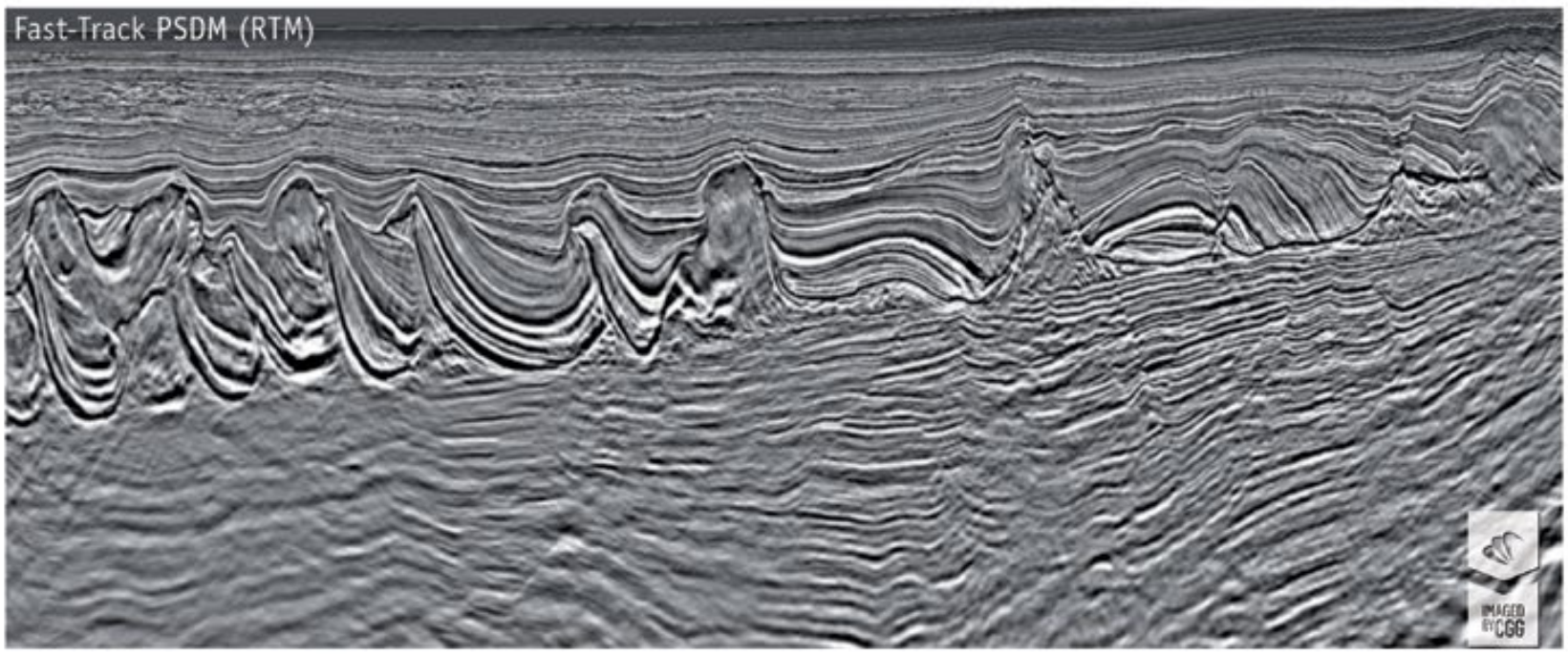
AAPG EXPLORER

JANUARY 2016

Brave New World

Change is the only constant in the oil industry's ever-shifting landscape.

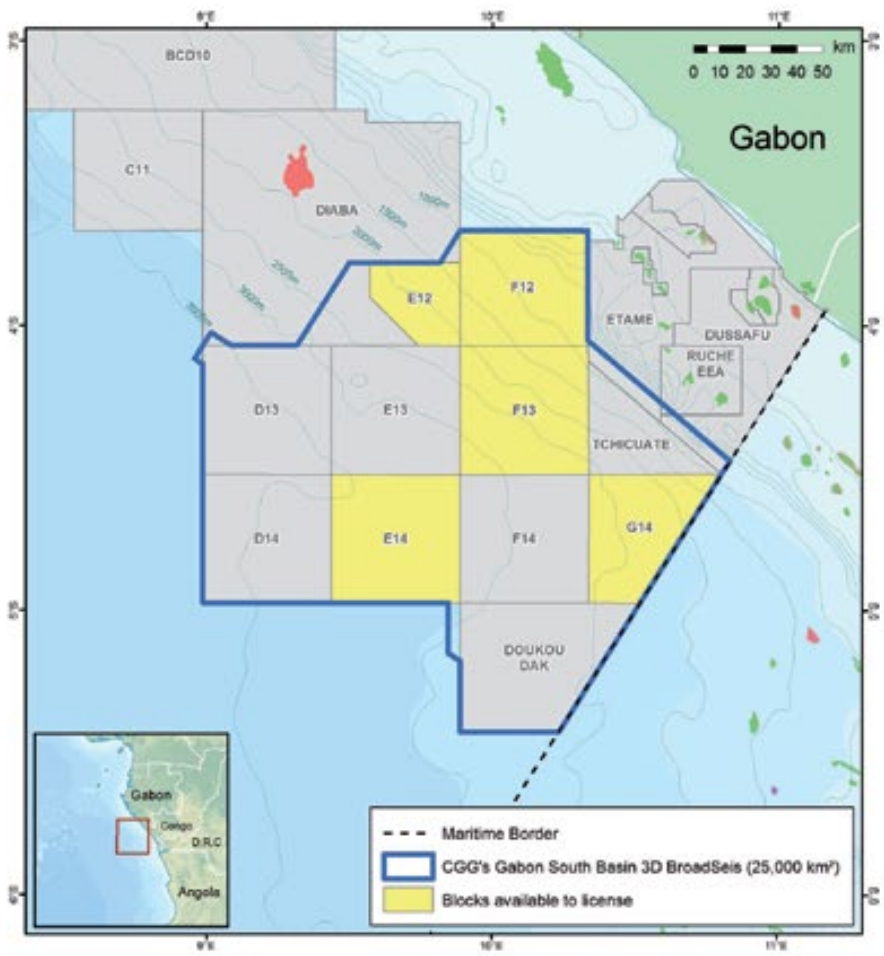
11th Gabon Deep Water Licensing Round



Until 31st March 2016, bids will be accepted for the new Gabon 11th Licensing Round which has a special focus on five blocks covering some of the country's key deep water acreage.

CGG is advising the Gabonese Republic's Ministry of Petroleum and Hydrocarbons on the promotion of this licensing round and, working with the Ministry, has acquired more than 25,000 km² of new 3D **BroadSeis**™ multi-client seismic data over the area. The fast-track data is available now.

Visit www.gabon11thround.com to find out more.



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January 2016

AAPG EXPLORER

PRESIDENT'S COLUMN

New Structure Rolling Out for AAPG

BY JOHN HOGG

Happy New Year to all! On behalf of your Executive Committee, I wish all of you good health and much happiness in the coming year!

The downturn has and will continue to affect all aspects of our industry, including AAPG.

As some of you know, we made a difficult decision to offer a voluntary opportunity for selected qualified segment of our staff to leave AAPG in the fourth quarter of 2015, and 13 out of 20 of the eligible staff accepted the opportunity and left the Association.

To those staff – many of whom have provided decades of service to AAPG and the membership – I personally want to thank all of you for making AAPG a world leader in petroleum geoscience and wish you all success in your future endeavors. You will always be part of the AAPG Family and will be missed, but not forgotten.

* * *

In the fourth quarter, the Executive Committee requested the Executive Directors to review the structure of the AAPG with a specific focus on realignment of our staff on the business of AAPG.

The new alignment, developed by the directors, will see AAPG focused on three corporate areas: business-revenue, marketing and Association administration; we will also maintain a corporate shared services group.

The business-revenue group will focus on the areas in which AAPG generates revenue for the Association: conferences, education, publications, our international offices and our wholly-owned subsidiary, Datapages.


HOGG

The new alignment, developed by the directors, will see AAPG focused on three corporate areas: business-revenue, marketing and Association administration.

Marketing will be a new primary focus for AAPG – not that we have never had marketing in the past, but now we will place all marketing components in one group to build a stronger and more consistent branding for AAPG.

The Association administration group will encompass all of the governance within AAPG: the Executive Committee, Advisory Council and the House of Delegates, and our programs such as Imperial Barrel Award, Visiting Geoscientist Program, Distinguished Lecture Program, the GEO-DC office. Corporate shared services will include accounting, information technology, our human resources functions, and a new member and customer experience center.

* * *

This new organizational structure will be rolled out through the next two quarters and your Executive Committee is confident this will provide a consistent alignment for the downturn and for moving into AAPG's next century.

As I move into the second half of my presidency I would like to thank the membership again for electing me to serve as your president.

It has been a wonderful experience filled with meeting and engaging with many members around the world, including students and young professionals who all are eager to be future leaders in our Industry.

I personally feel very good about the future after meeting so many amazing people, and when the price does recover, we will have the means to continue providing energy to the world in an environmentally responsible manner.

Candidates Announced for 2016-17

AAPG officer candidates for the 2016-17 AAPG Executive Committee have been announced, and videos that allow the membership to become more familiar with them, their careers and their thoughts were made available online last month.

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

The candidates are:

President-Elect

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

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

Vice President-Sections

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

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

Treasurer

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

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

Editor

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

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

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16 With the right policies in place, the **Vaca Muerta formation** could propel **Argentina** to its own U.S.-style **shale boom.**

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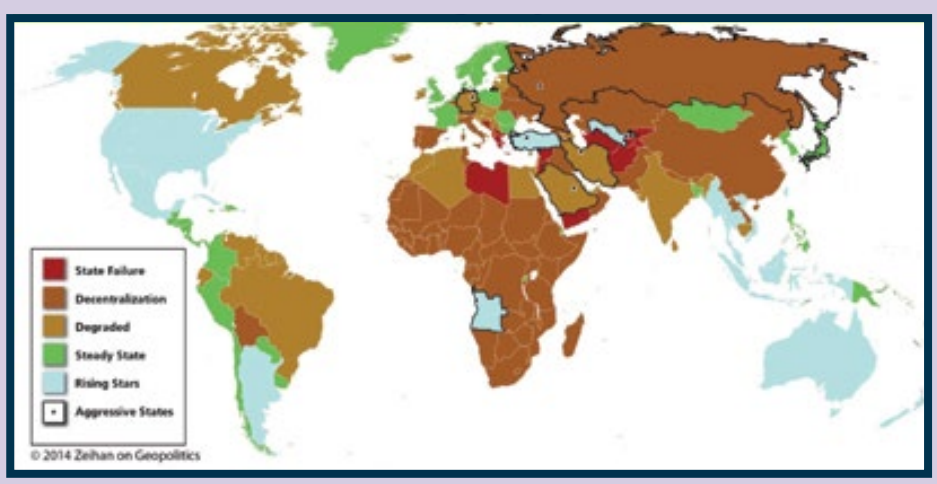

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ON THE COVER:

A view of the Vaca Muerta formation in the Andes Mountains in Argentina, which could be the wellspring from which the country's future oil fortunes flow. See story on page 16. Photo by Hernán Reijenstein.

Left: Geopolitics shape the direction of the world oil market as much as market forces alone, Peter Zeihan explains. See story on page 12.

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Editor's note: Robbie Gries is an AAPG past president and a Michel T. Halbouty Award winner. She is also co-chair of the Foundation's Visiting Geoscientist Program Committee.

Visiting Geoscientists Reach Thousands

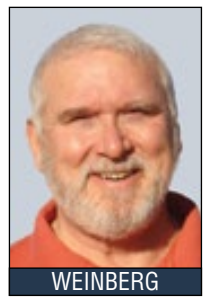
By ROBBIE GRIES


SCHROEDER


KRZYWIEC


LEONARD


RALANARKO


WEINBERG


WILLIAMS-STROUD

Since the dramatic expansion of AAPG/AAPG Foundation's Visiting Geoscientist programs in the fall of 2014, thousands of students around the globe have benefited from it.

More than 6,000 students participated in spring 2015 and more than 3,500 have participated already since July.

VGs are required to visit at least one university per year to maintain their status in the program, which is a respectable commitment in itself; but there are some who have far exceeded even that commendable standard since joining the program.

Fred Schroeder is one of the most popular VGs and has traveled to 14 universities throughout the last year, with additional trips scheduled. He is a consultant based in Houston, but he makes the effort anywhere he can combine business or vacation, particularly in the northeastern and southeastern United States and in Canada.

Trey Kramer of the University of New Orleans, said of Schroeder's Nov. 17 visit, "Great teaching ability … passion for the subject matter. Would love to have Fred back sometime! I have attended numerous AAPG and SEG short courses, this was in the top three best!"

Piotr Krzywiec, who works with the Institute of Geological Sciences in Warsaw, Poland, has given talks in Poland, Spain, Portugal, Italy and the United States – seven talks over the last year. His talks on geological and geophysical integration are popular at universities especially as they apply to unconventional hydrocarbon resources.

Ray Leonard, with Houston-based HydroDynamics Corp, gave an historic first-ever VG lecture in South Africa. His nine visits over the last year have been combined with his global business travels.

He has spoken in Oslo, Kiev; Coventry, England; Gubkin Russian State University in Moscow; Eötvös Loránd University in Budapest, Hungary; Geneva; LaSalle Polytechnic in Paris as well as the French Petroleum Institute; and at the University of Arizona. His presentation is about oil in the 21st Century and what changes can be expected.

Dwandari Ralanarko is the new VG co-coordinator alongside Herman Darman for the Asia Pacific Region; both work for Shell Oil. He began his year with an historic tour of five Chinese universities in Beijing, Wuhan, Chengdu and Qingdao (starting a new student chapter along the way). His fluency in four languages including Mandarin contributed to the success of this tour.

Last year Ralanarko visited Trisakti University in Jakarta, Lampung University and Diponegoro University in Semarang, Indonesia, and his attendance numbers broke records: His total student contact for the last 12 months was 2,350 students.

David Weinberg, a consultant from Albuquerque, N.M., gives technical talks on frac'ing and other aspects of the industry, as well as workshops on resume writing at New Mexico State, New Mexico Tech, University of Texas at El Paso and Texas A&M, College Station, Texas. This fall, Weinberg also made time during his vacation in Scotland to visit Heriot Watt in Edinburgh.

Sherilyn Williams-Stroud with California Resources Corporation in Bakersfield, Calif., recently joined the VG program. She has helped cover the Pacific Section, which has a bundle of student chapters and few VGs. She also takes time from business trips and vacations to speak in Texas and Colorado.

Michelle Judson, the VGP coordinator for the Pacific Section has initiated several efforts to better serve geology students on the west coast of the United States.

Other coordinators for the U.S. sections include Ione Taylor of the Eastern Section, Mary Broussard of the Gulf Coast, Doug Davis of the Mid-Continent Section, Dave Entzminger of the Southwest Section and Laura Mauro

See **VG Program**, page 10

Egypt Stands Out in 'Interesting Year' of Discovery

By DAVID BROWN, EXPLORER Correspondent

A number of interesting stories came out of international exploration in 2015.

Let's get to the big one right away: Everybody – *everybody* – was talking about the Eni SpA discovery of a supergiant gas accumulation offshore Egypt. It became the year's mind-blower.

In August, Eni announced that its discovery well Zohr 1X NFW found a huge natural gas field on the Sharouk Block under 4,757 feet of water in the Mediterranean. Seismic indicated the Zohr Prospect could hold 30 trillion cubic feet (Tcf) of gas, or 5.5 billion barrels of oil equivalent in place, the company said.

That important discovery also could point toward future large hydrocarbon finds, said Bob Fryklund, chief upstream strategist for IHS in Houston.

"It's a carbonate play. It's not a clastic play, so it's more significant in that way. A majority of the mega-plays over time have been carbonate plays," he said.


FRYKLUND

> **"When you look at the past five years, when you put on a map where those discoveries are, it's pretty impressive the number of new basins we've opened up."**

The Other Top Wells

The second area in the IHS Top Ten international wells list for 2015 was no surprise. Kosmos Energy said its Tortue-1 well on the Tortue West Prospect in Block C-8 offshore Mauritania made a significant, play-opening gas find.

The discovery intersected 351 feet of net hydrocarbon pay in Lower and Upper Cenomanian targets, the company reported. A confirmation well, Marsouin-1, in 7,874 feet of water encountered 230 feet of Cenomanian pay.

Earlier, Cairn Energy had opened a major new oil exploration play to the south in waters offshore Senegal with its FAN-1 and SNE-1 wells finding crude in Cretaceous sands, targeting the Shelf Edge Prospect in the Sangomar Offshore Block.

Confirmation well SNE-2, drilled late in 2015, appeared to validate an accumulation in the billions of barrels on the West Africa prospect.

Third on the list, and somewhat unexpected, was a major gas discovery in Turkmenistan. According to reports, a Bagly-1 prospect discovery in the Karakum Desert of the country's Mary province flowed 53 million cubic feet per day (Mmcfd). The find came near the established, giant Galkynysh field.

"It's giant gas reserves and they're continuing to add to it," Fryklund said. "A lot of basins we thought were mature are still delivering, like the Gulf of Mexico and western Africa."

ExxonMobil's Liza-1 discovery offshore Guyana in South America placed fourth on the list. The well, drilled by Esso Exploration and Production Guyana Ltd., went to 17,825 feet in 5,719 feet of water on the Stabroek Block and encountered more than 295 feet of high-quality oil sands.

A Major Comeback

Fryklund said the exploration year in review was notable for the size of some discoveries, the number of deepwater successes and its oil-gas balance.

"There's a couple of interesting things that stand out. Of the Top Ten wells, 80 percent of those were in deep water. The other thing is that we have two discoveries above 1 billion barrels" oil equivalent, Fryklund observed.

"It's a little more balanced, so it's 50-50 gas and oil. Some of that is helped by the Gulf of Mexico having a few entries in here this time," he said.

The majors have been largely missing from the big discoveries list in recent years, edged out by independents. Last year the majors came back, in a different mixture of successful explorers, Fryklund noted.

"It's interesting who those folks are, the mix of companies. This time it's NOCs that are making a lot of large discoveries. It's 50 percent national oil companies," he said.

Other Discoveries

Three discovery wells in the Gulf of Mexico also made the 2015 IHS Top Ten wells list, in a good year for GOM exploration.

Chevron's Sicily well in Keathley Canyon Block 814 about 180 miles offshore Louisiana was drilled to 33,749 feet and made a significant find, with reported gross resource potential of 300-400 million barrels of oil equivalent.

BP made a closely guarded discovery with its Hopkins well in the Green Canyon area and decided to fast track development, with rumors of a 60,000 barrel-per-day production facility.

And Statoil announced a major subsalt Miocene oil discovery on its Yeti Prospect in Walker Ridge Block 160, about 220 miles south of New Orleans and less than 10 miles south of the Big Foot field.

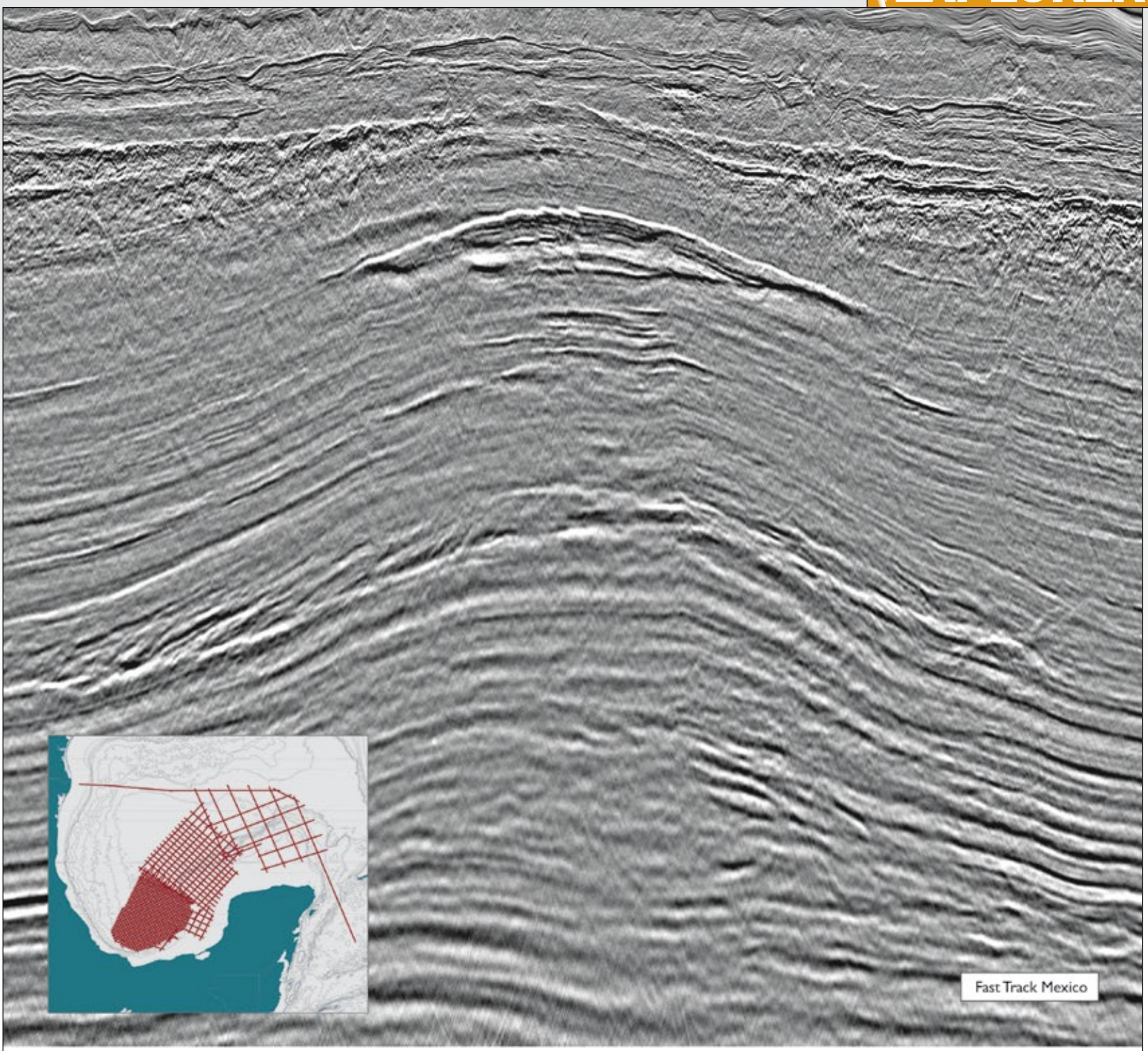
Statoil claimed an additional spot on the Top Ten list with yet another big gas find offshore Tanzania, bringing total discovered volumes in the East Africa Block 2 area to about 22 Tcf, the company said.

Rounding out the list were a China National Offshore Oil Corp. (CNOOC) discovery and a significant find by Kuwait Oil Company (KOC).

CNOOC's Lingshui 25-1 deepwater well in Qiongdongnan Basin in the South China Sea tested at about 35.6 million MMcfd and 395 Bopd from 239 feet of pay.

