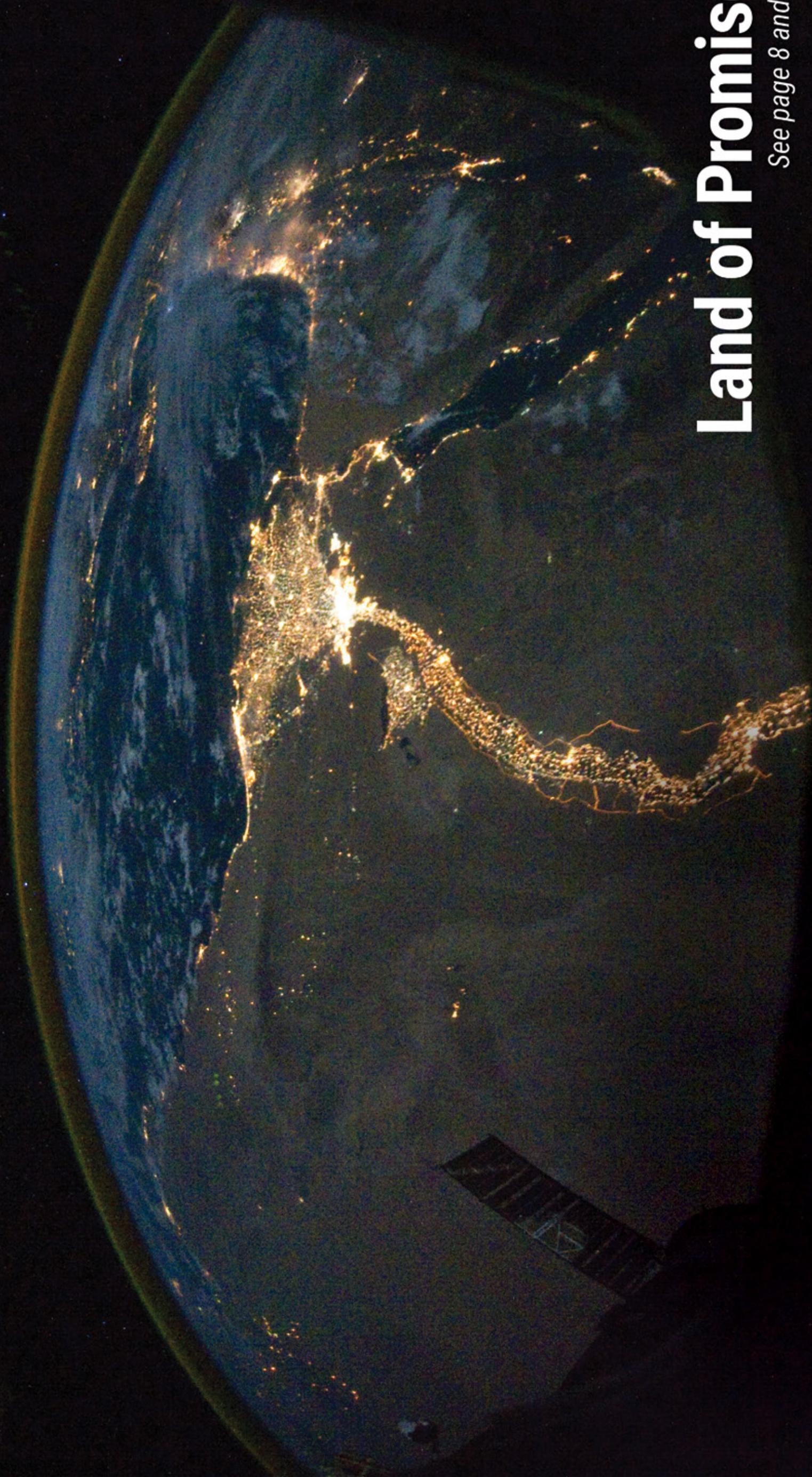


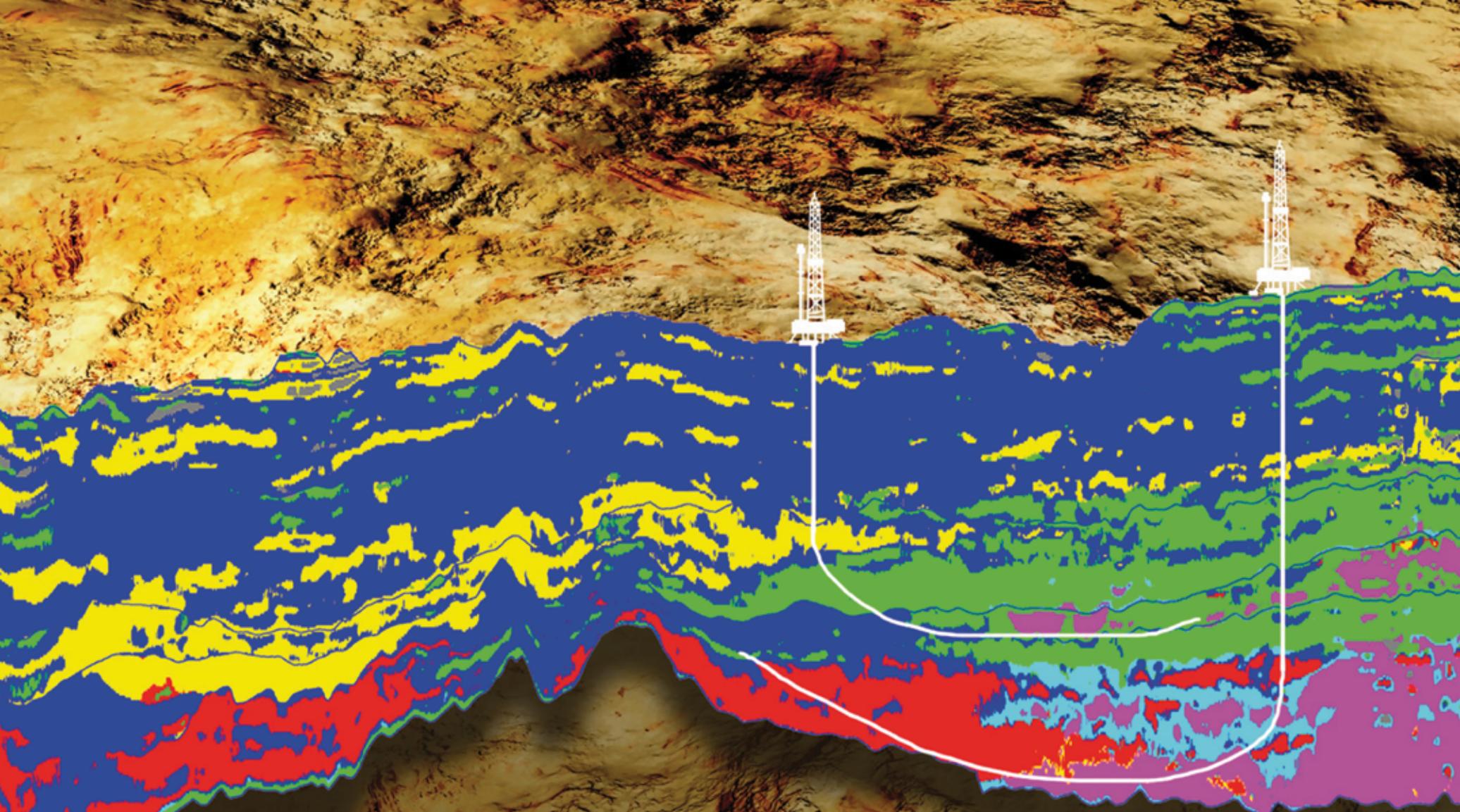
AAPG **EXPLORER**

December 2018



Land of Promise

See page 8 and 12



PUTTING YOUR DATA TO WORK

Gain greater insight with CGG GeoAnalytics

CGG **GeoAnalytics** pushes the boundaries of subsurface data analysis. Developed in partnership with **Analytica Inc.**, it reveals key production drivers by integrating and analyzing complex engineering, production and geoscience datasets.

Our approach lets you enhance prediction of future well performance and model the impact of various lateral well parameters and completion scenarios and their cost. Visit our website for an interactive virtual tour of our unique and proven workflows designed to improve your ROI.

There is safety in numbers!

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Passion for Geoscience



AAPG: 'Because We Are'

When we meet at AAPG conferences like the Annual Convention and Exhibition, the International Conference and Exhibition and region and section meetings, AAPG is fulfilling its mission and at its best: technical content with a business focus bringing together a diverse audience of attendees from academia, government and industry.

The theme of this year's ICE in South Africa Nov. 4-7 captured the state of the petroleum industry: "Shaping the future in a changing energy landscape." Our industry is working together on sustainable petroleum development as part of sustainable energy development.

At AAPG's recent Energy Transitions Forum in Amsterdam, Ashild Larsen, the chief information officer for Equinor, captured where we are as an industry: "The game to transform the energy industry is on – and the opportunity is at the intersection of people and technology," she said.

This is an exciting time to be a geoscientist, an exciting time to be a petroleum geoscientist and a significant time to be a part of AAPG.

'Because We Must'

The demand for energy is increasing in every corner of the world, so the creativity and skills that we bring to explore and develop energy resources have never been more important – not just for our profession, but for the quality of life of the global population and our planet.

The South African philosophy of "Ubuntu" captures this sentiment. It translates to, "I am because we are." As AAPG members, it might also be stated, "Because we can. Because we must."

Our role as AAPG members in this journey is crucial, and something to be respected and valued. Respected, because when we attend conferences and share in learning,



Students, YPs and AAPG leadership represented multiple generations of AAPG members at AAPG ICE South Africa Student and Young Professionals Networking Reception.

you are telling the world, "I'm a professional geoscientist, a proud petroleum geoscientist, and part of a group that is working on sustainable energy development." You should value conference experiences because we are exploring a new understanding of our roles as geoscientists.

This is a critical moment in our

Association's history and AAPG is changing to meet the needs of the changing energy landscape. Through our divisions – Energy Minerals Division, Division of Environmental Geosciences and the Division of Professional Affairs – we are embracing diversity and expanding our interactions with professionals in all technical and

business areas of energy solutions.

The petroleum industry and AAPG are moving in directions that make us partners with a diverse global society. We are purposely operating in ways that balance economic

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12 Land of Milk and Honey: Not historically known for its hydrocarbon resources, **Israel** is soon to become a **gas exporter** to its oil-rich Arab neighbors.

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ON THE COVER:

The continent of Africa is seeing an ongoing oil exploration boom while a gas revolution is afoot in Israel and the Eastern Mediterranean Sea. This image of the Nile River Delta, where Israel and Africa meet, was taken by Expedition 25 crew on the International Space Station.

History of EMD

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CORRESPONDENTS

David Brown

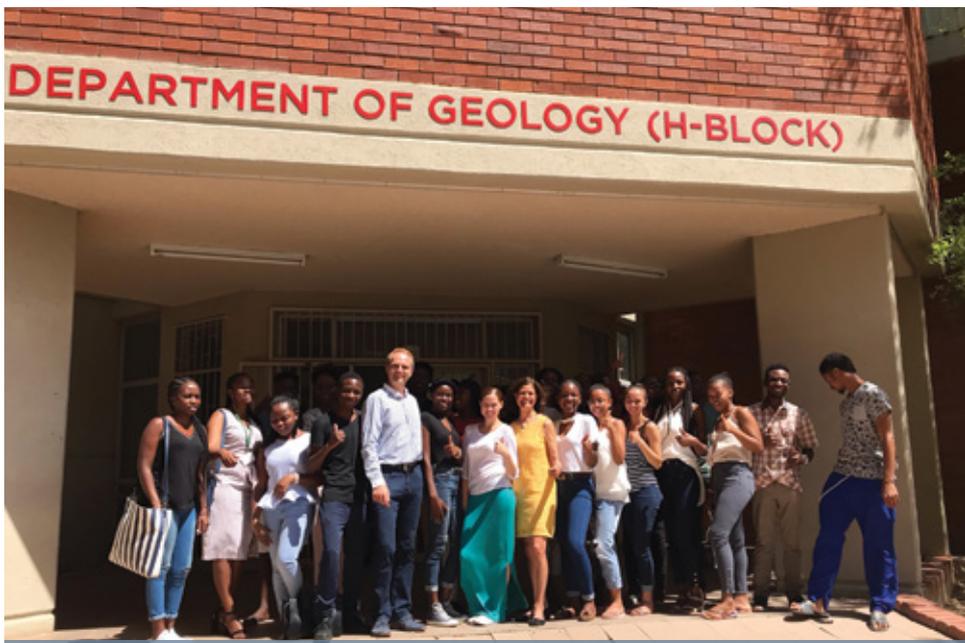
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Dr. Ansgar Wanke and students from the University of Namibia give a "thumbs up" to AAPG.



AAPG President Denise Cox receives the "Spirit of Africa" award at NAPE Lagos, Nigeria from Dr. Andrew Ejayeriese (center) and shaking hands with Sola Adebawo, communications manager for the Policy, Government and Public Affairs Department of Chevron Nigeria.

Interpretation® upcoming submission deadlines

AUGUST 2019

Machine learning in seismic data analysis

Submission deadline: 1 December 2018

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

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

Submission deadline: 1 December 2018

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

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

Submission deadline: 1 December 2018

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

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

Submission deadline: 1 December 2018

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

Working with 2D seismic data

Submission deadline: 1 December 2018

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

Brazil

Submission deadline: 15 December 2018

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

NOVEMBER 2019

Geohazards and their impact on drilling and development: Risks, challenges, assessment, and real-time practices.

Submission deadline: 20 January 2019

Special-section editors: Huyen Bui, Daniel Bean, Bill Berger, Eric Cauquil, Andy Hawthorn, Brett Judy, Andreas Laake, William Sager, Craig Scherschel, Niall Slowey, Fabian Vera, and Steve Wardlaw

Atlantic Margin of Canada

Submission deadline: 1 February 2019

Special-section editors: Ian Atkinson, David E. Brown, John Cody, William Dickson, Vsevolod Egorov, Michael Enachescu, Roy Fitzsimmons, John Hogg, and Jonathan Redfern

Wastewater disposal and CO2 injection

Submission deadline: 1 February 2019

Special-section editors: Ali Fadili, Yevhen 'Eugene' Holubnyak, Morten Kristensen, Hannes Leetaru, Michael Pycrc, Charlotte Sullivan, Michael Williams, and Zulfiquar Reza

Permian Basin challenges and opportunities

Submission deadline: 1 March 2019

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

FEBRUARY 2020

AVA/AVO Analysis and Rock Property from Seismic Data

Submission deadline: 1 April 2019

Special-section editors: Chen Bao, Reynaldo Cardona, John Castagna, Todd Dygert, Stephan Gelinsky, Tapan Mukerji, Brian Russell, Yuefeng Sun, Shiyu Xu, and Zhao Zhang

Joint processing and interpretation of active and passive seismic data

Submission deadline: 1 April 2019

Special-section editors: Michael Behm, Anne Obermann, Yangkang Chen, Wei Chen, Charles Sicking, and Jyoti Behura

Geomechanical State of Stress in the Earth: Measuring, Modeling, Monitoring, Employing

Submission deadline: 1 June 2019

Special-section editors: Nicholas Davatzes, Weiren Lin, Birgit Muller, Balazs Nemeth, Colin Sayers, Douglas Schmitt, and Mark Tingay

*E-mail interpretation@seg.org to inquire about submitting manuscripts past the submission deadline. Some sections may have increased flexibility regarding submission and review dates.

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SCHEDULED TOPICS

Visit <http://library.seg.org/page/interpretation-special-sections> for more details about these sections.

President from page 3

growth, environmental protection and social progress that helps us meet both the energy needs and cultural expectations of the world.

This is sustainable development. A concept that has become widely adopted and now defines the way global leadership, financial institutions and the public view energy solutions. AAPG is embracing this view, and its membership and customers can and should be part of that exploration.

I encourage you to take advantage of AAPG's conferences to explore the science, the technology and cultural diversity that are part of our global energy solutions.

Our creativity as geoscientists and the innovation and excellence of the petroleum industry are what underlie sustainable development. It is how we

will meet the energy needs of the present without compromising the ability of future generations to meet their own needs.

(This column is based on the speech given at the ICE 2018 opening ceremony. Vern Stefanic's ability to capture the AAPG presidential message of sustainable development that was the basis the speech is gratefully acknowledged.)

What Sustains You This Month?

This month I am sustained by the richness of AAPG's technical diversity and multicultural membership. An African proverb might capture the value of bringing our diverse association together at annual conferences:

"When you want to go quickly go alone.

When you want to go far, go together." I encourage each of you to attend an AAPG section and region meeting you have not attended in the past. Share your technical knowledge, discover new technology, grow your network and add your experience to global sustainable energy solutions. Together we will go far. #AAPGSustainsMe

Onward!

Denise M. Cox



A joint publication of SEG and AAPG

Interpretation®

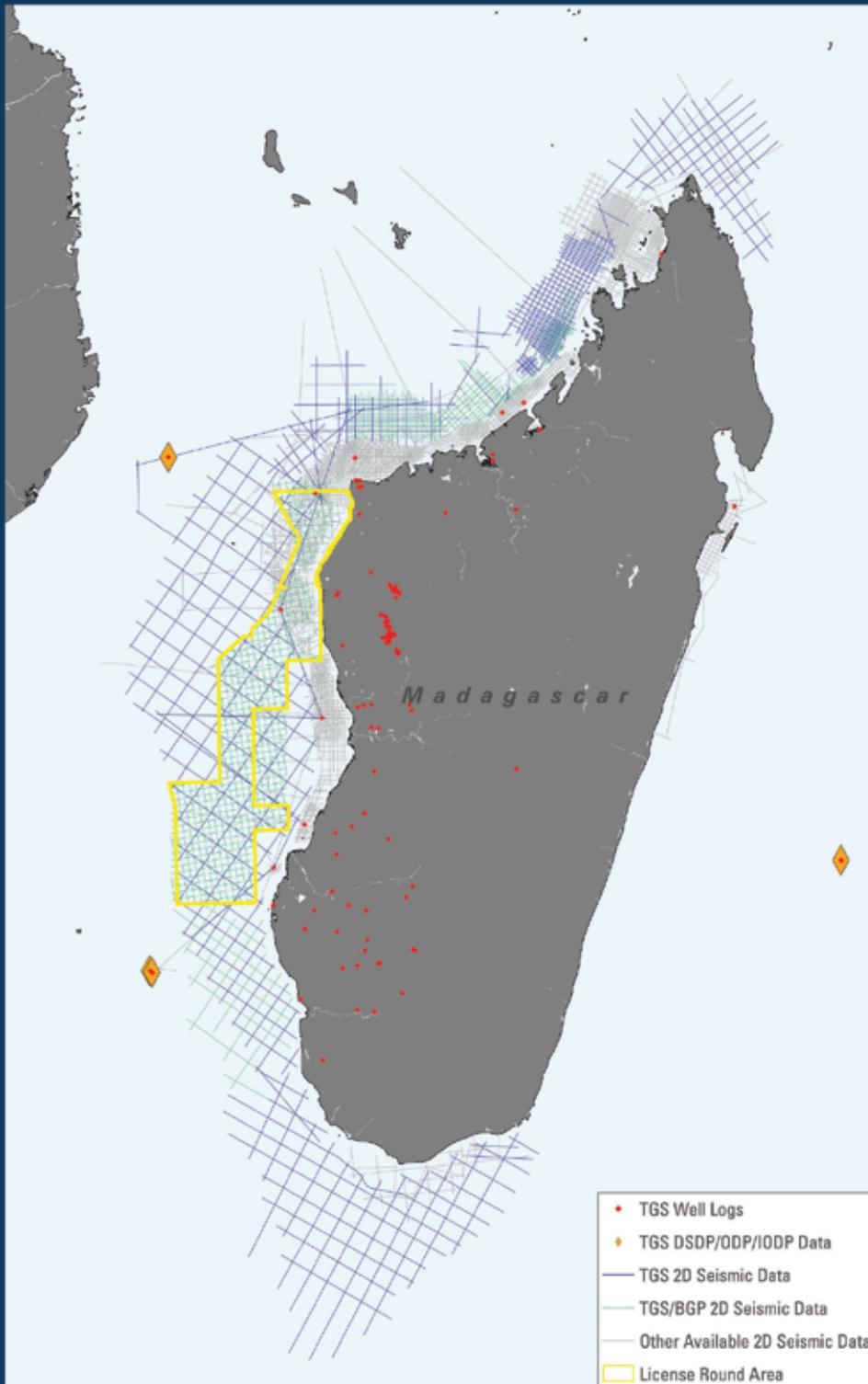
A journal of subsurface characterization



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

Explore Madagascar's open acreage

Let the bidding commence!



OMNIS, in partnership with TGS and BGP, are pleased to announce the opening of a Madagascar 2018-2019 Licensing Round.

Exploration in Madagascar began in the early 1900s with the discovery of hydrocarbon-rich sedimentary basins in the west, including the Tsimiroro heavy oil field and the Bemolanga tar sands. In spite of more than 100 years of exploration, the offshore of this frontier region remains largely under-explored. The Island shares a maritime boundary with Mozambique, a hydrocarbon province where large quantities of natural gas have been discovered.

