



AAPG

EXPLORER

DECEMBER 2014

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start in surprising places*

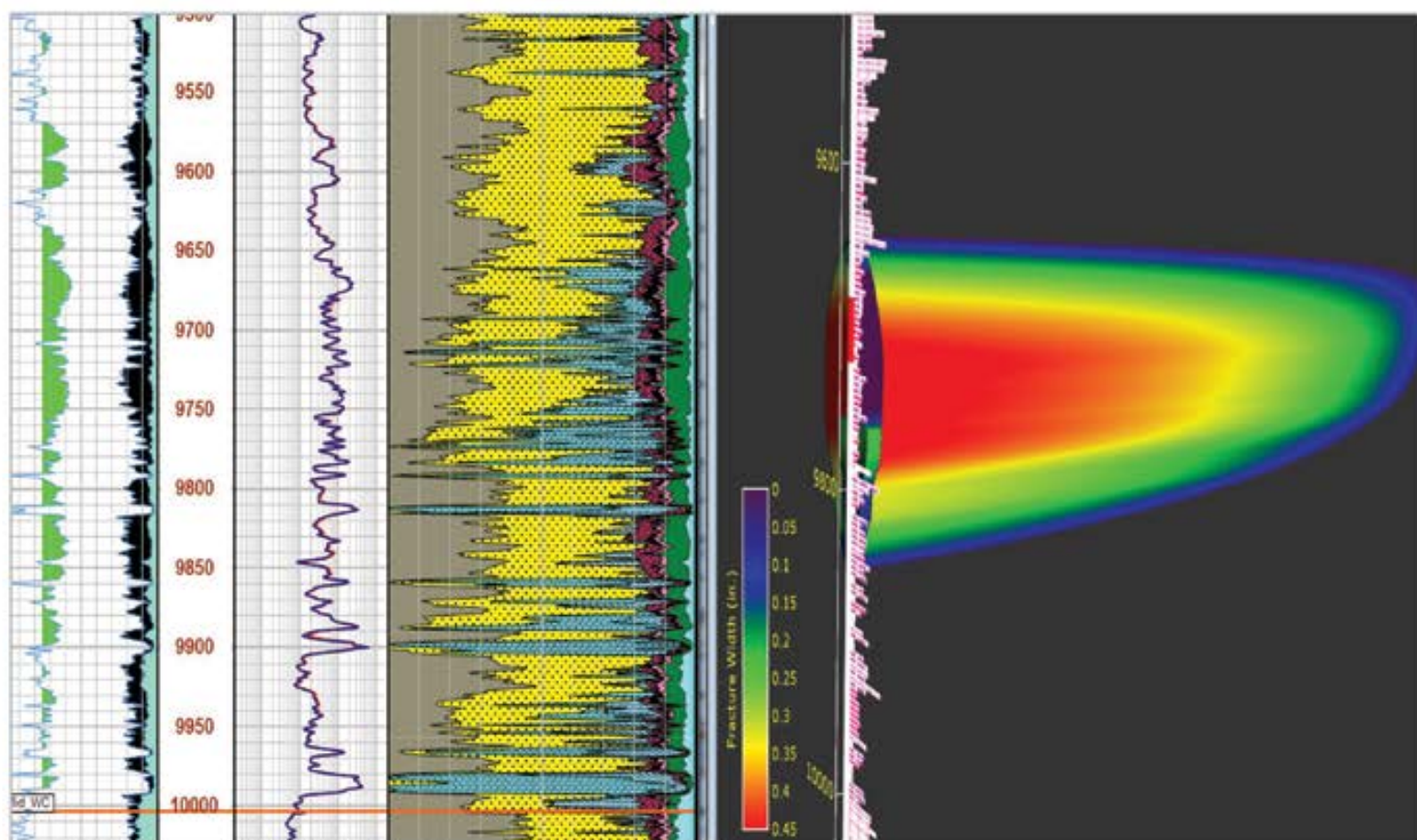
See page 3



Jason

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PRESIDENT'S COLUMN

Doing what we do better ...
Recognizing the 'Best of the Best'

By RANDI MARTINSEN

As the end of year approaches (and, for many of us, a holiday season), it's not unusual for our thoughts and emotions to turn toward others as we take an inventory of what's important in our lives.

End-of-year transitions are natural times for such reflections – and they give us the opportunity to realize and focus on how we're surrounded by people and places that matter.

Recently, for example, I've found myself taking time to think about all the things for which I'm grateful.

Top of my list is my husband, Jim, who always has been one of my strongest supporters – as well as a fantastic spouse, wonderful companion and great geoscientist (who, incidentally I met at an AAPG convention 35 years ago). I also am very fortunate to have three very loving and interesting children and two charming granddaughters.

Also on that list, I have some wonderful friends, many of whom I connected with via being active in AAPG as well as other professional associations.

* * *

In fact, I find that I'm grateful to AAPG for so many reasons; for the friendships, the mentoring, the shared learning experiences, the good times (and yes, perhaps even my husband).

I'm also grateful that we have so many talented and hard-working members and others who volunteer their talents, energies and their valuable time to



MARTINSEN

To be clear, it wasn't recognition that motivated these awardees to perform with excellence, it was passion.

advancing the science, the profession and the Association.

And, I'm very grateful for our talented, personable, hard-working AAPG staff. I've always had admiration for our staff, but over the past year I've come to more deeply appreciate all they do for the Association and its members.

* * *

It's appropriate, then, in this season of

remembering to recognize and celebrate those people who are this year's "Best of the Best" – the amazing people who have been named the winners of AAPG honors and awards.

This year's award winners are formally announced in this EXPLORER (see page 6), and all will receive their awards and public recognition during the opening session at the AAPG Annual Convention and Exhibition, which will be held May 31-June 1 in Denver.

Probably, there's someone on this list you know, or perhaps you are familiar with his or her work. Many of them will be highlighted even more in a number of articles over the next few months. I encourage you to read these articles about our awardees (as well as all the rest of the great articles presented each month in the EXPLORER) and reach out and congratulate them.

* * *

To be clear, it wasn't recognition that motivated these awardees to perform with excellence, it was passion – passion for the science, passion for learning, passion for making our profession and our world a better place.

Passion and a desire to do some good.

But recognizing their accomplishments and saying thank you is an easy, yet important, thing to do. So I say thank you to them, and thank you to all of you for your various contributions to AAPG and to our world.

* * *

And in this season of thinking about others, my wish for you is good health, great prospects and successful wells.

But mostly, may you all feel the passion.

Randi S. Martensen

Candidates Announced for 2015-16

AAPG officer candidates have been announced for the 2015-16 term. The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2016-17. The terms for vice president-Regions and

secretary are two years.

Biographies and individual information for all candidates will be available online in December.

Ballots will be mailed in spring 2015.

The slate is:

President-Elect

□ Paul W. Britt, Texplot Inc., Houston.
□ Gretchen M. Gillis, Aramco Services Co., Houston.

Vice President-Regions

□ Adebayo O. Akinpelu, Fixital Ltd., Lagos, Nigeria.
□ Peter M. Lloyd, Asia Pacific Training Ltd., Falicon, France.

Secretary

□ Heather L. LaReau, Noble Energy Inc., Denver.
□ Nicole S. Morris, FireWheel Energy LLC, Fort Worth, Texas.

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32 Game Change: Time and risk are still factors in drilling for oil, but computer advancements have reduced them to a fraction of what they were decades ago.

36 Sky of Blue and Sea of Green: Camaraderie, professional development and even a theme song emerged from AAPG's recent Latin America Region Student Chapter Leadership Summit in Peru.



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ON THE COVER:

Kelly Bruchez measures sections of the Niobrara formation a few miles south of Kremmling, Colo., while studying for his master's degree under AAPG Honorary member Stephen Sonnenberg of the Colorado School of Mines. Sonnenberg will help lead a field trip to the Niobrara and other unconventional systems at next year's ACE in June. Photo by AAPG member Nathan Rogers of ConocoPhillips.

Left: The Roan Cliffs outside Rifle, Colo., showing profound oil shales of Green River Formation (upper white cliffs) overlying red shales and sandstones of the Wasatch Formation. Photo by AAPG member K. Tanavsuu-Milkeviciene of Statoil ASA.

'A Powerhouse Emerges'

Abstracts Sought for Melbourne ICE

By CHRISTOPHER STONE, EXPLORER Correspondent

The call for abstracts is open for the next AAPG International Conference and Exhibition – a meeting that will be historic on many levels.

The 2015 ICE will be held Sept. 13-16 in the beautiful city of Melbourne, Australia – the first time ever AAPG has used that city as a setting for ICE. The meeting will be hosted by the Petroleum Exploration Society of Australia.

But another historic part is this: It will be the first-ever ICE that will be co-presented by AAPG and the Society of Exploration Geophysicists (SEG).

The meeting's theme is "A Powerhouse Emerges: Energy for the Next 50 Years" – a perfect theme, organizers say, because of both the AAPG-SEG union as well as the marking of the 50th anniversary of the Gippsland Basin oil discovery, which unlocked Australasian market activity.

Abstracts can be submitted online. Technical program co-chairs Pete McCabe, of the University of Adelaide, and Steve Mackie, with Santos, said their goal is to build an exciting program of talks, posters, short courses and field trips that focus on recent advances in petroleum

geology and geophysics.

"Although the conference will be worldwide in scope, particular attention will be paid to the petroleum potential of the Asia-Pacific region," McCabe said, "including sessions on unconventional reservoirs of the region and new and emerging E&P provinces in China, Southeast Asia, New Zealand and Australia.

"Of particular interest," he added, "will be a session on the Great Australian Bight, a large frontier basin offshore South Australia, that is an area of very active exploration by several

international companies."

In addition to the general sessions, the technical program also will feature three special symposia:

► The Reg Sprigg Memorial symposium will be a look back and forward for Australia's major petroleum provinces – the Gippsland Basin, Cooper Basin and Northwest Shelf, each celebrating 50 years of exploration and production.

Reg Sprigg (1919-94) was a key Australian petroleum geologist who figured in the establishment of both Santos and Beach Energy, which have been critical in the discovery and development of natural gas in the Cooper Basin in central Australia.

► A second symposium honors the career of Marita Bradshaw, who recently retired from Geoscience Australia, Australia's geological survey, after a career of more than 30 years in petroleum geology.

"Marita has been a tireless advocate of Australia's petroleum potential," McCabe said, "and has always been willing to share her deep knowledge of Australia's sedimentary basins and petroleum systems."

This symposium will focus on the paleogeographic evolution of Australia through time and its relationship to petroleum accumulations.

► The third symposium, on Eastern Australasian Basins (EABS), will be coordinated by PESA and will feature recent advances in our understanding of petroleum basins along Australia's eastern margin and across the Tasman Sea to New Zealand.

EABS and the Western Australian Basin Symposium (WABS), alternately held biannually by PESA, form the key up-to-date discussions of the petroleum basins on the Australian plate.

The remaining 18 technical program themes are:

- CO₂ Storage.
- Carbonates.
- Environment, Regulation and Social License to Operate.
- Geochemistry and Basin Modelling.
- Geophysics.
- Getting More out of Mature Basins.
- Mineralogy.
- New and Emerging E&P Provinces/ Australia-New Zealand.
- New and Emerging E&P Provinces/ South East Asia.
- Petroleum Systems.
- Petrophysics.
- Sedimentology.
- Stratigraphy and Applied Palaeontology.
- Structure and Tectonics.
- Technologies for Unlocking the Future.
- Unconventional Reservoirs.
- Worldwide Frontiers – China.
- Worldwide Frontiers – Other.

The abstract submission deadline is Jan. 15.

To submit an abstract, or for more information, contact Terri Duncan, technical programs coordinator, at (918) 560-2641; or email tduncan@aapg.org; or go to the website, ICE.AAPG.org

Exhibition space and sponsorship opportunities also are available. [E](#)

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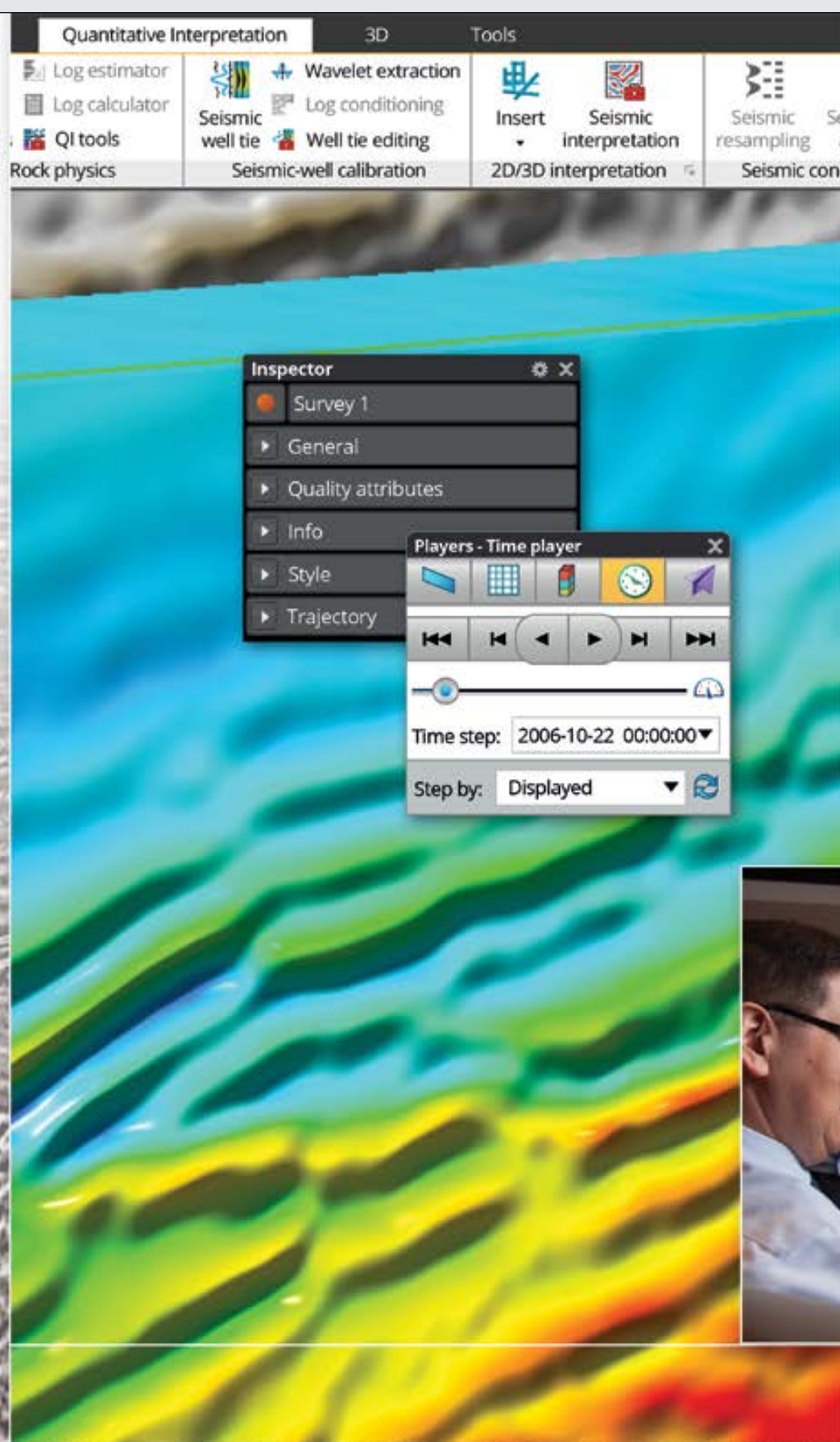
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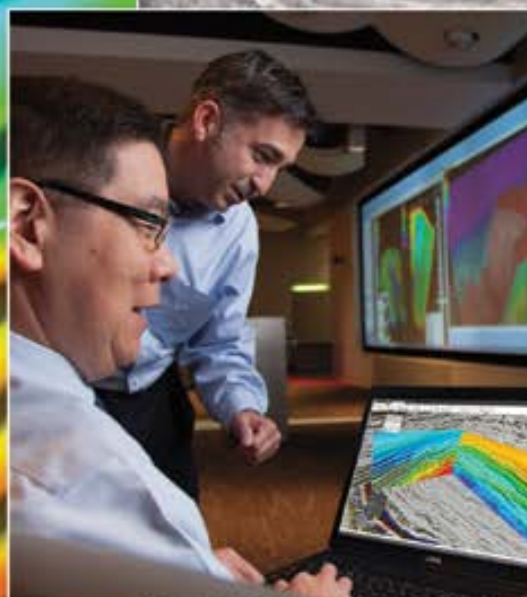
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RILEY

To be honored at Denver ACE

AAPG Announces This Year's Honorees

By VERN STEFANIC, EXPLORER Managing Editor

Paul M. "Mitch" Harris, a much-celebrated and award-winning geoscience researcher, author, editor, lecturer and professor, has been named the recipient of the Sidney Powers Memorial Award – AAPG's highest honor.

Harris, an AAPG Honorary member, is senior research consultant-Earth Science R&D for Chevron Energy Technology Co. in San Ramon, Calif.

He has been an influential and dynamic leader in geoscience research, technical programming scientific knowledge for more than 35 years – and as a two-time AAPG Distinguished Lecturer was instrumental in personally sharing the latest in geologic thought and concepts with thousands of professionals around the world.

Joining Harris at the top of this year's awardees list is **Alfredo E. Guzmán**, a past AAPG vice president-Regions and past president of AAPG's Latin America Region, who has been named recipient of the Michel T. Halbouty Outstanding Leadership Award.

Guzmán, a longtime executive with Pemex, the Mexican national oil company, is now with Altamira Petroleum Co., in Veracruz, Mexico.

Harris and Guzmán lead the list, but they are just two of the 48 award winners who have been announced by AAPG and who will be recognized at the opening session of the 2015 AAPG Annual Convention and Exhibition, set May 31-June 3 in Denver.

This year's list features a new technical publication award – the first SEG/AAPG Best Paper in Interpretation Journal Award, created specifically for contributions to the jointly produced publication, Interpretation.

AAPG awards, approved by the Executive Committee, are presented annually to recognize individuals for service to the profession, the science, the Association and the public.

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

Award winners announced by AAPG and who will be honored along with Harris and Guzmán in Denver are:

Honorary Member Award

Presented to members who have

Harris and Guzmán: Honored for Careers of Excellence

Harris, when he receives his award in Denver, will become the 68th Powers medalist in AAPG history, first awarded in 1945 to legendary geologist Wallace E. Pratt.

The Powers Award is given annually in recognition of distinguished and outstanding contributions to, or achievements in, petroleum geology.

Sidney Powers himself was a founding member and 14th president of the Association. He died in 1932 at the age of 42.

Frank R. Clark, in his memorial to Sidney Powers, said, "Sidney Powers will be known by future generations for his able contributions to pure and applied geology, but, important as are his scientific achievements, his character was greater, because it typified service to others."

Harris' contributions to science as well as his character and mentoring achievements both within and outside of Chevron have exemplified a life of service.

He is a widely recognized specialist in stratigraphic, depositional facies-related and diagenetic problems that pertain to carbonate reservoirs and exploration plays in most carbonate basins worldwide. He also has been praised for his strong interpersonal communication, organization and teaching skills, typified by his team-oriented approach to problem solving.

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

□ **Abdulrahman S. Alsharhan**, Middle East Geological Establishment, Al Ain, U.A.E.

□ **William J. "Bill" Barrett**, retired, Denver.

□ **Wallace G. Dow**, Cimarex, Tulsa.

□ **David Harold Hawk**, Energy Analysis and Answers, Boise, Idaho.

□ **John C. Lorenz**, FractureStudies LLC, Edgewood, N.M.

□ **Kay L. Pitts**, consultant, Bakersfield, Calif.



HARRIS



GUZMÁN

He received his bachelor's and master's degrees in geology from West Virginia University, and his doctorate in marine geology and geophysics from the University of Miami, Coral Gables, Fla.

He began his career in 1977 as a research associate in Houston with Getty Oil, and one year later became a project geologist for Gulf Research and Development, also in Houston.

He joined Chevron Energy in San Ramon, Calif., in 1985 as a senior research geologist, where he has continued his career as a staff research scientist, carbonate reservoir consultant and, in 2006, being named senior research consultant.

He is an adjunct faculty member at Rice University, the University of Miami and the University of Southern California.

Harris also has been published in more than 200 books, journals and guidebooks; served as an editor on 30

volumes; and with AAPG has won the John W. Shelton Search and Discovery Award, the Wallace E. Pratt Memorial Award and twice won the Robert H. Dott Sr. Memorial Award.

Guzmán is ninth recipient of the Halbouty Outstanding Leadership Award, given in recognition of outstanding and exceptional leadership in the petroleum geosciences.

He has a long record of achievements, both as a petroleum geologist and in leadership positions, particularly in the Mexican and Latin American petroleum industry.

Many of his professional successes, both onshore and offshore, have been with Pemex, the Mexican state oil company, where he received the highest position ever for a geologist – sub-director of the North Regions.

After retiring from Pemex Guzmán has been instrumental in Mexico as a commissioner in the National Hydrocarbon Commission, working to help revise exploration policies in Mexico.

A three-time past AAPG Distinguished Lecturer, Guzmán was president of the AAPG Latin America Region in 2005, and served on the AAPG Executive Committee as vice president-Regions in 2009-11.

Interviews with both Harris and Guzmán will be published in a future EXPLORER.

□ **Scott W. Tinker**, Bureau of Economic Geology, Austin, Texas.

Norman H. Foster

Outstanding Explorer Award

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

□ **Hans Christian Rønnevik**, Lundin Petroleum Norway, Baerum, Norway.

Rønnevik has had a remarkable career as an explorationist, particularly in the North Sea, where his discoveries have included the giant Snorre Field, the

Alvheim Field, the Volund Field and the giant John Sverdrup Field.

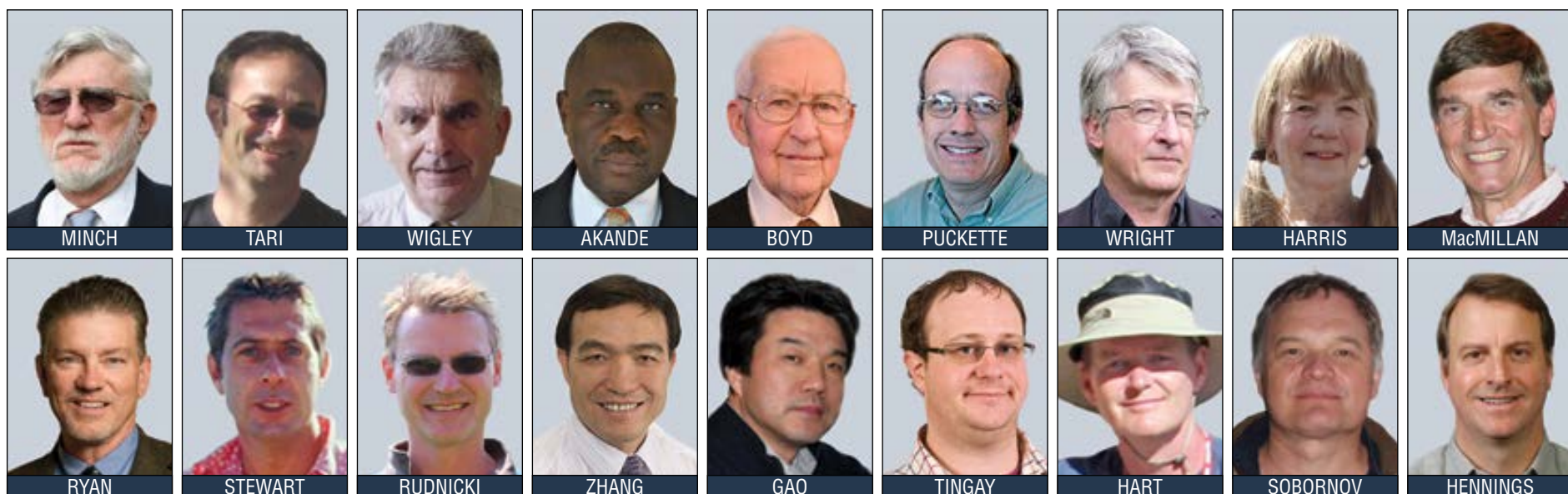
Robert R. Berg

Outstanding Research Award

Presented to honor a singular achievement in petroleum geoscience research.

□ **Kitty L. Milliken**, senior research scientist at the Bureau of Economic Geology, Austin, Texas – and a global authority in sedimentary petrography. (She also is a co-recipient of this

Continued on next page



Continued from previous page

year's Wallace E. Pratt Memorial Award; see below.)

□ **Mark D. Zoback**, Benjamin M. Page Professor, Stanford University, Stanford, Calif. – a principal investigator of the SAFOD project and a global expert on Earth stress and its impact on drilling.

Distinguished Service Award

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

This year there are 11 recipients of the honor:

□ **Ronald F. Broadhead**, New Mexico Bureau of Geology, Socorro, N.M.

□ **Ross A. Clark**, Kallisto Energy Corp., Calgary, Canada.

□ **Denise Mruk Cox**, Storm Energy, Panama City, Fla.

□ **John C. Dolson**, DSP Geosciences and Associates, Coconut Grove, Fla.

□ **Meredith Faber**, Noble Energy, Houston.

□ **William S. Houston**, New Zealand Oil and Gas, Wellington, New Zealand.

□ **Mark W. Longman**, QEP Resources, Denver.

□ **John A. Minch**, John Minch and Associates, Mission Viejo, Calif.

□ **James F. Reilly**, American Public University System, Colorado Springs, Colo.

□ **Gabor Tari**, OMV, Vienna, Austria.

□ **Peter Wigley**, Lynx Information Systems, London, England.

Grover E. Murray Distinguished Educator Award

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

□ **Samuel O. Akande**, University of Ilorin, Ilorin, Nigeria.

□ **Donald W. Boyd**, University of Wyoming, Laramie, Wyo.

□ **James O. "Jim" Puckette**, Oklahoma State University, Stillwater, Okla.

□ **V. Paul Wright**, Cardiff University, Cardiff, Wales.

Harrison Schmitt Award

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

□ **Anita Harris**, honored posthumously for her long career with the U.S. Geological Survey, best known for her work with conodonts, which resulted in a significant new method for locating petroleum plays.

Public Service Award

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

□ **Logan MacMillan**, Littleton, Colo., honored for his work with a variety of governmental and policy groups, including service on the RMAG Public Issues Committee.

□ **Timothy M. Ryan**, Ryan Exploration, Englewood, Colo., honored for "promoting earth science to the general public," especially in his work with the Denver Museum of Nature and Science.

Pioneer Award

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

□ **Ben E. Law**, Pangea Hydrocarbon Exploration, Lakewood, Colo.

Geosciences in the Media Award

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

□ **Iain S. Stewart**, professor of geoscience communication at the University of Plymouth and the host/producer of several earth science documentaries that have been presented on the BBC, PBS, Discovery Channel and YouTube, including "Earth: The Power of the Planet," "Hot Rocks: Geology of Civilization" and "How Earth Changed History" (see August 2014 EXPLORER).

Wallace E. Pratt Memorial Award

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

□ **Kitty L. Milliken**, **Mark D. Rudnicki**, **David N. Awwiller** and **Tongwei Zhang**, for "Organic Matter-Hosted Pore System, Marcellus Formation (Devonian), Pennsylvania," which appeared in the February 2013 AAPG BULLETIN.

Milliken and Zhang are with the Bureau of Economic Geology, Austin, Texas; Rudnicki and Awwiller are with ExxonMobil, Houston.

Robert H. Dott Sr. Memorial Award

Presented to honor and reward the author/editor of the best special publication dealing with geology published by the Association.

□ **Dengliang Gao**, for AAPG Memoir 100 – Tectonics and Sedimentation: Implications for Petroleum Systems.

Gao is with the Department of Geology and Geography, West Virginia University, Morgantown, W.Va.

J.C. "Cam" Sproule Memorial Award

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

□ **Mark R.P. Tingay**, for the paper "Evidence of Overpressure Generation by Kerogen-to-Gas maturation in the Northern Malay Basin," which appeared in the April 2013 AAPG BULLETIN.

Tingay is with Chevron Australia, Manning, Australia.

SEG/AAPG Best Paper in Interpretation Journal Award

Presented to honor and award the author of the best paper in the new SEG/AAPG journal, "Interpretation."

□ **Bruce Hart**, for the paper "Whither Seismic Stratigraphy," which appeared in August 2013 issue.

Hart is a geologist in Statoil's shale oil and gas research group, Houston.

John W. Shelton Search and Discovery Award

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

□ **Konstantin Sobornov**, for the paper "Structure and Petroleum Habitat of the Pay Khoy-Novaya Zemlya Foreland Fold Belt, Timan Pechora, Russia."

Sobornov is with Nord West Ltd., Moscow, Russian Federation.

George C. Matson Award

Presented to honor and reward the best oral presentation at the 2014 AAPG Annual Convention and Exhibition in Houston.

