AAPG EXPLORER
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A Twisted Tale of Shale

It's a mystery everyone wants to solve

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AN INTERNATIONAL ORGANIZATION

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AAPG EXPLORER

PRESIDENT'S COLUMN

Synergy Can Spark Significant Success

By TED BEAUMONT

Some older members of AAPG may remember when geologists, geophysicists and engineers worked under separate supervision and in separate departments in oil and gas companies. It may be hard for some of you to believe, but in many companies there literally was a geology department, a geophysics department and an engineering department.

Why were the disciplines separated? I really don't know.

Probably, though, it was due primarily to the conceived value of integrated confidential data. I also suspect unhealthy competition, as well as some misguided mistrust, between the different disciplines contributed to the limited sharing of data within a company. By separating the disciplines access to information was carefully controlled, and only upper level management could see the big picture.

Another reason might be educational background. My dad, who also is a geologist and longtime AAPG member, reminded me that geologists, geophysicists and engineers used to be educated separately.

Physicists were hired to be geophysicists, he said. They generally didn't have any geological course work. And engineers were not required to take any geological courses before they were hired to be petroleum engineers. As a result, it was natural to separate the disciplines into departments.

One older geologist/friend who worked for a major oil company told me that in his era he had to get special permission to look at seismic (2-D) sections, for which specific security was in place to handle their restricted use by geologists – usually under the watchful eye of a senior geophysicist.

My first job was with Cities Service Oil Company. Geologists, geophysicists and engineers were all in our separate departments, and even when we were all working on the same project we worked separately. We geologists generated prospects; they then were vetted for economics by engineers and "shot-out" seismically by the geophysicists.


BEAUMONT

> At first we were hesitant to trust each other, but we realized the more we combined our skills the better we were at finding oil and gas.

While I was working at Cities Service, however, things began to change between geologists and geophysicists. The big catalyst seemed to be the publication in 1977 of AAPG Memoir 26, "Seismic Stratigraphy: Applications to Hydrocarbon Exploration."

At that point geologists began to realize that seismic sections could show more than anticlines and synclines.

In Memoir 26, Peter Vail and his colleagues at Exxon Production Research postulated that seismic reflections are time synchronous and do not necessarily follow lithologic boundaries.

This controversial statement created much debate between geologists and geophysicists – and forced us to begin a dialog about exactly what seismic reflections represent geologically.

* * *

You might think it obvious that the two societies that represent petroleum geologists and geophysicists, AAPG and Society of Exploration Geophysicists (SEG), would get together often and have many joint projects where we could exchange ideas. However, there have been very few.

Those few, however, have been notable.

See **President**, page 4

Voting Continues for AAPG Officer Candidates

Ballots have been mailed and online voting continues in the election of new officers for the AAPG 2013-14 Executive Committee.

Voting will remain open through May 15.

To assist in the voting process, a special AAPG candidate insert was included in the March EXPLORER, offering a convenient compilation of biographies and individual information for all candidates.

Candidate bios, written responses to the question of why they accepted the invitation to stand for office plus video comments from each candidate, filmed at last year's Leadership Conference in Tulsa, remain available online at www.aapg.org.

The 2013-14 Executive Committee will take office July 1.

The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2014-15. The vice president-regions and secretary will serve two-year terms, and the editor will serve a three-year term.

The slate is:

President-Elect

❒ **Randi S. Martinsen**, University of Wyoming, Laramie, Wyo.

❒ **Kay L. Pitts**, Aera Energy, Bakersfield, Calif.

Vice President-Regions

❒ **István Bérczi**, MOL Hungarian Oil and Gas, Budapest, Hungary.

❒ **John G. Kaldi**, Australian School of Petroleum, University of Adelaide, Adelaide, Australia.

Secretary

❒ **Richard W. Ball**, Chevron Upstream, Southern Africa SBU, Houston.

❒ **Sigrunn Johnsen**, independent consultant with ProTeamAS, Stavanger, Norway.

Editor

❒ **Colin P. North**, University of Aberdeen, Aberdeen, Scotland.

❒ **Michael Sweet**, ExxonMobil Production, Houston.

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


Photo courtesy of Carlton Brett

ON THE COVER:

Sometimes, geology is both obvious and overwhelmingly dramatic – case in point, this fold in a Union Springs member of the Marcellus Shale at the Oriskany Falls quarry in New York, a popular field trip destination for geologists and the public alike. Shale plays are the industry's hot topic today – not just for professionals, but for the general public as well – and this "Shale Horizons" issue of the EXPLORER offers several stories that cover shale developments for several regions and aspects of the play. Cover photo courtesy of Gregory Wrightstone.

Left: A photo of the Upper Ordovician Strata of the Cincinnati Arch, destination of a field trip offered during the AAPG Annual Convention in Pittsburgh. See Page 22.

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Ray Named Deputy Editor of INTERPRETATION


RAY

Denver consulting geophysicist-geologist R. Randy Ray, current chair of the AAPG House of Delegates, has been named the deputy editor-in-chief of the new journal INTERPRETATION, which will be published jointly by SEG and AAPG.

The publication, a peer-reviewed journal created for advancing the practice of subsurface interpretation, will be issued quarterly with the first issue due in August.

Former SEG Editor Yonghe Sun is the publication's first editor-in-chief, serving a three-year term. The journal's editorial board will include members of both AAPG and SEG, and the organizations will alternate the appointment of editors-in-chiefs. The group not selecting the editor-in-chief will select the deputy editor-in-chief.

Ray, a member of both AAPG (Honorary) and SEG, has specialized for nearly four decades in the interpretation of geophysical and geological data for petroleum and coal exploration.

After working as chief geophysicist and senior geophysicist for several companies – including Cities Service, Breitburn Energy and Underground Energy, PanCanadian and Encana – Ray formed his own company, R3 Exploration, in 1980, and still serves there today as president.

An author and co-author of several articles and publications, Ray in 1995 was the founder of the still-highly successful annual 3-D Seismic Symposium in Denver; was the general chair of the 2009 AAPG annual convention in Denver; and served as editor in 2001-03 of the EXPLORER's popular Geophysical Corner.

He also was editor for the 1985 RMAG-DGS Seismic Atlas; the 1995 RMAG High-Definition Seismic Guidebook; and is the AAPG Search and Discovery editor for the Geophysical Corner website.

President
from page 3

SEG started in 1930 as Society of Economic Geophysicists. In 1932, they changed the name to Society of Petroleum Geophysicists and became affiliated with AAPG, holding joint meetings with AAPG for more than 20 years.

In 1937, they changed their name to what it has been since then: the Society of Exploration Geophysicists.

In 1972, AAPG and SEG co-published Memoir 16, "Stratigraphic Oil and Gas Fields." Twenty-four years later, in 1986, AAPG and SEG co-published Memoir 42, "Interpretation of Three Dimensional Seismic Data," written by AAPG member Alistair Brown. It has been a tremendous success and is now in the seventh edition.

This year SEG and AAPG are joint partners in two potentially very significant new projects:

- One, initiated by SEG, is a new journal to be called, INTERPRETATION. As described in the March EXPLORER, SEG and AAPG will share editorial responsibilities and expenses for this publication.

(See related story on this page.)

INTERPRETATION will be less technical than SEG's Journal of Geophysics and more technical, in terms of geophysics, than the AAPG BULLETIN.

- The other huge new project was initiated by AAPG through an idea generated by AAPG's former executive director, Rick Fritz, about a new conference that brings AAPG back together with SEG for the first time for joint involvement in a meeting since the 1950s.

The meeting will be called the Unconventional Resources Technology Conference, or URTeC for short.

URTeC, however, is being started not just by SEG and AAPG but also in partnership with the Society of Petroleum Engineers (SPE) – and this new, science-driven event marks the first time all three societies have been in such partnership.

The first URTeC will be held Aug. 12-14 in Denver (see related story, page 28).

Finally, geologists, geophysicists and engineers are formally getting together to share ideas concerning the exploration for and development of unconventional reservoirs.

Why was URTeC created? It is the understandable product of blending the disciplines for more effective exploration and development of unconventional resource plays. For example, engineers realize that an understanding of geological variation of shale gas reservoirs leads to better completion designs and, therefore, higher initial flow rates and higher EURs.

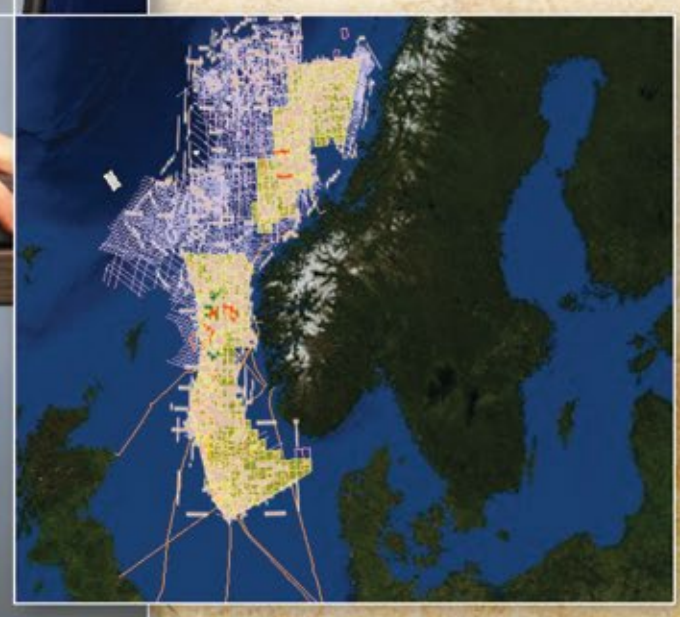
* * *

I sincerely hope all of this is just the beginning. Previous AAPG presidents like Dick Bishop have dreamed of the benefits of inter-society cooperation. One can only imagine what synergism between AAPG, SEG and SPE will create.

At first we were hesitant to trust each other, but we realized the more we combined our skills the better we were at finding oil and gas.

If we all forget our self-interests and work together we only have one place to go – onward and upward!

Ted Beaumont



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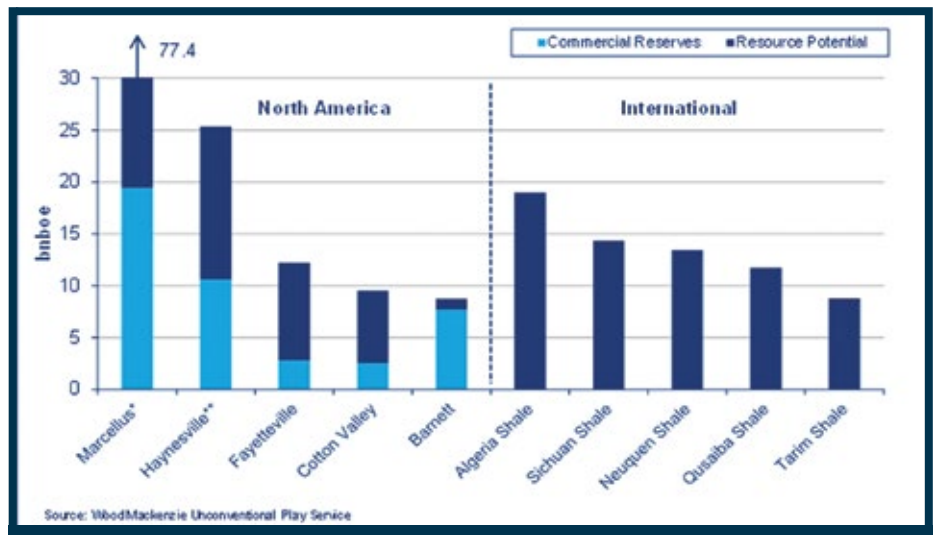


** The axis has been truncated and the Marcellus Northeast and Southwest plays have been combined as the 'Marcellus.' ** Haynesville Tier One and Tier Two have been combined as the 'Haynesville.'*

An unconventional approach

Strategies for Success

By LOUISE S. DURHAM, EXPLORER Correspondent

It's said that the only constant is change.

This is a given in the oil business.

Look at the domestic shale gas plays, which took off like a rocket once they became economically viable, principally via the combo of hydraulic fracturing and horizontal drilling.

Of course, it didn't hurt that natural gas prices soared into the double digits, topping $13/mcf in 2008 as shale gas was morphing from boomlet to boom.

CLARKE

Just when you least expect it, the unexpected happens.

Prices plunged into $3 territory a year later, and have nudged upward only a tad since that time.

Operators in the United States essentially created a new kind of recession by producing huge volumes of shale gas. The resulting oversupply played a key role in dampening prices.

They quickly switched gears, so to speak, and the big story today in the United States is shale oil along with liquids.

It's the money, honey.

With crude oil prices looking secure in the $90 range – for the moment – liquids are so in, and dry gas looks to be so yesterday.

Still, it depends on where you're looking.

Opportunities for gas E&P exist in the international arena, given that the North American shale gas bonanza failed to materialize in other countries. Countries such as Poland and China depend heavily on gas imports, which entail both a monetary and a political price.

Many countries are eager to duplicate the U.S. shale "revolution." They are licensing acreage to a range of companies, including domestic independents, utilities, NOCs and the majors, according to a study conducted by Wood Mackenzie's Unconventional Play Service.

With North American unconventional gas plays becoming evermore unprofitable, operators and investors have been forced to look at the alternative unconventional opportunities of international shale gas and North American tight oil.

"There are some tight gas and shale gas plays that are still profitable," said Robert Clarke, manager of Wood Mackenzie's Unconventional Play Service in Houston. "But on average, tight oil is the only one generating value.

"When we began our study," he noted, "we had noticed some of the largest players taking a more diversified approach with their unconventional portfolios."

Robert Clarke, manager of Wood Mackenzie's Unconventional Play Service in Houston, will present the paper "Unconventional Resources Around the World: Company Strategies for Dynamic Global Markets," at 8:05 a.m. Wednesday, May 22, at the AAPG Annual Convention and Exhibition in Pittsburgh.

Clarke's talk is part of the EMD session on "Shale and Tight Oil Plays Around the Globe."

Pros and Cons

Clarke summarized the leading pros and cons of the developing trend from a commercial vantage point:

North American Tight Oil

- Positives:
  - ✓ Offers highest financial returns.
  - ✓ Close to core of unconventional industry.
  - ✓ Portfolio benefits.
- Negatives:
  - ✓ High unit costs.
  - ✓ Ultimate resource potential uncertainty.
  - ✓ Downside price risks – particularly plays with high NGL component.

International Tight Gas

- Positives:
  - ✓ Huge resource potential.
  - ✓ Low entry costs.
  - ✓ Commodity prices generally higher, more stable than North America.
- Negatives:
  - ✓ Unproven geology.
  - ✓ Lack of infrastructure and services.
  - ✓ Environmental and regulatory challenges.

Clarke emphasized that for many operators and investors, the portfolio benefits and price risks in tight oil plays compete on a level playing field with the

See **Global Shale**, page 12

Study Gives Barnett Shale a Revised Future

By LOUISE S. DURHAM, EXPLORER Correspondent

The potential for shale zones as producing reservoirs rather than only seals or source rocks was not high on the minds of operators back in 1981.

The now-legendary oilman George Mitchell had his own ideas.

He determined that the Mississippian-age Barnett shale in the Fort Worth basin in north-central Texas had the capability to be a big-dog producer of natural gas locked within the dense formation.

Following some less-than-impressive drilling efforts yielding lackluster wells, Mitchell assembled a team of experts at Mitchell Energy to work with him to devise the particular hydraulic fracturing technology needed to coax economical production from the Barnett.

TINKER

> **"We'll see another 10,000 wells drilled, and most will be in the better areas because those have been tested now."**

No one realized they were embarking on a close-to-two-decade endeavor to attain success.

The Barnett subsequently was dubbed a "17-year overnight sensation."

But this hugely productive shale can be considered as the virtual lightening bolt that ignited the ensuing U.S. shale boom.

True, even though it continued kicking out massive volumes of gas, the Barnett soon faded from front-page glory as it became overshadowed by the excitement generated by the later shale darlings such as the Marcellus, Eagle Ford and the like – but this old dog still hunts.

Bad News, Good News

The Barnett play once again triggered an onslaught of media attention late in February with the announcement of a new study of the Barnett conducted by the Bureau of Economic Geology (BEG) at the University of Texas at Austin. The study was funded by the Alfred P. Sloan Foundation.

"I must have done 20 interviews the day after the announcement," said past AAPG president Scott Tinker, director of the BEG and co-principal investigator of the assessment along with Svetlana Ikonnikova, energy economist at the BEG. "The phone was ringing all day."

The study's results indicate that production from the Barnett will decline through 2030 – a fact that many newspapers highlighted – but also that until then there's still an enormous resource and huge potential, even with the current low prices.

So, is the glass half-empty, or half-full?

Tinker noted that the study integrates engineering, geology and economics in a numerical model that enables scenario testing based on a multiple of input parameters.

In the base case using $4 gas, the assessment forecasts a cumulative 44 TCF of recoverable reserves from the Barnett through 2050 based on already-drilled wells and the wells to be drilled through 2030.

The base case also shows annual production declining in a predictable curve from the current peak of 2 TCF per year to about 900 BCF per year by 2030.

The BEG effort is unique in its approach.

"Other assessments of the Barnett have relied on aggregate views of average production, offering a 'top-down' view of production," Tinker said. "The BEG study takes a 'bottoms-up' approach, beginning with the production data from every well and then determining what areas remain to be drilled."

This "bottoms-up" MO, Tinker said, provides a more accurate and comprehensive picture of the basin.

A Unique Approach

The team examined production from more than 16,000 wells drilled in the Barnett play through mid-2011.

"We divided this into 10 productive tiers, and then divided those by high and low Btu liquids and dry gas," Tinker said. "What we're showing is at $3.50 to $4 gas, operators have kind of retreated from the poorer quality rock, tiers 5 to 10, back to tiers 1 to 4 and are drilling fewer wells but still making money because of better rock quality and higher EURs.

"These are good wells because they are in the better areas," he emphasized, "so the aggregate field production didn't decline even with fewer wells.

"Drilling in the better rock is cost-effective even at lower prices."

If you're wondering how many locations remain before all of the good rock is drilled,

See **Barnett**, page 12

An update to its 2008 study

New USGS Bakken Assessment On Its Way

By LOUISE S. DURHAM, EXPLORER Correspondent

The Upper Devonian-Lower Mississippian age Bakken shale play in the Williston Basin in North Dakota and Montana has become a really Big Deal in the world of shale oil production.

So big that the U.S. Geological Survey is completing a two-year reassessment of the Bakken formation, following closely on the heels of the initial assessment undertaken by the organization in 2008.