Studies conducted on new data, in collaboration with TGS and BGP, suggest there is significant potential for future discoveries offshore.

Highlights:

- **Blocks:** 44 offshore blocks in the Morondava Basin, located on the western margin of Madagascar
- **Timing:** The Licensing Round will run from 7 November 2018 until 30 May 2019
- **Roadshows:** Will be held in Houston on Tuesday 19 February 2019, and in London on Tuesday 26 February 2019
- **Data access:** Existing seismic, gravity/magnetic and well data will be available for viewing via physical data rooms held at the TGS offices, in London and Houston; data packages will also be made available for clients

For more information:

info@madagascarlicensinground2018.com
www.madagascarlicensinground2018.com





PETERS



DUVAL



CAUGHEY



JONES



WICKSTROM



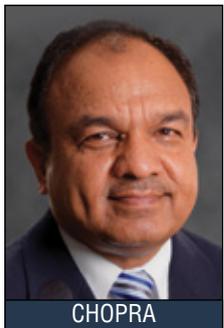
MARFURT



AL-GHAMDI



BRITTENHAM



CHOPRA



CURTIS



LAUBACH



MEDVIN



NEMETH



RYNOTT



TRIVEDI



WILLIAMS

Honoring the Best of AAPG

Kenneth Peters is this year's recipient of the Association's highest honor, the AAPG Sidney Powers Memorial Award.

Peters is an Honorary Member and is being honored for his foundational work in organic geochemistry and his advancement of petroleum geology's understanding of source rocks.

Peters works for Schlumberger as a geochemistry adviser. He has 40 years' experience with Chevron, Mobil, ExxonMobil and the U.S. Geological Survey, as well as Schlumberger. He has published more than 165 books and papers on geoscience, and he is an adjunct professor in the Stanford University Basin and Petroleum System Modeling Industrial Affiliates Program.

AAPG Honorary Member **Bernard Duval** joins him at the top of the awardees list as this year's Michel T. Halbouty Outstanding Leadership Award recipient.

As head of the Total Exploration and Production Scientific and Technical Center in France, Duval organized numerous research and development studies, the focuses of which included the sedimentology of deltaic systems, promotion of an early use of outcrop to field analysis, and stratigraphic-geochemical modeling, all of which led to direct applications and considerable reserves additions.

Duval's leadership, breadth of knowledge and clarity in communication are widely acknowledged as a major factor in Total's exploration success over the years.

Chuck Caughey is the recipient of this year's Vlastimila "Vlasta" Dvořáková International Ambassador Service Award. This award is given to those who have promoted growth and awareness of the AAPG organization internationally, outside the United States, and created opportunities for the Association to reach a wider audience of geoscientists worldwide. Caughey is being honored for his leadership role in promoting and organizing international events and for establishing greater connections and collaborations between regional professional and academic societies and AAPG.

Peters, Duval and Caughey will be recognized, along with the rest of the AAPG award winners, at the opening session of the 2019 AAPG Annual Convention and Exhibition in San Antonio, Texas, set for May 19-22

AAPG awards, approved by the Executive Committee, are presented



HONORS AND AWARDS

annually to recognize individuals for service to the profession, the science, the Association and the public.

Biographies and citations of all award winners will be included in a future AAPG BULLETIN.

The rest of this year's AAPG awardees are:

Honorary Member Award

Presented to Members who have distinguished themselves by their accomplishments and through their service to the profession of petroleum geology and to AAPG.

- ☐ **Kevin Bohacs**, ExxonMobil Upstream Research Center, Houston.
- ☐ **Larry Jones**, Spartan Petroleum Corp., Houston.
- ☐ **Larry Wickstrom**, Wickstrom Geoscience, LLC, Johnstown, Ohio.

Norman H. Foster Outstanding Explorer Award

Presented to Members in recognition of distinguished and outstanding achievement in exploration for petroleum or mineral resources, with an intended emphasis on recent discovery.

- ☐ **Chengzao Jia**, PetroChina Company Limited, Beijing, China, honored for his great contribution in significant petroleum discoveries, as an outstanding and visionary leader on lithostratigraphic reservoir exploration in China and for his seminal contribution to the giant discovery of the Kela-2 gas field in the foreland thrust and fold belts of northern Tarim Basin, China.

Robert R. Berg

Outstanding Research Award

Presented to honor a singular achievement in petroleum geoscience research.

- ☐ **Kurt Marfurt**, University of Oklahoma, Norman, Okla., honored for his research in the development and calibration of new seismic attributes to aid in seismic processing, seismic interpretation, and reservoir characterization.

Distinguished Service Award

Presented to those who have distinguished themselves in singular and beneficial long-term service to AAPG.

This year there are 10 recipients of the honor:

- ☐ **Ibrahim A. Al-Ghamdi**, Saudi Aramco, Dhahran, Saudi Arabia.
- ☐ **Marvin Brittenham**, retired, Encana, Parker, Colo.
- ☐ **Satinder Chopra**, TGS, Calgary, Canada.
- ☐ **John Curtis**, Colorado School of Mines, Englewood, Colo.
- ☐ **Stephen Laubach**, the University of Texas at Austin, Austin, Texas.
- ☐ **Evelyn Medvin**, Core Laboratories, Houston.
- ☐ **Kenneth Nemeth**, retired, Schlumberger (posthumous).
- ☐ **Tim Rynott**, Ridge Resources LLC, Durango, Colo.
- ☐ **K. B. Trivedi**, PetroSA, Cape Town, South Africa
- ☐ **John T. Williams**, Petrolog Inc., Ventura, Calif.

Grover E. Murray

Distinguished Educator Award

Presented for distinguished and outstanding contributions to geological education, both at the university level and toward education of the general public.

- ☐ **Michael Grammer**, Oklahoma State University, Stillwater, Okla.
- ☐ **Kathleen Marsaglia**, California State University, Northridge, Calif.

Harrison Schmitt Award

Presented to recognize individuals or organizations that, for a variety of reasons, do not qualify for other Association honors or awards.

- ☐ **Edward A. Merewether**, for providing the framework that generations of geologists have based their work on with regard to the geology of the Western Interior of the United States, concentrating on the stratigraphy and framework of the Cretaceous.

Public Service Award

Presented to recognize contributions of AAPG Members to public affairs – and intended to encourage such activities.

- ☐ **Timothy Elam**, retired, Chevron, San Ramon, Calif., honored for his fundraising and tireless efforts to improve the outreach programs of the Buena Vista Museum of Natural History.

Pioneer Award

Presented to long-standing Members who have contributed to the Association and who have made meaningful contributions to the science of geology.

- ☐ **Janel Edman**, Edman Geochemical Consulting, Denver, Colo., honored for her outstanding career of bridging scientific theory with practical understanding and application and her selfless dedication to advancing the science and economic success of petroleum geology and exploration.

Geosciences in the Media Award

Presented for notable journalistic achievement in any medium, which contributes to public understanding of geology, energy resources or the technology of oil and gas exploration.

- ☐ **Aaron Harber**, Aaron Harber TV Show, Denver, Colo., honored for the Aaron Harber Show's "Energy Roundtable Summit" educational series.



MARSAGLIA



ELAM



EDMAN



HARBER



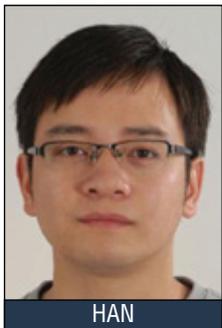
AFOLAYAN



LOW



RUNDOLPH



HAN

Young Professional Exemplary Service Award

Presented to Members who have promoted growth, awareness and expanded opportunities within the organization for Young Professionals.

☐ **Olaturbosan Afolayan**, Shell Nigeria Exploration and Production Company, Lagos, Nigeria, Africa, honored for her leadership and service for AAPG in the Africa Region.

☐ **Wan Ching Low**, Petronas, Kuala Lumpur, Malaysia, honored for her service and leadership within AAPG Asia Pacific Region.

☐ **James "Hunter" Lockhart II**, BHP Billiton, Houston, honored for his service and leadership within AAPG's Gulf Coast Section.

Wallace E. Pratt Memorial Award

Presented to honor and reward the author(s) of the best AAPG BULLETIN article published each calendar year.

☐ **Kurt W. Rudolph** and **Frank J. Goulding**, for "Benchmarking exploration predictions and performance using 20+ yr of drilling results: One company's experience" (February 2017 AAPG Bulletin).

J.C. "Cam" Sproule Memorial Award

Presented to recognize and reward younger authors of papers applicable to petroleum geology.

☐ **Yuanjia Han, Brian Horsfield, Richard Wirth, Nicolaj Mahlstedt and Sylvain Bernard** for "Oil retention and porosity evolution in organic-rich shales" (AAPG BULLETIN, June 2017).

John W. Shelton Search and Discovery Award

Presented in recognition of the best contribution to the "Search and Discovery" website in the past year.

☐ **Michael Grammer, Jim Karsten, Dennis Prezbindowski, Benjamin Dattilo and Jonathan Havens** for "Reservoir Characterization and 3D Modeling of Silurian Reef Slopes: Pipe Creek Jr. Quarry, Grant County, Indiana, #51440 (2017)" (Presented at the 2017 AAPG Eastern Section 46th Annual Meeting, Morgantown, W. Va., Sept. 24-27, 2017).

SEG/AAPG Best Paper In Interpretation Award

Presented in recognition of the best contribution to the new SEG/AAPG journal, "Interpretation."

☐ **Rui Zhang and Sergey Fomel** for "Time-variant wavelet extraction with a local-attribute-based time-frequency decomposition for seismic inversion" (Feb. 2017).

George C. Matson Award

Presented to honor and reward the best oral presentation at the 2018 AAPG Annual Convention and Exhibition in Salt Lake City.

☐ **Ayrat Gizzatov** for "Interaction of Surfactants at Nanoscale with Water-Wet and Oil-Wet Calcite Surfaces at Reservoir Conditions."

Jules Braunstein Memorial Award

Presented to honor and reward the best poster presentation at the 2018 AAPG Annual Convention and Exhibition in Salt Lake City.

☐ **Toti Larson, Benjamin P. Smith and Nick Ettinger**, for "From Carbonate Factory Collapse to Recovery: Insights Through Box Modeling of Carbon Isotope Excursions of Oceanic Anoxic Events (OAEs)."

(Editor's Note: Award winners' portraits are included according to availability.)



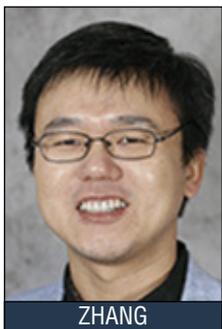
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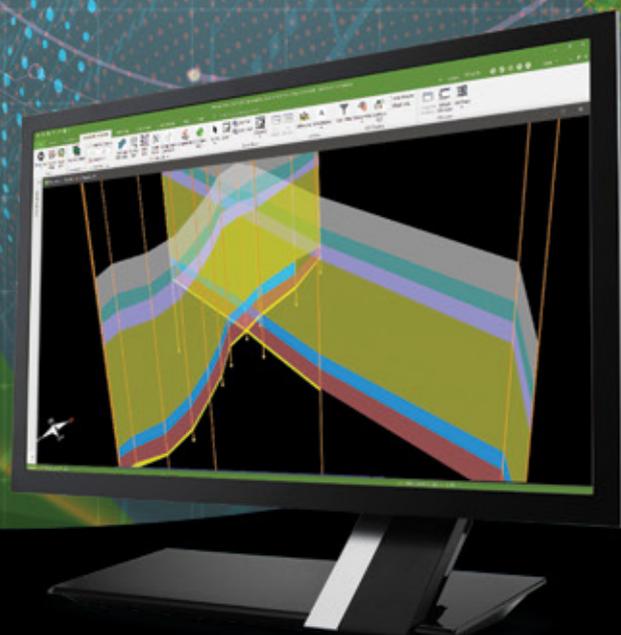


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Moving Forward



NeuraSection's evolutionary touch

Experience the newest features in NeuraSection. The revamped NeuraSection has been built around intuitive graphic visuals that use touchscreen technology, while reducing lengthy menus that hide features and slow productivity. NeuraSection helps you identify your needs faster so that you can improve your productivity.

Follow us and see how we are turning paper into petroleum.



Africa's Ongoing Oil Boom

Steadily and quietly over the past decade, Africa has emerged as the world's leading playground for oil and gas exploration.

Well, maybe not so quietly.

"It's quite an exceptional exploration record, really. There were 25 giant exploration discoveries over the past 10 years, more than anywhere else in the world. You can't argue with that," said Adam Pollard, senior research analyst in Edinburgh for Wood Mackenzie's sub-Saharan Africa upstream team.

From significant oil and gas discoveries in west Africa to trillion-cubic-foot natural gas plays offshore and onshore east Africa to the huge Zohr gas field find in the Mediterranean north of Egypt, explorers have notched success after success on the continent.

Now it's clear that the industry considers Africa a premier target for exploration drilling.

According to a recent report from Wood Mackenzie, giant African discoveries – finds of 500 million barrels of oil equivalent or more – are dominated by multi-tcf gas fields in the waters of Mozambique and Tanzania, Atlantic Margin play openers off Senegal and Mauritania, deepwater giants in Nigeria and pre-salt reserves offshore Congo and Angola.

Land of Opportunity

Pollard noted this string of successes points up the continued prospectivity of deepwater sub-Saharan Africa, still strong 40 years after Phillips Petroleum's first deepwater well offshore Ghana. But success isn't inevitable, he warned.

Following the industry's steep downturn, "deepwater Africa is starting to look attractive again" despite a few recent disappointing wells, Pollard said.

"At the end of the day, these are quite frontier basins without the highest chances of success," he observed.

Many African basins are relatively underexplored, however, and low entry costs in the frontier areas make sub-Saharan Africa an excellent prospect for explorers large and small, he said.

After years of exploration and production activity, industry infrastructure in Africa is good, Pollard noted. Coming out of a downturn, "it's quite easy to get hold of a rig these days," he said.

Availability of bid acreage also favors Africa at this point, Pollard noted. Oil majors alone have picked up more than 140,000 square kilometers of African offshore acreage in the past 12 months, according to Wood Mackenzie.

"There's a continuing acreage reload. And there are still some high-profile wells planned, offshore Namibia, offshore South Africa, off Guinea-Bissau," Pollard said.

"There seems to be a whole host of acreage coming up in bid rounds. There are 12 countries that have either recently launched a bid round or plan to soon," he observed.

According to the Angolan press, the country's minister of natural resources and minerals has announced that Angola expects to issue a new licensing round for onshore and offshore petroleum blocks in 2019, and "Senegal plans to launch a new bid round, with a new petroleum code," Pollard noted.

Challenges to Monetization

Despite the continent's record of exploration success, players in Africa have faced an enormous challenge in moving from discovery to production and resource monetization, he said.

"Converting volume into value is undoubtedly sub-Saharan Africa's Achilles heel," Pollard said.

"A lot of what they've discovered in the past few years has been gas, and that has additional difficulties in terms of monetizing it," he explained. "It's typically the lack of a local market and the high cost of export that get in the way."

Out of the 25 giant field discoveries in Africa during the past 10 years, 14 have not reached commercial status, according to Wood Mackenzie. Pollard said companies have relinquished a number of big gas discoveries in West Africa.

Typically, it takes 10 years or more from a substantial discovery in Africa to beginning of commercial production, he said.

Liquefied natural gas export projects were expected to ease the situation but funding has been tight and progress slow. Eni's Nene Marine oil and gas discovery in shallow water offshore the Republic of the Congo is a rare exception to the production hold-ups, coming onstream at the end of 2014, according to Wood Mackenzie.

In other areas, Cairn Energy intends to make a final investment decision on its SNE field development project offshore Senegal early in 2019, according to press reports. Also, plans for developing the Tortue fields straddling the offshore waters of Senegal and Mauritania have advanced this year.

"Mozambique's giant gas fields will underpin multi-billion-dollar projects. Eni and Anadarko have already cashed out US\$7 billion from farm-down deals" in Africa, Wood Mackenzie reported.

"Yet, similar fields over the border in Tanzania have made no progress and will likely miss the next LNG window of opportunity," it noted.

Some of the problems with natural gas monetization in Africa came from concession and lease terms that were not conducive to commercial development, Pollard said.

"In Angola it was okay if you discovered oil, but gas was a non-starter. They've since addressed that," he said.

"The Angolans have done quite a bit of work to make some reforms around fiscal terms. I think we'll see other countries do the same thing as they begin to realize they have to compete much more for investment," he predicted.

Planned Development

Total announced initiation of its Angolan Kaombo development in November. Located 260 kilometers offshore the country's capital of Luanda, Kaombo is the biggest offshore development in Angola.

An initial floating production storage and offloading vessel, Kaombo Norte, came onstream in July with a production capacity of 115,000 barrels of oil per day, Total reported. Start-up of a second FPSO of similar capacity, Kaombo Sul, is expected next year. Associated gas will be exported to an Angola LNG plant.

Explorers hope for attractive emerging plays in more than a half-dozen basin areas of Africa, including the Kwanza basin off Angola, the offshore Senegal and Sierra-Leone basins, the Rovuma basin off Mozambique, and onshore areas in Kenya, Uganda and Niger.

"In east Africa it's more of a development picture. Eni and Exxon have picked up acreage offshore Mozambique, south of where the big gas discoveries are," Pollard said.

For recent development efforts in Mozambique "trying to secure funding and

gas sales there has taken several years," he noted. Given that picture, an exploration strategy seeking additional major gas discoveries might be questionable, he added.

In north Africa, "Total and Eni are in talks to explore offshore Algeria, which is something new. The geology in the north of Algeria is quite different from the south," Pollard noted.

Algeria's state oil company, Sonatrach, signed two agreements with the companies in October that include an exclusive partnership for offshore exploration in the country.

"What they're likely to find offshore in the Med may be more similar to what's been found offshore Libya," Pollard said.

And Egypt also shows continued promise, following the giant Zohr gas field discovery offshore and attractive Nile Delta prospects, he noted.

As the oil and gas industry has emerged from the financial constraints of its recent downturn, companies have increasingly sought exploration opportunities in Africa, Pollard observed.

No matter what happens in the next 10 years, "sub-Saharan Africa will remain at the center of global exploration," he said. **E**



POLLARD



69th Annual Gulf Coast Association of Geological Societies 2019 GCAGS Convention

October 23-25, Marriott Westchase, Houston

Hosted by the Houston Geological Society and the GCSSEPM

General Chair: Mike Erpenbeck, Vice Chair: Larry Bartell, GCAGS President: Deborah Sacrey

Submit an Oral or Poster Abstract by March 4, 2019

Convention Themes

- 1. Unconventional GOM Mudrocks and Shale Plays**
Austin Chalk, Eagle Ford, Haynesville, Eaglebine and other plays
- 2. Onshore GOM Conventional Plays, Discoveries, and Case Studies**
Louisiana and Texas Wilcox, Miocene, Yegua, and other trends
- 3. Offshore GOM Exploration and Production Studies**
Cretaceous, Miocene, Deepwater Wilcox Plays, Risking, and Dry Hole Evaluation
- 4. Over the Border: Mexico Geology and Exploration, and Caribbean Exploration**
Mexico, Cuba, Belize, Trinidad, Offshore Central America, Regional Studies
- 5. Structural Geology, Gravity, and Magnetic Case Studies**
Ground Penetrating Radar Imaging, Use of Drones, and Lidar Imaging
- 6. Gulf Coast Environmental Geology**
Subsidence & Flooding Impact, Groundwater Quality, Public Education Outreach, Environmental Studies, and Professional Licensing
- 7. Petroleum Engineers and Geologists Working Together for a Better Answer**
Estimating Reserves, GeoModeling, Economics, Waterflooding, and Permeability Enhancement
- 8. Seismic Technology and Salt Tectonics**
Depth Migration, Subsalt Processing, AVO, Seismic Attributes, and Shallow Hazards
- 9. Understanding Big Data and Computer Aided Interpretation**
Machine Learning, Visualization, Augmented Intelligence, and Pattern Recognition
- 10. The Road to Business Success**
Deals, Financing, Starting Own Company, Young Professional Careers, and Consulting

2019 Convention Oral and Poster abstracts of up to 300 words must be submitted to the Technical Chair, Linda Sternbach, by March 4, 2019.

Send abstract and contact info in a Word document to linda.sternbach@gcagshouston.com.

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If you'd like to publish in the *GCAGS Journal*, the peer-reviewed journal of Gulf Coast geoscience, submit an extended abstract of at least 600 words, including 1-2 representative figures, to the *GCAGS Journal* Editor, Robert Merrill (rmerrill@catheart.com) by December 15, 2018.

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What Does the Election Outcome Mean for the Oil Industry?



MEDLOCK

“When you have a divided Congress, it’s hard to imagine anything substantive shifting.”

November’s midterm elections in the United States brought a split decision and gave the country a divided Congress.

The potential effect of the vote on the oil and gas industry and U.S. energy policy is also a toss-up, according to Kenneth Medlock III.

“That’s an open question at this point. It’s difficult to say, to be honest. It can go two ways,” he said.

Medlock serves as senior director of the Center for Energy Studies at the Baker Institute for Public Policy in Houston, as well as an adjunct professor and lecturer in the Economics Department at Rice University.

