between 1980 and 1995.

"By the end of this decade, they will occupy about 50 percent of the total U.S. workforce, and probably a larger percentage of our profession. It is a remarkable generation – well educated, socially concerned and incredibly adept at using information technology and social media," he said.

"According to the consulting firm, Global Collaborations, Inc., 45 percent of millennials will choose workplace flexibility over pay, 72 percent want a job that has an impact, and 70 percent say that giving back and social impact are their highest priorities. They are impatient with bureaucracy and desire responsibility. This leads to some interesting speculation on the impact of this generational change on our profession," he said.

More flexible employment relationships will be supported by ever-stronger information technology platforms to enable work in "virtual teams," he said.

"All of this would need to be supported by ever stronger online continuing education platforms to enable professionals to remain current in their fields."

Wilhelm said companies will need to make the transition from survival mode and prepare for the "war for talent" that may accompany the next upturn.

"The next few decades promise to be challenging, rewarding, and exciting. I am confident that there will be good times as well as tough times. I am equally confident that when the "future energy geoscientists" eventually retire, they will look back and see that it was quite a ride."

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

Masjid Suleiman No. 1 is now a popular museum. Source: Hadi Karimi, Wikipedia

Gusher

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HH1906 reaching a depth of 2,170 feet and the second in 1907 to a depth of 1,940 feet. Both were dry wells.

Reynolds decided to try a new well at his favorite area, which was about 55 miles northeast of Ahavaz. The area was traditionally known as Meidān Naftoon ("Field of Oil"). It was also home to the ruins of an ancient Zoroastrian fire temple, and for this reason local people (mistakenly) called it Masjid Suleiman ("Mosque of Solomon"). This place was mentioned in the geological reports of de Morgan, Burls and Dalton, but it was particularly attractive to Reynolds because in November 1903 on a brief trip to Kuwait, he had heard stories of rich oil seeps at Meidān Naftun from a British historian, Louis Dane. Reynolds had even gone to this desolate place in 1904 and again 1906 to observe the sedimentary rocks saturated with oil.

Reynolds was enthusiastic about the new site. Well No. 1 at Masjid Suleiman was spudded on Jan. 23, 1908. Reynold's optimism was encouraged by D'Arcy himself, as well as by Edward Hubert Cunningham-Craig, a geologist with Burmah Oil who, in November 1907, had made a survey of the Masjid Suleiman area together with Reynolds. However, Burmah Oil managers – having already spent a great deal of money on the D'Arcy Concession – were beginning to lose heart.

Arnold Wilson, a young lieutenant of the British Indian Army who had brought 20 gunmen with him in 1907 to protect the drilling operations in Persia, wrote in his autobiography, "S.W. Persia: A Political Officer's Diary," that Reynolds had received a telegram from the company to stop the operations altogether and ship the equipment back if oil was not found at Masjid Suleiman.

To buy time, Reynolds decided not to reply to this cable. History was repeating itself: half a century earlier, Edwin Drake had received a similar letter from his bosses just before he struck oil at Titusville, Pa.

A Gusher at Masjid Suleiman

Reynold's vision and persistence paid off. On May 16, 1908 a strong gas smell from the well was noted. Reynolds kept on drilling, and on May 26 at 4 a.m., the well hit a gusher that shot more than 80 feet above the rig. Reynolds, in high spirits, called for a camel courier and sent off a message to the telegraph office in Baghdad to inform his company that the oil was struck at 1,180 feet. Wilson, who had been sleeping close to the rig, also broke this important news to the British government, but in a coded message so that clerks could not notice: "See Psalm 104 Verse 15 Third Sentence and Psalm 114 verse 8 second sentence." Un-coded, the telegram read: "That he may bring out of the earth oil to make him a cheerful countenance ... the flint stone into a springing well."

The following day, Well No. 1 was tested at about 297 barrels of oil a day. In reply to the company's cable to the effect of stopping the operations, Reynolds wrote: "The instructions you say you are sending me may be modified by the fact that oil has been struck; so on receipt of them I can hardly act on them."

Well No. 2 in June and Well No. 3 in September 1908 proved to be even bigger gushers at Masjid Suleiman. It took seven years and close to half a million pounds to discover this first oil field in the Middle East. In 1912, a 130-mile pipeline connected the oil field to the Abadan refinery, the first of its kind and still one of the largest in the Middle East.