□ **Peter Hennings**, for the paper "Relationship Between Reservoir Quality and the Deformation Associated With Anticlinal Folding in the Tensleep Sandstone at Alcova Reservoir, Central Wyoming."

Hennings is with ConocoPhillips, Houston.

Jules Braunstein Memorial Award

Presented to honor and reward the best poster presentation at the 2014 AAPG Annual Convention and Exhibition in Houston.

□ **Rosanne Mckernan**, **Julian Mecklenburgh**, **Ernest Rutter**, **Kevin Taylor** and **Stephen J. Covey-Crump**, for the poster "Influence of Effective Pressure on Shale Matrix Permeability: Implications for Shale Gas Development."

All are with the University of Manchester, Manchester, England.

Gabriel Dengo Memorial Award

Presented to honor and reward the best oral presentation at the 2014 AAPG International Conference and Exhibition in Istanbul, Turkey.

□ **Zamir Bega**, for "Deep Oligocene Reservoirs as Potential Oil Play in Deep Waters of Western Black Sea Basin."

Bega is with OMV Petrom, Bucharest, Romania.

Ziad Beydoun Memorial Award

Presented to honor and reward the best poster presentation at the 2014 AAPG International Conference and Exhibition in Istanbul, Turkey.

□ **Grant Ellis**, for "Late Authigenic Pyrite – An Indicator of Oil Migration and Entrapment in the Bonaparte Basin, Timor Sea, Australia."

Ellis is with Eni Australia Ltd., Dalkeith, Australia.



Skills Gap Looming From Aging Workforce

By COURTNEY CHADNEY, EXPLORER Correspondent

An aging geoscience workforce coupled with college graduates lacking the requisite field experience to find employment could translate soon to a significant skills gap in the oilfield, according to a recent report from the American Geosciences Institute.

AGI's Status of Recent Geoscience Graduates 2014 report was motivated by discussions with industry representatives who identified distinct gaps in the practical experience of graduates. The data in the report highlights the impact of booming enrollments and the challenges students face in matching their education to the hiring demands of the industry.

The report is a continuation to an ongoing study launched in 2013 and examines concerns raised about:

- ▶ The motivation for completing a geoscience major.
- ▶ The quantitative abilities of recent graduates.
- ▶ The available field and research experiences for students.
- ▶ The opportunities available to recent graduates in the workforce.

"Since this kind of research has not been previously done, we are now able to provide supporting data to the often anecdotally cited issues, most of which are neither new nor surprising, only

now we are able to back them up," said Carolyn Wilson, AGI report author.

The report discusses several trends from 2013 and sheds light on ongoing workforce issues, such as the retirement and replacement of baby boomers.

Approximately 48 percent of the geoscience workforce is 55 and older, and AGI expects approximately 29 percent to retire over the next decade. AGI also predicts there will be more than 51,000 graduates over the next decade as well.

However, the U.S. Bureau of Labor Statistics predicts a 14 percent increase in the number of geoscience jobs by

2022. Therefore, the expected supply of geoscientists may not meet the full demand in the workforce.

Impacts on Employability

Wilson believes the workforce predictions highlight two critical points.

"First, geosciences will continue to be a lucrative career opportunity for future graduates. Second, because a large number of current geoscientists are reaching retirement, industries should be concerned about the potential major loss of skills and knowledge from the future workforce," she said.

Two other key trends Wilson noted from the study were the increase in graduates not participating in internships and the shortage of available spaces to attend field camps and courses during their course studies.

Both factors could potentially impact employability for these graduates as work and field experience remain top qualifications for new hires.

"While jobs are currently available in the geosciences, many graduates appear to have struggled finding employment," Wilson said.

Students interviewed mentioned lack of networking, experience and development of professional skills as barriers to finding employment.

However, the report indicates that nearly all graduates participated in at least one field experience. The report did note that not every student wanting to go to a field camp had the opportunity. This could be due to the fact that it may be difficult for students to gain admittance to field camps outside of their institution if their own institution does not have them.

Why these students are still struggling to find employment is a question AGI will continue to examine, Wilson said.

Other information released noted an increase in bachelor's graduates with plans to attend graduate school – however, there is concern that geoscience graduate departments are reaching capacity, making it more difficult to accommodate this increase in demand for continuing education.


"It is difficult to predict how these trends will affect the geoscience workforce in the future. However, this information creates a baseline understanding of the knowledge and skills gained by recent graduates as they enter the workforce," Wilson said.

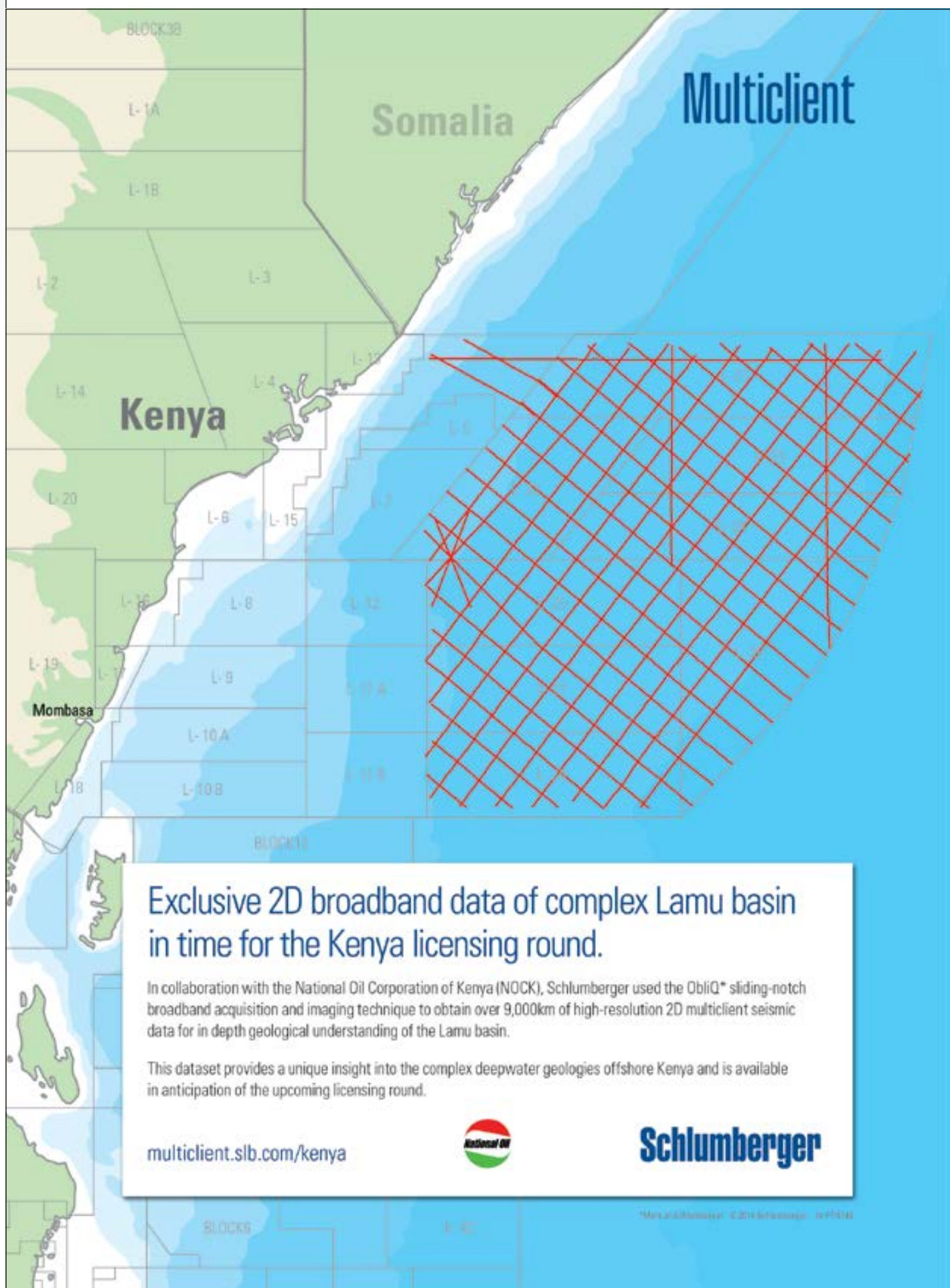
"This data can inform industry representatives on the potential training needs of future employees."

A Changing Culture

Wilson believes economic drivers and technological advancements have changed the geoscience workforce dramatically over recent decades, which have changed the culture and expectations of early-career geoscientists. This could benefit the industry, if the younger generation is plugged in properly.

"I would like to see more collaboration between industry and higher education to help facilitate the transition from graduate to geoscientist," she said.

The full report can be found at AmericanGeosciences.org/Workforce/Reports. 





Exclusive 2D broadband data of complex Lamu basin in time for the Kenya licensing round.

In collaboration with the National Oil Corporation of Kenya (NOCK), Schlumberger used the ObliQ™ sliding-notch broadband acquisition and imaging technique to obtain over 9,000km of high-resolution 2D multiclient seismic data for in depth geological understanding of the Lamu basin.

This dataset provides a unique insight into the complex deepwater geologies offshore Kenya and is available in anticipation of the upcoming licensing round.

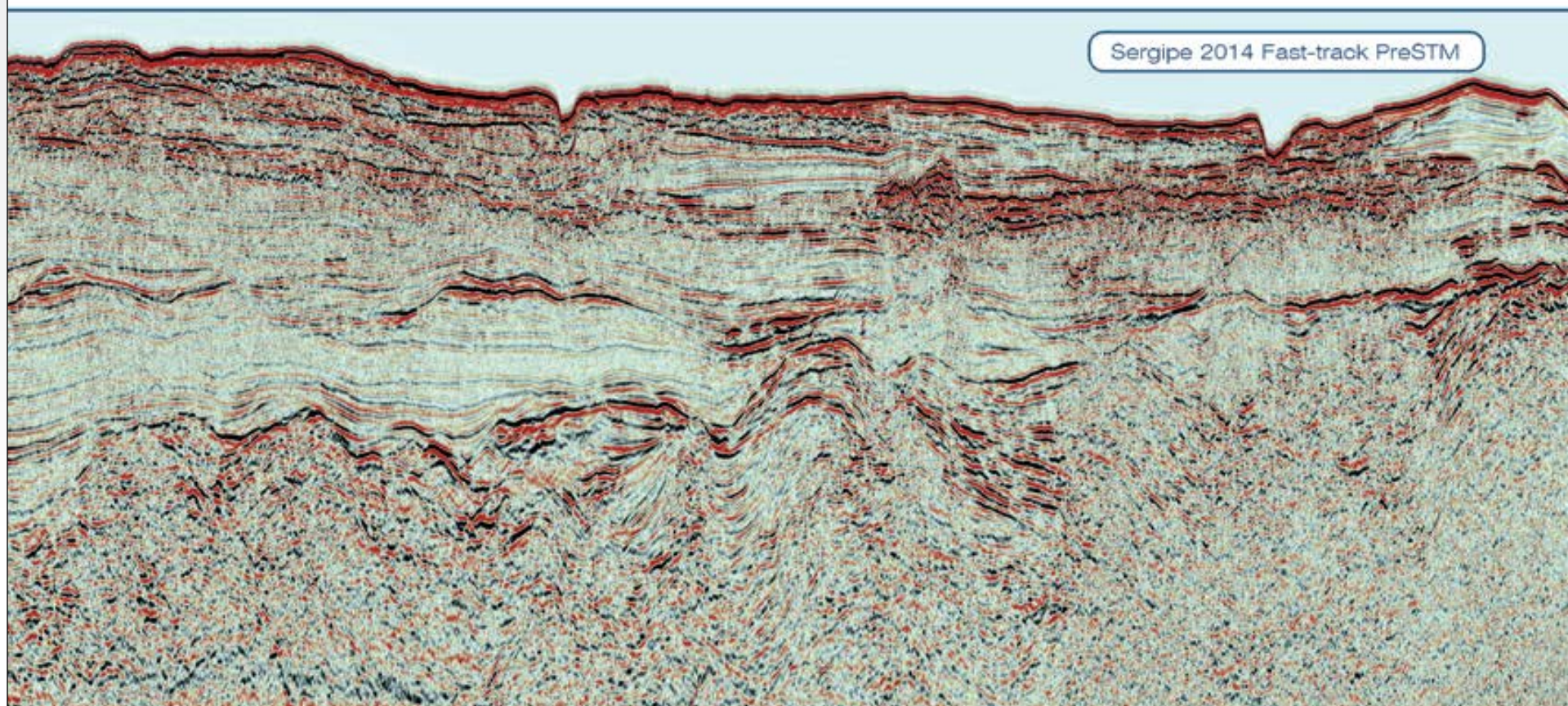
multiclient.slb.com/kenya

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Brazil: Eastern Margins

Long Offset 2D Multi-Client Seismic Data



Spectrum has available 16,000 km of newly acquired Multi-Client 2D seismic data offshore Brazil in the Sergipe and Alagoas basins along the eastern margin of Brazil. The new acquisition program will tie key wells in the basins, including the recent Barra, Muriu, and Farfan discoveries. PreSTM will be available in Q4 2014 and PreSDM data will be available in Q1 2015.

To supplement the new acquisition in the active exploration area, Spectrum has completed the reprocessing of 9,600 km of data through both PreSTM and PreSDM and is offering this data to industry ahead of the expected bid round in 2015.

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The Flex Trend in full view

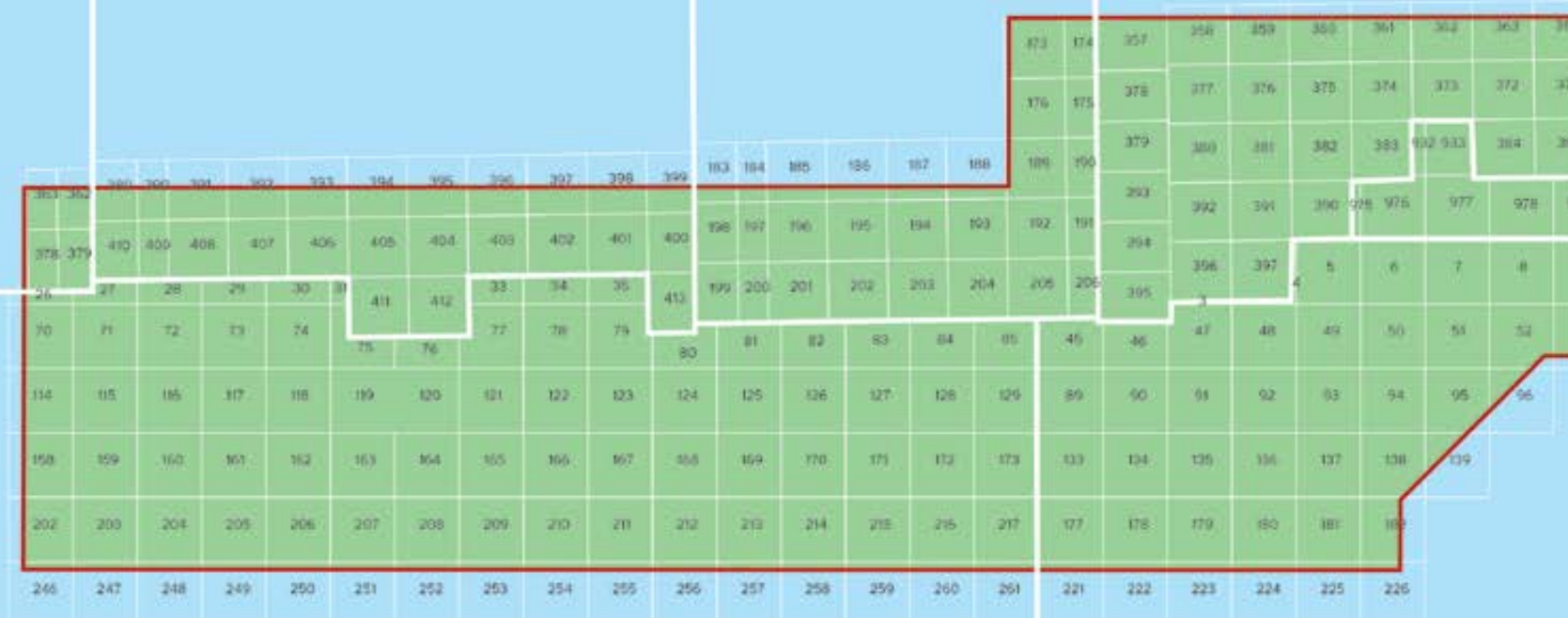
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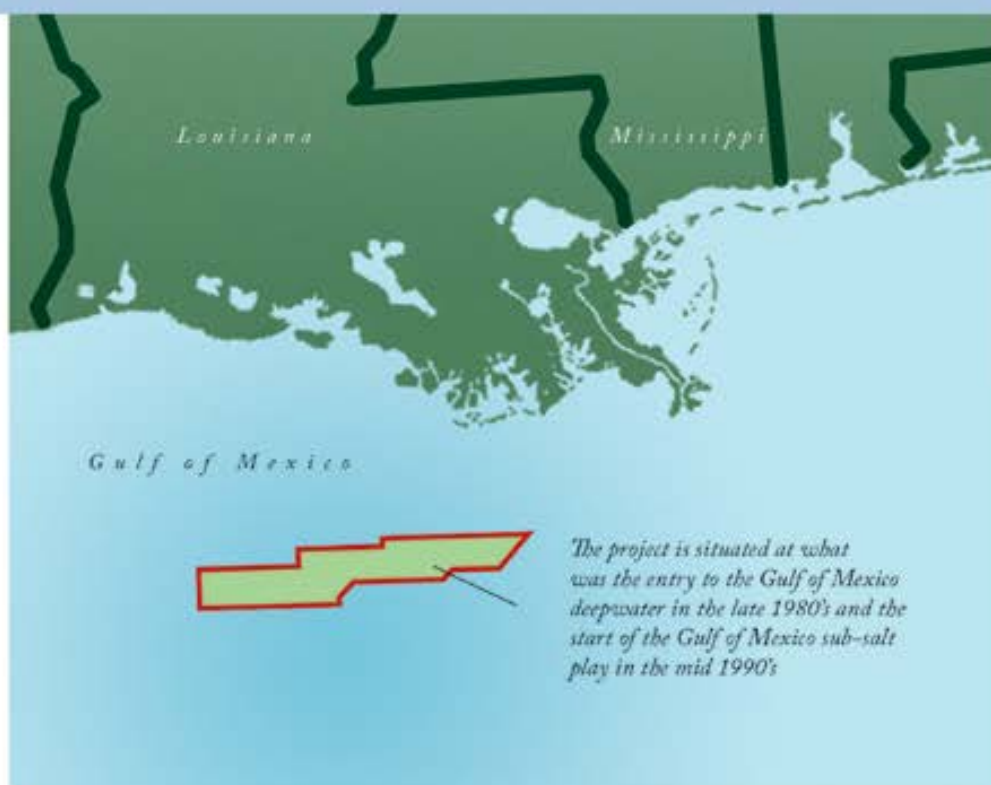
Green Canyon

Gulf of Mexico

Geophysical Pursuit and WesternGeco have completed a new wide azimuth program along the Gulf of Mexico shelf break.

The *Flex Trend WAZ* project covers 296 blocks in an area where no legacy long offset or wide azimuth data exists. Data acquisition was completed in January 2014, and final RTM TTI depth products are available on December 1, 2014.

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Hybrid configuration gets industry award

Combined Approach Used to Tackle Fracture Monitoring

By HEATHER SAUCIER, EXPLORER Correspondent

After many months of harnessing mind-bending ideas, a Houston-based team of engineers, geologists and geophysicists has developed technology to monitor hydraulic fractures from the surface and wellbore simultaneously.

Adding multiple dimensions to the monitoring process, they say, allows operators to more clearly understand drainage patterns of hydrocarbons in shale reservoirs and, more importantly, know with greater certainty where to drill the next well, how to optimize completions and maximize asset value.

Though the two monitoring techniques have been used effectively as individual applications for years, the team at MicroSeismic Inc. recently saw its hard work pay off with their first commercial success in the field using the new combined method.

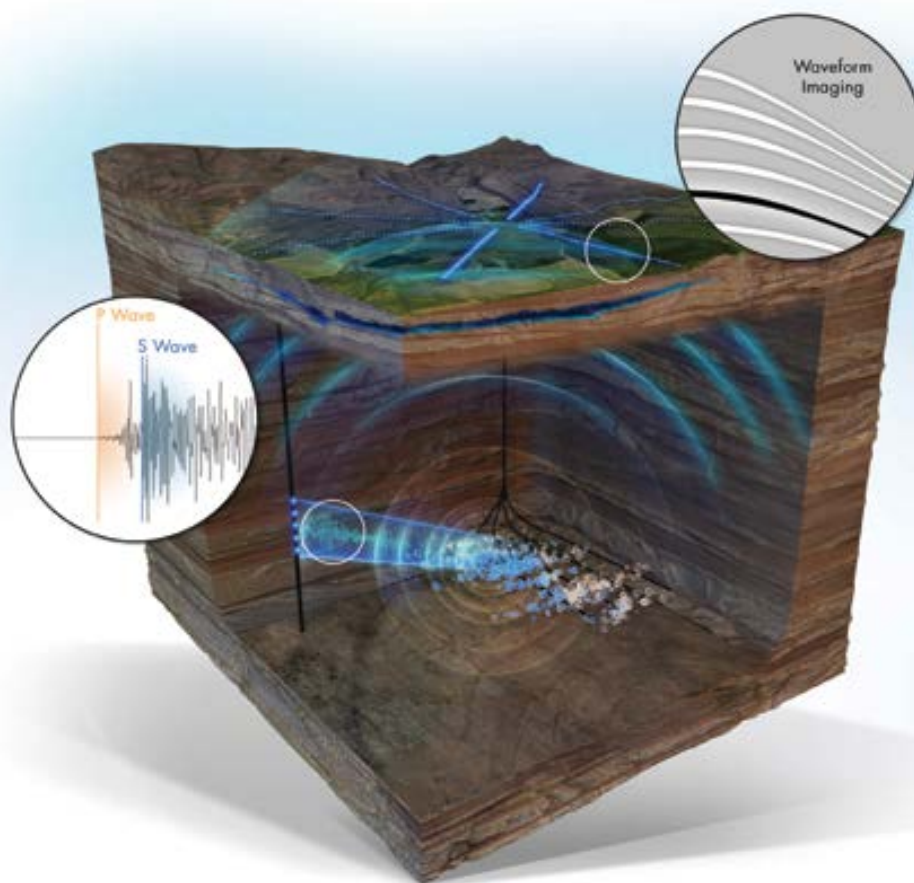
What's more, their technology has received formal recognition by the industry.

AAPG member Peter Duncan, co-chairman and founder of the company, accepted the Virgil Kauffman Gold Medal at the Society of Exploration Geophysicists' conference last October in Denver. Duncan, a former SEG president, has been an AAPG-SEG Distinguished Lecturer.

The award – which recognized the



DUNCAN



Hybrid: Combining surface and downhole arrays in one hybrid configuration allows for acquisition of more data with improved processing to create a better picture of the fracture network. The new PSET downhole technology images P and S waveforms rather than the conventional method of picking arrival times during downhole acquisition.

surface monitoring technology Duncan developed that led to his tandem microseismic monitoring achievements – recognizes scientists who have made notable contributions to the advancement of geophysical exploration in the past five years.

Not bad for a geophysicist and his team of four that began working out of a converted apartment leasing office in 2003. They were determined to be the first to monitor hydraulic stimulation from the surface when the rest of the industry was monitoring – and often running into problems – using downhole acquisition.

The plan for monitoring hydraulic fractures from the surface soon followed. Once Duncan mastered that, the notion of going downhole seemed simple enough: Take the company's proven surface monitoring technology, turn it on its side and insert it into a borehole.

"It seemed to me, and to others, that we should get the same results from the surface and from downhole," Duncan said. "We knew we would be able to acquire more precise information from downhole, yet see the entire fracture network from the surface."

However, the signals traveling from the mini, underground earthquakes to the surface and wellbore proved difficult to synchronize. After months of staring at countless seismic wavelets and working to align them, things started to take shape.

See [Synchronizing Data](#), page 14

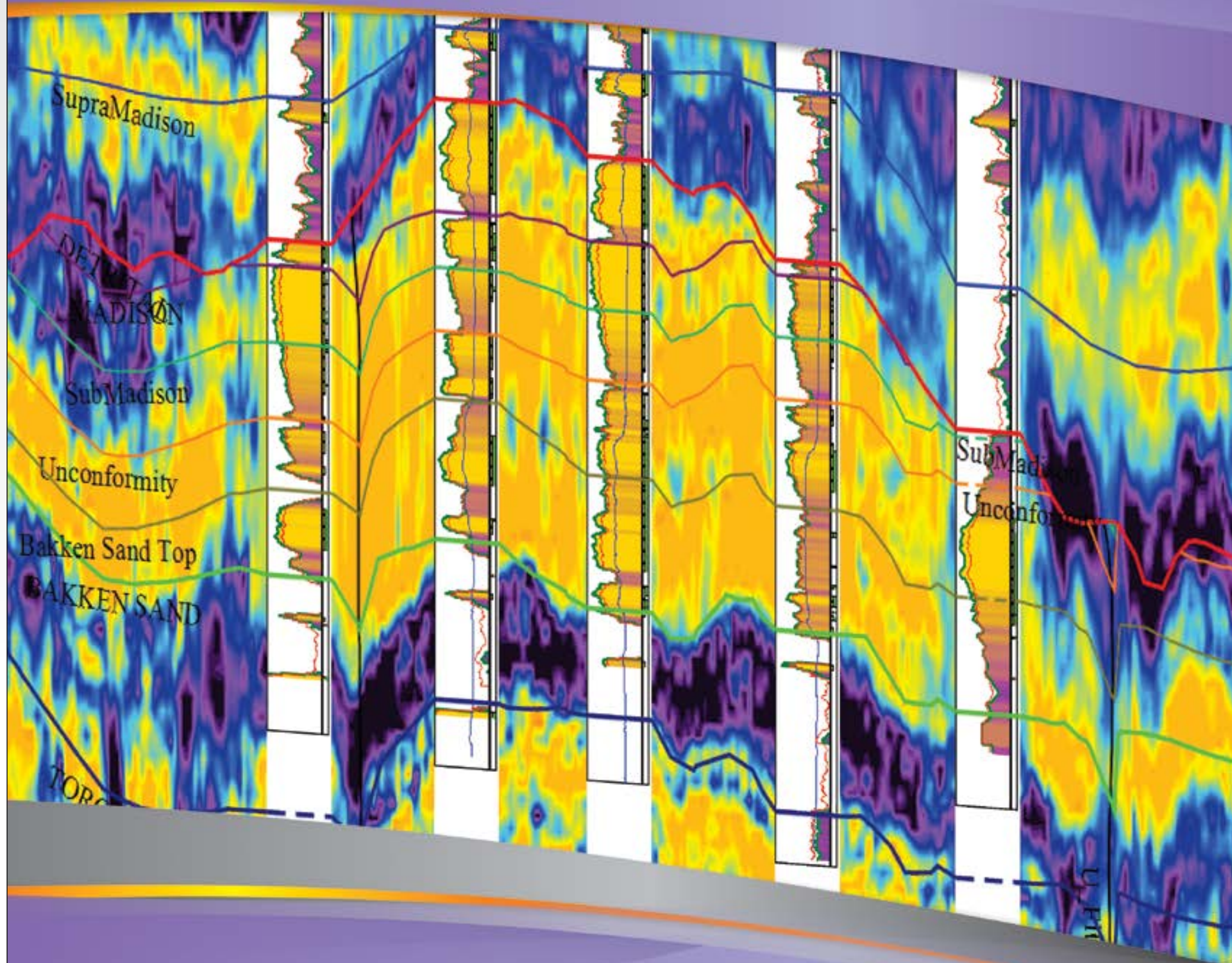
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Synchronizing Data from page 12

A detailed image of a complete fracture network came into view.

"There is no single individual who made this great 'ah ha' moment possible," Duncan said. Instead, he quickly credits his team for learning how to successfully synchronize data from five different dimensions: three spatial dimensions, time, and the dimension of the wave fields from the surface and downhole.

But there is still room for improvement. Data from the surface and wellbore are currently being processed separately. Duncan and his chief technology officer, Mike Thornton, who played a large role in developing the technology, are currently working to combine the two.

