AAPG EXPLORER
MARCH 2012

Treasure Chest

Irish coast reveals valuable clues

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AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AN INTERNATIONAL ORGANIZATION

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March 2012

AAPG EXPLORER

PRESIDENT'S COLUMN

Budget Matters Revisited

By PAUL WEIMER

My co-author for this month's column is Jim McGhay, AAPG Treasurer. Later this month, you will receive your dues statement, where there are two items that might attract your attention. We address them here.

In our October 2011 column, we reviewed the state of the AAPG budget, endeavoring to explain the causes of its cyclicity and what the Executive Committee must do to redress budget shortcomings.

As the EC and HQ staff have been analyzing our budgets during the past six months, it has become painfully apparent that our Association must find new ways to pay for the products, services, and programs – in quantity and quality – that we all have come to expect from a world-class organization. Of course, the alternative is to speak the unspeakable – cutbacks that, in seeking to preserve value, actually reduce it.

Contrary to some members' perceptions, we do not have vast stores of excess funds sitting idle that can be used to balance the budgets. Yes, we have our investment portfolio, ably managed by the Investment Committee, which is considered the AAPG's rainy-day fund to ensure the long-term financial viability of our organization in case of emergencies. The primary goal of the fund is to maintain at least one year's worth of operating capital. Right now, the emergency fund holds less than that – $15M in operating funds, $17M in operating costs. So, as you can see, there are in fact no truly accessible stores of cash on which to draw.


WEIMER

Two ways to address the need for revenue are by increasing dues ... and our service fees ... and now some positive news for future budgets!

As we wrote in October, two ways to address the need for revenue are by increasing dues, affecting all of the membership somewhat equally; and by increasing our service fees, which are paid directly by the individual and thus a choice that is separate from membership dues. In January, the Executive Committee voted on these two issues. Here are the details of the results.

Dues:

The Executive Committee is always and rightfully reluctant to raise dues; this act is not only unpopular, but affects us personally. During the past two decades, dues have increased about every three years for an average of about 3 percent/year, essentially keeping pace with inflation. However, services have continued to increase disproportionately even more than dues. Dues amounts to only 13 percent of the Association's total revenues, but it does represent one method of assisting with the balance of revenue and expenses. Therefore, to bring services and dues back into equilibrium, the EC has decided to raise the basic member dues from $90 to $105. This increase will help your Association in avariety of ways.

Printing and Shipping Costs:

One budget item, which has been out of sync with its actual cost for several years, is the cost of printing and shipping the BULLETIN. This is especially true with the availability of this journal in digital form and the continuing decrease in the number of members requesting the printed copy. So, increasing the "hard copy" printing and mailing fees for the BULLETIN is another area that must come closer to "actual costs."

Our bylaws state that all members will receive the BULLETIN as part of their yearly

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Ballots Mailed, Voting Opens for AAPG Election

Ballots have been mailed and voting begins this month in the election of new officers for the AAPG 2012-13 Executive Committee.

Voting will remain open through May 15.

To assist in the voting process, a special AAPG candidate insert has been included in this 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 AAPG Leadership Days event in Boulder, Colo., remain available on the AAPG website.

The president-elect winner will serve in that capacity for one year and will be AAPG president in 2013-14. The vice president-Sections and secretary will serve two-year terms, beginning July 1.

The slate is:

President-Elect

❒ **Donald D. Clarke**, geological consultant, Lakewood, Calif.

❒ **Lee Krystinik**, Fossil Creek Resources, Arlington, Texas.

Vice President-Sections

❒ **Thomas E. Ewing**, Frontera Exploration Consultants, San Antonio.

❒ **Kenneth E. Nemeth**, Schlumberger Seismic Reservoir Characterization, Houston.

Treasurer

❒ **Rebecca L. Dodge**, Midwestern State University, Wichita Falls, Texas.

❒ **Deborah K. Sacrey**, Auburn Energy, Houston.

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REGULAR DEPARTMENTS

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


Photo courtesy of Ole Martinsen

ON THE COVER:

It's a beautiful sight and, for geoscientists, a valuable part of the earth: The Carboniferous Ross Sandstone as seen southeast of Loop Head lighthouse, County Clare, western Ireland. The Ross Sandstone contains turbidite channels and lobes deposited in a distributive submarine fan – and here, bedding is predominantly tabular and bedding planes are locally exposed on the limb of an east-west trending Variscan fold. The cliff is approximately 40 meters (131 feet) tall. Photograph by David Pyles.

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Do You Have a Favorite Geoscience Paper?

AAPG will celebrate its 100th anniversary in 2017, and there are a number of projects planned to commemorate our centennial – including an initiative to develop a list of the "top 100" geoscience papers.

We are looking for papers that really made a difference in how we think, view things and do things – papers that changed paradigms. Although a number of committees have been created to solicit and review papers in different geoscience sub-disciplines, we are seeking input from our broader membership for this important project.

The papers do not have to be AAPG articles and could have been published in any geoscience journal. They should, however, bear relevance to the petroleum geosciences.

Do you have a favorite paper, a paper that made a difference in how you think or approach problems or in your fundamental understanding of the geosciences?

If so, please send an email with your list of "papers that made a difference" to 100papers@aapg.org.

In addition to the title and organization that originally published it, please include a short summary, including what geoscience sub-discipline it is relevant to, and why it should be a "top 100" paper.

Considerations when nominating a paper include:

- The significant contribution made.
- The change it made in how we think or do geoscience.
- The paradigm it changed (if any; not all papers worthy of being nominated necessarily created a paradigm shift).
- The breadth of application of the contribution (regional or global).
- Evidence of how this contribution has made a lasting impact.

Each of the papers ultimately chosen to be in the "top 100," along with a short summary or chart indicating why it is a "top 100" paper, will be published on a digital media and given to all 2017 – 100th anniversary ACE and ICE attendees.

President
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dues. In early 2004, the EC decided to make the digital version of the BULLETIN the default method for distribution. Any member who chose to receive the BULLETIN by hard copy was expected to pay for its extra cost. Unfortunately, this policy was never fully implemented. Currently, 80 percent of the shipping costs are still being absorbed by the Association; starting in July, however, these costs will be switched to those who choose to receive a hard copy of the BULLETIN. As a consequence, the EC voted to increase the shipping fees by $50/year. Increasing the shipping costs for those members who receive the hard copy BULLETIN will raise about $40,000 for the budget. With this policy, AAPG joins many other professional societies who faced the same issue with printing costs, and reached the same conclusion.

* * *

And now some positive news for future budgets! In early January, the executive directors of the AAPG, SPE, and SEG signed a Memorandum of Understanding to co-sponsor a new annual convention, titled the "Unconventional Resource Technology Conference (URTeC)." AAPG will act as the convention operator. The purpose of this meeting is to host an integrated, multidisciplinary science and technology event for onshore unconventional plays. Extensive floor displays will include all aspects of the science and technology behind the development of unconventional resources. The technical programs will highlight the interdisciplinary nature of the plays.

The first URTeC is scheduled for August 2013 in Denver. Several people have spent substantial time working on developing the structure and the organization of this conference, specifically Rick Fritz, Alan Wegener, David Lange, and David Curtiss. This convention is the newest program that has high upside potential for expanding our annual income. Needless to say, we are excited. Now the real work begins as we start to assemble the entire conference for its inaugural event.

* * *

At the Annual Convention and Exhibition on April 22, the AAPG will recognize the significant achievements of many of its members at the Awards Ceremony. We also wish to acknowledge here one group that goes unrecognized and is vital to the daily operations of AAPG – the AAPG staff. We have more than 70 employees working in five broad directorates: Communications, Finances, Global Development and Conventions, Geosciences, and Education. Within each directorate, we have two-four additional groups. In addition, we have three regional offices (London, Singapore, Dubai). All told, that is a lot of moving parts.

We have worked with many different professional societies, and one of the real strengths of the AAPG is the dedicated headquarters staff that has worked together for many years. Continuity like this can be rare in large professional associations, and it allows us to have extended success with good historical memory for the Association. For those of you who attend the annual convention in Long Beach this year, please take the time to say "thanks" to those staff who will be working there. They are a vital part of our Association, and we want to acknowledge them for their dedicated service.

Paul Weimer

Where would we be without shale plays?

Shales' Complexity Boosts Seismic Activity

By LOUISE S. DURHAM, EXPLORER Correspondent

Midst all the dismay triggered by the Macondo well's disastrous blowout in April 2010 in the Gulf of Mexico, something significant was evolving onshore that would prove to be the economic salvation for a number of industry participants.

The burgeoning unconventional onshore resource plays, principally shale, had begun shifting gears.

Players increasingly were becoming convinced that a shale is not just a shale to be drilled and produced in cookie cutter style. Instead, they are highly complex and variable rocks, often causing production to differ between wells in the same field.

Recognition of the need to define and understand this complexity was a clarion call for the seismic companies.

Indeed, seismic data rapidly became an essential ingredient in the operators' efforts to understand the risks and nuances of these shales, be they dry gas, oil or gas liquids producers.

"It's been recognized for maybe a couple of years that 3-D seismic data can play an important role in shale plays," said AAPG member Robert Hobbs, CEO at TGS-NOPEC Geophysical Co. S.A., in Houston. "We've been able to demonstrate that seismic data can be processed and analyzed such that you can interpret sweet spots in shale sections."

"I shudder to think where we'd be if shale plays weren't here," Jim White, CEO of F.T. Seismic Support, commented late in 2010.

World Region Crew Counts

	Seismic Jan. 15, 2012			Working Month Ago	Working Year Ago
	Work	Avail	Total		
Africa	54	25	79	54	72
Canada	13	27	40	13	21
CIS	46	10	56	47	47
Europe	39	9	48	39	29
Far East	67	11	78	67	69
Middle East	33	16	49	33	33
Latin America	34	8	42	34	43
United States	69	7	76	69	64
Totals	355	113	468	356	378

Counts for the CIS are based on partial data. There are an estimated 340 crews currently working in the CIS. Far East counts include only partial data for China and India.

"There would be hardly any work going on." White is former chairman of the International Association of Geophysical Contractors.

He reiterated this observation recently, emphasizing that "without shale plays we'd be in a difficult situation right now."

Teamwork – And Surviving

The proverbial fly in the ointment is that the big shale boom originated with shale gas. Before long, the industry watched somewhat aghast as gas prices came tumbling down as production volumes surged, creating a huge imbalance in supply and demand.

"Net-net is, the industry has produced itself – as we often do – into a low price environment for natural gas," said Bob Peebler, executive chairman at ION Geophysical Corp., which specializes in the equipment and processing parts of the business.

As a result, there's been a rapid adjustment among certain operators who not only have cut back their gas production but, in many instances, shifted to the oil and gas liquids-prone areas such as the Eagle Ford in Texas.

Even so, the wells that are not oil but gas liquids are producing gas themselves in some amounts.

"The industry will adjust and catch up with itself," Peebler predicted.

In the unconventional world of shales, steep decline curves are part of the package, placing an emphasis on the need for productivity.

"There clearly is increased emphasis – not only in the mechanical aspects of completing these wells but (also on) the geophysics and geologic aspects of where to drill and how to be more precise in designing completions," Peebler noted.

That drumbeat is still beating.

"There are a lot of people in that game, ourselves included, that are looking at the science; we think it will be a substantial area of growth," he emphasized.

"For us in the geophysical business, we're having to adapt to an understanding this is mainly an engineering problem, and we're helping them understand the reservoir more from an engineering point of view," Peebler said.

"It's how does the reservoir (fracture)? Where are the natural (fractures)? What is the rock brittleness? It's getting more into this idea that a shale is not a shale, and where it appears the same in two wells, they can produce differently," he explained.

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Gulf Lease Sale Should Spur Activity

The Obama administration has announced that the Bureau of Ocean Energy Management will hold the consolidated Central Gulf of Mexico lease sale 216/222 June 20 in New Orleans.

That is a very, very big deal.

To prepare, oil companies need high quality seismic data, e.g. wide azimuth, to evaluate open blocks that will be available for the license rounds. This is good news for companies like TGS, which have data libraries.

"The moratorium not only affected drilling but indirectly seismic activity as well, because it was hard to get pre-funding for new seismic surveys in the deepwater Gulf," said AAPG member Robert Hobbs, CEO at TGS in Houston. "It's more cumbersome even now to get a permit out there.

"But I think we'll see activity ramp up in the deep water.

"Our customer base hasn't changed," he emphasized. "They believe in the potential of the deepwater Gulf and believe whatever new regulations may come out of the government will be manageable.

"In December, we announced our first new wide azimuth program in the Gulf since Macondo," Hobbs said. "We call it an orthogonal wide azimuth program where we're shooting 90 degrees to a previous wide azimuth we acquired.

"We're processing both of those wide azimuth data sets as one survey, going from wide azimuth to more full azimuth – not totally but getting close," he noted.

"In the marine business, a lot of the technology is directed to how we can capture more azimuths in the subsurface to image around more and more complex geology," he continued. "As you acquire more and more azimuths, your challenge is how do you process all that data because you're increasing by orders of magnitude the amount of data you're acquiring.

"We put our R&D dollars into developing processing algorithms and in investing in compute power that enables us to do that."

Bob Peebler, executive chairman at ION Geophysical Corp., said he sees a trend toward the more high-end seismic, such as wide azimuth surveys, being acquired as spec from the get-go.

"I also believe exploration budgets are going up," Peebler said. "When they go up, that means the companies will spend more for geophysics and so the capacity could tighten up this year."

– LOUISE S. DURHAM

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"Without that, I don't think seismic could survive in this low price environment."

Onshore Multi-Client Surveys

A significant change brought on by the need for onshore seismic is the popularity surge for multi-client surveys on land where the norm has been proprietary shoots.

Some of the shale plays have a huge geographic extent with numerous operators – and numerous landowners – and individual proprietary shoots would break the bank, so to speak.

Peebler emphasized that the multi-client trend has to be driven by oil companies wanting to underwrite geophysical surveys.

ION has become involved in fairly significant activity on North American land and expects more to come. Among other programs, the company recently managed and executed a 200 square mile 3-D program in the Marcellus Shale.

"The multi-client business model onshore has taken off in areas such as the Marcellus (and) the Utica in Ohio," Hobbs said. "The Marcellus has been a boon for multi-client opportunities onshore."

TGS recently made its first foray into the onshore unconventional scene. Its business model entails assembling multi-client projects and chartering other companies to acquire the data.

TGS' initial move to onshore shale came in 2011 with its announced entry into the Utica Shale play, where a sizeable survey is planned to top out at almost 800 square kilometers. It awarded the acquisition to Tideland's Geophysical Services.

"From the get-go we decided to focus on liquids plays – wet gas and oil – with a strong feeling we'd get increased customer interest in that," Hobbs said. "The Utica has a lot of liquids, oil, wet gas."

Besides the Utica, Hobbs said they're looking at the Mississippi lime play in the Kansas area and plan a couple of projects in that region to kick off this year.

At press time a 280 square mile survey was under way in southern Kansas.

Seismic and the "F" Word

None of this would be happening without hydraulic fracturing, which is crucial to be able to fracture these dense rocks so the hydrocarbons can be produced.

Yet fracturing has become a dirty word in some sectors of the United States and elsewhere – including overseas, where

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3-D vs. 2-D Survey Summary (January 2012)

	4-D	3-D	2-D	Unknown	Total
Africa	0	22	11	3	36
Canada	0	9	4	0	11
CIS	0	4	35	4	43
Europe	0	9	6	2	17
Far East	0	16	16	2	34
Middle East	1	14	5	8	28
Latin America	0	11	7	0	18
Sub-Totals	1	83	84	19	187
Africa Offshore	1	15	2	0	18
CIS Offshore	0	2	2	0	4
Europe Offshore	0	19	3	0	22
Far East Offshore	0	22	10	1	33
Middle East Offshore	0	3	1	1	5
Latin America Offshore	1	11	3	1	16
Sub-Totals	2	72	21	3	98
Totals	3	157	105	22	287

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France banned it in all corners.

"The (hydraulic fracturing) question is a real paradox," Peebler said. "In North America, the momentum is so strong for natural gas and the job creation, I can't imagine places like Ohio, Pennsylvania and others pulling back.

"To me, water contamination isn't the issue – it's water conservation and how we become more efficient in using and recycling water," he emphasized. "A lot of us have to focus on that, and it will get better and better."

The manner in which a hydraulic fracturing job is approached is primarily based on seismic imaging, according to White.

"Negative press on (hydraulic fracturing) will have a negative impact on seismic because of the extended nature of the oil and gas business," he said.

The negative impact begins early on.

"When a group of citizens protest (hydraulic fracturing) and we come along and try to permit those same people to do seismic exploration, the reception will not be pretty," White said.

Impact on Unconventionals

Seismic data acquisition efficiency is a big deal for the onshore, which historically has been under-sampled. Getting good geophysical measurements in this environment is difficult – and expensive.

