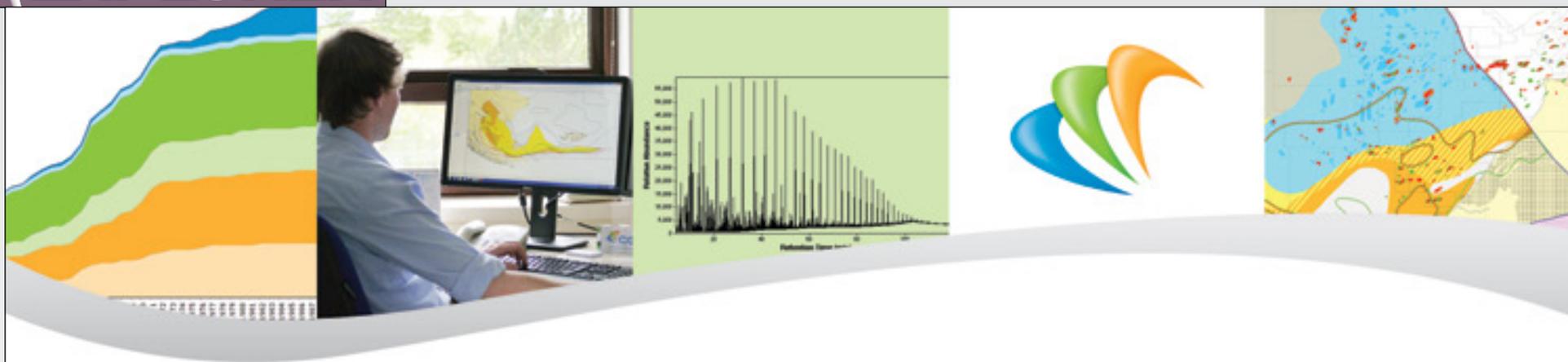


A Whole New World

*ICE gets a new setting for
science and scenic geology*

See page 8



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PRESIDENT'S COLUMN

Doing what we say we do

How Efficient Is Our Membership Process?

BY LEE F. KRYSZNIK

People who know me might kindly note that I sometimes repeat myself, so you are going to see several editorials wrapped around the concept of "doing what we say we do."

This time the question is: *Do we do what we say we do regarding the membership application process at AAPG?*

Since joining the Executive Committee last year I have had the opportunity to have numerous discussions with members and leaders in our Sections and Regions about the concept of AAPG membership.

Without prompting, these conversations often included strongly worded comments regarding the same topic – AAPG's membership application process.

We say we apply a rigorous membership application review process because we are a professional society and want to maintain the highest possible professional standards within our membership. We also say we want to be an inclusive organization that is open to qualified geoscientists of all nationalities. So, are we doing what we say we do?

* * *

AAPG Bylaws dictate that to become a member of AAPG, the prospective member must have at least a bachelor's degree in geoscience and at least one year of experience.

Interested parties also can join AAPG as an Associate member if they hold a college degree of any type and are employed in association with some aspect of geoscience. The AAPG



KRYSZNIK

Experience generally is easy enough to attest to, but how does a sponsor actually attest to another person's ethics?

Executive Committee (EC) can waive specific membership requirements on a case-by-case basis, where deemed appropriate.

OK, sounds fine so far. So, what are the issues?

Once past the initial membership requirements, the prospective member enters into the membership application process and immediately encounters the "Sponsorship Form," where three sponsors must attest that the potential member's experience and ethical behavior meet AAPG's standards.

And therein lies the rub.

Experience generally is easy enough to attest to, but how does a sponsor actually attest to another person's ethics? I can personally say that my true

insight into others typically stops at their skin. How can I know whether this person, once a member of AAPG, will act in an ethical way under stress?

On the other side, the prospective member may have been raised in a culture where a request to have their ethics and capabilities attested to by others may be profoundly insulting – or simply may be quite challenging in a place where very few AAPG members reside (this creates a self-fulfilling non-membership cycle).

* * *

Then there is the question of what we are actually accomplishing through our rigorous membership application review process.

In fact and practice, after all our vetting, AAPG delegates virtually never turn away any applicant who meets the basic AAPG education and experience requirements. Those who don't meet the requirements but have extenuating circumstances are referred to the EC, which for the most part have only refused recruiters and a few people who fall blatantly far outside AAPG's basic requirements.

Once the prospective member has cleared the sponsorship hurdle, there is the waiting period where we post the potential member's name and the level of membership they are applying for so that our membership can catch any scoundrels who may have slipped through.

In the 30 years that we can refer to staff memory in AAPG, less than a handful of individuals have had formal, written complaints offered through the posting process. One of those was an angry spouse who admitted that her wayward husband was an ethical geoscientist although she apparently had issues with his non-geological behaviors.

So we find our hard working volunteers and ever-vigilant staff very busily policing our potential members, year in, year out, at considerable financial cost, yet producing precious little net tangible effect for AAPG.

A rigorous membership review sounds great, but we catch hardly any riff-raff in the process.

Is it possible that like all of you, my fellow AAPG members, all of our potential members love geoscience and have

[See President, next page](#)

Dues Reminder: A Deadline Looms

A reminder from the AAPG membership department: 2013-14 dues must be paid before Sept. 1 to prevent losing any member benefits. Renewing is easy to do, and options are available:

- ▶ To do so online, go to www.aapg.org

and click on "Members Only."

- ▶ To do so by telephone, call (918) 584-2555.
- ▶ To do so my email, contact members@aapg.org.

And remember: Sept. 1 is the deadline.

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ON THE COVER:

The upcoming AAPG International Conference and Exhibition will be held for the first time in Cartagena, Colombia, offering a new setting of sun, sand and science for ICE attendees. And speaking of geology: Nearby (near Bogotá, Colombia) is Chingaza National Park, site of an ICE field trip titled "Synrift Sedimentation and Inversion Tectonics: A Journey Along the Meso-Cenozoic History and Petroleum Systems of the Colombian Eastern Cordillera. Cover Photo by Mario de Freitas. Photo left by Luis Alejandro Bernal Romero.

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AAPG Implements Open Access Policy

By JIM BLANKENSHIP, AAPG Geoscience Director

AAPG is implementing a new policy on Open Access publishing that will keep the Association current and engaged in the rapidly evolving policies being developed by governments in the United States and other countries to improve access to government-funded research.

The concept has been around for several years in the United States, spurred on by the rapid access to scientific publications via the World Wide Web and the rising cost of for-profit journal subscriptions.

Initially this policy has been heavily focused in the medical sciences, where

many research programs are funded by public agencies like the National Institute for Health. At its core is the concept that government-funded research should be freely accessible via the Internet.

Recently, however, the United Kingdom Research Council (UKRC) implemented new rules requiring researchers whom it funds to publish their results only in peer-reviewed journals that have an acceptable Open Access policy.

Similar rules are being developed by U.S. agencies that fund research in excess of \$100 million per year – for example, the National Science

Foundation and the Department of Energy.

“For AAPG to remain a viable publication outlet for UKRC funded research, and potentially in the future for other government-funded research, we needed to have a policy and procedures in place for those authors” said Colin North, professor of petroleum geology at Aberdeen University and chair of the AAPG Publication Committee.

AAPG’s Open Access policy was approved by the AAPG Executive Committee at its June meeting, developed with input from the full scope of AAPG’s editorial boards and designed to be

compliant with new UKRC rules and flexible enough to deal with pending rules from U.S. funding agencies.

“Little will change in AAPG’s publishing process for most of our authors,” said AAPG Elected Editor Michael Sweet. “However, for those researchers whose work is funded by government grants requiring an Open Access solution, we believe that this new policy will allow AAPG to remain an attractive venue to publish their work.”

Available Options

AAPG’s new Open Access policy will give authors requiring an Open Access solution two choices:

- ▶ One choice would require an upfront fee from the author and would make the final paper freely available to the public; this is often referred to as the “Gold Model of Open Access” in the publishing world.

- ▶ The second option will be the so called “Green Model of Open Access,” which requires no fee from the author, but allows for an early version of the manuscript to be posted for free download at an approved site.

AAPG’s new Open Access policy is in effect immediately.

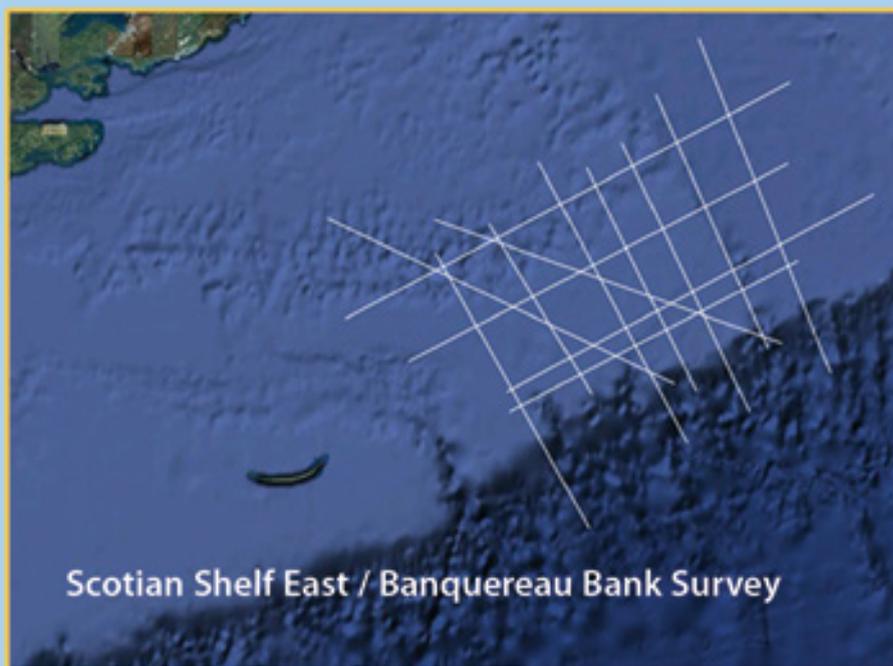
More information on the policy can be found at www.aapg.org/pubs/policy_openaccess.cfm.

JEBCO Seismic

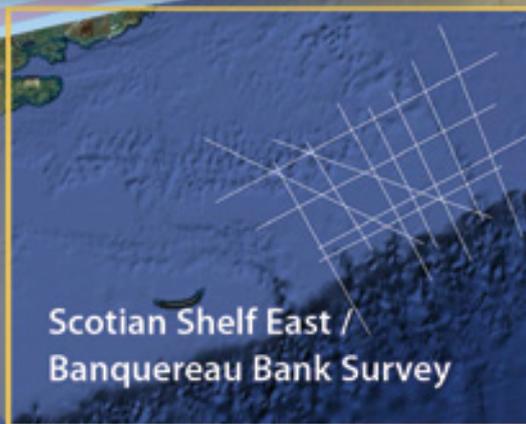
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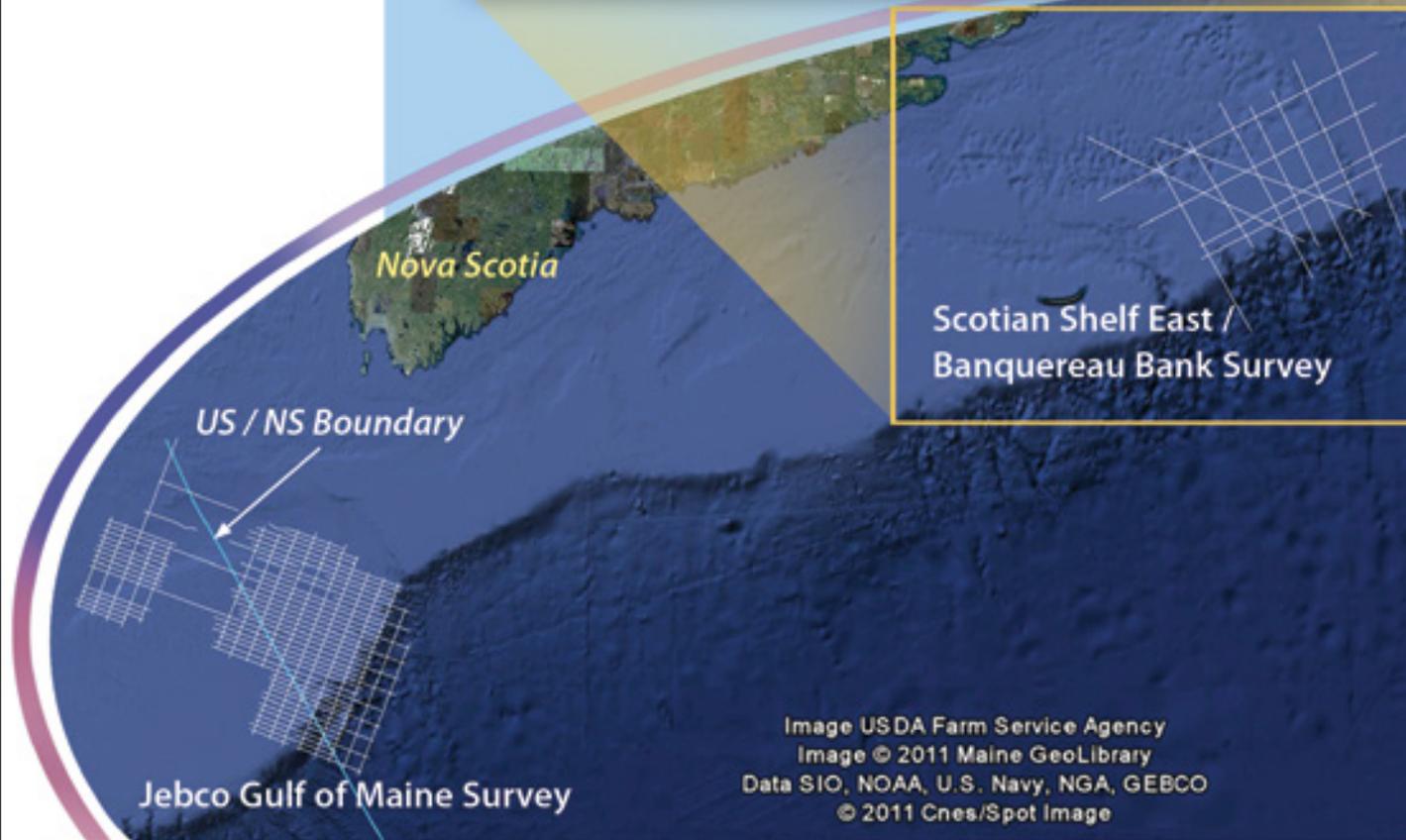
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Scotian Shelf East / Banquereau Bank Survey



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President from previous page

worked hard to earn the appropriate education, experience and trust of their geoscience colleagues? And do the numbers strongly suggest that virtually no other riff-raff want in?

The diligent and hard-working delegates and staff who do this tedious work are greatly appreciated and respected for their efforts, but I find myself asking if these fantastic volunteers and our hard-working staff don’t deserve to focus on tasks that step beyond being guardians of a castle gate where precious few barbarians ever approach.

Perhaps our volunteers and staff would prefer to do things that more directly serve AAPG’s rather well-qualified membership.

* * *

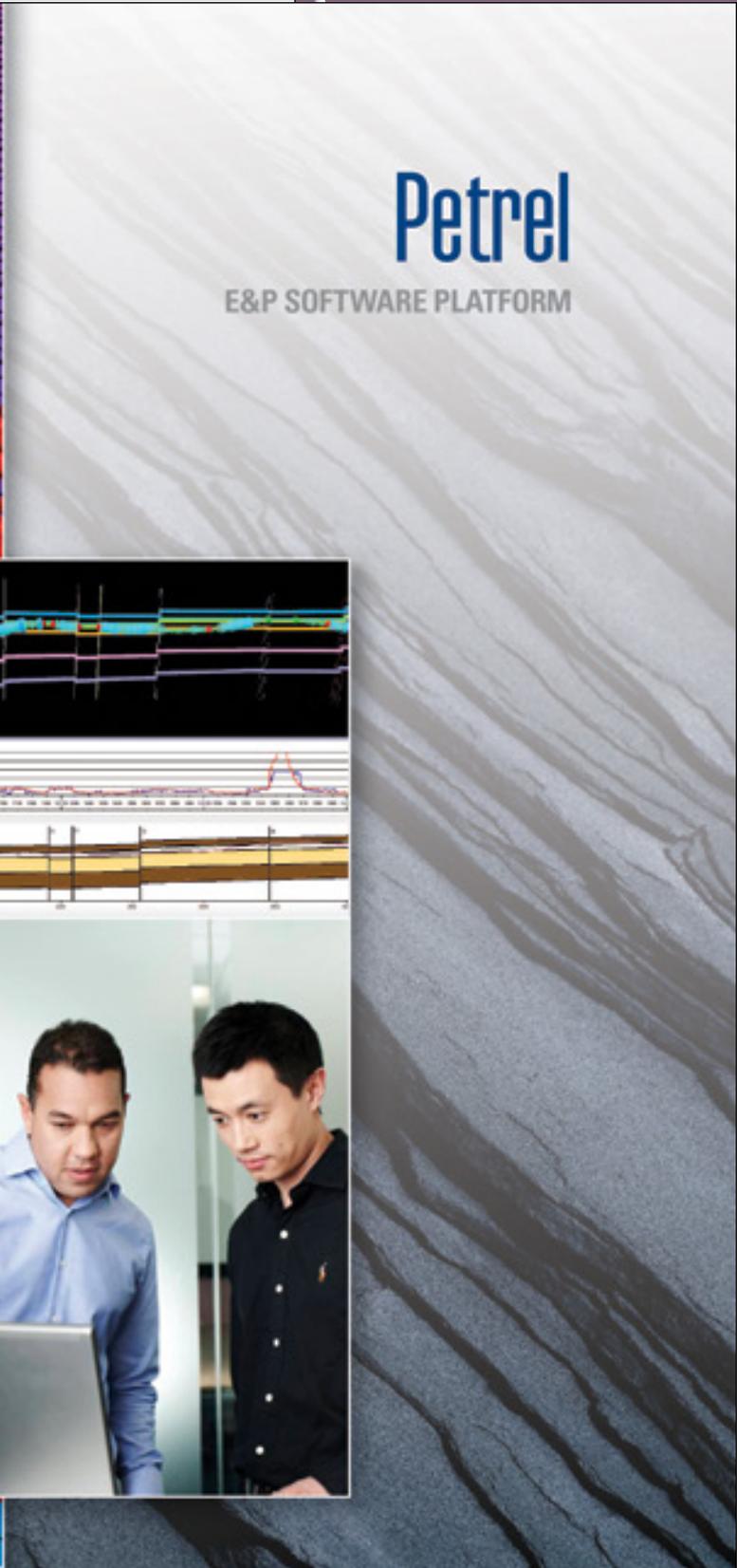
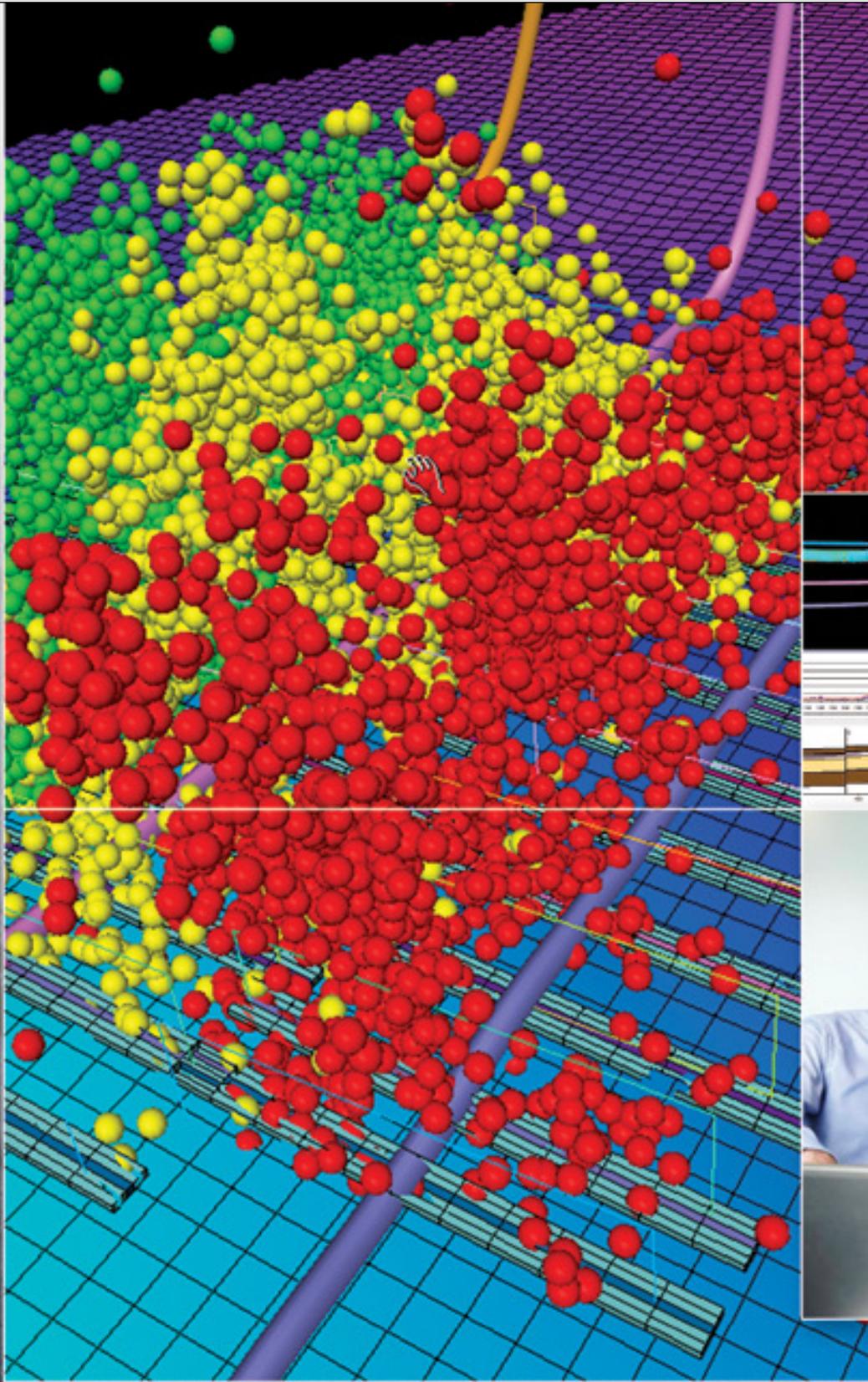
The Advisory Council recently proposed that AAPG drop its requirement for sponsorship, because the process has caused a huge expenditure of human and financial resources for little net measurable outcome.

This seems to make pretty good sense, although some of you will likely tell me why it does not.

Fire away! Send either your rousing support or your scorching flame mail to lee.krystinik@aapg.org.

I seek to understand as I continue to ponder AAPG doing what we say we do.





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AAPG, SEG join for new publication

INTERPRETATION Journal Debuts This Month

By VERN STEFANIC, EXPLORER Managing Editor

The inaugural issue of INTERPRETATION, a new journal jointly published by SEG and AAPG, has been completed and will be mailed free-of-charge to print recipients of the EXPLORER and The Leading Edge in early August.

INTERPRETATION is a peer-reviewed quarterly that comprises papers directly related to the practice of interpretation of the Earth's subsurface for exploration and extraction of mineral resources, and for environmental and engineering applications.

The journal aims to accelerate innovation in interpretation.

The August issue will include a special section on interpreting stratigraphy from geophysical data (see table of contents in accompanying box). The issue, in addition to print, also will be available online free of access controls at <http://seg.org/interpretation>.

The second issue, scheduled for November completion, will include a special section on interpretation for unconventional resources. It also will be available free both in print and online; those who would like to receive a free print copy of the November issue, however, must sign up online at <http://seg.org/freeissue>.

After the November issue, members and institutions will be able to subscribe to the journal, which will continue to be available both in printed form and online.

SEG, the world's largest international society dedicated to applied geophysics, announced the journal's creation in 2012. AAPG, the world's largest professional geological society, announced it would join SEG in its publishing in March.



SUN

Former SEG Editor **Yonghe Sun** is the publication's editor-in-chief; the deputy editor-in-chief is AAPG Honorary member **R. Randy Ray**, a consulting geophysicist-geologist in Denver and former editor of the EXPLORER's Geophysical Corner.

INTERPRETATION's inaugural editorial board includes members of both AAPG and SEG. The organizations will take turns appointing editors-in-chief for three-year terms.

"It is only natural that SEG and AAPG jointly publish the journal with their combined 70,000 members as the primary audience," Sun noted. "Subsurface interpretation requires the integration of data and knowledge from multiple geosciences practices and disciplines, and first and foremost among them are geology and geophysics.

"With easy finds gone," he added, "this is more so than ever."

An INTERPRETATION article typically will contain an interpretation that helps advance the methods and practice of interpretation, according to the editors. Articles that describe interpretation methods and applications involving integration of multiple data sets to quantify as well as visualize subsurface structure will be strongly encouraged.

Ray observed that once the editors are part of the board "they do not wear AAPG or SEG hats, but all will work to build the

"INTERPRETATION is a multi-disciplinary melting pot where the alchemy of ideas can interact to create new knowledge."



RAY

journal to be focused on interpretation of interest to geologists, geophysicists and engineers."

He also called Interpretation's launch "a historic event" that has been over 10 years in the making through various joint committees.

"There has also been a long-standing joint AAPG and SEG Geophysical Integration Committee that has shared ideas for publications and selected convention technical presentations to be part of both societies' annual meetings," Ray said. "The fostering of committee cooperation has combined with the experience of past presidents in SEG and AAPG recognizing the enhanced value of science when our members work together.

"Past SEG President (and AAPG member) Bob Hardage and past AAPG President Ted Beaumont, and their respective executive committees, were instrumental in making this happen now," Ray said.

"For the first time, SEG and AAPG will join together to hatch a new publication with all the goodwill and technical expertise that each can bring to the venture," he said.

"INTERPRETATION is a multi-disciplinary melting pot," Ray added, "where the alchemy of ideas can interact to create new knowledge."

AAPG-appointed associate editors in addition to Ray who are part of INTERPRETATION's first team of editors include:

▶ **Stephen A. Sonnenberg**, (an AAPG Honorary member), Colorado School of Mines and the Colorado School of Mines' Bakken Research Consortium, Golden, Colo.

▶ **Linda R. Sternbach**, Star Creek Energy, Houston.

▶ **Alistair R. Brown**, consultant and past editor of the EXPLORER's Geophysical Corner, Allen, Texas.

▶ **Karen Sullivan Glaser**, Schlumberger PetroTechnical Services, Katy, Texas.

A fifth AAPG member is yet to be announced.

SEG members who are part of Interpretation's first team of editors include:

▶ **William L. Abriel**, Chevron, Orinda, Calif.

▶ **Bruce Hart**, Statoil, Katy, Texas.

▶ **Donald A. Herron**, Sugar Land, Texas.