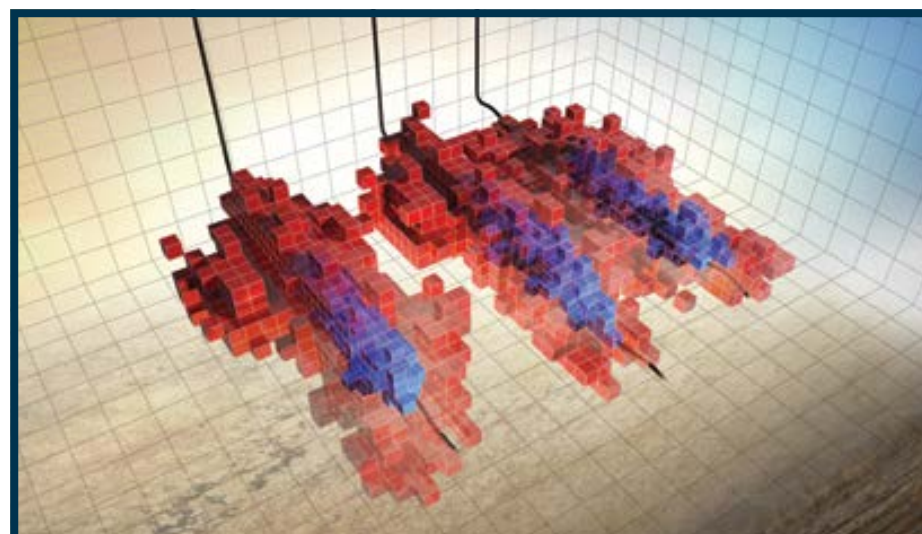
Evolution of Ideas

Initially out to conquer the field of reservoir monitoring, Duncan took a list of potential services he could provide clients and drew a red "x" through "hydraulic fracture monitoring," as the market was already covered by the big players monitoring vertical wells, he said.

But as the shale boom began to sweep the industry, the number of horizontal wells surged.

Operators who relied on downhole monitoring of fractures ran into issues as their lateral wells stretched farther and farther from the monitor well. Lacking the additional monitor wells needed to effectively observe the fractures, many approached Duncan for an alternative.

"The original practice of downhole microseismic allowed for drilling a monitor well a few hundred or a thousand feet from



P-SRV: With engineering analysis and recommendations using the data from the surface portion of the array, the client was able to understand what proportion of the stimulated rock volume was propped and used this information to improve well spacing and stage length on the next wells.

the frac well," Duncan said. "The trouble is, as you get more than a couple thousand feet away from the monitor well, you lose the ability to detect the arrival time of waves to the millisecond," thereby losing accuracy in the data acquired.

Because it was too costly for companies to drill multiple monitor wells, seismologists often relied on observing well pressures, injecting fluid and modeling the rock response to determine the location of fractures. Because this is in large part a guessing game, incorrect models were inadvertently developed, Thornton explained.

Duncan and Thornton began to explore how to monitor fractures in lateral wells from the surface. They reasoned that they could lay thousands of geophones over many square miles and monitor an entire

fracture network.

"The challenge is recognizing the fracture's pattern, the signature of the rock snap, and where it took place," Thornton said. "The industry doesn't care about the snap, crackle and pop of the rock. They care about what the fracture network is like so they can ultimately understand the type of drainage they will get."

Cornering the Market

Duncan recalled techniques used by Russian geoscientists looking for geothermal deposits in Iceland beginning in the 1980s.

They used geophones on the surface to locate the pipes and vents in subsurface rocks. They stacked their data and aligned entire wavelets to detect hot water

percolating through porous rocks.

Duncan opted to use the entire wavelet, as the Russians did, rather than rely solely on the arrival times of the compressional (P) waves and the shear (S) waves – which can be difficult to pick out because of surface noise and subsurface structures that often distort seismic waves. He called his technique Passive Seismic Emission Technology (PSET) and patented it.

By using full waveform imaging, the entire fracture network could be monitored from the surface in the absence of a monitor well.

The technique, Thornton said, has several advantages – because the entire wavelet is being analyzed, a computer can perform much of the monitoring and analysis on its own.

"This automated process looks at the data in a way that allows us to detect when the P wave arrives, position the wavelets, and locate the breaks in the rock in a more objective way," he explained. "You don't have to worry about the analyst picking arrival times and eventually getting tired or having two different analysts working on it and worry about consistency."

Completing the Picture

While their technique worked well for surface microseismic monitoring, it lacked certain aspects that downhole monitoring provided, namely the ability to detect really small events, as the surface geophones were located farther away from the fracture.

"We found that the geophones sometimes picked up too much noise from the surface and could only pick waves up to 10 milliseconds," Duncan said.

Furthermore, Duncan and his team

See Microseismic, page 16

GEOSCIENCE AT ITS BEST



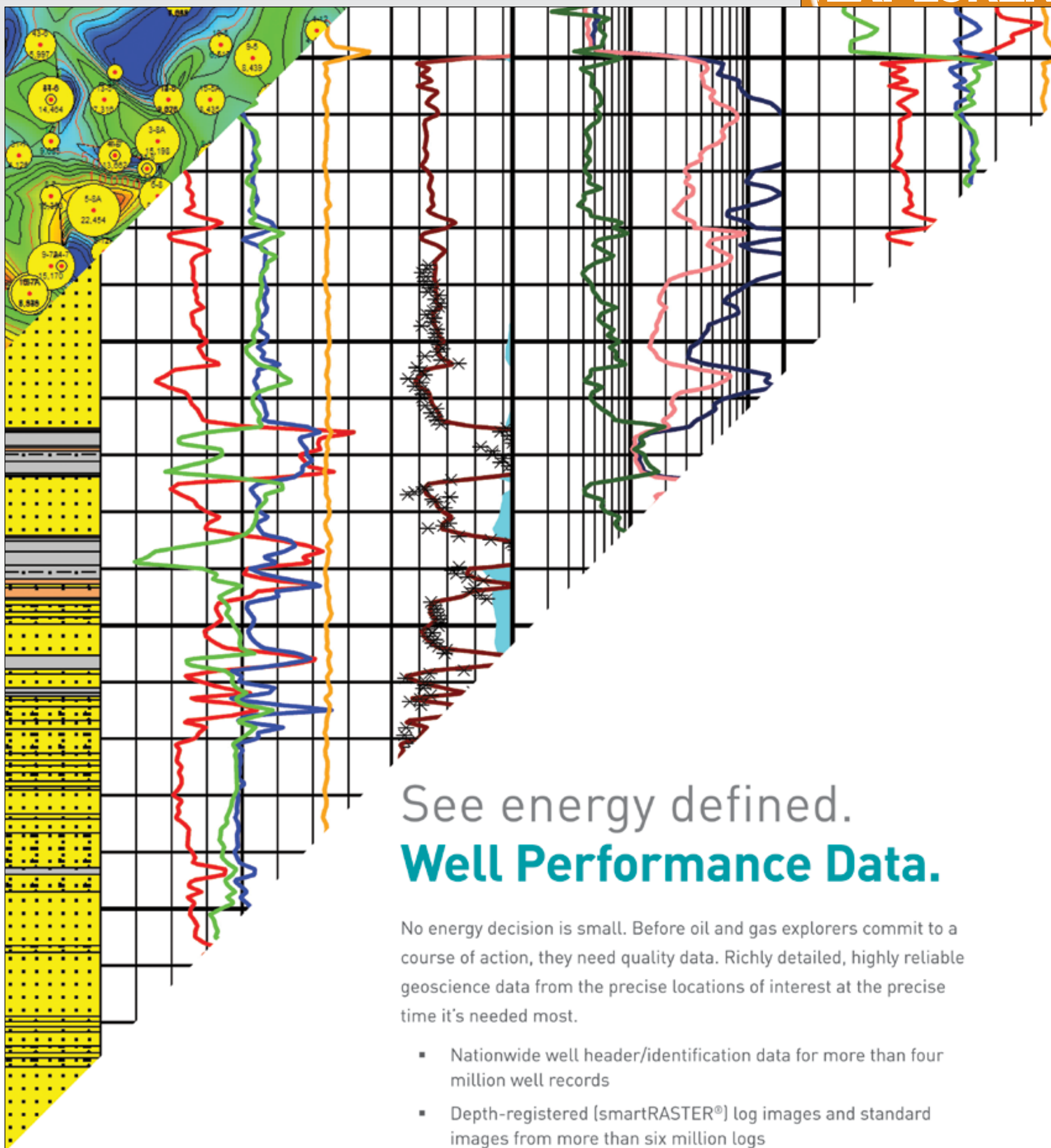
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Microseismic from page 14

discovered that not all reservoirs were easy to monitor from the surface. For example, some areas in the Permian Basin have large, loose gravel composition that absorbs seismic signals, and salts in the subsurface layers distort them.

The problem: Monitoring fractures strictly from the surface allows an entire fracture network to be seen, yet only includes the large, more detectable events. Monitoring fractures strictly from a wellbore allows the detection of smaller events, yet without the ability to view an entire fracture network.

The solution: Combine the two technologies for a more complete picture.

Not wanting to replicate their competitors, Duncan and his team worked diligently to apply its technique downhole.



THORNTON

“The industry doesn’t care about the snap, crackle and pop of the rock. They care about what the fracture network is like so they can ultimately understand the type of drainage they will get.”

The limited space in a wellbore allowed only a couple dozen geophones to be used rather than the thousands that could be spread out over the surface, Thornton said. Geophones in a wellbore had to be placed in a line and function as truncated antennas. To compensate for the limited number of sensors and data, both P waves and S waves needed to be captured.

Typically, seismologists monitor fractures

in a wellbore by handpicking the arrival of P and S waves. They calculate the difference in time between the wave arrivals, multiply that amount by the velocity of the P wave, and determine the distance from the sensor to the actual fracture.

However, “when you throw the wavelet away and just rely on the P and S waves’ arrival times, you have nothing to ground it on,” Duncan said. “If you have different

people picking P and S waves, there can be a subjective difference in the interpretations.”

Using the full waveform, Duncan and Thornton were able to detect the P and S waves downhole and estimate event locations by aligning the entire signal – not just the picked arrival times. This enabled them to see more clearly the smaller events and drive the detection threshold even lower.

By combining data from surface and downhole, they achieved an all-encompassing and detailed view of the fracture network. With that, they applied the technology in the Permian Basin with a client several months ago and achieved great success.

“It was clear from the beginning that a methodology that captured the best aspects of the downhole and the surface technique would yield superior results,” Duncan said. “By adapting our PSET algorithm to a downhole receiver, we have gone even one step further.”

Easier Said Than Done

The next step is to combine the two datasets for a single reading, and it’s not so easy. Subsurface waves, which travel horizontally to the wellbore, bounce between multiple layers of salt, shale and sandstone, which constantly change the waves’ velocity.

When looking at both surface and downhole signals, they essentially look like scribbles.

“We are using two cameras with different angles now instead of one, so to speak,” Thornton said.

He likened the problem to using both Google Earth’s aerial views and Google Maps’ street views to see one particular location.

“If you have the right source location, and the right velocity, and you correct for travel time, all the wavelets should be in alignment,” Duncan said.

While surface signals use a simple velocity calculation, downhole signals are much more complex, as wave propagation parallel to subsurface layers can be more difficult to model.

The key is building a “reasonable” velocity model that can account for two sets of signals that travel at different velocities, detect the time and location of a fracture, and not trigger on false positives or miss actual events, Duncan said.

“Nobody in the market has been able to merge those two datasets yet,” he added. “They can’t yet be processed in a single algorithm. So far, all the methods we have for creating alignment of the waves oversimplify assumptions about the velocity at which the sound is traveling. We are working on that now.”

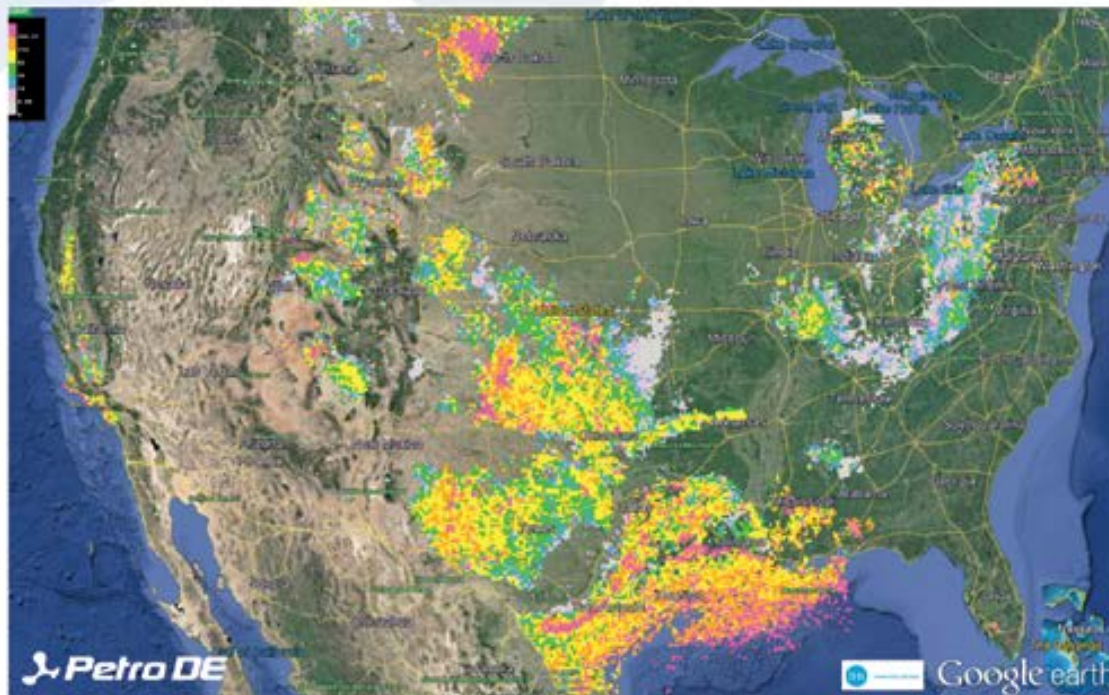
Others in the industry are doing the same.

Throughout the process, Duncan said he has learned that the models currently used by the industry to locate fractures provide a satisfactory evaluation of a fracture network, but bypass many reserves.

“I believe every frac should be monitored,” he said. “Today, only about 4 or 5 percent of fracs pumped are monitored. Monitoring should be as important to frac’ing as logging is to drilling.”

The lack of microseismic monitoring is preventing the industry from fully exploiting the shale potential, Duncan added. “We have huge amounts of data, and we are just beginning to integrate it and interpret it in a way that will revolutionize our industry,” he said. “We need to continue pushing that boundary to penetrate the market further.”

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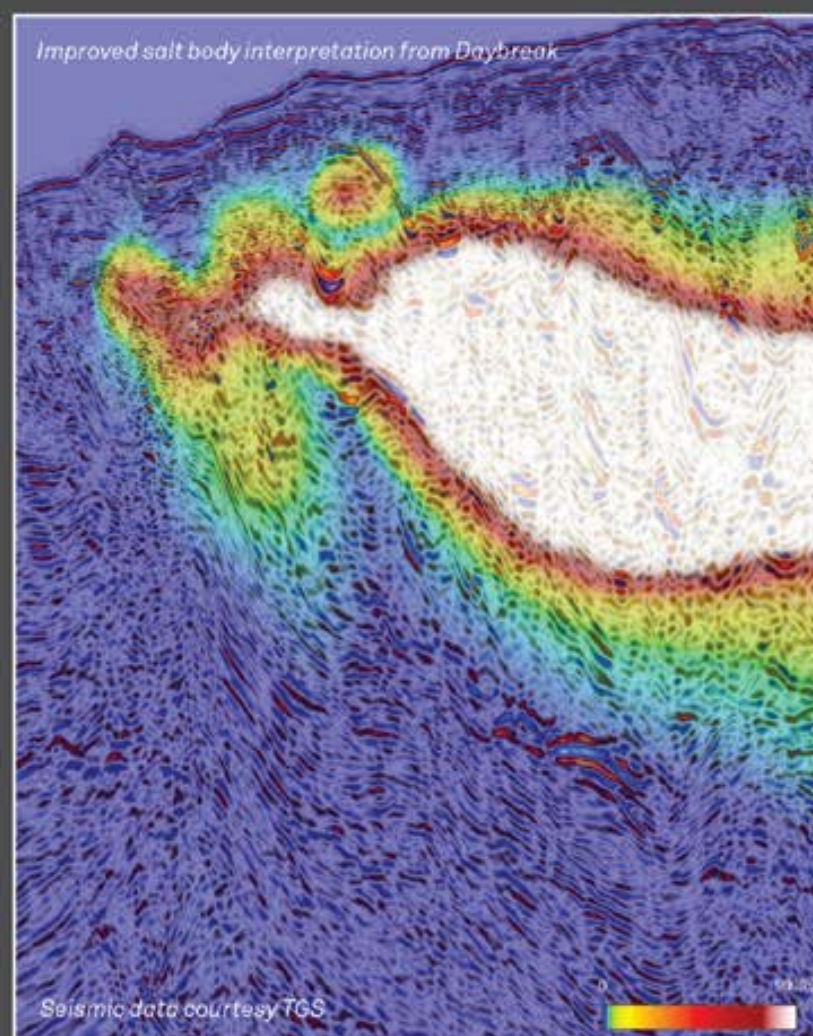
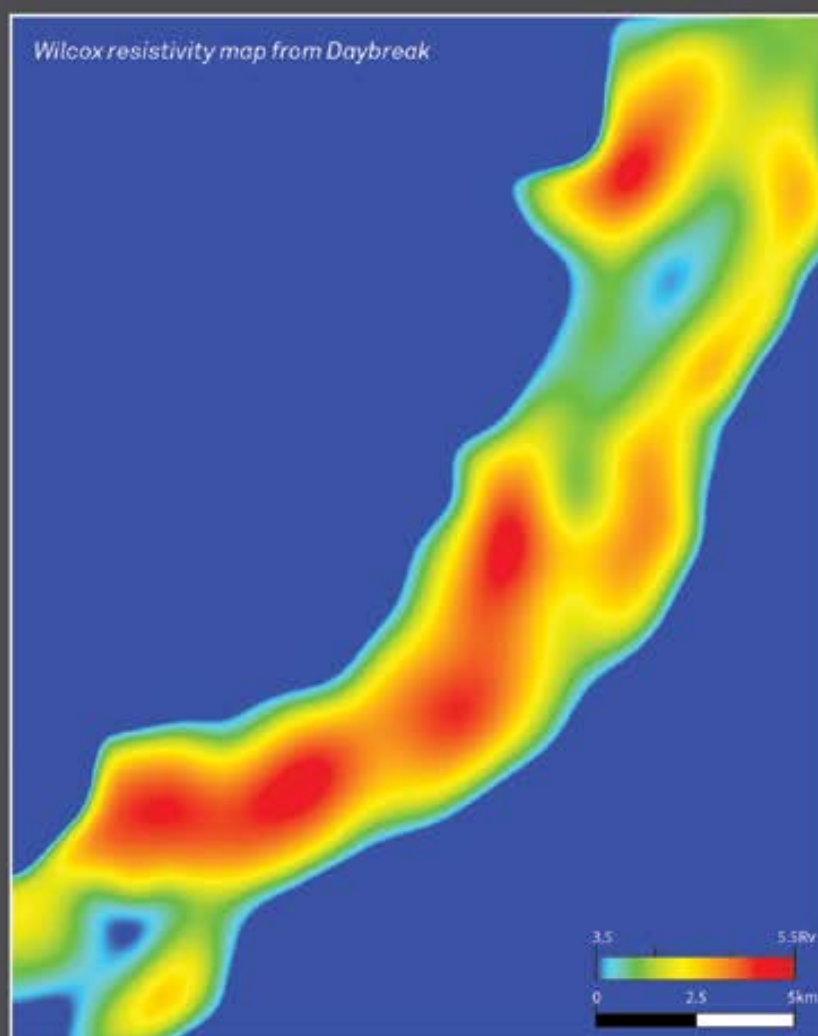
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Hi-Tech Spotlight: What's New in Downhole Geology

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

What's new in downhole geology, you ask?

According to the advertising and press releases that are sent throughout the media, there's a lot that's new – more, in fact, than we could ever cover.

But since this is our annual Downhole Geology issue, we thought we'd take a look at some of the latest advancements in drilling, well-logging and other downhole innovations rolled out in recent months by a few industry heavy-hitters.

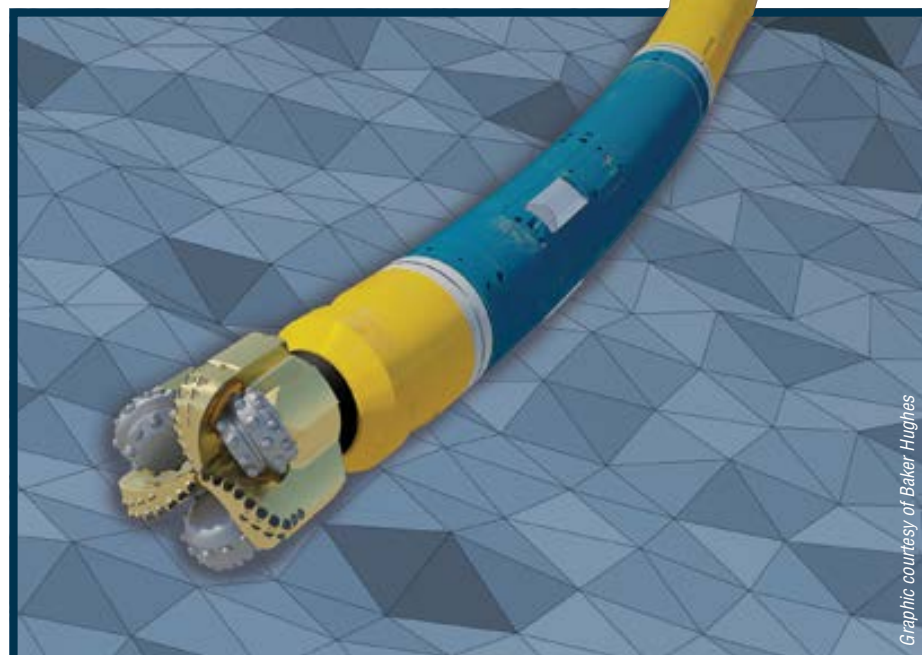
Weatherford

This development might be familiar to anyone who attended AAPG's Annual Convention and Exhibition in Houston early this year: Weatherford Petroleum Consultants AS announced the launch of its "Reveal 360" imaging technique.

They announced the new tech at ACE, but it's only been commercially available since August.

Weatherford boasts that the new technique removes the blind spots from wireline wellbore images using what they call "Morphological Component Analysis" and "Sparse Representation," which, company representatives said, is superior to the statistical-based approach used by competitors.

The process begins by decomposing the measured sections of the borehole wall into sparse representations of their morphological components using dictionaries of multi-scale, multi-orientation transforms – that's the Morphological Component Analysis



Baker Hughes' "AutoTrak eXact" high-build rotary steerable system.

stage. Then, the representations are reconstructed using information from the dictionaries to fill in the gaps.

"Gaps between the pads of wireline tools provide images in which 30 to 50 percent of the wellbore data is missing," explained AAPG member Peter Elkington, Weatherford Geoscience Development's chief geoscientist. "With Reveal 360, our processing technique environmentally normalizes the image and then removes the gaps between pads, providing a complete view of your wellbore."

LMKR

LMKR earlier this year introduced its Well Planning and GeoGraphix Pro software systems, which were exhibited at the Society of Exploration Geophysicists International Exposition and Annual Meeting in Denver recently.

LMKR GeoGraphix Pro is a new upgrade option to the company's GeoGraphix 2014 geophysical and geological software.

The GeoGraphix 2014 includes several new bells and whistles over the previous version, including enhancements in velocity

modeling, new 3-D visualization of fence diagrams, a larger user defined equation code window, multi-user concurrent access to external models, and unlimited attribute extraction.

The GeoGraphix Pro is an add-on (requiring a separate license purchase) that offers advanced 3-D visualization and high-resolution 3-D log templates, along with enhanced field planning capabilities designed for horizontal well plans.

LMKR also rolled out its new Well Planning software, which can be used in combination with GeoGraphix Pro to more easily create and edit directional surveys for individual wells or entire scenarios.

The company's Well Planning software is designed to enable the creation of multiple well plans by streamlining and integrating data for "an easy day-to-day well planning workflow," according to a company description.

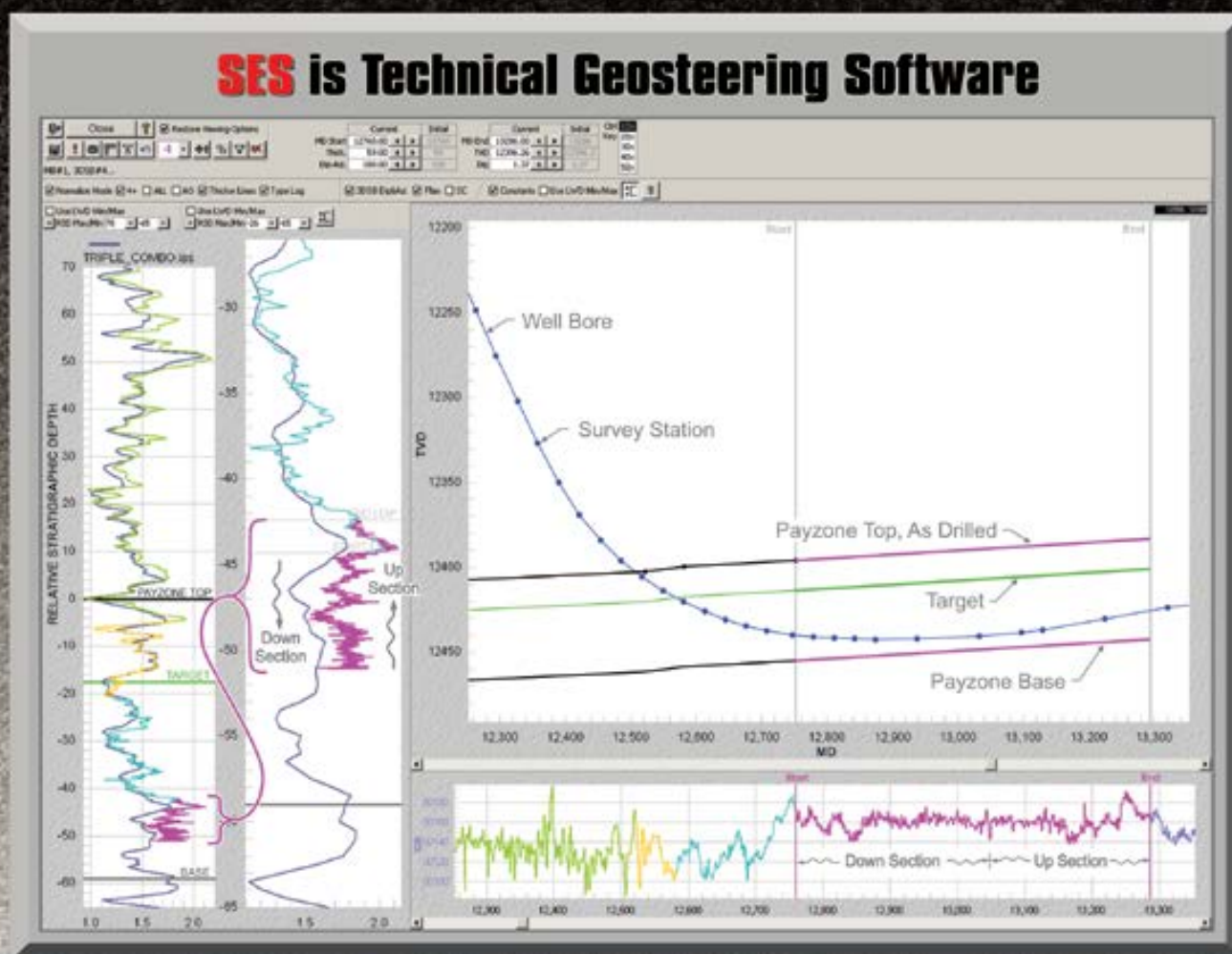
Baker Hughes

Baker Hughes recently introduced a slew of new technologies and applications, including the commercial release of its "MultiNode" all-electric intelligent well system, which allows operators to remotely monitor and control a greater number of production zones in both cased and openhole completions.

Company representatives said the MultiNode system improves initial production rates and ultimate recovery by combating early water and gas

See **Downhole Technology**, page 20

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GX TECHNOLOGY

Downhole Technology from page 18

breakthrough and actively balancing flow in production zones.

Primary components of the MultiNode system include active flow control device (AFCD) downhole valves, tubing-encased conductor (TEC) cable, and a surface control unit (SCU). Up to 27 AFCD valves can be run downhole, connected by a single TEC cable and controlled from the surface.

The MultiNode system can be adjusted after the well goes on production, unlike passive inflow-control devices, so the system can remain effective as fluid properties and reservoir conditions change. If water or gas breakthrough is detected in one part of the well, the AFCD in that zone can be choked back or closed completely

to lock out water and gas via a single control line while the well is producing.

The surface controls can be accessed using a supervisory control and data acquisition (SCADA) interface to remotely monitor and control production zones from virtually anywhere, and can continuously optimize production over a large number of zones without incurring unnecessary intervention costs.

Baker Hughes also recently announced the commercial release of its "AutoTrak eXact" high-build rotary steerable system, which was designed to improve directional control and borehole quality to help operators drill complex 3-D wells.

According to the company's description, the system "combines high buildup rate capability with advanced logging-while-drilling (LWD) services, enabling optimized completions, improving drilling efficiency, and maximizing production potential."