Later in the year, CNOOC announced a shallow-water oil discovery on the Shijutuo

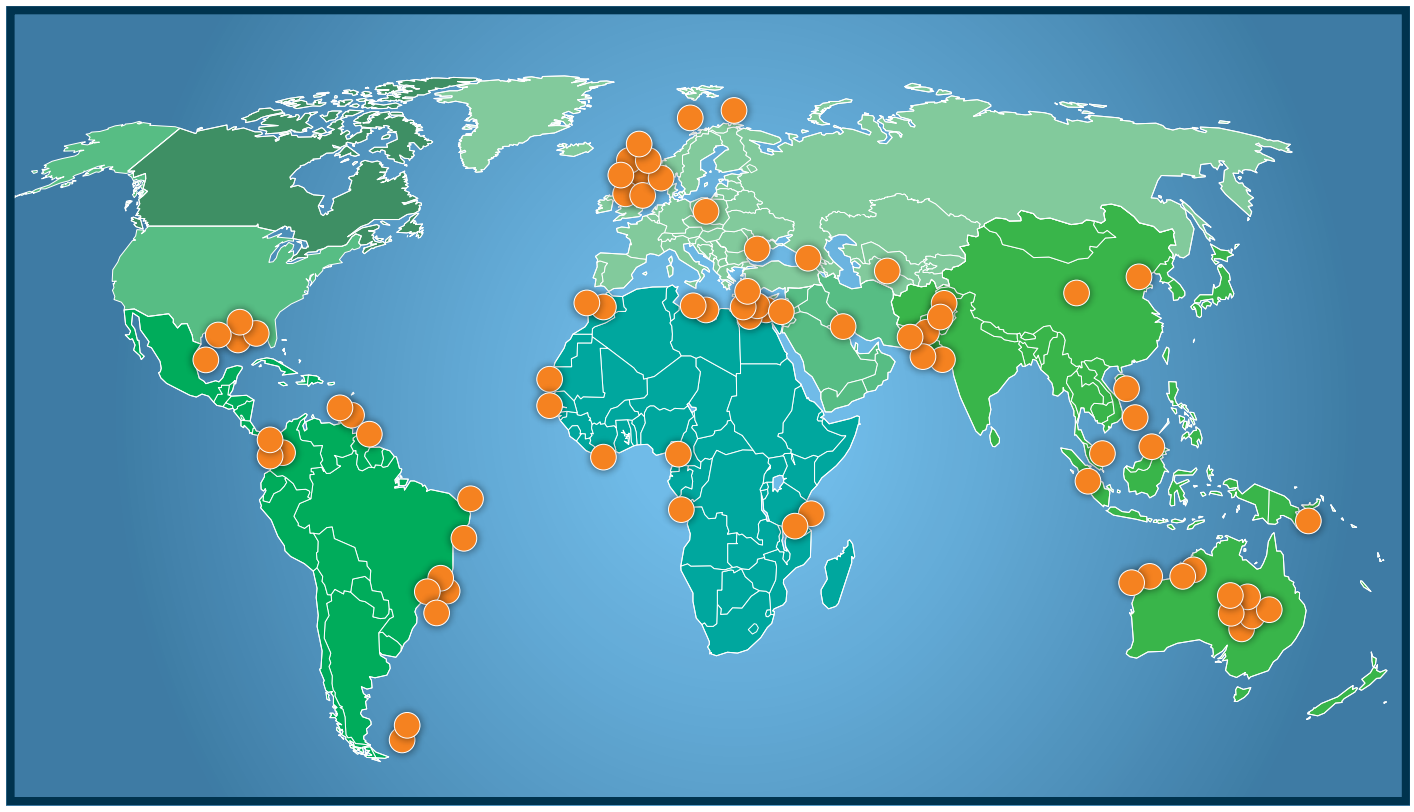
See **Discoveries**, page 18



Discovery Highlights Around the World

By DAVID BROWN, EXPLORER Correspondent

Selected highlights from international exploration activity in 2015:



January

Chevron Corp. made another Lower Tertiary discovery in the deepwater U.S. Gulf of Mexico with its Green Canyon Block 807 Well No. 2, about 140 miles offshore Louisiana. Drilled to 33,749 feet, the well intersected oil pay in multiple Wilcox sands, Chevron said.

China National Offshore Oil Corp. (CNOOC) reported a South China Sea gas discovery at the Lingshui 25-1 deepwater well in Qiongdongnan Basin. The well tested at about 35.6 million cubic feet of gas a day (MMcfd) and 395 barrels of oil per day (Bopd) from 239 feet of pay. Total depth was 13,123 feet.

Petrobras discovered more light crude in the Sergipe Basin off the country's northeast coast. Drilling on the Farfan Prospect found a new 28-meter column of oil plus gas in the BM-SEAL-11 Block, where a Brazil-India joint venture is a partner.

Caribbean Rex Ltd., a Rex International Holding subsidiary, said it found oil-bearing sands in two wells on the South Erin Block in Trinidad & Tobago. Its CH6 well went to 4,113 feet targeting Lower Forest A and B sands, and its CG8 well was drilled to 5,900 feet evaluating Lower Forest A2, B2 and Cruse.

Eni SpA announced an oil and gas find in the Melehia license in Egypt's Western Desert. The Melehia West Deep 1X discovery flowed 2,100 Bopd in initial production, with light oil in the Lower Cretaceous Alam El Bueib formation.

February

Petrobras discovered new Campos Basin post-salt heavy oil in concession BM-C-35 about 89 miles from Armacao dos Buzios in Brazil. Reported reservoir depths in the Basilisco well, drilled in 7,264 feet of water, were at 10,466 feet and 11,552 feet. BP holds 35 percent.

Drillsearch Energy Ltd. said logs indicated more than 30 feet of combined wet gas pay in the Ralgnal-1 well in PRL 130, South Australia, with 21.6 feet in the Patchawarra formation and 9.8 feet in the Tirrawarra formation. Gas flowed to surface at 5.88 Mmcfd. Drillsearch and Beach Energy each hold 50 percent.

Lundin Petroleum's 26/10-1 wildcat made a small gas discovery northeast of the Johan Sverdrup field in the North Sea. The well cut a 79-foot column in the Miocene Utsira formation.

Statoil found oil near the Ekofisk field in the North Sea with well 2/4-22S. It reported an 89-foot oil column in the Permian Rotliegend group, a 151-foot column in the Middle Jurassic Byrne formation and a 161-foot column in combined Byrne and Ula formations. Projected recovery is up to 12.6 million barrels of oil equivalent (boe).

Senex Energy Ltd. encountered oil shows in Numar sands and the Birkhead formation on the western flank of Australia's Cooper Basin. Its Martlet North-1 well evaluated potential less than a mile from the original Martlet-1 discovery.

San Leon announced a commercial gas discovery on the Rawicz prospect in southwest Poland. Its Rawicz-12 well flowed up to 4.1 Mmcfd. Palomar Natural Resources is operator with 65 percent.

March

Foxtrot International LDC, a RAK Petroleum subsidiary, found oil and gas offshore Côte d'Ivoire on Block CI-27. The Marlin North-1 well flowed 25 Mmcfd and 150 barrels of condensate a day from a 72-foot Turonian section, and 1,525 Bopd from a 30-foot oil column in the Lower Senonian.

BP Egypt scored another gas discovery offshore Egypt where its deepwater Atoll-1 well cut 50 meters of gas pay in high-quality Oligocene sandstones in the North Damietta Offshore Concession of the East Nile Delta. BP estimates the concession contains more than 5 Tcf.

Beach Energy reported strong oil shows from the Birkhead formation with its Stanleys-1 discovery in the Cooper Basin, South Australia. Logs indicated a 22.9-foot gross reservoir interval in the PRL 171 well.

Real Energy Corporation Ltd. said it tested Cooper Basin gas zones in its Tamarama-1 and Queenscliff-1 wells in Queensland, Australia. Queenscliff-1 was completed over the lower Toolachee and upper Patchawarra formations. Tamarama-1 was completed and perfed in a Toolachee section.

JX Nippon Oil and Gas Exploration Corp. discovered new oil in the UK Central North Sea. The 22/16-6, P1799 License well on the Dalziel structure flowed more than 8,000 boe per day. GDF Suez E&P UK Ltd. is operator with 30 percent interest; JX Nippon, RWE Dea UK and Total E&P UK hold interests.

Eni said it made a substantial discovery offshore Libya in the Bahr Essalam South exploration prospect of Area D, in 490 feet water depth. The B1-16/4 well hit pay in the Eocene Matlaoui formation. Eni projected the well could make more than 50 Mmcfd plus 1,000 barrels condensate per day in production configuration.

Drillsearch placed another gas discovery in Patchawarra and Tirrawarra sands at PEL 513 on the Western Cooper Wet Gas Fairway of the Cooper Basin, Australia. The Kyanite-1 well produced from several zones. Santos holds 60 percent and is operator.

More oil was discovered in Pakistan, where Oil and Gas Development Company's Palli Deep-1 discovery well produced 1,095 Bopd on choke. The well was drilled to 13,287 feet targeting the Lower Goru sands formation.

Santos Ltd. announced a "significant" oil discovery with its Bestari-1 deepwater well in Block R off Sabah in east Malaysia. The company reported 67 meters of high-quality pay between 1,860-2,702 meters, with evaluation drilling planned.

Statoil hit gas again in Block 2 offshore Tanzania, bringing total discovered volumes in the block to 22 Tcf. The company said it will pause drilling for evaluation, and may build an LNG facility with BG Group.

April

Premier Oil found net pay of 136 feet with its Zebedee well offshore the Falkland Islands. Drilled on the PL004b license, the well reached targets in Cretaceous F2 and F3 formations (Sebedee and Hector sands).

Woodside Petroleum Ltd. hit 61 feet of Jurassic sands gas pay in Production Licence WA-34-L, in Western Australia's offshore Dampier Sub-Basin. The Pyxis-1 exploration well reached total depth of 10,981 feet.

Statoil announced a subsalt Miocene oil discovery at its Yeti prospect in Walker Ridge Block 160 in the Gulf of Mexico. The Yeti well is about 220 miles south of New Orleans and less than 10 miles south of the Big Foot field.

Total's 25/6-5S Skirne East exploration well on the PL 627 license in the Norwegian North Sea found a 33-foot gas column in the Middle Jurassic Hugin formation. Estimated recoverable boe was 3 million-10 millon barrels. Centrica Resources Norge, Faroe and Det Norske Oljeselskap each hold 20 percent.

Karoon Gas Australia Ltd. said its Echidna-1 well in Santos Basin Block S-M-1102 offshore Brazil found a hydrocarbon-bearing section across Paleocene and Maastrichtian reservoir intervals. The company later put Echidna's contingent oil resources at 75 million barrels. Pacific Exploration & Production has 35 percent.

According to agency reports, Kuwait Oil Co. found the country's first high-grade, light-oil production with its Umm Ruaiss North 1 discovery and established three other new oil fields in north and west Kuwait.

Petrobras made a new discovery in the Amazon Basin's Block AM-T-84 in Brazil. Its Jusante do Aneba well found light oil and gas in arenaceous reservoirs from 4,429-6,233 feet. The company also announced an onshore Espirito Santo Basin oil find with the Guayacan wildcat, about 75 miles from Vitoria.

Chevron Australia said its offshore Isosceles-1 discovery well cut about 440 feet of net gas pay in Triassic Mungaroo sands, in the Greater Gorgon Area of Western Australia's Carnarvon Basin. The well is in the WA-392-P permit area 60 miles northwest of Barrow Island.

Drillsearch Energy Ltd. announced a near-field wet gas find in Cooper Basin, Australia. Its Emery-1 well in PEL 513 went to 10,702 feet and found "excellent" gas shows in Patchawarra Formation stacked reservoirs from 8,665-10,415 feet, plus about 25 feet of net pay in Tirrawarra sands. Santos is operator with 60 percent.

May

The MOL Group Mardan Khel-1 well in Pakistan's TAL Block tested high volumes of gas and condensate from four formations. It was MOL's seventh discovery on the TAL Block.

ExxonMobil Corp. made a major oil discovery with its Liza-1 well on Stabroek Block, about 120 miles offshore Guyana. The well was drilled to 17,825 feet and hit 295 feet of high-quality sandstone pay. Operator Esso E&P Guyana Ltd. holds 45 percent, Hess Guyana Exploration 30 percent and CNOOC Nexen Petroleum Guyana 25 percent.

China National Petroleum Corp. (CNPC) has discovered tight-oil reserves of more than 700 million barrels in its

Continued on next page

Continued from previous page

Changqing field, in the western Chinese province of Shaanxi. In first quarter 2015 the Ordos Basin field produced 487,600 Bopd, CNPC said.

Eni found gas and condensates again offshore Libya. Its A1-1/1 well was drilled in 410 feet of water and flowed 1,340 boe per day with estimated production capacity of 3,000 boe per day.

Premier Oil hit oil in the Isobel/Elaine fan complex in the North Falkland Basin. It said the bottom 75 feet of the Isobel Deep exploration well consisted of oil-bearing sands.

A CNOOC discovery on the Liuhua 20-2 Block in the eastern South China Sea tested at about 8,000 Bopd. Well LH20-2-1 went to 9,744 feet and found pay zones with total thickness of 116 feet. The well is in the Northern Slope Belt of Baiyun Sag in the Pearl River Mouth Basin.

Petrobras upgraded the potential of the Carcara offshore discovery. The 3-SPS-105 evaluation well about 250 kilometers south of Rio de Janeiro found light oil in a 1,175-foot continuous pay column.

June

Mercator Petroleum Ltd. discovered oil and gas on Block CN-ONN-2005/9 in the Cambay Basin, Gujarat, India. The Jyoti-1 well was drilled to 9,632 feet with multiple oil and gas shows in a "very good quality" Miocene clastic reservoir.

Petroleos Mexicanos (Pemex) said it made its biggest discovery in five years with four new fields in shallow water in the Gulf of Mexico, with potential for combined production of at least 200,000 Bopd and 170 Mmcfd.

Lundin Norway AS encountered a 164-foot thick gas column in appraisal well 7220/11-2 in the Barents Sea, in the western part of the Alta discovery in license PL 609. A sidetrack potentially tested at 860 Bopd and 65 Mmcfd.

Wentworth Resources hit gas with the MB-4 well in Mnazi Bay Concession, southern Tanzania. The well went to 9,146 feet and cut 219 feet of net pay in Lower and Upper Mnazi Bay targets.

July

The Cardona No. 6 deepwater development well on Mississippi Canyon Block 29 in the Gulf of Mexico cut 288 feet of net oil pay in two intervals, according to Stone Energy Corp.

Europa Oil & Gas said an ongoing extended well test on the onshore Wressle-1 oil and gas well in east Lincolnshire, England, produced more than 180 boe per day from the Penistone Flags zone.

Bowleven Oil & Gas found hydrocarbons in Paleocene (Tertiary) reservoir intervals onshore Cameroon. Zingana, the first in a two-well exploration program, was drilled on the Bomono Permit.

August

GeoPark reported another discovery success on the Llanos 34 Block in Colombia with the Chachalaca 1 well, drilled to 12,270-feet. Productive pay in the Mirador formation produced 1,100 Bopd.

Turkmenistan added more natural gas reserves with exploration in the Bagley-1 area of the Karakum Desert, in the region of Mary in the southeast of the country. Production capacity was estimated at 1.5 million cubic meters a day.

Buru Energy Ltd. said logs indicated a 75-foot oil-bearing interval at the top of the Ungani Dolomite section in its Praslin 1 well in Western Australia. The well is in permit EP 391 in the onshore Canning Basin.

Eni SpA made a supergiant gas discovery at its deepwater Zohr Prospect offshore Egypt. Its Zohr 1X NFW well, in 4,757 feet of water depth on the Shorouk Block, initiated a find that could hold more than 30 Tcf of gas in place.

September

GeoPark Ltd. said its Jacana 1 well on Llanos 34 Block offshore Colombia flowed 1,880 Bopd. Target zones include the Guadalupe and Mirador formations. Total depth was 10,900 feet in waters southwest of the large Tigana oil field.

Mari Petroleum Company Ltd. tested hydrocarbons in three formations with the Kalabagh-1A ST1 well on the Karak Block in Punjab Province, northern Pakistan. The Lower Jurassic Datta and Middle Jurassic Samana Suk flowed a combined 1,495 boe per day with 340 barrels of condensate per day, and the Paleocene Lockhart flowed 500 Bopd. MOL Pakistan Oil & Gas Co. BV holds 40 percent.

Pakistan Petroleum Ltd. made its third area discovery with the Fazl X-1 well on Block 2568-13 in Matiari District, Sindh, Pakistan. The well flowed 20.3 Mmcfd on choke with 50 barrels per day of condensate. Logs identified hydrocarbon-bearing zones in the Lower Goru formation.

In PL 104 in the northern North Sea, Statoil's 30/9-27 S wildcat found a 111-foot oil column in sandstone with moderate to good reservoir quality. Preliminary well estimates ranged between 35 million-70 million cubic feet.

LGO Energy said its GY-678 well encountered 480 feet of net hydrocarbon pay at the Goudron field in Trinidad. The well went to 4,219 feet with pay in the C-sands main target.

San Leon Energy discovered gas with the Laayoune-4 well on the Tarfaya conventional license in the Sahara region onshore Morocco. Reported gross reservoir thickness was 23 meters of sands and conglomerate.

October

OMG AV added another gas discovery in Pakistan's Sindh Province. Its Latif South-1 well flowed 2,500 boe per day from Lower Goru Intra C sands. OMV said more appraisal was needed to determine recoverables. Pakistan Petroleum Ltd. and Eni Pakistan Ltd. each hold 33.3 percent.

Mystery well: Afek Oil and Gas reportedly drilled into a 1,150-foot thick oil column at its Ness 5 site on the Golan Heights, Israel. The company later reported finding a "significant" amount of oil but did not release results.

LUKOIL Overseas Atash BV found a deepwater gas field offshore Romania with its Lira 1X, drilled to 8,858 feet. Field reserves in EX-30 Block could exceed 1 Tcf.

CNOOC made a shallow-water oil discovery with the Caofeidian 6-4-1 well on the Shijutuo Uplift in China's western Bohai exploration area. The well made 5,750 Bopd of light crude from a 180-meter pay zone. CNOOC said that was record Bohai-area test production from Paleogene clastics.

Pan Orient Energy Corp. had an oil and gas discovery in the Batu Gajah

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VG Program
from page 4

Johnson of the Rocky Mountain Section.

Samuel Akande and David Blanchard coordinate the program in Africa, Noelle-Joy Purcell and Janos Csizmeg handle Europe, Miguel de Armas (with assistance from Emily Llinás) coordinate the Latin America and Caribbean Region, Sa'id Hajiri coordinates the Middle East Region and Monika Mojelski and Frank Ryan coordinate the Canada Region.

Expanding the Visiting Geoscientist program was a major vision shared by AAPG President John Hogg, and AAPG past President Randi Martinsen. They recruited me to bring my experience from worldwide travels as AAPG president to co-chair with Andras Nemeth, who was not only chairing the program but building a presence in Eastern Europe. Within six months we recruited key people to be coordinators and recruited over 100 new VGs in all Sections and Regions.

Hogg was instrumental in helping fund the expansion program by requesting the AAPG Foundation Trustees consider providing additional funding to help reach universities which are off-the beaten-track for normal business travel.

Historically, VGs and/or their companies cover their own expenses to make visits, which is definitely a labor of love and devotion to geoscience students. This precluded many universities (most with AAPG Student Chapters) from realizing a visit from a professional energy geoscientist.

With this new (though limited) funding, each Section and Region has the ability to help with expenses for off-the-beaten-path travel. With more than 350 student chapters worldwide, 150 VGs are still not enough to sufficiently cover the globe each year, but we continue to recruit, and we continue raising awareness and knowledge about the program in universities.

AAPG members who enjoy visiting universities and speaking to students can participate by either becoming a Visiting Geoscientist or by reporting their visits to me and Nemeth as a "flash visit."

For more information, visit www.aapg.org/career/training/in-person/visiting-geoscientists.

Indonesia
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production sharing contract onshore Sumatra, Indonesia. The Akeh-1 well produced from four zones in the target Lower Talang Akar sands.

Lundin Malaysia BV found gas offshore Malaysia with the Mengkuang-1 exploration well in license PM307. It reached about 30 feet of gas pay in Miocene channel sands 46 miles northwest of the Bertam field. Total depth was 4,130 feet below sea level.

Circle Oil plc announced a gas discovery at the Caid El Gaddari-13 well on the Sebou Permit, onshore Morocco. The well hit about 20 feet of net pay and flowed at 4.45 Mmcfd on choke. Target depth was 2,857 feet.

A sidetrack to the Chevron Corp. Anchor-2 discovery on Green Canyon Block 807 offshore Louisiana in the Gulf of Mexico found an additional 694 feet of oil pay. Chevron said its combined Anchor Prospect hydrocarbon column was at least 1,800 feet in Lower Tertiary Wilcox reservoirs. The original well went to 33,750 feet.

Apache Corp. made two major discoveries in the North Sea Beryl area with its K and Corona wells. The 9/18a-39A Corona exploration well found 225 feet of net pay in reservoir-quality sands in a Tertiary prospect. Its Seagull appraisal on Block 22/29c cut 672 feet of net pay and tested at 8,700 Bopd and 16 MMcfd from Triassic sands.

November

Eni reported a gas-condensates discovery in the Nkala Marine prospect offshore Congo, in Marine XII Block. It said the Nkala Marine 1 well produced more than 10 Mmcfd of gas with associated condensates, and could contain 250 million-350 million boe in place.

Kosmos Energy reported a play-extending confirmation well in northern Block C-8 offshore Mauritania. The Marsouin-1, in about 7,874 feet of water, cut 230 feet of net pay in upper and lower Cenomanian intervals.

Petrobras announced the first extension well in the Pitu Discovery Evaluation Plan 37 miles offshore Rio Grande do Norte state in Potiguar Basin deepwater. Its Pitu North 1 oil well reached total depth of 13,780 feet in 6,050 feet of water.

A sidetrack to the Antelope-4 ST-1 well drilled in PRL 15 onshore Papua New Guinea encountered a 597-foot column of gas-bearing dolomite with a vertical gas column of 1,112 feet, according to a Total-led joint venture. The Elk-Antelope Prospect is estimated to hold 7-9 Tcf of gas.

December

A group led by Cairn Energy said the SNE-2 appraisal well on the Sangomar Deep Block offshore Senegal reached total depth of 9,268 feet, and preliminary results confirmed the 2014 SNE-1 oil discovery.

Wintershall Norge AS said its 35/11-18 wildcat in North Sea production license 259 found 902 feet of light oil reservoir in the Middle Jurassic Brent group. Targets were the Tarbert and Oseberg formations.

An appraisal well hit total oil and gas pay of 186 feet in two Upper Jurassic sands.

Game of wells

Who Will Rule the World Oil Market Over the Next Decade?

By HEATHER SAUCIER, EXPLORER Correspondent

While many are working to forecast when the price of oil might reach $80 a barrel again, renowned international strategist and geopolitical analyst Peter Zeihan predicts in stunning detail the rising and declining energy plays of 2025 and the countries that will ultimately triumph as the world's leading producers.

Zeihan, the author of "The Accidental Superpower: The Next Generation of American Preeminence and the Coming Global Disorder," was the keynote speaker at a November 2015 conference celebrating the 25th anniversary of Energistics, a nonprofit organization that manages the development and adoption of industry data management standards.

As if he were playing the games of chess and Risk simultaneously, Zeihan wove together factors of global recessions, changing demographics, civil unrests and the dance of supply and demand to support his theories on future energy power plays.

And, his predictions are so thoroughly supported with data and rich with geopolitical intrigue, Zeihan himself resembles a cross between a James Bond villain and an analyst for some military think tank (but much less menacingly, of course).

And Along Came Shale

Not only has shale oil turned the energy world upside down, Zeihan believes it is quickly paving the way for the United States to become energy independent by 2017.