After the Democratic Party secured a comfortable majority of seats in the House of Representatives, one possible outcome is for Democrats to launch intensive investigations of President Donald Trump’s executive actions and of activities in the Republican-controlled Senate, Medlock said.

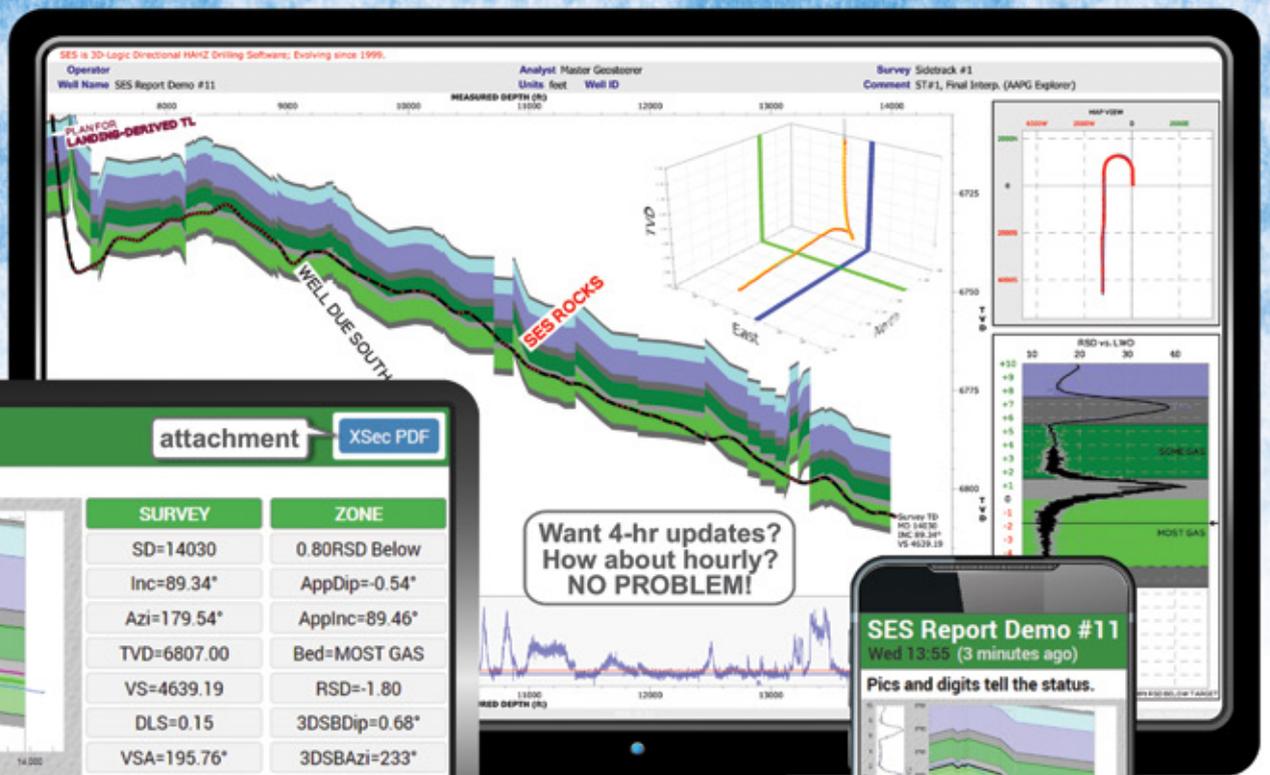
“You can see if the Democrats use ‘the power of the subpoena,’ things could get nasty over the next couple of years,” he noted.

Medlock said he would feel personally disappointed if inter-party squabbles dominate the next two years of U.S. politics, because Congress would have wasted a chance to form bipartisan alliances and forge a more united government.

Continued on next page ▶

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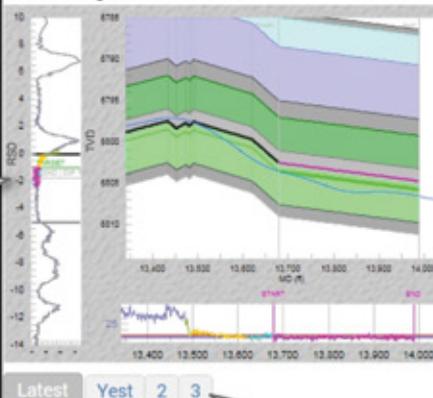
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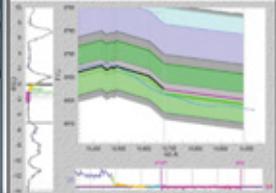
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Energy Independence and Global Warming

“If you take the optimist’s view, you can get to some progress and that would be an infrastructure bill,” he said. “A lot of people are talking about an infrastructure package, which could be beneficial to the oil and gas industry and the electric energy business.”

Action on an infrastructure measure would most likely be especially good for midstream investment, for pipelines and energy transmission, Medlock observed.

Two other areas likely to be affected by the Democrat’s new House majority are regulatory reform and climate change discussions, he said.

“The anti-oil and gas-rhetoric could increase, especially given the anti-regulation efforts of the Trump White House over the past couple of years,” he said.

Climate change has been almost ignored as an issue by the Trump administration and the Republican-controlled Congress during the past two years. Medlock expects that to change in 2019.

“In the House at the committee level, there will be a lot of movement on the climate front,” he predicted. “You’ve already heard some conversations about hearings over the withdrawal from the Paris climate accord, and the Clean Power Plan, and things like that,” he said.

In addition, some Democrats have talked about bringing back and reinvigorating the House Select Committee on Energy Independence and Global Warming, to raise the profile of climate change as a legislative issue.

State-level Measures

In the United States, initial regulatory power over the oil and gas industry generally resides at the state level. A number of measures affecting the industry were on state ballots during the midterm election, and results there also were mixed.

The most closely watched state proposals probably were an effort to ban offshore drilling in Florida’s state waters, an initiative to introduce a carbon tax in the state of Washington, a well-setback proposition in Colorado and two renewal-energy ballot questions in Arizona and Nevada.

In Florida, voters approved state Amendment 9 by almost 69 percent, according to posted results, easily meeting the supermajority requirement of more than 60-percent approval. The amendment bans drilling for oil or natural gas in the state’s territorial waters.

Environmentalists strongly supported the proposal, but many observers said endorsement by the state’s tourism industry and lingering memories of the Deepwater Horizon oil spill likely led to the high approval margin.

Nationally, Amendment 9 probably was best known as a strange hybrid that combined a ban on offshore drilling with a ban on electronic-cigarette vaping in workplaces.

Voters in Washington state rejected Initiative 1631, which would have put a tax of \$15 per metric ton on carbon emissions, beginning in 2020 and increasing by \$2/metric ton per year.

The ballot question generally drew opposition from the oil and gas industry, and an editorial in the Seattle Times newspaper urged a “No” vote. A coalition of environmentalists, unions, health advocates and billionaires Michael Bloomberg, Tom Steyer and Bill Gates supported the initiative.

Colorado voters defeated Proposition 112. The measure would have required most new oil and gas wells to be at least 2,500 feet from homes and other occupied buildings, except on federal land.

Opposition was led by the Colorado Oil

and Gas Association.

“We appreciate our fellow Coloradans’ support for responsible energy development. This measure was an extreme proposal that would have had devastating impacts across the state on jobs, education and numerous other programs important to each of us,” said Chip Rimer, chair of COGA’s board and senior vice president of global services at Noble Energy.

Proposition 127, a renewable energy initiative, was defeated by Arizona voters by almost 69 percent. The proposal would have increased Arizona’s renewable portfolio standards each year until reaching 50 percent in 2030. Opposition came mostly from the electric utility industry.

Ballotpedia estimated that almost \$55 million was raised between the support and opposition campaigns on Proposition 127, a total that made it the most expensive ballot proposition in the state’s history.

Nevada voters passed renewable-

energy initiative Question 6 by more than 59 percent, calling for electric utilities to generate half of their electricity from renewable sources by 2030. Nevada’s current RPS is 25 percent of electricity from renewables by 2025.

Ballotpedia noted that initiated constitutional amendments in Nevada have to be approved in two even-numbered election years to become effective, so Question 6 would need to be approved again in 2020 to amend the state constitution.

Stalemate, Not Checkmate

At the national level, several groups are pushing carbon-tax plans and a number of carbon fee-related bills have already been introduced in Congress, without success. Medlock thinks the odds of a federal carbon tax being approved remain slim.

“There is momentum gaining for passing a carbon tax, but I don’t see that happening”

during the next two years, he said.

“If you can’t get sufficient support on a carbon-tax measure in an environmentally-oriented state like Washington, the chance of getting a carbon tax passed at the federal level is not that good,” Medlock noted.

And he called Florida’s vote to ban offshore exploration in state waters “a paper tiger, because nothing is going on there anyway.”

The most probable effect from the midterm vote is some form of continued, overall congressional gridlock, Medlock said, with political factions more likely to reach stalemate than checkmate.

“It’s almost in a lot of ways laissez-faire: Let the market figure it out. It’s hard to imagine the pendulum swinging so far that we aren’t in the same place two years from now,” Medlock observed.

“When you have a divided Congress,” he said, “it’s hard to imagine anything substantive shifting.” 

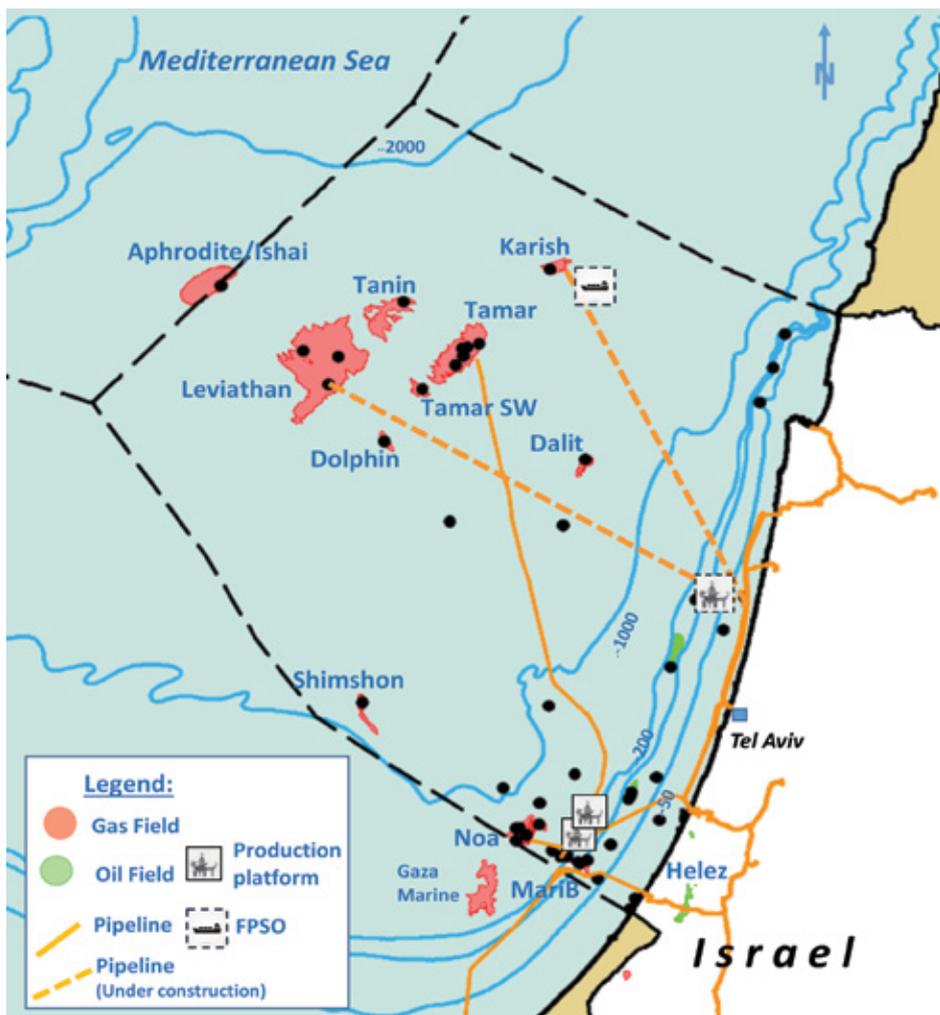
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The Israeli Gas Revolution and the Emergence of the Eastern Mediterranean Gas Province



Gas fields and infrastructures offshore Israel. The Leviathan and Karish production facilities are under construction.

An old joke used to be told in Israel: Why did Moses so unwittingly lead the Jewish people to the land of milk and honey and not to one of its petroleum-rich neighbors?

Not anymore. In the last decade, giant gas fields have been discovered in the Eastern Mediterranean Sea offshore Israel, and offshore gas is rapidly becoming the main source of energy for power generation. Today, Israel generates 65 percent of its electricity from gas and is planning to increase that to 90 percent. In an unexpected turn of events, gas will soon be exported from Israel to the nearby Arab countries of Jordan and oil and gas-rich Egypt.

This gas revolution is a driving force in the development of the entire Eastern Mediterranean Sea, where more gas discoveries were recently found offshore Egypt and Cyprus. Israel set the development of hydrocarbon resources as a cornerstone of its energy policy, and in November 2018 announced the second bid round for exploration licenses in its economic water.

History of Hydrocarbons

Hydrocarbon production in Israel dates back to the mid-1950s when oil was found in the Helez field in the coastal plain, some 70 kilometers south of Tel Aviv. At the time, this discovery was a source of great optimism for the young state with hopes to become another Middle Eastern oil emirate.

But, although some 18 MBBL of oil were since then produced, Helez remained the only significant hydrocarbon accumulation



Michael Gardosh is head of the Geology and Geophysics Department for the Natural Resources Administration of Israel's Ministry of Energy.

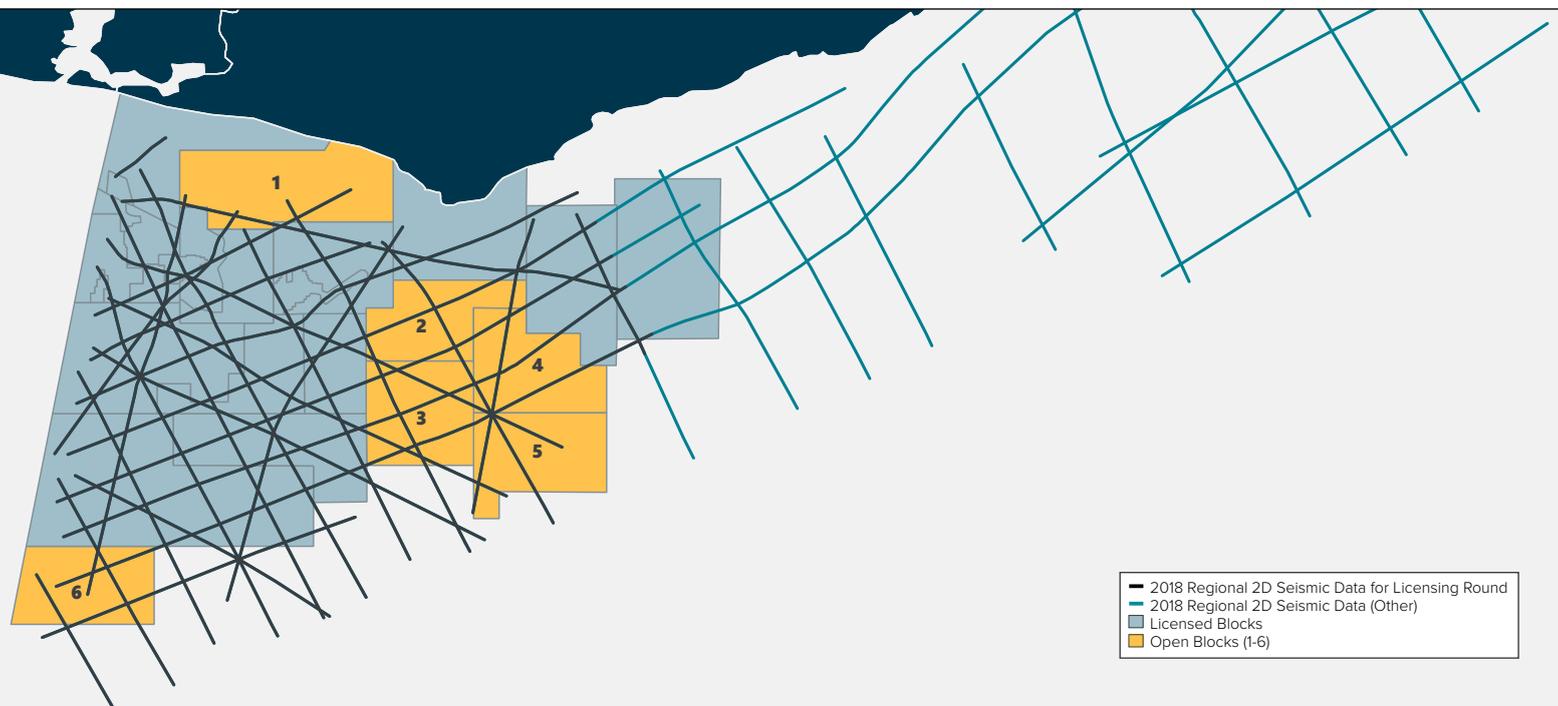
that was found, notwithstanding more than 40 years of continuous exploration efforts and 450 wells that were drilled onshore and offshore.

The turning point that led to the discovery of gas offshore took place in the late 1990s. Eli Rosenberg, a veteran of the Helez field, was studying the few wells that were drilled in the offshore during the 1970s and '80s, which were located in shallow water and targeted oil in deep Mesozoic structures. He came to the conclusion that they missed a different type of play in shallower stratigraphic units and deeper water.

Rosenberg identified in old 2-D seismic line a series of high-amplitude reflections above the vast, Messinian Evaporite layer, which resembled gas producing reservoirs in the Nile Delta of Egypt, some 300 kilometers to the west. He suspected these anomalies to be associated with gas-charged turbidite sands of Early Pliocene age. This novel gas play was never tested before in any of the wells drilled offshore Israel.

Rosenberg and his company, Avner Oil and Gas, joined the Israeli Delek Drilling and

Continued on next page ►



GHANA'S 2018 LICENSING ROUND

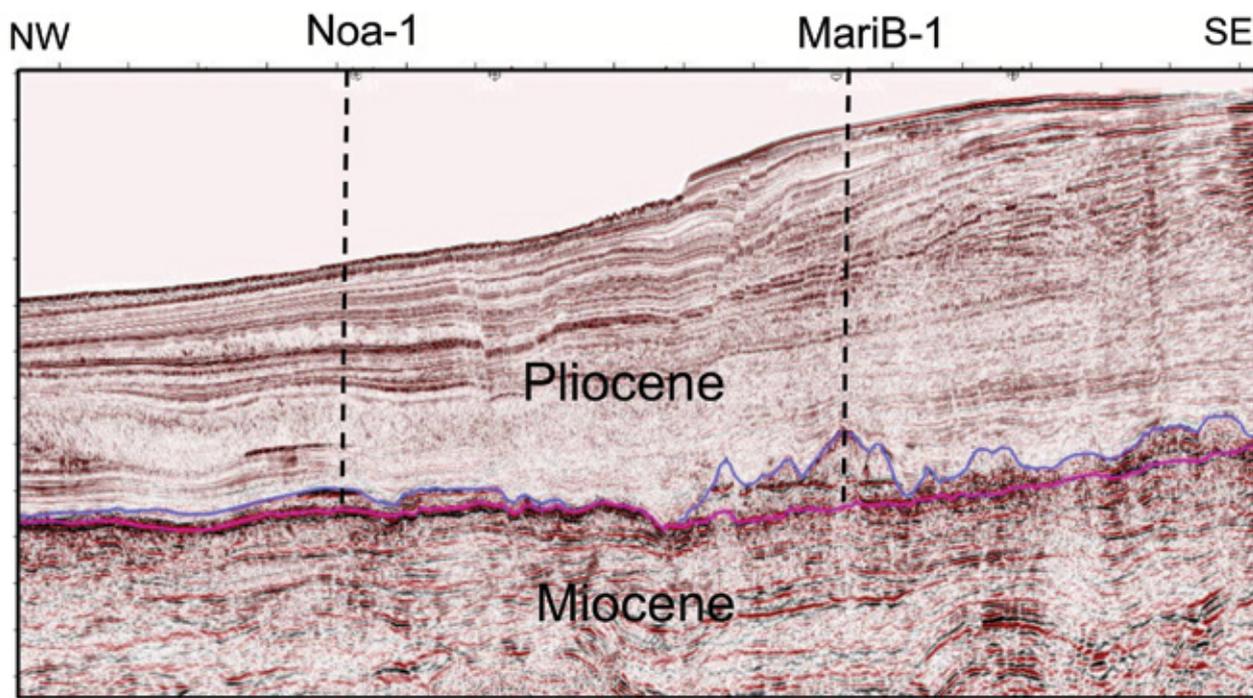
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Ghana's first licensing round is ongoing from Q4 2018 to Q3 2019, with the support of up to 3,800 km of the regional 2D seismic data (see map above). PSTM data is now available, PSDM expected February 2019. Contact us for more information:

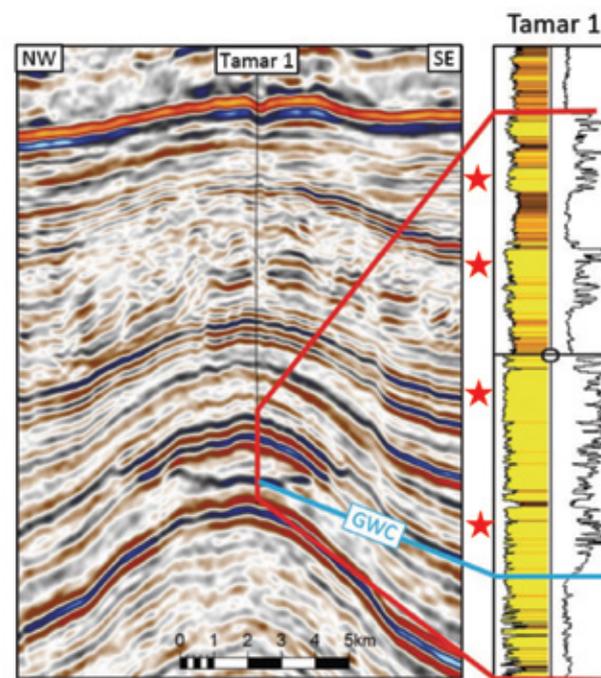
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Above left: A seismic profile showing the Noa-1 and the MariB-1 wells, the first gas discoveries offshore Israel. Note the high-amplitude anomalies in the Noa and MariB fields, located above the top of Messinian Evaporites (Pink marker).



