



AAPG EXPLORER

SEPTEMBER 2014

International Conference
& Exhibition 2014

Pillars of the Earth

*The world's leading geoscientists
gather in historic Istanbul.*

See page 6

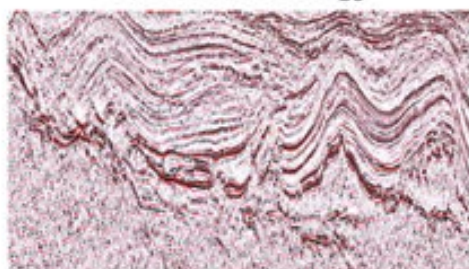


Robertson

Core Strengths

Geological solutions to geophysical challenges

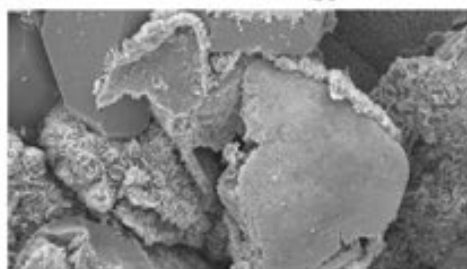
Structural Geology



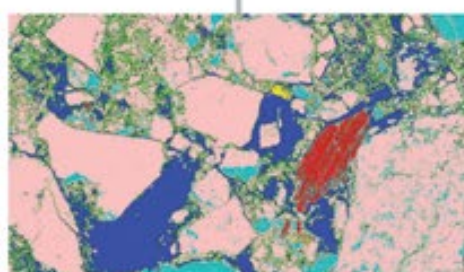
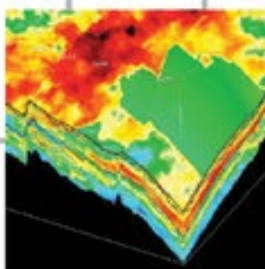
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PRESIDENT'S COLUMN

Engaging Members, Promoting Professionalism

BY RANDI MARTINSEN

I recently attended the AAPG Rocky Mountain Section annual meeting in Denver, "Cracking the Source" – it was a fantastic meeting.

Of course, I admit to being perhaps a bit biased in that the RMS-AAPG is my "geologic home" – but in addition to having great talks, great field trips and great short courses (as usual), here's why it was a truly fantastic event:

The RMS broke new ground in engaging and empowering its collection of young professionals (YPs).

Apparently, the Rocky Mountain Association of Geologists' (RMAG) leadership team noted that they have an enthusiastic and engaged young professional group there, so a goal was set by the Section leadership (with RMS-AAPG president **Elmo Brown** and RMAG president **Matt Silverman** leading the charge, I'm sure) to incorporate the energy and hard work of that group into helping put on a successful Section meeting.

One YP member, **Peter Bucknam**, was recruited to select a conference committee to help plan and organize the meeting. He in turn recruited two more YPs, **Cat Campbell** and **Laura Johnson**, to be general chairs.

This top heavy YP leadership for the Section meeting was a "step (leap?) out-of-the-box" approach to how geoscience conferences traditionally have been chaired and organized. Although these YPs were the conference chairs, they knew they had the support (and help, if needed) of the more-seasoned conference veterans/chairs.

* * *

The innovative approach proved to be a win-win-win situation for the RMS, the members (both YPs and older) who were involved, and AAPG.

In addition to the general chairs being YPs, nine out of 11 event committees were chaired or co-chaired by a YP member. For the most critical tasks and committees the YP leader was paired with a "seasoned conference



MARTINSEN

In Denver, YPs were pegged to help organize and run the Rocky Mountain Section's annual meeting – and the results were instructive for all.

veteran." This way the experienced folk could pass on their knowledge and their contacts for putting on these types of events.

YP member **Natasha Rigg** agreed to be the technical program co-chair, along with **Donna Anderson**. YP **John South** was exhibits co-chair, along with **Laura Wray**. And what great professional relationships this created.

YPs also were recruited to be session chairs, and these chairs in turn actively pursued getting people to submit abstracts on specific hot topics.

The field trip I attended was co-led by a YP, **Tofer Lewis** (great field trip by the way, Tofer and veteran member **Jeff May**). And at the suggestion of a YP committee member, another field trip was held specifically for YPs and students that provided a great forum for networking among our younger members.

In addition, over the two-year planning period, four of the YPs engaged in the meeting had babies, including the two general chairs, and another YP committee chair got married.

WOW is what I say.

What a clear demonstration that YPs can and are contributing to AAPG and geoscience at a time when so many other exciting things are going on in their lives.

What did the YPs gain?

► Valuable professional relationships with "veteran conference organizers."

► Forums to demonstrate their organizational and leadership skills.

► A feeling of satisfaction about a job well done.

What did the "veterans" gain?

► Incredible support for organizing the meeting.

► A sense of accomplishment in having passed on their experiences to those who follow.

► Perhaps a few hours on a weekend to pursue personal goals.

And what did AAPG gain?

AAPG gained a great meeting of incalculable value in terms of advancing the science and promoting professionalism and diversity within our community and within a host of YPs, who have gained skills, demonstrated their leadership abilities and who very well may be among the future leaders of AAPG.

Our YPs and student members are incredibly talented people. Frankly, I'm glad I'm not competing with them – they have so much to offer.

We need to welcome them – and engage them and their talents – throughout AAPG.

* * *

I hope this successful running of the RMS annual meeting will be an inspiration and a model to others throughout our Sections and Regions, to actively engage our young professionals and incorporate their visions of what our organization is – and what it can be – into our global vision.

We all stand on the shoulders of giants who have preceded us – but there is no future if we can't engage and motivate our youth to carry on and do even better.

Give 'em a chance (with perhaps a little guidance) – then stand back and watch what they can accomplish.

Randi L. Martensen

AAPG Officer Candidates 2015-16

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

secretary are two years.

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

Ballots will be mailed in spring 2015. The slate is:

President-Elect

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

Vice President-Regions

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

Secretary

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

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ON THE COVER:

West looking view of Emirhan east side— one of the many geologic attractions in and around Istanbul. The continental sequence (left) shows a mega halo kinetic sequence (hook) completely verticalized, truncated and covered unconformably by the marine sequences. The gypsum body in the front marks the basin evaporitic wall.

Photo courtesy of Jean-Claude Ringenbach.

Left: David Roberts leading a geology field trip. See story, page 32.

Earth Science Week

Bridging the Science Awareness Gap

By COURTNEY CHADNEY, EXPLORER Correspondent

This year's annual global celebration of geosciences known as Earth Science Week is set for Oct. 12-18.

A poster promoting activities being held during this year's event is inserted in U.S. addresses of this issue at page 5.

Since its inauguration in October 1998, the mission of Earth Science Week has been to promote the understanding and appreciation of earth science, as explained by Katelyn Murtha, outreach associate at the American Geosciences Institute (AGI), which coordinates the event.

"Current professionals are well aware of



MURTHA

the disconnect between science and the general public," said Murtha.

She and others hope Earth Science

"It is imperative that future generations understand the value of our natural resources ... to maintain the integrity of the field."

Week can help bridge that gap, especially among young people, as each year community groups, educators and

interested citizens organize educational and celebratory events around the Earth sciences.

"It is imperative that future generations understand the value of our natural resources, as well as be inspired by the wonders of our planet to maintain the integrity of the field," she said.

Earth Science Week has "something for everyone," from students just beginning their education to adults considering a career change.

Murtha assures the event will serve as a reminder of all the opportunities geoscience has to offer.

"Earth's Connected Systems" is the theme of this year's Earth Science Week, and will focus on how the geosphere, hydrosphere, atmosphere and biosphere are all intrinsically linked.

"We also have 'Focus Days' to allow each day to be special in its own way," Murtha added.

These include:

- ▶ International Earthcache Day and No Child Left Inside Day, both of which encourage active participation in the field.

- ▶ National Fossil Day, which focuses on fossils both large and small, from marine corals to large dinosaurs and flying reptiles.

- ▶ Geoscience for Everyone Day, a new initiative to inspire students from underrepresented communities to explore the exciting careers in geosciences.

- ▶ Geologic Map Day, a group effort involving AGI, the U.S. Geological Survey, the Geological Society of America and others to educate students about geologic maps and how they aid the public in policy, construction and natural resources.

Murtha recalls celebrating Earth Science Week as an undergraduate at Bowling Green State University.

"The geology department had a reading room for the students, and I took it upon myself to keep the spirits of my fellow students high," she recounted.

She did this by writing "Happy Earth Science Week" in big chalk letters, with her own tagline, "May the quartz be with you," which actually became a kind of rallying cry to "stay strong" as the semester's work became more difficult.

Although there are many great aspects of Earth Science Week, Murtha shared that her favorite is usually the contests. They include visual arts (grades K-5th grade), essays (6th-9th grades) and photography (open to all U.S. residents).

Murtha described how hard being a judge was, because submissions are all so spectacular: "The contests are a creative way for participants to express their passion for geology, which allows students who are more shy to still be involved."

There are many ways for adults and geoscience professionals to participate.

"Celebrating Earth Science Week can be as simple as giving a short presentation to a classroom or scout group, or donating Earth Science Week toolkits to a school," Murtha said. "For a larger celebration, consider leading a field trip to a local point of geological interest, hosting a geoscience fair at a school, or constructing a rock, mineral or fossil display for a library."

Earth Science Week is organized by AGI with support from the AAPG Foundation, U.S. Geological Survey, NASA, U.S. National Park Service, ExxonMobil, ESRI and others.



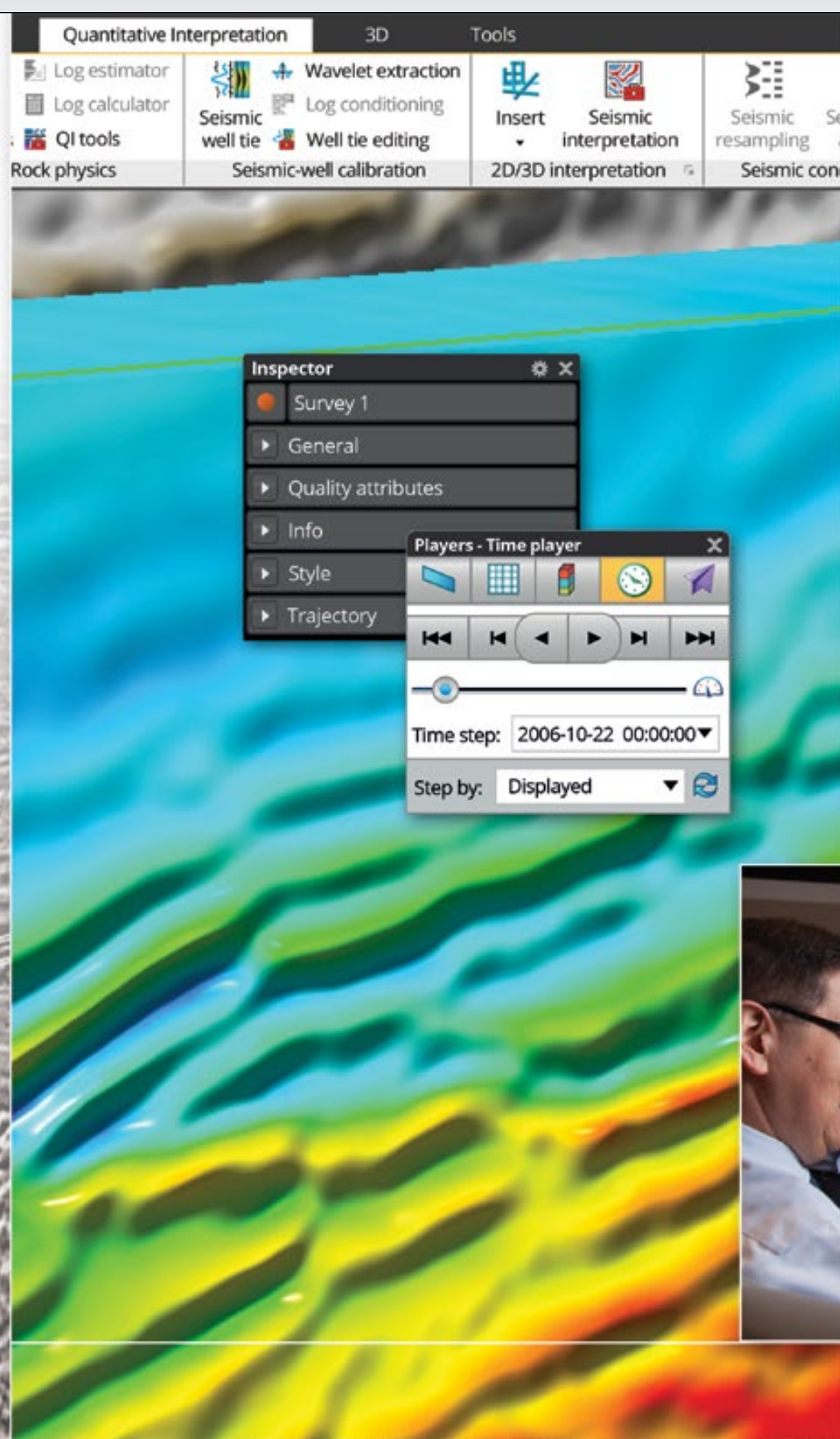
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Our exploration activities are growing. We're looking for passionate geoscientists who want a challenging career in the exploration field. If you are a talented **Geologist** or **Geophysicist** and work well as part of a team, we have several opportunities to enhance your career.

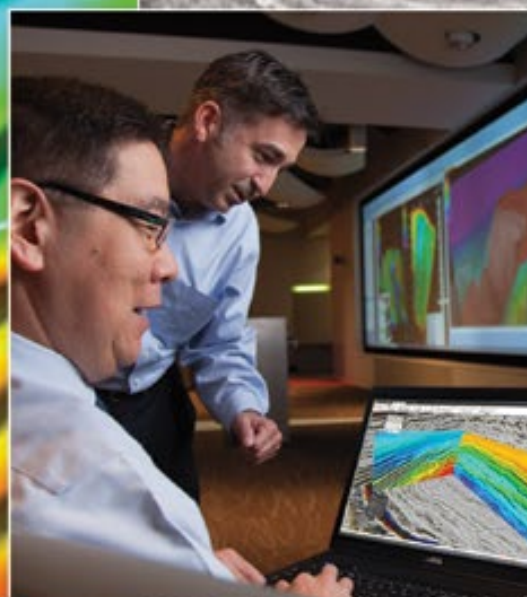


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Photo courtesy of Ben Morlok
Below: A panorama of Istanbul, Turkey, with the historic Church of Hagia Sophia (right) and the Sultan Ahmed Mosque prominent against the skyline.



ICE 2014

History, Geology Collide in Istanbul

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

“Spectacular geology and history, together.”

That’s how AAPG Honorary member Pinar Yilmaz of ExxonMobil set the scene for the upcoming International Conference and Exhibition (ICE), set Sept. 14-17 in Istanbul, Turkey.

“Participants will not only see the geology but also have a chance to visit the world-renowned historical locations,” she said of the upcoming conference, for which she serves as technical program co-chair.

Sponsored by the Turkish Association of Petroleum Geologists and the AAPG Middle East and Europe regions, the meeting’s theme – “The Spirit Between Continents: Energy Geoscience in a Changing World” – calls attention to the historical, cultural and geographical centrality of the locale.

Of course, geology always takes center-stage at ICE, and Yilmaz explained that it boasts a technical program that includes sessions on the following:

- ▶ Complex geology and tectonics of the Tethyan orogenic belt.
- ▶ Hydrocarbon potential of the Alpine-Himalayan basins.
- ▶ Unconventional potential of Turkey.
- ▶ Geology of the Mediterranean, Arabian platform, Arctic and Black Sea.
- ▶ Seismic data on key basins across the Black Sea and Turkey that illustrate the importance of the region to the oil and gas industry.

Of course, the information-packed technical program was helped in no small part by the record-breaking 820 abstracts submitted to this year’s ICE, which made the selection process for technical sessions highly competitive.

Yilmaz attributed that unprecedented level of interest to the immense appeal of the locale – geologically and professionally as well as culturally and historically.

“Istanbul is an exciting city,” she said.

“It’s easy to access, and culturally



Photo courtesy of Ismail Omer Yilmaz

Field view of the Late Santonian-Campanian black shales in Nallihan area (Oceanic Anoxic Event, OAE3).

it’s a bridge between the west and the east. It’s a modern city with incredibly beautiful historical sights and unparalleled archeological history,” Yilmaz explained.

“Also, it’s filled with great restaurants and luxury hotels,” she added.

Yilmaz also noted that, because of its proximity to the Middle East, Asia and Europe, there are about 120 countries from which no visa is required, and for the rest, the Turkish government boasts a highly efficient ‘E-Visa’ process by which to enter the country, which complements the more-than 200 countries to which Turkish airlines offer non-stop service.

“Istanbul is ranked in the top of any travel destination worldwide,” she said. “All these factors encouraged the authors.”

History and Geology

Yilmaz points proudly to field trips offered at this year’s ICE, selected to demonstrate how the rich and storied history of the region was shaped in large part by its unique geology.

“There is the Western Anatolian field trip on the geology of the Aegean region, characterized by rifting of the Paleozoic-Mesozoic sedimentary platform reflected in major graben/horst topography of the Neogene tectonics, and its impact on the ancient civilizations, settlements, trade routes,” she said.

“This trip provides an opportunity to observe close connections between the geological parameters and the existence

and longevity of some famous ancient settlements of western Anatolia,” she continued, “including the ancient world’s well-known cities of Ephesus, Miletus, Sardis, Hieropolis and Afrodiasias.”

The Sivas basin field trip with salt outcrops is “a perfect analog to numerous salt-related oil and gas fields producing in the Gulf of Mexico, Brazil and West Africa,” she noted.

“It is a natural setting to observe complex salt and sediment interaction that have undergone several deformation phases,” Yilmaz added. “The Sivas Basin is possibly the world’s finest open-air museum of salt tectonic structures. Although it is a continental basin, the structures are analogues of those developed in deep offshore domain in classical petroleum provinces controlled by salt tectonics such as in the Gulf of Mexico and Angola.”

She said high quality exposures to be featured on the field trip include:

- ▶ Diapirs
- ▶ Halokinetic sedimentary sequences
- ▶ Welds and evaporite sheets
- ▶ Minibasins and overturned edges of minibasins.

“In the vicinity of the evaporite bodies, interesting analogues for drilled structures where seismic does not provide an image will be shown,” she added.

Lastly, she said, “The field trip to Central Turkey not only traverses across Mesozoic ophiolite mélanges and Tertiary sedimentary rocks, but it also visits two very famous archeological sites: a UNESCO (United Nations Educational, Scientific and Cultural Organization) heritage site, Cappadocia, with its eroded volcanic tuff topography, where buildings carved into the tuff showcase Christian settlements from Roman times to today. Ancient buildings including churches carved in the tuff, with

See ICE, page 8



The Lion Gate at Hattusa (Bogazkoy).

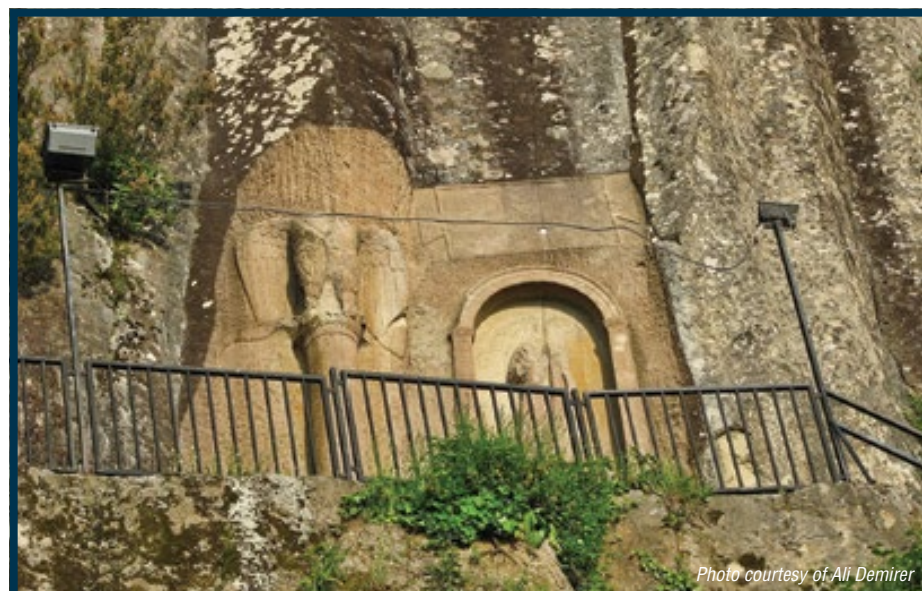
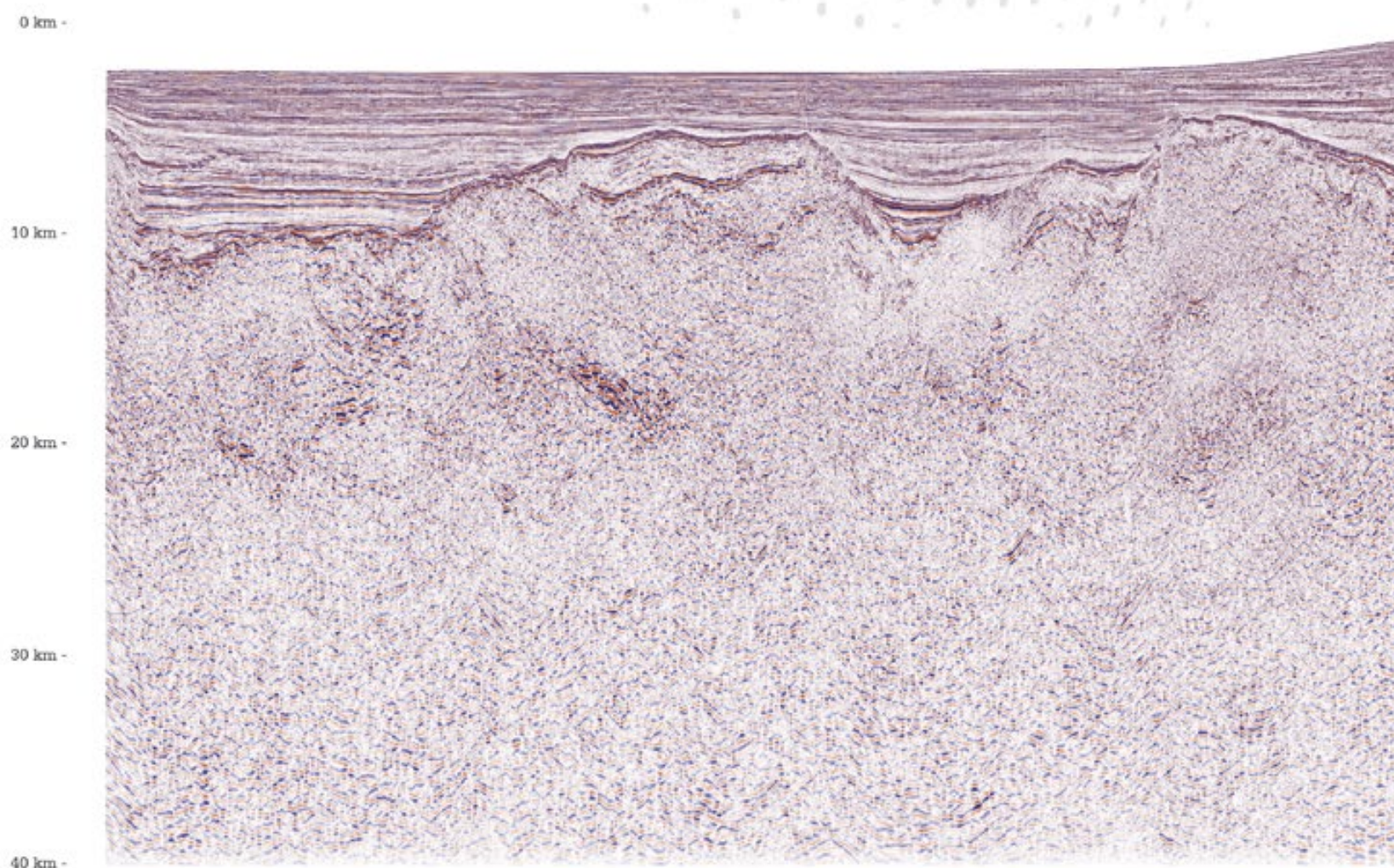


Photo courtesy of Ali Demirer

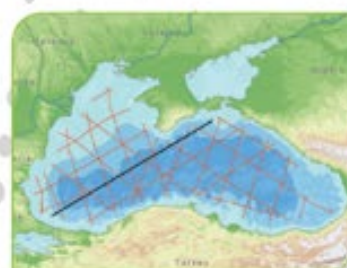
Kuskayasi, Late Cretaceous arc volcanics-Amasra.

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The Church of Holy Wisdom, or "Hagia Sophia," is one of the more recognizable and iconic landmarks of Istanbul.

Photo courtesy of Arild Vågen

ICE from page 6

decorations preserved.

"The other site to visit is the Bronze Age Hittite city of Bogazkoy – Hattusa (also a UNESCO World Heritage Site). The Hittites lived in what is now modern Turkey and northern Syria around 2000 B.C., and established an empire by 1600 B.C. Hittites are most famous for their fights with neighboring empires, including the Egyptians where the use of iron chariots gave them decisive victories. Hittites were forerunners of the Iron Age, developing iron artifacts as early as the 14th century B.C."


A Global Network

Like Byzantium and Constantinople

before it, Istanbul's geographic centrality makes it an important hub for international commerce, which Yilmaz said bolsters ICE 2014 as a unique opportunity for networking.

"You can meet with geoscientists from around the world, network and establish relationships with key independent and national oil company executives and top technical experts," she said.

Also, Yilmaz pointed out that because of Istanbul's privileged place as a geographic and economic hub, ICE 2014 is just the first among the major oil and gas conferences that will take place in there: the World Energy Conference (WEC) will be in Istanbul 2016, and the World Petroleum Council will have its Congress there in 2017.

"Istanbul won this honor over Houston, Almaty and Copenhagen," she said, "where 70 member countries voted." 

Deadline Looms For ACE Abstracts

The call for abstracts remains open for the next AAPG Annual Convention and Exhibition, which will be held May 31-June 3 in Denver – but the deadline is getting close.

Abstracts will be accepted through Oct. 2.

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.

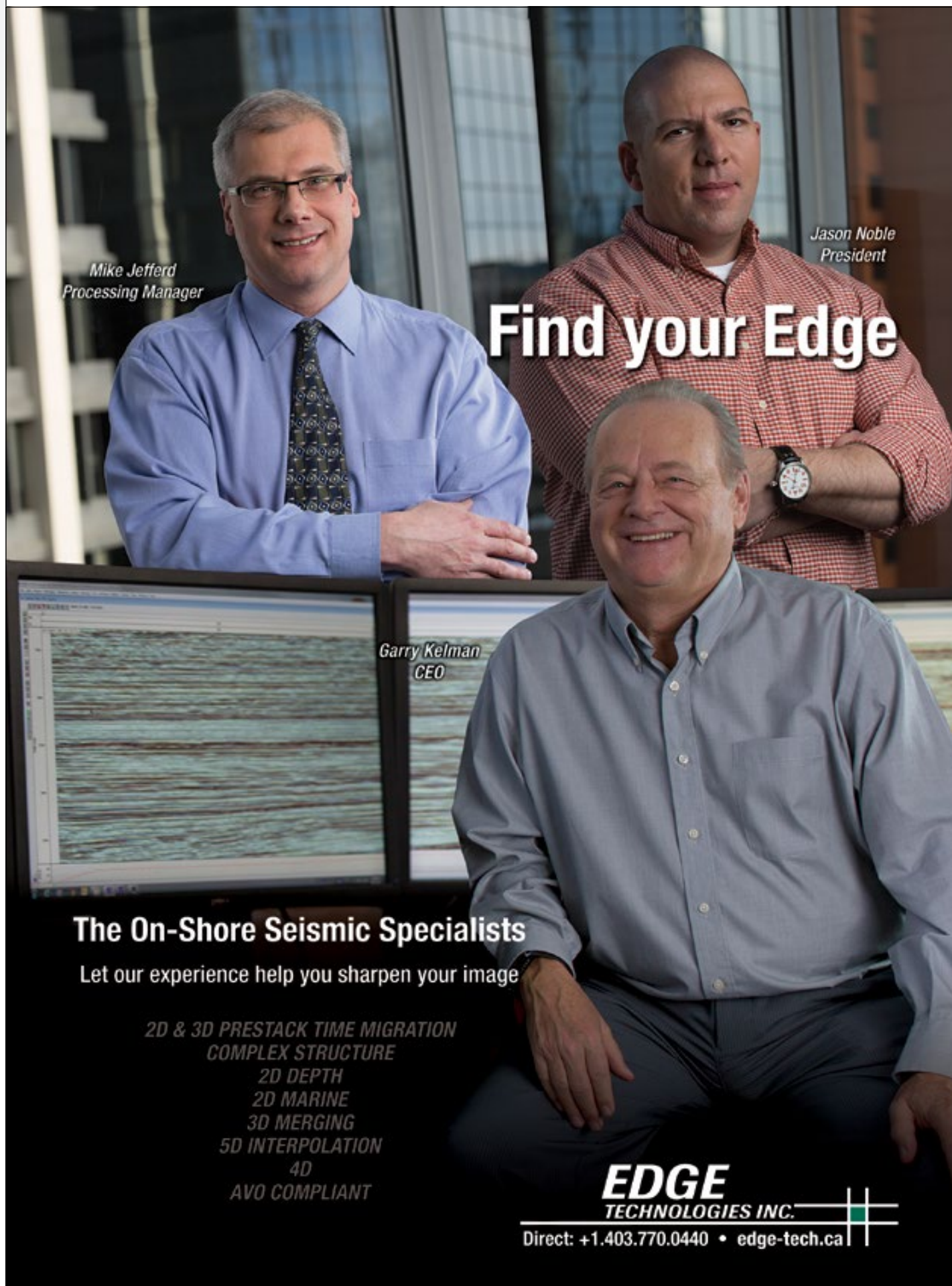
► SEPM Research Symposium –

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.

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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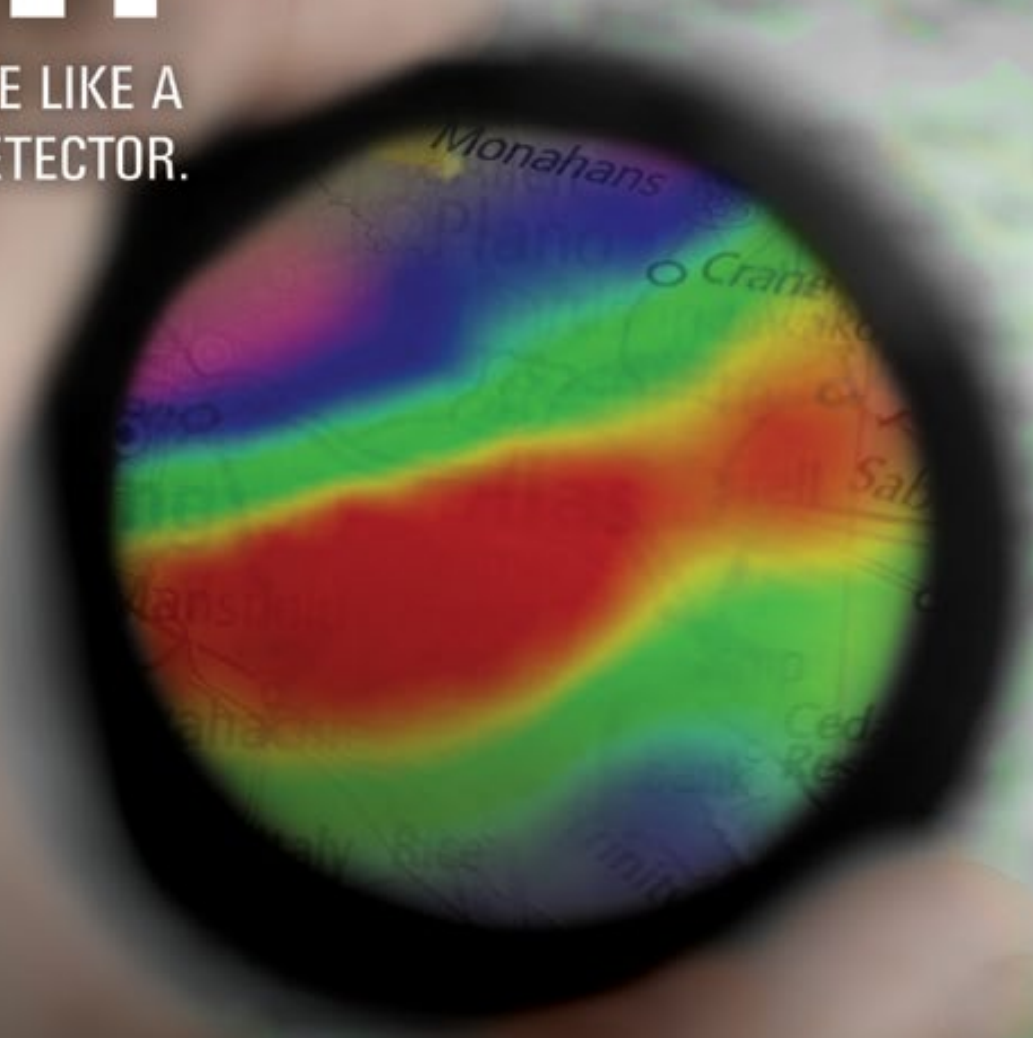
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TOO SLOW

- Days to create maps
- Weeks to research ownership
- Months to research production and ownership



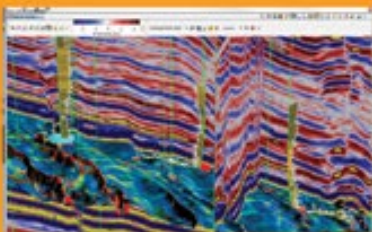
TOO RISKY

- Multiple landmen and manual processes greatly increase the chance of error
- Weeks of delay mean competitors could catch wind and acquire acreage first, or drive up prices
- Slow, costly workflows lead to missed opportunities, lost investment, and weaker competitive position

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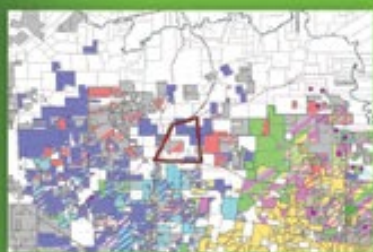
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[illegible]

Having zeroed in on prime acreage, the team needs to ensure that tracts are not held by production (HBP).

Doing so with Drillinginfo is as simple as activating **production data** within the AOI, which **differentiates true opportunities** from dead-end leads in a matter of minutes.

[illegible]

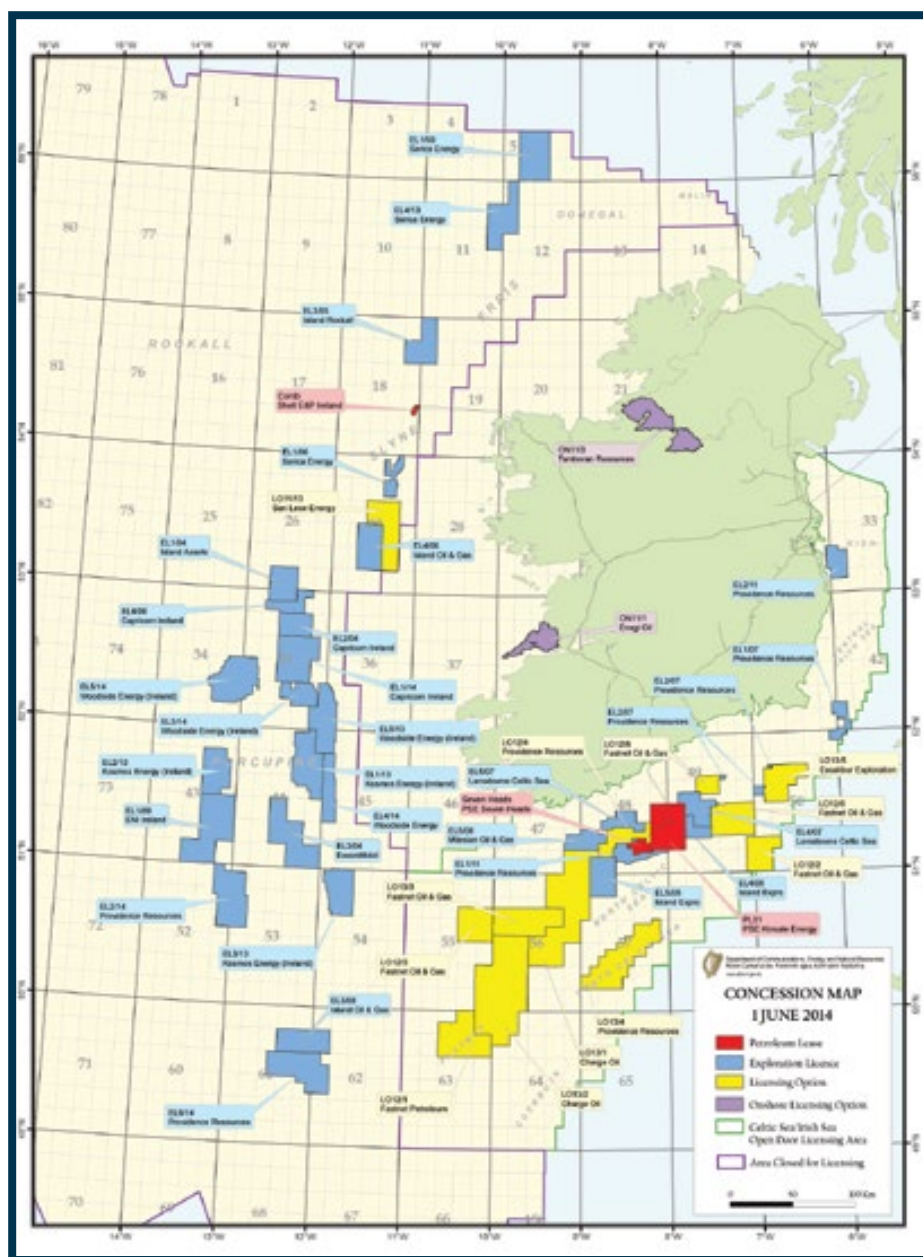
The final step in acquiring acreage can be the most costly and cumbersome—finding and contacting mineral owners.