It's their proprietary closed-loop steering control that makes the big difference in the precision of wellbore placement, enabling shorter curve sections up to 12 degrees per 100 feet.

Lastly, Baker Hughes in October announced the commercial release of its "SeismicTrak" seismic-while-drilling service, which provides precise measurements for reducing formation uncertainty and enables operators to hit their reservoir targets with greater accuracy.

The service delivers real-time seismic and waveform data that enables operators to adjust their well trajectory as necessary to avoid potential drilling hazards, the company said.

CGG and Baker Hughes

OK, *almost* lastly for Baker Hughes – the company also collaborated with CGG

to develop a joint petrophysics software called "PowerLog Frac," which CGG exhibited this fall at the Society of Petroleum Engineer's Annual Technical Conference in Amsterdam, Netherlands.

The software offers "a streamlined set of tools and workflows that allow engineers to rapidly analyze parameters such as water saturation, permeability and porosity," according to CGG's description.

The technology is intended to replace manual calculations and spreadsheets, which can reduce to hours what would otherwise be days of petrophysical analysis to model multiple fracturing scenarios.

Baker Hughes will use PowerLog Frac in its pressure pumping operations to generate scenarios immediately and directly drive its fracture simulation design software.

CGG

Along with PowerLog, CGG also offers its "Statmin" geo-software for determining areas most prone to fracture stimulation.

What PowerLog is to petrophysics, Statmin is to statistical mineralogy.

"Statmin's complete mineralogical model correlates with other petrophysical properties such as hydrocarbon volume and porosity," reads a company description.

"Results are then used to compute an estimated fracability or brittleness curve for each well even if it lacks sonics of any kind, using only triple combo logs which consist of gamma ray, SP, resistivity log, density, neutron and photo electric factor.

"After brittleness estimation, engineers have petrophysics, mineral volumes, estimates of permeability and fracability in all of the project wells, built on estimation of those wells with core data. The final step is to use the mineral model with porosity and fluid volumes to construct a rock physics model calibrated to wells with dipole sonic logs. This rock physics model is then applied to surrounding wells without sonics to help design the best frac job for each well."

Schlumberger

Schlumberger recently announced the release of its "Invision Evaluation" well integrity service, which helps operators evaluate zonal isolation by using integrated drilling, cementing and well logging data.

See **Innovations**, page 24

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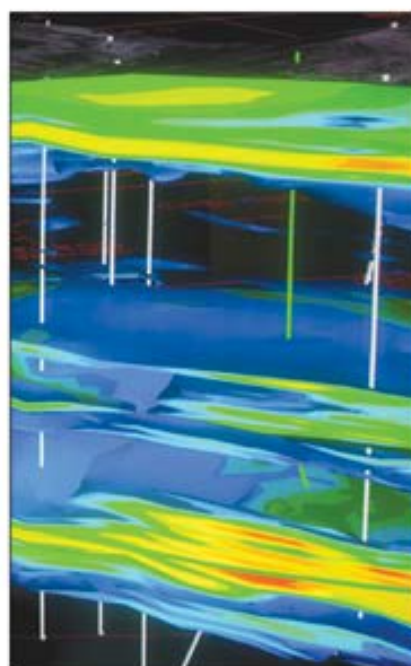


Reserve and resource estimation using reliable technology

Estimation of oil and gas reserves and resources is an important function for petroleum companies to support investment decisions. Reported reserves are used by the investment community for valuation of company stock, and by governments for regulatory oversight and forecasting national petroleum production. In 2008 the Security and Exchange Commission (SEC) published "Modernization of Oil and Gas Reporting", with new rules taking effect in 2009. One of the biggest changes was the introduction of the term "Reliable Technology" - A grouping of one or more technologies (including computational methods) that has been field tested and has been demonstrated to provide reasonably certain results with consistency and repeatability in the formation being evaluated or in an analogous formation.

The purpose of this special issue is to provide a collection of papers to address how reliable technology has been used to estimate reserves and resources. Contributions may include, but are not limited to, case studies illustrating:

- Use of pressure gradient data to establish gas or oil water contacts
- Use of seismic for reservoir modeling (reservoir definition and seismic inversion)
- Use of seismic for flow surveillance (4D seismic and history matching)
- Use of simulation without a history match
- Estimating Improved Recovery volumes prior to response and how continuity was established
- Methods used to prove technologies to be reliable both globally and locally
- Reserves estimations using an integrated or non-standard approach



"3D model". Figure courtesy Chevron Image Library.

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

The submissions will be processed according to the following timeline:

Submission deadline:
1 February 2015

Publication of issue:
November 2015

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Future fantasy nears present fact

Laser Drilling Research: Closer to Reality?

By KRISTI EATON, EXPLORER Correspondent

The idea of using lasers for drilling into the earth has long been to the oil and gas industry what flying cars and hoverboards are to the general public – the stuff of science fiction and futuristic fantasy.

As 2015 fast approaches (contrary to what we were promised in the “Back to the Future” movies) we haven’t quite cracked the code yet on flying cars and hoverboards, but there might be a consolation prize in the works: Laser-drilling may actually become a reality.

“Lasers are really very, very easy,” said AAPG member Ramona Graves, professor at the Colorado School of Mines and founder of Foro Energy.

Graves and her company are actively working toward commercializing high-powered lasers for the oil, natural gas, geothermal and mining industries – a technological advance long-awaited by many in the industry.

Her company specializes in using fiber optic cables to drill, complete and work over wells.

“The physics are very well understood,” she said. “Laser energy – light energy – is amazing.

“What makes this at all interesting is that rocks are complicated,” she added. “Every rock is unique.”

Economic and Technical Hurdles

Laser drilling was first thought up back in the 1970s, Graves said, but



GRAVES

“Rocks and lasers have great affinity for each other. What’s really nice is that the harder the rock, the better the lasers work.”

laser technology itself wasn’t sufficiently advanced for it to be feasible. But as technology improved from 10-kilowatt lasers to megawatt lasers that carry the capability of thousands of watts, the possibility that it could be used for drilling became more of a reality.

In 1998, Graves, then the dean of the College of Earth Resource Sciences and Engineering at Colorado School of Mines, and her colleague, Darien O’Brien, submitted a proposal to the Gas Research Institute, now Gas Technology Institute, to revolutionize drilling technology by using high-powered military lasers, which Congress had recently decided could be released to the general public.

“That’s a beautiful example of innovation and sharing technologies across disciplines,” Graves said. “The laser industry, they’re the physicists. They couldn’t even think of a use for high-powered lasers.”

Graves, who is a reservoir engineer, said she didn’t know enough about drilling engineering at the time to think it was impossible to use lasers to drill rocks.

Up until that point, there were significant drawbacks to laser technology, namely the economics. In the past 15 years, though, the costs of fiber laser have dropped from more than \$1,000 per watt to less than \$50 per watt.

The power availability also has increased from less than one kilowatt to more than 50 kilowatts with new developments in fiber laser technology.

Not only that, but Foro Energy, which was formed in 2009, demonstrated that high-power, long-distance fiber transmission could be achieved without a phenomenon known as “stimulated Brillouin scattering” and other non-linear effects, which can choke the transmission of high-power laser photons in a fiber-optic cable.

By showing that stimulated Brillouin scattering could be overcome, Graves said, Foro Energy has shown that high-power laser transmission over distances comparable to the lower-power telecom cables is possible.

By overcoming these obstacles, Graves and her company showed that lasers could indeed be used to drill holes in rocks.

“Rocks and lasers have great affinity for each other,” she said. “What’s really nice is that the harder the rock, the better the lasers work. Lasers like dense things. They don’t like things with holes in them.”

Not Ready for Prime Time

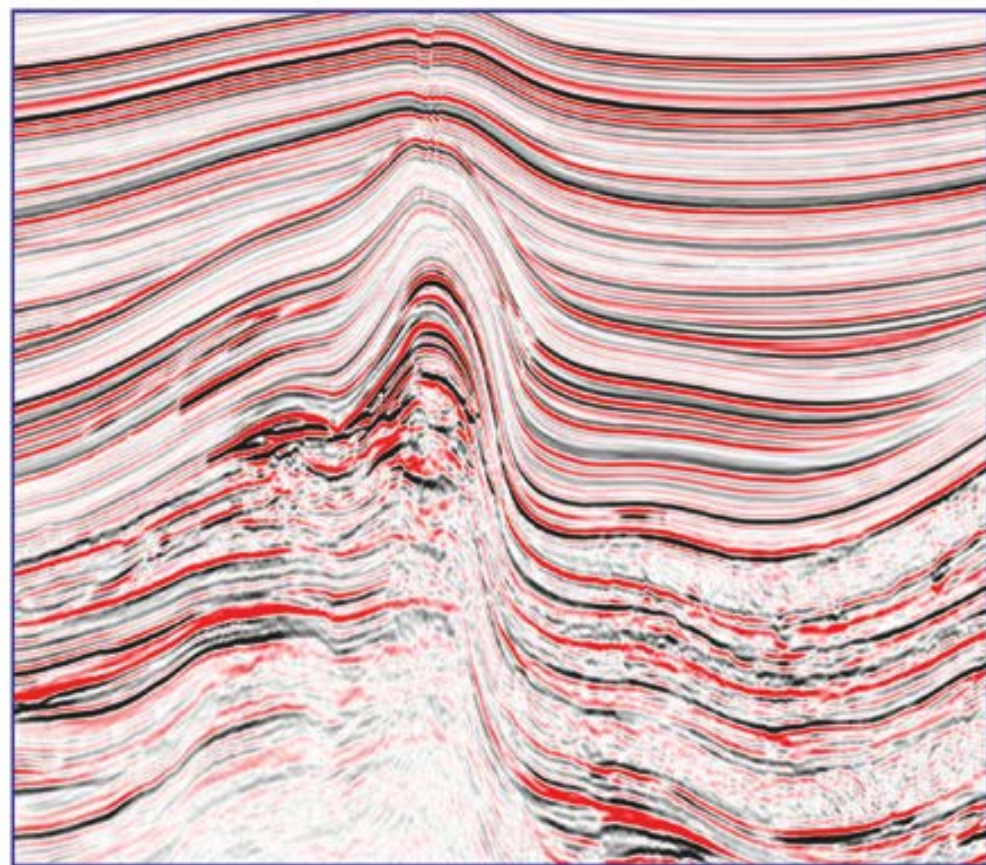
Foro Energy, which has a research lab in Colorado and a development lab in Houston, received an award from the U.S. Department of Energy’s ARPA-E transformational energy technology program for its innovative work.

“We delivered the fiber energy through a coil-tubing rig and proved that the concept could work on a big scale,” Graves said. “That’s come a long way.”

Understanding the rocks can be a challenge, though. The lasers are very well understood, Graves said, but the properties of the rocks and how they respond to laser technology is not as

See Interaction, page 24

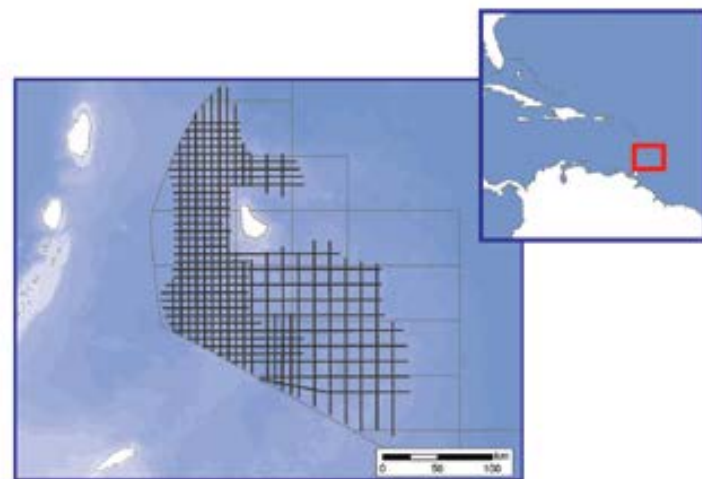
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Innovations from page 20

"One key component in achieving zonal isolation is cementing, which can impact productivity, help prevent sustained casing pressure and annular flow, and mitigate loss of well control issues," said Amerino Gatti, president of Schlumberger's well services division. "The Invizion Evaluation service combines all available data from open hole, cementing placement and acoustic logs for cement evaluation in an integrated workflow."

"This service supports customer decision-making during the well construction and completion phases," he added, "to help ensure a robust cement barrier."

The Invizion Evaluation service uses

real-time and post-job data to help identify zonal isolation issues that could impact well integrity, he added. To perform well, pad or field analysis, petrotechnical experts can evaluate drilling surface parameters, formation rock properties, cement barrier placement and cased hole cement evaluation logs.

Gatti also said it was field-tested in a range of locations, including offshore in the Gulf of Mexico and Alaska and in unconventional wells in the Eagle Ford formation and in Colorado.

Along with enabling customers to confirm that cement placement was achieved as planned, the Invizion Evaluation services also allowed them to identify zonal isolation issues, understand the short and long-term reasons the issues existed, and to minimize any potential impact on well integrity.

Halliburton


Halliburton's Wireline and Perforating division rolled out its "CoreVault" system in recent months.

The system is intended to provide a more accurate volumetric picture of the amount of oil and gas trapped in unconventional reservoir rocks, allowing operators to contain and bring the reservoir fluids within rock samples to the surface, allowing in-place volume measurement of hydrocarbons.

"Prior to the development of the CoreVault system, when traditional coring tools were used to bring samples to the surface, they allowed 50 to 70 percent of the hydrocarbons to escape from the rock as the samples depressurized," explained David Topping, vice president of Wireline and Perforating.

"Building a model of the volume of oil and gas in a reservoir thus required operators to estimate this fluid loss rather than measure the fluids in place, and estimates were often inaccurate," he said. "By preserving 100 percent of the fluids within the core sample, the CoreVault system allows for an improved understanding of potential production within the reservoir."

The system builds on the Halliburton Hostile Rotary Sidewall Coring Tool (HRSC-T) that recovers 1.5-inch-OD cores at temperatures up to 400 F (204 C) and pressures up to 25,000 psi.

When combined with the HRSC-T tool, CoreVault allows up to 10 cores to be sealed at reservoir conditions in a single wireline run, saving time over full-hole coring and allowing more targeted samples to be taken. 

Interaction from page 22

easy. There are different behaviors between various types of rocks such as granite, sandstone and shales.

"Because they have different chemical compositions and different depositional environments, the way lasers interact with them is quite different," she said, adding that earth stresses are not an issue with lasers.

Paul Deutch, president and CEO of Foro Energy, said confidentiality contracts prevent him from discussing projects, but he did provide information on an agreement with Petrobras. The program with Petrobras' research center, the Leopoldo Americo Miguez de Mello Research & Development Center, will focus on developing a next generation high-power laser drilling system, with the final goal of achieving a step change in the drilling of the pre-salt reservoir.

The agreement, which was announced in August, sets the stage for research between the two entities over three years, with the possibility for extensions.

Graves also was unable to provide specific details on where the technology is headed due to the confidential nature of Foro's contracts, but she said it is not moving in the direction of drilling.


Right now, she said, lasers would be good for perforating.

"We proved we can do coiled-tubing drilling, but that is a longer-term development," she said.

It's economical to drill, but it's a cutting-edge revolutionary technology in an industry that is a bit gun-shy at the moment, she said, adding that newer shale plays may renew interest.

Meanwhile, Argonne National Laboratory, which had been researching the feasibility of adapting high-power laser technology for drilling for gas and oil, has been unable to secure funding from the U.S. Department of Energy or any of the major oil service companies for laser/rock research and development since about the 2004-06 timeframe, according to Claude Reed, mechanical engineer at Argonne.

Brian Quirke, a spokesman with the Department of Energy Argonne site office, said the program was stopped because of changing priorities within the federal government.

"There was no more funding available for this work," said Christopher Kramer, media relations manager for Argonne National Laboratory, "so it was shut down here at Argonne." 

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Mary Alvarez



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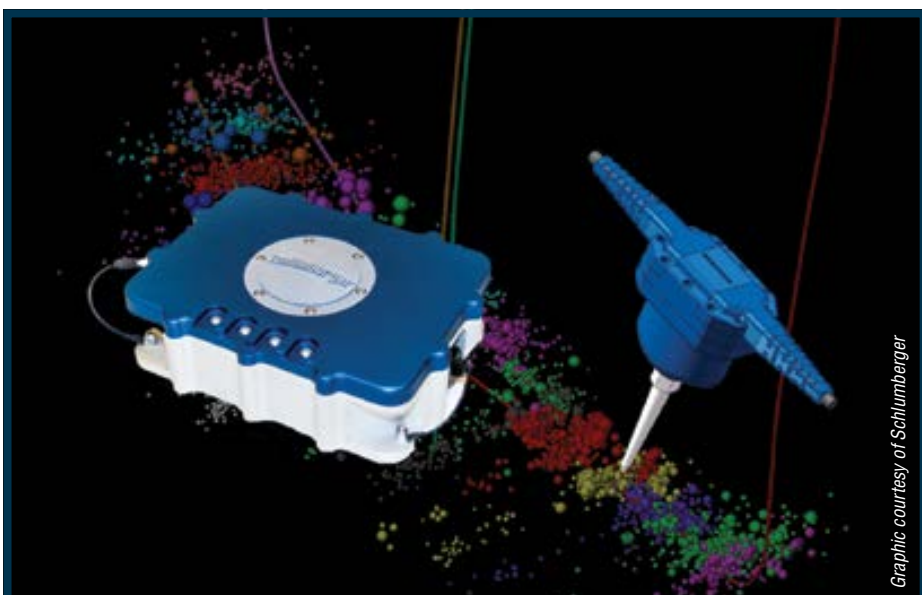
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Graphic courtesy of Schlumberger

Schlumberger's MS Recon tool.

Detecting With Precision

By KEN MILAM, EXPLORER Correspondent

When it comes to downhole geology, little things matter.

Those "things" would include the realm of microseismic measurements, because as unconventional plays and hydraulic fracturing become the norm throughout the industry, the need for microseismic imaging grows in importance (see related story, page 12).

Companies large and small are constantly developing, testing and using this technology, hoping to add value to today's efforts.

One of those companies recently spent two years developing a new microseismic surface acquisition system – a development they say is ready for prime time.

In field tests, Schlumberger's MS Recon

system improved the sensitivity to smaller microseismic events by boosting the signal-to-noise ratio more than two-fold compared to a conventional system, according to company representatives.

"The new microseismic surface acquisition system addresses the challenges of detecting small microseismic signals emitted during hydraulic fracturing at the surface and near-surface locations," said Joseph Elkhoury, who was the company's vice president and general manager of Microseismic Services, when the new system was announced earlier this year.

Detecting more microseismic events also aids decision-making, he said.

The company first looked at conventional systems and ways to improve performance based on what new challenges were being faced by operators in the field.

Time and money savings also were major concerns; as microseismic measurements are increasingly used in completion evaluation and field development decisions, companies expect improvements that will reduce survey costs and enhance the results' utility, according to marketing manager Michael Donovan.

"We decided to engineer a new system and include (our) proprietary technologies in sensor design and system electronics to improve the microseismic signal to noise ratio," he said.

"We also sought to create a system that was easy to deploy, provided flexibility when utilizing different surface array geometries and supported real time data transmission," he added. "MS Recon product development took about two years from concept to the first fully commercial job."

A Flexible System

The system features a proprietary geophone accelerometer and ultra-low noise electronics to produce a wide range of signal detectability.

The nodal-based wireless acquisition system also provides flexibility in designing and deploying the surface and near-surface arrays. GPS-synchronized data are acquired continuously and transmitted to a real-time operations support center.


"Our expectations were fully met regarding the ease of deployment and centralized data collection," said Uwe Rinck, operations manager, regarding their Texas field trials monitoring fracture treatments in a horizontal shale completion.

"The time to lay out MS Recon over a similar cable based system was reduced by 25 percent on the first job," Rinck added.

"We also have flexibility in deploying the sensor arrays to meet specific logistical or technical customer challenges," he said.

Signal quality is enhanced by using the geophone accelerometer, which has a broad frequency response across the range of interest and is designed to improve signal capture, he said.

The engineering design of the electronics improved signal-to-noise ratio when used in the lowest possible noise environments, Rinck said.

"While full-scale side-by-side trials are not practical, we have collected smaller amounts of 'conventional' system data alongside MS Recon," he said. "The data analysis tells us that the signal quality meets the expectations we had for improving frequency content and fidelity, which is then further enhanced during data pre-processing steps such as grouping, stacking and noise suppression." 



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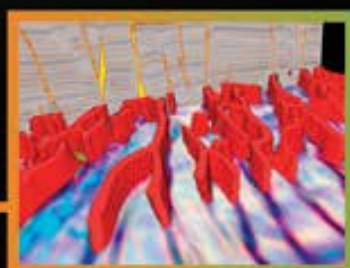
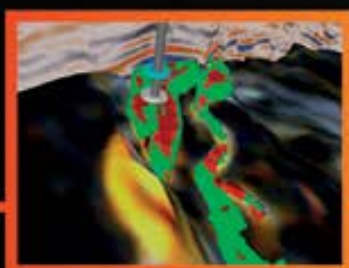
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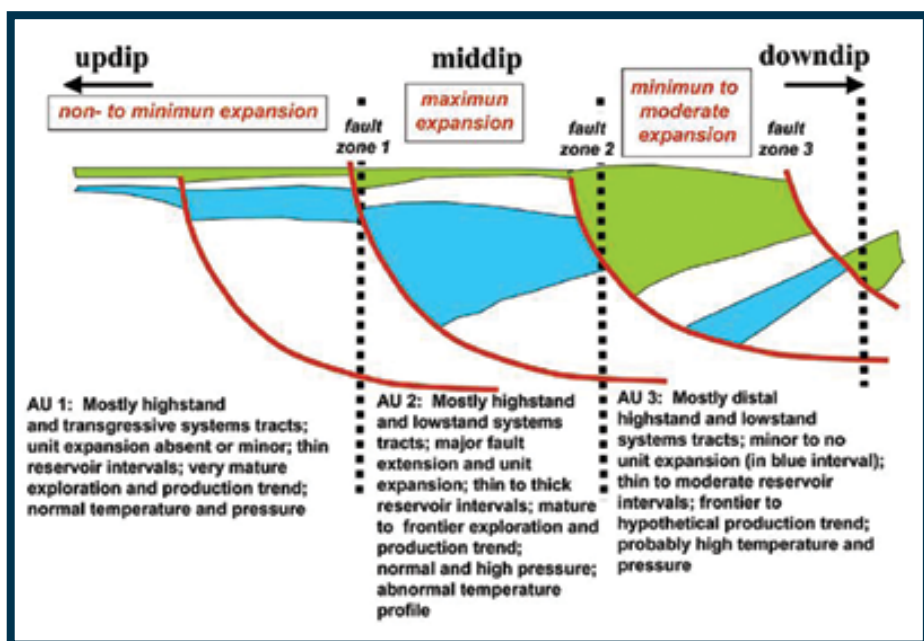


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Wilcox Sees Renewal

By LOUISE S. DURHAM, EXPLORER Correspondent

The Tertiary Wilcox sands in the Gulf Coast region have long been a favored go-to target for oil and gas prospectors.

The Wilcox Trend extends from south Texas across central Louisiana to the Mississippi border.

Like numerous other geologic formations, the allure of the Wilcox has waxed and waned owing to fluctuating commodity prices, among other issues.

Insufficient porosities in the Middle/Lower Wilcox and problematical petrophysical evaluations, combined with low prices essentially eliminated the Wilcox as an exploration target through most of the 1980s and throughout the

1990s, according to AAPG member Tim Rynott, owner of Durango-based Ridge Resources.

As hydrocarbon prices recovered and technology applications like hydraulic fracturing became commonplace, the Wilcox beckoned anew, attracting principally the mom-and-pop shops and the small to mid-size independents.

USGS Assessment

In 2007, the U.S. Geological Survey released a resource assessment of undiscovered technically recoverable oil and gas potential of Tertiary strata underlying the onshore areas and state waters of the northern Gulf of Mexico coastal region. Assessment Units (AU) were determined using a geology-based methodology.

USGS research geologist Catherine Enomoto provided a succinct overview of the Wilcox AUs included in the 2007 USGS effort:

"Wilcox Stable Shelf Oil and Gas AU reservoirs are sandstones that were deposited in fluvial, deltaic and near-shore marine shelf environments as a result of mostly highstand and transgressive systems tracts," she said.

She noted there has been considerable exploration and development of the Wilcox Group in this AU area, where reservoir intervals are thin, having temperature and pressure judged to be "normal."

The USGS estimated the mean undiscovered resource potential of the Wilcox Group here to be 54 MMBO, 472 BCFG and 15 MMBNGL. Some of the productive fields within the extent of this AU were in east-central Louisiana.

In the Wilcox Expanded Fault Zone Gas and Oil AU, the reservoirs are sandstones deposited in deltaic to submarine fan environments, as a result of highstand and lowstand systems tracts, according to Enomoto.

"Deposition was contemporaneous with significant growth faulting controlled by salt tectonics and underlying, older shelf margins," she said. "Units exhibit expansion adjacent to the extensional faults."

Reservoir intervals in this AU are thin to thick, having normal to high pressure, and they frequently exhibit an abnormal temperature profile. E&P activity in the Wilcox Group of this AU ranges all the way from mature to frontier.

The estimated mean undiscovered resource potential here was pegged at 52 MMBO, 2,498 BCFG and 75 MMBNGL.

Central Louisiana is the location for some of the productive fields in the AU.

"Within the Wilcox Slope and Basin Floor Gas AU, the reservoirs are sandstones deposited in distal deltaic, continental slope and basin floor environments that were part of distal highstand and lowstand systems tracts," Enomoto said.

She noted the reservoir intervals range from thin to moderate, with minor to no unit expansion as a result of growth faulting.

With regard to development activity, the Wilcox Group is frontier given that there are no fields in this area in Louisiana. This AU is an inadequately explored area harboring the largest mean undiscovered resource potential, which was estimated

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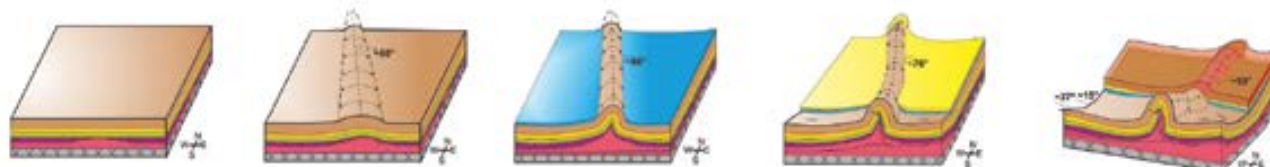


Balancing, restoration, and palinspastic reconstruction

Over the past two decades there have been significant improvements in the image quality of seismic data acquired and processed both on- and off-shore over complexly deformed areas. At the same time, however, the quality of the geological interpretations and models produced from this improved data has not demonstrated an equivalent progression. The majority of the 2D and 3D seismic interpretations published in industry reports and academic journals effectively remain conceptual cartoons that have been neither tested nor validated using the basic principles of structural geology. Most of these interpretations do not account for plausible progressive deformation that incorporates syntectonic sedimentation, compaction, relationship of fold shape to fault shape, and other factors that contribute to the observed deformed state in seismic data. Considering the interpretation in an evolutionary sense and applying these structural modelling techniques have been shown to produce more robust geological models, with far lower risk and uncertainty.

In this special issue, we would like to invite contributions that will help seismic interpreters to significantly improve their understanding of the tectono-stratigraphic development of their area of interest. Preferred manuscripts will focus on the application of a wide range of structural modelling techniques (e.g. section, horizon, and fault construction techniques; forward and reverse modelling using kinematic and geomechanical tools; structural balance and palinspastic reconstructions). We would particularly like to see integrated studies using geological, geophysical and petrophysical data from a wide range of tectonic settings. Contributions may include, but are not limited to:

- balancing and restoration of structural models in 2D and 3D
- modelling of deformation and sedimentation processes
- geological evolution derived from tecto-sedimentary relationships
- palinspastic reconstruction of paleoenvironments, structures, and facies distribution
- tutorials and articles that review the state-of-the-art techniques



The figure has been modified after: Vidal-Royo, O., Muñoz, J.A., Hardy, S., Koyi, H.A., Cardozo, N., 2013. Integration of modelling techniques in the understanding of the structural evolution of the Pico del Águila anticline (Enderal Sierras, Southern Pyrenees). *Geologica Acta*, 11 (1), 1-26.

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

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Software Upgrades the Oil-Hunting Game

By HEATHER SAUCIER, EXPLORER Correspondent

Advancing computer technology and increasingly sophisticated software packages are inundating the geosciences in exponential numbers – a trend that many say reflects and portends major changes in both the profession and the industry.

Simply put, computer programs are quickly chipping away at the risks and costs of exploration, turning the hunt for oil and gas into a more accurate and precise science.