Above right: A seismic profile showing the Tamar gas field and the gas-charged Tamar Sands in the Tamar-1 well (from Needham et al., 2017). Note the flat spot at the gas-water contact.

◀ Continued from previous page

the American-based Samedan Oil Co., later to become Noble Energy, to form the Tethys Sea Group. In 1999 the partnership drilled Noa-1 and in 2000 the MariB-1 wells; the first two gas discoveries offshore Israel. The reserves in the two fields were estimated at about 1.5 trillion cubic feet, enough to be commercially developed. In 2004 the MariB production platform, located about 25 kilometers off the coast, started to flow gas to Israel.

In the early 2000s another player was exploring in the Mediterranean Sea – the British multinational oil and gas company, BG Group. BG held several exploration permits offshore Israel and was shooting 33D seismic surveys on several attractive targets identified in regional 2-D seismic lines. One of these targets was a large four-way closure located some 80 kilometers west of the shoreline. The geology of this area was completely unknown. However, a conspicuous horizontal reflection that crossed the Tamar structure led BG geologists to believe that this “Flat Spot” is associated with gas-bearing sands below the thick, Messinian Evaporite layer. Plans to drill the Tamar structure were underway but the well, located in water depth of 1,700 meters, was estimated to be too risky and expensive and BG announced in 2005 that it was abandoning its stakes.

In came the Tethys Sea partners who purchased the BG share and joined Isramco and Dor Exploration to form the Tamar partnership. In late 2008, Noble Energy, the operator of the Tamar partnership, started to drill Tamar-1 and several months later discovered a large quantity of gas in turbidite sands of Upper Oligocene to Lower Miocene age named the Tamar Sands. The Tamar Sands play turned out to be an extremely productive target. This 200-300 meters-thick sand interval with excellent reservoir properties is widely distributed throughout the northern part of the Israeli EEZ where several large structures are found. Led by Noble Energy, exploration drilling into the Tamar Sands continued, resulting in five more discoveries between 2010 and 2013, including the giant Leviathan Field. The total amount of recoverable gas reserves in these fields is estimated to be in excess of 30 trillion cubic feet.

See Tamar field page 14 ▶

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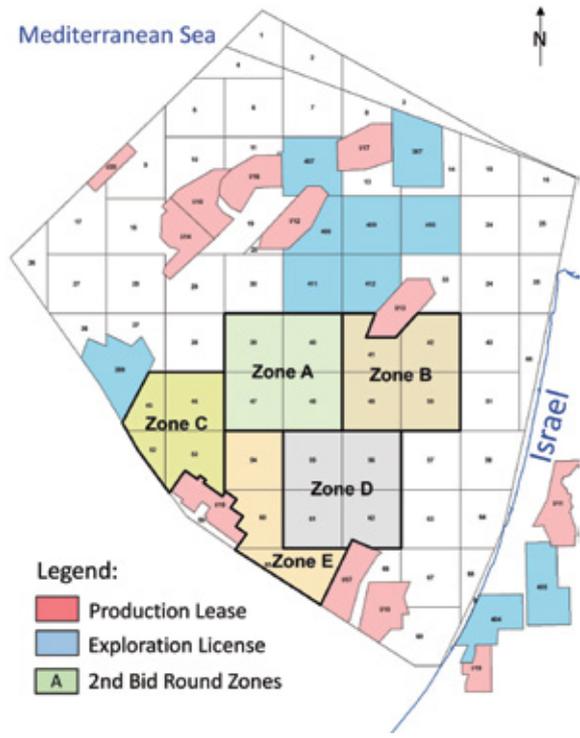
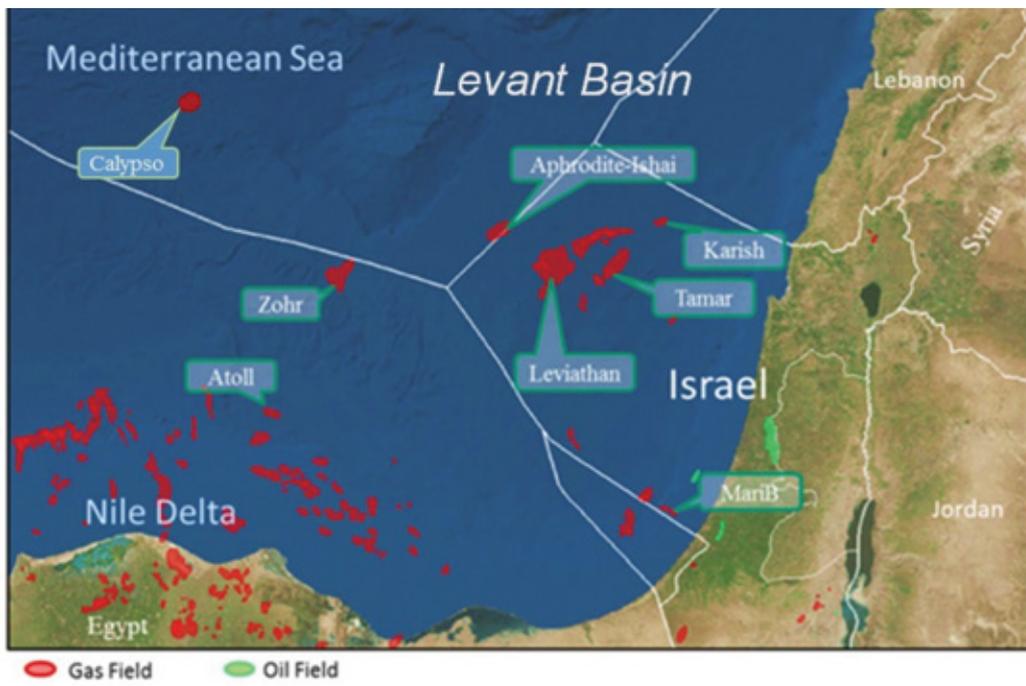
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Far left: Main gas fields discovered in the Eastern Mediterranean Levant Basin.

Left: A map showing the Israeli EEZ in the Mediterranean Sea, active leases and licenses and the five zones (A to E) offered for bidding in the second offshore bid round opened in November 2018.

Tamar field

from page 13

Ongoing Production

The newly found gas resources offshore Israel, although located in deepwater, are rapidly being developed. The Tamar field was connected to its production platform in early 2013, only 51 months after discovery, through a 150-kilometer long tie-back pipe – at the time the longest subsea flow line in the world. Tamar is now providing for all of Israel's domestic demand of close to 11 billion cubic meters annually. Gas from the Leviathan Field will start to flow to the shore in late 2019 and the Karish Field, now owned by Energean Oil & Gas, will be operated by a floating production facility that is planned to be installed in 2020-21.

Gas Exports

Gas from the Israeli fields will flow also to the surrounding Arab countries. Two contracts with the Jordanian National Electric Company and with an industrial facility near the Dead Sea, totaling 45 billion cubic meters of gas, were recently signed. Egypt, a major producer of gas is nevertheless in need of additional quantities for its growing domestic market and will import a total of 64 billion cubic meters from the Tamar and Leviathan fields. Two liquefied natural gas plants located in the Egyptian Nile Delta, one owned by Shell and the other by Union Fenosa, are an attractive option for export and negotiations are taking place to connect them with the Israeli gas fields.

Continued Exploration and Discovery

The activity offshore Israel was followed in 2015 with the discovery of the giant Zohr gas field by ENI in Egyptian waters in the northern extent of the Nile Delta and in early 2018 with the discovery of the Calypso gas field southwest of Cyprus. The gas was found in large carbonate buildups marking a new attractive play in this area. The Eastern Mediterranean, Levant Basin shared by Israel, Egypt, Cyprus and Lebanon is now becoming a global hotspot for exploration, driven through license offerings by all four countries. Israel just announced its second offshore bid round for five exploration zones located in the southern part of its economic water. Hopes are high that with the large quantities to be found in the Levant Basin the area will provide gas not only for the region but also to the European markets. Connecting the two areas requires the construction of the longest and deepest pipeline in the world but the prospects of having an additional source of gas are extremely appealing to the European Union leadership and feasibility studies on the East Mediterranean pipeline, carried out in cooperation between Israel, Cyprus, Greece and Italy are well underway. [E](#)

AAPG GLOBAL EVENTS

- Playmaker Forum - Midcontinent MoneyMaker**
Oklahoma City, Oklahoma | 4 April 2019
- Hedberg Conference - Hydrocarbon Microseepage: Recent Advances, New Applications, and Remaining Challenges**
Houston, Texas | 18-20 June 2019
The past two decades have seen not only a continued interest in the topic of hydrocarbon microseepage, but have resulted in ongoing development of new and novel exploration technologies and applications. These have led to improved integration of geochemistry with geology, geophysics, and remote sensing, and have resulted in more efficient exploration and development strategies.
- Short Course - Profitable Development of Shales**
Houston, Texas | 12 February 2019
This course follows the more modern approach of deemphasizing growth metrics and focusing on boosting return of capital, cash flow, and retaining cash to shareholders. The course will provide to the participants techniques, procedures, tool kits, and field case examples on how to further increase of production in a cost-effective way. Production growth can then be achieved with operation-generated cash flow.
- AAPG Geosciences Technology Workshop - CO₂ Opportunities Workshop: CO₂ for Enhanced Recovery and Sustainable Development**
Austin, Texas | March 2019
- AAPG Geosciences Technology Workshop - Unlocking Mexico's Offshore Potential**
Mexico City, Mexico | 6-7 March 2019
This two-day Geoscience Technology Workshop (GTW) will feature presentations and discussions related to appraisal and development in shallow water areas, exploration and production in deep water, enabling technologies for offshore activities, and best practices and lessons learned following Mexico's energy reform.
- Hedberg Conference - The Evolution of Petroleum Systems Analysis: Changing of the Guard from Late Mature Experts to Peak Generating Staff**
Houston, Texas | 4-6 March 2019
This Hedberg research conference will focus on the changes in petroleum systems analysis from the late 1970s to current day. The goal of this conference is to be a "passing of the torch" with an exchange of ideas from experienced specialists to young professionals. The attendees will be a mix of seasoned experts with a depth of knowledge and historical perspective, and exploration and development petroleum systems staff on the learning curve.
- AAPG Geosciences Technology Workshop - Boosting Reserves and Recovery Using Machine Learning and Analytics**
Houston, Texas | 16-17 January 2019
This machine learning and analytics workshop is unique in that it focuses on applied analytics with specific, powerful outcomes. These analytics are coupled with real-world operational knowledge. This workshop is ideal for large, small, and medium-sized operators, along with innovative start-ups.
- AAPG Geosciences Technology Workshop - Exploration and Development of Siliciclastic and Carbonate Reservoirs in the Eastern Mediterranean**
Tel Aviv, Israel | 25-27 February 2019
This two-day workshop aims to provide a broad platform for presenting and discussing the current understanding of petroleum geology in the region, encompass themes associated with the full life cycle of its plays and reservoirs, and provide an opportunity to integrate academia with industry across the Central and Eastern Mediterranean.
- AAPG Geosciences Technology Workshop - Recent Discoveries and Exploration and Development Opportunities in the Guiana Basin**
Paramaribo, Suriname | 5-7 November 2019
Don't miss this two-day Geoscience Technology Workshop (GTW) featuring presentations and discussions related to tectonic setting and prospectivity in the Guiana Basin, recent discoveries in Suriname, Guyana and French Guiana, best practices for development in emerging basins, data, and tools and technology to optimize offshore operations. Additionally, this GTW will go "beyond Guiana" and look at offshore exploration updates from throughout the region, and collaborative strategies for emerging hydrocarbon economies, via the government industry community.
- AAPG Geosciences Technology Workshop - Solutions for Appraisal and Development of Onshore and Offshore Fields**
Rio de Janeiro, Brazil | June 2019
An exciting two-day Geoscience Technology Workshop (GTW) that will feature presentations and discussions related to G&G, development, and production. The workshop is expected to have 50% geoscientists and 50% engineers in attendance. Final session themes to be determined.
- APPEX Global 2019**
London, United Kingdom | 5-7 March 2019
APPEX is the only truly global event focussed on prospecting, business transaction, and deal making for the oil and gas E&P sector – for prospects, properties, products, service providers, investors and all the decision-makers necessary to close a deal. APPEX 2019 is a two-and-a-half-day high intensity business environment that acts as a catalyst for deals to be struck and new ventures to be undertaken.

AAPG.org

AAPG to Hold First GTW in Israel in 2019

Due to the renewed interest in the Eastern Mediterranean owing to recent discoveries, Israel will see its first ever AAPG meeting early next year in Tel Aviv, Feb. 26-27, with the Geoscience Technology Workshop, "Exploration and Development of Siliciclastic and Carbonate Reservoirs in the Eastern Mediterranean"

Recent large gas discoveries offshore Israel, Cyprus and Egypt highlight the Eastern Mediterranean area as a hotspot for global exploration. This underexplored region is experiencing a resurgence of E&P activity, underlain by the emergence of new plays, both siliciclastic and carbonate. Petroleum geologists' understanding of the complex geology and different petroleum systems of the region, while studied for decades, is still evolving,

as new concepts are being tested, new data is being acquired and old data being revisited. Not unlike other regions, the development of discoveries here poses interesting challenges as well, with sources-to-markets spanning large distance and complex bathymetry, and high perceived entry costs.

This two-day workshop aims to provide a broad platform for presenting and discussing the current understanding of the petroleum geology of the region, encompassing themes associated with the full life cycle of its plays and reservoirs. It will also provide an opportunity to integrate academia with industry across the Central and Eastern Mediterranean, in a way that will help establish the region as a vibrant and prolific petroleum province.

AAPG will also hold a series of other GTWs elsewhere throughout the world this year and early next year:

► The "Shale Gas Evolution Symposium" will be held jointly by AAPG and the European Association of Geoscientists and Engineers in Manama, Bahrain, Dec. 11-13, 2018.

As the oil and gas industry emerges out of the downturn, and the world energy is at balance today between supply and demand, shale gas plays have become much more resilient and efficient in delivering unprecedented expectations of hydrocarbon supply. The shale gas producers and operators experienced the great challenge of lowering the cost of drilling and fracturing through

process optimization. The productivity of these formations continues to surprise the industry with its performance and sustainability of hydrocarbon production. Lowering the cost of production through innovative technologies and efficiency has validated the economic viability of shale gas plays.

► "Boosting Reserves and Recovery Using Machine Learning and Analytics," will be held in Houston, Jan. 16-17.

This machine learning and analytics workshop is unique in that it focuses on applied analytics with specific, powerful outcomes. These analytics are coupled with real-world operational knowledge. This workshop is ideal for large, small, and medium-sized operators, along with innovative start-ups.

► "Regional Variations in Charge Systems and the Impact on Petroleum Fluid Properties in Exploration" will be held in Dubai, United Arab Emirates, Feb. 11-13.

This three-day workshop will be dedicated to sharing knowledge, ideas and workflows related to predicting, characterizing and establishing fluid properties in exploration. The workshop will emphasize case studies and workflows which help delineate and mitigate for charge risk in exploration and appraisal. The ongoing exploration for hydrocarbons within the industry is increasingly moving toward targeting specific fluid types that fulfill explicit criteria within the framework of an exacting drilling program. An understanding of the controls on oil and gas phase and quality are essential in developing a predictive capability to help delineate areas of interest pre-drill and to fulfill discerning criteria for contemporary conventional and unconventional exploration plans. Charge systems analysis is a quantitative understanding of the formation, movement and alteration of petroleum fluids from the source interval, through carrier systems and into reservoir accumulations.

► "Unlocking Mexico's Offshore Potential" will be held in Mexico City, Mexico, March 6-7.

AAPG and the Mexican Association of Petroleum Geologists will jointly hold this GTW highlighting opportunities and best practices for exploration and production in the Gulf of Mexico. The two-day workshop features a series of technical presentations, panels, roundtable discussions and networking opportunities with leaders and experts from Pemex, Mexico's National Hydrocarbon Commission and companies operating in Mexico and throughout the region.

► "Gas Hydrates – From Potential Geohazard to Carbon-Efficient Fuel?" will be held in Auckland, New Zealand, April 15-17.

Natural gas hydrates have been studied extensively in the past three decades broadly, because they might constitute a geohazard, become an energy resource and play a role in climate change. The workshop will commence with an evening Icebreaker and continue the next two days, beginning with the latest developments in exploration methods as well as lessons learned from gas hydrate production tests. Geomechanical models and results from laboratory experiments will focus on hazards from gas hydrates to offshore installations.

► "The Art of Hydrocarbon Prediction: Managing Uncertainties" will be held in

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AAPG Geosciences Technology Workshop – 3rd Hydrocarbon Geothermal Cross Over Technology Workshop
 Geneva, Switzerland / 3-14 April 2019
 The Geothermal Cross Over Technology workshop will offer an exciting knowledge sharing and discussion platform where industry experts, country representatives, and academia can share their visions and perspectives on how the petroleum and geothermal industries can work together to create new opportunities to make geothermal energy exploration and production a reality.

AAPG Europe Regional Conference – Paratethys Petroleum Systems Between Central Europe and the Caspian Region
 Vienna, Austria / 26-27 March 2019
 This conference will concentrate on the petroleum systems of the Paratethys, from a hydrocarbon exploration and geoscience perspective. The geographic focus will be on the Pannonian, Black Sea, Caspian Sea basins, and various Alpine folded belts and their foredeep/foreland basins in the same region including the Alps, Carpathians, Balkans, Pontides, Crimea, and the Dnieper.

AAPG Geosciences Technology Workshop – Regional Variations in Charge Systems and the Impact on Petroleum Fluid Properties in Exploration
 Dubai, United Arab Emirates / 11-13 February 2019
 This three-day workshop will be dedicated to sharing knowledge, ideas and workflows related to predicting, characterizing and establishing fluid properties in exploration. The workshop will emphasize case studies and workflows which help delineate and mitigate for charge risk in exploration and appraisal.

AAPG/EAGE/MGS 4th Oil & Gas Conference – Myanmar: A Global Oil & Gas Hotspot: Unleashing the Petroleum Systems Potential
 Yangon, Myanmar / 13-15 November 2018
 Fourth in the series and continuing from our highly successful third geological conference in February 2017, AAPG, EAGE, and MGS are presenting another conference in Yangon, 13-15 November 2018. Exploration is still in the pre-drill phase, in other areas activities have progressed beyond first discoveries to an appraisal phase. As data is acquired, the understanding of the petroleum systems, both within industry and within academia, is enhanced and the full oil and gas potential is unleashed. This conference will provide the opportunity to understand the significant progress made over the last 20 months.

AAPG/EAGE Shale Gas Evolution Symposium
 Manama, Bahrain / 11-13 December 2018
 AAPG, EAGE, and SPE have joined forces to deliver the exciting and innovative Shale Gas Evolution Symposium. This two-and-a-half-day event will consist of oral presentations, high level keynote talks, poster presentations, and breakout sessions. The workshop will attract world experts in exploration, characterization, drilling, fracturing, and completion. Attendees will benefit from presentations on best practices and case studies about what the industry has learned from shale gas exploitation in recent years.

AAPG/EAGE Joint Workshop – Reducing Exploration Risk in Rift Basins
 Kuala Lumpur, Malaysia / 10-12 July 2019
 Exploration in many of the rift basins in the Asia Pacific Region have focused on the post-rift section. Much of the remaining exploration potential in these basins lies in the under-explored synrift section. The aim of this workshop will be to provide interpreters and decision makers with a better understanding of the fundamental petroleum system elements of rift basins to help them improve their exploration programs.