Technology advances are the driving forces that have enabled success in the unconventional plays.

Currently, there apparently are no jaw-dropping new technologies on the cusp of a splashy debut. Still, there's plenty to be accomplished with the available, relatively new high-tech tools already spurring efficiencies in the market.

Wireless, or cable-free, acquisition systems still are relatively new and have proved their worth commercially.

"Wireless technology is being put out to the general market, and the best thing is there's some commerciality to it," White said. "It's not prototypes.

"This is good for the seismic sector," he continued, "because their viability, dependability and increased efficiency over conventional systems bodes well for margins and success rates of some of these seismic companies.

"We all have access to this technology, so that levels the playing field."

Regarding onshore action on the international scene, Peebler views the next logical place for seismic data applications to be Europe. ION is conducting a land Span program in Poland, to try to understand the basin geology for the shale plays. The plan is to begin with a scientific approach.

Don't expect to see much activity in France, which has banned any and all hydraulic fracturing. In a bit of irony, French company Total S.A. recently inked a joint venture deal to team with Chesapeake in the latter's Utica shale action.

Conventional Results? 'Huge'

Unconventional activity clearly has a lock on sex appeal. Even so, conventional work has not gone the way of the dodo bird.

"Where we're seeing the greatest activity on land is the Middle East where we have desert shooting," Peebler said. "Areas like Nigeria, Saudi Arabia and Oman are still quite active. Libya was active, but I don't know if it will come back this year.

"The main trend in the Middle East is huge mega-surveys," he said, "100,000 station kind of surveys.

"The size of the crews has grown substantially over the last few years," he noted. "We're now seeing super crews. Part of that is with super crews you can collect an enormous amount of 3-D quickly – that means cheaply.

"The oil companies want to collect a lot more for less," Peebler said. "The total cost of the survey may be up, but they're getting enormous amounts of data – terabytes of data a day. It's huge."

As for the offshore international arena, TGS just announced a large 3-D survey offshore Angola, and Hobbs said they see a lot of opportunities overseas.

"Activity is increasing, and we're optimistic about this year," Peebler said.

Jim White, CEO of F.T. Seismic Support, concurred: "We still see a sustainable level of activity on the seismic side."

17 Questions With Henry Posamentier

By DAVID BROWN, EXPLORER Correspondent

Seventeen questions and answers about AAPG member Henry W. Posamentier, a leading industry researcher and recipient of AAPG's 2012 Robert R. Berg Outstanding Research Award.


POSAMENTIER

Question 1. How do you pronounce his name?

It's pronounced POSS-uh-men-TEER, with emphasis on the first and last syllables.

Henry is pronounced HEN-ree, as usual.

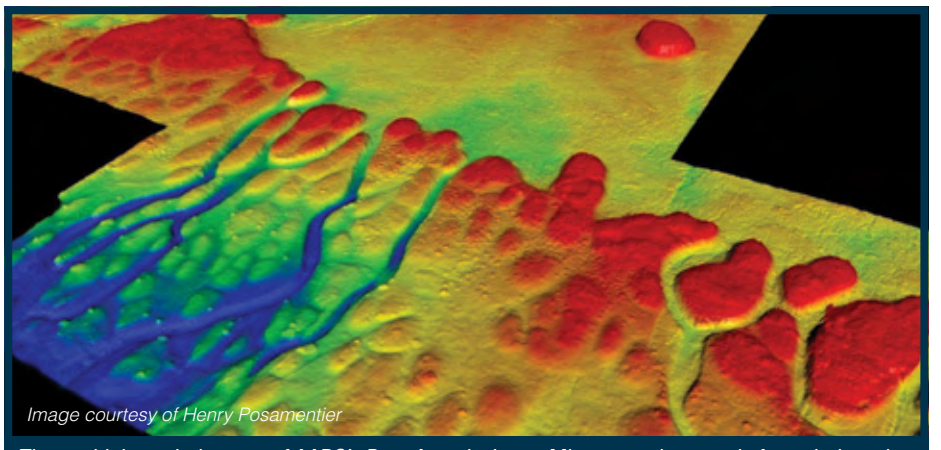
Image courtesy of Henry Posamentier

The world through the eyes of AAPG's Berg Award winner: Miocene carbonate platform, Indonesia.

Question 2. What's his expertise?

Posamentier is known for development of seismic geomorphology and his earlier contributions to seismic and sequence stratigraphy.

Born in New York City in 1948, he earned his Ph.D. at Syracuse University in New York, where he studied glacial geology.

Question 3. Glacial geology?

"My passion then was glacial geology, though I was always intrigued by stratigraphy and geomorphology as well," Posamentier said.

"When I joined Exxon back in 1979, the first day I walked in was the first time I ever saw a seismic section," he recalled.

Posamentier said for reasons he didn't grasp then, but understands better now, Exxon immediately started him off working with seismic.

Question 4. He began his career at Exxon?

He actually began teaching at the university level after graduation, but "Exxon made me an offer I couldn't refuse," Posamentier said.

"I thought, 'I'll try it for a year, and then I can go back to academia,'" he recalled.

Then he began his 30-plus-year career in the oil and gas industry.

Question 5. Where does he work now?

In Chevron's Reservoir Characterization Division, part of Chevron Energy Technology Co. in Houston. He's a senior exploration adviser.

Question 6. What else does he do?

Running and photography. In 2011, Posamentier ran in both the New York City and Boston marathons.

"I'm still into running. I still run marathons and half-marathons. And I like to think I'm still competitive in my age group, which brings a chuckle to my kids," he says.

Question 7. Where does he call home?

Hard to tell. Posamentier currently lives in Houston with his family, and said he plans to be there until all of his children are graduated from high school.

During his career, however, he's lived in Calgary for four years, in Dallas for six years, in Indonesia for three years and in Calgary again for six years.

Canada seems to be a magnet for him. He spent the 2011 year-end holidays in his home in Canmore, Alberta, just outside Banff National Park.

Question 8. What is seismic geomorphology?

"Seismic geomorphology is the study of landforms using seismic data. What we're tasked with doing is to determine lithology prior to drilling," Posamentier said.

It's basically a way to integrate section view with plan-view images in a 3-D context, for a better view of the overall geology.

"In the past, with 2-D data, all we could see was the stratigraphy – in other words, the section view," he said. "With 3-D data we've advanced orders of magnitude beyond that."

Question 9. What's the advantage?

You can identify geological features and subsequently infer the processes responsible for their formation, thus improving our abilities to better predict lithologies prior to drilling.

"With enhanced visualization of entire paleo-landscapes, we can now elevate our analyses and gain significant insight as to geologic process," Posamentier said. "By virtue of integrating seismic stratigraphy with seismic geomorphology, we're exponentially increasing our understanding of geologic processes."

Think of picturing a cake with horizontal views of the cake layers and vertical slices of all the layers, from several directions, and then putting together a full image.

"What we have now is the whole cake. Not only can we slice it vertically – to see stratigraphy – we can also slice it horizontally, to see geomorphology," he said.

"The detail we can see sometimes is startling," he added.

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Posamentier Pioneered Seismic Geomorphology

Henry Posamentier, an AAPG member who helped pioneer and develop the modern approach to sequence stratigraphy and who is this year's winner of the AAPG Robert Berg Award for Outstanding Petroleum Research, has been a scientific leader for decades.

Most recently he has pioneered and popularized the discipline of seismic geomorphology, which leverages both 2-D and 3-D seismic data to better understand the paleogeographic distribution of lithologies.

He has been a four-time AAPG Distinguished Lecturer, speaking to groups in the United States (1991-92), the Former Soviet Union (1996-97), the Middle East (1998-99) and in Europe and eastern Asia (2006), when he was the Dean A. McGee Distinguished Lecturer.

He offered two lectures that year: "Imaging Elements of Depositional Systems From Shelf to Deep Basin Using 3-D Seismic Data: Implications for Exploration and Development" and "Stratigraphy, Sedimentology and Geomorphology of Deep Water Deposits Based on Analysis of 3-D Seismic Data: Reducing the Risk of Lithology Prediction."

He received the 2001 George C. Matson Award for the paper "Seismic Geomorphology and Depositional Systems of Deep Water Environments: Observations from Offshore Nigeria, Gulf of Mexico and Indonesia."

He also has written for the EXPLORER's popular Geophysical Corner.

Posamentier
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Question 10. Is seismic geomorphology recognized as an important development?

Absolutely.

For his research, Posamentier received the Pettijohn Medal for excellence in sedimentology from the Society for Sedimentary Geology (SEPM) in 2008 and the William Smith Medal from The Geological Society of London in 2010.

He's been named recipient of the 2012 Robert R. Berg Award from AAPG, given "in recognition of a singular achievement in petroleum geoscience research."

Question 11. Is this something mainly used in offshore work?

Posamentier acknowledged that seismic geomorphology has been applied extensively to offshore prospects.

"The data quality is typically better offshore because you don't have surficial deposits like sand dunes or glacial outwash that can hit seismic data quality hard."

But Posamentier teaches workshops and short courses on the technique, and said, "some of my best examples are from onshore."

Question 12. Is color enhancement important in seismic geomorphology?

Color enhancement is useful, although not so much for Posamentier, who's partly color-blind.

"I tend to gravitate to interpreting almost exclusively in the gray scale – especially in plan view images, where we're looking for features like channels and other geomorphic elements, I just can't see what others see," Posamentier said.

"A lot of patterns in full color displays that are obvious to non-color-challenged interpreters are simply not obvious to me," he said. "Hence the preference for gray scale, where these patterns jump out for me."

Question 13. How important is experience in doing the interpretation?

Posamentier said he wouldn't have believed it when he was younger, but significant experience turns out to be essential for good interpretation.

"The interpreter lives and dies by the ability to understand patterns. It's all about pattern recognition," he observed.

"The more an interpreter has seen, the more patterns he or she has stored in memory and the better an interpreter will be," he said.

Question 14. Is seismic geomorphology now a standard tool for seismic interpreters?

It's a mixed bag. Much of the seismic interpretation he sees still tends to focus on static views of the data in two-dimensional space, and so often just in section view.

"There's so much information there that is ignored when you limit interpretation to the section view; this results in stratigraphic analysis without the benefit of insights derived from geomorphology," he said. "Integration of stratigraphy and geomorphology yields a far more robust geologic solution."

Question 15. What's the role of the petroleum geologist in seismic geomorphology?

Petroleum geologists provide a reality check on seismic interpretation, and their importance is growing, according to Posamentier.

"Petroleum geologists have to embrace the geophysical data. They have to leverage it and accept it as just another tool in the arsenal," Posamentier noted.

"Getting the geophysical data into the hands of earth scientists thinking geologically is absolutely critical," he added.

Question 16. What does Posamentier see in the future for seismic interpreters and petroleum geologists?

They'll go to the movies.

Question 17. Seriously, what does he predict?

"One of the areas where I see a lot of potential is another domain that lies largely untapped, and that is patterns when you are doing animation," Posamentier said.

"It's sort of like seeing a series of still photos compared to sitting in a theater and watching a movie," he said. "It takes 3-D interpretation to a new level."

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SEISMIC 2012

Seismic, wellbore data help break 'the rock code'

Data Integration Gives Complete Picture

By LOUISE S. DURHAM, EXPLORER Correspondent

The advent of 3-D seismic technology in the oil patch not so many years ago marked a humongous technological advance in the industry.

Today, geoscientists are looking beyond 3-D seismic as a standalone tool.

In many instances, they are harnessing the power that comes from integrating various other data types with 3-D seismic to predict sweet spots, potential productivity of yet-to be drilled wells and more.

Southwestern Energy, for example, recently completed a successful study combining various data with their 3-D seismic data in an area of their extensive Fayetteville shale holdings (see related story on page 20).


TRAMMEL

This big theme of integration enables advanced imaging of the reservoirs and corrects a lot of the noise of the rock overburden.

Steve Trammel, senior manager for industry relations at IHS, gave the EXPLORER an overview of the practice of integrating varied data with seismic – and, in his words, what it means for operators:

Let's Get Together

"The interesting theme being pursued now is integrating seismic data with all of the other data you can get from a well and logs and so forth. Shale gas and tight oil plays unlocking unconventional resources has completely changed the oil and gas supply picture in North America and represents perhaps the most exciting development in our lifetime.

"But these plays have tremendous variability, even within the same play. Integration of data from seismic and the wellbore itself holds the key to understanding the reservoir potential.

"We've found a lot of gas, and that was good for the consumers and energy security, but not so good for the producers due to the lowered gas prices.

"The payoff has been those same technologies, i.e. horizontal drilling and hydraulic fracturing plus the combination of all the other geophysical work, has unlocked tight oil zones and created a true renaissance in North American oil supply.

"The same variability noted in shale gas plays is a key issue for tight oil plays. I say tight oil because it's not just shale. Tight oil reservoirs are low permeability sands, silts, dolomitized zones often intermingled with shaly zones. It's complex plumbing.

"With all this variability across plays, operators have had to focus on how they can use geophysical technology we have today to help us understand what the risks are with all that variability – and to illuminate the sweet spots."

Isn't That Sweet?

"Like any resource plays, these plays typically are over a huge geographic area, so the key is finding those sweet spots – and that key overall is the integration of geophysics with other data.

"A reservoir in reality is a three dimensional section of the earth. Common sense says you need to create multiple views of that reservoir from a variety of data to have a full understanding of the reservoir. People in general are integrating 3-D with as much borehole data that are available at the start of the workflow and throughout the whole process.

"As an example, fracturing in tight rocks is critical to production, and 3-D can be used to define structures and faulting. So some of the output they want to get is direct mapping. They look at amplitude analysis and analyze via pre-stack inversion processes to understand variation in the brittleness of the formation.

"Brittleness directly translates into 'fracability.'

"Then you combine those geophysical attributes with borehole data and work up resistivity mapping from logs, for example, as part of the borehole data.

"You put all that together, and it can really show sweet spots and high grade where the well locations should be.

See **Seismic**, page 18

Seismic
from page 16

Let's Get Small

"Another geophysical technology comes into play when they integrate in the microseismic data.

"Microseismic is done to evaluate how successful the hydraulic fracturing jobs are – fracture development, extent and direction. Also, the rock properties picture comes into focus, and you really start to see your reservoir.

"Another important piece to this is that it identifies any geohazards, such as a massive fault or overpressure.

"If you have a big fault you could lose all of your treatment – your fracturing water – to the fault and not have it crack the rock per design. You want to make sure you're not getting into an area that has greater than anticipated faulting."

Extremely Loud and Incredibly Close

"This big theme of integration enables advanced imaging of the reservoirs and corrects a lot of the noise of the rock overburden – overburden noise can mask some pretty subtle attributes at the reservoir level.

"Once you look at production data, logs and other wellbore data after this overburden noise from the seismic is removed, you can start to see azimuth anisotropy, travel times and amplitudes – and that becomes a much more reliable way to pick those sweet spots.

"Generally, this integration of data reveals pretty subtle structural features in the rocks, helping to determine your original-oil-in-place and estimated ultimate recovery numbers, which are critical for the plays to judge them on how well they're going to perform."

Stress Test

"The 3-D data will illuminate rock strength and stresses, closure stress and faults and natural fractures.

"Many of those formation stress factors can be derived from Poisson's Ratio. Estimating the ratio helps you understand changes in stress gradient relative to the surrounding layers.

"Understanding what kind of stress this rock is under provides critically important help in designing hydraulic fracturing designs for the wells.

"You can combine geo-mechanical and stress properties with log data to estimate shale and carbonate content, porosity, hydrocarbon content and water saturation, natural fracture locations, trends and orientation.

"Data integration provides a more complete picture than any individual data views by themselves."

$mart Move

"What I've read and also learned from attending various symposia is that geophysicists are focusing their attention in four major areas today:

- Predicting anisotropy from full azimuth data.
- Acquire a good prediction of rock properties.
- Predict the principal stresses on the formation.
- How to characterize the fractures in the rock.

"In the integrated workflow, you take those four primary areas and link that to petrophysics you will get from logs. You do this integration early, and tie rock properties to the seismic response so you're getting a model of what these different rocks are going to do in different basins and geologic facies.

"Bring in completion data, engineering data coming from the well, production data and include production data from multiple wells in the area. Drill, hydraulically fracture and then run microseismic to see how the fracture designs are working.

"This work not only helps when drilling additional wells and designing their completions, it starts to create some analogs for those plays when you're within a play that typically covers a huge geographical area.

"Those analogs also get you started evaluating other plays' potential.

"I have a friend who says these unconventional rocks are so variable that in many cases people need to drill 20 to 30 wells at a cost of millions of dollars per well or more – that's really expensive lab work. Mitigating that time and expense with an integrated workflow of seismic and wellbore data shortens the rock code-breaking process."

Success in the 'Beautiful Mess'

"As we said, in the real world, rocks are three-dimensional and have overburden stress, lateral stresses and faults, and all the complex plumbing attributes of unconventional reservoirs. You can see some of this with seismic, but some gets masked with that overburden noise.