▶ **David H. Johnston**, ExxonMobil Production Co., Houston.

▶ **Kurt Marfurt**, University of Oklahoma, Norman, Okla.

▶ **John O'Brien**, Anadarko Petroleum Corp., Houston.

▶ **Juan Carlos Soldo**, Buenos Aires, Argentina.

▶ **Hongliu H. Zeng**, Bureau of Economic Geology, Austin, Texas.

Abriel, Hart, Herron, Johnston, Marfurt, Zeng, Brown, Sternbach and Glaser are members of both SEG and AAPG.

Once the inaugural board is complete with AAPG appointments, future additions to the editorial board will be based on the journal's editorial needs instead of considerations of the candidates' professional affiliations. ■

INTERPRETATION First Issue Showcases Diverse Papers, Special Focus

Articles in the initial issue of INTERPRETATION will include:

Pitfalls

▶ Pitfalls in Prestack Inversion of Merged Seismic Surveys (Sumit Verma, Yoryeny DelMoro and Kurt Marfurt).

Tools, Techniques and Tutorials

▶ Mudstone ("Shale") Depositional and Diagenetic Processes: Implications for Seismic Analyses of Source-Rock Reservoirs (Bruce Hart, Joe Macquaker and Kevin Taylor).

▶ Thoughts and Observations on Interpreting Depth-Imaged Data (Donald Herron).

Special Section: Interpreting Stratigraphy from Geophysical Data

▶ Introduction to special section (Hongliu Zeng, Bruce S. Hart and Lesli J. Wood).

▶ Whither Seismic Stratigraphy (Bruce S. Hart).

▶ Seismic Sequence Stratigraphy and Sedimentary Evolution of Carbonate Reservoirs in the Sinian Dengying Formation, Middle Sichuan Basin, Southwest China (Guangfa Zhong, Yalin Li and Dingjin Liu).

▶ New Insights Into Seismic

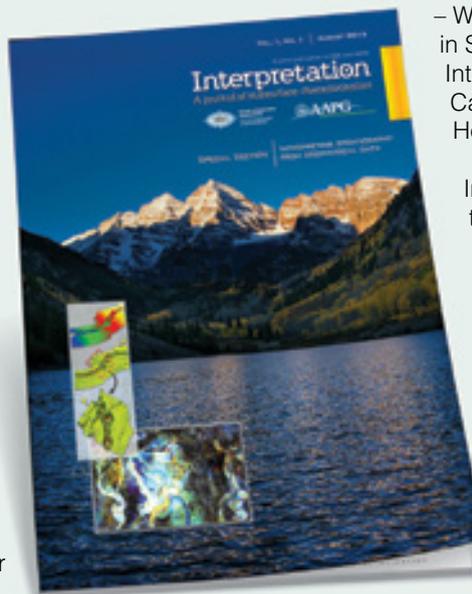
Stratigraphy of Shallow-Water Progradational Sequences Subseismic Clinoforms (Hongliu Zeng, Xiaomin Zhu and Rukai Zhu).

▶ Seismic and Sequence Stratigraphic Interpretation of the Area of Influence of the Magdalena Submarine Fan, Offshore Northern Colombia (Andrea Cadena and Roger Slatt).

▶ Seismic Geomorphology of Early North Atlantic Sediment Waves, Offshore North West Africa (Dallas Dunlap, Lesli J. Wood and Lorena Moscardelli).

▶ Resolving Subtle Stratigraphic Features Using Spectral Ridges and Phase Residues (Oswaldo Davogustto Cataldo, Marcilio Matos, Carlos Cabarcas, Toan Dao and Kurt Marfurt).

▶ Automated Spectral Recomposition



– With Application in Stratigraphic Interpretation (Yihua Cai, Sergey Fomel and Hongliu Zeng).

▶ Using the Image Grand Tour to Visualize Fluvial Deltaic Architectural Elements in South Texas, USA (Bradley Wallet).

General Technical Papers

▶ Inversion-Based Method for Estimating Total Organic Carbon and Porosity, and for Diagnosing Mineral Constituents

from Multiple Well Logs in Shale Gas Formations (Carlos Torres-Verdin and Zoya Heidari).

▶ Critical Reflection Illumination Analysis (Jun Cao and Joel Brewer).

▶ Seismic Interpretation of Tectonic and Paleogeomorphologic Controls on Sediment Dispersal Patterns in a Continental Rift Basin: A Case Study from the Bohai Bay Basin, China

(Hongtao Zhu, Hongliu Zeng, Xianghua Yang and Yawen He).

▶ An Assessment of the Top Khuff Reflectivity: Central Saudi Arabia (Salem Aljuhani).

▶ Discovery of Polymetallic Porphyry at the Silver Queen, British Columbia, Using Airborne EM and TITAN-24 DCIP and MT Surveys (Nasreddine Bournas).

▶ Magnetic Modeling of Iron Oxide Copper-Gold Mineralization Constrained by 3-D Multi-scale Integration of Petrophysical and Geochemical Data: Cloncurry District, Australia (James Austin, Phillip Schmidt and Clive Foss).

▶ Identifying Effective Interpretation Methods for Magnetic Data by Profiling and Analyzing Human Data Interactions (Yathunathan Sivarajah, Eun-Jung Holden, Roberto Togneri and Michael Dentith).

▶ Qualitative Geophysical Interpretation of the Sudbury Structure (Oladele Olaniyan, Richard S. Smith and William Morris).

▶ Interpretation of Airborne and Ground Magnetic and Gamma-Ray Spectrometry Data in Prospecting for Base Metals in the Central-North Part of the Itabuna-Salvador-Curaçá Block, Bahia, Brazil (Bruno Goncalves and Edson Sampaio). ■

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Photo by n.karim via Flickr

AAPG for the first time is headed to Cartagena, Colombia, for this year's AAPG International Conference and Exhibition. The historic walled city is on the right side of the photo.

Adding ICE to Colombian culture

Cartagena Program Casts a Wide Geologic Net

BY LOUISE S. DURHAM, EXPLORER Correspondent

The upcoming 2013 International Conference and Exhibition (ICE) in Cartagena, Colombia, is on target to be a unique, don't-miss event.

This year's event will be held Sept. 8-11 at the Cartagena Convention Center, with the theme being "Energy for Integration and Prosperity."

It will be the first time an ICE event has been held in Colombia, and the first ICE to be held in the AAPG Latin America Region since the 2009 meeting in Rio de Janeiro, Brazil.

Clearly, the location is one-of-a-kind.

Cartagena, which was founded in 1533, sits on Colombia's Caribbean coast, boasting prime beaches, historic Old Town and magnificent colonial architecture. Open patios on cobblestone streets virtually



VEGA

"One of the objectives was to have integration of the Latin America countries and present to the E&P community the things that people are doing in the different countries."

beckon you to sit and enjoy some robust Colombian coffee and memorable pastries.

Business-wise, the ICE meet is planned to please even the most discerning attendee.

It's certainly timely.

ICE general chair Victor Vega noted that

Latin America in large part is the scene of some hot E&P action, including:

- ▶ Heavy oil in the Andean foreland.
- ▶ Deep water in Brazil, Mexico, French Guyana, and Trinidad and Tobago.
- ▶ Unconventional resources in several of the countries, particularly Argentina (Vaca

Muerta formation), Mexico and Colombia (La Luna).

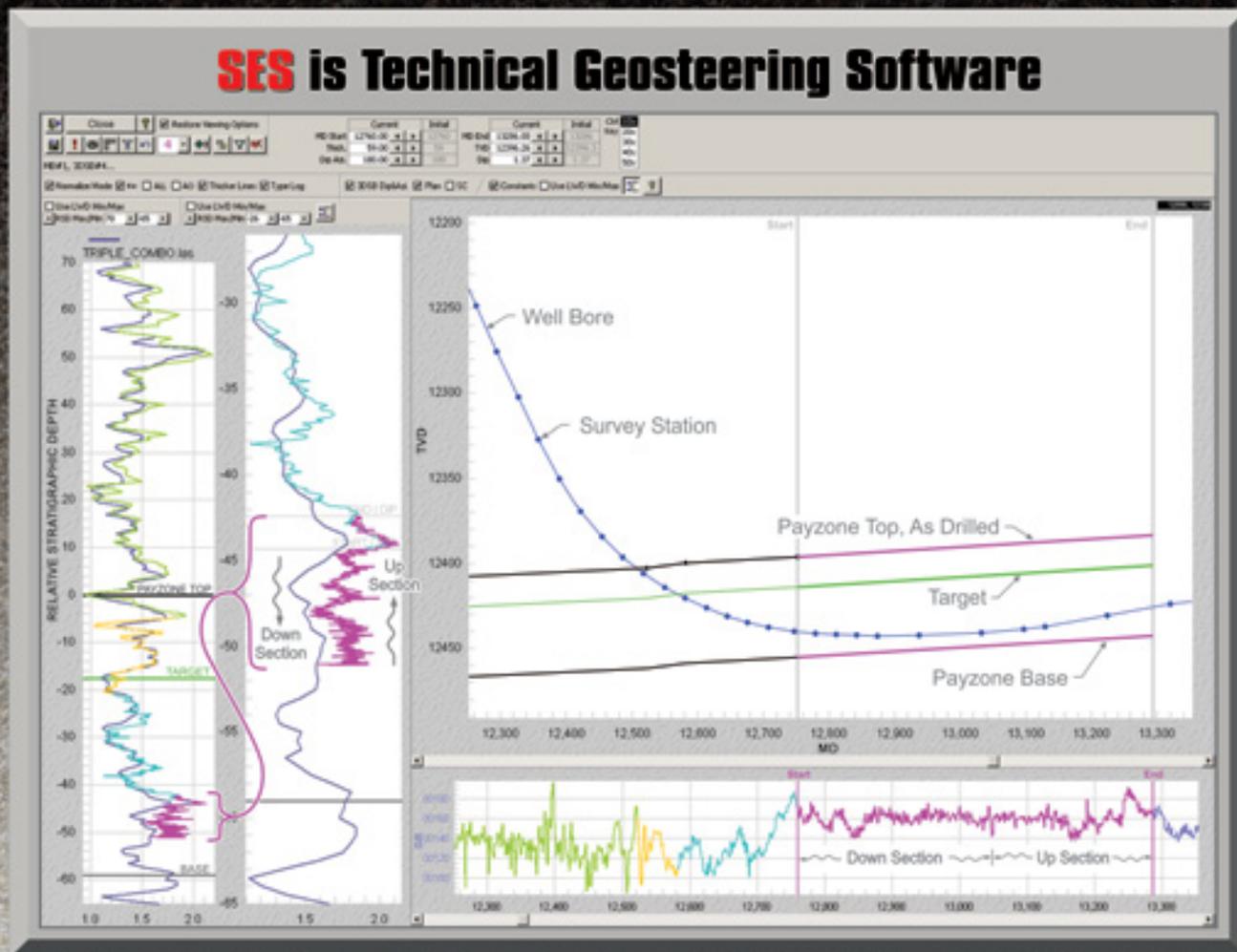
"From the start, my vision was to have the meeting in Cartagena where people can enjoy the city and its interesting aspects and at the same time have the opportunity to get the flavor of what's going on in Latin America," Vega emphasized.

"One of the objectives of the conference was to have integration of the Latin America countries and present to the E&P community the things that people are doing in the different countries," he noted.

The AAPG Latin America Region office in Bogotá benefits substantially from the help of volunteers from the various countries to

See **Cartagena**, page 10

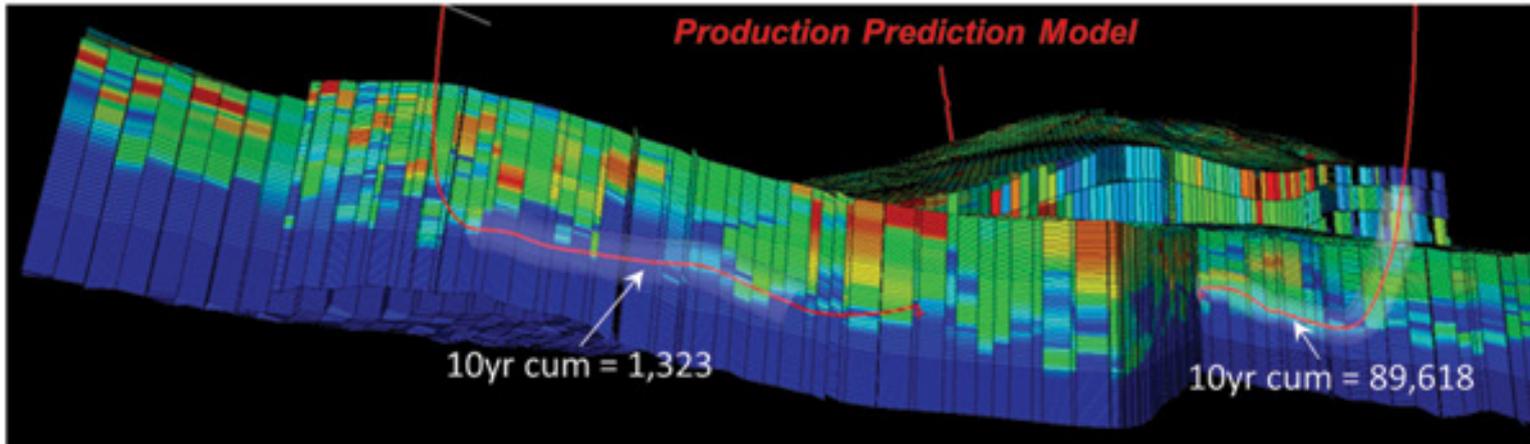
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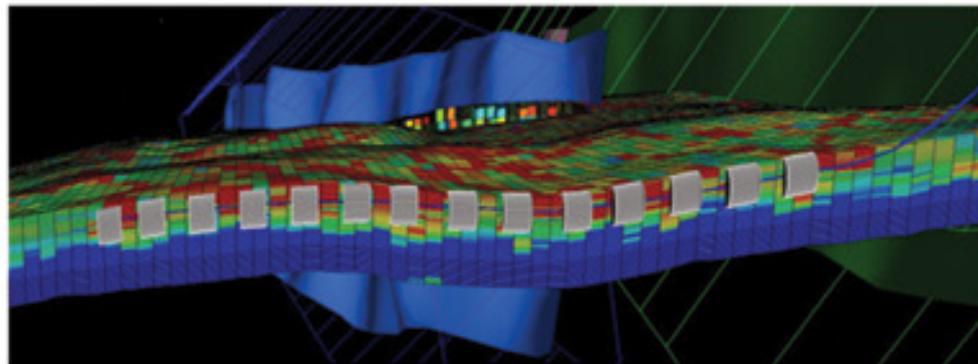
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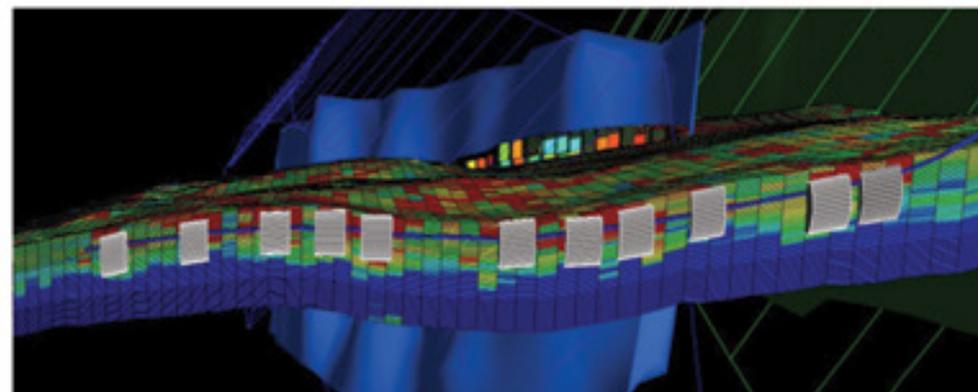


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AAPG Officer Candidates Announced

AAPG officer candidates have been announced for the 2014-15 term, and biographies and individual information for all candidates will be available in early August.

The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2015-16. The terms for vice president and treasurer are two years.

Ballots will be mailed in spring 2014.

The slate is:

President-Elect

☐ **Alfredo E. Guzmán**, consultant, Veracruz, Mexico.

☐ **John R. Hogg**, MGM Energy Corp., Alberta, Canada.

Vice President-Sections

☐ **Steven H. Brachman**, Petro-Hunt LLC, Houston.

☐ **Hannes E. Leetaru**, Illinois State Geological Survey, Urbana, Ill.

Treasurer

☐ **Vlastimila Dvorakova**, Czech Geological Survey, Brno, Czech Republic.

☐ **James W. Tucker**, consultant, Houston.



Photo by Luis Alejandro Bernal Romero

Modern and neogene outcrops on the Cienaga Grande de Santa Marta to El Rosario Islands area will be visited on an ICE field trip that will deal with climatic and tectonic controls as a predictive tool for petroleum systems.

Cartagena from page 10

help implement plans to better serve the resident AAPG members, while advancing the knowledge of geology.

Geoscience workshops along with new student chapters throughout the Region are a couple of the high profile achievements.

"I wanted ICE basically to be the culmination of all the years of work that have been done," Vega said.

A Program With a Twist

The program was designed with a unique twist or two.

The intent is to draw in a wider variety of professions/attendees than at past meetings.

"As a way to reach the type of people who don't usually come to the (ICE) meetings, we have included a regulators forum where the most important aspects and challenges of unconventional and deepwater E&P regulatory issues will be discussed," Vega said. "We want the regulators to come, along with the geologists, planners and business developers to engage in discussions and ask questions.

"This is important for us in the Region," he emphasized, "because those two topics are very important in many countries."

Another scheduled commanding event is the NOC's forum, where high-ranking officials from several Latin American NOC's will discuss their strategies and challenges. Following this is an IOC's forum, which will provide perspectives on global trends in the industry.

Vega noted that there also will be special individual country sessions to include exploration, science and activities in Brazil, Mexico, and Trinidad and Tobago.

The YPs and students will derive benefits from the ICE program.

One session that specifically targets these groups is dubbed "art of interviewing and career planning." The students will have the opportunity to exchange ideas and have dialogue with perhaps 30, or even 40, professionals having considerable experience and perhaps having lived in many countries.

"They can get insight on why these professionals made their career decisions," Vega said, "and the key things they think a student or YP should keep in mind for their career."

Time for Fun

But all work and no play is not necessarily a good thing, no matter the country.

This is Latin America, after all, so enjoy.

In addition to myriad opportunities for sightseeing, shopping, dining and more, a big-time bash dubbed the Party at the Plaza is on tap to showcase much of what makes this region alluring.

"It will be at the Plaza de la Aduana inside the Old City and will be an interesting cultural experience for the attendees," Vega said. "It will show some of the folklore of the country and provide the opportunity to experience a bit of Colombian culture.

"The final thing I'd like to stress is that ICE has the support of the Colombian government at the highest level," he emphasized. "We have invited the president of the country, the minister of mines, the president of the national hydrocarbon agency and the president of Ecopetrol."

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But there's more ...

Brazil Still Dominates South America Activity

By DAVID BROWN, EXPLORER Correspondent

Out of all the leading oil and gas plays in South America, the 8,000-pound elephant in the room hasn't changed, said Pedro Zalán.

"The pre-salt play of the Santos and Campos basins (in Brazil) continues to be the world's hottest spot in deepwater and ultra-deepwater exploration, yielding several new large discoveries of mostly light oil every three or four months," he noted.

Zalán, an AAPG member, is consultant geologist with Zag Consultoria em Exploração de Petróleo in Rio de Janeiro and will serve as Brazil Session co-chair at AAPG's International Conference and Exhibition in Cartagena, Colombia, in September.

He predicted even bigger news out of Brazil, soon.

"In October, the world will watch with astonishment the auction of a super-giant discovery, the Libra discovery, with recoverable volumes estimated at around 8-12 billion barrels with 26-42 billion barrels in-place. The bonus already established by the government is \$7.5 billion," he said.

The "great exploratory highlight in Brazil this year" has been the 11th Bidding Round carried out by Agência Nacional de Petróleo (ANP) in May, the country's first exploration-area offering in five years, he said.

In all, "142 blocks were licensed out of 289 blocks offered. There were bids in all 11 sedimentary basins offered. A total of 30 different companies, 12 native and 18 foreign, won these blocks and will act as operators," Zalán said.

"The total bonus paid by the companies for the blocks amounted to about \$1.4 billion. The amount of investments offered by the winning companies in terms of seismic acquisition and drilling of wells added up to around \$3.5 billion," he noted.

In the bidding round, two areas emerged as important future exploration arenas, according to Zalán. Brazil's equatorial Atlantic Margin encompasses five offshore sedimentary basins – from west to east: Foz do Amazonas, Pará-Maranhão, Barreirinhas, Ceará and Potiguar.

"The first received the highest bid ever offered in Brazil, \$170 million for one block. The great appeal of this margin is the geological analogy with the offshore basins of the homologous margins of Ghana and Ivory Coast in Africa," he said.

"Several deepwater discoveries in Cretaceous turbidites have been made in these African countries," he added, "of which the Jubilee field is the greatest star, with recoverable volumes estimated at one billion barrels and already producing around 100,000 barrels/day."

Here, There and Everywhere

In nearby French Guyana, the ultra-deepwater Zaedyus discovery just 30 miles (50 kilometers) from the border with Brazil

sparked intense competition for the blocks of the Foz do Amazonas Basin.

"In the deep and ultra-deep waters of the equatorial margin of Brazil, several leads constituted of shining bright – in seismic amplitudes – turbidites pinching out updip, seeming to replicate the histories of exploratory successes in the Ghanaian and French Guyanese basins," Zalán observed.

Another emerging exploration area is the onshore Parnaíba Basin in northeast Brazil.

"This huge intracratonic, Paleozoic basin was totally disregarded by the companies until a few years ago. After a successful exploratory campaign,

"Unconventional resource development will take place in Latin America, although plenty of conventional plays remain to be explored."

the Brazilian company OGX found four commercial discoveries of gas and put one of them, Gavião Real, into production," Zalán said.

"In that area, all 20 blocks received offers in a fiercely disputed contest, since gas is nowadays a highly valued commodity in Brazil," he explained.

Brazil isn't the only hot exploration region in Latin America, and Zalán cited several other prospective areas to watch:

► **Peru.**

"Significant gas and condensate discoveries are being made in the Peruvian sub-Andean fold-and-thrust belts, the Ucayali Basin, in the central-eastern part of the country by Petrobras and Repsol, all adjacent to the giant Camisea gas and condensate complex," he said.

► **Argentina.**

"In the Neuquén Basin, the Vaca Muerta and Los Molles formation shale gas and shale oil potential are estimated in the order of 600 trillion cubic feet of gas and 20 billion barrels of technically recoverable shale resources," he noted. "Tens of wells already have been drilled and tested with good results."

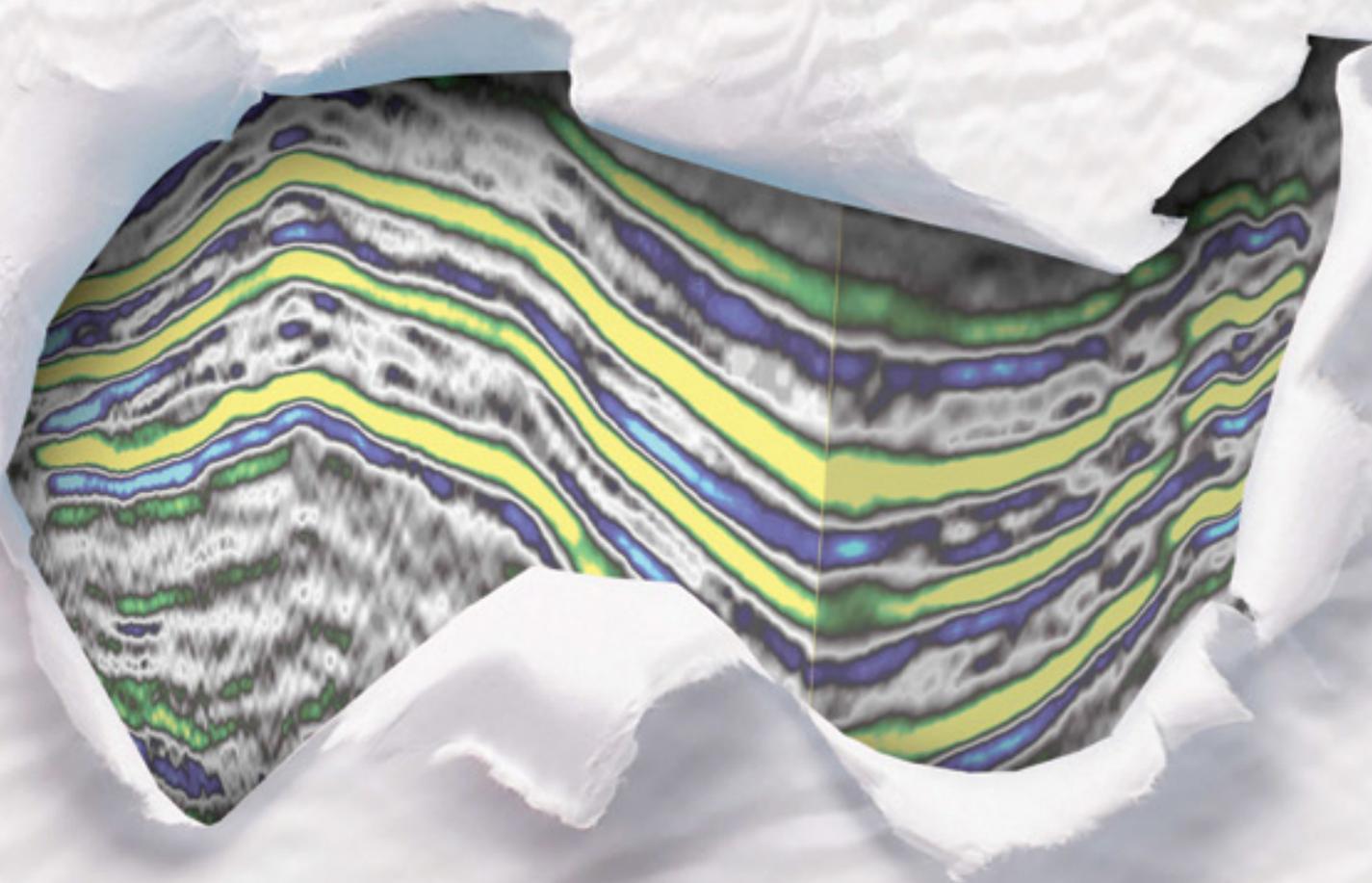
► **Uruguay.**

"In an auction held last year, eight blocks situated mostly in deep waters were awarded to major companies such as BP, Total, BG and Tullow. Besides that, Petrobras, YPF and Petrogal were already established in other offshore blocks," Zalán said.

See Activity, page 14

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Aeolian overlying fluvial deposits at Puente Picun Leufu (Quebrada del Sapo Formation), Neuquén Basin.