The Art of Hydrocarbon Prediction: Managing Uncertainties
 Bogor (Greater Jakarta), Indonesia / 7-8 August 2019
 The oil and gas industry will always face uncertainties. Managing uncertainties is a critical process as the industry increases cost efficiency, and the petroleum system condition continues to become more complex. Therefore, the integration of all subsurface uncertainties is crucial to achieve the best hydrocarbon prediction methods. Industry experts will gather to share their experiences and insights in understanding and managing these uncertainties from various play types in the Asia Pacific region and other surrounding areas.

AAPG Geosciences Technology Workshop – Gas Hydrates – From Potential Geohazard to Carbon-Efficient Fuel?
 Auckland, New Zealand / 15-17 April 2019
 This workshop, the third in New Zealand, aims at capturing the current state of research into gas hydrates and at projecting a way forward for mitigation of this potential geohazard and extraction of hydrates as a possible low-carbon energy resource. The workshop will feature latest developments in exploration and appraisal methods as well as lessons learned from gas hydrate production tests.

Geophysical Corner

Uncertainty in the Estimation of Volume of Shale from Well Log Data

Generally, the fine-grained shale rocks are found to be composed of 50 to 70 percent clay, anywhere between 25 to 40 percent silt- and clay-sized quartz, and 5 percent of minerals including feldspars and carbonates, comprising the total rock volume. A variety of techniques such as X-ray diffraction, infrared spectroscopy and electron microscopy are available, which help us understand the type of clay minerals present in a shale sample.

Usually, one comes across terms such as 'volume of shale (V_{shale})' and 'volume of clay (V_{clay})', especially in the calculations of water saturation in shale-bearing formations such as shaly sands. These are used interchangeably, assuming that they are the same, which they are not. The term V_{clay} is meant to refer to the clay mineral volume.

Using Gamma Ray Curves

Shale rocks contain naturally-occurring radioactive elements such as potassium, uranium and thorium and some others. While potassium isotope is present in abundance, uranium and thorium isotopes are found in lesser quantities. Gamma ray logging tools are used to detect the gamma ray emissions from formations containing the above-stated radioactive elements. The gamma ray logs curves are thus able to distinguish shale formations (with higher values) from others such as sandstones and carbonates. Not only that, gamma ray logs can also be used to determine the volume of shale present in a formation. Of course, there are other ways of computing the volume of shale from different well log curves, but gamma ray logs happen to be one of the methods, where gamma ray index is computed and is defined as $I_{GR} = (GR_{log} - GR_{min}) / (GR_{max} - GR_{min})$; I_{GR} represents gamma ray index, GR_{log} represents the gamma ray reading at any depth, GR_{min} represents the minimum gamma ray value which would correspond to clean sandstone, GR_{max} represents the maximum gamma ray value which would correspond to shale. The above calculation, when carried out for a shale volume, assumes first that the shale formation is composed of all clay, and second, that any increase from clean sandstone to shale is due to an increase of clay content only. Thus, one needs at least one or more points on a clean sand, and similarly some points on a real shale rock in the shale interval under investigation. In the absence of such values, the computation could fall apart.

As mentioned above, both these assumptions may not be satisfied in practice, and the result is an overestimation

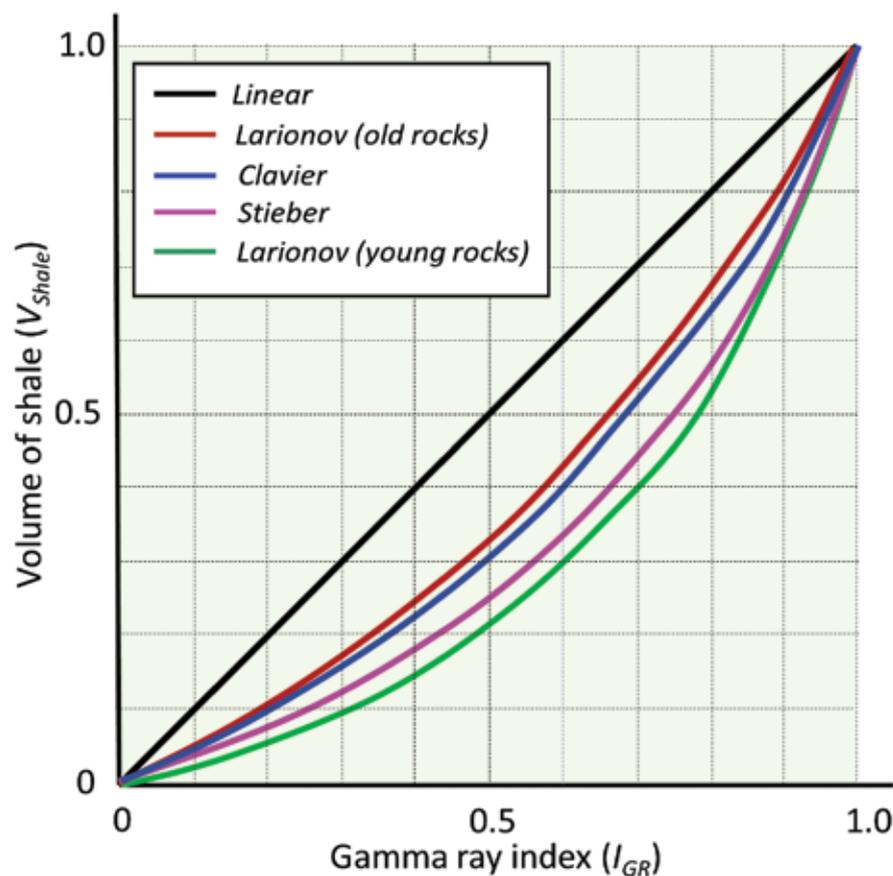


Figure 1: A crossplot showing the variation of the volume of shale as a function of gamma ray index. The solid black line is the linearly scaled data, the colored lines represent the different corrections applied to the data as shown in the legend.

of the volume of shale. In the interest of bringing in accuracy in such calculations, various linear and non-linear corrections have been suggested. Linear scaling of the volume of shale with a scaler that represents the average weight percent of clay in shale to non-linear corrections such as Larionov for tertiary (young) rocks or a similar correction for older rocks are in use.

The volume of shale can be scaled linearly with a scaler that represents the average weight percent of clay in shale. Empirical non-linear corrections have also been suggested by Larionov, one for



CHOPRA



SHARMA

Tertiary or younger rocks, and another one for older rocks. Some other corrections by Stieber and Clavier have also been proposed. All these corrections result in improved estimates in certain situations, but inaccuracies still show up in shaly sand formations. Besides, these empirical corrections have the drawback that they require other independent log curves or core data for calibration.

Figure 1 shows a general graphic that may be obtained if the volume of shale as determined from well log analysis were plotted against I_{GR} . The colored lines represent the different curves obtained

after the corrections proposed by Larionov, Stieber and Clavier are applied. When a linear scaler correction for the volume of clay is applied, the solid black line may be shifted to a similar line with a lower slope.

In figure 2, the sonic, density and gamma ray curves from a well in the Delaware Basin in west Texas and New Mexico in the United States, are shown in tracks 1, 2 and 3. The red curves show the input curves as such and the blue curves are their smoothed versions, which were used in the computations. In track 4, the computed volume of shale curve is shown in red, along with the scaled curve in blue and the curve with Stieber correction in black. Notice the large variations in these curves which will introduce discrepancies in the computations they are used in.

The volume of shale was computed by a petrophysicist by first subdividing the curves into five basic zones, with the prominent ones being the Bone Spring, Wolfcamp and the Barnett/Mississippian intervals. Next, the minimum and maximum values of gamma ray log in the respective zones were picked up. Finally, the computations of gamma ray index were merged into a single composite curve, shown in track 5.

Using Spectral Gamma Ray Curves

As mentioned above, the conventional gamma ray logging records the total gamma radiation emitted by the source elements and their decay products namely potassium, uranium and thorium. Spectral gamma ray logging distinguishes the three elements by the wavelength of their emitted radiation. Thus, should spectral gamma ray log curves be available, they can be used for applying appropriate corrections.

As uranium salts are soluble, they can be precipitated or transported after deposition. Consequently, for shale volume determination in sandstones, the use of thorium, and potassium components instead of the total gamma ray in the equations could be considered for volume of shale computation.

Conclusions

We have tried to highlight some of the challenges that may be faced during the determination of the volume of shale from unconventional shale resource plays from log data or other relevant data. While the importance of all the required data cannot be overemphasized, in the absence of such data, the results would be compromised. We are aware that enough work has been carried out by various petrophysicists from time to time, and different corrections, models and methodologies have been suggested, but they all require more information, whether that is in terms of core information, use of spectral ray curves or other measurements. It is suggested that several volume-of-shale estimates be computed with the available data, and a mean of those estimates be used in the analysis at hand.

(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.)

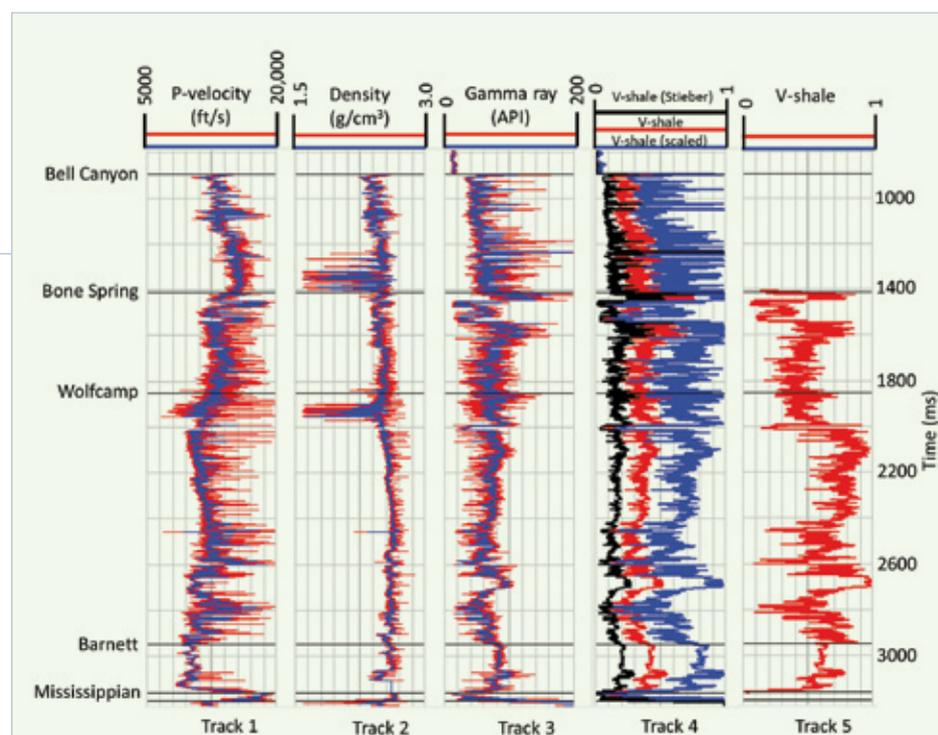


Figure 2: The sonic, density and gamma ray curves from a well in the Delaware Basin in west Texas and New Mexico in the United States are shown in tracks 1, 2 and 3. The red curves show the input curves as such and the blue curves are their smoothed versions, which were used in the computations. The volume of shale curves corrected using scaling and Stieber corrections are shown in track 4. The volume of shale was also computed by a petrophysicist by first subdividing the curves into five basic zones, the prominent ones being the Bone Spring, Wolfcamp and the Barnett/Mississippian intervals. Next, the minimum and maximum values of gamma ray log in the respective zones were picked up. Finally, the computations of gamma ray index were merged into a single composite curve, shown in track 5.



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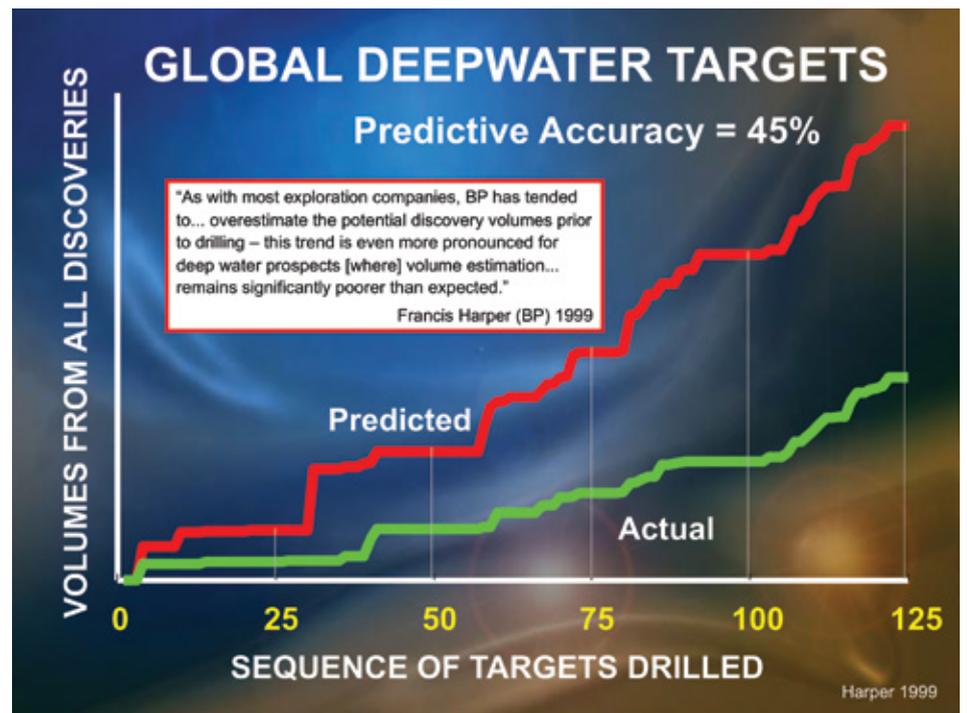
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Historical Highlights

A Player in the Emergence of E&P Risk Analysis



From left to right: Bob Megill, Ed Capen, Debbi Boonstra (AAPG staff) and Pete Rose, Calgary, 1989.



BP's deep offshore 1980-90s exploration campaign delivered less than half the reserves they predicted.

By the time they are drilled, almost all exploratory ventures today will have been geotechnically, statistically and economically analyzed to estimate – probabilistically – their ultimate recovery of oil or natural gas, or its EUR, and its present monetary value, or PV, given discovery.

The probability of discovering commercial hydrocarbons, or Pc, will also have been estimated, as well as the project cost through the stages of discovery and testing, or I, for “investment.” These three elements – PV, Pc and I – are necessary to generate the project's expected net present value, or ENPV – its chance-weighted value – the basic metric required to consider the project within the firm's exploration portfolio.

$ENPV = P_c \times NPV - (1 - P_c) \times I$
(NPV includes project costs [=I])

This process is generally known as “exploration risk analysis,” or ERA, and it evolved mostly during the period from 1975 to 2000, primarily as a response to declining global exploration performance. BP's deep offshore campaigns of the 1980s and '90s illustrate what was recognized as an endemic problem: explorers were discovering less than half of the EURs they forecast for their investors.

It wasn't as if explorers weren't trying to estimate project ENPVs during the 1960s and '70s. The problem was that they hadn't learned to apply probabilities to uncertain exploration parameters, such as gross rock volume, average net-to-gross, net pay, reservoir porosity and production rates. Monte Carlo simulation (and computers) were in the infancy of their exploration use. Explorers didn't know how to avoid

cognitive bias in estimating. Moreover, exploration itself was transitioning from a historical focus on “The Deal” to “The Business.”

The Course

In 1983, AAPG's Education Department wanted to establish a course on prospect evaluation. They persuaded Bob Megill, Exxon's exploration economics guru, and Ed Capen, Arco's guru on statistics and economics, to design one. Megill and Capen recognized that neither had much practical experience in prospecting: a third instructor was needed to translate their economics and statistics into practical applications that working geoscientists could grasp and apply to real-life prospects.

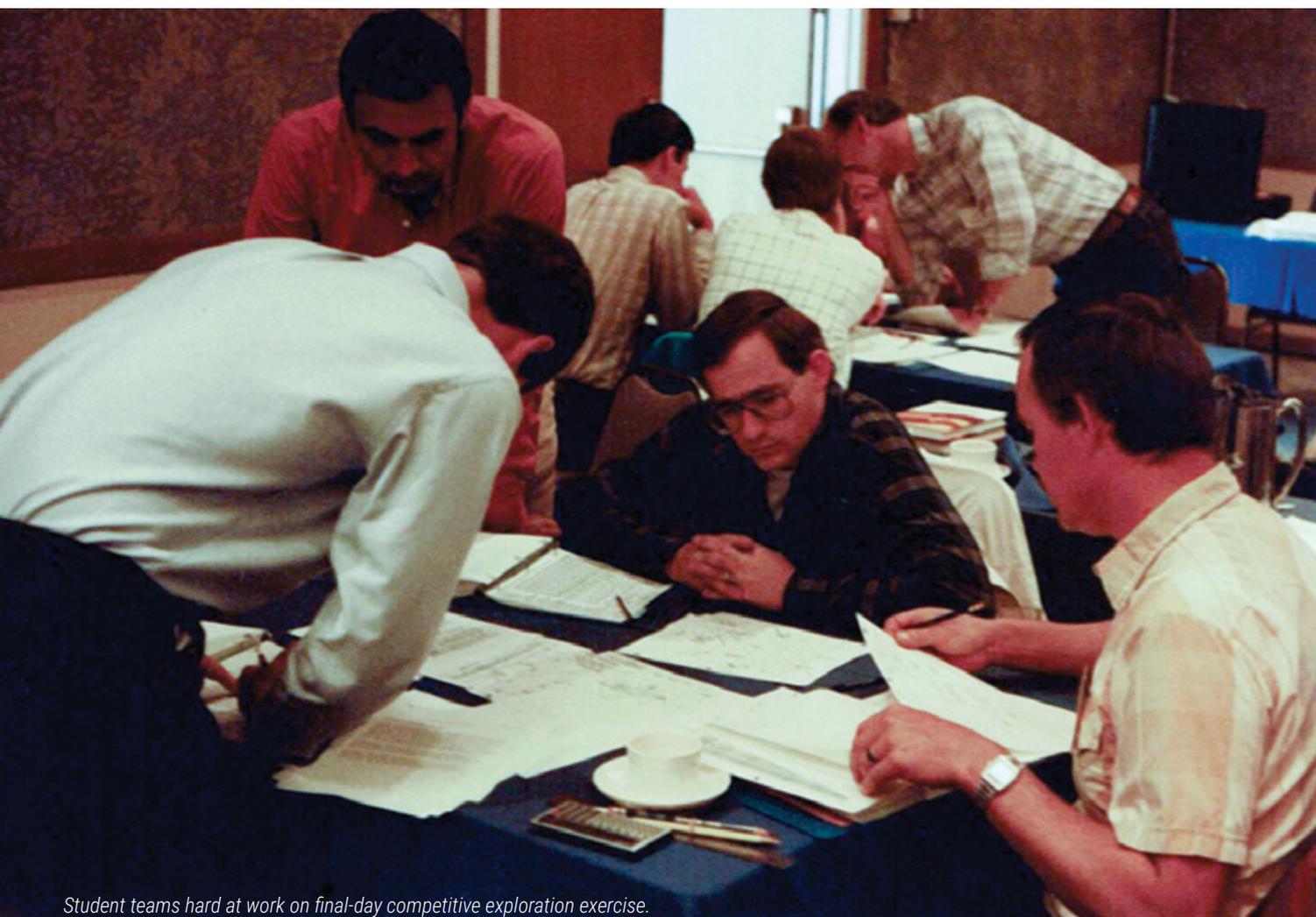
That turned out to be me – an

independent geologist with more than 10 years' experience with Shell, three years as chief of the United States Geological Survey's oil and gas branch and four years as chief geologist for Energy Reserves Group, Inc. I had overseen the first USGS work on probabilistic estimates of remaining U. S. oil and gas resources. I had attended the first two Hedberg Conferences on probabilistic resource assessment, where I met early seminal workers such as R. G. McCrossan and K. J. Roy of the Geological Survey of Canada; G. M. Kaufman of MIT; R. A. Baker, H. M. Gehman and D. A. White of Exxon; Gerard Demaison and R. W. Jones from Chevron, among others. Megill and Capen were also familiar with work I had done, measuring ERG's exploration and production performance (I compared prospect EURs and Pc versus actual results).

Bob and Ed were the recognized experts; I was just the working geologist who provided the geotechnical applications – the “bridge” from concept to implementation in the workplace. From the beginning, I soaked up their knowledge like a blotter, melding it with my own geological experience: they provided the theory, I provided the application. I welcomed the opportunity to learn new skills; besides, any new work was attractive – I was barely surviving the prolonged slump of 1984-90.

