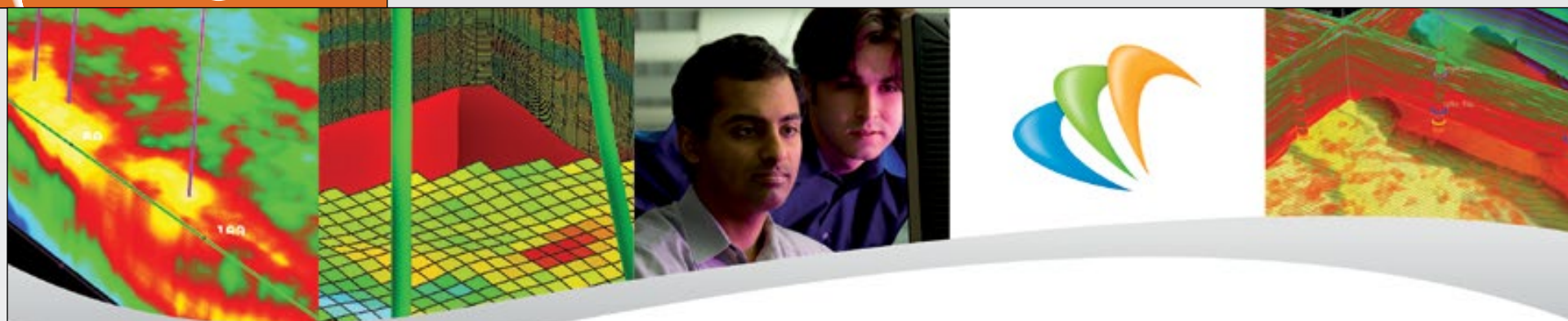


Dawn of Creation

*Unconventional plays emerge
on the global stage*

See page 20

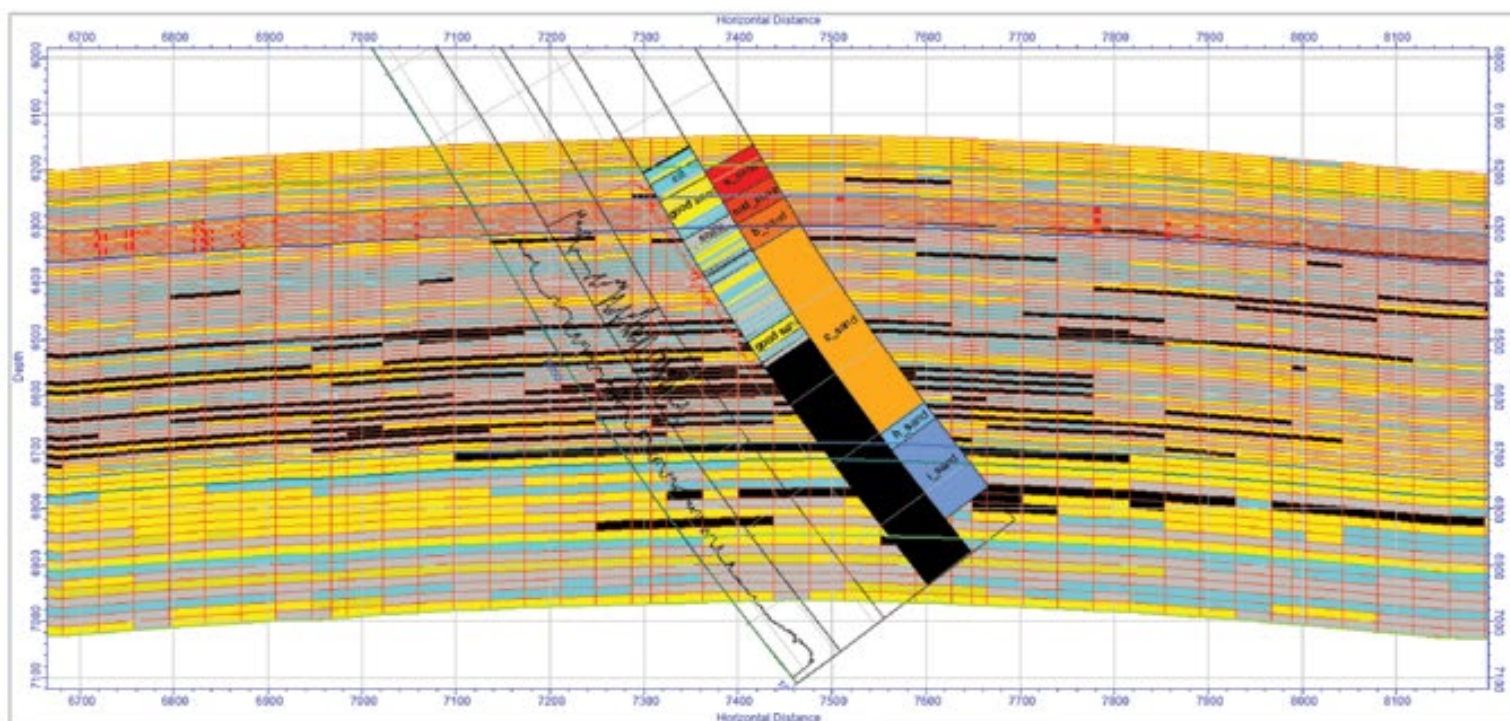




Jason

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jason.cgg.com/earthmodelbuilder



PRESIDENT'S COLUMN

My Agenda: Doing What We Do Better

BY RANDI MARTINSEN

During my candidacy and year as president-elect I often was asked about my agenda for AAPG.

My response: It is to help ensure that AAPG provides as much or more benefit to our members throughout their careers as it has for me.

I did not stand for office with any specific agenda relating to membership, governance, products or services.

My year as president-elect has been very insightful, however, and provided me with a better understanding of the many challenges facing AAPG as it approaches its centennial.

What are some of these challenges?

Well, simply making sure AAPG is technologically up-to-date in how we manage and communicate our science is a major challenge.

* * *

The methods by which organizations and people are connecting and communicating are rapidly changing in response to evolving information technologies. The rate at which data and information are generated also has accelerated, and consideration must be given to making sure we deliver accurate and valuable information in a timely manner.

There also is a lot more competition – from both for-profit organizations as well as non-profit sister societies – in terms of recruiting members, developing products and communicating science.

Doing what we always have done and doing it the way we have done it may have worked great for the first 100 years, but if AAPG doesn't adapt and change to do things in line with today's highly



MARTINSEN

This year, we're going to do our best to make sure AAPG is ready for the future. Changes are not only on the way, they're already here.

technological and highly competitive world, we may not be around to see another 100 years.

* * *

So many things in regard to the way we do business have changed since I went to work in the 1970s. In the '70s petroleum professionals did not work in teams; rather, geologists were organizationally and physically separate from geophysicists – and both were separate from engineers.

Everything was on paper; seismic interpretation, well-log correlation, well data information (How many of you recall "scout tickets?"). Then along came the personal computer and workstations, the "integrated team" concept, widespread satellite communication, the Internet, cell phones and, more recently, smart phones.

Everything now is "real time." Employees are on call 24/7. Everything in our lives, our industry and our society is accelerating exponentially.

AAPG must be able to nimbly and efficiently anticipate as well as respond to this changing landscape, so that we are poised to take advantage of new

opportunities that arise and discard outdated strategies, technologies, products and services.

* * *

One of the initiatives developed by my predecessor, President Lee Krystinik, to help AAPG thrive is the "Three-Year Business Plan," the purpose of which is to ensure that the activities of all aspects of AAPG – including Divisions, committees, Regions, Sections, subsidiaries and headquarters – are focused on streamlining and focusing AAPG's efforts to achieve its strategic and tactical objectives.

The implementation of this three-year business plan will ensure more continuity of planning and business operations from one EC to the next, as well as provide better financial stability for AAPG.

The Advisory Council (AC), our strategic planning body, also put forth a number of proposals last year aimed at discussing and evaluating options to help AAPG morph into an organization that is able and ready to take on the various scientific, technological and business opportunities the future holds.

These proposals include evaluating:

▶ AAPG's organizational structure and governance.

▶ The terms of office for AAPG officers and the whole election process.

▶ How to best develop and incorporate TIGS and SIGS into AAPG.

Implementation of the three-year business plan and evaluation of the various AC proposals are just some of the things the EC will address over the course of the year.

* * *

Below is a quote that is often incorrectly attributed to Charles Darwin, but is actually a summation of Darwin's work by a management professor at LSU in the early 1960s.

It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change. In the struggle for survival, the fittest win out at the expense of their rivals because they succeed in adapting themselves best to their environment.

This year, we're going to do our best to make sure AAPG is ready for the future. Changes are not only on the way, they're already here.

Doing what we do better is our first step toward tomorrow.

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TABLE of CONTENTS

10 Room to Grow: America's **shale boom** gives us breathing space to **transition to renewables** as developing countries grow hungry for energy.

16 Sweet and Sour: Knowing **where not to drill** is very often the key to success in the ongoing shale boom.

20 Coming Attractions: **Emerging unconventional resource plays** figure prominently in next month's second annual **Unconventional Resources Technology Conference**.

22 Bigger and Better: **URTeC 2014** promises to build on last year's inaugural summit of **geologists, geophysicists and engineers**.

26 One Size Doesn't Fit All: Variability is the only constant when it comes to applying **hydraulic fracturing and horizontal drilling** from play to play.

34 Winning Hearts and Minds: As **Shell Exploration & Production Colombia** sees it, **community support** is just as vital as good geologic data.



Scan this for the mobile version of the current web Explorer.



Photo courtesy of AAPG Publication Pipeline

REGULAR DEPARTMENTS

Professional News Briefs.....	38
In Memory	40
Policy Watch.....	42
Geophysical Corner	44
Historical Highlights	46
ProTracks.....	50
Regions and Sections	51
Making a Difference	52
Foundation Update.....	54
Readers' Forum.....	56
Classified Ads	57
Director's Corner	58
Divisions Report (DPA).....	58

ON THE COVER:

Since a large oil discovery was made in 2010 by the former Repsol-YPF, Argentina's Vaca Muerta geological formation in the Neuquén Basin has been highly sought-after by international operators. Photo courtesy of Shale Seguro.

Left: Bangladeshi university students unload books donated through AAPG's Publication Pipeline Committee. See story, page 52.

AAPG Candidates Named 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 this summer.

Ballots will be mailed in spring 2015.

The slate is:

President-Elect

Paul W. Britt,
Texplore 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.,
Falcon, France.

Secretary

Heather L. LaReau,
Noble Energy Inc., Denver.

Nicole S. Morris,
FireWheel Energy LLC,
Fort Worth, Texas.

Register now, save \$\$\$

New Addition Set for ICE

There's still time to save up to \$130 on registration fees for this year's AAPG International Conference and Exhibition (ICE), set Sept. 14-17 in Istanbul, Turkey.

That time is dwindling, however – the savings deadline is Aug. 5.

The theme for the meeting – hosted by the Turkish Association of Petroleum Geologists and the AAPG Europe and Middle East Regions – is “The Spirit Between Continents: Energy Geosciences in a Changing World.”

ICE 2014 marks the first time an AAPG international conference will be held in

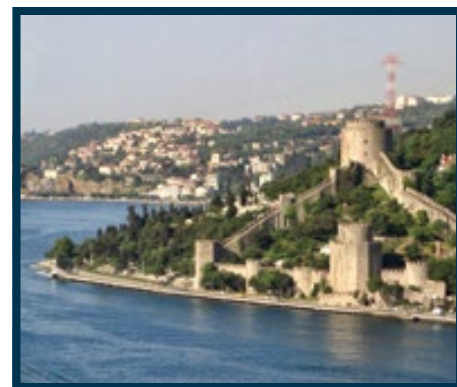
Istanbul – but that's not the only new dynamic being offered.

This meeting also marks the first time the APPEX Regional meeting will be held in conjunction with an ICE.

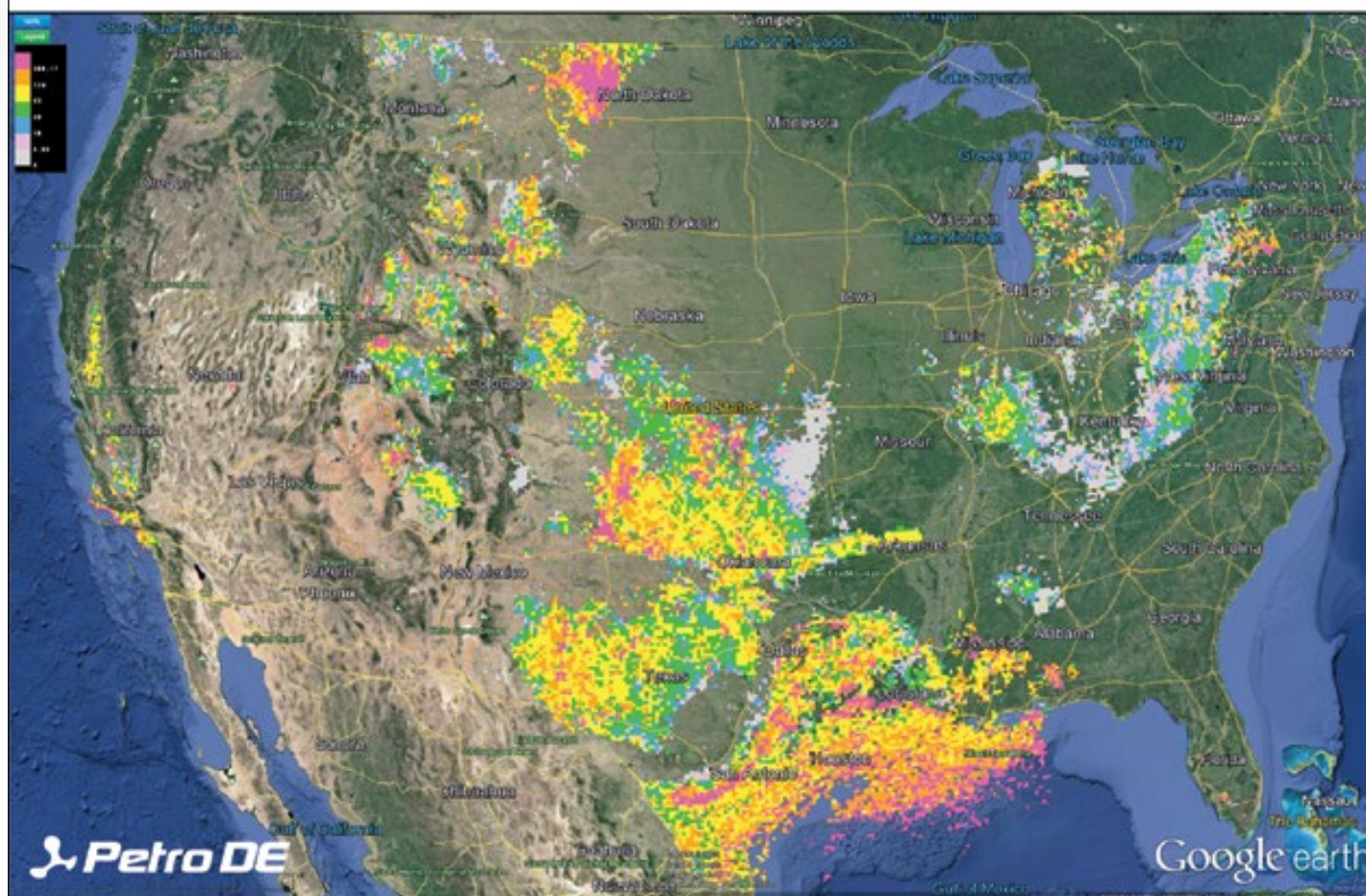
APPEX is an exploration-themed conference and exhibition, specifically dedicated to the E&P sector, which provides a venue for upstream E&P principals, senior managers, business developers and new venture managers to network and do business with NOCs, governments, financiers and global E&P deal-makers.

In addition to the networking and deal-making potential, APPEX also offers a variety of talks and sessions dealing with exploration opportunities in Turkey, the Black Sea region, Russia, Poland, Croatia, Montenegro, Iraq and other areas in the eastern Mediterranean and central-eastern Europe regions.

Organizers expect APPEX Regional to complement the ICE technical program, which itself will provide the latest in science – not only for regional plays, but also geological advances from around the world.



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The technical program themes include:

- ▶ New and Emerging E&P Provinces.
- ▶ E&P in Mature Basins.
- ▶ Regional Geology and Tectonics.
- ▶ G&G Integration.
- ▶ Unconventional Resources.
- ▶ Conventional Resources.
- ▶ Petroleum Systems and Geochemistry.

▶ Siliciclastics and Carbonates.
▶ Structural Geology and Traps.
▶ Health, Safety, Environment Geology and Hydrogeology.

- ▶ History of Petroleum Geology.

Several special forums are planned, including:

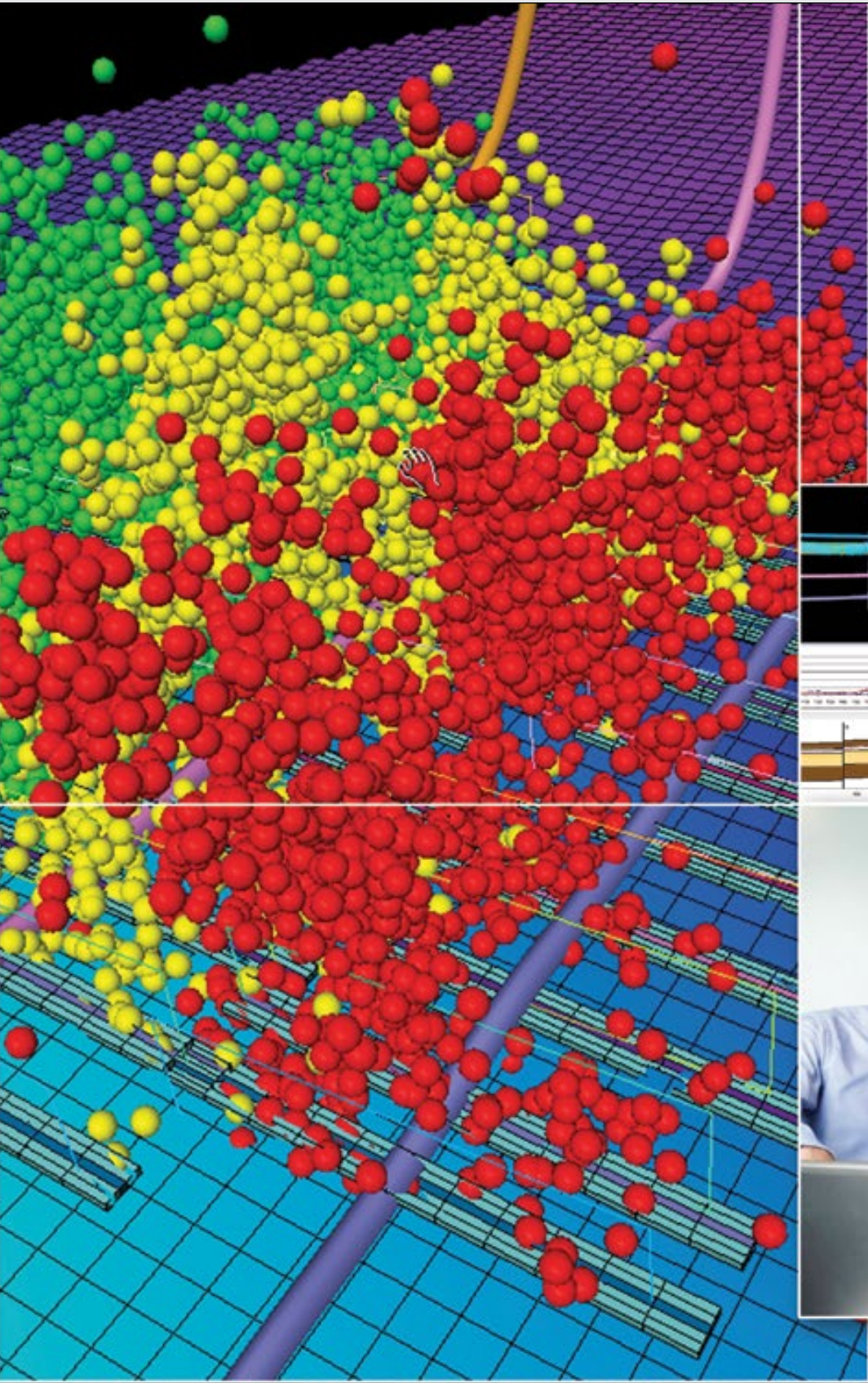
- ▶ Technical Innovation and Collaboration – Keys to Affordable Energy.

▶ Tethys Evolution.
▶ Sessions honoring the careers and work of AAPG legendary geologists Peter Ziegler and Dave Roberts.

▶ The newest presentation of the Discovery Thinking Forum, this time offering specific talks on northern Iraq, India's Barmer Basin, Yemen's Habban Field and Oman's Mabrouk deep gas discovery.

This year's topical luncheon will feature professor A.M. Celal Sengör, from Istanbul Technical University, talking about “Was the Geology of the Aegean Responsible for the Rise of the Human Civilization?”

Complete ICE details and registration information can be found online at ice.aapg.org/2014.



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EC begins 2014-15 term

Martinsen Assumes AAPG Presidency

Randi Martinsen, principal with Hydrocarbon InSight in Laramie, Wyo., assumed the presidency of AAPG on July 1.

Martinsen, a native of Brooklyn, N.Y., is a longtime senior lecturer of petroleum geology at the University of Wyoming, Laramie. She previously served on the AAPG Executive Committee as treasurer in 2006-08, and received the AAPG Distinguished Service Award in 2009.

Martinsen holds a bachelor's degree in earth and space science from the State University of New York, Stony Brook, and a master's in geology from Northern Arizona University in Flagstaff, Ariz.

She started her career in 1974 in Denver as a geologist for Cities Service Co., and five years later moved to Laramie to become a consulting geologist. Starting in 1981 she began her association with the University of Wyoming – she's been a sponsor for the University of Wyoming Student Chapter since 1993, and has since 2002 served as chair of the Rocky Mountain Rendezvous of Geoscience Students and Employers job fair, held annually in Laramie.

She started Hydrocarbon InSight in 2012.

Joining Martinsen on the Executive Committee is **John Hogg**, an AAPG Honorary member and newly named president of Skybattle Resources Ltd. in Calgary, Canada, who recently was voted



MARTINSEN



HOGG



BRACHMAN



TUCKER



KALDI



BALL



SWEET



DOLPH

president-elect and will serve as AAPG president in 2015-16.

Hogg, who previously had been vice president of exploration and operations for MGM Energy Corp. in Calgary, earned his B.Sc. in geology from McMaster University in Hamilton, Ontario. He had been exploration manager for ConocoPhillips Canada and a geologist for other Canadian and international companies before joining MGM Energy, often focusing on the Atlantic and Arctic regions.

He previously served on the AAPG Executive Committee as vice president-Regions and as chair of the AAPG House of Delegates.

Hogg will be one of two Canadians on the Executive Committee, joining fellow

See Officers, page 8

AAPG Advisory Council Members Announced

Lee Krystinik has been seated as chair of the 2014-15 AAPG Advisory Council.

Council members include past AAPG presidents Ted Beaumont and Paul Weimer; EMD president Frances J. Hein; DEG president Jeffrey G. Paine; DPA president Richard D. Fritz; and Larry Wickstrom, immediate past chair of the AAPG House of Delegates.

Section representatives are:

- ▶ Jon Schwalbach Jr., Pacific Section.
- ▶ John Robinson, Rocky Mountain Section.
- ▶ Peter MacKenzie, Eastern Section.
- ▶ William M. Whiting, Gulf Coast Section.

Section.

- ▶ John E. Jordan Jr., Gulf Coast Section.
- ▶ Robert E. Webster, Southwest Section.

The representative for the Mid-Continent

Section is yet to be announced.

International Region representatives are:

- ▶ Andrea Moscardiello, Europe Region.
- ▶ Miguel Ramirez, Latin America Region.
- ▶ Nosa Omorodion, Africa Region.

The representatives for the Canada, Asia-Pacific and Middle East Regions are yet to be announced. ■



MULTI-CLIENT PROJECTS

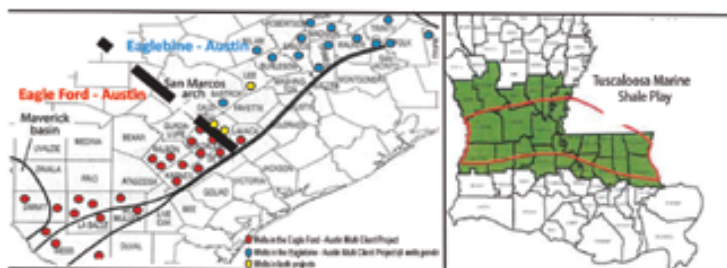
EAGLE FORD - AUSTIN

EAGLEBINE - AUSTIN

TUSCALOOSA



TOC, % Carbonate, High Resolution Biostratigraphy, Paleobathymetry and Maximum Flooding Surface Sequence Stratigraphy



Each participant can submit samples from up to 2 wells, up to 1000 feet in the Eagle Ford and Austin, Core is preferable, then sidewall cores & cuttings.

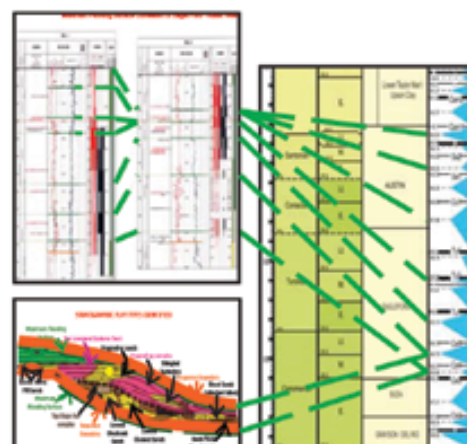
Immediately after joining projects, each participant will receive in digital format ALL data, final reports and charts on wells completed.

Subscription price: (When there are partners price is reduced for each participant)

Eagle Ford - Austin Project: Participants (1-15) filled; (16-18) \$24,900.

Eaglebine - Austin Project: Participants (1-10) filled; (11-15) \$19,900.

Tuscaloosa Project: Available June 20, 2014



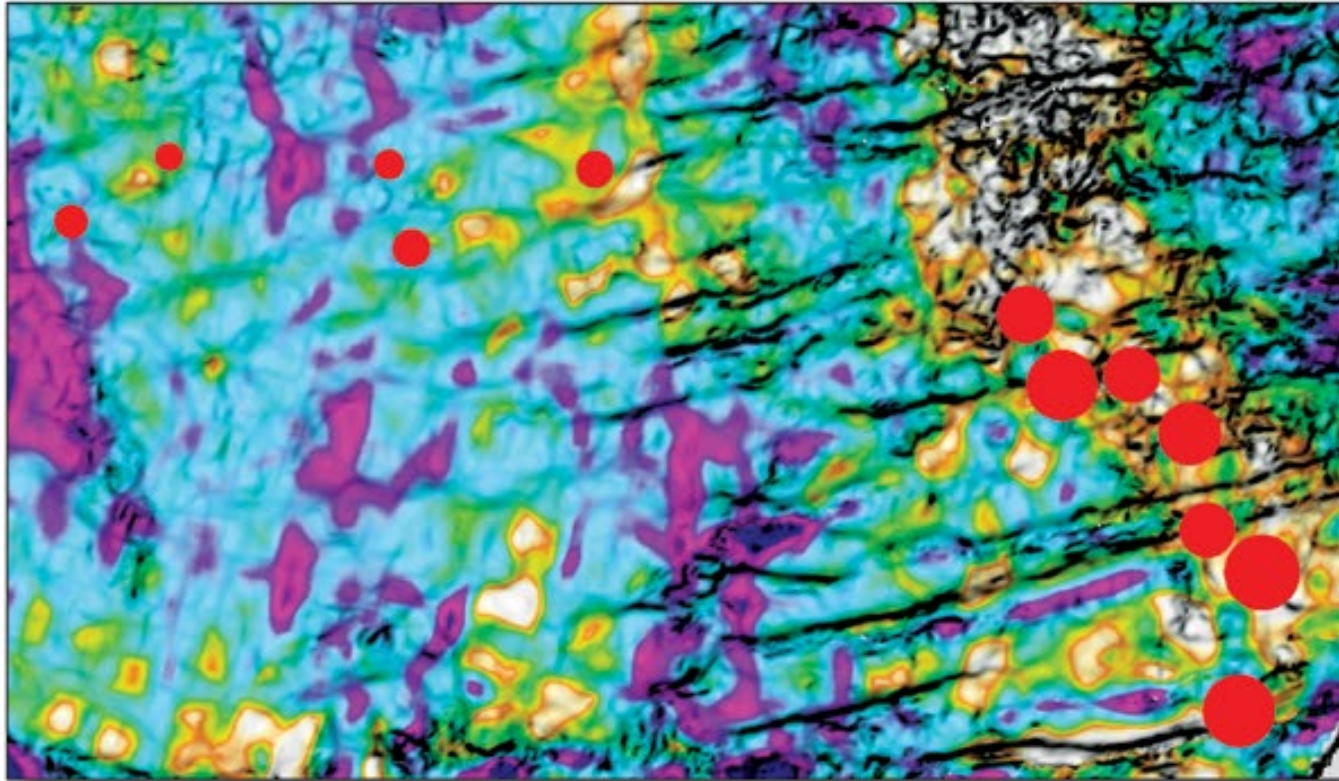
- Results of this project may assist companies as follows to reduce risk and cost:
- Identify, locate lateral/vertical differences in organic richness between 2 MFSs.
- Use MFS to identify & correlate zones of richness, brittleness & fractures from well to well
- Assist in landing points for lateral wells between same two (2) MFSs in different wells.
- Date unconformities, faults, amount of time missing
- Time-based data for accurate burial & thermal history in hydrocarbon generation modeling.
- Correlate MFSs in project wells along strike and up and downdip then to non-project wells
- Nine MFSs (as timelines) to construct maps; TOC, CO₂, kerogen, isopach, etc.

Please contact Walter W. Wornardt, PhD at 713-977-2120

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 - Basin Exploration
 - Reservoir Exploitation



GEOVENTURES®

Officers from page 6

Canadian **David Dolph**, team lead for global exploration-new ventures for Calgary-based Nexen Energy ULC, who began his one-year term as the chair of the AAPG House of Delegates.

Others recently elected to the AAPG Executive Committee and who began their two-year terms of office on July 1 were:

▶ Vice President-Sections – **Steve Brachman**, vice president of exploration and development, Wapiti Energy, Houston.