Magdalena Valley – Chaquira Valle del Magdalena – Chaquira.

Activity
from page 12

► **French Guiana.**

“On the steps of the Zaedyus discovery a large increase in the exploratory activity is expected for this ultramarine department of France as well as for its neighbors,” he said.

Earlier this year, partners in the Zaedyus play decided to extend drilling operations after a confirmation attempt intersected a 165-foot gross section of oil-stained sands in the lower part of the Bradypus fan, which was not a target formation. Partners include Shell France, Tullow Oil PLC, Total SA and Northpet Investments.

The late-2011 Zaedyus discovery discovered 236 feet (72 meters) of net oil pay in two turbidite sand systems, comparable to the Jubilee field offshore Ghana.

► **Colombia.**

“A great surge in production in recent years was not followed by significant discoveries,” Zalán said. “The reserve/production ratio is starting to be worrisome.

“However, there are several underexplored sedimentary basins in the country with great exploratory potential,” he added, “and several opportunities to be followed.”

The Lower Magdalena Valley, Catatumbo, Cesar-Rancheria and Cauca-Patia are areas with numerous indications of hydrocarbons and several poorly imaged, complex structures waiting to be defined by better seismic, he noted.

“The Amazonas Basin is a remote frontier whose geological similarity with the adjacent Brazilian Solimões Basin, the third largest hydrocarbon producing basin of Brazil, allows geologists to imagine the continuation of the gas/light oil trends into Colombia,” he said.

Unconventional Potential

Unconventional resource development will take place in Latin America, although plenty of conventional plays remain to be explored, according to Zalán.

“The large Paleozoic and Proterozoic Brazilian onshore basins are in general under-explored for gas in conventional ways. The exception is the highly productive Solimões Basin,” he said.

“So, for most of the huge Brazilian onshore, intracratonic basins, the exploration for conventional resources will be the norm for several decades ahead. There are simply not sufficient wells drilled to pinpoint sweet spots for the source rocks,” he added.

But the situation is dramatically different in the Cretaceous marginal basins. Reconcavo, Potiguar and Sergipe-Alagoas are mature basins with conventional resources practically exhausted.

In these basins the only way for the companies to develop new significant reserves is to engage in the exploration of nonconventional resources, Zalán noted.

“These are the basins with the greatest potential and best infrastructure for the beginning of the exploitation of unconventional resources in Brazil,” he said. “And this may just happen by the end of this year when the ANP will hold its twelfth bidding round, specially geared toward gas in onshore basins.”

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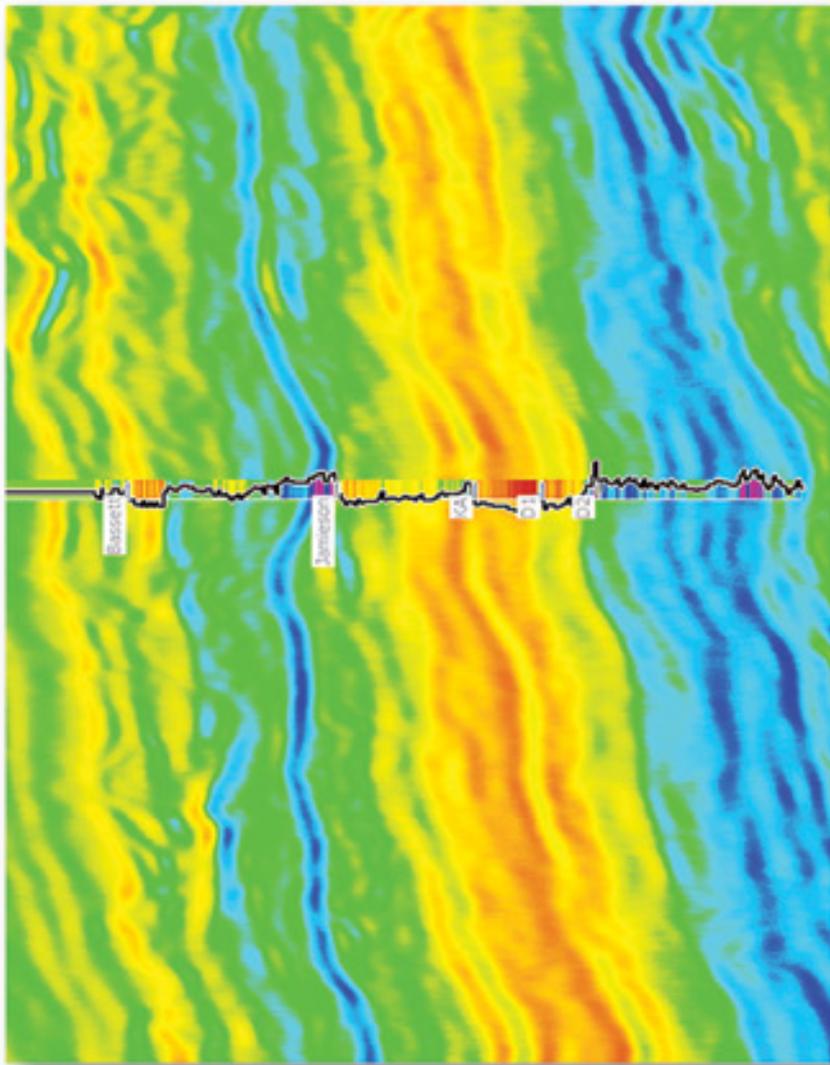
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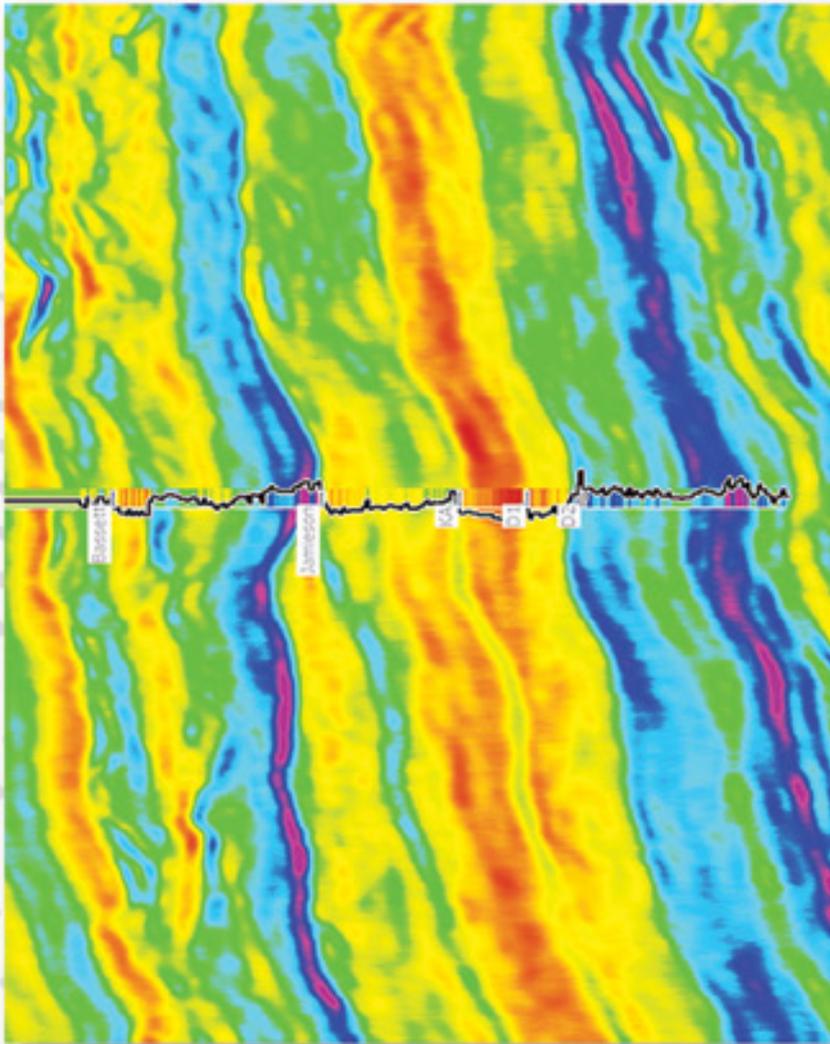
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'Promising future' for unconventional plays

Potential, Successes Top Regional Challenges

By DAVID BROWN, EXPLORER Correspondent

Latin America offers some of the most promising and most perplexing exploration prospects on the planet. AAPG's upcoming International Conference and Exhibition in Cartagena, Colombia, will be held at the corner of the continent with a view toward the heart of the action.

Geology represents only a piece of the puzzle in Latin American oil and gas plays. Politics, production challenges, anti-industry public opinion and difficult pathways to markets can complicate matters.



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Remote and sometimes rugged exploration terrain onshore requires careful logistics by operators.

AAPG member Miguel Ramirez, a co-general vice chair of the AAPG meeting, is an adviser to ExxonMobil de Colombia and president of AAPG's Latin America Region.

There are two government models in Latin America, Ramirez noted: "A more statist and interventionist style of government – Venezuela, Bolivia, Ecuador and Argentina – and more free markets, free enterprise-oriented governments – Mexico, Colombia, Brazil.

"Companies should pay attention also to countries where the rule of law and sanctity of contracts is upheld," he added.

Despite the challenges, Latin America



Not all Latin American activity is in Brazil. View of the Vaca Muerta, an extensive shale, unconventional resource play in the Neuquen Basin in west-central Argentina is among South America's hottest plays.

retains its attraction for exploration investment. Ramirez cited three active and emerging areas.

► First, "Sub-salt plays in the offshore Atlantic margin of South America, in particular Brazil. This may also extend into Uruguay."

► Second, "Heavy oil in the sub-Andean basins, extending from Venezuela, Colombia, Ecuador and Peru. The potential is large as evidenced by the

Rubiales field in Colombia."

► Third, "Sub-salt and salt-related plays onshore and offshore in Mexico."

He also sees a promising future for unconventional resource plays in Latin America, a region already known for its heavy-oil production.

"The potential is huge in the Cretaceous La Luna and equivalents in Venezuela, Colombia, Trinidad and Tobago, Ecuador and Peru and the Vaca Muerta in

Argentina," he said. "The issues facing unconventional in South America are probably more political – environmental, regulatory, community relations – than technical."

Challenges and Success Stories

Colombia illustrates the opportunities and challenges for the oil and gas industry in Latin America.

It has become one of the most attractive areas for international exploration investment. In a significant hydrocarbon success story, the country's oil production surpassed one million barrels/day this year.

That ramp-up reversed a worrying decline in oil production and met a longtime goal of the Colombian government. Encouragement for exploration, better terms for producers and an improved business climate contributed to the growth.

But also key was a decline in the number of attacks on pipelines and other oil-industry infrastructure by Colombian rebel groups, notably the Fuerzas Armadas Revolucionarias de Colombia, or FARC.

Those groups remain active, and could impede future gains. In May, pumping stopped on Colombia's second-longest oil pipeline, Cano Limon, after rebels reportedly used dynamite to blow up part of the line near the Venezuelan border.

A struggle within the industry involves

See Colombia, page 18

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Colombia
from page 16

state oil company Ecopetrol and Toronto-based Pacific Rubiales Energy Corp., Colombia's largest oil and gas independent, over the future of the giant Rubiales oil field in the Llanos Basin.

Rubiales was discovered by Exxon in 1981 in association with the Tethys operating group. Coplex Resources later acquired the field and drilled a handful of wells, but was unable to fund a full development program.

The Tethys group regained the field, and then was acquired by Rubiales Holdings, which became Petro Rubiales Energy. A merger between Petro Rubiales and Pacific Stratus in 2008 produced Pacific Rubiales Energy.

Colombia's newest frontier lies in the Caribbean offshore, where Ecopetrol and several large exploration companies plan activity.

Pacific Rubiales owns Meta Petroleum Corp., which operates the Rubiales, Piriri and Quifa heavy oil fields in the Llanos Basin, and Pacific Stratus Energy Colombia Corp., operator of the La Creciente natural gas field in the northwestern area of Colombia.

It has acquired PetroMagdalena Energy Corp. and C&C Energia Ltd., which have light oil assets in Colombia, a controlling interest in CGX Energy Inc., with a large

acreage position in Guyana, and holds producing and exploration assets in Peru, Guatemala, Brazil and Papua New Guinea.

An aggressive drilling, workover and production-upgrade campaign by Pacific Rubiales and Meta Petroleum helped turn the Rubiales field into Colombia's biggest and most important oil producer.

Ecopetrol and Pacific Rubiales have worked together as partners in the Llanos Basin, but some industry watchers believe

that Ecopetrol will attempt to become Rubiales field operator when current concession agreements expire.

That might be a non-event; Pacific Rubiales expects the field to go into natural decline starting in 2015.

Emerging Targets

The Llanos Basin remains an attractive exploration area for companies in and outside of Colombia. Notable drilling successes this year include:

► The Puerto Gaitan-1 exploratory well on Llanos CPO-06 Block found hydrocarbons in the upper sands of the Mirador formation and in the lower and middle C7 sands of the Carbonera formation. In an initial production test, the well flowed 367 barrels of oil/day from the lower sands.

Puerto Gaitan is the first of a nine-well drilling program on the CPO-06, CPO-07 and CPO-13 Blocks operated by Tecpetrol Colombia.

► P1 Energy Corp. of Calgary, Canada, and partners made a Mirador oil discovery on the Llanos 32 Block. The Bandola-1 well, near the group's earlier Maniceno discovery, went on production in April at 2,600 barrels/day. Total depth was 11,594 feet.

► GeoPark Holdings Ltd., with a subsidiary in Bogotá, drilled its Max 2 well to 10,866 feet in Llanos 34 Block. Initial oil production from the Guadalupe formation was 1,532 barrels/day. The Max field was discovered in 2012 with the Max 1 well, now producing at about 1,031 barrels/day.

Another emerging exploration area is the Magdalena basins area in western Colombia. On the Guama Block in the Lower Magdalena Basin, Pacific Rubiales has targeted the Miocene Porquero Medio C and D sandstones and siltstones, a low-permeability play successfully tested by several exploration wells.

Earlier this year, the company said its Manamo-1X well reached total depth at 7,600 feet and found 251 feet of net pay averaging 18 percent porosity, across a gross interval exceeding 400 feet. The well reached a maximum flow rate of 4.9 million cubic feet/day and 296 barrels of oil/day.

And in the Middle Magdalena, Canacol Energy Ltd. of Calgary has teamed with ConocoPhillips Corp. to explore for shale oil on part of Canacol's 334,000 net-acre holding.

ConocoPhillips will carry the cost of the drilling, completing and testing up to 13 wells.

Offshore Opportunities

Colombia's newest frontier lies in the Caribbean offshore, where Ecopetrol and several large exploration companies plan activity. Ecopetrol and Anadarko Petroleum Corp. have already announced a partnership agreement to explore two blocks in the Caribbean Sea.

Most of the offshore exploration is in early stages, however, and Ecopetrol does not expect offshore Caribbean exploration to contribute to its production until about 2020.

AAPG's international meeting will feature information forums on Colombia and other Latin American countries. Ramirez said the Cartagena ICE is unique in also having a regulators forum, a National Oil Company (NOC) forum and an Independent Oil Company (IOC) forum.

"The country-specific forums will provide a great opportunity to learn what is going on," he said. "These sessions also will provide an opportunity to network with the dealers and wheelers of the region." ■

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An example of Discovery Thinking

Mamba Proved East Africa Potential is Real

By LOUISE S. DURHAM, EXPLORER Correspondent

Operators have been optimistically poking around in the onshore and shallow waters of East Africa since the 1950s.

During several of those decades, exploration activity resulted in a few onshore natural gas discoveries, which were non-commercial at the time.



ORSI

The absence of oil finds is thought to have figured prominently in the ensuing drop-off of enthusiasm for further investments in exploration. The offshore basins were essentially unexplored.

Fast forward to the early years of the 21st century.

The area became intriguing once again, spurred in large part by the prospect of using LNG technology to export gas to expanding Pacific markets and elsewhere.

Rekindled exploration efforts, spurred by advances in technology and models based on a new reading of the region's geology led to a recent ginormous natural gas find.

That Big One occurred in 2011 when Eni E&P drilled the Mamba South 1 well, tapping into the supergiant Mamba gas resource in the Rovuma Basin offshore Mozambique.

The discovery unlocked an estimated



The big discovery occurred in 2011 when Eni E&P drilled the Mamba South 1 well, tapping into the supergiant Mamba gas resource.

AAPG member Marco Orsi, exploration manager for Mozambique at Eni, will present the paper "Mamba: Supergiant Gas Discovery After 60 Years of Exploration in East African Coastal Basins," at 4 p.m. Tuesday, Sept. 10, at the AAPG International Conference and Exhibition in Cartagena, Colombia.

Orsi's talk is part of this year's ICE Discovery Thinking Forum, which will be held that day from 1:55-5:20 p.m.

Other talks in the session will be:
▶ "Geological Thinking Behind the

Discovery of the Heavy Oil Trend in Rubiales-Quifa-Sabanero-CPE-06 Trend," by Jairo M. Lugo, with Pacific Rubiales Energy, Bogota, Colombia.

▶ "The Discovery, Reservoir Attributes and Significance of the Hawkville Field and Eagle Ford Shale Trend – A Texas Giant North American Gas Discovery," by Richard Stoneburner, Houston.

▶ "Santos Basin: 40 Years from Shallow to Deep Waters," by Flavio J. Feijo, with Petrobras, Rio de Janeiro, Brazil.

potential of 80 TCF in place for the Mamba area.

Eni was one of the first E&P players to enter the essentially unexplored Rovuma deepwater basin when it was awarded License Area 4 in Mozambique in 2006.

This was not the company's first foray into the basin. In 1982, Agip (now Eni) discovered the Mnazi Bay gas field onshore Tanzania. Mnazi remained the only discovery in the Rovuma until 2010.

One of the geological ideas that companies began evaluating around 2004 delved into the possibility to find oil in the Rovuma.

"Many of the companies began to re-evaluate whether the deepwater could be more oil prone even if all of the discoveries onshore were gas," said AAPG member Marco Orsi, exploration manager for Mozambique at Eni. "Some geological models suggested this possibility.

"When we took the block in 2006, we thought it might be possible there would be two plays – one oil, one gas," he said. "When we acquired more data, we realized it was most likely that the Mamba area was a gas prospect, so we drilled the first well looking for gas only, and not oil.

"All of the discoveries in deepwater to date," he added, "have been gas."

See Mamba, page 24

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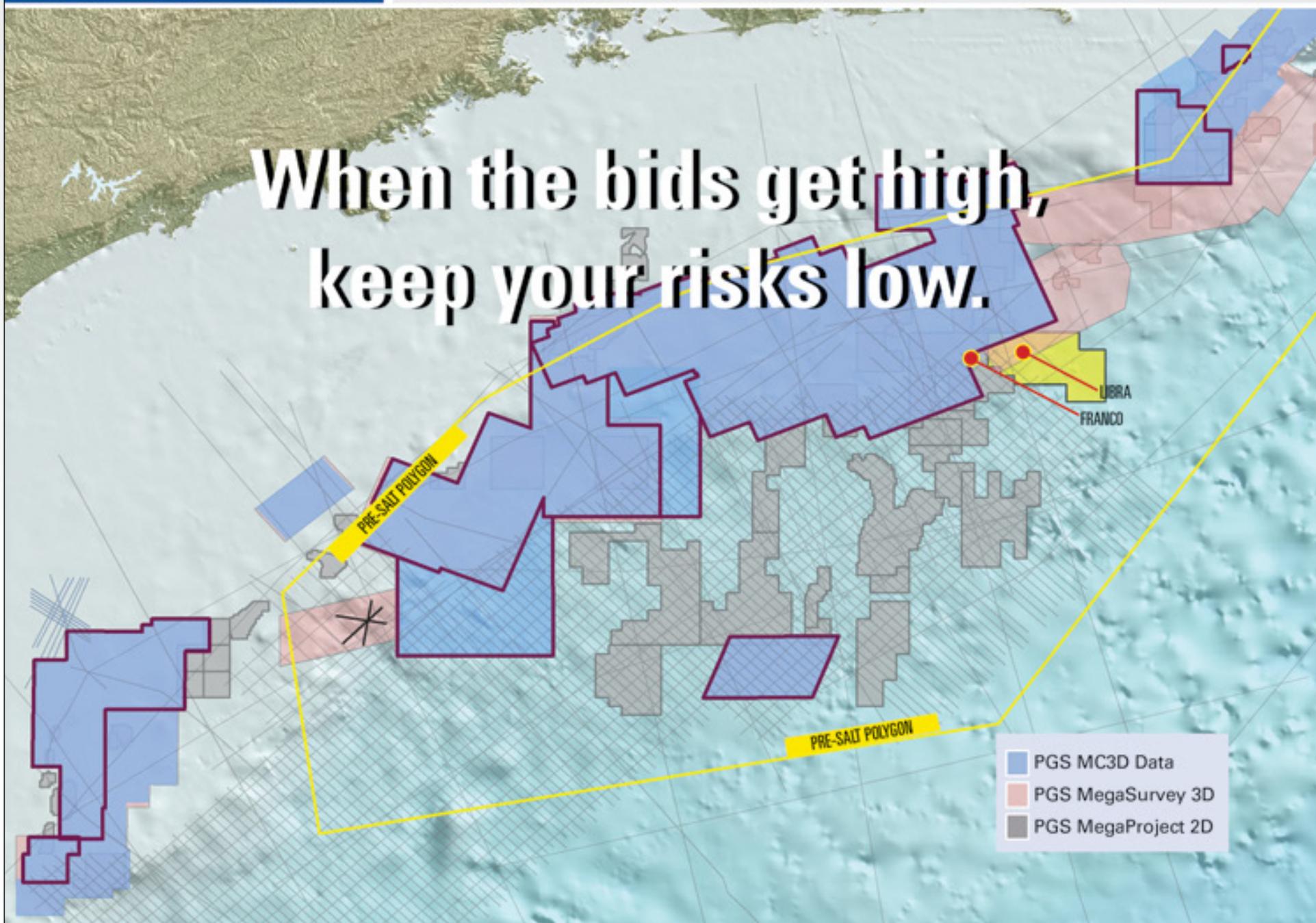
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Operators are hoping they can soon turn Caribbean potential into reality.

Uncertainties don't deter Geologists, Industry Eye Caribbean Lure

By LOUISE S. DURHAM, EXPLORER Correspondent

The Magdalena River is considered to be one of the great rivers in South America.

It originates in the Andes Mountains and travels northward for a distance of 1,000 kilometers, draining an area of 400,000 square kilometers prior to flowing into the Caribbean Sea near Cartagena.

The river drops its cargo of mixed volcanic, basement and reworked clastic

sediments into the offshore Colombia basin at a water depth exceeding 4,000 meters subsea. The result is a delta and a deepwater fan up to 16 kilometers thick and covering a 180,000-square-kilometer area, built from Miocene to the present time.

Operators long have been captivated by the region's onshore oil and gas seeps and mud volcanoes, along with the evidence pointing to oil and gas seepage offshore.

Oil and gas shows have been commonplace in the many wells drilled onshore and near shore.

Even so, only modest-scale accumulations have been encountered onshore. One sizeable (five TCF +/-) shallow water gas field dubbed Chuchupa-Ballena was discovered near the coastline.

But there's excitement aplenty over the potential for good things to come.

AAPG member Brian Frost will present the paper "Key Exploration Uncertainties and the Petroleum Potential of the Deepwater Caribbean Offshore Colombia," at 2:40 p.m. Monday, Sept. 9, at the AAPG International Conference and Exhibition in Cartagena, Colombia.

Frost is new ventures manager for international business development for Anadarko Petroleum Corp., The Woodlands, Texas.

His talk is part of the session "Deepwater Exploration and Production: Emerging Global Deepwater Provinces."

The Right Neighborhood?

Anadarko (APC) has six leases in the deepwater Magdalena fan, one being a farm-in with Ecopetrol. APC is the operator of all six blocks, two of which are technical evaluation agreements and four being E&P contracts.

"We're doing a 5,250-square-kilometer 3-D on five blocks with our partner, Ecopetrol," said AAPG member Brian Frost, new ventures manager for international business development at APC. "In the next couple of months, we'll start acquiring a 2-D survey on one of our technical evaluation agreement areas."

"We're supposed to drill two exploration wells at the end of 2014/2015," he said. "These will be the second and third deepwater wells in all of Colombia."

The first well was drilled by ExxonMobil, Petrobras and Ecopetrol about five years ago in 450 meters of water, basically testing the upper slope, Frost noted.

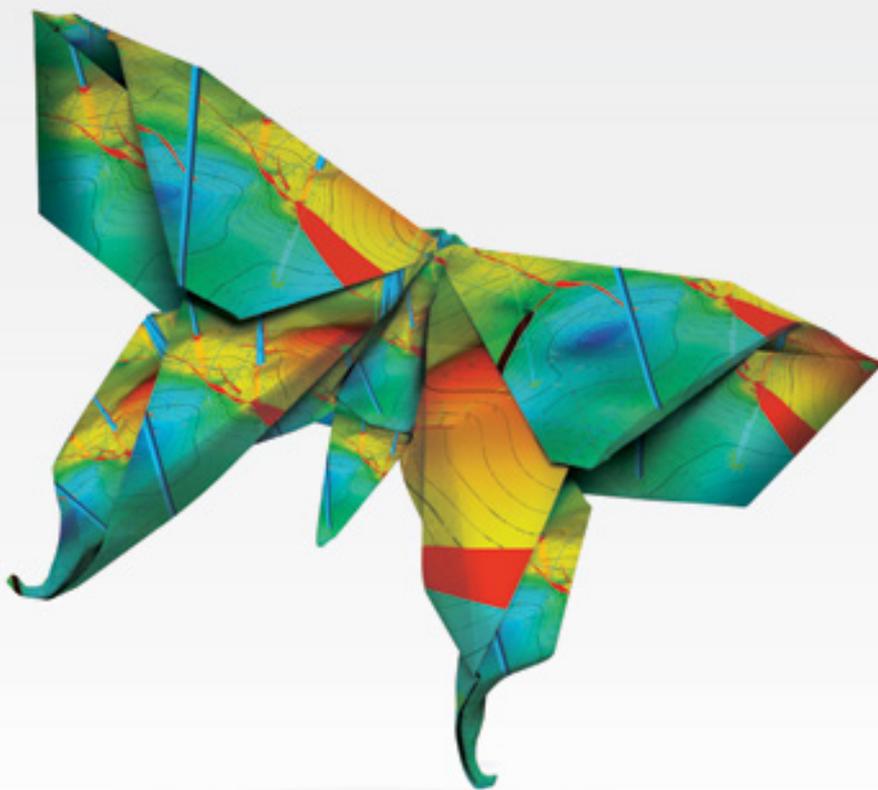
"We're going for the reservoirs down at the toe-of-slope," he said. "These wells will be in about 1,000 to 1,200 meters of water, and we see potential down to 3,000 meters water depth."