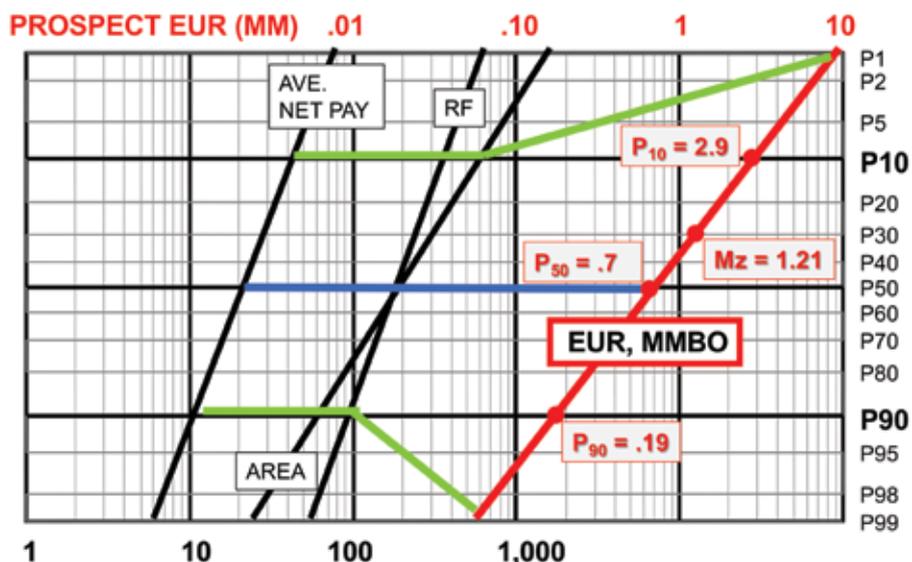
We offered our first course, a four-day affair, in Houston in the spring of 1984. It was fully subscribed. The course featured innovative teaching methods utilized by three experienced, articulate instructors who enjoyed teaching as a team. It focused intensively on the connections between geoscience, decision-making and profitability. The course concluded with a realistic exercise in which competing teams of students worked out the geology of a hypothetical exploration area, identified and assessed drilling prospects using course techniques and determined appropriate bidding strategies for obtaining acreage over the prospects – all before the age of personal computers. Each team backed its assessment with its own pocket money, generally \$3-\$12 per team member.

The first course was a resounding success, so we offered it again the



Student teams hard at work on final-day competitive exploration exercise.

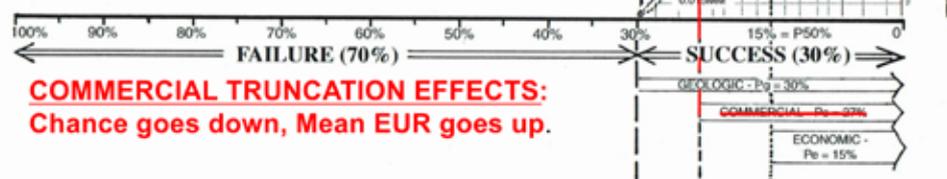
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Graphical Monte Carlo process combining three log-normal distributions (Area, Average Net Pay, Hydrocarbon Yield).

For a Prospect with: 1) **P_g = 30%** ;
 2) Mean (Mz) of EUR Distribution = **3.4 MM bbl**; and 3) EUR of **0.1 MM bbl** needed to cover costs of well completion & operating:

1) **P_c = (30% - 03% = 27%)**, 2) Mean of Truncated Distribution = **4.5 MM bbl**.



Marrying P_g to the Prospect Reserves Distribution (the "Two-step Process")

Continued from previous page

following fall in New Orleans, where it was again sold out and enthusiastically received. We had a winner, but we continually refined and revised the course, which we offered through AAPG several times per year for about 15 years, reaching about a thousand prospectors.

New Concepts and Tools

By 1989 the course content had expanded to five days, and we had developed six linked techniques to form a consistent, tested process for prospect risk analysis:

- ▶ Log-probability graphs to display and analyze lognormal distributions
- ▶ Forced predictions of resource components to fit the lognormal expectation
- ▶ The P90-P10 convention, used to express probabilistic uncertainty
- ▶ A simple graphical process duplicating Monte Carlo simulation
- ▶ Four-component model for Chance of Geologic Success (P_g) of a Prospect
- ▶ Defined stages of Prospect Success: Geologic (P_g), Commercial (P_c), and Economic (P_e) – the "two-step process"

New Career Directions

After his retirement from Exxon at the end of 1984, Bob Megill became a sought-after consultant. Ed Capen continued his career with ARCO, which limited his participation to three or four vacation-weeks per year. Megill and I, as consultants, began separately to include the risk analysis specialty in our consulting practices, adding elements of our own professional specialization. In late 1989, when fragile health motivated Bob to retire again, he generously suggested that I take over his client list, which I gratefully and eagerly accepted.

That led me promptly to a critical decision – rather than teach through a "middleman," I decided to self-vent all future commercial teaching. This resulted in substantially greater income for my business, Telegraph Exploration, Inc., and made possible the eventual establishment 10 years later of a new firm specializing in exploration risk analysis: Rose & Associates, LLP.

It also meant that my dear wife Alice and I would now operate as a business team travelling to the client's venue to put on my "version" of the evolving risk analysis course – Alice would handle all course logistics and administration and I would teach, usually about seven hours a day for

See **The Course** page 20 ▶

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Sixth annual meeting of Rose & Associates, LLP, El Segundo Ranch, Texas, 2005. L-R: Gary Citron, Pete Rose, Jim MacKay, Jim Gouveia, Ray Young, Mark McLane, Roger Holeywell, Bob Otis and Dave Cook.

The Course from page 19

four (later five) days a week. She quit her longtime job in Austin and we started a new business in January 1990.

Megill had left me a contract with Texaco. I later signed up Unocal. Other prestigious clients followed. In 1990, Alice and I taught the risk analysis course 26 times, in the United States, Canada and the United Kingdom. The following year we taught it 24 times. At the end of 1991, after reviewing our personal financial status, it was clear that I had found my way into a pretty attractive business while waiting

for the exploration prospecting game to recover. By early 1992, we were out of debt. The last prospect I generated was drilled later in 1992. It was a dry hole.

Over the next 10 years, Alice and I travelled the world, teaching exploration risk analysis in the United States, Canada, Mexico, South America, the Far East, Australia and Europe. It was intense, physically demanding, exhilarating, profitable – and the best time of our lives. I continued to refine and expand my version of “The Course” which I renamed “Exploration Economics, Risk Analysis and Prospect Evaluation,” adding several new chapters, one on play analysis (a summary of a newly developed separate four-day course), others on exploration economics and exploration portfolios.

Building the Business

Our little business continued to grow. After Bob Megill retired, I continued to teach with Ed Capen and his ARCO colleague, Bob Clapp, when they had vacation time available. After they retired in late 1992, we formed Petro-Risk Partners, teaching a handful of courses each year. The rest of the time I was free to teach and consult on my own, and I stayed extremely busy.

Starting in 1990, I began to give talks on various aspects of exploration and production risk analysis at regional, national and international meetings, mostly related to AAPG. I also took an active role in subsequent Hedberg Conferences, especially Snowbird in 1993, San Diego in 1995 and Galveston in 1998. This allowed me to share new ideas and techniques, and it provided excellent publicity for our course offerings, led to many new professional and business contacts, and substantial new business development.

Getting into the Software Business

Petro-Risk Partners had developed a formal protocol based upon the sequential procedures of our E&P risk analysis course, and we helped several major companies incorporate this protocol into software that promoted the uniform global use of such methods by their exploration staff.

In late 1996, Amerada-Hess asked me if any of our clients might be willing to license their software to a competitor. I called my contacts at those firms and relayed Hess’ question. Three client companies declined, but my Marathon contact said, “Let me get back to you.” A month later, he called me back and said, “Marathon will license their risk-analysis software. How much do you think we should charge?”

“Beats me – I’m ignorant about the

software business. How about ten grand?”

“Sounds good to me. We’ll split the \$10,000 with you, OK?”

So, I called my Hess guy, gave him my Marathon guy’s contact info, figuring they would close the deal, and I could feel good about helping two clients, as well as earning \$5,000 in the process. A few weeks later the check arrived; it seemed like “found money” to me.

Several months later, I got another call from Marathon: “Pete, we don’t want to be in the software business – we want you to be in the software business. Because of all your contacts in the E & P business, we’ll give you exclusive rights to market and license our risk-analysis software, and we’ll split any sales contracts with you 50/50. How does that sound?”

It sounded great, so I called Ed Capen, already a dedicated computer user, and relayed Marathon’s software offer, expecting my partner to jump at the opportunity for Petro-Risk Partners to begin marketing their own software to our many clients.

Instead, and instantly, he said, “That’s the dumbest idea I’ve ever heard – who in the world would pay good money for a software program they could build themselves?”

“Well, Ed, maybe there are dumb geologists like me who are more interested in applying risk-analysis to prospects than designing software to help them do it – especially if it uses a well-established, time-tested system like ours,” I answered.

Ed was unmoved.

I departed from Petro-Risk Partners at the end of 1997. Of course, Ed and Bob had been involved in the original consulting projects for our major oil company clients, so when I started receiving payments on

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Alice and Pete Rose, E & P Risk Analysis Course for UNOCAL Thailand, Bangkok, 1995.

◀ Continued from previous page

software sales, I set up a protocol by which they each would get a small royalty on every sale of my software license.

So here I was, a computer illiterate with a software license. I needed to find a software expert who also knew something about E & P risk analysis. It took a year or so and a hiccup to get my new business off to a sound start, and it led to an outcome I hadn't anticipated: I needed associates. My days as a sole proprietor were over.

Rose & Associates

My new software associate wasn't working out. But I also needed seismic expertise: Dr. Gary Citron chose to leave Amoco, take a chance with me, and become my eventual first partner in Rose & Associates, LLP. He was an excellent choice who, four years later, became the firm's second managing partner. Soon after, we added petroleum engineers Mark McLane (ex-Pioneer, ex-Exxon) and Jim Gouveia (ex-Amoco and BP), both future partners. We also added several recognized risk analysis experts such as Jim McKay (ex-Texaco), and Bob Otis (ex-Chevron).

Mark McLane took over our software business, Lognormal Solutions, Inc. After about a year, Mark wanted to return to teaching and consulting for Rose & Associates, so I brought in David Cook, a geophysicist from ExxonMobil, who proved to be a superb manager, and LSI continually grew under his direction.

Rose & Associates quickly developed a three-component business model, consisting of:

- ▶ Teaching a variety of risk-analysis courses
- ▶ Developing and licensing software that assured clients that all its E & P ventures were evaluated correctly and consistently using our time-tested methodology
- ▶ Consulting with client companies about their individual projects

In 2001, AAPG published my book, "Risk Analysis and Management of Petroleum Exploration Ventures," with the kind permission of Japan National Oil Company, which granted use of two reports I had prepared earlier for JNOC. The AAPG book was in fact an expansion of the 1999 version of "Exploration Economics, Risk Analysis and Prospect Evaluation," the descendant of the course that had been evolving since Capen, Megill and Rose had generated its earliest predecessor

in 1983. The AAPG book went through seven printings and was also published in Japanese, Chinese and Russian, and became widely known as "The Bible" for E & P risk analysis. I donated all royalties to AAPG in exchange for their agreement to reduce the price of the paperback edition, thus making them affordable to overseas geoscientists.

Stepping Down

Gary Citron became managing partner of Rose & Associates in 2003. The firm's headquarters moved to Houston. I stuck around for a couple of years to mentor our new managing partner. My last management initiative was to start developing risk analysis and software to deal with the emerging new resource plays. The entrepreneurial phase had ended and the consolidation phase began under Gary's fine leadership. Our management transition was timely and very successful. Rose & Associates continued to grow, gradually adding new partners and associates as demand grew. Peter Carragher, who previously worked for Amoco and BP, succeeded Gary Citron as managing partner in 2015. I sold my last share in the firm in January 2005 and prepared for a long and productive retirement, starting with the one-year presidency of AAPG.

Now, after 20 years, a software business that started from the most humble of origins has grown into a key component of Rose & Associates, along with training and consulting. Software sales and services have totaled around \$30 million in profits since 1998. The firm itself is the recognized global leader in the field of E & P risk analysis, with offices in the United States, Canada, Indonesia, China and the UK. There are now seven partners, 12 associates and an office staff of five.

Not bad for a dumb geologist who knew nothing about computers and software, who didn't know any better than to embrace the dumbest idea that a recognized guru like Ed Capen had ever heard! 

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

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A History of the Energy Minerals Division of the AAPG

Part 1 of 2



The Wichita Mountains in southwestern Oklahoma was the first post-convention field trip on an EMD topic. Zuhair Al-Shaieb led a field trip that examined uranium mineralization in parts of the Anadarko and Hollis basins. Photo by Mareibu.

In 2017, AAPG celebrated the 100th anniversary of its founding in Tulsa, Okla. This same year was also the 40th anniversary of the establishment of the AAPG Energy Minerals Division.

The EMD has evolved as an organization over the past 40 years to reflect the changes in the mix of resources fueling the world's ever-increasing energy demand. We look forward to serving AAPG and our Division members by continuing to promote the geological sciences related to unconventional and alternate energy resources which will be required to meet the global challenges of providing a sustainable energy future. The purpose of this article is to celebrate the 40th anniversary by providing a brief history of the founding and evolution of the EMD that may serve as a reference and guide for future EMD members and leadership.

From Conception to Division

The Energy Minerals Division had its early beginnings at the 1968 AAPG annual meeting in Oklahoma City with a "Fuels Symposium" on coal, shale oil, tar sands, nuclear fuels, geothermal energy, oil and

gas. The following year, AAPG President Frank B. Counselman appointed an ad hoc Committee for Proposed Division of Mineral Economics and he named Tom C. Hiestand as chairman, who is credited as being the first person to suggest and work for division status.

In 1970, AAPG President Kenneth H. Crandall appointed a special Committee on Mineral Economics Symposium and he named Hiestand chairman. This committee organized a program of eight speakers for the 1970 AAPG annual meeting in Calgary. Among the speakers, whose papers were published in the June 1971 AAPG Bulletin, were Michel T. Halbouty and Hollis M. Dole (assistant secretary of the interior).

Reappointed by AAPG President William H. Curry Jr., the committee produced only one invited paper at the 1971 AAPG annual meeting in Houston. The next year, the program was expanded to include representatives of other fuel and energy disciplines. The committee produced a half-day symposium consisting of seven papers at the 1972 annual meeting in Denver, which were published in 1973 by the Mineral Economics Institute at Colorado School of Mines (John A. Pederson and

Tom Hiestand were editors).

The two themes covered in this symposium were:

- ▶ National mining and minerals policy
- ▶ Economic incentives and deterrents affecting exploration and development of fuels/energy group of mineral resources during 1970-1973

The Committee on Mineral Economics was reappointed for the 1972-73 year, with Siegfried Muessig as chairman. For the 1973 AAPG annual meeting in Anaheim, the Committee organized an all-day symposium with 13 talks on "Economics of Energy Minerals." Having coined the



the EMD Uranium (Nuclear Minerals and REE) Committee since 2004.

Michael D. Campbell is a founding member of the AAPG Energy Minerals Division, served as EMD president 2010-11 and has been the chair of

term "energy minerals," the Committee on Mineral Economics now recommended it be renamed "The Committee on Energy Minerals," and it was reconstituted as such in the fall of 1973 under Chairman John A. Pederson.

Transferred from "special" to "standing" status in 1974, the Energy Minerals Committee moved one step closer to becoming a division. Pederson chaired the Committee on Energy Minerals for two years and planned for future programs and leadership. At the 1974 AAPG annual meeting in San Antonio, the committee presented a symposium, "Energy Minerals - What Are the Producible Reserves?"

At the 1975 AAPG annual meeting in Dallas, the committee presented a symposium on "Energy Minerals: Status and Role," with talks emphasizing geothermal energy and uranium. Pederson, in a renewed effort to achieve division status, asked R.C. Millspaugh to devise a questionnaire for polling all AAPG members as to the need for a "division." This questionnaire was completed and mailed

Continued on next page ▶

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◀ Continued from previous page

in early 1976 when Loyd Carlson was committee chairman. The questionnaire's results showed resounding support for a division that would gather and present papers on energy minerals in the AAPG Bulletin and at AAPG annual conventions. About 50 percent of respondents asked for short courses and field trips. Carlson was named chairman of the Energy Minerals Committee, presiding over the committee's work, which produced two more successful symposia:

- ▶ At the 1976 AAPG annual meeting in New Orleans, under program chairman Ruffin I. Rackley
- ▶ At the 1977 annual meeting in Washington, D.C., under program chairman Robert L. Fuchs, who coordinated presentation of 40 papers

The AAPG Executive Committee approved bylaws for a division, and at the 1977 annual meeting the House of Delegates in Washington, D.C. passed a resolution that division status be approved by the Executive Committee. Thus on June 12, 1977, the Committee on Energy Minerals became the Division of Energy Minerals. At this time, upon recommendation of a nominating committee, Carlson became the first EMD president, Warren H. Westphal the first vice president, and Ruffin I. Rackley the first secretary-treasurer – and by the end of June 1977, approximately 757 AAPG members had paid \$10 each to join the new division as founding members.

The First Decade

Tom Hiestand was named an EMD "Distinguished Founder" at the 1978 annual meeting in Oklahoma City. This honor was also extended to Pederson and Hollis M. Dole in 1979; to Carlson, Muessig, Westphal, Donald W. Axford, William R. Moran and Harry L. Thomsen in 1980; to Ruffin I. Rackley and Fuchs in 1993; to Samuel A. Friedman in 1994; and to Donald F. Towse in 1996.

EMD held its first annual program as a new AAPG division at the 1978 meeting. Samuel A. Friedman, assisted by Lawrence L. Brady and others, coordinated the program, consisting of 28 research papers that filled two oral sessions on uranium geology, one oral session on coal geology, and a fourth oral session on geothermal energy and tar sands. Two papers on coal geology were presented in an AAPG poster session.

Carlson and the EMD Program Committee established best-paper awards based on a rating system patterned after the AAPG Matson Award. Awards were presented at the next annual meeting. At later annual meetings, EMD added best poster awards, and both categories of awards continue to be made annually. Both the Eastern and Rocky Mountain Sections of AAPG also initiated EMD awards for both categories of papers at their annual conventions.

In 1978, David G. Campbell, AAPG annual meeting field trip chair, invited Friedman to plan and lead a two-day coal geology field trip to the Arkoma Basin in eastern Oklahoma. Thus, AAPG Field Trip No. 2, with guidebook and 38 participants, became the first EMD-organized pre-convention field trip. Zuhair Al-Shaieb, with guidebook and a full bus, also led a field trip that examined uranium mineralization in parts of the Anadarko and Hollis basins and the Wichita Mountains in southwestern Oklahoma – the first post-convention field trip on an EMD topic. Co-sponsoring special programs outside of AAPG annual meetings was begun by the former AAPG Committee on

Energy Minerals, which had cosponsored with sections of A.I.M.E. a symposium on "In-Situ Leaching of Uranium," held at Vail, Colo., in August 1976.

The Division also was the primary sponsor of a highly successful symposium on the Grants, N.M., uranium area, chaired by Frank E. Kottlowski, in May 1979. In two and a half days, an unprecedented 48 papers on uranium geology were presented. EMD received a record \$10,000 in net revenue from registrants at this symposium.

EMD co-sponsored the 1980 Rocky Mountain and Southwestern Section annual meetings. Phil Goodell chaired the El Paso symposium, at which 28 EMD papers covered uranium topics and two successful field trips were given to investigate uranium mineralization and mining.

At the EMD business meeting of the Eastern Section annual meeting in Evansville, Ind., in October 1980, EMD Executive Committee heard a request for an

annual energy minerals development paper to be published in the "World Developments" issue of the AAPG Bulletin. This idea led to the AAPG Bulletin's first publication of separate, comprehensive reports on each of the five commodities under the EMD aegis, i.e., coal, uranium, geothermal energy, oil shale and tar sands. These summaries were well received and exemplary annual reviews continued until 1990, when AAPG ceased publication of the World Development issue. Principal authors and organizers of these comprehensive papers were:

- ▶ Charles G. (Chip) Groat, Sam, Friedman, and Richard W. Jones, coal;
- ▶ Carroll F. Knutson and George F. Dana, oil shale;
- ▶ John W. Gabelman and W. L. (Bill) Chenoweth, nuclear minerals (uranium);
- ▶ Charles W. Berge, J.W. Lund, Jim Combs, D.N. Anderson, and P. Michael Wright, geothermal energy; and

▶ J.H.N. Wennekers, S.R. Seifert and TR. Lennox, tar sands.

The bylaws were revised in 1981 in yet another effort by the EMD to better serve the membership. The EMD structure was changed to emphasize the mineral commodities by adding geographical coverage, paralleling the AAPG organization. Commodity leaders became committee chairs, and section councilors were appointed who could network with AAPG section leaders to plan EMD programs. Also in 1981, the EMD membership first appointed officers and councilors (for 1981-83). Ruffin I. Rackley was appointed vice president of the Division for 1981-1982 and then was elected president the following year in 1983.