DI Land data can generate a comprehensive and accurate list of surface owners, royalty owners, and any **assignments or counterparties**. Toggling to **DI Courthouse** then allows the team to run the title indirect to uncover any **mineral severance**, find the **current owners**, and access information such as status, address, and interest amount. With DI, you can run a **chain of title** and print **complete legal documents** all without setting foot in a courthouse.



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Ireland Development Sporadic, But Promising

By LOUISE S. DURHAM, EXPLORER Correspondent

Ireland's Atlantic basins harbor the potential for major oil and gas discoveries in water depths ranging from 150 to more than 2,500 meters, according to the country's Energy and Natural Resources office.

Even so, exploration activity in the Irish offshore has been sporadic over the past four decades, according to Natural Resources Minister Fergus O'Dowd.

He noted recently that the last commercial discovery was in 1996 at the Corrib gas field, a Jurassic-age field about 83 kilometers off west Ireland's County Mayo coast.

Only 158 exploration wells have been drilled offshore Ireland to date, but there's an ongoing push to accelerate exploratory drilling and score some respectable production.

For a country wholly dependent on imported oil, any commercial discovery – large or small – will be significant.

Potential, But No Guarantees

O'Dowd was a major presence among the group of Ireland notables promoting the area's oil and gas potential at the 2014 AAPG confab in Houston.

He emphasized that the Irish hydrocarbon exploration sector faces considerable headwinds owing to such close proximity to the North Sea, where companies have accomplished much

successful drilling. Not surprisingly, the operators continue returning to this proven productive territory.

The models created from joint Canadian/Irish reconstruction of the geology of the Atlantic are said to show the possibility of regional world class Upper and Lower Jurassic source rocks, the Irish government office noted.

Source rock modeling, prospect evaluation and analog basin review show a yet-to-find potential of at least 10 billion barrels of oil equivalent.

There are no guarantees when it comes to oil and gas exploration, though.

Just ask Providence Resources Plc (PRP).

In 2012, the company announced that its Barryroe oil field in the North Celtic Sea Basin, about 40 miles off the Cork Coast in southwest Ireland, might hold as many as 1.6 billion barrels, according to a Bloomberg report, July 2014.

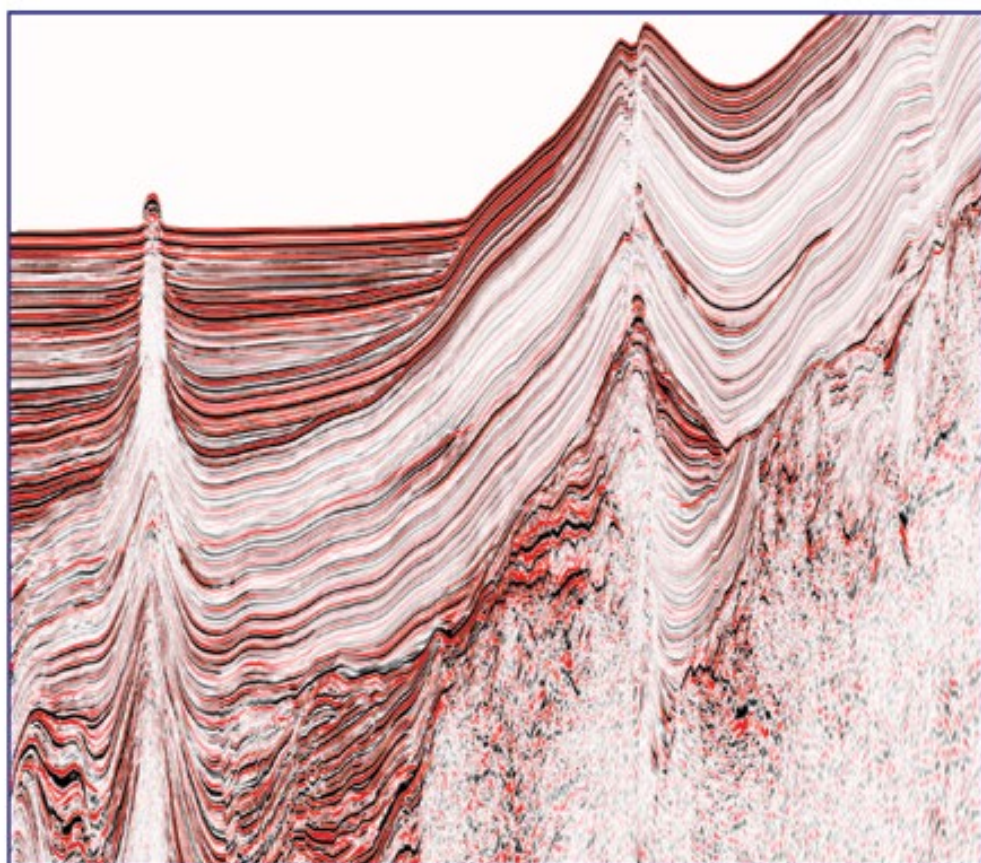
Providence has yet to find a partner to develop Barryroe. As a result, production has been delayed and its stock price has dropped precipitously.

The company has drilled only one appraisal well, and it may take additional evidence to draw in partners.

Even so, PRP CEO Tony O'Reilly said recently that they feel confident about being able to get a deal done, Bloomberg noted.

See Ireland, page 14

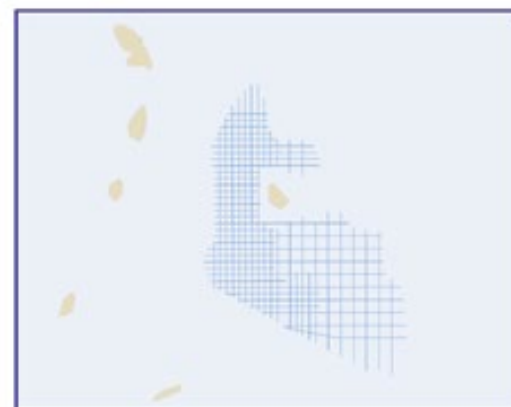
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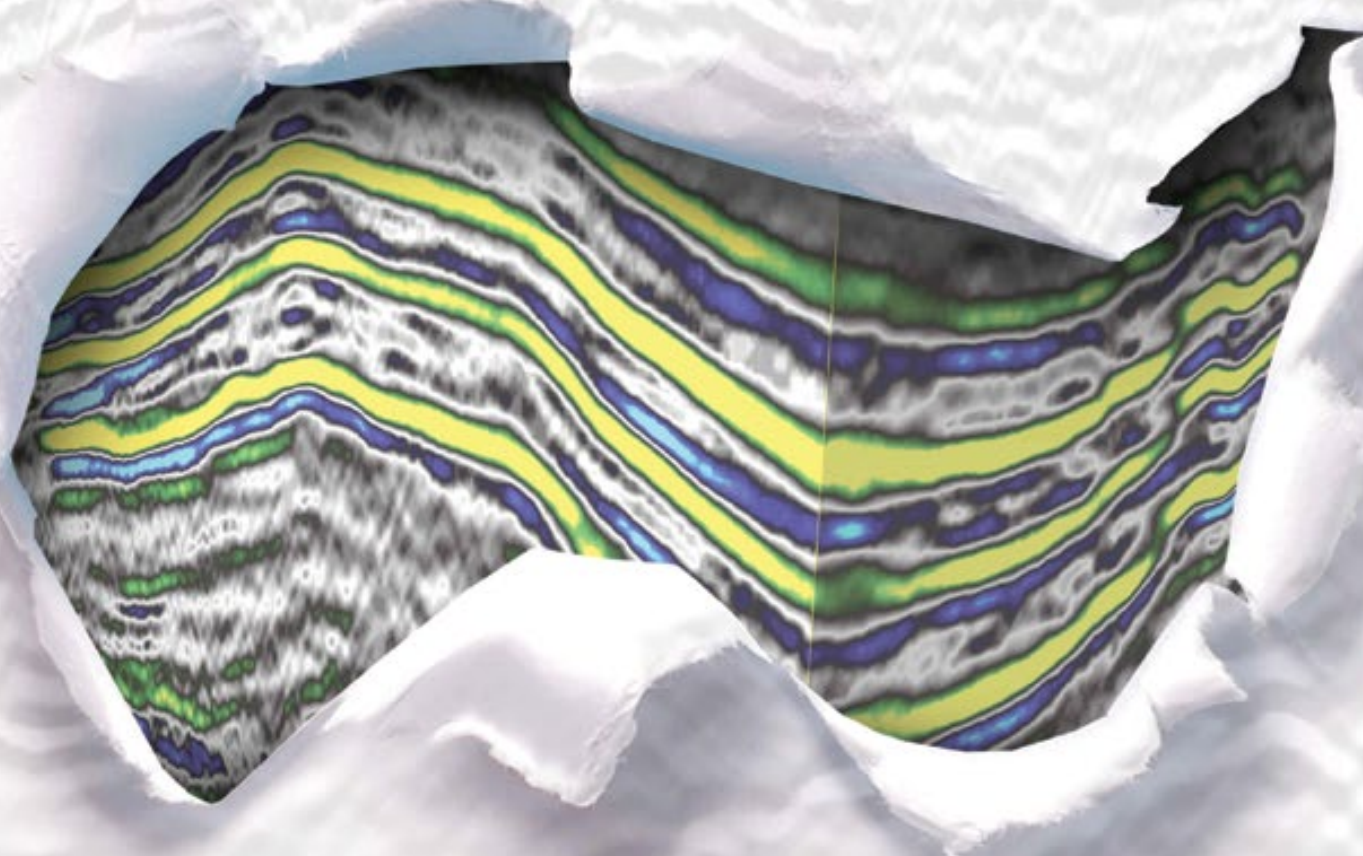
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Seismic Survey Under Way Offshore Ireland

By LOUISE S. DURHAM, EXPLORER Correspondent

It's a given that oil industry activity offshore western Ireland is slow-going. But it is going.

Irish oil and gas exploration and appraisal company Providence Resources announced in mid-August the commencement of 3-D seismic surveying operations over Frontier Exploration License (FEL) 1/14, or Spanish Point South, in the northern Porcupine Basin.

Spanish Point South is operated by Cairn Energy subsidiary Capricorn Ireland Limited on behalf of partners, including Providence.

The seismic survey is intended to cover an area encompassing 750 square kilometers.

According to Providence, this new

survey is designed to target the Upper Jurassic and Lower Cretaceous reservoir intervals. These intervals successfully tested gas condensate and oil from both the Spanish Point and Burren discoveries in adjacent acreage to the north of the designated area.


Four wells drilled earlier in the Spanish Point South area had hydrocarbon shows.

Providence noted the current best estimate of gross on-block, unrisksed prospective recoverable resources tallies 350 MBOE. This is in addition to the quoted recoverable resources for the Spanish Point discovery, located in FEL 2/04, and FEL 4/08.

John O'Sullivan, technical director at

Providence, presented a brief overview of what they anticipate to gain from the current effort.

"This new 3-D seismic survey over the Spanish Point South area is our third such program in this part of the basin since 2009," he said. "When combined, these new data will allow for a comprehensive re-evaluation of the total hydrocarbon resource potential of this area, where previous wells have successfully tested both oil and gas."

"We believe that the key risk is reservoir quality, rather than hydrocarbon presence," he emphasized. "So we consider that modern high quality 3-D seismic imaging will be a significant tool in reservoir prediction." 

Ireland from page 12

New Data Available

Newly available seismic data likely will be a key element to encourage operators to jump onto the exploration bandwagon promoted by the Ireland Energy and Natural Resources office.

Considerable 2-D seismic data acquisition activity kicked off in 2013, including a regional 2-D program.

The year 2013 was one of the most active years in Ireland in terms of 2-D and 3-D seismic, according to Clare Morgan, consulting geophysicist with the Energy and Natural Resources office.


Pre-STM data from 2013 will be available for purchase at the start of September, according to the agency. It is anticipated that the 2014 data can be purchased from the end of the first quarter 2015.

O'Dowd has announced details of the 2015 Atlantic Margin Oil and Gas Exploration Licensing Round, which will close in September 2015. He noted this will allow sufficient time for exploration companies to devote resources and commence work on evaluating data so they can make strong applications.

The licensing round will include all of Ireland's major Atlantic basins:

- ▶ Porcupine
- ▶ Globan Spur
- ▶ Slyne
- ▶ Erris
- ▶ Donegal
- ▶ Rockall

The main purpose for the licensing options will be to define exploration potential and actively promote the acreage. Exploration drilling will not occur under these options.

Once a company holding a licensing option decides to move to obtain an exploration license, the offered license will be a frontier exploration license of 15 years' duration. It will have an initial phase of three years with three subsequent phases of four years each. 

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Eastern Section Meets This Month

"Back to the Source" is the theme for the 42nd annual meeting of the AAPG Eastern Section, set Sept. 27-Oct. 1 in London, Ontario, Canada.

The meeting's technical program will feature papers, posters, short courses and field trips that focus on the geology, E&P concepts and "transformative changes and challenges" experienced in the Section's Appalachian, Michigan, Illinois and Black Warrior basins.

The opening session will be held at 4 p.m. Sunday, Sept. 28, following by an Icebreaker in the exhibits hall and an Eastern Section Young Professionals "Meet & Greet" event.

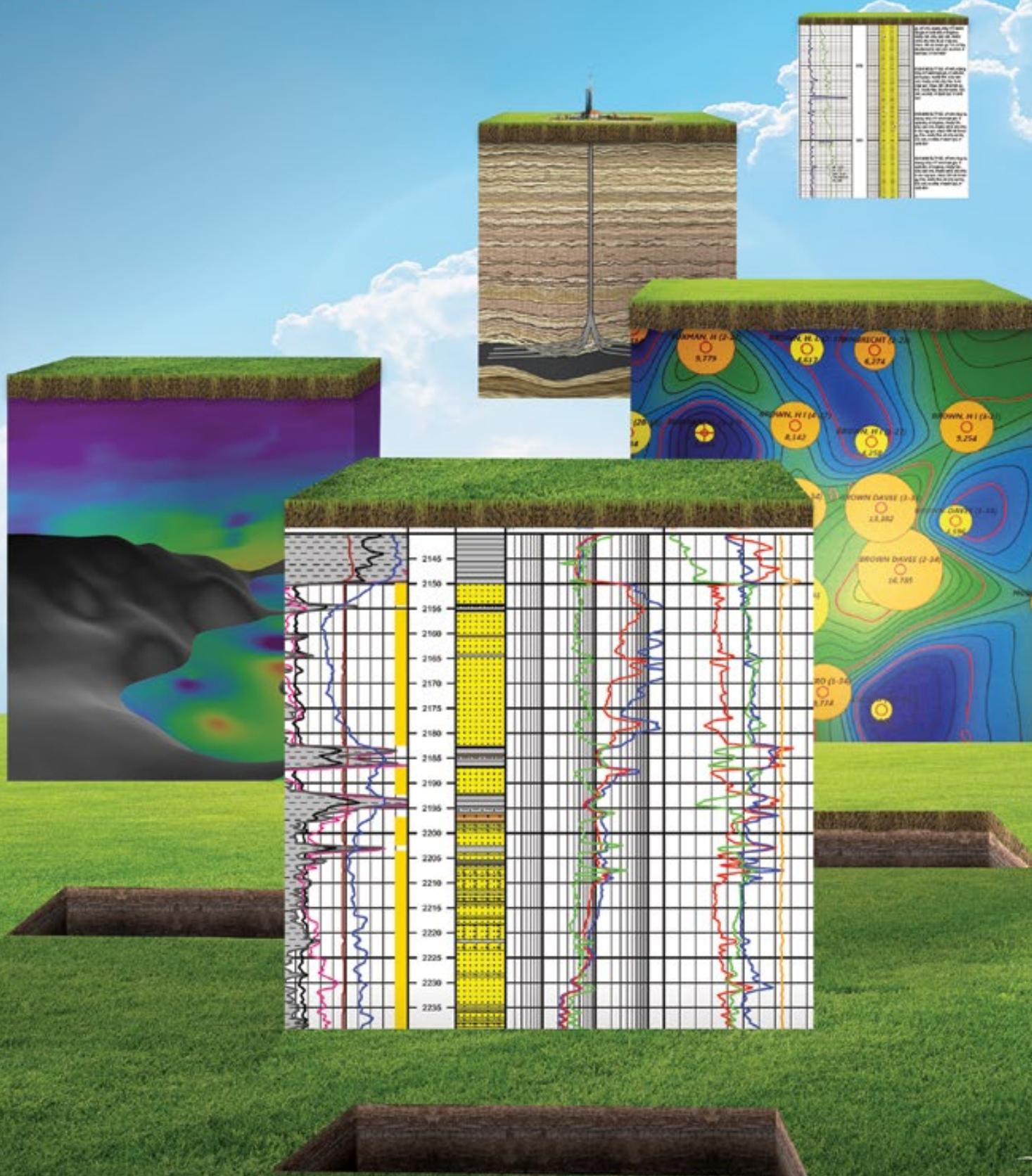
Luncheon speakers will be AAPG President-Elect John Hogg and award-winning geologist William A. Zagorski, known as the "Father of the Marcellus."

For more information, go to www.esaapg2014.org. 

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Polarcus has available for licensing over 14,300 sq. km of multi-client 3D seismic data over a number of prospective areas of the West African Transform Margin between Guinea-Bissau and Nigeria. World class discoveries in the region have generated an unprecedented amount of interest in these areas and open blocks and farm-in opportunities are increasingly sought after. Until now, these areas have lacked the modern 3D data required to properly understand the geology both on a regional and on a prospect scale. The Polarcus data provides significantly improved imaging of both the Carbonate shelf play and the deeper water sandstone plays.

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In conjunction with GeoPartners Limited, Polarcus has 1,025 sq. km of data over the central part of the Casamance-Bissau basin.

Guinea-Bissau

In conjunction with Petroguin and GeoPartners Limited, Polarcus has 2,380 sq. km of high density data over Block 7B at the confluence of the Southern Mauritania-Senegal-Guinea Bissau basin and the West Africa Transform Margin trend.

Nigeria Deepwater

Polarcus Nigeria Limited, a joint venture between Polarcus and Ashbert Limited, has exclusive rights from the Department of Petroleum Resources of Nigeria to broker an extensive modern 3D seismic database of over 11,000 sq. km, covering large tracts of the most prospective open areas available.



Lessons learned from U.S. model

China Poised for American-Style Shale Boom

By KEN MILAM, EXPLORER Correspondent

The lessons taken from U.S. shale gas successes hold major implications for China's energy future, according to researchers at the Energy and Geoscience Institute at the University of Utah.

The similarities and potential are explored in a paper to be presented at the AAPG International Conference and Exhibition this month in Istanbul, Turkey.

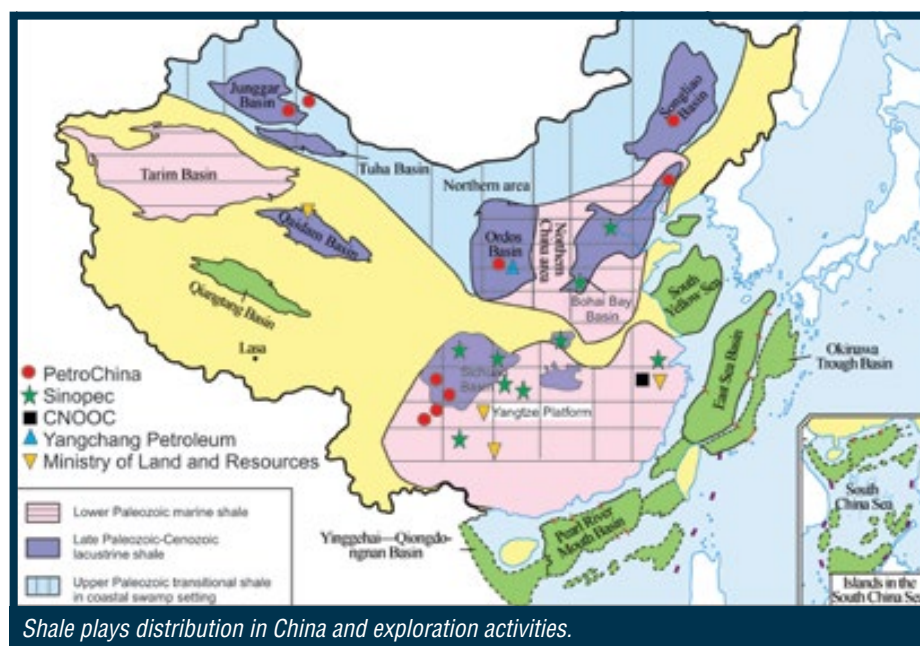
The authors are AAPG members Shu Jiang and Thomas Anderson, plus Jinchuan Zhang, Dongsheng Zhou and Zhengyu Xu.

Since the mid-1980s, "EGI has accumulated tons of knowledge from exploration to production based on years of research on successful North American shales and emerging China shales, South American Shales, India shales, Central Eurasia shales and others, which will help apply science from global research to China's oil and gas exploration," Shu said.

Made in China

Assessments based on U.S. shale gas and oil experience show China has the largest recoverable shale gas resource in the world (886 TCF based on recent China Ministry of Land and Resources data and 1,115 TCF, based on recent EIA data), Shu said.

"If the shale gas development in China is as successful as in the United States,



Shale plays distribution in China and exploration activities.

it will extract clean gas from the largest shale gas resources and help China's GDP to keep growing at a remarkable rate and build a resource-conserving and environmentally-friendly society," he said.

"At present, dirty coal makes up 70 percent of the fuel needed to power China's economy and China's natural gas consumption only accounts for 4 percent of its energy mix, compared to the global average of 24 percent, due to its huge energy demand and limited natural gas supply," he said.

"By 2020, China's natural gas consumption will reach 400 billion cubic meters and the demand gap will be 200 billion cubic meters since the conventional gas production will be only 200 billion cubic meters at that time. China is relying on shale gas to fill this gap," Shu said.

"Vast emerging and potential shale gas plays spanning in age from Paleozoic to Cenozoic are widely distributed in China" and more than 300 wells have been drilled, targeting marine, transitional and lacustrine shale gas and shale oil, he said.

Using U.S. methodology based on mineralogy, petrophysics, depositional, geochemical and well logs characteristics, the Chinese identified Barnett-like Silurian Longmaxi marine shale in Sichuan Basin in southwestern China, he said.

This has led to commercial production by Sinopec in the Fuling area in Sichuan Basin.

"The highest production rate is about 19.1 million cubic feet per day from the Silurian horizontal shale well," which is comparable to some of the best U.S. shale gas wells, Shu said.

"Horizontal drilling and slick water hydraulic fracturing technologies developed in the United States have been borrowed ... to prepare to develop vast China shale resources. The shale reservoir characterization, horizontal drilling and slick water hydraulic fracturing technologies have made China the first country outside North America to successfully develop a fifth shale gas field – Jiaoshiba Shale Gas Field in Fuling, Chongqing, southwest China," he said.

"The lithofacies of U.S. producing shales include siliceous shale, carbonate rich shale (Eagle Ford), chalk (Niobrara), dolomite (Bakken), and more," he added. "This has been applied by PetroChina and Sinopec to shale gas and shale oil exploration."

See China Shales, page 22

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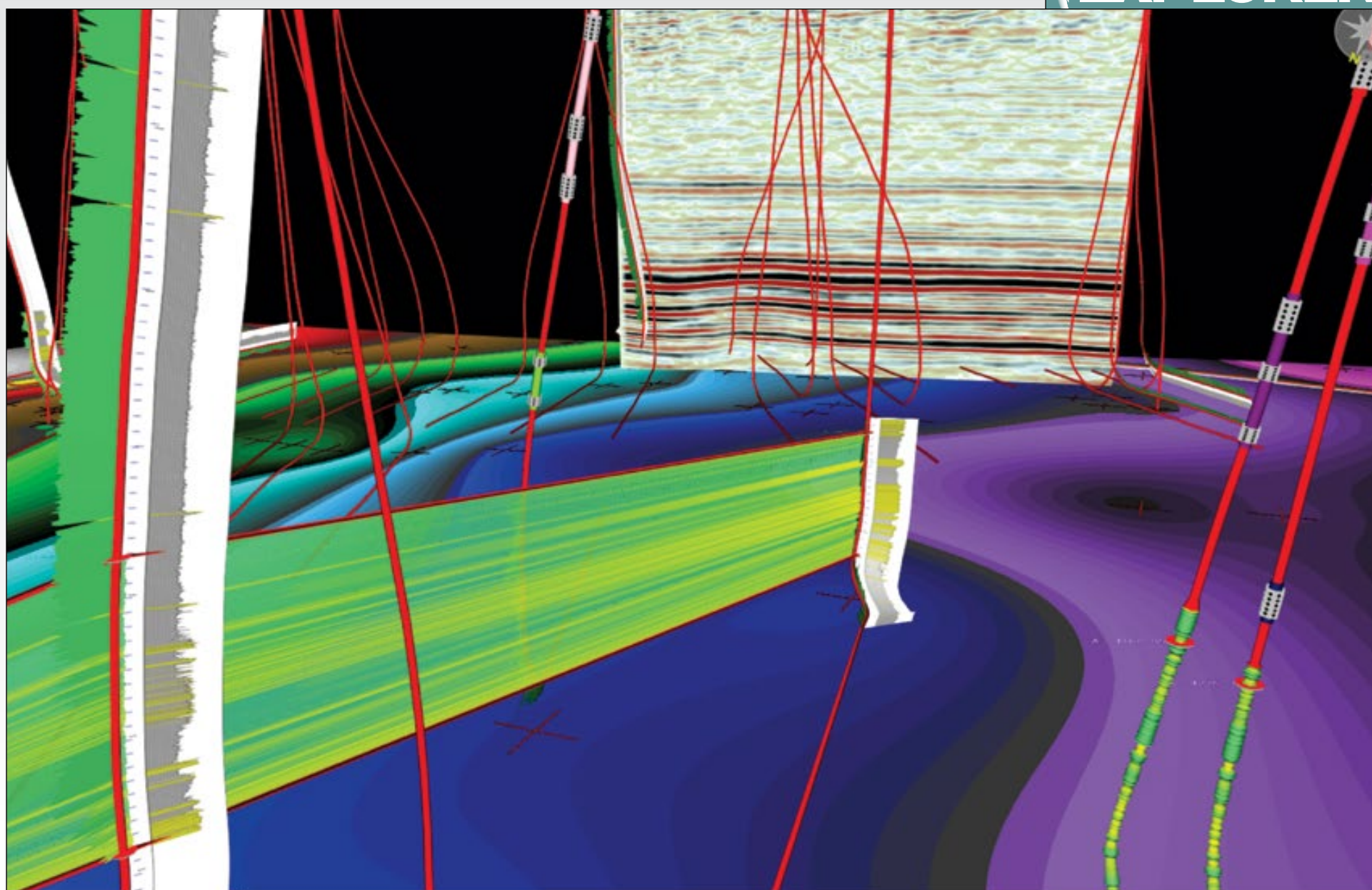
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Seeking foreign investment

Croatia Expands to Onshore Development

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

Croatia's call for foreign investment in the development of its largely untapped oil and gas resources recently expanded to include onshore development.

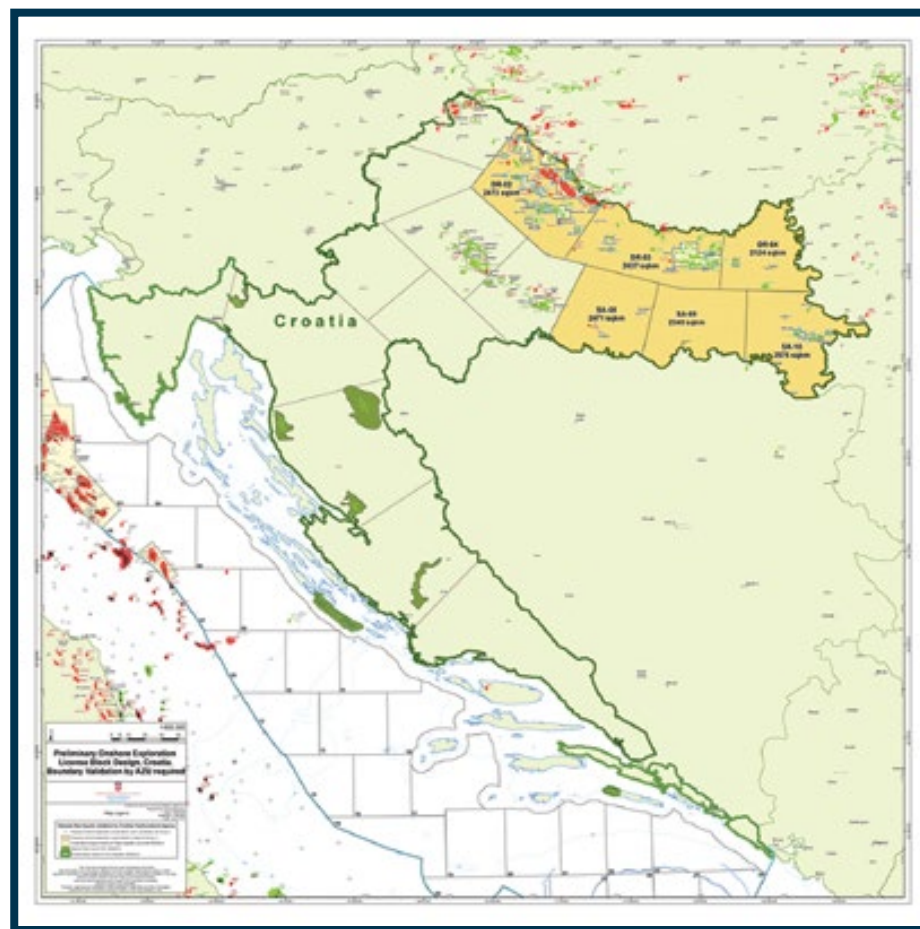
In mid-July, the Croatian Hydrocarbons Agency announced the country would be opening its first onshore licensing round, making available 14,600 square kilometers (a little more than 5,630 square miles) divided into six blocks across the Drava, Sava and East Slavonia regions.

This followed the news tied to AAPG's Annual Convention and Exhibition (ACE) in Houston earlier this year, where representatives of the Croatian Hydrocarbons Agency formally announced the country's first offshore license round. That opened April 2 and included about 37,000 square kilometers (about 14,000 square miles) divided into 29 exploration blocks.

Ivan Vrdoljak, Croatia's minister of economy, issued the July announcement of the country's first onshore license round, which is the first of three tenders for onshore development, at a press conference in Osijek in eastern Croatia.

"In spite of the fact that Slavonija region was the main well field for crude oil and natural gas in the last 40 years, the real potential was not accomplished," he said in a release.

That unrealized potential is demonstrated, he explained, by a



simple comparison between Hungary and Croatia, which have similarly-sized onshore areas across the Pannonian

Basin – but Croatia has only 33 percent of the number of onshore exploratory wells in Hungary, and less than 52

percent of the recoverable reserves discovered to date.

"However, under-explored but proven potential and geostrategic location gives Croatia fully the right to insist on becoming one of the most interesting countries on the map of oil and gas business in this part of the world," Vrdoljak added.

A Growing Interest

Vrdoljak noted that goal is validated by the interest already shown by major oil and gas players following the April announcement at ACE.

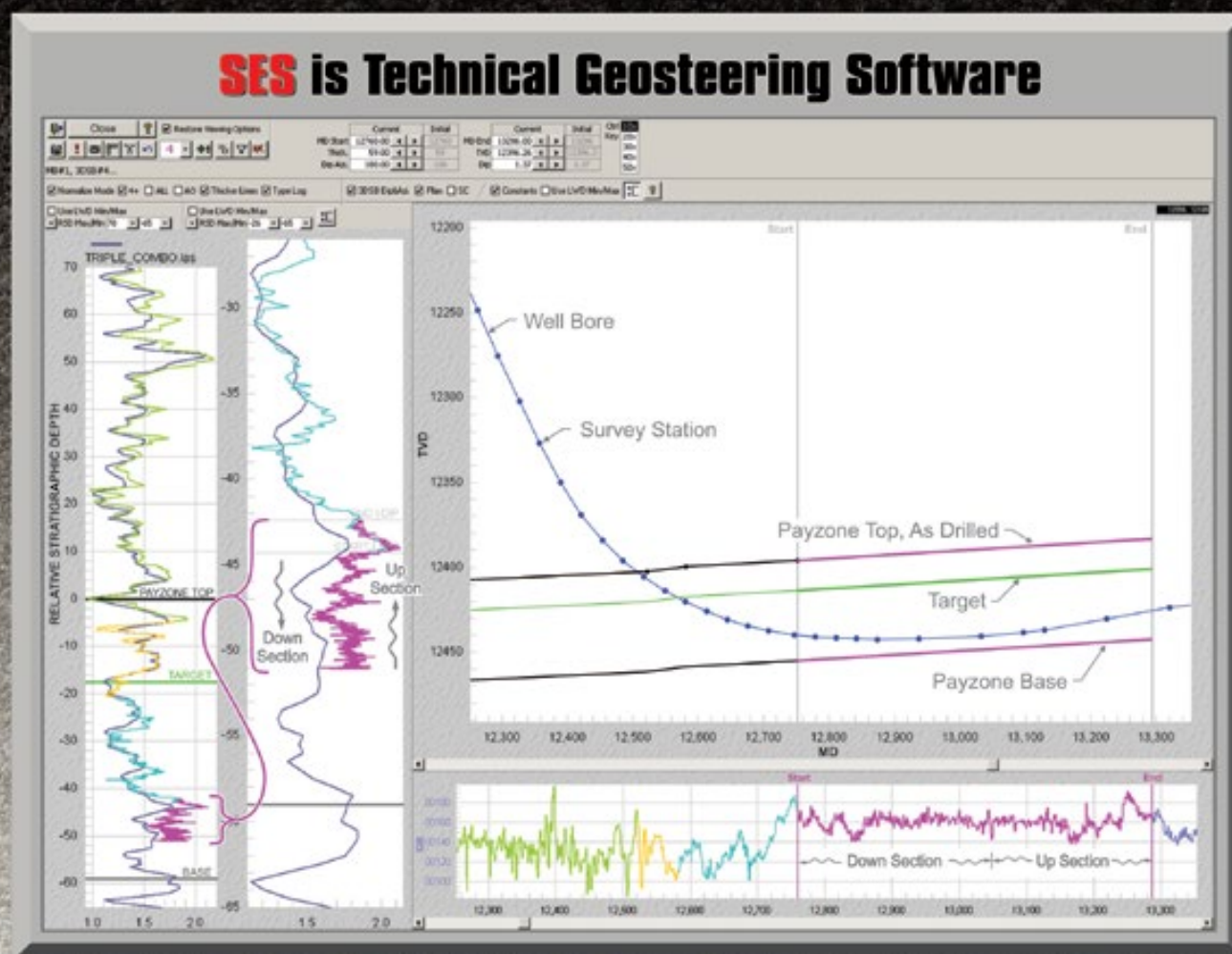
"Despite the fact that the Croatian side of the Adriatic has been quite under explored compared with other countries in the region, more than 40 global companies already visited the offshore Data Room and showed their interest to participate in the license round," Vrdoljak said.