“Software enables you to eliminate or minimize the number of dry holes,” said Nagaraj Srinivasan, vice president of Landmark. “It allows the industry to find more oil and manage its production over a substantial period of time at the lowest costs possible.”

“In the past, it used to take 30 to 40 days to drill a well,” he said, “and now we are doing it in several days.”

While some sing the praises of software that can crunch numbers faster than any human ever could, others remain quick to remind that new technology has its quirks, and that the knowledge gained decades ago by people examining rocks in the field and drawing contour maps with colored pencils can never be rendered obsolete by a computer.

Every Last Drop

During the mid-1900s, the average success rate of a well was 5 to 10 percent. Today, that number has jumped to 60 to 70 percent, according to statistics from the



SRINIVASAN

U.S. Energy Information Administration. Companies have good reason to believe those numbers will continue to climb as technology continues to evolve.

More than 30 years ago, Landmark introduced the first interactive 3-D seismic interpretation workstation, which was considered a major step-change in the industry, Srinivasan said. The workstation took hand-drawn and paper-intensive mapping workflows and digitized them for computers. Data could then be archived; repetitive workflows could be eliminated; and ultimately, interpretation and modeling could be automated, he said.

Vertical wells tapped many a reservoir until many believed hydrocarbons had reached the brink of depletion. The million-dollar question of “What’s next?” was then answered by a combination of horizontal drilling and hydraulic fracturing to extract oil and gas from shale.

“The easy oil is of a bygone era, and it’s getting increasingly more complicated to extract oil from offshore locations,” Srinivasan said. “And, onshore locations require a fundamentally different model as a

“In the past, it used to take 30 to 40 days to drill a well and now we are doing it in several days.”

result of unconventional plays.”

Today, companies must explore in smaller fields, in more subtle traps and in remote areas, making it more costly to drill wells. “The cost of drilling an offshore well reaches into the hundreds of millions of dollars. An onshore well can cost \$4 million to \$5 million depending on the area and completions that are added on, but overall costs can quickly add up for unconventional plays that require more wells,” he said.

In other words, before a well is drilled, companies want a high degree of certainty they won’t be staring into a dry hole. And these days, software seems to be the golden key.

“There’s a lot more companies in the software industry than there were 15 and 20 years ago,” said AAPG member and past elected treasurer Deborah Sacrey, owner of Auburn Energy, which offers neural analysis products that use neurons to find patterns with geological meaning in the numerous attributes of seismic data.

“Twenty years ago we had Landmark, the big boys, and not a lot of opportunities

for competition,” she said. “Now, people are inventing new things to do with data everyday and creating packages around it. Nearly half of the companies at an AAPG conference are now software vendors.”

Devil in the Data

A couple of decades ago a handful of computer programs existed that allowed geologists to correlate logs, determine the size of reservoirs and create models based on well data, said AAPG member Mary Carr, associate research professor in the Geology and Geological Engineering Department at the Colorado School of Mines. She’s also Rocky Mountain regional director for the Petroleum Technology Transfer Council (PTTC), and a co-executive director for the national PTTC.

“However, significant time was wasted maintaining data and reformatting data in order to move it between software programs,” she said.

Today, geologists who are looking for the next new play or the undiscovered sweet spot in a known basin need look no further than the plethora of software applications that process pre-stack and post-stack seismic data, perform amplitude versus offset analysis, inversion data, forward modeling data and more. All are designed to extrapolate inordinate amounts of information in short periods of time to help make decisions about where to drill.

While advancing software has greatly

[See Advancing Software, page 34](#)

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Advancing Software from page 32

improved data management, programs still can be cumbersome, and none of them do everything, said AAPG member Liz LaBarre, a senior geophysicist based in Denver. Interpretations derived from one program must continually be imported into other programs for further analysis, she explained.

"I am in and out of four packages on any given day," she said, adding that the learning curve for new software can be steep.

For geologists fresh out of a university, analyzing data can be even more overwhelming, explained AAPG member Mike Simmons, a Technology Fellow for Geosciences at Halliburton.



SIMMONS

"In exploration geology, a huge amount of time is spent by new geologists simply gathering data from past reports, well logs, seismic, geochemical data, sedimentological reports and other previous interpretations," he said. "Industry statistics show that for a new hire, it can take an average of eight years before he is able to make independent, creative decisions."

"In exploration geology, a huge amount of time is spent by new geologists simply gathering data ..."

One-Stop Shop

In an attempt to integrate all the data generated by multiple software packages and from multiple databases within a company, geologists are working with service companies to help develop holistic and integrated platforms on which all data can be combined, analyzed and manipulated.

"On a quarterly basis I talk with a few

different software companies to discuss my needs and what improvements I'd like to see," LaBarre said. "They've been pretty responsive."

Over the years, oil and gas companies have created hundreds and thousands of models that show a myriad of images of the earth's subsurface, Srinivasan said. Landmark's DecisionSpace Enterprise Platform aims to pull all those models into one and integrate them.

"This is a fundamentally different approach," Srinivasan said. "The earth is one, so the model has got to be one. Holistic exploration and production software is the step-change that we are looking for."

Imagine what the smart phone has done for people, he explained.

"It allows you to absorb information from the outside," he said, "such as traffic reports and weather updates – and helps you improve the quality of your decisions in your daily life. For example, based on today's traffic and weather reports, what time should I leave the office?"

"The quality of a decision is affected by the holistic view that you take into account before you make that decision," he added. "Holistic software can play a big role in deciding where to explore."

Platform technology is eliminating fragmented point solutions and creating a model with all geological constructs in place. It describes rock properties, fluid properties and the structure of a reservoir and improves your understanding of the subsurface.

"You can make a plan to design a well or series of wells, complete them, execute the well construction process, and produce and operate that well on an on-going basis," Srinivasan said.

Until now, the majority of industry efforts have been spent on defining traps and reservoirs through seismic acquisition and processing, and software solutions have mainly focused on tools for defining structure and reservoir quality, explained Alexander Neber, a technical marketing manager for Schlumberger Information Solutions.

"However, a significant percentage of exploration failure is due to a lack of understanding of charge and seal," Neber said. "Tools to assess charge and seal have, in the past, been difficult to use and integrate."

Integrated platforms, such as the Schlumberger Petrel E&P software platform, enable team members across the board – from geologists, geophysicists and reservoir, drilling and completion engineers – to work together to develop a single, volumetric earth model that is static and dynamic, and scalable for exploration and development projects.

"This eliminates workflow gaps in traditional systems, and there are no handoffs from one technical domain to the next," he said.

By seeing all the data at one time and in one place, geologists are given the opportunity to be more creative in exploration, Simmons said.

"If you can visualize all the data and interpretations in a 3-D environment, it generates ideas for new exploration targets very readily," he explained. "You're not going to find oil unless you are inventive."

What's Next?

As technology continues to improve, Sarey said she believes more software packages will be designed around attribute analysis.

"We have biases when looking at data

CALL FOR PAPERS

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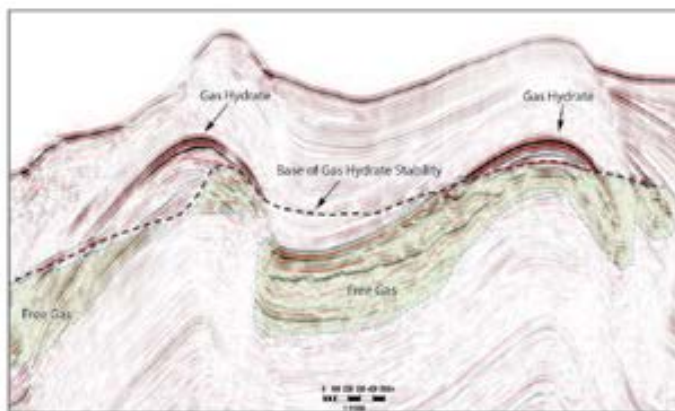
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- integration of well and seismic data in hydrate-bearing regions
- lithologic controls of gas hydrate occurrences through time
- geohazard evaluation
- characterization of gas hydrate occurrences in climate-sensitive settings



Seismic data at a deepwater site indicate the occurrence of gas hydrates at high saturation in sand-rich strata at the crest of two folds. Modified from Reichel and Gallager, DOE/FIT 2014.

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

The submissions will be processed according to the following timeline:

Submission deadline:
20 January 2015

Publication of issue:
November 2015

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LAR-SCLS 2014

Student Leaders Hold Action-Packed Summit in Lima

By EMILY SMITH LLINAS, EXPLORER Correspondent

Stimulating. Inspirational. Fantastic. Unforgettable.

Those were the words used to describe the Latin America Region Student Chapter Leadership Summit (LAR-SCLS) held in early November at the Peruvian Geological Society in Lima, Peru.

The action-packed event brought together 45 students representing 20 AAPG student chapters from seven countries, plus representatives from Young Professional (YP) chapters in Colombia and Peru.

Special guests included AAPG President Randi Martinsen, Secretary Richard Ball and Executive Director David Curtiss, each of whom delivered presentations and participated in activities throughout the weekend.

Planning

The LAR-SCLS fever began in the wake of the AAPG International Conference and Exhibition (ICE) in Cartagena in 2013, when Chevron sponsored Secretary Ball to lead the event, which was attended by 60 student volunteers.

The AAPG Student Chapter Committee (SCC) recognized a unique opportunity for training students gathered at the event, and they organized a “mini-SCLS,” which included participants from 14 student chapters in Latin America and the Caribbean.

The SCLS Cartagena participants were so inspired by the event that they started planning a larger, region-wide event for 2014. An organizing committee comprising representatives from Colombia, Argentina and Peru met through a series of Skype calls over a 13-month period.

“It was one year of really hard work,” said Diana Ruiz, LAR-SCLS organizing committee member and officer of the EAFIT University Student Chapter in Medellin.

“It was the first time we were planning this type of event, so at the beginning of the process it was challenging to make students and companies trust in what we were and to be motivated. Closer to the event, the challenges were related to finalizing the program and the logistics.”

Ruiz said the organizing committee overcame these challenges through their commitment, persistence and teamwork.

“The biggest advantage is that we knew how to work together as a team,” she said.

The committee chose Lima for the summit for its central geographic location and the competitive hotel and airfare prices, which made lodging and transportation affordable for students.

They scheduled the summit just prior to INGEPET Peru, a large industry conference that drew about 1,300 geoscientists and industry professionals from throughout the region.

The Program

The LAR-SCLS was successful in large part because of its comprehensive program, which included a variety of topics and guest speakers.

Flover Rodriguez, education liaison for the Colombia YP chapter, took the lead in organizing the program, which included input from AAPG SCC and AAPG Latin America Region leadership.

“We had a clear objective – to make an impact on the participants and to train leaders,” Rodriguez said. “We thought it was really important to train students through sharing experiences from experienced



The recent LAR-SCLS in Peru drew 45 students from seven countries representing 20 different AAPG student chapters.

AAPG members.”

Both senior and recent AAPG members participated throughout the program, which included technical, professional development, leadership and networking components.

Technical lectures began Friday night, when Randi Martinsen gave a talk on unconventional resources and echoed pioneer Walter Pratt’s statement, “Oil is first found in the mind.”

Lectures offered Saturday and Sunday included “Post-Drilling Lessons Learned/Surface Geology for Drilling New Exploration Wells,” by Walther Leon of Repsol Peru, and “The Origin of the Wind River Mountains Wyoming,” by University of Wyoming professor emeritus and AAPG member Jim Steidtmann.

AAPG Context

In addition to increasing technical knowledge, LAR-SCLS participants had the opportunity to learn more about AAPG.

Presentations including “Did You Know? AAPG Resources Available to Students” and “Financial Support Committee: How the Latin America Region Allocates Funding to Student Chapters” trained chapter leaders in how to leverage available resources to improve their programs’ success.

David Curtiss provided an overview of AAPG through the presentation “AAPG Continues to Navigate the Global Waters,” and then led a discussion that asked “What new programs should [AAPG] be doing? What should we sunset?”

The two-way conversation provided a unique opportunity for AAPG senior leaders and new members to talk openly about their ideas for making the Association more relevant to current and future generations.

Martinsen said she admired the enthusiasm, energy and talent of the students and YPs present at the summit.

“In addition learning what AAPG can offer students and YPs, I was impressed that the students and YPs wanted to know what they could do for AAPG and how to promote AAPG,” she said.

Professional Development

Professional development sessions provided practical career advice, explained through the personal accounts of AAPG’s global leaders.

The event’s first guest speaker was Richard Ball, who piloted AAPG’s first Global – Student Chapter Leadership Summit in 2007.

Ball’s talk, “How You Will Change the World!” outlined Ball’s experience of getting involved with AAPG and the idea he had to develop student leaders through SCLS events in the United States, then worldwide.

“I never dreamed the event would become so big and that seven years later I’d be in Lima hanging out with all of you,” he told LAR-SCLS participants.

Martinsen shared her experience working in the oil industry through a talk, “Succeeding as a Woman in the Good Old Boys Club.”

Her talk proved to be an inspiration to Pilar Vilorio, geology student in her final year of undergraduate studies at the National University of Colombia, Medellin Campus.

“I really identified with (Randi) and how perceptions of gender are changing, thanks to women like her and other geologists and engineers who, through their performance and professionalism, empower young professionals like me to keep changing this paradigm in our own countries,” Vilorio said.

Curtiss contributed to the discussion through his presentation that examined “three secrets to a successful career.”

Rodriguez focused on the importance of matching personality types with corresponding leadership positions – and working to ensure continuity from one leadership team to the next – in his talk, “What Makes a Good Organization?”

The presentation was well received, not only by students, but also by AAPG leadership, including Martinsen.

“I was especially impressed with Flover’s presentation dealing with how student chapter and YP chapter officers need to mentor members and work to develop future chapter leaders,” she said. “Without actively recruiting and mentoring those following

them in their leadership roles, the chances of continued success for the chapter are diminished.”

Leadership Sessions

The LAR-SCLS leadership sessions involved all Summit participants and focused on the importance of mentoring, teamwork and succession planning.

Initiatives announced during the summit included:

- The Student Leader Mentoring Program, designed to create a region-wide “leaders of leaders” network to provide support to student chapter leaders.

- The Sister Chapter Program, which pairs established student chapters with newer chapters and provides a formal mechanism for sharing lessons learned.

Vilorio, of the Universidad Nacional, Medellin Chapter, said she looks forward to sharing ideas with their new sister chapter, University of the West Indies-St. Augustine Campus, of Trinidad and Tobago.

“The principal goal of our chapter during our three years of existence has been to share all our experiences with newborn chapters,” she said. “We think it’s really important to find a way to keep the student chapters active. We try to share the best of our student chapter values and of Colombian culture.”

“Lessons learned” was a key component of the Student Chapter Presentations, in which speakers from the 20 universities represented at the summit shared their chapters’ values, activities, challenges and successes.

Creative ideas were another major component. Students from la Universidad de los Andes, of Bogota, Colombia, described their *ciclosalida* bicycling field trip and “Geosciences in Photos” photography competition. The Caldas University Student Chapter, also Colombia, shared its *Rock a’ Thon* initiative, which encourages students from throughout the university to bring rock samples to add to their department’s collection.

Continued on next page

Continued from previous page

Other students shared the importance of moving beyond the technical activities and giving back to the community. Members of the AAPG chapter at the Federal University of Sergipe in Brazil described their work teaching basic geology to children, and students at the University of the West Indies in Trinidad and Tobago discussed their fundraiser to support those affected by autism.

Student presentations highlighted common challenges for AAPG student chapters: finding funding, keeping students engaged and knowing how to deal with criticism from opponents of the energy industry.

They also highlighted common passions – a love for geoscience, for AAPG and for helping others learn about what the Association has to offer students and young professionals.

Raquel Gewehr de Mello, eighth-semester geology student from Universidade Federal do Rio Grande do Sul in Porto Alegre, Brazil, said she benefitted greatly from the student chapter presentations.

“Getting to know people who are working with the same issues and are dealing with it in different manners is the best way to learn how to improve and make the chapters stronger,” she said. “One thing I will take back to my chapter is the importance of teaching new members about being a committee member from the beginning. I don’t want to see all the hard work we have done fade away.”

Gewehr added that even new chapters like hers, which formed in 2014, have lessons to teach others.

“We showed others that new chapters are eager to learn how to be an active and strong chapter,” she said, “and we must walk together to be successful.”

Networking

LAR-SCLS participants had the chance to meet with Young Professionals at a Meet and Greet reception organized by the Peru YP Chapter.

During the session YP leaders shared their experience moving from academia to industry, and they provided tips to students preparing for graduation.

The rotating small group discussions also allowed YP leaders to hear feedback about what they should be doing to encourage recent graduates to stay involved with AAPG and their YP chapters.

The one-on-one interaction with professionals was meaningful to Marcela Aragão de Carvalho Ramos, an eighth-semester geology student at the Federal University of Sergipe.

“I loved getting in touch with professionals, especially because they shared with us their personal experiences and their long path to getting where they are,” she said. “We students were able to discuss everything in a very informal way with them, and for me it was very special since we don’t have this opportunity very often.”

The LAR-SCLS provided plenty of formal and informal networking opportunities, particularly during group meals and coffee breaks, where students celebrated their language and cultural differences as well as their common love for geoscience.

Students from the University of the West Indies-St. Augustine Campus in Trinidad & Tobago provided additional cultural diversity to the Summit, which was attended primarily by individuals from North and South America.

Jenai Valadere, third-year UWI Petroleum

Geoscience student, related the unique experience she had representing the only chapter coming from a Caribbean Island.

“We were able to discuss the geology and the culture of our country and answer any questions they had about our island,” Valadere said. “This sparked many engaging conversations among the participants.”

UWI colleague Barry Beckles agreed.

“Our contribution to the other participants came out of our interactions with them,” he said. “They were fascinated by the unique appearance of us, Trinbagonians. They loved our accent; the language is English. In Trinidad, the population is very mixed ... over 20 percent of the population identifies as being of mixed ethnicity. So we had to explain how diverse our culture is and the various aspects of it such as

See Yellow Submarine, page 38



Organizing Committee (from left): Melisa Galvan, Flover Rodriguez, Juliana Ceballos, Diana Ruiz, Randi Martinsen, Emily Smith Llinás, Ignacio Iregui, Richard Ball, Pablo Napan.

A powerhouse emerges: Energy For The Next Fifty Years

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Yellow Submarine from page 37

food, dress, among other things. Basically we enlightened them on what Trinidad and Tobago had to offer," he said.

Despite their differences, LAR-SCLS participants united under their common AAPG banner. They developed a theme song, "We're all part of the AAPG," sung to the tune of the Beatles' "Yellow Submarine," and they talked frequently about their "AAPG family."

The AAPG family cared for one of its own the second night of the LAR-SCLS, when participants learned that one of the students from Argentina was robbed at the airport and arrived in Lima with no money. Students took up a collection and the multi-currency donations allowed him to enjoy the remainder of his stay in Lima.

Lasting Impact

The impact of the LAR-SCLS was felt by all who attended.

Rodriguez said he was pleased to see all participants sharing their experiences and ideas for improving their chapters.

"It was inspiring," he said. "(The students) inspired me to keep working harder. But the most important thing I noted was that they really want to stay involved with AAPG! They were talking about continuing to serve as YPs after graduation! These types of comments make me feel that all our work paid off."

Melisa Galván, Latin America Region's student chapter vice liaison, said organizing committee members were overwhelmed by the Summit's success.

"It was great to see everything come



The LAR-SCLS-Meet & Greet was an opportunity to network and socialize.

together after all of the effort, desire and energy we invested in moving the event forward," she said. "We are proud of all that we were able to achieve, and that this experience has been beneficial both to the students and to us."

Ball, who took vacation time from his company to participate in the Summit, said the experience in Lima further cemented his passion for SCLS events.

"The LAR-SCLS was another example of the incredible enthusiasm AAPG student members possess," he said. "For the past eight years, I have made it a point to meet with a large percentage of the student membership. I am always amazed by their level of drive and passion for geology."

"One thing is clear," he continued, "the AAPG has an incredibly energetic student membership base that is ready to accept the challenges that lie ahead for industry. If the group in Lima is any indication, I would say that the future of industry is in good hands."

Bryant Fulk, AAPG SCC chairman, said he was pleased to hear about the success of the LAR-SCLS in Lima.

"The Student Chapter Committee is encouraged and amazed by student enthusiasm, especially in growing markets like Latin America," he said. "We look forward to continuing these events and watching former students like Flover take on more leadership roles in the near future within the organization."

Fulk also noted that SCLS events are possible thanks to support from the Hartman endowment, AAPG and corporate partners worldwide.

"The Student Chapter Committee has experienced unparalleled support from the Executive Committee, both financially and through people (like Richard's) time, as well as from the Corporate Advisory Board and from individual firms such as Chesapeake Energy. Both the committee and students everywhere greatly appreciate the support," Ball said.

The LAR-SCLS received a total of \$35,250 USD in support from the AAPG Student Chapter Committee, the AAPG Latin America Region, the Asociación Colombiana de Geólogos & Geofísicos del Petróleo, the Geological Society of Trinidad and Tobago, Tecpetrol, Equion Energía, Gems SA and Endeepor.

Organizations and businesses throughout Latin America and the Caribbean will be hearing from students again very soon. All of the 2014 organizing committee members are committed to working on next year's LAR-SCLS, which they hope to make even larger and more inclusive than the event in Lima.

"Plans for 2015 need to start right away – really, right now!" Galvan said, noting that the committee will need more sponsorships to bring in students from new chapters forming across the region. They also hope to include a YP Leadership Summit in conjunction with the SCLS.

"We all realize that these events are very necessary because they produce an exchange of ideas and experiences that creates a symbiosis between student chapters," Galvan said. "We also believe that the next SCLS should be done in conjunction with YP chapters so we can ensure a continuity and retention of members, and so our region can continue growing and improving every day."

Ruiz said the 2014 LAR-SCLS provided a solid stepping-stone to better events in the future.

"We learned a lot of things, and we want to improve," she said. "We want to get to more students, and we want to have more impact on them and on the region."

"The idea is to work with the YP leaders," she added, "to show to the students that their work with the AAPG doesn't end when they graduate." ■

Third Annual Mississippian Lime Forum February 19, 2015 – Oklahoma City, Oklahoma

This year's Mississippian Lime Forum unleashes science, technology, and experience to solve persistent puzzles, and dramatically improve economics. Consider 2015 a breakthrough year as new, sometimes controversial new techniques and technologies are being implemented for the first time.

Join us to gain a new understanding of the reservoirs and their complexity and to apply the knowledge to optimizing the reservoirs. Here are a few of the topics:

- Fracture networks and characterization
- Diagenesis: Processes and patterns
- Migration pathways and reservoir development
- Pore characterization and implications
- Geomechanical processes and implications on production
- New drilling techniques for optimizing reservoirs
- Geochemical insights: fingerprinting for targeting enriched zones
- "Stranded pay" – the new target

This one-day forum will be useful to geologists, engineers, geophysicists, and geochemists who will be able to apply the new knowledge to their operations and also to evaluating properties. Includes Oral presentations, posters, discussions, networking reception.

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Join leading experts to learn about important new developments in creating rigorous, consistent and statistically valid reserve estimations. It has been 5 years since the SEC published "Modernization of Oil and Gas Reporting" which gave companies more flexibility and options for reserve and resource estimation. In that same period, unconventional activity has skyrocketed, resulting in new challenges for applying SEC guidelines. This forum will focus on what has changed over the past 5 years and how companies and PRMS are adapting to the change. Presentations will include talks on estimating reserves in unconventional reservoirs, applying reliable technology to accelerate P1 bookings, and PRMS challenges and issues. Come hear presentations on the following subjects:

- Geoscience & Engineering: What new reserve challenges are facing earth scientists and engineers?
- Unconventionals: How to approach reserve and resource estimation?
- Reliable Technologies: What are they and how can they impact reserve bookings?
- SEC & PRMS Standards, Guidelines, Challenges, and Issues: What is next?
- Palynology and biostratigraphic advances

This conference will be useful to earth scientists and engineers who are involved in reserve and resource estimation (from exploration discovery through to production) as well as anyone who manages oil and gas assets or the reporting of reserves.

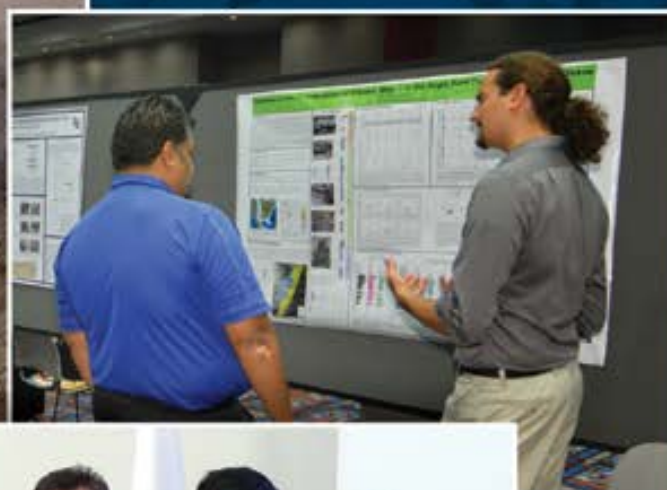
The Forum will take place on Thursday, Feb. 26, followed by a one-day JCORET-certified evaluator training class on Friday, Feb. 27.

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Same problems, different industries

The Best of This + The Best of That = Eureka!

By DAVID BROWN, EXPLORER Correspondent

Pumps & Pipes brings together the newest technologies from the oil and gas, medical and aerospace professions in Houston to talk about something they all have in common: Problems.

More specifically, members talk about problems because someone else in the room – from a completely different discipline and expertise – may already have found an effective solution.

The organization recently announced plans for its eighth annual gathering, the Pumps & Pipes 8 Symposium, on Dec. 8 at the Houston Methodist Research Institute, with the theme “Ideas to Insight.”

It's an exciting time for Mike Hess, assistant director of engineering for NASA at the Johnson Space Center in Houston.

“Typically we tend to throw it over and ‘go live’ in these things. You'll actually jump into surgery and see how they're using robots to operate on a person,” Hess noted.

“It's jaw-dropping, what the medical profession can do,” he said.

Talk to a Pumps & Pipes participant and you're likely to hear the phrase, “The other guy's toolbox.”

Drawing on experts in energy, medicine and aerospace, the program brings together technologists and practitioners in a sharing environment, with the idea that the solution to one person's problem might be found in the other guy's toolbox.

It seems like a natural idea, but it's far from obvious for scientists deeply involved



HESS

in their own research.

“There are a lot of times we go off and look at problems in the aerospace domain, and we don't really look at the possibility that what we're working on has an application for somebody else,” Hess said.

Pumps & Pipes started as a collaboration between the medical profession and the oil and gas industry, sparked by the chance meeting of two people on a jetliner.

NASA joined the mix later, but Hess said aerospace was present at the founding.

“An oil person and a medical profession person got together – and it was on an aerospace device,” he noted.

NASA conducts research in a number of areas with potential applications to medicine and energy, and it is equally interested in current research in those fields, Hess said.

Challenges can be similar in type, if not in degree.

Working in extreme environments? How about an environment with no

“There are a lot of times we go off and look at problems in the aerospace domain, and we don't really look at the possibility that what we're working on has an application for somebody else.”

oxygen. Or gravity.

“We've had folks from the medical profession come out and we show them what we can do for them, and it works the same way for the energy industry,” he said.

As an example, Hess talked about a pipeline company that was having trouble with its pigs – the maintenance and monitoring equipment that passes through the pipe along with shipped product.

“So we kind of showed them that we have this inspection ball that works in space,” Hess said. “And we said, ‘But in your case, we can add a tether to it.’”

Cross-Industry Collaboration

The first Pumps & Pipes conference was held in November 2007 at the University of Houston's Texas Learning and Computation Center, with the theme “Docs and Rocks.”

An invitation-only audience included geologists, surgeons, vascular biologists, engineers, physicists, computer scientists, imaging specialists, medical device

researchers, clinicians interested in cardiovascular disease and other scientists.

Since then, Pumps & Pipes has held a series of collaboration events, including an international conference at the Four Seasons Hotel in Doha, Qatar, in April 2011.

Research topics in previous programs have included microbial-induced corrosion of oil pipe, biofilm imaging, wellbore tractors, shape-memory metals and polymers, nanotechnology, robotics, navigation systems for deepwater wells and cardiovascular interventions, cardiac-valve bioengineering and imaging inside well bores and blood vessels.

The 2014 program announcement said Pumps & Pipes 8 “will voyage from inner space to outer space, with stops in between. We will be visiting Mars to get an update on NASA's Curiosity Rover and learn about a new Lander mission to study the geology of the red planet. We will also learn about performing surgery on children's pumps and pipes.

“This year's program will feature cutting-edge presentations, demonstrations and live video feeds from energy, cardiovascular medicine, NASA, academia and education. Our focus remains on providing a forum for networking, collaboration and problem-solving by exploring the other guy's toolkit.”