Asmari Reservoir

The Masjid Sulaiman oil came from the Oligocene-Lower Miocene, 1,000-foot thick limestone of the Asmari Formation – so named in 1924 by R.K. Richardson after the Asmari Mountain about 20 miles southeast of the field. The reservoir sits on a giant anticline pushed up by a major thrust fault at deeper levels of the Zagros foreland basin. The oil was light crude (39 degrees API) with 1.3 percent sulfur. Until Iran's 1979 revolution, 314 wells had been drilled in the Masjid Suleiman field, having produced a total of one billion barrels from the Asmari, and in 1979 the reservoir was still producing about 7,000 barrels a day. Although today Asmari limestone is no longer a producing reservoir at the Masjid Suleiman field (production comes from deeper reservoirs), Asmari limestone is still an important reservoir rock in many oil fields in the Zagros basin.

In Hindsight

The Masjid Suleiman discovery had enormous commercial and geopolitical implications. On April 14, 1909, a new company, the Anglo-Persian Oil Company, replaced the Concessions Syndicate Ltd., with a capital of £2 million, registered in London. D'Arcy remained its director until his death in 1917. In order to secure oil supply for the Royal Navy at a lower price, in 1914 Winston Churchill's government decided to buy 51 percent of the APOC. Indeed, Persian oil provided a considerable amount of cheap oil for the Royal Navy during World War I and II. In 1953, in the wake of nationalization in Iran, APOC was split into British Petroleum and the National Iranian Oil Company.

The Masjid Suleiman field put the Middle East on the word's oil map and paved way for other discoveries in Iran and other parts of the Middle East. And let's not forget the idea for drilling at Masjid Suleiman was suggested to Reynolds by a historian, which is an apt ending for this Historical Highlight.

DEG
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based on their academic training and current position in the workforce.

However, when I inquired as to what they actually did for work, day in and day out, I was not disappointed. The responses included permitting and land use, environmental studies (i.e., under the National Environmental Protection Act, or at the state level under such regulatory program like the California Environmental Quality Act, etc.), co-produced and wastewater management, which included induced seismicity and water quality studies associated with underground injection operations, aquifer exemptions, responding to oil spills and gas leaks, dealing with well integrity and abandoned well issues, and fugitive emissions and air quality monitoring programs, to name a few. Some were engaged in litigation involving environmental issues and impacts, climate change discussion, public hearings and outreach efforts. The majority were occupied with a preponderance of regulatory-compliance related activities.

What all these activities have in common is that these individuals are all environmental stewards in one form or another. Their activities have a significant environmental component – they are environmental stewards, they are environmental geologists. I define myself as an environmental geologist. Formally trained in petrology and geochemistry, I found that, throughout my 40 years of professional practice, just about everything I have worked on had an environmental component. In many cases, a significant one. Thus, over the years I realized I was not an engineering geologist nor a geochemist or a regulatory geologist. Yes, I was scientifically and technically trained in these areas, but with regard to what I contributed most, in my view, was being a responsible environmental steward. When boiled down to its elemental form, it was all about being a responsible environmental steward in the areas in which I roamed and of which I wanted to be a part.

Environmental Tourism

My areas of interest were past, present and soon-to-be industrial sites. These included nuclear, hydroelectric, geothermal and other energy-related sites and facilities, hazardous waste landfills, oil and gas fields, refineries and tank farms, and mining operations. Industrial sites are fascinating not only for their necessity and usefulness, but also from an historical and environmental perspective.

There is a term for a specific form of this affliction: environmental tourism. These are locations where communities and companies celebrate their industry's history and technology and promote self-motivation and high safety standards. Like a forbidden fruit that should not be enjoyed, these are symbols of society's growth over time. These are sites and destinations where a particular type of expertise from the past, present or future is showcased to the public. These include industrial heritage tourism, companies that open their doors to visitors to highlight their technology and methods or scientific tourism.