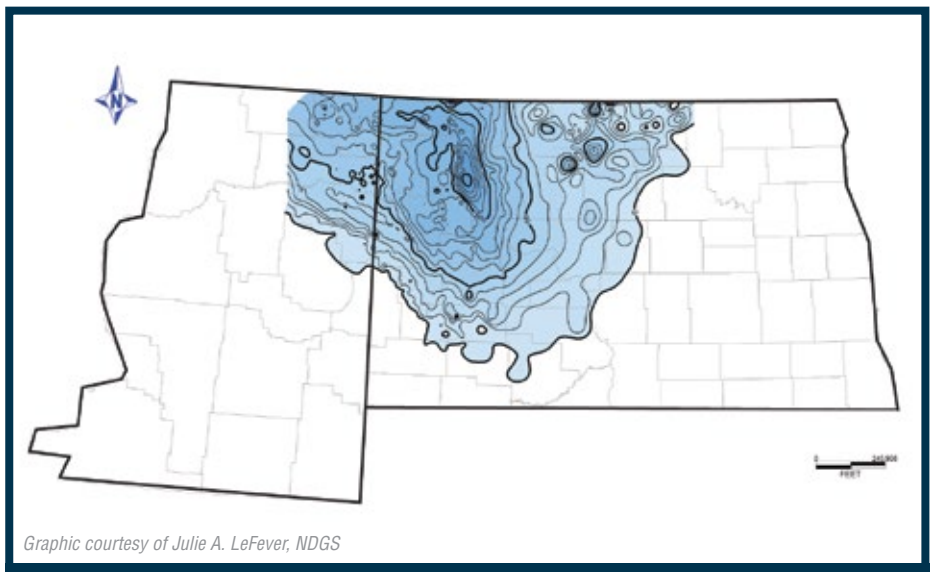
GASWIRTH

Noting that it's rare to reassess so quickly, the agency commented that the prolific Bakken is an unusual reservoir, emphasizing that what is technically recoverable has changed over the course of a short time period.

This is because as drilling escalated, knowledge of the geology improved – and significant information was derived from production data.

The 2008 evaluation estimated a total mean resource of 3.65 Bbo for unconventional oil resources and four MMbo for conventional resources, according to Stephanie Gaswirth, USGS research geologist and task chief for the new assessment.

It is anticipated the study will become available to the public later this year.



Graphic courtesy of Julie A. LeFever, NDGS

An isopach map showing the boundaries of the Bakken Formation (thickness map with a 10-foot contour interval). The darker the color, the thicker the Bakken.

The Big(ger) Picture

Noted oilman Harold Hamm, CEO of Continental Resources, is on record as saying that a conservative estimate for the Bakken is 24 billion barrels recoverable. He asserted that it's the largest field found in the world in 40 years.

Continental is the largest leaseholder and driller in the Bakken.

The Bakken petroleum system has been a target for the explorers for many years.

Its big breakout moment might be said to date back to 1995, when explorer and AAPG member Dick Findley determined there was good porosity and a likely oil zone in the fractured dolomitic middle section of the shale.

This eventually led to development of the giant Elm Coulee oil field in the Bakken in eastern Montana – and for Findley it eventually led to him receiving the AAPG Explorer of the Year award for his insight and efforts.

Today, lengthy laterals along with multi-stage fracturing technology might be called the icing on the proverbial cake when it comes to economical, prolific production from the shale.

The Three Forks formation underlies the Bakken, separated in some areas by the Pronghorn Member of the Bakken Formation ("Sanish Sand"). It's a part of the Bakken petroleum system and is some of the oldest production in the Williston Basin, dating back to the 1950s.

The 2008 assessment did not evaluate the Three Forks, but it is included in the 2013 assessment.

"This time, there will be undiscovered, technically recoverable resource numbers for the Bakken and the Three Forks as well," Gaswirth said.

Research geologist Stephanie Gaswirth will present the paper "Reassessment of Undiscovered Resources in the Bakken Formation, Williston Basin, North Dakota and Montana," at 9:05 a.m. Tuesday, May 21, at the AAPG Annual Convention and Exhibition in Pittsburgh.

Gaswirth is with the U.S. Geological Survey in Denver. Her co-authors are AAPG members Kristen Marra, also with the USGS in Denver, and Troy Cook, with the Department of Energy.

Her talk is part of an AAPG-EMD session on the Bakken Petroleum System.

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Global Shale
from page 6

low entry costs and unproven geology of international gas.

Well, you ask, who are these people?

Certain entities chase certain opportunities, according to Clarke. They are:

- Large portfolio players, such as majors and large indies, will continue to increase their investments in both North American tight oil and international gas plays.
- Niche investors, exposed to perhaps a couple of plays, will feel the pressure to be in the U.S. liquids plays.
- Supply players, such as NOCs and utilities pursuing access to volumes, will invite skilled unconventional operators to participate in their domestic gas opportunities.
- NOCs will partner with accomplished operators to access liquids plays in North America.

He emphasized that the metrics applied in the study were all on a Boe basis, in order to look at the relative economic strength of gas plays vis-á-vis oil plays.

"We expect competition to intensify in the North American tight oil market," Clarke said, "with more cash-rich oil companies looking to acquire acreage in producing plays.

"In international gas plays, larger companies will seek sizeable positions in the most promising shale gas assets," he added, "with supply players controlling access where they can."

Barnett
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the BEG assessment is optimistic.

The forecast is there are a number of locations in what is included in the top half of the tiers in the $4 base case, according to Tinker.

"We looked at every well, all 16,000 wells, and this had not been done before," he said. "We looked at decline curves on each and the per-well economics. This let us then ask where there are still more locations to drill.

"That's what's unique about our work, which included a dozen people working for a year and a half.

"We think this will tighten down the range of error or uncertainty going forward, combining engineering and geology with rigorous economics and then the bottoms-up approach of every well," Tinker said.

He added that this helps to narrow the range of error, depending on presumptions in the model, noting "we do have assumptions."

"We're very clear to call the 44 TCF our base case," he emphasized. "We can go higher or lower on lots of different assumptions.

"Even if we just let existing wells already drilled in the play decline and not drill another, we would still approach almost 20 TCF total from the Barnett," he noted. "It has produced about 13 TCF to date, so that would be another seven to eight TCF from wells already drilled.

"We'll see another 10,000 wells drilled," Tinker asserted, "and most will be in the better areas because those have been tested now."

The BEG is on track to complete similar studies of three other major U.S. shale gas basins by the end of 2013.

Bakken
from page 10

Team Effort

The USGS is mandated by law from the Energy Policy Conservation Act of 2000 to provide assessments of 32 priority basins in the United States, according to Rich Pollastro, retired USGS geologist who was the task leader for the 2008 Bakken assessment.

The subsequent Energy Policy Act of 2005 states that the same methodology must be used in producing these assessments.

Pollastro noted, however, that the methodology used to assess continuous, i.e. unconventional, accumulations differs from the conventional.

In the case of conventionals, the researchers look at sizes and numbers for the accumulations. With the continuous type accumulations, they assume the hydrocarbons are regional in extent, and it's a matter of how successful operators will be with recovery.

To get at the 2008 numbers, the area of the oil generation window for the Bakken continuous reservoir was determined and then divided into five continuous assessment units (AU). A sixth hypothetical conventional middle sandstone member AU was defined external to the area of oil generation. The final assessment numbers included all AUs.

The AUs were defined based on structural elements, source rock maturity of the Upper Bakken shale, and resistivity data.

"The reassessment of the Bakken formation redefines the AUs based on updated thermal maturity data, structural controls and the mapped extent of Bakken source rocks," Gaswirth said. "Continuous AUs are refined given the large amount of new production data available following 2008, particularly in the central basin, northeast Montana and northwest North Dakota.

"The Parshall and Sanish fields have also been developed substantially since 2008, yielding longer production histories and more robust EUR data."

Gaswirth has kudos for the industry and others.

"I talked with more than a dozen different companies, and they were really helpful," she said. "The geological surveys in North Dakota and Montana also were very cooperative and helpful.

"There was very good collaboration all around."

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from ffA

Looking down on the Marcellus

Aeromagnetic Data Can Shape Drilling Program

By LOUISE S. DURHAM, EXPLORER Correspondent

When it comes to the ubiquitous shale plays, it's no surprise to find that a raft of observers tend to view the Marcellus play as just more of the same.

Not so.

The Marcellus has its own special character.

"When I first started looking at it, I didn't see the kind of relationships I normally see," said AAPG member J.P. Fagan, president of Centennial Geosciences in Littleton, Colo. "It was kind of turned on its ear a bit, so to speak."

Fagan uses aeromagnetic data to help operators steer their Marcellus programs.

He noted that aeromagnetic surveys typically are used to find deep-seated faults that can give rise to shallower structures. These generally are identified with a focus on drilling areas closely associated with them.

"This is the exact opposite of what should be done in the continuous (unconventional) shale," Fagan emphasized. "In Marcellus shale exploration, one of the geologic hazards to be avoided is structurally complex areas with deep-seated faulting."

FAGAN

> **"We found the wells drilled near the tile edges had lower daily production rates in general compared to those kind of interior to a basement block."**

AAPG member J.P. Fagan will present the paper "Directing a Marcellus Shale Drilling Program Using High Resolution Aeromagnetic Data" at 1:40 p.m. Tuesday, May 21, during the AAPG Annual Convention and Exhibition in Pittsburgh.

Fagan's talk is part of a session on "Geology/Geophysics Integration Case Studies."

Looking Down

Building on past aeromagnetic data experience gained elsewhere, Fagan decided to look back on an aeromagnetic survey he had flown in 2006 in the northern core area of the Marcellus play along the New York-Pennsylvania border.

He went through reported production numbers, took the magnetic data and spotted the wells.

"I went in and took production data in six months bins and normalized the amount of gas produced by the number of days reported to get the average daily production rate," Fagan said.

And then he started looking at how this related to the magnetic data.

"I found that where you get near the edge of a basement fault contact, the magnetic field changes quickly," he said. "If you think of the basement like a series of blocks – sort of like tiles – we found the wells drilled near the tile edges had lower daily production rates in general compared to those kind of interior to a basement block.

"In taking higher resolution data, one of the processing tools we get is the horizontal derivative that shows how fast the magnetic field is changing with respect to the plane of the ground," Fagan noted. "One of the theorems of gravity magnetic interpretation is if you have faults that are near vertical, you will have maximum horizontal gradient over the fault.

"This is a basement fault, and you don't want to intersect this with horizontal legs on a well; it would eat up all your hydraulic fracture energy," he emphasized. "You want magnetically quiet areas, which occur where the magnetic field changes at a slow rate.

"Even small faults can divert a large amount of the stimulation energy."

Finding the Right Direction

Given the rapid magnetic changes observable near the basement faults, this yields a couple of choices if you want a good well – and who doesn't?

- Drill the well in the in the middle of the block.
- Site the well on the edge of the block and drill toward the center to encounter more enhanced natural fracturing without encountering the main fault.

"Parallel to the big faults, there will be secondary fractures associated with the main basement fault, and these are the ones you want," Fagan said. "You want to intersect these smaller systems and not lose your hydraulic fracturing energy to the big open fault systems.

"Magnetics is not a be-all/end-all," Fagan emphasized. "But it can help you go in the right direction.

"By incorporating aeromagnetic data into a shale exploration program," he said, "the greater the chance of avoiding faults and large scale fractures that lower peak well deliverability."

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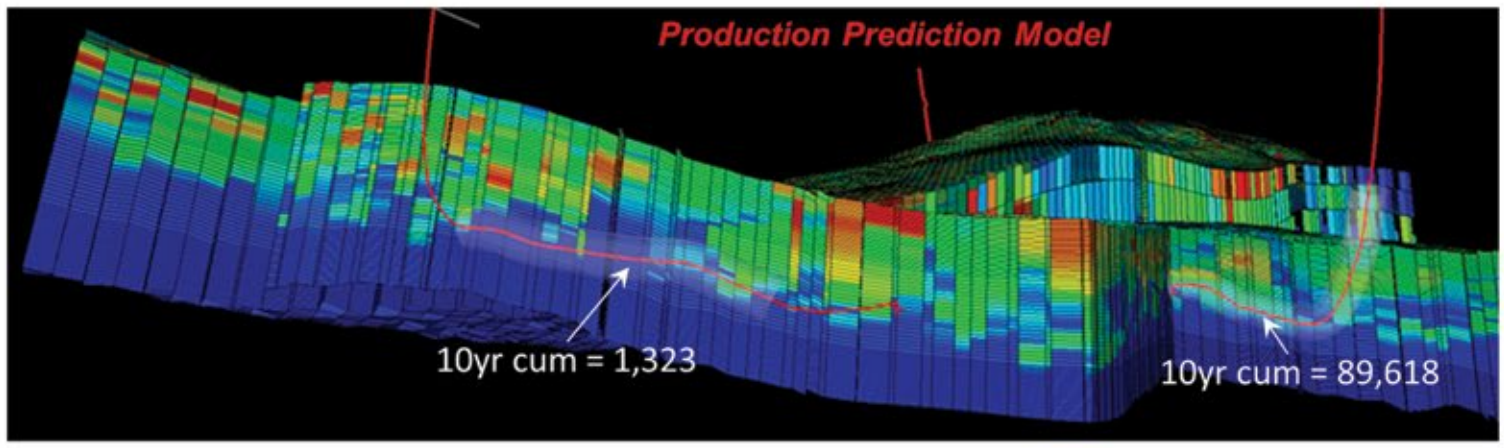

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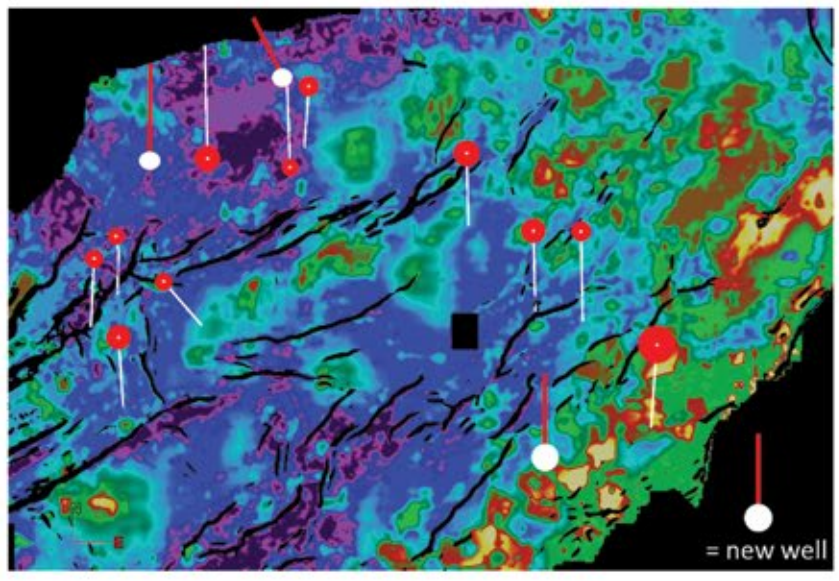

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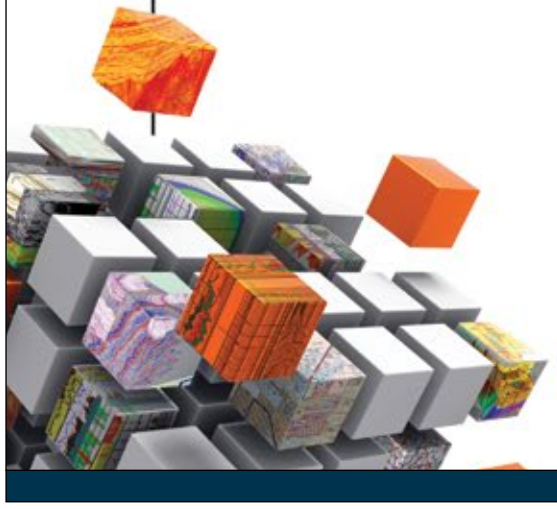

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North America vs. European shales

Study Data Provide New Shale Perspective

By LOUISE S. DURHAM, EXPLORER Correspondent

The surging oil and gas production from shale plays in the United States is essentially mind-boggling – there's even ongoing chatter about exporting some of the swelling supplies.

In stark contrast, shale E&P activity in Europe has yet to really take off.

This contrast has prompted some to press the research button to implement a study to compare the North American and European shale gas and oil resource systems.

"The activity is dictated by two things," said AAPG member John Curtis,


CURTIS

professor emeritus at Colorado School of Mines and director of the Potential Gas Agency there. "The rocks and the organic matter and the geologic history are one, and the other is regulatory and infrastructure.

"We're upstream, so we could take a look at what the geology and geochemistry had to say," Curtis said. "This was to see the utility of these data – especially the oil data, because with oils you know the reservoirs they came from and you can type back to the source rocks and then get a feeling for the entire petroleum system.

"We did this in a way that we could look at the oils in a number of basins and see what characteristics they had in common," he said. "We needed the depositional environment, thickness, organic content and such to pick that out.

"We were able in a broad sense to map these fairways."

AAPG member John Curtis will present the paper, "Comparison of North American and European Shale Gas and Oil Resource Systems," at 8:05 a.m. Wednesday, May 22, during the AAPG Annual Convention and Exhibition in Pittsburgh.

Curtis is professor emeritus at the Colorado School of Mines and director of the Potential Gas Agency at the school.

His co-authors are AAPG member John Zumberge and Stephen W. Brown, both with GeoMark Research, Houston.

The talk is part of an EMD session on the Evaluation of European Shales.

Observations

The study, which Curtis undertook in conjunction with GeoMark Research in Houston, employed a sizeable oil database covering North America and all except eastern Europe to compare and contrast the potential of shale gas and shale oil.

European rocks/locales included in the study are:

- Kimmeridge clay – North Sea.
- Alum shale – Baltic.
- Posidonia shales – Poland, Hungary and Russia.
- Toarcian shale – Paris Basin.
- Bazhenov shale – West Siberia.

"We compared the European basins to the Barnett shale, the Eagle Ford and a whole series of oils in the Rocky Mountains," Curtis said. "In comparing the North American oils to the European oils, we were able to derive the depositional environment, which was deepwater in many cases.

In fact, the "best thing we ended up identifying," Curtis said, was:

- The deepwater marine source rocks (type II kerogen).
- The correct level of thermal maturity to have converted organic matter to hydrocarbons.
- The correct mineralogy within the reservoir rocks that would be amenable to stimulation.

The Best Thing Is …

Curtis emphasized that a model for shale gas and shale oil producibility requires ample shale thickness, organic content (ideally hydrogen-rich) and a sufficient level of thermal maturity to generate economic gas or oil volumes. Ideally, the rock matrix is silica-rich and low in clay in order to be brittle enough to enhance stimulation treatment effectiveness.