Pumps & Pipes was established by Alan Lumsden, of the Methodist DeBakey Heart and Vascular Center, and William Kline, of

Continued on next page

AN AAPG GEOSCIENCES TECHNOLOGY WORKSHOP

Sixth Annual Deepwater and Shelf Reservoirs

27-28 January 2015 – Houston, TX

Determining reservoir connectivity, calculating pore pressure, understanding the structural subtleties, identifying hazards, and developing accurate images (including subsalt), are deeply affected by new multi-disciplinary discoveries in science and technology. New understanding of ways to map shelf deposit and to accurately map zones, correlate, identify remaining or new reserves and to determine connectivity and conductivity will be featured.

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Focus will be concentrated on the Gulf of Mexico, shelf and deepwater, including Mexico water.

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Workshops 2015

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- Imaging / image logs to determine fractures and fracture networks
- Carbonates behaviors in horizontals with induced fracture
- Geochemistry and geochemical processes in generation
- Geomechanical factors and transport mechanisms
- Data mining and analytics
- Petrophysical analyses and modeling
- Depositional environments and connection to reservoir characterization
- Palynology and biostratigraphic advances

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Geosciences Technology
Workshops 2015

Continued from previous page

ExxonMobil Upstream Research Company. The University of Houston was then added, represented by Ioannis Kakadiaris.

NASA came on board in 2012. Hess said the Johnson Space Center's special role in the agency makes cross-industry collaboration especially useful.

While the Jet Propulsion Laboratory in California leads NASA's rover program and the Goddard Space Flight Center in Maryland focuses on spacecraft, satellites and space telescopes, the Johnson Space Center is home to NASA's astronaut corps and devotes most of its work to human space flight.

"If a medical service company is working on an approach that can miniaturize something that can be used in a life-support system, we should partner with

that company," Hess said.

The next giant step for the space agency is a manned expedition to Mars, and "in order to get humans to Mars, NASA needs a number of technologies to be developed," he observed. "It takes months to get there and months to get back. You've got to be completely independent of Earth."

Maybe I'm Amazed

Advances in medical and oil and gas technology that can provide insights for NASA are essentially time savers and short cuts that give the agency more time to mature its own systems.

"What we need to be working on is what the commercial companies can't do," Hess said. "There's this near-Earth orbit work, but the middle is what we're calling the 'proving ground.'"

The proving ground includes numerous

areas of research where the Pumps & Pipes collaboration could be beneficial:

- ▶ Life-support systems.
- ▶ Extended space walk capabilities.
- ▶ Guidance, navigation and control systems.
- ▶ Intelligent materials and advanced structures.
- ▶ Improved thermal controls.
- ▶ Autonomous docking.

"We need enhanced exercise equipment for astronauts," Hess said. "What if, instead of using these big, bulky systems, you just strapped an exoskeleton on? And in everything, for the humans involved, we need better radiation protection."

Rock and soil studies could be highly important, because "when you get to Mars there may be a way to use the soil or the atmosphere of Mars, to bake out the oxygen," he said.

Hess emphasized the importance for NASA of developing systems not reliant on the Earth. People are used to navigating using GPS, but "there's no GPS for the solar system," he noted.

Pumps & Pipes began from the concept that the medical profession and the oil and gas industry face similar challenges, but in widely different contexts. NASA grapples with those challenges in outer space.

"We're all working on similar problems," Hess said. "Sometimes they're just phrased differently."

A consortium that brings together medical, energy and aerospace experts provides plenty of chances for cross-pollination of ideas and technology, plus a sizable amount of mutual admiration.

As Hess said:

"We all look at each other the same way and say, 'Wow! It's amazing what you're doing!'" ■

Integrated Platforms from page 34

because we are human. We may be biased to the point of seeing the forest and not the trees," Sacrey said. "The computer is unbiased when looking at statistical information. Using computer power to analyze data will be more of a game change in the next few years."

To Simmons, platform technology will become mainstream in the oil and gas industry.

"I hope not very far down the road an exploration geologist will come into his office and there will be one software platform with the whole of his company's data, published data and all global interpretations," he said. "He could zoom into an area he is interested in, like West Africa, input new data his company has just received from acquiring new wells, and make an interpretation on the fly."

"That previously took months," he said. "Now it can take days."

The Irreplaceables

Although advancing software is improving exploration and field development, the ultimate decision about where to drill still resides with humans. And, many with extensive knowledge from invaluable field experience will soon be retiring. Some companies are responding by bringing former employees out of retirement on a part-time consulting basis and to conduct field trips to pass on their knowledge.

It's a reality that has prompted companies, which have been stretching their seismic and software budgets, to now focus more on mentoring early- to mid-career geologists, LaBarre said.

"I've been a software junkie my entire career," said LaBarre, who began her career in 2006. "I'm not part of the colored-pencils group. One thing to say is software is no substitute for experience."

The intrinsic knowledge of reservoir rock behavior learned from working as an explorationist for 30 or more years cannot be captured by any software package, she said.

The economic conditions for the past five-plus years have stalled retirement plans for many geologists and geophysicists.

"In the next few years or so we will likely see a significant exodus," LaBarre said. "It's something the industry is aware of and is starting to come to grips with." ■

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More Research Needed on Induced Seismicity

By EDITH ALLISON, Geoscience and Energy Policy Office Director

The need for research to help understand the causes and mitigate induced seismicity was one of several topics at several recent Washington, D.C., workshops that explored what we know about the subsurface and its response to energy extraction technologies – and what research is needed for more efficient and safe energy development.

The workshops will help the U.S. Department of Energy (DOE) organize a new program that integrates applied and basic subsurface energy research in the areas of nuclear, geothermal, carbon dioxide storage, and oil and natural gas production and waste disposal.

The program is SubTER, for Subsurface Technology and Engineering Research and Development.

Industry involvement in the workshops allowed planners to learn about industry technology needs and interests, which is important to assuring the usefulness of research results. Industry involvement also is important because research projects will depend on industry's willingness to provide subsurface and operational data.

Several years ago, induced seismicity was of sufficient public concern that the National Research Council conducted a detailed analysis. Its 2012 report, *Induced Seismicity Potential in Energy Technologies*, found that felt seismicity was associated with a small percentage of geothermal, enhanced oil recovery and wastewater injection wells, but was documented for only one hydraulic fracturing operation.



ALLISON

Concern about induced seismicity has grown since 2012, as hydraulic fracturing, wastewater disposal and associated seismic events have mushroomed.

The study concluded, "The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events."

Concern about induced seismicity has grown since 2012, as hydraulic fracturing, wastewater disposal and associated seismic events have mushroomed.

The vast majority of felt seismicity comes from wastewater disposal wells – and felt seismicity is now tied to hydraulic fracturing treatments in British Columbia, Ohio and Oklahoma.

However, it still represents an extremely small percentage of wells.

Selected research findings included:

► **William Leith**, U.S. Geological Survey senior science adviser, reported that the number of earthquakes in the United States greater than magnitude 3 has increased from about 21 per year before 2000 to more than 300 per year from 2010 through 2012.

The increased seismicity correlates with an increase in injection of wastewater

in deep disposal wells. Leith noted that hydraulic fracturing does not seem to be related to the increase in earthquakes greater than magnitude 3.

He also noted that earthquakes may be triggered far from injection sources.

"It's pressure," he said, "not fluid flow."

► **Roberto Suarez-Rivera**, director of the Schlumberger Innovation Center, tackled the vexing industry question of why some sections within a horizontal well are more productive than other sections.

He provided examples of how hydraulic fracturing is a "competition between in situ stresses and rock fabric," and he described lab studies that showed that fractures do not go exactly where planned because of reservoir heterogeneities. Much of this rock variation may be smaller than the scale of subsurface measuring devices.

This and other presentations suggest that heterogeneity at all scales will be a major complication to improving energy recovery technologies and preventing induced seismicity.

► **K.J. "Kris" Nygaard**, senior stimulation consultant at ExxonMobil Upstream Research Company, listed research that would aid industry in characterizing and mitigating the induced-seismic risk:

✓ Improve our knowledge of subsurface stress and significant fault systems.

✓ Improve understanding of ground-shaking behavior and seismic wave attenuation characteristics.

✓ Develop capabilities to differentiate naturally occurring from induced earthquakes.

► **Thomas H.J. Goebel**, an applied seismology consultant at the University of Southern California's Induced Seismicity Consortium, reported his group has developed a model to differentiate tectonic versus induced seismicity.

They hope to go on to develop a model that works for both plate boundary regions like California and intra-plate regions in Oklahoma.

► **Austin Holland**, state seismologist, Oklahoma Geological Survey, explained what is known and unknown about Oklahoma's exponential rise in earthquakes.

The vast majority of quakes occurs within or near the top of the crystalline basement and are related to wastewater disposal wells. However, Holland estimated that about 2 percent of hydraulically fractured

Continued on next page

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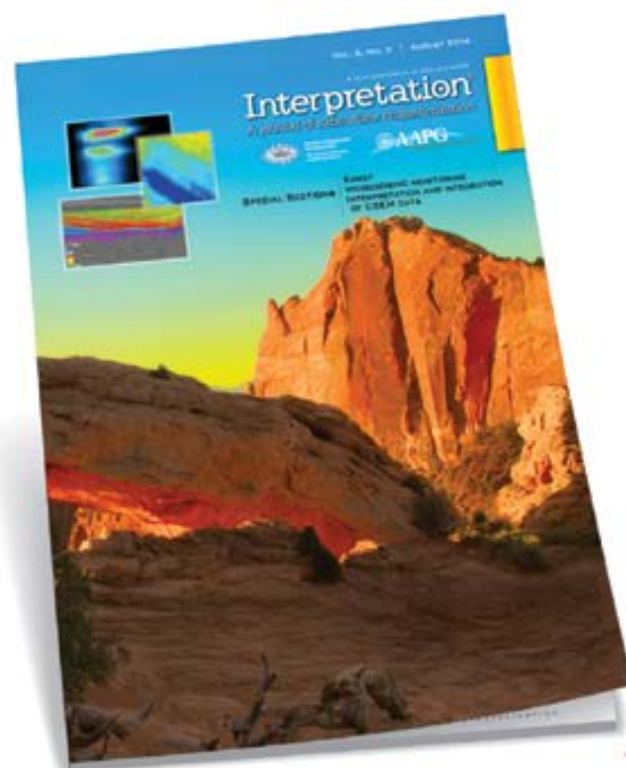
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REGIONS and SECTIONS

Start Planning Now For Global APPEX in London

By MIKE LAKIN

It's that time of year again, when most of world's upstream attention is tuned to the end of the year – and as 2014 is rapidly running out, budgets for 2015 are being finalized.

What remains of any budget for this year is being allocated to existing (but also new) opportunities, and the majority of the workforce is thinking about a short break around December's holidays – or even just the New Year celebration.

We all know January will arrive far too quickly, so now is the time to start planning to attend the annual Global APPEX Prospect and Property Expo, set March 3-5 at its traditional home in the Business Design Centre in Islington,

North London, just a stones' throw from the center of the city.

The state of world's economy obviously plays a key role in financing of upstream deals and the ability of the E&P companies to fund their international activities, which inevitably includes work program obligations and commitments.

With exploration even more difficult to finance in the present climate – even where companies have enough money to fund their obligation – reducing risk by farm-out, strategic divestment of interest or even just a wish to find strategic partners with complementary expertise leads companies needing to complete an A&D process.

To achieve this, what are sometimes

referred to as the “four Rs” are essential to consider when activating a divestment or farm-out process. You need:

- ▶ The RIGHT information.
- ▶ The RIGHT people.
- ▶ The RIGHT way.
- ▶ The RIGHT time.

Sounds simple, yes – but many forget how long the process can take and rarely start the process early enough. Independent global farm-out statistics from around 3,000 farm-outs reviewed and tracked over 15 years clearly show that a farm-out takes an average of 12-plus months to complete, so planning and optimizing a project marketing campaign for 2015 should have started by now with obligations in 2015 – or more


appropriately, in 2016.

APPEX, now in its 10th year, is just one of the key opportunities in which at least three of the Rs are available in London, all under one roof.

Early registration is advised, particularly if your company's plans involve exhibiting and presenting project opportunities.

So whether this is your first time or you're coming back for more, please reserve the first week in March to be in London for Global APPEX.

Register before Jan. 2 for the “Early Bird” rate and save up to 30 percent on fees.

For more information go online to europevents.aapg.org. 

Continued from previous page

wells might have earthquakes associated with the completion process.

A preliminary study of earthquakes and hydraulic fracturing treatments at a well in Carter County, Oklahoma, in July 2014, found earthquakes temporally correlated to injection. Most of the 26 earthquakes near the 3.5-kilometer deep well were between 3.5 and 8.5 kilometers depth and occurred within 100 minutes of the start of each of the four hydraulic fracturing injections. The varied locations of the earthquakes, some as far as seven kilometers from the well, require additional study.

Several speakers noted the need for more data. The existing seismic network is inadequate to identify the precise location of induced earthquakes. There also is inadequate data about the injection rates, volumes and pressures of wastewater disposal wells.

Joshua White, of Lawrence Livermore National Laboratory, recommended field laboratories to improve understanding of the subsurface by integrating subsurface characterization, monitoring and modeling.


Unfortunately, field laboratories are expensive to operate.

There may be alternative research data, however, in a few existing subsurface injection projects. For example, the Bureau of Reclamation has operated a well-monitored saline injection well in the Paradox Valley for 18 years, yielding an exceptional data set of injection and induced seismic events.

A few speakers mentioned the Horn River Basin seismicity. British Columbia Oil and Gas Commission and the Geological Survey of Canada publications (2012) define the low-level seismic events in the Horn River basin between 2009 and 2011. These events resulted from fluid injection during hydraulic fracturing in proximity to pre-existing faults. Seismicity was shown to correlate with injection volumes of hydraulic fracturing treatments.

Seismic events ranged in magnitude from 2.2 to 3.6, with only one event felt at the surface. Seismicity increased as stimulation volumes grew and declined with the decline in drilling operations.

The overarching, unanswered question posed by many was: Why is there seismic activity in certain regions, notably Oklahoma, but not in other areas of active drilling, production and wastewater injection, such as the Bakken producing area?

Oil and gas operators, and industry and academic researchers will have an opportunity to learn more about the DOE subsurface research program – and provide comments to DOE managers – at a Town Hall at AAPG's 2015 Annual Convention and Exhibition, set May 31-June 1 in Denver. 

The AAPG Mid-Continent Section and the Ardmore Geological Society wish to thank the following supporters, without whom the 2014 Field Conference—Exploring the Arbuckles: Outcrops to Resources—would not have been possible.

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Special Thanks to the Oklahoma Geological Survey

200-Year-Old Ohio Well Still Worth a Visit

By JEFF A. SPENCER

A commemorative event was held in October to celebrate the 200th anniversary of the historic Thorla-McKee oil well and salt works of southeastern Ohio.

What made this anniversary all the more interesting is that while the initial well site was destroyed many years ago, the second well (1816) still can be visited – and renovations are under way.



SPENCER

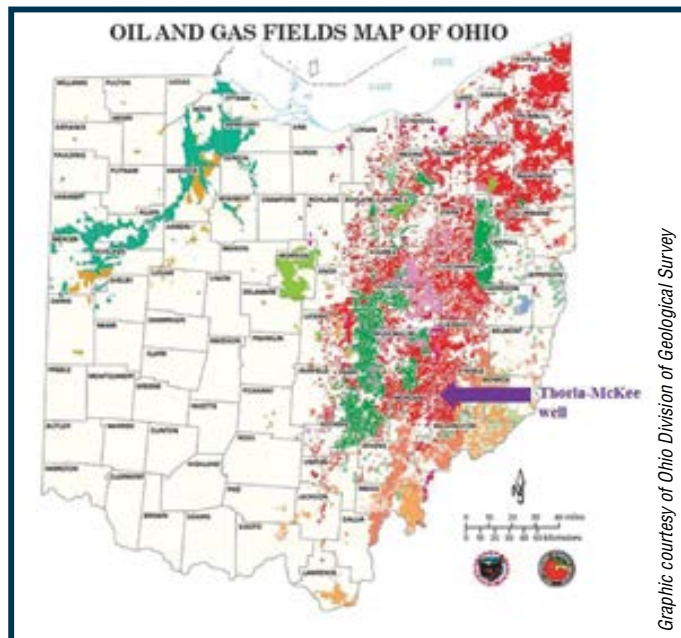
The Thorla-McKee well is located near the town of Caldwell in Noble County, Ohio, a site marked with an Ohio Historical Marker that was dedicated in 1992.

It is an important historical site for the history of North America's petroleum industry. Much like the 1818 traveler who visited the "natural curiosity" and wrote about the well, the site is still well worth a visit.

The approximately 200-year-old stump-cased well is a highly recommended stop for all workers in the petroleum industry, as well as anyone interested in the early history of the Ohio River Valley.

* * *

In the late 1700s and early 1800s, salt was brought west on packhorses, across the Appalachians to the Ohio River Valley. Early entrepreneurs realized there was a growing market for salt and a need to



Graphic courtesy of Ohio Division of Geological Survey

develop local sources.

The first salt works in the area was near Marietta, Ohio, and across the Ohio River in what is now West Virginia. While digging wells for salt brine, oil and gas were often encountered.

In 1806, the Ruffner brothers found oil and gas in their salt brine well in the Great Kanawha River valley. By 1815, there were more than 50 salt furnaces along the Kanawha River, and so much oil from the salt works was entering the river that it was known as "Old Greasy."

In 1814, Silas Thorla and Robert McKee

dug a well in search of salt brine near a deer lick in southeastern Ohio. Silas had learned the salt-making process working at a Kanawha salt works.

As with many of the early salt brine wells, the well was dug, or "kicked down," using the spring pole method. The pole usually consisted of a long hickory sapling, 35-40 feet in length, weighted on one end and braced against a forked stick.

The weighted drilling tools, or bit, were suspended from the sapling; a stirrup, or stirrups, would be attached to the sapling by rope.

Men would place a foot in the stirrup and push down the drill bit into the hole. The pole would then spring back after each "kick."

The surface hole ("head") was cased to bedrock – a depth of 16-18 feet – using a 34-inch diameter, hollow sycamore log ("gum"). The well encountered oil and gas associated with the salt brine; a nuisance to the salt operation.

The salt water was boiled down in cast iron kettles, some as large as six feet across.

The salt works was a 'round-the-clock

Continued on next page



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operation, with fires burning under the kettles day and night. Wool blankets were used to soak up the less dense oil, and then the oil was wrung out into large barrels. A large quantity of oil ran into the nearby creek.

The oil was bottled as "Seneca Oil" and sold as a cure for rheumatism, sprains and bruises. Some of the oil was burned in lamps, but it burned with a strong odor and much smoke. Occasionally, minor explosions occurred from small gas pockets igniting.

The salt works was destroyed by fire in 1831.

* * *

Working near these salt wells with the associated gas could be dangerous.

Robert Caldwell, who operated another salt works near the Thorla-McKee site, was carrying some blazing coals used to light up the work area. A live coal fell near a well, igniting the gas. Caldwell described a ball of fire rising in the air until it reached the top of a hickory tree, where it then exploded.

Caldwell survived the blast, which reportedly could be heard five miles away.

An early encounter with the Thorla-McKee well also was described in a July 7, 1818, letter from an unknown writer in Woodsville, Ohio, to a friend in Bolton, Conn. A portion of the letter was published in the Oct. 9, 1818, edition of Poulson's American Daily Advertiser of Philadelphia.

The writer described the well as three feet in diameter and 42 feet deep. A portion of a hollow "buttonwood" tree (sycamore) was used as a "curb to prevent people from falling into it." The well produced five barrels a week, and the oil was "as fine as any oil from the head of a sperm whale."

Nearby Duck Creek is described as covered with oil for three miles, and in one place the writer measured the oil three feet deep:

"A boy, a few weeks since, in order to ascertain whether oil would burn on water, touched a firebrand to the creek; instantly it was a tremendous flame, which ascended 200 feet in the air, nearly a mile up and down the stream. I saw limbs of trees, which were nearly 100 feet high, burnt off as smooth as if the blaze of a furnace had struck them."

Previous publications, as well as the Ohio Historical Marker, state that the current well is the second Thorla-McKee well. The first well, drilled in 1814, was covered up shortly after it was dug. Two years later, in 1816, a second well was dug near the site of the first well, and the 1816 well is the well preserved at the present location.

This may explain some of the discrepancies in the depth of the well – various accounts have the well between 200 and 500 feet deep.

In the early 1920s, children on their way to school would stop at the well and fill a tin with oil. They would give the tin of oil to the school janitor, who would use it to start the morning fire for heating the school.

* * *

A visit to the well today finds the oil-permeated stump still in place, partially protected by a chain-link fence. The historical area is in need of yearly maintenance, as the nearby creek commonly floods in the spring, damaging the wooden ties that brace the fence.

A sheen of oil on the water-filled stump and an occasional gas bubble attests to the continuous migration of hydrocarbons to the surface.

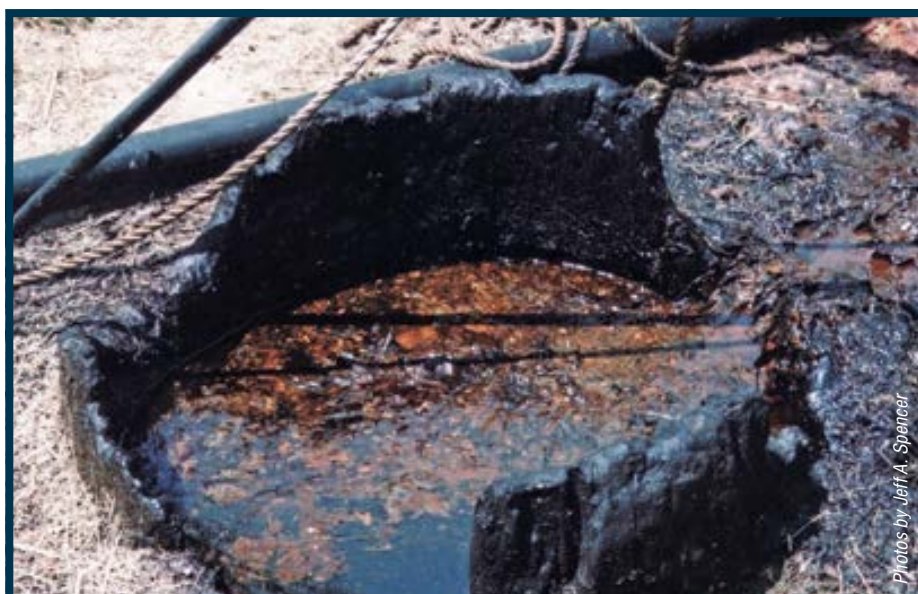
I collected a sample of the oil and water

in May 2007. An analyzed oil sample shows similarities to other oils in the region that were generated from the organic-rich Upper Devonian Ohio Shale. The API gravity of the oil was estimated to be 27.7 based on composition.

The small town of Macksburg is located approximately 10 miles south of the Thorla-McKee well, in Washington County. In 1860, a year after Pennsylvania's Drake well, this area became the center of activity for the first of several Duck Creek oil booms.

The well generally recognized as the discovery well for the Macksburg oil field was drilled on a William Rayley's land by James Dutton, Alden T. Warren and John Smithson, on the bank of Duck Creek a half-mile south of Macksburg.

The wellsite location probably was influenced by swimmers in Duck Creek, who would emerge with a film of oil on their bodies, presumably from a nearby oil seep. [E](#)



Photos by Jeff A. Spencer

The Thorla-McKee well with its sycamore surface casing.

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5-D Interpolation Compensates for Poor Sampling

By DANIEL TRAD

Three-D seismic surveys always suffer from poor sampling along at least one spatial dimension – that's why many techniques have been developed over the years to interpolate data, in particular before final migration.

Five-dimensional (5-D) interpolation is a wide umbrella covering methods that simultaneously interpolate all space dimensions – and although it is not possible to get the same quality from interpolated traces as the traces recorded in the field, 5-D interpolation has proven to be quite successful.

This is reflected in its application in increasingly challenging scenarios with more demanding requirements.

A few years ago interpolation was used to remove sampling artifacts in the stacked image from pre-stack migration; today it is used to improve amplitude analysis in common image gathers and time-lapse studies, which are much more demanding.

Although there are many implementations and flavors, the most commonly used algorithms for 5-D interpolation are based on Fourier transforms. They exploit two facts about seismic data:

- First, wavenumbers can only take a limited bandwidth along each dimension.
- Second, in the wavenumber domain, energy from wavefronts is focused but energy produced by sampling artifacts are spread everywhere.

Interpolation is simply achieved by removing low amplitude energy in the wavenumber domain – with the constraint that the signal has to be well-preserved.

Differences with Interpolators

The breakthrough on 5-D interpolation with respect to previous lower dimensional interpolation algorithms is that information in different dimensions is connected.

For example, a gap in the azimuth sampling for one common midpoint (CMP) can be infilled properly if neighboring CMPs have sampled those missing azimuths.

In addition, the wavefront curvatures in the five-dimensional seismic volume (e.g. inline, crossline, offset, azimuth, frequency) are smoother than when we look at one dimension in isolation. The physics of the wave propagation imposes restrictions on the 5-D volume that are violated by sampling artifacts and noise, so enforcing these restrictions automatically predict information on areas where there is no recorded information.

These restrictions are band limitation and smoothness in the spectrum.

Although in practice we can only approximately enforce these constraints, interpolation algorithms often achieve their goal beyond expectations. This is possible because predicted traces do not need to be perfect to help migration algorithms.

Although traces created from data interpolation contain only a portion of the information that a real acquired seismic trace would have, this is usually all a migration algorithm will keep after moving and stacking millions of samples.

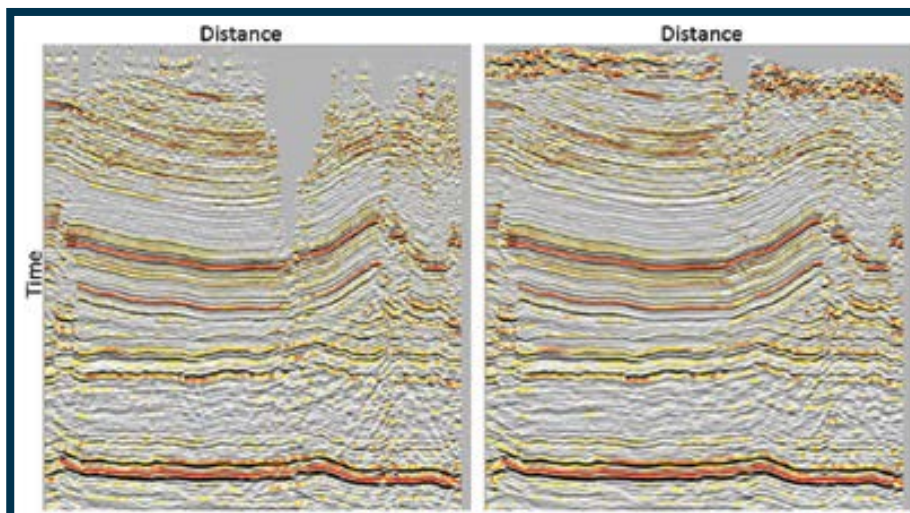


Figure 1 – Prestack time migration for a land data set in the Marcellus area without (left) and with (right) 5-D interpolation.

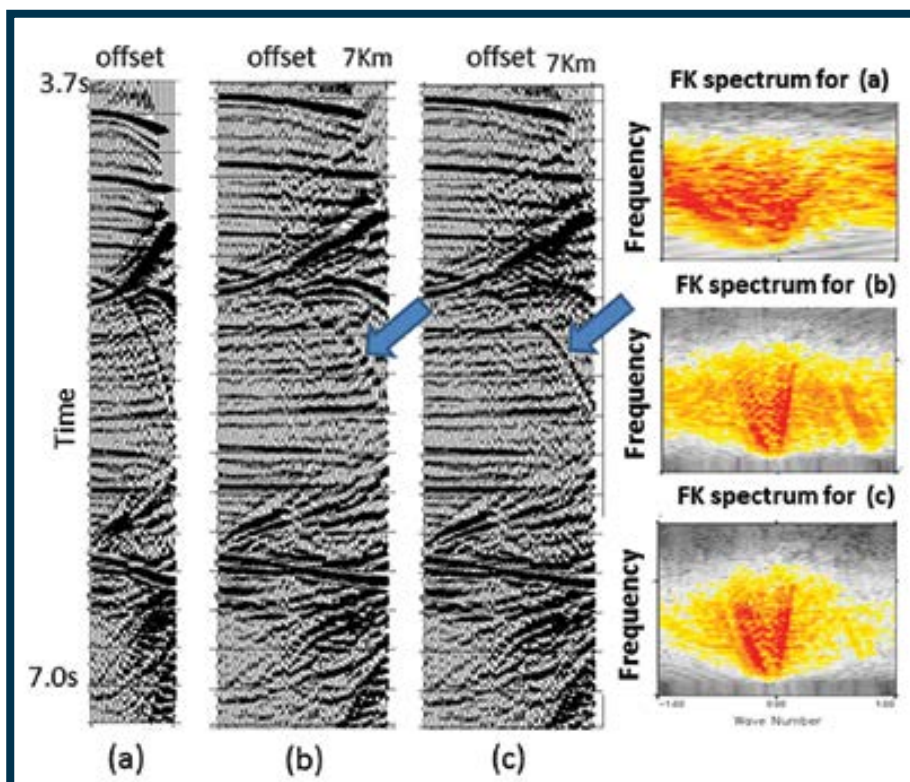


Figure 2 – Synthetic CMP gather from data regular along all dimensions from a complex salt environment with aliasing in all directions. This regular (but unrealistic) scenario causes 5-D interpolation to fail on the high move-out multiples (b), although a small irregularity in binning helps to unwrap aliasing (c).