Anadarko began looking in Colombia about four years ago, intrigued by the huge delta sitting there since Miocene time and the many oil and gas shows onshore. Piston coring in the deepwater revealed evidence of hydrocarbons.

"We thought it was a lot like East Africa prior to 2009, a lot of oil and gas shows onshore and seeps on the coastline," Frost

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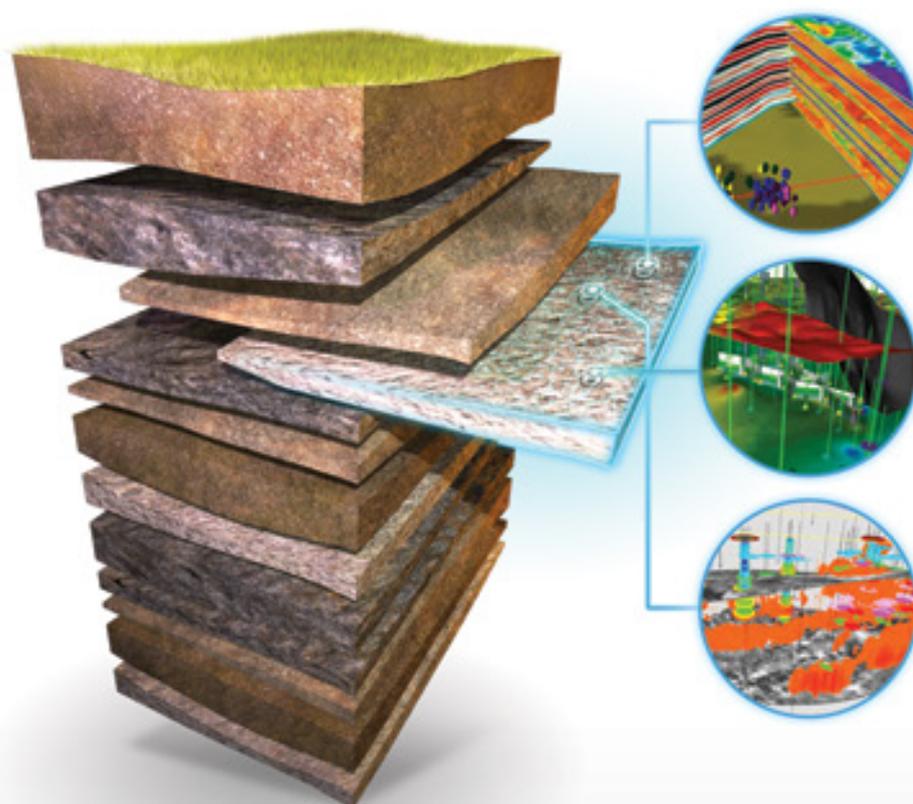


See Caribbean, page 24

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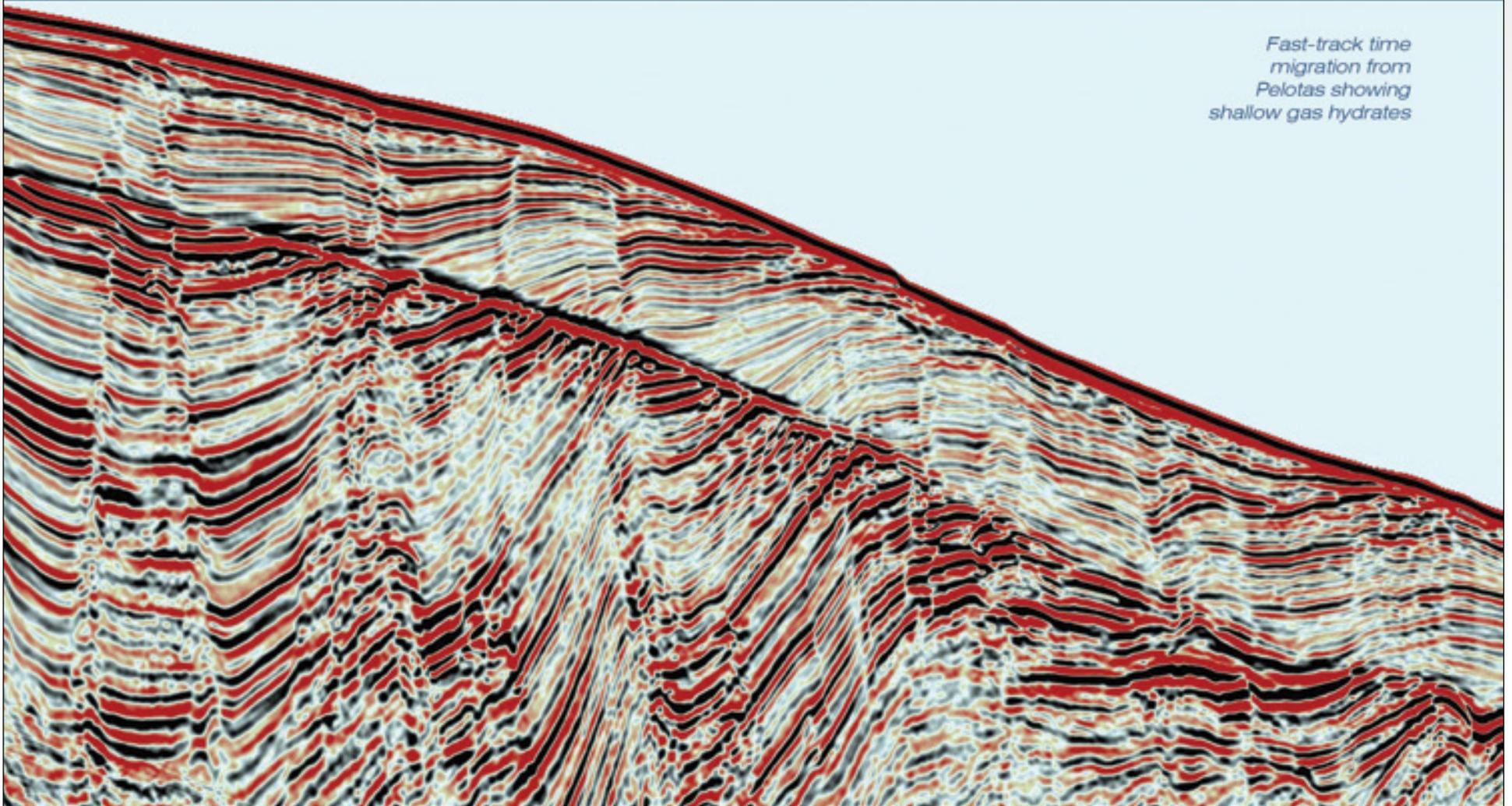
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The processing flow includes both pre-stack time and pre-stack depth migrations. Deliverables are expected to be available to clients Q3 2013.



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Photo courtesy of Kamenatehla via Flickr

The culture of Morocco is evolving into modern times. The country's geology is timeless.

New look at old worlds

Changing North Africa

By DIANE FREEMAN, EXPLORER Correspondent

It turns out that even in the most ancient of lands, change is a constant.

After decades spent visiting Morocco as well as trips to neighboring Algeria, an AAPG member who's led countless field trips to some of the earth's most exotic places says the two old countries are evolving into modern times.

"Over the last 40 years in Morocco I've seen an evolution of all aspects of their life," said John Warme, professor emeritus of the Colorado School of Mines in Golden, Colo.

He's been to Morocco about 25 times for fieldwork, seminars and meetings. In Algeria

he has done some consulting work and field trips along with producing reports for that country's national oil company.

"I've seen the transportation, medical systems and social systems improve in Morocco," he said.

Compared to Algeria, there's a big contrast in tourism and the export of mineral deposits. Phosphate is a big export from Morocco, he said.

"What I've seen is a slow recovery," Warme added, "from the departure of the French when they first gained independence to a rapid recovery in later

years and a dramatic increase in the middle class."

Warme, who received AAPG's Grover E. Murray Distinguished Educator Award in 2005, noted that in Morocco the Berbers dominate in the rural and Atlas

Mountain areas, and

there is a large Jewish population as well within the old cities. He noted that the Berbers herd sheep and goats in Morocco.

"Morocco is a tourist paradise because of the ancient cities with their medieval markets and the royal cities of Fez, Marakech and Rabat," he said. "You can go from the coastal areas in the mountainous areas and then drop into the desert – tourists do mountain treks and camel rides in the desert.

"You see some of that in Algeria," he added. "You can fly straight from Paris to the desert to look at the Tassili area and its deep canyons. It's a flat-topped area with deep canyons cut into it.

"You can look at the evidence of pre-Egyptian cultures," he said, "the rock paintings and carvings."

Meanwhile, oil and gas commodities far outshine all other commodities in Algeria, where the country's gas pipelines connect it to Europe.

"It's a prosperous country," he said.

'A Fantastic Example'

Warme spoke earlier this year at a meeting of the Denver International Petroleum Society discussing the geology and culture of the area.

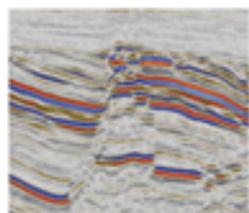
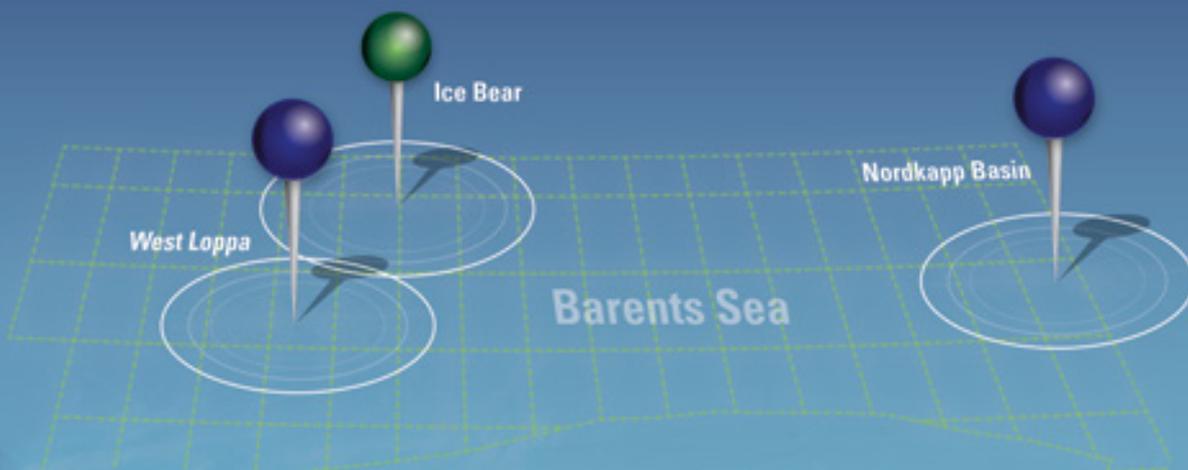
At the start of his talk, he displayed a map of North Africa and asked attendees to point out the areas where they have worked in that region. Many attendees had spent time in North Africa, some starting work there as far back as the late 1950s.

Warme himself first went to Morocco in 1973 to help reinterpret the geological history of the country in terms of plate tectonics. At that time he was teaching at Rice University in Houston and was participating in a joint academic program headed by the University of South Carolina and working with Morocco's Ministry of Interior.

"My initial interest was in looking at trace fossils," he said. "They're biogenic sedimentary structures in deepwater limestones, and I was studying those elsewhere. So I went over to Morocco to look at those and I realized that the High Atlas Mountains were a fantastic example of

See North Africa, page 28

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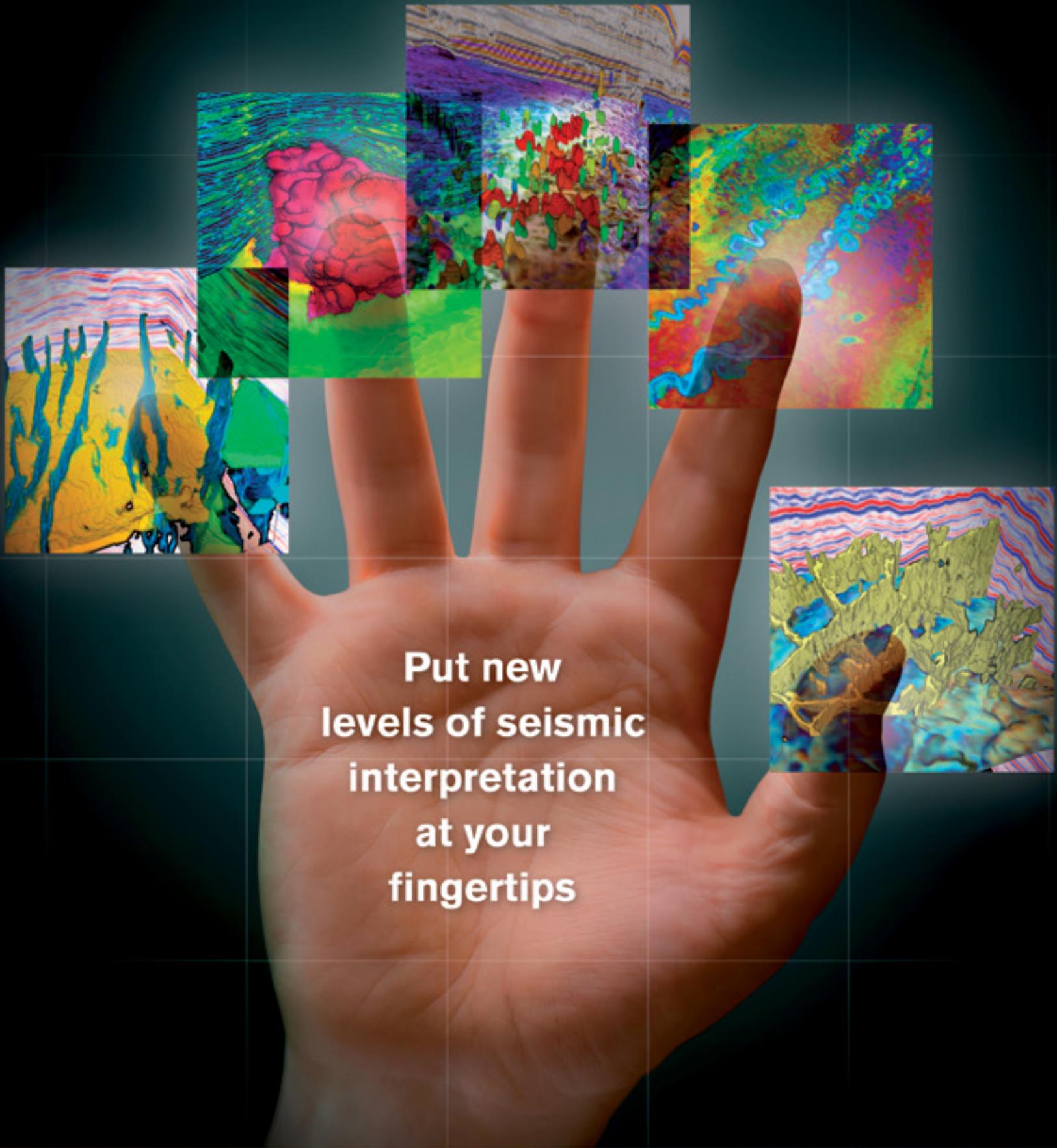
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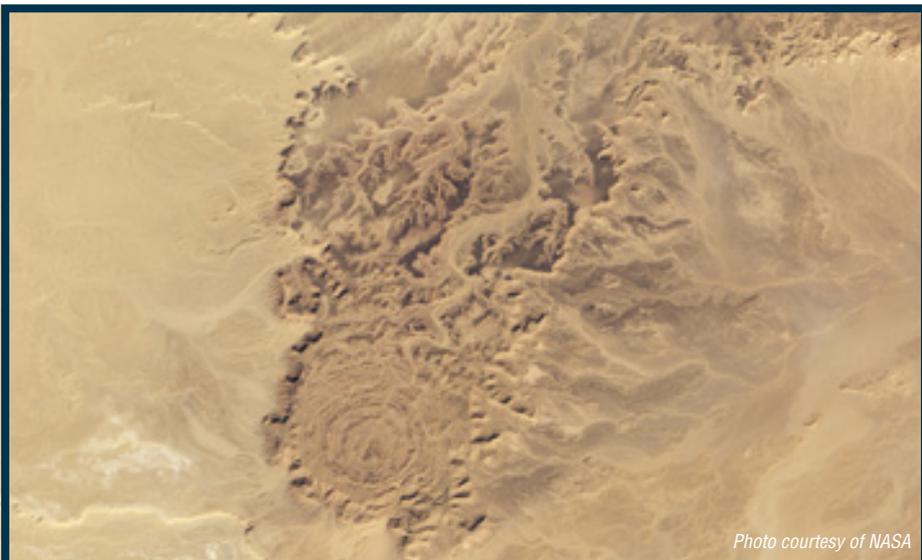


Photo courtesy of NASA



Photo courtesy of Eric Montfort

As seen from space, Algeria is largely a barren land (above left photo), but the geologic details at ground level are amazing. Above right, the southeast part of the Algeria holds the Tassili, famous for its archaeology and geology.

North Africa from page 26

inverted rift basin.

"I went back the next year and started looking at the entire basin, from one shoreline out into the deep water and central baseline platform and then out to shoreline again," he said.

Later, while teaching at the School of Mines, he secured support from the National Science Foundation to return to Morocco and examine the area in more detail.

"That resulted in one of the first North African field trips that AAPG ever sponsored," he recalled.

The Land Before Time

In the 1980s and 1990s Warne led AAPG educational field seminars to Morocco. Since then he has continued to run field trips to the country, bringing students there from the School of Mines, and he has worked with oil companies and some Moroccan symposia there.

He first went to Algeria in 1992.

"I was running an AAPG field seminar in Morocco and there were some Algerians at the seminar. They asked me if I'd be interested in doing a similar seminar there, moving from Jurassic limestones in Morocco to Paleozoic sandstones in Algeria," he said.

Warne went to the southeast part of the country in the Tassili, famous for its geology and archaeology. He was later invited to stay on and take a field trip up through north Algeria through Paleozoic sandstones.

"I saw how interesting it was and thought we could do a field trip for AAPG there," he said.

He later returned to Algeria (1993) for a much more detailed tour in the Tassili area.

"The part of Algeria where we worked was a flat lying area or craton. The rocks are relatively flat lying and there are a lot of unconformities in sections and stratigraphic sections are rather thin. And those were sandstone. They highly contrast with the rift carbonates that we worked on in Morocco," he said. "Those are generally thicker sections and a whole different environment."

Meanwhile, he had gone on safari in Tanzania and climbed Mount Kilimanjaro, seeing animals in east Africa.

"In Algeria I saw the rock carvings of some of those same animals who had lived in that area some 6,000 to 7,000 years ago," he said.

"I had just seen all these animals alive in east Africa – ostriches, giraffes, elephants, antelope, lions, rhinoceros – and then I saw these fantastic drawings and rock carvings in Algeria, where the same animals had lived before it turned to desert." 

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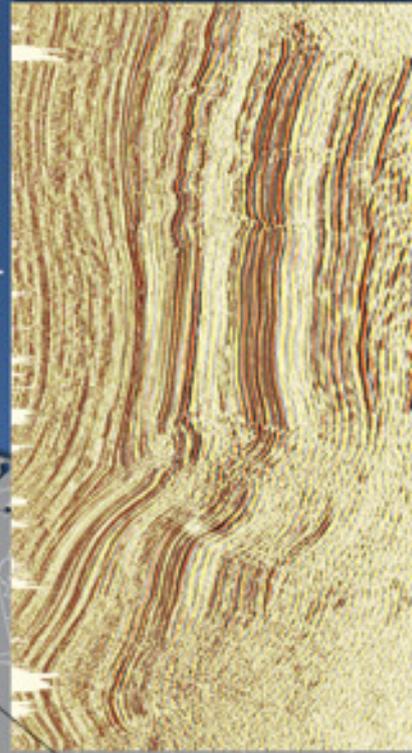


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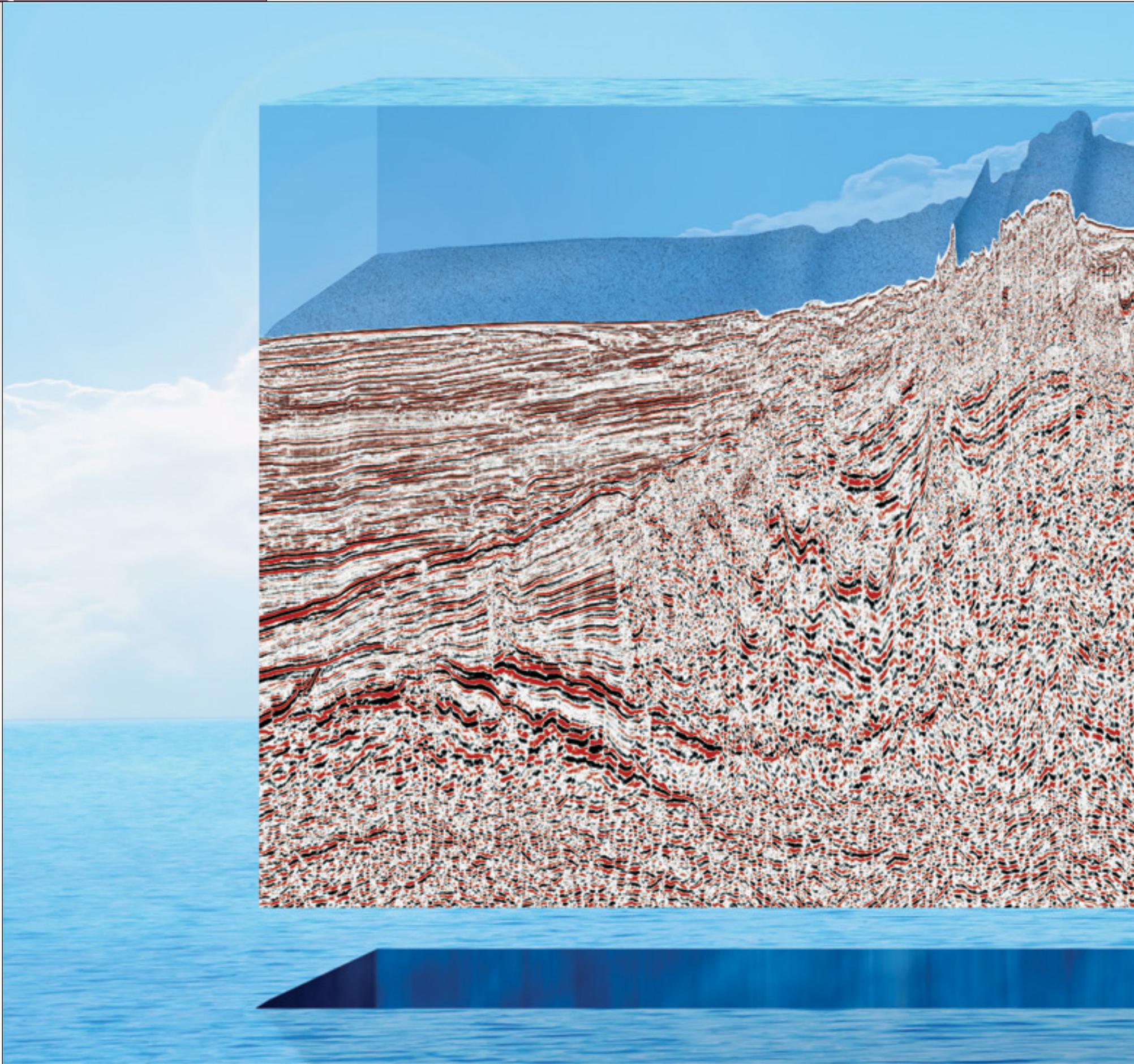


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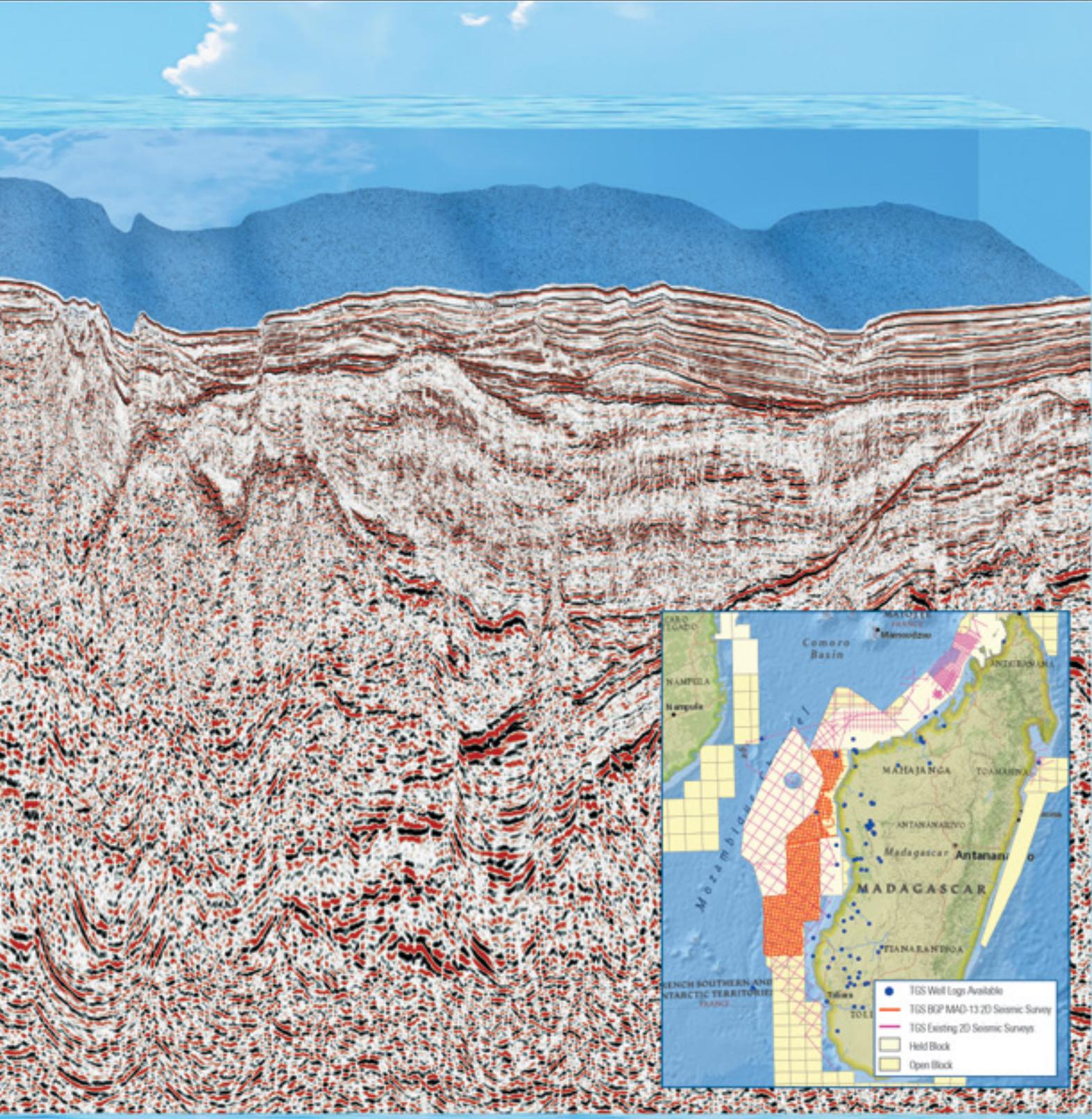
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Beautiful – for science and the public alike

Efforts Begin for Jurassic Coast Studies Centre

By JEREMY RICHARDSON, Director-AAPG Europe

AAPG members are being asked to be part of the effort to help create an educational-research facility to study a part of the earth in England that is a geologic magnet for scientists and the public alike.

