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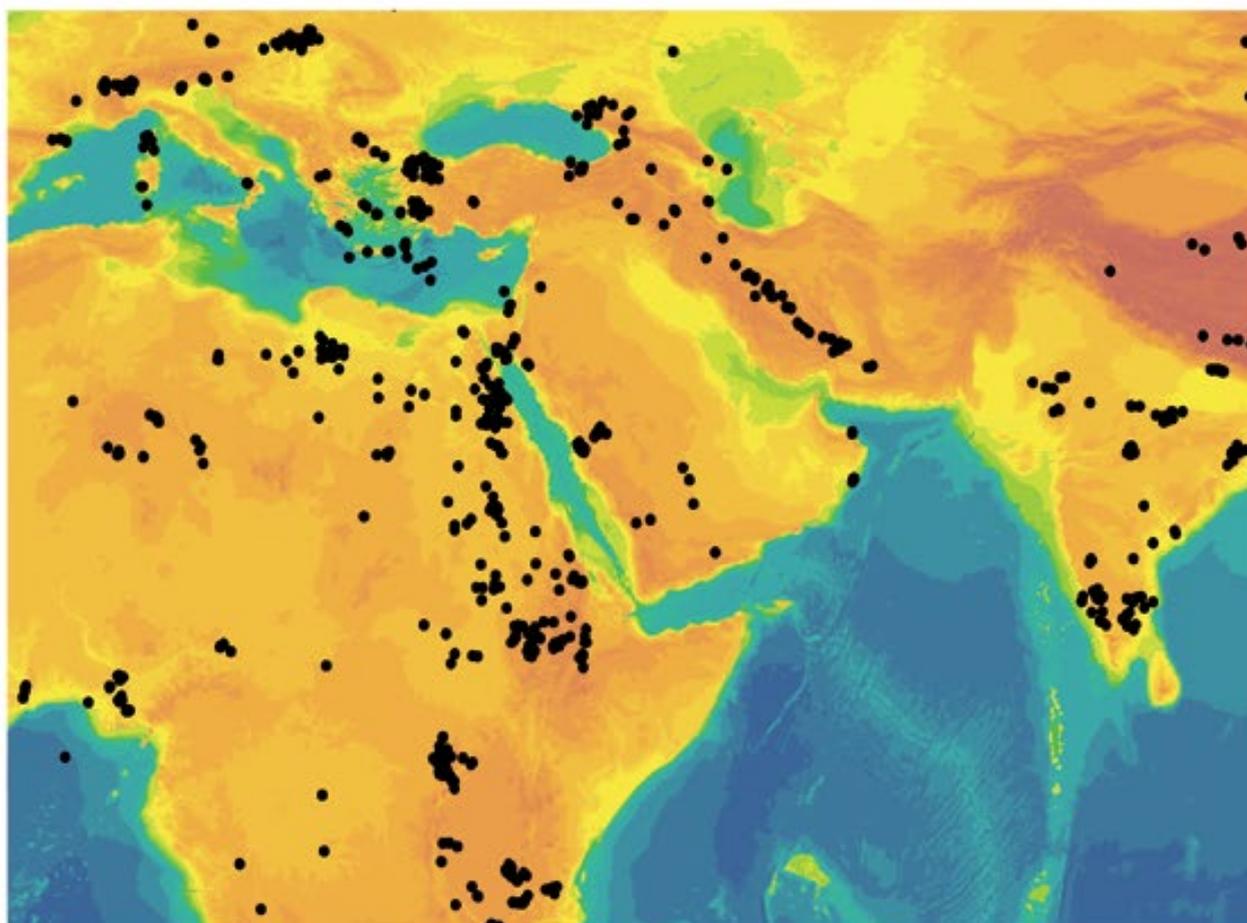
*New opportunities drive new paradigms
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See page 6.



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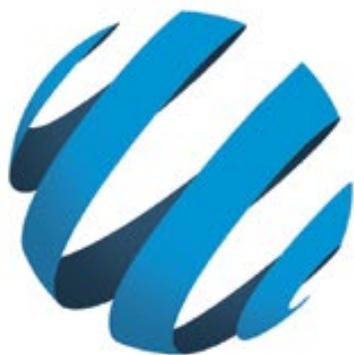


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PRESIDENT'S COLUMN

A Year of Hard, Yet Rewarding Work

BY PAUL BRITT

The question I'm most often asked lately has been, "Are you glad your term is almost over?"

My answer is "Yes ... and also No"

In other words, I'm ambivalent about the end of my term as AAPG president.

Serving as president carries with it a lot of work beyond what the membership sees directly. Quite a few decisions and problems come across an AAPG president's desk on at least a weekly, if not daily, basis. Just replying to emails from Members, Executive Committee members, staff and others can take up to an hour each day, on average. Planning for meetings and conferences, preparing speeches and presentations for conferences and the like take a variable amount of time during the year. And there are myriad other odd tasks that defy easy classification, but they also take up time, and that time adds up. The job of president could easily be a full-time paid position and still be quite a lot of work.