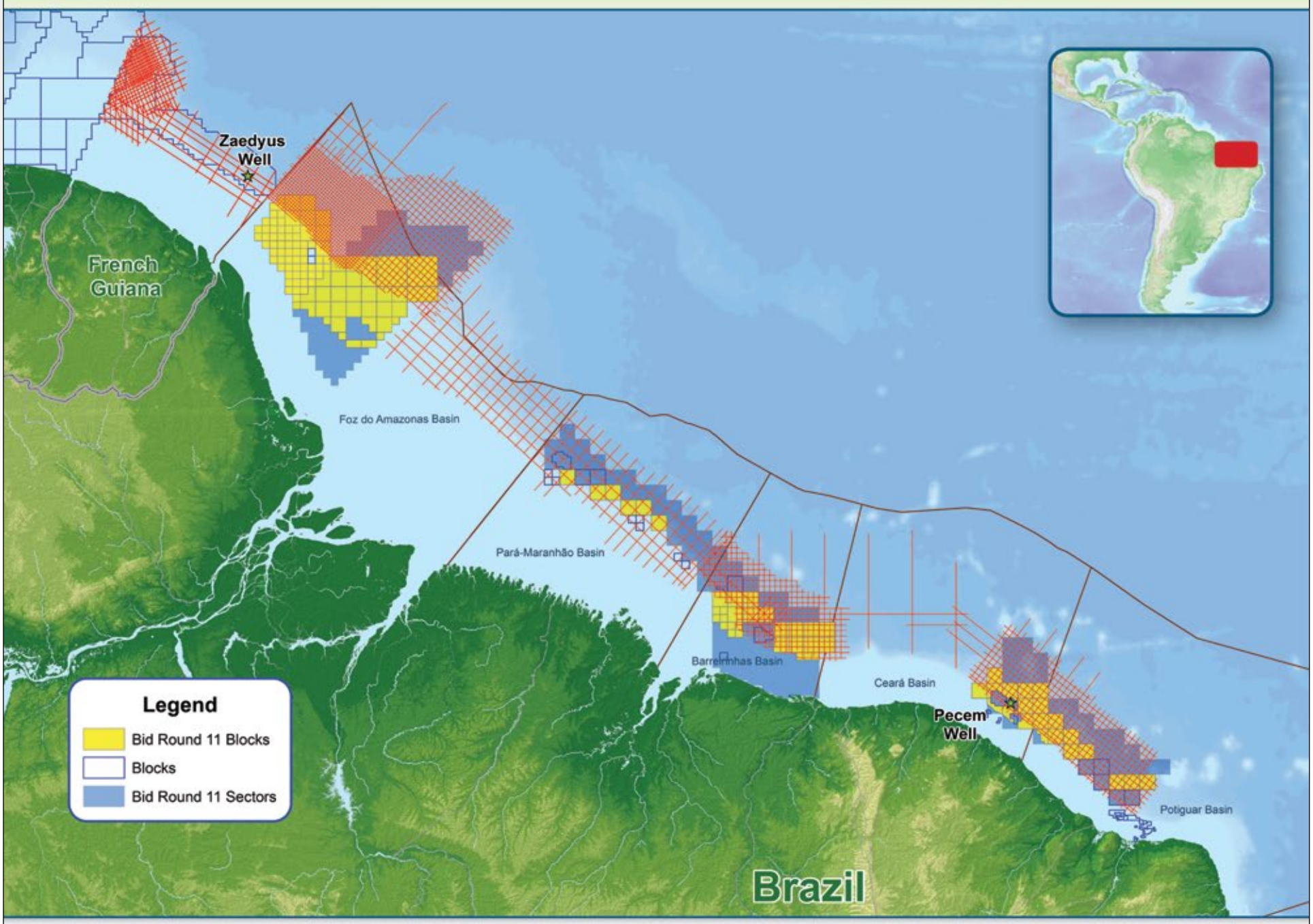
"Probably the best thing about our study is if you get new oils and have the data, you can plug things in and then see where the new data fit," Curtis said.

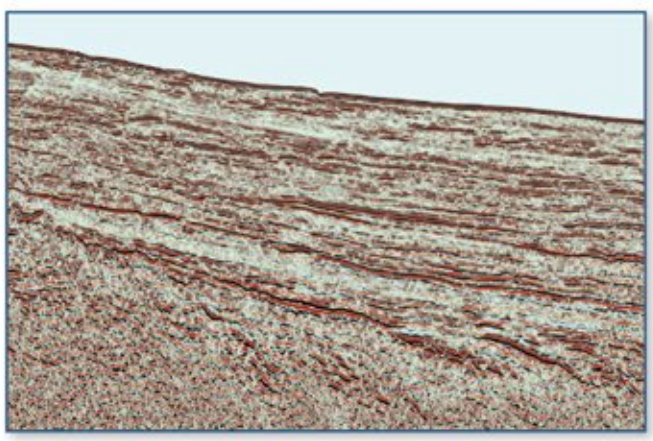
There are no plans to publish a report about the project, but Curtis will fill you in on the details during his talk at the upcoming AAPG Annual Convention and Exhibition in Pittsburgh.

He emphasized that it will be a "data-rich presentation."

Equatorial Margins Brazil

Multi-Client Seismic - Data Available for Brazil Round 11





Seismic section from the Potiguar Basin data

Spectrum is active in five basins along the Equatorial Margins of Brazil that are on offer in Round 11. We have new PSTM and PSDM data available for each of the Foz do Amazonas, Barreirinhas, Ceara and Potiguar surveys all of which were acquired with 10,000m offsets and 13 second record lengths.

Two reprocessing efforts are underway along the Equatorial Margins, one a 9,600 kilometer program in the Para-Maranhao basin that links the Foz do Amazonas basin to the Barreirinhas Basin. The second project is an 7,783 kilometer project in the deep waters of French Guiana, which will link the Zaedyus discovery with the recently acquired data in Brazil. The well tie data will be available in late March and the remaining data in April.

Our Multi-Client team is committed to delivering high quality data in advance of the upcoming Round 11. Companies participating in Spectrum's programs will have a competitive advantage in this round.

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AAPG Annual Convention & Exhibition

ACE Registration Savings Deadline is Near

Online registration continues to be available for this year's AAPG Annual Convention and Exhibition – but the last chance for reduced registration fees is arriving this month.

In fact, those registering either on or before April 29 can save up to $100 on their registration fee.

The 2013 ACE will be held May 19-22 at the David L. Lawrence Convention Center in Pittsburgh – the first time an ACE event has been held there, and the first time since 1986 for AAPG to hold its annual meeting in the eastern United States.

This year's theme is "Going Deep: Making the Play With Geotechnology," and a substantial part of the varied, far-reaching technical program will deal with the eastern U.S. shale plays that are dominating much of the industry's current activity.

For example, this year's Michel T. Halbouty Lecture, an annual ACE feature funded by the AAPG Foundation, will feature Jeff Ventura, president and CEO of Range Resources, who will discuss "Range's Path to Discovery and Commercialization of the Marcellus Shale."

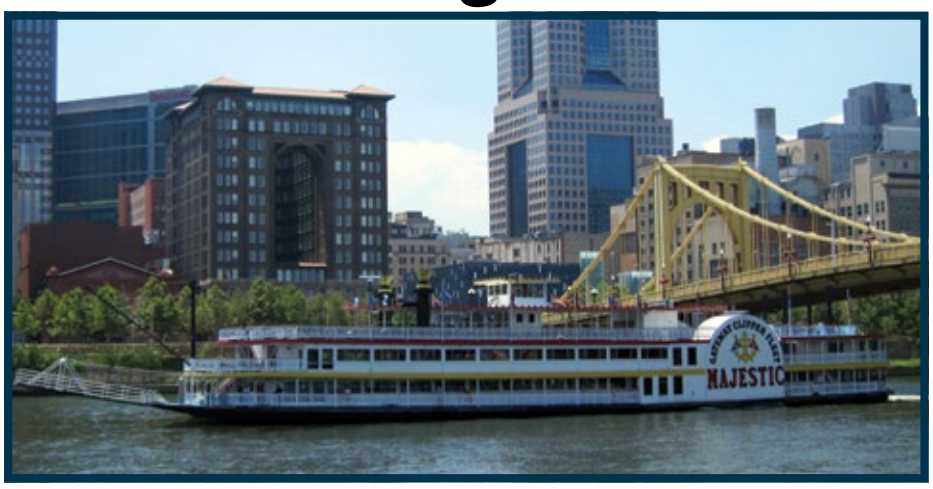
Other examples can be found in the short course offerings ("Basic Tools for Shale Exploration"), field trips ("Devonian Gas Shales of the Appalachian Basin," "The Marcellus Shale in South-Central Pennsylvania, Eastern West Virginia and Western Virginia"), forums and throughout the oral and poster presentations.

Other highlights include:

- Sunday's opening session, featuring an address by AAPG President Ted Beaumont and the bestowing of AAPG honors to the Association's and profession's best, led by Sidney Powers Memorial Award winner Dietrich Welte and Michel T. Halbouty Outstanding Leadership Award winner Stephen A. Sonnenberg.
- James Palm, CEO of Gulfport Energy, will be this year's All-Convention Luncheon speaker, talking about "Proving Up the Utica's Liquids Window."
- The Discovery Thinking Forum will be held on Monday, May 20 making it the seventh presentation of the AAPG100th Anniversary Committee's program recognizing explorers who have made a difference. This year's forum theme is "Important Discoveries Expanding Resource Play Concepts."
- A special Energy Policy Forum will be held on Tuesday, titled "Demand Side of the Natural Gas Price," moderated by AAPG's GEO-DC Director (and EXPLORER Policy Watch columnist) Edith Allison.
- The Imperial Barrel Awards ceremony once again will be presented in a colorful, exciting setting immediately preceding the opening session, open to all attendees.
- As always, the exhibits hall will be filled with the latest technology, information and energy services – and will be the site for the annual Icebreaker reception, daily refreshments, the Cyber C@fé and the AAPG Global Gateway and International Pavilion.

Details of the meeting – including the complete technical program, field trips, short courses and various events – can be found online and in the official ACE announcement that accompanied the February EXPLORER.

To register, and for more ACE information, go to aapg.org/pittsburgh2013.



The technical program for the AAPG Annual Convention and Exhibition is going to be diverse, comprehensive and compelling – and Pittsburgh offers nearby attractions to make the trip fun.

Photos courtesy of Jon Inners

Devil's Den from Little Round Top: Geology proved to be a major strategic factor in the American Civil War's Battle of Gettysburg.

'Fascinating Geology' Supports Hallowed Ground

By BARRY FRIEDMAN, EXPLORER Correspondent

There are almost 50,000 souls at Gettysburg, and part of this nation's DNA is in that soil. It is clearly a place, rich in history, tragedy and politics.

And geology.

For purposes here, as we approach the sesquicentennial of the battle that gave this land its lasting place in history, that is the topic – not so much about the spirits that inhabit the place, but the place itself.

Gettysburg is not only a battleground, not only a cemetery, but also was a blueprint for war.

"Few battles in recorded military history exhibit the relationship of topography and geology to the ultimate outcome of the fighting as clearly and dramatically as the Civil War battle of Gettysburg."

That's from AAPG member John Harper, chief of the Geologic Resources Division with the Pennsylvania Geological Survey, who will be part of a group that leads a field trip to the historical site as part of this year's AAPG Annual Convention and Exhibition in Pittsburgh (and again during the actual sesquicentennial July 1-3) called "Rifts, Diabase and the Topographic 'Fishhook': Terrain and Military Geology of the Battle of Gettysburg."

"The geology is fascinating," he says, "one of the rare areas of Pennsylvania with rocks less than 250 million years old."

Harper says the terrain, part of the break-up of Pangaea in the Triassic/Jurassic era, played a key role in what leaders of both armies did during the battle.

"From McPherson's Ridge to Seminary Ridge to Devil's Den to the 'topographic fishhook' (all in the Mesozoic Gettysburg rift basin), the tactics of the competing commanders – Meade for the Union and Lee for the Confederacy – can be followed and rationalized with the use of a geologic map."

Geologic Controls

Harper says one can plot the arrows to show troop movements from both sides that coincide with the vicissitudes of a land where almost as many Americans died in three days of fighting in south central Pennsylvania than did in 18 years of direct U.S. involvement in Southeast Asia.

A place like Gettysburg, then, should be seen from all disciplines – cultural, historical and, yes, even geological.

Jon Inners, who also is with the Pennsylvania Survey, explains, "The entire Gettysburg campaign from mid-June to mid-July was controlled by the Blue Ridge and Piedmont terrain of Virginia, Maryland and Pennsylvania."

He says that General Lee knew the area well.

"Lee used the Blue Ridge (called 'South Mountain' in Maryland and Pennsylvania) to shield his troops movements to Gettysburg

See **Gettysburg**, page 24

A statue of Gouverneur Warren, a civil engineer and prominent Union general, stands atop Little Round Top – appropriately, he was known as the "Hero of Little Round Top."

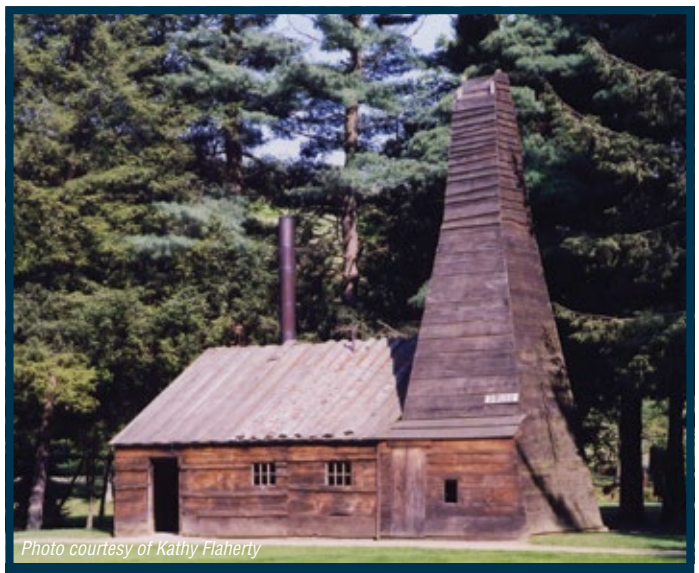


Photo courtesy of Kathy Flaherty

A replica of the Drake Well, on the grounds of the Drake Well Museum, Titusville, Pa. – and destination of ACE field trip 5.

Photo courtesy of Gary Lash

Another ACE trip heads to western New York, studying "Stratigraphy and Sedimentology of the Other Shales."

ACE Trips Offer Something For Everyone

By COURTNEY CHADNEY,
EXPLORER Correspondent

Planning on attending the AAPG Annual Convention and Exhibition this year? If so, remember there are diverse and unique ways to indulge in some pre- and post-convention fun, too.

This year, there's a field trip for everyone – perfect for every geology professional, history lover or nature enthusiast, from hands-on treks to the Marcellus Shale to the battlegrounds of Gettysburg, and even a rafting trip through Smoke Hole Canyon in West Virginia for the daring and young at heart.

"We ended up with what I think are some really great sounding trips," said AAPG member John Harper, field trip co-chair for this year's meeting in Pittsburgh.

To be specific, this year's slate of trips include "exploration of the Cambrian Drake Well museum, Pennsylvanian fluvial-deltaic stratigraphy in Kentucky, acid mine drainage in Pennsylvania, Ordovician stratigraphy and paleoenvironments in Cincinnati, and even a trip to Gettysburg to see how geology and topography affected the outcome of the infamous Civil War battle," Harper said.

And more. And because this is AAPG's first annual convention in the region, the trips offer an opportunity for trips to places never before visited by an ACE excursion.

Educational – and Fun

When compiling the list for this year's convention trips, Harper and his team made sure to include hot topics like the shales that have turned the region into one of the hottest areas on earth. To accommodate this, the team put together trips that would take participants throughout the Appalachian and Illinois basins.

They also received requests for petroleum history, geotechnical/geoenvironmental and carbonate-related trips, so they made sure to include those into the mix as well.

"All of these trips will be very informative and educational," Harper said, "so depending on anyone's particular geologic interest there will probably be something worth the cost and the time for everyone."

Harper anticipates that the gas shale trips will be the most popular, but he named a couple that he would pick if awarded the chance.

"I guess I have to say the Gettysburg trip, since I'm one of the field trip leaders," he joked, "but I would love to be able to go on the Cincinnati and GACB trips. The history of petroleum will be a great trip, and the rafting trip through Smoke Hole Canyon sounds like a hoot."

Complete information on the trips can be found in the official announcement that members received last month, and online at www.aapg.org/pittsburgh2013/fieldtrips.cfm.

Eagle Rock, Smoke Hole Canyon, West Virginia

Rock outcroppings (diabase) on Cemetery Ridge, near focus of Pickett's infamous charge on the final day of the battle.

Gettysburg

from page 20

on the way north, then used the mountains equally well to protect his army when he withdrew after the battle."

The course of the entire three-day battle, Inners reiterates, was directly controlled by this topography, with Lee driving the Union forces from the low hills west and northwest of town so they took up a final defensive position on the "topographic fishhook" of diabase ridges east and southeast of town.

Day by Day

The trip will encompass the highlights of what happened once he got there.

- Day One – Lee's approach to Gettysburg from the west.

"He used the deep gaps in the mountain range (some of which are formed directly along large east-west faults), Inners said, "then retreated through these same gaps on July 4-5."

- Day 2 – The fights at Devil's Den, Little Round Top, the Peach Orchard, southern Cemetery Ridge, Cemetery Hill and Culp's Hill, which Inners says were "fierce and indecisive."

- Day 3 – Cemetery Ridge, the final decisive engagement, including the infamous "Pickett's Charge."

Specifically, during that last day, Inners explains how Meade used the terrain quite effectively, and how General Daniel Sickles almost "screwed things up" for him by advancing west (sans orders) from a low spot on Cemetery Ridge to the Peach Orchard, a spot from which the Confederates nearly crushed them.

"In short, the Confederates were on the attack the entire battle, and the Union on the defensive," Inners said.

Inners and Harper are not steeped in wartime tactics, but both know had things turned over differently at Gettysburg, things would have turned out differently for America.

"It certainly would have made things much more difficult to arrive at a Union victory," Inners said. "But, thank goodness, that's how it all turned out!"

What a Trip!

As for the trip itself, participants will spend two days traversing and exploring the sacred ground, and Harper says as a bonus, a stop will be made at the stone bridge over Plus Run and the base of the Big Round Top to view the Triassic-age dinosaur tracks.

"All of the folks (and this includes geologists and paleontologists) who will be leading the trip, other than me, are big Civil War history buffs," Harper said.

One more thing: he says the weather is usually unpredictable, in that part of Pennsylvania, and participants should be on the lookout for ticks and poison ivy.

Why is that important?

Inners isn't so sure.

"Don't let Harper's answer bother you too much," Inners laughs. "May is certainly one of the nicest months in south-central Pennsylvania. The battlefield is quite open, and there really isn't much high grass where ticks would be a problem. If the weather is nice, Gettysburg is a beautiful place!"

So, no need to worry?

"Best to be safe, however, and plan for them."

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UNCONVENTIONAL RESOURCES TECHNOLOGY CONFERENCE
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Multidisciplinary focus

Curtains Rise for URTeC

By VERN STEFANIC, EXPLORER Managing Editor

Online registration is now open for a new multidisciplinary conference that merges the energies and resources of the industry's three top professional groups in one comprehensive look at unconventional resources.

The inaugural Unconventional Resources Technology Conference (URTeC) will be held Aug. 12-14 at Denver's Colorado Convention Center. The conference is a unique entity created, endorsed and supported by AAPG, the Society of Petroleum Engineers (SPE) and the Society of Exploration Geophysicists (SEG).


SONNENBERG


BEENEY

URTeC also will include a large, diverse exhibition hall, featuring items ranging from high tech to heavy equipment – and everything in between.

Registration for this integrated, peer-reviewed conference as well as details about the technical program and associated events can be found at www.urtec.org.

URTeC was created as a response to the rapidly changing energy landscape – and to the ways new scientific knowledge, next-generation technologies and an entrepreneurial spirit have combined to drive significant new oil and natural gas production in North America.

"This conference is unique because the technical program is an integrated program across three disciplines – geology, geophysics and petroleum engineering," said Stephen Sonnenberg, a past AAPG president who is one of the co-chairs for the URTeC Technical Program Committee.