The site focuses on the earth's Mesozoic history that is spectacularly laid bare in the cliffs of England's "Jurassic Coast" UNESCO World Heritage Site.

The site runs for 95 miles along the south coast of England and is the only place on Earth exhibiting a near-complete sequence of Triassic, Jurassic and Cretaceous rocks.

Immediately to the east lies Wytch Farm, Europe's largest known onshore oil field (500 million barrels).

The field's potential source rocks, reservoirs, seals and migration story are all there to be studied – as is a great wealth of geology, palaeontology and geomorphology that has generated interest since the earliest days of the development of the earth sciences.

Hence, the plans for a creation of a Studies Centre for the Jurassic Coast.

The Centre is intended to be an exemplary educational and research facility for professionals, amateurs and the public. Developed in partnership with the Natural History Museum in London, the U.K. Field Studies Council and a wide partnership of universities and science organizations, the aim is to inspire the



Photo by Jack Malvern

AAPG members are being asked to help create a research facility for England's "Jurassic Coast" UNESCO World Heritage Site.

next generation of earth scientists.

Inscribed to the World Heritage List in 2001, the Jurassic Coast is one of only 82 World Heritage Sites recognized for its internationally important rocks, fossils and landforms.

The site stretches from the Triassic of Orcombe Point at Exmouth in Devon eastward to the Cretaceous of Studland,

Dorset, 95 miles (122 kilometers) away – and encompasses 185 million years of Earth's history.

For more than 300 years the area has been a crucible for learning, inspiring and enthusing generations of scientists about all aspects of the earth sciences – from the evolution of life to the formation of petroleum deposits.

Getting Involved

The proposed Jurassic Coast Studies Centre would be a state-of-the-art, 120 bed multi-use residential facility. It will accommodate laboratories, seminar and conference facilities, workshops, actual and virtual classrooms and an exhibition space.

It will offer a wide range of courses delivered by many of the world's leading experts, including fieldtrips along the Jurassic coast to showcase the area's geological and geomorphological history.

Of note to AAPG members, more advanced courses will focus on the Jurassic Coast's petroleum systems.

The Studies Centre will be located about halfway along the Jurassic Coast in Lyme Regis – a small town with a big name, renowned for its geological and paleontological heritage that includes the remarkable fossil hunter Mary Anning and her pivotal role in the birth of paleontology.

The project is led by the Lyme Regis Development Trust (a community enterprise organization) and is a central strand to a regeneration strategy that will position the town as an internationally significant education destination.

AAPG members who would like to be part of the effort should contact Marcus Dixon, director of the Lyme Regis Development Trust at Marcus@lrtdt.co.uk.

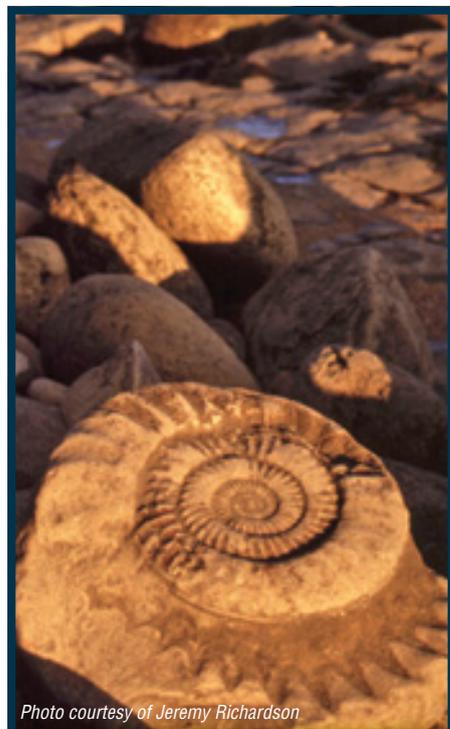


Photo courtesy of Jeremy Richardson

England's Jurassic Coast: A Natural Laboratory

Additional information on England's scenic and geologically significant Jurassic Coast:

▶ The connection between the Natural History Museum (www.nhm.ac.uk) in London and the Jurassic Coast, England's only natural World Heritage Site, dates back many years.

Research undertaken along the coast was fundamental to the early development of the earth sciences, involving some of the NHM's founding scientists, and specimens from the area have made major contributions to the early development of the NHM's collection.

▶ The Jurassic Coast is a natural "laboratory" and continues to be a very important source of new knowledge

for understanding current and past environments – it continues to be a source of material and inspiration for NHM's on-going research and education programs.

▶ The Natural History Museum, Jurassic Coast and Lyme Regis Development Trust (www.lrdt.co.uk) have been working in partnership since 2004 on a series of joint festivals based on the town's geology, fossils and pivotal role in the birth of the earth sciences. These events bring together the local community, fossil experts (www.fossilfestival.com) and collectors with a range of science institutes and universities to offer a range of arts and science activities to people of all ages leaving them wanting to know more.

▶ The Natural History Museum, Field Studies Council (www.field-studies-council.org) and Lyme Regis Development Trust jointly staged a pilot project in February and March 2010 to demonstrate effectiveness of joint working, the Jurassic Coast as outdoor classroom and likely demand in adult learners and professional career development markets. This Pilot Project was the subject of a formal evaluation involving all parties in May 2010.

▶ The collaboration builds on the current increases in society's thirst for understanding of the workings of the natural world and contributes to wider science objectives such as the International Year of Biodiversity, etc.



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Think: Morrice Sees a World of Opportunity

By BARRY FRIEDMAN, EXPLORER Correspondent

“We don’t have to fly to the moon and look back at Earth to see we all live on one planet.”

That’s AAPG member Susan Morrice, director and chairperson of Belize Natural Energy, and she thinks she has discovered the final frontier for geologists.

And it’s not on the moon, or farther out in space, or under the tar sands of western Canada – it’s much closer. It’s within ourselves, she said. In fact, it’s harnessing the power and potential of our own mind that is the real discovery.

“The technology behind all technologies is our mind,” she says, and then quoting the legendary Wallace Pratt, adds, “Oil is found in the minds of men.”

That, she says, is the technology behind all the technologies.

“In the minds of women, too,” Morrice quickly adds, but her point – her question, really – is, how do geologists explore their own limitations, their own possibilities?

“It’s that key component of education that has not been fully understood or utilized to enable mankind to evolve fully.”

Indeed, she says, this dynamic is the final lock on the door. How we mine that potential, how we share the combination once we do is the key not only to a successful discovery, but, as she puts it, “holistically in all areas of our lives.”

Getting Beyond the Box

Susan Morrice, a 35-year veteran of the profession who is credited with being



MORRICE

“That (personal touch) has also been a key part of my life’s learning.”

a key contributor toward giving AAPG its international presence, has been thinking about such a dynamic for at least that long.

Born in Ulster, Ireland, Morrice says, “In a way, everything outside Ireland was international.” After studying at Trinity College in Dublin, Ireland, she came to the United States in 1978.

“I joined AAPG very early on in my career.”

And her career as a geologist, too, took an early-in-her-career international direction. “Spending time working and living in the USA, I began to see what the American Dream was and that anything was possible.”

There was more outside the box than in, she thought – much more. Morrice would go so far as to say there is no box.

“There were so many opportunities all over the world, and yet there were unemployed geologists in the USA,” she recalled. “I wondered how to get them all together for the good of all.”

She quickly began to see those opportunities first hand as well, because

very early in her career she already was exploring onshore Ireland; on- and offshore Belize; offshore Spain; onshore U.K.; onshore Turkey; and many areas throughout the United States.

It was around this time that she met Robbie Gries, a Denver geologist of AAPG (the two, along with Susan Landon and Jeannie Harris, ultimately would comprise, if you will, what they called the “First Ladies Club” of the profession) who, as general chair of the upcoming 1994 AAPG annual convention in Denver, asked Morrice if she would head up the international section of the meeting.

“When I asked Gries what that would entail, Robbie said, ‘There had never been one.’”

It was Morrice’s responsibility to come up with a job description.

“I told Roger Slatt, who was the co-chair, of my idea to have an ‘International Pavilion,’ where all the countries of the world could exhibit their oil and gas potential and show off their country’s positive attributes all around.”

Growing the IP

Morrice, along with her colleague Debbie Sycamore, and her team then gathered about 100 volunteers throughout Denver (her home), most of whom also were members of AAPG.

“We had the greatest fun sending out invitations all over the world, inviting them to come to the AAPG convention,” Morrice said. “I remember 52 countries came that first year, and many had to be housed at the homes of local AAPG members because their countries did not have the funds to send their people.”

“I remember,” she continued, “when we sent out the invitations, representatives of one country wrote back: ‘We haven’t got any oil, but if you think we have could you tell us?’”

Morrice says, in retrospect, what turned out to be one of her finest memories of that first International Pavilion was the most obvious – the personal touch.

“That,” she said, “has also been a key part of my life’s learning.”

One also could say it has done the same for AAPG.

“The International Pavilion has grown by leaps and bounds throughout the AAPG and been replicated by many organizations,” she said. “In fact, billions of barrels have been discovered by taking action on that one simple idea I had.”

See Morrice, page 36

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The International Pavilion, which Morrice helped create, has become an important part of AAPG events.

Morrice from page 34

The Human Touch

This attitude has affected not only AAPG, but her own company, as well – Belize Natural Energy (BNE).

The company, she says, is the first oil company in the country, employs 96 percent of its staff from the Belizean community (240 workers), and has set up a trust of more than £2 million to provide education.

She is proud to have moved the term “giving back.” She wants to make a difference to the entire country.

It is a place, she says, where she fell in love with the people before she fell in love with the country’s energy possibilities.

“We are not in the business of getting in there, grabbing it (the oil) and

running,” she said.

“I have been approached by countries like Somalia, Haiti and not just the poorer countries. Dubai has approached us because they like our working model.

“This is something I’m really passionate about. I give talks regularly to MBA students on entrepreneurship at D.U. and I am currently working with one of the professors there to see if we can develop a course to this area of mind technology.

The company recently was awarded the 2013 GetEnergy Global Education and Training in Exploration award, presented in London, winning in the category “Learning at the Core.”

For its part, GetEnergy said the award “recognized the significant and sustainable quality of the work in which B.N.E. has been engaged, and its benefit to the wider oil and gas energy industry over the past year.”

“I believe we are the only oil company that a children’s book was written about – ‘The Magic in You,’ by Emma Maree,” she said. “We were awarded the Green Award and the Employer of the Year, and are known as the first Holistic Energy Company.”

She may also have the only company featured on “Oprah” – or more precisely, in Oprah’s favorite book, “The Secret.”

Having begun Clannah Natural Energy in her hometown, she is excited about the future. Mostly, though, she wants AAPG – the entire domestic industry, actually – to continue looking internationally.

“I would, and do, encourage all young explorationists around the world that I meet to join the AAPG, to get connected, make friends you can email and call even if they live thousands of miles away,” she said. “Take advantage of the new technologies and have Skype conference calls with maps and diagrams all handy to show people.”

Morrice, who now lives in Denver, says this isn’t just about geology, nor just about rocks and plays.

“It is the business of living.” ■

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New officers have been announced by the Division of Environmental Geosciences for the 2013-14 term.

(The EMD Executive Committee can be found in the Divisions Report on page 58. The DPA officers were listed in the July EXPLORER.)

The newly elected DEG officers are:

President-Elect

□ Jeffrey G. Paine, Bureau of Economic Geology, Austin, Texas. (Will be DEG president in 2014-15.)

Vice President

□ M. Jane Ellis-McNaboe, EnviroTech Consultants Inc., Bakersfield, Calif.

Secretary-Treasurer

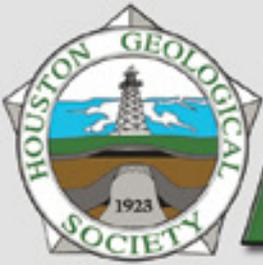
□ Steven P. Tischer, ConocoPhillips, Midland, Texas.

The rest of the DEG Executive Committee is:

□ President – Douglas E. Wyatt, URS Corp., Aiken, S.C.

□ Editor – Kristin M. Carter, Pennsylvania Department of Conservation and Natural Resources, Pittsburgh.

□ Past President – Tom Temples, consultant, Clemson, S.C.



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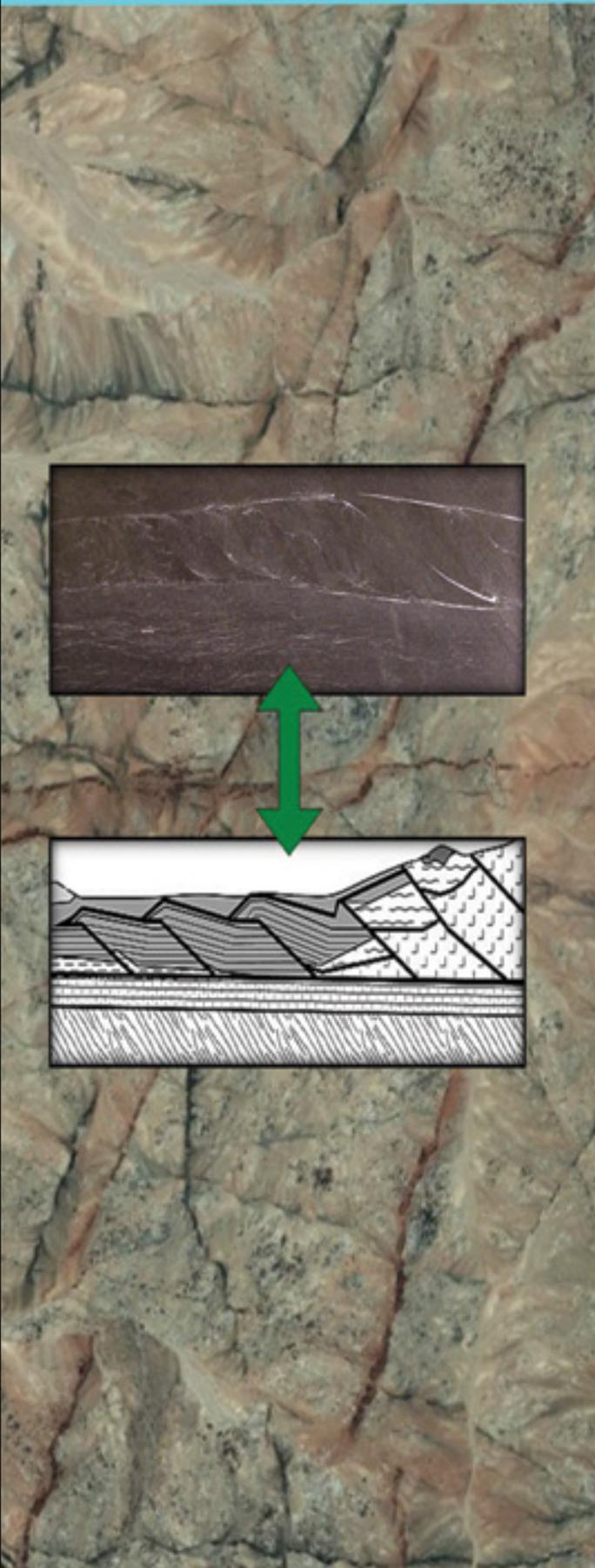
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PROTRACKS

YP Events Prove Big In Pittsburgh

By **NICK LAGRILLIERE**,
Young Professionals Committee Chair

AAPG's Young Professionals (YPs) played host for a couple of specific successful activities at this year's AAPG Annual Convention and Exhibition (ACE) in Pittsburgh – events that have become regular fixtures on the ACE agenda.

► First, on Sunday afternoon as the convention was getting started, the YP Meet-N-Greet proved once again to be a big success, thanks in part to the sponsorship of Noble Energy, which was represented by AAPG member Chuck



LAGRILLIERE

Caughey. The popular event attracted more than 200 students, YPs and mentors.

As in past years, the large group gathered just prior to the convention's opening session to network and discuss careers in the oil and

gas industry, the benefits of continued membership in AAPG and to enjoy refreshments.

After an hour of mixing and mingling at the Meet-N-Greet, everyone headed off to the Imperial Barrel Awards ceremony and the opening session.

► Following the Icebreaker, a sizeable crowd of YPs gathered at the "Olive or Twist" in downtown Pittsburgh for the YP Networking Reception, also sponsored by Noble Energy. Attendees enjoyed good food, local beers and the chance to network with other YPs attending the ACE.

How popular was this activity? Well, the invitation-only event wasn't advertised, but we still needed to turn back people who were trying to swing their way into the venue.

This "YP-only" gathering gave YPs another chance to share experiences with each other about working in the industry and being a part of AAPG.

► Finally, on Monday night we announced the winners of the cash prizes for the Networking Challenge, a competition where students flexed their networking muscle by engaging with AAPG leaders by collecting signatures around the exhibition hall during Sunday's Icebreaker.

Overall, the YP activities at ACE were a success, and the YP Committee would like to thank everyone who participated – as well as Noble Energy for their generous support.

We look forward to repeating the experience at next year's ACE in Houston. Stay tuned for details. 

Nick Lagrilliere is a geoscientist with Maersk Oil in Copenhagen, Denmark. He joined the independent in 2008 and is currently exploring Maersk Oil's acreage in deepwater offshore Angola. He has previously worked North Sea exploration and development in both the U.K. and Denmark.



In Pittsburgh, the annual Meet-N-Greet event once again proved to be popular with Young Professionals.

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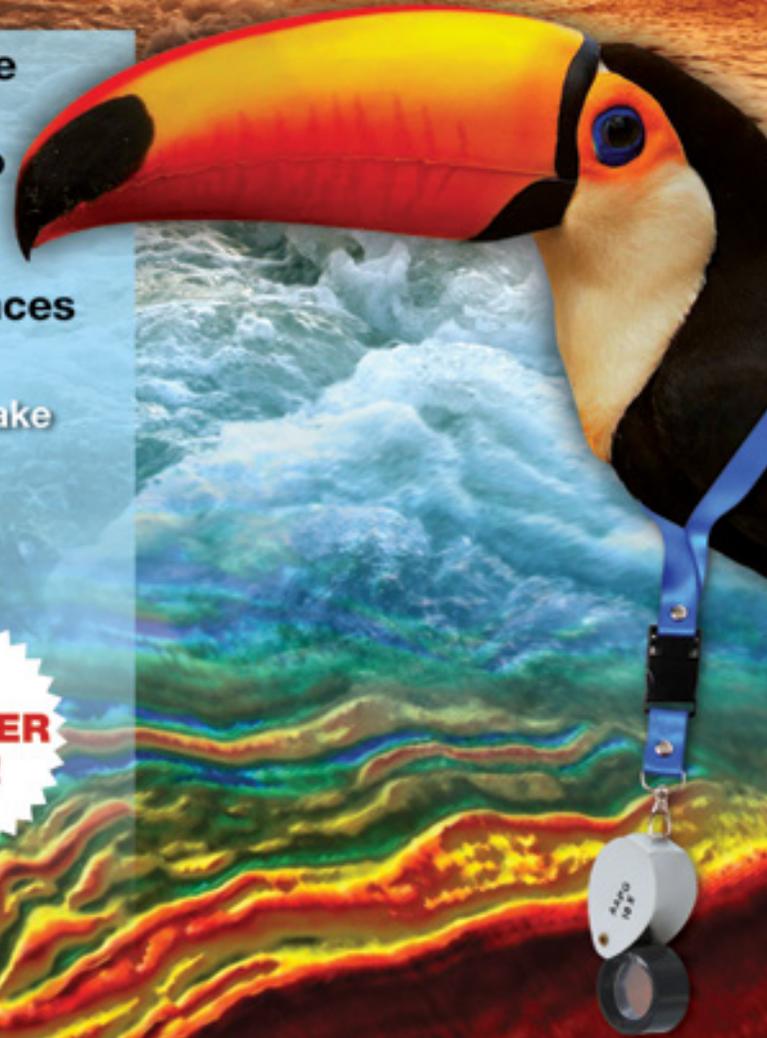
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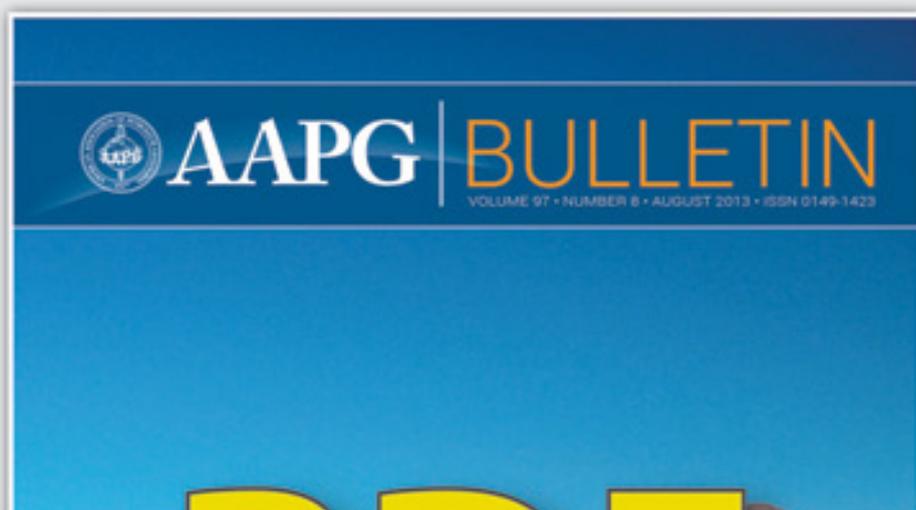




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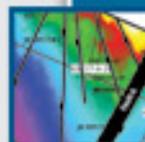
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FINDING NEW PETROLEUM IN NORWAY E&P Note

Lorena Moscardelli, Sarika K. Ramnarine, Leslie Wood, and Dallas B. Dunlap

Jurassic petroleum of the Norwegian continental shelf and North Sea is reaching the limits of exploration, and the Cretaceous is being considered for investigation. The discovery of the Agat field confirms the existence of a working petroleum system capable of charging Cretaceous reservoirs.



RESERVOIR QUALITY IN LACUSTRINE CARBONATES

Gareth Jones and Yitian Xiao

Reservoir quality in lacustrine South Atlantic rift carbonates is affected by geothermal convection driven by temperature differences in lake waters. Geothermal gradients are enhanced by high-permeability features such as faults, fractures, and continuous dissolution zones with exposure.



PREDICTING THE PRESENCE OF POROSITY

Binh T. T. Nguyen, Stuart J. Jones, Neil R. Gouly, Alexander J. Middleton, Neil Grant, Alison Ferguson, and Leon Bowen

Improved understanding of sandstone diagenesis in the Skagerrak Formation, Central Graben, North Sea, will help predict whether high porosity facies will be found at depths greater than 3,200 m, where hydrocarbons are currently being produced.



A SHALLOW MODEL BASED ON BOREHOLE DATA

Paola Sala, Marcel Frehner, Nicola Tisato, and O. Adrian Pfiffner

An integrated three-dimensional model of the shallow geology and of the shallow seismic velocity field is developed using publicly available borehole data. A new and more iterative workflow is presented that results in a robust geological model in the Chémery area, Paris Basin, France.



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

Cusiana – A Giant in the Colombian Foothills

By BERNARD C. DUVAL

This story, whose outcome was an important milestone for Total's exploration at the time of discovery, can be seen as complementary to the Mahakam success story, described in the September 2011 Historical Highlights column.

The Mahakam story dealt with the rejuvenation of a mature hydrocarbon province, while this case study on Cusiana is about a frontier play.

Cusiana also is a fitting example of decision-making under high-risk conditions, miscellaneous difficulties and uncertainties inherent to frontier exploration.

Some of the messages derived from the case are still valid and applicable today.



DUVAL

* * *

► **Message 1:** *Things do not always start in a grandiose way, and even "minor" actions can open the way to great opportunities.*

Total had not been active in Colombia since the early 1970s. In 1986 an offer was made to acquire a local company's minority interest in a joint venture operated by Exxon.

The main prospect was located in the Upper Magdalena Valley – a small, narrow but prolific basin developed between the Central and Eastern Andes in Colombia's southern interior.

Drilling already had started when the deal was signed, and an oil discovery was made soon after at Yaguara (Los Mangos). This was not a huge field by international standards, but with some 60 million barrels was significant in the local context.

Although the contribution to the reserve base was modest, the success inspired optimism and impacted Total's



Location and outline of the exploration block with discoveries.

Bernard Duval, an AAPG Honorary member and Distinguished Achievement Award recipient, dedicated his life to exploration of petroleum systems. He is an Associate Professor at the IFP School (Institut Français du Pétrole), Rueil-Malmaison, France.

strategy in Colombia – and it triggered a wave of technical studies.

Business contacts soon materialized and a decisive farm-out opportunity arose.

► **Message 2:** *Don't hesitate to break away from an overwhelmingly discouraged common attitude. Just do your homework!*

Triton, a small independent from Texas, had put together an offer to participate in a block named Santiago de la Atalayas, where they had recently shot a 2-D seismic program and defined a large anticline of significant closure (about 50 square kilometers) in the foothills of the Eastern Cordillera.

The farmout agreement would provide for the new partners to carry the cost of the first well in exchange for a stake in the block.

The play was not new – 17 wells had been drilled since the 1960s by different companies, some with big names, with no commercial success whatsoever. The lack of commercial success had caused frequent relinquishments and turnover of the different parties and operators.

Careful analysis of these wells showed that half of them had been abandoned for technical reasons linked to difficult drilling to depths close to 4,500 meters, and had not even reached the main target called the Mirador, a fluvial sandstone of Eocene age.

Another observation was that all those wells had been drilled on poor seismic, almost unfit to generate any reliable mapping. In other words, the available data did not allow geologists and geophysicists to actually validate a prospect and test the play. However all the Mirador intersections had shown some sort of oil and gas shows.

Only one well flowed around 700 b/d (on the same structure as Cusiana!), obviously insufficient to warrant commerciality in Andean conditions.