"Croatia's onshore is a well-known area with long lasting tradition of E&P, but its potential is yet to be fully utilized," he added.

"Considering that hydrocarbons have been proven and are being actively produced in every region of the Pannonian basin onshore, Croatia proves a working deep hydrocarbon system in the region. Preliminary analysis of the

See **Croatian Potential**, page 22

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China Shales

from page 18

Costly Process

Major differences also have been identified, including complex depositional and tectonics and stress setting, surface-ground conditions and maturity level, Shu said.


The lacustrine and transitional shales are clay-rich and difficult for fracturing using slick water techniques developed in the United States for brittle marine shale.

"The rugged ground and complex subsurface geology in China cost at least twice as much for fracturing than in the United States," he said.

Tectonic activities may have allowed much of the accumulated gas to leak, according to the work of Shu and his colleagues.

"Complex stress/geomechanics setting caused by complex tectonic activities in China also make shale gas fracturing to generate large stimulated reservoir volume way more difficult than in the United States," he said.

The EGI is the world's largest university-based industry cost-shared upstream E&P research program of its kind, with more than 70 corporate associate members representing 20 countries.

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Croatian Potential

from page 20

seismic and other available data shows that the Pannonian contains significant remaining potential," said Barbara Dorić, president of the Croatian Hydrocarbon Agency's management board, who also was at ACE to explain the bidding details.

In 2013, onshore production averaged 12,600 boe/d of gas and 10,900 bbl/d of oil and condensate, she said.

She said the six available blocks range from 2,100 to 2,600 square kilometers (about 810 to 1,000 square miles).

According to the current draft of the production-sharing agreement, Croatia would retain 59 percent of natural gas

resources found and 57 percent of the oil deposits, while the exploration company would keep the rest, she said.

Dorić invited potential investors to visit the CHA's online Data Room, which has legacy seismic data covering about 7,000 kilometers, 1,400 square kilometers of 3-D legacy seismic data covering 1,400 square kilometers and 500 wells located in the Pannonian Basin.

"Croatia's onshore is a well-known area with long lasting tradition of E&P, but its potential is yet to be fully utilized."

Pannonian's Potential

The Pannonian Basin is an integral part of the Alpine mountain belts of east-central Europe, completely encircled by the Carpathian Mountains to the north and east, the Dinaric Alps to the south, and the southern and eastern Alps to the west.

Studies using subsurface data have shown that the Pannonian area was extensively deformed by Mesozoic thrusting and subsequently disrupted by a complex system of Cenozoic normal and wrench faults. Thus, the Pannonian massif has undergone several types of deformation, which are partly hidden by a thick sequence of sedimentary rocks of Neocene-Quaternary age.

The Pannonian Basin is a system of small, deep basins separated by relatively shallow basement blocks. The Neogene-Quaternary sedimentary rocks exceed seven kilometers in thickness in some areas, and the basin system (including the Transylvanian basin) is about 400 kilometers from north to south and 800 kilometers from east to west. The standard interpretation is that it is a Mediterranean back arc extensional basin of the middle Miocene age.


When Croatia's Deputy Minister of Economy Alen Leveric announced the offshore licensing round at ACE, he said it was part of a broader effort to attract foreign investment to the country through a series of new legislative proposals, including the 2013 creation of the Croatian Hydrocarbons Agency, as well as Croatia's recent membership with NATO and the European Union.

"Joining NATO and the EU means security and stability for investors that come to Croatia," said Leveric.

He emphasized that most of the infrastructure already exists in Croatia to develop and transport oil and gas, and the prior bureaucratic hurdles were the only significant impediments to exploiting the country's hydrocarbon resources.

"We put special emphasis on encouraging and strengthening the upstream hydrocarbon sector as one of the priorities of the government of Croatia," he said.

"Now, everything else is up to you," Leveric added.

The offshore license round is scheduled to close Nov. 3. The onshore round will close Feb. 18, 2015. 

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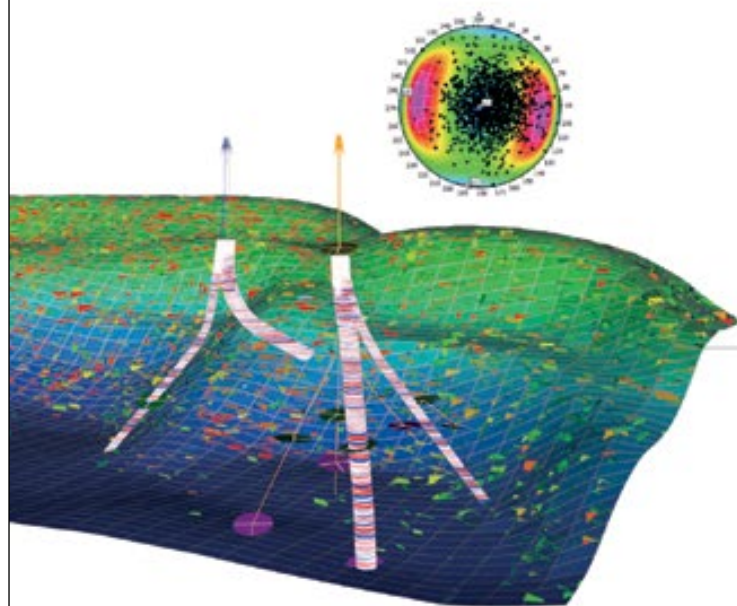
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Q&A with John Pigott

On the Messinian Crisis

By DAVID BROWN, EXPLORER Correspondent

Imagine the Mediterranean Sea drying out.

Imagine the late Permian, as the Earth warmed and dried, and much of life faced extinction.

Now put the two together, and you have the basis of an analog proposed by AAPG member John Pigott, associate professor at the University of Oklahoma, and his fellow researchers.

This concept will be examined in the presentation "The Messinian Mediterranean Crisis: A Model for the Permian Delaware Basin?" at the upcoming AAPG International Conference and Exhibition in Istanbul, Turkey.

EXPLORER: What are the main findings of this research?

PIGOTT: Both the late Miocene Mediterranean and the late Permian Delaware intracontinental seas became isolated when their major inlets to the world oceans pulsed in their restriction and eventually closed (the ancestral Strait of Gibraltar and the Hovie Channel, respectively).

As a result, with restriction and eventual cut-off, both basins became increasingly anoxic and saline, with organic rich sediments culminating in extensive evaporates (the Messinian and Ochoan Castille evaporates, respectively).

The two basins are separated both in time and space and they also differ in principal depositional environments: the dominantly clastic Mediterranean versus the dominantly carbonate Delaware basin.

Two questions are posed:

Are the parallels between the two basins in terms of associated tectonics, global climate change, and eustatic changes in sea level coincidental or process-related?

Can their comparative anatomy of tectonics and sedimentary processes-responses provide reciprocating insight into their hydrocarbon exploration, and potentially to similarly restricted evaporite basins elsewhere?

EXPLORER: What are the key scientific elements involved?

PIGOTT: When expressed laterally instead of vertically, the classic "Usiglio" sequence of evaporite mineral deposition (calcite -> gypsum -> anhydrite -> halite -> sylvite, and such) as basins become more and more restricted tends to generally point away from inlets of ocean water replacement.

Both the Messinian and Delaware basin salts exhibit a general west-to-east Usiglio lateral trend, suggesting basin restriction, evaporation and ocean influx from the west. When there exists a massive one-way transfer in water mass – for example, evaporation in a peripheral basin cut-off to the world ocean – the basin's sea level curve is antithetic to that of the parent world ocean.

This change is documented in the borehole-constrained seismic stratigraphy of the Messinian Nile Delta, which shows Mediterranean relative sea level fall during a time of global sea level rise.

Concomitantly, the global eustatic curve listens to peripheral basin water volume change, for example, the dramatic and almost globally pervasive Messinian unconformity observed in offshore seismic, which corresponds to the Zanclean Flood



PIGOTT

and transfer of massive quantities of ocean water back into the Mediterranean.

Consequently, can the oscillations observed in the global eustatic sea level curve be used as a guide to prediction of basin restriction and anoxia within these two basins?

EXPLORER: How does that affect source rock in these basins?

PIGOTT: It is not just the paradigm of the maximum flooding surface that provides the highest organic carbon content, but bathymetrically controlled pockets of anoxia, which can provide a heterogeneous basin distribution of preserved organic source-rock richness.

As salt conductivities are high, venting of heat allows sub-salt oil windows to be deeper than in adjacent non-salt regions of similar heat flows.

While these two evaporate basins differ dramatically in their ending, both share common themes of process-response, shared themes that can potentially impact their ongoing hydrocarbon exploration.

It should be said that each basin in the world is different. However, there are reoccurring common themes in geological process and response that directly affect the evolution of petroleum systems.

EXPLORER: How was your basic concept developed?

PIGOTT: In my day job, I teach and conduct research in basin analysis and seismic stratigraphy at the University of Oklahoma (OU). My students challenge me to find new paradigms. In my off times, I consult worldwide for companies and governments and instruct for the industry through PetroSkills.

My clients challenge me to find paradigms that help them find oil and gas. So looking for analogs within and among basins is a constant attempt at model verification. But as I do not work in a vacuum, this particular idea grew from the critical joint collaboration of my three co-authors (all AAPG members):

► **Michael T. Williams** (now at XTO), who spent hundreds of hours poring over logs in the Midland Library and setting up the three-dimensional basin model.

► **Kulwadee L. Pigott** (my wife and co-instructor at OU), who assisted with geochemical constraints upon the thermal histories and migration pathways.

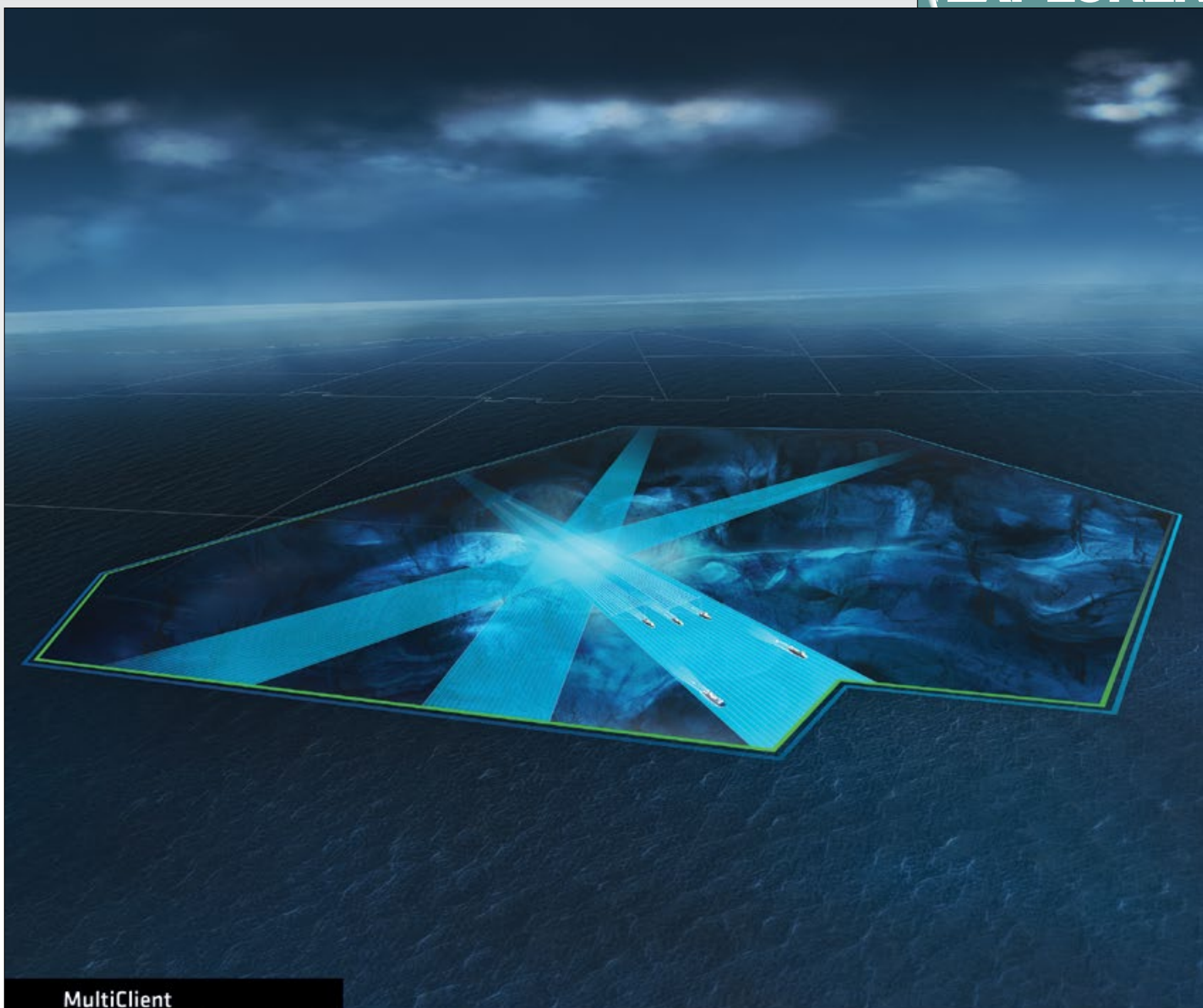
► **Mohamed Abdel Fattah** (post-doc at OU) who works with me on Eastern Mediterranean seismic stratigraphy.

Intrigued by the mysterious location of the missing Hovie Channel postulated by P.B. King in 1942, we noted evaporite mineral changes were more west-to-east than south-to-north. And in the Mediterranean, we noted a similar trend. So this was the nucleus of the idea of comparing the basins.

EXPLORER: What other implications does this have for oil and gas exploration?

PIGOTT: While exploration on the periphery of the Mediterranean continues to focus upon the effects of the Messinian crisis upon fluvial systems within incised valleys sealed by transgressive fills, are

See Zanclean Hypothesis, page 26



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Zanclean Hypothesis from page 24

there clastic analogs along the Delaware shelf edge?

The Mediterranean has a lumpy bottom with anoxic sub-basins, which focused organic deposition and preservation during restriction pulses. Might a similar spatial and temporal heterogeneity in source rock richness be exhibited by the sub-basins in the poorly seismically imaged Delaware Basin basement floor?

Post-Messinian tectonics have led to discoveries in the Eastern Mediterranean – the Levantine Basin by Noble Energy, for example. Could deciphering the strain history and structuring of the post-Permian Delaware similarly lead to new exploration ideas, especially in the East?

Can the Delaware – and for that matter,

the Permian Basin nonconventional play concepts – be used on the onshore basins peripheral to the Mediterranean (Western Desert of Egypt, for example)?

Could there be high-energy prospective reservoir sands associated with the Strait of Gibraltar Messinian Zanclean Flood and Hovie Channel influxes during Permian global sea level oscillations?

Do other Permian evaporite basins of the world have similarities to these two?

EXPLORER: *The Messinian salinity event has been well studied and has generated a lot of theories. Is this approach – and analog – a new concept for the Delaware Basin?*

PIGOTT: It is such an obvious comparison, it is difficult to imagine that such an idea has not been thought of and tested before. In any case, I do think asking the question is appropriate.

EXPLORER: *These events are far apart in time. Are the similarities really that strong?*

PIGOTT: There are definitely differences. But the time of the Permian and its demise is a really strange time in the Earth's past, climatically, biologically, geographically and, likely, atmospherically.

Any insight the more youthful and thus better stratigraphically resolvable and preserved Messinian can provide into not just the Delaware Basin, but also into the numerous other Permian evaporate basins of the world, would be most helpful not just in our general understanding of the Permian, but to its hydrocarbon exploration and exploitation.

Indeed, the Permian Basin in the United States is by no means a small exploration province, where some have projected its present production – at about 1.3 million barrels – to double in the near future with

increased unconventional exploration, and rival that of Kuwait.

EXPLORER: *What work remains to be done in this Messinian Mediterranean/Delaware Basin comparison?*

PIGOTT: Much. At the moment I, my wife Kulwadee, and my graduate students and post-docs are working on refining the Delaware sequence stratigraphy (AAPG member **Yuqi Zhou**); Delaware and Midland Basin modeling (AAPG member **Michael Williams**, **Esra Yalcin** and **Katie Garrett**); Permian Basin carbonate seismic stratigraphy (AAPG member **Sam Martin**); Permian-modern comparative Diagenesis (AAPG member **Emma Giddens**); and Mediterranean Seismic Stratigraphy (**Mohamed Abdel-Fatah** and **Jerry Zhai**).

We are hopeful these parts may fit into the puzzle and provide additional verification or refutation of our hypotheses concerning parallels between the two basins.

EXPLORER: *Is there anything here we should take away with us in thinking about glaciation, climate and rainfall today?*

PIGOTT: The global climate is complex, a result of more feed-back mechanisms than we as scientists can at this moment accurately predict for the short-term.

However, with respect to the long term, what we as geoscientists can do is attempt to decipher the Earth's past climates and thus provide from retrospection a model for forecasting future earth climates.

EXPLORER: *Just out of curiosity, do you accept the very fast Zanclean flooding hypothesis?*

PIGOTT: The Zanclean Flood, or Zanclean Deluge, has been proposed to be the event that refilled the Mediterranean 5.3 million years ago at an enormous rate in what some workers have estimated to be months to a decade in time.

To explain the massive inlet deposits viewed at the Gibraltar inlet, the Messinian evaporites, one must subscribe to large volumes of water being transferred.


From our bore-hole constrained seismic stratigraphy on the Nile delta what we do see is indeed an enormous transgressive (flooding) event, but at the moment we lack the stratigraphic resolution to resolve with certainty the number of years responsible.

Certainly, the flooding event was both immense and fantastic, in whatever amount of time it took.

EXPLORER: *You've recently returned from Iceland. What were you doing, and what did you think about the country?*

PIGOTT: Indeed, to put it philosophically: It is the ad posteriori that amplifies and augments the a priori in the geosciences. That is, the more we see and touch through experience, the greater the cerebral library introduced in the classroom can become if we tangibly put not just our minds but our hands around it.

Iceland is but another page in my geoscience cerebral book. In very few places in the world can one look at what happens when a hot spot is placed underneath a spreading center in a high latitude.

Iceland is a fantastic collage of physical and biological scenery – active and historical volcanic activity, strange igneous associations, glaciers, thermal springs, geysers, fantastic high energy storm beach processes, waterfalls, icebergs, moss-covered rift valleys with submerged canyons in which you can scuba dive, whales, seals, horses introduced a thousand years ago, and the mighty puffins. 

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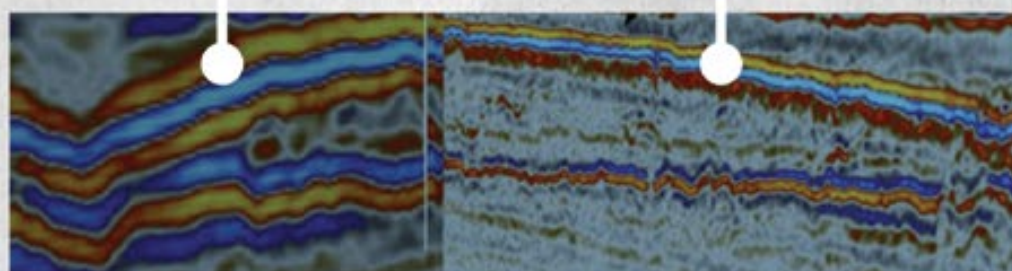
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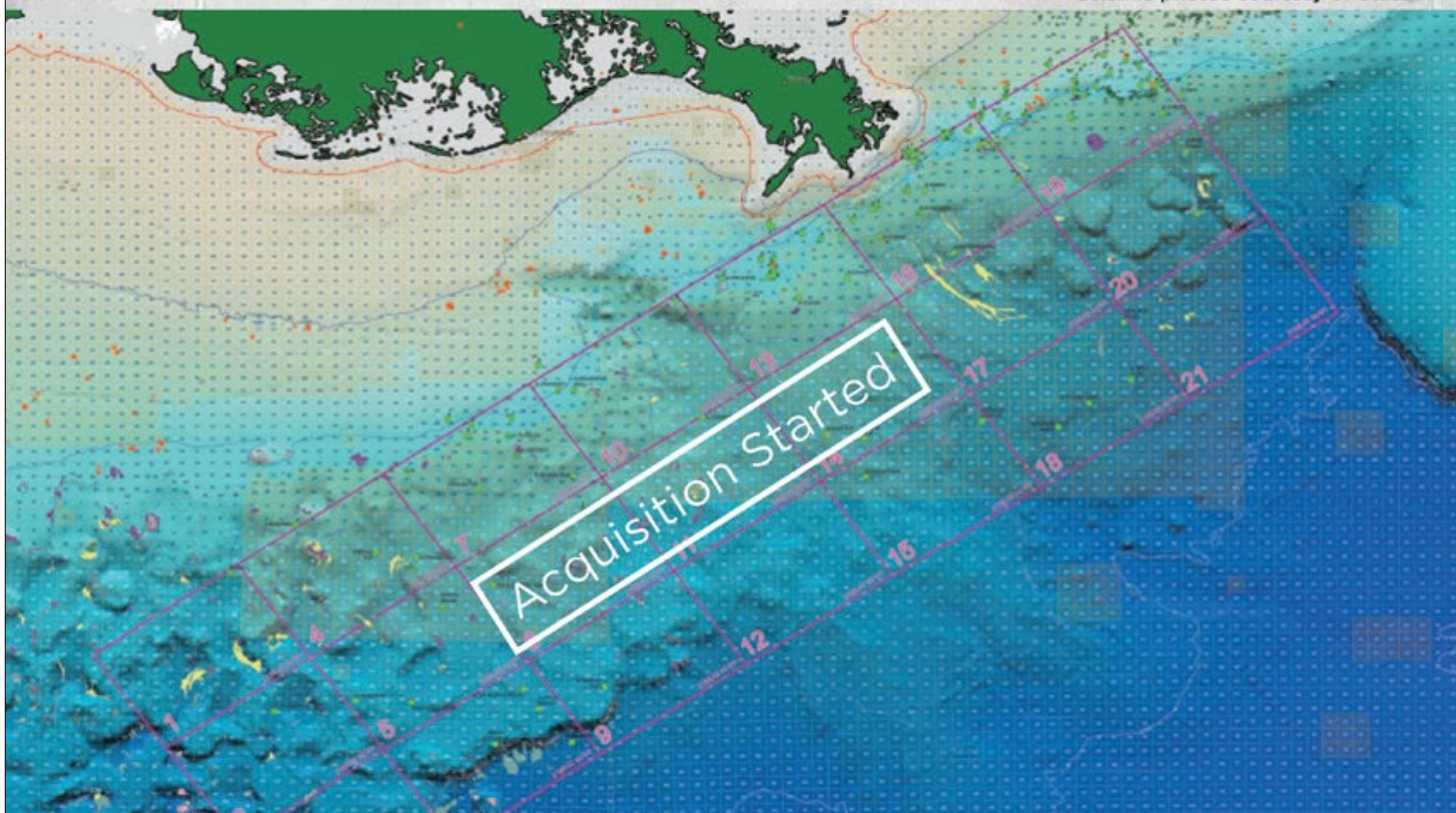
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Seismic photos courtesy of Statoil



3-D Seismic Revives Dormant Field in Oman

By KEN MILAM, EXPLORER Correspondent

Improved imaging technology has helped explorationists in the Sultanate of Oman reawaken a sleeping giant.

Mohammed Shaibani, Fatma Shehhi and Uzma Ghulam of Petroleum Development Oman outline the effort in their paper, "Reviving a Dormant Opportunity: The Mabrouk Deep Gas Discovery," which they will present this month at AAPG's International Convention and Exhibition in Istanbul, Turkey.

The Mabrouk field in northern Oman

was discovered in 1980. After the initial discovery well, two deep wells, Mabrouk-4 and 12, targeted the deeper Barik and Miqrat reservoirs of the Haima Supergroup – the same formations that are producing in the main gas fields to the east.

Flow rates were considered non-commercial and the effort was abandoned.

"With increasing demand for gas in the country, there was always intense activity to look for gas reserves, and Mabrouk was not forgotten as such," said Ghulam, senior seismic interpreter at PDO.

"Explorationists believed that it had potential, but it was always known to have a problem of poor data quality in the deeper gas reservoirs, so acquiring the latest 3-D seismic over the area was key," she said. "Due to the high demand, it was agreed to invest money and acquire advanced 3-D seismic over the area, which gave us a reasonably good image at depths of more than four kilometers."

The area was re-mapped in 2008 and researchers were surprised to realize the earlier wells had been drilled on the flanks of the structure.

"The improved seismic image of the deeper Haima section (Amin reservoir) was a key in the decision to spud a third well in the field," she said, "as the new map showed that the previous two deep wells were drilled on the extreme flanks of the structural closure, hence the updip potential was identified."

Exceeding Expectations

Mabrouk-32 was drilled in 2012, about five kilometers updip of Mabrouk-4 and both Barik and Miqrat sandstones as fully gas-bearing with good reservoir properties, the authors state.

They write in their abstract:

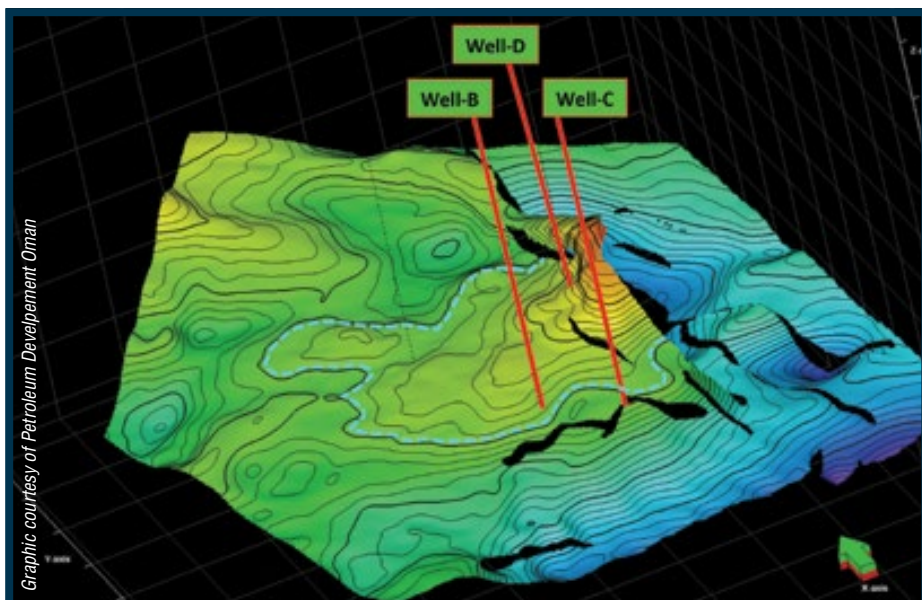
"Given the potential size of the structure, covering approximately 60 square kilometers, it was decided to immediately drill an appraisal well to assess the field's potential. Thus the appraisal well Mabrouk-35 was drilled down flank to confirm gas-water contacts.

"The results came in as expected, confirming the presence of almost three TCF of gas-in-place, making it one of the biggest gas discoveries in the Sultanate of Oman in the past decade."

The Barik and Miqrat reservoirs in Mabrouk-32 were hydraulically fractured and tested in late 2012 – and the well exceeded expectations.

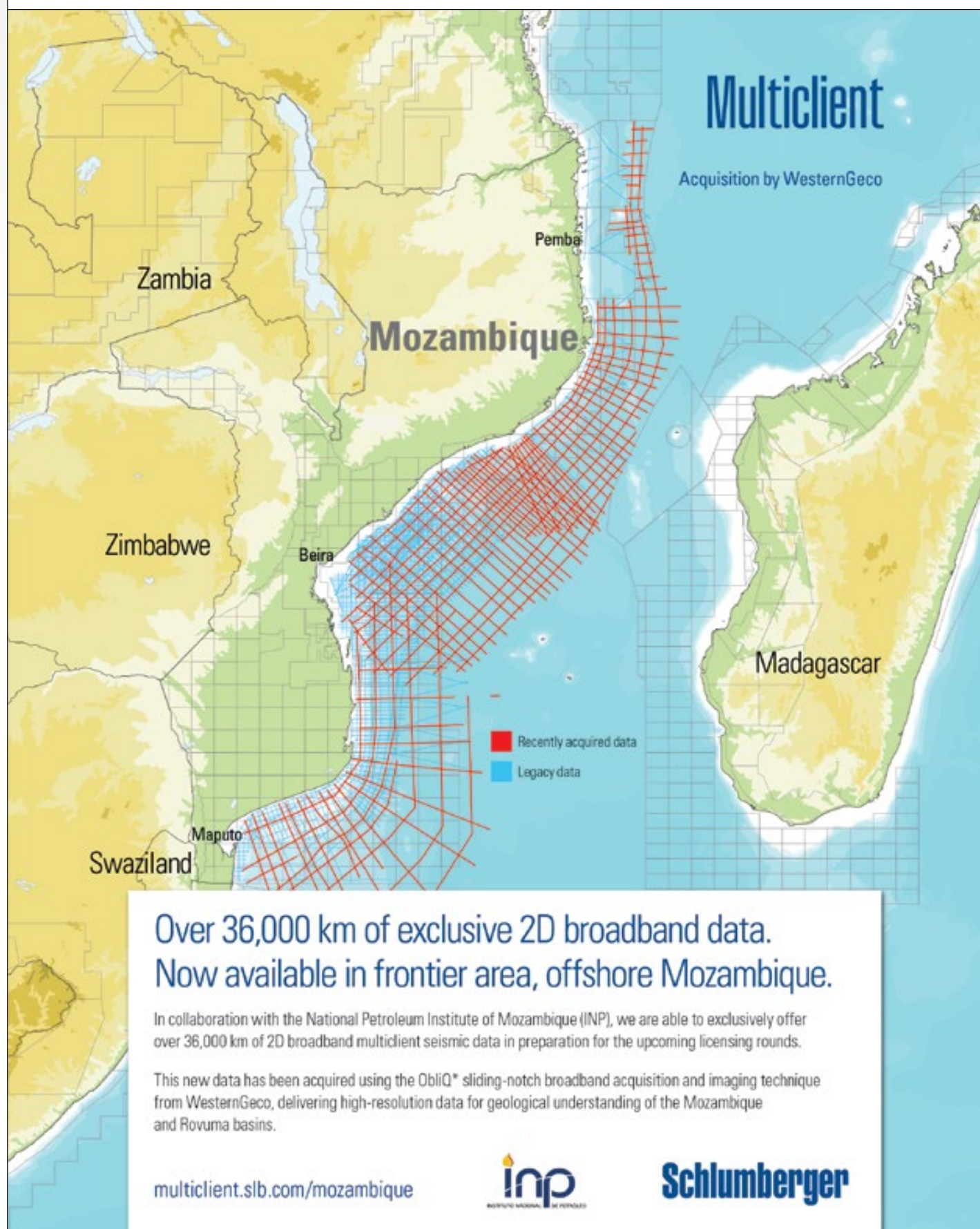
"For Mabrouk-32, it took only 10 months to drill a deep exploration well, test it and then get it connected to the production system – the fastest hook-up for an exploration well in Oman," Ghulam said. "This was despite the remoteness of the well and gas evacuation pipelines, and the fact that the delivery and installation lead times often exceed one year."

Almost one TCF had been booked at the end of 2012, and the initial development of the field is expected



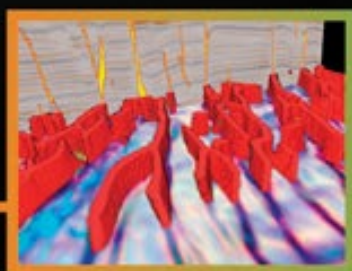
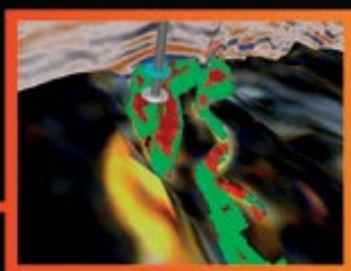
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Miqrat Reservoir Upside.



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Science birthed from Aegean

The Geology of History

By DAVID BROWN, EXPLORER Correspondent

Where did the study of geology and all other modern science begin?

Look for the starting place and you might go all the way back to the ancient city of Miletus in Ionia, among Greek-speaking people living in the Aegean coastal area of present-day Turkey.

A.M. Celâl Şengör, professor of geology at Istanbul Technical University, will talk about what happened there, and why, in the topical luncheon presentation "Was the Geology of the Aegean Responsible for the Rise of the Human Civilization?" at AAPG's International Conference and Exhibition, set Sept. 14-17 in Istanbul, Turkey.

Celâl Şengör will discuss the thesis "that it was the peculiar natural conditions of the Aegean Sea, the archipelagos – that is, the original sea of the Greeks – that made civilization possible.

"I am interested in finding out how the problems geology deals with have arisen. Without a knowledge of why and how certain questions are asked one cannot really understand the answers given," he explained.

"This naturally leads one to the Greeks, especially to the Ionian Greeks," he said. "They were the first ones to question nature directly without assuming that a god or any superior being has to intervene."

By searching for natural instead of supernatural explanations for reality, the ancient Greeks moved humanity toward science and, ultimately, modern civilization, according to Celâl Şengör.

In describing his concept of the origins of science and civilization, he cited the influence of the Austrian philosopher Karl Raimund Popper, author of "Logik der Forschung" ("The Logic of Scientific Discovery").

Popper wrote that the scientific method relies on empirical falsification or disproving hypotheses, and he "pointed out in a paper titled 'Back to the Presocratics' that it was this method that the Ionian Greeks had invented," Celâl Şengör said.

The Presocratic philosopher Thales "had become aware in Egypt that knowledge of geometry was possible without the help of the gods, although the Egyptians themselves had not made that



CELÂL ŞENGÖR

mental leap," he noted.

"He inquired back in Miletus, with his friend Anaximander, whether natural phenomena could also be 'known' like geometry," he said.

Thales and Anaximander soon realized the short answer was "No."

"The two friends realized that a complete knowledge of nature was not possible because it was boundless both in time and in space – the concept of apeiron, that is, boundless, proposed by Anaximander," he noted.

"Therefore the sensible thing to do is to generate testable hypotheses," he said. "When Thales and Anaximander invented this method, science – and with it, human civilization – was born."

It's All Greek to Him

That realization, founded in that place and time, was a turning point for humanity, Celâl Şengör noted.

"Science and the scientific method have great implications for us. We live by them whether we know it or not and whether we like it or not," he observed.

"Imagine living without your computer, your medication, your GPS or without a knowledge of atmospheric phenomena – or without geology, which would mean relinquishing almost all our energy resources and everything that goes with them," he said.

Celâl Şengör described himself as "a geologist who would like to think of himself as a generalist."

"Regrettably, I am not smart enough to live up to the demands of being a 'complete geologist,' as George Gaylord Simpson might have said, so I concentrate on tectonic problems and mostly on those in Eurasia, with general implications on such topics as crustal growth, mountain-building, rifting, et cetera," he said.

He's also a geologist with a keen interest in modern science and civilization.

"Curiously, civilization has never been invented elsewhere independently," Celâl Şengör said. "This is a most curious fact of human history. Our present human civilization is single-handedly a Greek product." ■

Mabrouk from page 28

to address about 40 percent of this volume.

"The Mabrouk field is also a producing gas and oil field from shallower reservoirs, hence it has well developed pipelines and production facilities that could be utilized for the gas produced from the deeper Haima Group reservoirs (Barik and Miqrar)," she said.

"The biggest lesson learned was that a good quality dataset is the biggest asset an O&G business can have, and decisions based on unreliable data will

always be questionable," Ghulam said.

"In highly explored and mature basins like that of interior Oman, the Mabrouk discovery has renewed our hopes, and this has triggered various new 3-D WAZ seismic and 4-D seismic acquisitions, which are currently ongoing," she said.

The Mabrouk field has been classified as a stranded gas opportunity, and regional scaled projects looking at all similar opportunities also are currently ongoing.

"Such a successful outcome," Ghulam said, "requires a lot of effort and precise planning from various departments and disciplines." ■

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Giants of geoscience

Honoring Peter Ziegler and David Roberts

By HEATHER SAUCIER, EXPLORER Correspondent

The global contributions to geology of the late Peter Alfred Ziegler of Switzerland and the late David Gwyn Roberts of Wales made such an impact on academia and industry that two special memorial sessions have been scheduled in their honor at the AAPG's International Conference and Exhibition in Istanbul, Turkey in September.