The other co-chairs are AAPG member Ken Beeney, with Devon Energy Corp., and Luis Baez, with BG Group.

"URTeC is a special meeting combining the resources of AAPG, SPE and SEG together to address unconventionals," Sonnenberg continued. "Unconventional reservoirs are the future for many countries around the world and are being actively pursued in North America with great success.

"The proof," he added, "is in the abundant oil and gas production coming from unconventionals."

Beeney echoed Sonnenberg's statements – and said the conference is a "must" for those involved in unconventionals.

""URTeC is definitely an event that cross-discipline asset teams should plan on attending," Beeney said. "The purposeful collaboration among the leading professional societies has created all the elements for a one-of-a-kind technical conference.

"The ability to engage across disciplines within the venue is unique," he added, "and the technical program was designed with this collaborative emphasis in mind."

Comprehensive Technical Program

The inaugural URTeC technical program offers 340 technical presentations – including oral and ePapers covering 20 themes related to the way oil and gas companies involved in unconventionals do business today.

> **"This convention is unique because the technical program is an integrated program across three disciplines – geology, geophysics and petroleum engineering."**

The conference itself will start with an opening Plenary Session titled "Unconventional Resources: Breakthrough Integration Changes Everything," moderated by past AAPG president **Scott Tinker**, director of the Bureau of Economic Geology in Austin and the state geologist of Texas.

The session will explore the foundational scientific, technical and business practices that, when leveraged by innovative integration in a multidisciplinary environment, differentially "moves the needle" across the value chain of unconventional resource identification, assessment and monetization.

Panelists will include:

- **Scott D. Sheffield**, chief executive officer, Pioneer Natural Resources.
- **John Richels**, president and chief executive officer, Devon Energy Corp.
- **Vello Kuuskraa**, president, Advanced Resources International.
- **William M. "Bill" Scoggins**, president, Colorado School of Mines.

Also slated are six interactive panels, taking an in-depth look at everything from technologies transforming the future to government regulations. They are:

✓ Nimble Independents: "Moving the Needle" with Innovation and Execution Excellence.

✓ Technologies That May Transform the Future.

✓ Making It Happen in the Field: Converting Technology Into Dollars.

✓ Sustainability, Job Creation and Public Image.

✓ Transportation and Processing Capacity of Market Infrastructure in Emerging Plays.

✓ Energy Policy Forum: Government Regulations That Affect Unconventional Resource Development, moderated by **Edith Allison**, director of AAPG's GEO-DC office and contributor for the EXPLORER's monthly "Policy Watch" column.

See **URTeC**, page 37

UPCOMING EDUCATION SCHEDULE

LAST CHANCE

Deep-Water Siliciclastic Reservoirs **Northern California**	April 14-19, 2013
Basic Well Log Analysis **Austin, TX**	April 15-19, 2013
Petrophysical Analysis and Integrated Approaches to the Study of Carbonate Reservoirs **Austin, TX**	April 16-18, 2013
E-Symposia: Successful Oilfield Water Management **2:00 p.m., CST**	April 16, 2013
Clastic Reservoir Facies and Sequence Stratigraphic Analysis of Alluvial-Plain, Shoreface, Deltaic, and Shelf Depositional Systems **Utah**	April 20-26, 2013

SHORT COURSES

Basic Tools for Shale Exploration **Pittsburgh, PA (with AAPG Annual Convention & Exhibition)**	May 18, 2013 *Early-bird rates end April 19!*
Integrating Data to Evaluate Shale Resources **Pittsburgh, PA (with AAPG Annual Convention & Exhibition)**	May 18-19, 2013 *Early-bird rates end April 19!*
Faults in the Northern Appalachian Basin and Their Effects on Black Shale **Pittsburgh, PA (with AAPG Annual Convention & Exhibition)**	May 19, 2013 *Early-bird rates end April 19!*
Application of Organic Petrology for Shale Resource Evaluation **Pittsburgh, PA (with AAPG Annual Convention & Exhibition)**	May 23, 2013 *Early-bird rates end April 19!*
Summer Education Conference – 11 courses over 5 days! **Fort Worth, TX**	June 10-14, 2013

FIELD SEMINARS

Geology of Grand Canyon, Bryce Canyon and Zion National Park **Nevada**	June 1-7, 2013
Play Concepts and Controls on Porosity in Carbonate Reservoir Analogs **Almeria, Spain**	June 2-7, 2013
Folding, Thrusting & Syntectonic Sedimentation **Central Pyrenees, Spain**	June 3-7, 2013
Lacustrine Basin Exploration **Utah**	June 9-16, 2013

Registration and Information:

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Providing strategic publishing leadership

Taylor Fellowship Committed to Excellence

By BEVERLY MOLYNEUX, AAPG Technical Publications Managing Editor

With the main goal of ensuring that AAPG remains a premier energy geoscience publisher, 50 members of the newly formed Charles H. Taylor Fellowship met in Houston for its inaugural meeting.

This first annual Charles H. Taylor Fellowship Meeting, held in February under the leadership of AAPG Editor Stephen Laubach, formally established a consultative body comprising current and former members of AAPG's Editorial Board – and each future meeting will continue to build upon this group's work in advising and assisting the Elected Editor in guiding and operating all aspects of the association technical and scientific publication effort.

The one-day meeting had a far-reaching agenda, capped off with a formal dinner, during which the Fellows were officially inducted.

Specific details that were addressed included:


LAUBACH

▸ The Future of the BULLETIN – Strategic Planning.

As the second-oldest energy geoscience journal in existence, the BULLETIN has an excellent reputation, very strong supply of submissions and a high citation index. AAPG Editor candidates Mike Sweet and Colin North led the Fellows in discussing the challenges facing all scientific journals, such as escalating production costs and the need for speedy publication timelines for academicians, with suggestions made to address the challenges.

A working group was planned to help monitor BULLETIN performance and vet publishing and reviewing developments in the industry.

▸ Best Editorial Board Practices.

The need for high-quality peer reviews exists for all AAPG scientific publications. The Associate Editors and reviewers volunteering their time for AAPG have wide-ranging specialties that have changed through industry ups and downs.

Led by AAPG Honorary Member Barry Katz, Fellows discussed plans to update current reviewer databases and to manage turnover and broadening of the editorial board as a whole.

▸ Book and Journal Publications – Future and Strategic Plan.

Led by Terrilyn Olson and Colin North, the challenges facing AAPG publications range from competition during the current era of rapid technological change, citation indices and AAPG structure and content providers.

Focusing on the various committees and current structure of AAPG, the group set plans in place to enhance coordination with all arms of the Association for the recruitment of journal papers and books.

▸ Outreach Initiative Planning for Potential Authors.

The importance of recruiting journal articles and books played a large role in the Fellows' afternoon discussion. The focus was on best practices to bring paper submissions to AAPG from students and young professionals, busy industry practitioners and international authors in AAPG's expanding regions.

Outreach specifically was planned as a training session that will take place at the 2013 Annual Convention and Exhibition in Pittsburgh, on how to do a review for AAPG, what is involved in producing an AAPG book and how to write a paper for an AAPG journal.

▸ AAPG Publication Awards Processes.

Leading a lively discussion centered on the practices and procedures for selecting the publication awards AAPG presents each year, Mike Sweet and David Pyles reviewed past vetting methods, and utilized the Fellows' feedback to create plans to improve the process used by AAPG to select publication awards.

There was a vigorous discussion about what constitutes "best" paper or book. Was it the best written? The one with most novel ideas? The paper most likely to have a big impact on the science?

The "best" was defined by the group as having:

✓ Clear presentation of ideas (illustration, organization, writing style).
✓ Scientific validity.
✓ Global impact.
✓ Innovative ideas or application.
✓ Utility of application to petroleum geology.

Integral to the discussion was the nominations process for the Dott, Pratt and Sproule publication awards to propose to the AAPG Executive Committee for the 2014 awards ceremony at the Annual Convention and Exhibition taking place in Houston.

That list of award winners will remain confidential until the proper time of notification and announcement.

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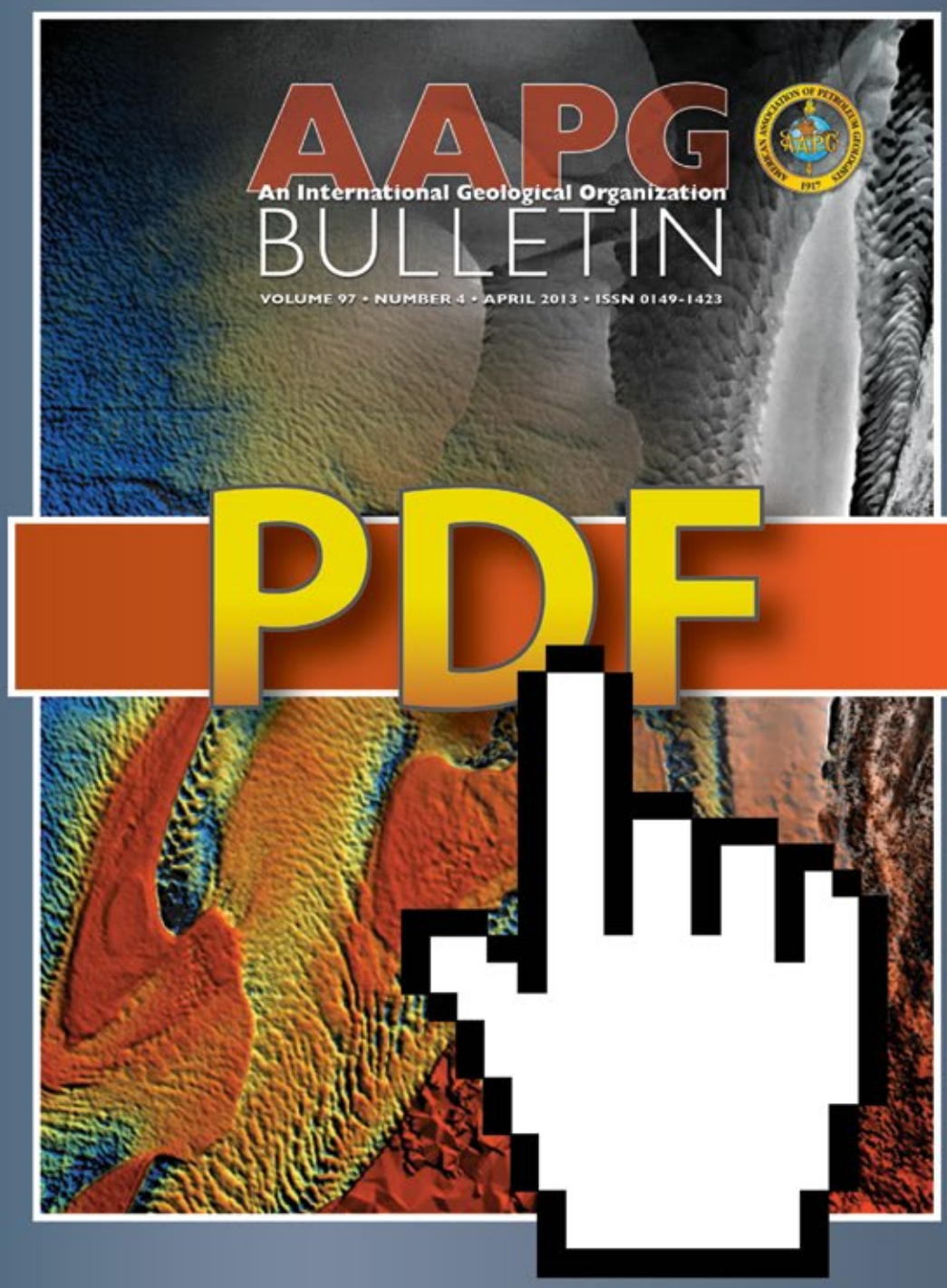


The AAPG Bulletin is a technical journal that is recognized in the industry as the leading peer-reviewed publication for information on geoscience and the associated technology of the energy industry.

The link below takes you to the Members Only login page where, with a few key strokes, you can click on a link for the Bulletin Online, the current issue, or for the Bulletin Archives, all issues of the Bulletin to date. Online as searchable html and .pdf files, the current issue is always available by the first of every month.

Members may access the AAPG Bulletin online at:
www.aapg.org/april_bulletin

Also, submit your next paper for consideration via www.aapg.org/bulletin.

Article highlights include:

Estimating the scale of paleorivers

Ian A. Lunt, Gregory H. Sambrook Smith, James L. Best, Philip J. Ashworth, Stuart N. Lane, and Christopher J. Simpson

This study analyzed the morphology, geometry, and deposits of bedforms and channels in the South Saskatchewan, a sandy braided river. Results add to the relatively small pool of data from modern rivers and aid in constraining the limits of dimensions of different lithofacies used in reservoir models.

Potential for CO2 storage?

Mai Britt E. Mørk

This study focuses on a CO2 storage pilot project in Upper Triassic-Middle Jurassic sandstones, Spitsbergen. Sandstone porosity occurs mainly in isolated molds and micropores while the most promising zones for CO2 injection may occur in beds with enhanced dissolution porosity.

Leakage via faults

Preston D. Jordan, Curtis M. Oldenburg, and Jean-Philippe Nicot

Storage of CO2 in brine-filled reservoirs is a possible means of reducing greenhouse gas emissions. The potential for gas leakage through faults is a significant concern and is evaluated through a case study in the southern portion of the San Joaquin Basin, California.

Estimating capillary pressures

Anita Torabi, Haakon Fossen, and Alvar Braathen

Permeability and porosity measurements from in-situ, core-plug, and thin section can be used to estimate capillary pressures and sealing capacities of different fault-related rocks without requiring direct laboratory measurements.

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.

Solving the Mystery of Angolan Oil

By TAKO KONING

It was a milestone year for everyone living in Angola. In 2002, Jonas Savimbi, the leader of the rebel group UNITA, was killed on Feb. 22 that year, bringing an abrupt end to the long and horrible 27 years civil war.


KONING

Suddenly it was possible to leave Luanda and travel in the countryside, something that was much too dangerous during the war years.

But before I embark on this story, first I must briefly explain how I ended up in Angola.

I've been living and working in Luanda, the capital city of Angola, since 1995. Unquestionably, 17 years is a long time for an expatriate to stay in one place, especially in a not-so-easy country like Angola, which is still recovering from a civil war.

In 2002 I retired from Chevron as a Texaco-legacy employee after 30 years of service worldwide in technical and management positions. The retirement occurred while I was living in Luanda, and rather than returning home to Canada, my wife, Henriette, and I decided to stay on in Angola.

Why stay longer? We like the people, and it is a place where one can "make a difference."

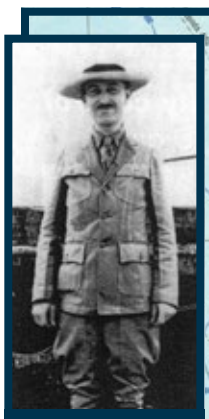
In 2003 I became the in-country consultant for Tullow Oil, and at the same time served as country representative for a Norwegian humanitarian organization, Yme Foundation, which was drilling water wells in northern Angola. In 2010 I became a consultant for Gaffney, Cline & Associates in Luanda.

While working for Texaco, I heard rumors about some oil seeps located north of Luanda. I read copies of some old records, which indicated that as early as the 1700s Portuguese explorers found oil seeps and asphalt deposits exposed at Libongos, about 60 kilometers northeast of Luanda. These are located along the outcrop edge of the Pre-Cambrian granites, which mark the eastern edge of the Kwanza sedimentary basin.

In 1820, 34 barrels of "bitumen" were shipped to Rio de Janeiro to be used as caulking to prevent ships from leaking. When the Portuguese explorer J.C. Monteiro was in Angola from 1855 to 1866, he described various seeps along the coast; other explorers mentioned the existence of "petroleum springs" they witnessed in the country.

I found this to be highly intriguing, but due to the war, travel outside of the city of Luanda was strictly off limits. When the war ended and the countryside slowly opened up, I finally saw for myself the Libongos oil seeps. That was mid-2003, and soon I started leading geological field trips there on a regular basis.

The field trip participants were not just geologists, but also engineers, economists, diplomats, university students and other non-industry types. I developed a geological familiarity with the area, perhaps better than anyone else in the country, since I was making repeated visits there.


Geologist Kessack Duke White

Garphics, photos courtesy of Tako Toning

The Angola story starts here: A map showing the Barra do Dande area.

A Challenge Accepted

2005 was the 30th anniversary of Angola's state oil company, Sonangol. The editor of Sonangol's corporate magazine, Universo, heard that I was leading geological field trips outside of Luanda and he challenged me to find the evidence of the first-ever drilling for oil in Angola.

Fortunately, AAPG member Mario Brandao, an Angolan geologist working for Sonangol who passed away in 2011, gave me photocopies of some bits and pieces of historic information about this drilling.

Brandao was a walking encyclopedia of information about Angolan geology, and the information I received from him indicated that the first-ever drilling was in 1915 – almost 100 years ago, about 15 kilometers inland from the Atlantic Ocean along the small Dande River, 30 kilometers northeast of Luanda.

Continued on next page

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I was pessimistic about finding any evidence of the drilling, since the information was so limited.

The records included a table summarizing the first drilling in Angola. In 1915, the Portuguese oil company Companhia de Pesquisas Mineiras de Angola (PEMA), drilled the first exploration well, which was called Dande-1. It went to a depth of 602 meters, and 13 wells were thereafter drilled – eight of which were drilled in the valley of the Dande River.

The records do not indicate why this area was targeted by PEMA. Seismic technology had not yet been developed, so perhaps they had mapped out an anticline based on surface geological mapping.

What I found to be extremely interesting was that one of the wells, Dande-4, drilled in 1916, was reported to have been drilled to a depth of 857 meters and flowed "Oleo denso, ¾ bl/12h; 850.6 – 857 m, recuper 6 bbls/dia," meaning the well flowed at six barrels of dense oil per day.

Brandao also provided me with information that in 1919, a Portuguese oil company, COPA (Companhia do Petroleo de Angola), was created in association with Sinclair Consolidated Oil, an American company, to explore in the north along the Congo River.

The American geologist who was contracted as exploration manager for Sinclair in Angola was Kessack Duke White, who went by ship from New York to Lisbon and then transferred to a ship to Luanda carrying Portuguese military prisoners.

White later wrote, "The entire trip required only one month, which was not bad."

Another American geologist, Chester Washburne, started a geological investigation in 1921 in a vast part of western Angola, which led to a drilling program of 21 wells. The reports indicated "the results were not very successful."

The concessionary contract with Sinclair ended in 1932, and that marked the end of the first phase of the Angola petroleum exploration.

Dande-4 – Drilled 1916, flowed 6 BOPD.

The Search Begins

Spurred on by the challenge to discover the first-ever drilling, in June 2005 I rounded up some friends and headed to the Dande River valley to find evidence of the drilling. Thank goodness we had strong four-wheel drives since the roads soon deteriorated into narrow tracks.