The first EMD brochure emphasizing benefits available for joining EMD was

See **Brochure** page 24 ▶

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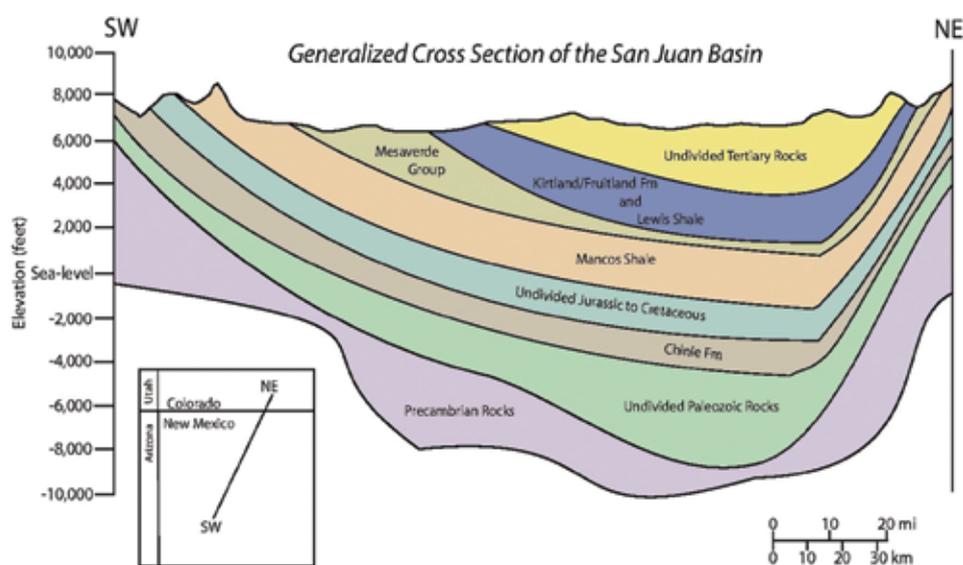


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Initial development of coalbed methane began in the San Juan Basin with passage of the Natural Gas Policy Act of 1978, and interest in coal and coalbed methane dominated interest in the EMD through to the '90s. Image by Nicholas Guiffre.

Brochure from page 23

published in 1981, initiated by EMD President Frederick Cheerer in an effort to maintain a rapid increase in EMD membership. The EMD brochure was updated and revised by a committee chaired by Sandra C. Feldman in 1988 and a new brochure was completed for distribution at the annual meeting in Salt Lake City, spearheaded by EMD President Margaret Anne Rogers and Outreach Committee Chair Jane McColloch.

Beginning with the first EMD meeting 40 years ago in 1978, a total of 947 oral and poster papers and numerous short courses (or seminars) and field trips have been presented at national and section annual meetings, as well as at special co-sponsored EMD meetings through 1997. A record high of 127 EMD papers were presented in 1980,

averaging 47 per year over the next few years. About 47 percent of the papers dealt with geology of coal and coal-bed methane (47 percent), with other papers covering uranium, geothermal and oil shale. These commodities were joined by remote sensing as a popular topic for convention papers for the next 10 years. Coal and coal-bed methane dominated papers given in the 1990s through the mid-2000s, especially at the Eastern and Rocky Mountain Section annual meetings.

In March of 1984, EMD reached a high of 2,013 active members. Although only 10-15 percent of the EMD membership attended the national annual meetings, responses to past EMD questionnaires showed that all the members remained interested in all the EMD commodities plus remote sensing with the increasing interest in satellite imagery. During the 1980s, EMD added the gas hydrates commodity as an "unconventional" energy source – increasing the diversity of the commodities represented by EMD.

Coalbed Methane Era

Beginning in the late 1970s, interest in tight (low permeability) gas increased with research and development and U.S. wellhead natural gas price incentives spurred by passage of the Natural Gas Policy Act of 1978. Interest in coalbed methane started in 1977 with initial development in the San Juan Basin of Colorado and New Mexico, with 91 billion cubic feet of gas produced during 1989. The EMD commodity chairs continued to produce annual and mid-year reports to reflect the status and utility of each of the commodities monitored.

In the early 1990s, coal and coalbed methane dominated interest in the EMD as reflected by the percentage of members, conference emphasis (papers and field trips), and publications showing the growth of coal to dominate national fuel production and consumption to drive the electrical power industry. Coalbed methane followed closely.

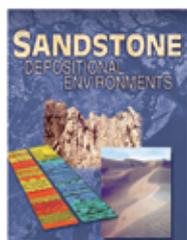
Certification of coal geologists was initiated in the mid-1990s as the coal industry employed geologists and technicians from other depressed commodities, such as oil shale, geothermal and conventional oil and gas. Certification added a dimension to EMD and the Division of Professional Affairs with the AAPG House of Delegates at the 1995 Annual Meeting in Denver approved changes in the wording of AAPG Bylaws to enable the DPA to manage this function and associated revenue in cooperation of EMD.

Enforced regulation of all activities affecting the natural environment through the 1990s required extensive and detailed management of all phases of the resource industries. EMD responded by maintaining liaison with the Division of Environmental Geosciences. EMD and DEG have since benefited from joint technical sessions and luncheons and plan joint publications for the future. Reciprocally, EMD contributed significantly to the health and progress of DEG. Many EMD members were encouraged to join DEG. EMD active membership was 1,862 as of May 1994, down 61 members from the end of fiscal year 1993 and down 175 from a peak of 2,037 in May 1992 resulting from low conventional oil and gas prices of the 1980s, which persisted into the 1990s. With low prices, unconventional energy resources were even less economic to develop. Alternative energy resources (e.g., coal and uranium) were competing with natural gas in driving the generation of electricity in the United States.

By the end of the 1990s, EMD held 1,700 active members who share interests and experience in the science and technology of energy minerals, including:

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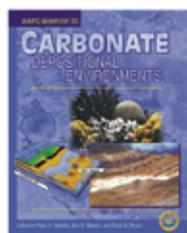


Memoir 98: The Great American Carbonate Bank—The Geology and Economic Resources of the Cambrian-Ordovician Sauk Megasequence of Laurentia

Edited by James Derby, Richard Fritz, Susan Longacre, William Morgan, and Charles Sternbach
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Comprised of 48 chapters, this Memoir covers the biostratigraphy, ichnology, stratigraphy, depositional facies, diagenesis, and petroleum and mineral resources of the GACB.

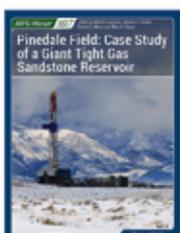


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Edited by Peter A. Scholle, Don G. Bebout, and Clyde H. Moore
Product #656

Price: Member \$59 / List \$79

Using a systematic treatment of the entire subject of carbonate depositional environments, this unique book is specifically designed for use by the non-specialist—the petroleum geologist or field geologist—who uses carbonate depositional environments in facies reconstructions and environmental interpretations.

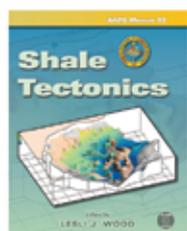


Memoir 107: Pinedale Field: Case Study of a Giant Tight Gas Sandstone Reservoir

Edited by Mark W. Longman, Stephen R. Kneller, Thomas S. Meyer, and Mark A. Chapin
Product #1252

Price: Member \$144 / List \$289

This Memoir contains 15 well-illustrated chapters that describe the history of field development, the deposition and diagenesis of the reservoir rocks, geophysical characteristics of the field, special core analysis techniques used to better quantify the reservoir, petrophysical characteristics and interpretations of the reservoir, the types and abundance of natural fractures, and fluid production characteristics in the Pinedale Field.



Memoir 93: Shale Tectonics

Edited by Lesli J. Wood
Product #1023

Price: Member \$99 / List \$139

This volume documents shale tectonics from a variety of basins around the world. It also provides information on the petrographic framework, behavior, geometries, and geodynamic models of shales.



Memoir 112: Imaging Unconventional Reservoir Pore Systems

Edited by Terri Olson
Product #1281

Price: Member \$144 / List \$339

The chapters in this volume include a few focused on imaging techniques and interpretation, several on comparison and integration of analysis methods, and some case studies. Several link new methods to new interpretations of specific reservoirs.

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University of Oklahoma
Andrew Rich
University of Oklahoma
Torsten Scholz
University of Oklahoma
I. Suta
University of Saskatchewan
Andrew Rich

Universidad Venezuela
Faye Geiger
University of Wisconsin,
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Kirt Campion
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*The monthly list above
of AAPG Foundation
contributions is based on
information provided by the
AAPG Foundation office.*

Foundation Update

'Energy Insights' 2018-19

Updated Distinguished Lecture program announced

AAPG's historic Distinguished Lecture program has undergone a revolutionary transformation aimed at extending the program's accessibility, audience and reach.

New topics, new speakers and the new use of technology mean that this year, for the first time ever, everyone on earth will have access to all Distinguished Lectures – at any time you want to connect.

Videos and complementary podcasts featuring this year's six lectures (for audio and visual streaming or downloads), themed "Energy Insights," will be available starting in December.

This year's DL roster features six speakers, selected by the AAPG Distinguished Lecture Committee, who are the pioneers in a new era of sharing and accessing geoscience information.

What's gone: The concept of one speaker physically "touring" a region for two-three weeks, speaking only to groups in those areas.

What remains: Audiences worldwide will be introduced to emerging trends, new technologies and cutting-edge research in the geosciences, all presented by top experts in their respective fields.

Why the change?

Because today's audiences expect instantaneous access and delivery of information. You've told us you receive information from a variety of online sources by downloading or streaming files, and you want the flexibility of choosing

a convenient time to view or listen to the information rather than attending a single scheduled event.

We got the message.

Here's how it works:

Presentations of the lectures are now recorded as videos and podcasts. The lectures will be available for download from GooglePlay and iTunes as well as direct

download from the AAPG website.

For individual viewings or listening, all presentations will be available 24/7.

Questions can be sent to the respective lecturer via a link that will be provided on the AAPG website, with the intent of rapid responses by the experts.

For groups and classrooms, webinars provide the opportunity for a "virtual

lecture experience." By contacting the AAPG Programs Team we can schedule the lecturer to be present for your group to host an online chat or Q-and-A session with audience members (this feature is subject to DL availability).

Continued on next page ►



ARANGO



CUNNINGHAM



HARRIS



HUDEC



STRIGHT



WARNY

This Year's Distinguished Lecturers:

► Irene Arango, senior geochemist, Chevron Energy Technology Co.: "Understanding Expulsion Capacity and Organic Porosity In Unconventional Petroleum Systems"

► Susan Cunningham, senior adviser, Darcy Partners: "What it Takes to be Successful In Exploration and Innovation"

► Ashley Harris, clastic stratigraphic team leader, Chevron Energy Technology Co.: "Re-evaluating the Relationship Between Relative Sea Level and Sediment Distribution Using Numerical Stratigraphic Forward Models"

► Michael Hudec, senior research scientist, director of the Bureau of Economic Geology, Applied Geodynamics Laboratory, University of Texas: "Evolution of the Salina del Bravo, Mexico: The Bravo Trough, Sigsbee Canopy and Perdido Fold Belt"

► List Stright, assistant professor, Department of Geosciences, Colorado State University: "Template-based Modeling: Bridging the Gap Between Quantitative Outcrop Studies and Subsurface Reservoir Characterization"

► Sophie Warny, associate professor/AASP chair in palynology, Louisiana State University: "Evolution of Antarctic Vegetation Cover from the Paleocene to the Pliocene: A Review of Case Studies from the Antarctic Peninsula, the Ross Sea, the Sabrina Coast and the Dry Valleys"

Thanks to you, we are ...



- Introducing young students to geology by funding creative educational programming and curriculum developed by organizations specializing in K-12 education.
- Placing grants directly into the hands of university students to assist their pursuit of geology degrees and careers.
- Enabling professionals to share their knowledge with students worldwide through lectures and visits to university campuses.
- Funding programs that provide opportunities for students and young professionals to improve the quality of life for people around the world through humanitarian relief efforts using geoscience technology.
- Recognizing outstanding leaders and educators for their achievements in geoscience.

... making a difference.

Log on to donate: Foundation.aapg.org



Texas Board of Professional Geoscientists Update

Earlier this year, in a surprise move, the Texas Sunset Advisory Committee recommended to eliminate the Texas Board of Professional Geology and repeal the Texas Geoscience Practice Act. A review period was established where the public and specifically geoscience professionals could comment on this decision. Local Texas geoscience organizations and societies mobilized quickly to protest this decision and move forward. The Sunset Advisory Committee received letters of support for the TBPG from across the geoscience community and this included a very strong letter in support for the TBPG from the AAPG Executive Committee.



GALLAGHER

there is more work ahead, we must ensure that the Texas State Legislature vote in favor of the Texas Geoscience Practice Act. This means we must continue to write letters to encourage our legislators to approve this act. There is also another way you can help and that is to support the efforts of the Texas Geoscience Council to educate legislators who we are and what we do as geoscientist.

Please go to their website and see where you can help (TXgeoscience.org) this does include donations.

I would like to recognize the efforts of HGS President Cheryl Desforges and DPA President-elect John Jordan to educate and inform all of us on the importance of the TBPG to the geoscientist and the public. Texas has one of the largest geoscience communities in the world and this could affect the practice of geology in other states. If we desire to be legally recognized as professionals, we must support the TBPG and the Texas Geoscience Council. [E](#)

On Aug. 2, licensed geologist in Texas received news that the final recommendation of the Sunset Advisory Committee was to retain the TBPG and recommend that the Texas State Legislature renew the Texas Geoscience Act for another six years. This reversal was good news but

Continued from previous page

Going forward, this new virtual approach also will impact the availability of speakers to participate as a DL – many of whom are unable to commit to the previous model's two- or three-week tour schedule. Recording their lectures on location in Tulsa takes a matter of two or three days, achieving a consistent production quality and increasing the number of qualified speakers participating in the program.

"The goal behind these changes is to maintain the program's excellence and reputation but also to make it more

accessible and relevant to audiences around the world, all designed to get the best geoscience information into the lives of the most people possible," said Vern Stefanic, director of AAPG's Administration and Programs. "It's a strategy to help ensure the DL program's success deep into the 21st century."

The time has come. The new Distinguished Lecture program is a concept that meets the needs of audiences in the digital age.

For more information contact AAPG program coordinator Heather Hodges at 918-560-2621. [E](#)

Indonesia from page 15

Bogor (Greater Jakarta), Indonesia from Aug. 7-8.

The oil and gas industry will always face tremendous uncertainties. These days, managing the uncertainties is critical as the industry increases the cost efficiency

while the petroleum system condition is getting more complex. Therefore, the integration of all subsurface uncertainties is crucial to have the best hydrocarbon prediction methods. Experts will attend, involve and share their experience and insights in understanding and managing the uncertainties from various play types in Asia Pacific and other regions.

For more information, visit AAPG.org/career/training/in-person/workshops. [E](#)



Teacher of the Year DEADLINE: FEB. 1, 2019

A message for all K-12 geoscience teachers: This could be you! The AAPG Foundation annually bestows the AAPG Teacher of the Year (TOTY) award to recognize outstanding and creative approaches to geoscience education – a \$3,000 prize for the teacher and a \$3,000 grant to the school for educational purposes under the teacher's supervision.

A request for AAPG members: Help us promote geoscience education. Do you know or know of a K-12 geoscience teacher who is making a difference in their world? Let them know about TOTY!

Apply today at foundation.aapg.org/programs/toty.



L. Austin Weeks Undergraduate Grant Program OPENS: JAN. 1, 2019 | DEADLINE: MARCH 25, 2019

The AAPG Foundation's L. Austin Weeks (LAW) Undergraduate Grant program annually awards deserving undergraduate level geoscience students and student-led geoscience associations (student chapters, associations and clubs) with \$500 grants to support educational endeavors. Apply for research grants and scholarships at foundation.aapg.org/students.



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a. Total Number of Copies (Net press run)	18279	18281
b. Paid Distribution (Do not include paid distribution above normal rate, advertiser's proof copies, and exchange copies)	13828	13831
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d. Paid Distribution Outside the State (Including Sales Through Carriers and Centers, Street Vendors, Counter Sales, and Other Paid Distribution Outside-County)	4258	3497
e. Paid Distribution by Other Classes (Do not include through the USPS (e.g., First-Class Mail®))	0	0
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j. Free or Nominal Rate Distribution Outside the State (Carriers or other means)	200	200
k. Total Free or Nominal Rate Distribution (Sum of lines g), h), i), and j)	200	200
l. Total Distribution (Sum of lines f) and k)	6458	6497
m. Copies Not Distributed (See Instructions to Publishers #4 page 610)	11821	11784
n. Total (Sum of lines l) and m)	18279	18281
o. Paid and Paid Plus Electronic Copies (Do not include on line 13)	13828	13831

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b. Total Paid Plus Paid Plus Electronic Copies (Line 13b) + Paid Electronic Copies (Line 15a)	13828	13831
c. Total Free or Nominal Rate (Line 13k) + Paid Electronic Copies (Line 15a)	200	200
d. Total Free or Nominal Rate Plus Paid Plus Electronic Copies (Line 13o) + Paid Electronic Copies (Line 15a)	13828	13831

16. Publication of Statement of Ownership: Publication is a general publication, publication of this statement is required, not to be printed in the February 2018 issue of the publication. Publication not required.

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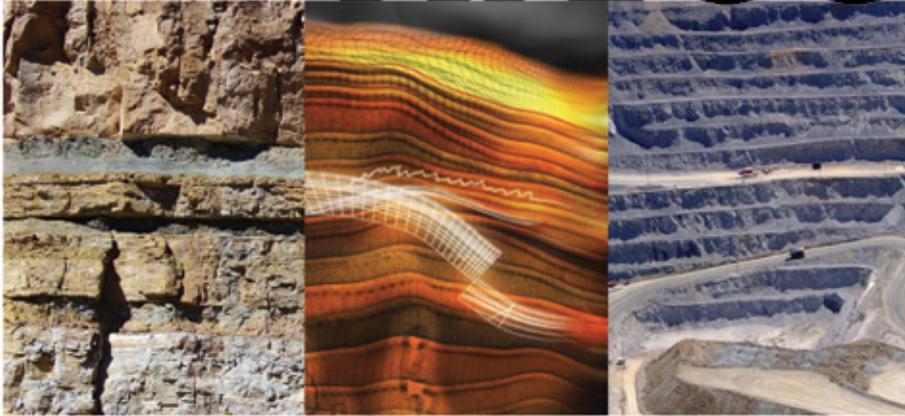


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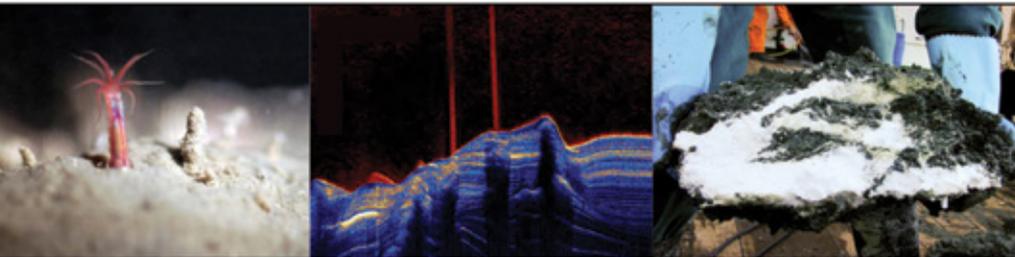
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AAPG Geosciences Technology Workshops 2019 Asia Pacific Region



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

15–17 April 2019 • Auckland, New Zealand

Natural gas hydrates have been studied extensively in the past three decades broadly, because they may constitute a geohazard, become an energy resource, and play a role in climate change. While the latter is the topic of significant blue-sky research, the petroleum industry is largely focusing on possible hazards to offshore installations from gas hydrates. Government-led research meanwhile is investigating the potential of hydrates as an energy source.

This workshop aims at capturing the current state of research into gas hydrates and at projecting a way forward for mitigation of this potential geohazard and extraction of hydrates as possible low-carbon energy resource. It will start with latest developments in exploration and appraisal methods as well as lessons learnt from gas hydrate production tests. Geomechanical models and results from laboratory experiments will focus on hazards from gas hydrates to offshore installations. Finally, novel production methods involving CO₂ sequestration, will be introduced in order to assess the possible role of gas hydrates as an energy source in a carbon-constrained future.

Keynote Speakers

Dan McConnell, Fugro, USA
Gareth Crutchley, GNS Science, New Zealand
George Moridis, Texas A&M University, USA
Judith Schicks, GFZ German Research Centre for Geosciences

The technical program expects to welcome strong oral presentations and several static posters.

Submit your abstract before 30 October 2018

Sponsorship opportunities are available to highlight your corporate visibility with the expected influential audience. Investments range from USD3,000 to USD25,000. Ask for a brochure from [Adrienne Pereira](mailto:Adrienne.Pereira@AAPG.org), AAPG Asia Pacific Office.

Who Should Attend

- Geologists
- Geophysicists
- Geochemists
- Petrophysicists
- Reservoir Engineers
- Academic and Government Researchers

More information available at: aapg.to/GasHydratesGTW2019

New Millennium from page 24

- ▶ coalbed methane, coal, geothermal,
- ▶ oil sands and oil shales,
- ▶ nuclear minerals,
- ▶ gas hydrates, and
- ▶ energy economics.

The New Millennium

With the rise and recognition of the potential value of shale gas and liquids, and with the rise in interest in other unconventional and alternative energy resources monitored by EMD, by the year 2000, the EMD had become the center of technical expertise within the AAPG for all of the unconventional and alternative energy resources. EMD promoted the exchange of information and understanding of new sources of energy through professional meetings, publications and other media. In addition, together with DPA, EMD encouraged professionalism and professional recognition for energy minerals geologists. Dues remained at \$20 per year. EMD's accomplishments after 2000 included a popular EMD program for the New Orleans Annual Meeting, including nine oral and poster sessions and two short courses. Chacko John was the vice chairman for this event, and the EMD luncheon speaker was Charles G. "Chip" Groat, director of the U.S. Geological Survey and EMD past-president, who spoke on USGS strategies for energy minerals.