▶ Treasurer – **Jim Tucker**, former longtime geologist for Saudi Aramco and now a consulting geologist in

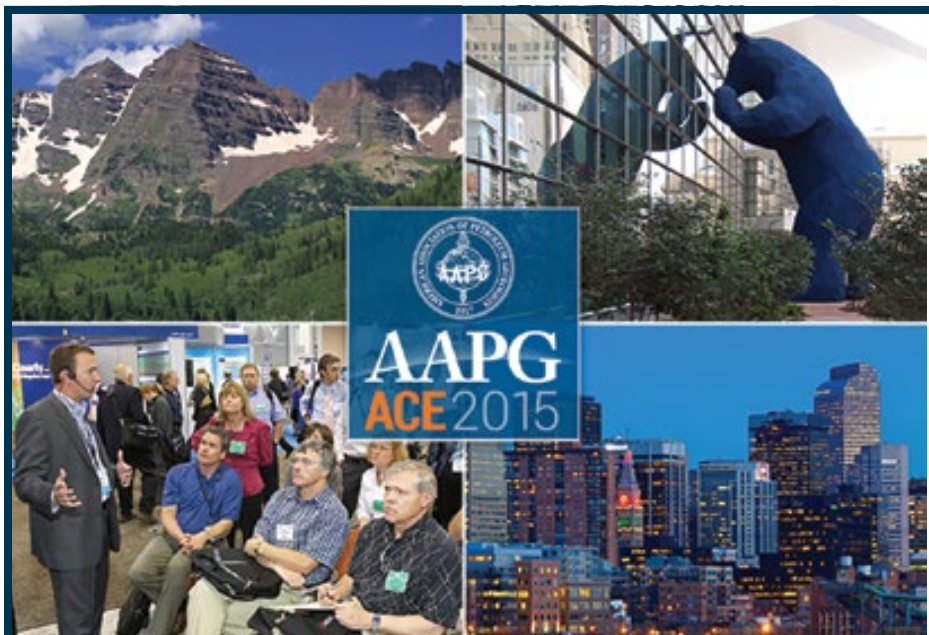
Houston.

Others on the 2014-15 committee are:

▶ Vice President-Regions **John Kaldi**, Australian School of Petroleum, University of Adelaide, Adelaide, Australia, completing the final year of his two-year term.

▶ Secretary **Richard W. Ball**, Chevron, Angola Block O, Houston, also completing the final year of his two-year term.

▶ Editor **Michael Sweet**, ExxonMobil Production, Houston, completing the second year of his three-year term. ☐



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Call for Abstracts Opens Online For Denver ACE

The call for abstracts is now open for the next AAPG Annual Convention and Exhibition, which will be held May 31-June 3 in Denver.

The meeting will be held at the Colorado Convention Center. ACE was most recently held in Denver in 2009, when the meeting drew 7,452 attendees.

The ACE 2015 overall theme is "Exploring the Summit of Petroleum Geosciences," and organizers intend to craft a technical program that is international in scope and appealing to multiple geosciences disciplines.

The call for abstracts seeks presentations to fill 13 diverse and timely technical areas.

Those session themes are:

▶ Unconventional Resources.

(Subthemes include sessions on tight oil plays; new technologies in unconventional; insights from pilot projects in unconventional resources; and tight gas sandstones, including horizontal drilling applications, among others.)

▶ Developments and Discoveries: From Known to Re-Emergent.

▶ Carbonates and Evaporites.

▶ Siliciclastics.

▶ Structure, Tectonics and Geomechanics.

▶ Energy and the Environment.

▶ Geochemistry, Basin Modeling and Petroleum Systems.

▶ Geophysics: Integration, Inversion and Illumination.

▶ The Other Unconventionals: The Expanding World of Energy Minerals.

▶ Core – The Ultimate Source of Underground Truth.

(The core poster session will be a full-day event, held in a secure room.)

▶ The Past Is the Key to the Present! History of Facets of Petroleum Geology.

▶ SEPM Research Symposium – Channels: From Geomorphic Expression to Stratigraphic Record.

▶ AAPG and SEPM Student Poster Sessions.

Also, exhibit space for the Denver meeting is now available – an annual showcase of the latest in technology and geoscience information. The exhibit hall also features the International Pavilion, which is a global showcase for countries promoting exploration and investment opportunities.

To submit an abstract, sign up for exhibit space or get general information about the meeting, go online to ace.aapg.org/2015. ☐



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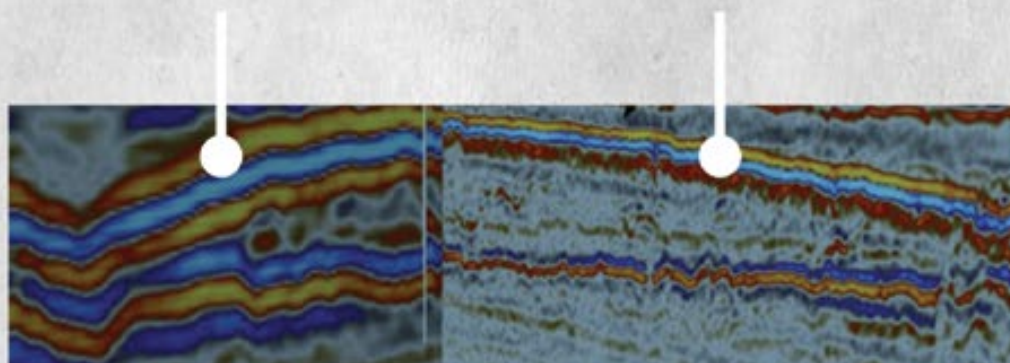
Dan Cooper: dan.cooper@ncs-subsea.com | Derek Skoyles: ds@dynaac.com

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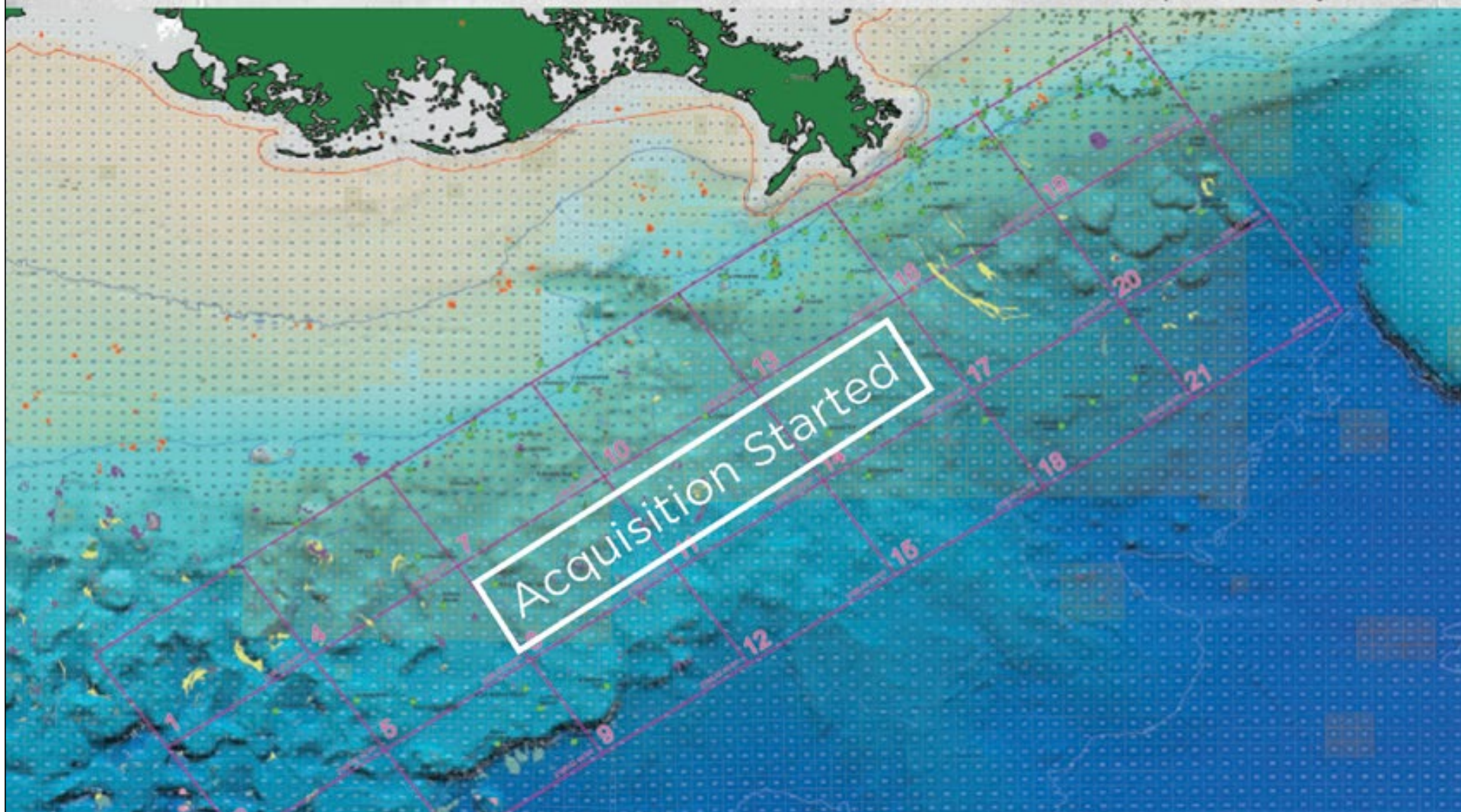
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Intersecting line from P-cable ultra high resolution cube



Seismic photos courtesy of Statoil



Finding the 'radical middle'

Unconventionals: Fuel for the Sustainable Switch?

By HEATHER SAUCIER, EXPLORER Correspondent

The shale oil and gas boom in the United States has unleashed a slew of numbers. They are a myriad of estimates, hypotheses and calculated guesses from a range of experts – all trying to predict the degree and duration of the nation's newly found energy security.

Unconventional resources are pumping billions of dollars into the country's coffers, creating millions of jobs and favorably tipping the import/export scales for oil, gas and petrochemicals – significantly reducing the country's trade deficit.

With all the facts and figures being tossed about, perhaps the most important is time.

The current, free-flowing supply of hydrocarbons has brought a sigh of relief to many who have been scrambling to find alternatives to dwindling supplies of conventional fossil fuels.

But while some estimate the shale energy boom has handed the nation at least four decades of energy security, this is not a time to rest easy, said past AAPG president Scott Tinker, the director of the Bureau of Economic Geology and state geologist of Texas.

"Unconventional resources have extended the future of oil and gas in this country," he said. "Let's use that time wisely."

Buying Time

The evolution of technology has taken the oil and gas industry from vertical wells to complex horizontal wells, each designed and stimulated to yield the maximum recovery from reservoirs that have remained untapped for years.

Tinker, who co-produced the 2011 award-winning documentary "Switch," which thoughtfully assesses the steps and pieces needed for long-term energy security, said now is the time for our thinking to evolve. The time bought by the shale boom should be carefully used to plan an intelligent "switch" to more sustainable resources.

"Energy powers our lives and we have a remarkable number of options. The transition is going to take many, many decades," Tinker said.

Production of current foundational fuels – oil, gas and coal – through unconventional means is currently on the rise. However, those upward arrows on the graph will inevitably change direction as supplies are depleted.

Sustainable energy, on the other hand, which comprises just 2 percent of the world's power, is steadily rising, albeit at a much slower pace.

Globally speaking, for oil, gas and coal to comprise just half of the world's power supply by 2064, Tinker said:

- ▶ The production of natural gas will have to roughly double.
 - ▶ Nuclear reactors must increase three-fold.
 - ▶ Renewable energy, including wind, solar, biomass and biofuels, will have to multiply by five.
- How will we get there?

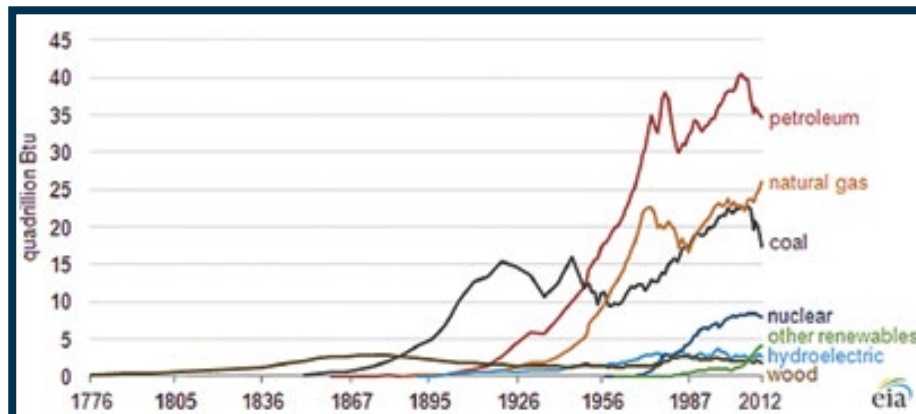
Getting from A to B

The world's use of oil, gas and coal can be linked to the fact that they are affordable, reliable and, although the clock

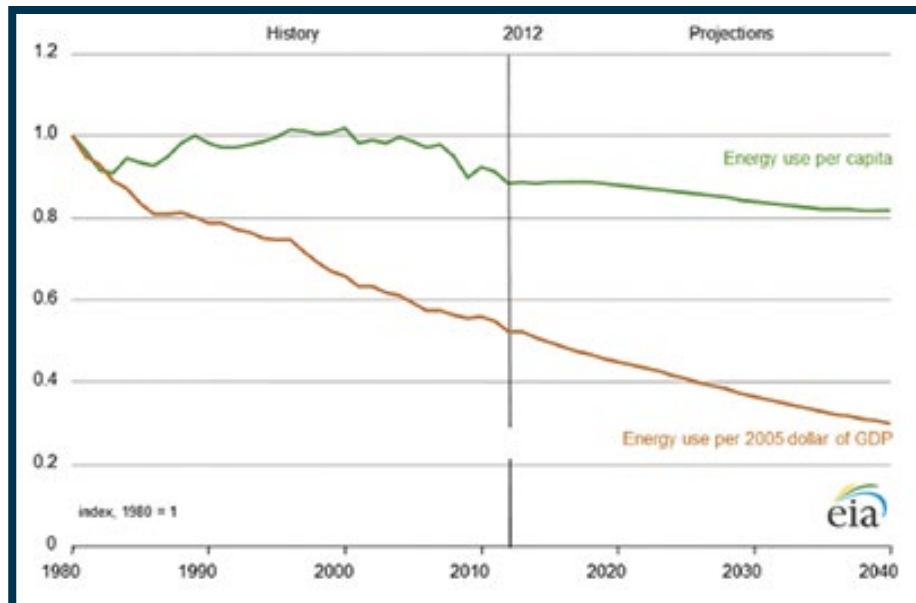


TINKER

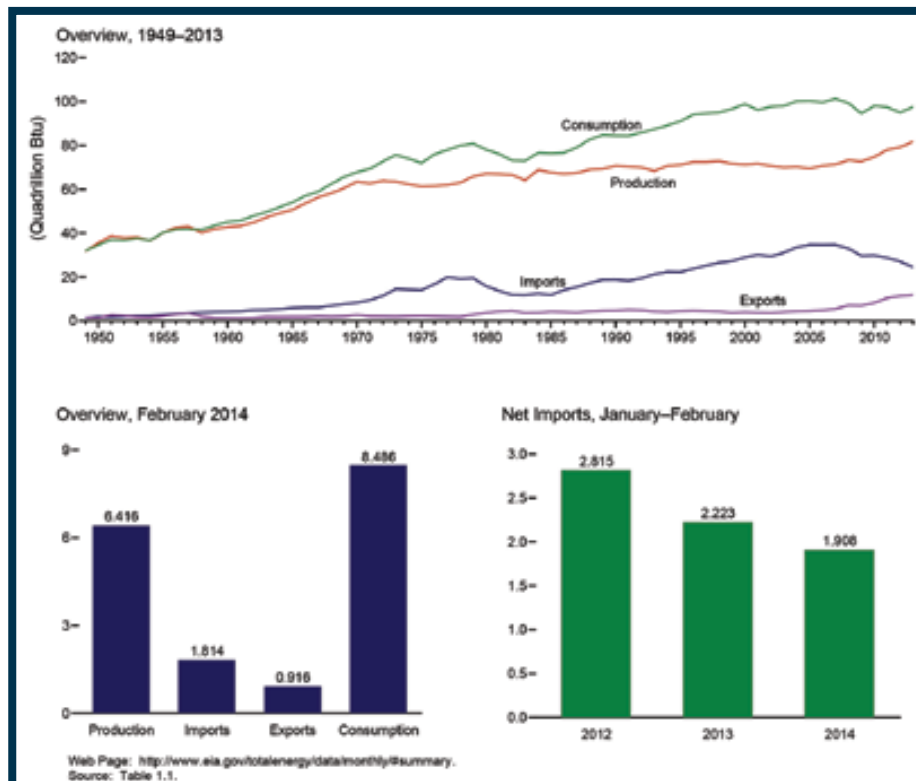
"Unconventional resources have extended the future of oil and gas in this country. Let's use that time wisely."



History of energy consumption in the United States (1776-2012).



Energy use per capita and per dollar of gross domestic product, 1980-2040.



Primary energy overview.

has begun to tick, available, Tinker said.

But a transition to sustainable energy is no flip-of-a-switch. It took France approximately 30 years to get roughly 80 percent of its electricity from nuclear energy. Denmark took about 35 years to get 20 percent of its electricity from wind.

Energy providers also must be able to fund the hefty upfront costs for large acres of land needed for biofuel, wind and solar farms, and the infrastructure for nuclear reactors.

Politics, industry and researchers must converge to provide an intelligent and efficient transition, Tinker said.

"We need to bring them into what I call the 'radical middle,' where we can recognize we are not always right and make compromises," Tinker said. "Let's build new infrastructure, but build it well. Build pipelines, but build them well. Allowing drilling, but regulate it well. A lot can go on in an intelligent world."

Changes are starting to be seen. Today, oil comprises 34 percent of the world's energy compared to 50 percent 30 years ago. Coal is at 29 percent, while natural gas and nuclear energy are at 23 percent and 5 percent, respectively, and both are climbing, Tinker said.

As experts work out the puzzle for long-term energy security, the "revolution" created by unconventional resources must be seen as an "evolution," Tinker said.

And, he added, the technology that is allowing production of an estimated two-thirds of the nation's natural gas resources and approaching three million barrels of oil per day must continue to improve to sustain consumers during this time of transition.

The Mother of Invention

Prior to 2007, the U.S. Energy Information Administration (EIA) did not report any data on shale gas and tight oil. At the time, the industry was largely pursuing conventional resources – although in more challenging environments – as more accessible reservoirs had been tapped to the max.

The need for hydrocarbons became a catalyst for the development of technology that could take operators to the Arctic, desert and deep sea. The majority of drilling has moved offshore into depths of 8,000 feet and greater.

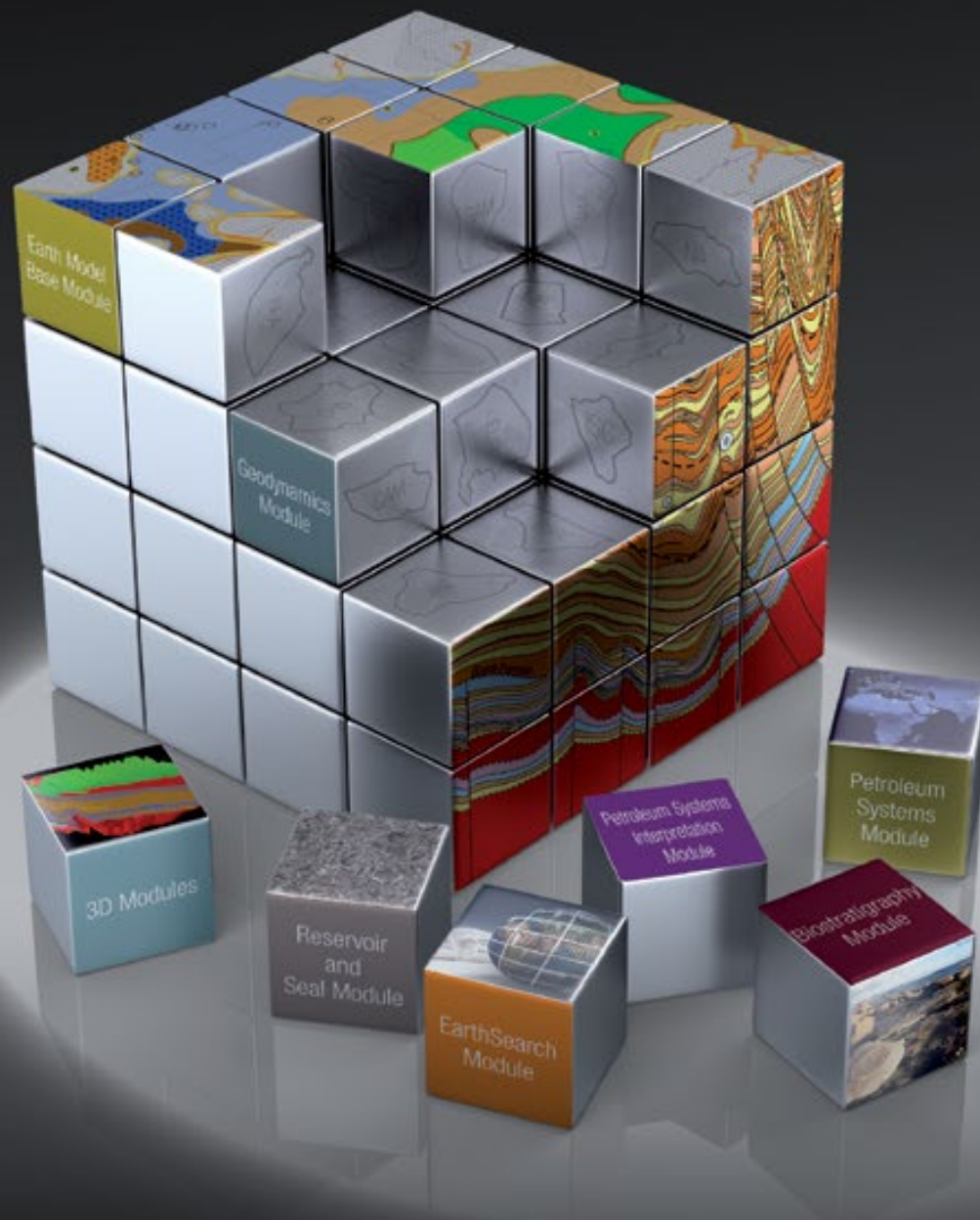
As computers capable of processing huge amounts of data in quick intervals of time became available in the mid-1990s, 3-D seismic became an invaluable tool for mapping reservoirs, said AAPG Honorary member R. Randy Ray, a consulting geologist/geophysicist of R3 Exploration in Denver. The number of geophones used in the mapping process jumped from 100 to 10,000, significantly sharpening the images of reservoirs and enabling more efficient drilling, he said.

Back on land, the late George Mitchell of Mitchell Energy was experimenting with horizontal drilling in the Barnett shale from the 1980s to the early 2000s, determined to recover the Fort Worth Basin's abundant supply of natural gas despite countless detractors. The right combination of horizontal drilling and multi-stage hydraulic fracturing unlocked hydrocarbons trapped

See **Unconventionals**, page 12

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Now Explore



Unconventionals
from page 10

in impossibly tight pores of shale.

"Once the Barnett shale started to work, the shale boom was on," Tinker said. "Many companies were born and built a whole portfolio around leasing and developing shale."

At the time, natural gas was the major play, as gas prices were on the rise. Then, the same combination of technology was applied in the Bakken formation in North Dakota and Montana – and it proved just as effective in recovering larger, tight oil molecules.

"The biggest step change in my whole career is horizontal drilling and multi-stage fracturing," said AAPG Honorary member and past AAPG president Steve Sonnenberg,

professor and Charles Boettcher Distinguished Chair in petroleum geology at the Colorado School of Mines. "If it were not for that combined technology, much of the Bakken would be uneconomical to produce."

In the 2000s, advanced downhole technology in geosteering enabled engineers to actually see into the wellbore as they steered the drill bit through the rocks. Drill bits and downhole motors also advanced. The trial and error process of

drilling was giving way to accuracy and precision.

As time has progressed, the legs of horizontal wells have begun stretching over two miles in lateral length. The recent record for the number of hydraulic fracture stages in one horizontal well is 92, Tinker said, noting its location in the Eagle Ford shale.

"Computing technology, communications technology and drilling technology continue to evolve and allow us

"We need to change the way we think about energy so we can change the way we use it."

to explore in ways that were never possible before," Tinker said. "We're working with the same rocks. We are just using new technologies to extract the resources.

"It used to be that if you cored a shale sample, you'd get fired," he said in tongue-in-cheek mode. "Now, if you *don't* core a shale you get fired."

Unconventional Nation

The direct and indirect effects of unconventional resources have created 1.7 million jobs in the United States, and a projected three million jobs will be created by 2020, according to IHS.

It also has added \$62 billion to the country's economy.

According to the EIA, the domestic production of oil, gas and coal satisfied 84 percent of the total U.S. energy demand in 2013.

EIA statistics also show that the shale energy boom has:

- ▶ Enabled the export of chemicals.
- ▶ Attracted investors from Europe, Asia and the Middle East.
- ▶ Reduced petrochemical imports.
- ▶ Reduced the nation's trade deficit.
- ▶ Enabled many to trade coal for natural gas for home electricity.
- ▶ Lowered carbon emissions.

Clearly ahead of all other countries in its development of unconventional resources, the United States has much to credit for its success.

Already in place, according to IHS, are a well-developed energy infrastructure, private-sector ownership of mineral rights, a competitive industry with many independent operators, access to risk capital, flexible and adaptive supply chains, and supportive state regulations and fiscal regimes.

"We have a tremendous volume of unconventional resources in this country, and they are greater than I think anyone ever thought," Sonnenberg said. "One of the most important things for people to realize is the technology out there to extract it is ever increasing, it is ever increasingly environmentally friendly, and I think the future is very bright."

Make It Brighter

While the United States is reaping the benefits from its energy boom, around the world are over one billion people without access to electricity, Tinker said.

"In the coming decades, the energy needs of India and China will surpass the United States and all of Europe," he said.

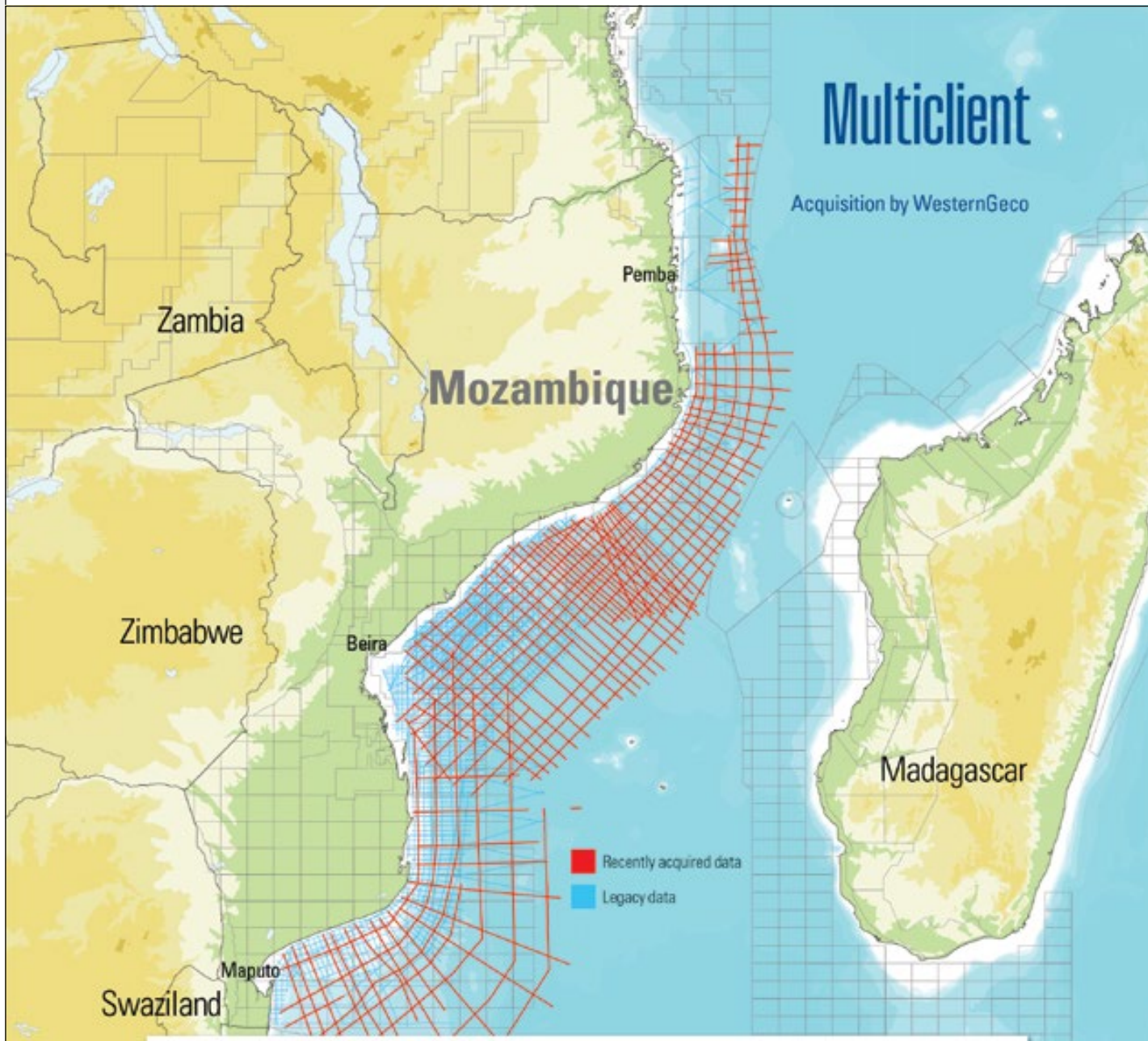
While experts gather around the table to solve the puzzle of the energy switch, Tinker revealed another energy alternative that, if employed by the world's 5.4 billion energy consumers, would make a solid impact on the need for resources: efficiency and conservation.

If more people turned off lights, insulated their homes, repaired leaks, installed radiant barriers and used energy-efficient appliances, a marked difference could be seen, he said. This personal cultural shift would translate to business, industry and government.

"We need to change the way we think about energy so we can change the way we use it," he said.

Among a host of energy-saving techniques adopted by Tinker and his Austin-based family is the recent purchase of a golf cart used to run errands near their home and take their kids to school.