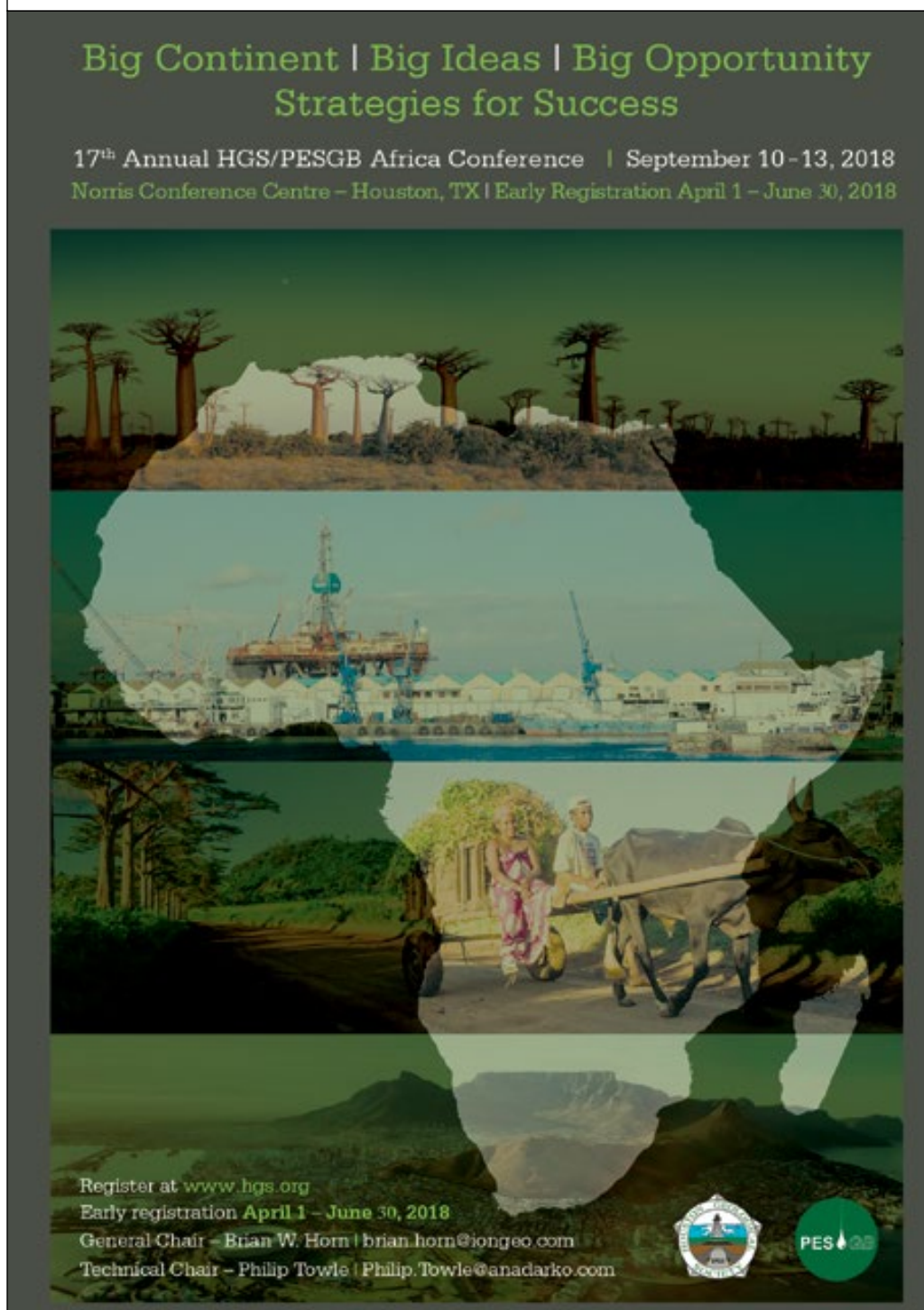
These destinations that celebrate sites such as cosmetic plants, breweries, bullet trains and underground salt mines are all over the world: France, Germany, the Philippines and Poland. In the United States, consider the Ford's assembly plant in Detroit, the Naval Yard in Brooklyn or Virginia's Belle Isle, or the numerous oil and gas fields and mine sites throughout the country.

I live in such an area: the Mother Lode, an area whose natural landscape was devastated by hydraulic mining while providing a venue for unsurpassed growth and development of a new land.

From an oil and gas perspective, think of the THUMS Islands off Long Beach, Calif., the Drake's Well Museum and Park in Titusville, Pa., and the numerous oil and gas museums and fields throughout the country. And note that the more successful we are in the development of a field, urban encroachment and infrastructure pressures follow. Being involved and engaged with the history of our industry and profession and promoting public outreach, introduced me to concepts like sustainability and environmental stewardship for the industries that have provided a quality of life and societal benefits historically unsurpassed.

