AAPG EXPLORER
MAY 2013

In the Beginning

The play that rejuvenated a region – and an industry

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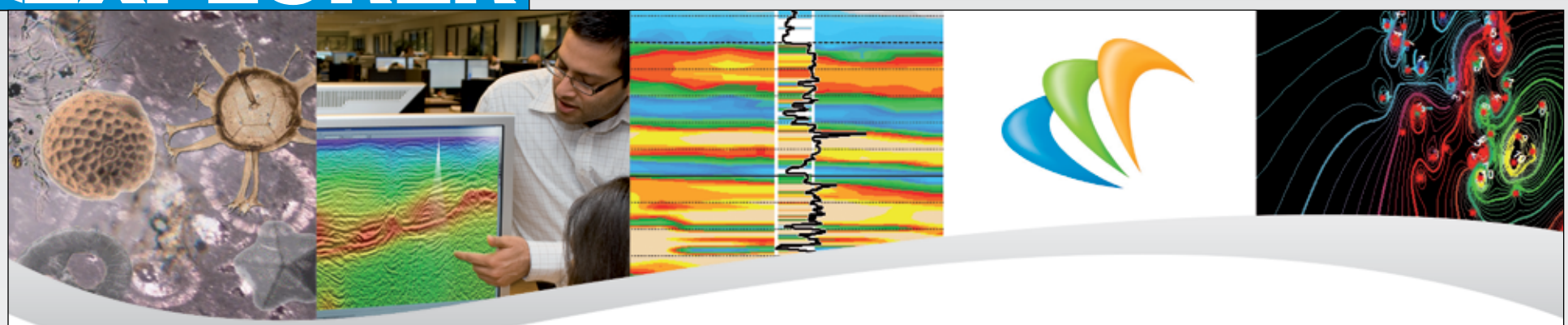
AAPG Annual Convention & Exhibition

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS AN INTERNATIONAL ORGANIZATION



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Vol. 34, No. 5
May 2013

AAPG EXPLORER

PRESIDENT'SCOLUMN

Proposed New Step Could Prove a Good Move

By TED BEAUMONT and LEE KRYSTINIK

(This month's column takes a look at what possibly could be an exciting new step for AAPG and the way we provide the best in science for our members, and in putting it together I asked AAPG President-Elect Lee Krystinik, an important person in this new initiative, to help in the writing.)


BEAUMONT

Perhaps you've heard of this group; perhaps you know of their work even if you've NOT heard of them.


KRYSTINIK

Petroleum geology is an integrative science – and as my column suggested last month, the most effective explorationists are those who integrate information from many different scientific disciplines and sub-disciplines of petroleum geology into their prospects.

It is critical, then, for AAPG leaders and staff to search for new ways to infuse fresh scientific content into AAPG publications and events, making our members more effective finders and developers of oil and natural gas.

Last year, AAPG was approached by a group of geologists who requested formal AAPG recognition. They are the Petroleum Structure and Geomechanics Group (PSGG), and since about 1996 they have met informally at each AAPG Annual Convention and Exhibition.

Perhaps you've heard of this group; perhaps you know of their work even if you've NOT heard of them. For example, you might recall the very successful and applauded November 2009 theme issue of the AAPG BULLETIN, "Occurrence and Significance of Fractures in Reservoirs;" that issue was the result of a Hedberg Conference put together by members of the PSGG.

The PSGG now desires formal recognition from AAPG in order to grow and continue as a science content provider for AAPG. They want to hold Hedberg Research Conferences and Geotechnical Workshops, publish papers and books, teach short courses and lead field trips.

* * *

After examining AAPG's bylaws, we on the Executive Committee have concluded the best way to provide the formal recognition the group requests – and the best way to bring PSGG into AAPG – would be as a new division.

In February the EC approved the request by PSGG to become a new division of AAPG.

The measure is subject to a vote of the AAPG House of Delegates (see related story, page 54), but no change in AAPG's Bylaws is required to form the new PSGG division.

The new PSGG division proposes to have a chair and vice chair. They will propose an annual budget subject to approval by the EC and will work within the present AAPG structure to accomplish goals that advance our science.

As proposed, this new division is not a significant financial cost to AAPG – but as is the case with the other divisions, funding will come from AAPG along with the expectation that the new division will generate technical product that will be marketable and help return a significant percentage of any cost incurred, all while furthering our science.


Pittsburgh, the famed City of Bridges, will be the site of this year's AAPG Annual Convention and Exhibition – the first time the city has hosted a national AAPG event. See story, page 8.

* * *

The broader intent of this measure is to focus the diverse technical communities within AAPG toward generating scientific product for the advancement of our science, and in direct support of our members' needs for new ideas and concepts toward finding more oil and gas.

Importantly, the proposed division is part of an ongoing effort to more directly link AAPG's activities to our primary goals and directives. The EC endorses the new division as well as the concept of potential additional divisions to better serve the diverse technical interests of our membership.

This approach is consistent with most other major geoscience organizations globally, where the number of technical divisions may exceed 10-20 (although we do not envision so many divisions within AAPG).

* * *

We and the other EC members are excited about adding the Petroleum Structure and Geomechanics Group to AAPG as a new division. We are just as excited about the possibility of adding other technical interest groups to AAPG as new divisions and infusing fresh scientific content into AAPG publications and activities.

We also look forward to see and hear from you in Pittsburgh at the AAPG Annual Convention and Exhibition this month.

Ted Beaumont

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


Photo courtesy of Chris Bolhuis

REGULARDEPARTMENTS

ON THE COVER:

Success wasn't always a sure bet for the play that is now known simply as "the Marcellus" – in fact, the first steps were challenging and often filled with disappointment. Persistence – and a bit of good fortune – proved to be a winning dynamic, however, and helped write a story that AAPG "Explorer of the Year" Bill Zagorski recounts on page 32. Photo courtesy of Chesapeake Energy.

On this page: AAPG Foundation Teacher of the Year Chris Bolhuis doing what he loves to do most as an earth science teacher – taking young students on field trips to view the geologic beauty of the American West. See story, page 66.

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Voting Deadline Arrives May 15 for Officer Candidates

Online voting continues in the election of new officers for the AAPG 2013-14 Executive Committee, but the voting deadline looms.

Voting will remain open through May 15.

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

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

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

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

The slate is:

President-Elect

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

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

Vice President-Regions

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

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

Secretary

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

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

Editor

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

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

Papers Sought For ATC

The call for papers has been issued and proposals are being accepted online for the next Arctic Technology Conference (ATC), set Feb. 10-12 at the George R. Brown Convention Center in Houston.

ATC is a technical and scientific event created by and modeled after the annual Offshore Technology Conference. It is designed to offer a multidisciplinary approach to exploration and development of the Arctic region.

ATC is managed and co-sponsored by AAPG. Fourteen other groups co-sponsor or endorse the event, including the Society of Exploration Geophysicists and the Society of Petroleum Engineers.

AAPG's representatives on the 2014 program are Michael Enachescu, with MGM Energy Corporation in Calgary, Canada, and Don Gautier, with the U.S. Geological Survey in Menlo Park, Calif. They join AAPG Honorary member John Hogg, also with MGM Energy, who was chair of the highly successful 2012 ATC.

ARCTIC TECHNOLOGY CONFERENCE
AN OTC EVENT SM

ATC's format features oral and poster presentations, special panel sessions and topical breakfasts and lunches.

"We are looking for a range of presentations that cover all aspects of technical and social performance in the Arctic," said Han Tiebout, chair of this year's Technical Program Committee.

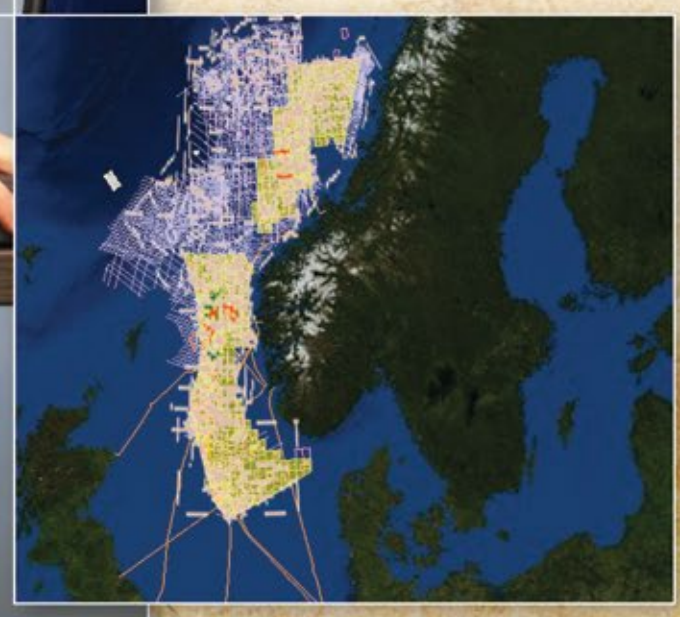
"Further, it's a fantastic opportunity to learn from you how we can improve our business through new technology applications and practices in a wide range of activities in the Arctic," he added. "We also are interested in hearing how these technical developments are being managed, both in the current business environment and for the future challenges we face in our industry."

Organizers seek propsals for five themes:

- Geology and Geophysics (including specific sessions on basin potential, frontier basin geology, geophysics and hydrates).
- Exploration and Production (including flow assurance, transition zone, gas hydrates and shallow gas).
- Physical Environment.
- Logistics.
- Regulatory Environment and Social Responsibility.

The call for papers deadline is June 13.

To submit a paper, or for more information, go to www.arctictechnologyconference.org.



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Variances depend on age, experience

Overall Salaries Show Slight Gain This Year

By VERN STEFANIC, EXPLORER Managing Editor

Salaries for petroleum geologists continued to climb in most categories during the past year, but at a slower rate than previous years – and the amount of the increase depended greatly on the amount of experience a geologist was bringing to the job.


AYLING

This year's annual AAPG Salary Survey shows a weighted average increase of 1.4 percent in geoscience salaries in 2012-13.

Mike Ayling, of MLA Resources in Tulsa, who has conducted the annual salary survey for AAPG since 1981, said that some age and experience groups within the survey actually did better than the overall average.

Others did not.

"The salaries that were up were largely due to people just coming into the business, or very experienced people," Ayling said.

"The 0-2 year experience levels showed a small increase, up 6 percent," Ayling continued, "but recently graduated bachelor level geologists also had a difficult time finding work – and the few that did, worked for lower salaries, depressing the overall average.

"Master's grads are getting hired on a pretty regular basis," he added. "Those with bachelor's degrees are finding fewer jobs."

2012-13 Geological Salary Survey

YEARS EXPER	HIGH	AVERAGE	LOW
0-2	$ 113,000	$ 100,500	$ 85,000
3-5	124,000	101,000	80,000
6-9	132,000	127,800	124,000
10-14	207,000	147,000	115,000
15-19	278,000	190,300	144,400
20-24	285,000	211,600	150,000
25+	425,000	212,000	147,000

Average Salary By Degree

YEARS EXPER	B.S.	M.S.	Ph.D.
0-2	$ 89,000	$ 103,000	$ 110,700
3-5	88,900	106,700	120,900
6-9	124,000	113,700	128,000
10-14	130,000	139,500	178,900
15-19	170,000	191,600	193,800
20-24	199,800	217,500	----------
25+	187,600	217,200	270,000

Historical Averages Salary

YEARS EXPER	2004	2005	2006	2007	2008	2009	2010	2011	2012
0-2	$ 67,800	$ 74,400	$ 82,200	$ 82,800	$ 83,600	$ 87,600	$ 93,000	$ 98,700	$ 100,500
3-5	75,600	81,300	89,600	107,800	108,000	105,600	102,300	109,400	101,000
6-9	78,800	95,400	98,500	121,100	118,400	121,700	127,800	137,300	127,800
10-14	107,500	114,400	111,500	119,800	121,900	123,500	139,100	153,400	147,000
15-19	116,000	119,600	141,000	151,600	139,400	150,800	151,000	193,600	190,300
20-24	112,800	139,000	155,000	167,400	176,800	180,300	191,000	199,200	211,600
25+	128,300	134,100	149,900	162,800	171,700	186,800	206,300	199,600	212,000

Also of note: Mid-experienced geoscientists (from three to 19 years experience) actually saw average salaries shrink, dropping from 2 to 8 percent.

Ayling saw this as an adjustment to the previous trend.

"These people have been in high demand for the past two-three years," he said of the group, noting their average salaries had "increased significantly over the past two years.

"While these groups remain in strong demand, perhaps lethargic overall hiring has taken a toll on averages," he said.

He also noted that those within the age groups may be receiving bonuses from their companies, "and there would be no way of accounting for that in our survey."

The more experienced geologists showed a 6.2 percent increase this year, "perhaps reflecting the value placed on their ability to contribute during a slack time of industry growth, a desire to retain experienced staff and a bit to make up for lower increases in the past," he said.

Even for the more experienced category there was a wide variance in salaries, which Ayling surmised may reflect the salaries of "those who are in management versus the working geologist."

The AAPG annual survey is based on U.S. salaries only, still considered the "gold standard" for the industry. The measurement for international salaries for explorationists is virtually on a country-by-country, case-by-case basis, Ayling said, which makes statistical averaging non-productive beyond the boundaries of any specific country.

Also, many ex-pats are paid U.S.-based salaries, while the national oil companies opt to pay compatriots on a different, lower scale.

First time to the City of Bridges

AAPG's Spotlight Turns to Pittsburgh for ACE

By VERN STEFANIC, EXPLORER Managing Editor

An area that helped spark first the country's and now the world's interest in shale and unconventional plays is going to be the site of a historic AAPG gathering.


CANICH

The 2013 AAPG Annual Convention and Exhibition will be held May 19-23 in Pittsburgh, a city that has experienced an energy renaissance thanks to the successful exploration and development of the region's Marcellus Shale play.

This will be the first time Pittsburgh has played host for an AAPG annual event, and the first time AAPG has held its annual meeting in the eastern United States since the 1986 meeting in Atlanta.

More than 900 oral and poster presentations and displays from more than 200 exhibitors will be featured.

General chair Michael Canich said the area's entire geological community is proud and ready to host a world-class event, which will be centered at the David L. Lawrence Convention Center.

"This year's ACE is going to be unique given the renewed emphasis of the Appalachian Basin and how unconventional plays across the country are being shaped by the science and technology taking place in the eastern United States," Canich said.


Pittsburgh's David L. Lawrence Convention Center, site of this year's AAPG Annual Convention and Exhibtion – the first time the city has played host to an AAPG annual event.

Although Pittsburgh's historic roots and its connection to unconventionals will clearly be on display, the technical program also boasts a comprehensive look at activities, developments, science and potential from around the world.

Two author signings will be offered at the AAPG Bookstore during the AAPG Annual Convention and Exhibition in Pittsburgh.

The events will be held during the ACE Icebreaker reception, from 5:30-7:30 p.m. The AAPG Bookstore will be located in the AAPG Center in the exhibits hall.

Book signings will be offered for:

- "The Reckoning: The Triumph of Order On the Texas Outlaw Frontier," by past AAPG president and Honorary member **Peter R. Rose**.
- "Bootstrap Geologist: My Life in Science," by AAPG member **Eugene Shinn**, professor at the University of South Florida and at the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

A reminder: Members can renew their AAPG membership while at the Annual Convention and Exhibition.

Come by the General Store, located within the AAPG Center in the exhibits hall, and conveniently pay your 2013-14 dues during the convention.

And while there, be sure to check out the unique AAPG apparel and merchandise at the General Store. All proceeds benefit the AAPG Student Chapters working in the Store.

It also offers:

- The Imperial Barrel Award ceremony, open to the general public, at 3 p.m. at the David Lawrence Convention Center – immediately preceding the opening session.
- Three special forums ("History of Petroleum Geology," "Discovery Thinking" and "Energy Policy").
- A special session on "Hurricane Sandy and Our Vulnerable Developed Coastlines."
- This year's Michel T. Halbouty Lecture, given by Jeff Ventura, president and CEO of Range Resources, who will talk about his company's "Path to Discovery and Commercialization of the Marcellus Shale."

The opening session itself will begin at 4 p.m., led by Canich and featuring an address from AAPG President Ted Beaumont plus the annual AAPG awards ceremony, a fast-moving, colorful tribute to the year's top honorees.

Honors due at the opening session

Welte Leads the List of Awardees in Pittsburgh

By SUSIE MOORE, Communications Project Specialist

Dietrich Welte, a leader in research and development of the concept and software in 3-D numerical basin and petroleum system modeling and author of the first comprehensive textbook used in the field of geochemistry, will receive the 2013 Sidney Powers Memorial Award, AAPG's highest honor, during the opening session of the AAPG Annual Convention and Exhibition in Pittsburgh.

Welte is a retired professor emeritus from Technical University RWTH, Aachen, Germany, and adjunct professor from Jacobs University in Bremen, Germany – a university he helped initiate.

In winning the Powers award he joins two others, Martin Jackson and Robert Weimer, as the most honored geologists in AAPG history, all having won five awards.

Joining Welte at the top of this year's AAPG awardees list is Stephen A. Sonnenberg, Boettcher Distinguished Chair of Petroleum Geology at Colorado School of Mines, Golden, Colo., who has been named the winner of this year's Michel T. Halbouty Outstanding Leadership Award.

Also honored will be AAPG Honorary member and past president Robert "Bob" Gunn, this year's recipient of the L. Austin Weeks Memorial Medal, the AAPG Foundation's highest award.

They and 52 others will be honored during the ACE opening session, set Sunday, May 19 at 4 p.m., at the David L. Lawrence Convention Center in the Spirit of Pittsburgh Ballroom.

The program is preceded in the same room at 3 p.m. by the AAPG Imperial Barrel Award ceremony.

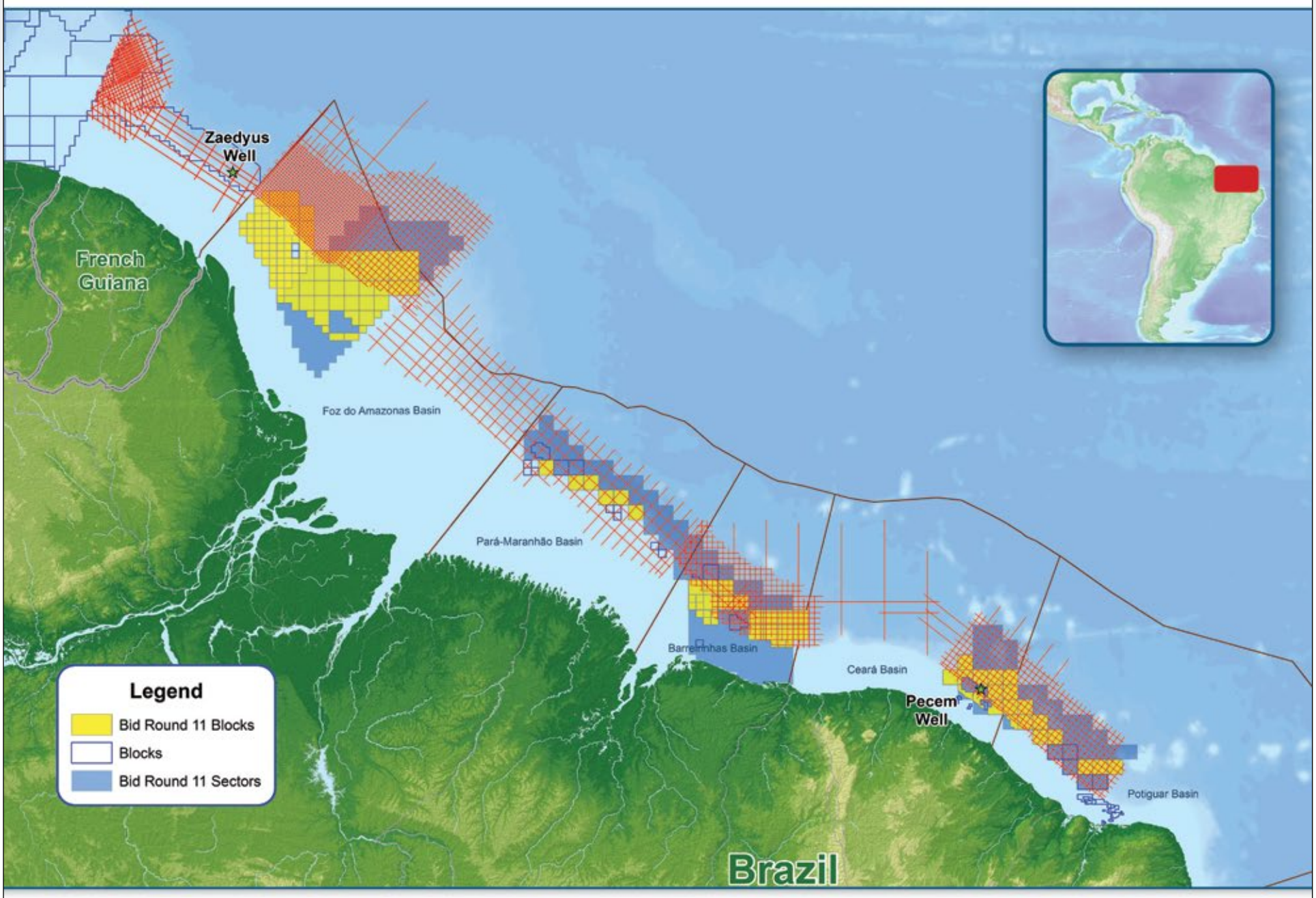
In addition to honoring the awardees, the opening session also will feature the official welcome from ACE general chair Michael R. Canich and the presidential address from AAPG President Ted Beaumont.

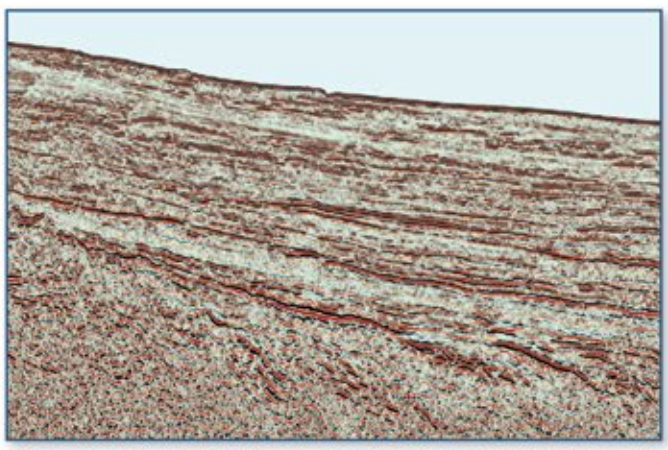
AAPG awards, approved by the Executive Committee, are presented annually at the ACE opening session to recognize individuals for service to the profession, the science, the Association and

See **Awards**, page 14

Equatorial Margins Brazil

Multi-Client Seismic - Data Available for Brazil Round 11





Seismic section from the Potiguar Basin data

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

Reprocessing efforts are underway along the Equatorial Margins. The first is a 9,600 km program in the Para-Maranhao Basin that links the Foz do Amazonas Basin to the Barreirinhas Basin. The second project covers 7,783 km in the deep waters of French Guiana. This will link the Zaedyus discovery with data recently acquired offshore Brazil.

The well tie data will be available in April and the remaining data in May. Our Multi-Client team is committed to delivering high quality data in advance of the upcoming Round 11. Companies participating in Spectrum's programs will have a competitive advantage in this round.

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Posthumous honors due in Pittsburgh

Al Naim, A Towering Figure in the Middle East

By VERN STEFANIC, EXPLORER Managing Editor

Abdulla Al Naim, vice president of exploration for Saudi Aramco and a towering figure in Middle East exploration and AAPG leadership activities in the region, will be honored posthumously during the opening ceremony of this year's AAPG Annual Convention and Exhibition in Pittsburgh.

Al Naim died unexpectedly Dec. 31, shortly after being notified that he would be awarded Honorary membership in AAPG. He was 57.

Family members – Abdulaziz, Yasmeen, Abdulrahman and Haifa Al Naim – will attend the ceremony and accept the award in his honor.


AL NAIM

AAPG Executive Director David Curtiss called Al Naim "a visionary leader and geoscientist – the energy profession has lost a tireless advocate for the advancement of science and technology to find and develop the oil and natural gas the world so desperately needs."

As a professional geologist, Al Naim was a giant in the industry, regarded as an authority on the history of exploration in Saudi Arabia and deemed the country's best regional geologist.

He authored and co-authored several papers about the Middle East geology, with a special interst in basin-centered gas – a subject he spoke on in many conferences.

But in addition to his success as a geologist, Al Naim was just as instrumental in opening the doors of the profession to young geoscientists, mentoring many young professionals and helping to create scholarship programs that brought additional opportunities to many more.

Leadership was another of his assets, and he repeatedly played crucial roles in the founding, organizing and implementation of several geoscience groups, including serving as president of the AAPG Middle East Region in 2005-06.

"He was a big supporter for AAPG and its activities in the Middle East," said Pinar O. Yilmaz, also of ExxonMobil and herself an AAPG Honorary member.

"Through his efforts and support, the AAPG Middle East Council was able to pursue unmatched levels of activities," she added, "bringing geoscience workshops and seminars to all companies and universities in the region.

"Abdulla also was a gentleman geologist," Yilmaz added, "one whose interest and passion for the rocks combined with humility, humanity, kindness and intelligence made him a man of the world."

Biographer Abdulkader M. Afifi wrote that Al Naim was born and raised in Dammam, "literally between oil facilities and within sight of Aramco's headquarters in Dhahran."

"Abdulla's true passion was exploration," Afifi noted.

Al Naim received his bachelor's degree in geology from King Saud University in Riyadh, then began his career with Aramco in 1978 as a wellsite geologist. This was followed by a number of administrative assignments within the company, leading to the positions of manager of the area exploration division (1996), manager of the exploration operations department (2002) and manager of the reservoir characterization department (2004).

He became Saudi Aramco's executive director of exploration in November 2004, and was appointed vice president in April 2006.

At one point he also held the position of acting vice president of petroleum engineering and development, being responsible for the management and development of all Saudi Aramco oil and gas fields.

An AAPG member since 1986, Al Naim was instrumental in the founding of the AAPG affiliate Dhahran Geological Society, and then served as the group's first president. At that same time he served on AAPG's International Committee.

He served on the organizing committees of the regional Society of Petroleum Engineers (SPE) technical conferences, and was a member of the technical and executive committees of every GEO conference since its inception in 1994, serving as the chair in 2006.

At the time of his death Al Naim was a member the AAPG Corporate Advisory Board, and was instrumental in providing guidance and corporate support for AAPG conferences, workshops, field trips and publications on both the local and international levels.

Al Naim received several awards for his leadership, including the AAPG International Special Commendation Award in 1999 and an AAPG Distinguished Service Award in 2006.