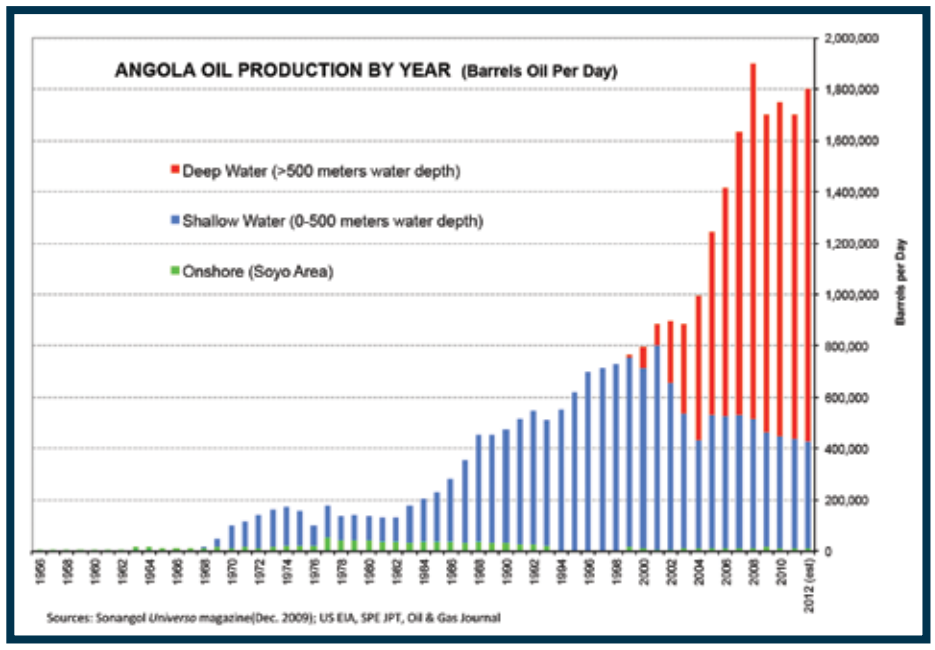
We were expecting to find nothing due to the passage of so much time. One hundred years of exposure to a hot tropical environment like Angola had probably destroyed all evidence of drilling, such as wellheads.

As we drove along we asked local people in small settlements we passed through if they knew anything about the drilling in the area 100 years ago. You could sense them asking themselves why are these people looking for something that happened 100 years ago? I am sure some thought we were crazy.

At the same time we would ask in Portuguese, "Existem minas aqui?" meaning, "Are there landmines here?" We wanted to be sure that we were not driving through minefields laid down during the war.

Our luck changed, however, along the south bank of the Dande River, where we met Chico Fonseca, the administrator of the village of Catanga, and his colleague, Jose Nelito. We asked them if they knew

See **Angola**, next page



CALL FOR PAPERS

Interpretation

A journal of subsurface characterization

SEISMIC ATTRIBUTES

Seismic attributes are an integral part of modern 3D seismic interpretation workflows. Used in conjunction with seismic amplitude and 3D visualization, attributes accelerate conventional analysis and highlight subtle features that may otherwise be overlooked. Because attributes quantify frequency, amplitude, phase, and configuration of seismic reflectors, they serve as input to pattern recognition and clustering software to extrapolate an interpreters seismic stratigraphic analysis to large 3D volumes. Finally, attributes correlated to well-log, microseismic, and production measurements provide an estimate of reservoir properties away from the available well control.

The editors of Interpretation (www.seg.org/interpretation) invite papers on the topic "Seismic Attributes" for publication in the February 2014 special section or supplement. Contributions are invited on algorithmic innovations, effective workflows, data conditioning, and integration of seismic attributes with geologic and engineering measurements.

We anticipate contributions on:

- Attribute interpretation workflows to map tectonic deformation.
- Attribute interpretation workflows to map depositional environment.
- Attribute interpretation workflows to map diagenetic alteration.
- Attribute interpretation workflows to map geohazards.
- Attribute prediction of petrotypes.
- Attribute algorithmic innovations.
- Attribute response to improved data conditioning (e.g., footprint suppression, bandwidth extension,…).
- Attribute correlation with AVO, impedance inversion, and azimuthal anisotropy products,
- Attribute calibration with microseismic, image log, production log, ECS, and other modern tools.
- Attribute fracture characterization.

Interested authors should submit their manuscripts for review no later than 1 June 2013. In addition, the special section or supplement editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for Interpretation (mc.manuscriptcentral.com/interpretation) and select the Seismic Attributes Special Section option in the manuscript type dropdown box. The submitted papers will be subject to the regular peer-review process, and the contributing authors are also expected to participate in the review process as reviewers.

SUBMISSION TIMELINE

Submission deadline	Peer review complete	All files submitted for production	Publication of issue
15 June 2013	26 October 2013	9 November 2013	February 2014

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A joint publication of SEG and AAPG

Society of Exploration Geophysicists

Tako Koning, leading a field trip to Angola's Barro do Dande area. Koning, who won the 2009 AAPG Public Service Award, frequently leads such trips to the country's historic region.

Angola

from previous page

anything about wells drilled by the Portuguese almost 100 years ago.

I was dumbstruck when Fonseca nodded and said, "Yes, we will take you there."

He and Nelito climbed into our cars and we drove for a few kilometers, then hiked through a bit of jungle toward the river when he announced, "There it is."

I was absolutely amazed to see an oil-covered pipe sticking up from the riverbank opposite us.

Fonseca then disappeared and returned with an old dugout canoe. As he paddled us across the river he casually mentioned that there were crocodiles in the river, but he assured me, "Don't worry, they only attack dogs and not people."

When I clambered out of the canoe and onto the river bank, I realized that I was looking at wide diameter casing sticking about two meters high above the river bank, full of heavy oil with a small amount dripping down the outside of the casing. The oil was dense and tar-like, probably due to biodegradation of the lighter components. I concluded that I was looking at Dande-4.

Of the eight wells that had been drilled in the Dande River valley, none except for Dande-4 was reported to have found oil. That meant I was looking at Dande-4, the first well in Angola to have actually tested a flow of oil.

In 1916 cementing and plugging of wells would have been rudimentary technology, so likely the well had not been properly plugged off. I also concluded that the continuous, very slow flow of heavy oil both inside and outside of the casing probably helped preserve the wellhead from the effects of a century of tropical weathering.

Standing and looking at the wellhead gave me a rush of emotions. It was like going back a century in time – I imagined these now long-forgotten pioneers drilling here in the first serious attempt to find oil in Angola. The conditions would have been extremely difficult due to the heat, humidity and the ever-present threat of malaria and other tropical diseases, plus a possibly hostile local population.

I envisioned these long-forgotten engineers, geologists, drillers, roustabouts and roughnecks as they wrestled with their primitive rig in the wild bush – and I am sure that many men, both Portuguese and Angolan, died in this effort. These early explorers for oil truly were heroes having worked so far away from home and under such difficult conditions.

Bonus Discovery

But the story does not end there.

While crossing back to the south bank of the Dande River, I remembered I also had with me a good Petro-Consultants well-base map of the Kwanza Basin, showing that in 1974, Compagnie Francaise des Pétroles (CFP) the forerunner of Total Petroleum, had drilled a well, Catanga-1, to a depth of 1,408 meters on the south bank of the Dande River.

Likely CFP was trying to intersect the same oil zone found in the nearby Dande-4.

When I mentioned this to Mr. Fonseca, he said that although he was only 10 years old at the time, he remembered the well drilled by the French. Not far from the shore he located the drill site, now overgrown by trees but with a small depression where the rig had been located.

The records show that Catanga-1 was plugged and abandoned; Fonseca remembered that the drillers were in a big rush to get the rig out because it was the rainy season and the river was already overflowing its banks.

I thought that perhaps there was another reason why the rig left so quickly – it may have been because Catanga-1 was drilled just one year before Angola's independence from Portugal in 1975. The military regime in Lisbon was overthrown in the Carnation Revolution in 1974, and the new government had announced that in 1975 Angola would cease being a Portuguese colony and be given independence.

There was a lot of political uncertainty in Angola, with various political parties fighting to head up the government at independence – so maybe CFP was in a big hurry to get their rig out of Angola to a safer location.

The Next Chapter?

Today Angola produces almost two million barrels of oil per day. With the exception of 10,000 barrels of oil per day currently being produced near the town of Soyo in northern Angola, Angola's oil production is entirely offshore.

But perhaps the story of Dande-4 is not yet finished. Perhaps someday, Angola will follow suit and build an oil museum at Dande-4 like the oil discovery site of Titusville in Pennsylvania, where Colonel Drake drilled the first oil discovery well in the United States; or like the historic site near the town of Leduc, Canada, commemorating the 1947 discovery of major oil reserves in Devonian reefs that catapulted Canada into becoming a major oil producing nation.

In the meantime, I continue to lead field trips to the Barra do Dande area to acquaint people with the interesting geology and to teach them about Angola's fascinating petroleum heritage.

Website Offers Voting, Certificates on Demand

By JANET BRISTER, AAPG Website Editor

Many online changes and new features are being added to the AAPG website – and this seems like a great time to review them.

For example: Have you voted yet?

By now you should have received your ballot in the mail. But before that you received an email from the SBS DirectVote system. This is the impartial service that runs our election.

They have sent you an email with an election passcode unique to you. This code along with your member number unlocks the ballot for you to vote electronically.

The interface is simple.

You enter your information in the appropriate fields. Select the candidate you'd like to see serve in that office. You're even provided a bio and CV to review. Then, before completing the process, you may review your selections – and alter, if need be.

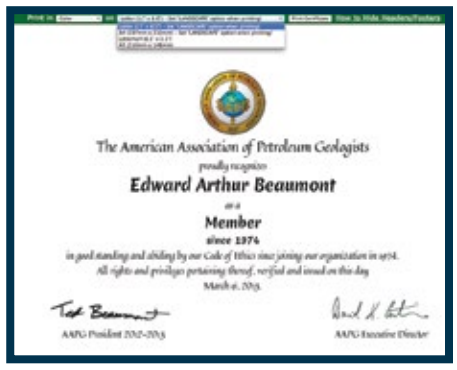
If you are interrupted in this process, your selections are stored and you may return to complete the process.

However once your vote is cast, you are done. There's no turning back after that.

Membership Certificates

Is your certificate of membership starting to fade on your office wall? No worries. We have a great solution – and if your dues are current it's free.

Member Services had your web team set up a certificate of membership that AAPG Members may now print at any time they desire.



There's even a selection of sizes.

Here's how it works:

When you go to Members Only and log in, there is a new navigation item on the left "Print Membership Certificate." It is located about halfway down just under "Print Membership Card."

According to Vicki Beighle, manager of AAPG Member Services, those members of the AAPG in good standing may access this service any time.

Included on the certificate is your name – as it appears in the AAPG database – your current level of membership, the year you joined and the date you printed the certificate.

All of this is automated so there is only the preview of the certificate when you go to this new feature.

However, there are some special print options in a green bar displayed across the top of the certificate window.

Your options are four different sizes to center on paper options sized to your area

(aka letter or A4) – a full page and a half-page version for each.

Likewise, you may select a color or a black and white printout for the best result on your printer.

Option Play

In the green bar above the certificate, starting from the left, you may first choose your print option: Color? Black and white? Different artwork accommodates your print choice for the best possible result.

Next you may choose the size of your certificate. All will center on your paper so you may trim to fit in a frame or use on card stock to tack onto a board. We've even left room for a border in case you'd like to choose some paper that looks more decorative.

It is important to note with the larger options that you need to choose the "landscape" orientation for your print before you send it to the printer. This is found within your printer's page setup.

You are almost ready to click the "Print Certificate" button.

Keep It Clean

Since you'll want your certificate as clean as possible, and you really don't

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URTeC

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Exhibiting Opportunities

But it's not all technical presentations – the robust exhibition has been planned as providing an effective way for industry to target a multidisciplinary professional audience.

"Industry has been encouraging AAPG, SPE and SEG to collaborate in this area for some time," said Paul Weimer, another past AAPG president. "While our societies frequently work together, URTeC may rank as our most significant joint venture in the United States since we all joined the Offshore Technology Conference in the late 1960s."

Exhibitors are giving the multi-society collaboration a thumbs-up.

"IHS is more than elated to be a part of URTeC's inaugural expo show and conference. It's the first show of its kind where we're able to reach three large and influential groups of customers in one setting and the overlap here is fantastic," said Kenedy Hughes with IHS. "Geologists, geophysicists and engineers will now see how the solutions we offer are integrated and how we can connect their workflows and assist them in advancing their decisions."

Getting in on the ground floor has been a common theme with exhibitors who signed up early.

"Weatherford is involved in the inaugural URTeC because it is likely to become the preeminent unconventional conference in North America," said company representative Melanie Kania. "No single existing conference today provides Weatherford the opportunity to interface with the cross section of industry professionals who are the target audience for the URTeC."

Companies interested in exhibiting still have an opportunity to get in on the ground-floor of this landmark event. For complete details or to register visit www.urtec.org.

*(Editor's note: **Julie Simmons**, AAPG's conventions marketing manager, contributed to this article.)*

Continued from previous page

want to have to trim it, we've provided an information link that shows you how to configure your browser's printing interface.

Most browsers print a header and/or footer that number your page(s), identifies who is printing the page, adds the page's URL, today's date, etc. Most likely you'd prefer to not print these on your certificate.

Just to the right of the "Print Certificate" button is a link to instructions to configure your browser's header and footer options.

About that Member Card

So, when you were looking for the "Print Membership Certificate" option did you also notice the "Print Membership Card?"

This has been available to AAPG members for a long time, but you may have never noticed it.

This option does exactly what it says: It provides a wallet-sized version of your card. It pulls from your AAPG Member record. So any time you have lost your card, you may print it afresh through your Members Only log in.

Good browsing!

Consensus Still Eludes Emissions Debate

By EDITH ALLISON, GEO-DC Director

Regulations aimed at reducing carbon emissions are now common – 33 countries and 18 sub-national jurisdictions will have a price on carbon in 2012 – but the topic is contentious in the United States and other countries as carbon emissions regulations take hold.

Most of the world's current regulations, including those for the European Union and California, involve some form of cap-and-trade – a limit, or cap, is set and companies are permitted to sell or trade their unused portion to other companies that cannot meet the limit. As the cap decreases through time, total emissions should decline and renewable energy technologies expand.

This system is popular because it uses a market-based approach. Cap-and-trade systems successfully lowered sulfur oxides (SOx) and nitrogen oxides (NOx) emissions in the United States starting in the mid-1990s.

A carbon tax is popular with economists and policy analysts interested in reducing greenhouse gas emissions because it is simple – companies that produce fossil fuels pay a fixed amount for each ton of carbon dioxide emitted by the fuels they produce. The tax also can raise huge sums of money for use in stimulating renewable energy technologies or reducing other taxes.

A main concern is that a carbon tax is highly regressive and would require some form of rebate to people who spend a disproportionate share of their income on fuel. In Canada, British Columbia, Alberta and Quebec have carbon taxes.


ALLISON

> It is almost impossible to determine if carbon emission restrictions are stimulating or depressing jobs and gross domestic product.

Both cap-and-trade and carbon taxation are intended to encourage fuel users, from electric generating companies to car owners, to choose more-efficient technologies or switch to less carbon-intensive fuels. Higher costs for carbon are predicted to spur technical innovation and conservation.

Design and implementation of either system would involve political decisions on the industries to be included or exempted, the dollar value assigned to carbon or the emissions credits, and the level of the cap. Many governments that have implemented cap-and-trade or carbon taxes have chosen low taxes or high caps that have little impact on producers or consumers.

United States

Pundits and policy analysts in Washington, D.C., have been talking about ways to reduce carbon emissions for many years, but now there is increased interest by environmental groups, many Democrats in Congress and the president. This expanded interest seems driven by the damage from super-storm Sandy that devastated parts of the northeast United States in October, and a pending government decision on whether to permit the Keystone XL pipeline to cross the U.S.-Canada border.

Ironically, both issues are weakly linked to carbon emissions: the storm was an unfortunate coincidence of two relatively common storms, a hurricane and a nor'easter; and the failure to build the Canada-to-U.S. pipeline will probably not reduce oil sand production.

Supporters of a U.S. cap-and-trade system include: President Obama, many Democratic members of the U.S. Congress, environmental groups and some big companies including Shell, GE, Dow Chemical and Duke Energy. Opponents include most Republicans in Congress and many conservative think tanks and advocacy groups.

Because of divided control of the U.S. government, no legislative actions are likely this year. However, executive branch action is possible this year because the Environmental Protection Agency (EPA) has the ability, confirmed by a Supreme Court decision, to regulate carbon emissions.

In his state of the union speech, the president asked Congress to pass carbon cap-and-trade legislation. He also stated that if Congress does not act he would take executive actions to reduce pollution, help prepare for the consequences of global warming and speed the transition to more-sustainable energy sources.

EPA already has instituted greenhouse gas emissions regulations for vehicles; the regulations call for light-duty vehicles to limit emissions to 163 grams of carbon dioxide per mile by 2025. The level is half the 2010 emissions. This carbon emissions portion of the regulation received little notice because it is paired with National Highway Traffic Safety Administration miles-per-gallon limits – the familiar CAFE (corporate average fuel efficiency) standards.

In March 2012, EPA announced plans to restrict carbon emissions from new fossil fuel-fired power plants. Public hearings in May and June and a public comment period lasting until late June will influence the final regulation.

The draft regulation would allow new natural gas combined-cycle power plants, but plants that use coal or petroleum coke would be required to have technology such as carbon capture and storage in order to meet the carbon emissions limits. Visit EPA's carbon-pollution-standard website

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to register for the hearings or submit comments on the proposed rule.

States, including California, Washington and Oregon, currently have restrictions on coal-fired power plants.

California Carbon Regulations

Under a 2006 law, California instituted cap-and-trade regulation for power generators, oil refineries and industries that produce 25,000 metric tons per year of carbon emissions. The state also has regulations governing vehicle emissions.

The state's carbon emissions trading program began with a November 2012 allowance auction. The second auction in February produced a price of $13.62 per ton for 2013 emissions. This price is expected to have little impact on consumers; however, future allowances will be more expensive as emissions caps decline.

Economists note that whether the California system has a positive or negative impact on the state economy depends on how the revenues are used.

European Union

The European Union in 2005 initiated its carbon cap-and-trade program, which applies to 12,000 facilities. Power plants, oil, steel, cement, glass, and pulp and paper sectors are required to participate.

The system initially issued more allowances than there were actual emissions. Revisions to reduce the surplus emissions have yet to pass and allowances are trading at values well below the level required to stimulate industry to reduce emissions.

The EU planned to charge a carbon-emissions tax on non-EU airlines flying into Europe starting in 2012; however, the tax has been delayed a year because of objections by non-EU countries and airlines.

Canada

British Columbia and Quebec plan to participate in the California emissions allowance auctions in the future.

In the meantime, British Columbia has a carbon tax of $30 (Canadian) per metric ton. The tax revenues are returned to taxpayers through cuts in business and personal income taxes. The tax is equivalent to 7.24 cents (Canadian) per liter of gasoline. According to The Economist magazine, the B.C. carbon tax is popular with a majority of citizens; the provincial economy is growing faster than the rest of Canada; and per capita fuel consumption has declined more than elsewhere in Canada.

Quebec's carbon tax is very low – less than a cent per liter of gasoline. Because most of Quebec's power comes from hydroelectricity, power prices are essentially unaffected.