"There's a tremendous role that each of us plays in efficiency," he said. "What you do and what I do are the most important part of our energy future." ■



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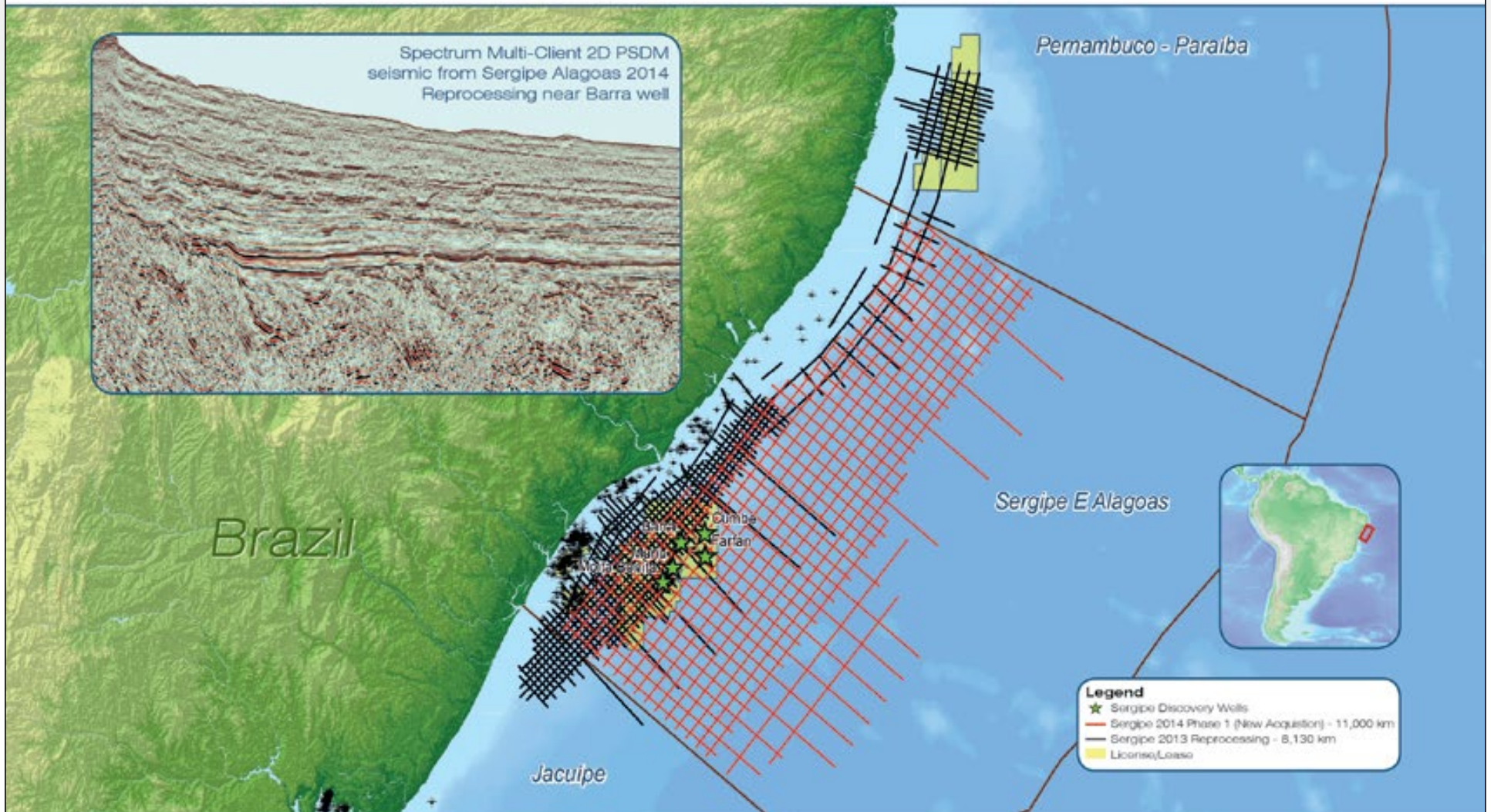
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Brazil: Sergipe Alagoas

New 2D Multi-Client Seismic Data Available



Spectrum has commenced a 10,000 km Multi-Client 2D seismic survey 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 and PreSDM data will be available in Q4 2014.

To supplement the new acquisition in this active exploration area, Spectrum has completed the reprocessing of 8,130 km of data through both PreSTM and PreSDM and is offering this data to industry in order to get a head start on the expected upcoming round in 2015.



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Geophysical Pursuit, Inc (GPI) is incorporated as a Texas Corporation on May 21st, 1984.

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In 1985 GPI acquires its first seismic program in Vermilion Parish, LA. Between 1985 and 1987 GPI acquires over 750 miles of 2-D seismic data in both Vermilion Parish, LA & Kern County, CA.

1987

In 1987 GPI enters into a partnership with Western Geophysical Company (now WesternGeco) by purchasing the proprietary rights of the Camerina Trend 2-D survey in Cameron Parish, LA.

1995

Within the ongoing partnership with Western Geophysical, GPI commences its first 3-D survey: 385 square-mile Galveston Bay.

1997-99

Partnering with Petroleum Geo-Services (PGS), in 1997 GPI enters the Deepwater Gulf of Mexico by acquiring 3-D data in the Western Gulf of Mexico. Between 1997 and 1999, GPI acquires over 700 OCS blocks in WGOM.



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2004-07

In 2004, GPI, partnering with WesternGeco, acquires over 350 OCS blocks of OBC 3-D within West Cameron & Main Pass (Central Gulf of Mexico). The 20-year partnership between GPI & WesternGeco now exceeds 50 seismic joint-venture programs.

2009-12

GPI, in partnership with Geokinetics, begins acquisition of the first Pennsylvania Multiclient 3-D survey within the Marcellus Shale, which has become a contiguous 3-D survey totaling over 2,000 square miles.

2011-14

GPI, in partnership with Geokinetics, acquires 1,600 square miles of contiguous data in Weld County, CO (Niobrara-Wattenberg area).

GPI enters into West Texas and Kansas with the acquisition of multiple proprietary 3-D surveys.

GPI contracts with Dawson Geophysical to acquire 400 square miles in Northwest PA (Utica).

2013

GPI, in partnership with SEI, forms SEI/GPI JV, LLC to acquire an exclusive marketing interest in the Global Geophysical 3-D database (9,500 square miles).

2013-14

GPI, in partnership with WesternGeco, acquires 300 OCS block of WAZ 3-D within the Flex Trend of the Gulf of Mexico.



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Cracking the code

Amid Boom, Shale Secrets Still Elusive

By LOUISE S. DURHAM, EXPLORER Correspondent

It's tempting to think that the industry is going to ride high on shale fever forever.

After all, it's still a thrilling and often lucrative ride, at least for some folks.

But forever is such a long time.

In this notoriously cyclical industry, the savvy players recognize the need to look back often over their collective shoulders to be reminded of what has come before.

Granted, the last decade-plus has been awesome for U.S. energy production from shale plays.

Given all the success stories, it's intriguing to realize these plays are still far from being a known – variability is indigenous. The players talk about “cracking the code,” but the “code” can differ even between adjacent wells.

A recent Bloomberg report noted that independent producers will spend \$1.50 drilling this year for every \$1 in return, and the International Energy Agency has reported that 2,500 new wells per year are necessary to maintain output of 1 MMBopd from the famed Bakken play.

Challenge may be the name of the game, but it's not the end of the game.

“You can only win if you play,” noted AAPG member Luis Baez, North American manager at BG-Group and co-chair of the upcoming Unconventional Resources Technology Conference in Denver.

The myriad still-unanswered questions about shales tend to stir up memories of the once-booming Austin Chalk play in south Texas. The complex Chalk has



MEEHAN

“The things we’re trying to characterize are often geomechanical values.”

challenged, and taunted, industry operators for decades.

The shale play staple technology, horizontal drilling, first became a household word on the brink of the 1980s when it became a kind of panacea to wrest production from the brittle, fractured chalk.

Industry veteran and AAPG member Nathan Meehan, senior executive adviser for advancing reservoir performance at Baker Hughes, has in-depth experience with these type plays and more.

Separating the Wheat From the Chaff

Meehan shared a bit of his considerable insight on shale issues:

“One of the things I’m concerned about is the ability for us to quickly identify what resource plays, or what portion of a resource play, are going to be commercial. If you examine the distribution of well performance even in commercial plays, a large fraction of the wells are uneconomical – like a third or more,” he said.

“And the people that have run production logs along the (shale) wells have identified that, typically, more than 30 percent of the frac stages in a good well have been unsuccessful – at least there’s been no significant contribution to production coming from them,” he said.

“If you look at every (shale) play in North America tested at any level, no one drilled something that had no chance whatever. They all had indicators of possible success.

“Yet a substantial number of those plays had gas results that would not be commercial at any foreseeable gas prices. Quite a few plays might be commercial at \$8 to \$10, but some not even at \$12.

“To me those are the technically unfeasible plays, he said, and that’s a huge fraction of the total number of plays.”

Meehan emphasized how essential it is to understand the reservoirs via characterization. It’s a whole different game from playing the long-familiar conventionals. Hydraulic fracturing complicates the characterization process, which entails

a number of factors having a complex relationship. Geomechanical values figure in significantly. Plus, it’s time to log areas further out in addition to those at the wellbore: “The technology solutions we’re looking for are ways to characterize the reservoirs and characterize those factors which drive production,” he explained.

“In conventional reservoirs, if you look at equations for Darcy’s Law and material balance, they’re full of variables that we sort of know how to measure, like porosity, permeability, viscosity. By characterizing those, we can predict how well the reservoir will perform to varying levels of success. Fundamentally, that’s what we do and what we’re kind of good at.

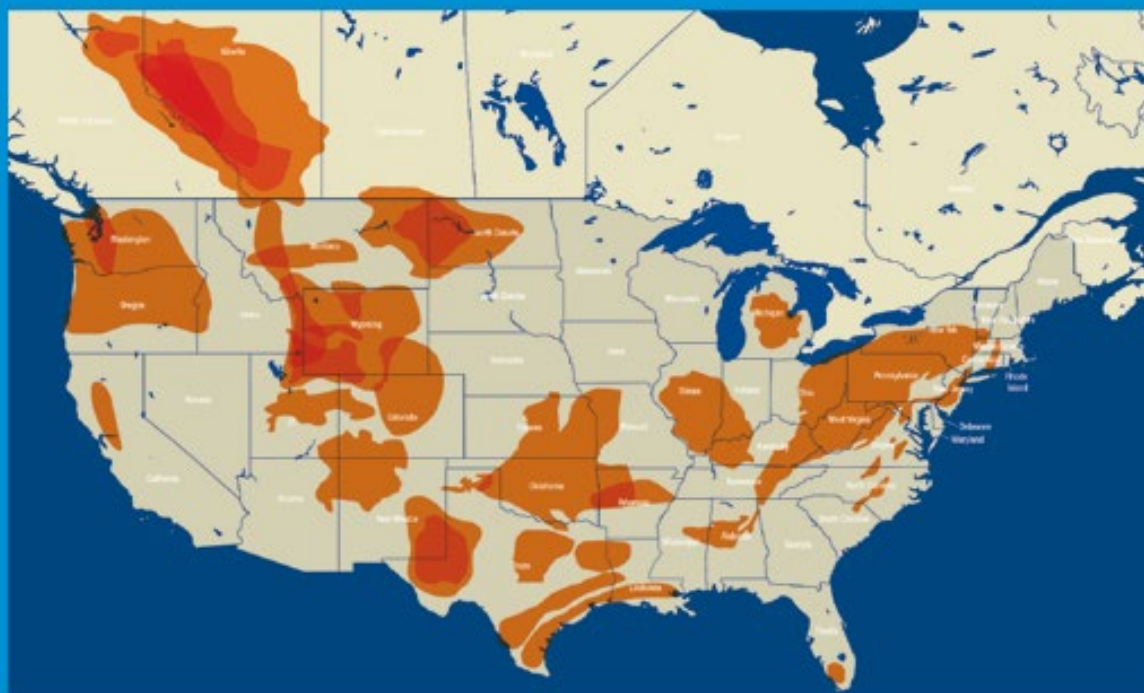
“The things people talk about for unconventional, such as TOC (total organic carbon), how susceptible the reservoir is to hydraulic fracturing or, indeed, complex hydraulic fractures – those don’t show up in Darcy’s Law or material balance equation.

“The factors that do indeed contribute to some degree to success don’t have a simple relationship.

“So the things we’re trying to characterize are often geomechanical values, not only the distribution of natural fractures but the distribution of critically stressed fractures, detection of slowly slipping faults, characterizing the fractures away from the wellbore.

“We’re looking at trying to do more and

[See Shale, page 18](#)



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Shale from page 16

more logs that will actually measure faults and fractures that don't intersect the well. That's a kind of technology we're going to have to have to understand the reservoir. Just the ones at the wellbore are probably not enough."

One Size Doesn't Fit All

Hydraulic fracturing has proven to be an indispensable technology in the oil patch, but like any technology, there's always room for improvement. Natural fractures need love, too.

"In hydraulic fracturing, we must do things that improve how we identify where to frac, as well as the designs. And we're going to have to have a better

understanding of where the frac jobs are going," Meehan said.

"Right now one unconventional operator might use lots of slick water fracs, one might decide to do hybrid fractures and another might do conventional fracs. But they typically do the same thing in every stage, like maybe 35 slick water jobs in a wellbore," he said.

"If you look at how variable the wells are along the (well path), it might be that we need to do different types of frac jobs along the well," he added. "We haven't done a good job of elucidating what drives performance because all of it is mixed together. We have very few detailed predictive measurements that show response from a given well."

Meehan said that the push to do factory drilling has led people to make fewer log measurements, take fewer cores and gather fewer reservoir characterization details.

"So," he continued, "it would be easy to conclude that variability from well to well is somehow statistical in nature, because we're not looking for and don't have the tools to find factors that drive reservoir performance."

There's still a debate as to how significant the natural fractures in a reservoir that slip and shear are to production, as compared to the surface area created by the hydraulic fractures.

"There are people who believe that the major contribution to production is these natural fractures that slip and shear as a result of strain associated with hydraulic fracturing, and that improves the permeability and connectivity away from the fractures. So much so that that's what drives the commercial production," Meehan said.

"There are others who model the reservoir with no change in permeability. They just model with complex hydraulic

fracturing," he said.

"It's likely a mixed answer," he concluded, "with some reservoirs leaning toward one and some toward the other."

Help Wanted

Yes, microseismic is a cool technology, but it needs help to identify what's going on, as Meehan explained:

"We do a very poor job, even with microseismic, of identifying quantitatively what changes there are in permeability away from the hydraulic frac; we don't know how to quantify that.

"My guess is that's a key driver to what constitutes a sweet spot," he added. "It's the potential to increase the permeability in the matrix as a result of hydraulic fracturing. We have to integrate reservoir characterization at the wellbore, away from the wellbore and through microseismic before we have a chance of understanding what these wells do.

"The problem, of course, is everyone has so many rigs going that no one wants to study and slow the process down, he said. "If you're having success in developing wells, you don't necessarily stop to figure out why – that's led to the factory drilling campaign."

Pad drilling is a relatively new kid on the drilling block, where multiple wells can go down in close proximity.

That can be a blessing and a curse. "Another technology we have to do better on is related to pad drilling," Meehan said, because "we all want a smaller footprint.

"There are a lot of places where we'll have to drill dozens of wells from drilling pads," he said. "Ultimately, for oil reservoirs, they'll all need artificial lift, and you can't put a dozen or more sucker rod pumps with surface pumping units all together where people can see them.

"We're going to have to change how we do artificial lift (and) hydraulic fracturing – and we have to dramatically change how we do reservoir characterization so we can then do real reservoir understanding instead of just statistical correlations," he said.

"There's a remarkable number of very simplistic analyses done just sort of by cross-plotting things in Excel," he added. "The amount of noise there and the lack of ties to fundamental physics gives these pseudo-correlations that kind of look like a visible correlation – but when you look and see R-squared is .4, you know there's essentially no predictive power."

Upgrading Water Usage

Water used for hydraulic fracturing can vary – it can be fresh, produced, flowback. The latter two are preferred, and are more plentiful where the wells are close together.

Water usage overall can be reduced with seemingly little, yet concentrated effort.

"Another thing that needs a technology boost is the water usage problem, Meehan said. "We use a great amount of water and must figure out a way to use otherwise non-usable water.

"With produced or flowback water, that's facilitated with more wells from a drill pad," he explained.

To minimize the amount of water used, Meehan said, we should:

- ▶ Stop drilling the really poor unconventional wells, "which would take out 30 to 40 percent of the wells," he said.

- ▶ Stop fracing the parts of the wellbore that won't contribute to production – "there's another 30 to 40 percent," he said.

See Reservoir, page 55

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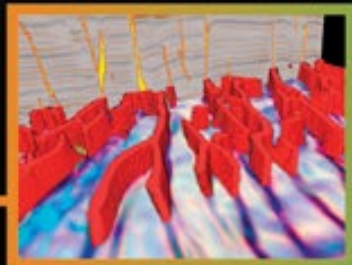
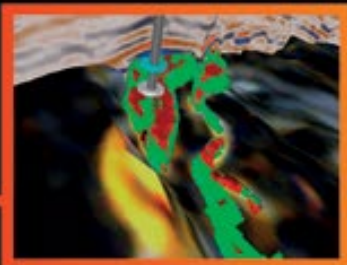
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Global Spotlight Shines On Emerging Shale Plays

By DAVID BROWN, EXPLORER Correspondent

Last year's Unconventional Resources Technology Conference (URTeC) was like a full-length feature documentary on unconventional oil and gas plays.

This year, URTeC has added an enhanced preview of "Coming Attractions."

In addition to looking at established plays, URTeC will provide significant information about emerging unconventional resource possibilities in North America and around the world.

URTeC is the oil and gas industry's only integrated event for unconventional resources, sponsored by AAPG, the Society of Petroleum Engineers (SPE) and the Society of Exploration Geophysicists (SEG).

By design, each conference session includes geological, engineering and geophysical perspectives. URTeC aims to be the one unconventional resources event where key disciplines come together in an integrated environment.

Like last year's inaugural meeting, URTeC 2014 will be held at the Colorado Convention Center in Denver, this year on Aug. 25-27.

The conference includes a full slate of oral presentations plus e-papers, interactive panel sessions, field trips and a total of 15 topical breakfast and luncheon sessions.

"Attendees with various levels of unconventional experience can attend. It attracts those that have expertise in unconventional with its top-quality content," said Jennifer Bell, chair of the ASME's Petroleum Division and chief executive officer of Elements Offshore LLC in Houston. She will serve as co-chair for the URTeC session "Emerging Plays: Roadway from Ideas to Sweetspots."

That's just one of several sessions on emerging unconventional plays scheduled at URTeC 2014, including a panel session on developing international plays.

"It also attracts newcomers, as the event has a balanced depth and breadth in content as well as networking opportunities for engineers and scientists that they may not otherwise have," she added.

Latin Potential

Interest in international unconventional possibilities kicked up sharply earlier this year.

In May, ExxonMobil Corp. announced its Bajo del Choique X-2 well in Argentina had



Orbitally controlled rhythmicity (Milankovitch cycles) of the Vaca Muerta Formation.

flowed at an average rate of 770 barrels of oil/day on choke in its first test. The well was completed in the Vaca Muerta formation, after drilling to a total measured depth of about 15,000 feet (4,570 meters).

"Not all shales are alike, so our first ExxonMobil-operated discovery in the Vaca Muerta play is a very positive sign that the shale in this area of Neuquén Province holds great promise as a liquids-rich unconventional resource for Argentina," said AAPG member Stephen Greenlee, president of ExxonMobil Exploration Co.

Vaca Muerta is seen as one of the most promising new international shale plays. Earlier this year, Chevron Corp. and state-owned oil firm YPF announced plans to invest an additional \$1.6 billion to develop Vaca Muerta potential.

Other shale possibilities have emerged in the Magdalena Valley area in Colombia, especially in the Cretaceous La Luna formation. Earlier this year, ExxonMobil and partner Canacol Energy Ltd. of Calgary announced they'd produced 590 barrels of oil/day from a La Luna discovery well after acid treatment.

Both the Vaca Muerta and La Luna will be the subject of papers in the oral presentation sessions at URTeC 2014.

Around the World

Intriguing unconventional possibilities

also involve emerging play areas in both Mexico and China. In Mexico, the industry's interest is focused on an extension of the Eagle Ford shale play into the northern Burgos Basin.

Eagle Ford potential and characteristics will be addressed in numerous oral presentations at URTeC, including a discussion of the play area east of the San Marcos Arch and an update on the Eagle Ford East-Eaglebine in the United States.

Mexico includes six main onshore unconventional resource provinces, and several successful shale tests already have been drilled in the country. According to state oil firm PEMEX, the total national unconventional resource potential could exceed 60 billion barrels of oil equivalent.

In late 2013, Mexico adopted its most significant energy reforms in 75 years, possibly opening its energy sector to international participation, another development drawing industry interest.

Development of unconventional in China has mainly targeted tight oil and gas, in addition to an established coalbed methane program. But the country has shale resource possibilities in more than a dozen basins, stretching from the Tarim Basin in west China to basins offshore the country's east coast.

Other presentations will examine upcoming unconventional plays from Saudi Arabia to the North Sea.

Discussion of emerging resource possibilities in North America will include Ordovician unconventional oil potential, the Skull Creek shale in Wyoming, a new resource play in Colorado and Aptian prospectivity in the Mississippi Interior Salt Basin.

'Everything for Everybody'

Once again, URTeC will feature an in-depth look at the most important continuing unconventional plays in the United States, including case studies and technical presentations on the Bakken, Marcellus, Eagle Ford and Woodford plays.

Presenters also will discuss developments in the Midcontinent Mississippi lime play, the Cana Woodford shale play, the Niobrara formation play, the Utica shale, the Mancos shale and the Wolfcamp play.

The emerging areas overview is just one of many session themes scheduled at URTeC 2014. Other sessions address:

- ▶ Regional case studies.
- ▶ Characterization of unconventional reservoirs.
- ▶ Application and integration of well data.
- ▶ Understanding the petroleum system.
- ▶ Optimizing recovery from unconventional reservoirs.
- ▶ Optimizing capital efficiency.
- ▶ Production performance of tight oil and gas reservoirs.
- ▶ Social performance.
- ▶ Reserves forecasting and estimation.
- ▶ Long-term performance.

Social performance presentations will include a session on "Water Management and Social License to Operate" and a discussion of sustainability issues, both emerging hot topics in unconventional development.

Bell sees the conference's breadth of coverage and its appeal to many different levels of interest as a unique advantage for URTeC.

"It's where someone like myself can go and enjoy the presentations and have a good time," she said, "and there are also certain tracks that are extremely technical, with people who are recognized experts."

"It's almost like it's everything for everybody." ■

Q&A With Ecopetrol's Edward Tovar: Latin American Shale Activity

By EMILY SMITH LLINAS, EXPLORER Correspondent

The hunt for unconventional plays and shale targets has become a global dynamic in the energy scene – and geologists and operators in Latin America are eagerly joining the game.

Edward Tovar is unconventional reservoirs manager with Ecopetrol, Colombia's national oil company. He has been working with unconventional reservoirs for three years and currently leads the company's efforts in the Middle Magdalena Basin.

He took a few moments to briefly talk with the EXPLORER about Latin America's current reality.

EXPLORER: *What are some of the most significant shale opportunities in Latin America?*

Tovar: Besides the opportunities offered by the Colombian basins, there are other

very attractive areas to explore in Venezuela, Argentina and Brazil, among others.

EXPLORER: *What should people outside this region know about the shale potential here?*

Tovar: People should know not only the composition of the source rocks but also the tectonic history behind those rocks.

EXPLORER: *Describe your role with Ecopetrol.*

Tovar: My primary responsibility is focused on leading the strategy of unconventional reservoirs in Ecopetrol.

EXPLORER: *What reservoirs are you exploring currently?*

Tovar: We [at Ecopetrol] are evaluating the cretaceous formations, well known as world-class source rocks. La Luna

and Tablazo formations in the Middle Magdalena Basin and other equivalent formations in the Catatumbo and the Upper Magdalena Basin as well.

EXPLORER: *What do you expect to find? Are there any preliminary results that you could share?*

Tovar: The program we have implemented has four stages: the evaluation or resource assessment, piloting of productivity, commercial demonstration and development.

So far, we have significant advances in resource assessment and identification of prospective plays for shale gas and oil.

EXPLORER: *What do you find most interesting about working with shale?*

Tovar: We have found a lot of interesting things, one of those is the possibility of

discovering new reservoirs in mature basins, as is the Middle Magdalena basin.

EXPLORER: *What is the biggest challenge your team faces?*

Tovar: We have many challenges to deal with. I would say there's a tailor-made learning curve to be constructed for the types of rocks we have in the Colombian basins.

EXPLORER: *How does working with shale exploration in Latin America compare to working with shale in other parts of the world?*

Tovar: In Latin America, we are taking advantage of the learning curve already constructed in North America. The major difference here is that there is less hydraulic fracturing capacity here than in North America. ■



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Bigger and Better: URTeC Aims High in Denver

By **KEN MILAM**, EXPLORER Correspondent

Bigger, bolder and better is what organizers are planning for this year's Unconventional Resources Technology Conference (URTeC).

The event, scheduled Aug. 25-27 at the Colorado Convention Center in Denver, comes billed as the industry's only integrated event for unconventional resource teams.

Last year's inaugural event drew more than 4,300 participants – and favorable reviews from those attending.

URTeC is sponsored by AAPG, the Society of Petroleum Engineers and the Society for Exploration Geophysicists as a showcase and information exchange for various key disciplines in unconventional plays.

"We have no new brilliant methods to do technology transfer," said AAPG award-winning member Bob Hardage of the Texas Bureau of Economic Geology, who will be participating in one of the many panel discussions planned at the event.

"You have to use a variety of approaches that range from luncheon talks to formal papers at professional meetings, from coffee bar chats to formal presentations before appropriate crowds, and from one-on-one emails to postings on public websites," said Hardage, a past editor of the EXPLORER's Geophysical Corner.

"The URTeC annual meeting will be the best venue where technology can be shared," he added.

Another URTeC panelist agreed: AAPG member Mark Sonnenfeld, vice president of geoscience for Whiting Petroleum Corp., listed technical conferences and



Last year's inaugural URTeC plenary session in Denver proved to be a popular, very successful event. Organizers are expecting more of the same this August.

publications among the major conduits for transferring information and technology.

And, this year's URTeC promises to have plenty of information and technology to share: "Overwhelming" was the word used

by technical programs coordinators Alicia Collins and Terri Duncan to describe the response to a call for papers for the event.

The Denver conference will include more than 300 multi-themed technical sessions,

On Tap: Something For Everyone

The Unconventional Resources Technology Conference (URTeC), which will take place Aug. 25-27 in Denver, is evolving alongside the industry. This year's format will mirror the industry's multidisciplinary approach to unconventional oil and gas through team presentations and panel discussions.

Geologists, geophysicists and engineers will come together and discuss how they collaborated to find the sweet spots, said AAPG Honorary member R. Randy Ray, URTeC's SEG co-chair, consulting geologist/geophysicist of R3 Exploration.

"We wanted to make it exciting and fresh. We're trying to spark some innovation in the content and how we are presenting it," Ray said. "We want this to be a multi-disciplinary experience with inter-disciplinary communication."

The conference will feature more than 300 multi-disciplinary presentations, including 189 oral sessions, 117 ePapers and 27 team presentations. Cored rock from unconventional resource plays from around the nation will be displayed in the exhibit hall.

"It's not like your father's convention," Ray said.

– HEATHER SAUCIER

topical breakfasts and luncheons, a plenary session, interactive panels and some of the industry's most respected speakers and thought leaders.

The idea behind the conference is to bring together scientists, engineers and business managers to cross-pollinate ideas and encourage an "asset team" approach to exploration and production in fast-developing, unconventional plays.

And, according to surveys of last year's participants, 100 percent said they found the event useful to them in their jobs and 91 percent said it succeeded in creating sessions of interest across disciplines.

Almost 200 exhibitors participated in last year's show.

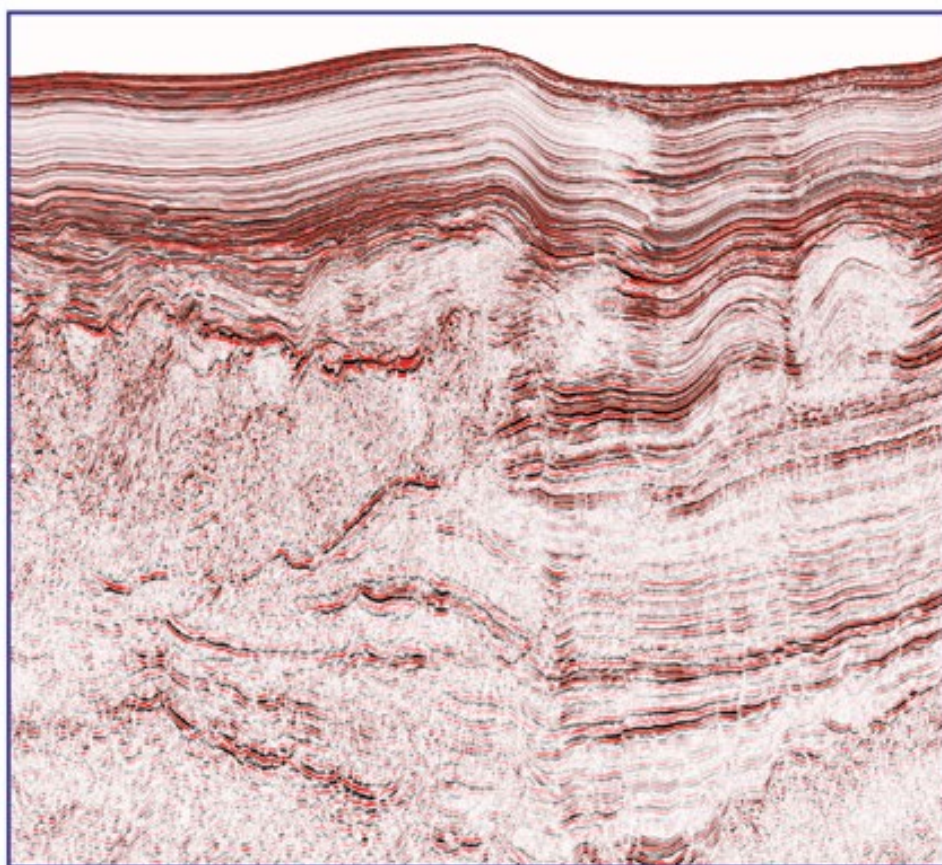
Cores from several unconventional reservoirs will be on display during exhibit hours, allowing attendees to view the actual rocks and compare analyses and results summarized by service companies that performed the studies. Cores are expected from Haynesville, Bossier, Eagle Ford, Marcellus, Utica, Woodford, Niobrara, Tuscaloosa and Bakken.

The opening plenary session will have a panel of experts addressing the topic of "Using Science and Integrated Technologies to Develop Unconventional Plays."

Other interactive panel discussions will include "Nimble Independents: Moving the Needle With Innovation and Execution Excellence," "Converting Technology Into Dollars," "Emerging International Plays" and "Water Management and the Link to License to Operate."

For more information or to register, visit urtec.org.