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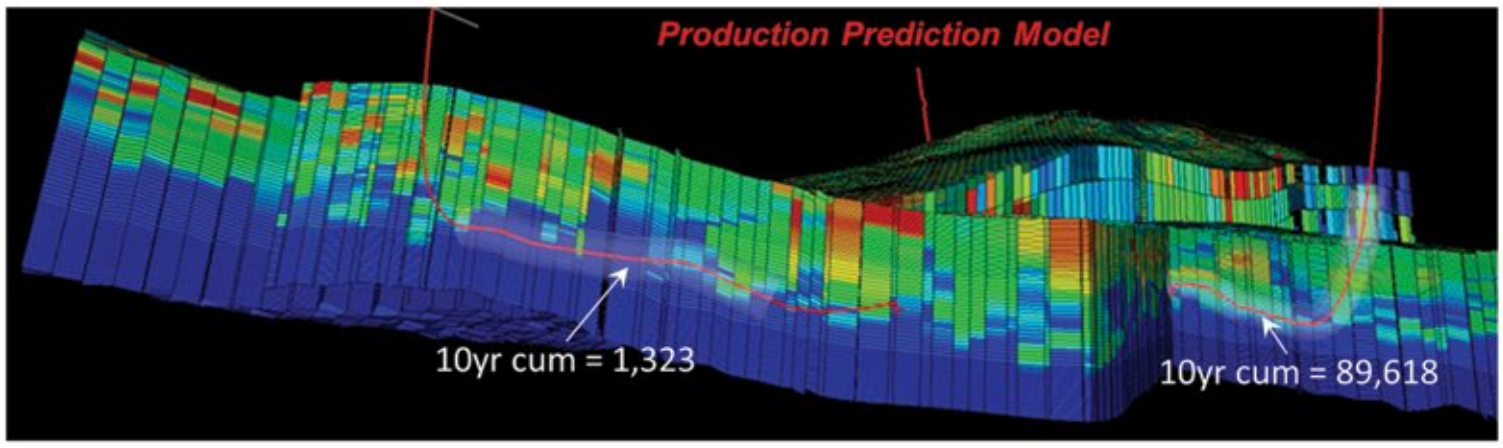

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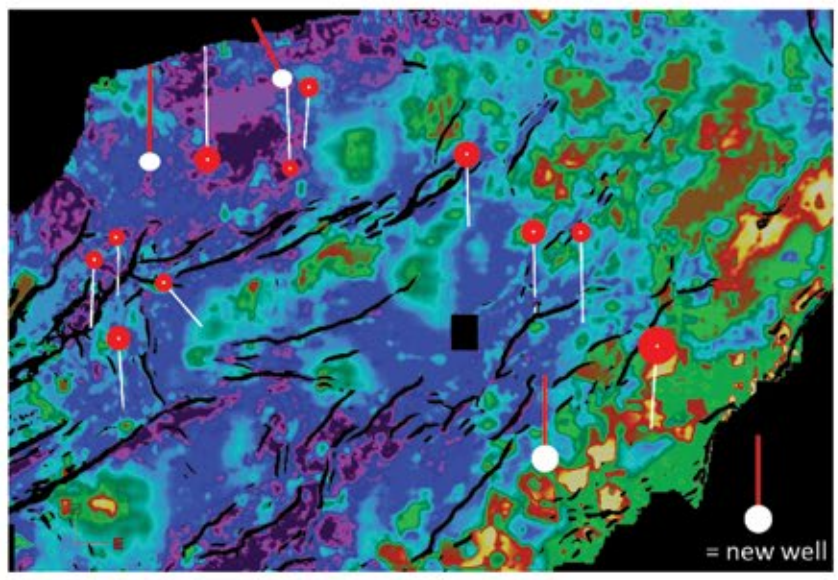

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DEVEUGLE


VERWER

Awards

from page 10

the public.

Welte began his career with Shell International as a research geochemist in 1959. Three years later he returned to his alma mater, University of Würzburg, Germany, where he worked four years. He later returned to the industry as a senior research geochemist for Chevron Oil Field Research (USA) in 1967.

Welte's textbook, "Petroleum Formation and Occurrence," first published in 1978 and expanded in 1984, is still used today in teaching petroleum geochemistry.

He founded the Institute of Petroleum and Organic Geochemistry at then-Kernforschungsanlage, now Forschungszentrum Jülich, in Germany in 1979, and later founded and was director of Integrated Exploration Systems in 1985.

Welte's previous awards from AAPG include the President's Award (1966), International Special Commendation Award (2000), the Special Award (renamed the Harrison Schmitt Award in 2011) (2004) and Distinguished Service Award (2006). (See related story, page 22.)

Sonnenberg, who is the seventh recipient of the Halbouty Outstanding Leadership Award, given in recognition of outstanding and exceptional leadership in the petroleum geosciences, received AAPG Honorary membership in 2008.

He has been actively involved in AAPG leadership roles over the last three decades, serving three times on the AAPG Executive Committee, as vice president 1995-96, as president-elect/president from 2002-04, and as chair of the House of Delegates in 2009-10, as well as serving on various committees. (See related story, page 28.)

Bob Gunn will receive the L. Austin Weeks award in recognition of his "extraordinary service in advancing the mission of the AAPG Foundation."

Gunn, a nationally noted petroleum geologist, was AAPG president in 1978.

He also is one of AAPG's most honored members – past awards include the Sidney Powers Memorial Award, the Public Service Award and the DPA Heritage Award.

Biographies and citations of all award winners will be included in a future BULLETIN.

Award winners announced by AAPG and who will be honored along with Welte, Sonnenberg and Gunn in Pittsburgh are:

Honorary Member Award

Presented to members who have distinguished themselves by their accomplishments and through their service to the profession of petroleum geology and to AAPG.

❒ **Abdulla A. Al Naim**, Aramco, Dhahran, Saudi Arabia (presented posthumously).

❒ **Jeanne E. Harris**, G&H Production, Denver.

❒ **Kenneth E. Peters**, Schlumberger Information Systems, Mill Valley, Calif.

❒ **Daniel J. Tearpock**, Subsurface Consultants, Houston.

Norman H. Foster Outstanding Explorer Award

Presented to members in recognition of distinguished and outstanding achievement in exploration for petroleum or mineral resources, with an intended emphasis on recent discovery.

❒ **William A. Zagorski**, Range Resources, Caraopolis, Pa. (See related story, page 32.)

Robert R. Berg Outstanding Research Award

AAPG's newest award, presented to honor a singular achievement in petroleum geoscience research.

❒ **Ronald A. Nelson**, Broken N Consulting, Cat Spring, Texas.

❒ **J. Frederick Sarg**, Colorado School of Mines, Golden, Colo.

Distinguished Service Award

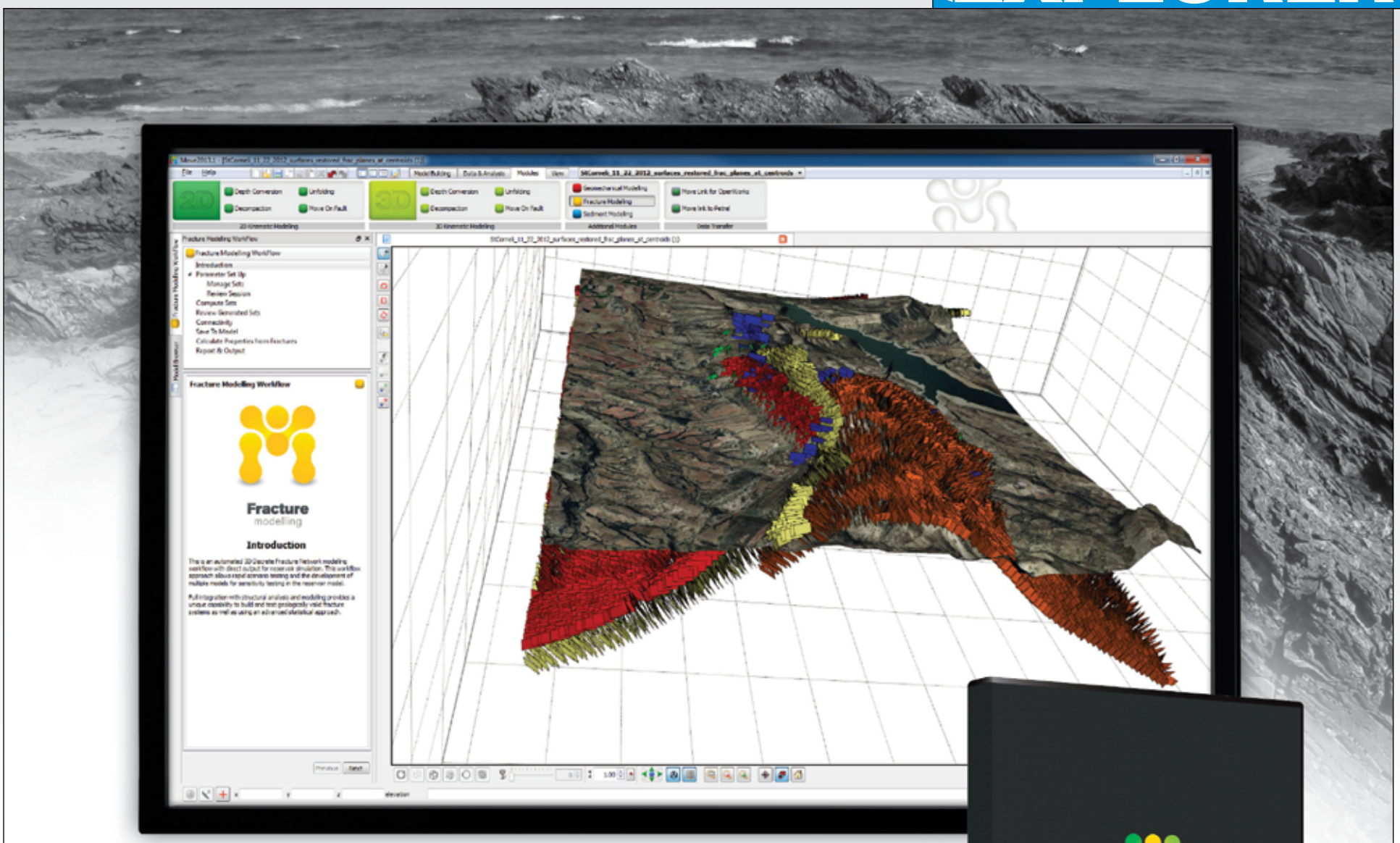
Presented to those who have distinguished themselves in singular and beneficial long-term service to AAPG.

❒ **Eugene L. Ames III**, Ames Energy Advisors, San Antonio.

❒ **Mark J. Gallagher**, Encana USA, Plano, Texas.

❒ **Frances J. Hein**, Alberta Energy Resources Conservation Board, Calgary, Canada.

See **Honors**, page 16



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Honors
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❒ **Joseph J. Lambiase**, Chulalongkorn University, Bangkok, Thailand.

❒ **Stephen D. Levine**, SK E&P, Houston.

❒ **Brian E. Lock**, University of Louisiana, Lafayette, La.

❒ **Richard A. Lorentz Jr.**, Krisenergy, Singapore.

❒ **William C. Stephens Jr.**, Mid-Con Energy Group, Dallas.

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

❒ **Laura C. Zahm**, Bureau of Economic Geology, Austin, Texas.

Grover E. Murray Memorial Distinguished Educator Award

Presented for distinguished and outstanding contributions to geological education, both at the university level and toward education of the general public.

❒ **Carlton E. Brett**, University of Cincinnati, Cincinnati, Ohio.

❒ **John R. Underhill**, University of Edinburgh, Edinburgh, Scotland. (See related story, page 48.)

Harrison Schmitt Award

Presented in recognition of outstanding accomplishment that is beyond the scope of other AAPG awards.

❒ **George B. Asquith**, Texas Tech University, Lubbock, Texas. (For his contributions as AAPG's all-time best-selling author.)

❒ **Martin G. Lockley**, University of Colorado at Denver (For contributions in the founding and administration of Dinosaur Ridge near Denver.)

Public Service Award

Presented to recognize contributions of AAPG members to public affairs – and intended to encourage such activities.

❒ **Alex S. Broun**, author, retired Exxon, Dripping Springs, Texas.

❒ **Jerome J. Cuzella**, consultant, Lakewood, Colo.

❒ **Donald S. Van Nieuwenhuise**, University of Houston, Houston.

Pioneer Award

Presented to long-standing members who have contributed to the Association and who have made meaningful contributions to the science of geology.

❒ **Robert E. Fox**, Term Energy, Lexington, Ky.

❒ **Paul R. Lamerson**, consultant, Lakewood, Colo.

Geosciences in the Media Award

Presented for notable journalistic achievement in any medium, which contributes to public understanding of geology, energy resources or the technology of oil and gas exploration.

❒ **Kirk Johnson** and **Ray Troll** for "Cruisin' The Fossil Freeway – An Epoch Tale of a Scientist and an Artist on the Ultimate 5,000-Mile Paleo Road Trip." Their book (writing and illustrations) describes their 5,000-mile journey throughout the American West.

Johnson is with the Denver Museum of Nature and Science, Denver; and Troll is a "fin" artist living in Ketchikan, Alaska. (See related story, page 52.)

Wallace E. Pratt Memorial Award

Presented to honor and reward the author(s) of the best AAPG BULLETIN article published each calendar year.

❒ **Andrew C. Aplin** and **Joe H.S. Macquaker**, for "Mudstone Diversity: Origin and Implications for Source, Seal and Reservoir Properties in Petroleum Systems," which appeared in the December 2011 BULLETIN.

Aplin is with NRG, School of Civil Engineering and Geosciences, University of Newcastle, Newcastle-Upon-Tyne, United Kingdom; and Macquaker is with ExxonMobil, Spring, Texas.

Robert H. Dott Sr. Memorial Award

Presented to honor and reward the author/editor of the best special publication dealing with geology published by the Association.

❒ **Ken McClay**, **John Shaw** and **J. Suppe** for AAPG Memoir 94: Thrust Fault-

See **Awardees**, page 18


SAWEKA


OLIVEIRA


TINNIN


KATZ


SIBLEY


VONK


HAWK


ENTZMINGER

Awardees
from page 16

Related Folding."

McClay is with University of London, Surrey, England; and Shaw is with Harvard University, Cambridge, Mass.

J.C. "Cam" Sproule Memorial Award

Presented to recognize and reward younger authors of papers applicable to petroleum geology.

❒ **Peter E.K. Deveugle** (co-author), for the AAPG BULLETIN paper, "Characterization of Stratigraphic Architecture and Its Impact on Fluid Flow in a Fluvial-Dominated Deltaic Reservoir Analog: Upper Cretaceous Ferron Sandstone Member, Utah."

Deveugle is with Chevron ETC, Perth, Australia.

❒ **Klaas Verwer** (co-author), for the paper AAPG BULLETIN paper, "Effect of Pore Structure on Electrical Resistivity in Carbonates."

Verwer is with Statoil ASA, Bergen, Norway.

John W. Shelton Search and Discovery Award

Presented to recognize the best contribution to the "Search and Discovery" website in the past year.

❒ **Anne Grau** and **Robert Sterling**, for "Characterization of the Bakken System of the Williston Basin from Pores to Production; The Power of a Source Rock/ Unconventional Reservoir Couplet."

Grau is with Fidelity Exploration in Denver; and Sterling is with Cirque Resources in Denver.

George C. Matson Memorial Award

Presented to honor and reward the best oral presentation at the 2012 AAPG Annual Convention and Exhibition (ACE) in Long Beach.

❒ **Jonathan Allen**, for the paper "Improved Reservoir Characterization at Kern River Field, California, USA: New Insights into an Old Field Using 4-D Saturation Modeling." Allen is with Chevron, Bakersfield, Calif.

Allen's co-authors are Dave Larue and Dale Beeson. Larue is with Chevron, Newport Beach, Calif.; and Beeson is with Chevron Perth, San Ramon, Calif.

Jules Braunstein Memorial Award

Presented to honor and reward the best poster presentation at the 2012 AAPG ACE.

❒ **Simon Campbell, Stanislaw Mazur, Nicola Henshaw, Ahmed Salem, Adriano Sebastiao, Jane Saweka** and **Artur Oliveira**, for the poster "Kwanza Basin: Sub-salt Basin Structure and Sediment Thickness from Integrated Analysis of High Resolution Aeromagnetic Data."

Gabriel Dengo Memorial Award

Presented to honor and reward the best oral presentation at the 2012 AAPG International Conference and Exhibition (ICE) in Singapore.

❒ **John Tinnin**, with Halcon Resources in Houston, for the paper "Case Study Demonstrating the Ability of 3D/3C Seismic to Predict Natural Fractures and Petrophysical Properties of Shale."

His co-author was Ron Harris, of Anadarko Petroleum, Houston.

Ziad Beydoun Memorial Award

Presented to honor and reward the best poster presentation at the 2012 AAPG ICE.

❒ **Bodo Katz**, **David M. Sibley** and **Adam J. Vonk**, all with Chevron in Perth, Australia, for the poster "Balancing Depositional Concepts and Seismic Attributes in Reservoir Models of Fluvial Deposits at Wheatstone, Northwest Shelf Australia."

House of Delegates Honorary Member

The AAPG House of Delegates' highest award.

❒ **David H. Hawk**, consultant, Energy Analysis and Answers, Boise, Idaho.

HoD Distinguished Member

❒ **David J. Entzminger**, regional geological manager-Permian Basin, Whiting Petroleum Corp., Midland, Texas.

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A new/old horizontal target

Mississippi Lime – A 'Thoughtful' Challenge

By LOUISE S. DURHAM, EXPLORER Correspondent

The advent of the U.S. shale boom placed the spotlight on horizontal drilling and hydraulic fracturing like never before, and with good reason.

These technologies almost always are referred to in a manner indicating they are specifically associated with the still-hot shale plays.

But what's being overlooked for the most part is that these now-common high tech applications are utilized to drill and complete wells in many fields where there is no shale.

Remember the Austin Chalk drilling frenzy in south Texas beginning in the late 1980s? Then-esoteric horizontal drilling was the key ingredient to make it work.

Similarly, the Mississippi Lime play concentrated in northern Oklahoma and southern Kansas is a modern day example of where advanced, improved versions of this technology and others are being used to drill and produce non-shale reservoirs.

This regional carbonate deposit lies beneath the productive Atoka and Morrow sands and above the Devonian-age Woodford and the older Silurian-age Hunton formations.

It might best be called a new/old drilling target, given that vertical wells have been drilled into the Mississippian section in this region for decades, with the Mississippi Lime giving up only marginal production in many instances.

A variety of rocks occur in this relatively new play – including chert, tripolite, speculite and chat, which has yielded minimal hydrocarbon volumes for many years via vertical wells. Some operators equate chat to tripolite or weathered chert.

The Mississippi Chat is a thin, siliceous zone of variable reservoir quality that intermittently develops on top of the Mississippi Lime, according to petroleum geologist and AAPG member Dan Boyd, formerly with the Oklahoma Geological Survey.

There's a steep learning curve to this play, and Boyd cautioned late in 2011 not to expect everything to pan out.

MATSON

> "The Mississippi Lime is a new play type ... It brings new metrics to evaluate, new skill sets to be utilized and developed and new nomenclature."

Photos courtesy of Chesapeake Energy Corporation

The Mississippi Lime play is found in southern Kansas and, as seen here, northern Oklahoma.

Talks Set for Discovery Thinking Forum

Tulsa geologist and AAPG member Shane Matson will present the paper, "The Mississippi Lime: Outcrop to Subsurface and the Evolution of a Play," as part of this year's Discovery Thinking Forum at the AAPG Annual Convention and Exhibition in Pittsburgh.

The forum – the seventh presentation of the AAPG 100th Anniversary Committee's program recognizing explorers who have "made a difference" – will be held from 1:15-5 p.m. Monday, May 20, at the David L. Lawrence Convention Center.

Forum co-chairs are AAPG Honorary members Charles Sternbach and Ed Dolly.

This year's forum will offer five talks from seven explorers who will share how they overcame great challenges in both business and geological aspects to find exploration success. The format calls for philosophies of exploration, stories from remarkable careers, professional insights, colorful anecdotes and lessons learned.

Other speakers at this year's forum are:

- **William Zagorski**, vice president-exploration for Range Resources, who will discuss "The Marcellus Shale – Geologic Considerations for an Evolving North American Liquids-Rich Play." (See related story, page 32.)
- **John Roesink** and **Jason Anderson**, senior research geologists, Bill Barrett Corp., who will discuss "The Wasatch-Green River Resource Play, Utah."
- **Robert Spitzer**, vice president-exploration, Apache Canada, who will discuss "Horn River Devonian Shale Gas Discoveries in Northeast British Columbia."
- **Marshall Deacon**, senior petrophysical adviser, and **Robert Lieber**, geologic adviser, Noble Energy, who will discuss "Integrated Reservoir Evaluation as a Means for Unlocking Maximum Resource Value in an Unconventional Reservoir: Niobrara Formation, DJ Basin, Colorado."

Starting On a Challenge

On the positive side, Boyd was enthusiastic there will be sweet spots.

Spyglass Energy Group in Tulsa is among the operators who are zeroing in on these.

It's challenging.

"The Mississippi Lime is a new play type," said Spyglass geologist and AAPG member Shane Matson during a presentation on the subject that he gave at the recent Playmaker Forum in Houston. "It brings new metrics to evaluate, new skill sets to be utilized and developed and new nomenclature."

Matson might be said to be carrying on family tradition. He's the great grandson of AAPG's fifth president, Charles Matson, and the grandson of retired petroleum geologist Tom Matson.

Tulsa-based Ceja Corporation drilled the first modern horizontal Mississippian well in 2003 to exploit the tripolite, according to Matson. By 2009, 20 wells had been successfully drilled and completed, essentially kicking off the Mississippi Lime play.

"Three years ago, I was on a logging job for my first horizontal Mississippi Lime well, targeting the low porosity section, or the Dense," Matson said. "We interpreted 1,200 feet of open natural fractures in an 800-foot interval.

"Someone on the well from Schlumberger said that the rock was not just fractured, but shattered," he said.

"We recognized we had discovered a new reservoir.

"We were in Osage County, and there was no announcement of the well, which we had permitted through the Bureau of Indian Affairs," Matson continued. "We went from 45,000 acres to a gross 550,000-acre position in six months."

Water: An Important Aspect

Matson emphasized the entire play is huge in aerial extent, encompassing 30 million acres, where more than a thousand wells have been drilled.

In comparison, the famed Elm Coulee Field in the Bakken play in North Dakota is 12 million acres with 5,000 producing wells, while the East Newark Field in the Barnett covers three million acres with more than 15,000 producing wells.

The complex Mississippi Lime is actually comprised of multiple reservoirs having highly varying petrophysical parameters:

- Unconventional (un-altered): 2 percent to 5 percent porosity; requires massive stimulation; has low natural deliverability. Possible to understimulate.
- Semi-conventional (altered): 15 percent to 20 percent porosity; requires stimulation; medium deliverability. Possible to overstimulate and produce abundant water.
- Conventional (highly altered): 35 percent to 48 percent porosity; no stimulation; high natural deliverability near the wellbore, but doesn't drain large area due to low permeability.

The reservoirs often are stacked or laterally adjacent to one another, according to Matson. The sweep efficiency of the hydrological system increases with porosity.

"The variability of the section coupled with the high fluid volume production has led to another paradigm shift in how the industry interprets reservoir objectives in horizontal carbonate plays," Matson noted.

"This variable reservoir requires thoughtful stimulation design," he said. "You must understand the rock you're stimulating."

Matson emphasized the play is about water.

It's crucial not to underestimate how much water a well will make because there must be adequate disposal capacity for produced fluids.

Handling all this water along with other drilling issues can be mighty power intensive. Matson noted it's estimated there will be a need for another 500 megawatts of generation to fully develop the Mississippian play.

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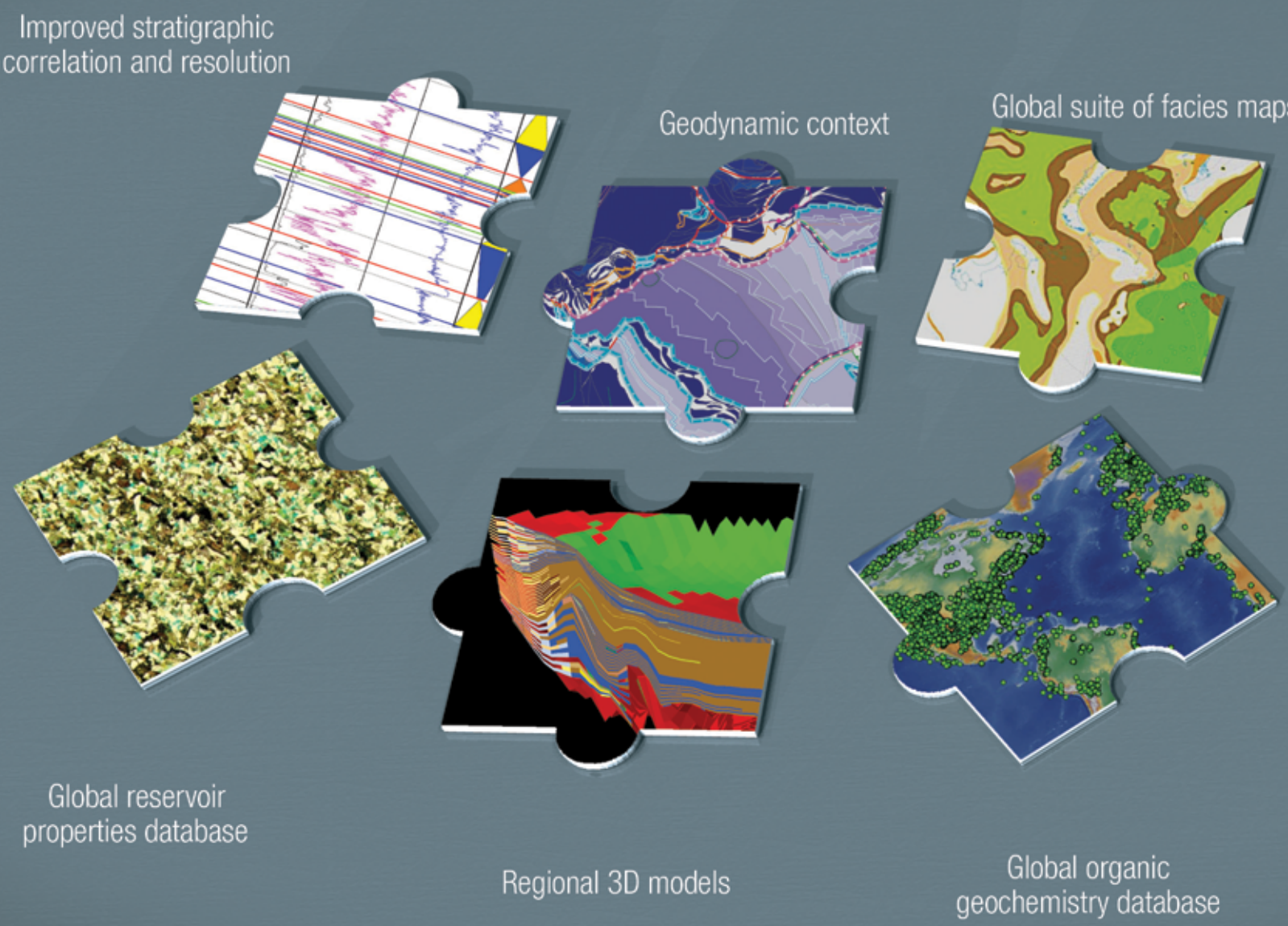

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A pioneer of modern geoscience, geochemistry

A Conversation With Dietrich Welte

By DAVID BROWN, EXPLORER Correspondent

Dietrich Welte is a pioneer of modern geoscience, co-author of the first comprehensive textbook on geochemical process-focused exploration, an outstanding academician and researcher, a leader in the development of basin and petroleum-system modeling.

He also is now the 2013 recipient of AAPG's highest honor, the Sidney Powers Memorial Award.

Welte's previous recognition from AAPG includes the President's Award in 1966, the International Special Commendation Award in 2000, a Special Award in 2004 and the Distinguished Service Award in 2006.

A native of Würzburg, Germany, he has made a powerful, lifelong contribution to teaching the geosciences in Europe and to developing and applying scientific principles to exploration around the world.

The way he was: Left, Welte on a field trip to Israel, 1978; right, at the Institute for Petroleum and Organic Geochemistry at the Nuclear Research Center (KFA) in Jülich, Germany, 1981.

EXPLORER: When did you know you were going to become a scientist?

Welte: Already as a schoolboy I was exposed to an atmosphere where science was part of daily conversations. Both of my parents had a scientific educational background. My mother had a Ph.D. in biology, which was very rare in the early 1920s for a woman.

My father was a geoscientist and university professor. Both of my parents died very early. My father was killed during the Second World War as a soldier and my mother died soon after the war from typhoid fever.

EXPLORER: Why did you study geoscience?

Welte: My interest for science was persistent, and when I started university in the city of Würzburg in Bavaria in 1952, I was undecided whether I should study chemistry or geology. Consequently, I tried as much as possible to devote time to both fields.