Alberta has a carbon tax of $15 per metric ton for emissions that exceed emission limits and are not offset by purchased emissions credits. The proceeds go to a technology development fund.

The low tax rates in Quebec and Alberta should have little to no impact on producers or consumers.

Is it Possible to Measure Success?

It is difficult to determine if carbon emissions are responding to carbon taxes. Many of the carbon regulations have been in place only a couple of years. Other regulations have placed a value on carbon emissions that is too low to impact consumers' energy decisions.

Complicating statistical analysis is the fact that the recent global recession and recovery distort yearly trends.

Despite these caveats, here are some statistics:

- Global carbon emissions rose 2.6 percent from 2011 to 2012, and global carbon emissions are 58 percent above 1990 levels (as per the Global Carbon Project, a multi-national partnership of carbon-cycle scientists).
- The European Environment Agency reported that the EU27 countries with a carbon emissions restrictions saw emissions rise from 2009 to 2010, an exception to a long-term downward trend that has carbon emissions down 17 percent from 1990 to 2011.
- The Energy Information Administration reports that the United States, without a national carbon tax, saw carbon emissions rise 3.2 percent from 2009 to 2010 as the country recovered from the recession. Carbon emissions declined in 2012, as natural gas replaced coal for power generation and renewable energy grew, but are still 4 percent above 1992 levels.

It is almost impossible to determine if carbon emission restrictions are stimulating or depressing jobs and gross domestic product (GDP). As expected, proponents and opponents of carbon taxes or regulations generate different forecasts.

Unbiased analyses will require several years of experience with these systems.

IN MEMORY

Donald Bloustine, 66
Oklahoma City, Dec. 7, 2011

Gerald Pat Bolden, 87
Midland, Texas, Feb. 19, 2013

Charles Daniel Bump, 77
Houston, Jan. 31, 2013

Frank Kell Cahoon, 78
Midland, Texas, Jan. 30, 2013

Douglas Rean Callier, 90
Napa, Calif., Feb. 9, 2013

Harry Edward Conners III, 65
Washington, Mich., Feb. 11, 2013

Dee Witt Layman, 85
Madison, Miss., Oct. 31, 2011

Alfred Edgar Miles, 82
Houston, Jan. 19, 2013

Jandi Sutedja, 69
Friendswood, Texas, Dec. 29, 2012

Tadeusz Wolnowski (Member 2009)
Zielona, Poland

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

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer. This month's column deals with using phase residues for identifying geological features.

It's Just a Phase (Residue)

By OSWALDO DAVOGUSTTO

In the March issue of Geophysical Corner, my colleagues Marcilio Matos and AAPG member Kurt Marfurt discussed the concept of phase unwrapping and the computation of phase residues.

This month, we go deeper: I elaborate on the application of phase residues to seismic data – and the resulting subsequent interpretation of geological features.

Some geologically induced spatial discontinuities, such as channels and faults, easily can be identified as seismic phase shifts or amplitude anomalies when they are above seismic resolution – but phase shifts from condensed sections and erosional unconformities can be subtle and not as easily detected.

Spectral decomposition is a proven, powerful means of identifying such discontinuities at specific frequencies that are otherwise buried in the seismic broadband response.

* * *

Although seismic acquisition and processing preserve seismic phase very well, little has been published about interpreting the phase components resulting from spectral decomposition.

Morlet complex wavelet transform phase residues can improve seismic spectral decomposition interpretation by detecting the phase discontinuities in the joint time-frequency spectral phase component – by evaluating the phase shifts that are derived from thickness changes in a wedge model.

We unwrap phase the phase traversing a rectangular contour about each time-frequency sample. In almost all incidents, the contour closes. However, in some cases we have a +180 or -180 degree phase anomaly. We display the location of these phase residue anomalies and correlate them to stratigraphic discontinuities and inconsistencies in seismic data quality.


DAVOGUSTTO

We are able to map interference patterns between the wavelets that occur below seismic resolution.

For example, here we apply the phase residues to a seismic dataset that served as one of the first published applications of spectral decomposition.

The geology consists of an incised valley system in the Red Fork formation of the Anadarko Basin that had at least five stages of incision and fill. Previous works described that the fill of the mentioned incised valley as comprising lag deposits, shales, coals, muddy sands and sands.

This dataset also is known for the occurrence of invisible channels – channels that can be detected and correlated through logs, but that are below the resolution of the seismic data.

Based on the response of the phase residues and the tops interpreted from the logs, we identified the incision stages in the phase residues attribute. We interpreted each stage as a seismic horizon and constructed a geological model that honors the well, seismic and attribute data.

This geological model can be further used in reservoir modeling for reservoir properties, such as net-to-gross, porosity and permeability, with the versatility that these properties can change as the depositional environment changed from stage to stage.

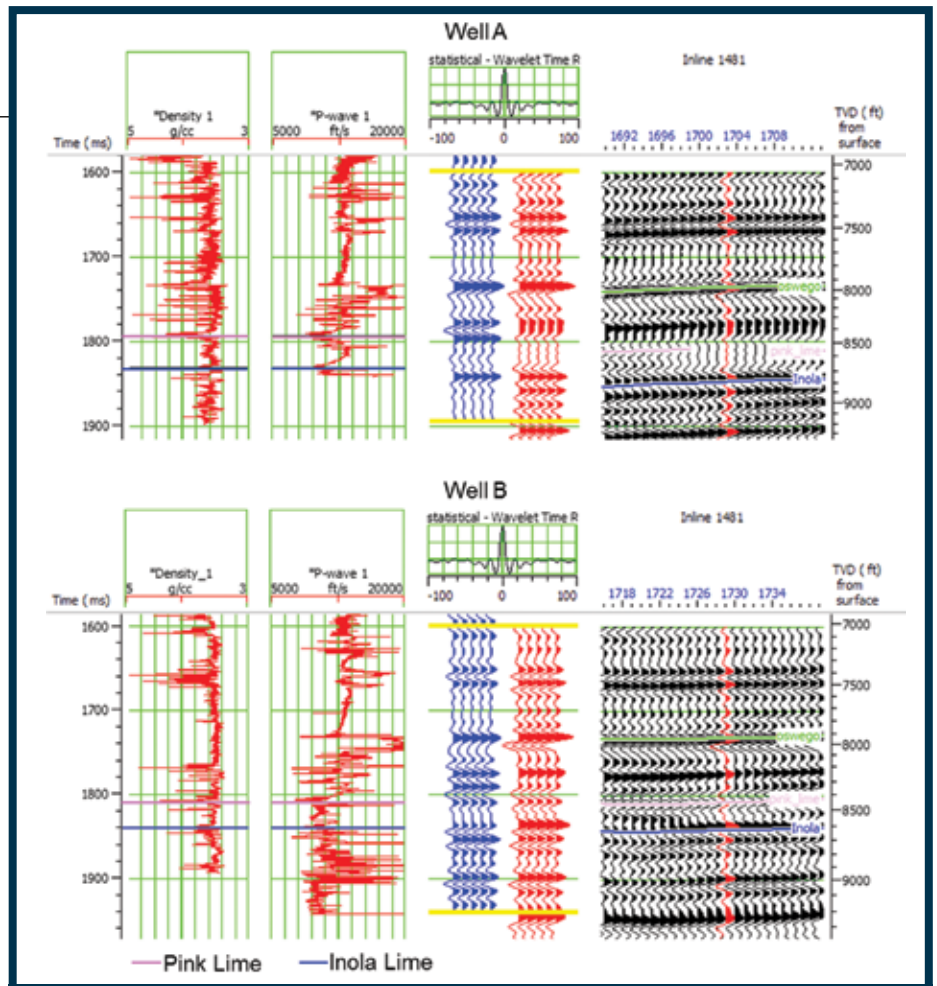

Figure 1 – Well to seismic calibration for wells A and B. Correlation coefficient for both wells is 75 percent.

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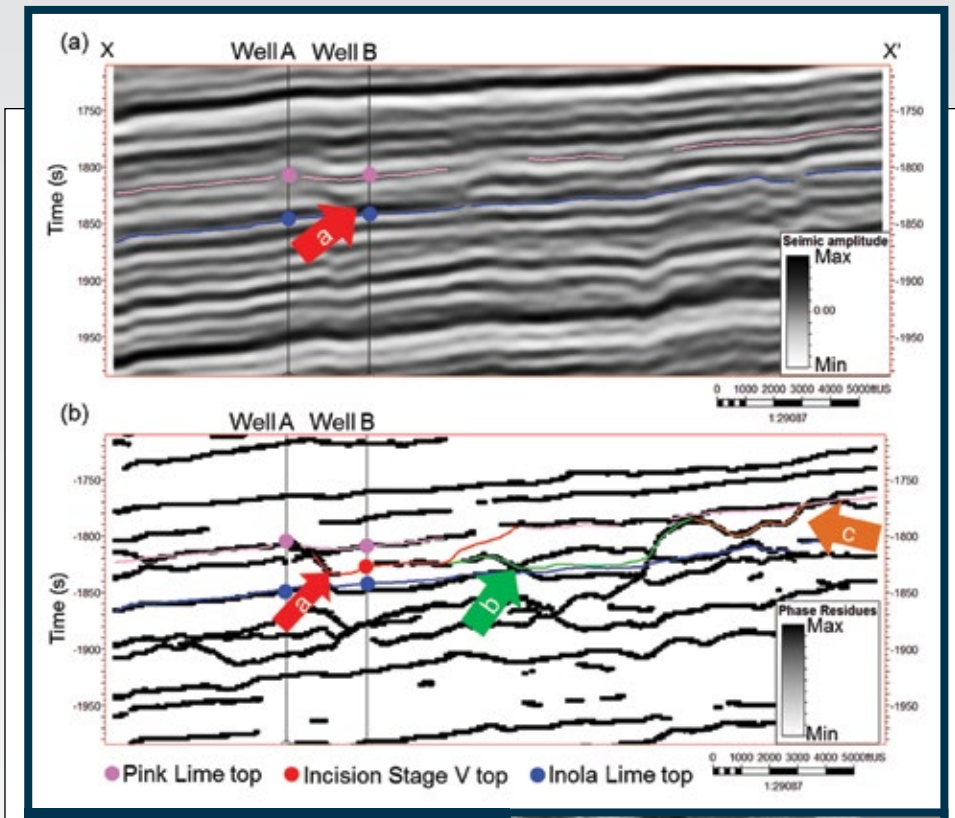
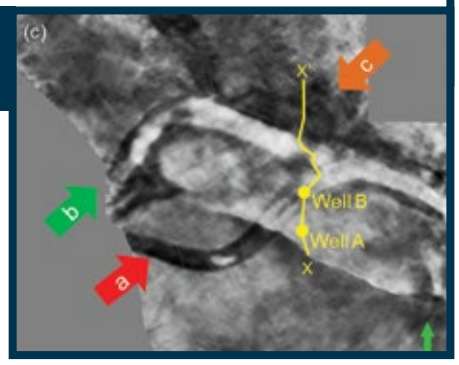


Figure 2 – (a) Seismic data; (b) the phase residues response of a representative time section; (c) and time slice through seismic amplitude at 1.8 s.



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* * *

Figure 1 shows our well-to-seismic calibration for two wells, A and B. Locations of wells A and B are shown in figure 2c.

The correlation coefficient is 75 percent for both wells.

We identify very distinctive patterns in the log response for each well – well A is located in the regional Red Fork facies and shows faster P-wave velocity, whereas well B is located in the incised valley system facies and displays lower P-wave velocities from the sonic log.

In figure 2 we display the seismic data (a), the phase residues response of a representative time section (b) and a time slice through seismic amplitude at 1.8 s (c).

Seismic data (a) are able to resolve only one of the incision stages identified on the time slice of the data (c). This is a common problem in midcontinent datasets, where channels are identified in time slices but not on vertical sections.

Using phase residues (b) we identify three anomaly responses that correlate with the channel-like features interpreted as incised valleys in the time slice data (c).

Using the well and the phase residues data, we interpreted the incision stages.

In figure 3 we show a chair diagram of the seismic data with a time slice at 1.8 s (a) and a 3-D view of the geo-cellular grid constructed from the combined well log and phase residues interpretation (b). This detailed geo-cellular grid allows us to model the properties of each incision stage and the regional Red Fork as a separate event with their on-reservoir properties and modeling technique.

* * *

In conclusion, we demonstrated how the use of phase residues can be effectively applied to reveal and enhance important stratigraphic features not otherwise revealed by conventional seismic amplitude.

We have developed a workflow that combines well data with phase attributes in order to produce a well-to-seismic consistent stratigraphic model.

I would like to thank Mark Falk and Al Warner for their support and advice in this project. I also would like to thank Chesapeake Energy Corporation and CGG-Veritas for donating the data for this project, and to Schlumberger and CGG-Veritas for facilitating the software used in these displays.

(Editor's note: Oswaldo Davogustto is an AAPG Student member at the University of Oklahoma, Norman, Okla.)

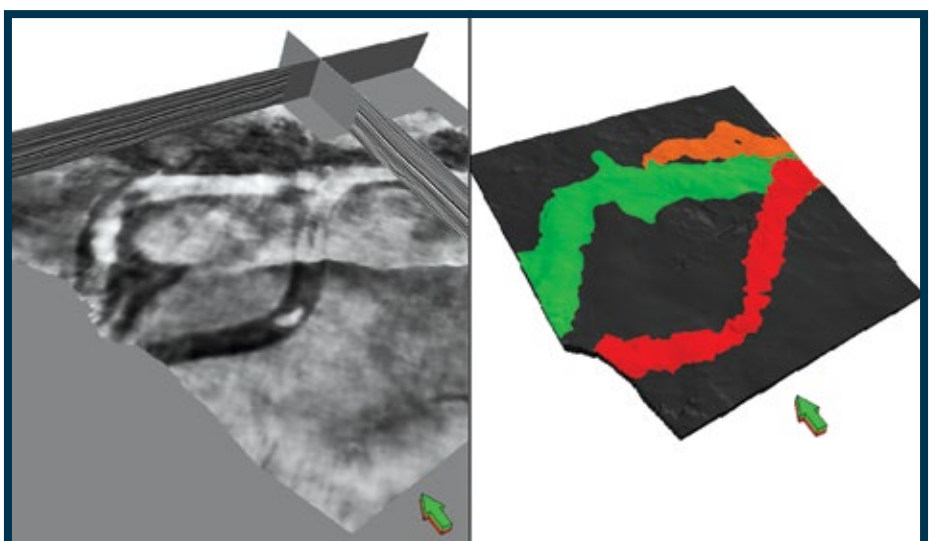

Figure 3 – Chair diagram of the seismic data with a time slice at 1.8 s (a) and a 3-D view of the geo-cellular grid constructed from the combined well log and phase residues interpretation (b).

"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.

PROFESSIONAL newsBRIEFS

Bob Blackmur, to geologist, DCOR, Ventura, Calif. Previously geologist, Venoco, Carpinteria, Calif.

Cliff Clark, to senior geologist, Forestar Petroleum, Denver. Previously senior principal technical adviser, Neos GeoSolutions, Denver, and previously senior geoscientist Rex Energy, Denver.

Greg Hummel, to senior geologist-Los Angeles Basin, E&B Natural Resources, Carson, Calif. Previously senior geologist-Cat Canyon field, ERG Operating, Santa Maria, Calif.

Dan Jarvie, to chief geochemist, EOG Resources, Houston. Previously president, Worldwide Geochemistry, Humble, Texas.

Creties Jenkins, to partner, Rose and Associates, Houston. Previously senior vice president, DeGolyer and MacNaughton, Dallas.

Kenneth L. Marx has retired from Devon Energy. He resides in Bellaire, Texas.

Mark O'Koren, to chief explorationist-Mesozoic, Stephens Production Co., Houston. Previously EVP exploration, ReSearch Exploration, Houston.

James "Jim" Schuelke, to senior geophysical adviser, Apache Corp. E&P Technology, Houston. Previously reservoir characterization coordinator, Devon Energy, Houston.

Gene Sparkman, to senior vice president of business development, Lumina Geophysical, Houston. Previously senior vice president-business development, SIGMA Cubed, The Woodlands, Texas.

Ralph Worthington, to vice president, R&P Exploration, Midland, Texas. Previously regional geological manager, Cimarex Energy, Midland, Texas.

Qingming Yang, to chief operating officer, Approach Resources, Fort Worth, Texas. Previously EVP-business development and geosciences, Approach Resources, Fort Worth, Texas.

Hudec Wins GCAGS Levorsen Award

Michael Hudec, a senior research scientist at the Bureau of Economic Geology in Austin, Texas – and no stranger to AAPG technical awards – has won the A.I. Levorsen Memorial Award for presenting the best paper at last year's GCAGS annual meeting.

Hudec's winning paper was titled "Explanation for Differences in Deepwater Salt Tectonics Between the North-Central and Northwestern Gulf of Mexico."

Hudec previously received AAPG's George C. Matson Award for presenting the best paper at the 2005 AAPG Annual Convention and Exhibition in Calgary, Canada, and the AAPG Jules Braunstein Award for the best poster presentation at the 2008 AAPG Annual Convention and Exhibition in San Antonio.

The next GCAGS annual meeting will be held Oct. 5-8 in New Orleans.

"ProTracks" is an ongoing feature of the EXPLORER, offering news and information pertinent to getting started or getting better in your career. Jonathan Allen is Pacific Section lead of AAPG's Young Professionals Committee.

PROTRACKS

Encore Performance: YPs Set for ACE Meet-N-Greet

By JONATHAN ALLEN


ALLEN

The AAPG 2013 Annual Convention and Exhibition (ACE) in Pittsburgh is just around the corner – and whether this is your first convention or your 20th, I urge you to consider participating in the YP Meet-N-Greet.

This year's event will take place at 2 p.m. Sunday, May 19, in the David L. Lawrence Convention Center – adjacent to the site of this year's Imperial Barrel Award celebration and the convention's opening session.

This year's event also marks the fifth year the Meet-N-Greet has taken place, and it has proven to be a valuable experience for all who attend.

At the Meet-N-Greet, Young Professionals – mentees – are grouped with experienced AAPG attendee mentors, who serve as guides to convention newcomers. Participants are then encouraged to attend both the opening session and Icebreaker as a group, with mentors introducing their mentees to other AAPG members and their colleagues.

Clearly, mentees benefit from the opportunity to speak with mentors outside of their school or company.

AAPG elected Secretary Denise Cox, who has participated as a mentor at both ACE and International Conference and Exhibition events, mentioned that many of her past mentees made comments like, "I really appreciate you being straight with me. No one else was giving me the information I needed."

The Meet-N-Greet also is a great way to get the inside scoop on the industry and AAPG from experienced professionals, as well as meet AAPG leadership in a relaxed atmosphere before the convention program begins.

And the Meet Goes On …

Many mentees have seen their relationship with their mentors last well beyond the Meet-N-Greet – and even beyond the convention. Spencer Rolfs, a student at California State University, Fresno, contacts his mentor, past AAPG president Scott Tinker, whenever he needs advice on academic or career goals.

"To have access to such an influential person has been great, to say the least," Rolfs said, "and on more than one occasion he has helped me out tremendously."