Rethink Your Self-definition

Why DEG membership is reflective of a small sector of the AAPG family in my humble view is simply a matter of how we define ourselves. We are all environmental stewards, and as you attend the various meetings and conventions and take notice of the many topics dealing with environmental issues in the petroleum industry – induced seismicity, underground injection, waste water management, soil and groundwater contamination assessment and mitigation, well integrity, abandoned oil and gas wells, climate change, fugitive emissions and carbon capture, storage and utilization – consider being a part of DEG. If you think you are not an environmental geologist, maybe you should think again. If you are not a member of DEG, maybe you should be. If Charles were alive today, I suspect he would be.



Classified Ads

MISCELLANEOUS

Director's Corner

Endings and New Beginnings


CURTISS

As ACE drew to a close, everyone — from our organizing committee to our staff — took great pride in delivering an excellent event for everyone who attended. There is joy in success, and perhaps a bit of sorrow that after all that effort, it's over so soon.

The origin of the term is shrouded in obscurity, variously ascribed to Native American Indian tribes of the Great Plains or to 19th century authors writing about them: the "Happy Hunting Grounds," a term used for the afterlife, describing a verdant place where game is plentiful and the souls of the departed spend an eternity hunting and feasting.

It was Monday morning, May 25, the first full day of the Annual Convention and Exhibition, and this term – the Happy Hunting Grounds – which I first learned as a boy reading the "Little House" books by Laura Ingalls Wilder, flashed into my consciousness as I read a text message from my wife, Susan.

I was up early that morning, out of my room, and headed to the front doors of the Hilton in Salt Lake City. Unlike most Mondays at ACE, however, I wasn't off to my first meeting. Instead, I was heading to the airport, heading home to Oklahoma City. Lily, my younger daughter, was graduating high school that evening, and I was off to celebrate her and her accomplishments.

ACE had begun well. The Advisory Council and the Executive Committee had conducted meetings on Friday and Saturday. The House of Delegates was in session on Sunday morning. The business and governance of the Association were well in hand.

The next generation of petroleum geoscientists had proven their mettle in the Imperial Barrel Award competition with the University of Louisiana-Lafayette taking top honors with San Diego State University in second place and Pennsylvania State University in third.

The opening session was inspiring as General Chair Michael Vanden Berg welcomed the attendees to Utah, a must-visit destination for geologists, and President Charles Sternbach asked everyone to reflect on an AAPG event that changed their lives, echoing AAPG legend Wallace Pratt's words, "Anything is possible. Everything is possible."

We honored Sidney Powers medalist Mike Forrest and Michel T. Halbouty Leadership awardee Hans Krause. We recognized the scientific and service accomplishments of many AAPG members. And the energy in the exhibition hall was high.

I was feeling good as I headed to the airport that morning, confident that our attendees were going to have a superior experience, and that I could shift gears to family matters for 24 hours.

Joy and Sorrow in Equal Measures

The text message from Susan upon landing at Denver International Airport shook me up. She was at the veterinarian with Sadie, our 12-year-old Great Pyrenees dog, who had not eaten in two days and had awakened that morning unable to walk. At 110 pounds, that was a problem, but thankfully Susan and Anna, our eldest, muscled her into the car and off to the vet.

As the afternoon progressed and we finalized the preparations for Lily's graduation and party – wanting to make this day about her and her achievement – Sadie's prognosis dimmed. She wasn't in pain, but she was seriously ill. She wasn't going to make it.

My rueful response to a colleague's question about how my quick trip home went was that it included all the elements of a country music song: joy and sorrow in equal measures.

Family and friends gathered in our house to eat and celebrate. The graduation ceremony hit all the right notes. The loud cheers and sign-waving by parents, grandparents, siblings and friends as Lily received her diploma caused just enough embarrassment to let her know how much she's loved and admired.

Just before midnight, after everyone had gone to bed, I drove alone to the veterinary hospital. They took me back to Sadie's kennel, where crouching by her side, I fed her some food, held her water bowl, and stroked her head as I said goodbye.

The alarm went off at 3:30 am and I was up, heading back to the airport, back to Salt Lake City and the rest of ACE. As I was in the air, Susan, Lily and James, our youngest, were with Sadie, with her to the end, as her heart stopped beating and she breathed her last.

"When you are sorrowful look again in your heart, and you shall see that in truth you are weeping for that which has been your delight," writes Lebanese-American poet Khalil Gibran. "Some of you say, 'Joy is greater than sorrow,' and others say, 'Nay, sorrow is greater.' But I say unto you, they are inseparable."