An organized student excursion in 1954 to the emerging post-war chemical industry in Frankfurt quickly brought the decision. I could not imagine spending part of my life as an industry chemist "in a little laboratory with unpleasant odors."

From then on I focused on geology, and after my interim examination I moved from Würzburg to the University of Göttingen to take courses in sedimentology and mineralogy.

EXPLORER: Your biggest early influence was in modern geochemistry, a field you helped develop. What got you interested in geochemistry?

Welte: After the fall semester of 1956 I returned to the University of Würzburg and received a diploma in geology, equivalent to a master's degree, in July 1957. During my stay in Göttingen I was exposed to geochemistry, which also suited my former inclination toward chemistry.

Winning a Fulbright scholarship brought me to the United States. There, I studied and worked as a graduate assistant in the geochemistry department of the Pennsylvania State University.

EXPLORER: And geochemistry was the start of your career?

Welte: An invitation by P.H. Abelson, at that time director of the Geophysical Laboratory in Washington, D.C., stimulated my interest in organic geochemistry.

The fate of organic substances in the Earth's crust – the remnants of former

See **Welte**, page 24

Recent Sidney Powers Winners:

2012 – Koenraad J. Weber
2011 – John W. Shelton
2010 – L. Frank Brown Jr.
2009 – Marlan W. Downey
2008 – Fred F. Meissner
2007 – Arnold H. Bouma
2006 – Robert M. Mitchum Jr.
2005 – Kenneth W. Glennie
2004 – Lawrence W. Funkhouser
2003 – Peter R. Vail
2002 – James L. Wilson
2001 – Robert M. Sneider
2000 – Gerald M. Friedman

The way he is: Dietrich Welte continues to push the envelope on research and science.

Welte

from page 22

plants and animals, and chemical changes induced by burial and subsidence – stimulated my curiosity as a would-be-chemist who was familiar with such geological phenomena as diagenesis and metamorphism.

Therefore, and because only very few geologists at that time were knowledgeable in organic chemistry, I decided to take a chance and try to make a professional career in this field.

EXPLORER: How did you get your first job in the industry, with Shell Oil?

Welte: In 1959, shortly before I received my Ph.D. in geology and geochemistry, I got an invitation to visit Shell International Oil Company, at that time called BIPM, in Den Haag, Netherlands.

A paper I had published the same year, about my very early mass spectrometric work at Penn State University using odd- and even-numbered carbon chain abundances to distinguish marine from limnic and terrestrial organic matter, had caught the attention of Shell. I was recruited by Shell in the same year.

EXPLORER: What would you have been if you weren't a geoscientist?

Welte: Looking back, it is difficult for me to envisage a different professional career, other than to be a geoscientist.

If it would have been something else, I am pretty certain it would have been something connected with the natural sciences.

EXPLORER: What have been your most enjoyable jobs?

Welte: My first own and more or less autonomous research project in the early 1960s with Shell into the study of source rocks and petroleum migration considerations in the strange world of the tropical jungle of the Niger Delta.

Another would be having the chance to found, build up and guide a research Institute for Petroleum and Organic Geochemistry at the Nuclear Research Center (KFA) in Jülich, Germany, from 1975 to 2000.

That was an opportunity and a challenge at the same time. It was a dream come true for a geoscientist: the chance to combine a vast suite of modern analytical methods with geological concepts to investigate subsurface geo-processes in space and time.

A special, enjoyable period was the cooperation with the oil and gas company Canadian Hunter and its president, John Masters, in Calgary in the 1980s.

EXPLORER: You were an early and important pioneer in basin modeling. How did that interest develop?

Welte: During my time with Chevron in La Habra, Calif., in the 1960s I was exposed to reservoir simulation projects and the ongoing development of the black oil model.

In the 1970s and 1980s, when my friend and colleague (and AAPG Honorary member) Bernard Tissot and I had published our textbook "Petroleum Formation and Occurrence," it was clear that the geochemical principles of source rock maturation, petroleum generation and many aspects of migration were reasonably well understood.

Then, looking at the so called Arrhenius equation, it was obvious the missing link to a numerical process simulation for the generation of petroleum, in analogy to reservoir simulation, was the reconstruction of the temperature history of a given source rock.

This triggered my interest in developing a research program for basin modeling.

EXPLORER: What did you see as the goal of basin modeling?

Welte: Modern geosciences live on the integration of formerly separate and sometimes even isolated fields like organic geochemistry, stratigraphy, sedimentology or other specific fields.

From the beginning, basin modeling aimed at integrating practically all the geoscientific disciplines with the ambitious goal to understand and quantify the chain of complex subsurface geo-processes in a holistic manner.

EXPLORER: What is most important for

See **Powers Winner**, page 26

Powers Winner

from page 24

the future of oil and gas exploration and production?

Welte: It was not by accident that I named the basin modeling company I had founded *Integrated* Exploration Systems. Organic geochemistry was, and will be, one of the core disciplines in basin modeling, simply because organic molecules derived from formerly biological material have a fantastic memory.

Characteristic mixtures of hydrocarbon molecules and especially so-called biomarkers can tell us about their origin, source facies, maturity and, in certain instances, even about distances of migration.

This memory effect of organic molecules and the understanding of petroleum formation based on chemical kinetics was a game-changer in exploration. It opened the door from a static approach (find the trap) to a dynamic approach – that is, to understanding, reconstructing and quantifying the chain of processes from source to trap.

The mobilization of the hydrocarbons in mature source formations will stimulate additional geomechanical and geochemical research to better understand and improve production efficiency of shale oil and shale gas potential.

This, in turn, enforced a more focused collection of the all-important geological and geophysical subsurface data. In other words, this dynamic "petroleum systems modeling" approach became the modern blueprint for integration.

As a consequence of the numerical simulation of petroleum-related geo-processes in space and time, product prediction and risk assessment also gained a superior quality.

There is, in my eyes, no question that both exploration and production benefit alike from this integrated dynamic approach of what was originally called basin modeling. Product prediction and improved risk assessment also allow earlier and better planning of costly technical infrastructure and the use of financial resources.

EXPLORER: What is your view of the current activity in unconventional resource development?

Welte: Unconventional petroleum resources, like shale oil and shale gas, are part of the natural generation sequence of petroleum.

The current activity in unconventional resource development simply has shifted the emphasis from the end of the petroleum systems line, existing accumulations in classical reservoirs, to the beginning of the petroleum systems line – the hydrocarbons that have been retained in source rocks, or their organic-lean immediate neighborhood.

This new interest in mature source formations certainly gained a great momentum due to advances in directional drilling and hydraulic fracturing.

The mobilization of the hydrocarbons in mature source formations will stimulate additional geomechanical and geochemical research to better understand and improve production efficiency of shale oil and shale gas potential.

The integrated petroleum systems modeling described before is certainly an important and promising approach to further develop unconventional petroleum resources.

EXPLORER: What do you think about the current controversy over climate change?

Welte: The repeatedly propagated claim by the media and politics of a man-made climate change has, since the late 1980s, pushed aside the chance of an honest scientific debate in many Western countries.

Science organizations, inclusive of those in the geosciences, failed to bring this issue back to objectivity. The reasons for this failure are certainly diverse, but one of many reasons is the close association of certain scientific circles with politics and the media.

Geoscientists know that climate change is a normal, natural phenomenon, which occurred frequently during the Earth's history. They also know that the paleoclimate record of millions of years does not support the hypothesis of a decisive influence of atmospheric CO_2 on the Earth's climate.

There is ample evidence that during the great ice ages in the Silurian and Carboniferous/Permian, atmospheric CO_2 concentrations were much higher than today. We know from ice core data spanning several 100,000 years that it was the temperature that increased first, and that the rise in atmospheric CO_2 was always lagging behind.

EXPLORER: How should geoscientists respond?

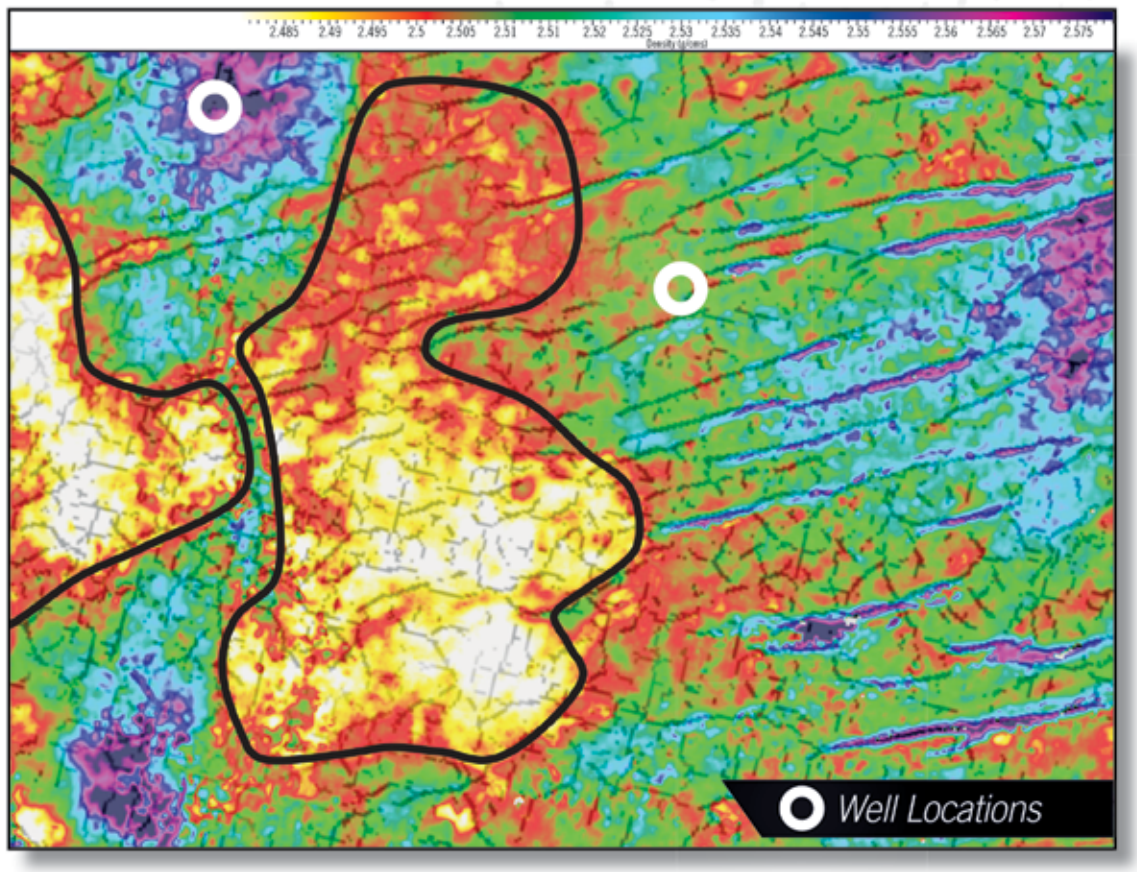
Welte: As geoscientists, we are aware of the fact that there are great uncertainties in understanding the details of the natural carbon cycle with respect to its different sources and sinks and the inherent flow dynamics and quantities.

Since the man-made CO_2 amounts to approximately 6 percent of the global CO_2 cycle, the impact of anthropogenic CO_2 is still obscured by the uncertainties within the much bigger natural cycle.

It is high time that we, as geoscientists, raise our voice loudly and inform the public everywhere that the CO_2 hypothesis, derived from purposely designed computer models, stands on weak ground and is far from being confirmed.

From my own experience I know that a critical review of the CO_2 hypothesis, which is really necessary, only has a chance of success if it is made via a neutral, highly respected and scientifically competent platform.

Reducing risk and uncertainty in unconventional reservoirs.



Unconventional Reservoir Sweet Spot Identification:

This map, from ION's LakeviewSCAN™ in the lower Marcellus, shows density with fault probability overlain. Rock physics calibration indicates that density values lower than 2.5g/cc correspond to high TOC (circled regions). ION's multicomponent ResSCAN programs yield more reliable density estimations from joint PP/PS inversion. Integration of fault probability reveals a distinct change in the structural fabric corresponding with an elevation of TOC.

Doing the job, being 'effective'

Sonnenberg's Leadership Skills Stretch Far

By BARRY FRIEDMAN, EXPLORER Correspondent

When leaders of AAPG decided to honor someone each year with an award for outstanding leadership, you'd like to think someone in the room was saying, "Yeah, Sonnenberg. Definitely."

The choice is a natural.

Or, as Lee T. Billingsley, an AAPG past president, says of Sonnenberg:

"He epitomizes effective leadership in a professional organization."

Stephen A. Sonnenberg is this year's winner of the Michel T. Halbouty Leadership Award, which next to the Sidney Powers Memorial Award is AAPG's most distinguished prize.

First presented in 2007, it is given in recognition of outstanding, exceptional leadership in the petroleum geosciences.

Even a casual look at Sonnenberg's past gives ample evidence for the inevitability of the choice.

An Honorary member of AAPG, Sonnenberg has displayed his leadership as:

- An AAPG president.
- Before that, a term as AAPG vice president.
- A 15-year member of the House of Delegates (and its chairman from 2009-10, making three stints on the AAPG Executive Committee).
- President of both the Division of Professional Affairs and the Rocky Mountain Section.
- General chair of the 2001 AAPG annual meeting in Denver.
- Playing crucial roles in several AAPG national conferences and meetings.
- A member of a plethora of AAPG committees – his AAPG activities page has more than 70 entries – including important roles on the Corporate Advisory, Budget and Advisory committees.
- Co-chair for this year's inaugural Unconventional Resources Technology Conference (See April EXPLORER).
- Heads the Colorado School of Mines' Bakken Research Consortium.
- The recipient of five AAPG Certificates of Merit and three more awards from the HoD.
- A professor and Charles Boettcher Distinguished Chair at the Colorado School of Mines.

SONNENBERG

> One of his goals at the Bakken Consortium: To get operators to think, literally, out of the geologic box.

Inspiring Thoughts

Those who can, lead; those who can lead well, teach.

And those who combine all of that have known what it means to have the gift of inspiration.

That would be Sonnenberg.

"One of the best quotes on leadership I have read is by John Quincy Adams," he said in talking about leadership and the Halbouty award. "'If your actions inspire others to dream more, learn more, do more and become more, you are a leader.'"

And where to put that to better use than the classroom.

"Currently I am running three consortiums at the Colorado School of Mines," he said, "Bakken, Niobrara and Vaca Muerta petroleum system studies – and I mentor over 20 students each year."

He talks about his satisfaction with seeing the results of student-based research ("with guidance, of course") and watching students blossom and grow through time.

"It is fun to see them accomplish things in the companies they go and work it, too," he said. "It is great to encourage students to become the future leaders."

He thinks the state of geology education in this country is "OK to good," primarily, he said, because of the public outreach that various societies – including AAPG – have done.

"I know that it can always be improved, however," he added. "When budget cuts occur, it seems that cutting geology-related programs are at the top of the list."

The good news?

"Geologists are fairly vocal," he said, "and help keep most things on track."

Seeing the Bigger Picture

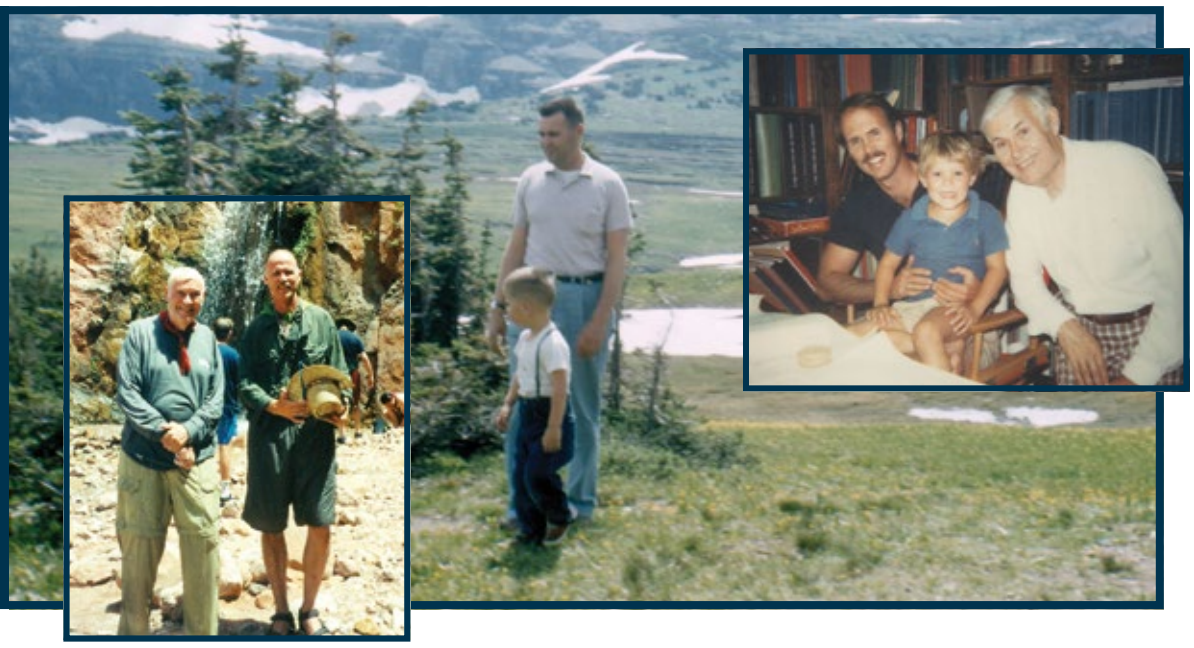
His encouragement, though, is not just for those entering the profession; it's also for those already in it. And one of his energies at the moment is the aforementioned Bakken Consortium.

"The consortium project on the Bakken studies all aspects of the petroleum system from the source beds to the reservoirs," he said.

See **Sonnenberg**, page 30

Recent winners of the AAPG Michel T. Halbouty Leadership Award have been:

2012 – Robbie R. Gries	2009 – M. Ray Thomasson
2011 – Daniel L. Smith	2008 – James A. Gibbs
2010 – Patrick J.F. Gratton	2007 – John Amoruso



Leadership begins at home: Steve Sonnenberg with his dad, Frank, at various parts of his "career" – including a field trip where they were "checking the geology" in the mid-1950s. The late Frank Sonnenberg was a longtime AAPG member.

Sonnenberg
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One of the goals is to get operators to think, literally, out of the geologic box.

"Operators tend to focus on their early successes," he said, "so I advise them to remember other aspects of the play, including the well-known concept that part of the production comes from the shales, in addition to the silty dolostone reservoirs."

Leading this project, he says, has given him the ability to see the bigger picture and to give advice to other consortium members.

Or at least, he tries to.

"Some of them listen," he says.

On Bakken, though, he wants to make sure the right story gets out.

"The general public gets lots of mixed information about what is going on," he said, speaking about the play that has dominated the media's energy reporting.

"If there is bad news to report (such as an operational problem), the public generally always hears about it," he said. "The good news on employment and the economic benefits of the Bakken unfortunately doesn't get the press that it should."

Working On a Dream

But if his work in and with the Bakken is his job, much of his passion is expressed in geology – and in the opportunities for leadership that the profession has provided.

"My greatest success so far in all that I have done is being president of AAPG," he said, proudly. "It's one of the most enjoyable and challenging things that I have done."

He talks of the traveling to various conferences and experiencing the global perspective on oil and gas.

"It was fantastic," he said of his time heading the AAPG Executive Committee. "Interacting with geologists around the world was – and still is – great."

As a geologist, as a leader, he knows that it's never just one thing that makes a person an effective leader.

"The qualities that mark good leadership include: Commitment, competence, character, communication, attitude, relationships, focus, integrity, passion and vision," he said.

Sonnenberg also knows that awards (and he's won many) do not happen in a vacuum – and that's a lesson he learned early in his career.

"I did my master's degree under Bob Berg at Texas A&M University and my Ph.D. degree under Bob Weimer, Colorado School of Mines," he said. "Both are Sidney Powers medalists from AAPG, and they both inspired me and all the rest of their students to get involved in professional societies."

They were instrumental, in fact, in him becoming an active member in the Rocky Mountain Association of Geologists, first as a program chairman and then in a variety of other ways as the results of networking became evident.

Asked whether those leadership opportunities were circumstance or design, he says, for certain, at least one experience was the result of a dream.

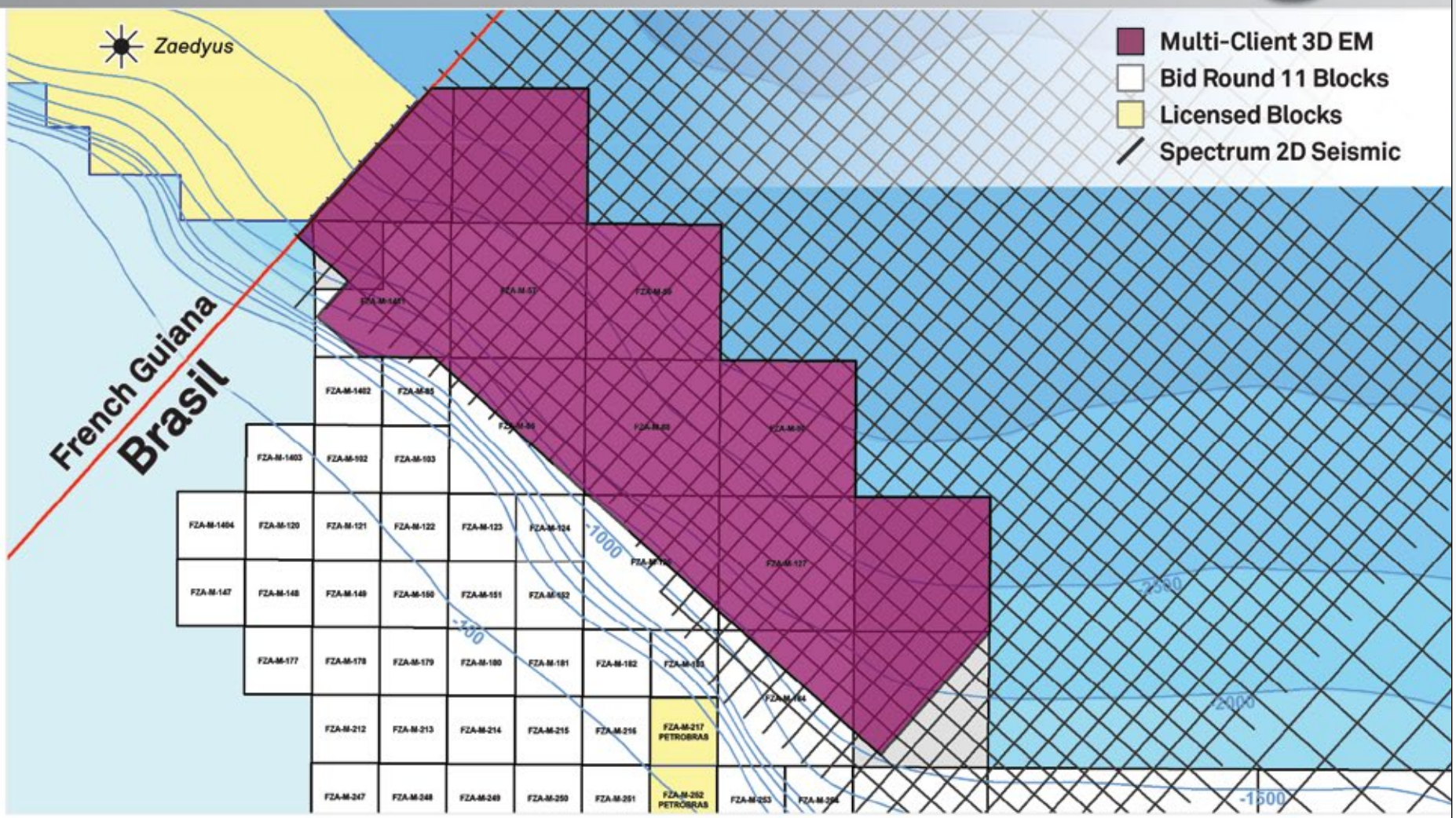
"I set a goal in the leadership arena to be the president of AAPG early in my career," he said. "This goal was accomplished through committee work, being active in all areas of AAPG governance."

Don't Forget to Remember …

He is biased, he'll tell you that, but he

See **Halbouty Award**, page 38

Irresistible Knowledge



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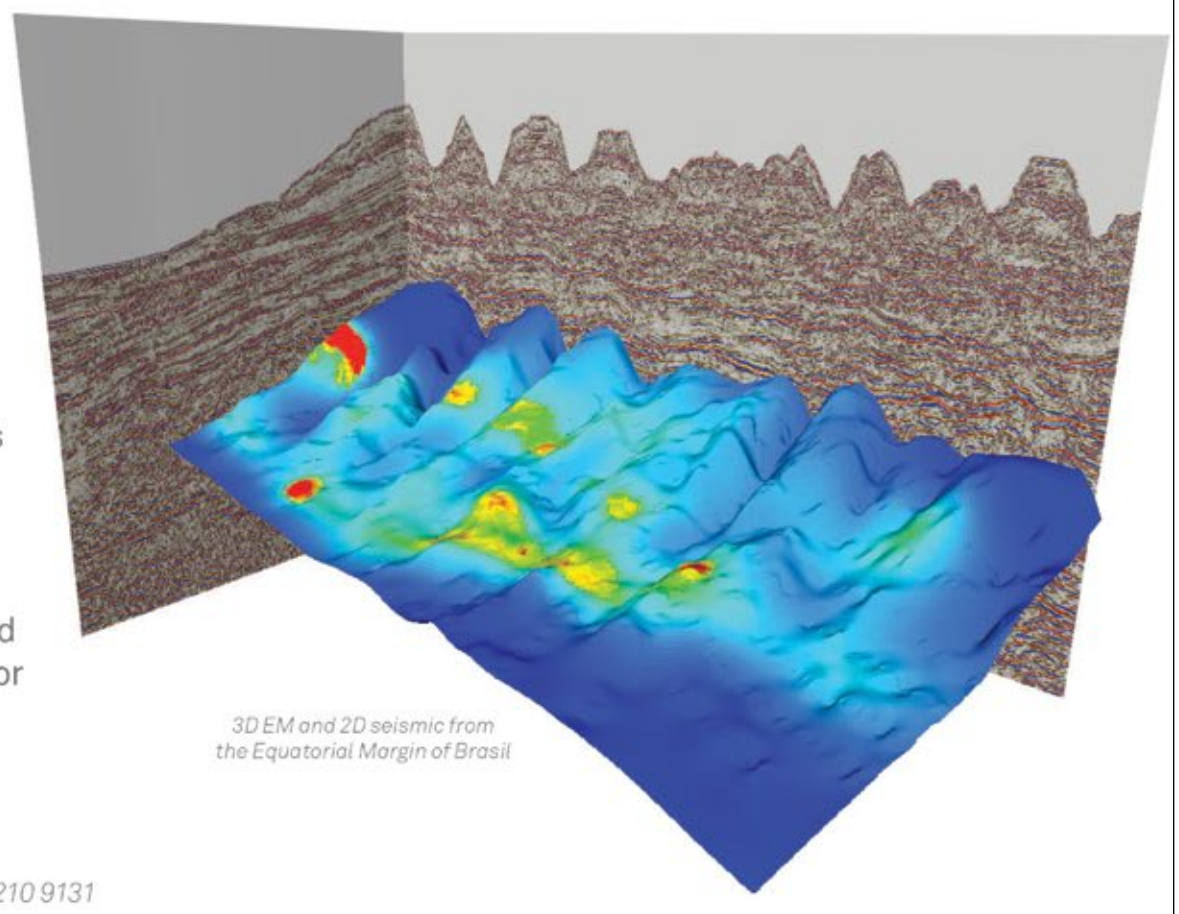

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Explorer of the year

Zagorski Made His Mark With the Marcellus

By DAVID BROWN, EXPLORER Correspondent

To understand why Bill Zagorski is getting AAPG's Outstanding Explorer Award at the upcoming AAPG Annual Convention and Exhibition in Pittsburgh, you have to travel far, far back into the distant reaches of Deep Time.