"It's only when you bring in other views of the rocks that you can really get a complete picture to eliminate some of the variability that poses risks causing sweet spots to be missed, slowing down your development of best practices for a specific play and ultimately affecting your economic success.

"Integration already is a reality. It's just good to get it underscored and realize this is what people are doing today. This whole integration theme entails taking reservoir evaluation methods developed over the last 20 years or so for conventional reservoirs and bringing it all together.

"As we continue to understand the complex plumbing in unconventional reservoirs, we know Mother Nature is beautifully messy. Seismic data integration with wellbore data helps us move from uncertainty to variability to predictability."

SEISMIC 2012

Integration yields new tool, not a new technology

Fayetteville Model Has 'Predictive Value'

By LOUISE S. DURHAM, EXPLORER Correspondent

In the fast-paced arena of new unconventional finds, the latest hype almost always is all about the latest discovery.

Look at the Fayetteville shale play for example.

Highly touted among the earlier discovered shale gas plays, its high profile status was soon eclipsed in the midst of the near-frenzy generated by these type plays as they rapidly proliferated across the United States.

But ascribing the Fayetteville a second class status also proved to be a tad premature.

Turns out there was – and is – much more to the story.

The U.S. Geological Survey's 2010 assessment of undiscovered Natural Gas Resources of the Arkoma Basin Province and Geologically Related Areas estimates the potential undiscovered petroleum resources in two of the three Fayetteville assessment units to be 13.2 Tcf of natural gas.

The Fayetteville shale, which is geologically equivalent to the famed Barnett shale in Texas, occurs in the Arkoma Basin. It extends across northern Arkansas from the state's western edge throughout the north-central region for a total aerial extent of 5,000 miles.

Shale thickness tallies 50 to 500 feet, and it's found at depths between 1,500 and 6,500 feet.

Southwestern Energy Co. is credited with initially recognizing the economic viability of the Fayetteville shale in 2002, ultimately becoming the first operator in the play.


JEFFERS

This project was "all about integrating seismic data with other kinds of information rather than sort of a stand alone geophysical project."

Today, the Houston-based company is the largest producer in the play with a leasehold topping out at 915,884 net acres and year-end 2010 production hitting 350.2 Bcf net.

Initiating the Integration

Once development was comfortably under way, a team comprising geologists, geophysicists and engineers decided it was time to knuckle down to better identify the intricacies of this shale, using an array of data combined with the company's own 3-D seismic.

The ensuing one year-plus joint project, implemented via a Southwestern-Schlumberger partnership, wrapped up in early 2011.

"We undertook an integrated reservoir characterization project to model major factors believed to most influence Fayetteville shale reservoir producibility, and to determine whether the model could be sufficiently constrained to predict areas of higher production performance," said AAPG member John Jeffers, director of geosciences for the Fayetteville shale division at Southwestern.

He noted the pilot project was based on the idea of using seismic data for reservoir characterization and integrating it with other types of geological and engineering data and carrying it through to reservoir simulation.

In fact, the study represents an important synergy between 3-D seismic and engineering data.

A reservoir model was developed via integration of all available well, log, petrophysical, sonic, image, core stimulation, production, microseismic data and processed 3-D surface seismic over a specific area.

The static reservoir model was used to history match the short- and long-term production performance and its variations across the exploration area.

History matching production profiles of multiple wells is a critical step toward understanding the key production drivers in unconventional shale gas formations, according to Jeffers.

Predictive Value

Southwestern holds about 1,400 square miles of 3-D seismic in this play, and the project focused on a single locale broken out into three study areas of 10 to 15 square miles, each in the heart of the company's development area.

"This was intended as a pilot to try out techniques and see if it had value," said AAPG member Jim Lemaux, staff geophysicist at Southwestern.

"The thing we were hoping to be able to do was build a reservoir simulation model that had predictive value that would let us predict the performance of wells not yet drilled," Lemaux said.

"We validated it in this model by using blind wells and then seeing if we could predict the performance of wells we hadn't used in the calibration," he said, "and we were reasonably successful in doing that.

"We found that this kind of work – carried out carefully and constrained with the right kind of data – does have predictive value," he said, "and can be used in helping us to determine how to develop an asset like this."

See **Fayetteville**, page 22

Last Chance Looms for ACE Registration $avings

Online registration continues to be open – and savings are available – for this year's AAPG Annual Convention and Exhibition, which will be held April 22-25 in Long Beach, Calif.

Those who register before April 2 can save up to $100 off the full registration fee.

The ACE theme is "Directing the Future of E&P: Starring Creative Ideas and New Technology," and more than 400 papers and 700 posters will be offered, covering the latest in science, exploration and industry trends from around the world.

Also featured will be five special forum events, including this year's presentation of the Discovery Thinking program – recognizing five more geologists who join the "100 Who Made A Difference" list – and the annual Michel T. Halbouty Lecture, this year featuring John Grotzinger, Jones Professor of Geology at the California Institute of Technology and chief scientist for the Mars Science Laboratory, who will discuss the search for source rocks on Mars.

This year's technical program is set on 11 themes:

- Active Oil and Gas Fields – Development and Production.
- Emerging Frontiers.
- Siliciclastic Reservoirs – Exploration and Characterization.
- Carbonates and Evaporites – Exploration and Characterization.
- Unconventional Resources.
- Basin Analysis and Petroleum Systems.
- Alternative Energy.
- Environmental and Energy Research.
- Structural Geology and Neotectonics.
- Geophysics and Seismology.
- Geoscience Principles and Applications.
- Student Poster Sessions.

To register and for more information, go to www.aapg.org/longbeach2012.

Fayetteville

from page 20

The three chosen study areas were selected to assess how much data were needed to make a reasonably constrained model. One area was data rich, one not so rich and the other had only one well.

"We wanted to test the limits of predictive value of a seismically based model with varying levels of geologic calibration," Jeffers said, "and also how much production time was needed to be incorporated into that model from existing producers to get a good history match.

"There was a reasonably good fit in a reservoir simulation world on all three," he noted. "We were pleasantly surprised by the predictive value of the model."

Multi-Purpose Data

Southwestern is known to be among the lowest-cost operators in the Fayetteville shale play, and Jeffers noted the study effort is the kind of work that allows them to be more selective in what they do and to continue developing even when gas prices are low.

The company's 1,400-square-mile trove of seismic data alone represents a nearly $200 million investment, according to Jeffers.

The original reason to acquire the seismic was to use it for structural interpretation to plan horizontal wells, avoid faults and other challenges.

"Through time we realized the possibility of using that data to help us characterize reservoirs and predict well performance," Lemaux said. "A large part of that was getting development drilling far enough down the road so we had well data to actually calibrate to because it's difficult to make good use of seismic data for reservoir characterization in this kind of play without a lot of geologic constraint to it.

"At the same time, you need a lot of geophysical coverage to help you interpolate between existing wells," he continued. "There's a lot of white space between existing wells, and your seismic volumes help you fill that in with your best estimate of what those properties are doing."

It's not unusual to see geoscientists using seismic data in shales only to attempt to identify sweet spots, where to drill and where to skip over.

"Most of our acreage will be developed," Jeffers said, "and we're using the seismic data more to determine how to develop each area as it's helping us to decide appropriate well spacing, completion technique and things like that.

"The high level message," Jeffers said, is that this project was "all about integrating seismic data with other kinds of information rather than sort of a standalone geophysical project.

"It was not about investigating a new technology," he said, "but more about integrating engineering data with geology with geophysics with production and completion data to come up with the best solution for how an area is behaving and how to most effectively develop it."

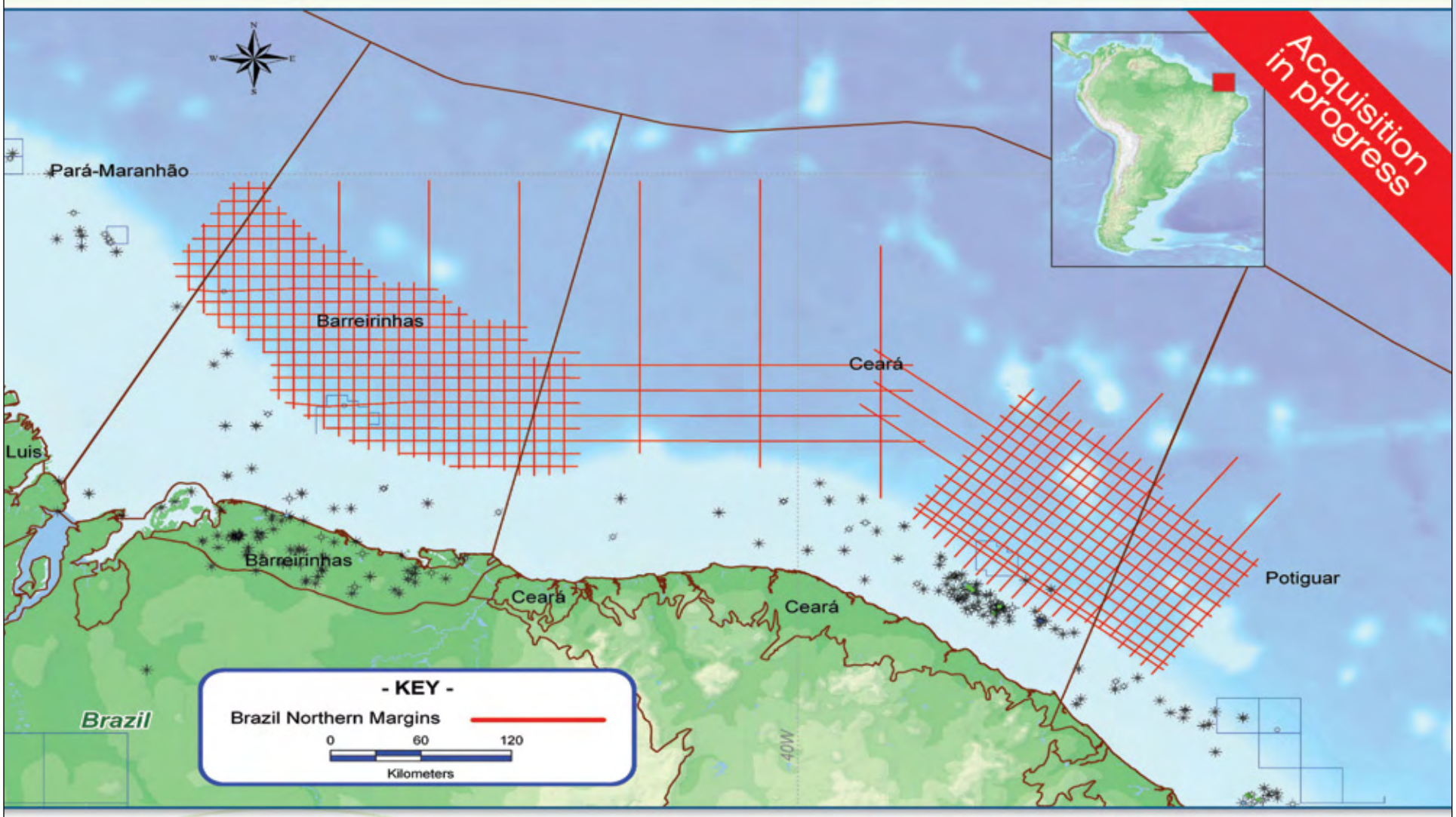
The Southwestern team and project partner Schlumberger together brought the necessary know-how to the table.

"Schlumberger had skills and experience we didn't have in reservoir modeling," Jeffers said. "We had knowledge and experience in this play and operations, as well as the practical side of geophysical applications and field development practices.

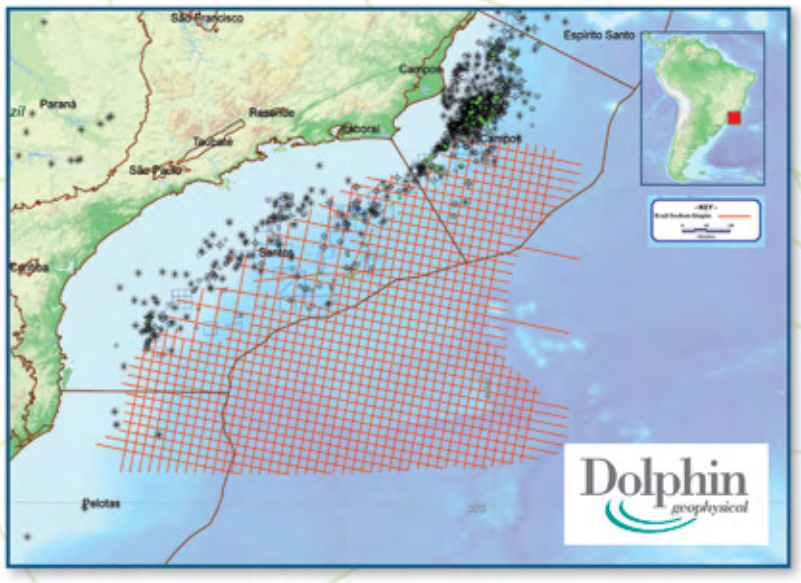
"That partnership, the unique structure, was beneficial to the results."

Offshore Brazil

New Multi-Client Acquisition, Campos Santos, Northern Equatorial Margins



Northern Margins - planned Spectrum Multi-Client coverage



Campos Santos - planned survey coverage

Spectrum has begun acquisition of a new 2D Multi-Client seismic survey in the Northern Equatorial Margins Offshore Brazil. Phase 1 of the program is 12,000 kilometers of high-quality seismic data from the Barreirinhas and Ceara basins with additional regional tie lines. The program will provide oil companies with a competitive advantage in the upcoming Licensing Round 11.

In addition, Spectrum and Dolphin Geophysical are set to commence an extensive, long-offset 2D Multi-Client survey over the Santos/Campos basins. These Multi-Client surveys will be acquired by Dolphin Geophysical and processed by Spectrum with the aim to better define the exploration prospectivity. The data will be available ahead of the expected pre-salt bid round anticipated in the 2012-2013 timeframe.

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New channel complex outcrop discovered

Ireland Outcrops Still Yield Deep Secrets

By CHRISTOPHER STONE, EXPLORER Correspondent

Some come to view the dramatic, awe-inspiring beauty. They are not disappointed.

Others seek to decipher its vivid, detailed history of the earth, on full-display and to the trained eye, as readable as pages in a book.

But those looking for clues to new hydrocarbon discoveries are there with specific purpose – finding geological insight and understanding that will help bring exploration success around the world.

And they, most definitely, are finding what they seek.

The area is the Mississippian-Pennsylvanian deepwater-deltaic basin fill succession of western County Clare and northern County Kerry in western Ireland. This area exposes more than 2,000 meters (6,600 feet) of deepwater basin floor shales and sandstones, slope mudstones and sandstones and a thick deltaic succession deposited in a sedimentary basin (the Shannon/Clare basin) centered on the Shannon Estuary.

This area has been used by literally thousands of geoscientists from all over the world as a research and training area since the 1950s, utilized by virtually all major petroleum companies for research and education courses, and has been the excursion site of an untold number of students – primarily from Europe, but also from North American universities.

And the value of the Clare Basin outcrops to explorationists has especially increased over the past two decades, as sandstone reservoirs within many deepwater basins and basin margins globally have been at the forefront of new exploration in the Gulf of Mexico, the South Atlantic basins such as Angola and Brazil, northwest European basins and in California.

"The value of outcrop analogs such as the Clare Basin for detailed understanding of exploration and production geological models cannot be underestimated," said AAPG member Ole Martinsen, winner of the 2011 AAPG Robert R. Berg Outstanding Research Award.

"The stratigraphic context, spatial view of reservoir and seal rock character and dimensions lead to much better predictive models for exploration success," he said, "and production effectiveness and efficiency."

Many themes at the upcoming AAPG Annual Convention and Exhibition in Long Beach, Calif., will focus on deepwater reservoirs and their outcrop analogs – and Martinsen and his colleagues, citing their research and work on and at the rugged Irish coastal outcrops, will be presenting a lot of those papers.

"Some outcrop analogs that expose deepwater and related reservoirs have stood the test of time, over many decades, as global analogs for discovery of new insight, development of knowledge and not least as world-class training areas for literally thousands of geologists in the petroleum industry and academia," he said.

Valuable Training Ground

The last decade saw a major resurgence of outcrop studies, facilitated by the advent of new technology such as LiDAR scanning, photorealistic mapping (see June 2004 EXPLORER), behind-the-outcrop drilling and remote sensing data.

"New outcrop technologies allow for refined interpretations, facilitated by more precise and higher-resolution, digital collection of data," Martinsen said, "and also by allowing collection of data that compare with subsurface data.

"This increases the value of outcrop data enormously, and bridges between outcrops and the subsurface," he said.

"In addition, seismic modeling allows for creation of synthetic seismic data that, combined with the digital and photorealistic outcrop data and the core and log data from the outcrop wells, allow for reservoir models to be created that compare directly with subsurface data," he added.