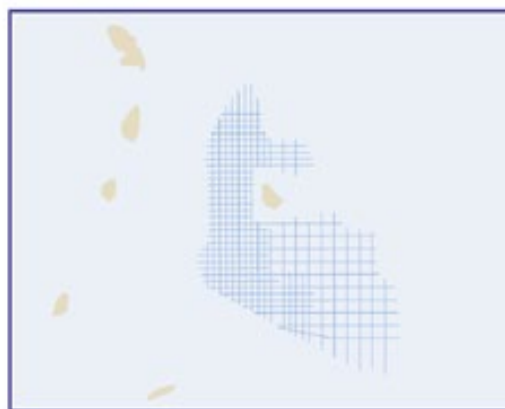
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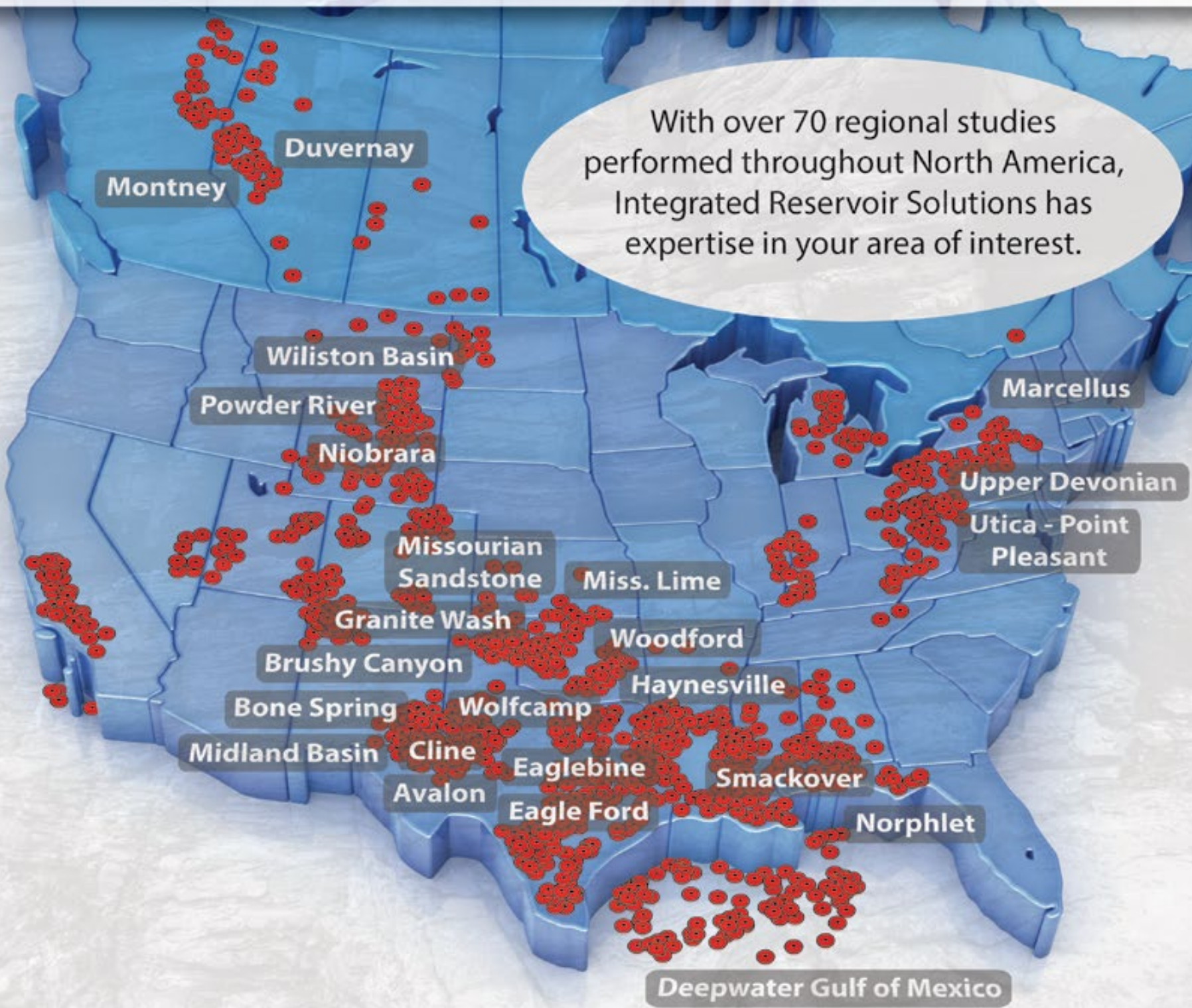
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Putting it together

Making Technology a Profitable Enterprise

By **KEN MILAM**, EXPLORER Correspondent

The aim is pretty clear: "Converting Technology Into Dollars."

That's the title of one of several panel discussions scheduled for the Unconventional Resources Technology Conference (URTeC) Aug. 25-27 at the Colorado Convention Center in Denver.

Panelists will include:

- ▶ AAPG member **D. Nathan Meehan**, senior executive adviser, Baker Hughes.
- ▶ AAPG member **Bob Hardage**, senior research scientist, Bureau of Economic Geology. He's a past president of SEG and former editor of the EXPLORER's



HARDAGE

Geophysical Corner.

- ▶ AAPG member **Mark Sonnenfeld**, vice president geosciences, Whiting Petroleum.

"The best contribution I can make is to inform attendees about emerging new seismic technology that provides significant cost savings in acquiring P and S seismic data."

- ▶ **Dennis Degner**, director of operations, Range Resources.
- ▶ **Jeff Meisenhelder**, vice president,

unconventional resources, Schlumberger.

AAPG member **Douglas Valleau** of the Houston Geological Society will moderate the discussion.

The panel will explore how top-tier organizations lead the way by rapidly improving and deploying unconventional resource technologies and incorporating new learnings across their organizations.

"Because I am a geophysicist, the best contribution I can make is to inform attendees about emerging new seismic technology that provides significant cost savings in acquiring P and S seismic data," Hardage said.

"This topic is important," he added, "because S (shear) waves are particularly valuable for evaluating unconventional reservoirs."

Show Me the Money ... and Reservoirs

The Bureau of Economic Geology has been involved in evaluating unconventional reservoirs for the last decade, conducting several projects in different disciplines each year, he said.

The economic impact on his state's economy is significant, according to Hardage.

"For example, a short note in USA Today ... stated that royalty payments from unconventional reservoir production on university lands is adding \$1 billion annually to the university lands account that supports the University of Texas and Texas A&M University Systems," Hardage said. "This contribution of unconventional reservoir production is only a small part of the overall economic impact that unconventional reservoirs have in Texas."

"One type of reservoir that fits into the unconventional category is geothermal," he continued. "The BEG also has an aggressive program in geothermal systems. Many people do not think of geothermal when unconventional reservoirs are discussed."

He outlined some of the challenges faced in the Barnett Shale.

"From the seismic imaging perspective, one challenge has been, and still is, to predict geomechanical (rock stiffness) parameters with remote sensing so frac programs can be improved and optimized," he said. "For optimal estimation of rock stiffness with seismic data, it is essential to image reservoir systems with both P and S seismic wavefields."

"We at BEG think we may have a way to do this imaging at low cost and across earth surfaces where conventional S-wave sources cannot be used," Hardage said.

Sharing Trade Secrets

Sonnenfeld's company, Whiting Petroleum, has been involved in the horizontal middle Bakken play since 2005 and the Niobrara play since 2010.

"In the Bakken we have 15 rigs running, and in the Niobrara we have three rigs running, anticipating several more before year end," he said.

"The greatest challenges," he added, "are how densely to drill/downspace to maximize recovery efficiency and present value."

"Pilot project design, implementation,

See **Technology**, page 26

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Getting the basics

Unconventional Fracturing

By LOUISE S. DURHAM, EXPLORER Correspondent

Hydraulic fracturing has become so widely used, principally in shale well completions, the casual observer might be inclined to think it's not only commonplace but a standard, one-size-fits-all technology application.

Not so.

Reservoirs are nothing if not variable, and hydraulic fracturing design and implementation are complex undertakings.

This is particularly true today.

"The current methods allow dozens of fractures to be created in a single wellbore, which is essential to developing these types of reservoirs," said Steve Hennings, owner and principal engineer at Source Rock Engineering in Littleton, Colo. "But in most cases, treatment costs have escalated beyond the cost to drill the well.

Additionally, actual field results from around the world show that relatively slight changes in treatment design have huge impacts on production rates, he continued.

"Until the appropriate treatment design is identified and confirmed for each individual play," he said, "commercial development of shale or tight reservoirs is difficult or even impossible to achieve."

Along with the fracturing experts, there are other industry professionals who must have an understanding of this technology in order to input their own brand of expertise to ensure that all goes well.

Enter the geologist.

"Successful treatment design and optimization for unconventional reservoirs requires that we integrate formation data from a variety of sources," Hennings said.

This includes key geologic data that often aren't considered or collected for conventional reservoirs.

"If there are people working to implement development plans and not talking to geologists, it's a really big red flag," he emphasized. "It's so significant to incorporate the geology with well completion design."

Target Audience

Hennings doesn't just talk the talk; he walks the walk.

Recognizing the need to bring up-to-speed the professionals who are not widely recognized as essential to these multi-faceted unconventional completions, he travels far and wide presenting a daylong educational course. It covers

results gleaned from a variety of hydraulic fracturing field trials worldwide that entail completions in shales and tight reservoirs.

Both technical and non-technical factors controlling the success of a particular treatment design are addressed, as well as a review of the reservoir properties that govern which type of fracturing treatment should be most applicable to a new play area.

A URTEC short course on "Hydraulic Fracturing Fundamentals for Unconventional Reservoirs," taught by Steve Hennings, will be offered in Denver Sunday, Aug. 24. It is one of six short courses offered for URTEC.

For more information on any of them, go online to www.urtc.org.

A unique aspect of the short course is its target audience.

Hennings said it's designed for geologists, engineers and people with some technical background on evaluating and developing oil and gas.

"It's probably not for people who do this kind of work every day," he noted. "It's for (those) who want to get more familiar with what's involved with it and why people request the information they do."

"For example," he said, "what kind of information do the people completing these wells need from the geologist, and what are they using that information for?"

Hennings emphasized the course participants will acquire an improved understanding of myriad aspects of hydraulic fracturing:

- ▶ Unique terminology applied in current hydraulic fracturing treatments.
- ▶ Concepts and terms that are unique in defining shale and tight reservoir properties.
- ▶ Five different objectives for creating a hydraulic fracture.
- ▶ Fluid, equipment, proppant and other design options.
- ▶ Data and concepts required to select the appropriate treatment interval.
- ▶ Methods that are being applied in the current major plays – and why they vary by play.
- ▶ Treatment design and calibration field tests.
- ▶ Methods for evaluating a treatment, and common evaluation mistakes.
- ▶ Common mistakes in designing treatments.

Technology from page 24

and interpretation sooner rather than later in a sweet spot's development history – this trend is one of the most important areas of technology development at the moment," he said.

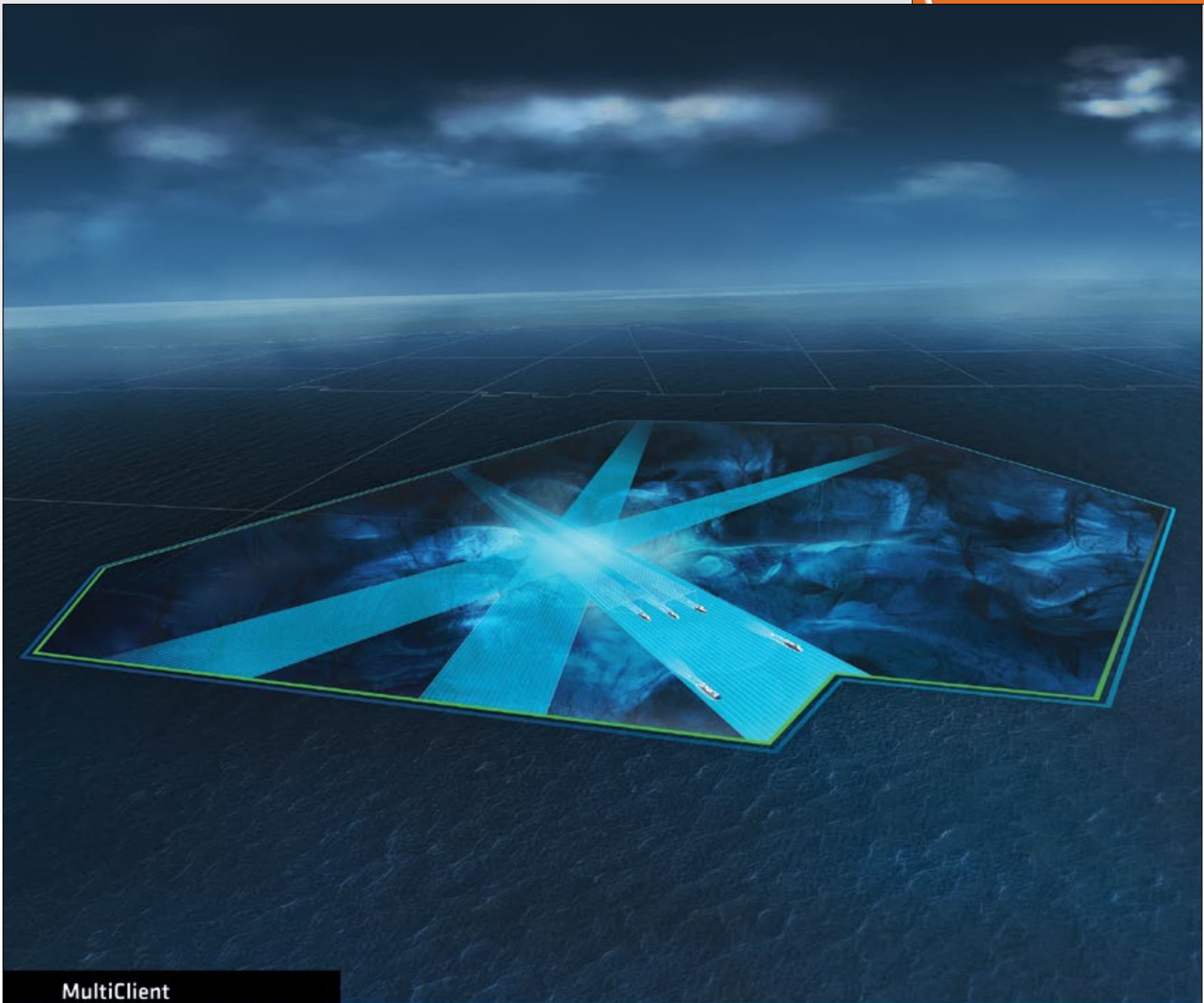
"These projects can involve anywhere from three to 16-plus wells and typically diverse data types; the more diverse and independent the data types acquired, the more robust the interpretive results," he said. "Specifically, HD pilot objectives emphasize how frac jobs and drainage areas among closely-spaced wells interact to produce incremental versus accelerative production.

According to Sonnenfeld, microseismic technology has made major, rapid strides and evolving hydraulic fracturing technology is making sweet spots in areas considered low-performing scant years ago.

Sonnenfeld also said discussions at conferences like URTEC are a valuable way to share ideas and new technology, especially across disciplines.

"There are also different degrees of data sharing across technical fields; specifically geology, geophysics, petrophysics and engineering," he said. "I would describe engineering as being the most open, followed by geology, and finally geophysics.

"In some areas like drilling and completion," he added, "secrets' travel fast."



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Accelerating development – and connections

Student Chapters Breed Professional Success

By BARRY FRIEDMAN, EXPLORER Correspondent

A APG student chapter program began modestly enough – more modestly and probably in fewer numbers than you think.

“Initially it was approved for a three-year pilot program comprised of six institutions: New Orleans, Oklahoma, Southern Methodist, Texas A&M, Texas Tech and Maryland.”

That’s AAPG member Bryant Fulk, who started his AAPG career as a dedicated member of the San Diego State University student chapter and now heads the Student Chapter Committee, talking about the history and importance of the concept behind such entities.

It is a history that began in 1978 and has since grown to more than 320 institutions in more than 40 countries – and thanks in part to the AAPG/AAPG Foundation’s Imperial Barrel Award, it’s also a history that now stretches around the world.

To that end, “Outstanding Student Chapter” awards are now presented annually both to the top domestic and international groups – and the competition for the prize intensifies each year.

This year’s winners, announced in Houston at the recent AAPG Annual Conventional and Exhibition, are:

Domestic

- ▶ First: University of Utah.
- ▶ Honorable mention: University of Oklahoma and the University of Auburn.



FULK

“Student chapters can be successful for many reasons, but the common theme I’ve seen among the great ones are enthusiasm and sustaining that enthusiasm.”

International

- ▶ First: Pembangunan Nasional University (Surabaya, East Java, Indonesia).
- ▶ Honorable mention: Diponegoro University (Semarang, Central Java, Indonesia) and Gadjah Mada University (Yogyakarta, Indonesia).

Making a Connection

The initial purpose of AAPG’s student chapters program, Fulk said, was to bring students together with the profession – and vice versa – and to provide “a means of contact with the geological profession both inside and outside academia.”

As the trajectory of the AAPG commitment to the programs grew over the decades, so did the trajectory of individual school’s commitments to both their geology department and their student chapters.

One such case is one of this year’s top student chapters, the University of Utah.

“I’ve been the faculty advisor for this group since I arrived here in 2003,” said AAPG member Cari Johnson, associate professor of geology and geophysics at the University of Utah.

In the early days, she said of Utah’s program, it was a smaller but always very active group.

There were telltale signs. “I’m not sure what our numbers were like,” she said, “but the growth over time is evident in the large masses of pizza and bagels we now order for the meetings.”

Specifically, something special about this year’s winning team, she said, is its perseverance.

“One thing that I love about the group is that they seem to have adopted what I think is an informal mantra for many of us in the department,” she said.

That would be “Work hard, play hard.” “These students tend to be leaders, vocal and energetic department supporters,” she said, “and they produce some of the best research I’ve seen.”

And that, according to Fulk, is why the chapters were deemed such a good idea in the first place. It would foster the kind of drive and passion the industry needs.

“I don’t think it’s an accident that many of the students I encounter at our leadership summits experience early success in their careers,” he said, adding that many student chapter leaders go on to serve in the committee or on other committees within AAPG.

“Additionally, many of them, even after they leave school, take active leadership roles in their companies,” he added.

“I’d like to think the enrichment we are providing young leaders is leading to their success, but correlation does not indicate causation,” he said.

“The more likely cause is that the individuals who pursue our student chapter leadership opportunities are natural leaders, and we simply provide a vehicle to bring their ambitions to fruition,” he said.

“We like to think we accelerate their development in the petroleum industry.”

Pay It Forward

Johnson, too, is aware of the link. “The AAPG Foundation and student chapter coordinators have been great about logistical and financial support,” she said. “It’s a really nice partnership.”

These student coordinators pay it

Continued on next page



Continued from previous page

forward, too.

"There is also a lot of important mentoring that goes on through the student chapter," Johnson said.

For example:

"Our recruiting companies start showing up just one week into fall term," she said. "Some of the master's students literally just finished their bachelor degrees, know very little about the petroleum industry and are thinking about starting grad school, not necessarily finding a job. The returning students do a great job of helping everyone come up to speed on what to expect and why it's important."

And Fulk has noticed what's been going on at Utah.

"The University of Utah is a great recent example of an entire university that has improved its standing within industry through success in the Imperial Barrel Award and by being active in student chapter programs," he said.

Birgita Laksmi, from award-winning Pembangunan Nasional University, said its student chapter program consists of 48 students and operates as smoothly as "a clock that hangs on the wall."

"It is an integration of many small gears inside," Laksmi said, "working with rhymes and harmony in order to fulfill its main purpose," which is to work as "a family" to "achieve what's never been achieved before."

The Pembangunan chapter includes nine geophysical engineering students and 39 geological engineering students.

"We hope that our spirit may spark other student chapters to have more integration than ever before," she continued, "that our main purpose of being an AAPG student chapter will be fulfilled, in order to spread

the awareness of geoscience, advancing them worldwide.

"Being in this student chapter is not a burden," she said. "It's a responsibility, it's a commitment. It's a passion on its purest form."

The Right Stuff

In Utah's case, according to Johnson, student chapters helped take the school to the next level.

"Nothing is new at the school – it is and has always been an outstanding source of stratigraphers and a breeding ground for great fundamental mappers – but (the school) has increased its exposure to talent recruiters through participation in AAPG student programs."

Fulk believes you can see the difference these programs are making.

"Student chapters can be successful for many reasons," he said, "but the common theme I've seen among the great ones are enthusiasm and sustaining that enthusiasm."

And you can just tell when a student is truly excited about the opportunity to learn about AAPG and the industry, he believes.

"They ask questions like, 'How do I get exposure to someone with this expertise? What resources are currently available for a guest lecturer? Where are the best recruiting events? Why is the Bakken and Eagle Ford so successful from a reservoir characterization standpoint?'"

"They just truly want to know more about the industry, and they want to be the best scientists they can be," Fulk said. "Those are the students we want to continue to support. They don't ask 'How do I get money for pizza or beer?'"

Well, not until the work's done, anyway.



Auburn Cracks the Top SC Tier

One of the wonderful byproducts of the AAPG/AAPG Foundation Imperial Barrel Award is how it allows all schools – even those not normally regarded to be in the top echelon of the nation's geology schools – a chance to shine.

Remember when Butler University reached the NCAA basketball finals a few years back?

Well, such was the case this year in the competition for the top AAPG student chapter:

Auburn University won honorable mention this year, along with the University of Oklahoma.

Oklahoma is a name that's been there before. But Auburn?

This would be the school's first time in the student chapter spotlight.

Auburn University's student chapter has been around since 1986, and according to AAPG member David T. King, professor of geology at the school, the program's success is due to a unique combination of corporate sponsorship, university support and student quality.

"I would say that we average about 12-15 members in our whole chapter each year," King said. "Since Chevron and other companies have taken over paying dues for students who want to join, the membership has been steady, and everyone who is qualified and wants to join does so."

Additionally, the Auburn chapter works



KING

closely with the school's other geology student group, Sigma Gamma Epsilon (SGE, the geology honor society), of which he has been its adviser since 1983 – but mostly, he said, the recognition belongs to the DNA of those in the program.

"We have a group of interested and enthusiastic students at Auburn," he said. "It is the students who make the organizations work, not the adviser."

One former student and member of the school's IBA team, Jeff Keevan, said that while at Auburn he "had a great experience with IBA."

He now works for Anadarko Petroleum.

"After coming to work for an oil and gas operator, I can now say that the experience is invaluable for anyone who wants to work in the energy industry," he said. "It gives a good baseline understanding of what some oilfield geologists do on a daily basis, and I know that people here look highly upon students who have competed in IBA."

As for this year's award, King is pleased with the school's success – but not especially surprised.

"Auburn is not in the traditional oil patch, but we have many highly motivated and well qualified students who want to join the oil business," he said.

And perhaps that may be just the kind of encouragement a school not in the traditional oil industry mix can build on for its next IBA run.

"A student," King said, "does not have to be at an oil patch university to dream of working in the oil business for such a career." ■

– BARRY FRIEDMAN

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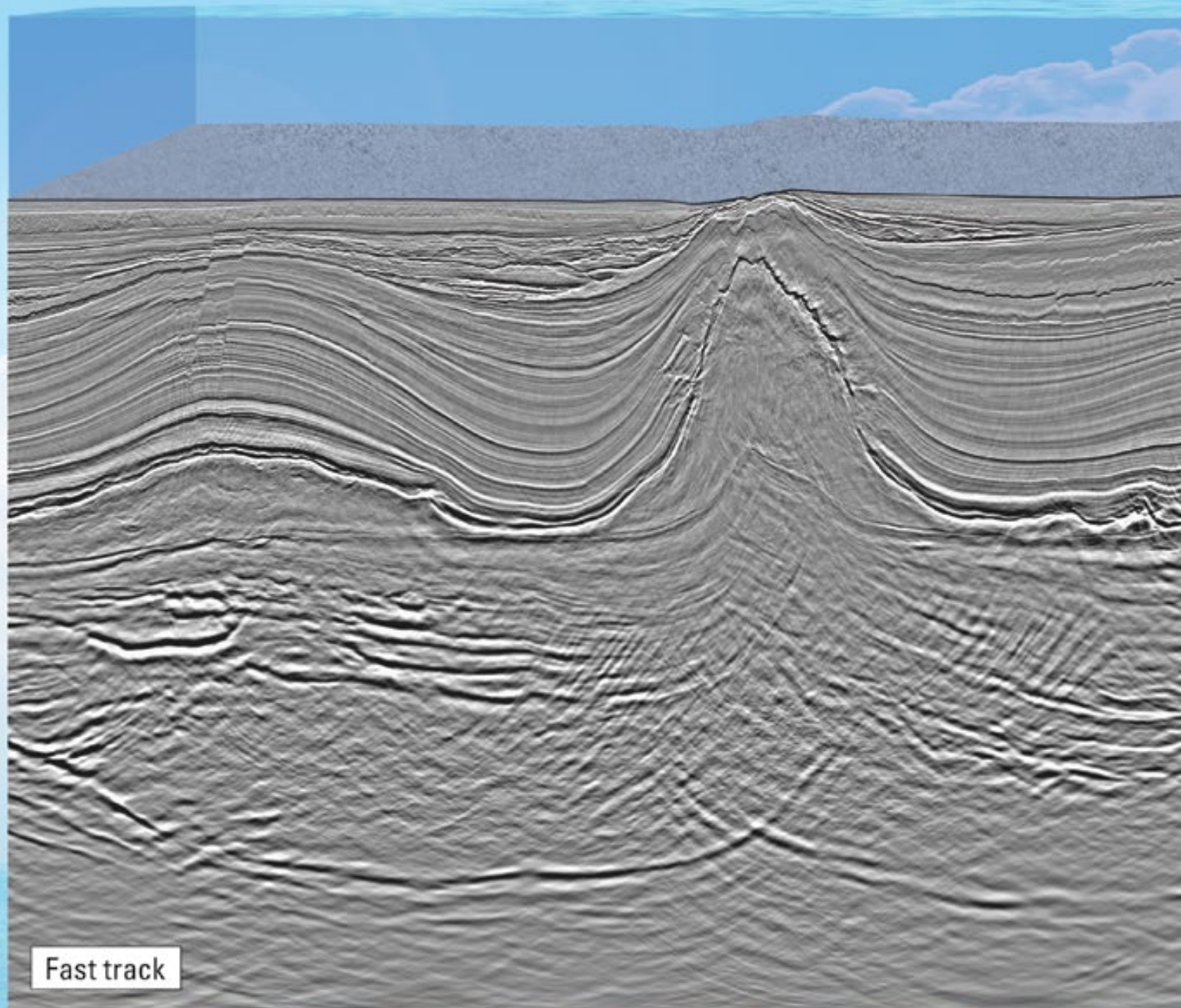
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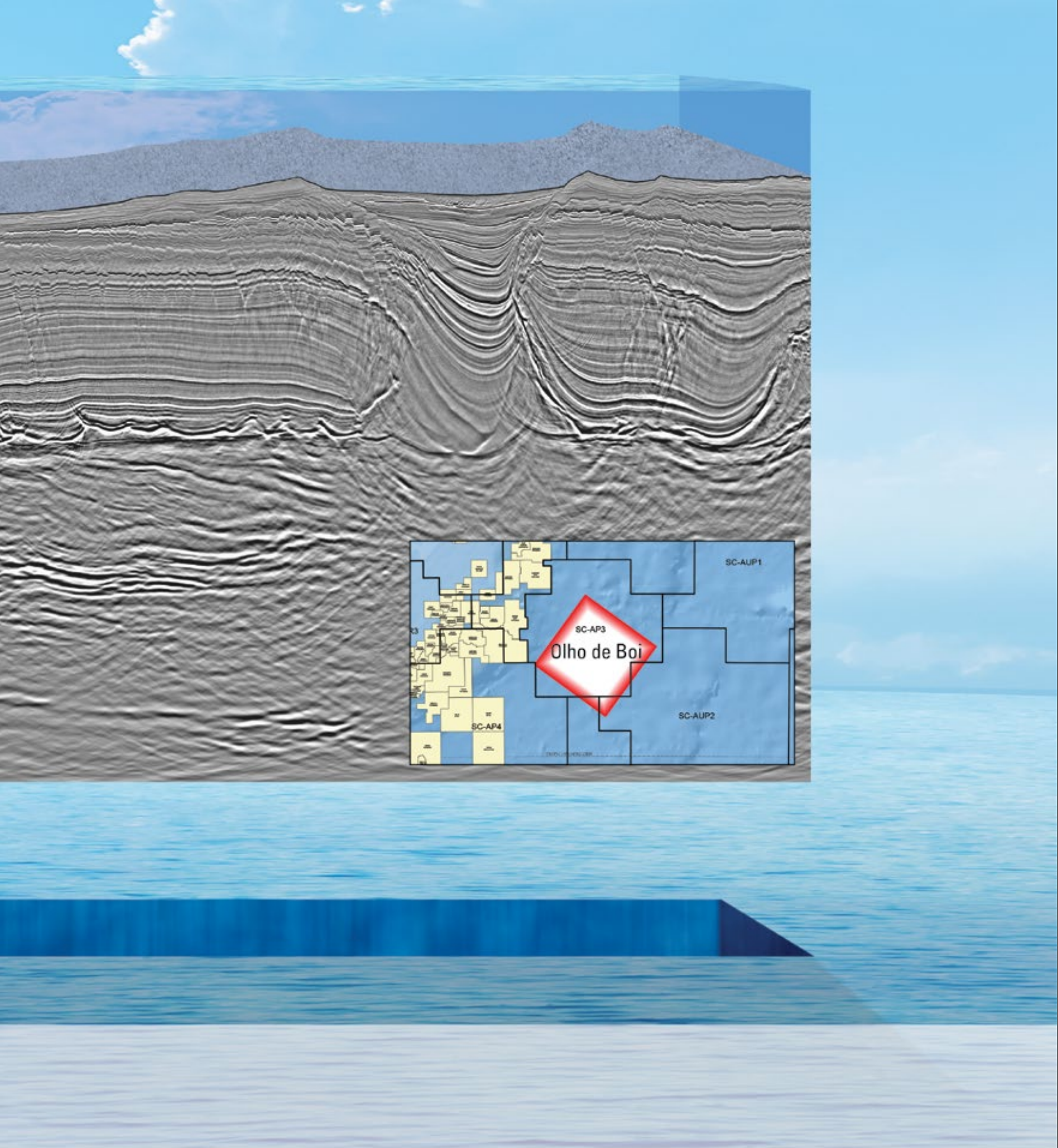
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Convective heat brings the sparks

Surprise! Hot Spots Also Can Be Sweet (Spots)

By LOUISE S. DURHAM, EXPLORER Correspondent

Geoscientists have expended considerable effort in the quest to nail down the technology needed to predict “sweet spots” in the unconventional shale plays.

At the start of the now-phenomenal shale play bonanza, the thinking in general was that the rocks were homogeneous across an area of interest.

Then reality set in as the shale E&P players came to realize via the drill bit that heterogeneity rules, and homogeneity and uniformity are not even bit players in the big picture.



EDMAN

Instead, these dense rocks can vary considerably even from one well to the adjacent well, which adds considerable intrigue, aka risk, to leasing and drilling.

Seismic data often are used to evaluate a prospective area's potential to produce. But this is expensive, so it's often wise to first use some less pricey alternatives to get a grasp on what to anticipate.

These other methods include remote sensing, integrated organic/inorganic petrography, gravity, magnetic and various types of thermal maturity data to initially identify those areas with higher production potential.