All the way back to 2004.

It's hard to believe now, but back then the industry was just awakening to how the technology from the successful Barnett Shale development in Texas could be applied to unlock other North American shale plays.

Zagorski was in Pennsylvania, working a play for Range Resources Corp. and evaluating a well that passed through the Devonian Marcellus Shale. He had the idea of using Barnett-style horizontal drilling and high-volume hydraulic fracturing to develop the Marcellus.

What happened next is exciting, informative, dramatic, instructional and perhaps even inspirational – a success story that has become part of the industry's lore.

Today, Zagorski serves as vice president-geology for Range Resources-Appalachia LLC in Southpointe, Pa.

A native of Pittsburgh with bachelor's and master's degrees in geology from the University of Pittsburgh, he was named "Father of the Marcellus" by the Pittsburgh Association of Petroleum Geologists in 2009.

And this year he receives AAPG's Norman H. Foster Outstanding Explorer Award, to be presented at the AAPG Annual Convention and Exhibition in Pittsburgh, and given "in recognition of distinguished and outstanding achievement in exploration for petroleum or mineral resources, by members who have shown a consistent pattern of exploratory success."

Bill Zagorski, this year's winner of the AAPG Norman H. Foster Outstanding Explorer Award, looking at (and explaining) data from the Marcellus Shale play.

AAPG "explorer of the year" honoree Bill Zagorski is going to have a high profile at this year's AAPG Annual Convention and Exhibition in Pittsburgh.

First, Zagorski will receive his Norman H. Foster Outstanding Explorer Award at the ACE opening session and awards ceremony, which begins at 4 p.m. Sunday, May 19.

Second, he'll also be part of this year's Discovery Thinking Forum, which will be held from 1:15-5 p.m. Monday, May 20, where he will discuss the liquids rich portion of the Marcellus Shale play.

This year's forum will offer five talks from seven explorers who will talk about their exploration experiences and successes. (See related story, page 20.)

Getting Started

"I had an interest in science and geology from a very early age," Zagorski recalled. "I was drawing dinosaurs on a tablet when I was four or five and collecting rocks with my dad when I was seven."

Although he began his university studies majoring in chemistry with a minor in mineralogy, he soon switched to geology – but not yet with a focus in oil and gas.

"I didn't have the 'Ah-ha!' moment in petroleum geology until I finished undergraduate school," he said.

Zagorski went to work for Atlas Energy Group Inc. in Pittsburgh, then moved on to new independent Mark Resources Corp., which he called "a great career opportunity."

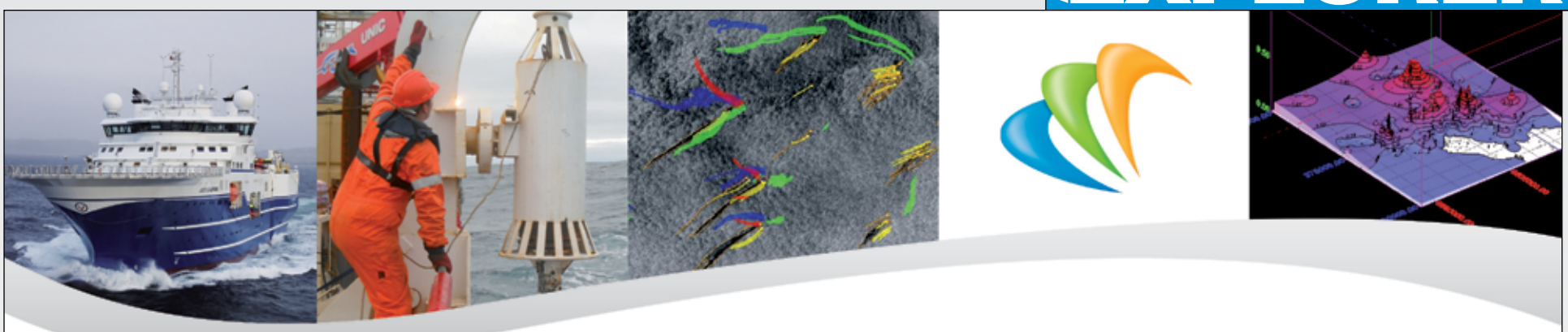
"I started getting familiar with the Devonian Shale and the Marcellus when I took that job in 1983," he said. "Back in that time there was quite a bit of research going on in the Department of Energy, and you had the Section 29 tight sands tax credit, so you were looking at $8, $9 per mcf gas prices."

At Mark Resources he became interested in Western Canada's Elmsworth Field – and legendary AAPG geologist John Masters' basin-centered gas concepts.

"It's not uncommon now, but at the time it was quite unconventional as it went against the anticlinal theory," he said.

Zagorski used these concepts to study the huge Clinton Medina fields in Ohio and Pennsylvania and came up with a major success: generating the prospect that became the Cooperstown Gas Field in Pennsylvania and led to the drilling of thousands of wells. These studies also

See **Zagorski**, page 34



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Zagorski

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led him to earn his master's degree at the University of Pittsburgh.

In 1992, Lomak Petroleum Inc. acquired Mark Resources. Zagorski eventually became manager of geology for Lomak, which later became Range Resources Corp.

He generated prospects in numerous areas and formations, including a regional unconventional play targeting the Trenton/Black River Formation in New York, which led to Utica/Trenton discoveries in the Clyde Field.

His interest in the Trenton Black River play grew out of regional studies related to expanding several new high volume gas discoveries being made in West Virginia and south central New York, which were attracting significant industry interest.


ZAGORSKI

> "I had something new to bring back to the company – we had our own Barnett Shale-style play here."

"Although the Trenton Black River play had been extensively developed early for oil in the giant Lima Indiana field, that play had not been successfully tested in the deeper part of the Appalachian Basin," he said.

"We ended up in 2000 putting together a couple of acreage blocks down here in southern Pennsylvania to test these deeper reservoir concepts."

'A Barnett Shale Equivalent'

In 2003, Zagorski and his colleagues identified a large, untested domal structure in Washington County, Pa.

"Back at that time most of the conventional wisdom on the Marcellus was that it couldn't be developed commercially. It wasn't in everyone's psyche to be looking at that play," he said. "We wanted to drill a formation that was shallower than the Trenton/Black River but deeper than the Marcellus on this structure."

In 2003, Range Resources drilled a well, the Renz Unit #1, to test the structure. While significant shows were encountered, attempts to complete and commercialize these deeper zones failed, and the company was preparing to plug and abandon the well.

Zagorski thought the prospect still had possibilities.

He was right. The Renz later became famous as the start of the Marcellus Shale play.

"In 2004 I went to visit a geologist in Houston (Gary Kornegay) I'd worked with years before in Utah's Uinta Basin," Zagorski recalled. "He had a prospect he wanted me to look at in the Neal/Floyd Shale in the Black Warrior Basin in Alabama," Zagorski recalled.

Part of the prospect pitch included a comparison of the Floyd as an analog to the Barnett Shale.

"At that time I hardly knew what the Barnett Shale was," Zagorski said.

He soon found out, and similarities to the Marcellus were striking.

"That was the point in time I had the 'Holy smokes!' moment," he said. "I had something new to bring back to the company – we had our own Barnett Shale-style play here."

Zagorski said he took the concept to then-Range Resources CEO Jeffery L. Ventura, a seasoned petroleum engineer with both domestic and international experience, who gave the project and completion recommendation a green light. The company went back to the Renz well and tried a large, Barnett-style hydrofrac in the Marcellus.

Resulting gas production for this first vertical test started at around 300,000 cubic feet a day (mcf/day), later topping out at 800,000 cubic feet a day (mcf/day), he said.

"That opened our eyes. What we did then was to take a look at the formation a heck of a lot closer than we had before," Zagorski said. "We ended up drilling two more vertical confirmation wells. Then we began drilling our first horizontal well in late 2004, 2005. That wasn't any fun.

"Now the hard part started."

The Dream Comes True

Recognizing the Marcellus' potential, Range Resources began leasing aggressively in southern Pennsylvania to add to its existing acreage positions. The company's Marcellus team drilled and completed its first horizontal test in early 2006.

"It wasn't as good as the vertical," Zagorski said. "The second didn't get any gas. The third was twice as good as the first, but still not as good as we needed to establish commerciality."

Time was going by and costs were piling up.

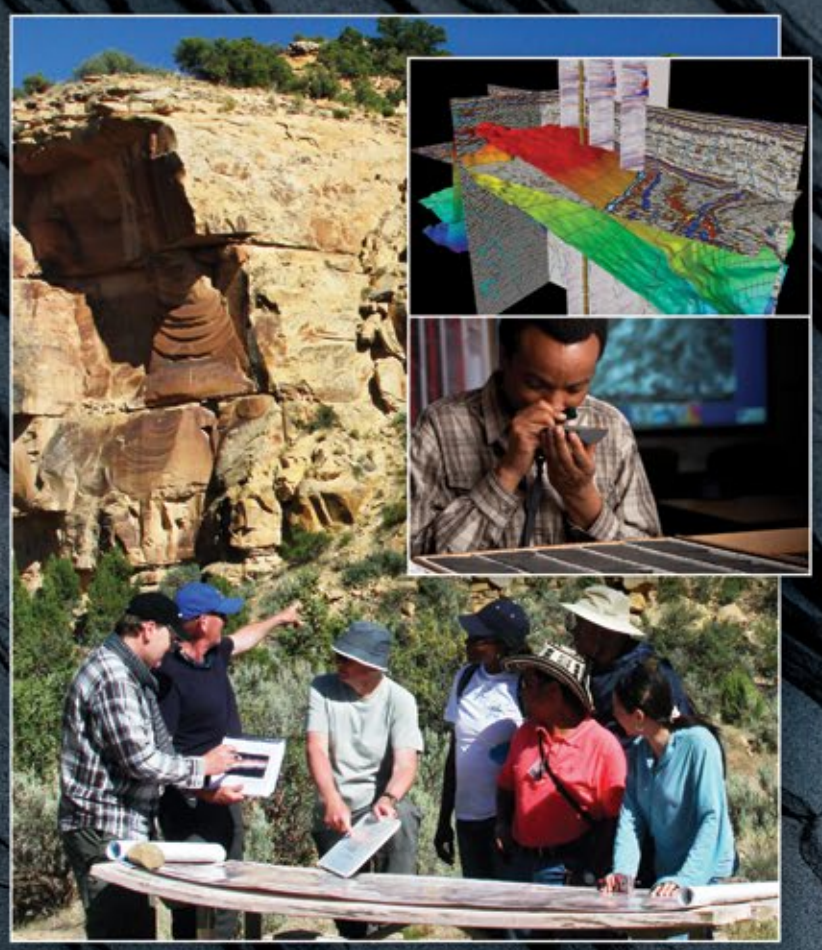
He credits Ventura with the long-term vision to continually support and steer the project, saying, "The senior guy was behind the play from the very start.

"Jeff had a vision to transform Range from a traditional exploration company to one focusing on resource plays that were highly repeatable and offered large scale development," he added, "so the Marcellus really fit perfectly for his vision."

Ventura will tell his own story about the challenges of the Marcellus as he is the keynote speaker for the Michel T. Halbouty Lecture at ACE 2013 on May 20.

In 2007, they took what they had learned from the first three horizontal tests

See **Marcellus**, page 38



Meeting Israel's needs

Levant Basin Brings Potential to New Areas

By LOUISE S. DURHAM, EXPLORER Correspondent

The eastern Mediterranean, particularly offshore Israel, is proving to be a sort of natural gas behemoth.

For many years, Israel appeared to have been left on the short end of the stick, so to speak, when the massive hydrocarbon deposits common to this part of the world materialized.

A few small oil and gas deposits were discovered intermittently, but that was it.

But now there seems to be a new story emerging – a history-making exploration/development endeavor that *doesn't* involve shale.

This story began when Noble Energy arrived on the scene in the late 1990s, when it was known as Samedan. The company ultimately tapped into enormous supplies of natural gas offshore Israel in the Levant Basin in the eastern Mediterranean Sea.

Its subsalt Tamar natural gas discovery, which was drilled in approximately 5,500 feet of water, was the largest conventional gas discovery in the world in 2009. The target Oligo-Miocene-age clastics at Tamar occur at depths of approximately 15,000 feet subsea.

Until the Tamar discovery, these reservoirs had never been tapped into by the drill bit.

Noble operates Tamar, where it has a 36 percent working interest. Other owners include Isramco Negev 2, Delek Drilling, Avner Oil Exploration and Dor Gas Exploration.

To date, Noble and partners have drilled six successful subsalt exploration wells in Oligo-Miocene reservoirs in the Levant Basin, discovering approximately 37 Tcf of natural gas.

Its Leviathan field to the west of Tamar is estimated to hold as much as 18 Tcf, with the most recent number for Tamar upped to 10 Tcf.

Noble's other natural gas discoveries in this deepwater exploration play are Dalit, Dolphin, Tanin and Cyprus A.

Plenty to Go Around

Prior to its subsalt exploration here, Noble made some Plio-Pleistocene post-salt finds to the south of Tamar in shallow water.

The first of these was the Noa-1 in 1999. The 1 Tcf Mari-B field went on production in 2004, followed by Noa and the recent Pinnacles discovery, which both began producing in 2012 via the Mari-B platform.

These finds, while respectable, tend to be overshadowed by the results of drilling activity to the north.

"The main subsalt play area is over 10,000 square kilometers in water depths of approximately 1,300 to 1,700 meters," said AAPG member Dan Needham, development geoscience manager of Noble's Eastern Mediterranean Business Unit.

"The Oligo-Miocene reservoir section is comprised of thick deposits of alternating thin silts, mudstones and sandstones," he said, "deposited by sandy turbidites in a deep water setting.

"At Tamar, there are over 250 meters gross thickness of high quality reservoir with greater than 20 percent porosity and more than 500 millidarcies permeability," Needham noted.

"Leviathan is a faulted four-way closure, reaching as large as 300 square kilometers," he said. "The gas is biogenic in origin and comprised of 99 percent methane, the same as Tamar."

The Tamar field was put online March 31, with the gas flowing from the field to the Tamar platform and on to the Ashdod Onshore Terminal.

Israel reportedly has exports to the European markets in its crosshairs.

There's considerable ongoing chatter about an Israel to Turkey pipeline, and judging from some of the print media reports, this appears to be a possibility. However, the ever-shifting geopolitics in this general part of the world dictates that uncertainty is the only certainty.

For now, the gas is being used to meet Israel's domestic needs.

"We have up to 1 Bcf per day capacity from the facilities at Tamar, and we have the ability to expand to 1.5 Bcf in the future," Needham said. "We're looking to average 700 million a day this year.

"What's unique about this marketplace is we sell gas directly to the user in Israel," he noted. "There's no midstream buffer, like the Henry Hub and such.

"We have peak capacity in excess of our daily average production because of production swings in a 24-hour day," Needham said.

"They need more gas during the day than at night, and they need more in the summer than the winter, so we have to have this peak capacity that's above what we're averaging," he explained. "Sometimes we hit peak capacity, but it's more of an instantaneous occurrence."

Revving the Ferrari

The huge Leviathan discovery is not yet producing, and a startup date hasn't been announced. Among other obstacles,

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AAPG member Dan Needham, development geoscience manager of Noble Energy's Eastern Mediterranean Business Unit, will present the paper "Exploration Success in the Eastern Mediterranean: Levant Basin Gas Discoveries" at 10:30 a.m. Monday, May 20, at the AAPG Annual Convention and Exhibition in Pittsburgh.

Needham's paper is part of the session on "Recent Discoveries and Leading Edge Technologies."

> **The reservoirs are capable of delivering high rates of production.**

Marcellus
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and drilled the fourth horizontal test of the Marcellus. This time, they moved the landing of the horizontal well 20 feet higher in the section.

Immediately following this discovery the company drilled and completed three more successful horizontal wells in a row, each more productive than the fourth.

That provided the breakthrough needed. That well tested at 3.2 million cubic feet a day, the company's and industry's first commercial horizontal Marcellus well.

Range Resources announced those results in late 2007, and in 2008 the Marcellus Shale play went into overdrive. Some predicted the Marcellus would become the biggest producing gas field in the United States.

In 2012, it did.

"I thought my strength was in my conviction," Zagorski said. "I feel very blessed to have been given the opportunity to be part of the early pioneering of shale gas."

Maybe I'm Amazed

When industry people talk about finding successful approaches to get high production from a reservoir, they often call it "unlocking the play." The Marcellus had been unlocked, but developing it was far from easy.

"There were no experienced crews up here," Zagorski said. "It was a real challenge.

"One of the critical breakthroughs was Range started a technical office here in Southpointe, Pa., in 2007, led by Texas Barnett shale veteran Ray Walker, now Range's COO, from Fort Worth. This office was then staffed with people who were focused specifically on developing the Marcellus," he added.

In the end, shale play development proved an old exploration home truth once again. To get good oil and gas production, go where the oil and gas is.

"I'm a big proponent of looking at old gas shows," Zagorski said. "It seems to me the bigger and more consistent the gas shows, the better the reservoir."

"The reason I think the Marcellus and other recent shale plays got missed is that, prior to the Barnett, it was believed that there had to be natural fracturing for shale plays to produce commercially, like the Big Sandy Field in Kentucky and West Virginia. In that field they were using various stimulation designs, early on shooting with explosive followed by various frac methods, most often nitrogen foam fracs," he said.

The new approach to unlocking shale production with large-scale water fracs and horizontal drilling "seems so simple now, but it was largely untested and counterintuitive up until 2004 with the Barnett play successes," he noted.

Range Resources now claims between 26 trillion and 34 trillion cubic feet (Tcf) equivalent of resource potential in the Marcellus Shale, and another 12-18 Tcf in the Upper Devonian shales above the Marcellus.

Zagorski hadn't seen that coming.

"Initially, in my studies, I couldn't get my estimate of the prospect potential to the company past a half a Tcf, or even a Tcf," he said.

He's amazed, even dazed, at where successful development of the Marcellus Shale has led.

"All that work I had done in various plays and prospects over the last 30 years," he said, "we can achieve in a matter of months now.

"It really is amazing."

Levant
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facilities are limited in places and there are commercial issues to be resolved, such as export approvals and more.

The reservoirs are capable of delivering high rates of production.

"Someone commented that it's like having a Ferrari, but you have to drive it through a school zone," Needham quipped.

Even before these enormous discoveries, the U.S. Geological Survey considered the hydrocarbon potential of the Levant Basin to be significant enough to undertake an assessment of undiscovered oil and gas resources.

The study, which was released in March 2010, estimated a mean 1.7 billion barrels of recoverable oil and a mean 122 Tcf of recoverable gas in the Levant Basin province.

Now that Noble has discovered over 37 Tcf, just in the Oligo-Miocene reservoirs in the basin, it's time to ask what's on tap for an encore.

"We're drilling an exploration well in Israel called Karish," Needham said. "After that, we plan to drill an appraisal well offshore in Cyprus.

"We're also looking at a deeper oil play," he said. "We hope to drill a well to test that concept probably late in 2013 or early 2014."

Halbouty Award
from page 30

says, "geologists are the greatest people in the world."

Who sometimes need to be reminded why they're doing this, of course. After all, even the most skilled and experienced of geologists have challenging days.

And when that happens, his advice is to remember two things.

First, remember the basics.

"My advice to anyone in the petroleum business these days is to understand the geology, geophysics and engineering of the play," he said, "and then develop it in an environmentally and socially responsible fashion."

To those entering the profession, he says, read the books, build your net, learn how to "push back," maintain your technical skills, remember your employee may be your boss someday, maintain balance in your life and support your profession."

The second piece of advice:

"Enjoy what you do!"

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The editors of INTERPRETATION invite papers on the topic of "Interpreting AVO" for publication in the May 2014 special section/supplement of INTERPRETATION.

Since amplitude variation with offset (AVO) analysis was introduced to the geoscience community in the 1970s, the interpretation of AVO data has become a basic component of many geoscience projects. The development of innovative interpretation technologies for AVO has been sustained through libraries of drilling analogs as well as better integration of stratigraphy, rock physics, direct borehole measurements, improved amplitude preserving data processing, and theoretical modeling. As a result, AVO and related quantitative interpretation methods now commonly influence decision-making throughout exploration and development.

The objective of this special INTERPRETATION section is to showcase both the history as well as recent advances in AVO interpretation. Emphasis will be placed on the art and science of the interpretation process of incorporating AVO into exploration, development, and production projects. Topics of the special section will include but not be limited to:

- impact of the rock types and stratigraphic facies on the AVO response,
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- capturing and describing uncertainty in AVO predictions, and
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Interested authors should submit their manuscripts for review no later than **31 July 2013**. In addition, the special section/supplement editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for INTERPRETATION (https://mc.manuscriptcentral.com/interpretation) and select this topic in the manuscript-type dropdown box. The submitted papers will be subject to the regular peer-review process, and the contributing authors also are expected to participate in the review process as reviewers.

We will work according to the following timeline:

Submission deadline
31 July 2013

Peer review complete
31 December 2013

All files submitted for production
20 January 2014

Publication of issue
May 2014

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INTERPRETATION special section
CALL FOR PAPERS

Photos courtesy of Terry Engelder

Penn State University professor (and AAPG member) Terry Engelder, whose long connection with the Marcellus Shale has brought him international recognition for his expertise.

Engelder earns high profile

Marcellus Turns Penn Prof Into a 'Celebrity'

By LOUISE S. DURHAM, EXPLORER Correspondent

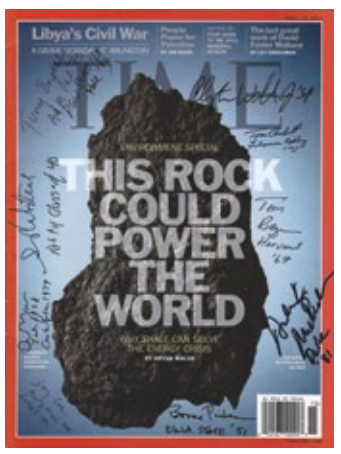
Tell Terry Engelder he's famous, and he comments wryly, "If you say so."

Engelder, professor of geosciences at Pennsylvania State University, has long been an expert on the Devonian black shales.

His profile escalated dramatically with the onset of the now-renowned Devonian age Marcellus Shale play, which spans a distance of 400 miles, trending northeastward from West Virginia and into New York.

Not surprisingly, his profile also will be large at the upcoming AAPG Annual Convention and Exhibition in Pittsburgh, conveniently set close to Engelder's own backyard.

At ACE, Engelder's listed as a supporting co-author for three technical talks that will be presented – all dealing with the Marcellus Shale – and he'll be a leader on the field trip "Devonian Gas Shales of the Appalachian Basin."



Engelder's connection to Marcellus geology goes back decades, but his tie to the shale play began garnering attention in late 2011, when Range Resources announced initial test rates between 1.4 and 4.7 mcf/d for five horizontal wells drilled in the Marcellus.

That announcement essentially coincided with a press release from Penn State, noting that Engelder, working in conjunction with fellow AAPG member Gary Lash, a geoscience professor at SUNY Fredonia, had estimated the recoverable gas from the Marcellus Shale to be 50 Tcf.

The play quickly acquired legs.

"That was my initial volumetric calculation, which was designed to be very conservative," Engelder said. "When production data became available, I did a statistical analysis on the very first data.

"As a result of this, I thought ultimately that under favorable price conditions the Marcellus would yield as much as 489 Tcf," he said. "By favorable, I mean something like $8 to $10 per Mcf."

Joints and a Woman's Legacy

Engelder began mapping rocks in the Appalachian Basin, including the gas shales, in the late 1970s. He published his first paper on the topic in 1980 in the Journal of Geophysical Research.

The publication kicked off his now-longtime consulting business with industry, when management at a division of Shell read the paper in the mid-1980s and contacted him for input on the Antrim Shale, where they were drilling for gas.

Natural hydraulic fracturing in the basin was confirmed in a series of papers by Engelder and various co-authors.

"The play is all about the fractures in the rock and how you tap into them," he said. "The Marcellus has two sets of vertical fractures, or joints – the J1 and the J2.

"The more dense, more closely spaced east-northeast trending J1s are cross-cut by the less well developed northwest-trending J2 joints," he noted.

Engelder emphasized the fractures and joints were first discovered long ago by a woman geologist, Pearl Gertrude Sheldon.

Sheldon, a structural geologist, earned her doctorate from Cornell University in 1911, according to a Cornell Press-issued book about the Marcellus penned by Tom Wilber. Her doctoral thesis reportedly

See **Engelder**, page 44

Engelder and fellow AAPG member Gary Lash, who were among the first to recognize the Marcellus Shale's potential.

Engelder
from page 42

focused on faulting in the Appalachian Basin black shales.

Sheldon spent considerable time studying the geology in the Taughannock Falls State Park area in central New York. She published the results of her work in a paper titled "Some Observations and Experiments on Joint Planes," which appeared in 1912 in the Journal of Geology.

"If you look back, in terms of influence a woman has had on the U.S. oil and gas industry, you'd be hard-pressed to find someone with more impact than Pearl Sheldon," Engelder said emphatically. "This happened even before AAPG originated."

In terms of his scientific contribution to the ongoing Marcellus action, he commented that his most significant paper was written in conjunction with one of his graduate students, Alfred Lacazette, in 1992.

Lacazette, also an AAPG member, is now with Global Geophysical Services in Denver.

"In that paper, we had first discovered that the prime mechanism for driving natural fractures in gas shale was not water but natural gas," he said. "Up to that point the paradigm was that natural hydraulic fractures were water driven.

"A lot of the basis for gas recovery is a consequence of the presence of those natural hydraulic fractures that Lacazette and I documented (more than) 20 years ago," he said.

In widespread acknowledgement of his scientific expertise, Engelder was featured in a shale-focused cover story in a leading national news magazine in 2011. He also was included among Foreign Policy Magazine's Top 100 Global Thinkers for 2011, sharing spot 36 on the list with Gary Lash and legendary Texas oilman George Mitchell, renowned "father" of the prolific Barnett Shale play in Texas.

Friends and Foes

Ongoing media recognition, making the rounds on the lecture circuit and meeting other demands that go with the territory can make for an exciting life.

It's not all glory.

Typical of the experience of high profile industry/hydraulic fracturing proponents, Engelder has been targeted by a number of "off-beat" websites along with other widely known anti-fracing, anti-fossil fuel groups.

He's not losing any sleep.

"I judge my success based on heat coming from (a certain) website," he said. "If they're on to me, that means I must be doing something right.

"Early on, I became the Dr. Strangelove of the fracing debate," he quipped. "Everyone and his brother are pretty sure I'm the super pariah.

"When (a leading environmental group) came out in favor of natural gas, largely because of the (lesser) environmental impact natural gas had on global emissions compared to coal, the group's members compared their president to me as a measure of the ultimate insult," Engelder joshed.

There were weighty issues of a sort early-on.

When capital-focused Jefferies initially asked Engelder in 2007 to evaluate the Marcellus in terms of its potential for gas production, he was told by a Jefferies staff member during a one-hour conference call that "billions of dollars of investment capital are listening to you."

He had qualms about releasing his initial estimate of 50 Tcf, thinking of the negative impact it might have if wrong.

The positives won out.

"The human economy can only be nurtured and grow in proportion to the energy to which systems have access," Engelder stated. "I did what I did based on the knowledge that his would be a very positive impact on the American economy; it would be huge."

No one would argue that this university professor has come a long way, baby.

He's a happy camper.

"It's rare for a university faculty member to interact with the public to this extent," Engelder commented earnestly. "It's a real thrill."

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ACE paper

Data Reveals Safety Dynamics For Marcellus

By LOUISE S. DURHAM
EXPLORER Correspondent

Check out a variety of news sources for environmental-oriented stories associated with shale drilling/hydraulic fracturing, and you'll find a variety of opinions, accusations and such, particularly in the public domain.

Many of them are far out.