Tinker, who has participated as a mentor at the Meet-N-Greet for several years, said "YPs are the future of AAPG, and that is a future I am committed to."

The YP Meet-N-Greet is not only beneficial for the mentees – past mentors also have expressed how rewarding it was to connect with the future of the industry and AAPG.

Cox, for example, finds it very rewarding to follow students from academia to industry to leadership positions in AAPG.

"As a small independent, they help me stay connected with a global oil and gas industry," she said. "As an AAPG member, they make me proud."

Whether as a mentee or a mentor, past participants agree the YP Meet-N-Greet is a fantastic experience that helps to make the convention less intimidating and overwhelming to new attendees. It helps to put a face on AAPG, and it's an opportunity for students and YPs to interact with industry and Association leaders – and for our organization's leaders to get energized by the next generation.

Take the opportunity to participate in the Meet-N-Greet and you will be amazed at how rewarding and valuable connections and friendships made at ACE will last your entire career.

See you in Pittsburgh!

AAPG FOUNDATION

2013 Undergraduate Grant Recipients Announced

Congratulations to the 61 recipients of the L. Austin Weeks Undergraduate Grant. The students and their respective AAPG Student Chapters receive $500 each.

University	Student
Adam Mickiewicz University, Poznan	Szymon Belzyt
Alexandru Ioan Cuza University, IASI	Sergiu Loghin
Angelo State University	Mario Mata
Auburn University	Jessica Story
Babes-Bolyai University	Cristian Mircescu
Baylor University	William Horner
Brawijaya University	Rofi Nurbilad
Cairo University	Mohamed Gebril
California State University-Long Beach	Riki Paulson
California State University-Northridge	Stephanie Holgren
Colorado School of Mines	Andrew Graham
Diponegro University	Budi Amboro
Eotvos Lorand University	Daniel Budai
Gadjah Mada University	Kinanti Hapsari
Hasanuddin University	Daniel Pardede
Idaho State University	Lakin Beal
Imperial College London	Charles Cooper
Indian School of Mines	Vibhor Agarwal
Institute Technology of Bandung	Yoseph Adiatma
Institute Technology of Medan	Marshal Simon Simamora
Makerere University	Hillary Mumbere
Missouri State University	Vanna Carr
New Mexico Tech	Natasha Trujillo
Obafemi Awolowo University	Tolutope Lagunju
Oklahoma State University	Whitney Campbell
Rice University	Caleb McBride
San Diego State University	Kenneth Haase
Southern Methodist University	Alex Philipson
Stephen F Austin State University	Daniel Sutton
Suez Canal University	Khairy Wahid
Texas A&M University-Kingsville	Stephannie Resendez
Texas Tech University	Matthew Tave
Trisakti University	Ignatius Primadi
Universidad Industrial de Santander	Flover Rodriguez
University of Aberdeen	Laura-Jane Fyfe
University of Akron	Kenneth Jambor
University of Alabama	Jennifer Simpson
University of Arkansas	Matthew Ruggeri
University of Bucharest	Andrei Strachinaru
University of Colorado in Boulder	Recipient to be named
University of Ibadan	Teluwo Lukmom
University of Ilorin	Faniran Oriyomi
University of Indonesia	Ramsyi Afdhal
University of Iowa	Samuel Saltzman
University of Kansas	Tina Redinger
University of Karachi	Rashid Mukhtar
University of Leoben	Bernhard Rupprecht
University of Manchester	Nicholas Cope
University of Missouri	Michelle Rathe
University of Nebraska-Lincoln	Eric Reiss
University of Nevada-Las Vegas	Daniel Haber
University of New Orleans	Rachel Carter
University Of Padjadjaran	Rizky Putra
University of Sriwijaya	Ayu Firdani
University of Tulsa	Kathryn Garrett
University of Utah	Tyler Duncan
University of Wyoming	Lauren Dazey
West Virginia University	April Marrara
Western University	Kristyn Smith
Wichita State University	Isabel Vloten
Yerevan State University	Samvel Demirtshyan

Your support of this program will enable more students and their AAPG Student Chapters to benefit. Please make a contribution to the AAPG Foundation today.

To give to the AAPG Foundation, go online to http://foundation.aapg.org/donate.cfm or mail to P.O. Box 979, Tulsa, OK 74101. Questions? Call 1-855-302-2743.

FOUNDATIONUPDATE

Supporting a Lofty Mission

By NATALIE ADAMS, AAPG Foundation Manager

As an ever-growing field, geoscience has no shortage of needs – for example, the dissemination of current, accurate information to the public, research funding, grants to university students, publications to universities that have lean budgets, K-12 rock kits, young professional career guidance, and the list goes on.

Fortunately, the vision to "give back" has taken hold within the petroleum geology profession. More than $34.6 million has been received by the AAPG Foundation during its history, from more than 15,000 donors.

Of that total, $22.2 million (64 percent) has been received in just the last seven years, from more than 7,100 donors.

Amazingly, more than 900 donors have given consistently to the AAPG Foundation for the last 10 years. Almost 200 of those have given for more than 20 years. The culture of philanthropy is catching on among the AAPG membership – and it even extends beyond life. More than $12 million has been contributed to the Foundation in the form of bequests.

However, the "90/10 rule" (90 percent of gifts come from the top 10 percent of donors) did not hold true here this year, when 90 percent of the gifts came from the top 2 percent of donors.

Drilling deeper, 66 percent of contributions came from AAPG members, and 30 percent of the year's contributions came from companies.

Some members, about 5.39 percent, gave a donation with their AAPG dues payments – but there are 10,837 individuals who have given to the Foundation at some point but not in the last 12 months. We need these lapsed donors to return to the fold.

We honor the donor – and yet, we ask still.

The challenge to meet and fulfill the mission is there, and a lofty one it is.

Foundation Contributions – February 2013

General Fund
Eugene Leroy Ames Jr.
In memory of Eugene L. Ames Sr.
Joseph John Bruns
In memory of Elton Rodgers
Jeffrey C. Bulsa
Steven Lewis Burleson
Alfred Townes Carleton Jr.
Marvin Paul Carlson
John Ernest Chatfield
James Robert Daniels
William E. Gipson
In memory of Charles Daniel Bump
Julio M. Jimeno
In memory of Amanda Jimeno
Crandall Davis Jones
In memory of Ed Miles
Crandall Davis Jones
Georgina Sarah Lorriman
Keith Nicholas Mangini
James S. McGhay
Donald Paul McGookey
In memory of Gerald Bolden
William Gerard Murray
Christopher Douglas Odham
Walter Charles Riese
Jess Perry Roach
Houston Leale Slate
Robert Lee Smith
Margaret Zoe Smoot
David Roger Steele
Harrison and Terry Townes
In memory of Bob Millspaugh
Victor J. Veroda
Eddie A. Williamson
Barry Lynn Zinz
In memory of John Griesbach

Awards Fund
Ziad Beydoun Memorial Award
David C. Blanchard
In memory of Gifford Kessler

Distinguished Lecture Fund
John Arthur Carver

Education Fund
Robert James Ardell
In memory of Charles Daniel Bump
Don Wendell Beauchamp
In memory of Robert F. Walters
Samuel Cole Guy
In memory of Charles Daniel Bump
Charles Howard Murrish
In memory of W.K. McWilliams Jr.
Robert Ellis O'Dell
Stuart and Barbara Strife

Grants-in-Aid Fund
Bernold M. "Bruno" Hanson Memorial Environmental Grant
William Gerard Murray

David W. Worthington Named Grant
David and Beverly Worthington

Edward B. Picou Jr. Named Grant
David C. Blanchard
In memory of Gifford Kessler

Robert K. Goldhammer Memorial Grant
Mark David Sonnenfeld
In memory of Robert Goldhammer
Whiting Oil and Gas
Matching gift given by Mark Sonnenfeld

William E. Gipson Named Grant
William E. Gipson
In memory of David S. "Scotty" Holland

James A. Hartman Student Chapter Leadership Summit
Drillinginfo Inc.

Imperial Barrel Award Fund
Drillinginfo Inc.
For Latin American teams

Military Veterans Scholarship Fund
Dwight McClintock Moore

Named Public Service Fund
The Gibbs Family Endowment Fund
James A. Gibbs
In memory of David S. "Scotty" Holland

Visiting Geoscientist Fund
Leonard Ancuta

Wallace Pratt BULLETIN Fund
Charles Jacob Hoke

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

DL Speakers Set for April Tours

By LORRY RICHARDSON, AAPG Distinguished Lecture Coordinator

The AAPG's Distinguished Lecture spring tours, funded by the AAPG Foundation, continue in April and include two speakers traveling throughout Western North America.

Touring in April are:

Jeffrey A. May, retired chief geologist for EOG Resources, will tour April 15-26, visiting Billings, Mont.; Regina and Calgary, Canada; Dallas and Austin, Texas; Tulsa; and Grand Junction and Boulder, Colo.

His topic is "Mudrock Reservoirs – Why Depositional Fabric & Sequence Stratigraphic Framework Matter."

Rusty Riese, the AAPG Ethics Lecturer, will tour April 4 and April 15, to groups in New Mexico and Texas, respectively. Riese's lecture is "Oil Spills, Ethics and Society: How They Intersect and Where the Responsibilities Reside."

Specific dates and locations for the above lectures are posted on the AAPG website.

In March, five Distinguished Lecturers presented a total of 28 lectures in 17 states, including California, Colorado, Iowa, Illinois, Kentucky, Louisiana, Missouri, Montana, Nebraska, New Mexico, New York, North Dakota, Oklahoma, South Dakota, Tennessee, Texas and Pennsylvania – and Calgary, Canada. The lectures were presented to 14 geological societies and 15 universities.

Playmaker Was a 'Gusher'

By CHARLES A. STERNBACH, DPA President

All wildcats start with an idea – and then, a very passionate person (someone who *must* drill the well) convinces backers to support the project. Supporters and planners join in, and with luck the well gets drilled. Then the *real* excitement begins.

I am happy to report that Jan. 24 ushered in a gusher (in an environmentally responsible way, of course) with the success of the inaugural Playmaker Forum. This one-day event, co-sponsored by DPA and the AAPG education department, had 225 attendees, 14 speakers and a packed networking icebreaker reception with about 50 young explorers.

The program built on the premise "from prospect to discovery, professionalism leads the way."

Many traveled far and wide to hear some of the best oil finders in our business talk about prospecting skills, the art of exploration, prospecting work flows, successful plays and emerging plays.

Programs like Playmaker showcase bright spots in what Divisions can offer all AAPG members – and help fulfill DPA's goal to "empower geologists to discover energy and excel in business."

Highlights included:

- **Dan Tearpock** and **Bob Shoup** presented the lead talk, "The 10 Habits of Highly Successful Oil Finders." You can see Dan's popular video (and several others) posted on the DPA webpage at http://dpa.aapg.org/. DPA members can see additional videos after logging into the DPA site.

Special thanks to Linda Sternbach for capturing the video presentations.

- **Harold Hamm** gave the keynote address about "My Vision for U.S. Energy Independence," and then the DPA presented him with its Heritage Award, with the inscription that read in part, "Harold Hamm and his company, Continental Resources, have transformed the Bakken into a huge success ... He has inspired many geologists working for majors or as independents."

Hamm noted that two of Continental's key managers "are younger than 30 years old."

- The morning program featured foundational prospecting skills and work flows. Comparisons between conventional and unconventional projects were drawn. **Bill Maloney** (Statoil) gave three examples of how Statoil turned ideas to profits through creative oil finders and deal making, from the Gulf of Mexico to North Dakota; **Steve Brachman** (Petro-Hunt) shared strategies for "Selling your prospect," which included preparing a 30-second, a five-minute and a "full" sales presentation; and **Richard Stoneburner** (formerly president of Petrohawk) presented his new AAPG Distinguished Lecture: "Unconventional Reservoirs: A New Approach to Petroleum Geology," with examples from the Eagle Ford.

- Following the networking lunch, we focused on analog plays and emerging trends by those who know them well. Hamm spoke on great success in the Bakken and Woodford plays, and **Bill Zagorski** presented the new liquids rich portion of the Marcellus shale, commenting that AAPG President **Ted Beaumont's** talk on Exploration Creativity was particularly important for new unconventional plays. You can see Ted's video on the DPA webpage.

Shane Matson, great grandson of George C. Matson (after whom the AAPG award is named), then presented a talk on the Mississippian Lime play; **Ken Mariani** (CEO of Enervest) told how his company holds a commanding position in the Utica shale play of Ohio; and **Kirk Barrell** and **Tom Bowman** spanned the Gulf of Mexico by connecting Eagle Ford Shale in south Texas to the Tuscaloosa and Eagle Bine plays, respectively in east Texas.

- **Rick Fritz** (past AAPG executive director) presented "Geoscouts: Leveraging AAPG and DPA to Improve Your Professionalism." Rick's vision involves mobilizing AAPG's vast library resources and web links to provide key information to explorers. You also can see Rick's presentation video on the DPA webpage.

As past AAPG president **Marlan Downey** says, "Geology is a science, exploration a business." DPA members excel at both – and the Playmaker Forum showed that timing, persistence, networking, the right skill sets and, yes, AAPG and DPA can play big roles helping explorers succeed.

So thanks to our many sponsors and the AAPG staff – Norma Newby, Susan Nash, Amy Mahan and David Curtiss – for believing in this wildcatter.

Letters to the editor should include your name and address and should be mailed to Readers' Forum, c/o AAPG EXPLORER, P.O. Box 979, Tulsa, Okla. 74101, or fax (918) 560-2636; or e-mail to forum@aapg.org. Letters may be edited or held due to space restrictions.

READERS' FORUM

'Peak'-a-Boo?

Arthur Berman's commentary, "Say It LOUD: A Few Words About Peak Oil" (March EXPLORER), sure was a step backward.

For most of the last decade those who wanted a discussion on the topic and who voiced a contrary view were summarily shouted down and buried under book after book and speech after speech about how dire was the oil supply situation. When the U.S. Geological Survey published its assessment of undiscovered resources they were accused of cooking the books with inflated figures. In the era of "peaker" domination, the cost of oil ran up to nearly $150/bbl and voices could be heard signaling potential prices of $500 or more. "Be thankful it is only $150," some were heard to exclaim as they headed off to the bank.

We also ran head long into the war in Iraq, and I, for one, have always wondered just how much of the thinking behind closed doors in Washington was about securing a beachhead in the Middle East oil patch because of "peaker" warnings.

Berman says, " … we have run out of the cheap oil on which the global economy is predicated." Really? I know the Saudis' are selling their oil for $80/bbl, but what does it cost them to produce? A lot less, I can assure you.

The world seems to have adjusted to this $80/bbl oil, and therefore Berman's further statement is equally curious: "Because of the high price of oil, consumption in the United States has fallen 1.5 percent since 2005."

Hello! Wasn't there a global recession soon after 2005? I don't think oil was the cause but rather a casualty of it. Also, and this is very important, the long-term trend of energy substitution has been taking place and we are now in the era of natural gas rising in prominence – substituting mostly for coal, but also for some oil.

So where do we now stand, and what should the AAPG be discussing?

The current hydrocarbon boon is palpable and good news for the United States and the world, in the short term. But in case you haven't heard, there is a raging debate going on about climate change and the role of carbon dioxide, a certain by-product of hydrocarbon combustion.

We do not need nor can we afford a knee jerk reaction, but we do need to carry out thoughtful discussions about the role AAPG should be playing in this arena. In the 1990s my fellow cornucopians understood that in time we would move beyond oil as an energy source and much oil would be left in the ground. Wasn't it a Saudi energy minister who cautioned the industry to think of the Stone Age and stones? Clearly the lack of stones did not spell the end of that era.

The AAPG has a serious problem, however, and it's the "P" in our name. I would like to suggest that in the next several years, the AAPG consider a path for a name change.

The organization is great. The mission is well understood. And the body politic is robust. So why don't we think about becoming the AEA (American Energy Association) or the WEA (World Energy Association)? The headquarters remains in Tulsa, the constitution stays intact and an overarching focus becomes the long-term transition from where we are today to where we need to be by the end of this century. With that, the renamed organization will be strong and vital well beyond 2100.

(And think about it this way: If "peakers" turn out to be right, a name change will really need to be made.)

David G. Howell
Walpole, N.H.

An Additional Thought

Regarding the story on AAPG Honorary member Dan Tearpock's 10 good habits for success ("These Habits Are Good," March EXPLORER): I heard Dan Tearpock's talk on "Good Habits ..." at the AAPG Playmaker Forum in Houston and also read an earlier version in one of SCA's newsletters. It's a great statement about work habits.

However, there was one good habit that I recommend be added. It is:

11 – The ability to overcome adversity.

It may be one of the most critical habits one can develop to survive, do well and recoup.

George Devries Klein
Katy, Texas

Bob Jacobi

Thank you for your interview of Bob Jacobi at the University at Buffalo ("AAPG Member Tapped for Fracture Review," March EXPLORER).

I'm an admirer of Bob, and was an adviser to the now-defunct Shale Institute at UB. I was particularly disheartened that an endeavor founded to bring fact and science to a promising study area was politicized (and "celebritized") to the point of paralysis, ultimately to be sacrificed without an adequate hearing. I can only hope that lessons have been learned by the administration, and that a stronger effort in the energy field may result.

To paraphrase Edmund Burke, the only thing necessary for the triumph of ignorance is for the knowledgeable to do nothing.

Bruce Appelbaum
Houston

A Great Teacher

Regarding your story on Chris Bolhuis being named the AAPG Earth Science Teacher of the Year (February EXPLORER): Mr. Bolhuis was my geology teacher in 11th grade, and the class was always one that I looked forward to attending – partly because I enjoyed the material, but mostly because of the enthusiasm and energy that he always brought to the classroom.

He would get fired up about every lesson he taught; so much so that we students would constantly tease him about his unceasing love of rocks.

His passion did not stop at the material, either. He was always weaving valuable life lessons into his lectures. For example, he told us never to build a house on clay, because it holds large amounts of water that is then unable to drain out and therefore ends up in one's basement – a lesson he learned from experience.

He often encouraged us to not let learning stop in the classroom – advice he lived out through example. Despite now teaching at the same high school he attended as a student so many years before, Mr. Bolhuis has been to more amazing places in this country than most people would hope to visit in three lifetimes. I remember I would go to class early to gaze and ask to hear stories about the immense rock and mineral collection he houses in his classroom – most items of which he collected himself in the field.

Along with my time in class, I had the privilege of attending a geology and biology trip sponsored by my high school, which takes 23 students out west for three weeks in a school bus – on which Mr. Bolhuis was

Continued on next page

Dues Statements on the Way

By VICKI BEIGHLE, AAPG Membership Manager

All members soon will receive their dues statements for the coming fiscal year, with the reminder that payments are due before July 1.

Members with email addresses on file also will receive an announcement and link to immediately remit payment online.

Renewing your membership in AAPG is good for the Association, but more importantly it is an easy and smart decision that can lead to one of the best investments of your career.

AAPG, via our publications, conferences and educational opportunities, continues to disseminate the most current geological information available. Our code of ethics and commitment to professionalism, advocacy and networking ensure our members are among the industry's best.

And we provide a wide variety of benefits and services to enhance your membership as well as your career.