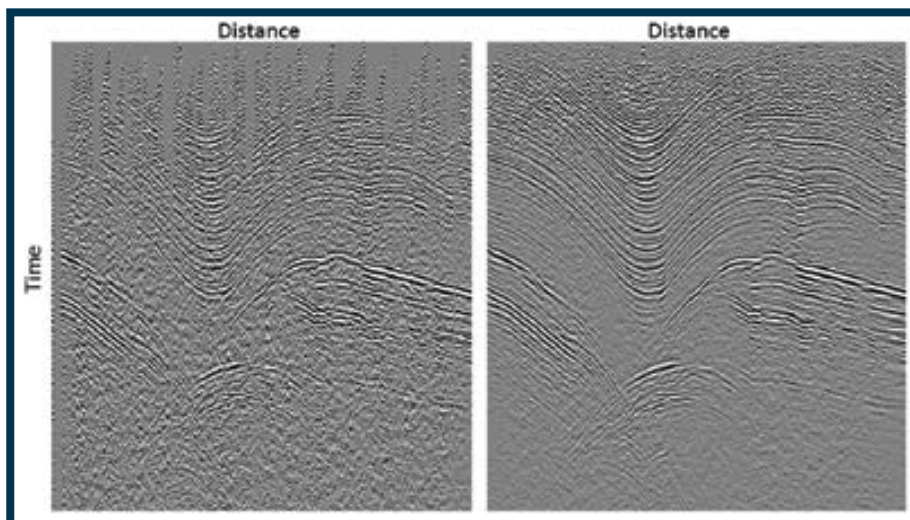


Figure 3 – Limited-azimuth sector stack for a land data set before (left) and after (right) 5-D interpolation, showing preservation of diffractions in a complex environment.

Figure 1 shows a prestack migration result with and without 5-D interpolation. The migration result has clearly improved with interpolation even when the added data do not agree exactly with the

unrecorded samples.

In many aspects, 5-D interpolation is easier than working on fewer dimensions. For example, this happens when dealing with aliasing, which is the

misidentification of high frequency data using lower frequency components. A signal that appears aliased in one dimension may not be aliased in another, and aliased frequencies in multi-dimensions may not overlap in the multidimensional spectra, so it is usually possible to separate them by applying constraints.

As a consequence, 5-D algorithms can get around aliasing more easily than lower dimensional interpolators by filtering lower temporal frequencies and carrying information about the localization of wavenumbers to higher temporal frequencies.

Furthermore, aliasing is more problematic when spatial samples are located on regular grids – but this never happens in five dimensions.

Figure 2 shows a synthetic case from a complex salt environment, which is more difficult than most real scenarios because it has regular sampling and aliasing in all dimensions.

In this case the use of standard band limitation plus an artificial sampling perturbation to the interpolation grid helped to interpolate beyond aliasing.

In practice, all land surveys have irregularity at least along offset and azimuth directions, and therefore are much easier to interpolate than this example.

5-D Interpolation in Practice

An area where 5-D interpolation has been seen to be very useful is in merging surveys acquired with different designs and sampling parameters. The mapping of actual spatial sampling to a multidimensional wavenumber domain provides the opportunity for seamless merging of different types of acquisitions.

For the same reason it has proven very useful for 4-D studies, although less has been published on this application, mostly for confidentiality issues.

However, there are many complications that often compromise the quality of 5-D interpolation results.

Its main assumption – that is, sparseness of plane wave events – is not totally realistic. To fulfill it, algorithms work on windows with appropriate overlap and size. Each window typically contains thousands of common midpoints, hundreds of offset bins and several dozens of azimuths.

► If these windows are too small, there are not enough traces to interpolate from.

► If the windows are too big, interpolation may not converge, either because events become too complicated and break the sparseness assumption, or because the optimization problem becomes too large for the algorithm to converge in reasonable time.

Diffractions are particularly good indicators of interpolation problems, and tend to be the first feature of the data to be affected by poor amplitude preservation. It is crucial to properly preserve diffractions in complex structures and techniques to evaluate the quality of interpolation through proper prediction of diffractions have been proposed.

Figure 3 shows a limited-azimuth

Continued on next page

Comprehensive Technical Program Gave Istanbul ICE World-Class Status

A world-class conference was set in one of the world's great cities this fall as AAPG for the first time held its annual International Conference and Exhibition (ICE) in Istanbul, Turkey.

About 1,400 participants attended and enthusiastically applauded the meeting's technical program, which centered on the theme "The Spirit Between Continents: Energy Geoscience in a Changing World."

The meeting started with a standing-room-only plenary session that addressed "Technical Innovation and Collaboration – Keys to Affordable Energy," moderated by Adif Zulkifli and AAPG Honorary member Pinar Yilmaz.

Other highlights of the technical

program included special memorial sessions that honored the work and legacy of acclaimed geoscientists Peter Ziegler (regional tectonics) and Dave Roberts (exploration in frontier areas).

Adding to the excitement surrounding the Istanbul technical program – a theme that attracted a record-breaking 820 abstracts – was the 11th installment of the Discovery Thinking Forum, an initiative of the AAPG 100th Anniversary Committee that recognizes "100 Who Made a Difference" in exploration.

The conference got off to an exciting start with an opening session led by ICE general chair Volkan S. Ediger and featuring remarks from AAPG President Randi Martinsen, who said the gathering


offered "the latest and best of cutting edge geoscience, technology and business opportunities, all under one impressive roof."

Martinsen also spoke of AAPG's continued globalization, citing data and demographics that add up to non-U.S. members now comprising more than 40 percent of AAPG's total membership.

"But you don't need to know all of the statistics to support the reality of AAPG's global outreach – all you need to do is look around this room, and around this conference over the next three days," Martinsen said. "Look at the diversity that we now represent, both demographically and in terms of our disciplines."

"And that's a big reason why I'm proud to be here, as AAPG president, participating in a meeting that is yet one more step in our efforts to continue making our place in the world – and, importantly, to have the world continue to be a growing influence in the story of AAPG," she said.

"We know if we find and promote the best science that 'people' will come to AAPG," she said. "And they, in turn, bring to the Association new knowledge, new perspective, new energy, new results, all of which keep AAPG an indispensable part of a geoscientist's career."

AAPG's next ICE will be held Sept. 13-16, in Melbourne, Australia. 

Continued from previous page

stack on a complex area before and after interpolation where preservation of diffractions has been essential.

Another aspect that often deteriorates results is noise.

In principle, random noise does not affect interpolation, because algorithms can only predict coherent energy.

Coherent noise, on the other hand, can barely be distinguished from amplitude variations and data complexity, unless strong assumptions are imposed. An interpolator designed to attenuate coherent noise could fail to preserve amplitudes on poorly sampled complex data.

Only by introducing additional information and strong assumptions about the data can the algorithm be made robust to noise.

Current Work and Trends

Five-D interpolation has become a mature technique in the last decade because of its extensive use for wide-azimuth surveys. There are, however, many unsolved issues and a large effort has been made worldwide to develop new algorithms and solutions.

A general trend has been to reduce issues related to binning by using algorithms that can handle exact coordinates. These methods require special care in the use of weights to handle amplitude preservation, but they are becoming easier to use and more flexible.

Another trend is to use more information by handling two versions of the data either for noise attenuation or for multicomponent data.

Finally, new techniques like least-squares migration attempt the use of basis functions that can capture geological information.

Although these techniques can be very expensive from the computational point of view, they have the advantage of including the physics of wave propagation, and therefore may allow geophysicists to go beyond 5-D interpolation.

(Editor's note: Daniel Trad is a research geophysicist for CGG in Calgary, Canada. His main areas of research have been signal processing, interpolation and, more recently, least squares migration for multicomponent processing. He received the 2011 Canadian Society of Exploration Geophysicists technical achievement award for his work in five-dimensional interpolation.)

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Pacific Section Convention Call for Abstracts

May 2-6, 2015 Mandalay Beach Embassy Suites,
Oxnard, California

The Pacific Sections of AAPG, SEPM, and SEG invite your submittals for oral and poster presentations at <http://psaapg.org/2015-call-for-abstracts>. We plan a broadly themed, high-quality technical program highlighting the geosciences' role in resource applications and environmental stewardship. Present your work and participate in a great line-up of field trips, core workshops, and short courses.

- California Reservoirs: Exploration to EOR
- Monterey Formation Challenges
- Clastic Sediments: Stratigraphy, Depositional Environments, and Source-to-Sink
- Structural Geology, Faults, and Earthquakes
- Advances in Seismic Imaging and Applications
- Integrating Petrophysics and Geoscience
- Water Resources: Geoscience Applications
- The New World: Navigating the Politics and Ever-Changing Regulations
- Alternative Energy

Hosted by the Coast Geological Society. Email
Jon Schwalbach at psaapg2015@gmail.com for
questions about the technical program.



FOUNDATION UPDATE

Professorial Award

Nominations Sought

By APRIL STUART, AAPG Foundation Program Coordinator

Nominations for the AAPG Foundation Professorial Award, presented annually to a college or university professor who demonstrates outstanding leadership in the field of geoscience education, are now being accepted.

The Foundation award is intended to put a spotlight on "Excellence in Education" by honoring professionals who inspire and shape the minds of future geoscientists – and therefore, the future of geoscience.

Student and faculty nominations are accepted for this award, and professors are encouraged to apply on their own behalf.

The Professorial Award winner will receive a \$1,000 award, recognition at AAPG's Annual Convention and Exhibition (ACE), and a beautiful commemorative plaque acknowledging the achievement.

Applications are due Feb. 1.

For more information or to make a nomination, go online to foundation.aapg.org/programs/.

MVSP Update

The Foundation also is continuing its drive to help veterans of the U.S. military – and their families – when they leave

the service and seek a career in the geosciences.

The Foundation's Military Veterans Scholarship Program, approved almost two years ago by the AAPG Foundation Trustees, has received contributions from many generous donors and volunteers who sought to provide financial aid for U.S. military veterans who want to advance their education by pursuing a degree in the geosciences.


The Foundation has raised more than \$425,000 – and heard from dozens of interested veterans, eager to participate when the program launched.

Now, we need others to step forward to grow this fund to support our dedicated service members.

We would like to be part of that effort by making a contribution to this important and worthy program.

A gift of \$50,000 will enable the Foundation to annually award a \$2,000 scholarship named on your behalf to a veteran in need for years to come.

Any and all amounts are greatly appreciated. Together we can encourage highly skilled veterans to enter fields of geoscience and enhance the field for us all.

More information can be found online, at foundation.aapg.org. 

Foundation Contributions for October 2014

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


AAPG | Geosciences Technology
Asia Pacific Region Workshops 2015

Modern Depositional Systems as Analogues for Petroleum Reservoirs

21-23 April 2015 | Wellington, New Zealand
Make plans to attend AAPG's first GTW in New Zealand.

Preliminary program outline:

1. Terrestrial Systems
2. Coastal and Marginal Marine Systems
3. Deep Water Systems
4. Integration and Applications

Confirmed Keynote and Technical speakers include:
Bruce Ainsworth (Chevron); Charles Paull (Monterey Bay Aquarium Research Institute); John McPherson (SED & RQ Pty Ltd); Dale Leckie (Canadian Society of Petroleum Geologists); Joe Lambiasi (Chulalongkorn University); Philip Barnes (NIWA); Greg Browne (GNS Science).

Optional Field Trip to Wairarapa and Optional Core Workshop set for 23 April (Day 3).

Who should attend?
Geoscience professionals engaged in exploration, appraisal, development and production of clastic oil and gas reservoirs; researchers and academics interested in sedimentary and petroleum geology; reservoir modellers.

For more information please email:
Adrienne Pereira, Programs Manager, AAPG Asia Pacific (apereira@aapg.org)

For more information on AAPG Asia Pacific Region events, visit our website:
aapg.org/events/event-listings

Sudden Impact

Your year-end contributions will help those who need it most.



United States Military Veterans Scholarship Program

Our goal with this important initiative is to enable veterans who are returning to civilian life with the opportunity to pursue a geoscience education – and potentially establish a career in the oil and gas industry.



Education Fund

The Education Fund provides K-12 earth science teachers with the resources they need to inspire young geoscientists, one educational initiative at a time.



L. Austin Weeks Undergraduate Grant Fund

Generously initiated by the late L. Austin Weeks and Marta Weeks-Wulf, this fund supports undergraduate geoscience students by helping with tuition and book expenses, field trips, exploration equipment and student-led activities.



Distinguished Lecture Fund

Distinguished Lecturers travel around the world to share their expertise and the latest findings, concepts and developments about geoscience.



Visiting Geoscientist Fund

This program supports and promotes professional advancement by bringing real world industry experience into the college classroom.



Grants-in-Aid Fund

Thanks to this program's many generous donors, master's and doctorate level students receive financial support for their lab and field research in earth science, from paleontology to stratigraphy.

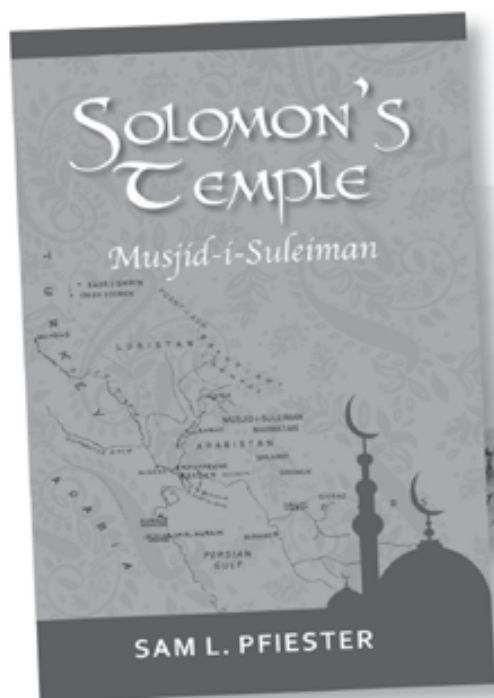
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PROTRACKS



YP activities at the recent Leadership Summit in Snowbird, Utah, included a field trip in Little Cottonwood Canyon's Albion Basin.

YP Leadership Summit Improving Retention, Engagement

By MEREDITH FABER, Young Professionals Committee Co-Chair

YP initiatives reached new heights this past August as young professionals met in Snowbird, Utah, for the fifth annual Young Professionals Leadership Summit (YPLS).

The two-day event, which immediately preceded AAPG Leadership Days, brought together 20 YPs from various Sections and Regions and a variety of companies to discuss how to improve student retention after graduation and how to keep students and YPs engaged in AAPG.

The attendees, who were a mix of Region and Section YP leads and local YP chapter members, were tasked by YPLS facilitators Jonathan Allen (Chevron) and myself, and the committee co-chairs with identifying not only what AAPG currently offers to YPs, but also what YPs really want from the Association.

In addition to networking, conventions, educational resources and career services – which were identified at past summits as the core elements of AAPG's value proposition – the attendees listed as the principal benefits AAPG delivers to YPs as being:

- ▶ Professionalism.
- ▶ Leadership skills.
- ▶ A diverse knowledge base.
- ▶ Company influence.

In terms of addressing needs and the services that would make AAPG more attractive to YPs – and which



FABER

would provide steps toward development of a "YP identity" within AAPG – the attendees named:

- ▶ Professional development courses.
- ▶ Mentorship and career counseling.
- ▶ The formation of a YP Special Interest Group (SIG).
- ▶ YP involvement in

education courses.

▶ An expansion of educational opportunities internationally (such as through the Visiting Geoscientist Program).

▶ YP discounts on Continuing Education courses.

The main outcome of these discussions was the fact that we, as YPs, need to articulate the value proposition of being a member of AAPG and emphasize that it has changed.

To improve retention, the Association needs to change too.

The YPs also focused on developing strategies to address issues specific to the Sections and Regions in a freeform discussion with members of Section and Region leadership.

This exchange segued into the final session of YPLS – a joint meeting convened by the Student Focus Chairman's Committee. In this session, the YPs met with the Student Chapter liaisons attending the Global Student

Continued on next page

Those attending the Young Professional Leadership Summit in Snowbird, Utah, were:

▶ Asia Pacific Region – Low Wan Ching (Petronas) and Junlong Liu (China University of Petroleum, Beijing).

▶ Canada Region – Robynn Dicks (Shell Canada) and Russ Phillips (Associate, Calgary).

▶ Eastern Section – Merrill Stypula (EQT) and Michael Jarvis (Range Resources).

▶ Europe Region – Tan Chun Hock (Talisman-Sinopec).

▶ Gulf Coast Section – Hunter Lockhart (BHP) and Sean Kimiagar (Halliburton).

▶ Latin America Region – Juan

Carlos Quinto (BPZ) and Nashomi Belfon (University of the West Indies, St. Augustine).

▶ Middle East Region – Aisha Bulushi (Petroleum Development Oman) and Marwa Alkhalaf (Saudi Aramco).

▶ Mid-Continent Section – Joe Voyles (Chesapeake).

▶ Pacific Section – Anne Draucker (Chevron).

▶ Rocky Mountain Section – Nicholas Nelson (Samson) and Ryan Thompson (Apache Corp.).

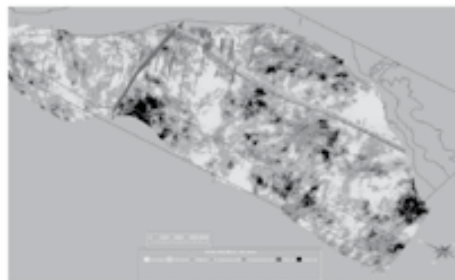
▶ Africa Region – Mimonitu Opuwari (University of Western Cape).

AAPG Geosciences Technology Workshops 2015

Opportunities and Advancements in Coal Bed Methane in the Asia Pacific

12-13 February 2015
Brisbane, Australia

Make plans to attend this first
AAPG GTW in Australia



Preliminary program outline:

1. Introduction & Regional Overviews
2. Understanding the Complexity of CBM plays
3. Characterising Complex Coal and Coal Inter-burden Geology
4. Advances in Well, Completion and Stimulation Technologies
5. Characterising, Predicting and Managing Produced Water
6. CBM Grand Challenges

Over 25 technical papers from across the Asia Pacific region, covering fundamentals of CBM-related play and reservoir geology, completion/stimulation engineering and water management will be presented by representatives of over 11 companies and 6 research institutions. Members will also participate in a session defining and discussing CBM-specific 'Grand Challenges'

For more information, contact Adrienne Pereira (apereira@aapg.org)

Who should attend?

Geoscientists, petroleum and well engineering professionals engaged in CBM/CSG exploration, appraisal, development and production for coal bed methane; researchers and academics in coal geology and hydro-geology, production technologists and reservoir modellers.

1-day course on Wednesday 11 February 2015 by Dr Ray Johnson (UQ Hon. Fellow and Principal at Unconventional Reservoir Solutions), on "CBM Stimulation- What Every Geoscientist Should Know about Fracturing Design, Execution, and Evaluation for CBM reservoirs!" Interested parties should contact Ms Leigh Humberdross (lhumberdross@uq.edu.au) before 15 December 2014.

To register, or for more information on AAPG Asia Pacific Region events, visit our website:

www.aapg.org/events/event-listings

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POSITION AVAILABLE

Department of Geology and Geophysics College of Geosciences Texas A&M University

To significantly advance research and instructional excellence in basin tectonics and analysis, the Department of Geology and Geophysics invites applications for a tenure-track and/or tenured position. We seek applicants whose interest is in lithospheric controls on basin formation, structural architecture of basins and application of sequence stratigraphy to understand basin formation mechanisms. The applicant must have a research background in tectonics/structural geology and a demonstrable record of integrating geological and geophysical data. Candidates research interests and expertise should broaden and complement existing strengths in the Department of Geology and Geophysics and in particular contribute and enhance research programs in petroleum studies and basin modeling conducted through the Berg-Hughes Center for Petroleum and Sedimentary Systems. The candidate will have the opportunity to collaborate with colleagues in a variety of related fields in the College of Geosciences that include the Center for Tectonophysics and the International Ocean Discovery Program (IODP), among others.

The academic appointment will be for nine-months, tenure track or tenured position, and is expected to be at the assistant, associate, or full professor level. Candidates with suitable qualifications may be considered for appointment as full professor, and a possible endowed chair.

Applicants should demonstrate a strong record of scholarship and the potential for developing an internationally recognized research and teaching program. The candidate will be expected to teach effectively at the undergraduate and graduate levels in his or her specialty and to supervise undergraduate, M.S. and Ph.D. research. For more information about Texas A&M University, the College of Geosciences and the Department of Geology and Geophysics, see: <http://geoweb.tamu.edu>.

A Ph.D. is required, and the appointment may begin Sept 1, 2015 or earlier. Review of applications will begin September 1, 2014 and will continue until a suitable candidate is found. Applicants should submit a PDF including a letter of application, curriculum vita with details of published work, a statement of research and teaching interests, and contact information (including e-mail address) for at least four references to Dr. Carlos A. Dengo at cdengo@tamu.edu; questions may be directed to the same e-mail address.

Texas A&M is a land, sea and space-grant university located in a metropolitan area with a dynamic and international community of - 200,000. Texas A&M is an affirmative action / equal opportunity employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. We encourage

applications from minorities, women, veterans and persons with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners. (<http://employees.tamu.edu/jobs/careers/dcsdetails.aspx>).

Position: The TCU School of Geology, Energy, and the Environment (SGEE) invites applications for the new Hunter Enis Chair in Petroleum Geology. The position is for a Professor of Professional Practice (PPP) with a goal of preparing students for careers in the petroleum industry. The position begins no later than the Fall 2015 semester. The new Hunter Enis Chair will be responsible for teaching petroleum geology related courses, developing an externally funded research program and supervising undergraduate and graduate student research. A working knowledge of industry-standard software used in subsurface mapping and geophysical well log analysis is also required. Applicants should have mid-career petroleum industry experience in petroleum exploration and production, or the equivalent in teaching petroleum geology in academic institutes. This position would be closely associated with the Energy Institute and will be expected to utilize the TCU Core Facility to maintain relationships and honor the requirements of the core donors. The normal teaching load is one upper-level course per semester comprised of new classes generated by the successful applicant in addition to coordinating adjunct faculty from industry to teach other courses. TCU operates on a teacher-scholar model. Faculty are expected to excel in the classroom, seek external funding, and maintain a vigorous student-involved research program. There will be an ongoing emphasis on communication with students, alumni, community, and donors.

School of Geology, Energy, and the Environment (SGEE): We are housed in the College of Science & Engineering at TCU (<http://www.tcu.edu/>). Our School merges several academic programs and research facilities to create unique educational and research opportunities for students and faculty, ranging from traditional degree paths in geology and environmental science to broader multidisciplinary options in energy and environmental resource management. The School presently has 15 faculty members, additional adjunct faculty from industry and other backgrounds, 40 graduate students, and 200 undergraduates. SGEE houses the Institute for Environmental Studies, the Center for GIS and Remote Sensing, and the Monnig Meteorite Gallery. It is also closely associated with the Core Facility and The TCU Energy Institute. For more information about our School and these associated academic and research programs, please visit our websites listed at <http://www.cse.tcu.edu/>.

Applications: The PPP position will be filled at the senior level. A Ph.D. is not required Salary will be commensurate with experience and

See Classified Ads, page 52

Continued from previous page

Chapter Leadership Summit (SCLS) and members of AAPG leadership to evaluate and brainstorm ways to improve the Visiting Geoscientist Program, the Grants-in-Aid Program and the Imperial Barrel Award Program.

However, the YPs' stay in Snowbird wasn't all work and no play – the YPs participated in several events, including a sundowner social where they made s'mores; a stargazing party where they admired the supermoon; and the many activities the Snowbird Resort has to offer. The highlight of the weekend was a hike to Cecret Lake in Little Cottonwood Canyon's Albion Basin, led by Ron A. Harris of Brigham Young University.

The YPC would like to formally thank the attendees, AAPG leadership and AAPG staff for making the 2014 YPLS possible.

Since August, the YPC already has been working hard to begin implementing initiatives based on YPLS input:

- ▶ We've updated our website – and hope to add more features soon.
- ▶ We're working with the Education Committee on a YP teaching assistant

concept and a teaching techniques short course for new instructors.

▶ We're currently seeking approval to distribute another YP survey to gauge how well our programs are reaching the YP demographic.

▶ We're collaborating with the Visiting Geoscientist Program Committee to encourage YPs to participate.

▶ We're assisting AAPG's GEO-DC office in getting YPs involved with the Geoscience and Energy Policy Office and its activities.


▶ We're meeting with the DPA to offer a YP perspective on professionalism.

▶ We're promoting the idea of a YP SIG – and discussing the possibility with the House of Delegates.

The success of this year's YPLS has generated considerable enthusiasm for YP programs, and the YPC hopes to use that momentum to make next year the best we've ever had.

See you in 2015!

* * *

Want to become more involved with the YPs in your Section or Region? Visit our website at aapg.org/youngpros, and contact your Section or Region representative. 

The Alaska Geological Society offers scholarship awards to graduate and undergraduate students who are conducting geoscience research projects in Alaska

including

Alaska Geological Society Scholarships
The Don Richter Memorial Scholarship



Scholarship information and applications are available online at **www.alaskageology.org**

The Alaska Geological Society, Inc.
P.O. Box 101288
Anchorage, Alaska 99510

*The Alaska Geological Society is a 501c3 nonprofit organization
Donations to these scholarship funds are tax deductible*

SAVE THE DATES

AN AAPG GEOSCIENCES TECHNOLOGY WORKSHOP

International Shale Plays 28-29 April 2015 – Houston, TX

All shale plays are different, and all shale plays shed light on other shale plays. Join experts to discuss world shale plays and share the "lessons learned" in dealing with a wide variety of lithologies, reservoir conditions, and degrees of heterogeneity. Find out the "must have" technologies and the emerging ones that are helping identify sweet spots, improve drilling and completion, and to return to the laterals and optimize the reservoir by launching a strategy of stacked pays and "stranded pay capture." Join experts who will share their experience and research findings in plays in Argentina, Colombia, China, Australia, Mexico, and other countries. We will compare them to analogues in North America with the goal of improving success rates in exploration, and optimizing production from existing and new reservoirs.



aapg.org/career/training/in-person/workshops

A JOINT AAPG-STGS GEOSCIENCE TECHNOLOGY WORKSHOP

Fourth Annual Eagle Ford Shale 9-11 March 2015 - San Antonio, TX

The Eagle Ford is by no means uniform, and understanding just why, where, and how it produces is of critical importance as we enter new phases of the exploration and development. Join us to learn how to best identify areas of differential enrichment and accessible porosity, and exactly how to use new technologies to detect fracture networks, sweet spots, ideal pressure, to develop effective drilling and completion programs within existing plays, and to push the frontier in the Mexican equivalents of the Eagle Ford. Learn how new drilling and completion techniques are being used to reduce costs and to optimize production. Key words: fractures, pressure, geochemistry, whipstocking, proppant and fluid program design, stimulation.



aapg.to/eagleFord2015



Classified Ads from page 51

qualifications of the successful applicant. TCU is an EEO/AA employer and encourages a diversity of applicants. Review of applications will begin immediately and continue until the position is filled. All application materials and supporting documents (letter of application, statement of teaching and research interests, current vita, and 3 letters of recommendation) must be submitted online at https://tcu.igreentree.com/CSS_faculty. The letters of recommendation should be sent to j.curry@tcu.edu.

The Department of Geology and Geophysics at Texas A&M University invites applications from individuals for a tenure-track faculty position as assistant professor in Carbonate Sedimentology/Stratigraphy. The position begins August 2015.

We seek candidates who will develop an externally-funded research program in the general area of Carbonate Sedimentology/Stratigraphy. This includes but is not limited to one or more of the following research topics: sequence stratigraphy, the sedimentary record of long-term climate change, depositional processes, and diagenesis. We seek applicants with strong potential to collaborate with current faculty as well as potential to interact with the Integrated Ocean Drilling Program and the Berg-Hughes Center for Sedimentary and Petroleum Systems, both housed within the College of Geosciences at Texas A&M, and the Department of Petroleum Engineering at Texas A&M.