Tales of methane-filled tap water from the kitchen faucet that reportedly catches fire when exposed to a lighted match are but one of many examples.

"There are not a lot of clear messages in the popular media," noted Deborah Glosser, doctorate program student in the Geology and Planetary Sciences department at the University of Pittsburgh.


GLOSSER

"The folks on the environmental side have their preconceived notions, and the industry has its own interests," Glosser said. "It's good to look at the data and decide for ourselves."

She has looked at plenty of HSE (health, safety and environment) data in Pennsylvania, alongside her academic adviser, Penn State geology professor Daniel Bain.

Bain also is an NETL (National Energy Technology Laboratory) collaborator through the RUA (Regional University Alliance).

Glosser's interest in the HSE data stems from her research project focusing on HSE incident reporting in Pennsylvania. The results will be incorporated into her doctoral dissertation – and will be the focus of a paper she'll be presenting at the upcoming AAPG Annual Convention and Exhibition in Pittsburgh.

She currently is funded by the NETL via Bain's RUA contract, with prior funding from NETL as an ORISE (Oak Ridge Institute for Science and Education) fellow.

"This is the first comprehensive study that's looked at incident reporting in Pennsylvania over time and in the context of actual drilling," Glosser said. "It's still a project in progress.

"Since I wrote the abstract (for the AAPG presentation), the Pennsylvania Department of Environmental Protection, which is Pennsylvania's equivalent to the EPA, released more data on penalties," Glosser noted. "Penalties are separate enforcement mechanisms from notices of violation (NOV)."

See **Safety**, page 75

Deborah Glosser will present the paper "Dynamics of Marcellus Shale Environmental Health and Safety Incident Reporting in Pennsylvania" at 2 p.m. Monday, May 20, at the AAPG Annual Convention and Exhibition in Pittsburgh.

Glosser is a doctorate candidate in the Geology and Planetary Sciences department at the University of Pittsburgh.

Her talk is part of a Division of Environmental Geosciences session titled "Evaluating Environmental Impacts from Shale Gas Development."

Photos courtesy of John Underhill

John Underhill, a former European professional football referee with a taste for teaching and classical Greek culture.

Murray Award winner

Geology: His Classroom, Inspiration and Passion

By BARRY FRIEDMAN, EXPLORER Correspondent

For John R. Underhill, who will receive the AAPG Grover E. Murray Memorial Distinguished Educator Award this month in Pittsburgh, the natural landscape – literally what's in front of us – is not just a sight to behold.

It's a narrative.

"For as long as I can remember," he says, "I have been fascinated with reading a landscape and what its shape can tell us about what lies buried below."

Underhill, who is Chair of Stratigraphy for the Grant Institute of Geology at The University of Edinburgh, says transmitting his excitement to his students has been not only his greatest joy, but his greatest challenge.

"I always thought if a teacher was not enthusiastic about his or her subject, it sent the wrong message."

And even then, enthusiasm can't do it alone.

"I think it's also important to be flexible and create an atmosphere conducive to constructive challenge such that any student feels able to ask any question without fear of failure or judgment," he said, "however daft they may seem, there are no daft questions."

Further, Underhill believes the study of geology is really a study of and about all of us; hence it shouldn't be relegated to a few classrooms on the second floor of the science building.

"To my mind, geology is of such fundamental importance to the earth and man's place on it, that it should be a core subject in all schools and something that reaches out to the wider world," he said.

"It's one thing knowing and thinking one understands how earth processes operate and the impact they have," he continued, "it is quite another to be able to communicate it effectively and to place it in context, be that societal need for resources, climate change or the impact of geology on past (Classical Greek) civilizations (Geo-Archaeology)."

It's Greek to Him

As for that last example, he's proving it.

A few years back, Underhill lead an international team that undertook geoscientific tests to investigate whether Odysseus' homeland, ancient Ithaca, could have been located on the western Kefalonian peninsula called Paliki.

Why is this important?

Because if Underhill and his team are able to show that an ancient marine channel separated the peninsula from the main body of the island in classical times, they will solve a problem that has been perplexing Greek scholars and archeologists for years: Why doesn't the modern island of the same name fit with Homer's original geographical description of it in the Odyssey?

This is the kind of stuff that keeps Greek mythology majors up late.

Underhill, who was a featured speaker on the subject at the 2007 AAPG European Region Energy Conference and Exhibition in Athens, Greece, knows that integration must

See **Underhill**, page 50

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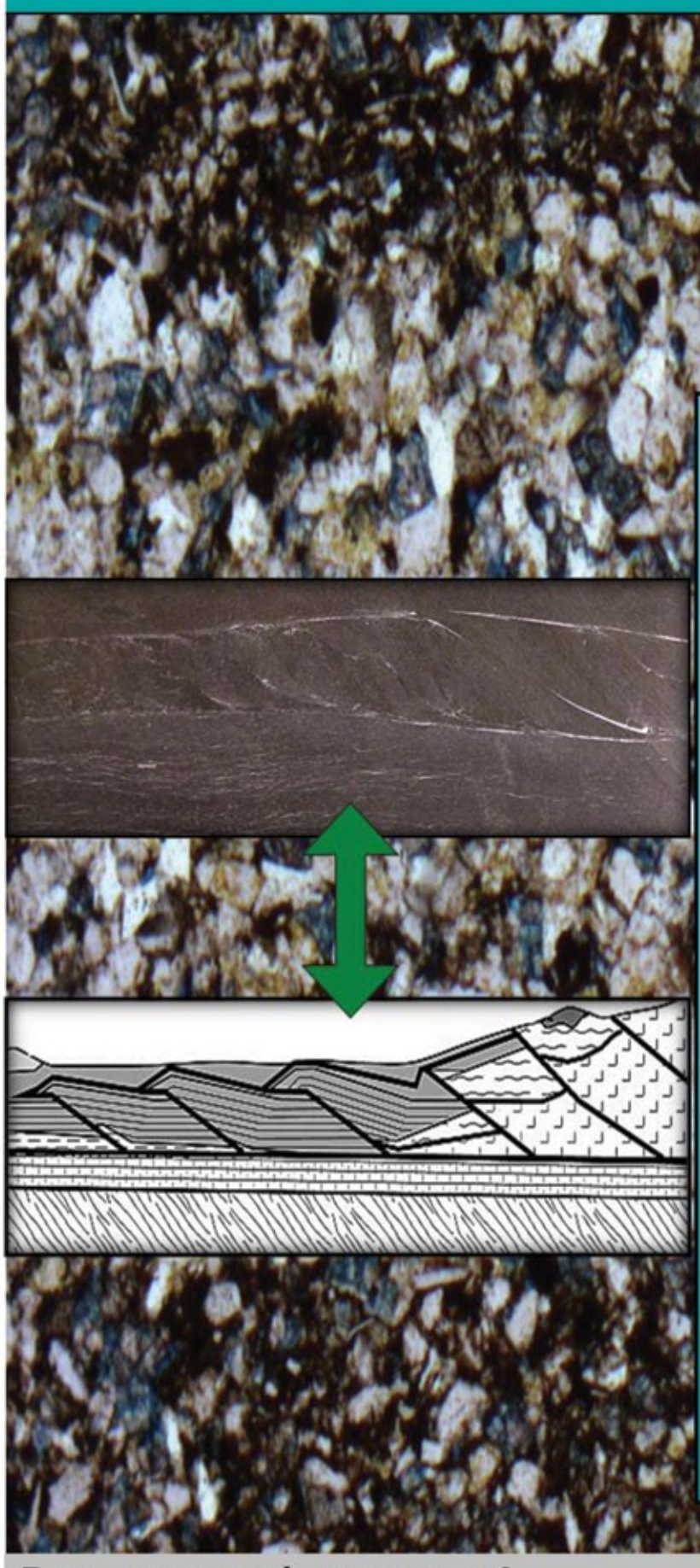

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Award-winning educator John Underhill has a special passion for Greek culture – and at the core of that relationship is geology.

Underhill

from page 48

not only take place within school curricula, but between academia and industry as well.

"I am delighted to have been a member of AAPG since 1984, some 29 years now," he said, a bit proud of his academic credentials in a professional society adding that, "It has given me so much through conferences, publication and fellowship over that time."

For the record, he is associate professor in the Institute of Petroleum Engineering at Heriot-Watt University, Edinburgh; Fellow of the Royal Society of Edinburgh; Fellow of the Geological Society since 1982 (Council Member 2005-08); was head of the Earth and Planetary Sciences Research Group in the School of Geosciences; and was the president of the European Association of Geoscientists and Engineers for 2011-12.

He also was the 1998-99 Allan P. Bennison Distinguished Lecturer in North America, presenting the talk "The Role of Propagating Normal Faults in Controlling Sequence Variability and Sediment Dispersal in Rift Systems."

He always seems to be teaching.

But along the way, he also has worked for Shell in various locations throughout the globe, including London and The Hague, and spent time with BP in Glasgow and Norsk Hydro, which, he says, was beneficial to both business and academia.

"It allowed me to maintain links with industry and develop my own skill set to train, educate and inform a generation of students" – students who keep changing, demanding more.

"I try to keep the content of lectures up-to-date," he said. "Making them topical, timely and relevant is essential as is being enthusiastic."

I Get a Kick Out of …

There's something else, too, that has occupied his time, his life – something that lies between avocation and recreation: For over 28 years he was a soccer referee of which 14 included officiating on international FIFA matches between 1994-2008.

And as dissimilar as geology and the sport may seem, they both represent something similar to Underhill.

"I have been fortunate," he said, "to follow two hobbies as careers."

Growing up, he says, he loved sports, generally, but soccer, specifically – and played through college.

"Having picked up an injury whilst representing my university, I turned to refereeing as a way and means to get back fit and back on the pitch."

And then a strange thing happened.

"I discovered I had a greater aptitude for it than playing," he said. "I am not sure if that made me a failed footballer or a promising referee."

You'd have to put money on the latter, for he has officiated at the top levels of Scottish and European Football for years, including 132 SPL matches and more than 40 international matches – including World Cup games.

And there was at least one time when his worlds of geology and football meshed perfectly – at the 2008 AAPG International Conference and Exhibition in Cape Town, South Africa, when he "refereed" a debate on the causes of the infamous Lusi mud volcano in northeast Java.

"I readily agreed to taking on what I saw as a fascinating and challenging task as a facilitator with a front-row seat," he said at the time.

He is now retired from the sport – and for him, not a moment too soon.

Or as he says, "Before I made any highly contentious decisions that would haunt me forever."

He's being modest. One imagines that many students grow up to be coaches and players – and somebody has to deal with them.

His joy, though, and the reason for the award have been found in the classroom where he strives to inform, educate and inspire.

"There is nothing like seeing a student suddenly grasping a difficult concept," Underhill said, "It is those Eureka moments that make it all worthwhile."

"It is a rewarding and enriching experience to see others that you have in some small way helped then go on to succeed in their chosen career path."

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Fossils, Freeways and a Great Story to Tell

By BARRY FRIEDMAN, EXPLORER Correspondent

At the moment, you can imagine one of them in a suit, presiding over a board meeting at the Smithsonian, in his capacity as director of the National Museum of Natural Art, in Washington, D.C., while the other is in a t-shirt, drawing fish or manning his seafood kiosk in Ketchikan, Alaska.

These two wrote a book together?

The two wrote a book together.

JOHNSON

TROLL

"Cruisin' the Fossil Freeway: An Epoch Tale of a Scientist and an Artist on the Ultimate 5,000-mile Paleo Road Trio," is exactly that – a book about a journey across the American West to explore the fossil record.

And it's not just any book – it's an award-winning book, because the two authors, Kirk Johnson (he's the suit guy) and Ray Troll (he's painting fish) will receive the AAPG Geosciences in the Media Award at this year's AAPG Annual Convention and Exhibition in Pittsburgh.

The award is presented for notable journalistic achievement in any medium that contributes to public understanding of geology, energy resources or the technology of oil and gas exploration.

"Ray and I first met in the early '90s," Johnson said. "I loved his art and he loved the fact that I was a paleontologist who liked art. We started collaborating in the mid-1990s and eventually tumbled to the idea of a road trip book.

"Cruisin' the Fossil Freeway" – it's not just the name of the painting, it's also the title of a book that earned Kirk Johnson and Ray Troll this year's AAPG Geosciences in the Media Award.

"Ray had drawn a picture of an old Volvo and morphed it into an Evolvo," Johnson continued. "We first thought about taking the road trip in a tricked-out Volvo, but soon realized that my big blue museum truck was the right vehicle."

Blending Art and Science

As to that business of understanding, Johnson says it's relatively easy to reach readers.

"I find that people learn much faster if they are laughing," says the man recently named to head the 70-person research and collections division (including curators, registrars, librarians, archivists, conservators, technicians, administrators and assistants) at the Smithsonian and its $3.5 million annual budget.

"Plus, there is a lot of funny stuff out there."

Which is where Troll comes in.

Their book consists of 19-framed color prints by the artist, and five large-scale murals.

Some are whimsical, some are stark, some are hysterical. All are informative.

But the book, like the artist himself, doesn't take itself all that seriously.

If you needed further evidence of the former, note Troll's website, where he poses next to a sign that reads, "Danger … Unstable." Even better, he also has had a ratfish named after him (a New Zealand species called Hydrolagus trolli).

"We're still getting email from people who have read the book and have decided to take their own tours across the fossil west," Johnson said.

Why did it resonate so much?

Well, to hear Simon Winchester, author of "The Professor and the Madman" and "The Map that Changed the World," tell it, the authors have a knack for story telling.

"The two describe Jurassic better than Spielberg," Winchester said.

Johnson, ever modest, gives the credit to his partner.

"The secret to the book is the amazing art of Alaskan artist Ray Troll," he says.

"Ray and I collaborated throughout the project. I wrote and photographed. Ray did all of the art and much of the photography as well. His art affects what I write and what I write affects his art," he said. "The collaboration is really fun."

Troll, who earned an MFA in studio arts from Washington State University in 1981 and was awarded a gold medal for "distinction in the natural history arts" by the Academy of Natural Sciences in Philadelphia, is known for his mastery at blending art and science. This synergy, if you will, culminated in his traveling exhibit,

See **Fossil Freeway**, page 62

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Delegates Primed to Tackle Division Proposal

By R. RANDY RAY, Chair-AAPG House of Delegates

The upcoming AAPG Annual Convention and Exhibition in Pittsburgh will be a busy and important time for the House of Delegates, which will hold its annual meeting Sunday, May 19.

We'll have several proposals for delegates to vote on, and I will ask delegates to exercise their judgment on a wide range of issues affecting AAPG now and in the future.

The most prominent proposal will be to form a new AAPG technical division called the "Petroleum Structure and Geomechanics Division" (PSGD) (see this month's President's Column, page 3).


RAY

> **I will ask delegates to exercise their judgment on a wide range of issues affecting AAPG now and in the future.**

Details of each of the proposals are available in the April Delegate's Voice, including discussions by AAPG leaders, and I encourage all delegates to come to arrive well prepared and ready to make these historic votes.

The business includes:

- First, delegates will vote on a Bylaws amendment allowing for flexibility to use an email option in notifying each member, including students and associates of delinquent annual dues. This housekeeping change will help Tulsa staff be more efficient and cost-effective in accomplishing membership notifications.

The full language of the amended wording is available for review at aapg.org/bylawschanges.cfm.

- Second, delegates will consider a proposal to change the boundary between AAPG's Asia Pacific and European Regions, which would result in five central Asians countries – Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan – moving to the European Region from the Asia Pacific Region.

The proposal was made because these countries have a better alignment of geologic interests and professional activity with the European community. In recent years giant oil fields have developed in this area and the geologic community is becoming increasingly active. Leadership in both Asia Pacific and Europe agree with the change.

- Third, the proposal for a new technical division comes from the Executive Committee, with its full support.

Background: The Petroleum Structure and Geomechanics Division began as a group of people who have been meeting informally at AAPG annual meetings since 1997, under the leadership of AAPG members Peter Hennings and current elected editor Stephen Laubach.

The group has grown to over 200 geologists who are interested in aspects of structural geology, including faulting, fracturing and seals, which are influenced by rock mechanical properties. This also incorporates the study of stresses and pressures at reservoir level that affect drilling and completion procedures.

Geomechanics has broad appeal and will interest current members as well as draw new members to AAPG from other professional disciplines with overlapping interest.

- Fourth, approval of Affiliated Society status has been requested by the Ghana Institution of Geoscientists (GhiG) and the Myanmar Geosciences Society, to be presented by Ed Rothman, chair of the Resolutions Committee. This is routine HoD business – and it shows the continuing growth of AAPG as a global geoscience community.

- Finally, delegates will vote on new officers for the HoD who will begin service immediately following the HoD adjournment. The candidates are:

HoD Chair-Elect

❒ **Paul Britt**, independent geologist and president, Texplore, Houston.

❒ **David Dolph**, team lead-Global Exploration, Nexen Petroleum International, Calgary, Canada.

HoD Secretary/Editor

❒ **Mark Rainer**, senior geologist, Jones Energy, San Diego.

❒ **Dan Billman**, president, Billman Geologic Consultants, Mars, Pa.

I encourage delegates to come prepared to vote on these proposals that will guide AAPG's future.

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Edith Allison, director of AAPG's Geoscience and Energy Office in Washington, D.C., can be contacted at eallison@aapg.org; or by telephone at 1-202-643-6533.

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

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

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

Interested authors should submit their manuscripts for review no later than **15 June 2013**. In addition, the special section or supplement editors would like to receive a provisional title and list of authors as soon as possible. Authors should submit via the normal online submission system for INTERPRETATION (https://mc.manuscriptcentral.com/interpretation) and select the Seismic Attributes Special Section option in the manuscript type dropdown box. The submitted papers will be subject to the regular peer-review process, and the contributing authors are also expected to participate in the review process as reviewers.

The submissions will be processed according to the following timeline:

Submission deadline
15 June 2013

Peer review complete
26 October 2013

All files submitted for production
9 November 2013

Publication of issue
February 2014

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INTERPRETATION special section

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POLICYWATCH

Energy industry impacts

NAS Report Tracks Workforce Issues

By EDITH ALLISON, GEO-DC Director

The National Academy of Science recently released its report "Emerging Workforce Trends in the U.S. Energy and Mining Industries: A Call to Action," which determines that the demand for energy and mining workers is higher than the current supply – despite offers of high salaries.

The report also concludes the demand for energy and mining workers will continue for many years, and the factors that drive the workforce shortage will grow unless corrective actions are taken.


ALLISON

This report is timely because major provisions of the America COMPETES (Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science) Reauthorization Act of 2010 are set to expire in 2013. The Act provides, among other things, funding authorizations for federal physical sciences and engineering research programs, as well as STEM (science, technology, engineering and mathematics) education programs.

The connection between quality of life and energy and mining workers is simple: The nation and the world depend on energy and mineral resources to keep their people and economies thriving, and a skilled workforce is essential to meet the nation's and the world's energy and mineral needs.

The National Academies report looks at energy sectors, including solar, wind, nuclear, and carbon capture, use and sequestration. This article will focus primarily on the oil and gas extraction industry.

First Priority

Accurate data and projections on the energy workforce are necessary to define the scope of labor shortages and requirements for new workers, but consistent and detailed data are lacking. A sample of the data evaluated in the National Academy report shows the inconsistencies and lack of granularity to assess specific oil and gas occupations:

- PriceWaterhouseCoopers (2009) estimated the total operational oil and gas direct workforce as 2,123,291.
- The Bureau of Labor Statistics (BLS, 2010) estimated the U.S. workforce in oil and gas extraction, well drilling and support activities for oil and gas operations at about 494,200. This number excludes self-employed workers.
- A subset of that population – the oil and gas extraction workforce, which includes self-employed workers – was estimated at 158,900 in 2010 (BLS).
- The BLS projects future employment in the oil and gas extraction workforce will increase by 23,200 between 2010 and 2020.
- The Energy Information Administration (EIA) estimates total employment in oil and gas extraction was 452,891 in 2010 and it is expected to rise to 459,032 in 2020, and then decline to 404,866 in 2030 and 383,205 in 2035, as U.S. oil production starts to decline in 2030 and gas production starts to decline in 2035.

> **There are too few younger workers to replace those who are retiring.**

Workforce Issues

The report finds the most important factor impacting all U.S. industries is that the large cohort of baby boomers are expected to retire in the next decade, and there are too few younger workers in the pipeline to replace those retiring.

Because petroleum-industry hiring was very low from the mid-1980s through about 2000, there also is an extreme shortage of geoscientists and petroleum engineers with 15 to 25 years of experience. This means a significant shortage of knowledgeable and experienced managers and mentors for younger workers.

Finding ways to retain the knowledge and experience of the retiring workers is an important concern.

The report also finds the current pipeline of students with strong STEM backgrounds is insufficient to meet industry needs, and efforts to grow this population are insufficient to meet future industry needs. Although the majority of energy and mining jobs do not require a four-year degree, many do require some education beyond high school; for example, there is a large demand for geological and engineering technicians with a two-year degree or certificate.

One bright spot is that community colleges have rapidly moved to provide two-year industry-focused programs and help funnel students into four-year STEM curricula.

Other workforce issues face the oil and gas industry:

- The U.S. petroleum industry faces growing international competition for workers as oil and gas production grows around the world. The problem is amplified because many foreign students in U.S. colleges and universities do not stay in the United States due to the difficulty in getting work visas.
- There is a shortage of faculty in geoscience and petroleum engineering. Although the faculty decline has slightly reversed in petroleum in recent years, it is expected to grow as older faculty members retire.
- Federal and state governments

See **Workforce**, page 58

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Energy Forum Set for Pittsburgh ACE

A special Energy Policy Forum on "The Demand Side of the Natural Gas Price Equation" will be held at 1:15-4 p.m. Tuesday, May 21, at the AAPG Annual Convention and Exhibition in Pittsburgh.

Moderator for the event will be Edith Allison, director of the GEO-DC Office in Washington, D.C., and columnist of the EXPLORER's monthly feature, "Policy Watch."

The growth in U.S. natural gas production has depressed prices. Although weather and macro-economic conditions influence price in the short term, new markets for natural gas can boost demand over the long term, bringing prices in line with production costs. This forum will explore some potential areas of growth in natural gas demand.

A moderated discussion period will follow the presentations. Panelists include:

- **Howard Gruenspecht**, deputy administrator, Energy Information Administration: "Projections of Future Natural Gas Demand."
- **Christopher Smith**, deputy assistant secretary for oil and natural gas, U.S. Department of Energy: "Expectations for Future Natural Gas Exports."
- **James R. Cooper**, vice president-petrochemicals, American Fuel and Petrochemical Manufacturers: "Potential Growth in Natural Gas Demand for Chemicals.
- **Paul Kerkhoven**, director, government affairs, NGVAmerica: Future of natural gas vehicles.

Workforce

from page 56

that provide necessary data collection and regulation are having a hard time attracting and maintaining qualified workers because of uncompetitive salaries, unappealing job locations and cumbersome government hiring practices. This has a negative impact on industry efficiency.

Potential Solutions

In the short term the oil and gas industry is boosting its workforce by hiring non-U.S. workers, increasing salaries and retention bonuses – especially targeting retention of older workers – and acquiring companies to acquire workers.

For the long term, among its many recommendations, the report encourages efforts to increase participation of under-represented minorities and grow STEM education.

Some of the recommended approaches are:

- Increased funding from industry and the federal government for academic research in the geosciences and petroleum engineering is necessary for attracting students and faculty.

Industry-government coordination or partnerships to fund university research programs help make education more relevant to industry while attracting students and faculty. These programs should be expanded.

- Several industry-supported educational programs are effective in encouraging minority students to complete high school and college and in choosing STEM careers. Successful programs should be expanded or replicated.

One example is the Cooperative Development Energy Program (CDEP), created at Fort Valley State University (FVSU) in Georgia that targets minority students using mentoring and internship programs starting in the seventh grade. Three years at FVSU are followed by two years at the University of Georgia. The program has graduated 100 students in earth sciences and engineering since 1997.

The AAPG Foundation established the Ike Crumbly-Minorities in Energy Grant in recognition of Ike Crumbly, an AAPG Special Award winner and the founder of CDEP.

GeoFORCE is a slightly younger but highly acclaimed program at the University of Texas.

- As health, safety and environmental regulations are moving from check lists to risk-based safety management systems, government-industry collaborations including worker exchanges can help address shortages of government workers and help educate industry workers.

- The report also encourages government to supplement non-government efforts to attract a greater number of traditional STEM students to energy and mining careers by showing their importance to the nation and the career opportunities they present.

The National Academy examples and conclusions should help Congress in considering a second, 2013 reauthorization of the 2007 America COMPETES Act.

Among other efforts leading up to the reauthorization:

- The Research Subcommittee of the House Committee on Science, Space and Technology reviewed four exemplary industrial and non-profit, philanthropic STEM education initiatives in a March 13 hearing. Example programs by Intel, Honeywell Aerospace, Project Lead the Way and the Museum of Science and Industry mirror existing geoscience programs, while focusing on other technologies.
- The Senate Committee on Commerce, Science and Transportation held a similar hearing in September 2012: Five Years of the America COMPETES Act: Progress, Challenges and Next Steps.

See **Policy Watch**, page 60

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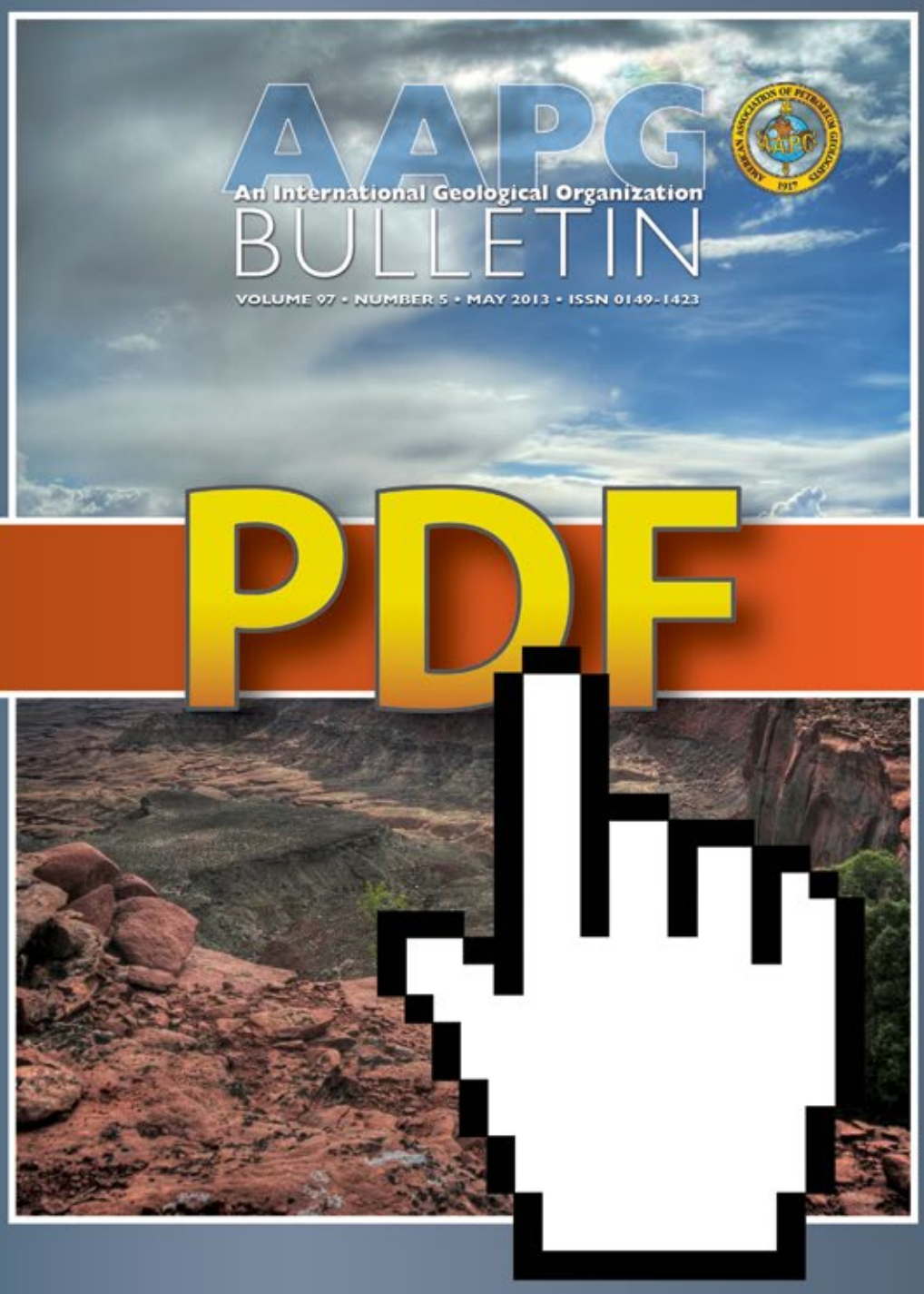

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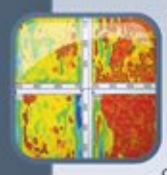
Experiments in a new fluid flow cell and introducing SSGR

Silvio B. Giger, Michael B. Clennell, N. Bozkurt Çiftçi, Craig Harbers, Peter Clark, and Mark Ricchetti



A new direct shear apparatus was used to run experiments to explore the critical shale smear factor (SSFc), the SSF where clay smears become discontinuous. In a companion paper, a scaled form of SGR (SSGR) to account for increased clay involvement is introduced.