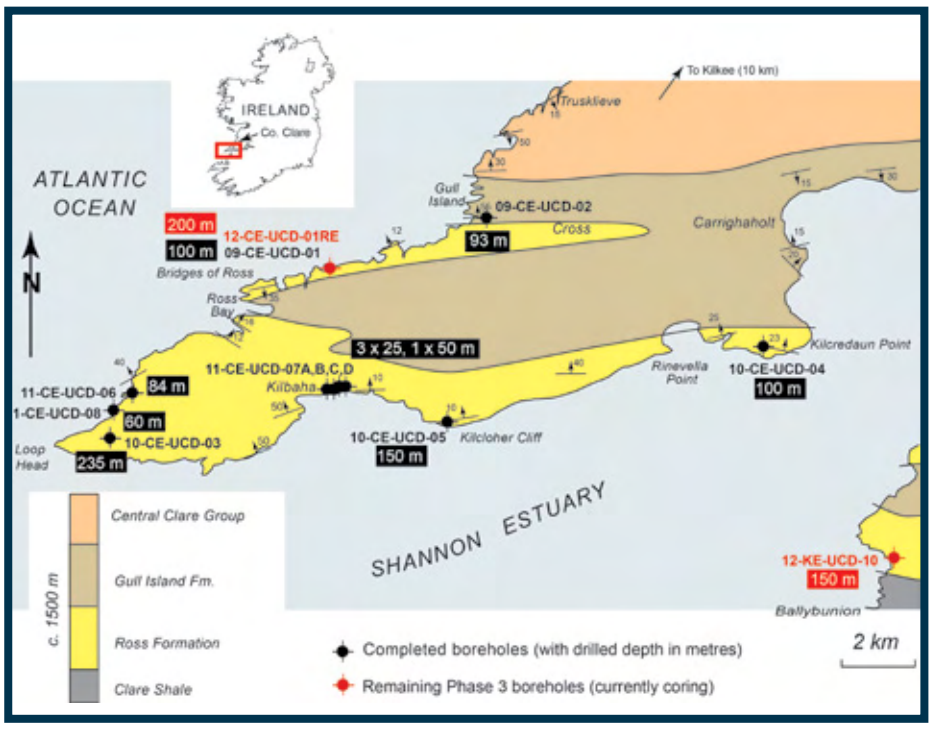
A 2008 SEPM research conference organized by Martinsen, Peter Haughton (University College, Dublin, Ireland) and AAPG members Andrew Pulham and Morgan Sullivan in County Clare focused on the new outcrop technologies (published last year in SEPM's "Concepts in Sedimentology and Paleontology"). These new technologies have been used in recent research phases by the authors in County Clare, and some of their new insights will be presented at the upcoming ACE.

Martinsen, Pulham, Haughton and AAPG member Trevor Elliott, a UK-based consultant and past AAPG Distinguisted lecturer, also are strongly involved in delivering training in the Clare Basin, and they all agree that the petroleum industry, universities and training companies "have long recognized the educational value of the Clare Basin."

"Every year there are numerous field classes that use the exceptional coastal geology as primary training tools and as analogs for global application," Pulham said.

"The outcrops are a particular favorite location for Irish students," Haughton added, "not least from University College

See **Outcrops**, page 30



Editor's note: Ole Martinsen and his colleagues will make several technical presentations at the upcoming AAPG Annual Convention and Exhibition, set April 22-25 in Long Beach, Calif.

For the specific times and titles, go to the online Itinerary Planner and browse the program using the author's name.

The presentation by Ole J. Martinsen focuses on the channel complex in the slope succession discovered in Google Earth, which adds significantly to how the deep-water sandstone succession in the Ross Formation is linked genetically to the shallow-water and deltaic sediments:

"Deepwater Slope Channels and Their Levees: New Insight From a Revisit to the Namurian (Early Pennsylvanian) Gull Island Formation, Western Ireland," will be presented at 9:05 a.m. Monday, April 23.

Photo courtesy of Ole Martinsen

Outcrop analogs such as those found at Clare Basin are invaluable for detailed understanding of exploration and production geological models.

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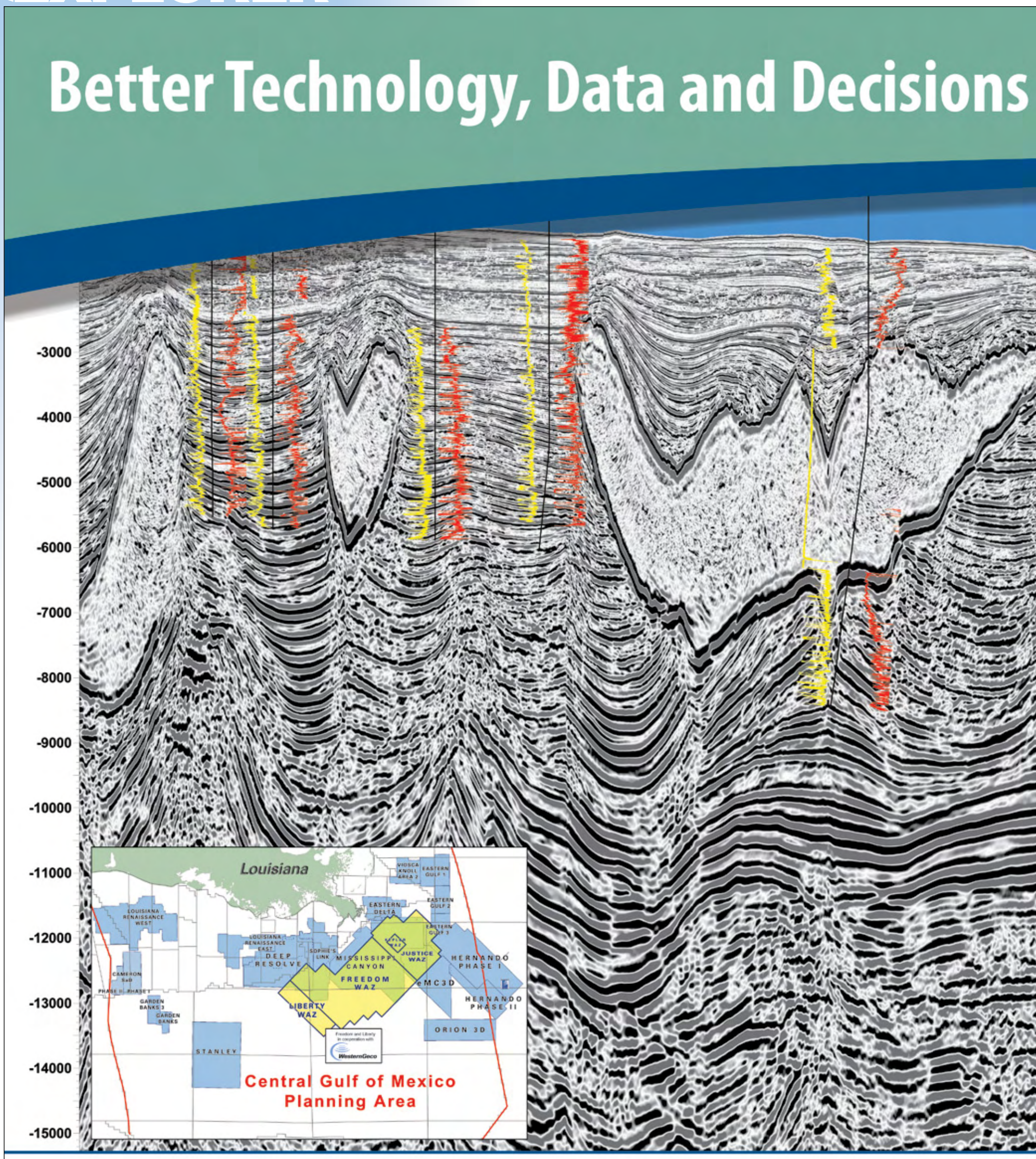

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Clare Research Has Far-Reaching Impact

By TREVOR ELLIOTT and OLE MARTINSEN

The onset of geological research that underpins the Clare Basin's present importance as a research and training area for the hydrocarbon industry commenced in the 1950s via biostratigraphic studies of the Clare Basin-fill by Frank Hodgson and a legion of Ph.D. students, most notably Gillian Lewarne. She established the biostratigraphy of the early deepwater shales (Clare Shales) that overlay the Carboniferous/Mississippian Limestone and record a prolonged period of deepening stratigraphy that preceded deposition of the turbidite sandstones (Ross Formation).

She also established, along with colleagues the biostratigraphic framework for the younger fluvio-deltaic deposits of the basin fill.

This time- and correlation framework – based on what we would now call condensed sections – became an essential template for subsequent research that exists to this day.

Subsequently Dan Gill, geology professor at Trinity College Dublin and later at Imperial College, University of London, became interested in the Clare area. Suspecting that parts of the basin-fill succession could be deepwater turbidites, he invited Philip Kuenen, one of the fathers of deepwater and turbidite sedimentology in the 1950s, to Clare. Their work resulted in a 1958 publication on the area's famous sand volcanoes.

Gill invited Lewarne to join him as a teaching assistant in Trinity College. On transferring to Imperial College


ELLIOTT


MARTINSEN

he appointed Ph.D. student Malcolm Rider with the task of unraveling the sedimentology of the Clare Basin fill.

Rider submitted his Ph.D. in 1969 and subsequently published his findings in several journals, but his 1978 paper in the AAPG BULLETIN is a classic paper where he highlighted the comparison of the Clare sedimentary rocks to the Gulf of Mexico basin.

The thesis itself is a remarkable document. It establishes the depositional settings for each of the stratigraphic units of the basin fill over the entire basin remnant. Each depositional setting was treated in depth via meticulous observations and well-reasoned, logical interpretations.

It was a benchmark Ph.D. thesis for its time and underpins the vast majority of subsequent work on the basin fill.

Included in the thesis is a chapter of the sedimentology of the modern Mississippi delta. Rider had identified the youngest part of the basin fill – the Central Clare Group – as the product of large prograding deltas that he felt were broadly similar to the Mississippi delta.

Not content with reading the published literature on the delta, he boarded a cargo ship bound for New Orleans and worked his passage across the Atlantic, eventually arriving completely unannounced at Louisiana State University, where he negotiated a short-term research opportunity in the university with leading researchers who had worked the Mississippi delta.

That resulted in the AAPG BULLETIN paper that has been influential literature way beyond the Clare Basin – and not least for relating modern depositional environments to ancient rock successions.

Going Global

Trevor Elliott met Malcolm Rider at the 1975 IAS Congress in Nice, France, and over a lunch asked if he could undertake research in the Clare Basin in order to extend some of Rider's work.

Rider agreed and a new phase of research commenced that ultimately led to the initiation of training courses for the oil industry in the area.

Also at the Nice Congress, John Collinson, then at the University of Bergen, aired the possibility of a training consultancy for the industry with Elliott.

Agreement was reached and Harold Reading, winner of the AAPG Distinguished Educator Award in 1997, and Collinson's and Elliott's former supervisor, also was included in a partnership named Sedimentary Research Associates.

Soon the Clare Basin became the partnership's flagship annual course, and the global use of the Clare Basin as a training ground was established.

During this period AAPG member Andy Pulham did his Ph.D. research on the deltaic deposits of the basin fill supervised by Elliott, and Ole J. Martinsen did his master's study of the slope component of the basin fill supervised by Collinson.

For Martinsen, winner of the AAPG Robert R. Berg Outstanding Research Award in 2011, the Clare Basin work has been the fundament of the later career in industry and research.

As understanding of the basin-fill developed further via these and other research projects, the Clare became increasingly recognized internationally – including among several major oil companies – and its use in the training oil company geoscientists became global.

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Photo courtesy of Peter Haughton

A recent study of outcrops at Ireland's Clare Basin was enhanced by Google Earth images.

Outcrops

from page 24

Dublin and Trinity College."

"The popularity of the area has resulted in a very large community (thousands) within the AAPG membership that has visited and gained insights from the area," Pulham said.

"A compelling draw is that many petroleum-rich margins around the world have reservoir rocks that are very comparable to those in the Clare Basin," he continued, "(and) in tandem with the training opportunities, the outcrops have repeatedly delivered new insights to key geological concepts and methods, such as deepwater sedimentary processes and sequence stratigraphy."

"Furthermore," Haughton said, "the lessons for understanding reservoirs in the subsurface are continuing to be delivered – and currently this is via behind outcrop drilling in west Clare and north Kerry."

The Borehole Project

In 2009, Statoil decided to sponsor a borehole project at the University College Dublin with Haughton and Pat Shannon as the principal investigators. The purpose has been to drill a series of behind-the-outcrop wells in the Ross Formation, a sandstone formation that bears very high resemblance to deepwater reservoirs in petroleum-rich basins around the world.

Including 2012 drilling there are 10 wells, covering different aspects of the formation – including classic, most-visited localities and new and inaccessible sections.

While the spectacular cliff sections show details of high importance, the well data are providing significant new results, such as stratigraphic insights and variability in sandstone bedding types, which previously have not been recognized in the dramatic cliff sections.

"Prior and recent studies on the stratigraphy have provided unsubstantiated results on both the biostratigraphy and on the correlation within the Ross Formation itself, and the cores in the wells show a bio-zonation that far surpasses previous understanding of the stratigraphy," Martinsen said. "New understanding of deepwater sedimentary processes has developed, through the work of Peter Haughton and students on the core and log data.

"While classic turbidity currents forming turbidites until recently were thought to be the dominant sedimentary process in deepwater basins forming deepwater reservoirs, new insight from deepwater successions such as the core and log data from County Clare show very clearly that many sandstone beds are much more complex and deposited to a large degree by transitional flows carrying a large proportion of muds," he said. "This impacts the quality of the reservoirs containing such beds, and currently many deepwater fields and reservoir units in petroleum-rich basins have this challenge.

"The Wilcox formation of the Gulf of Mexico basin is such an example," he added, "but other basins, too, globally show the same challenge."

Many companies holding acreage where this challenge is important have initiated outcrop work to understand the challenge better, according to Martinsen. Thus, well data with core and logs from the Clare Basin – combined with detailed outcrop work to see larger scale features – is essential to develop even better insight of the complexity of deepwater reservoirs, "at a time when many researchers have been comfortable with the classic and traditional understanding of these types of reservoirs.

"Having core and log data in basins like the Clare Basin, where the regional picture established, is thus very valuable for global implementation of these results," Martinsen said.

Google It

Google Earth has played a big role in the most recent studies of Clare Basin.

Martinsen, Pulham, Haughton and Elliott, were by chance exploring the Clare coast using Google Earth for future research drilling locations – and were very pleasantly surprised to discover hitherto unknown value in an intertidal exposure of deepwater stratigraphy near Doonbeg in central Clare.

This overlooked and previously

See **Clare Basin**, page 32

Photo courtesy of Ole Martinsen

The Clare coastline: For tourists, fun to visit – and for geoscientists, great to study.

A Geologists' Mecca

From the 1980s and still continuing, numerous petroleum companies have conducted research and training campaigns in the Clare Basin. Shell was one of the first to bring geologists from their global exploration and production projects to the area for training.

BP, Exxon, Chevron, Conoco, Norsk Hydro and Statoil also have invested heavily in the Clare outcrops.

Various academic institutions also have run their undergraduate and graduate field courses in the area – not least the Irish universities, but also major European and North American institutions.

Masters and doctoral research has resulted in a wealth of theses in the Clare Basin dating first from the 1950s and continuing today with two new graduate students at University College of Dublin and Trinity College. The latest research results will be presented by UCD doctoral candidate Colm Pierce at the upcoming ACE in Long Beach.

Interestingly, AAPG President Paul Weimer had a research student in the area in the early 2000s: David Pyles, who won the AAPG J.C. "Cam" Sproule Award in both 2009 and 2010 for his work.

In total, six decades of accumulated and continuing research and education have resulted in an unqualified estimate of the number of geoscientists visiting the Clare Basin at around 10,000 or more.

Clare Basin

from page 30

unstudied outcrop, exposed only at low tide, is a more than 200-meter thick succession that extends for over two kilometers along the coast – and it includes a seismic scale channel complex, possibly with levees.

"The reason this part of the coast has been neglected are the sweeping macro-tides and an assumed cover of recent sediments and seaweed in the area," Martinsen said, "but in Google Earth the outcrop had been captured at ideal low tide, revealing the exquisite channel complex.

"This newly discovered geology adds significantly to the value of the slope succession in the Clare Basin as an analog for, for example, the Neogene succession in the Gulf of Mexico basin," he added.

"The aerial images in Google Earth were key," Martinsen said, "and again proves that new technology delivers new perspectives, insight and ideas.

"It is proven in geology that many new concepts, such as seismic and sequence stratigraphy (driven by 2-D seismic in the 1970s and 1980s), and the new detailed insight into deepwater sedimentary processes and reservoirs driven by 3-D seismic in the 1990s and 2000s," he said.