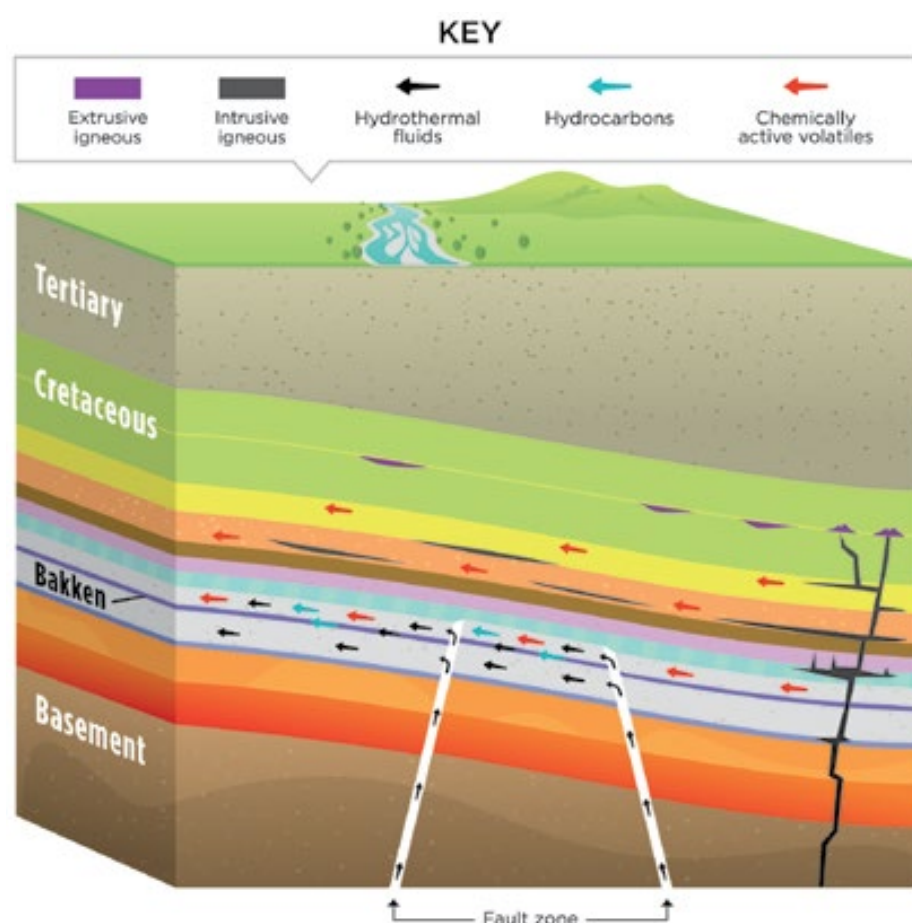
Once the geoscientists get a better handle on prospectivity, they can then opt to apply more esoteric and expensive technologies like seismic.

A Different Heat Source

A whole new and promising (and inexpensive) scientific approach is being touted as an effective way to help to zero-in on sweet spots.

Thus far, the research and findings appear solid. Yet the still-controversial concept likely will stir up considerable debate in the industry, according to AAPG member Janell Edman, principal at Edman Geochemical Consulting in Denver.

“In separate studies,” Edman said, “experts have independently come together on the concept of using a combination of less expensive screening technologies to identify areas of localized high heat flow where recurrent movement of basement faults in areas already known to contain rich source rocks results in the maturation of hydrocarbons



by hydrothermal fluids.”
“The published findings indicate that at both a mega- and a micro-scale, an internally consistent genetic model can be developed,” she said, “showing in multiple diverse locations that unconventional play sweet spots are often related to hot spots.”

She compared this to the general model for generating hydrocarbons where you have organic matter in the source rocks and conductive heat coming up from the basement into the sedimentary section. That heat matures the organic matter causing hydrocarbon generation.

“In the crust, you have radioactive elements that generate heat that comes up via conduction into the sedimentary section,” Edman emphasized, “and that’s the source of heat for most hydrocarbon models, or basin models based on burial history.”

“But in our work, we actually have fluid movement, and that heat from the hot fluids is causing maturation of organic matter,” she said, “so it’s just a different heat source.”

“Convective heat from the fluids is causing the generation.”

Convection Versus Conduction

The two types of heat transfer are quite different.

With conduction, the transfer of heat occurs slowly from the bottom to the top of successive rock units that are in direct physical contact, according to Edman. With convection, there is a rapid elevation of temperatures in multiple rock units simultaneously due to the relatively unconstrained movement of hot fluids.

She emphasized that convective heat flow via hydrothermal fluids is much more efficient than the transfer of heat by conductive heat flow.

Igneous activity in the shallow crust is more common than people realize, according to Edman, who noted that it’s this igneous driver that’s the ultimate origin of the hydrothermal fluids.

“The flow of hydrothermal fluids into the sedimentary section can be attributed to conduits provided by recurrent movement on faults and lineaments that extend to the basement,” she added.

In other words, the two major

components needed to find the hot spots leading to prediction of potential sweet spots are:

- ▶ An igneous driver for the hydrothermal activity.
- ▶ A system of naturally occurring faults and fractures acting as conduits for the hydrothermal fluids.

Shopping for the Right Sensor

Besides serving as conduits for hot fluid flow, natural fractures can be important to create areas of increased permeability.

Given the plethora of techniques used to try to pinpoint areas with production potential, Edman emphasized the importance of using a combo that works best in a particular area.

For example, in an area with dense vegetation, remote sensing is not the way to go.

And it helps to have a well or two to allow for petrographic evaluation.

“I have a photomicrograph that shows carbonate cement that came in with hydrothermal fluids,” Edman said. “Then you have these trails of oil, fluid inclusions included in that carbonate cement showing that you had generation of that oil at the time the hydrothermal fluids moved in.”

There’s more.

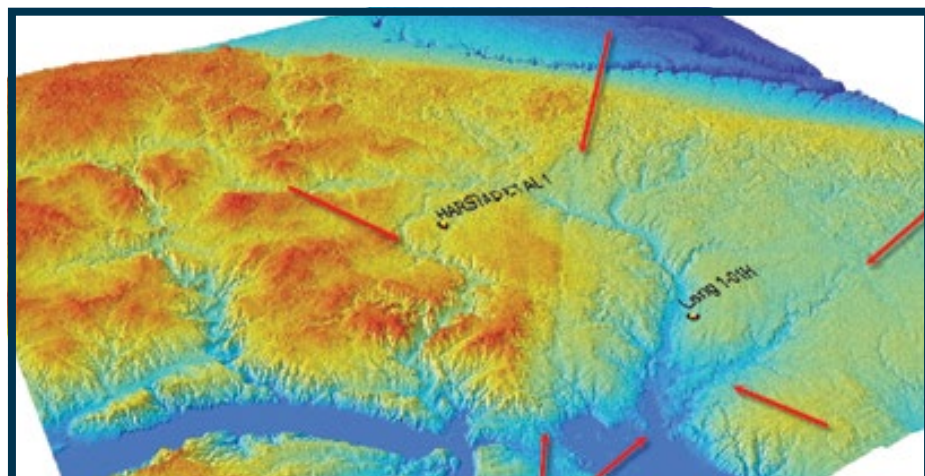
Edman noted that AAPG member Dan Jarvie and his colleagues demonstrated in 2011 that the oil at Parshall Field in North Dakota was generated in situ.

“That’s what we’re saying,” she added. “If you look at biomarker data that Dan did, it showed that those biomarkers are at the proper level of heating we’re finding by the organic petrography.”

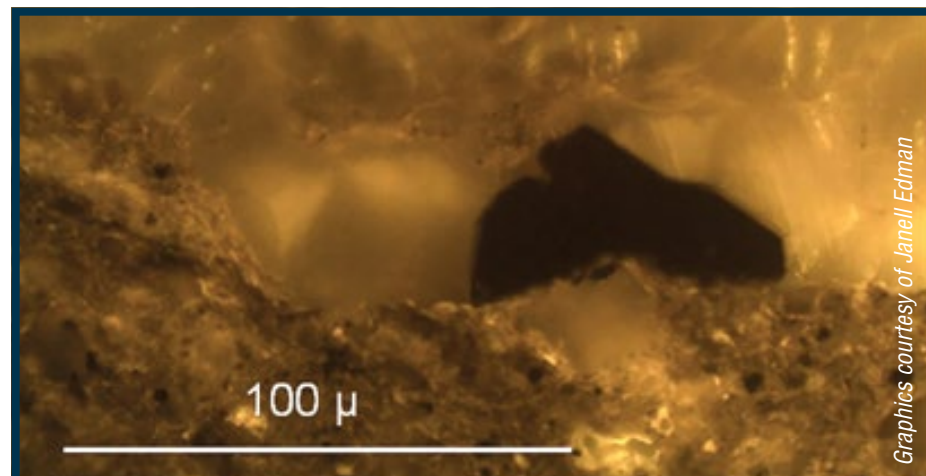
“A lot of people think the hydrocarbons migrated in from the west where the Bakken is more thermally mature,” she commented. “But if you look at these biomarkers from Parshall Field, they aren’t all that mature.”

Edman and her colleagues have some convincing examples from the Eagle Ford at First Shot Field in Texas and the Parshall and Stanley fields in the Williston Basin showing that better production is related to areas of localized convective heat flow.

“This is a great inexpensive way to look for sweet spots in these unconventional plays,” she said. “If you do use seismic, it can help you identify those areas where you want to spend your money for it.”



DEM of North Dakota. This type of macro-scale evidence showing lineations and discontinuities in the surface may be indicative of faults, fracture clusters and other features in the subsurface.

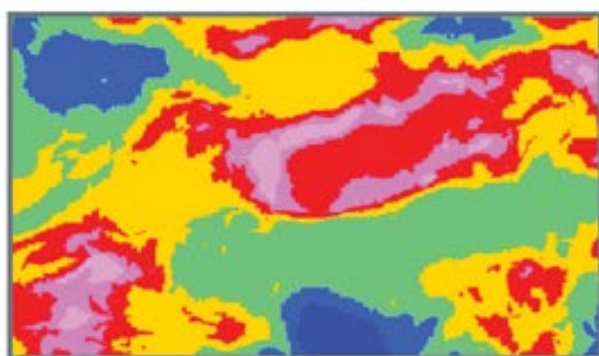


Oil inclusion trails in carbonate microveins of the upper Bakken member in the Long 1-01H well – micro-scale evidence that hydrocarbons were generated in situ at Parshall Field.

Graphics courtesy of Janell Edman

The Neuquén you never knew

Uncovering the hidden secrets of one of the world's largest shale plays



Using predictive analytics, NEOS GeoSolutions combined hyperspectral, magnetic, electromagnetic (EM), gravity, and seismic datasets to determine optimal drilling locations. Warmer colors indicate higher prospectivity.

Argentina's Neuquén Basin is one of the world's most dynamic and underexplored hydrocarbon systems. Its two principal shale targets – Los Molles and Vaca Muerta – have been rich source rocks for the conventional reservoirs that have been produced in the basin for more than 50 years. With new technologies available for unconventional asset exploration and development, producers are taking a second look at these extremely thick oil- and gas-charged shales. While several seismic and non-seismic datasets have been acquired, the coverage lacks uniformity, and no one has been able to integrate the data into a single, actionable interpretation – until now.

NEOS GeoSolutions has acquired high-resolution, airborne geophysical data over 30,000 square kilometers of the Neuquén Basin. Using innovative, multi-measurement methodology, the company has integrated these new measurements with existing well, geological, geochemical, and seismic data available in the public domain, from third parties, and from the project's underwriters. NEOS designed the Neuquén survey to provide the project's underwriters with an enhanced basement-to-surface understanding of the basin and its potential.

Initially, high-resolution hyperspectral imaging was acquired to map the regional lithology, the total organic carbon (TOC) of the target shales, and oil seeps and indirect hydrocarbon indicators on the surface. A second work stream generated 3-D models constrained by the structural aspects of existing seismic lines, available well data, and newly acquired gravity and magnetic measurements. These models provided useful exploration insights by depicting isopachs, burial depth, depth-to-basement, and proximity-to-intrusives for all target shale horizons.

The team also developed a new hydrocarbon maturation model by combining the 3-D model, existing basin TOC models, and surface samples. This analysis identified new areas of opportunity previously considered to be overmature. By interpreting the locations of volcanoes and intrusives from airborne magnetic data, a new thermal gradient model was developed, refuting the misconception that intrusives had terminally degraded regional opportunities.

Finally, NEOS combined all datasets using a geostatistical data mining technique called predictive analytics. By analyzing key attributes – including shale thickness, a set minimum amount of overburden over the objective, a minimum of faults and fractures along the drill path or near the bottom-hole location, the potential for generated and retained liquid hydrocarbons, and a relatively flat topographic area for drilling – NEOS and client geoscientists highgraded acreage to identify optimal drilling locations and reveal the lucrative secrets of the Neuquén.

▶▶▶ To learn more about this project or others in the *Unlock the Potential* series, visit: www.ThePotentialUnlocked.com

HIGHLIGHTS

KEY TECHNOLOGIES:

-  MAGNETIC
-  GEOCHEMISTRY
-  GRAVITY
-  HYPERSPECTRAL
-  PREDICTIVE ANALYTICS
-  SEISMIC REINTERPRETATION

AREA: Neuquén Basin, Argentina

CUSTOMER: Supermajor

FOCUS: Regional Mapping

TYPE: Unconventional

KEY INTERPRETIVE PRODUCTS:

- Regional 3D subsurface models
- Horizon-specific isopach maps
- Estimates of gas-in-place on an areal basis, developed using multi-variate analysis

CUSTOMER BENEFITS:

Reveals new prospectivity in the frontier portion of an established basin by integrating new airborne geophysical measurements with existing seismic, well, and geological and geophysical (G&G) data.



Communication is the key

Finding Unconventional Success In Colombia

By EMILY SMITH LLINÁS, EXPLORER Correspondent

A APG member Jorge Calvache, unconventional exploration venture manager at Shell Exploration & Production Colombia, knows firsthand the challenges companies face when they start operating in Latin America.

He has worked in the United States and Colombia and knows that, while the geology and technology are similar in the two countries, the operating environment is vastly different.

One of the biggest challenges companies face is working with the local communities living in areas targeted for exploration.

Calvache said differences begin from who owns the land.

"The situation is different in Colombia than it is in the United States, where in many cases landowners own the mineral rights," Calvache said. "People who own the mineral rights have an interest in drilling, because they get royalties. In Colombia, mineral rights are property of the state."

If companies expect community members to support exploration, he said they should be prepared to offer goods and services that provide sustainable benefits to the local population.

One example is hiring local people to work on the projects, particularly for the jobs requiring unskilled labor.

"If companies are going to drill wells, they need to make sure that they hire local people," he said.

Equally important is communicating



CALVACHE

"We asked them what they thought about the impact of the seismic, and they could not even tell where we worked."

proactively to community members – and to start that communication before work starts.

"If we're going to drill holes near their homes, they are curious and want to know what the companies will do and how they are going to benefit," he said, "and you need to talk with them before bringing in equipment."

"If you show up the first day with the drilling rig and you've not notified the community," Calvache commented, "they are not going to be happy."

Lessons Learned in Bolívar

Calvache learned about working with communities during seismic acquisition of non-conventional resources in Colombia's Bolívar department. When Shell started shooting seismic in the San Pablo area in 2012, the company experienced conflict with the communities.

"These communities have been exposed to lots of problems – guerilla, paramilitaries, narco-trafficking," he said. "People in the

region have been living a very difficult situation during many years. When we tried to enter there and shoot the seismic, we had problems."

Shell worked to establish trust with the community, hiring a local non-governmental organization to help farmers commercialize products, and building houses in the village so farmers could sell them.

In the end, Shell acquired the seismic, and made a sustainable social investment in the community that lasted beyond the time of acquisition.

"After completing the seismic, the community understood there were other ways of interacting, and they learned the benefits of working with Shell," Calvache said.

"They had previous experiences with companies who had communication and performance gaps, but we did not."

Calvache said Shell's experience in San Pablo highlights two important components of effective work with communities:

▶ Engage early.

- ▶ Build a relationship of trust. Two additional components include:
- ▶ Protect the local environment.
- ▶ Implement sustainable projects.

A Legacy

Shell specifically practiced the concepts in Simití, Bolívar, a town surrounded by swamps that serve both as a source of fish for the community and an integral feature of the cultural heritage.

Simití residents were concerned that seismic would damage the swamps, but Shell used a low perforation technique with limited explosive impact.

After completing the acquisition, the company restored the environment to its original state.

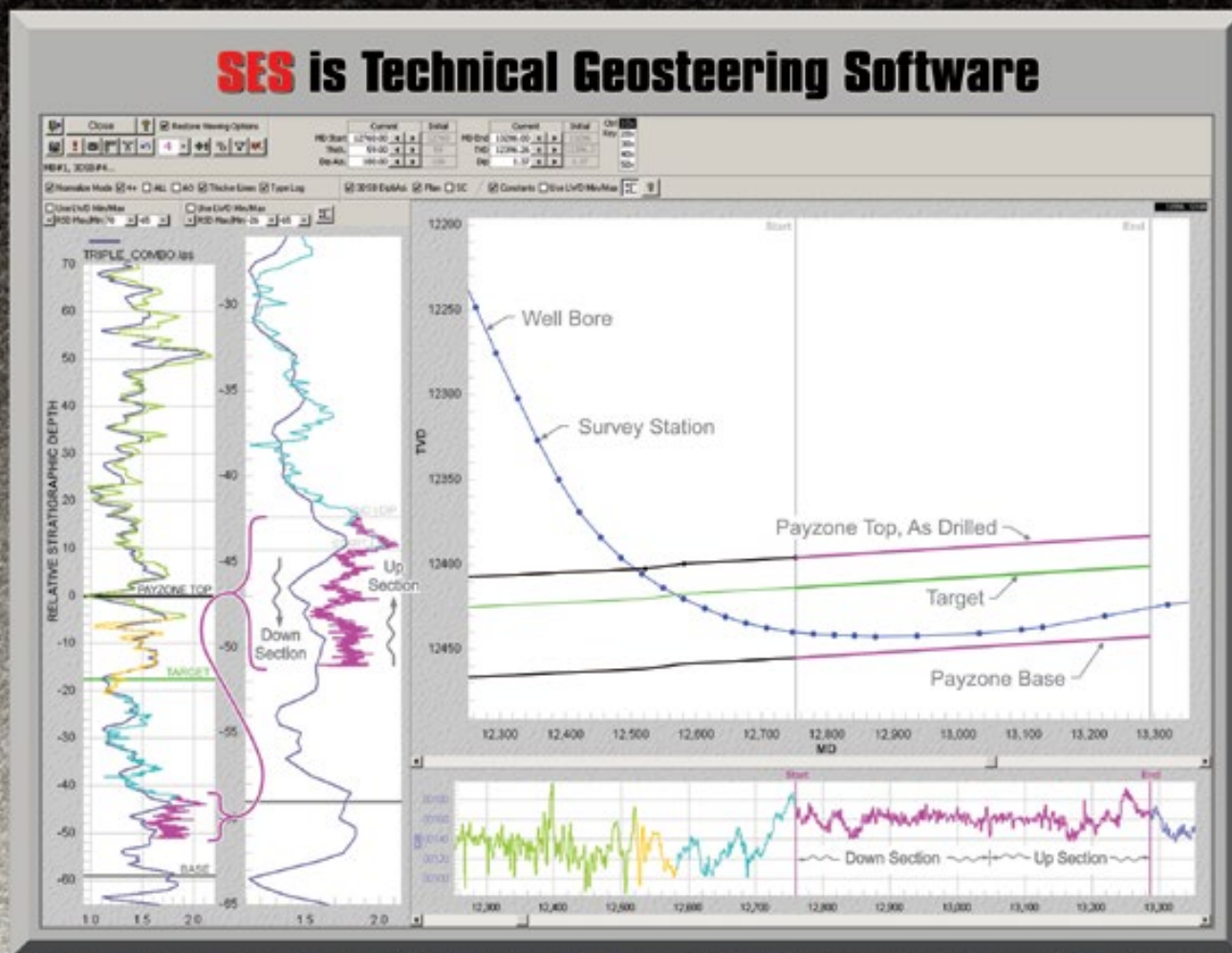
"We asked them what they thought about the impact of the seismic," Calvache said, "and they could not even tell where we worked."

In addition to communicating regularly with community members, Shell worked with community leaders and the Omacha Foundation to develop a swamp preservation and recovery program.

Calvache and Shell public affairs managers launched the Simití Swamp Preservation and Recovery Program at a ceremony held on Feb. 1, 2014. The Simití mayor, fishing industry leader, environmental minister, community leaders, teachers and

See Colombia, page 48

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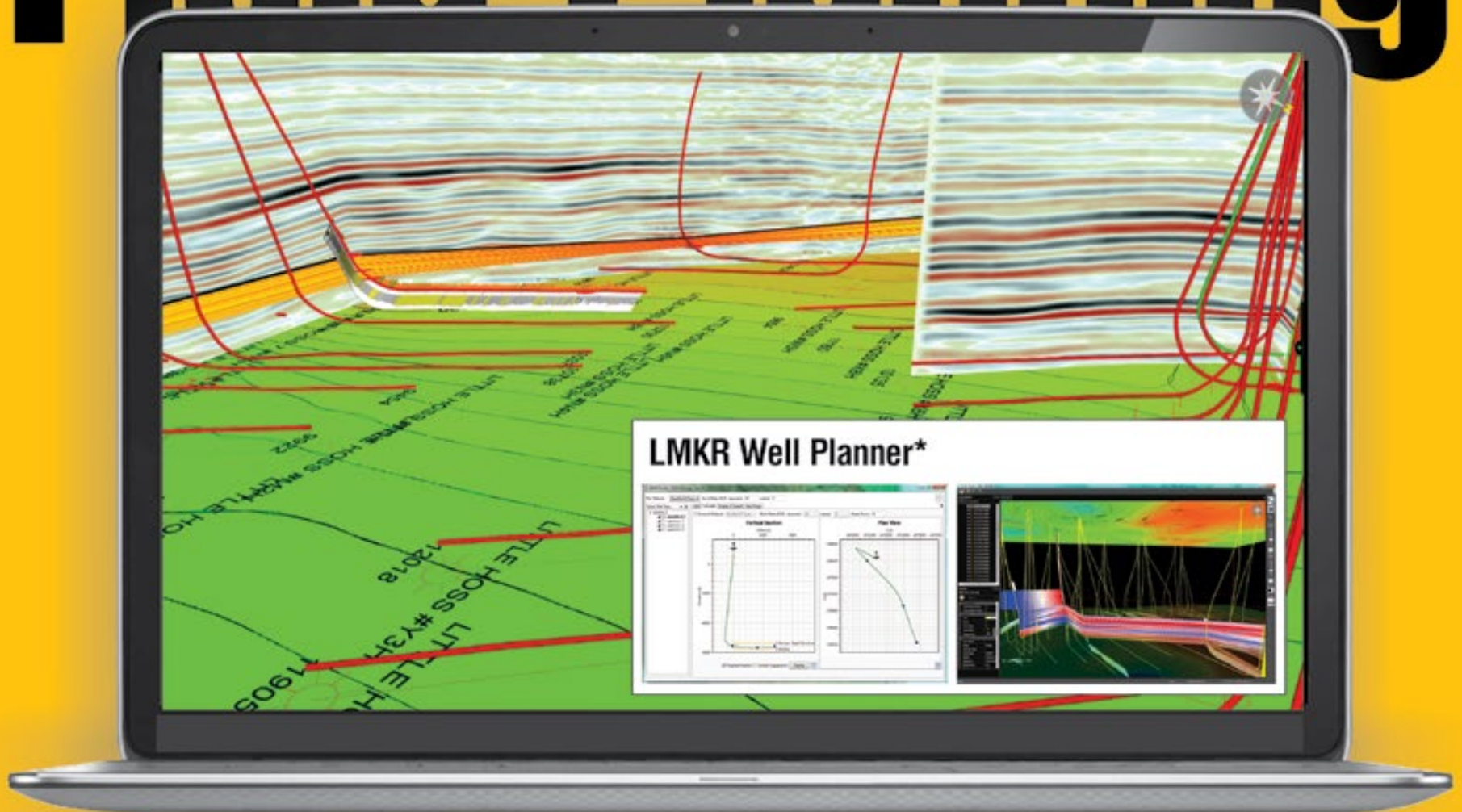
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Geology, Technology Mix In Geothermal Systems

By SCOTT MILLER

The Department of Energy (DOE) envisions that recent advances in subsurface mapping, data collection, data dissemination and leveraging of oil and gas industry techniques can translate into widespread commercial adoption of enhanced geothermal systems (EGS).



MILLER

Integrating this knowledge into EGS research and development also could be beneficial in addressing challenges currently faced by the oil and gas industry.

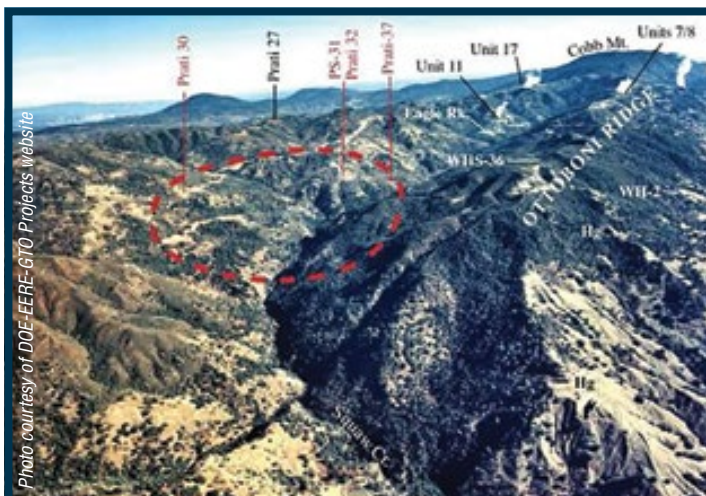


Photo courtesy of DOE/EERE-GTO Projects website

EGS wells Prati State-31 and Prati-32 at Geysers Field, Calif. The project was conducted by Geysers Power Company, LLC, partnering with Lawrence Berkeley National Lab and the U.S. DOE Geothermal Technologies Office.

Scott Miller is the spring 2014 American Geosciences Institute/AAPG Geoscience Public Policy intern. He has a bachelor's degree in geology from Appalachian State University, and before coming to AGI he worked at the Florida State University Antarctic Marine Geology Research Facility in Tallahassee, Fla. He plans to finish graduate school and use his higher degree to promote geosciences education and understanding to the public.

But first: What is EGS, and how does it work?

Closed Loop Approach

EGS uses low-pressure hydraulic or cold-water injection to produce a network of shear fractures in hot, low-permeability rock whose temperatures can exceed 200 degrees Celsius.

Geothermal fluid, consisting mostly of water, is pumped from an injection well through the network of fractures in hot rock, and the fluid is heated by conduction during travel.

The fluid exits via the production well as a source of thermal energy.

Conventional geothermal power production utilizes hot fluid circulating in naturally permeable systems at accessible depths, which currently restricts U.S. development to tectonically active regions found mostly in the West. EGS's theoretical advantage stems from its ability to access the inexhaustible supply of heat available in the subsurface beyond these naturally favorable settings.

While oil and gas extraction methods require expensive pumping and disposal of water that has been contaminated with lubricating fluids and mineral deposits during reservoir stimulation, geothermal operations recycle water in a "closed loop" system.

Recycling water keeps reservoir pressure constant, allowing for more accurate maintenance of fractures. Plant operators can alter the size of these fractures to increase or decrease fluid flow volumes per unit time throughout the reservoir.

Low flow rates are critical to EGS, because of the long time-period needed for adequate heat transfer from the reservoir rock to the cold, injected water.

The 2008 U.S. Geological Survey's Geothermal Resources Circular stated that EGS has the potential to produce on the order of 100 Gigawatts of electricity over a 30-year span, an order of magnitude greater than the potential of any other geothermal source, and a tenth of the current total electric generating capacity in the United States.

DOE is increasing funding for its Geothermal Technologies Office (GTO), which has sponsored full-scale EGS demonstration projects in locations such as Geysers Field, Calif.

In 2012, the Geysers Field project achieved steam production of 0.005 Gigawatts from a well depth of about four kilometers and a maximum reservoir temperature of 400 degrees Celsius, boosting confidence for possible national-scale development.

Geothermal energy extraction requires broadly similar technologies to those

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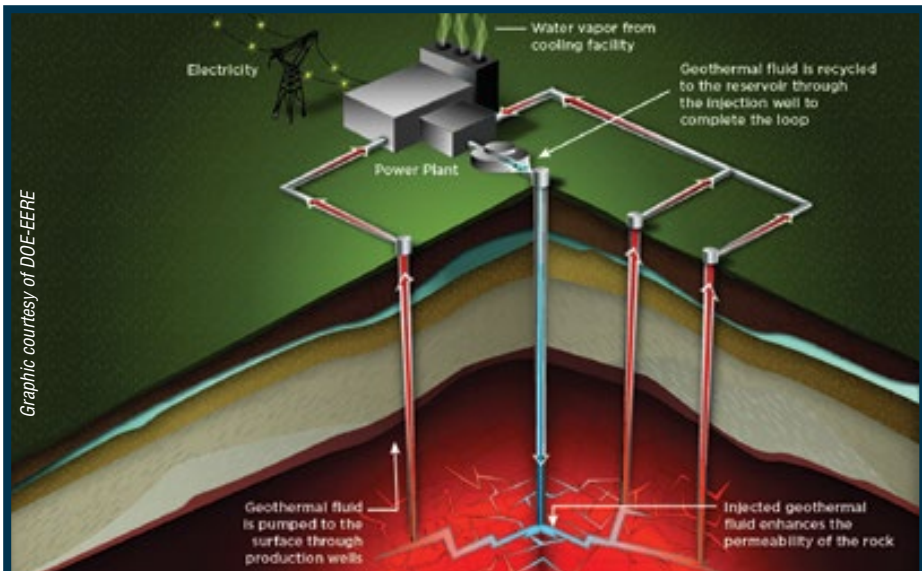


Diagram of the EGS process, where fluid is injected to fracture the hot, dry rock; is heated as it passes through the reservoir; and exits through the production well to generate electricity. After cooling, the water is recycled back into the system to start the process over again.

Continued from previous page

employed in the oil and gas industry, including use of integrated multi-dimension, multi-variable models to more accurately quantify estimates of both hydrocarbon and EGS resources. GTO projects factor in variables such as thermal conductivity and fracture spacing of rock formations to create 3-D seismic, thermal and flow visualizations of highest-yield EGS areas. These models provide a basis for researchers to manipulate reservoir pressure, flow and temperature conditions for optimal EGS output. This research also could provide insight on the feasibility of carbon sequestration and the oil/gas industry's current quandary on disposal of wastewater.

FORGE-ing Ahead

In February, GTO announced plans for a subsurface laboratory studying thermo-mechanical-chemical-hydrologic processes in deep rock, called the Frontier Observatory for Research in Geothermal Energy (FORGE). FORGE's research on hot, deep rock properties could provide valuable insights toward advancing EGS as a commercial resource.

FORGE developments also could also benefit groups interested in examining deep crystalline rocks for information on supercritical gas reservoirs, isolation of radioactive waste and geologic storage of CO₂.

While oil and gas industry horizontal drilling practices capitalize on the horizontal nature of hydrocarbon-rich bedding by providing extended contact between wellbores and reservoirs, EGS wells could employ horizontal drilling for maximized contact with hot rock, allowing more efficient fracture generation due to the sub-vertical nature of most fractures at depth.

GTO-contracted Baker Hughes is presently testing a directional drilling system designed to withstand temperatures up to 300 degrees Celsius in granite basement rock at the company's testing site in Tulsa.

Oil, gas and geothermal capabilities are bounded by equipment failure at depth due to high pressures and temperatures (P/T).