Applicants for the position must have a Ph.D. at the time of appointment. Post-doctoral research and teaching experience and past experience in the petroleum industry are desirable traits for this position. A record of research in both ancient and modern carbonate systems is preferred. Successful applicants will be expected to teach effectively at the undergraduate and graduate levels in their specialty, including classes in the Petroleum Certificate curriculum <<http://petro.tamu.edu>>; supervise undergraduate, M.S. and Ph.D. research, including students who are interested in pursuing careers in the petroleum industry. The successful candidate will be expected to initiate and maintain a vigorous, externally funded research program. Opportunities exist to participate in and build on collaborative

programs with colleagues in isotope geochemistry, seismic methods, photogrammetry and GPS in the College of Geosciences.

Interested candidates should submit electronic versions of a curriculum vita, statement of research interests and teaching philosophy, the names and email addresses of at least three references, and up to four reprints by email attachments, to the Chair of the Sedimentology Search Committee (sedsearch@geos.tamu.edu). Screening of applications will begin December 1, 2014 and continue until the position is filled. The Department of Geology and Geophysics (geoweb.tamu.edu) is part of the College of Geosciences, which also includes the Departments of Atmospheric Sciences, Geography, and, Oceanography and Sea Grant, the Geochemical and Environmental Research Group (GERG), and the Integrated Ocean Drilling Program (IODP). Texas A&M University, a land-, sea-, and space-grant university, is located in a metropolitan area with a dynamic and international community of 172,000 people. Texas A&M University is an affirmative action/equal opportunity employer committed to excellence through the recruitment and retention of a diverse faculty and student body and compliance with the Americans with Disabilities Act. We encourage applications from minorities, women, veterans, and persons with disabilities. Texas A&M University also has a policy of being responsive to the needs of dual-career partners.

The Department of Earth and Space Sciences at Lamar University is seeking a faculty member to join our department. The applicant must be qualified to teach and conduct research in stratigraphy and sedimentology, as well as teach geomorphology. The candidate will also be expected to lead annual field camps. The tenure-track position is at the Assistant level. The department has been growing in its number of baccalaureate majors and also serves a substantial general education teaching mission for other disciplines.

A Ph.D. in geology with a specialization in stratigraphy and sedimentology is required, along with qualifications supporting appointment at the level of Assistant Professor at Lamar University. Applicants must have a record of, or at least a demonstrated potential for, teaching, research, external funding, and publication. The candidate is expected to develop a vigorous externally funded research program. Ties with industry, federal, and

State agencies is also desirable. Field experience, excellent inter-personal and communication skills, and the ability to teach courses in geology at all levels are also required. Salary and start up package will be commensurate with education and experience.

Submit letter of application, resume, three letters of recommendation, and transcripts covering all academic work to the following address: <https://jobs.lamar.edu>. Please reference position number #499699.

If letters of recommendation cannot be uploaded to the application, please send them to:

Lamar University
Human Resources Office
P.O. Box 11127
Beaumont, TX 77710

ASSISTANT PROFESSOR IN GEOPHYSICS CONOCOPHILLIPS SCHOOL OF GEOLOGY AND GEOPHYSICS MEWBOURNE COLLEGE OF EARTH & ENERGY UNIVERSITY OF OKLAHOMA

The University of Oklahoma invites applications for a tenure-track position in Geophysics at the rank of Assistant Professor. The school has a strong seismic program and is looking for a faculty member to broaden the scope of the program in non-seismic methods. We seek a dynamic colleague who will teach and supervise students at all levels, while conducting an independent, externally funded research program in his/her field of expertise.

The candidate should hold a Ph.D., have a demonstrated research record, and an interest in teaching undergraduates and mentoring graduate students. Potential areas of interest include gravity, magnetics, electromagnetics, and GPS applied to crustal processes. Salary, benefits, and start-up funds will be competitive and commensurate with experience. The ConocoPhillips School of Geology and Geophysics has a large, vibrant faculty with a broad range of research activities and strong ties to the petroleum industry. The student body currently includes 182 undergraduates and 110 MS and PhD students. The Mewbourne College of Earth & Energy possesses extensive software and computing labs with PC and Linux platforms networked to our own dedicated cluster within the OU supercomputer center (OSCER). The College

hosts numerous industrial consortia, a research institute focused on seismic monitoring, and a field campus in Colorado for field courses in geology and geophysics. The geophysics group conducts active research projects that are funded by industry as well as by U.S. and foreign government agencies and institutes. The College maintains a comprehensive pool of geophysical equipment including GPR, seismic (active and passive), magnetic, and gravity instruments as well as extensive rock physics characterization laboratories. Through collaboration with industry, we have a suite of 3D seismic and microseismic data volumes that are used for teaching, algorithm calibration, seismic geomorphological analysis, crustal imaging, and a range of open source software for lithospheric-scale research. Information about the School and College, the facilities and the entities that it houses can be found at <http://geology.ou.edu>.


Review of applications will begin December 1, 2014, and on-campus interviews will start early in 2015. The search will continue until the position is filled. The anticipated starting date is August 15, 2015. Applicants are requested to submit a complete vita/resume, statement of research and teaching interests, and a list of five references who can be contacted, including phone numbers, e-mail addresses, and mailing addresses. Questions or information requests may be addressed to Chair of the Geophysics Search Committee, at (405) 325-3253, or ougeophysicssearchchair@ou.edu. Applications and nominations should be addressed to Geophysics Search Committee, University of Oklahoma, Sarkeys Energy Center, 100 E. Boyd Street, Room 710, Norman, OK 73019-1008.

The University of Oklahoma is an Affirmative Action, Equal Opportunity Employer. Women and minorities are encouraged to apply. Protected veterans and individuals with disabilities are encouraged to apply.

Assistant Professor in Geoscience Colorado State University


We seek to fill a 9-month tenure-track appointment to strengthen our offerings in Petroleum Geosciences. The preferred start date is August 2015. Requirements are a Ph.D. in geology or a

Continued on next page


AAPG | Geosciences Technology Workshops 2015
Asia Pacific Region

Tectonics and Sedimentation of South China Sea Region

26-27 May 2015
Kota Kinabalu, Sabah, Malaysia
28 May 2015 (possible field trip)



Make plans to attend the AAPG GTW in Kota Kinabalu

Potential speakers:


- Chris Morley (Chiang Mai University – Thailand)
- Robert Hall (Southeast Asia Research Group – Royal Holloway – UK)
- Robert Morley (Palynova – Indonesia)
- Claude Rangin (CNRS – France)
- Shu Jiang (EGI – Utah)
- Pinxian Wang (Tongji University – Shanghai – China)
- Chun-Feng Li (Tongji University – Shanghai – China)
- Michael B. Fyhn, Michael Bryld Wessel (GEUS – Denmark)
- Jian Lin (Woods Hole Oceanographic Inst. – USA)
- Awang Satyana (SKKMIGAS – Indonesia)
- Manuel Pubellier (CNRS-France)

South China Sea region is a tectonically complex area and gains strong interest for different geoscience research projects for many years. The sedimentary basins developed in the margin of this region also are tectonically controlled. Different theories and concepts were introduced to explain the geology of the area. Limited data may constrain the development of the geological understanding of the region.

This workshop will bring key knowledge holders of the region and give the opportunities to those who are interested to exchange ideas. The objective of the workshop is to provide a big picture of the geology of the region, understand the knowledge gap and hopefully provide a steer for future research projects.

For more information on AAPG Asia-Pacific Region events, visit our website:

aapg.org/events/event-listings


VirginiaTech
Invent the Future

Faculty Position – Natural Gas Production

Department of Mining and Minerals Engineering

The Department of Mining & Minerals Engineering at Virginia Polytechnic Institute and State University (Virginia Tech) invites nominations and applications for a tenure-track faculty position at any level (Assistant Professor, Associate Professor, or Professor), with rank to be determined by applicant qualifications. Endowed professorships/chairs may also be available for well-qualified individuals. Faculty members at Virginia Tech are expected to pursue and sustain a high level of scholarly research and publication; teach and advise undergraduate and graduate students; and contribute quality service and outreach to the department, college, university and profession.

The successful applicant is expected to develop an internationally recognized and externally funded research program in the broad area of "energy, materials and the environment" with a specific focus in natural gas/shale gas production (Reservoir Modeling, Advanced Drilling, Geomechanics, Hydraulic Fracturing, Well Stimulation, Geophysical/Well Monitoring, Petrography, Health and Safety, Sustainable Practices and Environmental Considerations). The successful applicant will be expected to assist in the development of a new graduate degree program in Natural Gas Engineering. A Ph.D. in petroleum engineering, natural gas engineering, chemical engineering, mining engineering, geosciences or closely related field is required. Demonstrated practical and/or research experience in upstream natural gas/shale gas production is preferred. All candidates are encouraged to have, or seek upon employment, professional engineering registration.

Virginia Tech's Mining and Minerals Engineering Department is one of the largest mining engineering programs in North America. The Department currently enjoys a strong international reputation for its academic, research and outreach programs. The Department is currently comprised of 9 full-time faculty members, with an enrollment of +200 undergraduate and +35 graduate students. Research expenditures in the Department are in excess of \$6 million per year. External funding for ongoing research includes support from state, federal and industry sources. The Department is housed within a nationally ranked College of Engineering at Virginia Tech. Virginia Tech, the land-grant University of the Commonwealth, is located in Blacksburg, Virginia, adjacent to the scenic Blue Ridge Mountains. The university has a total enrollment of +30,000 with +7,000 students enrolled within the College of Engineering.

Candidates who wish to be considered for these positions should apply online at www.jobs.vt.edu to posting number 117604. Please submit online a vitae, transmittal letter, statement regarding research/teaching interests, and names/addresses of three references (including contact phone numbers and email addresses). The review of applications will begin on December 15, 2014, with the intent to have the position filled before August 10, 2015. For further information regarding this announcement, please visit the Mining & Minerals Engineering Department web site at www.mining.vt.edu. Questions regarding the search may be directed to Dr. Gerald Luttrell (Luttrell@vt.edu) who serves as chair of the departmental search committee.

Virginia Tech is committed to the principle of diversity and, in that spirit, seeks a broad spectrum of candidates including women, minorities and people with disabilities. Virginia Tech is a recipient of a National Science Foundation ADVANCE Institutional Transformation Award to increase the participation of women in academic science and engineering careers.

Continued from previous page

closely related discipline, a strong research record and future potential in geosciences, evidence of research interests that complement and enhance existing departmental strengths, and that catalyze new interdisciplinary directions in the future, and evidence of teaching interests that strengthen the department's offerings in petroleum geosciences and related areas. Preference will be given to candidates with a commitment to geo-education and potential for excellence in teaching, including field education and professional career preparation of undergraduate and graduate students, an interest in research and associated activities related to geosciences hydrocarbon industries, an established or promising peer-reviewed publication record, the ability to obtain and manage external research funding, and the ability to establish strong research and industry partnership programs within the department, college and/or university. The successful applicant is expected to teach at both undergraduate and graduate levels and develop a vigorous externally funded research program supporting graduate students.

To view a complete position description and apply, please visit: <http://warnercnr.colostate.edu/employment-opportunities.html> by 5:00 pm January 23, 2015.

CSU is an EO/EA/AA employer. CSU conducts background checks on all final candidates.



The University of Texas at Austin Research Position in Clastic Sedimentology

The Bureau of Economic Geology, Jackson School of Geosciences at The University of Texas at Austin invites applicants for a full time research position in clastic sedimentology and stratigraphy. We seek an experienced candidate to conduct cutting edge research and lead the Quantitative Clastics Laboratory (QCL), a consortium-funded research group focused on the description, analysis, and quantification (morphometrics) of clastic depositional systems that are potential reservoir analogues.

This is a senior-level position. Requirements include a PhD in geology or closely related field, five to ten years of post-PhD experience, a strong record of publishing, evidence of successful leadership, as well as the ability to acquire and retain industry sponsors.

The candidate's research focus could include, but would not be limited to, source-to-sink dynamics, process sedimentology, evolution of complex continental margin settings, basin analysis, sequence stratigraphy, and application of seismic geomorphology to reservoir characterization. The candidate should be motivated to work with colleagues in developing improved understanding of scaling issues from the core to seismic level, including the roles of outcrop description and physical modeling. A strong desire and ability to successfully sponsor PhD and Master's level students is also highly valued.

Success in this position requires a desire to lead

a small team, and to craft a long-term vision that will result in growing and sustaining the QCL. Abundant opportunities exist for collaborating with industry researchers, interacting with other researchers and faculty of the Jackson School, advising graduate students, and acquiring or sharing laboratory and field equipment.

Preference will be given to candidates with deepwater clastics systems expertise, and those who have an appreciation of energy industry needs and challenges.

The Bureau of Economic Geology, with a staff of 250 including approximately 60 graduate student research assistants, is the oldest research unit of The University of Texas at Austin. The Bureau hosts ten research consortia, strongly supported by industry. We enjoy outstanding IT resources and support. The Bureau has a diverse workforce, extensive laboratory facilities, and operates the largest rock-core collection in the U.S. (~1500 miles of core). The Jackson School of Geosciences is highly ranked and is the largest U.S. geoscience program.

Austin is a thriving city of about 1 million, renowned for live music and Texas Hill Country ambiance.

Candidates can apply at the Research Scientist or the Senior Research Scientist level, depending upon qualifications. Go to <https://utdirect.utexas.edu/apps/hr/jobs/nlogin/search/0/> for complete description and to apply for posting number 141111010702 (Research Scientist) or 141111010701 (Senior Research Scientist).

The University of Texas at Austin is an equal employment opportunity/affirmative action employer. All positions are security sensitive, and conviction verification is conducted on applicants selected.

MISCELLANEOUS

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trend onshore Louisiana and the Davy Jones 1 discovery well in the South Marsh Island area offshore Louisiana.

“Well logs and 2-D seismic data were used to interpret the depth and morphology of potential Paleocene and lower Eocene Wilcox Group Slope and Basin Floor reservoirs in south-central Louisiana,” she emphasized.

These may occur in the poorly explored area previously estimated by the USGS to contain the largest mean undiscovered conventional resource potential of the three AUs, according to Enomoto.

“It's difficult to determine whether the sediments preserved in the Wilcox group were deposited on a continental slope or basin floor based on the available data,” she commented. “The interpretation of the newly acquired seismic data suggests that the lower Tertiary strata have been folded and faulted.

“Therefore,” she added, “the Wilcox Group likely has anticlinal closures and fault traps that may have accumulated hydrocarbons.”

Wilcox from page 30

by the USGS to be 26,398 BCFG and 423 MMBNGL.

2-D Seismic Data, Well Data

Subsequent to the 2007 USGS effort, the agency acquired 2-D seismic data and well data that augment previous interpretations and studies, according to Enomoto.

“The new seismic and well data should reduce some of the risks considered in the 2007 assessment,” she said, “and will help to refine the range of possible input for the resource assessment forms during the next assessment.”

Enomoto recently completed a study describing some of the well log and reflection seismic data characteristics of the slope and basin floor reservoirs with gas discovery potential that may lay in the area between the Wilcox Group producing

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Perth:	March 9 – 13, 2015		

Unconventional Resource Assessment and Valuation

Houston:	May 11 – 15, 2015	Calgary:	May 11 – 15, 2015
	Oct 26 – 30, 2015		Oct 5 – 9, 2015
OK City:	Aug 10 – 14, 2015	Denver:	June 15 – 19, 2015
Pittsburgh:	Oct 5 – 9, 2015		

Evaluating Tight Oil and Gas Reservoirs

Calgary:	March 9 – 13, 2015	Houston:	May 18 – 22, 2015
Denver:	Oct 5 – 9, 2015		Sept 21 – 25, 2015

Play-Based Exploration: Mapping, Volumetric and Risk Analysis

Aberdeen:	Sept 14 – 16, 2015	Houston:	Nov 16 – 18, 2015
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FACULTY OF SCIENCE - EARTH AND ATMOSPHERIC ADMINISTRATION

TENURED OR TENURE-TRACK POSITION IN STRUCTURAL GEOLOGY OR ORGANIC GEOCHEMISTRY

The Department of Earth and Atmospheric Sciences, University of Alberta, invites applications for a full-time tenured or tenure-track position at the Assistant or Associate Professor level in either structural geology or organic geochemistry.

We are seeking an individual with expertise in the structural geology of sedimentary basins or with expertise in organic geochemistry applied to problems in petroleum systems. An applicant in the area of structural geology will preferably have experience in interpretation of seismic data.

Applicants must hold a PhD in either structural geology or organic geochemistry and have an established research program in an academic or industrial setting in one of these areas. Applicants must have a track record of publications, the potential for attracting external funding to support their research program, and experience in teaching advanced industry or post-graduate courses.

For detailed information see:
<http://www.careers.ualberta.ca/Competition/A107924023/>

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

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“uplifting the whole people”

— HENRY NOBLE, 1904, FOUNDER, PRESIDENT, 1906

Winds of Change Don't Automatically Spell Disaster

By DAVID CURTISS

We live in a world of constant change. That's a truism, of course. But 2014 has been remarkably tumultuous, full of aggression and violence. Around the globe we've seen increased political instability with governments wobbling and major economies teetering on the brink of recession.

Troubled winds are blowing as this year comes to a close. And our industry is feeling their effects.

Oil prices have been declining since midyear and have swooned in the last quarter. There are many factors that drive the price of oil, of course – but a combination of new U.S. oil supply entering the market from plays such as the Bakken and Eagle Ford, decreased demand for product as global economic growth slows and a strong U.S. currency have resulted in much lower prices than we've seen in the recent past.

Now, I struggle to call \$75 per barrel a low price. But it is certainly causing anxiety among some OPEC states and other large oil-exporting countries whose political and economic systems depend wholly on oil sales in global markets.

And many of our members with whom I've been speaking are feeling anxious about what these changes mean for their companies and their jobs.

Certainly, if you work for Halliburton or



CURTISS

We can read changing circumstances and adjust our responses to reach our goals.

Baker Hughes, you woke up last month to find that your world was changing.

On Nov. 18, Halliburton, the world's second largest oil field services company, announced its intent to buy third-ranked Baker Hughes in a deal valued at close to \$35 billion.

In its announcement, Halliburton mentioned the complementary product suites of the two companies, and an expectation that the new firm will realize up to \$2 billion in annual cost savings through the merger.

The deal still must be approved by shareholders of both firms as well as regulators.

But analysts believe this merger may be the beginning of a new round of consolidation in the energy industry, as lower share prices create opportunities for more deals.

The winds of change are blowing.

* * *

As we wrap up 2014 and look ahead to a new year, I'd urge you to take some time for self-reflection, to think about how you plan to deal with the many changes that are affecting your world.

One common response is to **ignore them**, and to pretend they don't exist.

This is one of those strategies that works well, until it doesn't. Suddenly you are faced with a situation that you did not foresee, that you cannot control and for which you are completely unprepared.

A second response is to **resist change**.

Folks who adopt this strategy see change as an enemy to be fought. Sometimes this works. But frequently the forces driving the change are larger than the individual or group resisting it, and the result is a bloody battle that ends in defeat. Remember the Spartans at the battle

of Thermopylae?

The third response is to **embrace change**.

You may not like it. It may not be what you would have chosen. But just as a sailor reads the wind and adjusts his sails to use the wind he has to reach his port, so we can read changing circumstances and adjust our responses to reach our goals.

Don't be a passive observer, waiting to see what happens as your world changes.

Are you ensuring that you are at the top of your technical game if you're in a technical role? AAPG can help you with that.

Do you have an active network of professional colleagues and friends whom you can call upon to help if circumstances at your job change? You need to be building that network now, before you need it. AAPG can help you with that.

Troubled winds indeed are blowing across our world, and winds of change are buffeting our industry. The simplest and most natural response is to ignore or resist.

Yet, I'm reminded of a quote by 19th century American theologian William G.T. Shedd, who said, "A ship is safe in harbor, but that's not what ships are for."

Chart your course for 2015.

DIVISIONS REPORT: DEG

Our License From Society

By JEFFREY G. PAINE, DEG President

In our Division's September EXPLORER column we considered the desire to turn unanticipated consequences of hydrocarbon exploration and development into anticipated issues.

In many environmental areas, it seems the energy industry is often on the defensive and is forced to react to real or perceived environmental issues rather than employ forethought to anticipate the majority of issues that might arise from energy-related activities. Once the issues are identified, exploration, development, production and distribution activities could be planned and engineered to eliminate or minimize many of the issues the industry could face in the future.

The historical experience provides numerous examples of real and perceived environmental issues that have required a response from industry – generally adding cost to exploration, development or production – and damaging the reputation of the energy industry, not to mention the actual environmental damage, if any.

Government regulation of industry also tends to be reactive: Something happens, it comes to the attention of the media, the public and the government, and in response the government often enacts regulatory measures designed to prevent future occurrences of the same type of event.

Which brings us to the next topic: retaining (or regaining, in cases where it has been lost) the social license to operate, something John Hughes highlighted while considering topics for the AAPG International Conference and Exhibition (ICE) set next September



PAINE

Regardless of government regulation and economic constraints, public opinion and pressure matter to the longevity, success and stature of any industry.

in Melbourne, Australia. Regardless of government regulation and economic constraints, public opinion and pressure matter to the longevity, success and stature of any industry.

Consider nuclear energy. The promise of practically limitless "clean" energy that grew out of advancing nuclear technology in the 1950s, '60s and '70s led to a boom in construction of nuclear power plants. Subsequent well-known disasters, such as the partial meltdown at Three Mile Island in 1979 and the massive explosion and radiation release at Chernobyl in 1986, along with society's inability to identify acceptable long-term storage options for spent fuel and other highly radioactive material, effectively ended construction of new nuclear facilities and rescinded the social license to operate.

It wasn't until public concern arose over the climatic effects of fossil fuel consumption that nuclear energy began to regain that social license.

The Fukushima Daiichi nuclear disaster in 2011, a dire consequence of the Tohoku magnitude 9 earthquake and the tsunami it generated, quickly served to rescind that social license once again. It remains to be seen whether

the passage of time, improvements in technology and society's ever-growing need for energy can overcome the challenges of nuclear energy.

Doubtless numerous less extreme examples could be cited throughout the industrial age where notable impacts on the environment or public health caused one industry to lose its social license and another to gain it.

* * *

The oil and gas industry maintains its social license because it provides most of the world's energy. That energy is relatively inexpensive, and there are currently few to no alternative sources ready to fill the void should oil and gas go away.

Real and perceived environmental impacts that include effects on atmospheric composition and climate, oil spills, disposal of co-produced water, side effects of hydraulic fracturing and induced seismicity are at the forefront now, potentially eroding the social license that the industry requires for long-term success, however that is judged.

Industry forethought and the

anticipation of potential environmental concerns before they become real or perceived issues are the keys to maintaining that license and ensuring that energy exploration, development and production is done in a manner that recognizes the importance of it.

Actions by everyone from the rig hand to the CEO play a role in cultivating that license.

Not coincidentally, environmental topics at the 2015 ICE in Melbourne and the 2015 Annual Convention and Exhibition (ACE) in Denver are relevant to the social license.

Abstracts for the ICE program are being accepted through Jan. 15 – a program that devotes an entire theme to "Environment, Regulation and the Social License to Operate."

Topics within that theme should resonate. They include:

- ▶ Best practice in stakeholder engagement.
- ▶ Evidence-based regulation.
- ▶ Emerging monitoring technologies.
- ▶ The social license itself.

Similarly, the Energy and Environment theme for ACE includes topics focused on public policy and relations for happy exploration and development, geophysics applied to oil and gas environmental issues, unintended consequences and anticipating environmental impacts.

It is gratifying that numerous DEG volunteers are helping to elevate these important topics from the periphery so they can be rigorously addressed at regional, national and international venues.



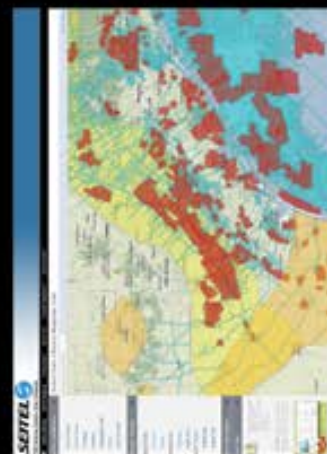
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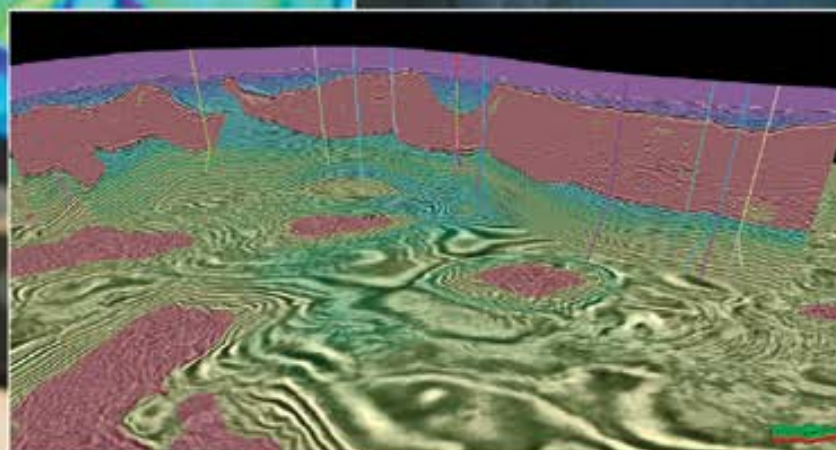
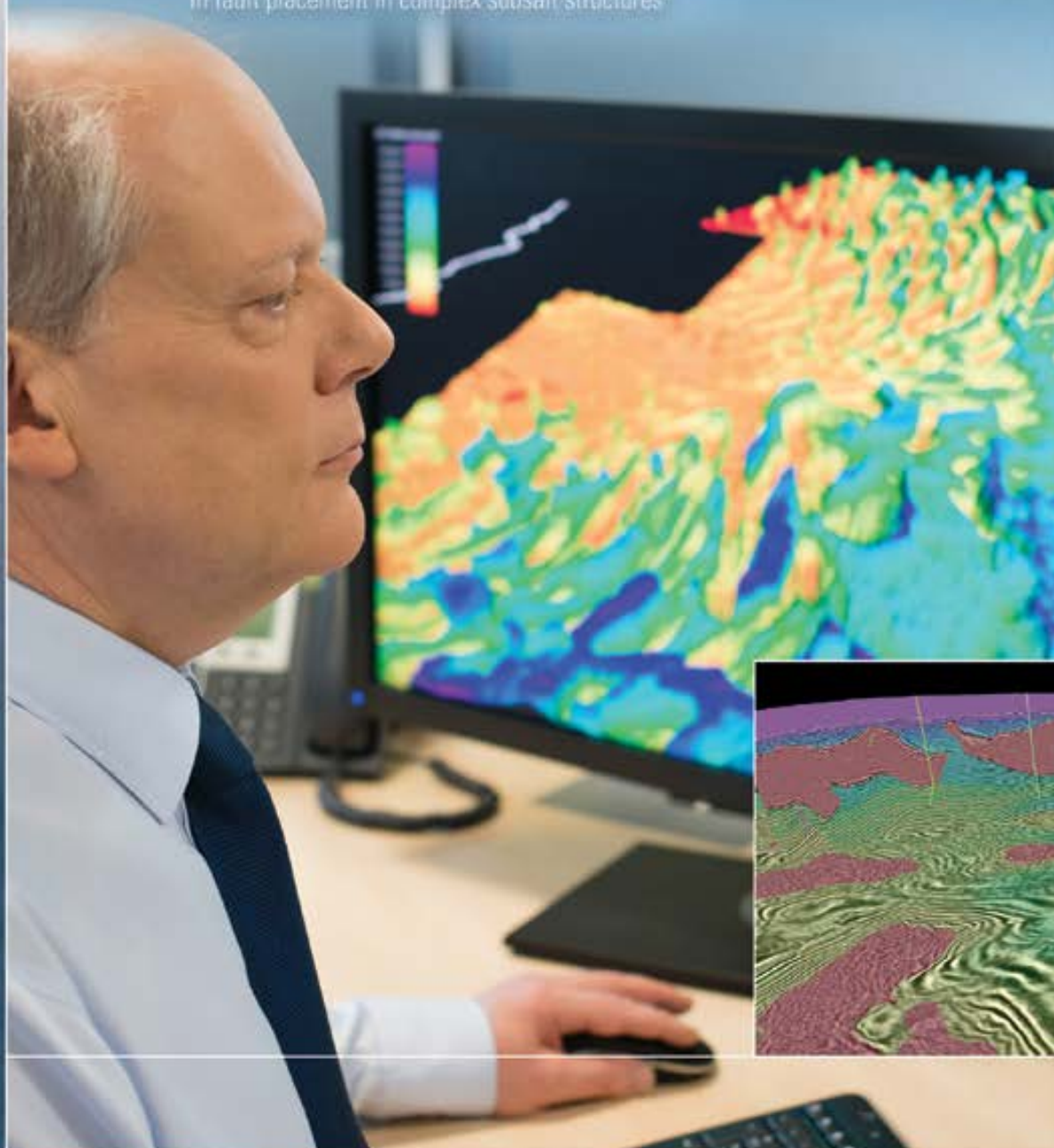


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