Ever-evolving technologies, such as 4-D seismic, are eliminating the 20/80 rule – the idea that 20 percent of frac stages generate 80 percent of petroleum from shale fields.

"You know exactly where to go (in a formation). There is no guessing. This has dropped the use of inputs – whether that's skilled labor, sand, or water or chemicals – by two-thirds," Zeihan said. "Cross that over with new drilling techniques that are now becoming industry standard … and the results are mind blowing."

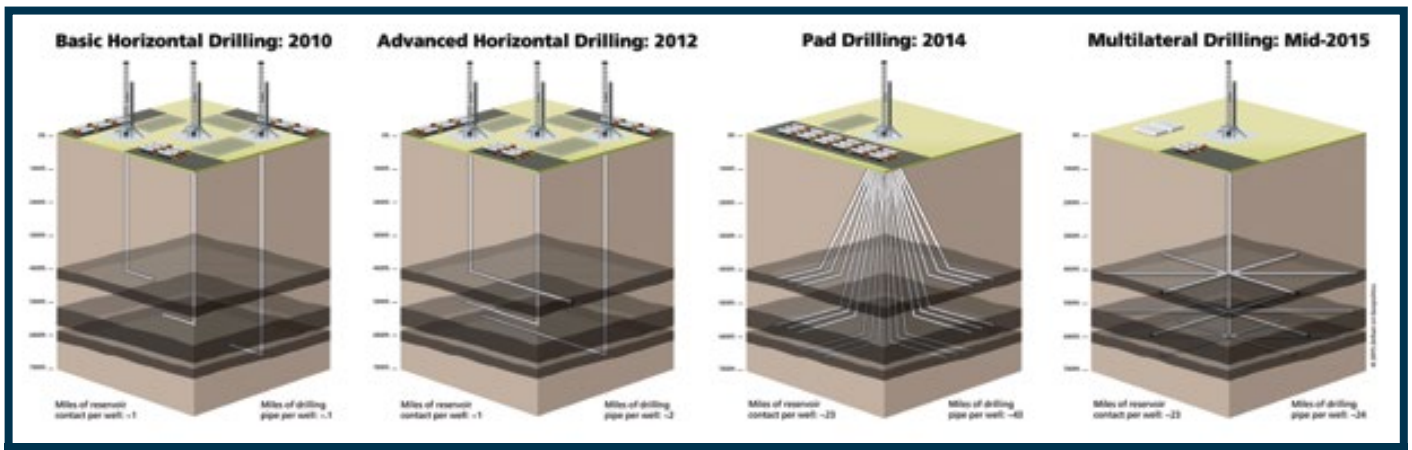
Five years ago, wells went down a mile and extended laterally by 600 feet. Two years later, they reached out a mile. "That's a ten time increase in drilling capacity per pad," he said. "Then they started combining surface infrastructure, and you have upwards of 20 straws going into the ground in the same place. Your surface costs have now dropped about three-quarters."

Zeihan predicted that one straw attached to 20 or 30 miles of lateral pipe will be industry standard by the end of 2016.

"Think of what that does to input costs," he said. "We are not in an energy production recession in the United States. We are in an energy input recession. That's very different."

Zeihan believes the break-even costs in the shale patch soon will be at $35, perhaps even $30, a barrel.

"That will make shale cost-competitive with every oil production zone in the world outside of the Persian Gulf," he said. "Imagine what's going to happen when re-frac'ing becomes industry standard."



Evolution of the drilling pad.

Era of Decline

Consumption of energy has dropped in the United States, beginning with the 2008 recession and oil prices reaching $80 a barrel, prompting many to buy hybrid automobiles – ultimately cutting American demand by 2 percent, Zeihan said. Combine those factors with the fact that Baby Boomers, the largest generation ever seen in the United States, are beginning to retire and drive less, and demand is undoubtedly decreasing.

"The United States is looking at at least 15 – probably closer to 25 – years of secular demand decline even with oil prices at $40 a barrel," he noted.

Furthermore, with the advent of shale energy, the United States is now importing oil from six locations instead of 30.

"We are seeing the end of the American import story," Zeihan said, explaining that net imports to North America are less than 3 million barrels per day and will continue to decline as advanced hydraulic fracturing technology becomes the norm.

In Europe, demand is declining as well – mostly because of its financial crisis, Zeihan said. "The Europeans were looking at secular demand decline even before you consider the recession that they've pretty much been in for the last seven years," he said. "That means less inflows of energy."

"Throw in the Russians and they are starting to dominate the oil matrix of Western Europe, and the only place you can go (to sell oil) is Asia. So the Asian premium … instead of being $3 to $8 a barrel, it's like 50 cents to maybe $1.50. Not nearly as exciting," Zeihan said.

ZEIHAN

Add to that the reality that the United States is becoming less interested in the wider world and no longer needs to provide naval security for global maritime free trade, as was established in the Bretton Woods system of monetary management in 1944. The United States' motivation for sustaining that system was to buy alliances with other countries for economics and security, and to ultimately win the Cold War, Zeihan said.

"Only 7 percent of our GDP came from exports last year, and half of that was from NAFTA (North American Free Trade Agreement)," Zeihan said. "So we've got a global system that the Americans designed to fight a war that ended 25 years ago. This is the culmination of the Americans stepping back from the global system a little bit every year for the last 25. And very soon the plug will be pulled."

The Domino Effect

Having set the global stage of today, Zeihan began to predict the consequences of the United States' shale boom and simultaneous disinterest in the wider world:

With Asia being the primary market for oil, the Asian premium is inverting at a time when there is overproduction.

"A system this lopsided cannot possibly last," he said.

Secular demand is changing, but more importantly, secular supply is too. A crack in the Middle East, a crack in the Russian system and a crack in East Asia – all of which are leading toward sharp supply declines in the world's major basins and an inability to get what's left of that supply to East Asia – and the following breakdowns begin to take place:

The Canadians, who have supplied oil to the American Midwest, are trying to negotiate a series of pipelines to the American Gulf of Mexico refineries so its heavy sour crude can be mixed with the United States' light, sweet oil from shale for a medium blend, which existing refineries can process without being retooled. If these pipelines – "the Keystone being the loudest one" – cannot be negotiated, Canada's Athabasca Region will likely shut down, Zeihan surmised.

Looking at Russia, Zeihan pointed out that the country is becoming imperialistic to secure its borders, knowing its army is dwindling on account of a low birth rate since the end of the Cold War.

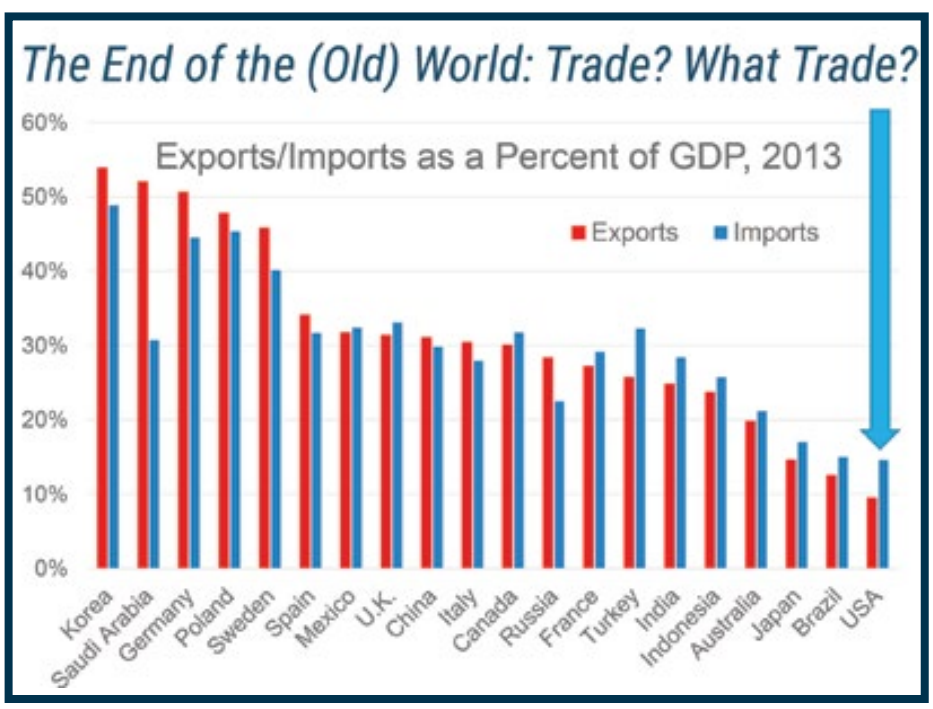
"The entire western periphery of Russia stands out from the rest of the geography, from the rest of the world, because the highest physical barrier between the Russian populations and everybody else is about the same elevation as an interstate on-ramp in Kansas," Zeihan quipped. "There's nothing there that stops people from marching in."

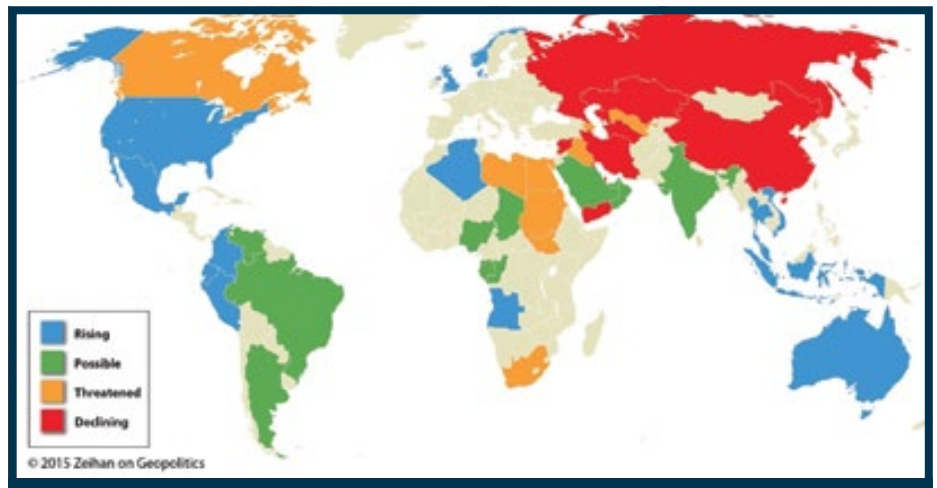
Zeihan believes Russia's goal is to expand to include the Caucasus, the Carpathians, the Polish Gap and the Baltic Sea countries to shrink its western periphery from 3,000 miles to roughly 600.

"Militarily, it's not a challenge. The countries around Russia are weaker than Russia is. The only question is timing," Zeihan said. "If you move forward three or four years when it has really sunk into the Americans that they can go on their own and be alright, then we enter a world where we look to the French to convince the Germans to invade Poland to fight off the Russians, which if you follow your history is not a preposterous concept."

In this conflict, it is not out of bounds for Russia to cut oil and natural gas supplies to other countries as a political tool prior to an invasion, Zeihan said. Or, its targets might cut the supply chain to give the Russians pause. "Either way you are looking at 6 million barrels of crude

See **Russia**, page 14





Supersizing global oil: projected energy plays of 2025.

Russia
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per day and 150 billion cubic meters of natural gas facing some degree of threat," Zeihan said.

Strategy

Here is how Zeihan foresees the conflict erupting: Once the Russians invade the Baltic countries, Sweden will lead an alliance to join in. When the Russians invade Poland, the Germans will feel no choice but to jump in. Zeihan said Russia believes it can handle the Swedes and the Germans, yet it will not be able to do that in the midst of a third conflict with Turkey.

Therefore, Russia must launch a distraction strategy to bring the Turks out of the coalition – "which brings us to Syria," Zeihan said. The Fertile Crescent area of Syria contains 60 percent of the population and 95 percent of the food production. While ISIS does not inhabit that area, it could.

"Do you ever associate ISIS rulership with state agricultural output?" Zeihan asked. "Russia's plan is simple. Remove the barriers in play so that ISIS can get to the Syrian heartland, and if you have a three-way war between the rebels, the government and ISIS, you generate a famine and 15 million refugees. All of them have to go to Turkey."

Zeihan added more color to his analysis: "Regardless of whether or not Turkey just shoots everyone at the border, invades in order to impose stability on Syria, tries to process them, or tries to pass them through to the Europeans – no matter what choice Turkey makes, strategically, it is occupied for at least half a decade, which means the Turks don't have a free hand to intervene in the Ukraine or the Caucasus. Russia has removed Turkey from play. It's a brilliant move. Morally, horrific. But strategically brilliant."

Conflict in the Persian Gulf

On another front, as the Americans slowly pull out of the Persian Gulf, potential for conflict will heat up, Zeihan predicted, with the Saudis and Iranians opposed politically, economically and strategically.

"Because of shale they are now exporting the same product along the same routes going to the same countries. But really, think of this as the Texas A&M and UT rivalry, just with more guns," he said. "And like all great rivalries, eventually fans end up on the wrong side of the border in the wrong bar."

Speaking of Iran and Saudi Arabia alone, 11 million barrels per day of crude production could be at stake. "That assumes nobody gets caught in the crossfire," Zeihan said. "That assumes that the war, the conflict, doesn't spread anywhere else. And it will."

He reminded that there are eight major conflicts currently taking place in the Middle East, and the Saudis and the Iranians are opposed in all eight of them.

"The Saudis are using their checkbook diplomacy to fund, arm and create groups as they need, and the Saudis are winning in six of those eight conflicts. Syria is an example of a conflict where the Saudis are winning. ISIS gets funding from Saudi Arabia," Zeihan said.

"What will be really fun is when the day comes for artillery to be exchanged and the Iranians will fall back on the strategy they've had the last four years: Try to close the Gulf, which will convince everybody in the global system to put pressure on the United States to end this, to prevent a global energy recession," Zeihan said.

At that point, however, the United States will likely have lost interest, he continued. "In fact, I expect the Saudis to help. Because to fight the Iranians, the Saudis have a bypass pipeline. They can get 5 million barrels of crude out."

Therefore, Iran loses all export capacity for a period of time, and things begin to look bleak for Iraq, Kuwait and Qatar as well, Zeihan said. "You're looking at potentially 20 to 25 million barrels of crude that just can't get out," he said.

On Asia's Shoulders

Moving eastward, Zeihan pointed out a third global conflict that could arise in Northeast Asia. "If we get into a position where we have an absolute shortage of crude, remember why the Asian premium has existed since the Nixon administration. It's a long sail – no suppliers – all the way to Northeast Asia," he said.

"If there is a reduction in output anywhere, the entirety of the impact is felt in Northeast Asia. Northeast Asian countries – all of them – are navally capable. And if the U.S. isn't providing the security, they will have no choice but to deploy their own navies to the Persian Gulf, pick sides in the Middle East and … then escort crude back home to their home countries," Zeihan said.

Speaking tongue-in-cheek, he added, "As we all know, the Chinese, the Japanese, the Koreans and the Taiwanese have a long – centuries long – history of cooperation and brotherly appreciation. There's no chance whatsoever that anything could go wrong in any of that."

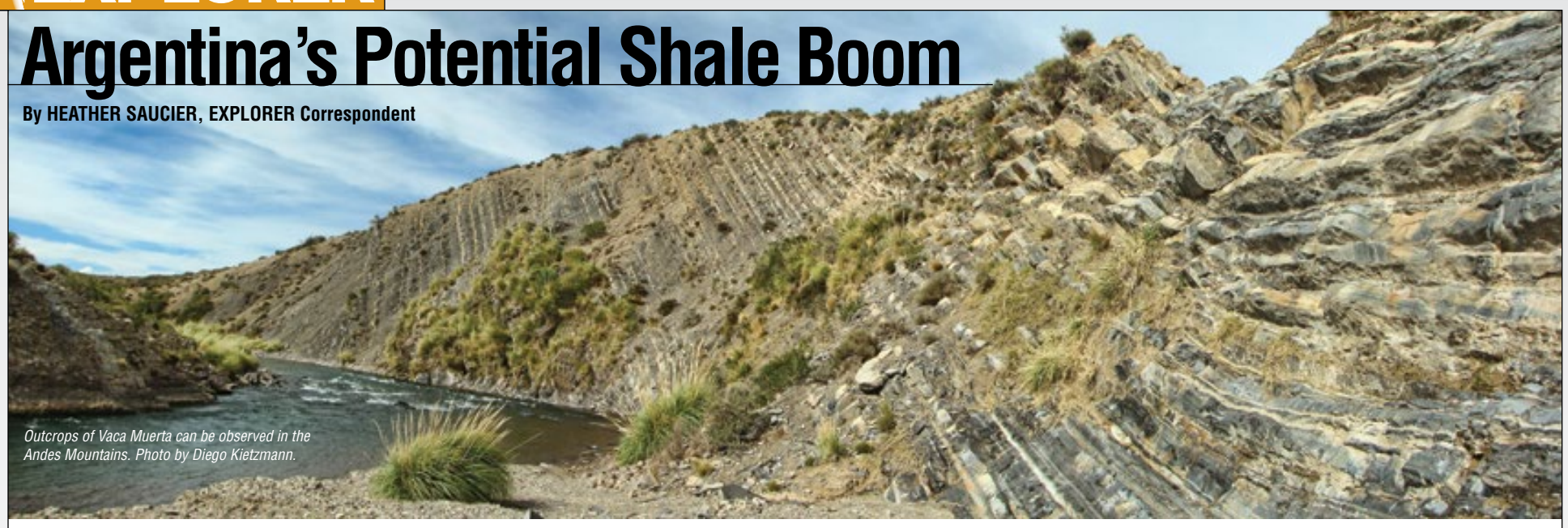
Escaping Energy Disruptions

While Zeihan predicted that energy disruptions are essentially guaranteed in Russia-Europe, Saudi Arabia-Iran, and Northeast Asia, countries and regions that

See **Secured Locations**, page 18

Argentina's Potential Shale Boom

By HEATHER SAUCIER, EXPLORER Correspondent



Outcrops of Vaca Muerta can be observed in the Andes Mountains. Photo by Diego Kietzmann.

Since shale plays began revolutionizing the oil and gas industry, North America has been the dominant continent in making them successful. But a strong contender some 5,000 miles south of the U.S. border is beginning to turn heads.

Geologically speaking, Argentina is considered a rising star in the shale oil and gas industry because of its Vaca Muerta formation, discovered to be a world-class shale gas/oil play in 2010 and believed to contain an estimated 16.2 bbo and 308 tcf of recoverable natural gas by the Energy Information Administration.

"That's enough for the country to emulate the U.S. shale boom," reported Platts last August.

With an incredible thickness of 1,000 feet in its northern reaches, Vaca Muerta has operators contemplating stacking horizontal wells in each pay zone to optimize production.

Yet, the play is in the early stages of production and some fear it might stall there.

While Vaca Muerta has no doubt cleared the geology hurdle, standing in its way are obstacles of economics and national policies that could keep Argentina's bountiful resources in the ground.

International operators with stakes in the play remain hopeful that the country will continue a trend of revamping policies to help make long-term investments in Vaca Muerta attractive and safe.

And as they wait, they are surprising many in the industry by sharing proprietary seismic and well data to speed up the exploratory process with the hope of kicking production into high gear and eventually placing Argentina in a prominent position on the shale map.

Vaca Muerta Shale

Named after a hill called the "Dead Cow" in the foothills of the Andes Mountains in west-central Argentina where the Vaca Muerta Formation outcrops, this geological unit covers approximately 12,000 square miles in the Neuquén Basin.

It has been one of the main source rocks of conventional oil and gas in the Neuquen basin since 1918. Yet it wasn't until 2010 that the first Vaca Muerta unconventional oil discovery was made in the shale itself by then Yacimientos Petroliferos Fiscales (YPF)-Repsol, the former parent of Argentina's newly nationalized YPF.

The largest shale operator in the country, YPF reported in April 2015 that production had reached 43,000 bpd of oil equivalent in its most prolific field, Loma Campana, which is being exploited with a subsidiary of Chevron. It is the first shale oil development project outside of North America.

REIJENSTEIN

A year ago, the operator YPF reported an investment of more than $3 billion to drill roughly 350 vertical wells and roughly 50 horizontal wells in Vaca Muerta.

"Vaca Muerta rivals U.S. plays in having similar reservoir properties, like porosity, areal distribution, geomechanical properties, a wide range of fluid types – such as oil, condensate and gas – but a much higher thickness than other plays.

It is essentially like having multiple shale plays stacked one on top of the other," said AAPG member Hernán Reijenstein, an earth scientist and stratigrapher at who has worked on Vaca Muerta for nearly three years. "However, Vaca Muerta is on an earlier exploratory stage compared to most North American shale plays. There is still a lot to do!"

Initially, most operators in the basin believed the best approach to exploiting the thick portions of Vaca Muerta was to drill numerous vertical wells and hydraulically fracture them, Reijenstein said.

That thinking is now changing, partly influenced by proven horizontal drilling and fracturing practices in the United States, and partly because horizontal wells – although more expensive to drill – typically yield twice the productivity.

Of course, stacking horizontal wells – a design that would be required by Vaca Muerta's multi-layered pay zones – would be an exercise in trial and error, as few plays in the world are similar – the Montney shale play in Canada being one.

"It is a nice problem to have," Reijenstein said of the challenge.

Other operators are willing to try as well. It is reported that companies with partnerships, contracts or memorandums of understanding with YPF include ExxonMobil, Shell, Total, Medanito (of Argentina), Tecpetrol, Pan American Energy, Petrobras, Wintershall, Dow Argentina, Petronas (the Malaysian state oil company), Helmerich & Payne, Gazprom and Sinopec.

Tricky Economics

As some of the players move into the pilot phase of the play, the "slow progression" they are making is a sign of the difficulties that exist when doing business in Argentina, reported Platts, stating that the most difficult challenge is reducing drilling and completion costs to profitable levels.

YPF has brought down the cost of drilling a vertical well from $11 million in 2011 to $7 million in 2015. Yet, the cost of a typical horizontal well in the Eagle Ford or Bakken formations is $4 or $5 million.

Without profits, the reported $20 billion a year needed to develop Vaca Muerta won't be met. "Without the investment in drilling tens of thousands of wells, the economies of scale won't be reached on the fields to cut costs," Platts reported.

The roughly 400 wells drilled to date must still be tested for several years before companies will likely commit to investing a serious amount of capital – especially during an economic downturn.

To attract investors, Argentina has made some changes in light of the country's well-known economic and political turmoil. It has raised gas prices to $7.50/MMBtu, fixed light crude at $77 a barrel, introduced tax breaks on importing rigs, and extended shale field licenses to 35 years, according to Platts.

More importantly, though, the country must regain access to international financial markets after severely defaulting on loans. "It is hard to raise money for drilling in Argentina – and expensive," reported Platts. "Borrowing costs run about twice that of neighboring Brazil."

Without access to lower interest rates, developing Vaca Muerta will be difficult without funding from international investors.

Attracting Investors

As director of the Latin America and Caribbean Energy Program at the Jackson School of Geosciences at the University of Texas at Austin, Jorge R. Piñon has visited with countless financial leaders from various governments and understands the challenges of countries that are rich in resources but poor in capital and technology.

Piñon explained that, more often than not, these countries change agreements mid-game, making it difficult for international operators to stay on budget and generate anticipated long-term profits in order to recover capital investments.

Common game-changers have been:

- Changing royalty agreements.
- Upping concessions yet still requiring third-party investors to act as operators.
- Raising taxes on produced oil, among other assets.
- Increasing local content requirements.

"The issue with Argentina is the same as the issues with many other countries in Latin America. It's not an issue of geology. It's an issue of having the right 'shovel' to access those resources," Piñon said.