Continued on next page



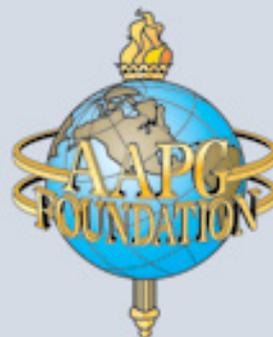
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Thanks to J. Todd Stephenson, VP Geoscience – Northern Division for Chesapeake Energy Corporation, the University of Cincinnati geoscience students and faculty have online access to the entire AAPG digital library, which is comprised of over 1 million pages of international, national and regional libraries of petroleum, geology and geophysics information. Now, 68 universities have a subscription through the AAPG Foundation.

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Stephenson received his M.S. in geology from UC in 1979. Dr. Pryor was his thesis advisor and Dr. Potter (currently UC Professor Emeritus) both have been very influential to Stephenson in his career in the O&G industry. This subscription is made in their honor.

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Continued from previous page

The proposal was presented to the entire industry (more than 50 companies). However only two companies, BP and Total, were genuinely interested and convinced that the offer deserved serious in-depth consideration.

It is important to note that in case of discovery, Ecopetrol, Colombia's national company, could exercise the right to take a 50 percent interest in the joint venture. Obviously, the petroleum community did not get excited, with good reason, about a risky and costly play seemingly tested on numerous locations.

Therefore it can be said at first glance that the glass could be half-empty (unsuccessful past programs) or half-full (abundant shows indicative of a working petroleum system?).

It is likely that many who looked at the opportunity had accepted the first scenario and did not go much deeper into the analysis.

► **Message 3:** *Unforgiving risk analysis is needed in preparation for decision-making, particularly for high risk projects.*

The charge of the petroleum system was the first to be analyzed. It was clear from the subsurface and surface data that the Gacheta Formation of Middle Cretaceous age, more or less equivalent to the famous La Luna Formation of the Maracaibo Basin, the main source rock responsible for its giant accumulations, was an ideal anchor for a thermogenic petroleum system.

My modest contribution in the debate was that I had worked extensively in western Venezuela in the past and during that rich experience had spent time in the field, sampling the rocks of the Quebrada La Luna, the very site of definition.

Marching the *rios* is the only way to do field work in such jungle-covered terrain, because outcrops are only present along the banks. Spending days in the water, soaked with heavy rains and with all kinds of "nice" animals for company, is an experience you will never forget – not to mention discovering the greatest organic-rich source rock you might dream of as a petroleum geologist.

If such source was present at depth, with the right level of maturation, well ... why not?

Geochemical modeling was conducted and showed that generation had probably started to take place in the area some three to four million years before the late Andean tectonics reactivated the existing Cenozoic back-arc basin (six million years ago), creating the potential traps of the foothills. The models also reflected a possible continuation of the process during the inversion and until the present, an idea supported by the presence of light oil shows in some wells.

Note that the modeling techniques of the time did not allow geologists to evaluate the transformation ratio. Therefore, a serious doubt remained about the charge versus trapping chronology, not to count the inherent uncertainty of any modeling exercise.

To complete the charge evaluation we had to consider a major westward dipping fault striking north 30-40 degrees (like all structures of the foothills), as the most probable conduit (but also a potential leaking factor).

Different discussions with colleagues from different companies, years after the discovery, led to the thinking that this problematic question of a late trapping formation was a key factor in rejecting the proposal.

The reservoir was an element of concern too, for lack of significant production rates during past tests. The culprit could be

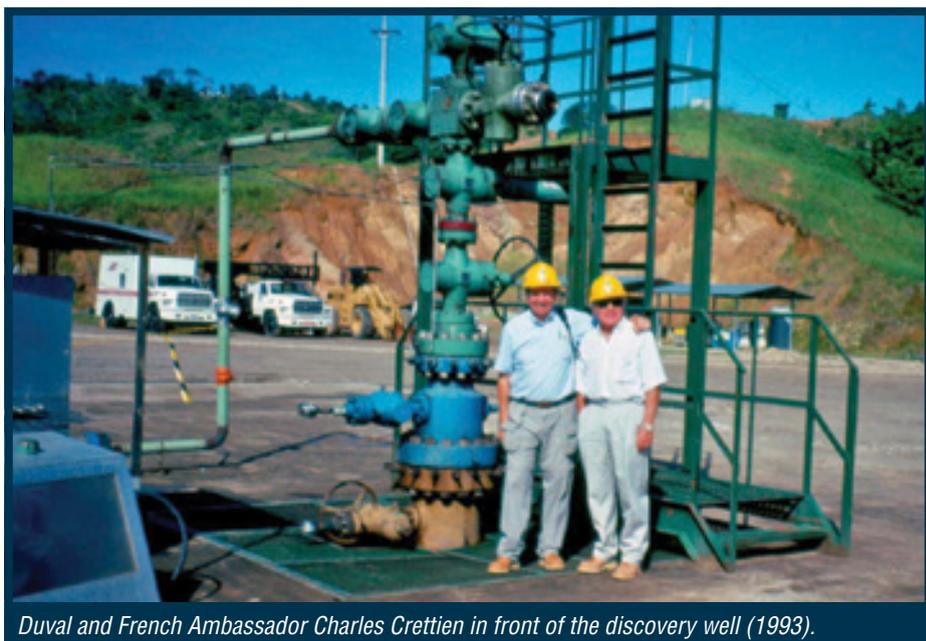
depth and the associated diagenesis, which Total had encountered in other reservoirs in different areas of the world, with porosities even well above those measured on the Mirador (which were low, around 7-8 percent).

The trap itself was given a lot of attention. After reprocessing and time-to-depth conversion exercises, the geophysical team concluded that the structure had resisted well to all thinkable velocity assumptions. Therefore, the geophysical team was able to create a reliable map.

All in all, the accepted probability of success was 15 percent, with the critical points gravitating toward the timing and reservoir elements.

As for the volumetrics, the probabilistic distribution gave a mean value of 175 million bbls, and a maximum value of 350 million.

See **Cusiana**, page 42



Duval and French Ambassador Charles Crettien in front of the discovery well (1993).

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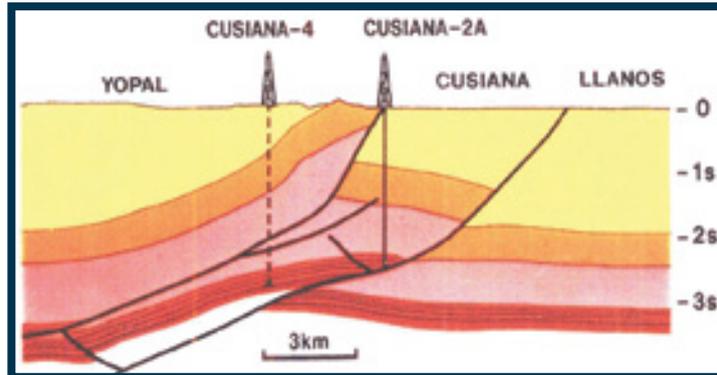
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Cusiana from page 41

► **Message 4:** *Having a wide-angle sweep vision of the geology – well beyond the local qualifiers of a prospect – may have a deciding impact on the evaluation. A willingness to take risk and an optimistic view of improving technical capabilities (e.g. drill better than was done in past operations) are key management drivers in frontier undertakings.*

One could think at the time that getting a green light at the highest level of the company would be an uphill battle: The project had a low chance of success, drilling was difficult and costly, 17 wells had been non-commercial and there was a sensitive political situation with concerns about safety in the Cordillera (which limited



Cross-section of the Cusiana anticline.

access to the field).

Sharing the development with a partner was a prerequisite given the level of risk. BP was an obvious candidate given their interest in the project, and the two companies quickly agreed to join forces.

BP would be the operator while Total would contribute key geoscientists and

engineers to the operating team, led by AAPG member Tony Hayward. Allowing the companies to communicate and share experience optimized both companies' contributions.

It is time to mention that Cusiana, like all exploration ventures, was a collective undertaking. One member of the team

in particular should be singled out and credited with the re-questioning of the "arrowed" thinking of the time, and advocating an optimistic concept: Jean Ferrat, a former IFP school student (same prom as your friendly scribe), later called 'L'Homme de Cusiana,' an inspired, gifted, intuitive geologist.

Jean was able to weigh on the positives and convince his colleagues and decision-makers that the half-full rather than half-empty glass should be given preference.

One of the arguments he made was linked to the existence of two oil fields, Bermejo and Orito, on the frontal part of the Eastern Cordillera. Although they were located far away from the proposed block (some 500 kilometers to the southwest, near the border with Ecuador), he insisted that at least somewhere in a similar fold-thrust-belt context the timing had been favorable, and that should help think of de-risking the related component.

To be honest, no uphill battle took place. When Jean and I met with Louis Deny, vice chairman of Total, who had a strong culture of the EP business, it was not difficult to convince him and get approval to go ahead.

► **Message 5:** *The "maximum" volumetrics may even sometimes be exceeded by reality. The improbable can – and does – happen!*

When the stage was set for the actual drilling operations, it was the start of a long story of difficulties of all kinds: stuck drill-bits, fishing, angle-drilling, questioning about the meaning of numerous shows encountered throughout the section, presence of a lot of gas (what to do with it?), doubts about VSP reflections and log interpretation (tight reservoirs or hydrocarbons?).

The Mirador sandstone finally was tested, yielding a disappointing flow of 1 000 b/d and six Mcf/d.

The teams did not get discouraged though, thinking that they could overcome likely damage caused by a long exposure of the reservoirs to the heavy mud. A second well, Cusiana 2A, located not far away from the first one, was needed to finally obtain a rate of 6,800 b/d and 19 Mcf/d, opening the way to commercial perspectives.

The actual reservoir quality was later attributed to the exceptional clean nature of a fine-grained sand, whose model could have been found on outcrops of the Forêt de Fontainebleau – 50 kilometers from Paris, a famous rock-climbing terrain!

It was astonishing to find oil and gas not only in the Mirador, but also down below in two sandy formations; the Barco and Guadalupe, of Paleocene and Upper Cretaceous age, respectively. All of the formations combined resulted in a 500-meter column of hydrocarbons and a potential areal extension and reserves much larger than expected.

In fact, the structure extended southward beyond the limits of the permit, to which acreage (Tauramena block) it was finally agreed to apply the same working interests as for Santiago de las Atalayas. The extension was then confirmed by a third well, Buenos-Aires-1.

In retrospect, one can think that charge was over-risked in a system with stacked generative layers, forebulge structures well developed at early stages, and possible, often underestimated, charge hysteresis.

► **Message 6:** *Summarized in two words of wisdom and action – OPTIMISM and PERSEVERANCE! Which brings us to the conclusion – it's THE HUMAN FACTOR, at all stages of the adventure, from*

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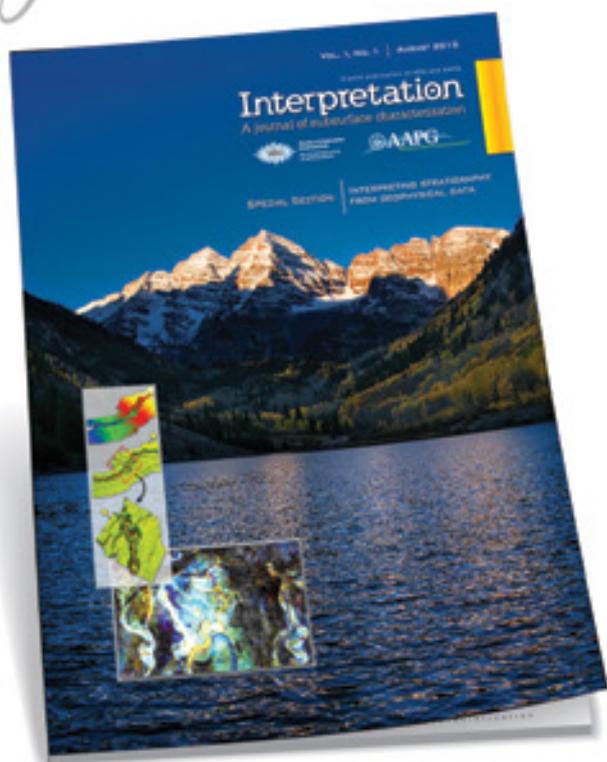


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Graphic courtesy of Michael McWalter

Countries' Teamwork Brings Survey Success

By MICHAEL McWALTER, AAPG Asia Pacific Region

I have just returned from Kompong Thom town, the capital of Kompong Thom Province, some 200 kilometers north of Phnom Penh, the capital of Cambodia.

In my capacity as adviser to the Cambodian National Petroleum Authority (CNPA), I had been invited to attend the kick-off meeting for the country's largest-ever onshore seismic program.

Finally, serious investment is being made in the exploration of Cambodia's onshore sedimentary basins. It is foreign investment, but regional in nature.

* * *

PetroVietnam Exploration and Production Overseas Ltd. (PVEP) was awarded Block XV by the Royal Government of Cambodia on Dec. 12, 2009, for a period of seven years over an area of some 6,500 square kilometers to the north and east of the Tonle Sap Lake.

After reviewing the results of prior exploration work, comprised principally of aeromagnetic and airborne gravity surveys conducted by the Japanese National Oil Co. in 1996 and some road-based vibroseis seismic data acquired by PGS a few years ago, PVEP has elected to enter into the next phase of its approved work program with the acquisition of 600 line-kilometers of 2-D reflection seismic data.

Exploration of Cambodia's onshore basins is at a fundamental level involving the definition of the basic structure and architecture of the basins. Based on the earlier surveys, the Tonle Sap basin is believed to comprise two depocentres, which are thought to hold sediments up to five kilometers in depth – but as yet, no drilling has taken place to elucidate the stratigraphy.

The kick-off meeting in the small provincial capital of Kompong Thom included:

- The CNPA, as petroleum sector manager and regulator of Cambodia.
- PVEP, the petroleum contractor.
- Seismic contractor BGP, the geophysics service company of the Chinese National Petroleum Corp.
- Provincial officials and officials of other national government ministries and agencies.

The seismic acquisition program was reviewed, and then the assembled group adjourned to the field survey site to the west of the capital to witness the start of the survey and the conduct of initial check shots.

* * *

The Tonle Sap Lake, which lies in the middle of Cambodia, is an expansive body of freshwater, alternately filled up by the Mekong River during the rainy season and then discharging its waters back into the Mekong in the dry season. It provides vast food supplies to the people of Cambodia and has a pristine and very large catchment area.

Therefore, environmental and social sensitivities toward exploration there are high – however, the two identified sedimentary basins are offset at depth from the current surface depression that gives rise to the lake, so it is unlikely that drilling will ever need to take place in the lake itself (although the footprint of exploration is clearly within the lake's overall catchment area).

Not only are there environmental and social impact risks, but there are significant safety risks attached to the survey, due to the presence of large amounts² of unexploded ordinance (UXOs) arising from the darker days of Cambodia's modern history and large scale aerial bombing and

See Cambodia Seismic, page 47

AAPG member Michael McWalter is a petroleum geologist who works as an industry regulatory and institutional specialist for various governments. Based in Port Moresby, Papua New Guinea, he is resident adviser to the Department of Petroleum and Energy of the Government of Papua New Guinea,

and a visiting adviser to the Cambodian National Petroleum Authority and the newly established Petroleum Commission in Ghana. He also is a director of both the Circum-Pacific Council for Energy and Mineral Resources and the Board of the Transparency International – Papua New Guinea.

Al-Hajri Ready for His New Leadership Role

By HEATHER SAUCIER, EXPLORER Correspondent

As a child, Sa'id Al-Hajri, Saudi Aramco's acting manager of the Upstream Ventures department, used to comb the beach and desert picking up shells and rocks with a curiosity that eventually led him to the field of geology.

After holding eight different positions at the company since he joined in 1986, Al-Hajri is now beginning his greatest outside role, as president of the AAPG Middle East Region, which he assumed in July.

Because the Middle East is the world's petroleum hub, Al-Hajri said one of his goals as president is to bring as much knowledge to the area as possible to enable Saudi Arabia and other Middle Eastern countries to advance their exploration efforts.

"It's a great satisfaction to be able to help create the necessary networks in the Middle East, bring in expertise from around the world, host our own workshops and discuss issues specific to the Middle East right here in the Middle East," he said.

"You don't have to fly all over the world to go to a geoscience workshop. We can bring it all here."

In Al-Hajri's view, the Middle East should be a "center of excellence in petroleum geology" that attracts geoscientists from around the world.

"We have the world's largest oil and gas fields, from which we have learned important lessons that we can share with the rest of the world," he said.

He stressed that as technology and knowledge continue to advance, sharing information and new discoveries through AAPG and other organizations will add to the success of the entire energy industry.

"The AAPG is undoubtedly the best organization that can help the region in bringing in geologic knowledge and creating the professional networks needed in the Middle East," he said.

Al-Hajri credits AAPG with promoting the Middle East GEO Conferences (GEO), founded by Saudi Aramco, which bring together geoscientists from Middle Eastern countries to discuss the area's particular challenges.

"GEO is on every geologist's calendar now," he said.

Noting that many areas of the Middle East are underexplored, Al-Hajri said the convening of exploration geologists in the Middle East through AAPG will help create a conducive and innovative environment that will lead to further discoveries in uncharted areas.

Keeping Busy

Al-Hajri has much to bring to the table, having worked at Saudi Aramco as the chief explorationist of the eastern area exploration division; administrator of the exploration data management division; chief geologist for the regional mapping division; and many other positions.

During his career, he and his teams have made numerous and significant oil and gas discoveries in the offshore Arabian Gulf and in onshore northeastern Saudi Arabia.

"It gives me great pleasure and a deeper satisfaction to see that some of these reservoirs and fields that we helped discover and develop, such as Karan, Hasbah and Arabiyah, are now on-stream,

creating wealth and fueling Saudi Arabia's industrial growth," he said.

Al-Hajri also has authored and co-authored more than 20 scientific papers in refereed journals and was the chief editor of the book, "Stratigraphic Palynology of the Paleozoic of Saudi Arabia." He also was a member of the editorial advisory board of "GeoArabia," the journal of the Middle East petroleum geosciences.

In addition to the AAPG, Al-Hajri is a member of the American Association of Stratigraphic Palynologists (AASP); Society for Petroleum Engineers



AL-HAJRI

(SPE); Dhahran Geological Society (DGS); British Micropaleontological Society (BMS); the European Association of Geoscientists and Engineers (EAGE); and the Commission Internationale de la Microflore du Paléozoïque (CIMP).

A palynologist by training, Al-Hajri regards himself as a student of natural history who in his spare time has ventured beyond the world of geology to explore the field of archaeology. He has often collaborated with archeologists of the Saudi Commission for Tourism and Antiquities in studying sites of old ruins in the desert and piecing

together ancient habitats.

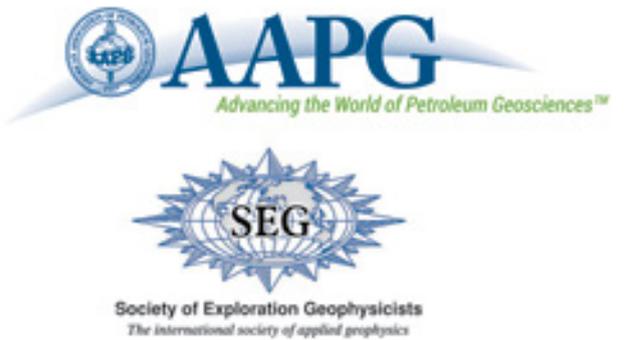
"We can determine the food people ate, the plants they grew on that ancient landscape and if they had domesticated animals or had any primitive industrial activities such as manufacturing arrowheads, making pottery or excavating mineral ores," he said.

"The fun part is when all the different experts each bring their pieces of evidence and everyone contributes to putting the story together."

As president of the AAPG's Middle East Region, Al-Hajri no doubt will apply similar processes and enthusiasm to advance petroleum geoscience in the Middle East. ■

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Shale Gas Workshops Offering Diverse Views

By EDITH ALLISON, GEO-DC Director

Starting in 2012 and continuing through this fall, the National Academies (NAS) are hosting workshops to inform the public about shale gas development. These workshops explore not only possible effects on air and water, but also consider health and social impacts.

Unlike NAS reports, the workshops are not consensus studies. That is, there will be a report of the proceedings or online access to copies of the presentations, but no findings, conclusions or recommendations.

Two workshops on elements of shale gas extraction have been completed and two are planned for later this year:

▶ A workshop on the "Health Impact Assessment of New Energy Sources: Shale Gas Extraction," sponsored by the Roundtable on Environmental Health Sciences, Research and Medicine (Board on Population Health and Public Health Practice, Institute of Medicine), was held April 30-May 1, 2012. It explored the health impacts of shale gas extraction, and considered the use of health impact assessments to assess and identify ways to mitigate potential health impacts.

▶ The National Research Council (NRC), Board on Environmental Change and Society, Division of Behavioral and Social Sciences and Education has completed the first of a pair of workshops addressing risk management and governance issues in shale gas development. "Risks of Unconventional Shale Gas Development" was held May 30-31.



ALLISON

The workshop included presentations by invited speakers and alternative comments from experts offering contrasting perspectives.

The workshop (described in more detail below) focused on public concerns about the risks to the environment and human health from large-scale development of shale gas.

The second workshop on governance of risks of unconventional shale gas development is planned for Aug. 15-16.

▶ "Development of Unconventional Hydrocarbon Resources in the Appalachian Basin," a workshop hosted by the NRC, Division on Earth and Life Studies, Board on Earth Sciences and Resources, Water Science and Technology Board, is planned for late August or early September at the University of West Virginia.

The workshop will examine the geoscientific aspects of hydrocarbon development from unconventional resources, including: geology and hydrocarbon resources; potential effects on surface and groundwater quality and quantity; potential effects on landscapes, including soil and living organisms, and other environmental systems; and technical and engineering processes.

* * *

The remainder of this column will focus on many of the presentations given at the most recent workshop, "Risks of Unconventional Shale Gas Development."

The workshop organizers stated their goal was to provide "a comprehensive, evidence-based look at the scope, nature and magnitude of environmental risks of unconventional shale gas development."

The workshop included presentations by invited speakers and alternative comments from experts offering contrasting perspectives as speakers considered risks to air, water, public health and communities.

Industry Assessment of Risks

▶ Kris Nygaard (ExxonMobil Production), an invited presenter, summarized the sequence of operational activities involved in drilling and completing a shale gas well. Nygaard presented data showing very low risk for three widely monitored events: contamination of aquifers by hydraulic fracturing fluids, surface release or spills of chemicals, and induced seismicity.

✓ Alternate presenter and AAPG member Mark Zoback (Stanford University) described prior studies by the Secretary of Energy's Advisory Board and the NRC, which concluded that shale gas can be developed in an environmentally responsible manner, although important environmental issues need to be solved.

✓ Alternative presenter Meagan Mauter (Carnegie Mellon University) enumerated potential risks from subsurface fluid migration, surface release of fracturing fluids, induced seismicity and truck accidents.

Air Risks

▶ Invited presenter Chris Moore (Desert Research Institute) reported on data gaps in the peer-reviewed literature and a severe shortage of pre-development baseline data. Moore also noted the shortage of data about the life-cycle emissions from natural gas drilling, completion, transmission and use. He described an obvious example of the uncertainties in emissions data and the need for additional study: the variation in the Environmental Protection Agency (EPA) estimates of methane emissions from natural gas systems. EPA reduced its estimated 2010 emissions by 33 percent from 2012 to 2013 reports.

✓ Alternative presenter Gabrielle Petron (NOAA) also described data limitations, noting that ozone-sampling sites are common in urban areas such as Denver, but rare in the oil fields north of Denver.

As part of NOAA's goal to quantify actual

Continued on next page

Call for Abstracts Deadline: 17 January 2014

Reservoir Quality of Clastic and Carbonate Rocks: Analysis, Modelling and Prediction

28-30 May, 2014
The Geological Society, Burlington House, Piccadilly, London

Corporate Supporters: bp, Statoil

Convenors: Pete Armitage (BP), Alan Butcher (FEI Natural Resources), Anita Csoma (ConocoPhillips), Cathy Hollis (University of Manchester), Neville Jones (BP), Bob Lander (Geocom), Jenny Orma (BP), Richard Worden (University of Liverpool)

Porosity and permeability exert a fundamental control on the economic feasibility of a petroleum accumulation and need to be quantified from basin access to mature production. Quantitatively reporting the mineralogy and pore space characteristics of reservoir rocks is vital in establishing the key controls on reservoir quality. Only by doing so it is possible to build predictive capability, essential to successful geological modelling and cross-disciplinary integration. This issue is becoming ever more critical with exploration and production of petroleum in increasingly challenging conditions and from less conventional reservoirs.

Despite the importance to the industry of understanding the controls on porosity and permeability of reservoirs, fundamental issues lack consensus in the community. Reservoir quality is controlled by a large number of interdependent sedimentary and diagenetic factors, including sediment provenance and weathering, depositional environment and climate, compaction, grain recrystallisation and dissolution, authigenic mineral growth and mineral dissolution, petroleum charge and structural deformation.

This conference seeks to address the major factors and processes controlling rock properties of clastic and carbonate rocks as well as showcase novel analytical techniques and demonstrate diagenetic modelling capability. Delegates from both academic institutions and industry are encouraged to attend and contribute in order to represent the wide range of current reservoir quality research.

Themes

- The effect of sediment provenance and environment of deposition on RQ characteristics
- RQ in the sequence stratigraphic framework
- Clay mineral diagenesis in clastic and carbonate rocks
- Quartz diagenesis in clastic rocks
- Carbonate diagenesis in clastic rocks
- Near surface diagenesis as a control on reservoir quality in carbonate systems
- Porosity modification in the burial realm
- Fluid-rock interactions and their impact on RQ
- Application of RQ analysis for petroleum exploration and production
- Petrophysical RQ characterisation and upscaling
- Porosity uplides - predicting anomalously good reservoirs
- RQ of unconventional reservoirs
- Computer modelling of diagenesis
- Experimental approaches to understanding RQ
- Analytical techniques to interrogate clastic and carbonate rocks
- Geomechanical and structural controls on RQ properties
- Using RQ to improve rock physics models
- Modern and outcrop RQ analogues

For further information please contact: Steve Whalley, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. Tel: +44 (0)20 7434 9944 Fax: +44 (0)20 7439 8975

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Cambodia Seismic from page 44

extensive mining of the area.

This requires highly specialised UXO clearance teams to survey the corridors of the seismic lines most carefully before any entry may be made for petroleum operations.

Housed in a dried-up rice field under a decorative Khmer awning, the assembled visitors eagerly awaited the boom of the first check shot. For many of them, particularly the National and local officials, this was their first experience of onshore seismic acquisition.

In a carefully choreographed demonstration, the first charge was set off and the thud of the source reached the visitors, followed by an appropriately visible small blow out from the shot hole, a safe distance in front of them.

"We do this many thousands of times and listen to the seismic reflections from the strata through a 10-kilometer chain of geophones spread out along the line,"

explained the Chinese BGP crew chief in English to one of the Cambodian officials.

Few of the Cambodians speak Vietnamese or Chinese and vice versa, so English becomes the *lingua franca* – but there are no Texan tones here!