Joy and sorrow. Endings and new beginnings.

As ACE drew to a close, everyone – from our organizing committee to our staff – took great pride in delivering an excellent event for everyone who attended. There is joy in success, and perhaps a bit of sorrow that after all that effort, it's over so soon.

Endings and new beginnings: This month we recognize outgoing President Charles Sternbach, Vice President – Sections Dan Schwartz and Treasurer Marty Hewitt as their terms on the Executive Committee conclude. We also welcome Denise Cox as president, Mike Party as president-elect, Jeff Aldrich as vice president – sections, and Richard Ball as treasurer.

Endings and new beginnings: A new chapter opens for Lily as she heads to the University of Oklahoma this autumn, ready and eager to make her mark on the world. I am so very proud of her.

Endings and new beginnings: I still find myself looking for her in her favorite corners, listening for her snoring, expecting to see her waiting for me at the door as I arrive home from work. Godspeed, Sadie, best girl, as you enter the Happy Hunting Grounds.

Maybe, just maybe, there you'll finally catch that squirrel.

By STEPHEN M. TESTA, DEG President

Divisions Report: DEG

"I a Geologist": How We Define Ourselves


TESTA

If you think you are not an environmental geologist, maybe you should think again. If you are not a member of DEG, maybe you should be. If Charles were alive today, I suspect he would be.

The famous phrase "I a geologist" is one from a young man 29 years of age named Charles Darwin. After his introduction to geology at the age of 21 by Adam Sedgwick, Darwin would eventually embark on the famous voyage of the Beagle which lasted from 1831 to 1836. He would soon thereafter publish in 1839 "Journal of Researches into the Natural History and Geology of the Countries Visited during the Voyage of H.M.S. Beagle Around the World, under the Command of Capt. Fitzroy, R.N." In 1842, he published "The Structure and Distribution of Coral Reefs. Being the First Part of the Geology of the Voyage of the Beagle, under the Command of Capt. Fitzroy, R.N. during the years 1832 to 1836," and in 1844, "Geological Observations on the Volcanic Islands Visited During the Voyage of H.M.S. Beagle, together with Some Brief Notices of the Geology of Australia and the Cape of Good Hope, Being the Second Part of the Geology of the Voyage of the Beagle." And in 1846, he published "Geological Observations on South America. Being the Third Part of the Geology of the Voyage of the Beagle." Prior to his extensive work in evolutionary biology with the 1859 publication of "On the Origin of Species by Means of Natural Selection, *or the Preservation of Favoured Races in the Struggle for Life*," his early published works focused on the formation of coral reefs, paleontology, rock cleavage, petrography, the structure of the earth, the formation of rocks and his efforts to create a "simple" geology based on an understanding of the vertical motions of the earth's crust, elevation and subsidence. At the age of 29, Darwin transformed himself from young man to naturalist and yes, a geologist, referring to himself in his notebook as, "I a geologist have ill-defined notion of land covered with ocean, former animals, slow force cracking surface &c (sic) truly poetical."

I bring this up because of the importance of how we define ourselves. How we define ourselves reinforces our perception of the relevance of what we do. Being relevant means having significant and demonstrable bearing on the matter at hand – that being how we decide to spend our time, assuming that we spend our time with pursuits that matter to us.

The same goes for organizations and how they promote the importance of such concepts as environmental stewardship and sustainability as they are applied in the context of social, economic and environmental interactions. How an organization spends its time and resources define its relevance. It was relevant to Charles, it is relevant to AAPG and it is relevant to us as individuals.

During my tenure as president of the Division of Environmental Geosciences, I have had the opportunity to illuminate some of these concepts and bring them closer to the forefront, reinforced by a new national "America First Energy Plan" that endorses them. However, based on the importance and relevance of such concepts as environmental stewardship and sustainability as it is applied to the energy sector, we do not see this relevance expressed in DEG membership, and I ask: Why? The overall membership of DEG makes up about 2 percent of the total membership of AAPG. Domestically, the Gulf Coast section makes up a little over a third of the membership, followed by the Eastern section at about 18 percent and the remaining sections hovering around 10 percent each. International membership makes up about 16 percent of DEG's membership. This is not a very large sector of the whole and I found myself questioning why DEG's membership was not more than it is.