"So is also the case for the wonderful and spectacular outcrops and global analogs seen in the Clare Basin," he added. "New technology, delivered by the borehole project and by global satellite data, such as in Google Earth, delivers fabulous new insight not realized earlier."

This story, according to the researchers, shows that it is important to hang in there:

"Geology in even classic, long-visited areas such as the Clare Basin goes through new phases of research and understanding," Martinsen said, "but the big breaks come when new technology is applied."

Barilaro Wins ICE Award

AAPG member Federica Barilaro has won the Ozan Sungurlu Memorial Award for the best student poster at last year's AAPG International Conference and Exhibition in Milan, Italy.

Her award-winning poster was "Upper Pleistocene-Holocene? Terraced-Slope Hot-Spring Travertine System and Its Modern Analog in the Albegna Valley, Southern Tuscany (Central Italy)."

She is a student in the department of earth sciences at the University of Milan.

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Steve Leifer will speak on "Hydraulic Fracturing: Separating Myth from Reality" at the Division of Environmental Geosciences annual luncheon at the AAPG Annual Convention in Long Beach, Calif. The luncheon will begin at 11:30 a.m. on Wednesday, April 25, at the Long Beach Convention Center.

Myths, misunderstandings and facts

Opinions Fractured on Hydro Fracturing

By DAVID BROWN, EXPLORER Correspondent

Whatever your position on hydraulic fracturing, you have to agree that it is highly dangerous, environmentally disruptive, poisonous and the work of the Devil ...

Or, that it's an advanced, low-impact, low-risk way to develop unconventional resources and increase energy supply.

Opinions vary.

In fact, environmentalists and oil and gas professionals do not always see eye-to-eye on the subject.

Steve Leifer looks at the Big Picture of drilling and hydrofracturing, from a global perspective.

"I have matters in all of the United States – and overseas," he said.

Leifer is a partner in the law firm Baker Botts LLC in Washington, D.C. He specializes in environmental matters and serves as chair of the firm's worldwide Environmental Department.

He'll also be the featured speaker at the Division of Environmental Geosciences' luncheon at the upcoming AAPG Annual Convention and Exhibition in Long Beach, Calif., talking about "Hydraulic Fracturing: Separating Myth From Reality."

With numerous clients in the energy industry, Leifer keeps as close an eye on hydrofracturing regulations and realities as anyone in the world.

His view on the current situation?

"It's pretty exciting out there," he said.

That's a statement of fact. With protest movements already established in New York, New Jersey, Pennsylvania and Ohio, environmentalists and anti-drilling forces are starting to mount serious anti-fracturing campaigns across the United States.


LEIFER

Appeals to emotion instead of logic or reason are especially difficult for the industry to counter.

France and Bulgaria have put outright bans on hydraulic fracturing. South Africa placed a partial moratorium on the process, and sporadic protests against hydrofracturing have been held in several other countries.

And that has presented the industry with a challenge.

"It's difficult with an emotional issue like this to come up with a way to change public perception," Leifer said. "We're certainly not winning the day, by any means.

Appeals to emotion instead of logic or reason are especially difficult for the industry to counter, he noted.

"Industry tries to advance its view by using science and rational arguments," he said. "Environmentalists don't have to do that."

Aiming for An Understanding

Leifer plans to discuss two sides of hydraulic fracturing: the technical process of fracturing itself and the regulatory environment in which fracturing takes place. Each carries its own set of possibilities, he observed.

"I'm going to mention both the risks and benefits, on both the legal and technical sides of things," he said.

While talking about fracturing necessarily means talking about regulators and regulations, Leifer said he plans to speak in terms familiar to a technical audience, with a minimum of legalese.

"I don't want to scare people off thinking half my speech is going to be in Latin," he explained.

Overall, Leifer said he would examine the various myths and misunderstandings that have grown up around hydraulic fracturing. That includes perceptions in the environmental community and in the technical community.

"I think the biggest myth is that hydraulic fracturing creates significant risk to drinking water supplies. That's not true," he said.

By contrast, some professionals in the oil and gas industry have tried to portray fracturing as a virtually risk-free practice.

"If anyone in the industry says there are zero risks, I would say that's a myth," he added.

Leifer also said he would discuss three recent developments in the hydraulic fracturing debate, where fracturing has come under scrutiny:

- Pavillion, Wyoming.

In December, the U.S. Environmental Protection Agency issued a draft report on its investigation of ground water contamination in and near Pavillion, where some residents had complained of objectionable taste and odor problems in well water.

The EPA conducted four sampling phases of ground water between March 2009 and April 2011, including samples from domestic wells, stock wells, municipal wells and monitor wells.

Results of sample analysis and of research designed and conducted at an EPA laboratory in Oklahoma indicated that hydraulic fracturing activity was a "likely contributor" to ground water contamination, according to the EPA.

"Alternative explanations were carefully

See **Leifer**, page 36

The Industry Learns Fast

The public debate over hydraulic fracturing continues, and in February it came to The University of Tulsa.

In the school's annual Chesapeake Lecture, AAPG member and past Distinguished Lecturer Terry Engelder engaged in a fracturing debate and discussion with Canadian geoscientist and energy researcher David Hughes.

The two began with dueling resource estimates.

Engelder, a geoscience professor at Pennsylvania State University, put himself in a middle position on shale-gas resource estimates, between the industry and government agencies.

"Even if that middle ground holds true, there will still be enough gas to make some major changes in, for example, our electrical generation infrastructure," he said.

Both agreed that hydraulic fracturing and shale gas development would continue to build the supply of natural gas in North America.

"We need it, so we have to look at best practices and reduce the impacts as much as we can," Hughes said.

Engelder said the industry made some missteps in the early days of shale-gas development, leading to public distrust, but added, "The industry learns fast."

– DAVID BROWN

Leifer

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considered to explain individual sets of data. However, when considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing," the report said.

Both diesel range organics (DRO) and gasoline range organics (GRO) in the well water, the EPA said.

"Domestic well results showed: the presence of DRO and GRO (in 23 of 28 samples), and trace levels of exotic organic compounds in some domestic wells including adamantanes, 2- butoxyethanol phosphate, phenols, naphthalene, and toluene," the report stated.

The EPA said no definitive conclusion was possible because of the lack of a baseline for water quality before fracturing operations began.

In addition to baseline data, an EPA panel had earlier called for "greater transparency on chemical composition of hydraulic fracturing fluids, and greater emphasis on well construction and integrity requirements and testing."

The Pavillion draft report stated, "implementation of these recommendations would decrease the likelihood of impact to ground water and increase public confidence in the (hydraulic fracturing) technology."

Dimock, Pennsylvania.

Some families in Dimock Township began complaining of contaminated well water in 2008, similar to the water complaints in Pavillion.

Cabot Oil and Gas Corp. had been conducting drilling and hydraulic fracturing operations in the Dimock area, and some residents associated the water quality problems with fracturing.

The Pennsylvania Department of Environmental Protection (DEP) ruled that Cabot's activities had affected the quality of 18 water sources. Cabot disagreed with the finding but signed consent orders with the DEP in 2009 and 2010, agreeing to fund escrow accounts and provide water for the affected families, among other actions.

In 2011, the DEP found that Cabot had fulfilled its obligations under the consent orders, and the company concluded water deliveries at the end of November.

Residents complained that their water remained tainted, and requested further governmental action.

The EPA then issued a determination that water supplies were causing health concerns at four Dimock homes. In January, it began potable water deliveries and said it would carry out its own water sampling and testing.

Induced seismic activity.

Various reports and conjectures have attempted to link small earthquakes or noticeable surface tremors to hydraulic fracturing activity. Lately, most of that focus has shifted to deep wastewater injection wells, Leifer noted.

Ohio ordered the shutdown of one injection well after a series of earthquakes hit the northeast part of the state. Injection wells also have been suspected of causing tremors in Arkansas, Texas and Oklahoma.

Leifer said the injection-well situation highlights a difference between fracturing water disposal in the western United States and in the east.

"In the west you can generally just take your water and inject it into an injection well. In the east, you can't do that," he said.

"That means the produced and flowback water must be shipped to a public-owned treatment works – a POTW, essentially a town water system. This raises the need to make sure the water does not unduly interfere with the operation of the POTW," he added.

State legislatures increasingly took up the subject of hydraulic fracturing last year. By the beginning of 2012, several states had considered placing a temporary moratorium on fracturing operations, but no state had banned the practice completely.

"I think that it is possible a state which does not have a great deal of shale gas could institute an outright ban," Leifer said.

"But it is highly doubtful that a state with serious reserves would shoot themselves – and their economy – in the foot by completely banning hydraulic fracturing," he added.

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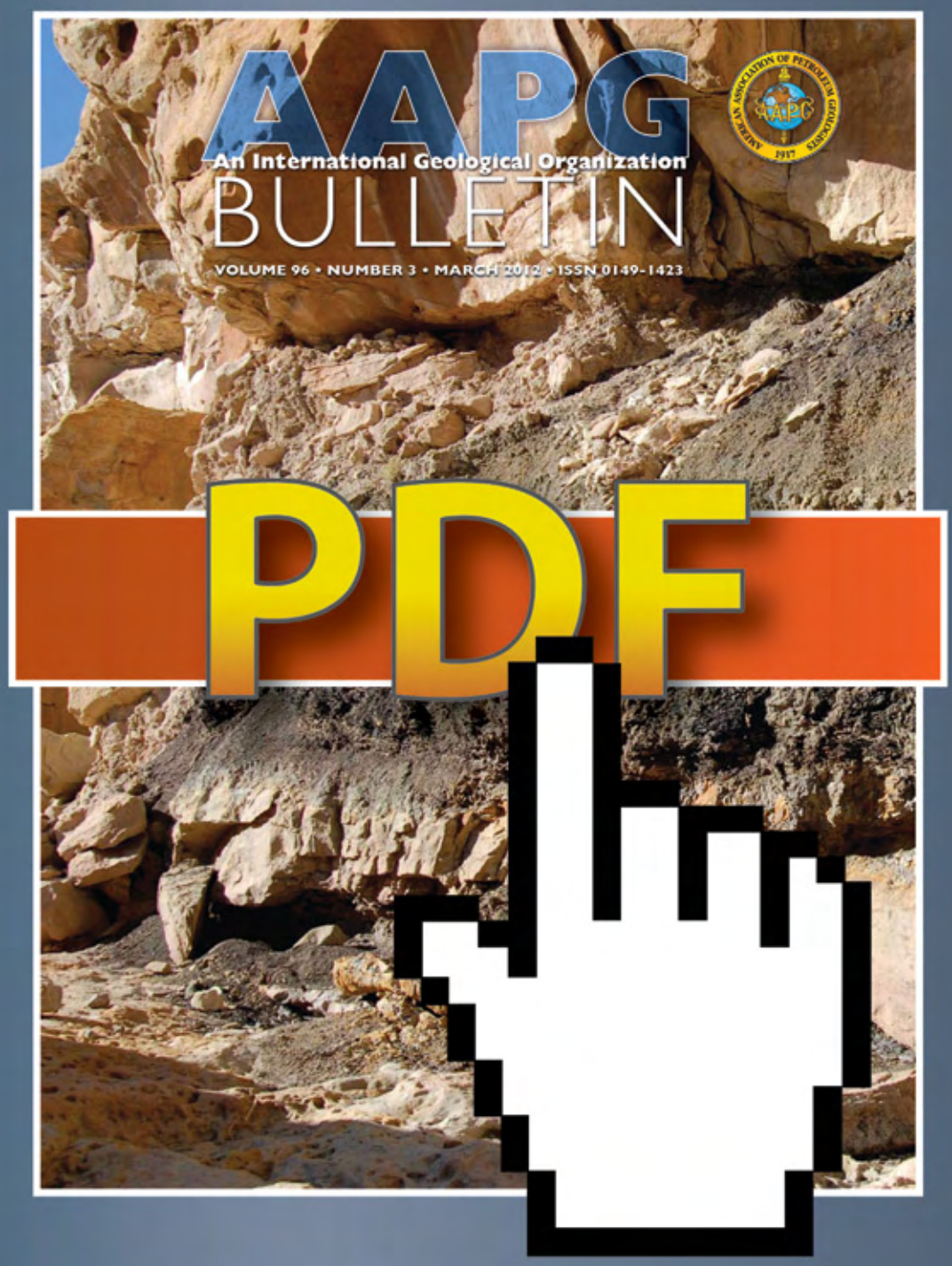

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Article highlights include:

Reducing uncertainty in subsurface studies

Weiguo Li, Janok P. Bhattachary, and Yijie Zhu

Variable sampling of measured sections of a complex fluvial-deltaic clastic wedge of the Ferron Sandstone, southern Utah, is used to evaluate potential correlation uncertainties of sparse-data sets. This procedure can also be used in marine successions where correlation is hampered by sparse data.

A convenient way to consider variable dependency

Zhuoheng Chen, Kirk G. Osadetz, James Dixon, and James Dietrich

Petroleum resource potential modeling characterizes undiscovered petroleum resources. Copulas, which describe variation between random variables, provide an alternate way to model joint distributions with greater flexibility in terms of marginal distribution and dependence structure.

Unayzah conventional and tight gas fractures

Mohammed S. Ameen, Keith MacPherson, Maher I. Al-Marhoon, and Zillur Rahim

The older units (B and C) of the Unayzah formation, Saudi Arabia, contain natural fractures that are essential to permeability, porosity, and reservoir performance. This study has lead to a well placement and completion design that optimizes the intersection of open fracture clusters.

Hydrocarbon potential in the Woodford Shale

Andrea Miceli Romero and R. Paul Philp

The Woodford Shale is studied to determine organic richness and type, hydrocarbon generation potential, thermal maturity, organic source matter variation, and depositional environment. This study reveals the significant lithological and chemical variability that occurs within shales.

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.

HISTORICAL HIGHLIGHTS

Baku Had Its Origins as a 'Nobel' Venture

By SIGRUNN JOHNSEN

The Nobel brothers, Robert, Ludvig and Alfred – the latter is the inventor of dynamite and the father of the Nobel Prizes – were Swedish inventors, engineers and investors who operated mostly in Russia, where they filled a technological void from about 1860 until 1900.


JOHNSEN

Specifically, they had a machine factory in St. Petersburg and were producing oil in Baku, Azerbaijan – and the combination helped them to make a fortune.

In the Beginning

The oil in Baku started flowing in 1875, and in 1879 the brothers founded their oil company, Branobel, with the main activities in Baku – where any farmer who put his spade in the right place could become an oil baron.

The full name of the company was Petroleum Production Company Nobel Brothers Limited. The original Russian name, ratified by the tsar, was "Tovaristjestvo Neftjanovo Troizvodstva Bretjev Nobel." The headquarters was in St. Petersburg.

The brothers expanded the operation – from the oil well and refinery to distribution with pipelines and tankers – and they set up petroleum storage sites around Russia and the rest of Europe.

The brothers also learned a lot from the United States, where the technology was way ahead of Russia. They often sent engineers to Pennsylvania to collect as much information as possible.

It was a breakthrough for the European energy market when the Russian steamer "Sviet" arrived in London in 1885, fully loaded with oil.

The brothers also invented new technology. A powerful engine for drilling and extracting oil was needed, and the brothers modified the steam engine and steam boiler to be adapted to use oil.

The distillation of the crude oil left a worthless residue, called masut. Ludvig Nobel then designed a new oil burner – and masut, with its high fuel value, came to be used in industry, steamships and railway operations.

Its economic importance for Russia's industrialization was enormous.

A Growing Influence

In 1888 Ludvig died in Cannes on the French Riviera.

After his death, his sons Emanuel and Carl took over. Emanuel managed Branobel and Carl managed the machine factory in St. Petersburg.

One of Carl's great achievements was to build an internal combustion engine that could run on oil – not on paraffin, as was previously the case. The factory displayed their new invention at the world exhibition in Chicago in 1893.

After Carl died in 1884, his younger brothers, Gösta and Emil, ran the machine factory.

In the autumn of 1888, Tsar Alexander III and Maria Fjordorovna, their family and ministers visited the Nobels in Baku. The tsar, who otherwise was always surrounded by both visible and invisible police, went around Nobel's factories without a single policeman.

(On the return journey, however, the tsar's procession was attacked by dissatisfied workers and about 20 travelers were killed.)

Emanuel acted on Tsar Alexander III's invitation to become a Russian citizen – the only one in the Nobel family – and he later received the title of "His Excellency." Emanuel remained unmarried and he became increasingly like a Russian prince, with a weakness for grand dinners and jewelry.