"They need to have the right model for private capital and technology to come in and monetize those resources. It's an issue of continuity and having a political system that somehow guarantees a long-term investment and commitment so that the rules of the game are not going to change every time there is a political change in the host country."

He added, "International companies have had doubts about Argentina because in the past, politically, they have changed the rules of the game."

However, Piñon believes that the newly elected President Mauricio Macri's choice of former oil industry executive Juan José Aranguren as Energy Minister (the former

Continued on next page

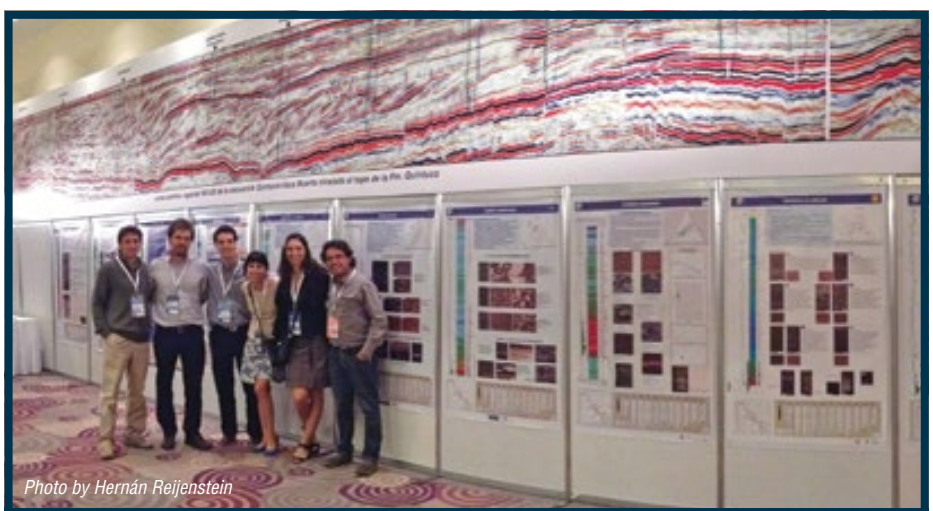


Photo by Hernán Reijenstein

Members of the Argentine Oil and Gas Institute (IAPG) congress, known as CONEXPLO, agreed to share well data and seismic information to better understand the Vaca Muerta play. A transect of the information was hung on the wall at the congress and ran 3 meters tall by 15 meters wide.

Continued from previous page

head of Shell Argentina), will bring much needed business experience into the policy position.

Having had several conversations with senior federal and provincial officials, Piñon said he believes that Argentina is ready to commit to a contract model that will attract long-term foreign capital and technology.

Importing much of its natural gas from Bolivia, Argentina needs a successful shale play to provide power to its people. "This is an opportunity they cannot throw away," he said.

In the Meantime

Despite the uncertainty, a number of operators who have leased blocks in Vaca Muerta agreed to press ahead in their ventures and share data and standardized interpretations from one of their exploration wells in addition to their 2-D seismic data to help piece together the regional geology of Vaca Muerta as a whole.

Such transparency saves each operator about two years of time, Reijenstein said. "Once you understand the geographical distributions of the rock properties throughout the basin and the regional context of the play, you can be more predictive in knowing where you will find sweet spots and more productive areas in your own blocks. And also, it can save some operators from losing money in marginal areas."

The idea of sharing information came from several geologists in advance of the November 2014 Argentine Institute of Oil and Gas (IAPG) congress, known as CONEXPLO. They proposed generating a regional, multi-company well transect that would run 250 kilometers long and span roughly 15 blocks of the basin.

The idea was quickly accepted by most of the operators, including Chevron, and eventually expanded to include 2-D seismic data and detailed outcrop descriptions from the western edge of the basin, Reijenstein said.

The regional seismic transect, which included tied well logs and mineralogical interpretations, was hung on the wall at the congress and ran 3 meters tall by 15 meters wide.

"You could see the different wells along the transect and see how the mineralogy changes from the base to the top," Reijenstein said. "It allowed people to gather in front of this huge panel, make observations, and discuss their own interpretations during the congress."

Reijenstein said he has never experienced this type of collaboration before and is grateful companies agreed to share proprietary data that many typically hold so sacred.

"From a scientific point of view, it's always much better when you are working with more data," he said.

Since the congress, those who participated in the transect agreed to have their well and seismic data published in a book with a working title of "Transecta Regional de la Formacion Vaca Muerta." The book incorporates integrated outcrop studies from Diego Kietzmann at the University of Buenos Aires with subsurface data from the industry to facilitate understanding of the Vaca Muerta play.

"The sharing information efforts between companies, universities and consortia are quickly advancing the Vaca Muerta knowledge at an industry level in Argentina," Reijenstein said.

The book will be published this year by the IAPG.

Progress To-Date and Future Plans in Vaca Muerta

- YPF has drilled and completed 400 wells in the Loma Campana block, which has become the first development field of the Vaca Muerta shale play. In the wet gas window, El Orejano block, which is currently in the delineation phase, has 17 wells in production. According to YPF, the development phase will begin in 2016.
- From an exploration standpoint, YPF has been exploring Vaca Muerta since 2010, drilling and completing more than 60 exploration wells. Exploration activity in the surrounding blocks of Loma Campana, such as Bandurria Sur and Bajada de Añelo, is coming to an end, with 10 wells drilled and production performances that have proved an important acreage of the southern core area. YPF plans to start the first phase of development pilots in 2016 that include La Amarga Chica (in association with Petronas). For the northern and western parts of the basin (dry gas, wet gas and oil window areas), YPF plans to accomplish its remaining exploratory commitments in 2016, with an opportunity to begin delineation of shale gas and oil projects after 2017.
- Tecpetrol drilled an exploration well in 2014 resulting in a discovery well (gas and condensate production). Future plans include a 2016 drilling campaign in blocks Fortín de Piedra, Los Toldos and Loma Ranqueles.
- Shell has drilled 13 horizontal wells from 2012 to date, 10 of which have been completed. Lateral length varies between 500 to 1,500 meters long. Two of those wells – in the Sierras Blancas block – are considered to be part of the top five producing wells in the Neuquén basin. Next year, Shell will inaugurate a pilot early production facility in its southern blocks where it has been granted a 35-year exploitation license.
- ExxonMobil has a $1 billion unconventional pilot plan in the Bajo del Choique and La Invernada blocks in the Neuquén basin to be developed in 2016-17. This is the only unconventional project of the company outside the United States. ExxonMobil declared commerciality on both fields in September 2015 and will apply for a 35-year production concession. ExxonMobil's subsidiary, XTO Energy, will oversee the local operations in these blocks.
- Wintershall has drilled three exploration vertical wells in the Aguada Federal block of the Neuquén Basin. One well was drilled in 2012 by Gas & Petroleo de Neuquén, a provincial company, and the two additional wells were drilled in 2015 by Wintershall. In early 2016 Wintershall will begin a four-horizontal well exploration program to evaluate upper and lower Vaca Muerta objectives.

Discoveries
from page 6

Uplift in China's western Bohai exploration area. Its Caofeidian 6-4-1 well tested at 5,750 barrels per day of light crude from a 180-meter pay zone in Paleogene clastics.

And KOC established Kuwait's first commercial, high-grade, light-oil production with its Umm Ruaiss North 1 discovery and other successes at the northern Al Rawdhatain and western Al Manageesh fields.

Expectations for 2016

A fruitful year for exploration advanced the industry around the world, but with a good-news, bad-news aspect, Fryklund said.

"When you look at the past five years, when you put on a map where those discoveries are, it's pretty impressive the number of new basins we've opened up," he noted.

There's a catch, however. Recent discoveries have tended to be more compact, smaller plays with secondary discoveries of diminishing size, Fryklund said. It isn't winner-takes-all, but often it seems like first-takes-most.

Fryklund said he's keeping his eyes on several intriguing play areas and wells in 2016.

"I would look, for the future, to the Kara Sea. That's where Rosneft made the Universitetskaya discovery last year. There's probably another 10 structures of that size up in there," he said.

Heritage Oil International plans to explore on the Caravaggio Prospect in Area 7 offshore southeast Malta, seeking commercial production from carbonate reef targets in Lower Eocene and Cretaceous, he noted.

"That's an interesting one. Another one coming up in 2016 is the Total well in Uraguayan waters. There's an area where we haven't seen activity in 20 years," he said.

"One of the things that strikes you over the past five years is that Asia has been slow going," Fryklund observed.

"China onshore still has some running room. It's dominated, obviously, by the national oil companies. The Chinese focus has really shifted – they have a focus of trying to get gas from shale," he said.

While exploratory drilling offshore Colombia has already shown progress, it's unclear whether the size and potential of the play will produce significant successes and ongoing development, Fryklund noted.

"Whether we get enough scale there is going to be interesting," he said.

Finally, a tantalizing and highly prospective offshore area in the United States lies close at hand, but probably will remain out of bounds.

"The one that still begs more modern exploration is the west coast of the U.S.," he said.

Fryklund said the oil price collapse presents a danger for international exploration, where a loss of momentum would delay future supply coming onstream, with an ultimate negative affect on global energy sourcing.

"If we aren't drilling wells and finding stuff, we're going to be pushing things further out," he said. "One of the things that worries people is, 'What's the first thing that goes away in one of these downturns?' It's exploration."

Secured Locations
from page 14

will likely escape the turmoil include: the United States, Mexico, Central America, Australia/New Zealand, Indonesia, Malaysia, Myanmar, Philippines, Vietnam, France, United Kingdom, Denmark, Netherlands, Sweden, Switzerland, India, Argentina and Turkey.

"These are locations that are geographically secure, physically secure in the future and have neutral-to-strong and grown demographies," Zeihan said.

A big piece of his reasoning – at least for the United States – is California, which is now the nation's largest oil importer. Fast-forward two years and it may be the only one, Zeihan said.

"That's fantastic … because you have access to American levels of security and protection, but a near bottomless local import market," he said.

Currently, California imports roughly 800,000 barrels per day. It sources more than half from the Persian Gulf. Although Kern County, Calif., has not yet been able to get into shale because of the cost, it likely will have a breakthrough soon, Zeihan said.

"Here you have a system where you can produce crude locally or in Alaska," Zeihan said. "Alaska, by a quirk of American law, is exempt from the export ban. So $50 crude for the long haul is really depressing … but if you can sell it for $150 in California, well hot damn. If you can produce in Alaska, which actually has a regulatory environment that you guys enjoy, and then sell that abroad, hot damn."

"So it's not the wider world but this – in terms of security and risk/reward – this looks brilliant," he said, adding that the United States, Mexico and Central America will have "rock bottom" energy prices because of shale.

Rising Plays of 2025

Combining countries' physical security, demographics and energy producing potential, Zeihan presented a predictive map of energy plays in 2025 that ranked countries from to "rising" to "declining."

Rising countries include: the United States, Mexico, Colombia, Ecuador, Peru, Australia, Indonesia, Vietnam, Thailand, Angola, Algeria, United Kingdom, Norway and Denmark.

"These are places where investment is good and security is good. The production horizons vary country by country, but you should see a pretty strong expansion," Zeihan said.

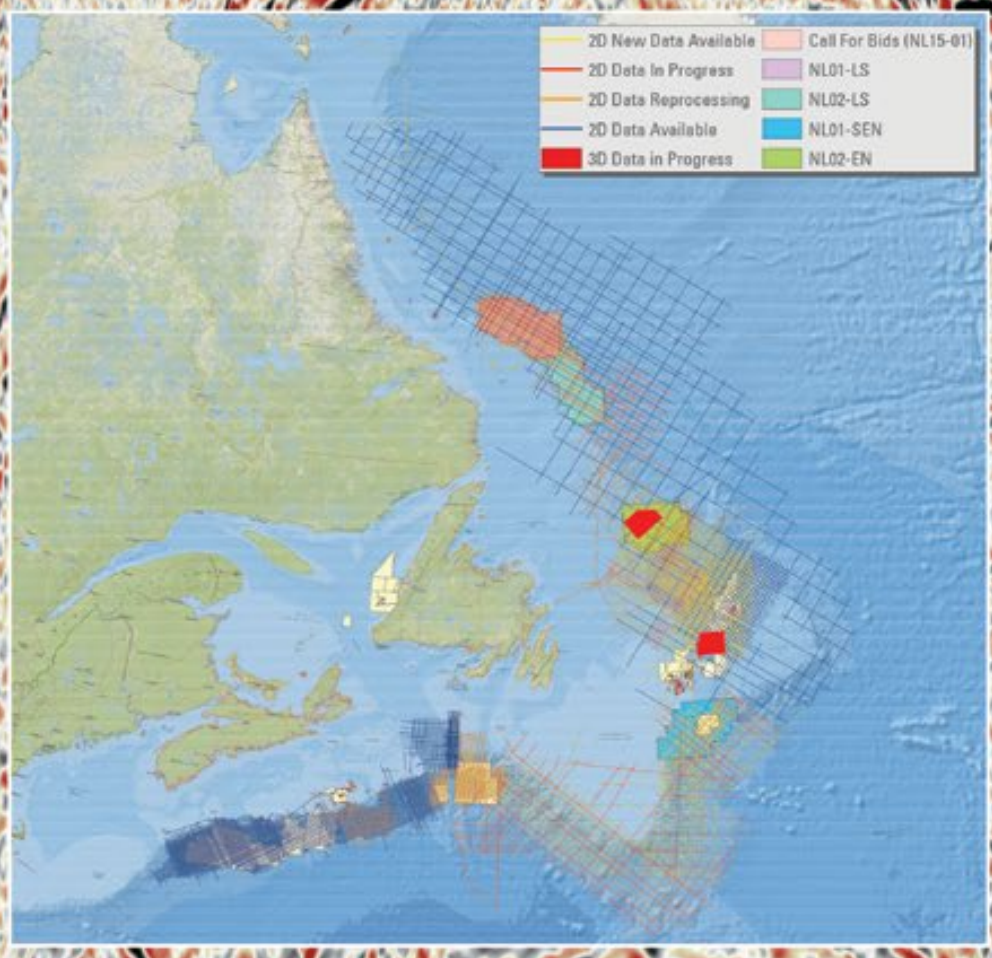
Countries that may encounter obstacles include Saudi Arabia, Argentina, India, Nigeria, Brazil and Venezuela.

In "declining" countries such as Russia, Kazakhstan, China, Yemen and Iran, Zeihan said, "I can't see a scenario where we will be seeing more crude or better operating conditions in these countries."

Zeihan ended his vision for the future of energy where he began – with shale. "Canada, Mexico, the United States, Argentina and Australia – that's it for shale in the appreciable volumes. For everyone else, it's whether they can sustain a relationship with an outside power," he said.

The United States, the "accidental superpower," comes out on top. "There's nothing in the broader external system," Zeihan said, "that could really threaten the United States in a systematic way."


See the energy at TGS.com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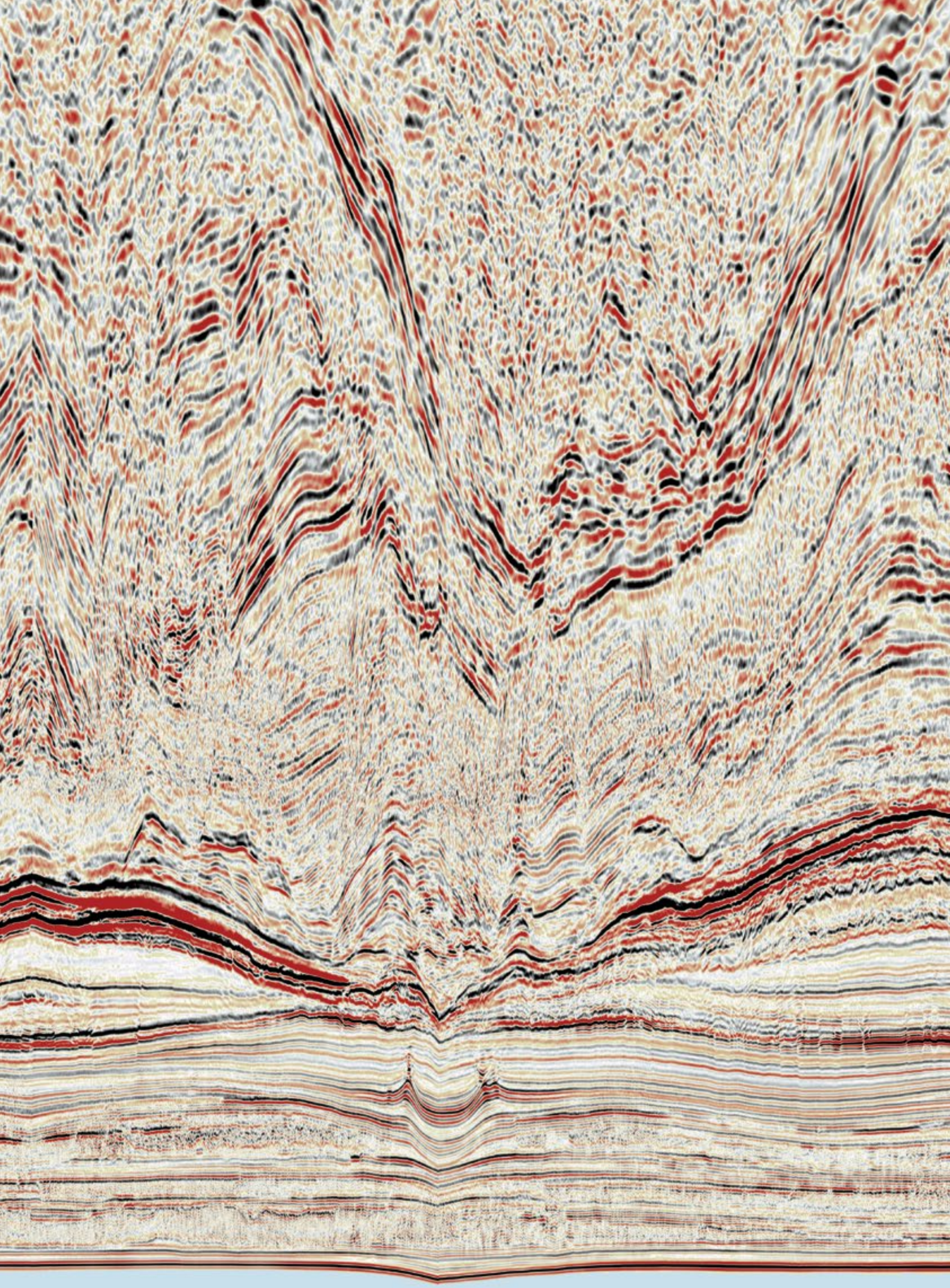
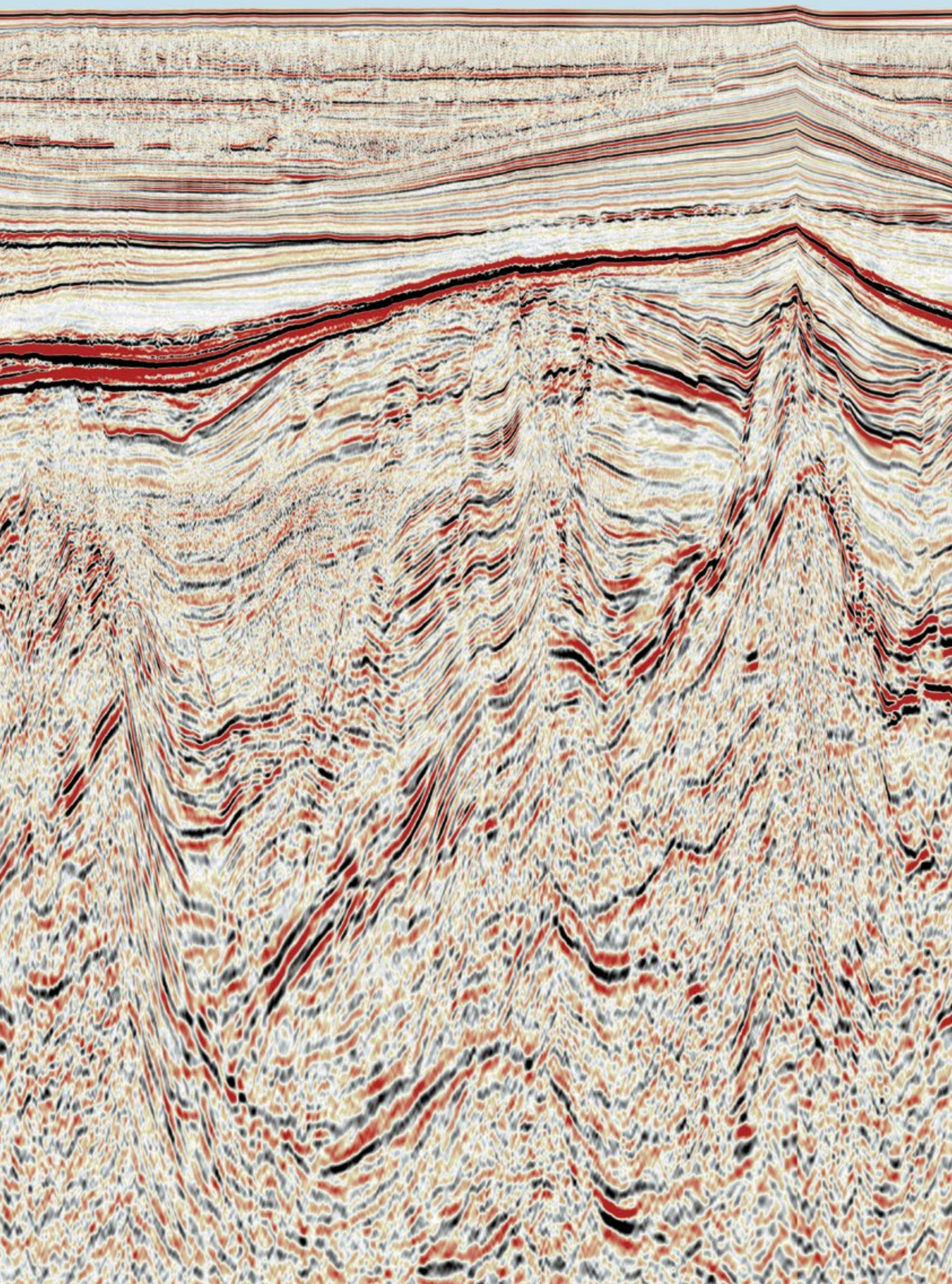
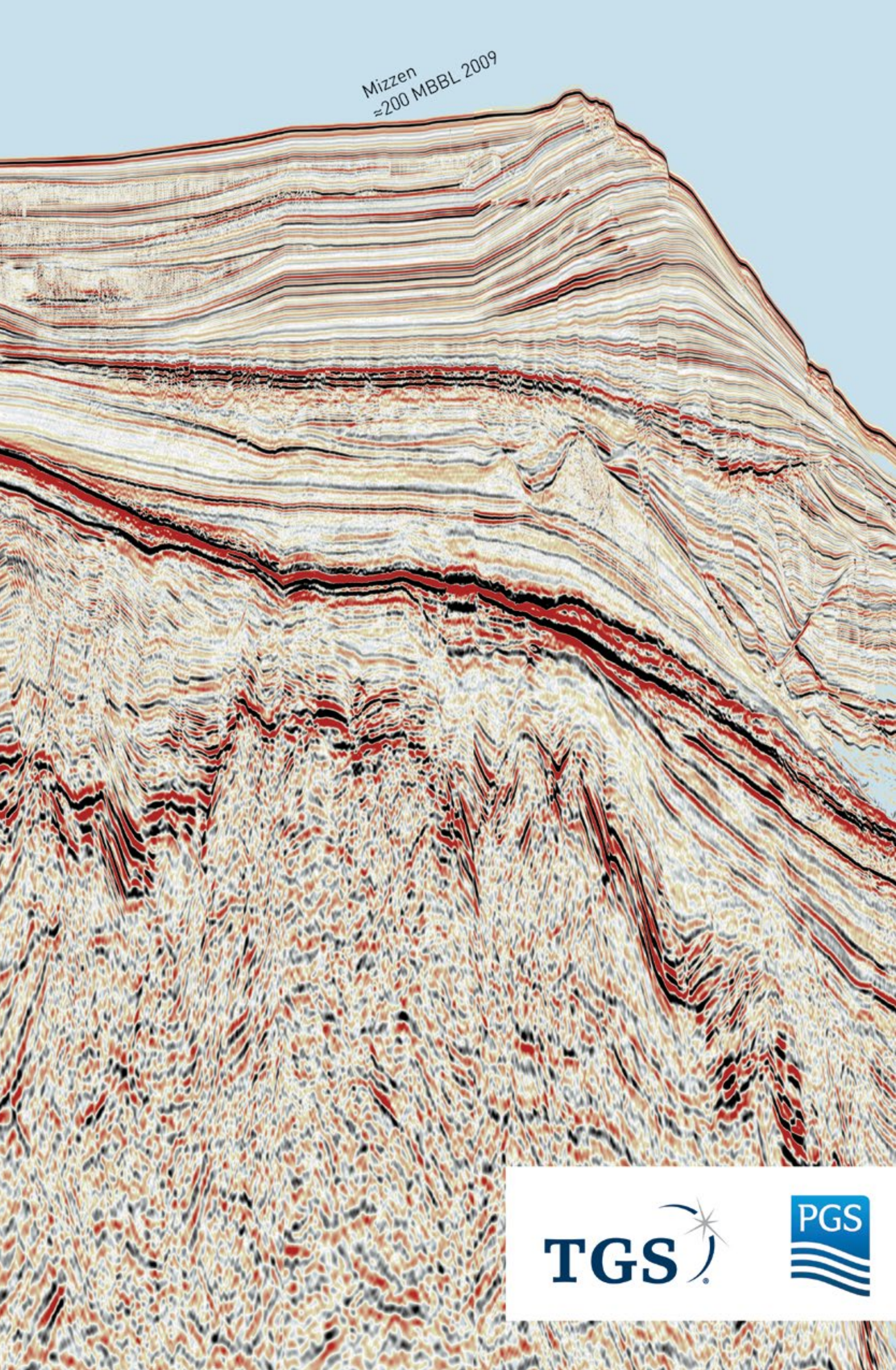


Bay du Nord
≈600 MBBL 2013

Harpoon
under evaluation 2013

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New Tool Manages Big Data in Real Time

By HEATHER SAUCIER, Explorer Correspondent

When Anadarko Corp. launched its most recent mega project in the deep waters of the Gulf of Mexico early this year, the 97-percent uptime it achieved during the first six months of production left many in a state of shock – in the best possible way.