Both were Honorary members of AAPG, and both left behind a legacy of geologic knowledge and insight that most believe will be felt for generations to come.

"Regional Tectonics: A Memorial



ZIEGLER



ROBERTS

Session Honoring Peter Ziegler" will be held Tuesday morning, Sept. 16, in a session chaired by AAPG members Keith

Gerdes and Andrea Moscariello.

"Exploration in Frontier Areas: A Memorial Session Honoring Dave Roberts" will be held that same afternoon, in a session chaired by Gerdes and AAPG member Michael Simmons.

The invited papers will honor what both men brought to the world of geosciences.

So who were these men – and exactly what is being remembered in these sessions?

Peter Alfred Ziegler
(Nov. 2, 1928 – July 19, 2013)

Perhaps known most for compiling the Geological Atlas of Western and Central Europe, Peter Alfred Ziegler is remembered for integrating four primary areas of geological study: tectonics, basin evolution, stratigraphy and petroleum geology.

Capable of putting highly complex pieces of the earth's puzzle together, Ziegler spent much of his career mapping the subsurface of the earth in western and central Europe in a geological atlas that became a benchmark publication in 1982 (and revised in 1990).

Building upon existing data, Ziegler took information from pervasive rock outcroppings, bore holes, vegetation and other sources, and applied his knowledge of tectonic evolution and its linkage to sedimentary basin systems known for oil and gas rich reservoirs.

For western and central Europe, the atlas became the impetus for the dawn of successful hydrocarbon exploration. Today, many consider northwest Europe one of the best-documented hydrocarbon provinces in the world, and the foundation for the development of one of the world's foremost hydrocarbon provinces.

"I had the great privilege to meet him in the Netherlands when he was working for Shell in the Hague, and I closely collaborated with him for over 30 years," said Sierd Cloetingh, professor of tectonics at Utrecht University in the Netherlands.

"Peter was deeply respected by the Netherlands scientific community," Cloetingh said, "evidenced by his membership of the Royal Netherlands Academy of Sciences and his honorary doctorate at Delft University of Technology."

What most may not realize is that much of Ziegler's work on the atlas was performed in his spare time, out of the sheer joy of playing detective, said AAPG member Andrea Moscariello, a professor of earth and environmental sciences at the University of Geneva.

"He had an extremely inquisitive mind, and he was extremely intelligent and always asked the right questions of himself. He was a person of uncommon ability to put all of the elements together," Moscariello said.

Ziegler's career consisted of 20 years of university teaching and research and 33 years as an exploration geologist in the petroleum industry, working for Shell in Canada and in the Netherlands.

At the university level, he was revered by many students for his ability to communicate complex subject matter in simple terms – just as he did in his atlas, making it highly accessible for students and young geologists, Moscariello said.

Ziegler also is noted for two equally important publications: the "Evolution of the Arctic-North Atlantic and the Western Tethys," published in 1988, and the "Evolution of Eurasia," published in 1989.

He retired from Shell in 1988 but continued a very active geological career, publishing widely in international journals and thematic volumes on the processes controlling extensional and compressional intraplate tectonics and on the evolution of the lithosphere.

In 1992 he was appointed Honorary Lecturer at the University of Basel, and in 1996 as Titular Professor for Global Geology.

He was elected Fellow of the Geological

CALL FOR PAPERS

► Submission deadline:
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Interpretation 3D visualization

AAPG, SEG, and SPE hosted the Interpretation Visualization Hedberg Research Forum in June 2014 in Houston, Texas. This multidisciplinary event focused on visualization efforts and cross-discipline potential for 3D software tools and methods. To broaden our coverage of this topic, we are expanding the call for papers to include with those based on the Hedberg program presentations in this upcoming edition of Interpretation. We are interested in papers that discuss the following topics:

- cybernetics, workflows, and infographics
- 3D seismic visualization techniques and methods
- visualization rendering and enhancement
- geobody, and other geometrical features,
- imaging and analysis techniques and methods

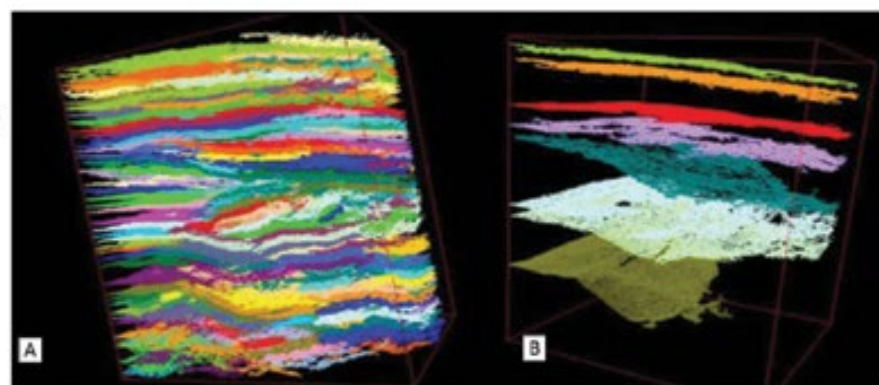


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Interpretation, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

The submissions will be processed according to the following timeline:

Submission deadline:
1 December 2014

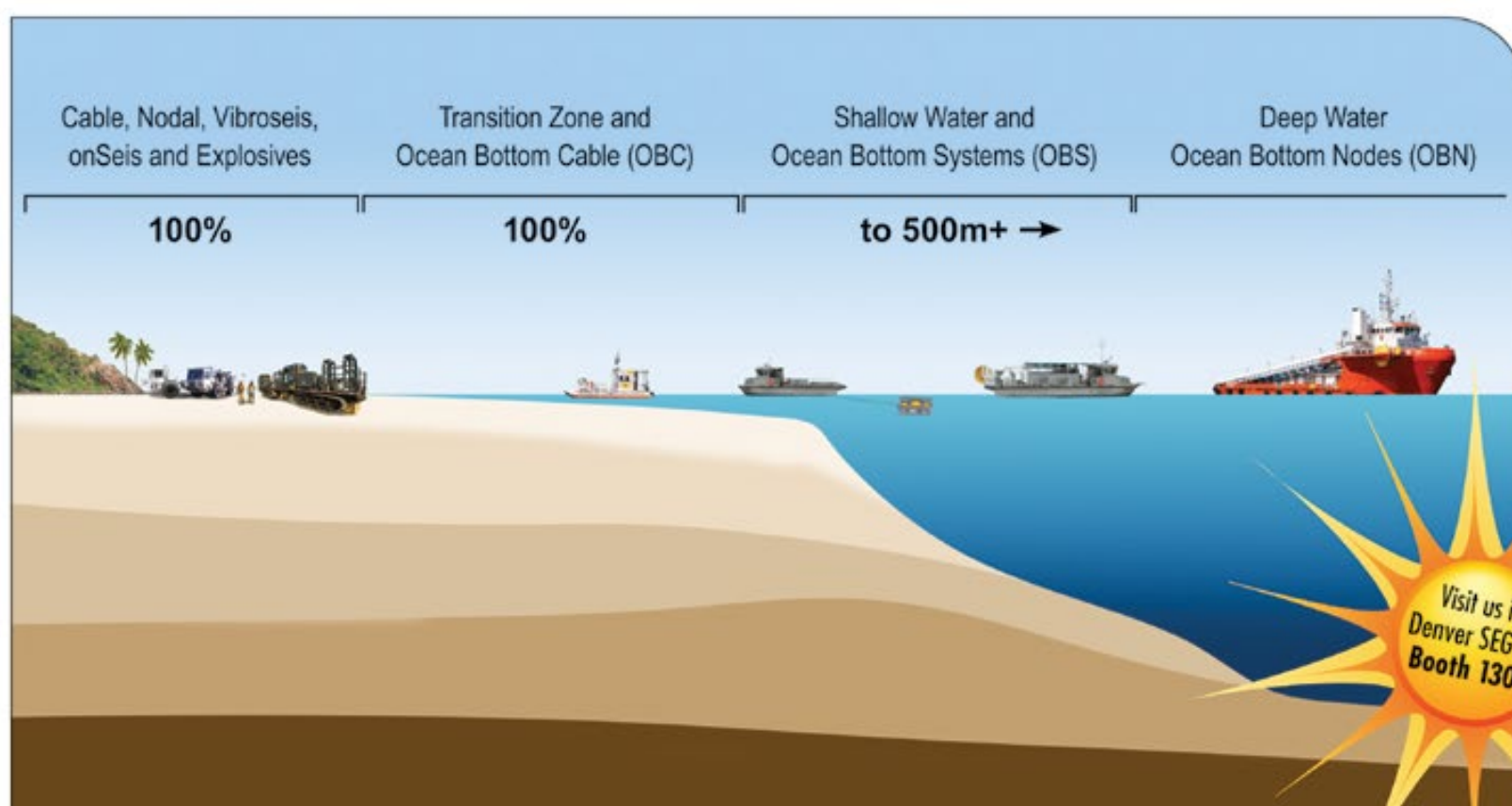
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PURPOSE DRIVEN

Ziegler from page 32

Society in 1978 and made Honorary Fellow in 1983. In 1988 he received the William Smith Medal and in 1992 gave the William Smith Lecture on "Plate-Moving Mechanisms: Their Relative Importance."

He also was honored by the AAPG as a Distinguished Lecturer, and by the Belgian Geological Society, the Royal Geological and Mining Society of the Netherlands, the Geological Society of Glasgow, the Geosciences Union, the German Geological Society and the Russian Academy of Natural Sciences for his work.

"I consider Peter Ziegler the father of modern sedimentary basin analysis," Cloetingh said. "By putting basins in their lithospheric context, constrained by high-

quality data sets including seismic reflection data and tectonic reconstructions, he set the stage for quantitative data-interactive basin studies.

"Peter was an immensely important bridge between industry and academic research on basins," he added. "He generously shared his vast knowledge and insights gathered through his numerous studies on basins around the globe with the community at large.

"He was a true giant, both as a person and as a geologist."

David Gwyn Roberts
(Jan. 4, 1943 – July 5, 2013)

Many tributes have been written to honor AAPG Honorary member David Gwyn Roberts, also known as "DGR," who has been described as a quintessential oceanographer/geoscientist, oil explorer,

author, teacher and mentor.

His accomplishments span his multiple careers, and he can be considered one of the most influential geoscientists of his generation, said Keith Gerdes, AAPG European Region president and global exploration adviser for Shell International.

Realizing that marine geology and geophysics were areas in which major contributions to geoscience could be made – especially in the wake of Frederick Vine's and Drummond Matthews' 1963 publication on seafloor spreading and the mechanisms of plate tectonics – Roberts left his post-doctoral studies to join the Institute of Oceanographic Sciences in the United Kingdom to study the oceans of the world.

His work focused on the structural and stratigraphic evolution of the continental margins of the North Atlantic, which he studied in collaboration with the major

French institutions such as the Institut Français du Pétrole (IFP). The concepts developed in his publications with Lucien Montadert and other co-workers during this time established many of the basic principles for the future study of continental margins, Gerdes said.

Roberts subsequently was made a doctor of science by the University of Manchester, his alma mater, for this groundbreaking work.

In 1981, Roberts joined the oil and gas industry, leading a new basin studies and sequence stratigraphy group for BP, where he identified an urgent need for formal geosciences training. This led to Roberts' creating a suite of iconic courses based on the principles of play-based exploration and technical excellence.

Working with the many geoscientists he trained through these courses, Roberts was responsible for major exploration successes for BP in the Gulf of Mexico, Egypt, Angola, Africa and the Far East.

In recognition of his dedication to science and to others, BP elevated him to the role of "Distinguished Advisor in Exploration" – the highest technical leadership role in the company.

"His influence and impact on our thinking and understanding of geoscience, particularly during the 1980s and 1990s, were profound," wrote AAPG member Mike Bowman, professor of development and production geology at the University of Manchester, in a November 2013 issue of the AAPG BULLETIN.

"His legacy will live on in those he mentored," Bowman wrote, "and in his enormously influential contributions to the science of geology."

After 22 years of service Roberts retired from BP but continued to work practically full-time, consulting with numerous oil companies and government organizations. He chaired and co-chaired major conferences and played active roles in various societies and advisory panels.

He was Honorary Fellow at The Royal Holloway College, University of London; a visiting professor at the IFP in Paris; and a Senior Research Fellow at the Southampton Oceanography Centre.


Roberts also was the founder and editor-in-chief of the Journal of Marine and Petroleum Geology and author of more than 80 publications and books, culminating in his magnum opus, "The Regional Geology and Tectonics of the World" (three volumes, 2,500 pages), which he co-edited with his good friend, AAPG Honorary member Bert Bally.

His numerous awards and citations include: two Certificates of Merit, the Distinguished Service Award and the Robert H. Dott Memorial award from AAPG; and the Petroleum Medal and prestigious Coke Medal from the Geological Society of London.

Roberts was made an Honorary member of the AAPG in 2001 and served as president of the European Region. In 2006, he was made an honorary member of the Geological Society of America (GSA), an award bestowed on only two non-Americans each year.

His knowledge of geoscience has often been described as "encyclopedic," yet he is also remembered for his unique ability to motivate and inspire other scientists.

"It is these attributes as much as his professional achievements that explain why he was held with such warmth, respect and genuine affection by those who were fortunate enough to work and learn from him," Gerdes said.

"It is why his passing is so keenly felt by the global geoscience community." 



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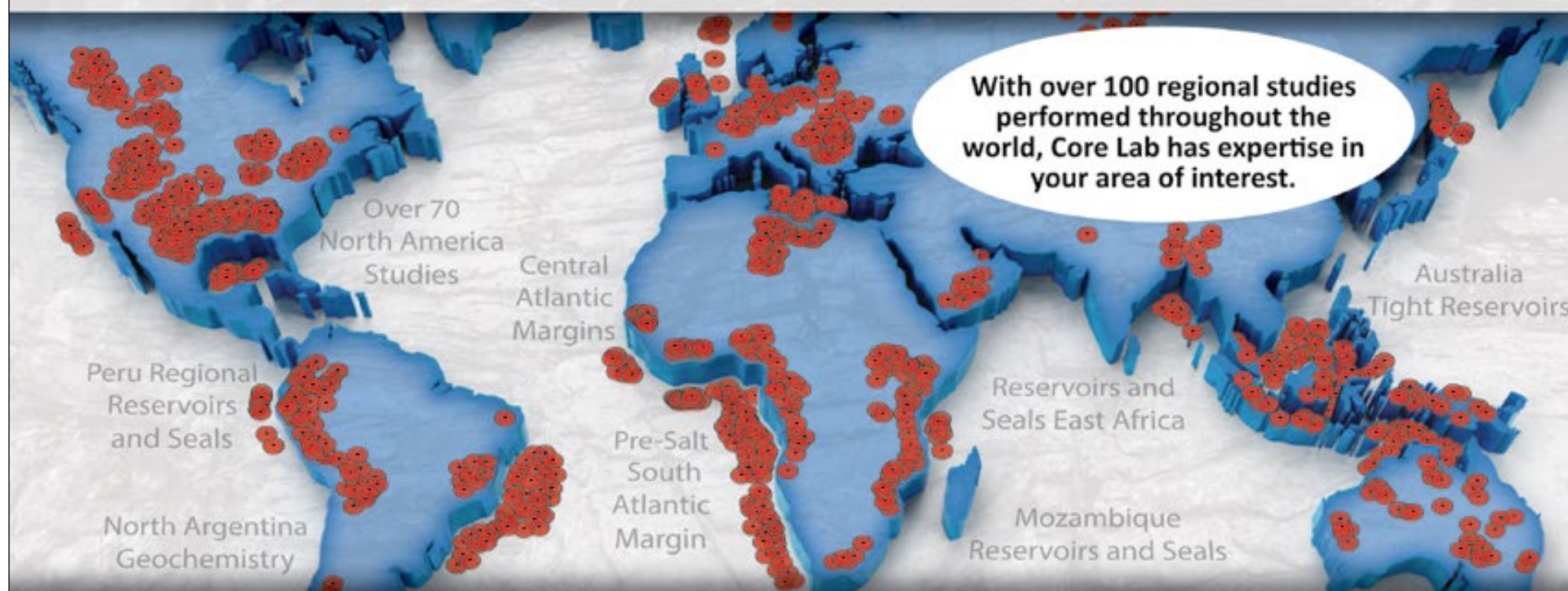
NEW! BRAZIL EQUATORIAL BASINS - RESERVOIRS AND SEALS
NEW! PERU - REGIONAL RESERVOIRS AND SEALS
PRE-SALT SOUTH ATLANTIC MARGIN: PHASE II
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BRAZIL - SANTOS BASIN / DEEPWATER PETROLEUM GEOLOGY
BRAZIL - DEEP WATER CAMPOS BASIN
BRAZIL - CRETACEOUS CARBONATES OF SOUTH EAST MARGINS
NORTH ARGENTINA - GEOCHEMISTRY

EAST AFRICA

NEW! MOZAMBIQUE - RESERVOIRS AND SEALS: PHASE IV
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- Virtual and physical data rooms will be available to pre-qualified bidders from 11 August
- Roadshows
- The submission date for the bid applications closes 31 October

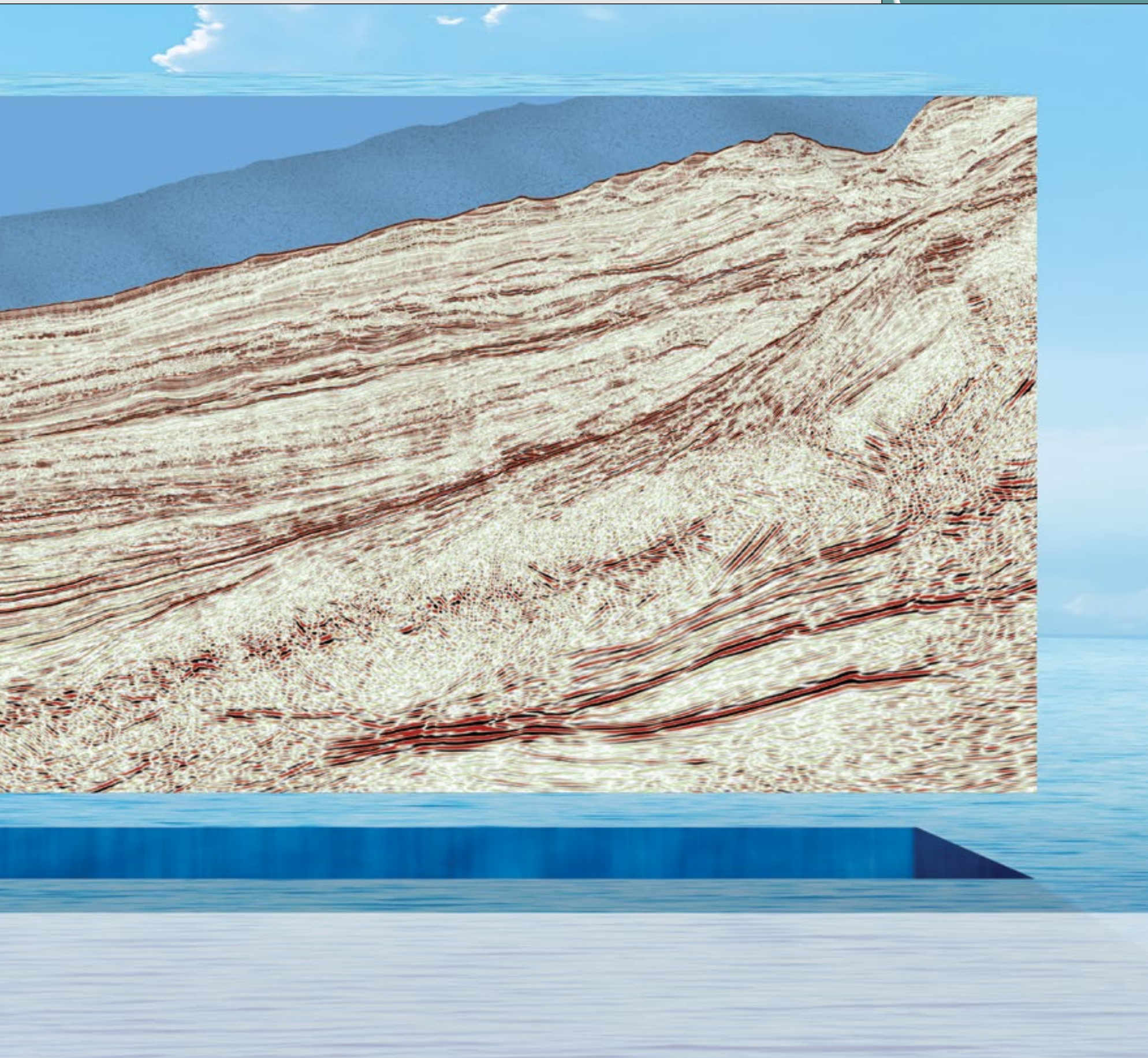
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For more information, contact TGS and NOCAL at:
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Mr. Sandman, bring me a shale boom

Getting Down to the Nitty Gritty of Fracturing

By LOUISE S. DURHAM, EXPLORER Correspondent

The ever-increasing number of hydraulic fracturing applications used to economically produce shale reservoirs impacts various businesses that profit from this phenomenon.

Think sand mining/processing, for example.

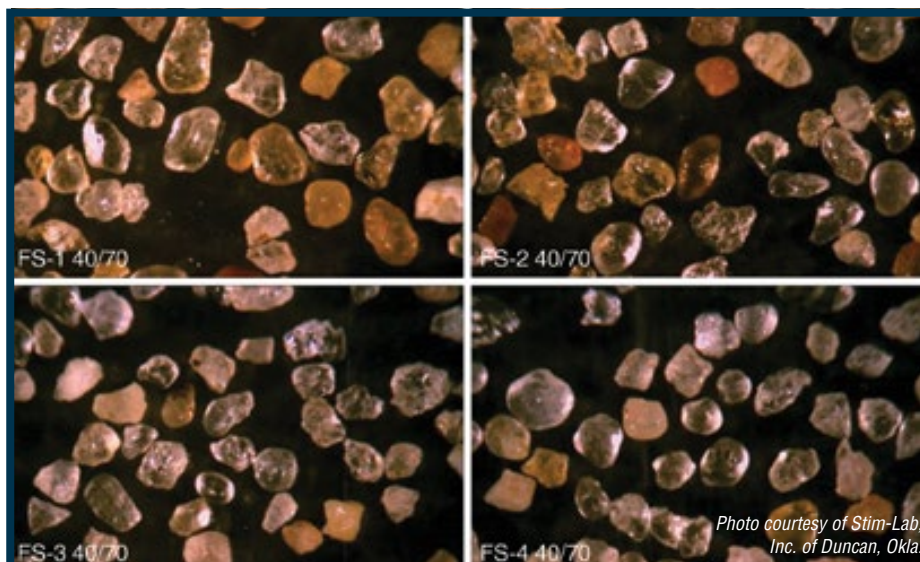
Typically, it takes millions of pounds of sand to fracture only one well. Commonly referred to as "proppant," the sand "props" open the many fractures created by high-pressure injection of sand-containing, chemically treated water into the dense rock.

As the water flows out at the end of the pressurized treatment, the proppant remains, preventing fracture collapse as the pressure declines. This enables the once-entrapped hydrocarbons to wend their way along the fractures to the borehole for production.

Total industry sand consumption for the year 2014 is estimated to be 95 billion pounds, according to a recent report by Houston-based PacWest Consulting Partners, which has been referenced widely by myriad print sources.

This amount exceeds 2013 use by 30 percent.

The industry's near-insatiable demand for this resource likely will continue to grow. A recent Bloomberg article predicted that deepwater offshore hydraulic fracturing is on track to be the next major iteration of the ongoing unconventional resources boom.



Standard 40x photomicrographs of individual grains of sands sampled for testing as proppant for hydraulic fracturing for the 40/70 sieve size fraction.

If you own the right type of sand, and plenty of it, you're golden.

Diamonds in the Rough

Therein lies the catch.

For the most part, the sand must be comprised of round grains that are crush-proof when subjected to enormous pressures. Detritus created from crushing would impede fluid flow enhanced by the spherical grains, potentially sealing the newly created fractures.

Industry sand favorites are Ottawa sand (also known as Northern White) and Brown Sand.

Color-free, clear Ottawa grains are pure silica and hard enough to be essentially on par with diamonds. Sourced from the Ordovician-age St. Peter sandstone, the industry-prized Ottawa is found in the mid-western United States, with a high concentration in Illinois.

Brown Sand is relatively plentiful in Texas, where it's known as "Brady

Brown." Even though a slightly lower tier than Ottawa, it is especially prized by drillers in the Lone Star State, given its proximity to the myriad well sites there.

Building a Better Sand Grain

Don't write off the innumerable remaining sands across the United States, though.

Processing, such as resin-coating sand grains to increase hardness, can alter certain less desirable sands to make them suitable for a particular area.

The Louisiana Geology Survey (LGS) recently conducted a small-scale preliminary investigation of sands, which are in plentiful supply in this hydrocarbon-rich state. The investigation was the initial step to assess the potential for economic development of silica sand deposits there to use as proppants for hydraulic fracturing.

LGS research associate Riley Milner led the research effort, which included samples from only four locales, owing to cost constraints.

The areas sampled are near Sicily Island and Aimwell in the Catahoula sandstone, and the Amite River Basin. Two samples were collected in the Catahoula and two in the basin, and subsequently subjected to laboratory analysis.

See *Catahoula Sand*, page 46



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- Session 1: Global Carbonate and Clastic Case Histories
- Session 2: Role of Petroleum System Analysis, Fairway Mapping and Geologic/Stratigraphic Framework in Stratigraphic Traps Exploration and Development
- Session 3: Middle East Carbonate Case Histories
- Session 4: Middle East Clastic Case Histories
- Session 5: Future Exploration Opportunities
- Session 6: Enabling Technologies for Stratigraphic Trap Prediction

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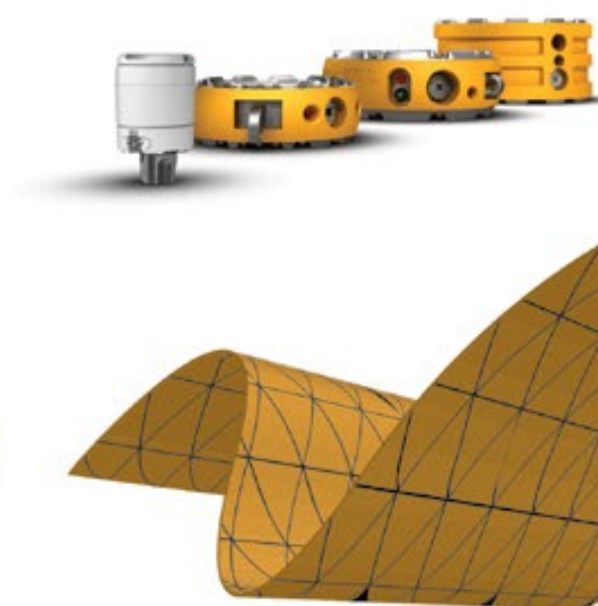
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GCAGS 2014: It's Not Just About the Oil

By LOUISE S. DURHAM, EXPLORER Correspondent

It soon will be time to pack up and head to Lafayette, La. for the 2014 Gulf Coast Association of Geological Societies meeting, hosted by the Lafayette Geological Society.

This is the 64th year for the popular annual confab, which has long been a high point in the industry – particularly for the geoscientists and companies who ply their trade in the hydrocarbon-rich Gulf Coast region.

Historically, the meeting agenda is rife with well-known and respected speakers, disseminating a tremendous amount of high-level info of value to the attendees. It's not all talk.

"One of the best gifts GCAGS gives the scientific community is its annual publication of the Transactions and GCAGS Journal in conjunction with its annual convention," said AAPG member Mary Broussard, GCAGS president.

She noted that this year's Transactions will be dedicated posthumously to AAPG Honorary member Daniel J. Tearpock, who founded his company, Subsurface Consultants, in Lafayette.

The theme of the 2014 get-together is "Survivor, the Gulf Coast."

To many industry veterans, the Gulf Coast is synonymous with oil and gas exploration.

A trio of long-ago notable events speaks volumes:

► 1901 – The giant Spindletop oilfield near Beaumont, Texas, proved to be a reality when the Lucas well came roaring to life.

► 1901 – The first commercially

"I tried to steer this year's convention a little bit away from the unconventional and get more focused on conventional."

successful oil well in Louisiana was drilled at Jennings, marking the birth of the industry in the state.

► 1947 – The first commercial offshore oil well was drilled in 14 feet of water in the Gulf of Mexico Ship Shoal area off southeast Louisiana.

The region has not only survived over the course of these many years, it is thriving, having weathered the numerous downtimes indigenous to the oil and gas industry.

Something For Everyone

In addition to its long-time role as the jumping-off point for most of the GOM action, the area harbors both conventional and unconventional resource plays.

"I tried to steer this year's convention a little bit away from the unconventional and get more focused on conventional," said GCAGS general chair and AAPG member Michael Quinn. "There is a session on unconventional, though."

"There are a number of environmental talks also," he emphasized.

"We're trying to make it so that if you

hear GCAGS, you don't just think 'oil,'" he noted.

Quinn said they're trying to make all interests feel "welcome at the table."

Broussard and Quinn both expressed excitement over the scheduled half-day educational forum set for Monday afternoon during the event.

"Mary reached out to people she knows in the industry who are leading experts on the geology and geophysics of the Gulf of Mexico," Quinn noted. "Four experts will spend an hour each talking about specific aspects of some piece of Gulf of Mexico geology, including salt, seismic, structure."

"Someone new to the basin, (such as a YP) could come away thinking of areas where they need to focus," he said. "And the group that's been in the industry longer will benefit as well."

The forum speakers, all AAPG members, are:

► J. Carl Fiduk, Schlumberger, Houston.

► Roger M. Slatt, Honorary member, University of Oklahoma, Norman.

► Ernest A. Mancini, Honorary member

and last year's AAPG Sidney Powers Memorial Award winner, University of Alabama, Northport, Ala.

► Fred Hilterman, Geokinetics, Houston.

Prospect expos have become ubiquitous, so come to the meeting prepared for the opportunity to cut a deal at "Prospect Alley." Companies – many of them local from Lafayette's long-established oil and gas community – will be on hand to show prospects to potential investors.

It's becoming increasingly important to spread the word about the industry to the community at large. One avenue is by way of school teachers. A one-day workshop dubbed "More! Rocks in Your Head!" will be offered for teaching earth science (grades 3-12 teachers only).


Quinn emphasized they are eager to attract YPs to the meeting, which is pretty much the norm today.


And for folks who have been around awhile, he offered some upbeat comments when queried about the 'great crew change.'

His intriguing observation was that he sees this as impacting the larger companies rather than smaller entities.

"With smaller companies, you have a tendency to keep on working," he said. "They like having you around to do the work, and you're having a good time doing it."



Speaking of a good time, there's a YP Pub Crawl on the event schedule for the meeting.

After all, this is south Louisiana, where you're seldom far away from a good party. 



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Call for Abstracts – 31 October 2014

Recognising the Limits of Reservoir Modelling

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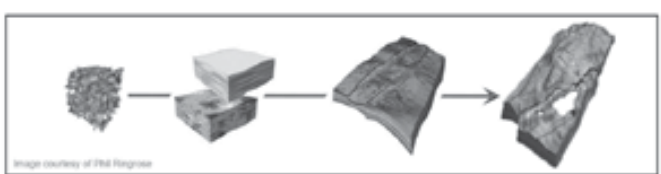


Image courtesy of The Regiores

Nearly 20 years ago a paper describing some then best-practice reservoir modelling included this statement in the concluding section: "The parameters that we used to fine-tune this match were the well connection factors, the well skin factors and the relative permeability curves".

Can we honestly claim to have made progress from that situation?

Geoscientists and petrophysicists labour hard at reservoir characterisation. We are seduced by precision and enticed by the sophistication now offered by software. Meanwhile, we have become habituated to permeability multipliers, pore-volume multipliers, adjustments to the relative permeability curves and to modifying fault properties (up to and including their existence), and use the resulting models to support major capital investment decisions.

So what have we actually learned in the 20 years since geocellular modelling arrived on our desktops? Can we turn all that hindsight around into useful foresight? In situations where we cannot learn from the history-match, what can we learn from history? What are the most frequent failings of our geocellular models?

Now that geomodelling is a mainstream activity, our attention moves to finding effective approaches to support investment decisions; multi-scenario, multi-scale modelling with multi-phase upscaling represents an ideal but requires smart and nimble application to be practical and efficient.

This conference seeks warts-and-all tales of reservoir models that eventually became accurate; descriptions of iteration between reservoir characterisation and reservoir performance; stories of managing small-scale heterogeneity in large scale models. The conference seeks to recognise the limits of our current workflows and chart a way forward to more accurate, useful and efficient reservoir modelling practices.

Contributions are invited on current reservoir modelling cases and techniques, dealing with:

- Handling incomplete or imperfect data – modelling data or concepts?
- Reconciling and integrating multi-scale data in models – dealing with gaps
- Multi-scale modelling – rather than single detailed models
- Impact of heterogeneity on fluid flow behaviour – what matters to flow?
- Conditioning to production data in mature fields – how to iterate effectively
- Advanced gridding and simulation techniques – breakthrough technologies
- Linking reservoir models to commercial decisions – adding value through modeling

Call for Abstracts:
Please email paper and poster contributions to laura.griffiths@geolsoc.org.uk and Richard.Sech@chevron.com by 31 October 2014

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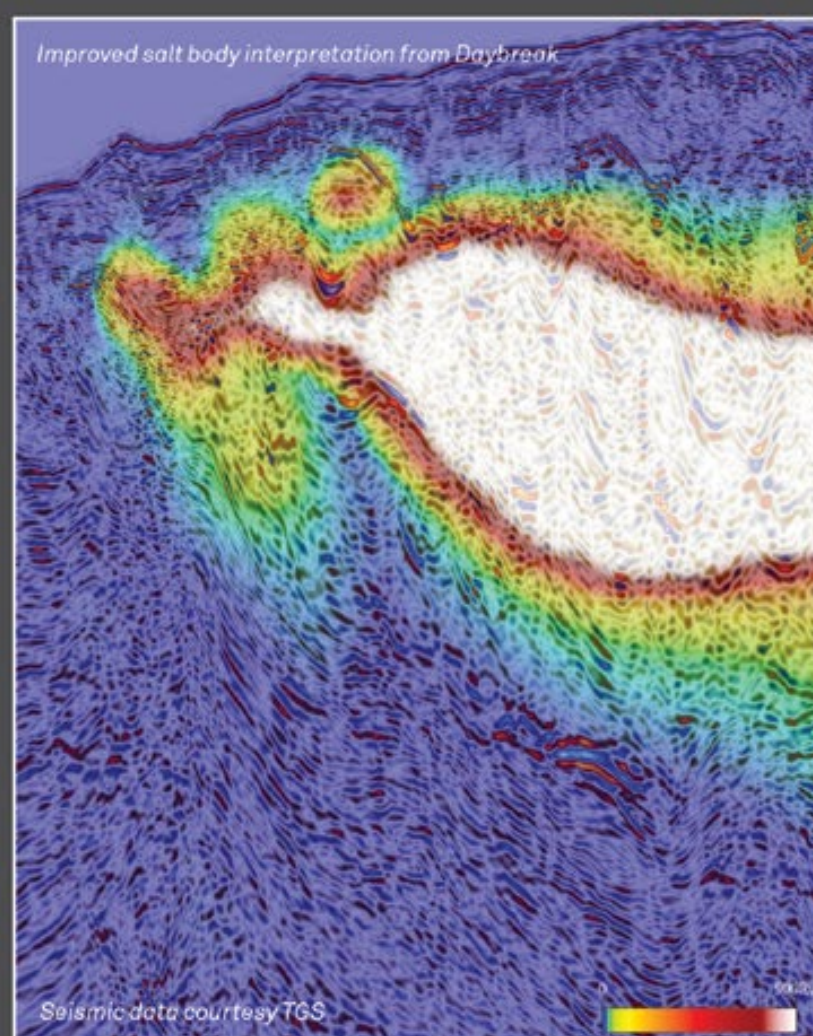
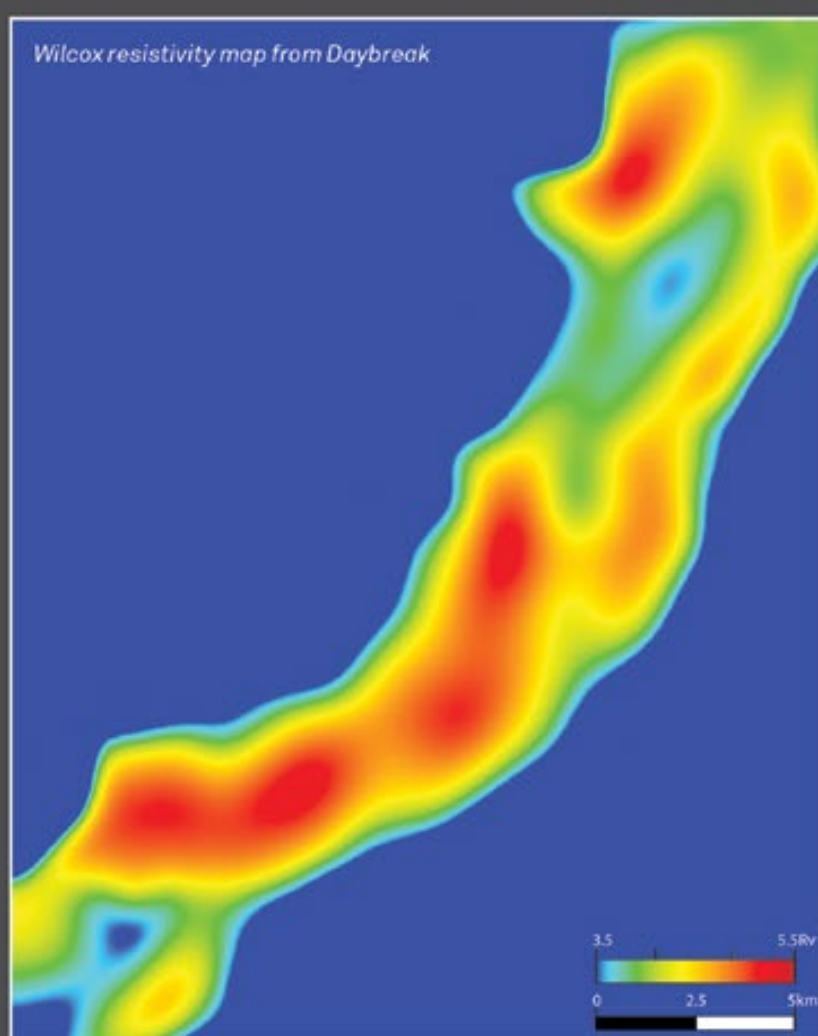
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GCAGS 2014

Resistivity for Determining Hydrocarbon Distribution

By LOUISE S. DURHAM, EXPLORER Correspondent

A big missing piece to the puzzle that is the still-fledgling Cretaceous-age Tuscaloosa Marine Shale (TMS) play in central Louisiana and southwestern Mississippi is the overall lack of published studies on it.