The greater part of Baku's pipeline system was, by the turn of the century, owned by Branobel. Almost 60 percent of the oil transported on the Volga came from the Nobels' factories. Branobel's fleet was greatly expanded; boats and barges were adapted for the rivers and canal systems:

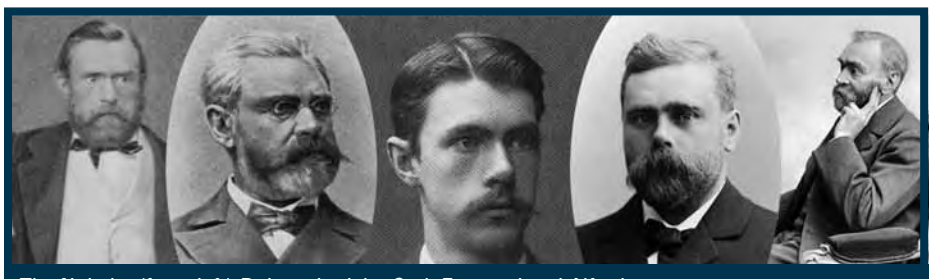
- On the Black Sea, boats went from Batum, Novorossisk and Rostov to Russian harbors.
- Via the Caspian Sea, oil was carried into Russia and on to Europe.
- Oil was transported to Vladivostok and China, as far as Shanghai, by train and camel.

In the strong competition between the European oil companies, the Nobel brothers had a great advantage, and by 1916 Branobel had a dividend of 40 percent and was producing a third of Russia's crude oil, 40 percent of the refined oil and supplying two thirds of domestic consumption.

Comes the Revolution

Then, in February 1917, the Russian Revolution began, and the tsar abdicated his throne. In June 1918, the new Soviet regime nationalized all privately owned industry.

See **Branobel**, page 40


The Nobels: (from left) Robert, Ludvig, Carl, Emanuel and Alfred.

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PROFESSIONAL newsBRIEFS

Ali Al-Hauwaj, to exploration manager, Dragon Oil, Dubai, UAE. Previously manager-exploration department, Saudi Aramco, Dhahran, Saudi Arabia.

Jim Fulcher, to senior explorationist-deepwater Gulf of Mexico, Venari Resources, Dallas. Previously subsalt Miocene team lead, Nexen Petroleum, Plano, Texas.

Rick E. Hart, to Williston Basin geologic manager, Statoil, Austin, Texas. Previously exploration geologist, Brigham Exploration, Austin, Texas.

Timothy R. Kustic, to state oil and gas supervisor, California Division of Oil, Gas and Geothermal Resources, Sacramento, Calif. Previously technical services manager, California Division of Oil, Gas and Geothermal Resources, Sacramento, Calif.

Logan MacMillan, to member/manager, LiTMus EPO, Littleton, Colo. Previously senior staff geologist, Anadarko Petroleum, Denver.

Timothy C. Maxwell, to chief geologist, Canadian Natural Resources, Calgary, Canada. Previously manager-geology and geophysics, northern North Sea, CNR International, Aberdeen, Scotland.

Doug McGuire, to technical sales director-North America, Paradigm Geophysical, Houston. Previously technical sales adviser-petrophysics, Paradigm Geophysical, Houston.

Sheree Thompson, to senior geological adviser, National Petrographic Service, Houston. Previously director of geology, Agile Seismic, Houston.

Nahum Schneidermann has been honored with the World Petroleum Council's Outstanding Achievement Award at the group's recent 20th World Petroleum Council in Doha, Qatar. Schneidermann, an AAPG Honorary Member, is retired from Chevron and resides in Walnut Creek, Calif.

Paul B. Welch, to geologist, Gordy Oil, Houston. Previously geologist, Anderson Welch Consulting, Plano, Texas.

Branobel

from page 38

The Nobels were wanted capitalists, and as Emanuel was a Russian citizen he was forced to flee with his family. The Nobels traveled – disguised as peasants – by horse and cart for several weeks, helped along the way by their companies' sales agents.

On Nov. 26, 1918, they reached Berlin. Back in Sweden, Emanuel renounced his Russian citizenship. He died in 1932.

The younger brothers, Gösta and Emil, stayed on, trying to save Nobel's assets in St. Petersburg. Gösta attended a meeting in Moscow with the new Soviet central oil committee. The Bolsheviks' intentions were to write a constitution for the oil industry with the state as owner and with the previous owners as technical advisers responsible for operation and deliveries to the state.

All the representatives for the oil industry refused to accept the proposals.

On Nov. 30, 1918, the two brothers were detained by the secret police, the Cheka. They were imprisoned, but, following negotiations, they were freed on condition that they would not escape.

Not long after, however, they sat on a train in a pitch-dark compartment filled with Red Guards. They made it to Sweden with the help of friendly Finns, and on Dec. 22, 1918, they arrived in Stockholm, where the rest of the whole Nobel family was gathered for Christmas.

The Final Years of Branobel

An industrial empire had been lost – not just their oil company and the machine-building factory, but also assets in companies in which they were part owners; oil companies, depots, tankers, shipping companies and oilfields.

The Nobels had no oil or funds for their European partners – all was left behind in Russia – and consequently, they had to sell the assets they had in Europe.

However, new opportunities arose.

In January 1919, American company Standard Oil had bought 11 exploration concessions in the still independent Azerbaijan, and was interested in more. The company inspected the Branobel plants in Baku and a price for half of Branobel's shares was negotiated.

A preliminary contract was signed in Paris on April 12, 1920. The reward for Standard Oil to produce oil at low production costs and sell to the Mediterranean countries was so great that they ran the risk of buying a company that the Nobels perhaps no longer owned.

On April 28 the Bolsheviks arrived in Baku by train. The political situation was uncertain, but Standard Oil was pressing on with the deal – and in New York, on July 30, 1920 the final contract was signed. Half of Branobel's shares were sold to Standard Oil and the Nobels' fortune was secured.

After Ludvig's two youngest sons, Emil and Gösta, died in 1951 and 1955, respectively, the Branobel oil company, established in 1879, was finally liquidated in Stockholm in 1969.

(Editor's note: AAPG member Sigrunn Johnsen is geological consultant with ProTeam AS, Stavanger, Norway. She is a past president of both the Norwegian Association of Petroleum Geologists and AAPG's European Region, and recipient of the AAPG Distinguished Service Award and AAPG House of Delegates' Distinguished Member award.)

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- ❒ University of La Paz, Bolivia
- ❒ (Universidad Mayor de San Andres)

Canada
- ❒ Mount Royal College
- ❒ University of Calgary

Columbia
- ❒ University of Industrial Santander

France
- ❒ The Institut Français du Pétrole Grant

Kazakhstan
- ❒ Kazakh National Technical University (KAzNTU Institute of Oil and Gas)

Switzerland
- ❒ ETH Zurich

Venezuela
- ❒ University of Central Venezuela

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Ex 1

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Corporation, Calgary, Canada, and a current AAPG-SEG Joint Distinguished Lecturer. This month's column deals with equalizing wavelets that are produced by different seismic sources.

GEOPHYSICALCORNER

When All Data Are *Not* Created Equally

By BOB HARDAGE

Tidewater areas can be difficult places to acquire consistent-quality seismic data, because different sources have to be used across exposed land surfaces than what are used across shallow-water areas.

Typically, explosives are used in shot holes in the onshore portion of a tidewater prospect, whereas environmental regulations may require that an air-gun source be used in shallow-water areas.


HARDAGE

These two seismic sources produce different basic wavelets – and profiles produced with explosives and air guns rarely tie in an optimal manner at common image coordinates without using wavelet-shaping algorithms to create equivalent reflection character across targeted intervals.

* * *

An example of using an explosive source and an air-gun source across a Louisiana tidewater area is documented as figures 1 and 2. This shallow-water test line was recorded twice because, at this location, explosive sources were allowed.

For one profile, the source was a 30-pound (13.6-kilogram) charge positioned at a depth of 135 feet (41 meters) at each source station.

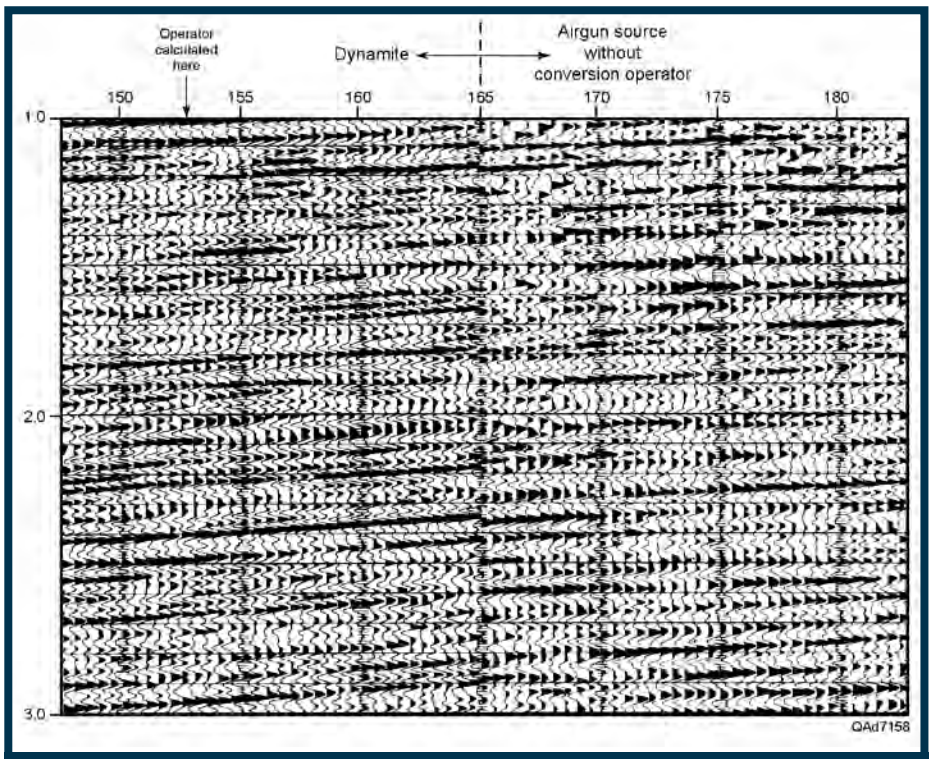

Figure 1 – This shallow-water profile was recorded with two different sources – shot-hole explosives and air guns. A portion of the image produced by shot-hole explosives is shown to the left of station 165; a portion of the image produced from the air-gun data is shown to the right. The interpreter preferred the data generated by the shot-hole explosives. Cross-equalization operators that converted the phase and frequency spectra of the air-gun data to the phase and frequency spectra of the shot-hole data were calculated at station 153.

For the second data acquisition along the same profile, the source was an array of four air guns with a combined volume of 920 in^3, and eight air-gun pops were summed at each source station.

Considerable processing effort was expended to make the final reflection character identical on each test line. The data illustrated as figure 1 show the results of the data processing.

The frequency content of the two profiles is approximately the same, but wavelet character is not identical at the junction point (station 165). In this instance, the interpreter responsible for this prospect decided that the reflection character expressed by the explosive source was preferred rather than the wavelet response shown by the air-gun source.

The challenge was that in neighboring tideland areas, regulations required that an air-gun source be used in water-covered areas – shot-hole explosives could *not* be used in shallow water as they had been across this initial test site, and a method had to be developed that would allow air-gun-source data to be used in conjunction with explosive-source data acquired across adjacent exposed-land areas.

Said another way, the problem was to create a basic wavelet in air-gun-generated data that was equivalent to the basic wavelet embedded in explosive-source data.

This type of problem has to be solved by data-processing procedures, not by data-acquisition techniques.

* * *

An approach used by many data

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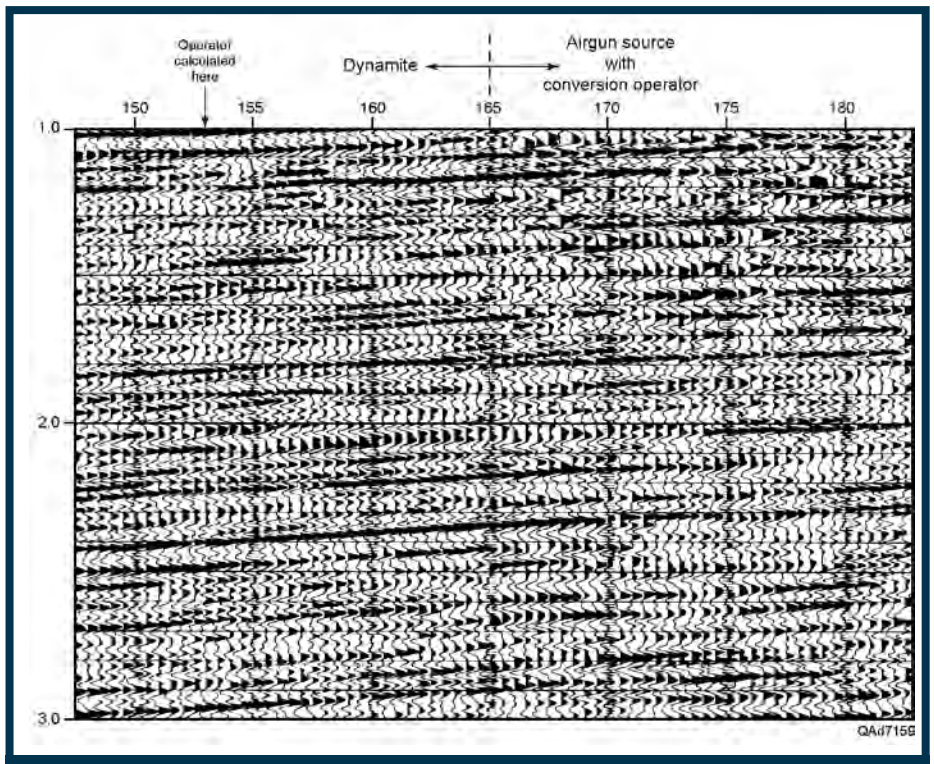

Figure 2 – The same data exhibited on figure 1 after cross-equalization operators determined at station 153 are applied along the complete air-gun source profile to create equivalent basic wavelets in both the air-gun and shot-hole data. The wavelet character at junction point 165 is now almost seamless. When this type of cross-equalization operator is applied to extensive grids of intersecting seismic profiles acquired with different sources, the consistent imaging wavelets produced in the overlapping data allow a better interpretation of subsurface geology to be done across a prospect area.

Continued from previous page

* * *

processors to ensure that equivalent basic wavelets exist in two seismic profiles acquired with different sources is to calculate numerical cross-equalization operators that convert the phase and frequency spectra of source A to be equivalent to the phase and frequency spectra of source B.

This technique was applied to the tidewater seismic data illustrated on figure 1 by using data from the image trace at station 153 to calculate cross-equalization operators that converted the phase/frequency spectra of the air-gun data to the spectra of the explosive-source data.

The result is exhibited as figure 2.

The wavelet character of the profiles now agrees better at the tie point so that common horizons, sequence boundaries, and facies character can be interpreted on both profiles with greater confidence.

The example discussed here is from a tidewater area where operating and environmental constraints forced different sources to be used on land-based and water-based seismic lines.

The concept of numerical equalization of the basic wavelets embedded in any grid of intersecting 2-D (or 3-D) data, however, applies to a variety of onshore and offshore areas where people have access to overlapping legacy seismic data that have been acquired by different companies at different times and with different energy sources.

(Editor's note: Bob A. Hardage is senior research scientist at the Bureau of Economic Geology, the University of Texas at Austin. He was the past editor of Geophysical Corner, and is currently serving as president of SEG.)

AAPG Sessions Planned for OTC

A panel discussion on offshore operational integrity and a professional ethics lecture highlight the AAPG-sponsored technical sessions at this year's Offshore Technology Conference, set April 30-May 3 in Houston.

Buford Pollett, an AAPG representative on the OTC Program Committee, will co-moderate a session on "Improving Operational Integrity in Offshore Energy Operations – A Global Perspective," featuring a panel composed of a multinational group of key figures from the global offshore energy industry.

Panelists include Rear Admiral James A. Watson IV, director of the U.S. Bureau of Safety and Environmental Enforcement, who was federal on-scene coordinator of the Deepwater Horizon oil spill.

AAPG Distinguished Lecturer on Ethics, W.C. "Rusty" Riese, adjunct professor at Rice University and a past AAPG vice president-Sections, will be a co-speaker at the May 1 Ethics Breakfast on "Oil Spills, Ethics and Society," which also will qualify for continuing education credits.

AAPG-sponsored sessions include:

- Ocean Mining: An Ocean of Opportunities.
- Metocean Exhilaration.
- Ocean Mining: Technology Developments.
- In Situ Monitoring of Slope Stability and Seabed Fluid Flow.
- Recent Updates in Offshore Geoscience.
- How Well Do You Know Your Well? A Collaborative Approach to Pore Pressure Analysis and Well Control.

Also on the AAPG-sponsored program slate is a topic breakfast on Nikaitchuq, offshore Alaska. The speaker will be David Moles, Alaska Eni representative and development manager.

See http://www.otcnet.org/2012/ for program and registration details.