The electronics that drive most subsurface tools fail at temperatures greater than 150 degrees Celsius – well below target temperatures for EGS. This poses a significant challenge to EGS, so GTO's research includes copious testing on high P/T well drilling, monitoring and pumping equipment.

In 2011, Oak Ridge National Laboratory successfully demonstrated operation of a tool for measuring porosity, lithology and density of rock as a function of depth at 350 degrees Celsius. With high temperature-tolerant monitoring equipment, researchers will be able to study reservoir evolution in real time.

Studies such as the 2014 JASON report on Enhanced Geothermal Systems say "micro-drilling" small holes 2-2.5 inches in diameter could improve reservoir characterization, engineering and micro-seismic interpretations for EGS and oil/gas operations. With advances in this technology, geophones, accelerometers and seismometers could be emplaced in an abundant network of micro down-hole arrays, providing for critical reservoir permeability characterization with minimal drilling costs.

This research is coupled with induced seismicity studies related to EGS development, and has broad applications related to the current hot topic of induced seismicity, which is under scrutiny because of events triggered by wastewater disposal from oil and gas activities.

An Integrative Approach

GTO explores other geothermal energy methods in addition to EGS.

Demonstration projects such as the University of North Dakota test at Cedar Creek Oil Field, for example, are examining whether co-producing geothermal fluids from existing fossil fuel infrastructure can be economic.

Also, higher costs of production per kilowatt-hour compared to conventional energy still plague geothermal endeavors in many settings, so GTO has dedicated a portion of its Systems Analysis research program to finding geothermal advantages through energy market and energy policy analysis.

Moving forward, federal investments in big and open data, public/private partnerships and cross-cutting initiatives provide an integrative approach to energy generation with benefits going beyond EGS and geothermal energy. The Administration's efforts through GTO specifically have tremendous applications for conventional energy, including knowledge gains in reservoir characterization and extraction techniques, and induced seismicity.

Based on increasingly interdisciplinary geosciences research, such knowledge could hold major societal implications – and creates extraordinary anticipation for the next groundbreaking discovery.

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In twelve years this conference has become established as a leading technical E&P forum on Africa, with attendance that can exceed 400. Participants include operators, service companies, consultants, governments and academia. The two day program of talks, technical posters and vendors' exhibits will be held on September 9-10, 2014 in Houston, Texas.

The conference, which alternates annually between London and Houston, is organized by the Houston Geological Society (HGS) and Petroleum Exploration Society of Great Britain (PESGB). The HGS-PESGB African Conference covers all aspects of African E&P, with particular emphasis on new ideas for plays and prospects, the geology of the continent and its conjugate margins, and application of emerging technologies.

Details of sponsorship opportunities and display booths are available from the HGS office. To become a sponsor or inquire about exhibit space, contact sandra@hgs.org

Further details appear on the HGS and PESGB websites www.hgs.org and www.pesgb.org.uk.

Conference Committee for 2014
 Martin Cassidy (chair), Al Danforth, Ian Poyntz, Donna Davis and Sandra Babcock (HGS)
 Ray Bate and Duncan Macgregor (PESGB).

Louisiana Geoscience Licensing Deadline Moved – Again – To End of Year

By LOUISE S. DURHAM, EXPLORER Correspondent

If you're a geoscientist who has not yet formally applied for licensure to practice your trade in Louisiana, don't despair.

The registration deadline has moved – once again.

This latest one zeroes in on the end of 2014, and it appears to be a done deal.

It's all about the Louisiana Geosciences Practice Act, which was signed into law as Act 974 by Louisiana Gov. Bobby Jindal in 2010.

This is one of three legislative Acts governing the Louisiana Board of Professional Geoscientists (LBPG), established for the practice of the geological profession in Louisiana.

Even though Act 974 became effective Jan. 1, 2011, there was still considerable fine-tuning needed, such as finalizing application forms. Final approval also required legislative scrutiny, which further delayed the process.

The initial grandfather deadline was set for Jan. 1, 2012 – but this, too, quickly became problematic.

"I was concerned about such a close deadline and began working in mid-October of 2011 to extend this with the goal that we must be fair to all," said AAPG member Madhurendu B. Kumar, chairman of the LBPG and its initial appointed member.

A new grandfather deadline was set for Dec. 31, 2013.

Still not enough time, apparently. "A number of geoscientists applied late for the grandfathered status," Kumar said. "Many of them missed the opportunity because of the limited short time frame allowed."

"In order to resolve such a problematic situation, I worked on behalf of the Board on legislation with Louisiana House Representative Hunter Green," Kumar noted. "As a result, H.B. 165, authored by Representative Greene, passed unanimously in the House and Senate and was approved by the governor as Act 228."

Under this new law, the deadline for grandfather applications has been extended to Dec. 31, 2014.

According to Kumar, the Board received about 1,600 applications prior to the previous 2013 year-end deadline.

Given the new extension, they expect more to arrive.

"Those who are supposed to be registered or licensed need to complete the application forms approved by the Board," Kumar cautioned.

The website is at www.lbobg.org.

"The new law permits the LBPG to use the licensee examinations given by the American Association of State Boards of Geologists," he added. ■

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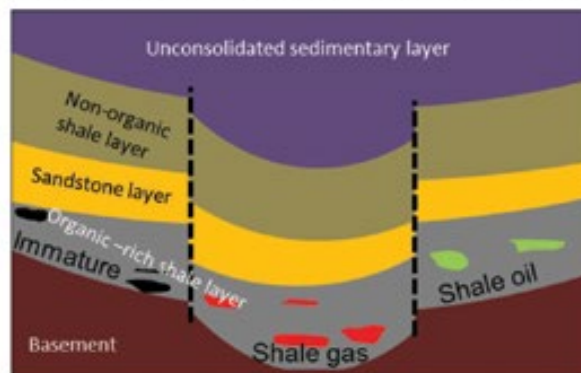


Organic-rich shales

Successful exploration and production programs for organic rich shales depend significantly on the kerogen characterization, i.e. identification of kerogen content and its maturity through indirect seismic methods. The major difference between a conventional reservoir and an unconventional reservoir is the addition of organic matter in the unconventional. Organic matter typically consists of kerogen (~90%) and bitumen (~10%). When the kerogen matures, it initially produces oil, and then gas. The properties of kerogen remain poorly understood, and predicting the response of kerogen rich rocks and kerogen maturity is a real challenge. For better characterization of the hydrocarbon production from organic-rich shales, a multi-disciplinary approach between geology, geomechanics, geochemistry, geophysics, petrophysics, and rock physics plays an important role. We are interested in papers that discuss advances in the following topics:

- Seismic detection and characterization of organic-rich shales
- Non-seismic geophysical methods for characterizing organic-rich shales
- Petrophysical evaluation methods for organic richness
- Geological understanding of organic richness for shales
- Characterization of cores and logs for organic-rich shales
- Rock physics analysis for organic-rich shales
- Impact of organic-richness on geomechanical properties
- Geochemical methods for characterization of organic-rich shales
- Case studies

Key questions: How can we characterize organic-richness and its level of maturity through different disciplines such as geology, geophysics, geochemistry, petrophysics, and geomechanics?



Schematic showing the generation of hydrocarbons from organic-rich shale layer in a sedimentary basin. Image courtesy Mallewar Yenugu.

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 November 2014

Publication of issue:
August 2015

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Brian D. Keith, to retirement and limited consulting, Bloomington, Ind. Previously senior scientist, Indiana Geological Survey at Indiana University, Bloomington, Ind.

Joel P. Johnston, to national oil and gas accounts manager, Terracon Consultants, Tulsa. Previously environmental department manager, Terracon Consultants, Tulsa.

George Devries Klein, has retired from SED-STRAT Geoscience Consultants, Katy, Texas. He will reside in Barragada, Guam.

Terrence Manning, to president and chief operating officer, Three Forks, Broomfield, Colo. Previously consultant, Petroleum Analysis Consulting, Houston.

James McIlroy, to adviser geophysics, DNO International, Dubai, UAE. Previously senior explorationist/adviser, OMV Petrom, Bucharest, Romania.

Miguel Ramirez has been appointed country manager for Colombia. Previously chief geologist, Mubadala Petroleum, Bangkok, Thailand.

Phillip S. Winner, to president and chief executive officer, Outrider Energy, Denver. Previously president, Layne Energy, Englewood, Colo.



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Heart of the Matter: RMS' Annual Meeting Will Be 'Cracking the Source'

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

Source rocks, source rocks and more source rocks will be the stars of this month's annual meeting of AAPG's Rocky Mountain Section, set July 20-22 at Denver's Colorado Convention Center.

"It's a source rock-heavy meeting, but we're also touching on other topics," said AAPG member Catherine "Cat" Campbell, general chair of the RMS annual meeting, in explanation of this year's theme, "Cracking the Source."

"If you don't start with a good source rock, you don't start," she quipped.

"Our source rocks are becoming our reservoir rocks," she said. "It seems to be the future of oil and gas, and a lot of the shale plays in the Rockies are being understood based on evaluating the

source rocks."

Campbell is a geologist for Robert L. Bayless, Producer, and RMS secretary/treasurer.

She said the focus will be on the source rocks of the Rocky Mountain area and their impact on the unconventional resources of the region.

AAPG Honorary member R. Randy Ray, consulting geologist/geophysicist of the Denver-based R3 Exploration, told the EXPLORER this year's theme is "a really hot topic" that should attract a significant turnout for several reasons, not least of which is that the Rocky Mountain plays to be highlighted – the Bakken and Niobrara – hold insights applicable everywhere.

"Both of those are really active for drilling



CAMPBELL

and showing a lot of success, and so the learnings will certainly apply to other unconventional resource plays in North America and around the world," he said.

The meeting, hosted by the Rocky Mountain Association of Geologists, will include more than 100 presentations

covering, along with source rocks, a range of topics that include technologies used in the identification, characterization and exploitation of these reservoirs, and new insights on the structure and stratigraphy of the Rockies and beyond.

Also planned are four field trips that take advantage of the Colorado setting.

"The field trips are just expressing how lucky we are to be in the Denver area – everything's within a couple hours' drive from Denver," Campbell said.

"It's kind of nice," she continued, "the Niobrara outcrops ... to be able to look at this world-class rock and know that it's being drilled in the DJ Basin is pretty cool."

For registration and other information, visit the website at www.aapgrms.org/2014.

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* Cancer Facts and Figures 2013 Survival rate for all sites improved 20% between 1990 and 2009.

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Lindale, Texas, Oct. 11, 2013
- Raymond F. Barrett, 61
Houston, Dec. 25, 2013
- Charles William Betton Jr., 83
Grand Junction, Colo.
Sept. 25, 2013
- William Ross Brinkoeter, 77
Houston, Jan. 6, 2014
- Gregory Lee Cook, 66
Oklahoma City, Oct. 21, 2013
- John R. Fisco, 62
Midland, Texas, Feb. 19, 2014
- John Patrick Gold, 74
Port Angeles, Wash., Feb. 6, 2014
- Marshall W. Hansen, 87
Buffalo, Wyo., May 4, 2014
- David E. Harmon, 81
New Concord, Ohio, April 23, 2014
- Tom P. Hart, 72
Lubbock, Texas, Jan. 9, 2014
- Donald Edward Henkel, 70
Houston, April 19, 2014
- Leonard Weldon Howard, 80
Corpus Christi, Texas, Oct. 4, 2013
- Walter Holmes Howe, 85
Mesa, Ariz., Jan. 28, 2014
- Michael E. Hriskevich, 87
Calgary, Canada, Jan. 31, 2014
- Walter Paul Kessinger Jr., 83
Lafayette, La., April 27, 2014
- John Charles Langford, 86
Destrehan, La., March 21, 2014
- Robin Clair Lease, 73
Tomball, Texas, Feb. 13, 2014
- Morris W. Leighton, 87
Urbana, Ill., April 11, 2014
- Laddie Fred Long, 88
Midland, Texas, April 17, 2014
- Earl Samuel Marie, 90
San Antonio, Jan. 4, 2014
- John Harris Marshall Jr., 90
Dallas, April 3, 2014
- Earl C. McKnight, 87
Prescott, Ariz., Jan. 30, 2014
- Charles Dawson McMurrey, 90
Houston, March 7, 2014
- George Edwards Moore, 74
Midland, Texas, March 31, 2014
- Henry Earl Repp, 88
Littleton, Colo., Oct. 14, 2013
- John Edwin Scherer, 89
Midland, Texas, May 11, 2014
- * John A. Taylor, 87
Oklahoma City, March 29, 2014
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Mount Dora, Fla., April 3, 2014
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Export Questions Spark Diverse Passions

By EDITH ALLISON, Geoscience and Energy Office Director

U.S. energy production, especially oil and natural gas from shale, is booming and expected to continue to grow.

Consequently, this bounty is pushing up energy exports – including coal that is displaced by natural gas in power generation – and refined products that are not regulated.

In addition, the unconventional production boom is spurring calls for reduced regulation of crude oil and accelerated permitting of natural gas exports.

Proponents argue that greater energy exports will stimulate the U.S. economy and aid our allies in Asia and Europe who depend on energy imports.

Another benefit of oil exports may be increased oil efficiency: Exports paired with imports may help balance the mismatch between producing areas, infrastructure and refinery capacity. Refiners currently benefit from the export of refined products, whereas oil producers would benefit from increased crude oil exports.

Opponents, however, argue that energy exports will increase energy costs for consumers and energy-intensive manufacturers. Environmentalists also argue that increasing exports will drive up global air emissions from soot to greenhouse gases.

Analyses of the impacts of natural gas exports conclude that exports could



ALLISON

Proponents and opponents of U.S. energy exports come to the table with data, projections and emotions supporting their views.

increase prices for U.S. residential and manufacturing consumers, and reduce domestic jobs.

The U.S. Department of Energy analysis, which forms the basis for determining if LNG export terminal applications are in the national interest, estimates that natural gas prices would rise slightly – but the average U.S. household would be better off, because exports would boost the value of the U.S. dollar, reducing the cost of imports.

The government has not completed a similar analysis for oil exports.

Coal Exports

The United States does not restrict coal exports. Exports are up almost three-fold over the past 10 years and are higher than the previous record volume in 1981. EIA projected – before the new EPA rules on existing power plant emissions – coal exports will continue to

grow 0.9 percent per year through 2040.

In 2013 the major recipients of U.S. coal exports were, in descending order, China, Europe, United Kingdom, South Korea and Brazil.

Low demand for coal-fired electricity in the United States is driving exports. The low price of natural gas since 2009 has depressed coal consumption for electricity generation.

An additional drag on coal-fired electricity generation is the large number of aging coal-fired plants that are inefficient or do not meet existing mercury and air toxic standards. EIA projects that 16 percent of coal-fired capacity will be retired between 2012 and 2020.

Air quality regulations such as state renewable energy standards and the recently proposed emissions restrictions for existing power plants should further reduce domestic coal consumption and stimulate exports.

Natural Gas Exports

The United States currently exports natural gas via pipeline to Canada and Mexico, but imports from Canada make the United States a net importer of natural gas.

Exports of natural gas to countries with U.S. free trade agreements (FTA) are unrestricted (20 U.S. FTA partners include South Korea, Canada and Mexico). The concept of exports to non-FTA countries was considered commercial only a few years ago, and the first exports may be in 2015.

The U.S. Department of Energy (DOE) grants natural gas export authorizations to non-FTA countries, unless the proposed exports will “not be consistent with the public interest.” Potential exporters also have to complete a costly environmental review through the Federal Energy Regulatory Commission before receiving final authorization from DOE.

DOE recently announced that it would change its authorization procedures to stop issuing conditional authorizations and only consider final authorizations after the environmental review is completed. This will prioritize applications from more advanced and potentially commercial projects.

EIA projects that U.S. exports of liquefied natural gas (LNG) will increase

See Exports, page 48

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This program will aid veterans who are seeking undergraduate and graduate degrees in the geosciences whose studies and/or research has application to the search for and development of petroleum. Veterans bring real world experiences, leadership skills and motivation that not only assures their educational success, but they also can be positive role-models and nurturers for their younger student peers.

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Your donation will leave a lasting impact on veterans who share your passion for the geosciences.

"As a veteran, I know firsthand the challenges associated with transitioning from the military to a career as a petroleum geoscientist. The AAPG Foundation's Military Veterans Scholarship seeks to make the transition a little easier, and to help meet our industry's future challenges by bringing these outstanding young men and women into our ranks."

Earl Wells, Deepwater GOM/JI, ExxonMobil US Production

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Dave Lawrence, AAPG Foundation MVSP supporter



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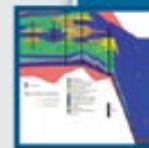
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AN EXTRAORDINARY OIL AND GAS PLAY

John Grotzinger and Zuwena Rawahi

Microbial facies and their associated clastic-textured carbonates can form reservoirs of significant lateral extent in both shallow and deeper-water settings. In the Ara Group of Oman, platforms of microbialite reservoirs, broken up during salt tectonics, are separated and surrounded by salt.



COMPLEX DIAGENETIC EVOLUTION

James W. Bishop, David A. Osleger, Isabel P. Montañez, and Dawn Y. Sumner

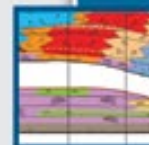
VDiagenesis modified lithologies, depositional fabrics, and pore systems in the Middle Permian Capitan backreef facies of the Yates Formation, Slaughter Canyon, New Mexico. Early diagenesis was dominated during sealevel lowstands by meteoric cementation and stabilization.



IMPROVED GEOLOGICAL SIMULATION MODELS

Nasser Al-Ghamdi and Michael Pope

High-resolution carbon isotope data were integrated with core descriptions and gamma logs to be used as a correlation tool to refine the sequence stratigraphic framework of the Shu'aiba Formation in Saudi Arabia. This process should lead to better models for reservoir characterization.



RELIABLE TIMELINES

J. Garrecht Metzger, David A. Fike, and L. B. Smith

Carbon isotope data from well cuttings and core generates chronostratigraphic logs of Late Ordovician-aged strata from subsurface samples in New York State. It is possible to correlate time-equivalent strata on a basin-wide or larger scale, even cutting across lithologies.



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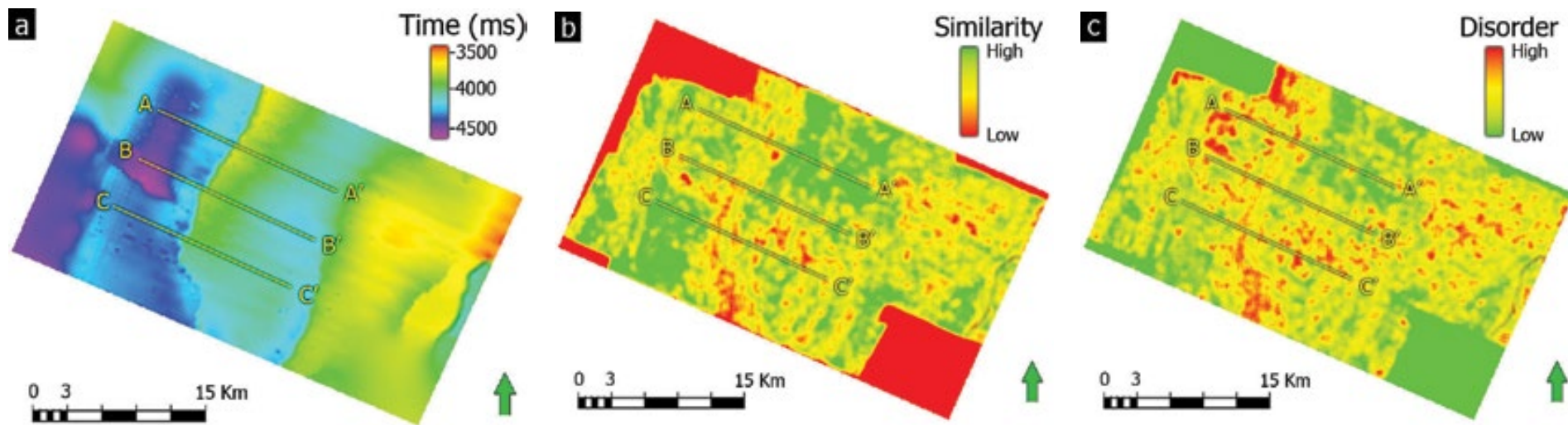


Figure 1— (a) Time-structure map of yellow horizon shown in figure 2 (below), and corresponding horizon slices through the (b) coherence and (c) Disorder volumes. Coherence is sensitive to structural and stratigraphic edges as well as noise. By design, disorder is insensitive to edges and only sensitive to chaotic noise.

Quantifying Confidence in Horizon-Picking

By THANG HA and KURT MARFURT

Risk analysis is a crucial task in making drilling decisions and involves many factors, such as well logs, modeling results, production maps and interpretation quality.

In his book on 3-D seismic interpretation, AAPG award-winning member Alistair Brown presents a workflow for the quantification of interpretation confidence. In this workflow, picks at 0, 1, and 2s indicated low, medium and high reflector quality. The interpreter then generates a confidence map from a coarse grid of picked lines.

In practice, such interpretation confidence maps are commonly excluded from risk analysis, simply because such quantification is not easy.

In this article we demonstrate the quantification of horizon-picking confidence, using two seismic attributes that are sensitive to chaotic features – namely the Sobel-filter and disorder attributes.

* * *

Our study area is located within the Halten Terrace, Norwegian North Sea. The area involves rift-related geologic structure, particularly a system of listric faults with a weak, soft layer of salt between basement and the upper sedimentary rocks.

Figure 1a shows the time structure map of an interpreted horizon in the study area.

Figure 2 shows representative vertical slices through the seismic amplitude data.



HA

The general idea is that the noisier the data, the less confidence the interpreter will have in picking a horizon.



MARFURT

While the horizon is relatively easy to pick in many areas, there are other areas where it is contaminated by steeply dipping migration alias artifacts. Autopickers work poorly on this horizon.

In order to quantify the confidence of the horizon picking task, we calculate attributes that are sensitive to chaotic features, such as salt, karst and seismic noise. The general idea is that the noisier the data, the less confidence the interpreter will have in picking a horizon.

The Sobel-filter implementation of coherence (the same Sobel filter as in your digital camera software) independently computes first derivatives of the seismic amplitudes between neighboring traces along the X and Y directions and combines them to form a coherence-like image. Disorder, on the other hand, cascades second derivatives in the X, Y and time directions.

Coherence algorithms are designed to emphasize continuous reflectors disrupted by incoherent structural and stratigraphic edges. In contrast, the disorder algorithm is design to emphasize noise and considers edges to be signal.

Both noise estimates are computed

along local reflector dip and are normalized by the energy of the data within the analysis window.

* * *

Figures 1b and 1c show the results of the Sobel filter and disorder attributes extracted and smoothed along the same horizon in figure 1a. Most of the horizon corresponds to relatively low coherence and high disorder, suggesting that seismic data quality is generally low.

Such data quality impacts the continuity of time-structure maps.

In line AA' shown in figure 2a, the right part of the image corresponds to a smooth time-structure map and high values of coherence and low values of disorder (appearing as green in figures 1b and c) corresponding to a smoother part of the map in figure 1a.

In contrast, line CC' in figure 1c exhibits poor data quality at the target horizon that gives rise to lower coherence and higher disorder displayed as yellow and red in figures 1b and c, and also results in a less smooth time-structure map in figure 1a.

Interestingly, the horizon on the

west side of line CC' (figure 1c), shows high coherence (in green) but medium disorder (in yellow). Note that while the horizon is picked as a (white) peak it is overlain by a higher coherence event that appears as a (black) trough. The coherence algorithm appears to measure the continuity of this higher amplitude neighboring reflector.

In this example, the disorder attribute represents data quality more accurately.

* * *

In summary, seismic attributes that are sensitive to chaotic features and noisy data, such as coherence and disorder, can be used to quantify horizon-picking confidence. Of the two attributes, disorder is relatively insensitive to faults and provides the more accurate result.

While both attributes are a measure of data quality along a picked reflector, they are not a measure of erroneously picking a more coherent neighboring reflector. Such interpreter error may be the biggest risk of all in the final map.

Authors' note: Thanks to Debapriya Paul for providing geologic information and seismic interpretation data of the study area. AASPI and Petrel were used in this project. Seismic data were provided courtesy of CGG.

(Editor's note: AAPG member Thang Ha is a master's student in geophysics at the University of Oklahoma; AAPG member Kurt Marfurt is his adviser there.)

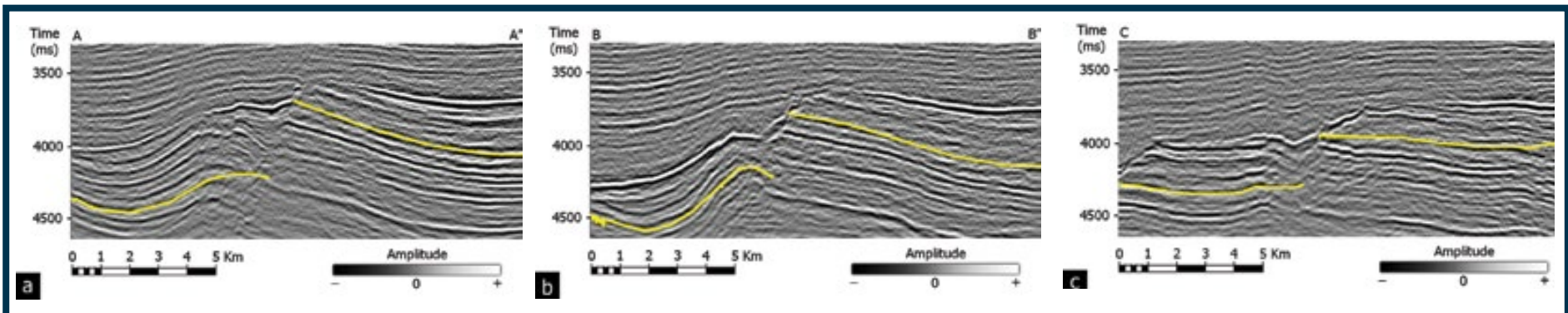
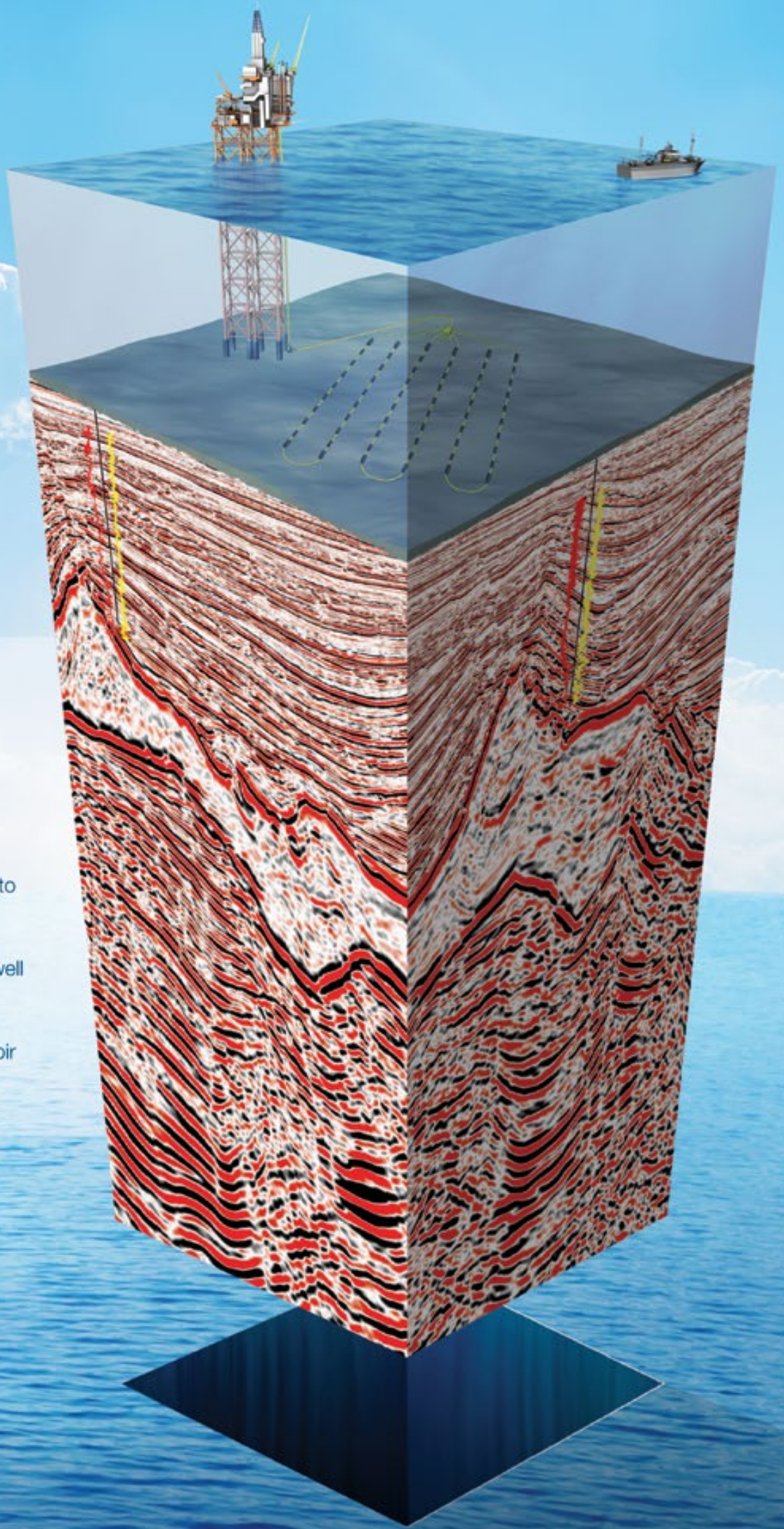


Figure 2 – Three vertical slices through the seismic amplitude volume showing the yellow picks used to make the map in figure 1a. (a) In line AA' the horizon on the east (right) side is relatively continuous and easy to pick. (b) In line BB' the data quality is poor along the entire picked line. (c) In line CC' the left side of yellow horizon is also noisy, but corresponds to a high coherence (green) area in figure 1b. In this example, the coherence map is sensitive to the overlying, higher amplitude continuous (black) trough.

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The Debate II: What's On the Caribbean Plate?

By KEITH JAMES

Once we've completed a study most of us geologists feel that despite the incomplete data with which we started, our insight has overcome that basic limitation.

Ours, however, is not an exact science – and the all-too-frequent dry wildcats return us to the level of fallible mortals.

I bring this up as an introduction to my comments here on Jim Pindell's rebuttal of my article on the origin of the Caribbean Plate (August 2012 EXPLORER).

Jim's article appeared in the July 2013 EXPLORER.

Whatever we serve up – Arroz a la Cubana or La Bandera Dominicana – we should check the ingredients. No one is infallible, but I feel many points in his article need correction.

Before I touch on the main ones, let me provide you with synopses of the Caribbean Pacific – first Jim's preferred model, and then the In-situ model that I prefer.