The EMD also completed its first year in 2005 as cosponsor of the journal *Natural Resources Research*, published by Plenum Press (now Springer), under the primary sponsorship of the International Association

for Mathematical Geology, an associated society of AAPG. Doug Peters served as the assistant editor of the journal selected by the EMD, working under Daniel F. Merriam. The cooperative initial three-year agreement provided for the EMD to contribute editorial and review expertise, as well as writing and soliciting technical papers for the journal. Later, Peter Warwick continued the relationship with the editors of the Springer Publishing Groups' *Journal of Natural Resources Research*. Since then, EMD has provided a consolidated review of the odd-year annual reports generated by each of the EMD commodity committees. The EMD co-sponsored *Journal Natural Resources Research* has published the bi-annual *Unconventional (and Alternative) Energy Resources in: 2017, 2015, 2013, 2011, 2009 and 2007*, with earlier periodic papers on various energy-related topics.

Of particular note in 2000, the environmental effects of coalbed methane production and waste-water disposal became a topic of national interest. A federal court in Alabama ruled that fracturing of coal beds was covered under the Safe Drinking Water Act and must be regulated under the Underground Injection Control Program. Fracturing had previously been exempted from the injection rules. A group from EMD worked with the DPA Government Affairs Committee to develop a policy statement which was subsequently approved by the AAPG Executive Committee.

Acknowledgements: The author thanks Ruffin I. Rackley, Samuel A. Friedman, Jack Pashin, and especially Wayne Camp and Brian Cardott for their suggestions and input on this article.

(See next month's EXPLORER for Part 2.)

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POSITION AVAILABLE

Sedimentary Geologist—Calvin College

The Department of Geology, Geography and Environmental Studies at Calvin College invites applications for a tenure-track, sedimentary geology

position beginning September 2019.

Ph.D. in hand or near completion is required. The successful candidate will teach Sedimentation and Stratigraphy, Historical Geology, and be a team member in teaching GIS as well as field courses in Montana. Additional teaching could include Oceanography, Paleontology, Hydrogeology, or other topics depending on the candidate's background and interests. The successful candidate will be encouraged to develop a research program with undergraduates. Information about the department can be obtained at www.calvin.edu/geo.

Calvin College is a Christian college in the Reformed tradition, and all faculty are expected to support the college's religious commitment and educational mission. Calvin is building a tradition of diversity, and seeks faculty who will contribute to that effort. More information can be obtained at <http://www.calvin.edu/go/facultyopenings>.

Applicants should send a full curriculum vitae; a letter of application that addresses the requirements and responsibilities of the position; a 250-500 word statement explaining how you seek to express your Christian faith in teaching and scholarship; and three letters of recommendation. Send these documents to: Dr. Deanna van Dijk, at dvandijk@calvin.edu. We will begin reviewing applications starting 1 December 2018.

Petroleum Geologist Alaska Department of Natural Resources – Division of Oil and Gas

Are you looking for a dynamic, exciting, professional work environment?

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DEG
from page 30

America annual meeting.

► I hope to witness a climate change statement that speaks to established science and the limits of knowledge at this moment in understanding future climate change and the role of humans.

In the past, I was mostly familiar with the NASA and NOAA work and views. Yes, I think humans are impacting the climate. No, you are not my enemy if you think differently. Although my head is (again) spinning from such a difficult subject matter, I enjoy the readings. The greatest disappointment, though, was at climate change talks at one sectional meeting. Two speakers made negative non-science-related comments about specific politicians and academic and government scientists. That is not who we are as scientists. I would not leave a professional petroleum-related organization over a climate-change statement alone, but I would quickly leave any scientific organization that routinely displayed unprofessional conduct at its meetings, whether from a speaker to an audience or an audience to a speaker. I applaud AAPG for its outstanding Code of Ethics and its meetings' Code of Conduct. These documents are the foundation of how we conduct ourselves as professional geoscientists.

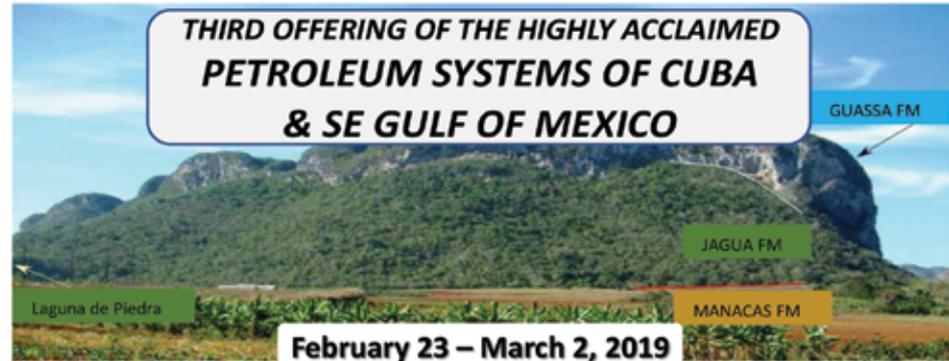
There are many groups trying to encourage civil dialogue and decrease polarization – that is a worthwhile goal that we can all learn from as we discuss the future of energy from scientific and technical viewpoints. We are human and

taking on hard subject matters will bring up some tough emotions that we must move through rather than fall into dysfunctional patterns. It will not be those with harsh extreme views on either side that create positive change for the future. It will be those that stay the course for positive change and action, using the best science and technology to meet humanity's energy needs with a continually-decreasing environmental footprint.

Environmental Stewardship

DEG takes its role very seriously as it represents AAPG. This year, thanks to the work of past DEG President Stephen Testa, we added this phrase to our purpose statements under DEG Bylaws: "Promote environmental stewardship within the petroleum/energy minerals industries." Well, yes! Our other statements certainly supported this, but this phrase really says it all. Are you a member of DEG? If you are like me for many of my 25 years as a DEG member, I paid my dues (now \$25) to support DEG but did not do much else. Friend, thank you for that small amount of money – it pays in part for AAPG staff members to help us, and it covers to different degrees the DEG president's travel (some of us have workplace-related money to help, but others do not).

If you are not a DEG member, consider supporting us. And to all DEG members, there are so many ways to help if you choose, whether taking up a subject and advocating it within DEG, serving as an officer, nominating worthy individuals for awards, and giving presentations at our AAPG-affiliated meetings. No matter what, though, stay on the high road as you travel in your professional career and help AAPG to lead the way. 📧



A scientific field excursion of the outcrop geology and petroleum systems of Western and Central Cuba and evolution of tectonic, structural and depositional systems of Cuba, the SE Gulf of Mexico and Proto-Caribbean

Field Trip Leaders: Drs. Manuel Iturralde, Paul Crevello and James Pindell

GeoExplorers is a US Nonprofit Corporation approved to offer this trip. To register or for further details: Contact Paul Crevello excursions@GeoExplorers.org

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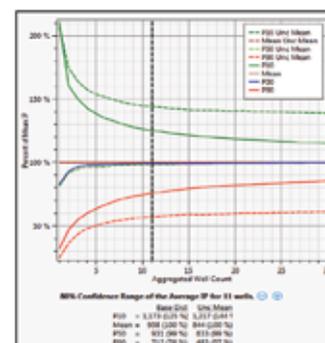
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AAPG continues to be a **global organization of nearly 30,000 select geoscientists** who earn the right to be called AAPG members.

Our audience reach stretches far beyond just our members. The EXPLORER newsletter alone doubles our membership and is proactively delivered to **more than 62,000 inboxes** twice a week.

For over 100 years, AAPG's audience has been among the best and most respected in the petroleum industry. Our audience is actively engaged in live plays across the globe and are a respected voice in purchasing decisions.

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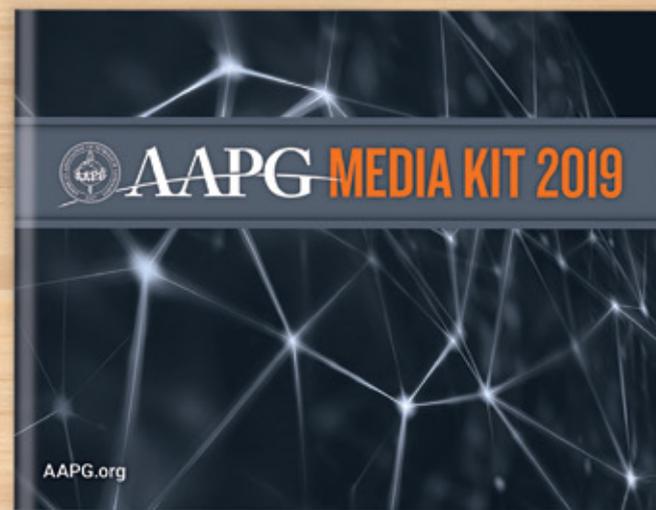
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The American Association of Petroleum Geologists has served as the bedrock of petroleum geoscience since the association's founding in 1917. Over the past 100 plus years AAPG has been, and continues to be, a global organization of nearly 30,000 select geoscientists who earn the right to be called AAPG members.

AAPG's audience is among the best and most respected in the petroleum industry. Our members are actively engaged in live plays across the globe and are a respected voice in purchasing decisions.

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AAPG IS A GLOBAL ORGANIZATION OF NEARLY **30,000** SELECT GEOSCIENTISTS

Director's Corner

Gratitude, Foresight and Investment in the Earth Sciences

The year was 1863. The United States was in the middle of a brutal and bloody Civil War, pitting neighbor against neighbor, brother against brother. The future of the Republic was in the balance.

President Abraham Lincoln, seeking to both win the war and preserve the union of "United" States, set aside the fourth Thursday of November that year, it was Nov. 26, as a day to reflect on the many blessings he and his fellow citizens enjoyed, even in their circumstances – to express gratitude, even in hard times.

I was reflecting on this story this past week as my wife, kids and I visited extended family, spending time with loved ones, resting, relaxing and strengthening the bonds that connect us.

Thankfully, the United States is not experiencing the same level of strife and discord today as it was 155 years ago. And yet, we face challenges – significant challenges – in this country and around the globe. For many, including many current and aspiring AAPG members, these are hard times.

Foundation and Foresight

Back in 1967, AAPG legend Michel T. Halbouty and others anticipated hard times – foresight that comes from working in an industry subject to commodity cycles, where bust follows boom.

In response to the uncertainty inherent in our industry they formed the AAPG Foundation, first as a trust, and then in 1986 as a non-profit corporation, to prepare in times of plenty for the inevitable times of lean. And for more than 50 years that's precisely what the Foundation has done.

Unlike the AAPG, which as an individual member-based professional association is focused principally on Members, the AAPG Foundation takes a wider view. As a



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charitable organization its focus has to create a public benefit and not simply benefit AAPG members. That's why contributions are tax deductible under U.S. law.

With that, the AAPG Foundation, led by Chairman Jim Gibbs, Vice-Chairman M. Ray Thomassen, Treasurer Lee Backsen, Secretary Mike Wisda, and Trustees Larry Jones and Jim McGhay, reflects the values and interests of AAPG members and the geoscience community. AAPG Foundation contributions come (mostly) from petroleum geoscientists and the AAPG Foundation is evaluating and funding projects and programs from these perspectives.

One of the values the Foundation emphasizes is support for science education, especially the Earth sciences, and scientific scholarship to advance the science and ensure a steady and qualified stream of incoming geoscience professionals.

The Foundation has several programs dedicated to this effort, including the L. Austin Weeks undergraduate grants, the Grants-in-Aid program, which supports graduate-level research, and the Deana and Paul Strunk Military Veterans Scholarship Program, which provides financial support for U.S. military veterans pursuing geoscience degrees and with an interest in a career in the petroleum industry. Each of these programs is supported by a dedicated endowment fund,

which continues to grow through individual contributions.

A second value is identifying and highlighting excellence in the Earth sciences, honoring those whose professional contributions in science, the workplace and the classroom support the underlying scientific and educational missions of the Foundation. This is accomplished by recognizing the Teacher of the Year in primary and secondary school and Distinguished Educators at the university level.

A third value is cooperation, and it's an important part of how the Foundation accomplishes its mission. One significant partner is AAPG itself, as the Distinguished Lecturer program, the Imperial Barrel Award competition, the Visiting Geoscientists program, and direct support for the AAPG Bulletin are all joint programs between the Association and Foundation. These programs support the objectives of both organizations.

The AAPG Foundation also supports the American Geosciences Institute's efforts to strengthen Earth science education in primary and secondary schools. It does that by supporting the global Earth Sciences Week program – a week each October dedicated to highlighting the Earth sciences and equipping teachers, both in the United States and abroad, with teaching elements to use in the classroom.

The Foundation has also supported AGI's development of an Earth sciences curriculum for use in schools.

Most recently, the Foundation has joined the Society of Exploration Geophysicists Foundation in its support of the Geoscientists Without Borders program, which provides grants to geoscience faculty members to apply their scientific skills to humanitarian projects in the developing world.

The Trustees also join other organizations in launching new projects, providing seed funding to help them launch new initiatives that advance the geosciences.

Investment in the Future

Where does the money come from?

This support for programs is the result of contributions of people like you and me, typically AAPG members who want to contribute to building a strong foundation for the geosciences, particularly the petroleum geosciences. These are folks who, like Michel Halbouty, want to take a portion of what they've gained as petroleum professionals and invest for the future. Invest it for the future of our science. Invest it for the future of our profession.

These investments, no matter how big or small, help to knit us together, to strengthen our community, to enable us to provide support for the next generation of geoscientists, and to help us collectively survive hard times.

As 2018 draws to a close, I invite you to consider how you can be a part of this important mission.

By MARY BARRETT, DEG President

Divisions Report: DEG

Climate Change and AAPG: Keeping Our Cool

I became a geology professor at Centenary College of Louisiana, a small liberal arts college in Shreveport, La., after leaving Mobil Oil in the early 1990s. My industry career previously had me focused on sedimentary rock science applications to both exploration and production. One of my new teaching duties was introductory environmental geology, where I stressed two different subjects: water and energy. I always started the semester with the personal observation that environmental science was a different beast to me. While, generally, geologists did not fight over rocks and minerals (although I recall two doctoral students ready to kill over dolomite), discussions about the environment were sometimes different. People with scientific backgrounds could often be caught up in greater social arguments and beliefs that took them away from the scientific method and the inquisitive and dispassionate nature of a good scientist. I always strived to present not only different scientific opinions but the social implications that were the underlying reasons for more heated arguments. I learned as much as any student did in developing this awareness.

Avoiding the Trap of Polemics

I accepted the nomination to again run for office at the Division of Environmental Geosciences, this time as president, after



BARRETT

It will not be those with harsh extreme views on either side that create positive change for the future. It will be those that stay the course for positive change and action, using the best science and technology to meet humanity's energy needs with a continually-decreasing environmental footprint.

going through an unfortunate episode where I challenged the truthfulness of an environmental geologist concerning oilfield cleanup reports to a state regulatory agency. That is where I deeply learned the challenge of: 1) not condemning an entire company or group based solely on the actions of a sub-set of people, and 2) trying to accomplish something useful and avoiding the attack on others in unprofessional anger or actions. I also witnessed how easily a group can get caught up in ideas they believe are morally superior to others' and how this can evolve into the old saying of "the end justifies the means." Sometimes without even being aware, we can move away from scientific and professional conduct because we so believe that our cause is just.

If you have been reading President Denise Cox's monthly columns in the EXPLORER or have heard her presentations at sectional meetings this Fall, you know that the AAPG Executive Committee has

created an ad hoc committee to review and update the AAPG climate change statement. It is being coordinated by Dr. Edith Wilson, the current president-elect of the EMD. I certainly was not the leader here – in fact, I had earlier expressed to Denise Cox that I had no interest in that subject matter as DEG president. I did not believe AAPG was qualified to give a scientific opinion on the last 150 years of climate records and its implications! My bias comes from my past decisions to not look to the petroleum industry in general or AAPG specifically to form my opinions about anthropogenic climate change. And given the many subjects of the petroleum industry and the environment that DEG could address in promoting its journal or its professional meeting sessions, why would I want that nasty rhetoric oozing out everywhere in today's climate change discussions? I am a chicken, aren't I?

But here we are, AAPG, at the beginning of re-visiting our climate

change statement. I am neither the contact person nor spokesperson for this committee, and my opinions here are my independent thoughts, preparatory actions and observations as a member of two petroleum-related organizations (AAPG and the Society of Petroleum Engineers):

► I realize and accept that DEG officers, past and present, have widely differing views concerning anthropogenic climate change. We are no different from the larger DEG and AAPG (and SPE) membership. We strive to model professional behavior to each other, and we remember that a person with a differing opinion is just that. There is no reason to demonize each other.

► I am immersing myself in a wide range of writings on climate change, including Gregory Wrightstone's book (see the September EXPLORER); "Climategate" emails of 1999; defendant oil companies' and plaintiffs' Spring 2018 submitted climate change "tutorials" as ordered in a case of the U.S. District Court, Northern District of California; IPCC report AR5 (2013); and the recent IPCC report SR15 (2018).

► I am attending every talk possible on climate change and sustainability, including AAPG affiliated sectional meetings, the annual SPE meeting and its webinars, and the upcoming Geological Society of

See DEG page 29 ►

Make Better Decisions on Brazil Exploration Opportunities



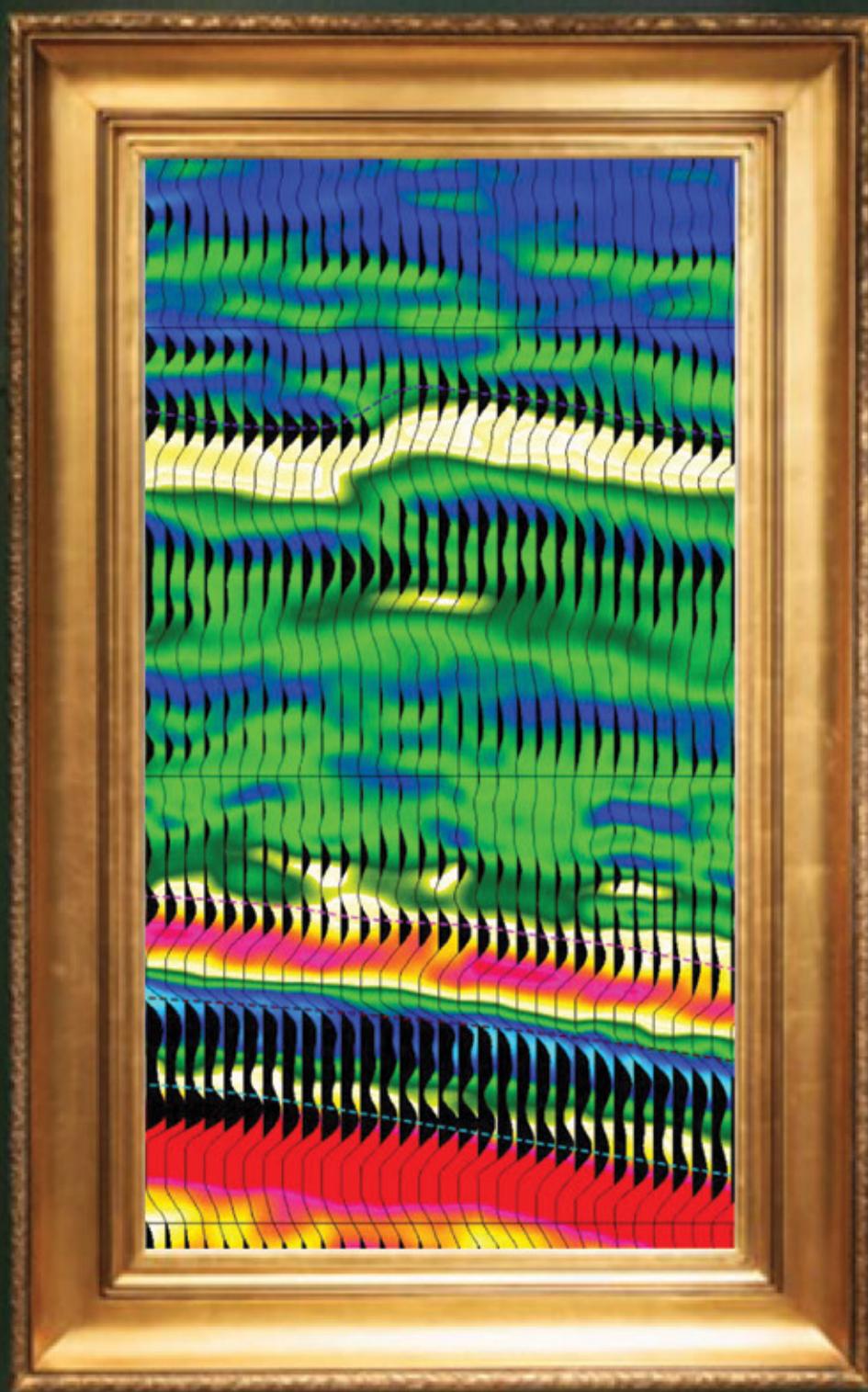
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