Editor's note: Regions and Sections is a regular column in the EXPLORER offering news for and about AAPG's six international Regions and six domestic Sections. Contact: Carol McGowen, AAPG's Regions and Sections development manager, at 1-918-560-9403; or e-mail to cmcgowen@aapg.org.

REGIONS and SECTIONS

Canada, Gas Industry Adjusts to Supply, Demand

By CAROL CAIN McGOWEN

Frigid temperatures and blizzard conditions moved across Europe in early February, setting new records – and as temperatures fell, gas prices from the main pipeline in Russia rose to the highest levels since 2006.

One week later in North America, colder weather pushed across the continent causing a slight uptick in natural gas consumption, but not enough to offset the excess supply and appreciably boost market price. About half the homes in the United States alone use gas for heating, but natural gas usage was lower than normal due to unseasonably warm temperatures in November, December and January.

In the classic economic theory of supply and demand, as demand for a commodity increases, prices rise. Increased supply drives the price down. In today's world, however, many other factors can affect price, including government regulations, fluctuating costs, transport systems, etc.

And in the current case, reduced product demand together with plentiful supply from shale gas play development appears to be the cause of a downward natural gas price trend.

A U.S. Energy Information Administration report from early February illustrates the economics in hard numbers:

"Total working natural gas in underground storage in the lower 48 states was 3,098 Bcf for the week ending Jan. 20 – 21 percent above the storage levels from one year ago."

Daily dry gas production averaged about 64.2 billion cubic feet per day (Bcfd) in January, up almost 10 percent from last January, according to the report. And natural gas prices hit a 10-year low on Jan. 19 at $2.32 per 1,000 cubic feet, according to industry reports.

As market prices for gas appeared to hit bottom, U.S.-based companies Chesapeake Energy and ConocoPhillips announced production cuts due to low prices and thin margins, while other companies have slowed drilling programs in purely natural gas fields.

Chesapeake Energy, the second largest natural gas producer in the United States, said last month it will sharply cut drilling spending, forecasting it will cut dry gas drilling capital expenditures to $900 million in 2012, compared with $3.1 billion last year.

Chesapeake also announced that it would trim production by about 500 million cubic feet per day, while ConocoPhillips reportedly is considering shutting down another 100 million cubic feet per day of production.

Around this same time, Royal Dutch Shell announced it will shift focus from shale gas to tight oil, due to declining U.S. gas prices. Chesapeake also announced a shift in its exploration efforts to liquids-rich plays like the Eagle Ford in Texas.

Even T. Boone Pickens, longtime proponent of natural gas-powered vehicles, recently offered a cure for declining gas prices. Reuters quoted Pickens as saying, "The only way to get natural gas prices up is to stop companies' drilling."

Over the past year, a chill in the economic climate also has settled over Canada. Previously, Canadian producers supplied approximately 20 to 25 per cent of North America's demand for natural gas – yet Canadian producers have seen their U.S. exports drop by 31 percent since 2010.

For a time, reduced demand due to the excess supply from booming U.S. shale gas production pointed to a partly cloudy economic outlook for Canada's shale gas industry.

Canadian Challenges

Meanwhile, with exports to the United States declining, many Canadian producers are facing similar issues, as Progress Energy Resources Corp. announced shutting-in up to 10 percent of its dry natural gas production (25-30 mmcf/d) and other companies are looking for opportunities to monetize plentiful natural gas supplies.

This period of low prices is seen by some as the optimum time to assess the potential of new business markets for natural gas, study the feasibility of bringing new technology to Canada and, ultimately, to invest in market diversification – all aimed at increasing the value of western Canada's natural gas.

"Production growth in British Columbia is second only to Alberta, and is attributed largely to the development of unconventional shale gas," according to a spokesperson for the British Columbia Ministry of Energy and Mines.

Recently, the National Energy Board (an independent federal regulator) and the British Columbia Ministry of Energy and Mines jointly assessed the huge volumes of shale gas potentially producible in the Horn River Basin. The 2011 energy market assessment, "Ultimate Potential for Unconventional Natural Gas in Northeastern British Columbia's Horn River Basin," is considered the first probabilistic resource assessment of a Canadian shale basin.

"The assessment suggests that B.C.'s Horn River Basin holds the potential for 78 trillion cubic feet of marketable shale gas (a medium estimate within the range of

Continued on next page

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production calculated in the study)," says the Ministry spokesperson.

Clarifying the significance of the assessed gas volume, the Ministry spokesperson added, "This is a significant number because the entire province currently produces just over one trillion cubic feet of gas per year."

Options and Exports

Canadian companies are looking for ways to monetize natural gas. The business case is straight forward – leverage the difference between low gas prices and high oil prices.

Among the possible monetizing options for natural gas are new markets or potential expanded markets under consideration in western Canada are: Liquefied Natural Gas (LNG) exports; gas-to-liquids technology (GTL); increased usage of natural gas used in oil sands production; and large-scale conversion of vehicles to natural gas-burning engines.

With the first three options producers are basically investing at natural gas price levels, then extracting liquids to sell at higher oil price levels.

According to a June 2011 Canadian Energy Research Institute report, "Faced with the prospect of a long-term glut of gas and low prices in North America, producers in western Canada have more incentive than ever to build liquefied natural gas terminals on the west coast to allow exports into the premium-priced Asian market."

On Feb. 3, Premier Christy Clark announced British Columbia's natural gas strategy, which includes the report "Liquefied Natural Gas – A Strategy for B.C.'s Newest Industry."

"We are creating new and exciting opportunities by diversifying our natural gas sector, strengthening job prospects for British Columbians and opening the door to new clean energy projects," she said. "My government is positioning liquefied natural gas as a cornerstone of British Columbia's long-term economic success."

The Canadian government recently approved a 20-year export license for the LNG facility being built in Kitimat – the first such license ever issued in Canada. By exporting LNG to markets in southeast Asia, like China and Japan, producers can access market prices for natural gas that are four times higher than North American prices.

China and Japan are both looking for new energy supply sources – China to fuel its massive infrastructure expansion, and Japan to diversify its fuel supply away from primarily nuclear energy.

The Kitimat LNG export terminal on B.C.'s West Coast is reportedly on target to be fully operational by 2015.

GTL Potential

Talisman Energy of Canada and South African energy and chemicals group, Sasol, are jointly conducting a feasibility study for a gas-to-liquids facility in western Canada. Sasol and Talisman previously joined forces to explore the Montney basin in Western Canada, where the two companies are equal partners in two shale gas assets near Dawson Creek, British Colombia.

The exact location under consideration for a GTL plant is not yet known to the public, but Alberta and British Colombia are taking steps to demonstrate their province's suitability and commitment to the project.

The Talisman-Sasol study will assess the infrastructure, work force capacity and potential markets for diesel fuel in western Canada and the western United States, including offshore opportunities needed to develop a GTL plant.

According to Rob Gibb, Talisman's manager of corporate and public affairs-Canada GTL Project, the study is expected to conclude by the end of June, and after that "business decisions will be made by the partner companies on whether and how to go forward with the project."

The primary product of the GTL process is low sulfur diesel – a superior performance diesel fuel that is readily useable without changes in engine design. Naptha, used to blend with bitumen, is also produced.

"By converting natural gas into transportation fuels such as diesel and jet fuel, the value of natural gas would more closely track oil prices," Gibb said.

Risk comes into the equation depending upon how predictable are the capital costs and operating cost estimates.

And, "depending on timing of the provincial regulatory process", Gibb added, "cost estimates could change."

Formed in South Africa to make oil from coal, Sasol began commercial use of its coal-to-liquids (CTL) technology in 1950. The first gas-to-liquids plant, developed for Oryx in Qatar, began production in 2007. Sasol now operates in over 30 countries in response to growing interest in its CTL and GTL projects.

"An Alberta location would be close to industry with lots of local demand for diesel and naptha," said Deborah M. Pietrusik, corporate relations manager for Sasol Canada. The Alberta oil sands industry blends naptha with oil sands to produce bitumen.

"Alberta has seen a shortage of diesel due to significant industry growth," she said, adding that the GTL plant "would alleviate local concerns about fuel shortages in the event of an unplanned outage at diesel-producing refineries."

If B.C. is selected as the proposed GTL plant site, the Kitimat export facility would provide access to global markets.

Officials in Alberta and British Columbia are vying for the honor of being the first province to welcome GTL technology, but also recognize the significant value of new jobs generated by the project. The feasibility study is looking at building either at 48,000 bpd plant or a 96,000 bpd plant, which could be optimized to 98,000 bpd. With either of these scenarios, 73 percent of the production would be diesel.

As Peitrusik puts it, "approximately 7,000 jobs will be employed during the construction phase." And when fully operational, she estimates, "the GTL plant will offer nearly 500 permanent employment positions."

WWW UPDATE

'E-Plan' Your Itinerary For Long Beach ACE

By JANET BRISTER, AAPG Web Site Editor

So many choices, so little time.

That's how members can feel when perusing the program of the rapidly approaching AAPG Annual Convention and Exhibition in Long Beach, Calif.

Fortunately, there is an online tool that will help maximize convention time.

Located on the landing page for the Long Beach meeting, note the link to the "Itinerary Planner." This tool is tied into the technical program abstracts and all scheduled events at the convention center.

It is invaluable to attendees.

Located in this single location are all details of the technical program sessions, luncheons, courses (both before and after the meeting) and special sessions and forums. It is designed to allow the user to browse, search and, ultimately, select the events of interest to them.

Once selections are made the itinerary will reveal the conflicts. Now you are empowered to tweak the schedule and then download it in several formats: PDF, .ics for your calendar, or Excel spreadsheet.

Try It – I Liked It!

When you first enter the Itinerary Planner you'll have the option to use it as a guest or you may provide your email. I urge you to provide your email, as it creates a record that allows you to store your selections, empowering you to come back to your itinerary repeatedly until you have it finalized.

The first thing I did was to browse and discover the features.

For example, when I expanded Monday, I found the All-Convention luncheon listed, along with all papers. Likewise, on Sunday, all sessions including short courses and opening session were included.

It was pretty cool to discover the entire experience could be planned (with only a few exceptions – read on.

I went through each day and found those important luncheons and forums that I needed, then I explored the "search" feature.

The search feature was quite robust, allowing me to look only for presenters or to display session types or session topics in my results.

Once I saw a session I liked, I could select the whole session at once (on the right) to include in my itinerary, or I could select individual sessions.

Since I wanted to target a specific presenter, I also found their name and could select their specific presentation – poster and paper, alike.

I noticed a nice feature for attendees who are limited to one day – the "Itinerary Level." When I used this it honed my view to the day(s) I selected.

Now, this was all from the default features of the site.

I took a break and left the site. Upon my return I entered my email address and everything I had completed to that point was there, so I decided to review my itinerary.

My Results

On the left is this small browsing menu, where I selected "view your itinerary." It quickly became apparent that I had a lot of conflicts.

There was a red icon with an exclamation mark in it that showed my conflicts, so the weeding began and I started to deselect and prioritize the items critical to my experience.

It was nice to know I could leave it for a few hours and consult with my peers about their plans. Then I would return to finish the process. It became evident this tool would help stay coordinated with co-workers so we could maximize our attendance.

There also is an option to add the itinerary with abstracts to a calendar.

Clicking this option gives an .ics file to import into a calendar. Now the itinerary can be viewed on other electronic devices.

I chose to download my itinerary into all options just to see what the results would be.

I found I needed to edit the resulting Excel spreadsheet into cells that would wrap the text and change the formatting to something more readable – but any one with rudimentary Excel skills could do that.

The print option formatted the results into a very usable PDF, too.

I noticed also that if a paper was withdrawn that was graphically noted with a purple "w" icon. (We hope your itinerary

Continued on next page

IN MEMORY

George E. Caspary, 73
Tallahassee, Fla., Dec. 21, 2011
Richard D. Christiansen, 65
Canon City, Colo., Oct. 30 2011
James H. Davis, 76
Houston, Dec. 3, 2011
Hindman Doxey Jr., 80
Jackson, Miss., Jan. 16, 2012
Robert P. Evans, 90
Shreveport, La., Nov. 27, 2011
Robert T. Halpin, 83
Dallas, June 13, 2011
Van Howbert, 84
Midland, Texas, Oct. 10, 2011
Erik A. Nelson, 87
Tulsa, Nov. 8, 2011
Richard D. Parker, 74
Russell, Kan., Dec. 24, 2011
Coy H. Squyres, 85
Houston, Jan. 16, 2012
A. Gordon Stollery, 64
Markham, Canada, Dec. 12, 2011
Cullen R. Thompson, 86
Houston, Jan. 7, 2012
James C. Whitten, 82
Midland, Texas, Sept. 11, 2011

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

MEMBERSHIP

Member Dues Statements Are Coming Your Way

By VICKI BEIGHLE, AAPG Member Services Manager

AAPG annual dues statements for 2012-13 are ready and will be coming your way soon, boasting a new look and new information for all members.

The changes were implemented based on input that we've received from various members and committees, as well as from a thorough review of our operational procedures. Simplification was our primary objective, and it was determined these significant changes would benefit the vast majority of our membership.

Those changes include:

- This year's dues statements are smaller in size, easier to understand and, for the first time in decades, will be arriving without accompanying member cards. Members have had the option to access/print both a member card and receipt online via MEMBERS ONLY for several years now, and these options remain accessible year round.

  Beginning this year, however, members who want to receive the standard card will be required to check the appropriate box, whether renewing online or returning payment with the statement.

- Members wishing to utilize our Graduated Dues Structure now will be required to remit payment online – or contact AAPG to have a revised statement provided to them.

- The suggested Foundation contribution (based on $2 per year of membership) will still appear on the statement, as will the (optional) opportunity to contribute to the GEO-DC office.

- Members will see a slight increase in dues (see President's Column, page 3).

- Members wanting to receive hard copies of the BULLETIN will be required to pay a $50 print fee (in addition to basic dues) plus applicable mail surcharge(s).

- Student members will no longer receive print copies of the EXPLORER, but will have online access beginning with the July issue.

Continued from previous page

won't show very many of those.)

My final choice? I used the "add itinerary to calendar" and "print itinerary + abstracts" so I could review the abstracts on my trip to Long Beach and have my schedule handy throughout the meeting.

The Exceptions

Committees and field trips were not included in this itinerary planner. This is because the focus of the planner is the convention center site.

At this time committee meeting assignments are still being made. Once completed these will be compiled into a PDF to download from the Long Beach website. Committee chairs will be notified when these are available.

If you are registered for a field trip or attending a committee meeting, you'll simply make note of that and merge it into your spreadsheet or add to your calendar. Obviously the PDF would not accommodate that – but a good pen on a printed piece of paper is still a pretty handy tool.

It makes sense to get these details before you complete your itinerary. The itinerary planner will remain available at all times so you may make your plans today and then finalize them after you know about the exceptions that might apply to you.

I will not download my final itinerary until about one week before my departure so I can make one final review and confirm none of my selected papers are withdrawn, or any conflicts arise due to schedule changes.

Good browsing!

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

Professor Johnson

I am absolutely delighted about the achievement of Howard Johnson (February EXPLORER), whom I would say made my career bright and intellectual by teaching me the things during the master's course at Imperial College.

Further, I was honored to have him as my supervisor, which not only enabled me to think wise but think critically in the world of geology.

Once again, my heartiest congratulations and praise for the professor.

Ammar Ahmad
Islamabad, Pakistan

(Editor's note: Howard Johnson is a recipient of this year's AAPG AAPG Grover E. Murray Memorial Distinguished Educator Award. He'll receive his award April 22 at the AAPG Annual Convention and Exhibition in Long Beach, Calif.)

FOUNDATION UPDATE

By NATALIE ADAMS, AAPG Foundation Manager

The AAPG Foundation will be well represented next month at the AAPG Annual Convention and Exhibition in Long Beach, Calif.

- The Members of the Corporation will meet during the convention, as well as the Trustee Board.
- Trustee Associates and a select number of Foundation supporters are invited to the Chairmen's Reception, hosted by Foundation Trustee Chair Bill Fisher and Don O'Nesky, the Trustee Associate chair.
- Lastly, the new Fundraising Advisory Committee will meet for the first time and discuss a new post-campaign fundraising strategy, under the volunteer leadership of Rick Fritz.

* * *

The James E. Hartman Student Leadership Summit Fund now exceeds $600,000, thanks to the generosity of Mr. Hartman. Because of his dedication to students studying geology, many new leaders will emerge for years to come.

A brand new initiative begins in the fall to enable students to develop their leadership skills.

If you have a passion to support future generations, add your contributions to the James E. Hartman Student Leadership Summit Fund.

* * *

The Foundation's Trustee Associates continue to provide strong financial support, and are pleased to welcome the following new members: **Pete Stark**, **John Dolson**, **Rita Monahan**, **James Painter**, **Terry Mather**, **Martin Shields**, **Larry** and **Barbara Meckel**, **Annell Bay** and **Loren Leiker**.

* * *

The AAPG Foundation is pleased to announce that Marathon Oil Corporation has endowed two GIS-UDRIL digital subscriptions: University of Texas at Austin and the University of Kansas.