► **Jim's model:**

The Caribbean formed as Jurassic oceanic crust in the Pacific, thickened into an igneous "oceanic plateau" in the Cretaceous, collided with and reversed the subduction polarity of a linear intra-



JAMES

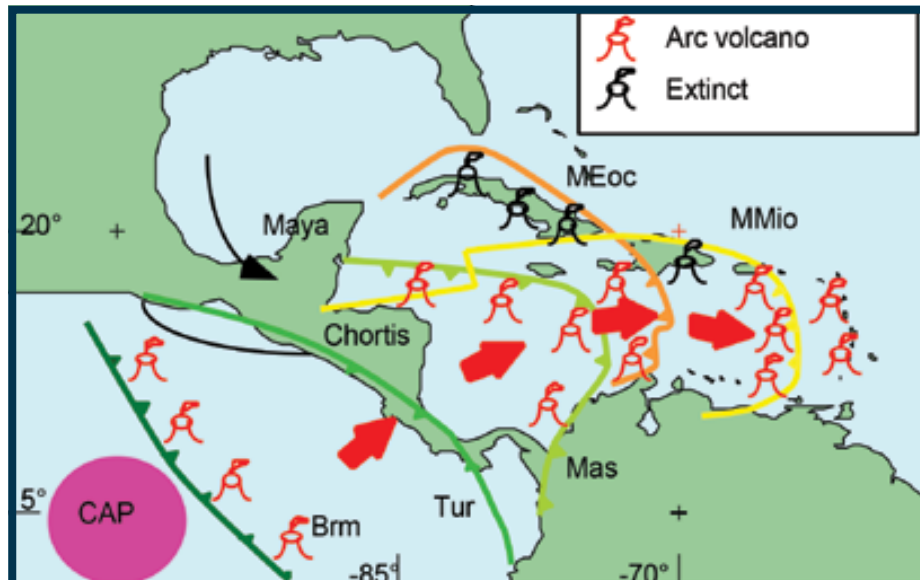


Figure 1 – The Pacific origin of the Caribbean Plate (CAP). Positions of the migrating volcanic arc: Brm – Barremian, Tur – Turonian, Mas – Maastrichtian, MEoc – Middle Eocene, MMio – Middle Miocene. Curved arrows indicate rotations of Maya and Chortis.

oceanic arc and became progressively engulfed by westward migrating North and South America (figure 1).

Diachronous interaction with the Americas curved and greatly extended the arc. Continental material along western Colombia and North America was subducted to HP/LT blueschist conditions, then resurfaced along the Greater Antilles and northern South America.

The large Maya and Chortis blocks

rotated 135 degrees counterclockwise or 100 degrees clockwise, and 180 degrees counterclockwise or 80 degrees clockwise, respectively.

Plate boundary jumps defined the Yucatan and Grenada basins.

The Caribbean consists largely of Jurassic-Cretaceous oceanic and volcanic rocks.

► **My model:**

The Caribbean formed between

separating North and South America, with which it shares structural fabric and stratigraphy (figure 2).

Caribbean margins carry Triassic-Cretaceous continental to marine rift deposits and carbonate platforms. Internal seismic architecture of highs flanked by wedges repeats that, seen on extended continental margins.

An overlying regional seismic marker reflects an upper Cretaceous basalt, with smooth (shallow water/continental) and rough (subaqueous) signatures.

A violent, regional Middle Eocene event generated wildflysch and emplaced major allochthons of volcanic and serpentinitic rocks, and metamorphosed marginal rocks onto the Greater Antilles and northern South America, shutting down volcanic activity.

Subsequent eastward relative Caribbean movement created eastward-migrating foredeeps progressively inverted in transpressional uplifts and invaded by their fold and thrust belts.

The Caribbean consists of extended continent (crustal thicknesses, gravity data, high silica content, ancient zircons), with volcanic rocks and serpentinitized mantle.

Point/Counterpoint

The following are points of disagreement between the two of us.

Continued on next page

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- The symposium is meant to target all disciplines and skill levels - from the geologist, to the engineer, to the environmental scientist, policy makers and government regulators.
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AAPG
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Hilton London Ontario
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Hosted by the
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Figure 2 – Regional tectonic fabric of Middle America. AP, Aneгада Passage; BP, Bahama Platform; BRR, Blue Ridge Rift; GF, Guayape F; MP, Mona Passage; PG, Perijá Graben; RHF, Rio Hondo F. Compiled from many sources. Parallelism of major Jurassic faults (RHF and GF) on Maya and Chortis with major structures in North and South America (e.g., BRR, MR, PG) deny rotation of these continental blocks. Blue arrow – direction of extension along northwest fractures; red arrows – movement of the Caribbean relative to the Americas, displacement of northwest South America toward and onto the Caribbean.

Continued from previous page

Pindell: Today, arguments for this story are more numerous and better documented than in 1985, and none contest it.

James: Jim has the book that lists him as co-editor (GSL Special Publication 328) and several other publications (see www.kjgeology.com) that include arguments against the Pacific origin for the Caribbean.

Pindell: The paucity of arc-related tuffs in the Cretaceous Proto-Caribbean passive margin sections of Yucatán, Bahamas, northern Colombia, Venezuela and Trinidad implies allochthonous origin of the Caribbean.

James: Yucatán, the Bahamas and Trinidad lie outside the Caribbean. There are tuffs in the Turonian of Colombia's Guajira Peninsula and Villeta Formation. Units of northern Venezuela (Villa de Cura, Tacagua, Tiara, Las Brisas, Las Mercedes), Trinidad (Toco, Sans Souci) and Tobago (Volcanic Group) include Upper Jurassic-Cretaceous volcano-sedimentary rocks formed on a passive margin.

Offshore Venezuela, Cretaceous units include volcanoclastics and basalts associated with limestones, black shales, quartz sandstones/conglomerates.

Pindell: Seismic tomography provides a measurable minimum of 1,500 kilometers of American-Caribbean relative motion.

James: Tomography in the eastern Caribbean (Van der Hilst, 1990) was necessarily derived from geographically limited stations. VdH emphasized that results "have a preliminary character and discussions and conclusions should be considered tentative."

"The blurred image of the Atlantic lithosphere subducted below the eastern Caribbean" was "a working hypothesis" – this does not translate into a "measurable minimum of Caribbean-American Tertiary displacement."

Pindell: Subduction and arc magmatism began along the western Costa Rica-Panama Caribbean margin in the Campanian. There is no Cenozoic Andes-type orogenesis in Costa Rica/Panamá.

James: An important tenet of the Pacific model is that subduction and arc magmatism began along Central America only when the leading edge of the Caribbean Plate encountered the Americas (in the Campanian).

In fact, arc magmatism began at least as long ago as the Albian – and probably in the Jurassic (radiolaria in volcano-sedimentary rocks on the Nicoya and Santa Elena peninsulas of Costa Rica, respectively).

Andean orogenesis is understood to involve the continent. Accreted Jurassic-Cretaceous oceanic rocks record convergence of the Pacific with Costa Rica where crustal thickness of 40-45 kilometers, seismic velocities and gravity data indicate continental foundations. Albian and Miocene quartz sands are present. High silica Tertiary ignimbrites in Costa Rica are chemically similar to continental rocks. Similar ignimbrites in Guatemala lie above Palaeozoic continental crust.

The common (several "intra-oceanic" arcs) reasoning, "since Costa Rica is an intra-oceanic arc these siliceous rocks must indicate formation of new continental crust," is false logic.

Circular reasoning also is applied to Caribbean blueschists: "They form under HP/LT conditions, hence in subduction zones, therefore blueschists in Cuba, Hispaniola and Venezuela evidence subduction."

No blueschists are present in the Central American or Lesser Antilles arcs, active at least since the early Cretaceous. HP/LT conditions can arise in foredeeps such as Trinidad's Columbus Basin, where up to 15,000 meters of younger Tertiary sediments lie above Mesozoic sedimentary rocks probably of similar thickness.

High pressure (compaction, source rock maturation, clay diagenesis, mineral

See **The Great Debate**, page 49

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AAPG | FORUM

Granite Wash and Pennsylvanian Sand Forum
 Sept. 25, 2014 – Oklahoma City

This forum is an intensive one-day review by experts of the latest findings regarding the productive extent and producibility in the Granite Wash of Oklahoma and Texas, along with Pennsylvanian sand-producing horizons. Starting with a big picture view and new understanding about basin modeling, heat flow and migration, participants will learn about new ways to map the reservoirs. Then they will learn petrophysical and geomechanical methods for understanding fluid flow, new ways to use 3D seismic and seismic attributes for identifying sweet spots, methods for predicting location of new reservoirs / step-outs, using new geology / geophysical information for optimizing drilling, completion and stimulation. Concepts, research results and case studies will be foregrounded.

Permian and Midland Basin New Technologies RX
 Sept. 4-5, 2014 – Houston

This two-day event is an exchange of new and emerging technologies and techniques that are needed to optimize operations in existing and expanded plays in the Permian and Midland. Learn new workflows and technologies to integrate petrophysical, geochemical, seismic, biostratigraphic and geomechanical information for reservoir optimization. Presentations will review new stacked pays and effective approaches in secondary and tertiary recovery, with a focus on the geological information to design and implement new waterfloods, CO₂ floods and other types of enhanced recovery technologies.

www.aapg.org/career/training/in-person/forums

The Great Debate
from page 49

transformation, fluid expansion, osmosis, efficient seals and tectonic pressure) and low heat flux could generate HP/LT conditions. Transpressional basin inversion returns them to the surface.

Metamorphic grade declines from west to east along the Greater Antilles and along the Venezuelan-Trinidadian Coastal-Northern Ranges. It increases toward major faults in Cuba and northern South America and grades laterally from sedimentary to metamorphic rocks.

* * *

Pindell: *Sinistral segmentation of Antillean rock units on the order of 300, 400 and 300 kilometers at the Oriente, San Juan-Muertos and Anegada fault zones, respectively, are apparent and consistent with Cayman Trough opening (700-1,000 kilometers – oceanic spreading fabric).*

James: Satellite imagery (Jim's 2013 figure 1) clearly shows that Cuba, Hispaniola, Puerto Rico and the Virgin Islands are sub-aerial parts of larger, much submerged blocks separated only by narrow deeps such as the Mona Channel (extension estimated 15 kilometers) and Anegada Passage.

Discussion of Greater Antillean geology only as accreted Cretaceous oceanic and arc rocks with younger cover consistently overlooks 30 kilometers of crustal thicknesses and Cretaceous marbles (intertidal-subtidal limestones now as deep as 6,000 meters – southern extension of the Bahamas carbonate platform) dredged from northern slopes.

Continental granitoids and red beds dredged from Cayman Trough walls do not lend themselves to oceanic origins here, either. Trough opening is neither calibrated (estimates from 150-1,400 kilometers; oceanic fabric appears only in the central 300 kilometers) nor dated (Pliocene, Oligocene, Eocene or Jurassic-early Cretaceous [North-South American offset] plus Oligocene- Recent [Caribbean-Americas offset]).

* * *

Pindell: *Cretaceous passive margin sections of Yucatán, the Bahamas, Colombia, Venezuela and Trinidad transform upward with east-younging diachroneity into tectonically active foreland basins with "arc-bearing" turbiditic flysch (mentioned examples include Maastrichtian Sepúr, Paleocene Molino and Eocene Cacarajicara and Amaro formations).*

James: An important Circum-Caribbean coeval, middle Eocene event separates Cretaceous passive margin from diachronous foreland basin history. It emplaced allochthons up to 1,000 kilometers long, 20 kilometers wide and five kilometers thick (Cuba, Venezuela, Jamaica, Hispaniola) and shut down volcanic activity along the north and south.

Middle Eocene wildflysch is followed by a regional, middle Eocene unconformity, shallow water carbonates and a late Eocene hiatus.

Luruaco, Matatere, Guárico, Pointe-a-Pierre, Chaudiere and Lizard Springs flysch records this coeval (not

diachronous) event across Colombia, Venezuela and Trinidad.

The age of Guatemala's Sepúr Fm is Paleocene-Eocene (fossils), not Maastrichtian – older content is reworked. Colombia's Maastrichtian (not Palaeocene) Molino Fm is mainly carbonaceous claystone, not "arc-bearing turbiditic flysch." Cuba's Cacarajicara and Amaro Fms are K/T boundary megabeds.

Following the Eocene event, deltaic-basinal, Eocene Misoa-Trujillo-Pauji, Oligocene La Pascua-Roblecito, and Miocene Areo/Carapita, Oficina, Retrench and Herrera sediments accumulated in foredeeps related to eastward younging, dextral transpression along northern South America, continuing today east of Trinidad.

They are not "arc-bearing."

* * *


Pindell: *There remains no hint of continental crust or salt in the Caribbean.*

James: Seismic similarity of internal Caribbean structure to that imaged and drilled offshore North America (half grabens, Jurassic-Cretaceous-Tertiary fill, including salt) and replication of a drilled Gulf of Mexico seafloor salt diapir by a Caribbean "seamount" (clearly diapiric, not volcanic) are not mere hints.

* * *

Jim Pindell regards the Pacific model as the simplest. Needless to say, I disagree.

Does it matter? Well, if you are interested in oil and gas, the in-situ model relates the Caribbean to its hydrocarbon-rich neighbors.

Caribbean nations should think about that. 

(Editor's note: AAPG member Keith James is a Fellow of the Institute of Geography and Earth Sciences, Aberystwyth University, Wales, and also lectures at the Venezuelan Hydrocarbon University. With Shell International he worked in Gabon, Spain, Venezuela, United Kingdom, the Netherlands and the United States. He then joined Conoco as chief geoscientist, international studies, Houston. He challenges Caribbean and plate tectonic paradigms. He is Consultant Geologist (Scientist Board, International Scientific Consortium "Geology Without Limits") to the project: Investigation of Lithospheric Deep Structure of the Caribbean Region by Seismic Methods, September 2013 EXPLORER.)

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YP Membership, Activities Are Booming

By MEREDITH FABER, Young Professionals Committee Co-Chair

The Southwest Section (SWS) Young Professionals (YPs) have had a great start to 2014.

The Dallas Geological Society (DGS) YPs, led by **Joe Bauman**, and West Texas Geological Society (WTGS) YPs, led by **Clayton Winkler**, have gained traction in their local geological communities – the total group has grown from about 50 in 2012 to over 200 YPs in 2014.

To get this kind of involvement the local societies have held events like crawfish boils, bowling nights, Texas Rangers baseball games and charity events.

Going forward, the SWS-YPs are committed to increasing participation from the other local societies and promoting membership in AAPG. It's an exciting time in our industry – and as YPs we should encourage involvement and learn as much as we can from our colleagues and peers.

Here are some quick recaps of the most recent SWS-YP events and the newly simplified process to become a member of AAPG.

DGS Update

On April 28 the Dallas Geological and Geophysical Societies held its 39th annual joint golf tournament at the Tribute and Old American golf courses; but this year included a twist as the inaugural Young Professionals Pro-Am Event was concurrently held.

With the goal of cross-generational



FABER

Reasons to Become an AAPG Member

- ▶ Networking with other geoscientists.
- ▶ Gaining knowledge of new technologies.
- ▶ Educational opportunities – through conferences, continuing education courses and field trips.
- ▶ Fostering scientific research.
- ▶ Building lasting relationships with current members.

networking, Pro-Am teams paired veteran geoscientists (the "Pros") with Young Professionals (the "Ams"). The event was well-received, indicating it may be the first activity in an annual event.

This year, 11 YPs distributed among six teams vied for the coveted YP Pro-Am bobblehead trophy, with the team of **Dick Swindell**, **Brandon Hussing**, **Mark Edwards** and YP **Brandon Lycka** finishing on top.

Thank you to all the Pros who invited a YP to play on their foursome – and to Denbury Resources and Columbine Logging for sponsoring some of our YPs' registration fees!

As of June, Mandi Beck is the new DGS YP chair.

WTGS Update

The WTGS YP group was formed this past fall with an eight-person committee keen to start getting the word out to Young Professionals about AAPG through networking events, seminars/speaker series and charity events in the local communities.

Meg Dodge with Weatherford Laboratories sponsored our inaugural event on the patio of Sedona Grill on Sunday, May 11. We had approximately 25 people attend the event, following the SWS-AAPG Icebreaker social.

One of the main goals for the Permian Basin YPG committee was to approach the various attendees and solicit ideas for future events and talks, and opinions on the best methods for increasing interest in the organization. The social route seems to be a relatively open and relaxed environment for gaining initial interest.

A number of suggestions pointed us toward planning to bring in speakers from the variety of areas in the industry.

AAPG Membership Process

The requirements to be an AAPG Member consist of having a bachelor's degree in the geological sciences; a minimum of one-year experience in the professional industry or teaching of geology; and one sponsor who is an

AAPG Member.

If you are currently a Student or Associate member and would like to upgrade your membership, go to <https://appmanager.aapg.org> and follow these steps:

- ▶ Click 'Apply for Membership' on the right-hand navigation panel.
- ▶ Log in.
- ▶ Confirm your personal information.
- ▶ Click 'New Application' and select the appropriate application (renewal, reinstatement, etc.)

▶ Complete the Transfer to Member form and enter your sponsor's name.

▶ Submit the application.
AAPG verifies the eligibility of all applicants and sponsors, and the prospective member is published online and available for view for 60 days.

* * *

If you want to become a new member, go to <https://appmanager.aapg.org> and follow these steps:

- ▶ Click 'Apply for Membership' on the right-hand navigation panel.
- ▶ Create AAPG login credentials.
- ▶ Confirm your personal information.
- ▶ Click 'New Application.'
- ▶ Complete the Member form and enter your sponsor's name.

▶ Submit the application.
Again, AAPG verifies the eligibility of

Continued on next page

SAVE THE DATE

Unconventionals Update GTW

Nov. 4-5, 2014 – Austin, Texas

Join us to learn the latest technologies being successfully applied in the main unconventional plays, and how the knowledge can be applied to other plays. Geochemical methods, integrated 3D seismic, fracture characterization, and more are used to identify sweet spots. Participants will also learn about the latest infill drilling, increased density (and issues of fracture interference), stacked pay development, proppant and fluid selection (avoiding formation damage), reservoir characterization while drilling, workflows and decision-making.

Bakken / Three Forks / plus Emerging Plays GTW

Nov. 17-19, 2014 – Golden, Colorado

Participants will learn how to be successful in utilizing the Three Forks in a stacked-pay, pad-drilling strategy when producing various Bakken members.

Attendees will learn how to apply 3D seismic and seismic attributes, use geochemistry and geochemical information to map sweet spots and to predict fracture behavior (including fluid behavior in the fractures, including fracture interference when infill drilling).

Sessions will also include new findings in emerging plays such as the Mancos.

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Hey Larry, what are you doing July 20-22, 2014?

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REGIONS&SECTIONS

GTW Draws Global Audience to Brazil

By EMILY SMITH LLINÁS

Preparation for the FIFA World Cup was not the only event attracting international audiences to Brazil in May. AAPG's Geosciences Technology Workshop (GTW) Brasil, "Stratigraphic Traps and Play Concepts in Deep Water Settings," brought in 143 geoscientists representing 12 countries from the Americas, Europe and Asia.

The workshop, co-hosted by AAPG Latin America Region and the Associação Brasileira de Geólogos de Petróleo (ABGP), followed the 12th Brazilian Licensing Round in 2013, which opened 240 exploration blocks in frontier areas across Brazil's emerging and matured basins.

GTW sessions provided participants with a greater understanding of geological and geophysical attributes of stratigraphic traps in deepwater settings, along with equatorial margin exploration analogs.

Brazilian native and AAPG member Flavio Feijó, a senior geologist working as teacher-mentor at Petrobras, said he attended the GTW to gain current knowledge on stratigraphic traps in deep water, as well as to meet up with old friends and to make new contacts.

"The workshop was a very pleasant experience, with good lectures and discussions and extensive networking during the breaks," Feijó said. "I improved my knowledge of deepwater settings in general, and about Brazilian basins in particular."

A significant portion of the workshop focused on stratigraphic traps in Brazil, including the Campos Basin, Pelotas Basin and Alagoas Basin, and a review of analogs from the Brazil Equatorial Margin frontier exploration initiative in deepwater stratigraphic plays along an oblique rifted margin.

But, as in the World Cup, Brazil was not the only player: the case histories and global analogs session included reviews of the eastern Mississippi Canyon protraction area of the Gulf of Mexico; cretaceous fan plays of the African Transform Margin and analogs from the Cretaceous play of the Jubilee Field; and new frontier basins in the South Atlantic Basins, including subtle traps in offshore West Africa.

Additional sessions highlighting evolving concepts on stratigraphic traps included studies of the Pelotas Basin in offshore Uruguay and the deepwater block of the Suriname-Guyana Basin on the West Atlantic Transform Margin.

The final session focused on the use of technology in defining stratigraphic traps and featured reviews of predictive tools for identifying traps, as well as the role of 3-D seismic and color seismic processing technology in defining stratigraphic traps.

The content was well received by



GTW Brasil organizers, presenters and session chairs.

participants, including AAPG member Peter Mullin, a new ventures manager at

PanAtlantic Exploration in Houston, who found GTW sessions even more valuable to him than sessions he attended at AAPG's larger annual and international conventions.

"These themed sessions are first class ... They allow focus and in-depth analysis, which in turn can lead to break-through thinking," Mullin said.

Session chair and AAPG member Jaime Buitrago, Mexico business development manager at ExxonMobil in Houston, agreed, stating, "The [GTW] format allows for people to focus on a subject without the

usual overload of a large convention."

Buitrago said he found GTW Brasil to be helpful, well organized and useful to a wide variety of participants. He said he benefitted personally by learning about effective, true stratigraphic traps.

"I was particularly impressed by Petrobras' paper about the stratigraphic traps in Sergipe-Alagoas," he said.

While two thirds of workshop participants came from Brazil, nearly one fourth came from the United States and Canada. Other countries represented included Argentina, Colombia, Jamaica, Suriname, the United Kingdom, Italy, Ireland, Norway and Malaysia.

CALL FOR PAPERS

► Submission deadline:
1 October 2014

<https://mc.manuscriptcentral.com/interpretation>

A joint publication of SEG and AAPG

Interpretation®

A journal of subsurface characterization



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Fractures

Natural fractures in reservoirs play an important role in determining fluid flow during production. Knowledge of the orientation and density of fractures is useful to optimize production from fractured reservoirs. Areas of high-fracture density may represent zones of high permeability, therefore locating wells in these areas is important.

Different methods using surface seismic, well logs measurements, and core analysis have been used for fracture characterization. The purpose of this special issue is to introduce the state of the art in interpretation methods for natural and induced fractures. We are interested in papers that discuss advances in the following topics:

- Azimuthal seismic anisotropy methods
- Shear wave splitting
- Well log measurements analysis
- Core analysis
- Lab measurements
- Diffraction imaging
- Microseismic monitoring
- Case studies
- Numerical modeling
- Seismic attenuation
- Effective medium theories for fractures



Figure courtesy Terry Engelder, Professor of Geosciences, Department of Geosciences, The Pennsylvania State University

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 October 2014

Publication of issue:
August 2015

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Continued from previous page

all applicants and sponsors and the prospective member is published and available for view for 60 days.

* * *

The SWS-YP group is growing rapidly and we hope to add a few more YP Chapters (FWGS, AGS, NTGS) this year.

Check out our website at www.southwestsection.org/yp/.

Pipeline Initiative Hits Shipping Milestone

By COURTNEY CHADNEY, EXPLORER Correspondent

It started with a desire to share science with schools and libraries that otherwise wouldn't have access to the latest AAPG publications.

A few books shipped here, a few more shipped there ...

And then the acorn became a tree.

AAPG's Publication Pipeline Committee recently had a small celebration to mark a very big accomplishment: Just a few weeks ago, the group officially topped the 100-ton mark of books, periodicals and other information that have been shipped around the world.

"With every shipment is a story," said AAPG member Martin Cassidy, founder and cheerleader behind one of AAPG's most successful programs. "We could write a book!"

"Geoscientists helping geoscientists" is how the Publication Pipeline Committee (PPC) describes its efforts, as they collect donations of geoscience books and periodicals – usually from AAPG members – and forward them overseas to universities in need.

The program, now supported by the AAPG Foundation, is in place to "improve geoscience education in developing countries by providing used geoscience books and periodicals at no cost to university libraries and other libraries that request them."

The books themselves come from individuals who donate them to the AAPG Foundation.

Places shipped to so far include:



Photos courtesy of AAPG Publication Pipeline

In case you think it might not matter ... Indonesia students were happy – and then some – when their shipment of books arrived courtesy the AAPG Publication Pipeline Committee.



Martin Cassidy, left, founder and cheerleader of AAPG's Publication Pipeline initiative, gets personally involved in the work – as shown here, helping with a shipment to Nigeria in 2010.

Afghanistan, Argentina, Bangladesh, Colombia, Ghana, India, Indonesia, Liberia, Malaysia, Nigeria, Trinidad and more.

It all started when Cassidy, who has won an AAPG Distinguished Service Award, in part for his efforts with the Publication Pipeline initiative, was asked to look at a donation of 50 boxes of publications from the estate of a well-known Houston geologist.

"The main library did not want them," Cassidy recalled. "They were offered to graduate students and staff, and with no takers they were to be thrown away."

After inquiring with other universities, he soon found that wasted publications were a common occurrence. Donations were accepted, a few books sold, but most were just thrown away.

Cassidy described the reality:

"Room constraints, duplication, a belief in digital libraries and lack of staff to even sort the donations prevented their preservation."

A Win-Win Situation

But Cassidy, having traveled and worked as an international geologist, knew of libraries that had few books – especially geoscience material – due to lack of funds or destruction of library holdings from war, terrorism, riot, fire or flood.

And he was determined to not allow

Continued on next page

Eastern UNCONVENTIONAL OIL & GAS Symposium 2014

The Kentucky Geological Survey and Center for Applied Energy Research at the University of Kentucky

are initiating an annual Eastern Unconventional Oil & Gas Symposium

to be held November 5-7, 2014 in Lexington, Kentucky, USA.

EUOGS will address a broad range of upstream and downstream issues related to unconventional energy production from basins in the Eastern USA.

A Call for Papers and other details are available on the meeting web site: www.euogs.org.

Abstracts are due by August 15, 2014.



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Remember — today's prospect may be tomorrow's play!



The University of Oklahoma MEMORIAL COLLEGE OF EARTH & ENERGY



AAPG member Ray Sorenson, left, an active participant of the Publication Pipeline initiative, and AAPG office services/facilities manager Jim Briggs, preparing a shipment of books earlier this year that were headed first to Houston, and then around the world.

Continued from previous page

these books to go to waste.

Cassidy rented a storage locker to store the residue of that initial Houston donation, thus marking the beginning of a non-profit company of volunteers that Cassidy would set-up in 2000 known as the Publication Pipeline.

"I realized there would be a flood of geoscience publications as our fellow geologists who retired, left employment or died," Cassidy said.

His Publication Pipeline would serve as a conduit of geoscience publications from the United States to universities in need all over the world.

"We would sort, inventory, pack and arrange shipment," Cassidy said. "Companies or geoscience organizations in the target countries would arrange import clearance along with the receiving university – shipments would be paid by companies active in the country of the university receiving shipment."

After reaching out to local interests and previous comrades, Cassidy found an early member in Rick Wall, who had worked with Cassidy previously on overseas projects.

Wall, who was currently working on a project in Nigeria, joined Cassidy and helped persuade his company, ConocoPhillips, to sponsor the very first official Publication Pipeline shipment in 2001 to the Nigerian Association of Petroleum Explorationists.

"Oil companies like to be involved in the area they are working in," Wall said. "It's a win-win situation for everyone."

After the first shipments, Cassidy knew they had a working model and could really grow it into something big – but they

would need more support.

The solution: They prepared a request to become an official committee of the AAPG.

"We realized that the effort was going to be a success and really fit in the family of activities of the AAPG of which I had been an active member for many years," Cassidy said.

The committee structure proved to be exactly what was needed.

"Our committee increased in members," Cassidy said, "and our collection of donations soon outgrew our rented storage units."

Food For Thought

Since becoming official in 2001, the effort has continued to grow – so much, in fact, that it continuously is in need of more space.

Along with reaching its 100-ton milestone, the Publication Pipeline recently reached another successful benchmark as they entered a new community partnership with the Houston Food Bank, which is now graciously providing a large amount of space in its warehouse for even more geoscience publication storage.

"The Food Bank feeds the body and we (PP) feed the mind," Cassidy said.

Currently, the Publication Pipeline has about 100 pallets in storage at the Houston Food Bank. Twenty pallets are on their way to Thailand, five are being prepared to go to Colombia, five to Venezuela and two are in preparation to go to a university in China.

Walls finds being a part of the effort

See Pipeline, page 55



A cause for celebration: The books from AAPG arrive in Nigeria.



The Geological Society of Colombia
(Sociedad Colombiana de Geología)
invites you to the

2nd EXPLORERS' SYMPOSIUM
Exploration in Tropical Terrains

Carmel Club • Bogota, Colombia
27-29 August 2014

Meet with energy explorers from tropical regions throughout the world, and enjoy an oil and gas and mineral academic program, as well as field trips. Other highlights include a case histories forum and business round.

Symposium themes:

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- Successful and unsuccessful exploration endeavors.
- Reconciling exploration and the environment.
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For registration and sponsorship information, see www.sociedadcolombianadegeologia.org/simposio/



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AAPG/MGS Conference in Yangon, Myanmar 14-15 August 2014
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- "Phanerozoic Tectonic and Palaeogeographical Evolution of East and Southeast Asia: Myanmar in Context"
Professor Ian Metcalfe, University of New England, NSW, Australia
- "Tectonic Evolution of Myanmar –A Brief Overview"
Dr Win Swe, Myanmar Geosciences Society
- "Timing and Significance of Tectonic Events adjacent to Major Cenozoic Basins in Myanmar"
Dr Chris Morley, Chiang Mai University, Thailand
- "Tectonic Evolution of the Bengal Basin Offshore Myanmar and Bangladesh with Special References to its New Petroleum Potential"
Dr Claude Rangin, Nice University, France
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www.aapg.org/events/event-listings

Trustee Associates Make a Solid Foundation

By APRIL HASTINGS, AAPG Foundation Program Coordinator

The AAPG Foundation is rock solid, thanks largely to a special group of contributors known as the AAPG Foundation's Trustee Associates.

Since 1978, this group of geoscience professionals has supported the Foundation's educational, charitable and scientific initiatives that bolster many fields of geoscience – while at the same time enjoying a special, one-of-a-kind camaraderie.

The generous nature of geologists pairs well with the aim of the Trustee Associates: men and women who enjoy the friendship of fellow geoscientists – and also are committed to positively impacting earth science education efforts and initiatives across the world.

Over the last 36 years, countless earth science teachers, university students, professors and various geoscience educational initiatives have benefitted from their generosity.

They are the Foundation's greatest group of supporters and keenest advocates, ensuring that geoscientists of tomorrow have the tools to ensure their success today.

Boundless Beginnings

The late Merrill Haas, a former Trustee and longtime Foundation supporter, captured the history behind the concept of the Trustee Associates in a letter he wrote late in his career.

Haas believed there was a fundamental vision underlying the goals of the group:



HAAS



McGEE



ARDELL



WISDA

They wanted to provide an opportunity for those who have benefitted from the geosciences a good way to pay it forward.

In his letter, Haas shared that fellow geoscientist and Foundation supporter Dean McGee suggested the organization create an affiliation patterned after another group of which he was a member.

McGee recommended that the members meet annually, provide input into Foundation affairs, sponsor projects and socialize together.