After two more check shots, using different source parameters, and a review of the seismic acquisition records that showed reflecting sediments were clearly present down to four seconds, a happy and contented audience journeyed back to town, to banquet at a local restaurant on delicacies that satisfied the appetites of Cambodian, Vietnamese and Chinese alike (and me, too!).

* * *

The end result: This survey, in a very good example of Asian collaboration and cooperation, brought together Cambodia, Vietnam and China respectively in the guise of CNPA, an upcoming national petroleum regulator; PetroVietnam, an expanding national petroleum company; and BGP, the large and globally deployed seismic contacting arm of the CNPC. 

Continued from previous page

emissions, a survey of wells operated by one company in Dish, Texas, found three of 22 wells had very high emissions, while the others were very low. This suggests operational or maintenance problems that may be easy to repair.

✓ Another alternate presenter, **Tiffany Bredfeldt** (Texas Commission on Environmental Quality), reported that a 2010 flyover of 5,000 storage tanks in the Barnett shale production area identified 88 sources of significant hydrocarbon emissions. The small number of problem facilities suggests that the problems can be corrected.

A study of air quality around Dish, Texas, by the Texas Department of State Health Services showed that nearly all of the documented emissions issues arose from human or mechanical failures. These items were quickly remedied and could have been avoided through increased diligence on the part of the operator.

Corrective actions amounted to little more than replacing worn gaskets, closing open hatches, and repairing stuck valves.

Water Risks

▶ Invited speaker **Avner Vengosh** (Duke University) reported that methane was found in water wells near Marcellus producing wells but not in wells far from production. Vengosh interpreted the Marcellus-related drinking-water contamination to be the result of natural gas entering the well annulus from the shale production formations or shallower formations and leaking into groundwater because of poorly constructed or failing well casings.

✓ Alternate presenter **Jean-Philippe Nicot** (Texas Bureau of Economic Geology) presented evidence for an alternative interpretation: Thermogenic gas in the shallow subsurface does not necessarily imply leaks – it can be natural. He cited a peer-reviewed paper in the May/June issue of the journal *Groundwater*, which analyzed 1,700 groundwater samples in northeastern Pennsylvania and concluded that methane concentrations are best correlated to topographic and hydrogeologic features, rather than shale gas extraction.

Public Health and Community Effects

▶ Invited presenter **John Adgate** (Colorado School of Public Health) reported that no comprehensive population-based studies of the public health impacts of

unconventional natural gas operations have been published. Adgate also stated that recent studies, such as his organization's health impact assessment of the Battlement Mesa area in Colorado, indicate a potential for health risks from the combination of physical, chemical and nonchemical stressors associated with the rapid change in industrial activity, population and income.

One of the findings of the Battlement Mesa study was that residents living near well completion activities had higher estimated risks for cancer and chronic non-cancer conditions, but the risks are within the EPA's generally acceptable range.

✓ Alternate presenter **David Brown** (Southwest Pennsylvania Environmental Health Project) reported on a survey of adults that visited the Cornerstone Care Clinic in Burgettstown, Pa.: at least 30 percent of the 240 participants were at risk of depression, compared to the expected rate of 19 percent nationally.

✓ Another invited presenter, **Jeffrey B. Jacquet** (South Dakota State University), described the potential risks to communities from shale gas development. He reported on studies that show the negative impacts of a boom-and-bust economic cycle, the community discord caused by unequal distribution of economic benefits associated with rapid energy development and the health impacts of stress caused by community change.

* * *

A few ideas appeared multiple times in the presentations:

▶ Speakers on the technical and logistical aspects of shale gas development described low risks for water and air pollution, and induced seismicity, which could be mitigated by improved industry practices.

▶ Public concerns are different from documented health and safety risks.

▶ Baseline or pre-development data are generally lacking for air and water quality as well as social and health status.

▶ No data are available regarding the health or social conditions of control populations or towns without shale gas development.

▶ The idea that harmful health impacts are due to the psychological stress caused by rapid increases in industrial activity was widely discussed even though clinical data are lacking. 

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Tight Reservoirs in the Middle East Workshop

28-30 October 2013

Sheraton Abu Dhabi Hotel & Resort, Abu Dhabi, UAE

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SESSION TOPICS:

- Exploration and resource assessment
- Reservoir characterization
- Drilling and completion
- Stimulation and production
- Tight reservoir development and economics



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7-9 October 2013

Kempinski Hotel IshTar, Dead Sea, Jordan

New discoveries and an increase in exploration activity in subsalt plays in the Middle East and North Africa make our **Exploration in Subsalt Structures in Rift Basins Workshop** a truly unique learning opportunity. See how recent advances in seismic technologies have led to enhanced imaging below salt layers. When combined with a better understanding of salt tectonics, this has renewed exploration interest in salt basins throughout the world resulting in new hydrocarbon discoveries.

Session Topics:

- Tectonic evolution of rift basins
- Seismic acquisition and processing for sub-salt imaging
- Exploration in rift systems
- Technologies for non-seismic
- Sequence stratigraphy and reservoir characterization of rift basins sequences



For more information visit middleeast.aapg.org



Quantitative Curvature Analysis: A Case Study

By EVAN STAPLES, ZE'EV RECHES and KURT MARFURT

Last month in this space we analyzed the relations of fracture patterns and layer curvature in clay models. This month we examine these relations in a central Oklahoma field developed by Pathfinder Exploration, Norman, Okla.

The dolomitized reservoir is 50-100 feet thick within the Hunton Group of Late Ordovician to Early Devonian age.

The data include a 3-D time-migrated seismic survey of about nine square miles, and 15,622 feet cumulative length of image-logs in seven horizontal wells.

* * *

The interpreted image logs (figure 1) of all wells revealed 3,971 fractures, as well as bedding surfaces and fault-zones. The majority of the fractures are sub-vertical to vertical, and their strike orientations are plotted with color-coding of our quality ranking (A to D) based on visual quality and continuity (figure 1, left portion).



STAPLES

Fracture density was binned in 55-foot bins, which are half the size of 110-foot 3-D seismic bins, for comparison between fracture density and seismic attributes. We assumed that lithological and thickness variations within the horizontal wellbores are minimal.



RECHES

The fracture orientations are fairly scattered, yet three major trends can be recognized (figure 1, left):

- ▶ A scattered ENE-WSW trend in wells 1, 2, 3 and 4.
- ▶ A scattered ESE-WNW trend in wells 5 and 6.
- ▶ A NNE-SSW trend in well 7.

We test the hypothesis that the fractures formed primarily as tensile fractures due to local curvature (see part 1 of this column in the July EXPLORER), and compare their density to the 3-D seismic curvature.

Figure 2 (left) shows a top Hunton horizon slice through the most-positive curvature volume. The horizontal wells are displayed with color-coded fracture density (fracture number/55-foot length).

Figure 2 (left) displays a few areas of good correlation between high fracture density and high most-positive curvature values (yellow arrows). In the next step (figure 2, right), the strike direction for high curvature values are plotted with color denoting the direction as shown by the time slice.

The general E-W strike directions of the curvatures appear to correspond with the high fracture densities in wells 3-7 (figure 1, left). Wells 1 and 2 do not cross areas with curvature zones of E-W strike directions.

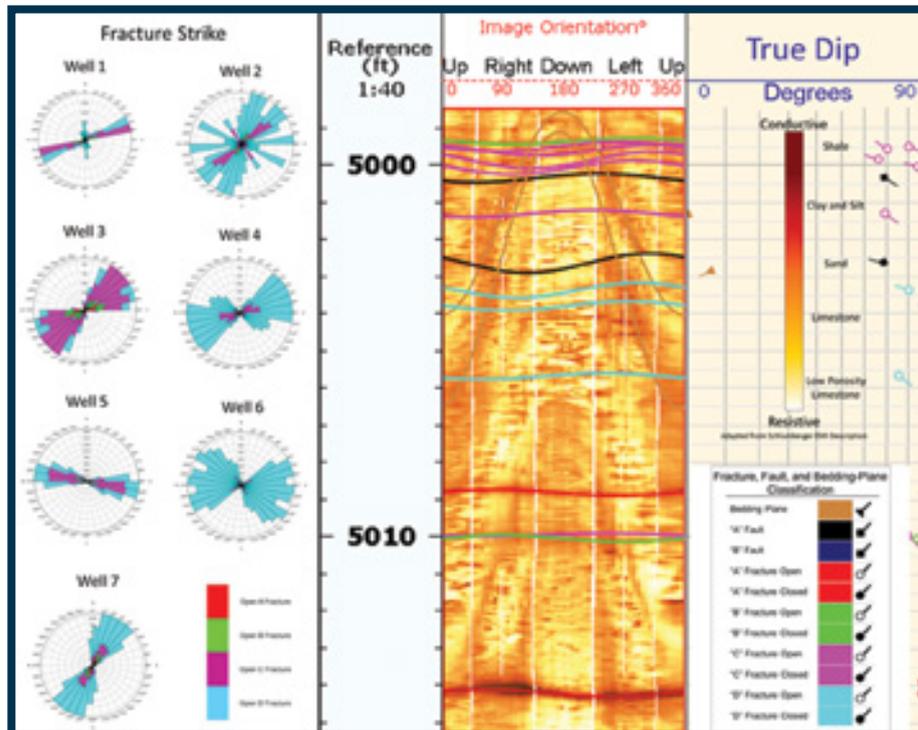


Figure 1 – (Left) Rose diagrams of each well indicating fracture orientation as measured from the image-logs. Fracture qualities of A-D are color coded red (A), green (B), purple (C) and blue (D). A-C fractures were the most reliable in determining fracture strike. (Center and right) Portion of an image-log interpretation showing the various types of interpreted fractures (A-D), bedding planes and faults.

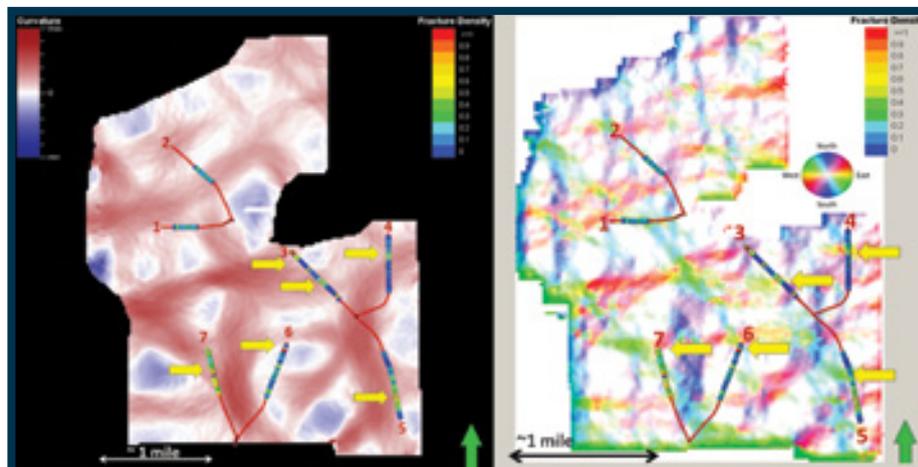


Figure 2 – (Left) Interpreted top Hunton horizon co-rendered with most-positive curvature attribute and displaying the horizontal wells drilled into the Hunton horizon and colored by fracture density. (Right) Most-positive curvature attribute co-rendered on the top Hunton horizon and colored by most-positive curvature strike direction. Yellow arrows on both images show areas where most-positive curvature visually correlates to high fracture density along the wellbore.

Table 1 – Correlation of Fractures with Most Positive Curvature

Well Number	Azimuthal Intensity Correlation (r)	Most Positive Curvature Correlation (r)	Azimuth	Measured Length Along Wellbore (ft)
1	No correlation	No correlation	---	---
2	0.69	0.61	45	5,800-6,290
3	0.77	0.72	75	5,400-6,230
3	0.88	0.66	45	7,275-7,605
4	0.80	0.67	75	7,120-7,560
5	0.70	0.75	45	7,890-8,495
5	0.57	0.53	-75	6,405-6,955
6	0.66	0.67	-75	7,065-7,505
7	0.69	0.74	-75	5,800-6,185

* * *

To further examine the correlations between fractures and the curvature, we used a workflow for azimuthally-limited weighted average of curvature features from the 2010, 80th Annual International Meeting of the SEG entitled Seismic attribute illumination of Woodford Shale faults and fractures, Arkoma Basin,

Oklahoma, by Guo and Marfurt.

Azimuthal intensity is:

$$[total\ strike\ length] / [total\ area\ of\ the\ search\ window]$$

This technique is similar to fracture intensity calculations in part one, but filters curvature strike direction by azimuth.

We calculated azimuthal intensity in 15-degree sections and correlated

them to fracture densities in the image-logs; high correlation exists where "r" approaches unity (table 1). For example, the interpreted fractures in well 3 strike 30-90 degrees (figure 1, left), and we found high correlation between fracture density and the azimuthal intensity at 45 degrees and 75 degrees, which are within the range of the interpreted fractures.

One should note that these high correlations are localized only in areas of high curvature, and do not exist along the entire wellbore. The other wells, excluding #1, exhibited similar behavior of areas with high fracture density and high curvature, and also had high correlation with one or more trends of azimuthal intensity.

* * *

In last month's (part one) compressional clay experiments we found that a critical magnitude of the curvature is needed to generate tensile fractures – and below this critical curvature there was no correlation between curvature and fractures.

We think that a similar situation occurs in the horizontal wells: areas of high correlation between azimuthal intensities and fracture density also show that most-positive curvature values highly correlate with fracture densities.

To identify the critical curvature magnitude in the present 3-D seismic area, we took the areas of high correlation between azimuthal intensity and fracture density in the wells and computed the curvature ranges for each high correlation interval. We then link them to the fracture density range (table 2).

It appears that the critical magnitude of curvature in the study area is between $8.71 \times 10^{-3} \text{ mi}^{-1}$ and $2.58 \times 10^{-2} \text{ mi}^{-1}$ as these ranges of curvature correspond to fracture densities > 0.5 (fracture/feet), suggesting that curvature induced most of these fractures.

Outside this curvature range the fracture densities are too low to be clearly correlated to the curvature.

We thus propose that the azimuthal intensity method can help to identify locations where curvature strike orientations in the subsurface appear to be locally related to fracture density

* * *

Our main conclusions are:

▶ Curvature calculations in clay models and the subsurface appear to follow similar patterns.

In clay models, a critical value of curvature is needed to initiate fractures. Fracture density rapidly increases with increasing strain until the saturation point is reached and few new fractures are generated.

Indications for similar behavior were observed in our subsurface analysis of image-logs and seismic data.

▶ Azimuthal-intensity by strike orientation is an effective filter to compare curvature orientation to fracture orientation. In our study, correlations between

Continued on next page

Discovery from page 42

concept to collective interplay before and during drilling, from the field to the different levels of decision-making.

A massive delineation program was then carried out, for which six heavy drilling rigs were soon mobilized (a rare effort at this stage of exploration), followed by development. As expected, Ecopetrol had exercised its back-in right once the field was formally declared commercial.

Another big (and happy) surprise was awaiting the joint venture. A second discovery was made seven kilometers north of Cusiana – a welcome sequence in a business that more often than once sets fire to great hopes.

The new field (Cupiagua) was found on a more complicated, intensely faulted structure, smaller in size and “boxy,” but containing a column of hydrocarbons three times larger than in Cusiana (1,500 meters).

The structure had been drilled in the past, with some light oil shows in the Mirador.

The Human Factor

All the phases of the deal and the operation itself bear witness of the importance of good geological thinking and technology: concept, processing, mapping, log interpretation, drilling, etc. My friend Jean played a key role in generating this adventure, but the accomplishment was not a cakewalk and would not have been possible without a symphony of skills and the strong valuable contribution from many colleagues and their collective interplay.

Also important was the responsibility assumed at different rank levels, as well as cooperation with the operator BP and

partners, Ecopetrol and Triton.

I can only mention some of them on Total's side, conscious of such an insufficient recognition: **Jean Laherrère** and members of his technical department, like **Jean Francisque**, who made the critical log analysis of the Mirador and recommended testing; **Henri Orihuel**, who helped interpret the VSP and conclude that 20ms of section remained to be drilled before reaching the frontal fault; **Jean-François Mondy**, geophysicist, whose structural interpretations were invaluable; **Jean-Michel Fonck**, whose team included **Jean Ferrat**; **Jean-François Mugniot**, who followed closely the appraisal and development operations; **Michel Coudeyre**, who was in charge of reserves evaluation within the BP team; and the engineers (**Arnaud Peyredieu**, **Jean Ropers**), who helped meet successfully

the drilling challenges, advising on the use of oil mud to go through the thick shaly caprock.

At some time during the inauguration day in 1996, I was standing with Jean on a site from which we had a full view of the impressive facilities of Cusiana Field: a \$6 billion investment to produce about 1,400 MMb, with a plateau close to 500,000 b/d (including Cupiagua), and I said to him:

“You see, Jean, all this huge machinery was born from an audacious concept and it was generated in your own mind. Warm congratulations, my friend!”

Many thanks to Jean Laherrère and Jean-François Mugniot, who have refreshed my memory and reviewed this article. Carson Caraway and Jean-Jacques Biteau have also kindly contributed to this review. ☒



Drilling location on Cusiana.

Continued from previous page

Table 2 - Fracture densities correlating to curvature

Fracture density	Low Curv. Value (mi-1)	High Curv Value (mi-1)
>0.8	1.15 x10-2	1.40 x10-2
0.8 to 0.65	1.06 x10-2	1.92 x10-2
0.65 to 0.5	8.71 x10-3	2.58 x10-2
0.5 to 0.3	2.22 x10-3	3.27 x10-2
0.3 to 0	3.17 x10-4	3.12 x10-2

curvature azimuthal intensity and fracture density indicated areas where curvature and fracture density are also highly correlated.

► The curvature attribute can serve as a better proxy for fracture intensity when compared with horizontal image logs.

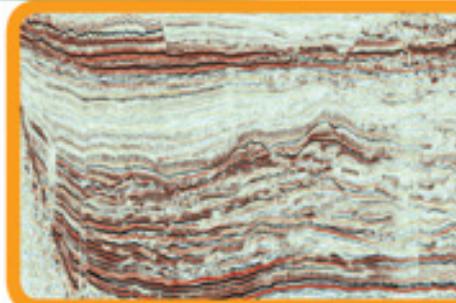
However, strain is only one component in fracture generation, with thickness and lithology (estimated by vertical logs, two-way travel time thickness, and seismic impedance inversion) also playing important roles.

Acknowledgements: Thanks to Pathfinder Exploration for providing the data used in this project, and to Schlumberger for providing software for this research at the University of Oklahoma. ☒

(Editor's note: Evan Staples is with ConocoPhillips in Houston, and Ze'ev Reches and Kurt Marfurt are with the University of Oklahoma in Norman, Okla. All are AAPG members.)



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 Venue: Westin Houston Memorial City, 945 Gessner, Houston, Texas, 77024, USA

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Fifth anniversary this month in Aberdeen

FOTL Still Making Geology an Art to Behold

By BARRY FRIEDMAN, EXPLORER Correspondent

When last we left Fabric of the Land in 2009, an exhibit held at the University of Aberdeen in Scotland that explores the interconnectivity between art and science – particularly geology – it was a modest show set in the digs of the school's geology department.

Its purpose then was to bring together local artists and scientists, showcase their work in an attempt to capture the rich geologic setting of the area.

It still does. It's just not so modest anymore.

The show, now in its fifth year, was designed to bridge the divide between the two disciplines, according to school professor and AAPG member Andrew Hurst, who founded and organizes the event.

Those disciplines often looked at each other with amusement and skepticism, Hurst noted.

But Hurst, professor and chair of production geoscience at the University of Aberdeen, also always believed that artists and scientists had more similarities than differences. And it seemed like a good idea to test the theory.

He turned out to be right.

The primary aim of FOTL, aside from linking the artistic and scientific communities of Aberdeen, was to encourage those to



HURST



The popular Fabric of the Land, an exhibit that blends art and geology, celebrates its fifth anniversary this month at the University of Aberdeen in Scotland.

explore and create lasting images of the Scottish environment and landscape and to show how it is shaped by the geology of the place – to show, in a sense, the fabric of the land.

"Through Fabric of the Land we seek to bring public attention to art and science and the areas of common inspiration," Hurst said earlier this year.

And for this show, like the first four, artists again were encouraged to create works that derive from, or are inspired by, that link; scientists were urged, as well, to explain,

to illustrate, to mold that art, to put it in perspective.

They both succeeded – often simultaneously.

Gifts to Share

This year's show will be presented Aug. 24-Sept. 13, and will feature more of the works submitted throughout the year.

It is an open admissions policy. Cash prizes are awarded for the top three entries. The only criteria: quality.

The work is viewed by a high profile selection panel from all backgrounds that participate in selecting the top exhibits – this year, around 60. In addition, a distinctive subsidiary theme is selected for each exhibition, bringing a wealth of even more creativity to the region.

"I think the main reason for the show's success," Hurst says, "is its unique offering. It's outreach in every possible sense of the word. Art and science uses each as facilitators. At its basic level, it's about mutuality."

What surprised Hurst at first (and you sense it still does) was what spurred artists to create.

"When we started, I thought the show would be a great opportunity for artists to sell their work, to help them do that," he said. "What I have learned, though, is not only do they like to sell the pieces – obviously – but they also want these works to be seen. To share them. To get them noticed."

Susana Braz, group external affairs manager for Dana Petroleum, the company now underwriting FOTL, echoes Hurst's beliefs and explains why her company is involved.

"Our perspective when we first got involved was that it was a very interesting event from University of Aberdeen – bringing art and science and community into the university," she said.

Bringing these groups together brought

[See Art, page 52](#)

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We will focus on defining and identifying "sweet spots," along with understanding compartmentalization and connectivity of the reservoirs, which are increasingly important in all fields, ranging from new shale and carbonates plays to mature conventional fields, both onshore and offshore.

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AAPG

Geosciences Technology Workshops 2013

SPOTLIGHT ON

David's involvement honored
Community Pride

By **SUSIE MOORE**, Communications Project Specialist

Edward K. "Eddie" David, president of David Petroleum Corp. in Roswell, N.M., and a past AAPG president, was twice recognized this year for his generosity and involvement in his community.



DAVID

Lecturer Rusty Riese to his community (and surrounding communities, as well) for a fund-raising event that not only dominated the local media but also netted more than \$105,000 for scholarships and education for students.

David has earned life memberships from the Roswell Geological Society and the New Mexico Landman Association.

But his reach – and knack for helping others – extends beyond not only his profession but the industry itself.

For example, he served on the Roswell school board and board of directors of First Federal Bank. He has been a member of the Roswell Rotary Club for 20 years and has served in various positions at Immanuel Lutheran Church in Roswell.

The list of accolades and achievements for David doesn't stop there.

He is the recipient of Lifetime Achievement Awards from the Leadership Roswell Alumni Association and Silver Beaver Award from the Boy Scouts of America, and was named Outstanding Citizen of the Year by the Roswell Board of Realtors.

David said he was honored but also "surprised" to receive both of the top awards this year.

But he'd be the only one.

Recently, Eastern New Mexico University-Roswell presented him with the school's President's Distinguished Service Award, for his longtime support and contributions; earlier in the year the United Way of Chaves County, N.M., bestowed on him the Margie Boles Lifetime Achievement Award for his continued positive impact on their community.

One could say David is a "natural" at it – that is, giving of his time and his money. Indeed, serving his community and profession comes naturally to David.

He has served in a leadership capacity for AAPG and the profession for more than two decades. He served as AAPG president in 1998, is an AAPG Foundation Trustee Associate and was named an Honorary member in 2005.

He also served as AAPG treasurer in 1992 and is a recipient of the AAPG Distinguished Service Award, as well as having served on various committees within AAPG.

Last year he organized and played a major role in bringing AAPG Distinguished

contributions and service to the society. Kraus is with University of Colorado, Boulder, Colo.

Andrew Miall has been awarded the Pettijohn Medal by SEPM, for outstanding contributions in sedimentology and stratigraphy. Miall is with University of Toronto, Canada.

Bonnie Milne-Andrews, to manager, Redlock Exploration, Houston. Previously manager-geological operations, Guinea, Hyperdynamics Corp., Houston.

Brian Romans has been awarded the Wilson Medal by SEPM, for outstanding contributions in sedimentary geology by a young geologist. Romans is with Virginia Tech, Blacksburg, Va.

Jeff Shellebarger, to president, Chevron North America Exploration and Production, Chevron, San Ramon, Calif. Previously managing director-IndoAsia business unit, Chevron.

Frank Sheppard, to exploration manager-Gulf Coast onshore region, Apache Corp., Houston. Previously senior geoscience adviser, Apache Corp. Houston.

Robert Wentz, to staff geologist, ConocoPhillips, Anchorage, Alaska. Previously staff geologist, ConocoPhillips, Houston.

Gregory Wrightstone, to shale exploration consulting, Pittsburgh. Previously partner and vice president, Mountaineer Keystone, Pittsburgh.

"Professional News Briefs" includes items about members' career moves and the honors they receive. To be included, please send information in the above format to Professional News Briefs, c/o AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101; or fax, 918-560-2636; or e-mail, smoore@aapg.org; or submit directly from the AAPG website, www.aapg.org/explorer/pnb_forms.cfm.

PROFESSIONALnewsBRIEFS

Chris Armistead, to new ventures district geologist, Samson Resources, Tulsa. Previously geologist III, Stone Energy, Morgantown, W.Va.

Richard L. Chambers has retired as chief product manager, Halliburton-Landmark, Houston. He now resides in Yukon, Okla.

Kevin Corbett, to president and chief executive officer, Channel Energy, Lakewood, Colo. Previously president, Wrangler Resources, Denver.

Ricky Cox, to vice president-west Texas exploration, Brigham Resources, Austin, Texas. Previously lead geologist-Texas asset, Concho Resources, Midland, Texas.

John M. Garrity has retired as China shale gas earth science adviser, Chevron China Energy Co., Nanjing, People's Republic of China. He resides in Nanjing.

Fariborz Goodarzi has been awarded the Gilbert H. Cady Award from the Geological Society of America, in recognition of outstanding contributions to the interdisciplinary field of coal geology. He is with FG and Partners in Calgary, Canada.

Rick Hart, to president/owner, Hart Exploration, Coldspring, Texas. Previously Williston Basin geological manager, Statoil, Austin, Texas.

Larry B. Kellison, to vice president of operations, Strata-X Inc., Denver. Previously chief operating officer, Eden Energy, Denver.

Jan Konstanty, to manager international exploration strategy and portfolio management, Shell International E&P, The Hague, Netherlands. Previously exploration commercial adviser, Shell International E&P, The Hague, Netherlands.