* * *

There are several important details of the dues process for members to consider:

- Continuing a system started with last year's statements, **graduated dues options** remain available to qualifying members. This information, however, will not be listed on the dues billing – the reduced rates are easily accessible online, or members can contact our office to request the required/designated form.

- **Member cards/receipts** are provided upon request. To make your request, just check the appropriate box – clearly displayed and easily found on the form – whether remitting payment via mail or online.

- This is an excellent time for qualifying members to consider taking advantage of the **AAPG Emeritus Member** designation.

Emeritus members save 50 percent on AAPG and DPA (certification) dues, as well as retain all privileges, benefits and advantages as a Member.

But you can be an Emeritus member only by request. To be eligible, you must:

✓ Be a Member (formerly known as Active class) in good standing with the Association (dues must be current).

✓ Be at least 65 years of age.

✓ Must have been a member of AAPG for 30 years (regardless of class).

To request a transfer and/or inquire of eligibility, contact Member Services at members@aapg.org; or via phone – U.S. and Canada call toll free at 800-364-2274, and all others should call 918-584-2555.

Remember, by continuing your membership, volunteering within the organization and voting in Association matters, you are positively impacting the future geoscience community.

Thank you for your continued support and dedication to the organization, science and industry.

Continued from previous page

one of two instructors. We visited many of America's National Parks to learn about their biology and geology.

Throughout the trip, I was able to grow closer to Mr. Bolhuis and learn that he was not only a passionate instructor, but also an outstanding mentor and someone I could look up to. Since that geology class and the summer program, Mr. Bolhuis has played a big part in influencing my life-long goals and values as well as my decision to attend college at the United States Air Force Academy and subsequently pursue a career in the military.

Jason Pluger
Hudsonville, Mich.

Texas A&M University at Qatar
Petroleum Engineering Program
Education City, Doha, Qatar
Position for Petroleum Geologist

The Petroleum Engineering Program of Texas A&M University at Qatar (TAMUQ) (http://pete.qatar.tamu.edu/Pages/default.aspx) invites applications for the position of assistant, associate or full professor in Petroleum Geology at the TAMUQ campus, Doha, Qatar. The anticipated start date is September 1, 2013. This appointment initially is a two-year renewable contract; faculty are eligible for a long-term rolling contract after a probationary period.

The sought faculty member will be expected to: (1) teach required core-curriculum geology courses for petroleum engineering; (2) co-teach the senior-design petroleum engineering project course, PETE400; (3) teach additional geology courses for students seeking a minor in Geosciences; (4) establish an externally funded research program in geoscience; (5) contribute to the establishment of a geoscience major if and when the decision is made to begin a program; and (6) provide additional service to the Program, University, and community as appropriate.

Texas A&M at Qatar (TAMUQ) is a partnership with Qatar Foundation, and is based in a modern 595,000 square-foot building completed in 2007. TAMUQ offers undergraduate degree programs in Mechanical, Electrical, Chemical, and Petroleum Engineering. The programs attract many of the best high school graduates in the region. The ABET-accredited Petroleum Engineering Program (http://pete.qatar.tamu.edu/) currently has 8 faculty members. The program benefits from state-of-the-art facilities and instrumentation in support of its educational and research missions.

Applicants must have an earned doctorate in geology and experience in petroleum geoscience or a related area. The successful candidate is expected to have a strong commitment to teaching excellence at the undergraduate and graduate levels, and a demonstrated research capability that will enable the candidate to develop an independent research program and publish in leading scholarly journals.

TAMUQ offers a competitive salary package commensurate with rank and experience. The package includes 12-month salary, overseas salary premium, housing, annual home leave allowances, dependent education, local transportation allowance, medical insurance, plus appropriate relocation and repatriation expenses.

Candidates should submit applications electronically (a single PDF file consisting of cover letter, CV, 1 pg. teaching philosophy, 1 pg. research philosophy and plans, 3 journal publications, and list of 3 references) to:

Dr. Vassilios C. Kelessidis
PETE Chair Search Committee
Texas A&M University at Qatar
Education City, PO Box 23874, Doha, Qatar
+974-4423-0657
Vassilios.kelessidis@qatar.tamu.edu

Review of applications will begin immediately and will continue until the position is filled.

Texas A&M University is an Affirmative Action/Equal Opportunity Employer. The university is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment, and strongly encourages applications from women, minorities, individuals with disabilities, and covered veterans. Employer paid advertisement.

DPA

from page 50

wiki-type, web-based service for AAPG members (sponsored by DPA), as a way to mobilize AAPG's vast library of resources to provide key information to explorers.

Volunteers will be needed to add insightful commentary to geologic information. You can learn more by watching a video of Rick's talk on the DPA webpage.

▸ Member recruitment.

Rick Fritz also chairs DPA's Membership Committee, and he is recruiting AAPG leaders who are not yet DPA members with great success.

DPA President-Elect Val Schulz plans to attend the AAPG European Regional Conference in Barcelona, Spain, this April. European AAPG members take note: DPA has reciprocal membership agreement with the Geological Society of London. DPA also has reciprocal agreements with SIPES and AIPG. DPA is recruiting young professionals as soon as they are eligible to join. Our online member application (dpa.aapg.org/certification.cfm) and a new instructional video to help guide you through the process makes joining DPA quick and easy.

▸ Long-Range Planning Committee.

DPA plans to chart our long-term course (20 years out) so that our business plan (three-five years out) can help us achieve maximum benefit to all members here and now.

* * *

Each year DPA brings new leadership, fresh ideas, energy and value to our members. This will be my last column in the EXPLORER, but as your DPA president for three more months I plan to solidify DPA's gains on global growth, improved member services, government affairs, stellar convention programs, continuing education courses, one-day events and career guiding publications.

During this busy quarter I look forward to presenting talks, chairing sessions, hosting Discovery Thinking forums, and listening to DPA and AAPG member ideas. Linda and I will travel to Fredericksburg, Texas, for the Southwest Section annual meeting, to Pittsburgh for ACE, to Washington, D.C., for Congressional Visit Days and to Cartagena, Colombia, for ICE.

Mike Halbouty reminded us that a geologist should leave his heritage better than he found it for his successors. That is our promise to keep – and DPA intends to keep our promises.

I am privileged to serve with DPA's Executive Committee: President-Elect Val Schulz, Past President Marty Hewitt, Vice President Paul Pause, Treasurer Debbie Osborne and Secretary Mark Gallagher, committee chairs (12), DPA councilors and alternates (36), the AAPG Advisory Council (17) and AAPG headquarters Division manager Norma Newby. Please join me in thanking these wonderful people when you see them at future AAPG events around the globe.

CLASSIFIEDADS

POSITION AVAILABLE

Open Position,
Brigham Young University

The Department of Geological Sciences at Brigham Young University invites applications for a tenure track Professorial Faculty position beginning as early as January of 2014 in the following areas: fine-grained clastic sedimentology, methanogenesis in unconventional reservoirs, and economic geology. An interest and ability to contribute to our summer field course is a plus. A Ph.D. at the time of appointment is required. Implementation of a vigorous, externally funded research program is required. The successful candidate will teach undergraduate and graduate courses in their area of expertise as well as introductory geology courses as assigned.

Excellent research infrastructure exists within the department, including laboratories and field equipment that support a wide-range of geophysical, geochemical, isotopic, petrologic and petrographic studies. Excellent computational facilities are also available within the Department and University.

The Department consists of 12 professorial faculty and 3 professional faculty, and offers B.S. and M.S. degrees. Research areas include petroleum geology, continental magmatism, geophysics (shallow and deep), structure and tectonics, stratigraphy, paleontology, planetary geology, mineral surface chemistry, hydrogeology, and climate studies.

Interested applicants should fill out an online application at:
https://yjobs.byu.edu

At this site, please also attach a curriculum vita, graduate transcripts, a statement of research experience and goals, a description of teaching philosophy, and the names and contact information for three references.

Brigham Young University, an equal opportunity employer does not discriminate on the basis of race, color, gender, age, national origin, veteran status, or against qualified individuals with disabilities. All faculty are required to abide by the university's honor code and dress and grooming standards. Preference is given to qualified candidates who are members in good standing of the affiliated church, The Church of Jesus Christ of Latter-day Saints.

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Houston, Texas USA

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CANADA EXCELLENCE RESEARCH CHAIR IN GEOFLUIDS IN SEDIMENTARY BASINS

Department of Geological Sciences and Geological Engineering
Faculty of Arts and Science and Faculty of Engineering and Applied Science

Queen's UNIVERSITY

One of Canada's leading universities, Queen's has a long-standing reputation for academic excellence, research, and a diverse and vibrant learning environment. With its strong tradition of public service, the University has helped to shape Canadian values and policies, educating notable political and cultural figures.

Queen's University is located in the heart of the community in historic Kingston, midpoint between Montreal, Toronto, and the nation's capital.

Queen's University is seeking an outstanding individual to take up a Canada Excellence Research Chair in GeoFluids in Sedimentary Basins. The CERC will be awarded to a world leading researcher, with selection based on the highest standards of research excellence. The CERC program dedicates $10 million over seven years to each chair holder and his/her research team, to support the pursuit of excellence in research (www.cerc.gc.ca/hp-pa-eng.shtml). In addition, the incumbent will be provided with the opportunity to make an application to the Canada Foundation for Innovation (CFI) program (www.innovation.).

The CERC holder will complement existing strengths by examining the details of fluid-rock interactions on all scales, from modeling large scale fluid flow in (hydrocarbon-bearing) sedimentary basins, to the origin and character of both mineralizing and barren fluids associated with energy-related commodities, to the pressure and chemical evolution of strata-bound fluids during earth history and into the future, to geochemical interactions between fluids and both natural and engineered materials. The Chair holder would focus on one, or both, of two major themes: (1) Energy and Mineral Resources (fluid evolution of sedimentary basins that potentially host petroleum and mineral deposits and exploration for buried deposits in basins); (2) Protecting and Managing the Environment (assessing element cycles in the environment that involve basins on all scales, or evaluating factors that affect waste disposal in sedimentary basins).

The successful candidate will be required to maintain a leading-edge research program, take a leading role in developing the GeoFluids program at Queen's, actively engage with industry, supervise graduate students, teach undergraduate and graduate courses, and make administrative contributions through service to the University, Faculty, and Department. Candidates must hold a relevant Ph.D. degree and have a demonstrated excellence in research, teaching and training of highly qualified personnel. Established research collaborations with industry and engagement in public policy will be considered an asset. Registration as a Professional Geoscientist or as a Professional Engineer in Ontario, or eligibility to acquire registration in Ontario is strongly encouraged.

Interested applicants are directed to the full details of the advertisement at:
www.queensu.ca/geol/department/employment.html

Applicants should send their curriculum vitae, contact information, the names of three referees including their contact information, along with a statement of research and teaching interests, and three examples of relevant publications to:

Dr. Cynthia Fekken, Chair, CERC GeoFluids Appointment Committee
Associate Vice-Principal (Research), Office of the Vice-Principal (Research)
251 Richardson Hall, Queen's University, Kingston, ON, Canada K7L 3N6
By email: fekkenc@queensu.ca

Review of applications will begin on April 1st, 2013. Applications will be accepted until the position is filled.

The University invites applications from all qualified individuals. Queen's is committed to employment equity and diversity in the workplace and welcomes applications from women, visible minorities, aboriginal people, persons with disabilities, and persons of any sexual orientation or gender identity. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents of Canada will be given priority. The academic staff at Queen's is governed by a collective agreement between QUFA and the University, which is posted at www.qufa.ca.

www.queensu.ca

DIRECTOR'S CORNER

AAPG and OTC: Advancing Offshore Science

By DAVID K. CURTISS, AAPG Executive Director

These days all the talk about resource plays and the boomtown atmosphere in places like Williston, N.D., and Midland, Texas, has shifted focus away from the offshore.

But worldwide offshore E&P remains a vibrant sector of the petroleum industry – and the upcoming Offshore Technology Conference (OTC) 2013 in Houston May 6-9 provides a great opportunity to see that first hand.

If you've never been to OTC, prepare to be amazed. The size of this premier offshore industry event is remarkable. Last year over 89,000 people attended, visiting exhibitors who covered more than 640,000 square feet of exhibit space.

As you walk from pavilion to pavilion at the Reliant Center in Houston you get a sense of the massive scale of this sector of the industry.

* * *

OTC was launched in 1969 as a multi-society collaboration. It includes 13 sponsoring organizations and two endorsing and several supporting organizations. AAPG is one of the founding sponsors.

OTC is managed and run by the Society of Petroleum Engineers (SPE) and led by a board of directors representing the sponsoring organizations. AAPG is fortunate to have Cindy Yeilding, VP of Gulf of Mexico exploration for BP, serving as our representative on the OTC Board.

In addition to the large number of exhibits at OTC there is a robust technical program that spans all aspects of offshore activity, from naval architecture to geoscience.


CURTISS

> As you walk from pavilion to pavilion you get a sense of the massive scale of this sector of the industry.

The OTC AAPG technical sub-committee is chaired by Buford Pollett of McDermott Middle East Inc., in Dubai. He and his committee members have worked hard to develop a geoscience technical program that advances new scientific understanding and technologies.

These technical sessions also provide a great opportunity for non-geoscientists engaged in the offshore sector to learn more about our part of the industry.

Geoscience sessions at OTC 2013 include:

✓ Offshore geotechnical engineering.
✓ Advances in submarine slope stability.
✓ Emerging trends and technologies in the marine geohazards arena.
✓ Ocean mining.
✓ Advances in geohazard assessment.
✓ Unconventional subsea resources exploration and mining techniques.
✓ Geoscience developments.
✓ Integrating stakeholder interests in the global offshore industry.
✓ Advances in sub-salt geoscience.
✓ Near-surface expression of petroleum seepage (two sessions).

In addition, there is a panel discussion on the global energy outlook and several AAPG members presenting as special speakers:

- DPA past president **Dan Tearpock** is one of two speakers at the Monday morning ethics breakfast titled, "Ethics in the Dynamic Offshore Industry."
- Past OTC board chair **Susan Cunningham** is the featured speaker at the Wednesday luncheon, speaking on "Business Innovation: A New Voyage for Independents."

My thanks to the many speakers who have agreed to present at OTC this year. And special thanks to the AAPG technical sub-committee for developing and championing such a diverse and interesting set of sessions.

* * *

In addition to OTC in Houston, the organization has developed several regional OTC events to showcase offshore science and technology in other parts of the world.

- **OTC Brasil** is scheduled for Oct. 29-31 in Rio de Janeiro. This event is jointly organized by OTC and IBP, the Brazilian Petroleum Gas and Biofuels Institute, and features the many exciting advances that have been made in the Brazilian offshore.
- The **Arctic Technology Conference**, managed by AAPG on behalf of the OTC partnership, has been running for several years. The next meeting is scheduled Feb. 10-12, 2014, in Houston, and is a focused event dealing with the opportunities and challenges of exploration and production in the Arctic.
- Finally, OTC is launching a new event in Asia in 2014: The inaugural **OTC Asia** is scheduled March 25-28, and will be held in Kuala Lumpur. The conference theme is "Meeting the Challenges for Asia's Growth."

* * *

AAPG is proud to be part of OTC and to contribute to broadly advancing the science and technology of offshore E&P with our partner societies. I plan to be at OTC 2013 in Houston and hope you will plan to join me. Make sure to stop by the AAPG booth to say hi.

Until then, keep exploring.

DIVISIONS REPORT

DPA Riding Wave of Momentum

By CHARLES A. STERNBACH, DPA President

In 2006 I had the privilege to serve as the general chairman for the AAPG Annual Convention and Exhibition in Houston. I believe every conference should have a meaningful theme to communicate common vision, and ours was "Perfecting the Search – Delivering on Promises." We merged Mike Halbouty's phrase "Perfecting the Search" about doing better science, with Pete Rose's phrase "Delivering on Promises" about solid business practices.

These phrases resonate to me today about the core of DPA: good science, practical business, keeping promises.

DPA delivered on our promise to create a new high-impact program on prospecting skills and networking by creating January's inaugural Playmaker Forum in Houston, a one-day event co-sponsored with the AAPG education department that boasted 225 attendees, 14 speakers and a packed networking reception with about 50 young professionals. (See related story, page 45.)

Playmaker debuted two weeks before NAPE for maximum impact and relevancy. Playmaker also raised funds toward DPA's financial support of AAPG's GEO-DC office – another promise kept!

DPA now moves forward with renewed mission and energy around our core beliefs. We created new momentum around prospecting skills and networking. For most DPA members, these topics are central to their passion, talents and economic drivers (see DPA column, July 2012 EXPLORER). And we are not done yet.


STERNBACH

> These phrases resonate to me today about the core of DPA: good science, practical business, keeping promises.

DPA Initiatives

- **Webpage updates.**

Web Committee chair Linda Sternbach has added video content to our site (dpa.aapg.org) to expand the reach of programs like Playmaker.

From Playmaker we have added highlight videos of Dan Tearpock's talk, "10 Habits of Highly Successful Oilfinders," Ted Beaumont's "Creative Petroleum Exploration" and Rick Fritz' "Geoscouts: Leveraging AAPG/DPA to Improve your Geoscience."

Videos are now posted on the DPA webpage making valuable content accessible on demand, throughout the year and around the globe "at a computer near you." The webpage also makes joining DPA quick and easy, with a new instructional video on how to guide new members through the process.

- **Discovery Thinking (DT) forums.**

As an organizer of these events (eight times), I know them well. We estimate about 5,000 seats have been filled for them at AAPG ACE and ICE conventions – and by posting DT talks on AAPG's *Search and Discovery* website we have achieved 15,000 hits, already reaching a global audience at least THREE TIMES the original participants.

We plan to build on the success of these programs up to 2017 (AAPG's 100th anniversary) with the help of wonderful people like Ed Dolly and Paul Weimer. Look for upcoming Discovery Thinking forums at AAPG ACE in Pittsburgh on May 19 and AAPG ICE Cartagena Sept. 10.

- **GEO-DC.**

Edie Allison, the director of our GEO-DC office in Washington, D.C., has scheduled the next Congressional Visits Day (CVD) for April 16-18. Linda and I plan to attend, and we welcome you to join us!

The GEO-DC office also plans exciting forums for upcoming meetings in Pittsburgh and at the inaugural URTeC conference, set Aug. 12-14 in Denver (see related story, page 28).

- **Reserves Forum.**

Education Committee Chair Bob Shoup and the Reserves and Resources Committee co-chairs Jim Coleman and Leslie O'Connor are planning a one-day course on reserves. This will help many DPA members engaged in the proper reporting of reserves and resources.

The program is currently planned for the fall of 2013, in preparation for year-end reserves reporting.

- **Heritage II publication.**

DPA has reprinted our popular book "Heritage of the Petroleum Geologist," which is filled with stories and career advice from some of the best oil finders in the business. You can receive a copy as a gift as a new member of DPA or from the AAPG bookstore.

The original editors (Bob Shoup, Deborah Sacrey, Rick Nagy and yours truly) are planning "Volume 2," to include many more international legends and role models.

When completed, the two-volume set will feature 100 inspiring geologists in time for AAPG's 100th anniversary in 2017!

- **Geoscouts.**

Rick Fritz (former AAPG executive director) envisions "Geoscouts," a new

See **DPA**, page 48