Marathon also pledged to endow eight more subscriptions in the next four years. Many thanks to **Annell Bay** and **Paul Weeditz** for making that gift happen!

Paul Buckthal of Amarillo, Texas, has endowed a University Subscription and GIS-UDRIL digital subscription for the University of New Mexico in memory of his wife, **Natalie Henkes Buckthal**, and in honor of his grand-daughter, **Natalie Heberling**, who attends that university.

* * *

A recent Visiting Geoscientist Program visit was made to Bahria University-Islamabad by Nadeem Ahmad, with the topic of "Seismic Stratigraphy as a Tool for Enhanced Exploration of Stratigraphic Traps."

Ahmad's visit has encouraged many students to apply for AAPG membership and the students there are looking to create an AAPG Student Chapter in the near future.

The AAPG Foundation would like to thank **Tako Koning** (see February EXPLORER) for his generous support of the Visiting Geoscientists Program.

* * *

Does your company match your giving?

More than $6,600 contributions came in the last two months from corporate matching gifts.

It's easy to find out if your company matches charitable contributions. The Foundation staff would be happy to help you double your gift!

* * *

We are sorry to learn of the passing of Trustee Associates **James Harrison Davis**, of Houston, on Dec. 3, 2011 and **Mark Dale Wilson**, of Midland, Texas, on Dec. 9, 2011.

Davis had been a Trustee Associate since 1984; Wilson had been a Trustee Associate since 2001.

Foundation (General)
BP Foundation
Matching gift for D. Ramsey Fisher
ConocoPhillips Corp. Contributions
Matching gift for Susan Young
EOG Resources
Matching gift for H. Leighton Steward
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James A. Hartman Student Chapter Leadership Summit Fund
James A. Hartman

K-12 Education Fund
BP Foundation
Matching gift for Jerome P. Siok
M.A. Custer
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In memory of Robert R. Berg
Gerald E. Harrington
John M. Sweet
In memory of Robert N. Specht, John Etnyre and David Davidson

E.F. Reid Scouting Fund
Samuel Thompson III
In memory of Kenneth I. Owens

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

PROTRACKS

YPs Plan Networking Opportunities in Long Beach

By JONATHAN ALLEN


ALLEN

The AAPG Annual Convention and Exhibition (ACE) is almost upon us, and that's good news to young professionals who want to begin building a professional network that will serve us the rest of our careers.

Whether this is your first convention or you are a regular, ACE can be an intimidating and overwhelming experience for early career professionals. On top of navigating the robust technical program of over 1,000 oral and poster presentations, there is the task of choosing from an impressive lineup of field trips and short courses, luncheons, receptions and featured lectures.

Add to that the challenge of deciding which of the over 100 exhibitors you would like to visit first, which day you are going to meet your old friends from grad school for lunch and when you'll find time to visit the Aquarium of the Pacific, and you realize that "overwhelming" may be an understatement.

To help you navigate those waters, two events have been planned for the convention's first day – both intended to specifically help young professionals maximize their ACE experience:

- The first event is the **YP Meet & Greet**, which begins Sunday, April 22, at 2 p.m.

The Meet & Greet is a great networking opportunity and one of your first chances to connect with other young and experienced professionals during the convention. Participants meet and are grouped with experienced AAPG attendees, who will serve as guides to newcomers to the convention experience.

You are then encouraged to attend both the opening session and Icebreaker as a group, where your new mentor will introduce you to other AAPG members and their colleagues.

This is the fourth year of the Meet & Greet and it promises to be a valuable networking experience for all who attend.

- The second event is the **YP Networking Reception**, which begins at 7:30 p.m. Sunday (right after the Icebreaker) and is yet another opportunity to enjoy food, refreshments and the chance to continue your networking potential.

This YP-only event will be held at the Long Beach Rock Bottom Restaurant and Brewery, and there you'll have the chance to meet members of the hosting YP Committee – and learn about all of the goals and initiatives that the committee has been tackling for the last few years.

The event promises to be a wonderful opportunity to network with colleagues old and new – and start your convention experience off on the right foot.

Whether or not you take advantage of these two events (and I hope that you do!), be sure to introduce yourselves to as many people as possible at ACE. Don't let the opportunity of having thousands of industry professionals under one roof go to waste.

You will be amazed at how the rewarding and valuable connections and friendships made at ACE will last your entire career.

See you in Long Beach!

(Editor's note: Allen, with Chevron in Bakersfield, Calif., is a member of the AAPG Young Professionals Committee and of the ACE organizing committee.)

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Seeking Geologist, responsible for conducting detailed prospect analysis and play fairway assessments within the Mid-Continent Region plus the generation and presentation of prospect ideas and leads to management. This position would be located in Tulsa, OK.

The successful applicant will generate and update maps, logs, cross-sections and corporate databases with new tops, correlations, shows and other pertinent geological data. Develop regional, multi-county stratigraphic framework and subsurface correlations.

Minimum qualifications, ten years of experience, knowledge of Mid-Continent upstream oil and gas, experience with conventional and un-conventional plays, experience doing play-fairway analysis assessments. Send resume to klefler@newfield.com.

* *

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Schlumberger-Doll Research, invites applications for a Geologist position based in Cambridge, MA USA. The candidate will join our Reservoir Geosciences Department. He/she is expected to bring a thorough knowledge of stratigraphy and sedimentology for the purposes of building integrated solutions in oil and gas reservoirs using well logs, core, and other data. The candidate will participate in projects with a group of geologists, petroleum engineers, petrophysicists, geostatisticians, and software engineers. Projects may include client-based oilfield case studies.

Job Requirements

The candidate is expected to have a Ph.D. in Geology, with a focus on sedimentology/stratigraphy. Expertise in sequence stratigraphy, carbonate and/or unconventional rocks, and 5-10 years oilfield experience preferred. Less experienced candidates with outstanding qualifications may be offered a post-doc position. Expertise in petrography, core-to-log integration, subsurface correlation, seismic interpretation, reservoir model building, and fractured reservoir interpretation is a plus.

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EXPLORER CORRESPONDENT

The AAPG EXPLORER, the monthly newspaper for the 35,000-member American Association of Petroleum Geologists, is seeking a news correspondent to focus on non-U.S. articles and features as assigned by the EXPLORER.

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DIRECTOR'SCORNER

Volunteers – The Engine That Powers AAPG

By DAVID K. CURTISS, AAPG Executive Director

In a previous column we talked about the fact that AAPG is a member-led organization. We elect our officers from among the membership, and these folks donate their time and talent to guide the Association during their term of service.

In all cases, agreeing to stand for an AAPG office is a multi-year commitment. And these folks demonstrate a remarkable spirit of volunteerism that is at the heart of what makes AAPG work.

* * *

AAPG's mission is to advance the science of geology, especially petroleum geology. We do this by engaging members from across all segments of the scientific enterprise:

- Practitioners who are actively exploring for oil and natural gas.
- Consultants and service companies providing both scientific and technology solutions.
- Faculty and students working to better understand fundamental geological processes.
- Government researchers and regulators.

In essence we learn from each other – and over the past century AAPG has become a forum to enable and promote this scientific exchange.

The centerpiece of advancing the science is the AAPG BULLETIN. As a peer-reviewed journal it is the gold standard for the science that we publish. Environmental


CURTISS

Start small. There's plenty of room for you to make your mark on the Association.

Geosciences, the peer-reviewed journal published by the Division of Environmental Geosciences, serves the same role in its niche. And our special publications, such as AAPG Memoirs, adhere to the same rigorous standards of our journals.

The authors of papers published in these journals and special publications are volunteers. The editor and associate editors of these journals and books are volunteers. The multiple reviewers who read and comment on each paper are volunteers.

One of the principal benefits of AAPG membership is receiving a copy of the BULLETIN each month – it's actually codified in the Association's bylaws. Likewise, the AAPG Bookstore plans to continue publishing new books that we can purchase to advance our own understanding of a particular topic. Yet none of these things exist without volunteers who contribute their time and talent to advancing the science and telling us about it.

Volunteers are the technical backbone of several of the offerings of the education department, including Hedberg research conferences and Geoscience Technology Workshops. These are two of our premier venues where volunteer experts share their knowledge and insights to encourage the exchange of scientific ideas and collaborative learning.

AAPG Section meetings are almost entirely based on the efforts of volunteers.

The AAPG Annual Convention and Exhibition and International Conference and Exhibition are two of our premier meetings where volunteers play pivotal roles. The list is long, but the technical program committees, the judging of talks and posters, soliciting sponsorships and developing short courses and field trips all rely on the efforts of volunteers.

Oh, and don't forget the speakers at the meetings. All of these folks submit abstracts, build slides and present their science to the attendees.

And we must mention the myriad program committees within AAPG. Each charged in some way with helping the Association achieve its mission to advance science, as well as provide valuable products and services to fellow members.

Who does all of these things? You guessed it: Volunteers.

There's a clear pattern here.

* * *

So many of the things that we as members have come to expect from AAPG – specific products and services we rely on – are the direct result of the efforts of members like you. Members who volunteer their time and talent to create these things are essential ingredients in making AAPG an association that is attractive to prospective members and delivers tangible value to its existing members.

Perhaps you have an idea for a product or service, a journal article you've considered writing, or simply a desire to be a recognized member of a larger community of geologists.

Maybe it's time to give something back – to use your unique skills and talents to elevate the discussion, to enhance the Association.

You don't have to start by making a multi-year commitment to a project or task. Start small. There's plenty of room for you to make your mark on the Association.

And as our dedicated volunteers will tell you, it's really a lot of fun.

DIVISIONSREPORT

Facts Hone Articulate Responses

By DOUG WYATT

If you asked my parents what their view of the oil and gas industry was they would describe a scene from an old black and white photograph of Spindletop, McKeesport or the Big Sinking Fields, where the ground was barren and black with oil and you could step from one rig floor to the next.

We have all seen these pictures.

While many opposed to oil and gas as an energy source would have you believe the same today, more modern opinions are better informed – and the industry is doing a good job at utilizing and promoting environmentally efficient technologies.

However, increasingly knowledgeable people are watching our business and asking pointed, scientifically valid questions about the overall environmental repercussions of what we do. Scientifically informed questions, particularly (sharp) pointed ones, require well-informed answers based on up-to-date, defensible research.

We all know the current hot-button topics – hydraulic fracturing, ultra-deepwater, CO_2 and warming – and there is a considerable amount of money being spent on large projects researching various aspects of these topics. Much, if not most, of my day is spent in research related to these areas.

However, there are other more subtle and less sexy areas of research that also add great value.

For example, as shale gas production progressively develops near populated areas, questions arise about everything from impacts to quality of life, trails and


WYATT

People are watching our business and are asking pointed, scientifically valid questions.

hiking, snails in creeks, noise, fugitive air emissions and at least a dozen other ecologically related concerns. All are valid and all potentially impact the way we do our business – especially in site costs and permitting, as well as in long-term company obligations.

This is true not just for shale gas but for coalbed methane, enhanced oil recovery and residual oil zone projects, and in all new concept exploration and production.

* * *

As informed and educated energy scientists, there is much that we can do in our day-to-day business that can help answer these questions.

- First, as scientists knowledgeable on all aspects of geoscience, from geophysics to geochemistry and from biostratigraphy to tectonics, we need to be able to explain – on a layman's level – what it is we know.

The first and foremost skill we need is the ability to communicate with all in the public sector. A few of us will talk with senators and governors, some of us with regulators and stakeholders, but all of us will talk with the general public. In all these cases we need to be able to explain in a clear, concise way what we know, why and how we know it and why it is important.

We need to be able to back up what we say with proof, such as a peer-reviewed study, examples and even common sense.

Almost every person on earth observes and lives with geology everyday but does not place it in the context of their daily lives. We can help them understand the world and why it is important to know.

Doing simple research can help with this.

In addition to the routine scanning and studying of our relevant scientific literature such as the AAPG BULLETIN and other oil and gas journals, skim the free government websites from DOE, USGS, BOEMRE, EPA, etc., just to see what concerns are active within the federal agencies.

Look at the White House web page and be familiar with the issues from the administration.

Review the free industry literature and magazines to see what the commercial companies are facing on a day-to-day basis.

Look at the advocacy websites such as the NRDC, Sierra Club and Green Peace.

Evaluate their data and comments against what you know. In many areas you might agree with much of what you have read, and in some cases might disagree. Evaluate why and how you agree or disagree.

- Second, develop your response.

Know their issues and their facts and know your issues and your facts. They might be the same – but where different, or where you feel facts are skewed or being used inappropriately, address the issue in a logical scientific way.

Practice discussing emotional topics with concern, but without inflammatory rhetoric.

Use note cards, mnemonics, whatever you need – but always remember that your best asset is the geoscience knowledge you already have.

A little bit of daily, routine, simple research can address many issues of concern for our industry – and ensure continually improving environmental exploration and production.

(Editor's note: Doug Wyatt, of Aiken, S.C., is director of science research for the URS Corporation Research and Engineering Services contract to the USDOE National Energy Technology Laboratory. He also is a member of the DEG Advisory Board for the AAPG Eastern Section.)

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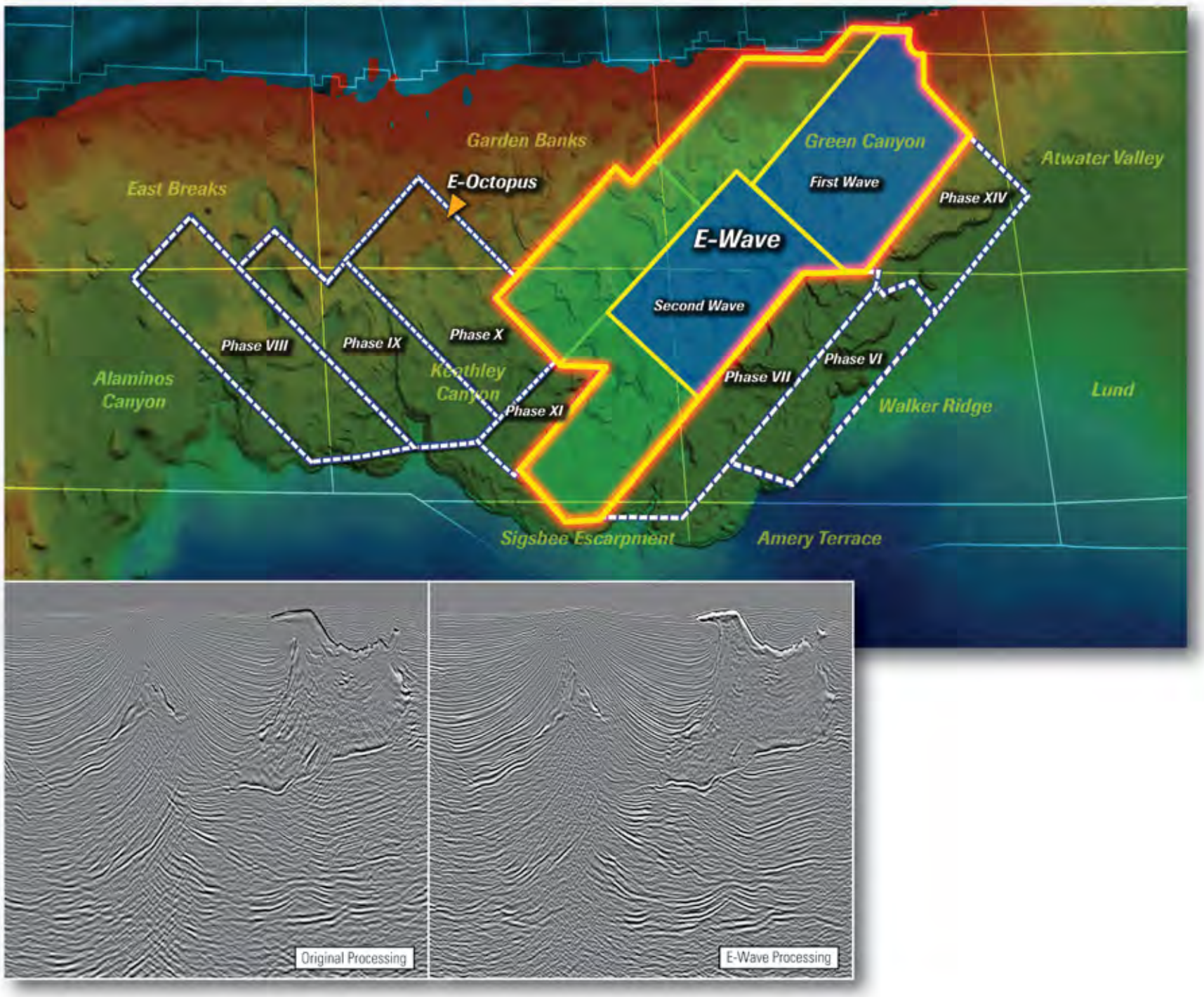

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