Turbidite sand prediction

Kosuke Egawa, Toshiko Furukawa, Tatsuo Saeki, Kiyofumi Suzuki, and Hideo Narita

The Ogasa Group in the Nankai Trough contains gas hydrate-related deepwater turbidite sequences. Three-dimensional horizon surfaces mapped from 3D seismic and well log data can predict paleobasin characteristics and depositional processes in deepwater turbidite systems.

Significance unappreciated

G. Shanmugam

Internal waves associated with baroclinic currents can form deep marine sands. Although they are documented in modern marine settings, there is no way to distinguish ancient counterparts, and potential exists for misinterpreting these deposits as turbidites or other similar features.

A thought process for modeling geological data

Frédéric Amour, Maria Mutti, Nicolas Christ, Adrian Immenhauser, Gregory S. Benson, Susan M. Agar, Sara Tomás, and Lahcen Kabiri

Considerable effort has been devoted to the development of simulation algorithms for facies modeling. This study, using outcrop analogs, shows that the use of one single simulation technique is unlikely to correctly model the natural patterns and variability of carbonate rocks.

AAPG EXPLORER

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer. This month's column deals with a basic question: What is seismic interpretation?

What Is Seismic Interpretation?

By ALISTAIR R. BROWN

Seismic Interpretation is the extraction of subsurface geologic information from seismic data. On that definition we all are agreed.

However, if we seek a more penetrating explanation, we find practitioners get tongue-tied and talk around the subject in a variety of ways.

In this article I attempt to give a longer, more descriptive definition that will apply to every interpretation project involving reflection seismic data.

The danger in seismic interpretation is in thinking that everything we see is geology!

* * *

Reflection seismic data comprise:

- Continuity of reflections indicating geologic structure.
- Variability of reflections indicating stratigraphy, fluids and reservoir fabric.
- The seismic wavelet.
- Noise of various kinds and data defects.

Seismic interpretation is the thoughtful procedure of separating these effects.

The seismic wavelet starts as the pulse of seismic energy, which, generated by the energy source, travels down through the earth, is reflected and travels back up to the surface receivers carrying the geological information with it. This recorded wavelet is minimum phase of some frequency bandwidth, and during data processing it is converted (we hope) into a zero-phase wavelet, making interpretation easier and more accurate.

The interpreter is not directly interested in the wavelet itself but rather in the geological information that it carries.

Thus, understanding the wavelet and distinguishing its characteristics from details of the geology is one of the critical tasks of today's interpreter.

* * *

Noise is ever-present in seismic data. It may be random noise, it may be multiple reflections, it may be refracted energy, it may be other energy of unknown source.

The data may suffer defects because of:

✓ Irregular data acquisition showing as footprint.

✓ Obstacles to the data acquisition crew.

✓ Equipment difficulties in the field.

✓ Processing problems.

The interpreter must know enough about the acquisition and processing to recognize these undesirable features, and thus to not confuse them with the geology he/she seeks.

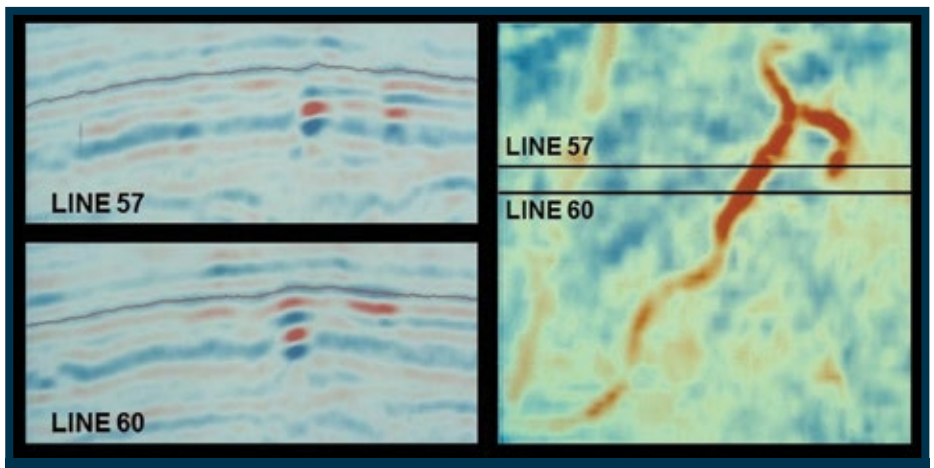
* * *

Seismic energy is reflected from interfaces where the acoustic properties of the rocks change. These interfaces follow sedimentary boundaries created at the time of deposition of the sediments.

Following the continuity of these reflections then defines for us the structure imposed on these boundaries by the tectonic forces of geologic history.

Following this continuity and making structure maps is thus the most basic, and most traditional, activity of seismic interpretation.

To aid in this endeavor the seismic interpreter can manipulate the data and the display in various ways.



The horizon track on Lines 57 and 60 defining the structure, and the Horizon Slice sliced through the data volume 40ms below. (From Interpretation of Three-Dimensional Seismic Data, AAPG Memoir 42, SEG Investigations in Geophysics No. 9, Seventh Edition, 2011.)

BROWN

The danger in seismic interpretation is in thinking that everything we see is geology!

The time-honored approach to prepare the data for structural interpretation is to apply AGC (Automatic Gain Control) in the late stages of data processing. This reduces amplitude variability (where most of the statigraphic information lies), and hence increases visible data continuity.

The interpreter also may compress the display color bar to optically saturate and thus to render invisible more of the amplitude variations. Other techniques include the use of Instantaneous Phase (which completely destroys amplitude information) and Structurally Oriented Filtering.

All these are good ideas – provided the interpreter realizes that they are directed at structural interpretation only, and that the requirements of later, more advanced types of seismic interpretation are quite different.

* * *

Once the structure has been established, the interpreter turns his attention to stratigraphic interpretation and the detection of hydrocarbon fluids.

Overwhelming important here is seismic amplitude – and the amplitude may be presented to the interpreter or extracted from the data in various ways. The data loaded to the workstation must be True Amplitude and Zero Phase, and the interpreter must satisfy himself that the data used are such.

Understanding the wavelet is complicated and very important (part of the fundamental separation of effects) but outside the scope of this article.

In order to increase the visibility of stratigraphic variations the interpreter will remove the structure – and the best way to do this is to make a Horizon Slice.

The concept behind the Horizon Slice is the reconstitution of a depositional surface at a key point in geologic history. The structure used for the reconstitution is most commonly defined at the level of the objective. However, it is often better to define the structure at one level (conformable with the objective) and to use this to remove the structure at the objective level.

This very effectively separates structure into step one and stratigraphy into step two.

This procedure is illustrated in the accompanying figure. The horizon tracked on the two vertical sections follows a reflection with good structural continuity and little, if any, stratigraphic variability. The horizon track is then displaced downwards by 40 ms (a simple horizon computation on the workstation) to intersect the prominent red blob visible below it, and the amplitude is then extracted along the displaced track.

The resulting Horizon Slice, on the right of the figure, shows a very clear channel (the spatial pattern of the red blob) with interesting amplitude variations along it.

* * *

When the seismic interpreter extends his analysis even further and enters the field of reservoir evaluation, the data requirements are even more stringent, but the Horizon Slice concept is still effective in removing the effects of structure. Some form of Inversion may be used here, and this process converts interface information (amplitude) into interval information (acoustic Impedance).

The more advanced forms of inversion seek to remove the wavelet, and this is therefore part of the fundamental idea of separating effects. However, the challenge here is to exactly understand the wavelet that has to be removed.

This is difficult, and many inversions suffer and projects fail because of this issue.

So seismic interpretation is the thoughtful separation (with workstation assistance) of the various effects that the subsurface and the seismic acquisition process have mixed together!

(Editor's note: AAPG member Alistair Brown is a consulting reservoir geophysicist residing in Allen, Texas. He was the first joint AAPG-SEG Distinguished Lecturer, is the author of AAPG Memoir 42, "Interpretation of Three-Dimensional Seismic Data," recipient of an AAPG Distinguished Service Award and a former editor of the EXPLORER's Geophysical Corner.)

Policy Watch

from page 58

As a guide to the present and future role of the federal government in STEM education, the National Science and Technology Council released a December 2011 report, "The Federal Science, Technology, Engineering and Mathematics Education Portfolio." The report found that in fiscal year 2010 the federal government spent over $3 billion on STEM initiatives – less than 1 percent of all education funding in the United States.

Much of the federal STEM funding targeted economically disadvantaged and minority groups. Federal STEM programs supported: minority-serving colleges and universities, improving curricula and teacher effectiveness for K-12, and increasing students' knowledge and interest in STEM.

Finally, yet importantly, many non-profit groups and volunteers work to encourage students to choose STEM careers – and support their education. AAPG Foundation provides grants to many STEM education initiatives, and the Youth Education Activities committee coordinates projects and volunteers.

A few example projects are:

- Continuing education courses and course scholarships for middle school and high school earth science teachers.
- The American Geoscience Institute Earth Science Week.
- The E.F. Reid Scouting Program, which supports Boy Scouts, Girl Scouts and other youth organizations, and helped develop the Boy Scout Geology Merit Badge.
- Maps in Schools and Rocks in Your Head Programs, which offer teacher training and classroom materials.
- The Teacher of the Year award, which spotlights quality geoscience education.

Members can learn about these activities, contribute to the AAPG Foundation and join the Youth Education Activities committee by visiting AAPG's website.

The GEO-DC blog will alert AAPG members on the progress of legislation reauthorizing the American COMPETES Act. Readers can subscribe to the blog on the GEO-DC web page, www.aapg.org/geoDC/.

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

Fossil Freeway
from page 52

called "Dancing to the Fossil Record," a show that opened at the California Academy of Sciences in San Francisco.

Join Together With the Band

For his part, Johnson, who has a master's degree in geology and paleobotany from the University of Pennsylvania and a doctorate in geology and paleobotany from Yale University, seems genuinely pleased – both with the book's reach, its success and its recognition.

"Both Ray and I are honored to receive the award," Johnson said.

When I ask Troll for a comment, he replied:

"Looks like Dr. J has covered most of the bases nicely."

He does, however, point me to iTunes, where I could find his band.

"Look for Ratfish Wranglers' 'Cruisin' the Fossil Freeway.' Yes there's a musical CD!"

And the man who is featured on his site between two jars of lumpfish with the caption wishing everyone to "do a good deed for a spiny lumpsucker," the man who runs a Soho Coho gallery in Ketchikan, situated in an old historic house of ill repute located on a salmon spawning stream, adds:

"Everyone should be in a band regardless of talent or ambition."

Who wouldn't want to take a trip with these guys?

PROTRACKS

YPs Have a *Switch* Hit

By DREW KREMAN, AAPG YP Mid-Continent Section Lead

"What is the future of energy?"

This was the question addressed by past AAPG president Scott Tinker in the film "Switch," a documentary that he produced (and narrates) that intends to deliver a fair and balanced view of the practical realities of and upcoming innovations in energy production.


KREMAN

At a recent screening in the Blue Room Theater on the corporate campus of Chesapeake Energy in Oklahoma City, approximately 70 young professionals (YPs) from multiple oil and gas companies in the area experienced his exploration of solutions to the world's potential energy crisis.

This screening was the culmination of planning that began at the fall 2012 Student Chapter Leadership Summit in Oklahoma City, when students from the University of Kansas AAPG student chapter presented their experiences in organizing a screening of "Switch."

After hearing the students' workflow, the AAPG Mid-Continent YPs seized upon the idea of hosting a "Switch" screening for local YPs. Planning soon started – and after the venue was secured, the decision was made to hold the event March 7.

The months of preparation and collaboration resulted in an event attended by YPs from Baker Hughes, Chesapeake Energy, Continental Resources, Devon Energy, Halliburton, Sandridge Energy and several other companies – and with so many companies represented, the screening served as not only an educational event, but also as a networking event.

Collaboration

The screening, while highly successful, would not have been possible without effective collaboration between the AAPG YP Mid-Continent Sub-Committee and the OKC Young Professionals in Energy (YPE) Committee – the YPE group does an excellent job sending out invitations to its events and tracking the RSVPs, skills that the YP Mid-Continent Sub-Committee utilized to promote the "Switch" screening.

As a result, while this event was the first to be co-hosted by the two groups, it probably won't be the last. Great attendance and several post-screening discussions were solid evidence of their successful teamwork.

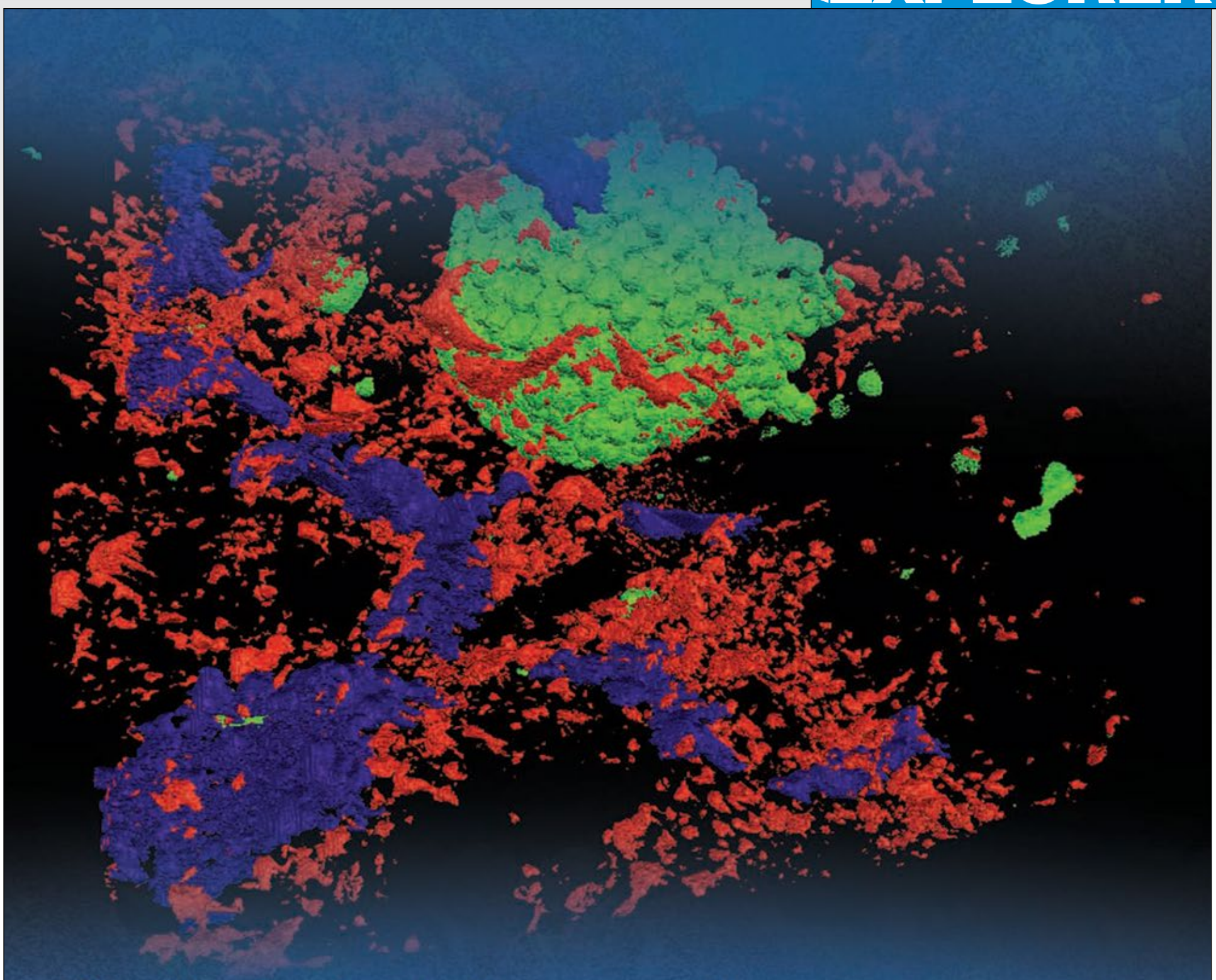
After the film, AAPG members Hank DeWitt and Tom Layman of Chesapeake Energy did a fantastic job fielding questions from the audience. Queries related to our energy independence, job security in the energy industry, sources of energy and the film itself demonstrated the enthusiasm YPs have for the energy business.

The success of this "Switch" event follows on the success of screenings held by the Pacific Section and Canada Region YPs – and the YP Committee hopes to continue this trend by hosting screenings in the other Sections and Regions.

* * *

- For more information on how you can be a part of YP events in the Mid-Continent Section, email Drew Kreman at dkreman@gmail.com.
- To learn more about YP events in your area and how you can get involved, visit the YP Committee page (aapg.org/youngpros/) and contact your Region/Section representative.
- To host a screening of "Switch," go to www.switchenergyproject.com to contact an Arcos Film representative.

(Editor's note: Drew Kreman is a geologist with Chesapeake Energy, Oklahoma City, currently working the Barnett Shale in the Fort Worth Basin.)



Marcellus: Blessing? Curse?

Author Knows Both Sides of a Controversy

By DAVID BROWN, EXPLORER Correspondent

In answer to the question "Is the extensive Marcellus shale development a blessing or a curse for landowners?" author Seamus McGraw has been known to answer:

"Both."

He bases that answer on experience. His widowed mother signed a lease on her Pennsylvania farm with Chesapeake Energy Corp. at the peak of the Marcellus land frenzy. That brought her a handsome lease bonus on her hundred acres.

A blessing.

McGRAW

It also brought a disorienting incursion of trucks and heavy equipment, the grinding roar of drilling rigs, worries about water quality, the discharge of chemical-laced fluid into rivers and streams, a disruption of lifestyle and landscape, a crippling strain on community.

The curse.

McGraw related his family's experiences during the advent of the Marcellus shale play in "The End of Country," published in 2011. The book provides a window on the many ways the developing play affected his mother and her neighbors in their rural neighborhood.

He will discuss that period and his current perspective on oil and gas development on Tuesday, May 22, as speaker for the Energy Minerals Division luncheon at the AAPG Annual Convention and Exhibition in Pittsburgh.

About "The End of Country," McGraw said, "I think it's about the challenge that comes from what happens below the surface being mirrored in communities above the surface."

"The word 'fracking' has come to be a very powerful word in this conversation," he added. "We push the word and pull it – we Silly Putty it to cover everything that happens in the process."

In McGraw's view, hydrofracturing equates to pumping fluid down a hole under enormous pressure to create fissures and to exploit existing fractures. He thinks communities go through something similar when an unconventional play develops.

"They have been exploiting existing fractures within these communities," he said, "with enormous consequences."

Regrets? He's Had a Few

McGraw described himself as still deeply conflicted about his family's actions in leasing their farm for drilling. He recounted a radio interview during which he was asked, "Do you regret the decision you made?"

"I said, 'I'm a 54-year-old, chain-smoking, recovering alcoholic. I can probably count the things I *don't* regret on the fingers of one hand,'" he recalled.

The better question would be "Would you do it again?" McGraw observed.

"And the answer is, 'Yes, I would,'" he said.

In a way, that answer reflects McGraw's environmental beliefs.

> **"I'm a 54-year-old, chain-smoking, recovering alcoholic. I can probably count the things I *don't* regret on the fingers of one hand."**

"We've reduced our coal consumption partly by development of renewables," McGraw said. "We've reduced our carbon output by about the total carbon output of England. We've taken some real steps. Not enough, but real steps."

Yet the United States' recent ability to curb pollution and greenhouse gas emissions largely comes from something else.

"If you listen to the EIA (the U.S. Energy Information Administration), the biggest reason is natural gas," he said.

Unconventional resource development has produced not only more abundant but also much cheaper natural gas supplies, shifting the balance away from more-polluting, coal-fired power plants.

It also has lessened America's dependence on imported oil and gas. And McGraw said that's important when he thinks about his young son, and his own days as a journalist writing about the war in Iraq.

"I don't want him standing on the same sand I was standing on with a gun in his hand, trying to protect someone else's water or someone else's oil," he said.

McGraw might have seen the worst of the industry's early push into shale gas. Numerous frac fluid spills occurred in northeast Pennsylvania, many caused when drillers lost control of flowback.

His family's farm is just five miles from Dimock, where an operator was ordered

See **McGraw**, page 67

Award-winning author Seamus McGraw will be the speaker for this year's Energy Minerals Division Luncheon, set at 11:30 a.m. Wednesday, May 22, at the AAPG Annual Convention and Exhibition in Pittsburgh.

McGraw's talk will be titled "Comfortable in Our Own Ignorance."

The session will focus on how extreme voices on both sides of the public debate over shale gas exploration and development are effectively undermining efforts to develop the resource more safely, damaging efforts to maximize its potential environmental advantages and preventing the real economic benefits from taking hold.

The perspective, he says, goes for both sides of the debate.

DPA-AWG speaker tackles U.S. economy

What Happens When Assumptions are Wrong?

By COURTNEY CHADNEY, EXPLORER Correspondent

It's a directly simple but perhaps deeply disturbing conclusion:

"Everything we know is wrong."

To be specific, Patrick Leach says everything is wrong about what we know about the U.S. economy.

That's not just his opinion. That's the title of a talk he'll be sharing this month at the AAPG Annual Convention and Exhibition (ACE) in Pittsburgh.

Leach is an author and CEO of Decision Strategies, a consulting firm that helps clients in the oil and gas industry untangle the complexities of the decision-making process.

He's also the speaker for the Division of Professional Affairs-Association for Women Geoscientists luncheon that will be part of the upcoming ACE in Pittsburgh.

His basic premise about why everything we know about the economy is wrong:

All the logic, intuition and metrics humans have for making decisions were developed during a time when resources were abundant, human populations were relatively small and we could afford to focus on maximizing returns today because tomorrow always held new frontiers filled with limitless riches.

But today, he believes, the primary objective of most modern societies – constant economic growth – is mathematically unstable and impossible.

LEACH

Patrick Leach, author and CEO of Decision Strategies, will speak on "Everything We Know Is Wrong" at the upcoming Division of Professional Affairs-Association for Women Geoscientists luncheon during the AAPG Annual Convention and Exhibition in Pittsburgh.

The luncheon will begin at 11:30 a.m. Tuesday, May 21, at the Westin Hotel.

Adam Raised a Cain

Leach's inspiration stemmed from Stuart Kauffman's "At Home in the Universe."

"I began to wonder if the increased economic volatility and global economic stagnation we see these days might be related to a fundamental change in the nature of the global economy," Leach said, "as everything has become more interconnected."

After further investigation, Leach decided that the common accepted economic theory of Adam Smith's "Invisible Hand" needed to be challenged.

"Adam Smith developed his theories at a time when the world's resource base must have looked essentially infinite," Leach said. "As a result, underlying many of his – and our – approaches to economics is an assumption that there is always more stuff out there to get."

Leach said he concluded we as a country have moved from a labor-constrained economy into a resource-constrained one – and that meant if we don't begin to change our way of thinking, we could be in some serious trouble.

"Every previous society that grew, developed and prospered to the point where their environment could no longer sustain their standard of living ultimately faced a choice," Leach said. "Change your behavior or collapse."

The Unanswered Question

Leach realizes his message isn't easy for some to accept.

"By historical standards, Western civilization is still pretty young," he said. "The fact that we've made huge progress for the past 200 years or so does not mean that it will automatically continue."

He hopes his ACE luncheon talk will inspire convention goers to challenge some of their pre-existing beliefs about the economic world.

"I would like the audience to really consider the possibility that we have moved into a new era of a hyper-connected global economy, one in which we find ourselves repeatedly bumping up against resource limitations," he said.

Leach believes geologists, of all people, have the most chance of understanding this new theory, because geologists understand that one hundred years is not a very long time.

"The fact that our society has seen enormous success over the past 200 years or so doesn't mean that the trend will continue, regardless of our technological prowess," he said. "We are currently faced with the same decision that successful societies of the past have faced."

His question: Can we learn from their mistakes?

Chris Bolhuis, this year's winner of the AAPG Foundation Excellence in Teaching Award (Earth Sciences Teacher of the Year) will receive his award at the All-Convention Luncheon during the AAPG Annual Convention and Exhibition in Pittsburgh.

AAPG's Teacher of the Year

Creativity, Adventure Fuel Bolhuis' Approach

By SUSIE MOORE, Communications Project Specialist

"Geology is like seeing the world through the eyes of an artist." Eloquently spoken, and perhaps a bit surprising, considering the guy who said it confessed when he went to college he had no idea what he wanted to do for a career, let alone think he would choose a career in geology – and end up loving it.

The guy who said it, Chris Bolhuis, is now a 16-year veteran earth sciences teacher; and more importantly, this year's winner of the AAPG Foundation Excellence in Teaching Award (Earth Sciences Teacher of the Year.)

Bolhuis credits his early career choice to two people: A college professor and his father.

"When I went to college, I had no idea what I wanted to do for a career," he said. "I ended up taking a geology course as a general education requirement," and "fell in love with geology right away.

"My professor, Norm TenBrink, was instrumental in this," Bolhuis said. "His passion, enthusiasm and gift with students was infectious."

His father's influence came to him through words of advice. Bolhuis remembers him saying: "When the right path presents itself, you will know. Take that path and you'll never work a day in your life."

That geoscience path presented itself to him, and he never looked back.

Photo courtesy of Chris Bolhuis

Bolhuis teaching his three-week long summer field course in geology and biology last July. Wyoming's Grand Tetons are in the background.

Relationships and Relevance

Bolhuis received a bachelor's degree in geology and a master's degree in education with an earth science emphasis from Grand Valley State University in Allendale, Mich.

He began teaching science at Hudsonville High School in Michigan 16 years ago – the same high school he had attended.

Continued on next page

McGraw
from page 64

to provide several families with potable water after the Pennsylvania Department of Environmental Protection found water wells there were tainted by shale gas drilling.

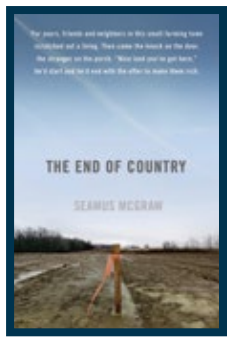
He's now skeptical about the hype surrounding estimates of unconventional gas reserves – and the idea that the United States may become the Saudi Arabia of global gas supply.

"We're not going to be the Saudi Arabia of natural gas," he said. "What we're likely to be is the Nigeria of natural gas."

'A Larger Theology'

In his career as a freelance journalist, McGraw's writing has appeared in such diverse publications as Popular Mechanics, Reader's Digest, Playboy and Spin. He'd decided to give up journalism when the Marcellus shale events came along.