The familiar 1997 study, which originated at what is now the Basin Research Energy Section of the Louisiana Geological Survey, continues to be the defining work.

That's why the work of AAPG member John Allen, geologist at Tesla Offshore, New Orleans, might be of keen interest to



ALLEN

geologists. He elected to write about the TMS for his recently completed thesis at the University of Southern Mississippi.

Allen received his master's degree there in geology in 2013, so the publication is hot off the press.

"These greater pressures along with the gas will stimulate the oil trapped in the tight shale to travel to the surface during production."

"A friend of mine was working in the shale and suggested the topic," Allen said, "and my professor thought it was a good idea, and that's how I got into it."

The title says it all: Determining Hydrocarbon Distribution Using Resistivity, Tuscaloosa Marine Shale, Southwestern Mississippi.

He emphasized that the purpose of the study was to investigate the TMS Trend in southwestern Mississippi using electric logs and IHS's proprietary Petra mapping software to document the structure, stratigraphy and hydrocarbon distribution.

The maps and cross sections generated include:

- Isopach map of the base of the resistive section to the first Lower Tuscaloosa sand.

- Net pay isopach map of the resistive section.

Allen noted that the paleogeography of the study region undoubtedly provided the perfect scenario for geologic development of the TMS resource.

"It provided the necessary depths required for the rocks to mature," he said. "And it provided the accommodation space needed to guide the Tuscaloosa deltas into the area, which may have enhanced the preservation potential of organic matter through periodic rapid burial, and deposited the cross bedded laminations found within the section."

It's All Good News

Allen elaborated, pointing out that the laminations produced structural planes of weakness, which intensified fracturing, porosity and permeability, tending to make the rock more brittle and susceptible to additional fracturing.

The array of conclusions reached from the study likely will pique the interest of anyone playing, or thinking about playing, this still-new frontier.

He noted, for example:

- The resistive, hydrocarbon-bearing section of the TMS is located at the base of the shale, tending to thicken with depth throughout the study area.

- The areas of thickest high resistivity are located within the southern part of Wilkinson County, where thickness tallies 210 feet. This is triggered by higher temperatures and pressures occurring with the increased depths, which enables the organic-rich rock to mature, spurring further hydrocarbon generation.


- Gas volume and pressure increase with depth throughout the study area, as indicated by mudlogs.

"These greater pressures along with the gas will stimulate the oil trapped in the tight shale to travel to the surface during production, greatly increasing the chances of attaining commercial quantities of hydrocarbons," Allen said.

Enter a caveat:

"The resistive section lies directly above the Tuscaloosa sands, and this could lead to potential hydraulic fracturing risks," he cautioned.

At the end of the day, it's all good news.

"This study identifies areas favorable for hydrocarbon production," Allen said, "while indicating areas potentially hazardous to hydraulic fracturing." 



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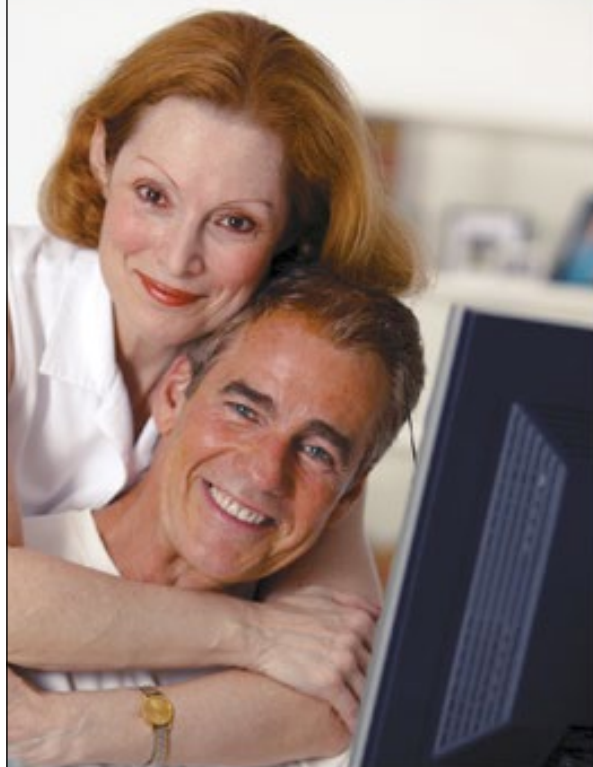
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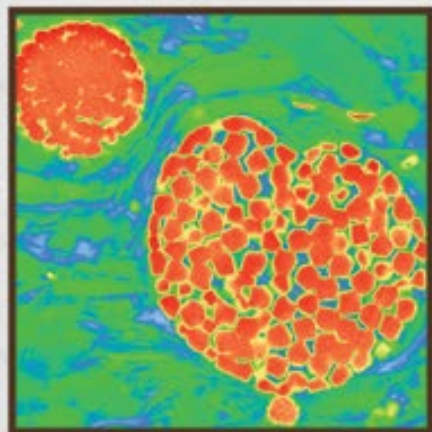


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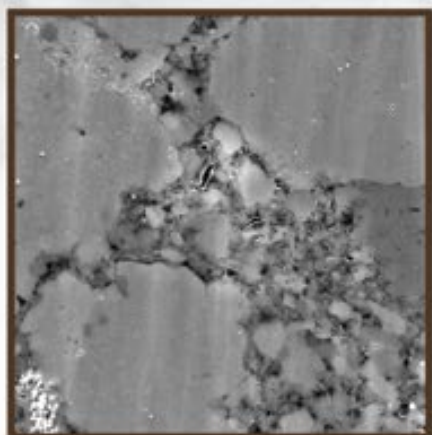
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- Hybrid Unconventional Systems - Tight Targets



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- Geologically-driven Completion Techniques in Unconventional Reservoirs
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Helen Foster

PROWESS Honors a Career of Seizing Opportunity

By HEATHER SAUCIER, EXPLORER Correspondent

Many female geologists who came into their careers in the 1930s and 1940s found it challenging to emerge into a predominantly male-dominated discipline. For the most part, they worked within the confines of a classroom or a laboratory, or perhaps temporarily replaced male scientists drafted during World War II.

The options for female geologists might not have matched those of their male counterparts, but for some women – they were opportunities nonetheless – and they deserved chasing.

Helen Laura Foster, an AAPG member who is now 94, took full advantage of the

dearth of male scientists during the war. She left a teaching job at Wellesley College in 1948 and marched into a career of a lifetime, which she shaped by persistence, gender aside.

Working in the Tokyo office of the Military Geology Branch of the U.S. Geological Survey (USGS) after Japan was defeated in 1945, Foster and others were charged with gathering information about the little known South Sea islands formerly under Japanese Mandate.

"When the war broke out in the Pacific region, the United States was greatly handicapped by its near total ignorance of these distant islands south of Japan,"

Foster recently recalled from her Carson City, Nev., home. "These were major jumping off points with hidden airports, air bases and things we knew very little about. We did not want to be caught out in the cold again if hostilities should rise again."

Japanese geologists took the project in stride and showed a willingness to either provide or gather geological data, Foster said. The project produced many maps and reports on the geology, soils, vegetation, shorelines, ground water and cross-country movement, as well as a complete annotated bibliography of the geology and soils of the islands for the U.S. government.

Outstanding in the Field

After a year on the project, Foster was asked to remain in Tokyo to continue working on the Post Hostilities Mapping Program.

Wanting to stretch her wings outside of an office, Foster said she would remain only if able to work in the field – a request as avant-garde then as a woman asking to fight in the front line of combat today.

Whether or not the time was right, or her insistence simply brooked no refusals. Foster not only was given a field project, but she was later made chief of the Ishigaki Field Party that worked non-stop collecting data on the island of Ishigaki, a geologically complex island in the Ryukyu island chain south of Japan.

"Helen's story is a prime example of how great careers are born from seizing an opportunity with both hands and running with it," said Amanda Haddad, AAPG member and chair of the association's Pioneer Women – a committee of the Professional Women in Earth Sciences (PROWESS). "Even more impressive is that she did it in a male-dominated field and at a time when not many women received Ph.D. degrees or worked in the field. That is why Helen is a true pioneer."

In the 1940s, when the USGS published a brochure about military geology – clearly stating a woman's limited place in the field – Foster was making forays into literally uncharted territory. In tow were a second geologist, two soil scientists and a botanist.

Not only did Foster lead the group, she performed most of the major geological mapping using her expertise in complex geological structures and in metamorphic rocks.

A side perk to working in Japan was being able to meet Emperor Hirohito several times and tour his palace's grounds, including his laboratory, which included a glimpse of his specially-made microscope and scientific workbooks.

On weekends, Foster also was able to hop on a small ship to the island of Oshima, a volcano that was in eruption at the time, and study volcanic activity and the effectiveness of constructing walls to retain the flow of molten lava.

Hank Schmoll, Foster's former colleague, said her adventurous spirit and willingness to experience the world made the mapping of Ishigaki a highlight of her career.

"I never had the feeling that she was at any particular disadvantage for being a woman," Schmoll said. "She was accepted by the guys – she had to be, because she did everything that was required of her."

While some might have turned down an assignment on a little-known Pacific island, Foster saw it as a ticket.

Schmoll recalled, "Helen said, 'Sure, I'd love to do that – here's my chance to get out and see the world.'"

Bear In Mind

Schmoll met Foster on separate assignments for the USGS in Alaska in the 1960s, after Foster completed her mission on Ishigaki. In Alaska, Schmoll was sent to help remap Anchorage after

CALL FOR PAPERS

► Submission deadline:
1 December 2014

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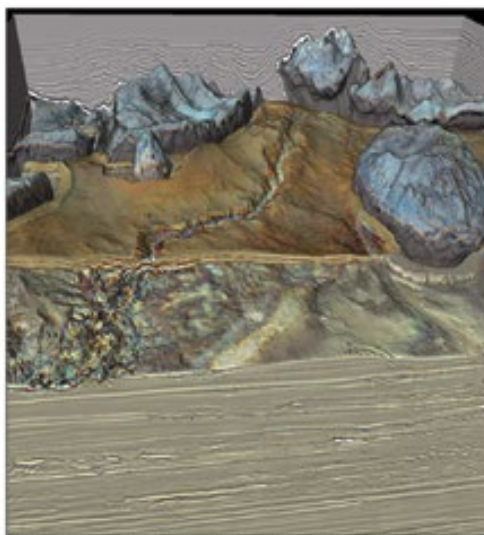


AAPG
Advancing the World of Petroleum Geosciences

Earth Model: Effective interpretation for conventional and unconventional reservoirs

The editors of the Interpretation journal would like to follow up the successful 2014 Earth Model Forum with a special section on the same theme. The Earth Model Project is an SEG initiative to promote integration of earth science data and knowledge to provide quantitative interpretations. Both participants and non-participants of the Forum are invited to submit papers to the section. The goal is to help stimulate a fundamental change in visualizing and predicting subsurface structure, rock and fluid properties quantitatively along with estimates of uncertainty. From emerging data types and format handshakes to multidisciplinary workflows, this section's focus is on industry's current best practices with "Effective Interpretation in Conventional and Unconventional Reservoirs" and the value it brings to the business. We are interested in papers that discuss the following topics:

- Interpretation case studies on integration of seismic, well and core data
- Conventional and unconventional reservoir characterization and reservoir property uncertainty
- Quantitative risk reduction and structural uncertainty
- Volume based seismic attributes used in interpretation
- Stratigraphic interpretation – framework building, body identification and tracking
- Interdisciplinary prospecting
- Geoinformatics
- Data types and format handshakes



Salt-sediment interaction near Green Knoll, deepwater Gulf of Mexico. Image courtesy of Schlumberger

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 December 2014

Publication of issue:
August 2015

Special section editors:

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Continued from previous page

the Great Alaska Earthquake in 1964. Foster already was mapping in yet another inconspicuous place: the Yukon-Tanana Terrane, a vast area, not known at the time for minerals or other items of interest – a no-man's land, if the pun allows.

"This was not the glamorous place to work, but that didn't mean anything to her," Schmoll recalled. "She was the No. 1 geologist for a vast region. What more could a geologist want? She always seemed happy to be there."

Indeed, Foster has many fond memories of being airlifted by old Army H-21 helicopters to various spike camps and other field locations to map very remote areas of Alaska. Often the unreliable mode of transportation – called "flying bananas" – would break down, forcing her and an assistant to rely on any

survival food they might have carried in their packs until they could be retrieved.

"We are eating our last meal," Foster recalled saying once via radio to a pilot of a broken-down chopper.

Dodging bears was another hazard that came with the job.

Once, on a solo mission traversing a ridge in a remote valley teeming with juicy blueberries, Foster spotted a large grizzly bear headed her way as he ate his way down the berry trail.

"I wanted to get away from him before he spotted me, but every time I moved away he stepped closer," she recalled.

Pulling out her radio to signal for help only intrigued the bear, causing him to move within 15 feet of her.

"I held up my backpack and talked to him until the helicopter arrived and scared

See Alaska, page 46



Photo courtesy of Helen Foster

Foster conducting geologic mapping of Alaska's Big Delta in 1978.

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The Present And Future Of GeoPrediction

Catahoula Sand from page 38

"All four samples were right on the borderline as being acceptable for proppant in terms of sphericity, acid solubility, bulk density and stress," Milner said.

"Other analyses by pit owners in the Amite River Basin and other locations in the Sparta sand are all right on the borderline," he noted.

Already, there is a business operation in Sibley, La., specializing in resin coating of fracturing sands. A pit owner near Natchez, Miss., is mining the Catahoula sand, apparently with the idea of resin coating, according to Milner.

"In Sibley, they're resin-coating the Texas Brown, which is being shipped in,"

he said. "They're processing about 100 rail cars a day on a spur right off the railroad.

"There's a guy in the Amite Basin in East Feliciana who is hydro-washing sand and selling it as a proppant to a company in Houston to go offshore," Milner said. "He has a jet wash system where if the grains are broken, it washes these broken ones out, retaining the strongest and roundest grains."

As to Milner's preliminary findings, the sand studied might not be suited for deep Louisiana plays such as the well-known Haynesville Shale or the Tuscaloosa Marine Shale.

Yet not all wells are at great depths.

"If they resin-coated it, it could go up to 15,000 psi crush strength," he said. "Right now, it's right at 7,000 psi.


"In shallower wells, this could be used for fracing."

Milner is convinced of the need to expand this initial study effort into a full-blown research program.

"This preliminary study of silica sand resources in Louisiana for proppant has shown to warrant further study of natural sand resources in the state," he said.

"With all the drilling, along with the businesses processing sands for proppant, we need to do a statewide analysis of sands," he said. "There's a lot of sand in southeast Louisiana along the Amite, the Comite, in Tangipahoa and that region, and it's good enough quality for glass.

"There are a lot of things Louisiana sands can be used for that are not being dealt with," he emphasized. "There's potential for other areas of development far beyond fill, concrete aggregate and the like.

"That's what this study was about." 

Alaska from page 45

him away," she said. "I got lucky because the bear seemed young and more interested in the blueberries than in me."

Whether she was on a snake-infested Pacific island or in the thick of Alaskan terrain, Foster felt at home despite the unknowns around her.

"After spending two to three months walking all day in semi-rugged terrain, she'd take a vacation," Schmoll recalled. "She'd put a pack on her back and spend time wandering around in the High Sierra. That was her thing. She was happiest by herself wandering around in the wild. That was when she was in her prime."

'The Petroleum Girl'

Early on, Foster explored her love for geology at the University of Michigan as a science and math major, prior to obtaining a master's degree and doctorate in geology.

When required to attend a biology field course as an undergraduate, she managed to sneak into a geology field course instead and spent time at Camp Davis near Jackson Hole, Wyo. — one of few camps that allowed women at the time.

Foster later returned and helped teach with a former professor.

Also offered at the University of Michigan during World War II was a two-year course for women working on college degrees who wanted to enter the oil and gas industry.

Those pursuing the track were called "the petroleum girls," Foster recalled, adding that many companies were eager to hire the women, as most men were away at war.

With so many opportunities for female geologists and other scientists around her at the time, it is no wonder Foster proclaimed, "I've always had good experiences. I've never felt like the odd man out."

In fact, while in Japan, Foster credits herself and other American female geologists for encouraging Japanese professors to open the doors of geology to female students — a thought even more outrageous in ultra-conservative Asia at the time.


"There were about three female students who went out into the field," she said. "I think we had some influence on it."

Schmoll recalls all the Christmas cards he has received from Foster over the years — each one capturing her in a far-away land she chose for geological field trips or vacations.

When she was 93, a card arrived in Schmoll's mail with a photo of her near the peak of an Alaskan mountain named after the late Marvin Warbelow, a well-known bush pilot.

"You could get fairly high up in an all-terrain vehicle, but the rest of the way you had to hike," Schmoll said. "That's the kind of person Helen was."

Although Foster retired in 1986, geology is still very much a part of her life. She often partakes in "sightseeing geology" trips in Nevada and continues to hike and ski in the winter.

"There are so many aspects of geology and still so many opportunities for discoveries to find out about the Earth," she said. "Geology affects all aspects of people's lives. Knowledge of the Earth can contribute in many ways to the betterment of life." 

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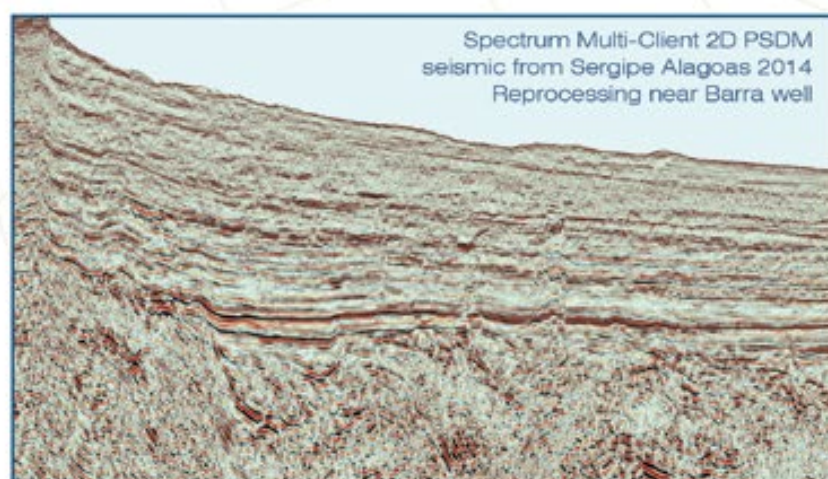
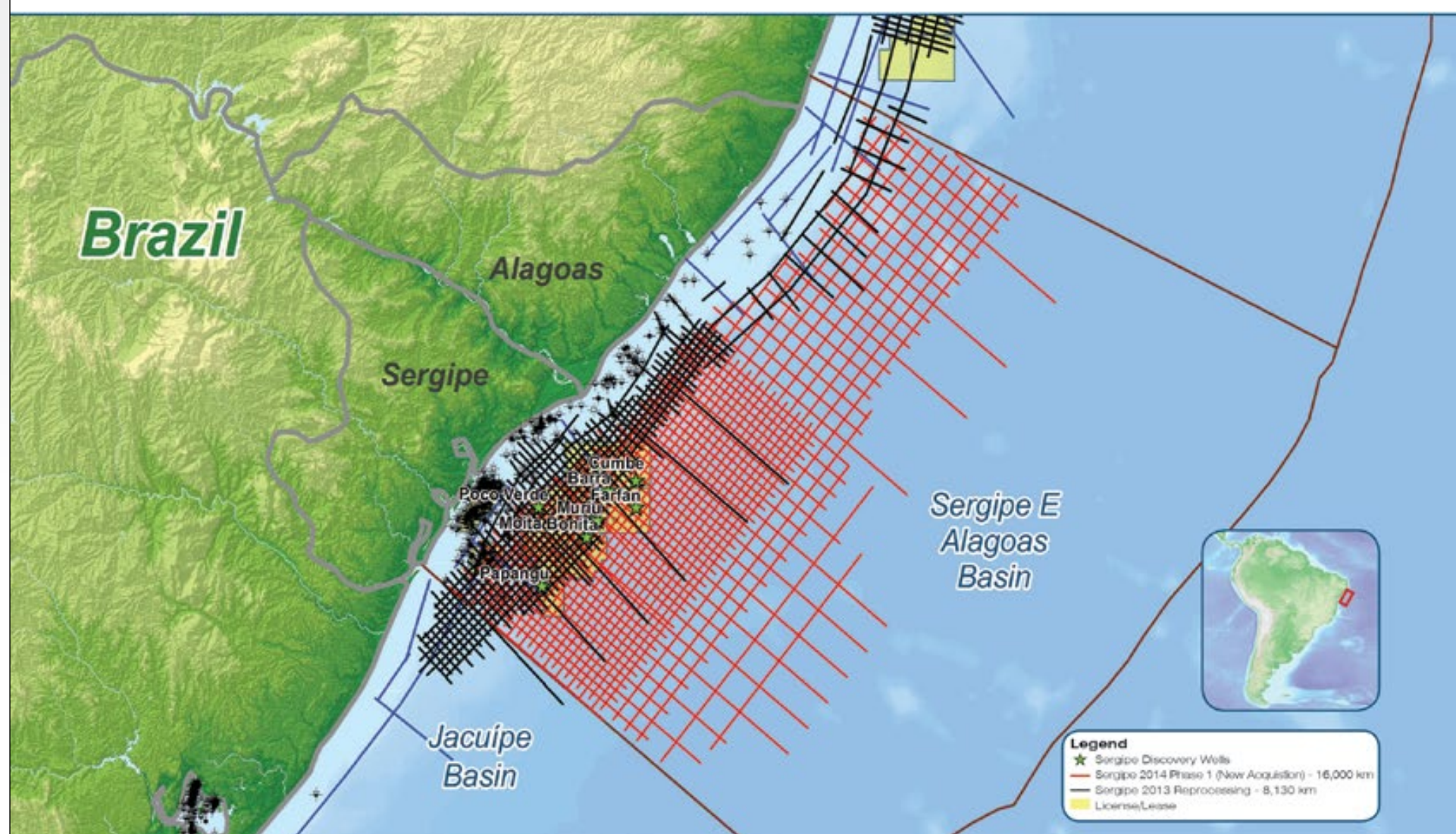
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Refraction Sparked Huge African Discoveries

By JEAN LAHERRERE

Saharan fields Hassi Messaoud (10 Gb reserves, discovered in 1956) and Hassi R'Mel (100 Tcf gas plus 2.4 Gb condensate reserves, discovered in 1957) are by far the largest oil field and the largest gas field in Africa.

Both were found thanks to refraction.

In 1947 SNREPAL (50 percent BRP and 50 percent Algerian government) decided that the Algerian northern portion of the Sahara looked sufficiently promising and attractive to launch an initial exploration program. A joint geological survey with CFP (now Total) followed, and in 1952 both companies agreed to share exploration on 12 Algerian government-issued licenses, covering 200,000 square kilometers, on a 51/49 percent basis.

The terms were tough and called for 50 percent surrender of the acreage in 1957 and another 25 percent in 1962. The choice of the operator of the checkerboard permits was decided among the companies by the roll of a dice: SNREPAL got the even numbers and CFP the odd numbers!

* * *

At that time I was a young geophysicist working for CFP.

Results from the initial gravimetric surveys in the northern part of the Sahara were poor and difficult to interpret – and the first reflection seismic surveys were essentially useless, with poor penetration because of the large thickness of dry sand on the surface and of evaporites in the Triassic formations.

At the recommendation of H. de Cizancourt, refraction seismic was then chosen, and high velocity markers (about 6,000 m/s = basement) were mapped.

The CFP exploration team was headed by Claude de Lapparent, with Gilbert Pommier, my boss, as chief geophysicist. CGG (Compagnie Generale de Geophysique) was the contractor chosen to carry out this difficult refraction survey and to interpret the data.

I sometimes have to remind today's young explorers that 60 years ago there was no GPS, and surveying was a very important part of geophysics, starting with an astronomical sun point to establish a net of beacons.

Surveying the Sahara was possible thanks to 4x4 trucks left over from World War II and aerial photos.

And despite all of these seeming limitations we found oil – and sometimes lots of it!

For refraction shooting in the Sahara we used fertilizer mixed with fuel and prime, on surface or in hole at an offset of 15 kilometers. I measured the anisotropy of the sediments in Om81 with the geophone in the basement at 3,700 meters, shooting four tons on surface. The high anisotropy in the seal of salt and anhydrite needs correction to interpret the results.

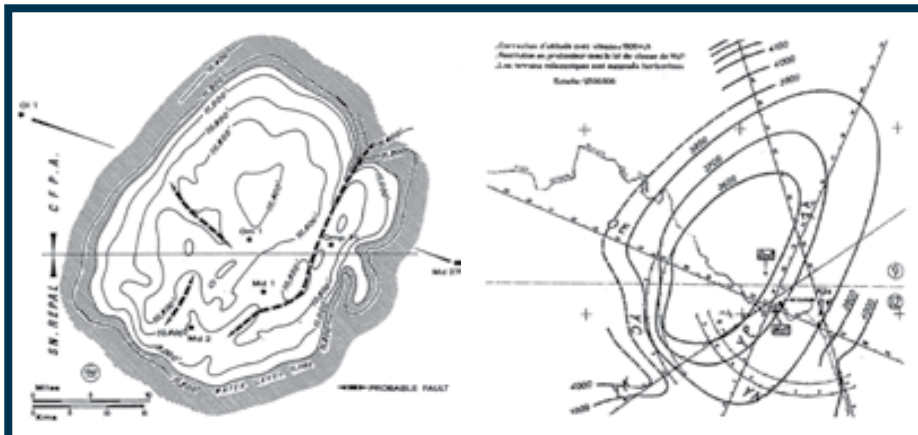
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After drilling 20 deep dry stratigraphic holes in January 1956, with only one having oil shows, SNREPAL and CFP began drilling wildcat well Md1 at Hassi Messaoud on a refraction seismic structure. They needed a well, because 50 percent of the permit areas had to be surrendered the following year.

The structure of Hassi Messaoud,



Maggy Mai, the author's wife, at the Hassi Messaoud water well 1958.



Left – Hassi Messaoud field: Isobaths of the reservoir in 1967 with the water level from Combaz 2002. Right – Hassi Messaoud structure interpreted by G. Pommier (isobaths of 5,900 m/s marker) in the proposal of Om1 well, from A. Combaz 2002.

colloquially known among the interpreters then as Pommier's egg, was mapped from several refraction lines centered on the water well Hassi Messaoud, also the site of the refraction party's main camp.

In July 1956 the first Hassi Messaoud wildcat discovered light oil (43 degrees API) in a sandstone below thick Triassic salt. The discovery was confirmed by well Om1, and the magnitude and historic significance of the find were highlighted by General De Gaulle's visit to Hassi Messaoud in March 1957.

Further drilling in the area proved the sandstone was Cambrian in age, forming a large dome draped over a granite porphyry basement. Closure is structural on the

flanks and on the crest a pre-Triassic unconformity. The field has an area of about 500 square miles (1,300 square kilometers) and an oil column of 900 feet (270 meters). Sandstone porosity, and especially permeability, is very variable and not all production wells, drilled later, were successful, even though some had initial production rates as high as 6,000 b/d.

* * *

A strange thing on Hassi Messaoud is found in Wikipedia about the origin of the name.

For the 50 years since it was drilled it was well known that the name came from

and finally deputy exploration manager.

After 37 years of worldwide exploration with Total, he retired in 1991. He is now

writing articles and giving lectures. He has written several reports with Petroconsultants and Petroleum Economist on the world's oil and gas potential and future production. He wrote with Colin Campbell The End of Cheap Oil in Scientific American March 1998. He chaired the 2002 World Petroleum Congress (Rio de Janeiro) panel on hydrates

"Economic Use of Hydrates: Dream or Reality?" He is a member of ASPO (Association for the Study of Peak Oil and Gas). He founded ASPO France in 2005. For questions or comments, he can be reached at jean.laherrere@alsatis.net.



LAHERRERE

Jean Laherrere was born May 30, 1931.

After graduation from Ecole Polytechnique and Ecole Nationale du Pétrole in Paris, he participated with Compagnie Francaise des Pétroles (now Total) in the Sahara exploration with the discoveries of two supergiant fields: Hassi Messaoud and Hassi R'Mel. He went to explore central, southern and western Australia. He was in charge of exploration in Canada for Total in Calgary where he started exploring Labrador Sea and Michigan.

After 15 years overseas, he went to Total headquarters in Paris where he was in charge successively of the new ventures negotiation, technical exploration services and research, basin exploration departments

the 10-meter deep camel water well. "Hassi Messaoud" in Arabic is translated as "lucky well," because Hassi means well and the surname Messaoud means fortunate, prosperous or happy. This water well for camels, first shown in a 1927 map, was dry by the 1950s, and the French military forces built a new one 50 meters away (with a door with an arch). This well has now disappeared and was replaced by a fake well, shown by Wikipedia.

Wikipedia asserted that the first water well was drilled in 1917 by Messaoud Rouabeh, a regional well digger. Another site says that he found "a strange liquid," which was analyzed in France then and determined to be oil, drilling a few meters with a goat horn – a bad joke!

Nowadays 600 heirs of the so-called oil finder claim rights over the field owned by Sonatrach!

Hassi R'Mel (2,400 square kilometers in Triassic sandstones) also was found on a refraction high. Its gross production of gas is high because:

► Condensate is not concerned by OPEC quotas.

► R'Mel condensate is produced at high rate (300 kb/d in 2010) with a large amount reinjected in the field, which is the base of all Algerian gas production (in 2009, 7 Tcf gross production and 3.4 Tcf reinjected).

* * *

Using Sahara experience, I did a refraction survey in the Canada Northwest territories in 1958 with dog teams, skidoos, fertilizer plus fuel explosive on surface and one helicopter to check a surface anticline at depth.

After the success in the Sahara, CFP decided to explore Australia's Simpson desert, looking for Paleozoic reservoirs.

We shot a long line (300 kilometers with 1,000 dunes) across it in 1963 (it is now used 50 years later by tourists to cross the Simpson desert, and named on the maps as the French line). We used reflection geophones to shoot long offsets in order to see the reflection events as refraction first events.

FPC Australia drilled two dry wells on the Simpson desert and decided to relinquish the permits. Later, about 20 wells were drilled in the Pedirka and Simpson basins, and they all were dry.

Our exploration of the Simpson desert was a failure as finding oil, but was a success as finding quickly and cheaply that the oil potential of these basins was very poor, thanks to refraction.

* * *

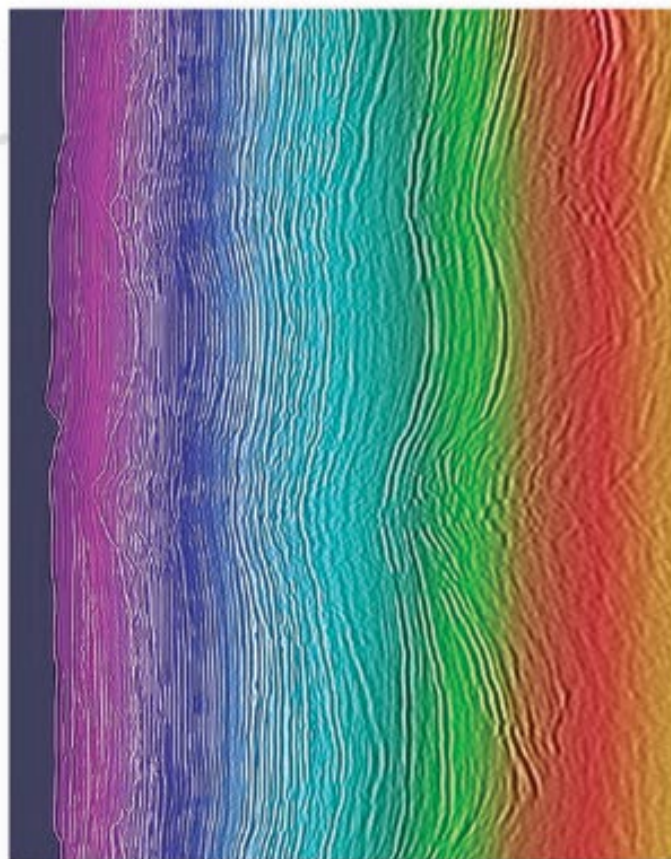
In my 2000 French paper (there's an updated 2005 translation of my "Memories and Thoughts On 50 Years of Oil and Gas Exploration") I offered lunch in the best Paris restaurant to anyone able to show me the large Hassi Messaoud structure on a reflection profile without the help of wells.

One CGG manager told me that he was going to Algiers soon and that he hoped to bring back such a profile. But few months later he told me that he was unable to find such data.

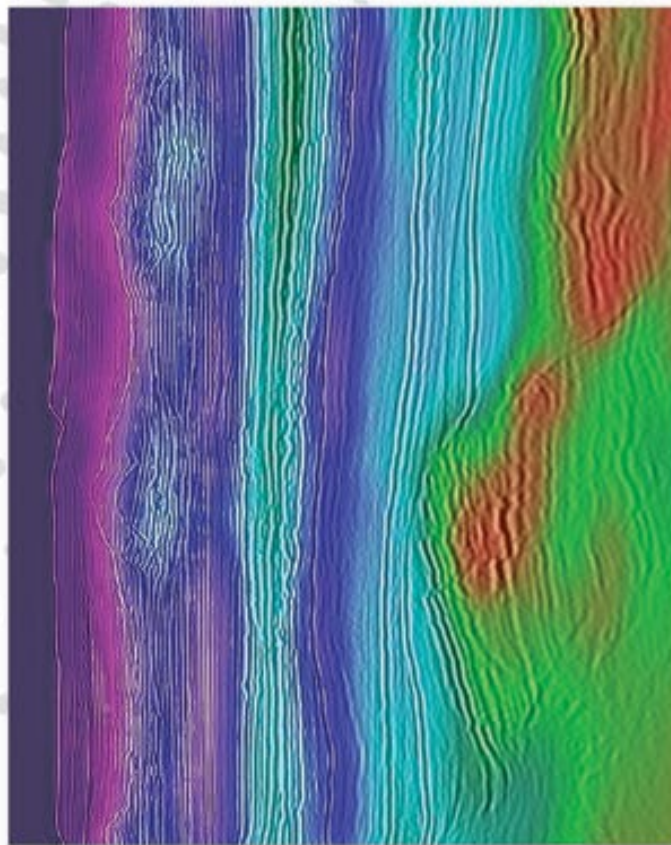
My bet is still good!