"That is basically unheard of for a new facility and new platform," said Huan Gamblin, a reservoir engineer for Anadarko who is part of the Gulf of Mexico Asset Development Team.

He attributes the success of the operation to efficient production operations and the management of new wells with a new tool developed by Anadarko with assistance from Landmark, a business line of Halliburton.

Called IPSO, which stands for integrated production surveillance and optimization system, the tool has become Anadarko's solution for an issue presently challenging the industry as a whole: the management of big data.

IPSO allows decisions to be made effectively and consistently by the right people at the right time, and it delivers value in exploration, appraisal, development and the production of oil and natural gas resources, Gamblin said.

"The global resource pool of personnel with direct digital oil field experience is still very limited. (Designing and implementing) IPSO required people with hybrid skill sets – with a mix of petroleum engineering, information technology, automation, real-time systems, system integration and machine learning," explained Sathish Sankaran, subsurface manager, deepwater international reservoir development, Anadarko and project adviser for IPSO.

"By forming a small team of skilled and experienced personnel for development and support of installed solutions, we were able to build upon years of experience very quickly," Sankaran said.

With IPSO now in place, geologists, geophysicists and engineers can glance at a dashboard and see in real time the productivity of each well, well degradation, pump failures, pressure and temperature changes, and a host of other measurements from downhole meters and sensors that pump billions of bits of data into their computers every year.

IPSO serves as a powerful filter and translator, allowing only the most helpful and critical information through for processing, integrating and analysis, Gamblin said.

"It is an integrated workflow tool that talks to all of our relevant data sources containing well telemetry," he explained. "It performs routine surveillance using Anadarko-developed algorithms and models that automatically calculate well productivity, detect well anomaly, and provide inputs to advanced engineering software to enable expedited analysis."

Furthermore, IPSO "absorbs" results from various engineering analysis software, further facilitating integrated analysis within the tool, Gamblin said. "It was custom designed by the company and built specifically to accelerate our engineering workflow."

Real-time dashboard tracks production rate, pressure, drawdown and productivity index.

Real-time production plots allow engineers to quickly identify wells' flowing rates, pressure and performance anomaly. Each plot view can be fully customized (color, scale, axis, time reference or cumulative fluid reference, log or linear) and saved by engineers to their specific discipline.

IPSO Facto

By the very fact that Anadarko, like other operators, has struggled to get its arms around overwhelming volumes of data produced from ever-advancing technology in the wellbores, tools such as IPSO are born out of sheer need.

"In a typical Gulf of Mexico deepwater field, more than 4 billion bits of data come shooting out of sensors inside wells in real time every year," Gamblin said.

This data is then stored in different data warehouses for extraction and analysis. "The data is essential to the efficiency of our operations and something that must be well managed, he said.

The driver behind the IPSO system was the need to enable engineers to expedite routine engineering surveillance analysis and accelerate advanced reservoir analysis workflows, Gamblin explained. "This provides more time to focus on resource development while also maintaining routine well surveillance," he said.

Charged with creating the tool in early 2014 was Anadarko's Gulf of Mexico asset development team, which consisted of engineers across multiple disciplines who designed the tool, and two Landmark graphic developers who built it.

One of the main goals of IPSO was to tackle common challenges in today's data-intense digital oilfields:

- A massive influx of real-time data that has become unmanageable.
- An explosion of different software applications and data formats that make data gathering, processing and interpreting an arduous process.
- Global teams stationed in different parts of the world that are unable to see the same data in real time, leading to inconsistent decision making.
- Workplace experience gaps caused by attrition, leaving companies with young talent that lack the knowledge of best practices.

'A Priori' Digital Oilfields

Before operators encountered the challenges of big data, data from oilfields were much more simple.

In the late 1990s and early 2000s, operators in the Gulf of Mexico began developing fields roughly 2,000 feet deep. They consisted of dry tree wells with unreliable bottom hole pressure and temperature gauges and were deployed on spar platforms to extract oil and gas.

"Data from those gauges were kept in a low resolution format in individual spreadsheets for storage and analysis – because data storage was very expensive at the time," Gamblin said.

As Anadarko and other operators ventured into deeper waters – roughly 5,000 feet deep – in the late 2000s and early 2010s, wells shifted to predominantly subsea wells with a multitude of sensors.

At the same time, the gauges' reliability increased along with data bandwidth, increasing exponentially the amount of telemetry from each well, Gamblin said.

Real-time data also was made available for well monitoring. However, because the data came from different sources and in different formats, there were many discrepancies that needed to be addressed before it could be effectively interpreted and analyzed.

"The previous low-frequency engineering analysis spreadsheets were no longer adequate to provide proper timely engineering analysis," Gamblin said. "This created a strong motivation to develop a specific automated engineering analysis tool."

Hence, the idea for IPSO was born.

Problem Solver

IPSO was charged with no small task. It needed to:

- Measure, control, model and integrate workflows to allow engineers to make good decisions quickly.
- Listen to wells and reservoirs using a real-time surveillance system to avoid well and reservoir productivity degradation.
- Collaborate between different disciplines so each could look at the same data before making recommendations.
- Incorporate best practices of Anadarko's senior employees so consistent decisions could be made in their absence.

If IPSO could deliver, issues with reservoir connectivity and drive mechanics could be assessed, and engineers would gain the ability to predict well performance and mitigate well performance issues. "What is the well doing? Do we have degradation of the well? Are there opportunities to drill

Continued on next page

Continued from previous page

infill wells?" These are questions that IPSO was designed to answer, Gamblin said.

Engineers needed a surveillance system to know how each well was performing at all times. They needed to measure productivity drawdown, to perform pressure transient and material balance analyses, and to history match reservoir simulation models for calibration purposes.

Once a reservoir simulation model is calibrated and history matched, it can be used to forecast well performance over time and determine future infill drilling locations, Gamblin said.

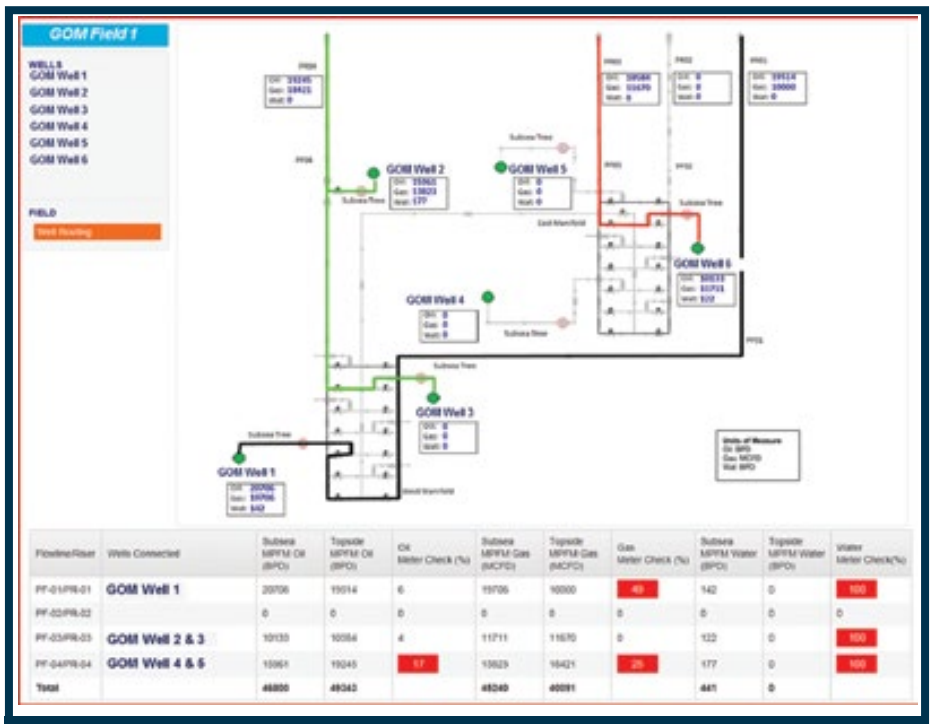
"It was essential to recognize fit-for-purpose models to keep the solution design simple for implementation and support," Sankaran added. "Strong project management (also) was required to deliver on-time work products to the engineers."

Implementing IPSO

When up and running, IPSO operates in two phases.

Phase One consists of:

- Monitoring and visualization of the well telemetry.
- Automatic and routine well surveillance analysis.
- Quick data preparation for advanced engineering analysis.
- Data integration from industry-standard engineering analysis software.
- Metering and allocation check to ensure proper production allocation.
- Tracking and reporting a well's key performance.



Automatic well routing detection tracks each well's flow-line assignment.

"We are 11 months into this and all is working well," Gamblin said. "The idea behind Phase One is to enhance but not replace the current workflow, so we take less time preparing data and more time analyzing it."

Phase Two, which is expected to start development in 2016, will focus on production operations including:

- Root cause analysis, which identifies the cause of any abnormalities encountered by topside production equipment.
- Reservoir simulation.
- Pipeline performance.
- Asset integrity, which is the routine surveillance of the telemetry from topside platform equipment to ensure it remains within operating tolerances for the sake of longevity and reliability of the equipment.

"Going forward, I envision all deepwater fields of Anadarko will embrace IPSO right from the development phase, and it will become a way of working in this digital era," Sankaran said.

"It will help us deploy a global workforce trained on best practices and cross-functional workflows."

Adding Value

Through automating reservoir surveillance and production, emphasizing value-driven workflows, and supporting engineers through common-sense concepts, "IPSO is adding value especially in a $40 per barrel market where increased efficiency is key to profitability," Gamblin said.

"The value that IPSO is adding is the early identification of production issues and performance, the prevention of expensive well works and production loss, accountability and transparency – as all can see how the wells are performing – and an impressive increase in uptime and efficiency," he said.

Specifically, IPSO is streamlining well surveillance so that problems, such as sleeves plugging or fines migration, can be quickly identified and addressed. It is automatically calculating key performance indicators, tracking well degradation, and decreasing the downtime for wellbore engineers. And, the number of employees using IPSO is on the rise.

That is likely because IPSO's intuitively designed dashboard – which shows well flows, choke changes, real-time pressures and real-time flow rates in intuitive colors including red, yellow and green – makes using the tool rather easy.

IPSO also communicates information in terms of trends, charts and in reports. "These provide engineers a quick visual analysis of well performance and identifications of well anomalies," Gamblin said.

Sound like a lot?

"For Anadarko, this is just a start," Gamblin said. "We are now asking ourselves, 'What else can we do?'"

REGIONS and SECTIONS

A Busy Year In Europe …

By JEREMY RICHARDSON, Director, AAPG Europe Region

It has been an interesting and eventful year in Europe for AAPG.

With all the less-than-good news around, we felt it was important to maintain a program of events and activities throughout the year, offering an education program, helping members, supporting the Distinguished Lecturer and Visiting Geoscientist programs, aiding with the networking and business opportunities for exploration and smoothing through the grants program for students offered by the AAPG Europe Region Council.

Although we are constrained by the events in the industry we have still tried to match the wishes of the members and, most importantly, the students, graduates and young professionals as the industry, and the world, needs to go on, and we all know the prospects, exploration and prosperity will soon return.

APPEX Global

APPEX Global, our international E&P conference held in London each year, was very buoyant.

For the past 14 years APPEX, the Prospect and Property Expo, has brought together principals, senior managers, business developers and new venture managers for an unmatched opportunity to network and do business with national oil companies, governments, financiers and global E&P deal-makers and decision-makers.

In March earlier this year, 60 exhibitors, almost 550 delegates and more than 80 speaker presentations emphasized the importance of this event on the international calendar.

Next year's APPEX will be March 1-3.

3P Arctic Conference

Following up this event, in October AAPG Europe held our biennial 3P Arctic Conference and Exhibition, held this year in Stavanger, Norway.

The Arctic is, in terms of hydrocarbon exploration, arguably the only remaining true frontier with major exploration potential, and it is hence of major industrial interest. From a tectonic perspective, the Arctic remains one of the least understood regions of the world, and thus attracts researchers from academia, government and industry.

Although the remoteness and harsh environment of the Arctic makes data acquisition and operations more difficult and costly than elsewhere, this challenge also has an upside in that it invites a more open collaboration among scientists of various disciplines, between companies, and across national borders.

Accordingly, the conference drew an impressive turnout of delegates and boasted 100 presentations in three rooms over the three days with topics that included mapping, hydrates, petroleum systems, orogenies, plates, basins and ridges across the entire Arctic region from the Barents, Canada, Greenland, Norway to Siberia.

Our thanks go to the fantastic and energetic conference chairs: Erik Lundin, David Houseknecht and Sergey Aplonov.

IBA

Going back to March 2015, we also ran our Europe Region AAPG Imperial Barrel Award (IBA) competition; and congratulations go out to all the teams who competed in Prague. They were too numerous to mention each by name, but there were 23 in total from all over Europe, from Kiev to Stavanger, Coimbra to Moscow.


RICHARDSON

A massive "thank you" goes out to all the sponsors who made this competition as large and successful as it turned out.

The winners this year in Prague were Royal Holloway who flew the European flag to the AAPG IBA finals in Denver in June at the ACE, where they beat the other 11 finalists in a hotly fought competition to be crowned AAPG IBA winner for 2016.

AAPG Europe Regional Conference

Thanks also go to Nuno Pimentel and Rui Pena Reis for their excellent vision and stewardship of the annual AAPG Europe Regional Conference and Exhibition in Lisbon last June. Almost 300 delegates, 92 presentations, 68 posters and four field trips made this event a great success. Major sponsorship by Partex, Galp and Repsol was a great help and the conference focusing on "Tethys-Atlantic Interaction Along the European-Iberian-African Plate Boundaries" allowed the freedom to cover a great many topic areas.

The 2016 AAPG Europe Regional conference will be held in Bucharest, on the shores of the Black Sea, May 19-20, 2016.

See **GTW Update**, page 33

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

Preconditioning of Seismic Data Prior to Impedance Inversion

By SATINDER CHOPRA and RITESH KUMAR SHARMA

The calibration of seismic data with the available well control is an important step that provides the link between seismic reflections, their stratigraphic interpretation and subsequent prediction of reservoir and fluid properties.

The standard practice to do this has been to produce synthetic seismograms from well logs with a bandwidth similar to that of the seismic data. The synthetic traces are produced by picking up the sonic and density logs for a well and calculating the reflection coefficients. These reflection coefficients are then convolved with a suitable zero or minimum phase wavelet and choosing a frequency response similar to that of seismic.


CHOPRA


SHARMA

The wavelet could also be extracted from the seismic data. Thereafter, the synthetic seismogram is displayed in the same polarity as the seismic and either overlaid or inter-fixed on the seismic data at the location of the well, after making a shift adjustment in time. Such a correlation helps to quickly identify individual reflections, which can then be interpreted on the seismic data.

The frequency content of surface seismic data varies with time due to attenuation or other effects, so generally we see higher frequencies in shallow intervals that are gradually lowered with increasing times. In figure 1 we show a seismic section over a 1s interval, but higher frequencies in the upper 500ms and lower frequencies in the lower 500ms are seen. This can be seen on the wavelets that are extracted in the upper and lower intervals and the frequency spectra generated for the two intervals, as shown in the insets.

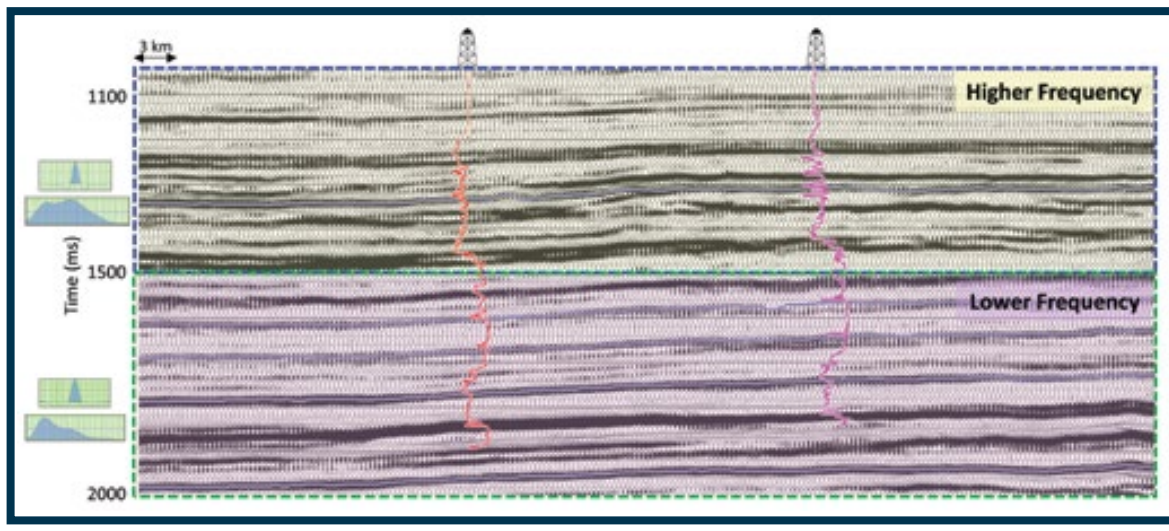


Figure 1 – Figure shows a segment of a seismic section passing through two wells, wherein the upper half exhibits higher frequency and the lower half shows lower frequency. The frequency spectra and the extracted wavelets from the two intervals are shown to the left. The impedance logs at the location of the wells are shown overlaid.

Synthetic Seismograms

A synthetic seismogram generated using the wavelet from the shallower interval would exhibit a reasonable frequency match in the upper interval, but will show a higher frequency content for the lower interval as compared with the seismic data. We show this in figure 2, where in (a) we have the P-velocity and density logs used for generating the synthetic traces in blue. These are compared with the real seismic traces in red, and the correlation coefficient between them is 0.723. Notice in the shallow portion highlighted with the black dashed box, the frequency content between the synthetic and the real traces seems similar. However, in the lower portion highlighted with the blue dashed box, the synthetic traces seem to exhibit a somewhat higher frequency (HF) content. As mentioned above, this is because the wavelet extracted from the upper interval was used for generating the synthetic seismogram.

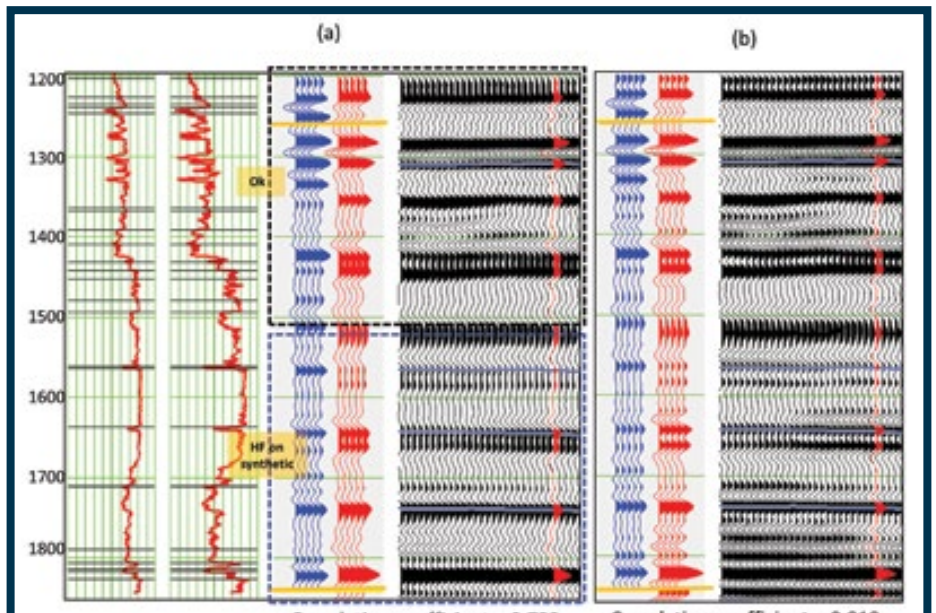


Figure 2 – (a) Creating a synthetic seismogram using the wavelet extracted from the upper half of the seismic section shows a good correlation with the real seismic data for the upper window. We do however notice higher frequency on the lower half of the synthetic seismogram. (b) Generating a synthetic seismogram using a wavelet extracted from seismic data after running thin-bed reflectivity inversion. The correlation coefficient calculated between the synthetic and the real seismic data traces, before and after thin-bed reflectivity inversion on seismic data between the windows indicated with the yellow bars is shown to increase from 0.723 to 0.818.

One way to address this problem would be to extract an average wavelet over the full window and then generate a full-window synthetic seismogram that could be correlated with the seismic. However, this would have a lower resolution in the upper window and a higher resolution in the lower window, something that is contrary to what we expect.