"Nearly three decades of writing for newspapers and magazines, in a career that had never provided more than a meager and unreliable income, had left me frustrated, angry and pretty much dead broke," he wrote in the acknowledgments for "The End of Country."



As a final gesture, McGraw wrote a proposal for a book based on his family's experiences and the Marcellus play, expecting and half-hoping it would fail.

That wasn't a mistake. People who don't write much and don't write for money often think of writing as a special talent or skill. People who write a lot and write for money tend to think of writing as a chronic disease.

McGraw's only mistake was in thinking there's a cure.

As it happened, his proposal for "The End of Country" drew considerable interest and ended up in a bidding tug-of-war between major publishers. McGraw is now at work on another book, a ground-level look at the debate over climate change.

"The idea is that if we can pry the discussion away from the talking heads and talk to the hearts, maybe we can start to find common ground," he said.

Too often, McGraw observed, people will take a position on an issue like hydraulic fracturing based on preconceived notions and their personal belief systems, not on experience and research and facts.

"When I find out where somebody stands on this issue, I can tell with frightening accuracy where they stand on five or six or seven or eight other hot-button issues. And that's absolutely tragic," McGraw said.

"It's not being evaluated on its merits," he noted. "It's being evaluated as part of a larger theology."

Comfortably Numb

McGraw's luncheon talk at the AAPG meeting is titled "Comfortable in Our Ignorance." The title comes from an experience he had at a lecture discussion.

"This person stands up and cites a cataclysmic event here in Pennsylvania," he recalled.

The event was so remarkable it would have drawn intense coverage not only in the United States but around the word, McGraw said, if it had actually occurred.

It hadn't.

"It never happened," he said. "But this person wasn't lying to me. I looked into this person's eyes and knew this person absolutely believed it had happened."

After he asked a few questions, McGraw noticed "almost a look of terror" as the person realized the event might not have been real.

McGraw said the individual stood up to leave and announced, "I am not going to argue with you. I am comfortable in my own ignorance."

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"Honestly, I didn't know if I'd even like to work with kids. All I knew was I loved geology," Bolhuis said. "It wasn't until I spent considerable time in the classroom that I realized the kids are awesome.

"They feed off my energy just as I feed off of theirs."

To engage his students at the beginning of a semester, Bolhuis first works at building a relationship with them.

"It all starts with relationships," he stressed. "Once a foundation of respect is established, the kids will respond to whatever is happening on any given day."

As for his method of teaching, he admits that's a little more complicated.

"We'll do traditional labs, inquiry activities, lecture, field trips … whatever it takes," he said, "to maintain a rigorous curriculum while doing my best to make my classroom the place where the kids want to be at that particular time."

With issues like "fracing, climate change, oil and gas reserves, mountaintop removal, diminishing fresh water and natural disasters" in the media daily, he said, "a teacher doesn't need to look very hard to bring relevancy into the class.

"It (geology) is always in the news," he said, "perhaps more than any other field of science."

Life Lessons

Bolhuis' creative teaching doesn't stop in the classroom. He uses every chance to take his students outdoors to explore.

"I take every opportunity to let students observe the magnificence of geology and learn to understand the power that caused it," he said.

But getting his students out in the field of geology comes at a price – and to minimize bussing costs, Bolhuis obtained his CDL (commercial driver's license) so he could drive the school bus to field trip sites.

One student recalls the enthusiasm and energy Bolhuis brought to the classroom when he was his student.

"He (Bolhuis) would get fired up about every lesson he taught," he said, and "we (students) would tease him about his unceasing love of rocks.

"His passion did not stop at the material, either," the ex-student continued. "He was always weaving valuable life lessons into his lectures."

Bolhuis said he is fortunate to have a career that he loves. Teaching and making an impact on each of his students is a bonus.

"I have to remind myself every day that I never know where my influence begins, nor where it ends," Bolhuis said.

"I want to make an impact," he said. "I want to make a difference."

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.

Making the familiar strange

Lucas and the Michigan Basin Reef Project

By RICHARD R. VINCELETTE

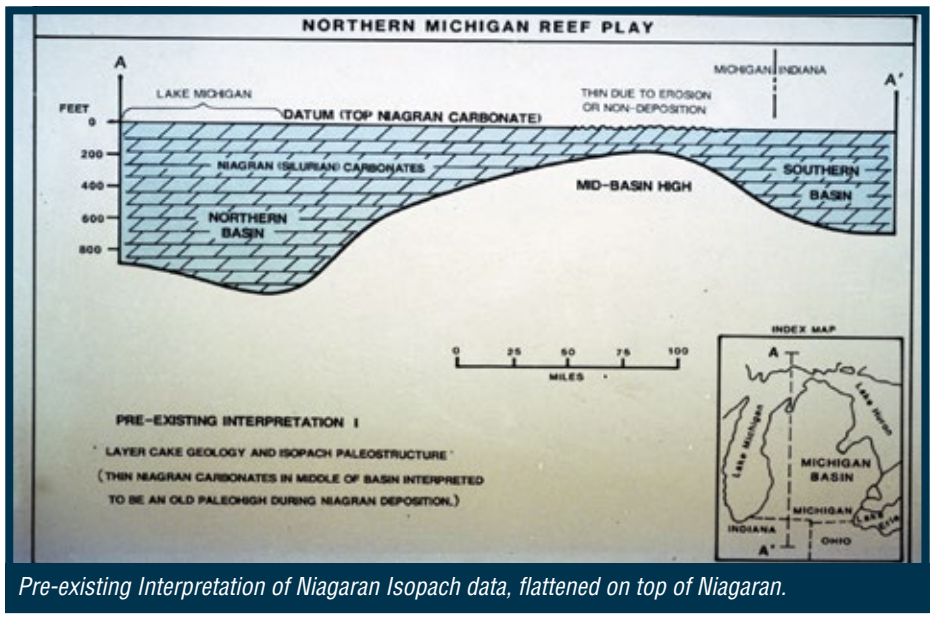

VINCELETTE


LUCAS

Author's note: In 1993, I was asked by Ted Beaumont and Norm Foster to join them in teaching an AAPG course on creative thinking. We needed an example of successful creative thinking in oil and gas exploration to discuss with the class, and I immediately thought of Pete Lucas and his role initiating Shell's successful efforts in the Niagaran reef play in the Michigan Basin.

I called Pete, and he provided me with new insights on how his ideas evolved in developing the exploration concepts utilized in this very successful play.

The following is based largely on that interview.



Pre-existing Interpretation of Niagaran Isopach data, flattened on top of Niagaran.

This story is an illustration of how a single geologist working for a major company can develop new exploration concepts in a "mature basin" and turn it into one of that company's most successful plays in the onshore United States.

It took place nearly 50 years ago, but the lessons learned are still relevant today.

The geologist is Pete Lucas, the company is Shell Oil, and the play is the Niagaran reef trend along the northern margin of the Michigan Basin.

* * *

Our story starts in 1959, when Pete was assigned the task of determining the exploration potential of the Michigan Basin – a basin that was considered by many to have been thoroughly explored, and any remaining targets being too small to interest a major oil company.

This did not deter Pete; in fact he welcomed the challenge.

He started by examining the basin's existing producing fields, and became intrigued by potential of Silurian-aged (Niagaran) reefs. At that time, the major reef production from this interval was from the Boyd-Peters reef complex in the southeastern part of the basin.

Pete wondered if any potential remained for similar accumulations in other portions of the basin.

One of his first steps was to construct a series of regional Niagaran cross-sections across the basin. Pre-existing published interpretations, based on isopachs of the Niagaran, outlined a thin area in the middle of the basin identified as the mid-basin high.

Pete had his first "Aha" moment in a hotel room in Lansing, Mich., where he was examining his correlations sections. He literally and figuratively turned the existing interpretation upside down by the simple process of flattening the geologic cross sections at the base of the Niagaran instead of the top. The mid-basin high became a mid-basin low with the thin representing "starved basin" sedimentation, the thick areas became carbonate shelves and the area of rapid change in the isopachs became a shelf margin.

* * *

The next step was to test the new conceptual model. Pete was able to show from an examination of core and drill cuttings that the basin thin was indeed a basinal facies characterized by fine-grained, dark-colored carbonate, whereas the thick Niagaran areas contained a light-colored carbonate often characterized by the presence of shallow-water fossil assemblages.

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Pete then constructed a series of regional maps in the Michigan Basin. His eyes were drawn to what became known as the Northern Shelf, which was a lightly explored area that had a well-defined transition from shelf to shelf margin to basin.

The standard exploration concept at that time was to explore for reef development and/or porosity along the shelf margin – but Pete also had another idea.

He had read a paper by Phil Playford, an Australian geologist, that identified an isolated "pinnacle" reef outcropping in front or basinward of a well-defined shelf margin of outcropping Devonian-aged carbonates in the Canning Basin in northwestern Australia.

Pete took this idea and postulated that, although none had been penetrated by the limited well control, a possibility existed that hydrocarbon-bearing pinnacle reefs could be present basinward of the Niagaran shelf margin along the Northern Shelf area.

To narrow the exploration area for pinnacle reefs, Pete used a series of isopachs of the Niagaran carbonates and the immediately overlying section of the Salina Evaporites to define a shelf slope in front of the shelf margin that was transitional into the basinal facies. He postulated that this shelf slope area was the most likely area to have pinnacle-reef development.

Of the 38 wells available in the area only about 17 actually provided the key isopach and onlap data to define this 15-mile wide and 140-mile long exploration fairway. The entire unexplored area of both shelf margin and shelf slope occupied an area of approximately 2.2 million acres.

One of the problems Pete had in presenting his ideas to Shell was the pre-existing concept of the time equivalence of facies, often used to map the time-line of basin development by noting the change from shore face to shelf to deeper water carbonates and thick basinward shales to be deposited at least in part at the same time.

Objections were raised that reef development in front of a carbonate shelf was unlikely if the time-equivalent facies were evaporites deposited in very-high salinity water.

Here again, Pete had to rely on a fairly new concept that in a "starved" basin, the thicker infill section, whether shale or evaporate, post-dated the carbonate development.

In other words, in the Michigan Basin, the shelf carbonates and the potential pinnacle reefs in front of the shelf grew first, followed by evaporate infill, which buried the reefs.

* * *

Pete was successful in convincing his management of the potential of the Northern Shelf play, and in 1964 several seismic lines were shot along the northern shelf margin.

Unfortunately, the resulting seismic quality was very poor due to the presence of thick glacial drift at the surface in this area. The project was shelved, and Pete Lucas, who was still considered a rising star in the company, was transferred to a new project and new area in the New Orleans office.

* * *

In 1967 Shell held a conference on stratigraphic traps at its Denver regional office. I attended the meeting as a representative from the Shell Development Research Laboratory. Also in attendance was AAPG Honorary member Bert Bally, who at the time was the manager of exploration research at the laboratory, and Jim Hohler, the manager of exploration operations from the head office in New York City.

The remainder of the room was filled with Denver office exploration staff members.

During the conference, presentations were made on 24 separate stratigraphic traps for consideration as seismic research projects for the lab or for additional exploration efforts by the Denver office.

At this time a convergence of events smiled on Pete and his ideas. Pete's former district manager, AAPG member Reed Peterson, still thought enough of Pete's ideas about the Michigan Basin to invite him back to again present his ideas.

In addition, the newly appointed exploration manager, Jerry Pirsig, was not only a geophysicist, but since he was from Shell Canada, had experience in obtaining usable seismic data in areas of thick glacial drift. Furthermore, a new play starting in 1965 had developed in Canada – the Rainbow Reef Trend, in which prolific oil fields had been discovered in Devonian pinnacle reefs surrounded by thick evaporites in a starved-basin setting.

This was an ideal analog to the Michigan Basin, and Pirsig knew that seismic had been used successfully to identify these reefs.

I still have a vivid memory of the conversation between Bert Bally and Jim Hohler on the post-meeting cab ride back to the airport. I was focused on which stratigraphic traps could benefit from research efforts at the laboratory; whereas all Bert and Jim wanted to talk about was what great potential the Michigan Basin Reef play had as a major opportunity for Shell.

* * *

The rest, as they say, is history.

Almost immediately, the Denver office assembled a dedicated staff of geophysicists, geologists, petroleum engineers and landmen focused on acquiring seismic data, land and potential drill sites along the fairway Pete had identified.

Shell drilled its first discovery on a pinnacle reef in along the fairway in 1969, and continued with a very successful exploration and development program in the area.

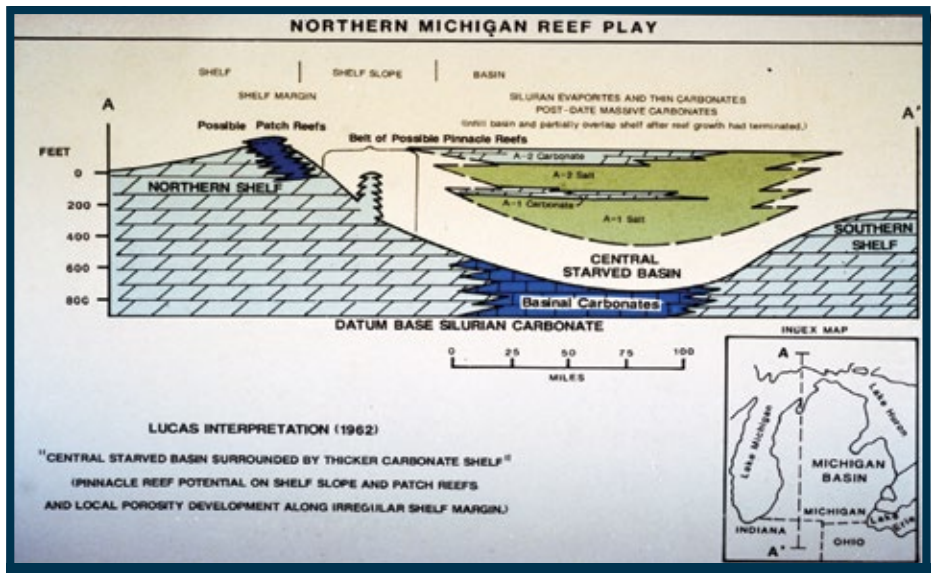
Today, more than 500 individual pinnacle reef fields have been found along this fairway. As noted by AAPG Honorary member, past president and Sidney Powers Award winner Marlan Downey, who presented a summary of Shell's success in this play in the March 2000 EXPLORER, this play still stands as the most profitable single onshore play for Shell over the last 50 years. Cumulative production today stands at 410 million barrels of oil and 2.4 TCFG.

The accompanying map shows the location of Pete's original fairway with the productive reef trend superimposed. The correlation is rather amazing.

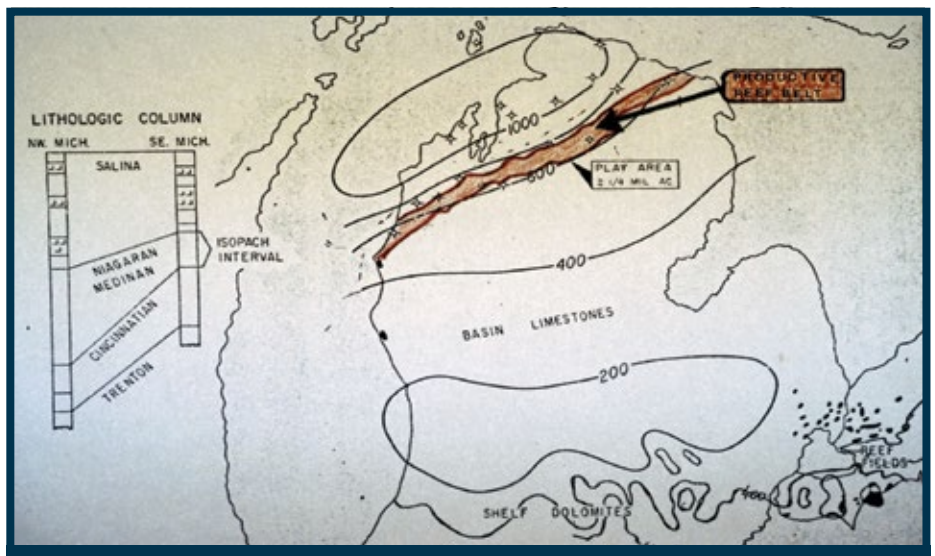
* * *

Pete Lucas went on to have a very successful career with Shell. When he retired in 1991, he was the general manager of exploration and production research for Shell Development Company.

When I attempted to contact Pete to let him know about this article, I was saddened to learn about his recent passing away (January 2012). He left behind a great legacy of creative thinking for those of us in the exploration business.



Lucas interpretation of Niagaran Isopach data, flattened on base of Niagaran.



Lucas original Niagaran isopach map, showing location of potential reef fairway along northern shelf slope. Present-day productive area shown with brown overlay.

The 'Store' Opens: It's Not Just for Books Anymore

By JANET BRISTER, AAPG Website Editor

The name has changed. The URL has changed. The experience has changed.

No longer does AAPG have a "Bookstore online." It has become the "AAPG Store."

And the Store is the online place to buy, download and register for AAPG events.

The first phase is completed, which means books and products are both available for purchase, along with AAPG education event registration.

In other words, you are now able to purchase either item in one location.

Over the next several months I'll get into the nitty-gritty details – this month is a chance to introduce you to the "Storefront," details page and shopping cart.

Searching

As you can see in the accompanying graphic, **Search Store** is highly visible and searches all fields of the site. It accommodates ISBN numbers, author names, titles, publishers, descriptions, product or event codes, notes, address fields and more.

The listed results include available products and education events.

The default search results are alphabetized by title. You have the added option of sorting by price and date.

Moving down the right side of every page you'll notice first the cart summary. As you add items to your cart this window will maintain the title and pricing tally.

(If you are a member and do not see member prices, you'll need to log in before your member rate will appear.)

Special Items, when available, display next. These are rotating specially priced or promoted items that are available throughout the site while shopping.

Education Events and **Product Categories** are pre-searches provided to hone the items you wish to consider.

You'll notice seven education event categories, including "All." This alphabetized list can be sorted by date or price.

The product categories have an expanding menu interface keeping your category list more manageable.

Popular Searches is a tag cloud displaying what other users have searched for most within the Store – the larger the word, the more often it has been searched.

The Storefront also highlights promotions, specially priced items, events that are about to expire, new releases, best sellers and more.

Going to the AAPG Annual Convention and Exhibition in Pittsburgh this month?

If so, please stop by the Communications kiosk in the AAPG Center in the exhibits hall, and we can explore together what the Store offers.

I'll also be able to answer general questions about the AAPG website – and would be happy to address specific issues that you might have with our operation.

Hope to see you in Pittsburgh.

– JANET BRISTER

Details

The familiar details page includes social objects to let you share your interest, make recommendations or tweet about your purchase.

Inspect the graphic by rolling your mouse over the image. When available, this enlarges the graphic provided for greater detail viewing.

Additional information you may see when viewing a product or event includes items others purchased along with the item you are viewing, as well as suggested products or events based off of similarities between what you are viewing and what we have available in the Store.

For the education events detail you'll discover expanded details that are better organized.

Add to calendar runs a script that adds the event of interest to your calendar.

The **map feature** shows the location of the event you are considering if it is a physical course. This embedded Google Map then allows you to look at other information of interest surrounding the venue, get directions and additional options

Continued on next page

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: Jeremy Richardson, director of AAPG's Europe Office in London, at jrichardson@aapg.org. Ciaran Larkin is the Europe Office's conference producer.

REGIONSandSECTIONS

Prospects, A&D Highlight APPEX Global Conference

By CIARAN LARKIN

AAPG Europe's annual APPEX Global conference returned to the Business Design Centre in London in March, attracting more than 700 attendees representing independent oil and gas producers, major corporations and national oil companies.

The program featured a series of presentations on A&D developments in Europe, Asia, South America, Australasia and the Middle East, all coupled with a bustling exhibition showcasing the latest E&P prospects from around the world.

APPEX Global was conceived as a forum to expose underexplored parts of the world to the industry. For buyers, this annual event has firmly established itself as an ideal place to reach out and explore new E&P opportunities. For sellers, there is no better place to showcase new prospects.

APPEX Global Highlights

Some of the meeting highlights included:

- AAPG member **Peter Burri**, of the Swiss Association of Energy Geoscientists in Basel, Switzerland, spoke about criteria for assessing the potential of shale gas prospects, highlighting the strict regulatory environment and public pressure against the exploration in some states.

- Like all business decisions, A&D involves an assessment of risks and benefits. **Paul Mason** of Total spoke about the business drivers for A&D from a corporate perspective, listing factors for consideration such as the risk/reward gap, internal resources and how a prospect might fit into a portfolio.

- It's no secret that oil production is declining in certain parts of the North Sea. So what does the future hold for exploration in the region? **Tom Dreyer** of Statoil expressed the importance of cross-border collaboration, the need for a willingness to risk testing new plays and the importance of technology-driven exploration.

- When it comes to A&D, Russia is often viewed as a difficult entry point, particularly for independents. This issue was addressed by AAPG member **Konstantin Sobornov** of the North Uralian Petroleum Company in his presentation on Russian oil industry trends, including a perspective on how social and economic barriers could be overcome.

Julian Lee of the Centre for Global Energy Studies expanded on this in his presentation on geopolitics of oil markets in the Former Soviet Union.

- Energy security challenges are an important consideration when making the decision to commit to an A&D project. **Angus Miller**, a senior adviser to the Foreign Office in the U.K., spoke about this topic in relation to the Caspian Sea and Central Asian States, referring to the delicate geopolitics in the region and explaining the implications of increased interest in prospects from China and Eastern Asia.

- There is an abundance of exciting E&P opportunities in Africa, and **Charles Gurdon** of Menas Associates spoke about growing success of new basins in east and west Africa. Countries with E&P prospects up for grabs included Namibia, Kenya, Chad and South Africa.

- At this year's APPEX Finance Forum participants received an update on the state of oil and gas funding five years on from the global financial crisis and insights into criteria for funding exploration.

Up next: AAPG Europe is holding APPEX Regional 2013 in Istanbul Nov. 5-6. For more information go to europe.aapg.org.

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Google provides.

Other important information highlighted in the details include if the product you seek is sold out, the event you want to register for is full, and other such messages.

Out of stock products give you the option to request notification about availability, as applicable.

Shopping Cart

It is very simple to not only view your cart but to update it.

Your cart summary is available on every page, and at any time you can select View Cart/Checkout to edit. To increase or decrease the amount of an item in your cart, simply modify the amount field and choose "Update Quantity." To remove an item completely, change the quantity to "0" (zero), update and your item goes away.

Should you leave your cart for a day or two and return to make your purchase, your cart will reflect the availability of your items immediately so there are no surprises about trips or classes being sold out or products being out of stock.

When shipping options are available, you may estimate your shipping before purchasing your item. Explanations of each shipping option also are included.

If you have a coupon code simply enter it in the Coupon field. We now have the ability to offer discounts on events, products, shipping and more.

When customers are logged in, you always are able to view previous orders.

Ever lose a receipt or been hunting for a confirmation?

View Previous Orders gives you a list of all your purchases. It includes a summary of each order and the option to print or to email any receipt or confirmation.

Likewise, if your purchase was to be available for download, you find the link for that item in this list.

What's Missing?

Not much. The top navigation provides access for Members who need to pay their dues or update their profile, change their password, make a donation or access the archives to which they subscribe.

Likewise, Members Only has updated its top navigation so you can easily return to the Store to buy, register or download; view your cart or check your order history.

Just remember http://store.aapg.org for all your AAPG books, products, services and education event registration.

Good browsing!

Match Game: A Win-Win Result for Foundation

By NATALIE ADAMS, AAPG Foundation Manager

The AAPG Foundation has seen a dramatic uptick in matching gifts recently.

Specifically, matching gifts given to the AAPG Foundation increased from $11,000 in 2011 to over $39,000 in 2012.

"What is a matching gift," you ask?

Many companies offer programs that will match charitable contributions made by their employees. In other words, if you make a gift to the Foundation, your company may do the same thing, matching the amount that you've contributed.

Many thanks to the BP Foundation, Encana Cares Foundation, Chevron Humankind, EOG Resources, Dominion Foundation, ConocoPhillips, BHP Billiton Matching Gift Program and Cimarex Energy for making 2012 an exciting year.

Three more companies already have been added to the 2013 honor roll of matching gifts: Lewis and Clark Exploration, Whiting Oil and Gas and McMoRan Oil and Gas Company.

You don't have to be an employee of a large company to make an impact. So far in 2013, the AAPG Foundation has received more than $8,000 in matching gifts.

Of course, we'd love to add more names to this list. Contact the AAPG Foundation if you can add your company's name.

* * *

An incredible show of support has poured in to the Foundation as a result of our appeal to boost the undergraduate scholarship fund known as the L. Austin Weeks Undergraduate Grant program.

The program was established by a $1 million contribution made by L. Austin Weeks, and the earnings from the investment of this gift provide for approximately 40 grants.

Additional donations have enabled the program to grow – and because the demand for the grants has increased, so too has the need for additional contributions.

The good news: So far in 2013, our donors have contributed more than $49,000 to this fund. This will add new universities to the existing list of grant recipients.

The awards for 2013 recently were dispersed, and thank-you letters are pouring in from the 67 individuals and student chapters that received funding this year. The needs being met range from books and tuition to field camps and rock hammers. Students clearly are very appreciative for the financial backing that comes from donors like you.

To see a list of recipients, visit http://foundation.aapg.org/2013L.AustinWeeksUndergraduateRecipients.cfm.

* * *

Student needs continue to be met as university subscriptions to the Datapages archives are added to their list of resources.

- Thanks to **Paul Buckthal**, Texas Christian University is the newest recipient of a Datapages subscription.
- Thanks to **Marathon Oil**, the University of Oklahoma and the University of Montana have new subscriptions to the GIS-UDRIL.

* * *

A word to AAPG members: As you prepare to send in your annual dues, please consider adding a contribution to the AAPG Foundation. Your gifts enable us to continue to support many university student scholarships and programs, K-12 educational programs, teacher's aids and training, lecture tours and dozens of other resources and initiatives.

In 2012, 5.63 percent of AAPG members gave to the Foundation at some point in the year.

Can you help us grow that number?

For more information or to donate online, visit foundation.aapg.org.

Foundation Contributions for March 2013

General Fund
BHP Billiton Matching Giving Program
Matching a gift given by David Tett
Chevron Humankind
Matching gifts given by Donald Medwedeff and Richard Ball
ConocoPhillips Corporate Contributions
Matching a gift given by Edward Davies
Lewis & Clark Exploration
Matching a gift given by Donald R. Hembre
Festus Kayode Alabi
Robert James Ardell
In memory of Bob Hirsch
Peter E. Blau
Gareth Edwin Cross
Michael P. Dolan
Tom and Carolyn Hamilton
In memory of David Scott "Scotty" Holland
Donald R. Hembre
Jenny Younker Hope
Crandall Davis Jones
In memory of John Switzer
Martin Arthur Kopacz
Jay Glenn Marks
Ronald Alan Nelson
Troy Alan Phillips
Walter Charles Riese
George C. Sharp
Rudolf B. Siegert
Carl Kurt Stropoli
Lawrence Tedesco
Victor J. Veroda

Amoruso Special Publications Fund
Paul H. Dudley Jr.
In memory of John R. Switzer and David "Scotty" Holland

Digital Products Fund
W. Richard Moore

Texas Christian University
Walter Paul Buckthal
In memory of Doyle G. Whitaker

University of Colorado
Frederic August Tietz

University of Missouri, Columbia
Lawrence Tedesco

University of Saskatchewan
Valary Schulz West

Distinguished Lecture Fund
Chevron Humankind
Matching a gift given by Robert McCrae
John Robert Kerns
In memory of Donald E. Lawson
Ronald Alan Nelson
Herbert Mark Stanley Jr.
In memory of Ann Stanley

Education Fund
McMoRan Oil & Gas Co.
Matching gift/George Severson

Continued on next page

Volunteers Needed To Teach Geology at Scout Jamboree

AAPG is looking for a few good men (and women), to talk to young people about geology and petroleum careers.