A more detailed paper with references is available on AspoFrance.org site [AspoFrance.org](http://www.aspoFrance.org) site [AspoFrance.org](http://www.aspoFrance.org) site

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State Geo Departments Struggle to Stay Afloat

By BRIAN ERVIN, EXPLORER Assistant Managing Editor

In their collective struggle to stay afloat, geology departments at state-run universities are calling upon industry to throw them a life preserver.

AAPG, among other interests within the industry, has consistently answered in the form of a multitude of grants and scholarships – but it's not nearly enough to maintain the current educational landscape, according to some educators.

"You know, we're going to get to the point one day where there's not going to be geology programs like we know them, unless we have support from the industry," said AAPG member David King, a geology professor at Alabama's Auburn University and the faculty adviser of AU's AAPG student chapter.

"Universities like mine – state universities – are now state *assisted*," he said. "They're not state *supported*, and that's true of most places. They look to outside money to make up the difference because we don't have the tax revenue support like we used to."

The Classic Squeeze

Of course, the problem King addressed is a widespread one and it's gotten plenty of mainstream media attention.

Just do an Internet search for the phrase "university budget cuts" and an endless train of news articles will show up about different universities and different state legislatures, all telling the same story: Since even before the recession, funding from states has been in steady decline while enrollment has steadily increased, forcing state-run schools to tighten their belts and scrape for savings and revenue wherever they can find it.

"This is the classic squeeze in our business," said Rick Aster, the new head of Colorado State University's Department of Geosciences.

Along with raising tuition, schools also typically cope by packing classrooms and asking faculty to do more with less, which has worked out well in some cases, but not others.

Geology programs, of course, fall into the latter category.

"You might be able to teach calculus to 500 kids with those electronic clickers on their desk, but you can't really teach field geology and not go out in the field," King said.

His comments were echoed by Aster, who explained that the field and laboratory work, as well as the quantitative and scientific intricacies of the subject, demand more hands-on teaching and learning than a simple lecture-style teaching model will allow.

"If you look at educational paradigms, our pedagogies are considered highly desirable," Aster said. "Our field camps that we've done, traditionally, are classic examples of experiential learning, where people go to the outcrop, they observe, they share, there's back-and-forth with the instructor. It's highly experiential, and that leads to great learning outcomes, but it requires a lot more effort than doing large lectures and multiple-choice computer-graded exams.

"Geosciences has a traditionally low student-to-faculty ratio, even at some of the more pressed universities," he added. "If you look at a psychology department or a big math department and so forth, those people can be pushing 30-40 undergrad students per faculty member.



KING

"You know, we're going to get to the point one day where there's not going to be geology programs like we know them."

"But the course and the traditions are different, the teaching demands are different, the laboratory demands are different and so forth," he continued. "Sometimes you worry about people making apples-to-oranges comparisons between different fields."

And that "apples-to-oranges" comparison is all too often the standard operating procedure for administrators, at least in King's experience.

"At most universities, the administrators are not scientists," he said, explaining that most administrators tend to assume that the teaching model that worked for them in their own classroom experience will work for all subjects.



ASTER

"It requires a lot more effort than doing large lectures and multiple-choice computer-graded exams."

STEMing the Problem

Adding to geoscience professors' difficulties is yet another problem that's been plaguing education and the national economy in general: A widespread lack of preparedness among students in what are known as "STEM" subjects (Science, Technology, Engineering and Math), which leaves them woefully unprepared for the demands of an undergraduate geoscience program.



DODGE

"One of the things that would help departments ... would be if they had more majors coming in – if there was more demand for the geology major."

"Certainly, we have a lot of schools where the high school science teacher doesn't have much of a scientific background," Aster said.

In fact, it's not entirely uncommon to hear about high school athletic coaches ... who also teach geology as a side-gig (that is, if the school offers a course in geology in the first place).

"Some of those people can surprise you, but a lot of them just are not trained, scientific educators," he said. "They don't know about the fact that geoscience is one of the most data-intensive, highly computational fields in the world."

So, without adequate preparation or even realistic expectations of what geology entails, university-level instructors have to

take up the slack by remediating many students in key subjects that, ideally, they would have learned in high school.

"We do have to fill that in, and there is a subset at all large schools of students who are either not particularly strongly trained in math, or who have some degree of math fear that we have to bring up to speed," Aster explained. "It's certainly something we have to address both in the core curriculum at a big university like this, and also in some of our curricular items."

"It's significant here and I suspect its significant basically everywhere," he added.

King pointed out another factor compounding the problem further: "We don't have accrediting agencies like engineers do – nobody comes in and tells

the administrators, 'Look, you need to do this with your geology program or we're going to take away your accreditation, and then the degree won't mean anything.' They don't have that in geology."

So, with the pressure of ever-decreasing funding and without clear outside guidance on how geology should be taught, school administrators nationwide typically see two options: Pack more students into classrooms and diminish educational quality, or cut the program entirely.

And because of the higher price tag associated with teaching geology relative to other subjects, it's usually the most conspicuous target when administrators have to find places to make cuts.

"They'd rather have courses where they don't have labs, but that's not a science," King said. "You can't get a degree like that."

Consequently, as explained by AAPG member Rebecca Dodge, associate professor of geosciences at Midwestern State University in Texas, geology programs and other science departments are increasingly becoming an endangered species in higher education – especially if enrollment in the program is low in the first place.

"Honestly, if you're in a state college,

like I am, the state organization that looks at departments on state universities all over Texas a couple of years ago started looking at how many students were graduating with degrees in geology or chemistry or math or whatever, and they just about did away with the chemistry program," she said.

"Geology and environmental science combined into one program, because we were graduating enough people, but they killed our physics program," she added. "And this can happen, and has happened to geology departments."

And if schools start cutting geology departments, King said the damage would be all but impossible to reverse.

"It could be another geology department that's gone, and there's nothing we can do about it," he said. "Once a program like that is gone, they never bring it back ... Once it's gone, it's gone."

It Takes an Industry

Without hope in sight for any significant reversal in state funding trends, geoscience educators like King, Aster and Dodge are looking to the private sector to alleviate some of the pressure.

And to some degree, that's already begun to happen.

"AAPG is providing scholarships this summer for 17 teachers from across the nation to take an online course on 'Teaching Earth Science at the high school level,'" Dodge said.

The American Geosciences Institute is offering the course, paid for by scholarships provided by the AAPG Foundation, and it's hosted by the Illinois Institute of Technology, using their online course software.

"This a course for high school earth science teachers, and it's designed to make sure that earth science, in the states where it's taught at the high school level, is taught really well," said Dodge.

Dodge developed the course and is the co-instructor of record, along with an instructor from AGI.

The course is a pilot program, with a national rollout planned for later this year.

As participation in the course increases, Dodge said it will prepare high school students for college and graduate-level geoscience courses by equipping their teachers in high school, and it will increase enrollment in those programs.

"One of the things that would help departments that don't feel they're getting the resources that they need would be if they had more majors coming in – if there was more demand for the geology major," she said.

"Some of these high school students, when they're in high school, can figure out that they want to be a geology major. And, it's designed to encourage more high school students to become geology majors and to think of that as a valid career choice, and that will benefit departments with low enrollments, and even departments with high enrollments will get more students," she said.

Of course, higher enrollment has been part of the overall problem threatening to drive geology programs to extinction, but not all enrollments are created equal, as Dodge explained.

"My experience has been, on several different college campuses, that very few students sign up to be a geology major in their freshman year. They decide that they'll

See Education, page 53

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Integrated Data Enhance Dolomite Mapping

By RITESH KUMAR SHARMA, SATINDER CHOPRA and AMIT KUMAR RAY

Carbonate sedimentary rocks that have been dolomitized and laterally sealed by tight undolomitized limestone frequently are seen to produce hydrocarbons. The process of dolomitization increases the crystal size and pore size, and thus enhances its porosity and permeability.

As dolomites are less ductile relative to limestones and sandstones, their porosity and permeability also are enhanced by fracturing.

Additionally, as they are less reactive than calcites, dolomites are less likely to lose porosity with depth due to dissolution or re-precipitation. For this reason, dolomites often make better reservoirs in carbonates.

Of course, the reservoir geometry usually depends on the process of dolomitization and stratigraphic architectures – however, the differentiation between limestones and dolomites is a challenge.

The purpose of this article is to describe a workflow for discriminating limestones and dolomites, and to map the lateral extent of dolomite reservoir rocks that have a thickness below the seismic resolution.



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The Basics

One accepted model for dolomitization is that when hot magnesium-rich brines flow along conduits (faults and fractures) in limestone rocks, hydrothermal dolomites and the associated minerals and fabrics are formed.

For the Upper Ordovician Trenton and Black River carbonates, in eastern Canada the magnesium required for dolomite precipitation was supplied by magnesium-rich seawater-derived (Silurian and/or Devonian) saline waters from the dissolution of Silurian evaporates. These waters became heated during their descent along faults and fractures to reservoir depths at the center of the basin. Hot basinal brines migrated laterally through basal sandstones, ascended into the network of faults and fractures and precipitated fracture-related dolomite.

Compared with clastic reservoirs, the characterization of dolomite reservoirs presents challenges, because many of the conventional methods – comprising attributes such as Lambda-Rho and Mu-rho – are not very effective. Consequently, we need to look for alternative methods for their characterization.

While making measurements in the wells (logging), the latest density logging tools make it possible to differentiate between dolomites and limestones using the photoelectric index log. The tool has a gamma ray source that emits the radiation, which enters the formation (about an inch or so), gets scattered and loses energy.

The intensity of the back-scattered

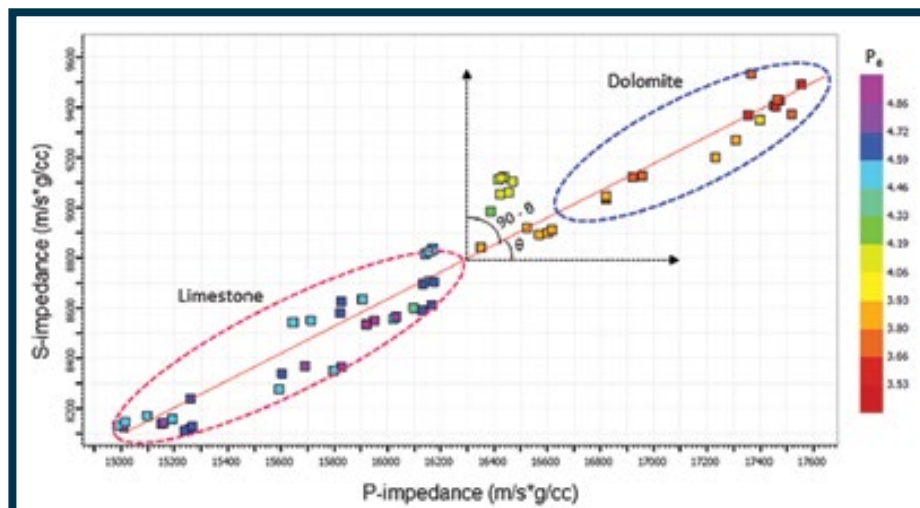


Figure 1 – Crossplot between P-impedance and S-impedance, color-coded with P_e values. The blue and red ellipse encloses the points with low and high values of P_e corresponding to dolomites and limestone, respectively.

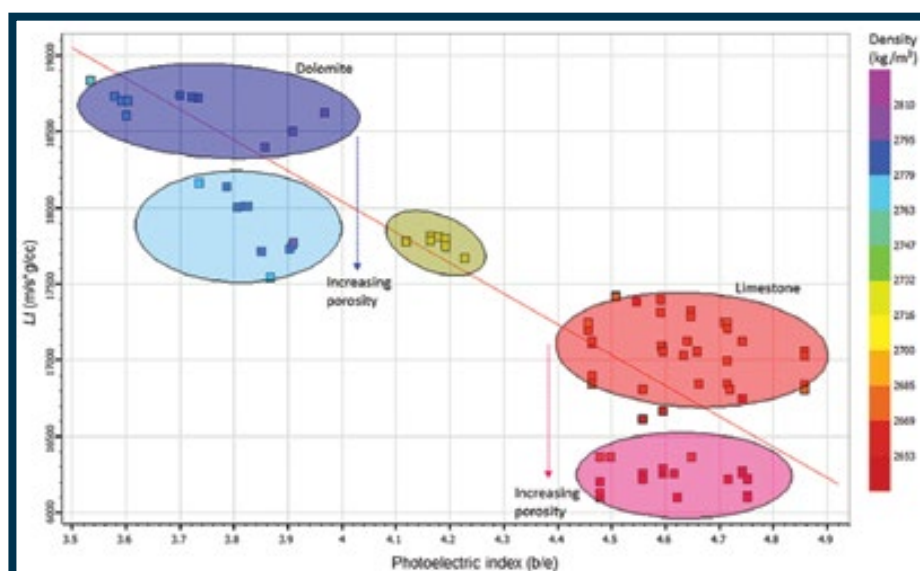


Figure 2 – Crossplot between LI and P_e for well log data in the zone of interest color-coded with density values. The scatter of points exhibits a linear relationship. The blue and red ellipses enclose the points with low and high values of P_e corresponding to dolomite and limestone, respectively.

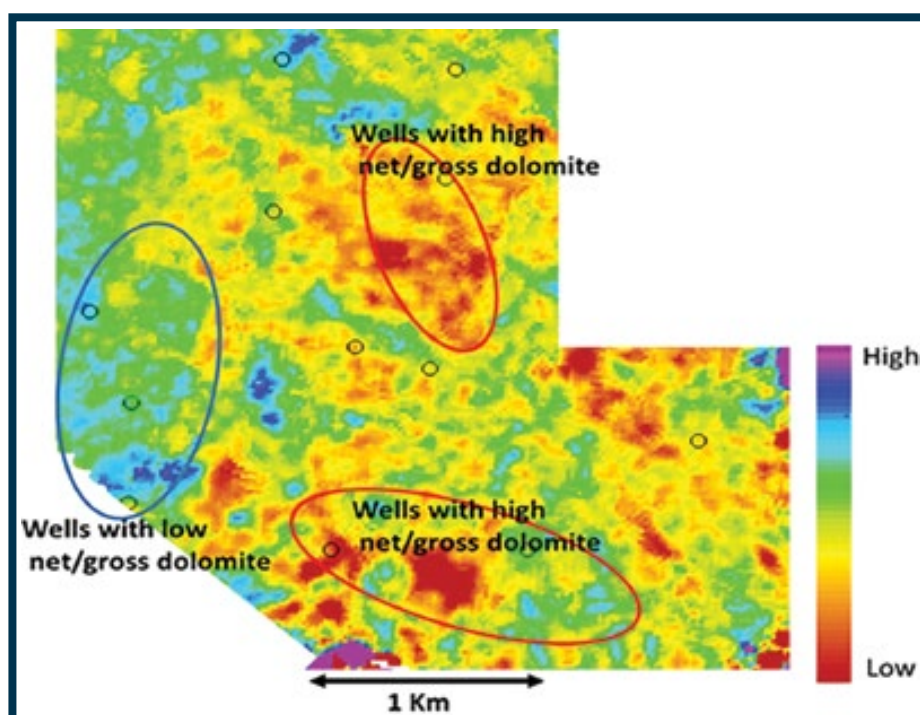


Figure 3 – Horizon slice from inverted P_e data. The predicted response correlates fairly well with well data.

radiation is picked up by the detectors installed on the tool.

While the higher energy part of the back-scattered radiation is related to the density, the low energy component is a measure of the average atomic number of the formation or the rock matrix properties (lithology).

Fluids have very low atomic numbers, and so have little influence – the limitation, however, is the availability of P_e curves only at well locations.

As there is no direct way of computing a 3-D volume of P_e from seismic data, we look for an indirect way of computing it.

The Method

We demonstrate an integrated workflow in which well data and seismic data from eastern Canada are used to discriminate between limestone and dolomite.

The workflow begins with the generation of different attributes from the well-log curves. As shown in figure 1, using the crossplot between P-impedance and S-impedance, color-coded with P_e values, the blue and red ellipses are drawn corresponding to points that have low and high value of P_e to identify the dolomite zones.

Instead of using these two separate attributes, it is possible to differentiate between limestone and dolomite by rotating the clusters in a counterclockwise direction. Such a rotation leads to new attribute, namely lithology impedance (LI), which incorporates lithology formation and can be defined as $LI = I_P \sin \theta - I_S \cos \theta$, where θ is the angle of the regression line intersection with the horizontal axis (figure 1).

The purpose of generating this attribute (LI) is to be able to use a single attribute for distinguishing the dolomites from limestones.

Next, to be able to derive the P_e attribute from seismic data, we investigate the relationship between the LI and P_e well log curves. Such a crossplot is shown in figure 2, where one can notice a linear relationship in the scatter of points, which are color-coded with density.

Such a relationship between LI and P_e curve is deduced from the crossplot and then used for obtaining P_e volume from the seismic data.

An important observation one can make from figure 2 is that LI can be used to distinguish the dolomite from limestone. The dashed blue and magenta lines on this crossplot show the effect of porosity for dolomite and limestone respectively.

For deriving these attributes from seismic data, we begin with the prestack seismic gathers. After generating angle gathers from the conditioned offset gathers, the P-reflectivity, S-reflectivity are derived using Fatti's approximation to the Zoeppritz equations. Due to the band-limited nature of acquired seismic data, any attribute extracted from it will also be band-limited, and so will have a limited resolution.

As the target dolomite reservoir is thin, it is necessary to enhance the resolution of the seismic data. For this purpose, thin-bed reflectivity inversion (see 'Thin-Bed Reflectivity Inversion and Some Applications,' May 2008 EXPLORER) was run on the two reflectivities and then filtered back to a bandwidth that is higher than the input data bandwidth.

These filtered thin-bed reflectivity data are next inverted into P-impedance and S-impedance. Once these impedance volumes are obtained, it is possible to compute LI.

Using the relationship between LI and P_e established from the well, we transform the LI volume into a 3-D volume of P_e , and use that to infer the dolomitic zones. To map the dolomite zones laterally, a horizon slice of P_e volume over a window that includes the zone of interest was generated.

A part of that horizon slice is shown in figure 3.

It has been found that throughout the 3-D

Continued on next page

Education from page 50

major in geology after they take a geology class and they really, really enjoy the field trips or the lab or something. So, they change majors to geology," she said.

"What that means is that it takes them more than four years to graduate," she said, "and that makes the geology department look like it's not doing a good job."

Not appearing to be doing a good job, of course, puts a department on the chopping block when budget cuts need to be made.

"That's just one part of the puzzle to help departments that feel like they're under pressure because they don't feel like they have enough majors," Dodge added.

Help Wanted

There are, of course, many more puzzle pieces needed from the industry to restore geoscience departments to their once-proud stature.

And money, of course, is great for buying puzzle pieces, among other much-needed instructional tools.

"One thing that that oil companies, large and small, can do for U.S. geology programs – assuming they want them to be around for the future – is to actively support such programs with funds and employment contacts," King said. "This needs to go on outside the oil patch. Grant support to faculty is also critical; and student internships. Just the Imperial Barrel Award is not enough."

King wants more than just financial support from the industry, though. Hand-in-hand with that, he said, would be active communication with administrators to convey the needs of the industry, and what a quality education in the geosciences should look like.

Also, Aster listed a few different areas in which the industry could help:

- ▶ More (paid) summer internships.
- ▶ More scholarships (like those offered by AAPG).
- ▶ More research funding.
- ▶ Endowed funds for research or specialized faculty expertise in particular areas.

Continued from previous page

area the predicted P_e response within the reservoir interval correlates fairly well with the net to gross dolomite within the same interval.

Conclusions

Rotation of data in P-impedance versus S-impedance crossplot space facilitates the computation of a single attribute known as lithology impedance (LI) that yields information about lithology discrimination within the formation. It was then used to transform the inverted P-impedance volume into a 3-D P_e volume.

The derived P_e volume was analyzed, and a fairly good match was seen at the blind wells.

It was found that throughout the area covered by the 3-D seismic volume, the predicted P_e response within the reservoir interval correlated fairly well with the net to gross dolomite within the same interval.


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

(Editor's note: The authors all are with Arcis Seismic Solutions, TGS, Calgary, Canada.)

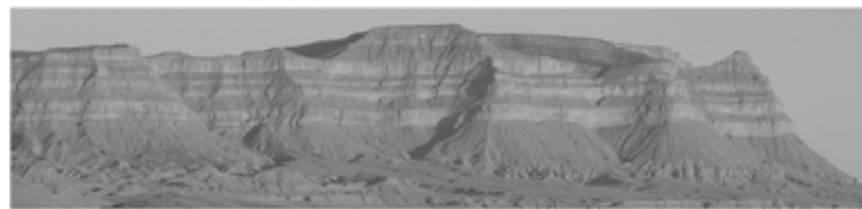
"We would love to see more private sector involvement (and there are all sorts of win-win arrangements) if the people in the various communities were highly motivated to increase their number of high-quality résumés and hires," Aster said.

"That said, it's not a panacea. It's part of a set of solutions for addressing the challenges and stress points for higher education," he added.

King said that kind of involvement happens more near major areas of oil and gas production, but it's not sufficiently widespread to preserve the current state of geologic education.

"If we want only those big schools near the oil patch to be the ones that survive with geology programs, and that's good with everybody, we can just keep going down this same path," he said. "But I think it's good to have diversity and different kinds of geology programs." 

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AAPG Region Leadership

Q&A with Keith Gerdes

BY HEATHER SAUCIER, EXPLORER Correspondent

Keith Gerdes is the current president of the AAPG European Region, and as such will be making some remarks in the opening ceremony for the AAPG International Conference and Exhibition, set Sept. 14-17 in Istanbul.

This article is part of a continuing EXPLORER series on the people who comprise AAPG Region leadership around the world.

EXPLORER: *Where were you born, brought up and educated?*

GERDES: I was born not far from the site of the Olympic Stadium in the east end of London and grew up in Dagenham in Essex. The area had a transitory and multi-cultural population that was continually replenished with groups from all over the world, and I think that initially sparked my interest in geography and travel.

It was a busy and exciting area to grow up in – devoid, however, of any inspiring landscapes to ignite a passion for geology. The people and their achievements were an inspiration, however, and the area produced an impressive array of talent during my childhood – World Cup winners, Olympic Gold medalists and Hollywood actors all grew up within a kilometer of my home. As children we grew up believing that if you worked hard, stayed out of trouble and were given the right opportunities you could achieve surprising results.

I attended my local primary and comprehensive schools – the latter was a busy place with over 2,500 children. I was a typical sports-mad child with football as my main interest, and from an early age I was training with a professional club and was chosen to represent London and my county. I was still focused on sport and

playing semi-professionally in my final year at school when I came under the influence of some excellent, motivated teachers who encouraged me to develop my interest in science and think about continuing my education at university.

I then went to Durham University where I graduated with a degree in geology and geophysics.

During my undergraduate course I was fortunate enough to be selected for a research cruise to eastern Greenland and the North Atlantic. The experience of mapping sea floor spreading anomalies really got me hooked on the puzzle of how the Earth worked.

I subsequently applied for a doctorate unraveling the tectono-stratigraphic evolution of the Red Sea and Gulf of Aden. This involved two seasons of geological and geophysical fieldwork in the Eastern Desert of Egypt and a three month research cruise along the Red Sea and Gulf of Aden, docking in Port Said, Djibouti and Bombay along the way.



GERDES

I loved the combination of travel, often to challenging new places, meeting new people and trying to unravel the complexities of how the Earth worked, and I hoped to find a job which could provide opportunities to follow my interests.

EXPLORER: *Who and what were early influences in your life?*

GERDES: My parents were obviously a major influence when I was growing up. They had been evacuated from London during the Blitz and that had completely disrupted their childhood. They saw education as a privilege and an opportunity. They continually supported my sister and me in everything we did and encouraged us to make the most of every opportunity.

I also have been influenced by two other outstanding personalities that I have remained friends with over the years.

The first major influence was Sam Ramsammy, one of my schoolteachers and now an executive board member of the International Olympic Committee. Our headmaster was an avid anti-Apartheid campaigner, and when Sam was given 48 hours to leave his homeland, our teacher sheltered him in exile. Whilst in hiding Sam led the drafting of the Gleneagles Agreement,

which ostracized the Apartheid regime from international sport and was the first step in disengaging the regime from the international community. He was a model of dignity and humility with a great generosity of spirit despite being separated from his family and friends for decades.

Sam returned to his homeland with the ending of apartheid, and in 1992 became the manager of the first post-apartheid South African Olympic team. Sam's actions and personal sacrifice played a direct role in changing the lives of millions of people. His quiet determination to stick to his beliefs, fight injustice and improve the lives of people at often significant cost to himself is a constant inspiration.

My other early influence was another great educator, Tony Maxwell, who came into a tough London comprehensive and managed to make academic achievement "cool" – no mean achievement. He was passionate about providing opportunities for his charges and nurturing their potential, and was awarded an OBE for his services to education.

EXPLORER: *What made you join Shell – and when?*

GERDES: After completing my doctorate entering the energy industry

See Gerdes, page 56



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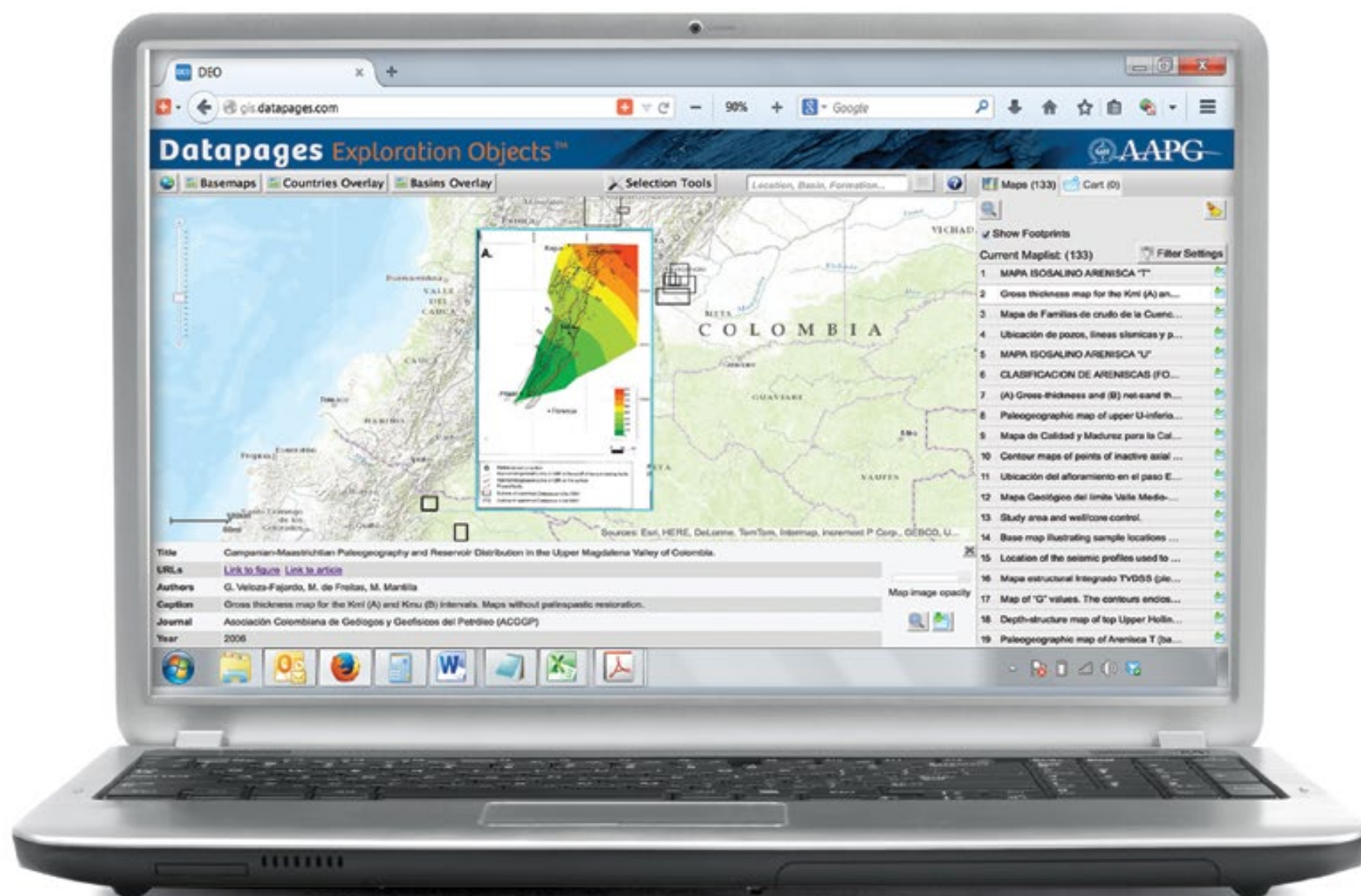


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Gerdes from page 54

just seemed a natural progression. At the time Shell's reputation for geoscience excellence was unsurpassed – there were outstanding geoscientists in exploration and research whose work and ability to find oil and gas was respected the world over. Shell also had a reputation for treating its staff very well and nurturing talent, so it was an attractive proposition.

I subsequently left the company to further my career and then was invited to rejoin in 2003 when global exploration was reformed. I have worked in the global exploration head office assessing new venture business opportunities ever since.

EXPLORER: *What have been your key jobs to date?*

GERDES: I have been fortunate enough to have covered a broad spectrum of exploration and production roles, and I use elements of all that experience in my current role. My first role as a development geophysicist in a very active production department was a great place to start. This job gave me early exposure to the processing and interpretation of seismic data constrained by wells, well and seismic operations (onshore and offshore) and the drilling of oil and gas discoveries. I also was able to follow discoveries through to field development and appreciate the commercial and engineering aspects of a project lifecycle.

I then moved into a more new ventures role specializing in play-based exploration, basin analysis and sequence

stratigraphy. This role also had the responsibility of creating and delivering geoscience courses both as lectures and in the field. I worked with some great geoscientists and visited some iconic field locations around the world. I found the global application of PBE fascinating and one of those applications led to the discovery of a new play in a frontier basin that delivered in excess of 5 TCF.

I then worked as an exploration manager responsible for all aspects of comprehensive, well-funded exploration programs. Initially this role covered a number of license blocks in a few countries but it eventually developed into a regional role assessing exploration, development and production new business opportunities in Europe, Africa and the Middle East. I was basically responsible for most aspects of a functioning exploration office, ably assisted by a great team of consultants – from the purchase of computing systems to the design of work program budgets and the negotiation of contracts and, eventually, the interpretation of the datasets that had been acquired and processed to identify drilling locations.

I also was responsible for the HSE of all onshore and offshore operations. In that environment the quality of the business and corporate relationships you build is critical and I learned a huge amount about the greater industry, the character of different companies and the management of people.

I eventually moved back to Shell and have been involved in new venture and play development ever since. I have found the breadth of my experience to be very useful when evaluating new upstream business opportunities.

EXPLORER: *What makes you "tick" in a job?*

GERDES: That's easy – finding oil and gas. Sometimes explorers can lose sight of the fact that this is what we are here for, expanding the company asset base.

In the course of my career I have been fortunate enough to see my work lead directly to the opening of four plays in four different frontier basins on four different continents. Each one had the potential to transform the economies of the countries involved. There are not many professions that offer the opportunity to have such a positive effect on the lives of so many people.

I suppose I am still fascinated by the subsurface puzzle and feel privileged to have worked with some incredibly talented, motivated and enthusiastic people. I also enjoy mentoring the younger staff and interacting with academia – I co-supervise a number of doctorate students and serve on Industrial Liaison Boards at three UK universities.

EXPLORER: *Tell us about your current role – the responsibilities, expectations, challenges.*

GERDES: My current role in new play development is to identify new business opportunities that have the potential to be material for a company of the scale of Shell. As the business world gets smaller and the competition from NOCs and niche exploration companies becomes more intense, such opportunities become increasingly more difficult to find. The challenge in our team is to combine the best forensic geoscience with our collective global experience to discipline our subsurface


creativity in the search for new plays.

The great thing is that it is still possible to succeed – work by our team identified the farm-in opportunity onshore Albania, which led to the drilling of the oil discovery announced in Q4 2013.

EXPLORER: *Tell us about your role as president of the AAPG European Region.*

GERDES: As president, I am effectively the CEO of the Region, which has a significant budget and an office in London with five extremely hard-working staff. Together with a great team of volunteer AAPG members they organize various conferences, educational events and workshops in places from Lisbon to Georgia. The London team look to our Executive Committee for guidance on managing the budget, what events to hold and where they should be held, what subjects should be covered and the "evergreening" of the substantial education program.

The position also has a significant role in representing the industry to the public – I am regularly asked to present to a wide variety of groups and I already have acted as an industry expert on review boards for the UK government on the distribution of research funds in the oil and gas sector. Our industry has the potential to transform the economies of countries and improve significantly people's lives by finding new sources of energy.

I enjoy the challenge of getting that message across to the broader public, particularly the younger generation, and try to engage and inspire the scientists of the future to consider a career in the energy industries. 

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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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IN MEMORY

Ruth A.M. Schmidt, who earlier this year was the first woman recognized by the Professional Women in Earth Sciences (PROWESS) in its program of honoring AAPG's first 100 female members, died March 29. She was 97.

Schmidt's career, especially her often dramatic work in Alaska, was the subject of articles in the April EXPLORER.

Jack W. Bessellieu, 80

Fair Oaks Ranch, Texas
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Otto J. Buis, 83

Fort Worth, June 10, 2014

Maxwell Clinton Cater, 85

Conwy, Wales, March 14, 2014

Jack Remo Century, 84

Calgary, Canada, April 18, 2014

Milton Orville Childers, 85

Aurora, Colo., April 24, 2014

William Atlee Clement, 66

Edmond, Okla., Sept. 8, 2013

Robert Alan Cohan, 57

Bakersfield, June 3, 2014

Robert Norman Davids, 75

Crossville, Tenn., March 31, 2014

Ross Elmo Dawson Jr., 78

Houston, Nov. 22, 2013

Shelby Mirle Eddington, 84

Fort Lauderdale, Fla.

April 24, 2014

Robert Randolph Evans, 84

Wichita Falls, Texas, Feb. 4, 2014

William Jack Ford, 85

Williams Bay, Wisc., July 11, 2014

Laurence Bruce Forney, 89

Houston, June 11, 2014

Timothy Lee Hanson, 55

Duncan, Okla., June 18, 2013

Robert Eugene Harpster, 83

Oakland, Calif., March 8, 2014

Robert William Kretzler, 88

Midland, Texas, Nov. 12, 2013

Peter Lehner, 87

Richterswil, Switzerland

Oct. 27, 2013

Kenneth Eugene Masters, 84

Conroe, Texas, July 26, 2014

Dennis Stoddard McMurdie, 74

West Valley City, Utah

Sept. 29, 2013

Robert R. Miller, 81

Houston, April 24, 2014

George Morrison Nevers, 81

Houston, March 9, 2014

Paul W. Nygreen, 88

Walnut Creek, Calif., Nov. 11, 2013

Richard Calvin Peryam, 93

Goliad, Texas, April 28, 2014

Gerald Wayne Pybas, 77

Kilgore, Texas, May 2, 2014

Gary Richard Reagan, 82

Lafayette, La., Jan. 15, 2014

Gordon Arthur Robertson, 79

Calgary, Canada, May 25, 2014

Ruth A.M. Schmidt, 97

Anchorage, Alaska, March 29, 2014

Sarfaraz Uddin Siddiqui, 63

Islamabad, Pakistan, July 18, 2014

John H. Van Amringe, 81

Pasadena, Calif., May 24, 2014

Robert William Waring, 85

Oklahoma City, June 9, 2014

William Robert Webb, 83

Williston, N.D., June 28, 2014

Peter A. Ziegler, 85

Binningen, Switzerland

July 19, 2013

(Editor's note: "In Memory" listings are based on information received from the AAPG membership department.)

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The Role of Industry in Developing YPs in Canada

By CAROL CAIN MCGOWEN

Whether upcoming young professionals work with companies exploring the Atlantic Margin potential of offshore eastern Canada or the ever-challenging unconventional plays in Alberta, the stakes are high for university graduates and young professionals pursuing energy industry careers in Canada.

With the impending exit from the global petroleum industry work force by retirement age geoscientists, companies are stepping up their recruitment efforts at many universities.

Since taking on the role of co-chair for



WACH

the International Barrel Award Program (IBA) in 2012, AAPG member Chuck Caughey has talked with representatives of many companies who are either recruiters

or senior level explorationists serving as industry judges for the global annual IBA competition.