Another way that could be adopted is that separate wavelets are extracted in the upper and the lower windows and separate synthetics are generated and compared. As well, the inversions would need to be performed in separate windows, which is time-consuming. In such an exercise, we can expect to see lower resolution in the lower window compared to the upper window.

If we go back and examine the input seismic data, we see that the bandwidth of the data is somewhat narrow, with the peak frequency at 12 or 15 Hz and noise after 60 Hz. Also, the frequency spectrum shows a roll-off after 30 Hz. In figure 3a we show a segment of a seismic section from the input data, and the frequency spectrum is shown in the inset. To be able to extract some more information from the data, we should at least be able to make the frequency spectrum look flatter.

We achieve this with thin-bed reflectivity inversion, a process that extracts time-varying wavelets from

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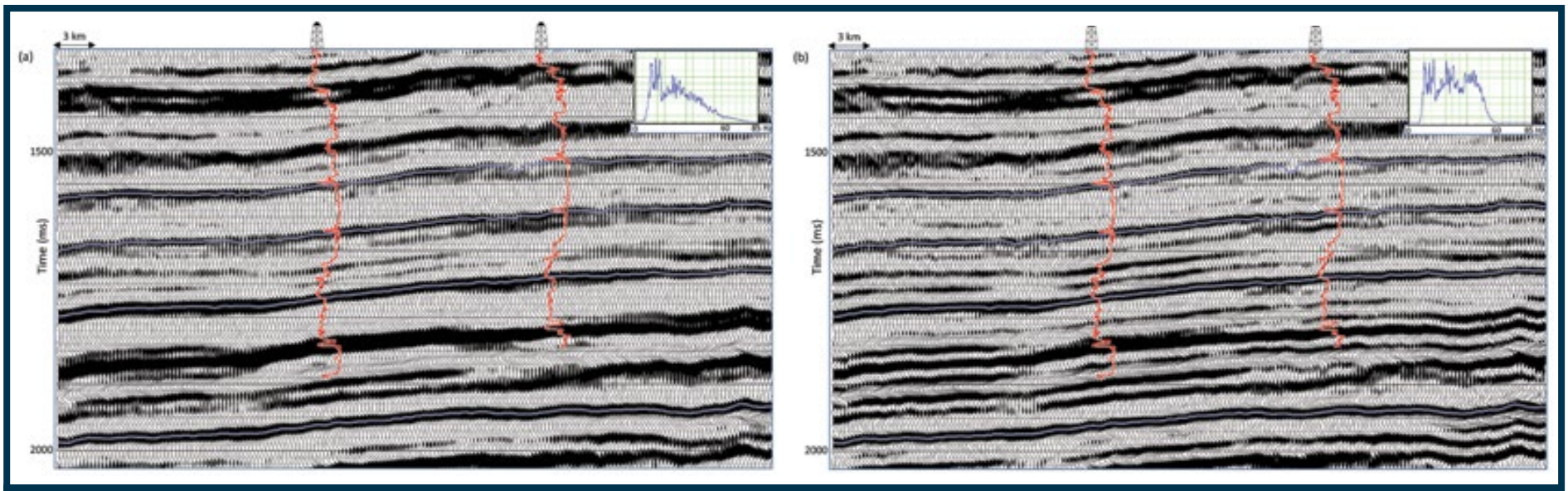

Figure 3: Segment of a seismic section from the (a) input seismic data, and (b) input seismic data with thin-bed reflectivity inversion and filtered to the same bandwidth as the input seismic data. The frequency spectra in the insets show the bandwidth of the seismic data as 5-10-50-60 Hz but that of the filtered thin-bed reflectivity inversion is now seen as flatter.

Continued from previous page

the seismic data and using principles of spectral inversion produces sparse reflectivity estimates. The advantages include being able to pick up more reflection detail, to perform more accurate interpretation on seismic volumes obtained by convolving reflectivity volumes with wavelets of higher bandwidth than the input data, and to visualize subtle anomalies when some attributes are run on thin-bed reflectivity inversion output. More detail on this method and its applications can be picked up from the Geophysical Corner columns in the May 2008 and July 2009 issues of the EXPLORER.

Enhancing Bandwidth

We put the input seismic data through thin-bed reflectivity inversion and derive the reflectivity volume. In principle, once the reflectivity volume is derived from the seismic data, it is possible to filter it back to a frequency bandwidth higher than the input seismic data. But there are some seismic interpreters in our industry who are not comfortable with the idea of enhancing the bandwidth of the data beyond the recorded frequencies. Keeping that in mind, here we filter the derived reflectivity volume to the same bandwidth as the input seismic data (i.e. 5-10-50-60 Hz).

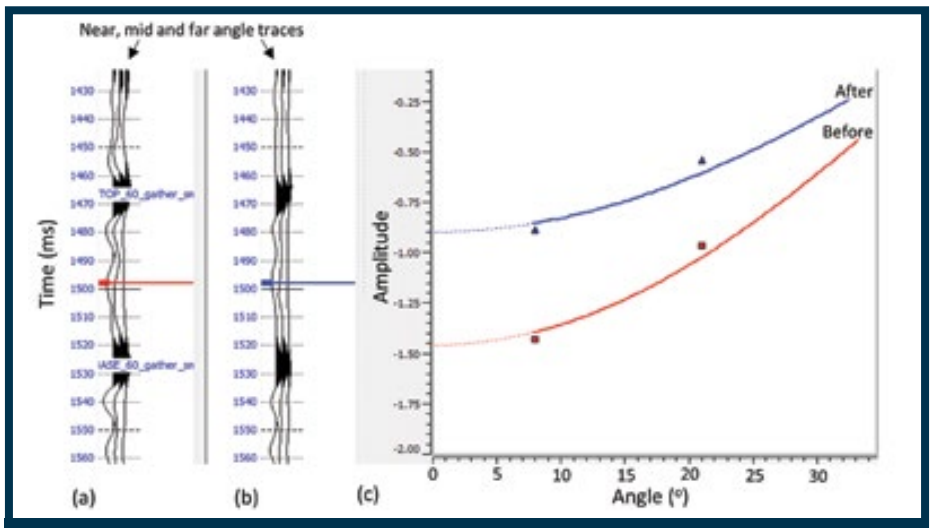

Figure 4: The angle stack traces for a short time window, created for data before (a) and after thin-bed reflectivity inversion (b) are shown to the left, where the red and blue bars mark similar events. The amplitudes of these similar events are plotted as a function of angle to the right in (c). Notice that while there is a small change in the amplitude of the events after thin-bed reflectivity inversion, the relative amplitude variation with angle is very similar.

The seismic section equivalent to the section shown in figure 3a is shown in figure 3b. Notice the improvement in the resolution detail, which is also seen on the frequency spectrum shown in the inset. The amplitudes of the frequencies beyond 25 Hz have been enhanced so that the spectrum now looks flatter. The correlation with the impedance logs also looks much better. We show a section of the data after thin-bed reflectivity inversion in figure 2b, where the synthetic seismogram generated from the well log data shows a better correlation with the seismic data. The correlation coefficient is now seen increased from 0.723 to 0.818.

The preservation of amplitude variation, both in the post-stack and the pre-stack seismic data, is usually a mater of concern for seismic interpreters. This is important for all AVO analysis work as well as impedance inversion performed on the seismic data. We picked up the pre-stack seismic data for a data volume from central Alberta, and after

See **Geocorner**, page 33

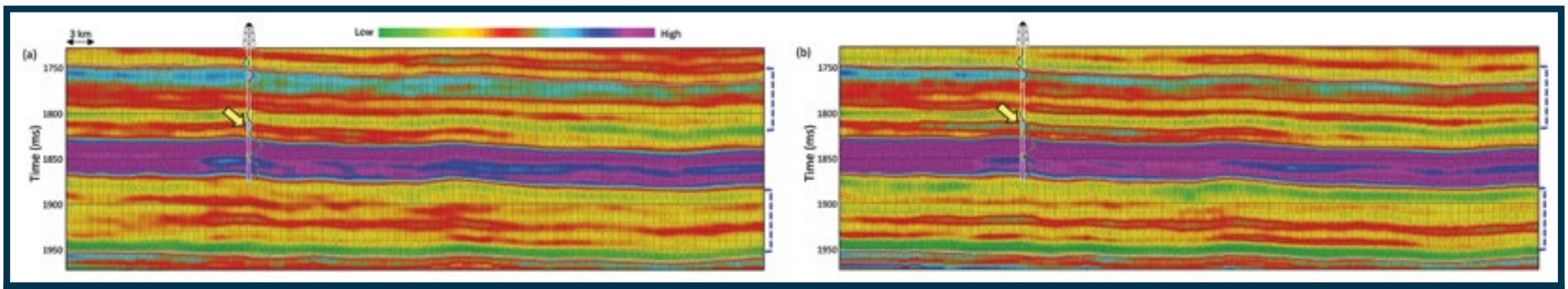

Figure 5: Segments of P-impedance sections generated using (a) the input seismic data, and (b) the data with thin-bed reflectivity inversion. The impedance log at the location of the well is shown as a curve, as a color strip. Notice the yellow arrows indicating the mismatch between log and the inverted impedance in (a) and a much better match in (b). Also, the intervals indicated to the right with dashed blue braces indicate the zones that show more well-defined events in terms of impedance in (b).

Foundation Programs: A Recap of 2015

By TAMRA CAMPBELL, AAPG Foundation Administrative Coordinator

Despite the challenges to the industry and the profession, last year was an eventful one for the AAPG Foundation.

Here are just a few of the highlights of Foundation programs in 2015:

- A record number of 350 students and student-led organizations applied for and received L. Austin Weeks Undergraduate grants, with a total of $76,000 awarded.
- The Grants-in-Aid Program continued to see increases in the number of students that applied and received grants, as well as, in the quality of the applications. Last year, $239,000 was disbursed to 121 master's and doctoral students.
- Michael S. Johnson established the John W. Robinson Named Grant in honor of John W. Robinson. Other existing named and memorial grants continued to receive donations and grow.
- The Military Veterans Scholarship Program funding increased to more than $650,000, thanks to generous donors like Paul and Deana Strunk and John Bookout. More than 40 applications were received for the first round awarding $20,000 to 10 deserving U.S. military veterans.

The Foundation thanked Bill Gipson for his nine years of service as a Trustee before he stepped down and welcomed David W. Worthington as the Foundation's newest Trustee.

There were some changes within the Members of the Corporation: Charles Weiner retired after 19 years of service, while Jerry Namy and Pete MacKenzie were elected as new members.

During their annual meeting at The Broadmoor in Colorado Springs, Colo., the Trustee Associates, the Foundation's major donor group, inaugurated new officers: Rick Fritz as chair, Larry Jones as vice-chair and Pete MacKenzie as secretary/treasurer.

The group will meet in Hawaii, Oct. 19-22, 2016, for its 39th annual meeting.

Also, two new Trustee Associates joined the group's rank: John Armentrout and Craig Reynolds.

Sadly, the Trustee Associates also grieved the passing of other valued members in 2015: Dudley J. Hughes, John P. Lockridge, Franklyn R. Engler, Jon R. Withrow, Richard L. Stallings, Bill St. John and Ruldolf B. Siegert.

The Foundation would like to thank all donors and volunteers for their contributions in making 2015 a successful year and we look forward to what 2016 will bring.

James Campbell, a MVSP 2015 recipient.

Foundation Contributions for November 2015

General Fund

Frank J. Adler
Robert Edward Bierley
Dylan Geoffrey Cobb
ConocoPhillips Corporate Contributions
Matching a gift given by Susan Young
Leon Horace Gerlich
Murray Walter Hitzman
Ian W. Moxon
Sarah Springer and Rusty Riese
Sabine Roessle
Frans S. Van Buchem
Barry Lynn Zinz

Daniel A. Busch Library Fund

Anthony Reso

Distinguished Lecture Fund

Willis Reider Brown
Grant from Willis R. Brown Trust at Fidelity Charitable
Thomas Stanzel Laudon
In memory of L.R. Laudon and R.B. Laudon

Grants-in-Aid Fund

Ian W. Moxon

Jon R. Withrow Named Grant

Michael H. and Michelle A. Booth
In memory of Jon R. Withrow
M. Charles Gilbert
In memory of Jon R. Withrow
H.W. and Norma Peace
In memory of Jon R. Withrow
Hugh W. and Jana Peace
In memory of Jon R. Withrow
Mr. and Mrs. J.B. Silman
In memory of Jon R. Withrow
Roger Duane Wilkinson
In memory of Jon R. Withrow

Michel T. Halbouty Memorial Grant

Mallorie Elizabeth Jewell

Ohio Geological Society Named Grant

Steven Paul Zody

Pittsburgh Association of Petroleum Geologists Named Grant

Pittsburgh Association of Petroleum Geologists

James A. Hartman Student Leadership Summit Fund

Chevron Matching Employee Fund
Matching gifts given by Richard Ball

Military Veterans Scholarship Program

John F. Bookout Jr. Military Veterans Scholarship Fund

Marlan and Marea Downey
In memory of Dick Gardell

Military Veterans Scholarship Fund

Jack R. Banttari
William E. Crain
Grant from William and Jean Crain Foundation at Schwab Charitable
Chevron Matching Employee Fund
Matching a gift given by Charles Rubins
Norbert Everett Cygan
In memory of Loyd Carlson
Robert E. and Betty K. Hilty
Shell Oil Company Foundation
Matching a gift given by Alan Kornacki

E.F. Reid Scouting Fund

Norbert Everett Cygan
In honor of D.H. Glenn

L. Austin Weeks Undergraduate Grant Fund

Willis Reider Brown
Grant from Willis R. Brown Trust at Fidelity Charitable

GTW Udate
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GTWs

We were pleased to run several Geoscience Technical Workshops this year. Of particular interest was a GTW in Sicily (a first for AAPG) chaired by Raffa de Cuia, Davide Casabianca and John Cosgrove on fractured reservoirs, which also allowed for four fascinating field trips, including a guided trip up Mount Etna, in the snow, in April.

APPEX Regional 2015

We also recently held our APPEX Regional conference in Nice, France. This was an opportunity to focus regionally on exploration opportunities and prospects. This event was organized in cooperation with the AAPG Africa Region.

I mentioned at the beginning of this piece the importance we place on students, so, apart from the AAPG Imperial Barrel Award competition, which we see as the backbone of our student educational programs, the Europe Region Council have also granted $40,000 to 10 universities who have in turn included another 30 universities in their educational events and field trips. These programs allowed over 400 students to take part in AAPG-funded events in 2015 and we are very keen to ensure an even spread of opportunities to universities throughout Europe, rather than just accepting grant requests from the closest universities or those with higher profiles.

We are looking forward to Tony Dore, the latest Distinguished Lecturer, embarking on a tour in Europe next May and we are busy putting together a program for him.

Our thanks go to Keith Gerdes, AAPG Europe president whose term ended in June 2015. He brought great insight and experience to the Region leadership and we are very appreciative of the time he spent with the AAPG. He handed the leadership baton to Jonathan Craig, whom we all are very excited to work with over the coming two years.

Finally, mention needs to be made of the passing of our friend, colleague and a great former president of the Region, Vlasta Dvorakova. She is deeply missed as she was taken so suddenly from us in June. She worked tirelessly for the AAPG and was always on the end of a phone or Skype to help and support in any way she could.

Here's hoping for a slightly better 2016 for everyone. If you would like more information on any of the AAPG Europe activities please let us know.

IN MEMORY

Eric Ericson, 87
Santa Fe, N.M., Oct. 24, 2015

Richard H. Lane, 73
Washington, D.C., Oct. 16, 2015

Babatope Olaleye, 60
Lagos, Nigeria, Nov. 2, 2015

Robert Ragsdale III, 90
Benbrook, Texas, Nov. 5, 2015

John Shaw (Member 1962)
San Marcos, Calif., Oct. 22, 2015

Ernest Szabo, 91
Rio Rancho, N.M., Jan. 5, 2015

James Prentice Walker, 78
Oklahoma City, Aug. 24, 2015

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

Geocorner
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conditioning of the gathers, generated the near-, mid- and the far-angle stacks.

Simultaneous Inversion

This is the input required for simultaneous inversion, which we have discussed earlier in our article published in the June 2015 issue of the EXPLORER. In figure 4 we show the amplitude variation of the near-, mid- and far-angle traces for one such gather for two equivalent events, before and after thin-bed reflectivity inversion. We notice, that though there is a small change in the amplitude of the events after thin-bed reflectivity inversion, which is expected, the relative amplitude variation with angle is very similar.

Finally, simultaneous inversion was run on the pre-stack data after preconditioning and thin-bed reflectivity inversion run on angle stacks. The result of the impedance inversion in the form of P-impedance sections, before and after thin-bed reflectivity inversion are shown in figure 5a and b. The overlaid impedance logs are shown as curves as well as colored strip logs. Notice the mismatch indicated with the yellow arrow between the log and the inverted impedance values in figure 5a, whereas it shows a reasonably good match between the two in figure 5b. Also, in the intervals indicated by the dashed blue braces to the right, many of the events are seen better well-defined and more focused in figure 5b than figure 5a.

We thus conclude from the above exercises that the varying frequency content in seismic data can pose problems while carrying out synthetic seismogram correlation to seismic data. The roll-offs that are seen on the frequency spectra of input seismic data can be flattened out with the application of thin-bed reflectivity inversion. This application is a post-stack process but can be fruitfully run on the near-, mid- and far-offset stacks, which then can be put through simultaneous impedance inversion. The results of such exercises can lead to more accurate interpretations, which obviously help the bottom-line.

We thank Arcis Seismic Solutions, TGS, for allowing us to present this work.

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

40 Years of Petroleos de Venezuela

By GUSTAVO CORONEL

The idea of nationalizing Venezuela's oil industry had been in the wind for a few years leading up to 1976, and conditions in the global oil market lent considerable momentum to the popularity of the proposal. Weighed in the balance of 40 years of hindsight, though, nationalization has proven to be nothing short of tragic for the nation's oil and gas sector.

The first and second boards of Petroleos de Venezuela. Coronel is in the second row, fourth from left, with Gen. Alfonzo to his right.

The Road to Nationalization

Meeting in Caracas in December 1970, OPEC decided to cut oil production as necessary to defend oil prices.

Pressure for national control of the oil industry in producing countries increased to such an extent that, by early 1972, an editorial in the Washington Post warned U.S. readers about Venezuela's preparations for a takeover of its petroleum assets.

In 1973, OPEC took a more dramatic step of actually cutting oil production to put pressure on Israel to retreat from occupied Arab territories. In addition, it posted a 70-percent increase in oil prices and imposed an embargo on oil exports to countries that were friends of Israel.

This geopolitical upheaval coincided with the landslide electoral win of Venezuelan presidential candidate Carlos Andrés Pérez, who had promised to nationalize the Venezuelan oil industry. After taking power in December 1973, he promoted an intense debate over the pros and cons of the idea.

At this point in time, and thanks to a combination of laws and government decrees, Venezuela was obtaining a very large percentage of the oil industry income without any risks, since all investments were the responsibility of the foreign oil companies acting as concessionaires.

Nevertheless, investments were very low, due to the political uncertainty surrounding the future course of the industry. At the end, however, the decision to take over the Venezuelan oil industry was driven more by political considerations than economic factors. Venezuelan leaders believed complete ownership of the oil industry was essential if the country wanted to enjoy true sovereignty over its petroleum resources.

As this political drama was developing, I was a middle manager working for Shell Venezuela.

For many years Venezuelan oil industry managers and technical staff had been a highly disciplined group who did their jobs efficiently, without getting involved in the country's political give and take. But this time we felt it was different. The decision to nationalize the oil industry was a matter of the most critical national importance since oil accounted for almost all of our national income. We felt, as Peter Drucker once said about strategy, that the country "not only had to do the right thing but had to do it right."

One morning in 1974, over a cup of coffee with my colleagues Odoardo León Ponte and Marcos Marín Marcano, we concluded that we had to participate in the debate. We knew more than the politicians did about the technical, operational, managerial and financial challenges involved in nationalizing the industry. Why should we allow them alone to make decisions of such importance without our input?

Deciding to act, we rented a conference room for 30 people in the Caracas Tamanaco Hotel and sent out an invitation to our colleagues. Half an hour before the meeting we had about 500 people at the door, struggling to enter! The owner of the hotel, Rafael Tudela, showed up and decided to lend us the Ballroom at no extra cost. That night we formed AGROPET, the Association of Oil Industry Employees, to participate in the nationalization debate, and I was named president.

Predictably, the political sectors, from left to right, accused us of being a front for the foreign oil companies. We had to endure the most vicious attacks in which terms like "traitors" and "mercenaries" were among the kindest.

However, after only two weeks, the association had 1,100 registered members and had begun to participate in the debate. We went to the radio, to the press, to television to talk about a subject we knew well, often debating live with representatives of the political parties.

These debates quickly brought to the surface the validity of our arguments and culminated in an invitation from President Carlos Andrés Pérez to meet with us at the presidential palace. This meeting was attended by 400 oil industry managers and technicians and several of us made presentations to the president and his cabinet about the different issues we believed had to be faced in nationalizing the industry.

I believe this meeting represented a turning point in the nationalization process.

The political decision to nationalize had already been taken but the manner in which it finally took place was largely the product of our input to the highest levels of government.

Many of us felt that the decision to nationalize had not been the right one, but we had to do it right, at least. The political sector wanted a takeover without compensation to the foreign companies, and a nationalized industry operating with a total self-sufficiency that was impossible to attain. We knew there would have to be a transition in which the former concessionaires would continue to play a subordinate support role.

The Difference a Day Can Make

The day before nationalization – Dec. 31, 1975 – all was as it had always been. On Jan. 1, as if by magic, the names, logos and colors of the well-known international oil companies had been replaced by those of the new state companies.

In a decision that deviated from other examples of nationalization, the organizational model adopted by the Venezuelan state-owned oil industry was not that of a single state company, but a financial and coordinating holding company, Petroleos de Venezuela, and four integrated operating companies, which would allow the holding company to compare their relative efficiencies.

The company would be totally owned by the state, reporting to the Ministry of Petroleum as the representative of the shareholders and was designed, by law, to be a commercial enterprise.

In a surprising move for me, my family and almost everyone in the industry, I was chosen as a member of the first board of directors of Petroleos de Venezuela, PDVSA, doubtless as a result of having led the association of employees who participated in the debate.

During a presentation to the president, I had said that an essential prerequisite to become a member of the board of the new company was "not to be a politician." This made the president laugh heartily and his ministers grimace. The president probably felt that naming me to the board would guarantee the new company would not become politicized.

When I notified Alberto Quirós, my company's president, of my new job he told me: "Gustavo, congratulations and you are fired!" and proceeded to give me a big hug.

A few days later, when meeting with the new board for the first time, President Pérez said to us, "If you ever receive from me a request to employ anyone or assign a contract to anyone, do this …" and he threw a wrinkled piece of paper into the wastebasket.

CORONEL

Gustavo Coronel is a Venezuelan geologist with degrees from the University of Tulsa and the Universidad Central de Venezuela. After a 21-year career in the Venezuelan and international petroleum industry (1955-75) he became a member of the first Board of Directors of Petroleos de Venezuela, a position he held until 1979.

He left the oil industry in 1981 and went to Harvard as a fellow in the Center for International Affairs. Coronel worked in the civic sector from 1990 to 2000 as the founder and president of a non-government organization fighting government corruption and promoting civic leadership in Venezuela and several other Latin American countries.

He has published four books on Venezuelan oil and other topics and keeps a blog: www.lasarmasdecoronel.blogspot.com. He lives in Northern Virginia where he is an independent consultant on the geopolitics of energy.