A few slots are still available for geologists wanting to help teach Geology Merit Badge at the Boy Scouts' 2013 National Jamboree, set July 15-24 near Beckley, W.Va.

Anyone willing to serve one (or both) weeks should contact Ron Hart, at AAPG headquarters (rhart@aapg.org), who coordinates the volunteer program on behalf of the AAPG Foundation.

"All programing at a Jamboree is organized by volunteers," Hart said, "and every four years, the AAPG Foundation provides funding for materials and logistics in support of the Jamboree instructional team."

Nearly 30,000 teenage boys (and a few thousand teenage girls) will come to the new Summit Bechtel Reserve scout camp, northeast of Beckley.

"Of course, we want geologists to talk about rocks, minerals and petroleum," Hart said, "but this year we also are looking for people who can talk about GIS and GPS navigation.

"Our program at the 2013 Jamboree is going to be a mixture of both high technology and low technology," he continued. "We have to show the next generation of geologists how to adapt and use new technology in their field work."

This year's instructional team includes people from ESRI (the GIS software company), the West Virginia Geological Survey, Concord University (Athens, W.Va.) and several petroleum organizations.

Volunteers are asked to serve either a one- or two-week tour. Accommodations are provided, but may be a little rustic.

Expo Draws Record Numbers

A record number of students participated in the recent AAPG/SEG Spring Break Student Expo at the University of Oklahoma, hosted by the ConocoPhillips School of Geology and Geophysics.

The two-day event attracted 446 student registrants from 105 universities, most ever for the event. Helping to make the event possible, 21 corporate and academic sponsors participated – including the AAPG Foundation.

The Expo featured formal interviews for full time and intern positions; geology and geophysics poster competitions; and networking opportunities through a company exhibition hall.

Poster winners, who were honored at the closing reception, were:

Geology

- First place – AAPG member **Katy Jensen-Doescher**, University of Louisiana at Lafayette.
- Second place – AAPG member **Robert Clark**, University of New Orleans.
- Third place – AAPG member **Guang Chen**, University of Oklahoma.

Geophysics

- First place – AAPG member **Lamees Mohamed**, Western Michigan University.
- Second place – **Guarang Patel**, University of Oklahoma.
- Third place – AAPG member **Roderick Perez**, University of Oklahoma.

Continued from previous page

Donald Dean Clarke
Norman Douglas Fagge
Mr. and Mrs. John M. Sweet
In memory of Eric Richards; In honor of Gene Richards

GIS-UDRIL Fund
Montana State University
Marathon Oil Corp.
University of Oklahoma
Marathon Oil Corp.

Grants-In-Aid Fund
Lawrence Tedesco

Harry and Joy Jamison Named Grant
Paul H. Dudley Jr.
In memory of Joy Jamison

James E. Hooks Memorial Grant
Lawrence Tedesco

John E. Kilkenny Memorial Grant
Pacific Section AAPG Foundation

R.E. McAdams Memorial Grant
Lawrence Gordon

Roger W. Stoneburner Memorial Grant
Jean K. Funkhouser
In memory of Thomas Richard Kelty

Imperial Barrel Award Fund
Marathon Oil Corp.
Gerhard Diephuis

Named Public Service Fund
The Gibbs Family Endowment Fund
James A. Gibbs
In memory of Charles J. Hoke; In honor of Robert Gunn

E.F. Reid Scouting Fund
Norbert Everett Cygan
In honor of Eagle Scout David Glenn

L. Austin Weeks Undergraduate Fund
Robert James Ardell
William J. Barrett
William C. Blanks
In memory of Don Hewitt Blanks Jr.
G.W. Brock
Walter Paul Buckthal
In memory of Natalie Henkes Buckthal
Donald Dean Clarke
John McRae Colvin Jr.
Ellen M. Brown and Jamin Condou
In memory of Grosvenor Brown
David Kingsley Curtiss
Edward K. David
In memory of Michael Shearn
William James Davies
Rodger Espy Denison
In memory of Bill Muehlberger
Kim Andrew Doud
Paul H. Dudley Jr.
In memory of Samuel Thompson III
Helen Laura Foster
In memory of William Patton
Troy Allen Freund
Larry P. Friend
John Edward Gilcrease
William E. Gipson
In memory of Charles Mankin
David Carl Groves
Paul Michael Guerino
Bernard Louis Hill Jr.
Ross W. Hinton
Warren Jerald Hudson
Alfred James III
In memory of Lowell R. Landon
Charles G. Johnson
Michael Sam Johnson
Wayne Perry Johnson
Raphael V. Ketani
Harold William Knudsen
George William Krumme
Jonathan Mark Lester
Allen Lowrie
In memory of Rhodes W. Fairbridge
Thomas M. Maher
In memory of Graham Dryden
Robert W. Maxwell Jr.
John Vincent Miesse
William Allen Monroe
Edward Gilpin Murphy
Dan Errol Pfeiffer
David Gene Rensink
Julius Mosal Ridgway
In honor of Ralph Hines
Cecil R. Rives
Noelle B. Schoellkopf
James Fredrick Swartz
Paul Joseph Szatkowski
David Paul Thetford
Kane Christopher Weiner
In honor of Charles Weiner
Daisy M. Wood
In memory of P.W.J. Wood

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

SPOTLIGHTON

Wichita Falls Honors Gunns


GUNN

Robert D. "Bob" Gunn and his wife Carol were honored jointly as 2012 Wichitan of the Year at the annual Wichita Falls Chamber of Commerce and Industry North Texas Economic Forum and Wichitan of the Year luncheon.

The couple has been called the "dynamic duo" for their involvement and devotion to the city of Wichita Falls, serving on numerous community and non-profit boards.

Local media outlets covered the story, and to the surprise of no one who knows them, the Gunns were surprised and humbled upon receiving the award.

"We dearly love this town," Bob Gunn said. "As time was good to me, I was able to give back."

Bob Gunn, a past AAPG president and AAPG Honorary member, received the Sidney Powers Memorial Award in 1997 – AAPG's highest honor – as well as the AAPG Public Service Award in 2004 and the DPA Heritage Award in 2005.

He also is an AAPG Foundation Trustee Associate and recipient of the 2013 L. Austin Weeks Memorial Medal – given in recognition of extraordinary philanthropy and service in advancing the mission of the AAPG Foundation.

Gunn will receive the Weeks Medal during the May 19 opening ceremony at the AAPG Annual Convention and Exhibition in Pittsburgh.

– SUSIE MOORE

PROFESSIONALnewsBRIEFS

John Bates, to exploration manager-Kurdistan region, Iraq, Marathon Oil Tower, Houston. Previously president and general manager, Marathon International Petroleum Indonesia, Jakarta, Indonesia.

Andrei Belopolsky, to exploration manager new ventures, Premier Oil, London, England. Previously exploration new business team leader, Premier Oil, London, England.

Gary G. Bible, to president, Cougar Dome, Helenwood, Tenn. Previously vice president geology, Miller Energy Resources, Huntsville, Tenn.

Deborah Bliefnick, to senior geologist, Qatar Petroleum, Doha, Qatar. Previously consultant reservoir geologist, Badley Ashton and Associates, Horncastle, England.

Larry Brooks, to president, Hondo Exploration and Production, Spring, Texas. Previously technical specialist-geology, Pioneer Natural Resources, Irving, Texas.

Mark Doelger has been appointed to the Wyoming Oil and Gas Conservation Commission by state Gov. Matt Mead. Doelger is president, Barlow and Haun Inc., Casper, Wyo., and a partner in Stakeholder Energy, Casper.

Abhi Manerikar, to senior associate, Rose and Associates, Calgary, Canada. Previously vice president-exploration and geoscience, Talisman Energy Norge AS, Stavanger, Norway.

Bryant M. Mook, to president, chief operating officer and a director of Brenham Oil and Gas, Houston. He also is chief executive officer and general director of Mook Energy and Production Co., and technical adviser-petroleum engineering, geology, ATX Oil, both in Houston.

Jan C. Pluis, to Norway country manager, Chevron Upstream Europe, Oslo, Norway. Previously new ventures team leader, Chevron Upstream Europe, Aberdeen, Scotland.

Peter "Pete" Rose has been named recipient of the Petroleum Group Silver Medal, the Geological Society of London's most prestigious award, in recognition of "outstanding achievements" over his E&P career. He'll receive the award at the Group's annual meeting in London, England, in June. Rose, an Honorary member and past AAPG president, resides in Austin, Texas.

Joann E. Welton has retired as senior reservoir quality specialist, ExxonMobil Upstream Research, Houston. She resides in Houston.

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

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

Strategies for Success

Regarding your story on "Strategies for Success" (April EXPLORER): The article by Louise Durham has shed light on many important areas of concern that need to be addressed and dealt with collectively.

Transparency and access to a common data pool with respect to the challenges (international or local) and how to deal with them are the only way for advancing our unconventional exploration and exploitation trend – and continue as geoscientists to play our role in providing energy in an affordable and safe way.

Let's remind ourselves of the advancements made through the digital era back in the 1970s, and the technical transformation that has followed in 2-D, 3-D, 4-D seismic in securing more energy resources, without which we could not have responded efficiently to the population explosion and energy needs over the years.

Therefore, let us continue our drive and take advantage of the breakthroughs in communications and the web, and use them as a means of bringing us closer to being able to respond to the ever-increasing challenges – and change the "unconventional" to the "conventional" soon.

Abdurrazak Ali Endisha
Cairo, Egypt

Shaking it up

In regard to John Lorenz' article on massive stimulation by underground nuclear explosions (Historical Highlights, March EXPLORER): There were other studies done in 1965-1967 on the Nevada Test Site.

I was involved in very detailed geologic studies to discover the control of surface fracture patterns formed above explosions that were unrelated to and beyond the central chimney collapse. These were found to be attributable to through-going joint sets related to faults. The explosions jostled the joint-bounded blocks in the Paleozoic bedrock causing the fractures to propagate upward through 2,000 feet of alluvium and reproduce the joint pattern on the surface.

Where the joint pattern changed, the fracture pattern changed. The deeper shots produced better surface patterns.

Explosions close to the Yucca Fault also triggered fault offset.

Jostling of joint and faults by repeated earthquakes over long periods of time might explain the many surface lineaments present in relatively low seismically active areas such as the eastern United States.

Patrick Barosh
Bristol, R.I.

It Seems Obvious

Planet earth and mankind could not survive without CO_2. As to climate change, the climate science community is increasing its support that "CO_2 is neither a pollutant nor a driver of climate change."

Those holding an opposite view should read "Fire, Ice, Paradise," by H. Leighton Steward. His views regarding CO_2 enjoy wide support by many in the climate science group. Steward suggests we ask ourselves as we ask others, "Are we willing to bet our economy, our standard of living and lose our opportunity to provide more food and shelter for millions of people on a warning of catastrophic global warming that never happened, even when CO_2 levels in the atmosphere were 18 times higher than today?"

Further support for Steward's positions regarding CO_2 comes from a group of more than 20 scientists and engineers known as The Right Climate Stuff (a group that includes AAPG Honorary member and former NASA astronaut Harrison Schmitt).

It seems clear (also even obvious) that our politicians and government agencies should take another look at the real effects of CO_2 on climate before madly rushing into ill-conceived legislation in the matters of carbon tax, etc., and massive continuation of subsidies for alternative fuels, which can either compete with fossil fuels in cost or efficiency.

Dick Baile
Houston

Safety
from page 34

The difference between the NOV and a penalty is that the penalty carries a monetary fine, according to Glosser.

She noted the issuance of penalties declined between 2008 and 2011 during various drilling stages. Yet non-minor, or serious, NOVs increased during that time.

"This brings up the idea that maybe the inspectors are using more discretion over time," Glosser said.

"We also see that as Marcellus exploration has become more popular, there has been more funding dedicated to the programs," she added, "which has resulted in more inspectors being hired and more inspections being performed by the Pennsylvania DEP."

Self-Reporting

In a recent feature story on drilling safety in the Marcellus, a leading business/financial newspaper noted that inspections of Marcellus operations more than doubled between 2010 and 2012, according to Pennsylvania DEP data, when the department doubled its staff of inspectors. Violations dropped about 50 percent during that time.

At least part of this drop was attributed to larger companies buying out some of the small drillers who, though often skilled at what they do, are not always adequately financed to implement the somewhat extreme safety measures needed.

These buyouts are rather typical of big plays, which often are triggered by smaller companies. The small entities essentially pave the way for their well-funded big brethren to move in and apply the latest and greatest technical expertise.

For example, when big-major Shell bought early-Marcellus-driller East Resources, it reportedly shut in the rigs for a couple of weeks to retrain the workers as a first step to improvement.

Following the takeover, Shell is reported to have averaged less than one violation for every four wells drilled.

DEP data indicate that small private firms and public companies that tally below $2 billion in stock market value are most often the ones cited for infractions.

Glosser noted that drillers often report their own incidents, and the DEP will send someone to inspect.

"When the drillers are self-reporting, the public complains less," she emphasized. "In the years when the public is reporting more complaints, the drillers are reporting fewer incidents."

The benefits of understanding the Marcellus HSE incident reporting include:

- Identification of engineering and operational risks.
- Promotion of public confidence in shale gas development practices.

EMD
from page 78

Over the course of three days, the AAPG delegation received briefings about current legislative and regulatory events and had the opportunity to meet with policy makers and their staff in Congress and federal agencies.

GEO-DC is co-sponsor of the Energy Policy Forum that will be held during ACE at 1:15 p.m. Tuesday, May 21. It's open to all meeting attendees.

* * *

This will be my last quarterly column in the EXPLORER as EMD president and I would like to thank the members of the EMD Executive Committee for their time, talent and willingness to serve this year: President-Elect **Jeremy Boak**, Vice President **Bob Trevail**, Treasurer **David Tabet**, Secretary **Bruce Handley**, immediate Past-President **Stephen Testa**, and also **Norma Newby**, AAPG headquarters division manager. It truly was an honor and privilege to serve EMD alongside this team.

I also would like to acknowledge the EMD committee chairs and councilors for their contributions to EMD during my term. Please join me in thanking these technical ambassadors who are willing to contribute to EMD, some who have been involved since EMD's beginning in 1977.

I look forward to visiting with all EMD members – and potential members – in Pittsburgh this month.

IN MEMORY


WAGNER

Fredrick J. Wagner Jr., a co-founder and editor of the AAPG technical journal Geobyte and later an AAPG science adviser, died Jan. 11 in Tulsa. He was 83.

Wagner, who received his geology bachelor's degree from Franklin and Marshall College, Lancaster, Pa., and his master's from Washington University in St. Louis, began his career with Socony Vacuum Oil Company in Caracas, Venezuela. He later was a research geologist for Carter Oil Co. in Tulsa, eventually involved with geological computer applications for the company in Libya. He also worked for Skelly Oil (and eventual successors Getty and Texaco) before joining AAPG.

Geobyte was a journal devoted to computer applications, created as a response to the growing importance of computers in petroleum geology and the geosciences. It published quarterly in 1985-88, and then bi-monthly from 1989-93.

He also was a vice president for Petroconsultants in Geneva, Switzerland, and an instructor with Oil and Gas Consultants.

* * *

Richard Azer, 84
Mio, Mich., Jan. 1, 2013
Grosvenor Brown, 86
Ventura, Calif., Feb. 12, 2013
Jerry Clark, 77
Corpus Christi, Texas
Jan. 14, 2013
Billy Gene Cole, 86
Midland, Texas, Nov. 10, 2012
Clarence Conrad, 87
Mandeville, La., March 5, 2013
William Dady, 91
Sun City, Ariz., Feb. 24, 2013
Garland Denton, 81
Highlands Ranch, Colo.
Dec. 29, 2012
Robert Dougherty, 81
Great Bend, Kan.
Feb. 18, 2013
Donald Heilner, 88
Greeley, Colo., March 23, 2013
Gary Henry, 77
Wichita Falls, Texas
March 7, 2013
Joseph McCullough, 83
Corpus Christi, Texas
Feb. 5, 2012
Emil Gerald Rolf, 83
Sligo, Ireland, Jan. 21, 2013
Kenneth Smith, 94
Dallas, March 6, 2013
Fred Wagner Jr., 84
Tulsa, Feb. 14, 2013
Doyle G. Whitaker, 80
Breckenridge, Texas
Jan. 11, 2013

CLASSIFIEDADS

POSITION AVAILABLE

Open Position,
Brigham Young University

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

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

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

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

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

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

MISCELLANEOUS

SAMPLES TO RENT

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* * * * * * * * * * * *

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

DIRECTOR'S CORNER

Taking Steps to Foster and Advance Science

By DAVID K. CURTISS, AAPG Executive Director

Here at headquarters we are busy with final preparations for the trip to Pittsburgh for AAPG's Annual Convention and Exhibition (ACE) from May 19-22. The organizing committee has done a magnificent job getting ready for this meeting, and participants will experience a rich technical program of talks and posters on a wide variety of topics.

ACE is one important way AAPG seeks to achieve its strategic goal of being indispensable to the energy geoscientist, providing opportunities for scientific and professional growth as well as networking.

Being indispensable is an ambitious goal – and in my mind it is all about relevance and value.

Are AAPG's products and services relevant to the global petroleum geoscience community?

Do they provide value to members and are they attractive to non-members?

Is what we're currently doing moving us toward our goal, or do we need to innovate and seek new ways to provide more relevant content and value?

Ok, that last one was a rhetorical question: AAPG *must* innovate in order to remain relevant, let alone become indispensable.

We must continually look for new and better ways to serve the petroleum geoscience community.

* * *

Our House of Delegates will be voting on a proposal in Pittsburgh that has the potential to be an innovative step to boost AAPG's relevance.

The proposal is to form a new technical division focused on structural geology and geomechanics. And the request emerged from a group of experts that have been meeting at ACE annually for nearly a decade. They represent both industry and academia, and are focused on the application of structure and geomechanics to the exploration and production of hydrocarbons.


CURTISS

> As geologists we are integrators ... The better we do this, the more relevant we will be.

In its evaluation and approval of the request, the Executive Committee saw an opportunity to support and harness the commitment and energy of this group and align them with AAPG's mission of advancing science. If approved, the new Petroleum Structure and Geomechanics Division's exclusive focus will be on pursuing new scientific insights and breakthroughs, and then disseminating those through the many channels that AAPG provides, including:

- Hedberg conferences.
- Geoscience Technology Workshops (GTWs).
- Special sessions at ACE and ICE.
- Publications.
- Theme issues of the BULLETIN.

The new Division's members benefit directly from being part of the process that leads to the insights and breakthroughs. AAPG's members and global petroleum community benefit from access to this information – and as a global geoscience Association we provide relevant and valuable content and take a step closer to becoming indispensable.

* * *

One concern that has been expressed to me by several members and House Delegates is that the proposed new Division is too specialized. After all, most practicing geologists do structural geology as part of their daily work. What makes these Division folks so special?

My response is threefold:

- First, if structural geology or geomechanics really appeal to you and you want to work with your industry and academic peers to advance this part of the geosciences, then please get involved with this new Division!
- Second, if your desire is to stay abreast of the leading thinking in the field of structural geology and geomechanics, then take advantage of the opportunities to learn from this group through the meetings and publications they produce.
- Third, if you have absolutely no interest in these disciplines, simply be aware that AAPG wants to support those who are strongly committed to the advancement of the petroleum geosciences.

But if you fall into that third category, I'd ask you to consider: Which geoscience discipline or practice does appeal to you? Is it sedimentology and stratigraphy, geochemistry, petroleum systems and basin modeling, reservoir characterization, development geology, risk assessment or reserves calculations?

I can foresee technical divisions in these areas – and more – if we can identify a core group of industry practitioners and academics who want to take up the challenge of advancing the science.

As geologists we are integrators. We use the findings from myriad geoscience disciplines, chemistry, physics, biology and engineering to find oil and natural gas. Bridging the gap between the specialist and generalist is an essential part of our job as an Association. The better we do this, the more relevant we will be.

Will this approach work? Can AAPG create a better system to foster and support scientific advances and breakthroughs? Can we more effectively disseminate that content to our members and customers to demonstrate our relevance?

Can we truly become indispensable? Let's take this step forward and find out.

DIVISIONS REPORT

EMD Will Have a High Profile in Pittsburgh

By ANDREA REYNOLDS, EMD President

In my 15 years as an AAPG member, I've actively been involved in planning and serving in various roles during AAPG's Annual Convention and Exhibition (ACE), particularly when I lived in Houston.

"Space City" is on the regular rotation for the ACE, most recently hosting the meeting in 2002, 2006 and 2011 (and again next April). Other petroleum industry-friendly cities such as Denver, San Antonio, Calgary, New Orleans and Dallas also attract a fair share of AAPG ACE events.

The 2013 ACE, however, is being held in a new location, planned in the "City of Bridges" and situated a stone's throw from Titusville, home of the 1859 Drake discovery well and the birthplace of the U.S. oil industry.

Few likely had the foresight that Pittsburgh would someday host an ACE, and I certainly did not envision a relocation back to my northeastern U.S. roots while working for a major energy company!

However, in these times of rampant resurgence in onshore plays, one should perhaps expect the unexpected. I am proud to say Pittsburgh has been my adopted home for the past two years, and the Eastern Section will be hosting its first ACE in nearly 30 years.


REYNOLDS

In the years since Range Resources' Renz #1 discovery well in the Marcellus Shale, Pittsburgh has emerged as the "it" city as more operators develop their position in the Appalachian Basin and new plays such as the Utica/Point Pleasant have matured.

Like Pittsburgh, EMD is experiencing a wave of renewed excitement as advancing technologies unlock previously economically challenged plays, and new opportunities within EMD disciplines are becoming more attractive and feasible.

EMD is truly excited about the upcoming ACE, and we invite you to join us for our jam-packed technical program and events during the meeting. **Doug Patchen**, the EMD vice chair for the 2013 ACE, organized an outstanding program for EMD.

That program includes:

- Seven oral sessions (Theme 1). The topics are:
  - ✓ Lower Paleozoic Unconventional Plays of the Northeast U.S.
  - ✓ Shale Plays of the Americas (Non-U.S.)
  - ✓ The Bakken Petroleum System.
  - ✓ The Eagle Ford Petroleum System.
  - ✓ Evaluation of European Shales.
  - ✓ Worldwide Unconventional Reservoirs.
  - ✓ Shale and Tight Oil Plays from Around the Globe.
- Four poster sessions (Theme 1):
  - ✓ Resource Plays (I and II).
  - ✓ Unconventionals (I and II).
- Three field trips:
  - ✓ The Marcellus Shale in south-central Pennsylvania (led by Lee Avary and John Dennison).
  - ✓ Organic-Rich Shales of New York – Core Workshop and Field Trip (Taury Smith and Jim Leone).
  - ✓ Coal Measures of Kentucky (Steve Flint).
- Two short courses:
  - ✓ Black Shale Core Workshop (CoreLab).
  - ✓ Hydraulic Fracturing of Shale Reservoirs (Randy LaFollette).
- Finally, this year's EMD Luncheon, set Wednesday, May 22, features **Seamus McGraw**, author of End of Country, who will discuss "Comfortable in Our Ignorance," which will explain how extreme voices on both sides of the public debate over shale gas exploration and development are effectively undermining efforts to develop the resource more safely, damaging efforts to maximize its potential environmental advantages, and preventing the real economic benefits from taking hold.

At press time, seats were still available – but this luncheon is expected to sell out, so get your tickets while they last!

For more details on McGraw, read his interview on page 64, or visit his website at www.seamusmcgraw.com.

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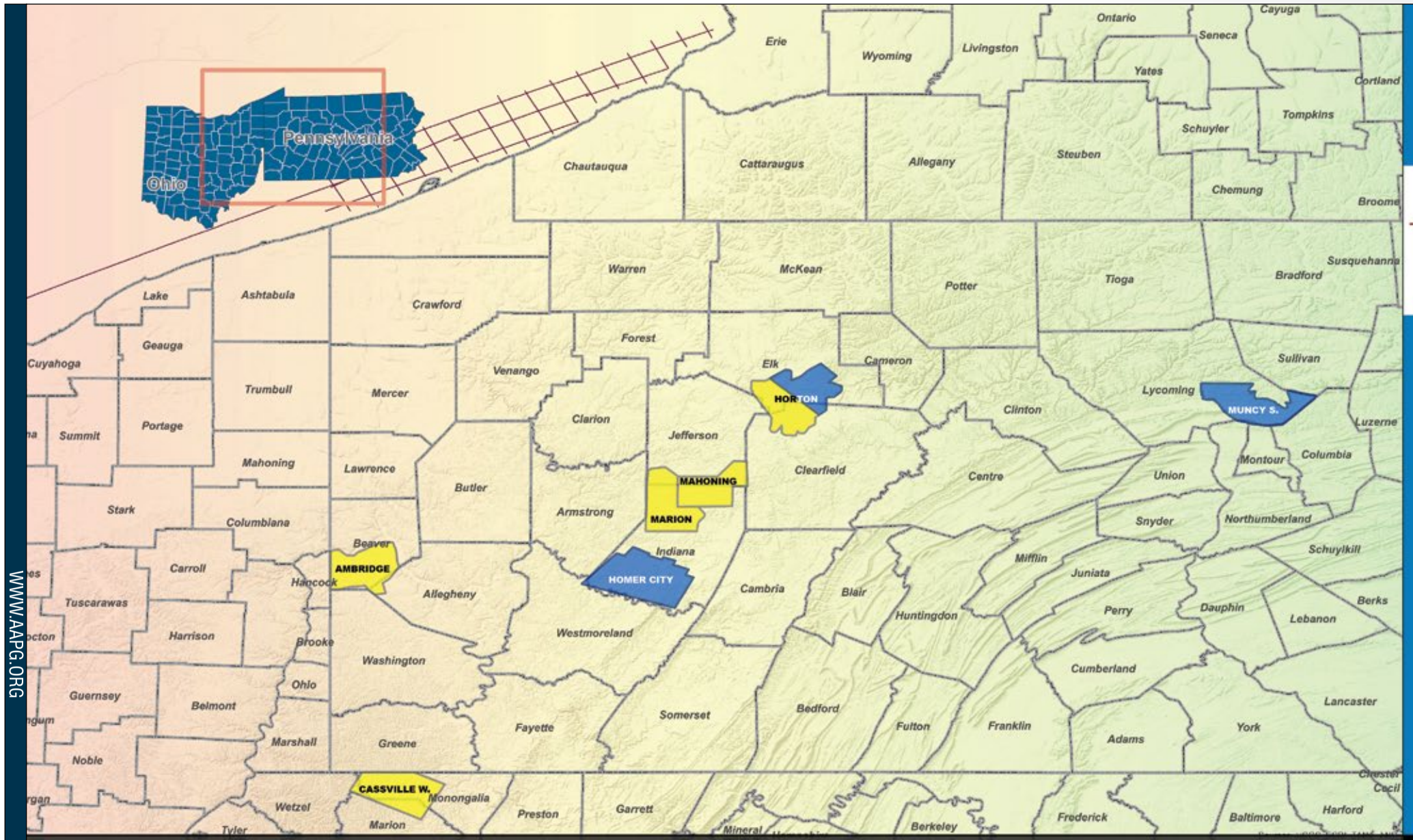
On behalf of EMD I was able to be part of this year's AAPG Congressional Visit Days, held in mid-April and organized by **Edith Allison**, director of the AAPG GEO-DC office in Washington, D.C.

See **EMD**, page 48



Marcellus-Utica

Available 2D Data

In Progress 3D

Available 3D

AVAILABLE AND IN PROGRESS SURVEYS

Ambridge	158 Sq. Miles
Cassville West	170 Sq. Miles
Homer City	234 Sq. Miles
Horton	235 Sq. Miles
Mahoning	130 Sq. Miles
Marion	152 Sq. Miles
Muncy South	162 Sq. Miles