Mary Kraus has been awarded honorary membership by SEPM, for outstanding scientific

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Call for Abstracts – 15 November 2013

Petroleum Geoscience of the West Africa Margin
 31 March - 2 April, 2014
 The Geological Society, Burlington House, Piccadilly, London

Convenors:
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Petroleum Exploration along the West African margin has a long history. Discovery of commercial oil in the Niger Delta in 1956 and offshore Angola in 1966 led to these two countries becoming the largest oil producers in the region today, accounting for 5% of global daily oil production. Even with this extensive history, however, new exploration plays continue to be found with imaginative ideas & innovative technology.

In the last decade, independent oil companies have aggressively pursued new concepts – from stratigraphic traps in Ghana to recent exploration success in Cameroon & Equatorial Guinea. Independents and Majors now compete head-to-head in the more "mature" areas such as Gabon & Angola, investing in new play concepts and exploring the pre-salt, prompted by successes on the conjugate Brazilian margin. To the south, Namibia is undergoing renewed exploration activity. In short - it's an exciting time to be exploring in West Africa.

This conference will showcase the regional geology, from Morocco to South Africa, sharing insights on recent exploration successes and emerging plays, & integrating inputs from academia, industry, and national oil companies.

Call for Papers:
 Please email paper and poster contributions to laura.hayward@geolsoc.org.uk and Teresa.Ceraldi@uk.bp.com by 15 November 2013

For further information please visit www.geolsoc.org.uk/westafrica14 or contact: Laura Hayward, The Geological Society, Burlington House, Piccadilly, London W1J 0BG. T:020 7434 9944 F:020 7494 0579

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AAPG Foundation

Dear Sirs,

Re: Notification of Donation to AAPG Foundation in Memory of Steven James O'Connor.

I just wanted to send thanks to you for advising me of the generous donation made by Mr. Wolfgang Schollnberger in memory of my late husband, Steven O'Connor.

I have written personally to Mr. Schollnberger telling him how pleased and very grateful my family and I are that he has chosen to honour my husband's contribution to the oil industry and to the AAPG in this way.

My husband was a member of the AAPG for 30 years of his professional career and published quite a few papers, some of which appeared in the AAPG publications. He was always very proud of his work and hoped that future geologists would find his papers of value. Education was extremely important to him and his work as a mentor to younger geologists was something that gave him the most satisfaction.

Thank you for allowing his memory to live on in this way.

Sincerely,

Cheryl O'Connor

New Zealand



Steven James O'Connor, 1951-2012

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Students Reap Benefits From Foundation Gifts

By NATALIE ADAMS, AAPG Foundation Manager

Leaders from student chapters across the globe attended the recent Student Chapter Leadership Summit and AAPG Leadership Days in Tulsa, where they learned how to increase the success of student chapters as well as prepare for the professional world of petroleum geology and engineering.

This annual event is made possible by contributions from James A. Hartman and the AAPG Foundation.

"Bringing students together at the SCLS and making them a part of the annual Leadership Days is paramount to ensuring the vitality of the next generation's geoscientists," said AAPG Secretary Richard Ball, who with Bryant Fulk helped organized the event.

Many mentoring opportunities exist at Leadership Days, which is AAPG's annual networking and training event.

During the event, student chapter leaders are paired to establish relationships between universities with different strengths to share technical and organizational resources. This is done to encourage international cooperation via student bonds, which will grow into professional connections.

Many use the time to plan and organize international field trips, set up Skype lectures featuring distinguished speakers and to brainstorm regarding fundraising and event planning.

To read more, visit <http://foundation.aapg.org/programs/studentchapterleadership.cfm>.

And to support future geoscientist leaders, donate to the AAPG Foundation today.

Letters continue to pour into the Foundation office from Grants-In-Aid recipients, expressing appreciation for their awards.

Peter Hawk, a master's student at the

University of Adelaide, Australia, writes:

I would like to express my appreciation of receiving the 2013 Jean G. Funkhouser Memorial Grant. The grant will be utilized toward my project – Evaluation of Petroleum Systems on the Billiuna Shelf and Adjacent Structural Regions, Eastern Canning Basin. I endeavor to utilize the award to partially fund a source rock study with samples collected from the West Australian Core Library.

I would like to thank the contributors to the Memorial Grant and the AAPG Foundation's Grants-In-Aid program for their donations and generosity.

I believe that gestures such as this go a long way toward encouraging comprehensive academic activities.

His and more letters can be viewed at <http://foundation.aapg.org/students/graduate/current.cfm>.

* * *

The AAPG Foundation fiscal year ended June 30 and contributions were impressive, totaling more than \$2.7 million.

We can't express too many times how much we appreciate every gift.

Designations were made to 28 different funds. Bob and Carol Gunn's \$1 million gift to the General Fund will enable the Trustees to allocate more funding to proposals all over the globe. Thousands of other donations were made to support everything from education and scholarships to professorial grants and publications.

To help the AAPG Foundation provide more scholarships and other much-needed funding, please give today.

To donate or for more information on all of the Foundation programs, visit www.aapg.org/eDonation/Core/eDonation.aspx.

Let's make 2013-14 an even bigger year.

Art from page 50

them closer to each other's world, too, which she says, for some, was just a reminder for some of them.

"Many scientists started out as artists."

As the show grew, space became tighter (Hurst said a limit had to be placed on not only the number of exhibits featured, but also their size.)

Luckily, when the department's offices are renovated, so, too, will the space used for FOTL.

The show also will start to travel.

First stop: Edinburgh, home of the Scottish Parliament.

Braz says the proximity of the show will make it easier for government officials to see the exhibition, see its importance and, with any luck, help promote and fund it accordingly. As it stands now, the FOTL has already secured at least one grant from government institutions that matches Dana's funding.

"This has a potential to grow," she says.

That growth, both Braz and Hurst say, will one day bring FOTL to other schools

and facilities within the country.

"It can be much bigger," Braz adds.

Hurst says costs probably prohibit taking the show much past Scotland, despite their aspirations; touring it through Europe would be difficult, through America impossible.

But he says the show could be recreated in university communities in the United States – similar to Aberdeen, which he calls a "vibrant" setting – where a similar arrangement between artists and scientists could be explored. He has been in early talks with some American colleagues about such a venture.

Hurst passionately believes there is something wonderful about the connection between art and science. He himself is a scientist, yes, an administrator, yes (though he likes this part of his world least of all) but when he looks forward to retirement, he looks forward to doing something else, something he's always loved.

"I want to write. I am a writer," says this scientist.

"Both sides," he says of science and art, "help each other."

And he's looking forward to seeing if that's true.

Foundation Contributions June 2013

The names that appear here are of those who have made donations to the AAPG Foundation in the past month – predominately through adding some additional monies on their annual dues statement.

To these people, and to those who have generously made donations in the past, we sincerely thank you. With your gifts, the AAPG Foundation will continue its stewardship for the betterment of the science and the profession of petroleum geology.



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William Gorom Watson
In memory of Robert N. Watson
Ritchie Wayland
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William Glen Wendell
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Joseph Theodore Westrich
Joe Rolfe White Jr.
Bob Andrew Whitney
Mark Steven Whitney
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Jeremy Crosby Wire
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Thomas Stanzel Laudon

Allan P. Bennison Distinguished Lecture Fund
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Jose Abelardo Sanchez Araiza
Wayne Alvin Schild

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

Student Chapters Can Use Website for Reports

By JANET BRISTER, AAPG Website Editor

AAPG Student Chapters can now submit their reports online. This is because AAPG has developed a new wizard to guide chapter leadership through the process and, on the back end, allow AAPG staff to receive more timely information.

“Student Chapter reporting is one of the most crucial ways that we receive information from our existing student chapters,” said Mike Mlynek, assistant manager of AAPG’s member services department and staff liaison to Student Chapters. “It is the lifeblood of the chapter that keeps it moving forward, affecting everything from chapter status, eligibility for various programs and rankings for the Outstanding Student Chapter Awards.”

Previously, chapter leadership would either mail or email their reports to AAPG. But with computer access now common on college and university campuses, “It is only fitting that we introduce a better way to deliver those reports to headquarters,” Mlynek said.

This new streamlined process allows for a Student Chapter to upload the reports that are due every six months. It immediately confirms to the chapter and member services staff that it has been received.

Several manual steps are eliminated, including a delayed confirmation of receipt of reports.

Brian McBroom, member services specialist, points out the efficiency since “the new wizard ties into pre-existing applications such as the student chapter

American Association of Petroleum Geologists
Students

Home Student Expos Outlook (News) Contact Student Affairs Chapter Links Awards **Chapter Reports**

In order to upload your report, begin by submitting the ID of your student chapter below:

Student Chapter ID

School	Colorado School of Mines
Address	1500 Illinois Street Golden CO 80401 USA
REF_NUM	7231
CHAPTER_NAME	Colorado School of Mines Student Chapter of AAPG
ID	XXXXXXXX

Student Chapter Report Upload

Please complete the information below and upload your Student Chapter Report. This application will accept documents in the following formats: .zip, .doc, .docx, or .pdf. The file size must remain under 30 MB.

Student Chapter ID
 School Name
 Name
 Email Address
 Report Uploading
 Report Year

No file chosen

search and the approval processes for the Weeks Grant recipients.”

McBroom helped establish the L. Austin Weeks Undergraduate Grant wizard to assist the AAPG Foundation collection

of reports required for the Weeks Grant process.

“Updates to these applications will be immediate as well, using the information provided for the reports,” McBroom said.

Step-by-Step

So let’s review the steps of the Chapter Report submittal wizard.

- ▶ First, gather what you’ll need:
 - ✓ Student Chapter ID.
 - ✓ Report(s) saved to a PDF, Word document, text file such as ASCII or Rich Text Format. Those extensions would be: PDF, .doc, .docx, or .zip.
- ▶ Go to AAPG’s student website, at <http://students.aapg.org/>. If familiar with this page you may already have noticed a new link within the header labeled “Chapter Reports.”
- ▶ Enter your Student Chapter ID, as it is required to begin the process. This will bring up information from your records on file confirming your chapter. The person submitting the data will be asked to enter their name and email address.
- ▶ Choose the correct report option – mid-year or end-of-year – and the report year.
- ▶ Click the “Choose File” button to locate the file of your report on your local hard drive, then select the upload button. An on screen confirmation will appear and an email will be sent to the email address provided and to AAPG staff.

Continued on next page

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AAPG: Partner for life

Career Center Enhanced

By KARRIE DIGGES, AAPG Member Services Department

As part of our ongoing effort to increase member value and provide opportunities to enhance your career needs, AAPG is pleased to announce the following new tools/resources available now on our Career Center:

► **Career Learning Center** – Our Learning Management System will help you further your training with customized learning content. The Career Learning Center encourages an integrative career and professional development process that enhances your skill set.

► **Career Tips** – Search by career stages or services you need using keywords or phrases. Access information, products and services on job hunting, résumés, interviewing, negotiations, networking stock option, annual reviews and more.

Topics include:

- ✓ Choosing the right coach.
- ✓ Preparing résumés, letters and references.
- ✓ Finding job opportunities.
- ✓ Negotiating your offer/closing the deal.
- ✓ Planning and advancing your career.
- ✓ Professional résumé writing – Multiple options are available here, and fees are based upon various levels of career development, needs and position you are seeking. Pricing starts at \$29.95 up to \$825 for those seeking CEO positions.

✓ **Career coaching** – Get individual help from our experienced coaching staff. Coming from a variety of professional backgrounds, all have graduated from an accredited coach training program, are members of the International Coach Federation (ICF) and are certified in behavioral style analysis and interpretation. (Three 30-minute coaching sessions for members – \$224.)

► **Social Networking/Profile Development** – Make the right connections to job opportunities you never knew existed. Do

you know that the number one way to get a job is through networking? How well do you network? How MUCH do you network? Sometimes it's hard to find the right places to meet people with similar positions or in similar fields. You literally have millions of possible connections at your fingertips.

We will create an online identity for you at the following sites:

- ✓ LinkedIn
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- ✓ Plaxo

And here's what this will do for you:

- ✓ Establish a solid online presence with the information you want others to read about.
- ✓ Let you be found by employers who are doing Google searches or on LinkedIn with certain keywords.
- ✓ Connect you to old friends and colleagues who may have, or know of, job opportunities.
- ✓ Watch the possibilities open up in many different areas than the traditional avenues.

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AAPG is committed to being your career partner for life. For more information regarding the AAPG Career Center please visit <http://www.aapg.org/careers/careercenter.cfm> or contact Karrie Digges, AAPG member services department, at kdigges@aaapg.org.

future," Mlynek said.

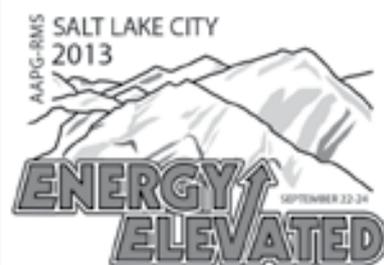
Mlynek and McBroom worked closely with Taron Graves, AAPG .NET developer, to bring this new tool to the Student Chapters.

Good browsing!

Continued from previous page

And ... you're done.

"We are positive that this will improve upon our efforts and look forward to the introduction of other improvements to help AAPG students and their chapters in the



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- Unconventional Resource Plays
- Carbon Capture, Utilization, and Storage
- New Resource Plays
- Geothermal Resources of the Rocky Mountains



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- 5 Utah-based field trips and 4 short courses
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Improving E & P Effectiveness

It's a Gas, Gas, Gas

I always enjoy reading Edith Allison's comments from Washington in her monthly Policy Watch column. Edith does a great service to the industry, educating AAPG members around the globe about the role of politics in energy production, pricing and moving toward "self-sufficiency."

Then (AAPG Executive Director) David Curtiss in his monthly Director's Corner is always pointing to a good future for gas – with a smile. I never miss his column.

Of course, getting things done (converting diesel, subsidized corn-based ethanol or gasoline-powered vehicles to CNG in the United States) is another matter.

The question is, how to ignite the program!

If federal and all state government vehicles could be converted, a big push to have public and private vehicles converted

would follow.

Examples of this can be cited: The president of Turkmenistan, for example, in 2011 ordered some of the presidential vehicles be converted to CNG-powered, although the nation did not have any indigenous know-how about such conversion and invited a Turkish company to build such conversion centers.

I am sure that all know Turkmenistan is a very small nation, but has very large reserves of natural gas. And the country is expanding its export markets rapidly, including to China.

Why is Washington on a snail-speed about this quick job?

To those in environmental activist clubs, please note that major cities in India are using CNG – and now citizens there again can see the blue sky, stars and breathe

easier than was possible just a few short years back. Can't we work together for economic health and cleaner air from use of affordable local energy source?

And to those who are afraid of reserve depletion from LNG business, please note that just one tiny undeveloped sub-basin in the Eastern thrust belt of the United States has more gas reserves than total unconventional gas reserves of China. Then there are other resource-full basins in the Lower 48 that are yet to see any serious exploration and drill bits.

So enjoy the plentiful resource – but conserve and remember that this fossil energy deserves worthy pricing. Drop a line to your local elected representative and senator – state and federal.

Kumar Bhattacharjee
Las Vegas, Nev.

Thumbs Up

AAPG members have been active in the study of climate change for many years.

Some have participated directly in research on paleoclimatology and others have debated policy implications. Their contributions and discussions have focused on selected data sets, such as Neogene climate cycles, or specific environmental and policy responses, such as reduction of emissions and business implications.

However, integration of all factors and processes of climate through time is critical to fully understand and assess climate change.

A new book integrates clear explanations with examples of climate chemistry, physics and oceanography – for professional scientists as well as anyone interested in the scientific underpinnings of the current paradigm shift in understanding climate.

"Experimenting on a Small Planet – A Scholarly Entertainment," by William W. Hay is published by Springer-Verlag – a delightful book filled with stories of scientific discoveries and personalities that is *not* a textbook.

It has 28 chapters, ranging from "The Language of Science" to "The Climate System" to "Carbon Dioxide" and "The Future." Each chapter is a concise explanation of a specific scientific discipline of physics, chemistry, geology, oceanography and climatology.

Clever cartoons (by Greg Wray) introduce each chapter's theme, and the chapters are structured in three parts – history, scientific explanation and a list of important discovery events.

The chapters are followed by short "Intermezzos" that describe events in Hay's fascinating 60-year career as a professional geoscientist, each one woven with politics of the times and personalities of colleagues and collaborators.

For example, Hay provides insight into the politics of funding the ocean drilling proposals. His adventures with scientists on the other side of the "Iron Curtain" during the 1960s and '70s recall those challenging times.

I found it easy to read and full of information about the people who pioneered the various scientific disciplines that now are part of climate science. I was amazed at the wealth of history, data and understanding of the complex issues.

All AAPG members who want a more complete background of these "changing times" will find scientific gems and entertaining information in this lucid book.

Robert W. Scott
Cleveland, Okla.

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IN MEMORY

- James Richard Biddick, 82
Tulsa, May 19, 2013
- George Boulanger Choquette, 95
Comox, Canada, April 13, 2013
- John Ralph Gregg, 82
Forsyth, Mo., May 10, 2012
- Steven Michael Hansen, 58
Tucson, Ariz., June 10, 2012
- Harold Walter McGovney, 56
Tulsa, Feb. 11, 2013
- John Sandy Jr., 78
Plano, Texas, May 14, 2013
- Ralph Hartwin Warner, 80
Kingwood, Texas, April 7, 2013

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

CLASSIFIED ADS

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

CLASSIFIED ADS

POSITION AVAILABLE

**Pevhouse Chair in Geosciences
Texas Tech University**

The Department of Geosciences at Texas Tech University invites applications for the Pevhouse Chair in Geosciences. The purpose of this endowed position is to support innovative research and education that are broadly aligned with petroleum geosciences and may include geophysics, structural geology, geomechanics, sedimentology, petrophysics, and organic geochemistry. A Ph.D. in geosciences or closely allied field is required, as is a record of research as demonstrated by professional publications. The chair holder will conduct a vigorous, externally-funded research program, direct graduate student research, and teach undergraduate and graduate courses in his/her specialty. The position is expected to be filled at the tenured Full Professor level.

Texas Tech is a state-supported, graduate research-oriented university with over 32,000 students. The Department of Geosciences consists of twenty-four tenured/tenure-track faculty, with teaching and research emphases in solid earth geosciences, atmospheric science, and geography. It offers degree programs in solid earth geosciences at the BS, MS, and Ph.D. levels. The chairholder will join a dynamic, growing Department with more than 200 undergraduate majors and more than 60 graduate students. Texas Tech is committed to growth in disciplines aligned with hydrocarbon geology through addition of at least one junior faculty position.

The Department computer labs are equipped with GIS, geologic mapping/modeling, and seismic processing/interpretation software packages. Available experimental/analytical facilities include a stable isotope laboratory, XRD, XRF, analytical SEM, TEM, laser ablation ICP-MS, a heat flow lab, and remote sensing spectroradiometers. In addition, the Department of Petroleum Engineering maintains experimental and analytical facilities in petrophysics, drill fluids, cement, enhanced recovery, and reservoir simulation, as well as X-ray CT/nuclear magnetic resonance imaging lab.

Lubbock is located on the Southern High Plains in close proximity to the Permian Basin. The city has a population of over 225,000 and the semi-arid climate is conducive to outdoor activities. Cultural amenities include musical, theatrical, and sports events, and the city offers numerous options for shopping and dining. The city also offers the best healthcare facilities in the region, including the university's Health Sciences Center. The cost of living is low compared to national norms.

Applicants must first go to the employment website of the university at <http://jobs.texasstate.edu>. There, go

to "Search Postings", search for requisition number 87107, and fill out necessary forms in applying for the position on-line. Then, applicants should submit a letter of application, curriculum vitae, a statement of teaching and research interest, names and contact information (including e-mail address) of at least 3 professional references. These documents should be uploaded to the employment website and we request that copies be emailed or sent directly to: Dr. Calvin Barnes, Pevhouse Chair Search Committee, Department of Geosciences, Texas Tech University, MS 1053, Lubbock, TX 79409-1053.

Additional information on the department can be found at website <http://www.depts.ttu.edu/geosci/>. E-mail questions regarding the position are received at cal.barnes@ttu.edu. Review of applicants will begin immediately and continue until the position is filled.

Texas Tech University is an affirmative action/equal opportunity employer, committed to excellence through diversity. Texas Tech welcomes applications from minorities, women, veterans and persons with disabilities.

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Good Reasons Why Keystone Should be OK'd

By DAVID K. CURTISS, AAPG Executive Director

You don't have to spend much time around the oil and natural gas industry to understand that it is political. No matter where you work as a petroleum geoscientist – in academia, government, or industry – the odds are high that you'll encounter situations in your career where politics affect your ability to do your job.

There are some good reasons for this:

► First, energy resources are a fundamental building block of modern society, and oil and natural gas represent more than 60 percent of the global energy portfolio.

► Second, finding and producing these energy resources is a massive industrial undertaking, requiring large investments and creating significant numbers of jobs.

Consequently, government officials take great interest in what we're doing. Problems arise, however, when the politics around an energy project overshadow the real issues at hand.

And that is the case with the Keystone XL pipeline.

* * *

I've written about the Keystone XL project twice before in these pages. The issue under review is whether the State Department should issue a presidential permit for the cross-border section of the pipeline to transport Canadian oil sands crude to refineries along the U.S. Gulf Coast.

It's been a long and frustrating process, now in its fifth year, where the debate has



CURTISS

It should come as no surprise that the Canadian government is now looking for other outlets for crude oil produced from its oil sands.

shifted from the merits of the proposed pipeline project to its impact on climate change. And President Obama added fuel to the debate in his June 25 speech at Georgetown University on climate change:

"Now, I know there's been, for example, a lot of controversy surrounding the proposal to build a pipeline, the Keystone pipeline, that would carry oil from Canadian tar sands down to refineries in the Gulf. And the State Department is going through the final stages of evaluating the proposal. That's how it's always been done.

"But I do want to be clear: Allowing the Keystone pipeline to be built requires a finding that doing so would be in our nation's interest. And our national interest will be served only if this project does not significantly exacerbate the problem of carbon pollution.

The net effects of the pipeline's impact on our climate will be absolutely critical to determining whether this project is allowed to go forward. It's relevant."

Go back and reread the president's words again. There's something there for everyone.

Opponents of Keystone XL were delighted to hear the president link climate

change considerations to the national interest, crowing that he had essentially killed the project.

Supporters of Keystone XL heard those words, preceded by the statement, "Now one thing I want to make sure everybody understands – this [building a low-carbon energy economy] does not mean that we're going to suddenly stop producing fossil fuels. Our economy wouldn't run very well if it did," as evidence that the president is firmly committed to having the State Department issue the presidential permit.

What's a trading partner – the United States' largest trading partner – to do?

It should come as no surprise that the Canadian government is now looking for other outlets for crude oil produced from its oil sands.

The June issue of Petroleum Economist includes an extensive review of Canadian oil sands. The Keystone XL clearly remains a top priority, with Canadian Prime Minister Stephen Harper actively engaging policy makers in Washington, D.C., to marshal support for the project. But the industry is developing additional plans to bring these resources to market.

The reason for this is significant production growth expected from the oil sands, with a doubling forecast

between 2012 and 2023. It would take the equivalent of three Keystone XL pipelines to move this volume of crude. So, the industry also is evaluating pipeline options to Canada's West Coast as well as to the East Coast.

Canada "has ambitions to become a world oil and gas force," writes the Petroleum Economist. "But it is tough to be a global energy superpower when you have only one customer."

* * *

But that customer is still buying.

In fact, according to the Energy Information Administration, even with total U.S. crude imports falling, the volume of imported Canadian crude continues to rise – and much of that is from the oil sands.

So, the United States is evaluating a project that strengthens the bilateral relationship with our largest trading partner, through the building of a pipeline that encourages investment and job creation, and brings to U.S. and global markets the vast energy resources in Canada's oil sands, thereby enhancing global energy security and providing consumers with affordable and reliable energy supplies.

I'm not sure how best to define "in the nation's interest," but the preceding sentence seems like a pretty good start.

It's time to set politics aside and issue the presidential permit for the Keystone XL pipeline.

DIVISIONS REPORT

Finding Focus for the Year's Agenda

By JEREMY BOAK, EMD President

Even with a year of preparation as president-elect, I find myself stepping into the role of Energy Minerals Division (EMD) president with some trepidation.

This concern is not about the people in the Division, nor the importance of the efforts EMD exerts on behalf of the technical missions of AAPG.

My concern is about finding the right avenues to direct the energy I see available in EMD – and finding the way to communicate that makes sure that it gets harnessed to strengthen the technical and scientific foundation of our Division and Association.

To do that, I think I have found some themes that can help focus our efforts – but they are neither glamorous new initiatives nor creative insights about petroleum geology or AAPG. I hope my time as president can be dedicated to hard work and open communication (especially with my fellow Division presidents), to:

► Define how Divisions new and old can best enhance AAPG's technical mission.

► Decide how Division budgets can be structured to support that technical role.

► Upgrade and rejuvenate our communications tools (starting at



BOAK

My concern is about finding the right avenues to direct the energy I see available in EMD.

websites, but looking beyond) to encourage participation based on recognized value.

► Expand the appeal and recognition of the Division and the Association to make it an even more visible voice for our industry.

* * *

I am excited to welcome and congratulate a team of elected officers I have come to know as talented, knowledgeable, energetic and dedicated.

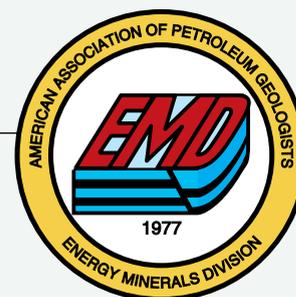
With Fran Hein as president-elect, Jim Clough as vice president, Charles Boyer as treasurer, Bruce Handley as secretary and Andrea Reynolds as past-president, I know we have a strong Executive Committee ready to work together to address the challenges that our Division

faces this year, and to provide effective and relevant support as the Association works through some exciting changes.

I also am pleased to serve an AAPG president, Lee Krystinik, whom I have appreciated as cheerful, thoughtful, insightful and fun for close to 30 years – and to make some new friends among the current leadership team as well.

I am likewise looking forward to the opportunity to work with – and continue to learn from – our Commodity and Supporting committee chairs and their vice chairs.

Whether you have just switched to a new resource area or are interested in what is going on in your area or other parts of the energy extraction business, look at some of the annual reports posted at the EMD website to see what a valuable information source these committees are.



EMD has a strong and still-growing membership interested in the resources and issues those committees address, from shale gas and liquids – what we now might call "mainstream unconventional" parts of the petroleum industry – to uranium, coal and oil sands, long-standing resource fields that always have been allied to the oil industry, to oil shale and gas hydrates, the unconventional resources of the future.

Our Energy Economics and Technology Supporting Committee puts together exciting reports on the common and crosscutting themes of the whole energy landscape.

* * *

EMD offers personal contacts and relevant information to any professional interested in the technical direction of the industry. Visit our website, contact our team and ask for help, offer a hand on EMD sessions or publications – or just give us some feedback.

I would be pleased to hear where you think EMD should go in the next year and beyond.

Don't go to the field alone!



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