Getting to Work

The new holding company and its operational affiliates had a tough job ahead: exploration was at a standstill, production levels were reasonable but needed to be increased, refineries were bordering obsolescence, plus technological and marketing contracts had to be negotiated and signed with former concessionaires.

And, to top it all, we had inherited 14 operating concessionaires that had to be fused into four integrated companies. This process of "rationalization" was not a simple elimination of some of the companies but involved a study of the existing operations and of the best potential synergies to be found among the different companies.

This task was to be supervised by a committee of the holding company and coordinated by one of the members of the board. I was chosen to coordinate this process, which proved to be very complex, as are all tasks that involve people.

We had 14 companies, some small, some medium-sized, some large and, predictably, each organization wanted to survive, which was not possible. We worked systematically, meeting with the top management of all the companies, listening to their arguments.

This was a very intense, emotional process, rich in personal and even political conflict but also in demonstrations of true professionalism and intellectual honesty. Our work, done in combination with international management consultants, clearly indicated there were three main companies into which the others should be incorporated: the original Exxon (Creole), now called Lagoven; the original Shell, now called Maraven; and the original Gulf, now called Meneven.

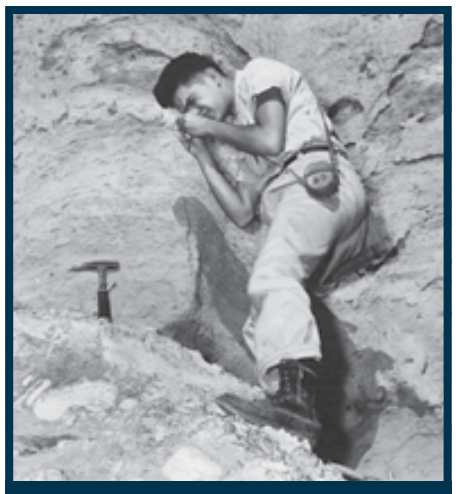
Combined, they accounted for about 85 percent of total oil production. Months of discussions and analyses finally concluded in the structuring of four main companies: Lagoven (the previous Exxon/Creole + Amoco); Maraven (the previous Shell + Phillips + Chevron + Sun Oil); Meneven (the previous Gulf + four smaller companies); and, finally, Corpoven, an amalgam of CVP, the original state oil company, plus the assets of Mobil, Texaco and Sinclair.

This type of organization allowed Venezuela to escape from the single state oil company model that had proven unsuccessful all over the world: in Indonesia, Argentina, Mexico, Nigeria, Brazil, Bolivia and Peru. It was more costly, yes, but it preserved the spirit of competition among the operating companies and allowed for comparison of relative efficiencies.

As one of the members of the board most up-to-date with operational facts, also known for having a gift for writing, I was chosen by the president of PDVSA, General Rafael Alfonzo Ravard, to write his speeches. He gave three or more speeches per week to the most diverse audiences and would give me the specific points he wanted to include in each, while the rest was essentially up to me. His main guidelines, which I would have to repeat as a mantra in every speech, were about PDVSA's need to always:

- Have professional management.
- Be free from politicization.

Continued on next page



Coronel in Maracaibo in 1955.

Coronel left in 1977 during his time as general manager of the Cardon refinery, giving a tour to Gen. Rafael Alfonzo Ravard, president of Petroleos de Venezuela.

Continued from previous page

- Enjoy financial self-sufficiency.
- Keep normal, uninterrupted operations.
- Possess a meritocratic organization.

He would tell me, "Gustavo, these are the main concepts we have to hammer into the political minds if we want to win this fight."

For almost a decade from 1976 the nationalized PDVSA won that fight. The company enjoyed the respect of the political world. It gained international credibility and improved in almost every aspect. Proven reserves increased. Production was kept at about 2.3 million barrels per day. The refineries underwent a dramatic transformation, from producing 62 percent of residual fuel oils to producing 65 percent of gasoline and distillates, while accepting a diet of heavier oils. International marketing was progressively done in-house.

In 1977 I was temporarily assigned as general manager of the Cardón Refinery, to start planning for the change in the refining pattern of this plant. This task required complicated logistics and additional human resources since we did not have enough engineers in the country. I sent a team to India where we recruited a group of (mostly) excellent professionals who helped us during this stage.

By 1986 the job in the four big Venezuelan refineries had been essentially completed.

The End of the Honeymoon

At first imperceptibly, later in a more pronounced manner, the honeymoon between PDVSA and the political sector weakened.

As the government grew familiar with the operations of the industry, they started to see real or imaginary warts in PDVSA's face. Increasing friction appeared between the company and the Ministry of Energy and Petroleum since the ministry staff wanted to assert their authority at operational and planning levels and had never been quite satisfied with letting the managers trained by the multinationals do the job.

Many influential members of the political sector felt that Venezuelan managers, trained by the multinationals, were not patriotic enough.

In 1979, the Venezuelan Society of Engineers demanded the Venezuelan oil industry employ "all newly graduated engineers" to replace the technical assistance contracted with the former concessionaires.

Also that year, the naming of the new board of PDVSA had a political flavor not present before. The board would now be replaced every two years, increasing the tendency to politicize the organization. From then on the government would have the final decision about the size and contents of the budget of the company and could assign responsibilities to members of the board – clear signs of political interference.

Hugo Pérez La Salvia, the new minister of Energy and Petroleum, said, "With the advent of nationalization we inherited the management of the multinationals and I think these managers already had a mentality derived from their work with the concessionaires. This situation must change!"

Although PDVSA would still work in an acceptable manner for some more years, the changes represented the "writing on the wall" for the nationalized oil industry. Instead of public administration adopting the good habits brought by professional management to public business, the bad habits of public bureaucracy began to invade the oil industry.

For me and many of my colleagues, this was the end of a dream. As we had feared when the decision to nationalize was taken, keeping the oil industry free from politicization was impossible.

Today, 40 years after nationalization took place, Petróleos de Venezuela has been run into the ground. The government that came in power in 1999 ended all pretenses of autonomy for PDVSA. Oil income started being diverted into the hands of the executive without providing PDVSA the required funds for reinvestment and proper maintenance.

The company was redefined as a social company in charge of multiple activities that had little to do with oil, such as importing and distributing subsidized food. Production levels went down about 600,000 barrels per day as compared to 1998 levels. The number of employees quintupled. Company debt went from $2 billion in 1998 to about $70 billion today.

Currently refineries are running at 65 percent capacity. Much of the oil exported is going into the hands of ideologically-friendly governments at non-commercial prices. Worst of all, the ratio of production to proven reserves is the lowest among all oil producing countries.

In particular, the huge deposits of heavy oil in the Orinoco Belt area have remained essentially undeveloped for the last 16 years while the most capable foreign companies have left the country.

The negative results of nationalization have been seen in other countries as illustrated by the examples of Pertamina in Indonesia, PEMEX in Mexico, YPF in Argentina and PETROBRAS in Brazil. But the case of PDVSA is, in my opinion, the most tragic illustration of what can happen to a nationalized oil industry.

I knew all along that, in 1976, Venezuela made a wrong decision but, together with a large group of professional managers, did my best to implement it well. We nationalized all the risks for the sake of nationalistic pride.

It could have ended differently, but … we are not Norwegian!

Editors note: Robert Yeats, a longtime geology professor at Oregon State University, won the AAPG Michael T. Halbouty Memorial Human Needs Award in 1998.

AAPG 'Needs To Be Part of the Conversation' on Climate Change

By ROBERT YEATS

In 1926, the AAPG organized an international conference in New York on the continental drift hypothesis of Alfred Wegener, as described in his book, "The Origin of Continents and Oceans," first published in 1912.

Most of the papers presented were in vigorous opposition to continental drift, especially among American geologists. The only scientists who embraced Wegener's hypothesis were from South Africa; they argued that continental drift explained their observations, including comparisons with other continents in the Southern Hemisphere.

The consensus among most was that the hypothesis had no value and should be rejected. Except for the South Africans, the continental drift hypothesis was abandoned.

After this conference, a discouraged Wegener returned to his first love, exploration of the Arctic. On his fourth expedition to the Greenland ice cap, Wegener lost his life. His body is still buried there.

The problem was that critical information from the deep ocean had not yet been collected.

During World War II, because of German U-boats, the Allies began exploring the ocean floor, which revealed that it is not a featureless plain, but consists of mountains, mid-ocean ridges, trenches and great faults (see the movie, "The Hunt for Red October"). The advent of new marine survey tools led to the new global tectonics, and from there, to plate tectonics.

I worked for Shell Oil during this great change in our understanding, including a study by two Richfield Oil geologists that


YEATS

> **If climate change is left to politicians, society is unable to present a common front against the warming of our planet.**

the San Andreas fault is characterized by offsets measured in hundreds of miles.

I became convinced by the evidence, even though many Shell managers who had studied under Andrew Lawson of the University of California at Berkeley didn't believe it.

Even so, Shell supervisors encouraged me to continue my investigations and to present my ideas to exploration offices around the country. I owe Shell a great debt for that opportunity.

Now, of course, plate tectonics and large-scale displacements on the San Andreas fault are widely accepted and are concepts used by AAPG members in petroleum exploration.

But now fast-forward to 2015, and geologists are now faced with a different hypothesis: climate change.

Subsurface well and seismic data give geology the third dimension, and my students used the data to map earthquake faults in California and the Himalaya. Their familiarization with subsurface data made them attractive to the petroleum industry, and many went on to successful careers in oil and gas. Salaries in geology, driven by industry, were the highest among the sciences.

But many members of AAPG reject the research on climate change being published worldwide, even though most climate scientists accept varying forms of global warming based on analysis of ice cores from Greenland and Antarctica, melting of Arctic sea ice and a steady increase in CO_2 in our atmosphere.

Students graduating from major universities take courses in climate science as well as structural geology, geophysics and basin analysis – and some do research in the field – before accepting jobs in oil and gas.

Rejection by many AAPG members of the evidence for climate change leads to geologists talking past one another. As a result, as pointed out in Edith Allison's column in the July 2015 EXPLORER, the argument has become political.

The House of Representatives, she reminds us, has passed a bill that reduces research funding to geoscience programs by 12 percent, which will cut back on research in fields of great interest in oil and gas exploration and earthquake research – including my field, mapping of faults based on subsurface data.

Allison quotes Rep. Lamar Smith, R-Texas, as saying, "Funding is cut for lower priority areas, including … redundant climate research." As written, Smith's bill treats all the geosciences as "lower priority."

Congressional budget-cutting is very coarse, like attacking mosquitoes with a shotgun.

This debate leads to proposals by some academic colleagues to have university foundations divest themselves of fossil fuel stocks. We fought that off at Oregon State, as did Harvard and other universities, but the public outcry against huge political expenditures by billionaires like the Koch brothers makes targets of oil companies.

If climate change is left to politicians, society is unable to present a common front against the warming of our planet.

AAPG is the largest geoscience organization in the free world, and its members know more about frontier areas now being explored than anyone else. Part of our scientific responsibility is to act as advisers, not advocates for one political stand – either for or against climate change.

AAPG needs to be part of the conversation.

I propose AAPG sponsor an international conference on climate change, including the leaders in climate research and those questioning its validity, and including the idea that higher CO_2 levels in the atmosphere are due to increased burning of fossil fuels.

AAPG members are scientists. Let's take a leadership position so that the argument is based on science and not politics.

INDUSTRY HIGHLIGHTS

CGG GeoConsulting Introduces Seep Explorer and GLOGOS

CGG GeoConsulting announced that it has acquired GLOGOS, the Global Onshore Gas-Oil Seeps data set, from Gas Consult. GLOGOS will be incorporated into the new Seep Explorer, creating the world's only onshore and offshore fully-attributed GIS-based seeps product suite for regional-to-prospect source de-risking.

Hydrocarbon seep detection from satellite imaging maps the location and repeatability of naturally occurring oil seepage offshore and is a recognized and valuable tool for new ventures and exploration teams and has been adopted by the majority of the major international oil companies.

For more information, visit cgg.com.

Weatherford and Chevron Push Temperature Barriers in the Gulf of Thailand

Weatherford International announced the development of the HeatWave Extreme service for commercial use by Chevron Thailand. The HeatWave Extreme service includes an enhanced logging-while-drilling (LWD) tool string capable of withstanding temperatures of up to 410 degrees Fahrenheit.

The partnership is part of Weatherford's strategic focus to develop the right technology for the right market through collaboration with key clients globally. For more information, visit www.weatherford.com.

Schlumberger Acquires Fluid Inclusion Technologies, Inc.

Schlumberger announced the acquisition of Fluid Inclusion Technologies, Inc., a U.S.-based oil and gas service company specializing in laboratory analysis of trapped fluids in rock material, and advanced borehole gas analysis on drilling wells.

The expanded rock and fluids services and technologies enable integrated workflows from Schlumberger field and laboratory services. For more information, visit www.slb.com.

LOLA Energy Announces Backing by Denham Capital

LOLA Energy, a newly formed independent oil and gas company, announced that it has recently closed on a $250 million equity commitment from leading energy and resources-focused global private equity firm Denham Capital. The equity funding will supplement equity commitments from the executive management team and be used to pursue toil and gas properties in the Marcellus and Utica shale plays in Appalachia.

For more information, visit www.lolaenergy.com.

DPA
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with a PAPG monthly dinner meeting on the evening of April 12, 2016, providing an opportunity to come to Pittsburgh the day prior to the forum, network with local geoscientists and enjoy an Appalachian Basin technical talk.

Subjects range from creative and entrepreneurial thinking to technical talks covering Appalachian Basin shale plays (Marcellus, Utica, Upper Devonian and Rogersville) and new discoveries in the Michigan Basin.

The keynote speaker from Rice Energy will provide insight to the strategy and tactics used to propel a company from a startup into a successful player and ultimately through an initial public offering, in an area of the Marcellus and Utica Shale plays dominated by large independent exploration and production companies. Networking opportunities will be available throughout the day including a mixer after the forum.

These programs are available to all AAPG members and Young Professionals. We invite eligible professional geologists to apply for membership in DPA.

PROFESSIONAL newsBRIEFS

Gregory L. Brown, to chief geophysicist, Flying Poodle Geoscience Consulting, Sugar Land, Texas. Previously geophysical adviser, Woodfield Energy, Houston.

James A. Jacobs has been awarded the AIPG Martin Van Couvering Memorial Award from the American Institute of Professional Geologists. He is a hydrogeologist, Clearwater Group, Richmond, Calif.

Dale Short has retired from EOG Resources, Tyler, Texas. He will reside in Tyler and complete his term as president of the East Texas Geological Society.

D. Craig Smith, independent in Midland, Texas, has been elected as president of the Society of Independent Professional Earth Scientists. Other AAPG members elected to the board of directors for the 2015-16 term are: Vice president, **Douglas H. McGinness II**, CMX Oil & Gas in Wichita, Kan.; Vice president of national energy, **Patrick A. Nye**, Nye Exploration and Production in Corpus Christi, Texas; and Secretary, **Michael L. Jones**, Charger Exploration in Houston.

Raymond Sullivan has been awarded the Presidential Award and Honorary membership from the Northern California Geological Society. He is professor emeritus geology, San Francisco State University, San Francisco.

Long-Range Outlook for Oil and Natural Gas

By EDITH ALLISON, Geoscience and Energy Policy Office Director

The long-term projections have changed little in the year since this column last reported on the annual International Energy Agency (IEA) "World Energy Outlook," but the tone is much different.

Last year's report was concerned about finding the investments to meet demand; now the world has surpluses of oil and gas and a booming renewables industry.

One interesting observation in last year's report that may help to explain the energy surplus: 2013 investments to provide energy were $1.6 trillion, double those in 2000.

The 2015 World Energy Outlook (WEO) includes optimistic projections for substantial growth of all energy forms, although coal consumption will grow only 0.4 percent per year to 2040. This WEO analysis reflects the rapid changes in energy markets over the past year and, in its "New Policies" scenario, considers the implications of emissions reduction pledges submitted in advance of the United Nations Climate Change Conference in Paris.


ALLISON

Policy reality may be quite different from the 2015 Paris pledges assumed in the new policies projections.

Under new policies:

- Global energy consumption would grow by 32 percent by 2040, driven primarily by China, India, Africa, the Middle East and Southeast Asia. The European Union, Japan and the United States would lead the consumption declines characteristic of economically advanced countries. This year's growth projection is significantly lower than last year's (37 percent), based on the assumption that developed countries will cut their energy consumption more than previously estimated.
- Global oil demand would grow rapidly to 2020, driven by low prices. The WEO models predict that the global oil price reaches $80 per barrel in 2020 and climbs to $128/bbl in 2040 (in 2014 dollars). Constrained by higher prices, demand grows more slowly after 2020. From now to 2040, China's and India's consumption grows 6 and 5 million barrels per day (mb/d), respectively, while developed nations' consumption declines by about the same total amount (11 mb/d).

The modest growth in oil consumption as the standard of living grows in much of the developing world reflects the expectation that energy use per unit of GDP will continue to decline due to industrial and agricultural efficiencies, and growth in the services sector.

- Non-hydro renewable energy (bioenergy, geothermal, wind, solar and marine) grows significantly under all modeling assumptions, but is projected to benefit the most from new policies. Non-hydro renewable electricity generation would grow 450 percent, to 19 percent of the total electric supply.

Government regulation will drive that growth – renewables power generation would be almost 30 percent larger under new policies than current policies. However, WEO projects that renewable production can expand without subsidies as the cost of production technology declines and production moves to areas with higher-quality resources.

- Hydropower would grow more than 50 percent under either current or new policy models, driven by China's current, and probably ongoing, emphasis on hydropower.

Of course, policy reality may be quite different from the 2015 Paris pledges assumed in the new policies projections. For example:

- Congress is working to eliminate the Clean Power Plan that is part of the emission reductions pledged by the United States in advance of the Paris climate change summit, and some presidential candidates promise to eliminate some emissions regulations.
- Population growth and the need to provide electricity and cleaner cooking fuels to billions of people may lead to unexpected policy decisions.
- Future increases in the cost of oil may prompt some countries to reinstate recently revoked government subsidies, thus encouraging fuel consumption.

Comparison of the future of fossil fuels under new policies and current policies is interesting – the differences are not striking, suggesting population growth and an increasing standard of living in less-developed countries will dominate energy trends.

Continued on next page

READERS' FORUM

After reading the article on the Ad Hoc Committee on Governance (in the December EXPLORER), it is clear AAPG is actually a very large commercial enterprise. I'm not surprised that Mr. Krystinik's presentation prompted lengthy and diverse discussions.

The committee's "current reality" struck me, as a 40-year member and certified petroleum geologist: "The Executive Committee has seven officers focused on governance and one focused on science."

I always have looked to AAPG for technical papers of interest. Do we need to refocus in this area?

"Much of what AAPG does is focused on managing governance of AAPG" and "Volunteers and staff often envision different perspectives of AAPG priorities and functions."

This appears to describe a diluted and diffused leadership, whereby no one is actually sure what the mission of AAPG is and where it's headed?

"Lack of strategic and business alignment between AAPG, Sections and affiliated societies is 'costly and divisive.'"

Is it time for an international professional society (which is what we are) to re-think its basic structure? Maybe the sections should be totally re-designed and re-structured? Maybe we need an international bulletin and a domestic bulletin?

Having said this, I also wish to commend all AAPG staff and volunteers for their continued professional expertise and volunteer time and effort. Many, many things have been done well and right! For example, I think the addition of Search & Discovery and Datapages have been two premier examples! However, this ain't just a simple organization to run.

Robert Von Rhee
Coweta, Okla.

(This letter is in regard to the December EXPLORER article "The Predictive Power of Porosity.")

Thank you Kitty Milliken for your dedication to learning more about these fine-grained rocks. It is through this depth in knowledge and the increased production and rock data from these same wells that we will be able to narrow the unknowns in the hunt for oil and gas in fine grained rocks. We can only wish you all the best in your continued efforts.

Conrad Maher
Newport Beach, Calif.

I read Jessie Holland's article in the November EXPLORER on "Job Searching When Jobs are Scarce" and would like to add an additional comment to the article. I think the article hit upon many important considerations in the job search, but felt there was one important item overlooked when it comes to building a résumé.

The article suggested that résumés should contain enough information to quickly catch the attention of recruiters and managers. There were three key pieces of information suggested to capture that attention. These three bullet points from the article regarding résumé building are summarized as follows:

- Your specialization within a technical discipline.
- Your exposure to geographical areas, plays, depositional environments, reservoir types.
- The software you are capable of operating.

I would suggest one more.

If a job seeker desires to capture the attention of a manager or a recruiter, they should briefly outline their accomplishments.

Résumés are designed to get reviewer's attention and to get you an interview. If I am reviewing a résumé related to hiring, I want to know quickly what the person has accomplished – what are they proud of? I want to know the highlights, achievements and results of the job seeker – be it breakthroughs/perspectives, insights, wells drilled, value-created, etc. I do not want a résumé that reads, "I am an exploration geologist (or research or development geologist), and I worked this, correlated that, mapped this and did that."

I want to know that this person's past achievements resulted in positive outcomes for their previous companies.

Paul Babcock
The Woodlands, Texas

Continued from previous page

- Under IEA's current policies scenario, oil production in 2020 is only slightly higher than in its new policies scenario. By 2040, world oil supply reaches 117 million barrels per day (mb/d) under current policies and 103.5 mb/d in the new policies scenario.
- Under either the current or new policy scenarios, global natural gas production rises more than any other fossil fuel to 2040. The WEO models show global gas production growing 45 percent to 2040 under new policies; current policies would support almost 60 percent growth. These projections are lower than in the 2014 WEO, reflecting current expectations of lower growth in gross domestic production (GDP) and increased efficiency measures.
- The IEA report also models two less likely but more impactful scenarios: severely restricting carbon emissions and long-term low oil prices. This column will not discuss these outlier scenarios.