Haas proposed the name "Trustee Associates," and the group was announced at a Foundation development dinner at the Plimsoil Club in New Orleans on May 22, 1976.

Designed to Wear Many Hats

The Trustee Associates program was designed to provide a platform for interested participants to bolster the Foundation's ability to reach its goals and objectives, and to provide a way to recognize those individuals who provided substantial

financial support.

The group also was shaped to serve as an advisory body to counsel the governing members of the Foundation, the Board of Trustees.

The plan was set. The group would meet annually, at which time new Trustee Associates would be recognized.

The group's first annual meeting was held in May 1978 at Shangri-La Resort, Monkey Island, Okla., shortly after the dedication of the AAPG Weeks Energy Resources Tower in Tulsa.

Membership totaled 67 supporters, and 31 Trustee Associates attended the first annual meeting. The requisite contribution at that time was \$2,500.

Looking Forward

Today membership has grown to nearly 280 Trustee Associates, with nearly 100 members attending the annual business meeting at a location selected by the event's chairman.

This fall the meeting will take the group

to Austin, Texas, to discover and enjoy the "City of the Violet Crown."

In addition to conducting business, the members will enjoy field trips of geologic interest, historic tours, visits to local wineries and more.

This year's chairman Jay Henthorne and his wife, Mary Beth, will host a special dinner and awards ceremony. Also, the Foundation will formally recognize top honors given to two stellar Trustee Associates, Bob Ardell and Michael Wisda, both of whom were recognized with the Trustee Associates Service Award for outstanding support and service to the Foundation.

The 2015 meeting will whisk the group to the Broadmoor in Colorado Springs, Colo., and in 2016 they will meet at the Mauna Kea Beach Hotel off the Kahala Coast in Hawaii.

The Trustee Associates play a stellar role in the continued development of the Foundation's financial resources.

Membership is by invitation by other Trustee Associates. Prerequisites are AAPG membership; a \$15,000 contribution to the AAPG Foundation; the sponsorship of three Trustee Associates.

The group supports more than 30 funds and programs, including educational programs, awards, publications, lectureships, fellowships and digital resources.

If you are interested in learning more about the programs that they support, or in securing an invitation for membership, contact foundation@aapg.org; or call toll free, 1-855-302-2743, or 918-560-2664.



THANK YOU to our most rock solid group of supporters,
THE AAPG FOUNDATION TRUSTEE ASSOCIATES

Your support makes the difference in our ability to accelerate educational opportunities and resources for those advancing the geosciences.

The AAPG Foundation is fortunate to have earned the generous and loyal support of a select group of geoscience professionals known as the Trustee Associates. These individuals:

- Support and advocate AAPG Foundation programs.
- Provide counsel and leadership to its Trustees.
- Lend guidance and support to its fundraising efforts.
- Guide the scientific and educational agenda, which it underwrites.

Over the years, this group of advocates has given immeasurable support in time, talent and treasure to the Foundation for the purpose of advancing geosciences.

We appreciate all of your continued support!



Trustee Associates pause for a photo during their annual meeting in Cle Elum, Wash. in 2013.

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AAPG and SPE in May successfully convened a joint workshop in Ho Chi Minh City, Vietnam, – the first such collaboration in the Asia Pacific Region – on “Optimising Marginal Fields by Understanding Data and Cost Implications: Reservoir Quality, Architecture and Economics.” The event drew 60 delegates (above). Included here are co-convenors Jan Van De Mortel, Weatherford Malaysia (front row, left) and Hans Schwing, Murphy Vietnam (front row, right).

Reservoir from page 18

“It’s understanding the reservoir, the completions,” he added, “eliminating the poor wells.”

Sweet Spots, Sour Spots

The widely touted sweet spots are good. Zeroing in on sour spots may be preferable.

“People talk about sweet spots as if by seismic or mapping we can find the very best parts of the reservoir,” Meehan elaborated.

“One exercise I do in all the big plays is to look at a couple of simple things: How much production is there? How many operators are in the field and how many does it take to produce half of the production of the field?”

Meehan explained that there are typically about 100 operators at a play, but only a handful of them – maybe around six – produce fully half of all production from that play.

For the rest – the bottom 80 percent or so – production is, on average, very poor.

“If people were able to find the sweet spots, the place where the best wells are, the average would be much higher,” he said. “There’s some sort of variability that’s difficult for us to quantify from seismic.”

“I believe we can find the sour spots, or poor areas, maybe easier from seismic and logging,” he said. “If it’s like anywhere else in the entire oil industry, you will get this sort of log normal distribution of quality.”

“Sweet spots sort of suggests we can just find the right hand of that tail,” he continued, “but I don’t think we can do that consistently – no one has. I do think we can differentiate what that big fat left side of that tail is, the distribution that’s uneconomic. I think there are some seismic indicators and some things that suggest it.”

“One is when we see big faults that cut through the higher zones or down into water,” he continued. “Those areas tend to be poor; they tend to suck up a lot of the fracture and put it out of zone – or worse, put it into a water-bearing zone.”

You can detect that by way of geoscience and geophysics, he said.

You also can find some areas that have a very poor likelihood of natural fractures – but you must then understand if natural fractures are contributing in a meaningful way to production.

“A lot of people write a lot of stuff about finding sweet spots,” Meehan added. “I think one of the technologies where we will be more successful going forward is avoiding sour spots.”

“That’s probably not a real name, but (it works) just because it’s the opposite of sweet,” he said. “I haven’t read any papers about avoiding sour spots.”

Pipeline from page 53

extremely satisfying, as he is able to make an immediate impact on someone else’s life.

“Who wouldn’t want the opportunity to give students the tools they need to get an education?” he asked.

Wall believes one of the only downsides to the work is the fact that they rarely get the chance to be present when the universities receive the donations. However, the committee likes to ensure that they always have an AAPG member present from that country to participate in the donation ceremony and document the exchange with photos and reports.

One of Wall’s favorite pictures has been

a photo of a shipment from Indonesia that captured students unpacking mountains of books with huge smiles.

“Seeing the enthusiasm in their faces – it makes it all worth it!” he said.

Wall, however, believes there is a new focus for the committee to tackle – in order to send out as many books as they possibly can, they need new blood to join the effort.

“We have the foundation set for future success,” Wall said, “we just need more people to help us achieve our goal.”

Interested? Any and all AAPG members are encouraged to be part of the program through donations of used books, but also by actually being a part of the committee who makes it all possible.

For more information, go to foundation.aapg.org/programs/publicationspipeline.cfm.

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<http://www.roseassoc.com/instruction>

Commentary

AAPG and Gender

By KATIE JOE McDONOUGH

I have some thoughts on Lee Krystinik's President's Column "Bursting Bubbles" (May EXPLORER), which dealt with women, leadership and AAPG.

First of all, great kudos to you for addressing the issue, and for the many positive points that you made in the writing. I totally agree that AAPG (and many other male-dominated professional organizations) is/are missing out by not tapping into the wealth of resources available in a diverse and multi-faceted membership.

Your column, however, belies an underlying societal perspective that actually lies at the heart of the problem. The two admonitions I would add are:

► We're still in a mode of "leaving it up to the men" to facilitate women's participation.

The verbs you used in your writing serve to illustrate the prevailing perspective, which is a deep-seated part of the problem. It's all about the guys "allowing, providing, inviting, making room," etc. – so the decisions are still (ironically, considering the problem you are addressing) left up to the guys to "do to" or "do for" the women.

Guys, you're still in rescue mode.

How about you just treat female professionals similarly to your male colleagues – listen to (and act on!) our ideas, challenge us, discuss with us and, yes, encourage us when opportunities come along, just as you would for any male colleague.

And ladies, aren't we beyond the Era of Rescue? Let's step up and speak up! Don't wait to be invited. And see below.

► The erroneous but oft-repeated-until-it-seems-true statement about women bearing the brunt of having and caring for their children needs serious re-evaluation.

Biology obviously dictates the "having" part, but the "caring" part being the woman's responsibility alone is unnecessary, a cop-out by both genders and, frankly, a damn shame for all the enrichment lost to both children and adults.

The rewards and life-changing experience of molding young minds (and yes, changing the diapers associated with those young minds) is available to both genders, and the only way we will develop a societal mindset that respects childrearing is by both genders insisting that everyone participate – and honoring and facilitating that participation.

We need either or both genders clamoring to take time out for a Procreational Sabbatical (as my C.V. reads), and being respected for doing so, instead of viewing it as taking a hit at a

critical time in their careers.

(An example of that facilitation is the employer for whom I worked paper seismic data on our Lyons SS kitchen bar while preschoolers napped).

So guys, let's back up your offers of help a few years to a point where it genuinely makes a difference – to the childbearing years – and cease perpetuating the notion that the three choices the President's Column laid out so eloquently for women to make are only for the women to make (it's the third millennium, after all!).



McDONOUGH

* * *

There is a fourth option, and that is to decide that the "tough choices" can and should be up to both genders. I realize that this may involve a fundamental shift in our societal thinking; unfortunately the current mentality (by both genders) implies that we harbor a level of disrespect and even disdain for child rearing.

I envision a future where childrearing becomes a revered as opposed to onerous task (Facebook COO Sheryl Sandberg notwithstanding) – so I challenge us all:

Men: Can you honestly say that you think that raising children is important enough that you would take paternity leave or convince your workplace to let you work a flex schedule for a few years – or even quit?

So, did you? Will you? Are you willing to reschedule a business trip (ask a female colleague to pick that core point!) to make sure you make your daughter's band concert? Maybe it's easier to assume that the choice is all up to the woman, or that "she wants to do it?"

And while I'm at it, why not use that management position to argue forcibly for family perks for our younger male and female professionals, to facilitate everyone's participation?

Women: Let's step up and lean in!

I do mean at work, in all the ways that Lee Krystinik mentioned in his column (without waiting to be "invited," of course!), but I also mean at home – stop the Superwoman nonsense and make sure that both genders are "balancing work and family" (how many times have you heard a guy discuss that?), whether you have kids or not.

Women may have to push things a bit until the mentality changes, but many guys are pretty reasonable – particularly when you argue fairness issues ("I'm in meetings until 5:30 too, and I only get paid 75 percent of what you do!").

READERS FORUM

Arctic E&P Challenges

Regarding the article "Challenges – and Rewards – Lure Arctic Efforts" (February EXPLORER):

Although there is scanty data in the Arctic area (about HSE – health, safety and environmental dynamics in E&P operations), the real barrier in this prospective area is a harsh remote environment. The fragile ecosystem in the Arctic area would be a serious challenge – we need more sound scientific, non-

refutable environmental recipes for the Arctic ecosystem preservation.

In addition, the area's remoteness and a limited working season could be other big problems for our crews.

So, I suppose that HSE is just the real problem that is very challenging for all us, including geologists, physicians, meteorologists, engineers and environmental scientists.

Chul Woo Rhee
Cheongju, South Korea

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Schlumberger-Doll Research, in Cambridge, Massachusetts, USA, invites applications for a structural geology research scientist position. The candidate will join the Geology Program of the Reservoir Geosciences Department.

The candidate will help develop the next generation of quantitative structural geology methods and workflows for unconventional field exploration and development.

Responsibilities

- Understand fundamental structural geology principals of stress, strain, and deformation mechanisms from the grain to reservoir scale.
- Understand structural interpretation methods using well, seismic, and other physical measurements.
- Develop, implement, and test structural workflows and use these to develop interpretation and answer products related to market needs.
- Document findings and results in reports and communicate to peers, management and to other Schlumberger research, engineering, and operations centers.

Qualifications

- A PhD in the field of structural geology is required, although an advance degree in related disciplines will also be considered.
- Experience and skills in quantitative interpretation and modeling of faults, fractures, stress, and strain.
- Experience in any of the following areas will be considered a plus: geomechanics, structural restoration, unconventional resource characterization, quantitative modeling for well placement, hydrofracture optimization, or completion design.
- Strong technical and communication skills, as well as the ability to foster effective working relationships with fellow scientists and engineers.
- Strong preference will be given to candidates with 5-10+ years of industry experience. Candidates with less experience will be considered for an Associate Scientist position.

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Faculty Position: Geomicrobiology and Bioremediation

The Department of Earth Sciences and The BioTechnology Institute (BTI) at the University of Minnesota seek applications for a tenure-track faculty position in the area of Geomicrobiology and Bioremediation. We are interested in a broad range of topics in geomicrobiology, microbiology, biogeochemistry, or related fields, with application in areas such as acid mine drainage bioremediation, dynamics of sulfate and nitrate removal, microbial bioremediation, biomineralization, and/or groundwater bioremediation. The appointment will be a 9 month (B-Term), tenure-track position at the assistant or associate professor level with

responsibilities in research, teaching, and service. Rank will be determined based on qualifications. The Department of Earth Sciences, located in the College of Science and Engineering, will be the academic and teaching home, and the BioTechnology Institute, in the College of Biological Sciences, will be co-home for research activities. This position is part of an interdisciplinary research cluster focused on the use of bioremediation to conserve our environment and advance industry. This cluster, one in a series supported by the Minnesota's Discovery, Research and Innovation Economy (MnDRIVE) Initiative, focuses on using scientific discovery and innovation to enhance efficient environmental stewardship and to position the state as a leader in key industries.

Duties and Responsibilities:

Applicants should have strong core fundamentals that allow them to easily move across disciplinary boundaries and become involved in interdisciplinary research opportunities at the Department, Institute, University, state and national levels. The successful candidate will develop an externally funded research program spanning basic and applied research aspects of bioremediation, teach undergraduate and graduate courses, and advise undergraduate and graduate students. The successful applicant will also complement current University of Minnesota research strengths in water, geomicrobiology, microbiology, geochemistry, and lake and river dynamics, and programs including the BTI, LacCore, the Water Resources Center, and the Saint Anthony Falls Laboratory.

Required Qualifications

- Ph.D. degree and a strong publication record in one or more of the areas listed above.
- Evidence of commitment to teaching and student learning.
- Demonstrated ability in or strong potential for research that translates to Minnesota's environment and industries.

Preferred Qualifications

- Ability to communicate effectively with diverse audiences.
- Track record of interacting creatively, collaboratively and productively with other scientists.
- Postdoctoral or equivalent experience.
- Materials Required
- A letter of intent
- A CV with a list of publications
- Statements of research and teaching interests
- Names and contact information of three referees who can address the candidate's teaching and research potential.
- In support of our strong commitment to and respect for diversity and cultural competence, finalists invited for interviews will be asked to provide a statement describing interest, experience with, and commitment to diversity and inclusiveness.

Applications must be completed online:

https://employment.umn.edu/applicants/jsp/shared/Welcome_css.jsp

Search for requisition number 191508. Review of applications will begin September 8, 2014. Applications will continue to be accepted until the position is filled. Expected appointment is Fall 2015. Questions may be directed to Prof. Chris Paola at cpaola@umn.edu.

Find out what makes Minnesota a great place to work and live. Learn more about the University of Minnesota, and the Twin Cities at <http://www1.umn.edu/faculty/>.

The University of Minnesota provides equal access to and opportunity in its programs, facilities, and employment without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. The University supports the work-life

balance of its faculty and especially encourages applications from women and members of under-represented groups.

Any offer of employment is contingent upon the successful completion of a background check. Our presumption is that prospective employees are eligible to work here. Criminal convictions do not automatically disqualify finalists from employment. However, a criminal record, the age and time of the offense, the seriousness and nature of the violation, and any rehabilitation will be considered as it relates to your position.

DIRECTOR OKLAHOMA GEOLOGICAL SURVEY UNIVERSITY OF OKLAHOMA

Applications are being solicited for the position of Director, Oklahoma Geological Survey (OGS). The OGS is located on the University of Oklahoma campus in Norman, Oklahoma, and is under the direction and supervision of the Board of Regents of the University of Oklahoma. Organizationally, the OGS is located within the Mewbourne College of Earth & Energy, which also includes the ConocoPhillips School of Geology &

Geophysics and the Mewbourne School of Petroleum & Geological Engineering. The Director of the OGS reports administratively to the Dean, Mewbourne College of Earth & Energy. If appropriate, the successful candidate may hold a dual appointment as a faculty member within the College as an Associate or Full Professor, renewable term or tenured. Candidates should hold a doctorate in geology, geophysics or a closely related field.

Prior experience with a public agency would be beneficial. The objectives and duties of the Oklahoma Geological Survey include the following:

(a) A study of the geological formations of the state with special reference to its natural resources, including coal, oil, gas, asphalt, gypsum, salt, cement, stone, clay, lead, zinc, iron, sand, road building material, water resources and all other mineral resources.

(b) Management of the Oklahoma seismic recording network, and the reporting and analysis of earthquake activity in the state.

(c) The preparation and publication of bulletins and reports, accompanied with necessary illustrations and maps, including both general and detailed descriptions of the geological structure and mineral resources of the state.

(d) The consideration of such other related scientific and economic questions that shall be deemed of value to the people of Oklahoma.

The Director of the OGS has the responsibility of overseeing activities related to geological and geophysical studies of Oklahoma and adjacent areas, preparation of reports documenting the findings of these studies, and communication of these results to individuals, agencies and the general public as appropriate and/or required.

The position requires supervision and administration of an organization of approximately 50 staff and associated facilities including offices, labs and the Oklahoma Petroleum Information Center (OPIC), which contains an extensive collection of rock cores and samples, other well information and selected facilities for the examination of these cores and samples. It is anticipated that the Director of the OGS will work with Oklahoma universities, state and federal agencies, industry and other entities to conduct research in areas of public interest, as well as providing advice and service in the areas of geology, geophysics and natural resources. One particular area of current high interest is the recent, significant increase in Oklahoma earthquake activity. The successful candidate will have the demonstrated experience and ability to oversee these activities, while acting as

the State Geologist of Oklahoma. Areas of experience that could be considered include an appropriate background with state or national surveys, administration in academia, experience in industry or research, or other related areas. Review of candidates will begin June 1, 2014 and continue until the position is filled. The anticipated starting date is January 1, 2015. Applicants are requested to submit a complete resume, statement of relevant experience and a list of five references who can be contacted, including names, phone numbers, e-mail addresses and complete mailing addresses. Questions or requests for additional information may be addressed to:

Larry R. Grillot,
Dean of the Mewbourne College of Earth & Energy, and Chair of the OGS

Director Search Committee, at (405) 325-3821, or lgrillot@ou.edu. Applications and nominations should be addressed to OGS Director Search Committee, University of Oklahoma, Sarkeys Energy Center, 100 East Boyd Street, Room 1510, Norman, OK 73019-1008.

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

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Two-Way Street: Making a Connection That Counts

By **DAVID CURTISS**

Here in Oklahoma, the month of July delivers the beginning of summer, kids out of school and a unique blend of oppressive heat and sweltering humidity that makes you feel like you're in a slow-cooker.

At headquarters it's the beginning of a new year. On July 1 a fresh Executive Committee led by President **Randi Martinsen** took the reins, approved a budget for the new fiscal year and is beginning its work to lead the Association.

Veteran EC members Secretary **Richard Ball**, Vice President-Regions **John Kaldi** and Editor **Mike Sweet** are joined by President-Elect **John Hogg**, Treasurer **Jim Tucker** and Vice President-Sections **Steve Brachman** in this endeavor.

These are your leaders, and I encourage you to reach out and communicate with them during the coming year.

I also want to take this opportunity to thank past president **Lee Krystinik** for his leadership of the Association and Executive Committee, and most emphatically for his wise counsel to me over the past two years that he's served on the Executive Committee.

As past president, Lee's work isn't done yet. He now rides over to lead the Advisory Council further down the trail blazed by past president **Ted Beaumont**.

(You'll note the riding-themed metaphors I'm using in this column. Having incoming and outgoing presidents who are both accomplished equestrians is forcing me to learn a new vocabulary.)



CURTISS

Yes, volunteering is about "giving back." But I'd argue it's much more than that. It is, in fact, an investment in yourself.

When I first began to work for AAPG, back in Washington, D.C., in 2006, one of the first people I met was **Deborah Sacrey**, our out-going treasurer who has been involved in our policy work since the very beginning. We've worked closely over the years, and the perspective and advice she's given me both at GEO-DC and as executive director have helped me do my job immeasurably better.

Thankfully, she's still only a phone call away.

I've known **Tom Ewing**, who departs as vice president-Sections, almost as long as I've known Deborah. And Tom brought a wonderful balance of thoughtfulness, perceptiveness and practicality to a host of EC discussions over the past two years.

Even into the final weeks of his term he was providing me counsel on matters related to the Sections and affiliated societies.

* * *

Having the opportunity to work directly

with our EC members to grow AAPG is one of the perks of my job. And it's important to recognize that they are volunteers.

Volunteerism is at the heart of AAPG and permeates our organization. It includes those who volunteer to help us advance science by giving a talk or writing a journal article, those who work on committees to build specific programs or services, and those who serve in leadership and governance roles.

When you get involved with AAPG you're serving other members and the profession. This engagement also builds your professional network and can help you develop specific skill sets, particularly interpersonal skills – after all, in a volunteer organization you don't dictate, you can only persuade.

Yes, volunteering is about "giving back." But I'd argue it's much more than that.

It is, in fact, an investment in yourself – both as a person and as a professional. And that's what being a member of a professional organization is about – helping you advance and succeed.

* * *

It's summertime here in Oklahoma. And many of us in this part of the world will be taking time this month with family and friends to vacation, to relax and recharge both physically and emotionally.

As you climb that mountain trail, cast a fly along the riverbank, listen to the waves break on the shore or simply sit on your back porch at dusk listening to the crickets chirping in the grass, take a few minutes to reflect on your career and professional life.

Where are you and where are you going? Can you describe what it would look like to take your career to the next level?

What are the skills or contacts that you need to get there?

Is there an AAPG program or committee or group that you could get involved with to gain those skills or contacts?

If so, consider getting plugged in.

And if you don't see a program that will help you, then I'd ask you to send me an email through the website. Let me know what kind of program you're looking for, what you believe you need to be successful, and let's talk about it. Maybe we can build it together.

This is your year to take the reins, saddle up, and steer your career into an even brighter future.

Giddy up!

DIVISIONS REPORT: DPA

Season Premiere: A New Theme for DPA

By **RICK FRITZ, DPA President**

The discovery of large quantities of oil in the early 20th century expanded the industrial revolution with an abundance of cheap, mobile energy across the world. This was the start of the "Oil Age."

One hundred years later we stand on the brink of another revolution – cheap natural gas for the near future. We are at the start of the "Natural Gas Age," and whether we like it or not, natural gas will most likely be cheap for the foreseeable future.

Although this is not great for gas producers, think of the effect this will have on the world's economy.

For example, North America now has a system that will provide some of the cheapest energy in the world. As a result of new technology, many countries will see this "gas effect" around the globe.

During my term as DPA president this year our theme will be "Culture of Greatness." This may sound arrogant, but I think it is important to recognize and promote the culture of professionalism and discovery that has provided cheap energy for mankind for more than 100 years.

It is the ingenuity of our collective professions that initiated the resource plays in the past decade. I think this is no accident. I believe it is the culture in our industry to be inquisitive, aggressive and searching that led to this new development.

Coupling this with the correct strategy of investment in science and technology for



FRITZ

a good return has developed the new resource discoveries we have today.

The Division of Professional Affairs is a leader in professional development and discovery within AAPG. I thank you for your confidence in me as the leader of DPA, and I appreciate the opportunity to work with past DPA president **Valary Schulz**, the new Executive Committee, DPA councilors and the AAPG staff led by divisions manager **Norma Briggs**.

Val is a great leader and under her leadership we accomplished a lot for DPA last year.

The DPA originally founded to provide professional peer certification to its members. Although professional certification is still a very important part of our program, DPA has grown to be much more.

The first sentence of our mission statement is, "The DPA promotes professionalism and ethical standards for the AAPG." To me, the greatest value of DPA is the professional relationship among our members – I am always amazed at the networking opportunities within our group.

Our overarching goal is to develop DPA into a leader in professional development and discovery in our industry – a gold standard. As a result, we are focusing on education and training – especially in regards to prospecting and reserves.

Another past DPA president, AAPG

2014-15 DPA Officers

- ☐ President – **Richard D. Fritz**, SM Energy, Tulsa.
- ☐ President-Elect – **Michael R. Canich**, Trimont Energy, Pittsburgh.
- ☐ Vice President – **Gregory F. Hebertson**, Midstates Petroleum, Houston.
- ☐ Secretary – **Terence G. O'Hare**, Emerald Energy, Dallas.
- ☐ Treasurer – **Connie L. Mongold**, Shell Exploration and Production, Houston.
- ☐ Past President – **Valary L. Schulz**, Cinco Resources Inc., Dallas.

Honorary member **Charles Stembach**, is chair of the Playmaker Forum Committee, and currently we have five Playmaker Forums scheduled for fiscal year 2014-15. Locations will be in Calgary, Canada; London, England; Midland, Texas; Pittsburgh; and Oklahoma City.

These build on the success of two previous Houston Playmaker events (2013, 2014), which Charles conceived and organized.

Other events include:

▶ **Mark Gallagher** has developed a very popular educational program on "Geosteering." These courses are typically sold-out.

▶ Last year **Bob Shoup**, DPA's Continuing Education chair, led a successful forum on

"Reserve Analysis," and another is planned for this year by current DPA Reserves and Resources Committee chair **Eleazar Benedetto-Padron**.

Of course DPA will continue to support AAPG's GEO-DC program, and we will look for opportunities to expand this program globally. Currently we are reviewing a new climate change position paper for AAPG.

Finally, with the development of AAPG's new website, we plan to overhaul the DPA site for easier use and access to information. **Dianne Phu** is the DPA website committee chair so please contact her if you have any questions about the website or would like to volunteer.

Presidential Medal of Freedom winner **John W. Gardner** once said:

"History never looks like history when you are living through it. It always looks confusing and messy, and it always feels uncomfortable!"

I believe the global decoupling of gas and oil prices will be recognized as a major event in history – and we plan to make DPA an integral part of the new resource revolution that is spanning the globe.

For all of our programs we need people – young professionals to senior geos.

So if you are a DPA member please contact us to get involved; we are looking for you!

And if you are not a member then please contact a DPA member, DPA staff or go online and become part of DPA.

We look forward to a great year – come and join us! 📧



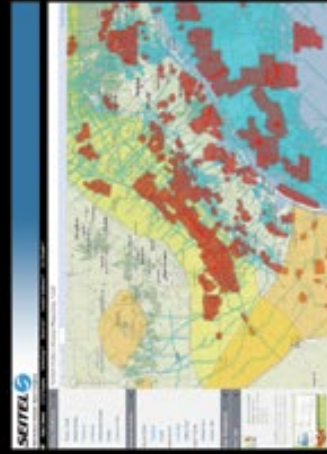
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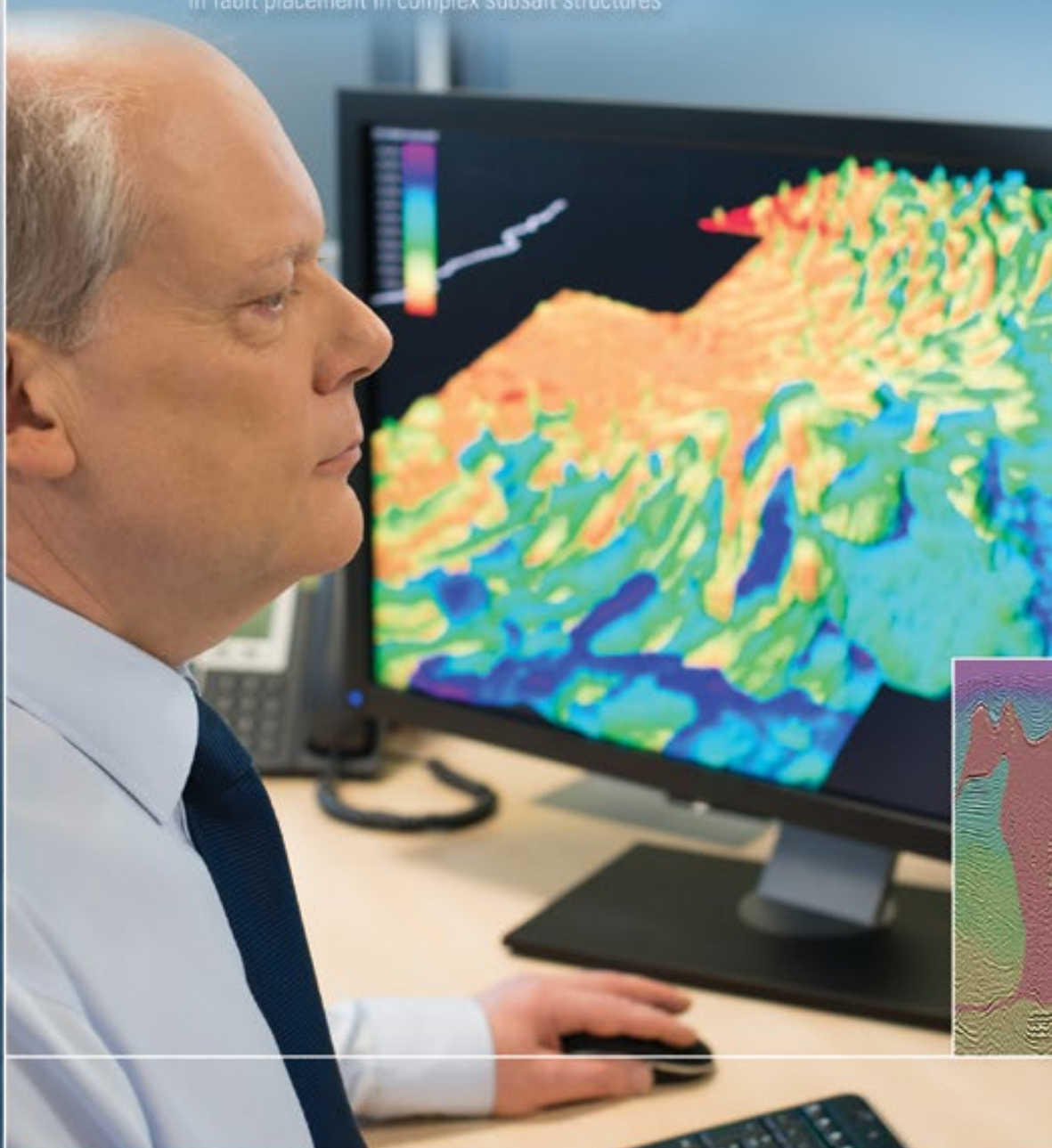
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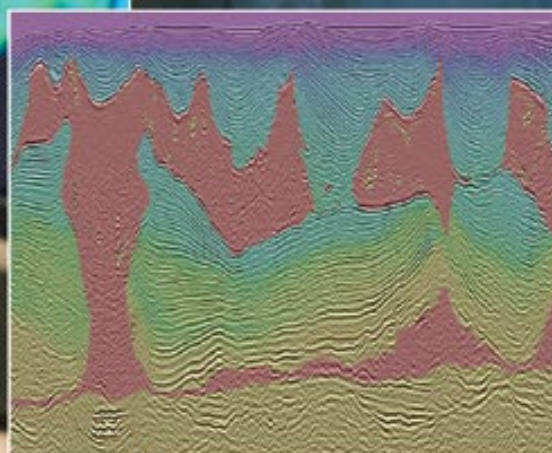
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