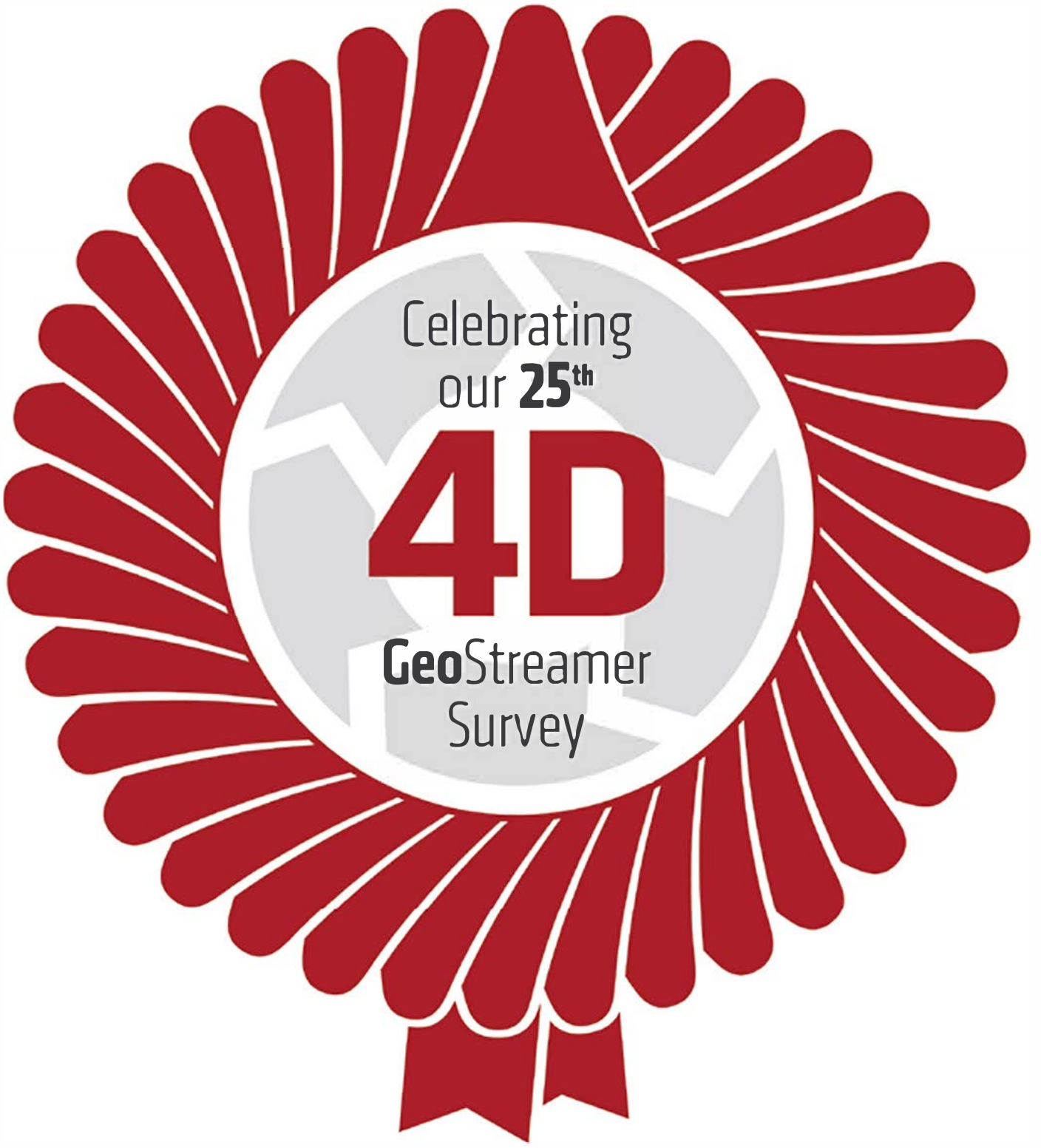
Something is not right and my concern is not without foundation.

Environmental Stewards By Any Other Name

As I listened to the oral presentations and toured the various posters presented at the sectional and leadership meetings I attended during my tenure as DEG's president, I would ask students and professionals two primary questions: how do they professionally define themselves and what exactly they do in their day-to-day working lives?

An appreciable number of responders defined themselves as petroleum geologists, structural geologists, exploration geologists, petroleum geochemists, seismologists, quaternary geologists and glaciologists, etc., notably,

See **DEG**, page 29 ▶



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