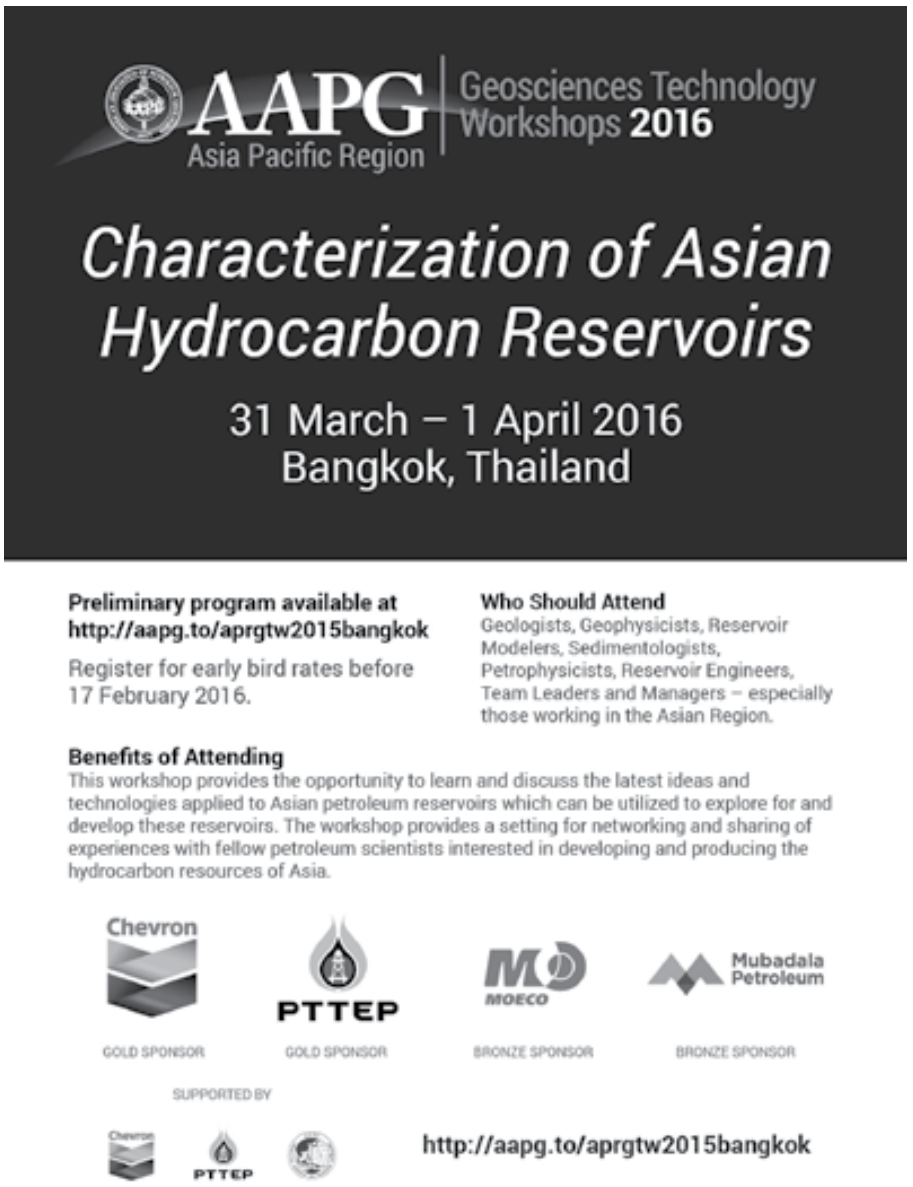
IEA notes that the long-term ramifications of the recent oil-price drop are hard to predict in light of the fact that both oil producers and consumers are not reacting to the price changes as rapidly as they have in the past. In addition, technological innovation can be a significant factor in changing energy supply and demand, but continues to be difficult to predict.

One area in which technology plays an important but difficult-to-predict role is tight oil and shale gas. IEA projects that U.S. tight oil production will plateau in the early 2020s at slightly more than 5 mb/d. The U.S. Energy Information Administration 2014 global projection is similar. On the other hand, ExxonMobil's and BP's long-range forecasts – 2040 and 2035, respectively – expect unconventional hydrocarbons to continue to grow, aided by technological innovation.

Population growth will also play a major role in total energy consumption and choices in energy type. The world's population is expected to rise from 7.1 billion in 2013 to 9 billion in 2040. The increase will be concentrated in Africa, India, Southeast Asia and the Middle East. These areas of high population growth are also areas that use lower cost, carbon-intensive fuels. The new policies scenario predicts that gas demand grows almost 250 percent from 2013 to 2040 in China and India, and 75 percent in the Middle East as these areas expand overall energy use and include lower-emission fuels. China will cut coal consumption, but India will need cheap coal to provide electricity to 600 million new consumers and gasoline for increased car ownership (growing from 6 percent of households having a car).

CLASSIFIED ADS

You can reach about 37,000 petroleum geologists at the lowest per-reader cost in the world with a classified ad in the EXPLORER. Ads are at the rate of $2.90 per word, minimum charge of $60. And, for an additional $50, your ad can appear on the classified section on the AAPG web site. Your ad can reach more people than ever before. Just write out your ad and send it to us. We will call you with the word count and cost. You can then arrange prepayment. Ads received by the first of the month will appear in the subsequent edition.



CLASSIFIEDADS

POSITIONS WANTED

Director and State Geologist
University of Kentucky
Department of Kentucky Geological Survey

The University of Kentucky is seeking experienced applicants for the senior level faculty position of Director and State Geologist at the Kentucky Geological Survey. For more information or to contact the search committee about the position, go to kgs.uky.edu/StateGeologist. The minimum requirements for the position are a Ph.D. and 10 years of related experience in geology. Applicants should have excellent communication skills, an active research program, and management experience in an equivalent organization. A diverse background in government, industry, and academia is desirable.

This position is open until filled; the Search Committee will begin reviewing applications in early February 2016. Salary is commensurate with education, experience and qualifications.

To apply for requisition #FE00397, a UK Employment Application must be submitted at www.uky.edu/ukjobs. Apply directly at http://ukjobs.uky.edu/postings/88097. If you have any questions, contact HR/Employment, phone (859) 257-9555 press 2, or email ukjobs@email.uky.edu. The University of Kentucky is an Equal Opportunity Employer and is committed to a policy of providing equal employment opportunities to all candidates.

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Assistant Professor Strategic Natural Mineral Resources – Economic Geology - Missouri University of Science and Technology

The Department of Geosciences and Geological and Petroleum Engineering invites applications for a full-time tenure-track faculty position in economic geology - strategic natural mineral resources, at the Assistant Professor level, to begin August, 2016. The successful candidate will be expected to develop an active externally-funded research program that investigates processes related to ore genesis, mineral resources, ore deposit exploration, and demonstrate a commitment to interdisciplinary research. We seek individuals who will integrate their research with excellence in teaching at both the graduate and undergraduate levels. Teaching responsibilities will include service courses as well as courses in the individual's area of expertise. The Department currently has 20 full-time faculty, and 318 undergraduate and 241 graduate degree-seeking students with established B.S., M.S., and Ph.D. programs in Geology & Geophysics, Petroleum Engineering, and Geological Engineering. Closely associated departments include Mining Engineering and Environmental Engineering. Local area establishments with potential collaborative research opportunities include the U.S. Geological Survey (Mid-continent Geospatial Mapping Center), Missouri Department of Natural Resources, Fort Leonard Wood (U.S. Army), the Missouri S&T Rock Mechanics and Explosives Research Center (RMERC), Materials Research Center (MRC), and Energy Research and Development Center (ERDC). Visit our department web pages for more information on faculty and research (http://gse.mst.edu/). Questions regarding this position should be directed to the chair of the search committee, Dr. David Wronkiewicz (wronk@mst.edu).

A Ph.D. in Geology and/or Geophysics is required. The final candidate is required to provide an official transcript showing completion of the terminal degree listed in the application materials submitted. A copy of transcripts must be provided prior to the start of employment. In addition, the final candidate may be required to verify other credentials listed in application materials. Failure to provide the official transcript or other required verification may result in the withdrawal of the job offer.

Applications must include a letter describing interests and possible contributions to our programs, curriculum vita, statements of teaching interests and research goals, up to five reprints of published work, and the names and contact information of three referees. Review of applications will begin on February 15, 2016 and continue until the search is completed.

All application materials including resume/vita, cover letter, reference letters, portfolio, etc., must include the position reference number in order to be processed and must be submitted electronically to: http://hraadi.mst.edu/hr/employment . Acceptable electronic formats are PDF and Word.

Missouri University of Science and Technology Human Resource Office Position Reference Number #00065394 (Geoscientist).

Missouri University of Science and Technology is an affirmative action/equal opportunity employer.

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DIRECTOR – Kansas Geological Survey -The University of Kansas, Lawrence. Full-time position serving as the Director of the Kansas Geological Survey (KGS) and State Geologist. Must develop and articulate a vision of KGS programs, understand the concept of serving Kansas through high-quality research in the applied geosciences, and embrace a collegial leadership style. Requires doctorate in the geosciences with 10 years professional experience, 3 years administrative experience, national recognition in geoscience research, excellent communication skills, knowledge of natural resources and the environmental aspects of their use, and demonstrated ability to deal with natural-resource policy issues. The KGS is a research and service division of the University of Kansas (KU). Created in 1889, the Survey studies the geology of Kansas, develops new techniques for exploring and analyzing geologic data, and produces and disseminates maps, reports, and scientific papers. Among the premier earth-science research and service institutions in the U.S., the KGS has an annual state budget of $5.8 million, a fiscal year 2014 grant and contract budget of $2 million, and employs more than 115 researchers, support staff, and students engaged in a variety of disciplines. Staff collaborate extensively with faculty and students in academic departments at KU. Full announcement and application info. at www.kgs.ku.edu/General/jobs.html. Review will begin January 25, 2016, position open until filled. For further information contact Jim Butler (jbutler@kgs.ku.edu) or Greg Ludvigson (gludvigson@kgs.ku.edu). KU is an EO/AAE, http://policy.ku.edu/IOA/nondiscrimination.

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Senior Research Scientist - Geo/thermochronology & Sedimentary Petrology

Commonwealth Scientific & Industrial Research Organisation (CSIRO)

CSIRO Energy has established a world-class argon geo/thermochronology facility with a focus on illite dating directed primarily at petroleum exploration activities. The laboratory has state of the art clay separation and characterisation facilities combined with modern mass spectrometers.

CSIRO is seeking an innovative research scientist to lead the laboratory and undertake strategic and applied research relevant to petroleum exploration and appraisal for both conventional and unconventional resources. The candidate is expected to have expertise in in K-Ar geo/thermochronology and sedimentary petrology with an emphasis on diagenesis and clay mineralogy.

Location: Kensington, Western Australia Salary: AU $106K to AU $124K pa plus up to 15.4% superannuation Tenure: term of 3 years Reference: 4901

Applications close on 24 January 2016 (11:30pm AEDT time).

For full details of the position please visit our web page at http://www.csiro.au/careers Choose 'current vacancies' enter 4901 and press 'search jobs'.

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King Abdullah University of Science and Technology

The Physical Science and Engineering (PSE) Division (http://pse.kaust.edu.sa) at King Abdullah University of Science and Technology (KAUST) invites qualified applicants to apply for faculty positions at all ranks (Assistant, Associate and Full Professor) in the Earth Science and Engineering (ErSE) program.

KAUST is an international, graduate research university dedicated to advancing science and technology through interdisciplinary research, education, and innovation. Located on the shores of the Red Sea in Saudi Arabia, KAUST offers superb research facilities including core labs, generous assured research funding, and internationally competitive salaries.

The university encourages fundamental and goal-oriented research to address the world's pressing scientific and technological challenges related to the sustainability of water, food, energy, and the environment.

The science produced in PSE focuses on understanding, modeling and manipulating matter at all scales (nano, meso and macroscopic levels), in all forms (bulk, thin films, divided colloids, fluid flows, the earth as system, etc.) and in interaction with external stimuli (light, heat, fluids, stresses, etc.).

The ErSE program currently has eleven full-time faculty members, about 42 postdoctoral fellows and research scientists and more than 64 graduate students. Research areas include: applications of modern computational methods to study geophysical problems associated with the atmosphere and/or ocean circulation, earthquakes, oil exploration, reservoir modeling and subsurface phenomena. These areas are enhanced through close collaboration with some of the best geophysical and meteorological centers in the world, and through KAUST's advanced central research facilities, including supercomputing and scientific visualization. A research center specifically devoted to Upstream Petoleum Engineering (UPERC) has recently been created.

More information about the ErSE program and research activities is available at: http://erse.kaust.edu.sa.

The ErSE program at KAUST has open faculty positions at Assistant, Associate or Full Professor rank in experimental geophysics, in particular in the fields of:

Atmospheric aerosols
Boundary layer and air-sea interaction
Structural and/or sedimentary geology
Carbonate reservoirs: formation and properties for UPERC
Multiscale flow and coupled processes for UPERC Petrophysics and wireline logging for UPERC
Geophysics and rock physics for UPERC
Robust reservoir simulation with flow coupling for UPERC

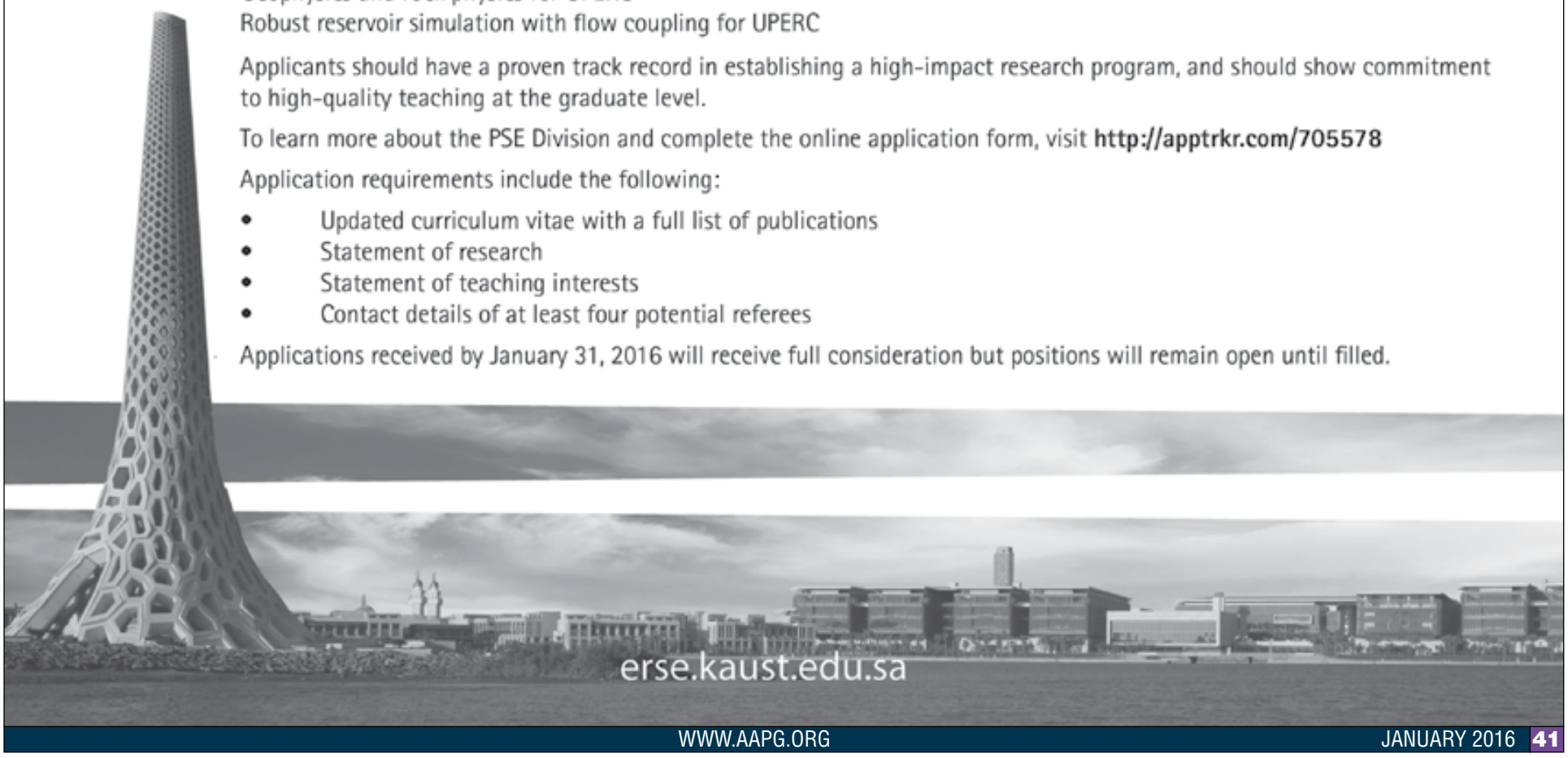
Applicants should have a proven track record in establishing a high-impact research program, and should show commitment to high-quality teaching at the graduate level.

To learn more about the PSE Division and complete the online application form, visit **http://apptrkr.com/705578**

Application requirements include the following:

- Updated curriculum vitae with a full list of publications
- Statement of research
- Statement of teaching interests
- Contact details of at least four potential referees

Applications received by January 31, 2016 will receive full consideration but positions will remain open until filled.



DIRECTOR'S CORNER

Cautious Optimism Sets Tone for IPTC

By DAVID CURTISS


CURTISS

Clearly the E&P industry faces big challenges, but this isn't the first time we've been in a downturn and it won't be the last.

The International Petroleum Technology Conference (IPTC) is one of AAPG's premier events in the eastern hemisphere.

Emulating the integrated multidisciplinary nature of today's E&P workflows, IPTC is a partnership of four geoscience and engineering societies: AAPG, the European Association of Geoscientists and Engineers, the Society of Exploration Geophysicists and the Society of Petroleum Engineers. The event alternates each year between various cities in Asia and Qatar and is a prime example of the increased intersociety cooperation we are pursuing to better serve our profession and industry.

Last month, 3,800 attendees participated in the 9th edition of IPTC in Doha, the capital of Qatar, a vibrant, bustling city on the Arabian Gulf.

"Technology and Partnerships for a Sustainable Energy Future" was the theme of the conference, and attendees gathered for three days of panels and technical sessions, covering a wide variety of geoscience and engineering topics.

The conference was hosted by Qatar Petroleum and co-hosted by Shell.

One hallmark of IPTC is that it also provides the opportunity to hear from high-level government and industry officials – and to gain their perspectives on the state of the industry. Given the current state of the industry and commodity markets, this was particularly valuable.

The opening session featured H.E. Sheikh Abdulla bin Nasser bin Khalifa Al Thani, prime minister and interior minister of the State of Qatar. He was joined by H.E. Dr. Mohammed bin Saleh Al-Sada, minister of energy and industry of Qatar, Saad Sherida Al-Kaabi, president and CEO of Qatar Petroleum (QP), and Andy Brown, upstream international director of Shell.

A topic foremost on their minds was the COP21 United Nations climate change conference that was under way in Paris at the time. Qatar, ranked third in the world in proved natural gas reserves by the U.S. Energy Information Administration with 885 TCF (2014 numbers), sees its resource base as essential to helping the globe meet its carbon dioxide emissions targets resulting from the talks.

This session was immediately followed by the first CEO Plenary Session. Hosted by Al Jazeera's news anchor and reporter Darren Jordon, the participants included: QP's Saad Sherida Al-Kaabi; Ben Van Beurden, CEO of Shell; Amin Nasser, president and CEO of Saudi Aramco; Ryan Lance, chairman and CEO of ConocoPhillips; and Patrick Pouyanné, CEO of Total.

Emphasizing the importance of technology to drive economic efficiencies in a low-price environment, the panelists shared examples of how their companies were responding to low commodity prices. They also discussed the importance of cooperation and partnership, particularly with the service industry, to develop new approaches and improved technology.

The following day the second CEO Plenary Session, again moderated by Jordon, picked up where the first left off. The participants were: Ali Al-Jarwan, CEO of ADMA-OPCO; Adel Ahmed Albuainain, CEO of Dolphin Energy Limited; Lorenzo Simonelli, president and CEO of GE Oil & Gas; and Lukman Mahfoedz, CEO of Medco Energi International.

Technology and innovation were again the themes of the day, with Mr. Al-Jarwan observing that technology is essential to the future of our industry, but we have to be cost-effective and smart in R&D. He also stated that there were two elements to innovation: freedom and risk-taking. Not everything will work, but you must have the freedom to try.

Simonelli told the audience that cooperation was the way forward for the energy industry, and that every industrial company needed to be a digital company in today's world. And, while we're navigating this downturn, he still sees opportunities for the next-generation energy workforce.

Overall, the atmosphere of the conference was one of cautious optimism. Clearly the E&P industry faces big challenges, but this isn't the first time we've been in a downturn and it won't be the last. Each time, the industry adjusts, changes and continues to deliver the energy to fuel the world.

A second hallmark of IPTC is that it is the one event each year where the presidents of the partnering societies get together. John Hogg joined EAGE President Mohammed Al-Faraj of Saudi Aramco, SEG President John Bradford of Boise State University, and SPE President Nathan Meehan of Baker Hughes.

Not only did the presidents use this opportunity to get to know each other better and to discuss current activities and opportunities for cooperation, they also participated in several formal events, including a Society Presidents Session and the IPTC student program.

John spoke to the students about the importance of professionalism, ethics and volunteerism to their careers, particularly important to these students entering the workforce in the midst of this downturn.

They left the session to network with each other and the industry professionals attending IPTC.

Getting out there and meeting people is essential to a successful career. And on that note, I'd like to invite you to join us for the 10th edition of IPTC in Bangkok, Thailand on Nov. 14-16, 2016. You even have until Jan. 15 to submit an abstract to present in Bangkok. I'd urge you to do so.

IPTC is an AAPG event and a great opportunity for AAPG members in Asia and the Middle East to get involved and share great geoscience. IPTC is led by a board of directors with each partner society appointing two.

I'd like to thank our representatives, David Blanchard, chair of the IPTC Board, and Peter Baillie for their commitment to IPTC, and for their service to AAPG and the profession by developing and nurturing this conference since its inception. Their leadership has been instrumental to its past and future success.

Plan to join them in November for the 10th IPTC in Thailand, the land of smiles.

Best wishes for a healthy and prosperous 2016.

DIVISIONS REPORT: DPA

Spreading the Word: DPA-Sponsored Playmaker Forum

By MICHAEL R. CANICH, DPA President

Fellow AAPG/DPA members, Happy New Year to all!

In the interest of continuing my theme of "Spreading the Word" about AAPG's Division of Professional Affairs, here's an update on some exciting events organized by DPA members for the spring of 2016.

Now is the time to plan to attend these educational and networking forums on discoveries and new plays.

Many of you may be familiar with the Playmaker concept, as we have previously held five very successful events. A great example of this program was held last Jan. 14, 2015 in Midland, Texas.

Kudos to Mike Party for a great Playmaker on prospecting skills and discoveries that packed the Midland convention center with 300 attendees.

These and other past Playmaker videos are available online at the following link: http://www.searchanddiscovery.com/specialcollections/pm.htm

A Playmaker is a one-day forum where geoscientists share with fellow geoscientists technical and professional paths to business success. The fraternity of geoscientists is an essential element and the one-day time frame fits nicely into busy schedules.


Midland Playmaker luncheon.

Forums feature:

- Educational talks (skill sets, workflows and resources).
- A headliner luncheon with a broad vision and case study of success.
- Analog discoveries in proven and emerging plays.
- Networking breaks and an ice-breaker reception where participants, speakers and young professionals can exchange business cards and ideas.

The Playmaker Forum series continues on its successful march around the globe. DPA is currently planning Playmaker forums in Denver, Pittsburgh and Bakersfield, Calif. We are scouting the possibility of an event in AAPG Regions and other U.S. cities.

If you would like to serve as a general chair or if your section or region would like to host a Playmaker event in partnership with AAPG Education and DPA, please contact michael.canich@trimontenergy.com.

Here are upcoming spring 2016 events. Additional details will be forthcoming:

- The Rockies Playmaker Discovery is planned for March 24, 2016 at the Marriot Denver City Center. Chair Steve Sonnenberg and his team have assembled 10 exciting talks on Rocky Mountain plays. These include Peter Dea as the luncheon speaker on the topic "Plays that worked and didn't work." This event is co-hosted by the Rocky Mountain Association of Geologists (RMAG).

- The Playmaker Forum Bakersfield, Calif. is planned for March 31, 2016, at the AERA conference center. Chair Kurt Neher and team report that spring will be a particularly good time to hold a conference dedicated to new concepts in exploration and production. The usual PSAAPG section meeting will be held jointly with RMAG, Oct. 2-5, 2016 in Las Vegas.

- The Playmaker Forum Pittsburgh is planned for April 13, 2016 at the Sheraton Pittsburgh, near the Pittsburgh airport for easy access and parking for all attendees. Chairs Michael Canich and Dan Billman report that the forum is sponsored by the DPA in conjunction with two local societies, the Pittsburgh Geological Society (PGS) and the Pittsburgh Association of Petroleum Geologists (PAPG).

This one-day event will be preceded

See **DPA**, page 37