Caughey observed that in Europe and

"Students do not need a master's degree to obtain a professional position in Canada in any sector, petroleum, mining or environmental."

the United States, industry tends to recruit from graduate programs, while in Canada industry recruits a significant number of undergraduates.

"In my experience," Caughey said, "most large independents and majors in the United States hire at the master's and doctorate levels, whereas more students are hired at the bachelor's level in Canada."

The reason for the difference, he explained, is that in Canada undergraduate students following a prescribed program are eligible for professional accreditation as professional geologists/ geophysicists.

Professional accreditation is regulated by each Canadian province. In Alberta, for example, the Association of Professional Engineers and Geoscientists of Alberta (APEGA) sets practice and ethics standards, registers professional geologists, geophysicists and engineers and confers the designations P.Eng., P.Geo., P.Geol., P.Geoph.

Only those individuals licensed with APEGA can practice or use titles relating to these professions in Alberta.

"Students do not need a master's degree to obtain a professional position in Canada in any sector, petroleum, mining or environmental," said AAPG member Grant Wach, a professor of petroleum geoscience at Dalhousie University, in Halifax, Nova Scotia, and recipient of the 2012 AAPG Foundation's Professorial Award.

"In fact, students enter these fields directly after completion of their undergraduate degree," he added.

As Wach explained, professional registration in Canada ensures that universities have industry feedback – professional associations like APEGA are legislated by their province and directed by councils of industry professionals.

Professional associations provide direct input on university curriculum development, and as Wach noted, "associations like APEGA keep universities current on government and industry's expectations for undergraduate training as accredited professionals."

In Canada, standardization of professional skills is stressed and students are encouraged to apply with professional organizations like APEGA for registration as a geologist or engineer-in-training. Then, with five years' experience and proof of education competency, graduates become registered professionals.

By comparison, the AAPG Certified Petroleum Geologist designation requires 10 years of industry experience and does not have a standard curriculum requirement.

Canadian undergraduates are offered a number of opportunities through internships. All universities in Canada have a built-in structure to the academic calendar that results in a longer break period. Canadian universities offer classes over the same number of weeks as schools in the United States, but Canadian schools finish classes by early May, allowing a full four months for internship opportunities.

Other career advantages offered by several Canadian universities include specific co-operative education courses that give students training in interview skills and how to develop resumes and placements with employers.

The result? "Employers come to Canadian universities and post positions,"

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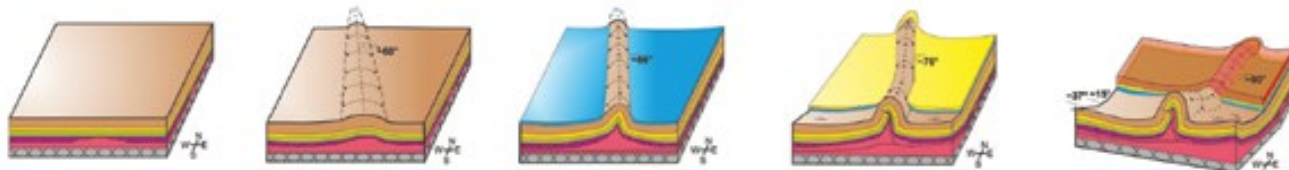
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Balancing, restoration, and palinspastic reconstruction

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

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

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



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

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

The submissions will be processed according to the following timeline:

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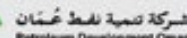


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- Estimating Reserves in Unconventional Reservoirs, John Seidle (MHAUSA)
- Reliable Technologies, Sarah Saltzer (Chevron)
- SEC Reserve Reporting Standards, John Hodgins (SEC)

Goals

The Reserves Forum will focus on global reserve estimates; on making rigorous, consistent and statistically valid reserve estimations; on examining the engineering component of reserve assessment, providing information on compliance and reporting requirements.

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PROTRACKS

YPs Thrive in SE Asia

By REETU RAGINI and SARAH SAUSAN

AAPG Young Professionals (YPs) in the Asia-Pacific Region are quickly moving toward establishing a strong YP group in Indonesia.

The growing success of this group was exemplified at the Indonesian Petroleum Association Convention and Exhibition (IPA Convex), held in May in Jakarta – 150 students representing 14 Indonesian Student chapters, 32 YPs and 15 “expats” participated in several activities organized by the AAPG Indonesian Student Chapter (SC) and the Asia-Pacific YPs.

On the convention's first day, the AAPG YP-SC exhibition hall booth was inaugurated in conjunction with the organizing meeting of TESEP (Teacher Earth Science Education Program), which was attended by AAPG House of Delegates chair-elect Robert Shoup.

As YPs Dwandari Ralanarko and Putu Ayu Saraswati explained, TESEP is a geoscience guest lecture program in Australian universities that will be implemented in Indonesia as AP-GEP (Asia Pacific-Geoscience Education Program).

During the following two days, students and YPs were given the opportunity to interact with industry mentors, which included many illustrious AAPG faces. During the sessions, each SC was given 30 minutes to give a poster presentation of their latest campus activities. These presentations were followed by networking opportunities, where participants exchanged knowledge and experiences on various geologic topics.

The program also included three YP talks, by Bagus Priyanto, Dwandari Ralanarko and Amin Ahlun Nazar, which



RAGINI



SAUSAN

revolved around the speakers' experience and included advice on leadership, organization, student chapter operation and technical knowledge on geology and geophysics.

Scientific papers also were presented

in the IPA technical session by YP speakers.

Asia-Pacific president, Peter Baillie, joined AAPG vice president-Regions, John Kaldi, Shoup and AAPG members Herman Darman and Robert Morley for a panel discussion, where all shared their experiences and commented on various challenges they've encountered while working in the Industry.

Darman also presented a career talk in which he gave valuable tips to the student and YP attendees on developing professional skills.

Baillie presented three student chapter awards on the event's final day:

► Outstanding Student Chapter Award – the Universitas Pembangunan Nasional “Veteran” Student Chapter.

► Honorable mention – the Universitas Padjajaran Student Chapter.

► Honorable mention – Universitas Gadjah Mada Student Chapter.

Baillie also acknowledged the Universitas Padjajaran Student Chapter for winning second place in the AAPG SC video contest held earlier this year.

We're thankful to all the AAPG members who helped make this event a memorable one for our YPs and students.

(Editor's note: Reetu Ragini is the Asia-Pacific Region's YP Lead; Sarah Sausan, also an AAPG member, is a student at Universitas Gadjah Mada, Yogyakarta, Indonesia.)

Industry Shift
from page 58

Wach said. “Students in co-op programs have first crack at these positions.”

As senior industry staff numbers diminish through retirements and as the world's energy resources become increasingly more difficult and costly to find and produce, universities may see a shift in expectations from industry.

Skyrocketing costs associated with drilling and producing deep offshore wells or wells producing from extremely tight reservoir rocks may drive industry to realign training budgets at the expense of field schools that emphasized sedimentology, stratigraphy and structure. And as more and more experienced geoscientists reach retirement age, companies have fewer mentors available for training and supervising recent graduate hires and early career professionals.

With this shift away from high cost in-house field schools combined with the loss of senior personnel who can lead the schools, Susan Nash, AAPG director of education and professional development, sees the shift in demand for AAPG field courses from companies doing business in Canada and elsewhere.

“Some of our field seminars that are

directly applicable to the skills used in exploration and drilling are in higher demand than ever,” she said. “For example, we have a course led by Keith Shanley that involves traveling to the Book Cliffs to show correlations between outcrops and sequence stratigraphy. It's very helpful for geologists after they return to the office and are involved in planning and geosteering wells.”

Wach notes another kind of shift, as industry recruiters from the United States make their way up the Atlantic Coast past prestigious universities like Harvard and MIT to recruit Canadian students.

“In the past,” Wach said, “industry would come to universities asking who were our brightest students ... they were not concerned about which geoscience discipline students were pursuing.”

Wach described a shift in skills that industry expects universities to provide away from workstation skills toward a greater emphasis on basic skills in petroleum geoscience.

“Now I see that industry wants ... students with outcrop and field experience,” he said, “along with sedimentology, stratigraphy, structure and sedimentary petrography. But field camps are expensive, and universities need to keep these vital programs alive.”

Military veterans scholarship program

Hiring Our Heroes

By HEATHER ANDERSON

The field of geoscience has a long history of military veterans in its ranks, including U.S. Navy Rear Admiral Harry Hess, the father of plate tectonics; Army Lt. Col. Michel T. Halbouty, former AAPG president; and former Marine George Asquith, world famous petrophysicist.

Asquith served in the U.S. Marine Corps from 1956-59 and said during those years he "learned many things – but the two most important were discipline and the importance of the individual contributing to the group."

After his stint in the Marines, Asquith studied geology at Texas Tech University and then went on to the University of Wisconsin where he received his master's in 1963 and doctorate in 1966, both in geology. Since then Asquith has enjoyed many successes in industry and academia, including receiving the AAPG Distinguished Lecturer award and becoming AAPG's best-selling author.

"My three years in the Marine Corps were without a doubt very important to me throughout my career," Asquith said.

Today, a new generation of veterans is entering the work force, which is a great opportunity and resource for a petroleum industry continually looking for educated, disciplined and motivated workers to fill the positions of retiring baby boomers.

One such "new" resource is ExxonMobil geoscientist and AAPG member Earl Wells, who enlisted in the Marine Corps after high school and served as a squad leader in Iraq. After returning to the United States, Wells was selected for Marine Corps officer training and remained on active duty while attending North Carolina State University, majoring in geology.

In 2008, Wells was commissioned as a Marine Corps second lieutenant through the Marine Enlisted Commissioning Education Program (MECEP). He then served as a Naval ROTC instructor at N.C. State while pursuing his master's in geology.

Earl was honorably discharged from the Marines and joined ExxonMobil in 2012. His successful journey from enlisted Marine to petroleum geoscientist is "entirely due to the character, strong work ethic and discipline instilled in me by the Marine Corps," Wells said.

Upon entering industry, Wells set out to give back to other veterans by helping initiate the AAPG Military Veterans Scholarship Program with former AAPG treasurer Clint Moore, the son of a World War II veteran and pioneering geophysical engineer. By empowering veterans to overcome the financial obstacles of attending school and supporting a life, Wells and Moore hope to establish a "pipeline" of talented young veterans that will become the great petroleum geoscientists of tomorrow.

The mission of the Foundation's Military Veterans Scholarship Program is to provide financial aid to veterans seeking geoscience degrees that focus on the exploration and development of oil and gas.

The program primarily provides scholarships for veterans seeking bachelor degrees, although graduate level students are eligible for consideration.

Like Wells, Asquith, Halbouty and Harry Hess, countless other veterans already have excelled in and greatly influenced the oil



WELLS

and gas industry.

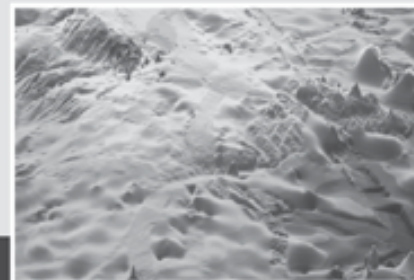
Contributing to the Military Veterans Scholarship Program will benefit the industry by investing in disciplined, hard-working and motivated geoscientists of the future. By joining forces with former members of the armed forces, our entire profession wins.

Donations currently are being accepted via the AAPG Foundation website. When donating, designate your Foundation donation to the Military Veterans Scholarship Program. [E](#)

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The deadline for manuscripts is 1 December 2014.



For more information, contact the editors:

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POLICYWATCH

Should the U.S. Fill the Russian Gas Gap?

By EDITH ALLISON, Geoscience and Energy Office Director

The U.S. shale oil and gas production surge and the resulting shift of the United States from a major importer to an exporter of oil and natural gas are well known, but there is disagreement about what this means for U.S. and global energy security.

Much of the current energy security focus is on Europe, because the recent Russian-Ukrainian disputes could disrupt natural gas flow to Europe this winter.

In June Russia halted gas deliveries to Ukraine while promising to continue to supply gas passing through Ukraine to Europe – but many European countries are concerned that disputes between Russia and Ukraine could lead to disruptions of Russian gas deliveries like those that happened in January 2009.

According to the U.S. Energy Information Administration (EIA),

Europe, including all EU members plus Turkey, Norway, Switzerland and the non-EU Balkan states, consumed 18.7 trillion cubic feet (Tcf) of natural gas in 2013. (For comparison, the United States consumed 26 Tcf in 2013.)

Russia supplied 30 percent (5.7 Tcf) of this European et al volume, and 16 percent (3 Tcf) of the total natural gas consumed in Europe passed through Ukraine's pipeline network.

* * *

In Washington, D.C., some legislators are advocating for accelerated government approvals of natural gas exports, while enthusiastically proclaiming a new global energy balance where the United States can assure that Europe will have adequate gas supplies to weather any natural gas curtailment by Russia.

Others oppose increased energy exports because they may increase prices for domestic consumers, degrade water quality or increase greenhouse gas emissions.

These disagreements mean that legislation to accelerate the federal permitting processes probably will not become law.

In addition, given the time required to build already-approved export facilities, liquefied natural gas (LNG) exports cannot get to Europe before this coming winter.

Some exemplary congressional positions include:

► House Energy and Commerce Committee Chairman **Fred Upton** (R-Mich.) has proposed an American energy policy that reflects the U.S. energy abundance, and would use energy as a diplomatic tool to provide energy to our allies to protect them from dependence on energy from Russia or the Middle East.

► Representative **Cory Gardner** (R-Colo.) is the author of H.R. 6, the Domestic Prosperity and Global Freedom Act. The bill, which passed the House but is unlikely to pass the Senate, would accelerate government approval of LNG export applications.

Continued on next page

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Newman Joins AAPG's D.C. Office

Colleen Newman recently was named policy communications advisor for AAPG's Geoscience and Energy Policy Office in Washington, D.C.

She'll join office director Edith Allison there in efforts to expand AAPG's outreach efforts with policymakers, like-minded industry groups and the media.

She has been engaged in energy policy issues in Washington D.C. for over 20 years, serving for four years as a federal affairs liaison and energy policy adviser to Puerto Rico Governor



NEWMAN

Luis Fortuño. She also served in a similar capacity to the governor in his role as Puerto Rico's sole congressman and as his adviser on issues before the House Natural Resources Committee, including offshore oil and gas development.

Newman also has worked for the American Fuel and Petrochemical Manufacturers (formerly the National Petroleum Refiners Association) and the law firm of Brickfield, Burchette, Ritts and Stone, PC.

She can be reached via email at cnewman@aapg.org.

Continued from previous page

► Representatives **Ed Markey** (D-Maine) and **Henry Waxman** (D-Calif.) are among those opposing U.S. energy exports on the basis that they would raise prices for industrial and residential consumers.

A July 8 hearing of the Senate Committee on Foreign Relations, Subcommittee on European Affairs on European Energy Security, chaired by Sen. Chris Murphy (D-Conn.), provided testimony suggesting the topic is more complex.

► **Edward Chow**, of the Center for Strategic and International Studies, a Washington, D.C.-based bipartisan think tank, noted in his testimony that the post-2010 decrease in U.S. imports of LNG freed global supplies for Europe.

In response, Gasprom lowered natural gas prices to Europe, eventually contributing to western Europe purchasing more Russian natural gas and LNG import facilities operating at 25 percent of capacity.

Chow also noted that European gas supply and distribution sectors have little competition, which has discouraged a diverse and interconnected European energy sector that could better weather disruptions in Russian gas deliveries. He described the years of failure of Ukrainian government(s) to reform the country's energy sector as contributing to the current natural gas crisis.

Neither Chow nor the other witnesses provide any quick solutions to a situation in which Ukrainians might go without needed natural gas this winter or use natural gas destined for eastern and central European customers.

► **Andras Simonyi**, at Johns Hopkins University Center for Transatlantic Relations, testified that for many years the European energy strategy has focused on increasing renewable energy production and reducing greenhouse gas emissions, but not on reducing consumption. Breakthrough technologies have not appeared to deliver the needed growth in renewable energy production; instead, reliance on Russian natural gas has grown.

Simonyi observes that it is clearly in the interests of the United States to work to make Europe less energy dependent on Russia, and recommends

facilitating increased LNG exports to Europe.

► **Brenda Shaffer** of Georgetown University pointed out that the European Council recently released its draft Energy Security Strategy, which proposes cooperative efforts to correct the European energy imbalances: Some nations in eastern and southern Europe rely on Russia as their sole supplier, have limited natural gas storage capability or few pipeline interconnections with their neighbors.

Another source of future diversification could be from the eastern Mediterranean – if additional volumes of oil and natural gas are discovered in Israel, Cyprus and their neighbors.

► **Amos Hochstein**, of the State Department Bureau of Energy Resources European, testified that energy security is an integral part of U.S. national security and that the State Department has been actively engaged in advocating for diversification of European energy supplies, including the natural gas pipeline from Azerbaijan to southern Europe, which could begin delivery in 2019.

* * *

The current Washington, D.C. focus is on natural gas, but also worrying is the global oil balance.

EIA statistics show that global energy supply is adequately meeting current demand, despite supply disruptions in Iran, Nigeria, Iraq and Libya that are keeping about three million barrels of oil per day (bopd) off the market.

The huge growth in U.S. oil production – three million bopd since 2008 – and slow economic growth in many parts of the world have balanced current supply and demand.

However, unrest in the Middle East or Africa could easily reduce supplies below global demand.

In fact, the volume of oil that could quickly come on line in the event of a major energy emergency is quite small. The Oil and Gas Journal reports that Saudi Arabia is believed to have about 2.6 million barrels of oil per day (bopd) of surplus capacity – equivalent to about 3 percent of global demand.

(Surplus capacity in other OPEC countries and natural gas liquids, although not counted in these statistics can provide modest additional volumes.)

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Foundation Supporters' Global Reach

By APRIL HASTINGS, AAPG Foundation Program Coordinator

Since its inception, the Foundation has promoted programs supporting earth science initiatives and educational advancement around the world.

From providing endowments for university students to have the latest in digital mapping resources at their fingertips to funding master's and doctorate level research in the lab and field through the Grants-in-Aid program, Foundation supporters have multiplied their reach by affording opportunities for others on a global scale.

Three Foundation programs in particular offer funding opportunities for educators, geoscience undergraduate students, student-led associations and master's/doctorate level research worldwide.

Those awards include:

► The Foundation **Professorial Award** is granted annually to a college or university professor who has demonstrated outstanding leadership in the field of geoscience education anywhere in the world. The award is intended to encourage geoscience professors to stay current on industry trends and cutting edge technology and sharing that information with their undergraduate and graduate students, further enhancing fields of earth science.

The Professorial Award winner receives a \$1,000 award, recognition at the AAPG Annual Convention and Exhibition Chairman's Reception, and a beautiful

commemorative plaque acknowledging the achievement.

► The **Grants-in-Aid** program promotes international research in the geosciences.

Through it, financial assistance is provided to a select number of graduate students (currently enrolled in master's or doctorate programs) whose thesis research has application to the search for and development of petroleum and energy-mineral resources and/or to related environmental geology issues.

In 2015, the Foundation will award \$239,000 in funds to more than 90

students across the world.

► The **L. Austin Weeks Undergraduate Grant** program awards deserving undergraduate level geoscience students and student-led geoscience associations (student chapters, associations and clubs) with \$500 grants. These grants are intended to support the educational endeavors of undergraduate geoscience students and their student-led organizations internationally.

Thanks to generous contributors, including L. Austin Weeks and Marta

Weeks-Wulf, the Foundation will proudly grant \$76,000 in funds to geoscience students and their student associations in 2015.

The Foundation aims to continue expanding its reach to touch all corners of the world, wherever there is a need to for earth science exploration and advancement.

For more information about any of these programs, or to contribute to the cause, visit our website at foundation.aapg.org.

Foundation Contributions for August 2014

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Thomas Nelson Lindskog

Roy Long

Thomas J. Long

Continued on next page

CALLING FOR NOMINATIONS AND APPLICATIONS FOR THE 2015 **TEACHER OF THE YEAR** AWARD

Applications and nominations are now being accepted!

The Teacher of the Year (TOTY) award once again will be granted to an outstanding K-12 teacher within the United States who has demonstrated excellence in the field of geoscience education.

Six teachers across the country will be identified as finalists from six U.S. geographic sections (Pacific, Rocky Mountain, Mid-Continent, Southwest, Gulf Coast and Eastern).

The winner will receive \$6,000, including \$3,000 for his or her school's use, and \$3,000 for personal use by the teacher. The winner also will receive an expense paid trip for two to ACE in Denver to receive the award.

NEW THIS YEAR: Each of the five remaining finalists will receive a \$500 cash award!

- **Nominate a teacher:** Students, parents, faculty and associations are encouraged to nominate teachers for the award. The teacher will be notified and encouraged to apply.
- **Apply:** Teachers are encouraged to apply for the award on their own behalf.

Nominations Due: Nov. 15

Deadline: Dec. 1

Visit the website to nominate or apply today!

foundation.aapg.org/programs/toty



2014 TOTY award winner, Heather McArdle with Foundation Chairman James Gibbs at the All-Convention Luncheon.

GeoCare Adds Value to Membership

AAPG's GeoCare Benefits Insurance Program, a program designed and offered to add value to your AAPG membership, provides 12 months of term life and six months of disability income insurance coverage new U.S. members under age 50 in most states.

There is no cost to the member or to AAPG for these benefits.

The term life coverage of \$30,000 is issued for one year to members regardless of whether they are employed or students.

For the disability income coverage, a monthly benefit of \$600 is provided for six months to members who are employed. At the end of these no-cost periods, the new members have the opportunity to continue the coverage by paying the premium with no underwriting required.

Members also have the opportunity to increase their coverage by completing an application and going through underwriting.

Over the years, AAPG's Term Life New Member Program has paid \$360,000 in benefits for the deaths of 12 members due to both injuries and illnesses. Since 2006, three death claims have been filed where the new member's family was

unaware that the coverage existed.


These deaths were brought to the attention of the insurance company during an audit of unclaimed property. One claim was for a death that had occurred seven years previously, and a second for one five years previously. Those two claims have been paid.

There is one claim pending for a death that occurred in 2013.

The disability income coverage was instituted in 2009. This also is an enhancement to AAPG's member benefit package and a complement to the term life coverage.

This program is designed to add value to the new members for their AAPG membership.

If you are a new AAPG member, please keep your welcome letters and Certificates of Insurance when they arrive – and as a favor to your loved ones, make sure they know that these benefits are part of your membership package.

Most importantly, when the time comes to retain the term life and disability income insurance by paying the premium, take advantage of the opportunity to continue your valuable coverage. 

Continued on next page

Leslie Blake Magoon III
Kirk Malinowsky
Holger Mandler
Paula N. Marner
Robert Anthony Martin
James A. McCarty
Patrick McConigley
Gerard McGinn
Michael R. McWilliams
David V. Meghreblian
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Kurt Douglas Miller
Ayonma Wilfred Mode
Thomas Edward Moore
David Stewart Muller
Catherine Marie Murphy
Janet Lee Murphy
Michael Murphy
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Patrick James O'Connell
Sergio Rivero Ojeda
Howard M. Orlean
Ariana Osman
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Gary Joseph Patin
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Stephen L. Shaw
Julie Ellen Shemeta
Charles Glen Shortridge
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Dana Skerbetz
William Mark Smith
Nicholas Murray Spence
Dennis M. Sponable
David Stelzer
Michael D. Stephenson
Brandt Oliver Temple
Mee Kee Teng
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Holly Rose Vescogni
Phillip Gene Von Tungeln
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Chih-Cheng Yang
J. Marc Young
Joe Brian Young
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Barry Lynn Zinz
In memory of George Edwards Moore
Jeffrey Raymond Zoller

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Teacher of the Year Award
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L. Austin Weeks Undergraduate Grant Fund
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Mark Alan Pasley

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

MARK YOUR CALENDARS! IMPORTANT AWARD DEADLINES 2014-2015



Teacher of the Year Award: OPEN NOW

Nominations Due: NOVEMBER 15 | DEADLINE: DECEMBER 1

This award recognizes an outstanding K-12 geoscience educator in the United States. The finalist will receive a \$6,000 award; \$3,000 for school use under the teacher's supervision for educational purposes, \$3,000 for personal use, and an expense paid trip for two to the 2015 Annual Convention & Exhibition in Denver, CO. to receive the award.

NEW THIS YEAR: Each of the five finalists receive a \$500 cash award!

Professorial Award: OPEN NOW

Nominations Due: JANUARY 15 | DEADLINE: FEBRUARY 1

This is the fourth year for this award. The Foundation will award \$1,000 to a higher education professor for Excellence in the Teaching of Natural Resources in the Earth Sciences. Applicants should have a minimum of three years full-time teaching experience at a college or university.

Grants-in-Aid: OPEN SEPTEMBER 15

DEADLINE: FEBRUARY 15

The purpose of the Grants-in-Aid program is to foster research in the geosciences. Grants provide financial assistance to graduate students (currently enrolled in master's or doctorate programs) whose thesis research has application to the search for and development of petroleum and energy-mineral resources, and/or to related environmental geology issues. Grants range from \$500 to \$3,000 each.

L. Austin Weeks Undergraduate Grants: OPEN JANUARY 15

DEADLINE: MAY 15

The L. Austin Weeks Undergraduate Grant program awards deserving undergraduate geoscience students and collegiate student-led associations (geoscience student chapters, associations and clubs) with \$500 grants. These grants are intended to support educational efforts of undergraduate geoscience students and student-led geoscience organizations.

Military Veterans Scholarship Program: OPEN JANUARY 15

DEADLINE: MAY 15

The Military Veterans Scholarship Program is designed to promote the advancement of student veterans in educational geoscience programs. The goal is to promote geoscience education and career opportunities to the veteran population, aiding in the transition of veterans to educational and civilian technical professions.

AAPG Foundation
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Web: foundation.aapg.org



Thinking Like Oil

Regarding "Thinking Like Oil," the commentary by past AAPG president, Honorary member and Sidney Powers Memorial Award winner Marlan Downey (August EXPLORER): Jeeze ... What a great article.

I usually read about two, maybe three sentences and then move to the next article. That is NOT because I have a short interest span. With this I not only read through it, but after the first few sentences I had a yellow marking pencil and was looking for the rules (Marlan didn't specify how many!).

In short, the one I liked the best was the pressure generated by the conversion from original organic material to oil and gas. I can't recall any analytical data on that subject. It is possible that the geochemists

were off on another planet and failed to communicate to us grunts in the trenches – or maybe I wasn't paying attention. I always wondered how the oil got out if the only force was simply buoyancy. Live and learn.

Without belaboring the details, I compliment you on going directly to the point of our profession. But gee, it is fun to try to figure out why and when and how it got that way even though you can't detect one lousy prospect.

Lee Lawyer
Houston

Seismic and Geology

Regarding your article "Ahead of the Curve," (August EXPLORER) about bringing geology back into seismic interpretation: Congratulations, Jeannette Wolak, assistant professor in the

department of earth sciences at Tennessee Tech University in Cookeville, Tenn. You bring a very good point.

Over the 30 years of my upstream oil and gas work I have seen the evolution of seismic and its influence on oil and gas exploration. People like Bob Sheriff, Fred Hilterman, Peter Vail and many others have a strong impact on the way we use seismic today. Recognition of the fact that seismic reflections are chronostratigraphic is fundamental in bringing geology back to seismic interpretation and using seismic as a stratigraphic tool.

Despite many publications since AAPG Memoir 26, it is unfortunate that seismic data are not fully exploited. Interpreting high-resolution seismic and 3.5 KHz pinger data in shallow offshore geohazards provided significant

advantage and impetus in using the data is recognizing high-resolution incised valleys, flooding surfaces, levees and terraces in channel fills, multiple-erosion surfaces, high-resolution geomorphology as a function of last glaciation in many parts of the world, and 3-D architectures of many other sedimentological processes in shallow shelf and slope environments.

I strongly advocate blending seismic data, physics of acquisition and processing, classical sedimentology and stratigraphy. It is essential to bring seismic visualization to match depositional environments in different scales.

Chronostratigraphy could be the common language for teaching seismic and stratigraphy in this effort. Many tools are available now to identify subtle features in seismic data even in highly deformed and sub-salt environments. Some of these features are responsible for very large fields in stratigraphic traps, and geologists must exploit seismic data fully to help develop fields economically.

Sharma Dronamraju
Katy, Texas

Don't Blame the Students

I really must protest your article "Geology, Interrupted" (August EXPLORER): I regularly visit with students at three big name earth science universities. On each visit I am rejuvenated by the student's optimism, enthusiasm and eagerness to learn.

In general they are delightful and I think anyone that gets to work with them is privileged.

Today's earth science students are expected to know and understand structural and stratigraphic geology, seismic methods and data, petrophysics, rock physics, reservoir characterization, production and reservoir simulation. This is far different from the past where students specialized in just a few of these subjects.

The student's presentation and communication skills are excellent and their presentations match the best that I experienced within a major oil company in the 1980s.

At that time I watched Ph.D. geologists balance a cross-section based on seismic data in time – a cross-section that crossed several of the world's most famous strike-slip faults and also a major wrench system. The various disjoint provinces were so obvious from the seismic data that it was too embarrassing to discuss the project at all.

At the same time oil company seismic researchers were spending large sums to try to determine the location of fractures in a fold system.

A structural geologist would have been willing to predict the locations of these fractures for nothing and would have been unable to comprehend the seismic budget.

Today's students would not be able to understand such silos – however, the silos still exist in universities.

We see hypothetical earth models confused with real earth models. We see stress models proposed in seismic departments that no structural geologist would validate. There are masses of published work that is just plain wrong. We need a system that critiques past publications and flags those known to be wrong.

If students start texting in a lecture it is likely that the lecturer is droning on for 45 minutes, killing a single idea that the students understood in the first five minutes.

CALL FOR PAPERS

► Submission deadline:
20 January 2015

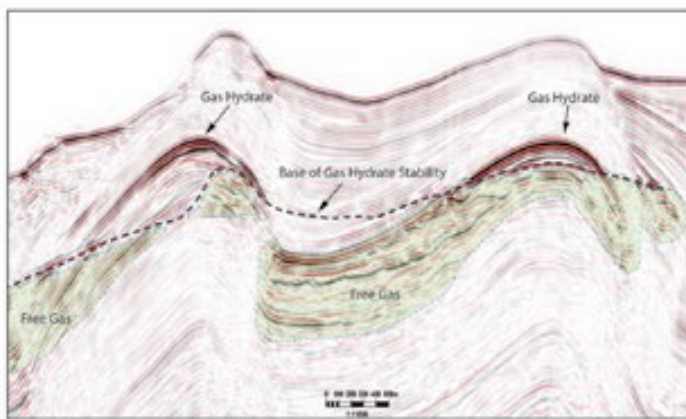
<https://mc.manuscriptcentral.com/interpretation>



Exploration and characterization of gas hydrates

Manuscripts are requested that document the latest techniques, concepts, and findings from the evaluation of gas hydrate accumulations in either deepwater or permafrost-associated settings. Our emphasis is on the description of gas hydrate occurrence in nature as revealed through integrated geological and geophysical investigation. We are interested in papers that discuss the following topics:

- regional resource assessment and characterization
- prospecting approaches for occurrences with energy resource potential
- evaluation of potential reservoir quality and productivity
- integration of well and seismic data in hydrate-bearing regions
- lithologic controls of gas hydrate occurrences through time
- geohazard evaluation
- characterization of gas hydrate occurrences in climate-sensitive settings



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

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

The submissions will be processed according to the following timeline:

Submission deadline:
20 January 2015

Publication of issue:
November 2015

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DEG from page 70

with adequate forethought.

Consider a few examples of environmental issues we have faced over recent decades:

- ▶ The debate over climate change and the role of fossil fuels as a driver.
- ▶ Salinization of soil and water through surface discharge and legacy wellbore leakage.
- ▶ Hydraulic fracturing and the ongoing controversy over water usage, fugitive gas and induced seismicity.


Each of these issues could have been anticipated – and impacts avoided or minimized (or perhaps consciously accepted as an unavoidable side effect by society as a whole) – if we considered a broader view of potential environmental impacts as a routine part of our planning and development process.

With this in mind, I encourage all of those with an interest in environmental topics to participate in the conferences, meetings, workshops and short courses planned for the coming year to help shape the broader environmental

discussion and spread the word about the issues we face and the effort we're expending to address them.

At the 2015 Annual Convention and Exhibition in Denver, for example, an entire theme will be devoted to Energy and the Environment. There are seven subthemes that address many of the environmental issues facing the industry today, including:

- ▶ Carbon sequestration and EOR.
- ▶ Water access, use and recycling.
- ▶ How geophysics can help address environmental issues.
- ▶ Public policy and relations.
- ▶ Solar and wind energy in oil and gas production.
- ▶ Unintended consequences – and better anticipating – of possible environmental impacts!

Please consider submitting abstracts on these and other environmental topics to the annual convention in Denver next May (abstract deadline Oct. 2!), the international meetings and the Section meetings to help us continue to cultivate a broader, more anticipatory environmental approach in our exploration and development activities that play such a crucial role in support of our civilization. 

Continued from previous page

We used to flip to the end of our notebook and work on other ideas when this happened in the past. Texting is just today's response.

The lecturer should take the hint. Please do not knock today's students. They are great.

Huw E. James
Houston

Wow! What a damning assessment of today's geology students and education. It will be interesting to hear the students' perspectives.

Are the inattentive students plugged into their earphones finding a way to graduate? If entering geology students do not have the desired skill sets and scientific curiosity, then changes are needed at the pre-college level – and at home.

I find that most of today's young geologists employed by the petroleum industry are very well adapted for the computer age (Nintendo geologists), and although they may not know how to apply their knowledge to make an interpretative subsurface map, they are generally very eager to learn. It is imperative for the remaining experienced petroleum geologists and educators (old-timers) to help instill the desire and joy of discovery, high professional standards and pride in our work.

Wayne K. Camp
The Woodlands, Texas

Oil Finders

Regarding the Foundation Update article, "Geo 'Firsts' – Remember When?" (August EXPLORER): I first met past AAPG president Ted Bear at UCLA in 1965, and he recruited me to be an oil finder instead of a sedimentary petrologist.

I spent years in Alaska, helping to discover Cook Inlet gas and North Slope oil for Union Oil and Arco. I agree 100 percent that details kill innovation.

I am peddling a process for gas production that goes against the grain of engineers. They want proof that it will work

before we try it out. I call it needing to know the end before the beginning.

Good friends like Ted Bear are gone or on their way out. Thanks for giving us your advice now rather than later.

Gary Player
Cedar City, Utah

The Elusive Secrets

Regarding Louise Durham's story "Amid Boom, Shale Secrets Still Elusive" (July EXPLORER): This is a very thought-provoking summary.

Since I am retired and no longer working in the industry – but do have 55 years of experience in the upstream end – I have many questions about "shale" reservoirs, and in the article Nathan Meehan has provided much to think about in our pursuit of reserves from the oil and gas trapped in source rocks. It is clear that we do not understand enough about the source, deposition and diagenesis of the sediments in which this potential resource is trapped.

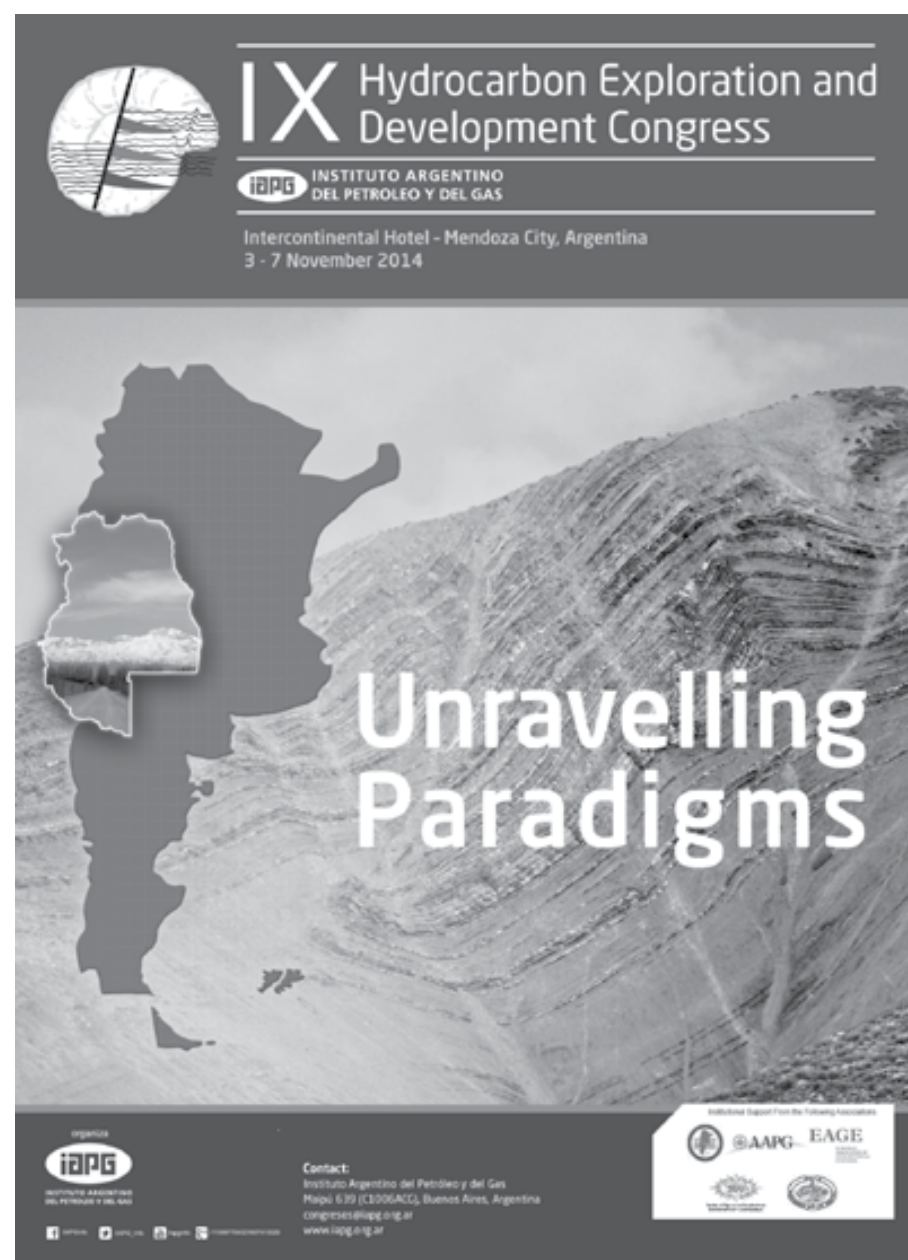
Meehan has confirmed a nagging suspicion I have about what we know about these sediments – and what more we need to know to ensure that we get more energy out of the resource than we put in.

He quotes Luis Baez as saying, "You can only win if you play." If the overall economics of the play is one of a few winners (some big), but with more investment than can be recovered with the sale of produced reserves, the result will be the same as that of the casinos that proliferate the globe. The house wins.

In the case of shale reservoirs, they will have defeated our industry if there is not an acceptable return for all of the investment, not just part of the investments where luck played a major role.

From Meehan's experience and perspective we are busy with "treadmill drilling" and not doing enough serious study of these complex shale rocks to increase our prospects of getting more out than we put in. I regret that I am no longer involved in helping to make this happen.

Conrad Maher
Newport Beach, Calif.



IX Hydrocarbon Exploration and Development Congress

IAPEG INSTITUTO ARGENTINO DEL PETRÓLEO Y DEL GAS

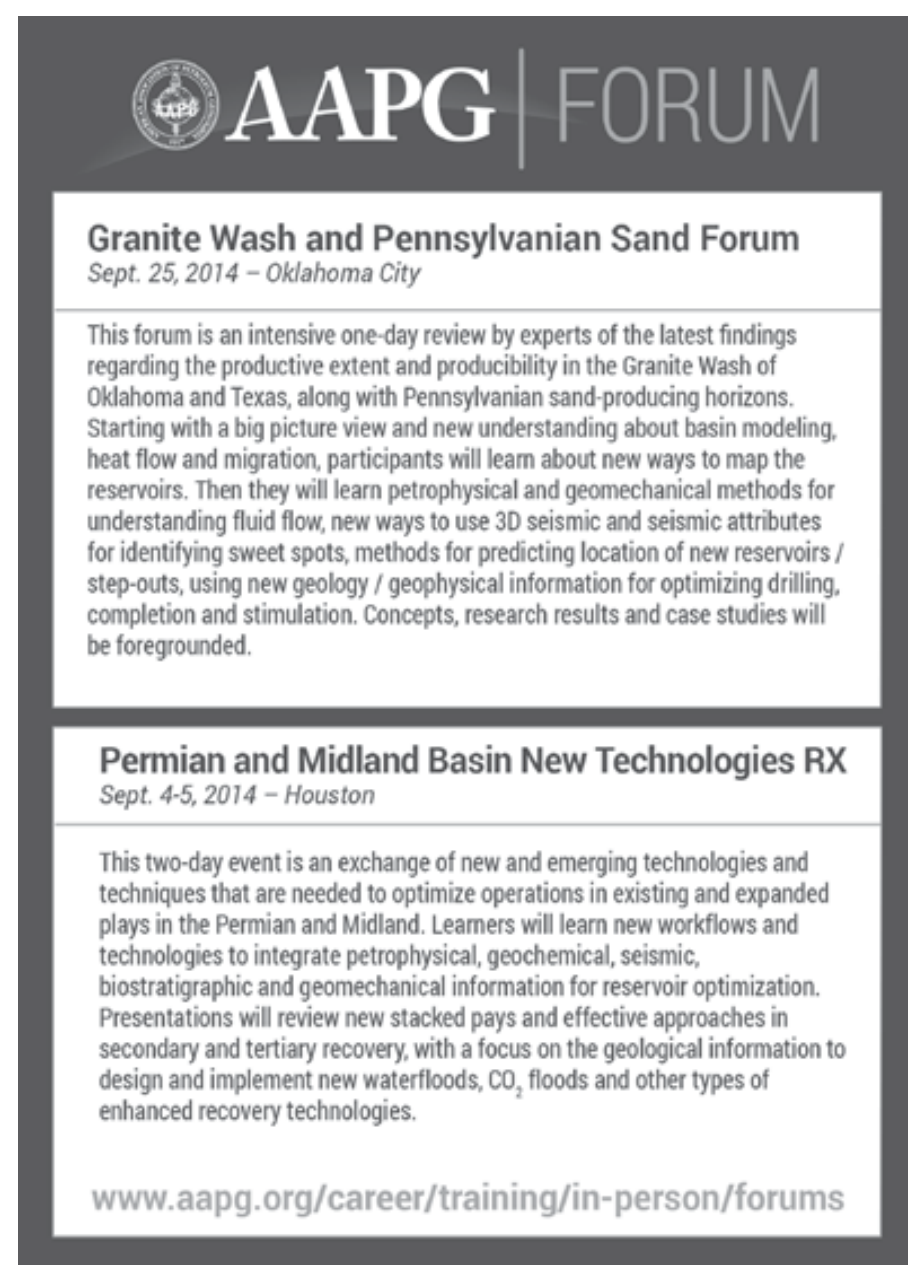
Intercontinental Hotel - Mendoza City, Argentina
3 - 7 November 2014

Unravelling Paradigms

IAPEG
INSTITUTO ARGENTINO DEL PETRÓLEO Y DEL GAS

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www.iapg.org.ar

AAPG EAGE



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. Learners will 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

POSITION AVAILABLE

Director Illinois State Geological Survey Prairie Research Institute University of Illinois at Urbana-Champaign

The Illinois State Geological Survey (ISGS) is part of the Prairie Research Institute (PRI) at the University of Illinois at Urbana-Champaign which is centrally located between Chicago, St. Louis, and Indianapolis. PRI houses 5 large scientific surveys covering a wide range of expertise including biology, water resources, climate, geology, sustainable technology and archaeology. The ISGS is a premier state geological survey, with over 200 scientists and technical support staff, serving the needs of the public, government, and industry with earth science information and research relevant to natural resources, environmental quality, economic vitality, and public safety. The University is a land-grant institution that provides access to world-class laboratory and academic facilities, Big Ten athletic events, and internationally acclaimed cultural opportunities.

We are seeking an individual to serve as the chief executive officer and lead scientist for the ISGS, who will provide outstanding leadership, direction, and overall administration for the development, coordination, and implementation of scientific research and service programs, public engagement activities, state-mandated functions, and professional services undertaken by the ISGS.

Advanced degree required, Ph.D. preferred, in an earth science discipline. Alternate degree fields may be considered depending on nature and depth of work experience as related to ISGS vision and priorities. Demonstrated successful research career and experience in research management, including science-related program development, science-team administration, and/or public service. An established leader demonstrated by success in an area of research core to the ISGS in a multidisciplinary research organization with a

strong commitment to affirmative action and diversity.

Ideal candidates will hold a doctoral degree and an academic track record appropriate for a tenured full professor at the University, or commensurately significant other qualifications in the field of earth science or related field.

Applications must be received by October 31, 2014. Applicants may be interviewed before the closing date; however, no hiring decision will be made until after that date. To apply, please visit <https://jobs.illinois.edu/academic-job-board> to complete an online profile and to upload a 1) cover letter, 2) résumé/CV, 3) the names and contact information (including e-mail addresses) of five professional references. All requested information must be submitted for your application to be considered. Incomplete information will not be reviewed.

For further information please contact Lori Walston-Vonderharr, Human Resources, Illinois State Geological Survey, at lwalston@illinois.edu or 217-244-2401.

The University of Illinois is an EEO Employer/Vet/Disabled <http://inclusiveillinois.illinois.edu/>

Director Kentucky Geological Survey University of Kentucky

The University of Kentucky seeks a Ph.D.-level geoscientist to serve as the Director of the Kentucky Geological Survey in Lexington, Kentucky and the 13th State Geologist of Kentucky. This is a high-level administrative position within the university. For more information about the duties of this position go to kgs.uky.edu/StateGeologist. To apply for job # RE00309, submit a UK Online Application at www.uky.edu/ukjobs. If you have any questions, contact HR/Employment, phone (859) 257-9555 press 2. Application deadline is November 16, 2014.

The University of Kentucky is an equal opportunity employer and encourages applications from minorities and women.

Richard T. Buffler Post-Doctoral Fellowship

A post-doctoral fellowship is being established within the Institute for Geophysics (UTIG), Jackson School of Geosciences (JSG), The University of Texas at Austin for the purpose of honoring Dr. Richard (Dick) T. Buffler, whose scientific research into the geology of the Gulf of Mexico (GOM) underpins our current rich understanding of this prolific hydrocarbon basin and the unique confluence of structural and stratigraphic processes related to its formation and fill.

Dick worked at UTIG from 1975 until his retirement in 2002, collecting and interpreting new seismic data from the Gulf basin. He participated in 12 Gulf of Mexico cruises (including co-chief scientist of DSDP Leg 77), and he authored or coauthored over 83 publications related to the Gulf. He also mentored 73 students many of whom produced Masters or PhD theses related to the Gulf (33), and he helped lead a major UTIG research effort in the GOM, the Gulf Basin Depositional Synthesis (GBDS) project, which has enjoyed 19 years of continuous industry support under Dr. William E. Galloway and now its current director, Dr. John W. Snedden.

The successful applicant for this new position should have the following skills:

1. Demonstrated research interest in basin-scale depositional systems, ranging from alluvial to deep-water, siliciclastics and carbonates, Pleistocene to base Mesozoic.
2. Competence in seismic interpretation, including experience with 2D or 3D seismic workstation software.
3. Competence in geological interpretation of well logs.
4. Knowledge of biostratigraphy and use of fossil datum for correlation.
5. Excellent oral presentation and writing skills.
6. Experience with ArcGIS and other computer software (Word, Excel, PowerPoint, etc.).

Essential Job Functions:

1. Identify and lead new research avenues in Gulf of Mexico depositional systems that support existing and future exploration efforts of the GBDS Industrial Associates.
2. Generate scientific publications that enhance the technical reputation of UTIG, The Jackson School of Geosciences, (JSG) and The University of Texas at Austin.
3. Conduct and present research to industrial associates with clarity and a deep understanding of their oil and gas industry challenges.
4. Collaborate with UTIG and JSG researchers and faculty, where appropriate.
5. Mentor undergraduate and graduate students as appropriate.
6. Domestic travel as needed.

The position will have two years of initial support and will be based in Austin, Texas. Interested Persons should submit a detailed Curriculum Vitae (CV) that includes academic and professional experience, statement of research interests and names and contact information of three references to PostDocUTIG@ig.utexas.edu. For full consideration, applications must be received by October 15, 2014

Stephen F. Austin State University CHAIR, DEPARTMENT OF GEOLOGY

The Department of Geology at Stephen F. Austin State University invites applications for the department chair position. We seek an individual with strong management, communication, and interpersonal skills to provide innovative and energetic leadership. Duties include managing curricula, budgets, student enrollment, personnel, program assessment, and developing strong, mutually beneficial relationships with industry and alumni. The incumbent

Continued on next page

Senior Lecturer in Petroleum Geology

Ref: 006769

Building upon existing strengths in petroleum geosciences, UCD School of Geological Sciences seeks to appoint a Senior Lecturer in Petroleum Geology to create additional academic capacity in this strategically important area. The appointed person will be expected to develop a dynamic research programme in collaboration with industry partners and will be an enthusiastic university teacher who can contribute to both BSc (Geology) and MSc (Petroleum Geoscience) degrees, as well as other cognate programmes such as the ME (Energy Systems).



UCD is an equal opportunities employer.

(S)he will complement our existing expertise in petroleum geoscience, which currently includes structural geology, clastic sedimentology, seismology, reservoir characterisation and modelling. The successful candidate will likely have particular expertise in petroleum exploration. However candidates with a wider range of cognate research interests are encouraged to apply.

Further details including a complete Job Description and guidelines on how to apply online for this appointment are available at: www.ucd.ie/hr/jobvacancies/

Closing date: 17:00 GMT on 10th October 2014.

Continued from previous page

will teach a reduced load of courses and develop a research program in his/her area of expertise. Applicants must have credentials for appointment at the associate or professor rank in geology.

Submit a letter of application, CV, and contact information for three references to <https://careers.sfasu.edu> (posting 0603046). Also mail official transcripts to:

Dr. Kenneth Farrish, Search Committee Chair
Stephen F. Austin State University
Department of Geology
PO Box 13011 SFA Station
Nacogdoches, TX 75962-3011
(936) 468-3701

Review of applications will begin on Jan. 9 and will continue until the position is filled. Equal Opportunity Employer; Security-sensitive position; this position will be subject to a criminal history check.

Research Scientist Position
in Structural Geology

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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Schlumberger is an equal opportunity employer and is committed to the diversity of its workforce.

Petroleum Geology and Basin Analysis

The Department of Earth and Environmental

Sciences at the University of Kentucky invites applications for a tenure-track (nine-month) faculty position in the broad field of petroleum geology, to begin January 2015 or soon thereafter. Exceptional candidates at all ranks will be considered. We seek candidates who will expand the department's growing program in petroleum geosystems, and complement existing strengths in sedimentary geology, tectonics, geophysics, and paleontology. Collaboration with the Kentucky Geological Survey (KGS) and UK Center for Applied Energy Research expands opportunities for research and resources. A Ph.D. is required; post-doctoral and/or industry experience is essential.

The research specialty for this position will focus on basin analysis and petroleum exploration. Expertise in one or more of the following will be deemed highly desirable: subsurface mapping, formation evaluation, exploration seismology, reservoir characterization, geological modelling, seismic stratigraphy and/or structural geology. Candidates who emphasize computational methods and actively integrate seismic reflection and well-log data into research and teaching will be given preference.

We welcome applications from scientists that possess a record of publication in high quality, peer-reviewed journals, and who have developed, or show the potential for developing, a nationally recognized research program. A record of, or a demonstrable capacity for collaborating with partners in the energy industry is critical to the mission of this position. The successful candidate will have the ability to mentor graduate and undergraduate students, and must be committed to field and classroom-based instruction at both the undergraduate and graduate levels.

The department maintains well-equipped stratigraphy, sedimentology, radiochemistry, near-surface geophysics, stable isotope geochemistry, electron microprobe and detrital provenance laboratories. The KGS, housed on the UK campus, maintains an active petroleum research program, complete with a visualization laboratory and core repository, as well as facilities for XRD, XRF, organic geochemistry, and organic petrography.

Interested applicants should submit a merged PDF to the Petroleum Search Committee, c/o Ms. Adrienne Gilley (Adrienne.gilley@uky.edu). The document should include a cover letter, curriculum vitae, brief statements of research and teaching interests, copies of relevant research publications, and contact information for at least three references. We will begin review of applications on September 1, 2014; applications will be accepted until the position is filled. The University of Kentucky is an Affirmative Action/Equal Opportunity university that values diversity and is located in an increasingly diverse geographical region. Women, persons with disabilities, and members of other under-represented groups are encouraged to apply. The University also supports family-friendly policies. Additional details of the Department of Earth and Environmental Sciences and the University of Kentucky may be viewed at our web pages: www.as.uky.edu/ees and www.uky.edu.

Petroleum Geologist

The North Dakota Geological Survey announces a permanent position opening for a geologist. Successful applicant will be responsible for conducting geologic studies and investigations to generate maps and reports on the oil-producing horizons in the Williston Basin of North Dakota. Applicants must have a master's degree in geology. Applicants should have strong written and verbal communication skills. Preference will be given to applicants with experience in reading, interpreting, and correlating petrophysical logs, describing oil well core, and generating contour maps. The successful applicant will be hired as a Geologist III with a starting annual salary between \$55,000 and \$85,000 plus benefits, dependent upon the level of schooling and applicable experience. The State of North Dakota has a very competitive health insurance and retirement plan. Apply online through the State of North Dakota online job application system at: https://www.cnd.nd.gov/psc/recruit/EMPLOYEE/HRMS/c/HRMS_HRAM.HRS_APP_SCHJOB.GBL?FCUS=Applicant&SiteId=11000

Include a cover letter, resume, references, and college transcripts. Contact Mr. Fred Anderson: North Dakota Department of Mineral Resources, 600 East Boulevard Ave., Bismarck, ND 58505. Phone (701) 328-8000 for more information. Deadline for applications is September 1, 2014, but the position will remain open until it is filled.

If unable to fill at a Geologist III level, the job will be filled as a Geologist II which requires a master's degree in geology or a bachelor's degree in geology with three years of petroleum industry experience. For more information about the North Dakota Geological Survey, see <https://www.dmr.nd.gov/hdgs/>. The North Dakota Geological Survey is an Equal Opportunity Employer.

Petroleum Geologist

The North Dakota Geological Survey in Bismarck, North Dakota is advertising for a subsurface geologist to conduct geologic investigations of the oil-producing horizons in the Williston Basin of North Dakota. Petroleum Geologist

The North Dakota Geological Survey is currently advertising for a subsurface geologist to fill a vacancy in their Bismarck office. This is a permanent, full-time position which will be filled at the Geologist III level.

The successful applicant will be responsible for conducting geologic studies and investigation to generate maps and reports on the oil-producing horizons in the Williston Basin of North Dakota.

Salary Range: \$55,000 to \$85,000 per year with fully paid family health insurance
To apply: https://www.cnd.nd.gov/psc/recruit/EMPLOYEE/HRMS/c/HRMS_HRAM.HRS_APP_SCHJOB.GBL?FCUS=Applicant&SiteId=11000

North Dakota Industrial Commission, Department of Mineral Resources – North Dakota Geological Survey, Bismarck, North Dakota

TransAtlantic Petroleum

An independent oil & gas company located in Addison, Texas, is currently seeking to fill several geological positions. A minimum of five years of experience in the oil & gas industry is required for the staff positions and ten years of experience for the senior geological positions. Knowledge of Petra and/or SMT is preferred. A strong understanding of structural geology is desired along with experience with carbonates. International experience especially in Turkey or other eastern European countries is a plus.

TransAtlantic Petroleum is an international company with assets in Turkey, Bulgaria, and other eastern European countries. TransAtlantic believes that people are the key to a Company's success. We are looking for self-motivated individuals who are team players with excellent interpersonal skills and a high degree of analytical ability. Please email resumes and inquiries to jobs@tapcor.com.

ASSISTANT OR ASSOCIATE PROFESSOR OF
GEOLOGICAL ENGINEERING,
HAROLD HAMM SCHOOL OF GEOLOGY
AND GEOLOGICAL ENGINEERING,
UNIVERSITY OF NORTH DAKOTA

The Harold Hamm School of Geology & Geological Engineering in the University of North Dakota's College of Engineering and Mines invites applications for a tenure-track faculty position in geological engineering at the assistant or associate professor level. We seek an outstanding candidate in the field of hydrogeology who will develop or maintain a dynamic research program that will attract and support graduate students through external grant funding. Teaching responsibilities will include classes in hydrogeology and groundwater with other undergraduate and graduate geological engineering courses in the candidate's area of expertise. Applicants must have an undergraduate degree in engineering (geological preferred) and hold a Ph.D. in geological engineering, engineering geology, or a closely related science or engineering field. The successful candidate will be expected to (1) develop a strong external funded research

program, (2) contribute to the School's graduate and undergraduate programs through teaching, and (3) provide service to help the faculty and administration attain School, College of Engineering and Mines, and University goals, and (4) direct activities in the School's Environmental Analytical Research Laboratory (EARL). EARL is a water analysis lab that supports teaching and research by students and faculty. Major equipment includes a SOLAAR M6 Atomic Absorption Spectrometer, a Dionex DX-120 Ion Chromatograph, a Shimadzu TOC-VcsN Total Carbon Analyzer, and a LECO SC-432DR Sulfur Analyzer.

Applications will be accepted until the position is filled, with screening to begin immediately. The appointment will begin August 15, 2014 or January 1, 2015. Applicants must submit, in PDF format, a brief letter of application describing her or his qualifications for the position, a curriculum vitae, a statement of teaching and research interests, and the names and addresses of three references to und.geposition@engr.und.edu. Reference letters and credential materials (such as degree certificates and transcripts) may later be required. This position is subject to a criminal history background check.

The University of North Dakota is an Affirmative Action/Equal Employment Opportunity Employer. The University of North Dakota encourages applications from women, minorities, veterans and veterans with disabilities. The University of North Dakota determines employment eligibility through the E-Verify System. The University of North Dakota complies with the Jeanne Clery Disclosure of Campus Security Policy & Campus Crime Statistics Act. Information about UND campus security and crime statistics can be found at http://und.edu/discover/_files/docs/annual-security-report.pdf. Applicants are invited to provide information regarding their gender, race and/or ethnicity, veteran's status and disability status on the form found at <http://und.edu/affirmative-action/apcontrolcard.cfm>. This information will remain confidential and separate from your application.

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Vacation is Key to Better Productivity

By DAVID CURTISS

Here in the northern hemisphere summer is drawing to a close. Days are getting shorter. And parents have endured the ritual of back-to-school shopping while the kids are being reintroduced to the ritual of nightly homework assignments. It's back to the grind, with the memory of summer vacation a glowing, fading ember of a campfire floating through the air.

You did schedule a vacation this year, didn't you, taking time to rest and recuperate?

Sadly, given the pace of modern life it's increasingly difficult to actually take a break. The pressures we feel to stay engaged can be very real: If you've got a well drilling at the moment it's not an ideal time to disconnect.

But these pressures also can be imagined, or simply the result of bad habits.

Will the entire business collapse if you are out of the office for one to two weeks? Are you able to resist checking email over the weekend?

* * *

Professor Daniel Levitin, cognitive psychologist, neuroscientist and author, urges us in the Aug. 9 New York Times to take mental breaks seriously – they're essential to the health of our brains and decision-making ability.

In today's world we're barraged with information. Levitin cites a 2011 study indicating that each day we take in the amount of information equivalent to 174 newspapers, a five-fold increase in 25 years. Our brains are struggling to handle the volume.

And much of the information flow we're dealing with is grim. Here in the United States racial tension is raising its ugly head. Relations between Russia and the west are chillier than at any time since the end of the Cold War. And civil war, sectarian violence, and social unrest fester in hotspots around the globe.

As an international industry we're often directly affected by these events. And



CURTISS

Levitin points out that "if you're feeling overwhelmed, there's a reason: The processing capacity of the conscious mind is limited."

Our brains are wired such that attention is a binary switch: We're either focused on a particular task or day-dreaming. The former is the mode we're operating in when we're trying to get things accomplished; the latter occurs when our minds are wandering and we often experience creative insights.

There also is an "attentional filter" that enables us to direct our attention to what matters most.

Multitasking is the term used to describe the mental juggling required to keep in balance all of the demands of modern life. Except that there is no such thing. The brain cannot focus on more than one thing at a time. It's actually engaged in rapid task switching – from one task to another – and you can't keep this up forever.

As science writer John Tierney explains in the New York Times magazine on Aug. 17, 2011, "No matter how rational and high-minded you try to be, you can't make decision after decision without paying a biological price. It's different from ordinary physical fatigue – you're not consciously aware of being tired – but you're low on mental energy. The more choices you make throughout the day, the harder each one becomes for your brain, and eventually it looks for shortcuts."

The brain is experiencing decision fatigue. And as Tierney explains, the shortcuts it typically defaults to are to:

► Act recklessly or impulsively without considering the possible outcomes or consequences of a particular decision, or ...

The science suggests we each have a certain amount of mental energy for daily decision-making. How we spend that energy will determine our productivity and accomplishments.

► Avoid making any decision whatsoever, because that is surely the safer choice than potentially making the wrong call.

The science suggests we each have a certain amount of mental energy for daily decision-making. How we spend that energy will determine our productivity and accomplishments.

* * *

I think it is fair to say that the president of the United States is someone who makes a lot of decisions on a daily basis, many with the potential for significant consequences. We don't want the president – or any other world leader – taking those mental shortcuts if at all possible.

So how do they manage decision fatigue?

Did you know that President George W. Bush nearly always wore a blue tie? It's something that struck me during his presidency. I didn't know why.

But President Barack Obama offered a clue in a piece authored by Michael Lewis for the October 2012 issue of Vanity Fair, speaking about the job of being president: "You'll see I wear only gray or blue suits. I'm trying to pare down decisions. I don't want to make decisions about what I'm eating or wearing. Because I have too many other decisions to make."

Now, President Bush may wear blue ties simply because he likes them. But I suspect that he, too, relied on routine to preserve mental energy for more important decisions.

I'll admit this sounds crazy, but what

if they're right and deciding whether to have a vanilla or chocolate milkshake at lunch exhausts your ability to make a good decision about where to TD that well you're drilling?

Levitin offers additional hints for managing your mental energy, suggesting that maximum productivity and creativity are possible when we divide our day into chunks of time – 30 to 50 minutes – focused on specific tasks. That means avoiding distractions like email or social media during these intervals. They get their own dedicated chunks of time.

And rest – restorative time – whether in the form of vacations, unplugged weekends, and even naps is essential to our mental wellbeing.

Both Presidents Bush and Obama have been criticized for the amount of time they spend away from the White House resting and vacationing. But they clearly see the need for this time away.

And if they can schedule downtime, don't you think you can too?

* * *

Work hard. By all means, work hard. But recognize that busyness isn't the answer; creativity and innovation probably are. So cultivate practices of rest and relaxation that support your health and good decision-making.

"If we can train ourselves to take regular vacations – true vacations without work – and to set aside time for naps and contemplation, we will be in a more powerful position to start solving some of the world's big problems," Levitin concludes. "And to be happier and well rested while we're doing it."

Let your mind wander – and *then* get to work.

David H. Curtiss

DIVISIONS REPORT: DEG

Unintended Consequences to Anticipated Issues

By JEFFREY G. PAINE, DEG President

After reading Doug Wyatt's (now past president of DEG) last column in the June EXPLORER, which summarized DEG's progress during the past year, I'm reminded of two things:

► How far we've come in the last few years.

► How important it is that we sustain those advances in the coming year.

While serving DEG in elected and volunteer roles is an honor, it is also a call to do something special with the opportunity we have to shape our society and our profession.

Congratulations, Doug; I hope you'll help us continue the progress in this and future years!

* * *

I remember when I was a young boy in the early 1960s, and my grandfather driving me around the oilfields near Burkburnett, Texas – climbing rusty,



PAINE

rickety stairs on tank batteries to check the level of crude, and watching him periodically open his car door a crack to expectorate some Beech-Nut residue on the Wichita County gravel roads.

I also remember crossing salt-crustured draws that received the brines produced from those same fields, giving nary a thought to the ultimate fate of that salty water and what its effect on soil and water might be.

Most of that water undoubtedly ended up in the already salty Red River

or in shallow alluvial aquifers along the drainages, slowly diluting over the subsequent decades with rainfall and runoff.

By the late 1960s, surface discharge of produced waters was banned in Texas, replaced with the requirement to dispose into the subsurface.

Now that process, once seen as the perfect solution to near-surface salinization, is itself under public scrutiny as a possible cause of induced seismicity.

Our industry is overwhelmingly filled with professionals who want to do the right thing the right way, yet real or suspected environmental impacts recur with some regularity.

* * *

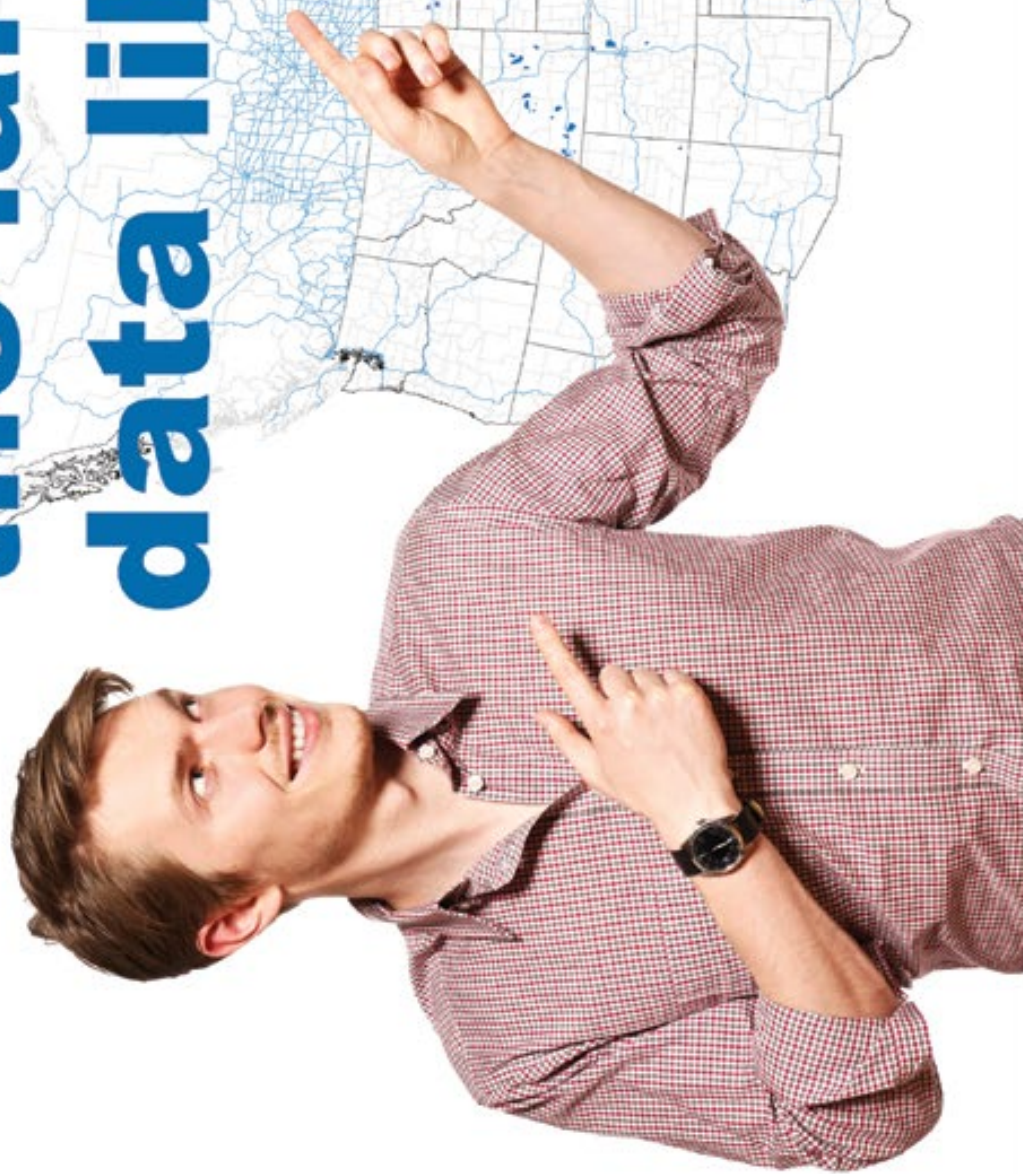
This brings me to an overarching DEG theme for the coming year: Migrating our perspective away from dealing with unintended consequences of exploration and production activities to a mindset in which we try more rigorously to anticipate possible environmental impacts before they become an issue.

Our industry is overwhelmingly filled with professionals who want to do the right thing the right way, yet real or suspected environmental impacts recur with some regularity.

Some of these are small-scale accidents that would be difficult to avoid no matter the preparation, but more major ones could likely be anticipated and, much like the effects of a defensive-driving mindset that we cultivate while on the road, minimized or avoided entirely

See DEG, page 67

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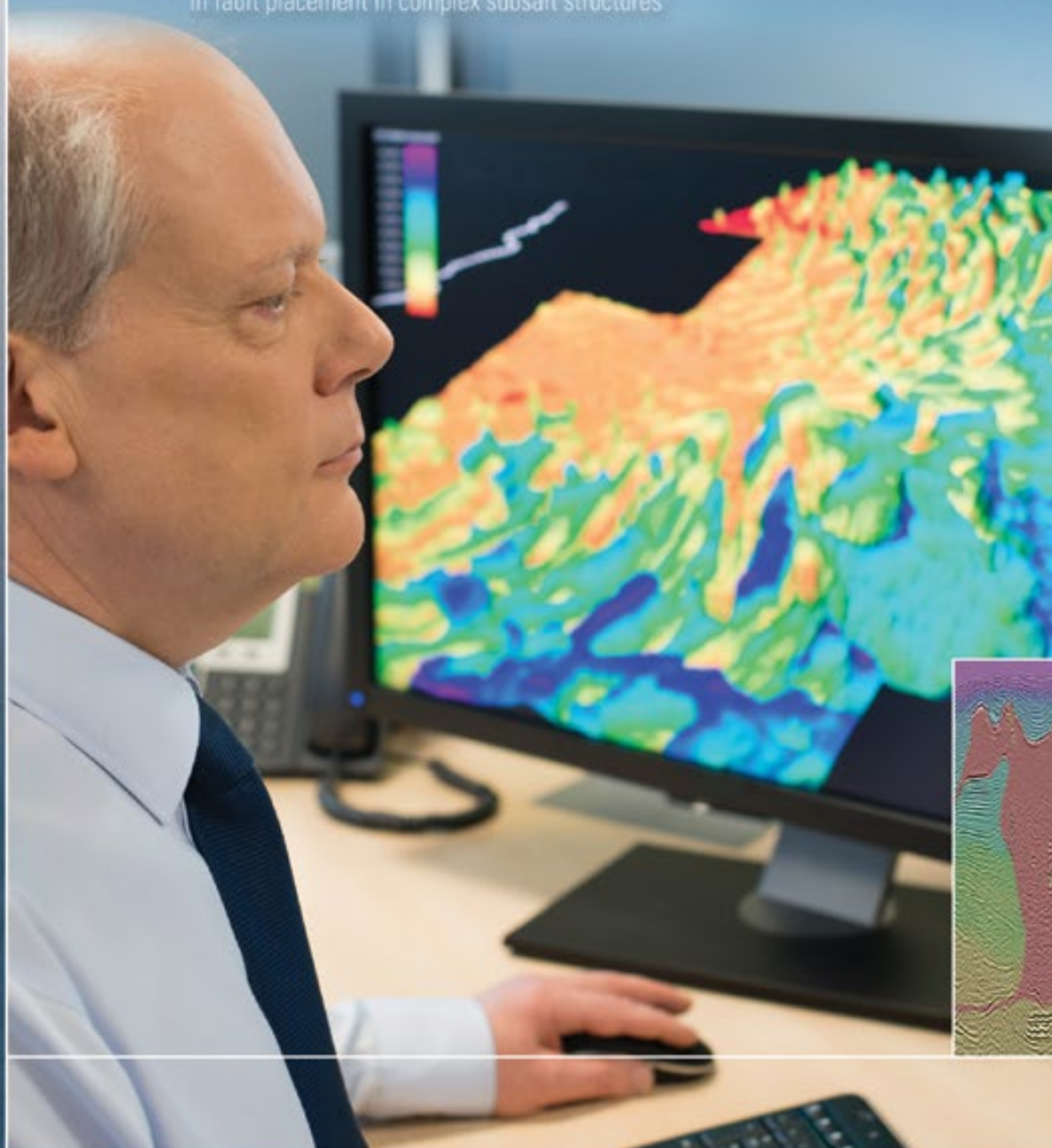


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