But, it's rewarding work, and there is still a lot that remains to be accomplished before the end of my year. Although, some of that might be the most unpleasant kind of work: difficult decisions about programs to restructure or cut in order to keep the Association fiscally responsible in the coming years.

With regard to being president of AAPG, a year is both a long, and a short time.

A Year in Review

One of the responsibilities of the office is to, well ... *preside* over the Association, and that means offering guidance on the various issues that affect the membership, which the purpose of this column in the Explorer.

Since this is my final installment, I'd like



BRITT

With regard to being president of AAPG, a year is both a long, and a short time.

to step back and take stock of the topics I've addressed throughout the year, from the prior year's results from the Annual Convention and Exhibition, the drop in membership at the beginning of the year and the anticipated drop again at the end of this year, hydraulic fracturing around the world, innovation in the industry and the future of the geoscientist, the reward of giving the AAPG awards, policy and geoscience, big data, student chapters, the Imperial Barrel Award program, AAPG's 100th anniversary and ACE, cost cutting measures and the budget, both this year's and next year's.

Also, just as the president of the United States is the diplomat-in-chief for the country, the president of AAPG is likewise an ambassador of the Association who represents our members' interests at various industry gatherings throughout the year.

Meetings this year included the Unconventional Resources Technology Conference (URTeC), the 35th International Geological Congress, the International Conference and Exhibition (ICE) in Cancun, annual meetings for the Gulf Coast, Eastern and Rocky Mountain/Pacific sections in the fall, the International Petroleum Technology Conference (IPTC), the first joint SPE/AAPG Africa Energy and Technology Conference, APPEX Global, ACE in my hometown of Houston,

the Southwest Section meeting, the 6th Geological Conference of the Geological Society of Trinidad and Tobago, and then another the Rocky Mountain Section meeting.

In addition, there were many other conferences for which I had to decline invitations due to scheduling conflicts, but would have liked to attend.

No Substitute For Personal Interaction

At more than half of those meetings, I gave presentations that focused mainly on workforce trends, innovation and the future of geoscience.

The reception I received at all of these meetings was phenomenal and I was struck by how appreciative the members were that the AAPG president had come to their meeting.

That had a significant impact that more than offset the cost of travel, and it's an impact that could have not have been made remotely by way of teleconference.

That personal interaction made a big difference at each of these events, particularly when I engaged student chapters and gave numerous student presentations. The AAPG student members are a very engaging, passionate lot, and I am encouraged about the future of the geoscience profession and I'm grateful that I had the opportunity to

influence and interact with them on behalf of the Association.

Looking Ahead

Speaking of the future, this year was once again very tough financially for the association, due largely to underperformance of meeting attendance because of many factors, like company travel restrictions, which resulted in lower than expected revenue.

To mitigate the deficit, cost-cutting measures, virtual Executive Committee meetings and other savings were implemented. Staff was very conscious of expenses throughout the organization.

The good news is that we did not have to go into the Rainy Day Reserve Fund.

Next year will likely be much the same as the industry is expected to be fairly similar to this previous year. Your Executive Committee will be making some necessary decisions on AAPG programs and services before the end of the fiscal year, identified by an EC sub-committee in response to Advisory Council strategic recommendations.

All of this is to ensure that AAPG remains financially sound and continues to serve its members in the most important products and services. And, the stage has been set in this pivotal year to make AAPG nimble and adaptable to the changing landscape of the energy industry in this new, second century of the Association.

I would just like to thank all of the members and staff on behalf of the entire Executive Committee for your encouraging words and cooperative efforts this year. It has truly been a pleasure to serve.

STAFF

Managing Editor
Brian Ervin
bervin@aapg.org

Art Direction/Production
Matt Randolph
mrandolph@aapg.org

Graphics Support
Ben McNett

Advertising Coordinators
Companies A-K
Mike Taylor
1-918-630-5672
mtaylor@aapg.org

Companies L-Z
Tracy Thompson
1-918-560-9414
tthompson@aapg.org

CORRESPONDENTS

David Brown
Courtney Chadney
Barry Friedman

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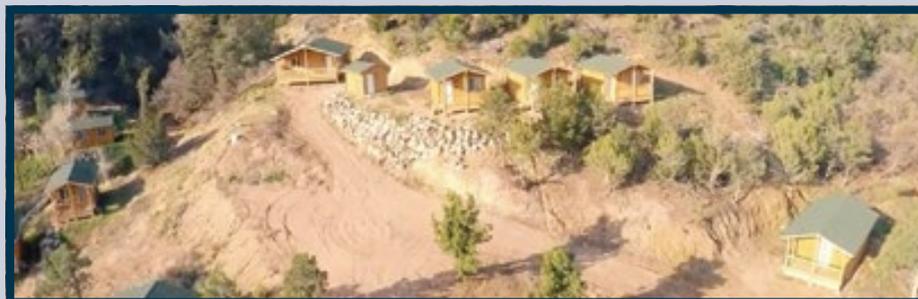
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ON THE COVER:

The University of Oklahoma's Bartell Field Camp, which is home to the university's geology and geophysics field courses. It's located on the northeastern edge of the Wet Mountains and overlooks the Cañon City Embayment, a structural reentrant in the Colorado Front Range. The area is an ideal geological field laboratory – the Phanerozoic section and faults associated with the mountain front are exposed and available for study.

AAPG Officer Elections Results

Independent geologist Denise Cox, president of Florida-based Storm Energy, has been voted president-elect of AAPG for the 2017-18 term.

Cox, an AAPG member since 1984, will begin her duties on July 1. She will serve as the Association's president in 2018-19.

Also elected to the incoming AAPG Executive Committee were:

☐ Vice president-Regions – **David R. Cook**, who retired after a long career with ExxonMobil, Maldon, Essex, England.

☐ Secretary – **Laura Johnson**, a senior geologist for Anschutz Exploration Corp., Denver.

Both the vice president-Regions and secretary serve two-year terms.

The newly elected officers will begin their duties July 1, serving on an



COX



COOK



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Executive Committee headed by **Charles Sternbach**, president of Houston-based Star Creek Energy, who assumes the presidency on that date.

Also new on the committee will be **David Entzminger**, president of Entzminger Geoscience Services, Odessa/Midland, Texas, who will assume the chair of the AAPG House of Delegates.

All will be joining current EC members **Daniel E. Schwartz**, managing partner of Black Fox Resources, Bakersfield, Calif., vice president-Sections; **Martin "Marty" Hewitt**, retired, Calgary, Canada, treasurer; and **Barry Katz**, senior research consultant, Chevron, Houston, editor.

Schwartz and Hewitt will be completing their two-year terms in 2017-18. Katz will be completing the second year of a three-year term.

Voting results indicated 32 percent of AAPG's 13,545 eligible voters cast ballots in this year's election, with 65 percent of the voting done online. 

Benefit Changes Coming for Graduated Dues Users

By **VICKI BEIGHLE**,
AAPG Administration Team Lead

Members and Associate members utilizing the AAPG graduated dues structure will notice a change of benefits beginning July 1, focusing on individual capacities.

AAPG's Graduated Dues Program is based on a member's ability to pay, based on their personal gross income. Those earning less than \$50,000 annually can save up to 75 percent each year.

Delivery of, and access to, publication options are based upon the level of dues paid. And effective July 1, the dues structure and respective publication access/options will be:

► Level 1 – Full dues are \$105 annually for those earning greater than \$50,000.

There are no changes to Level 1; those paying \$105 will continue to receive online access to the Bulletin, print copy of the Explorer and full access to the Bulletin archive.

► Level 2 – Individuals who earn less than \$50,000 but more than \$25,000 would qualify for a 50-percent savings by requesting to pay "Reduced-Half" dues (\$52.50).

Level 2 will continue to receive online access to the Bulletin and will have full access to the Bulletin archive, but will no longer receive a print copy of the Explorer.

► Level 3 – Those earning less than \$25,000 annually would qualify for a 75-percent savings by requesting to pay "Reduced-Quarter" dues (\$26.25).

Level 3 will continue to have online access only to the Explorer and Bulletin, but will not have full access to the Bulletin archive; instead they will receive 24 months (rolling) access.

Proof of income is not required – this system is honor-based and defined by our code of ethics.

These changes are necessary for AAPG to remain compliant with accounting policies and principles mandated for us as a 501(c)3 non-profit organization.

In accordance with our bylaws, Emeritus members paying half dues will not be impacted by these changes, as their dues are reduced in recognition of their classification and are not income based.

All dues levels maintains the option of paying for print copies of either (or both) the Bulletin and Explorer – but only those paying at the level 1 or 2 rate will have full archive access.

AAPG is pleased to offer these cost-savings options, especially during this downturn, because this structure was created so that no geoscientist would be restricted from participating due to financial constraints.

Please remember our bylaws mandate annual dues must be reset to full value with each billing cycle; those qualifying must request the reduced dues each year.

If you have questions or need assistance with your dues, please contact our Customer Experience Team: (918) 584-2555, (800) 364-2274, or email: members@aapg.org. 



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** According to "Accidents or Unintentional Injuries", Centers for Disease Control and Prevention, September 2015.

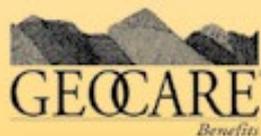


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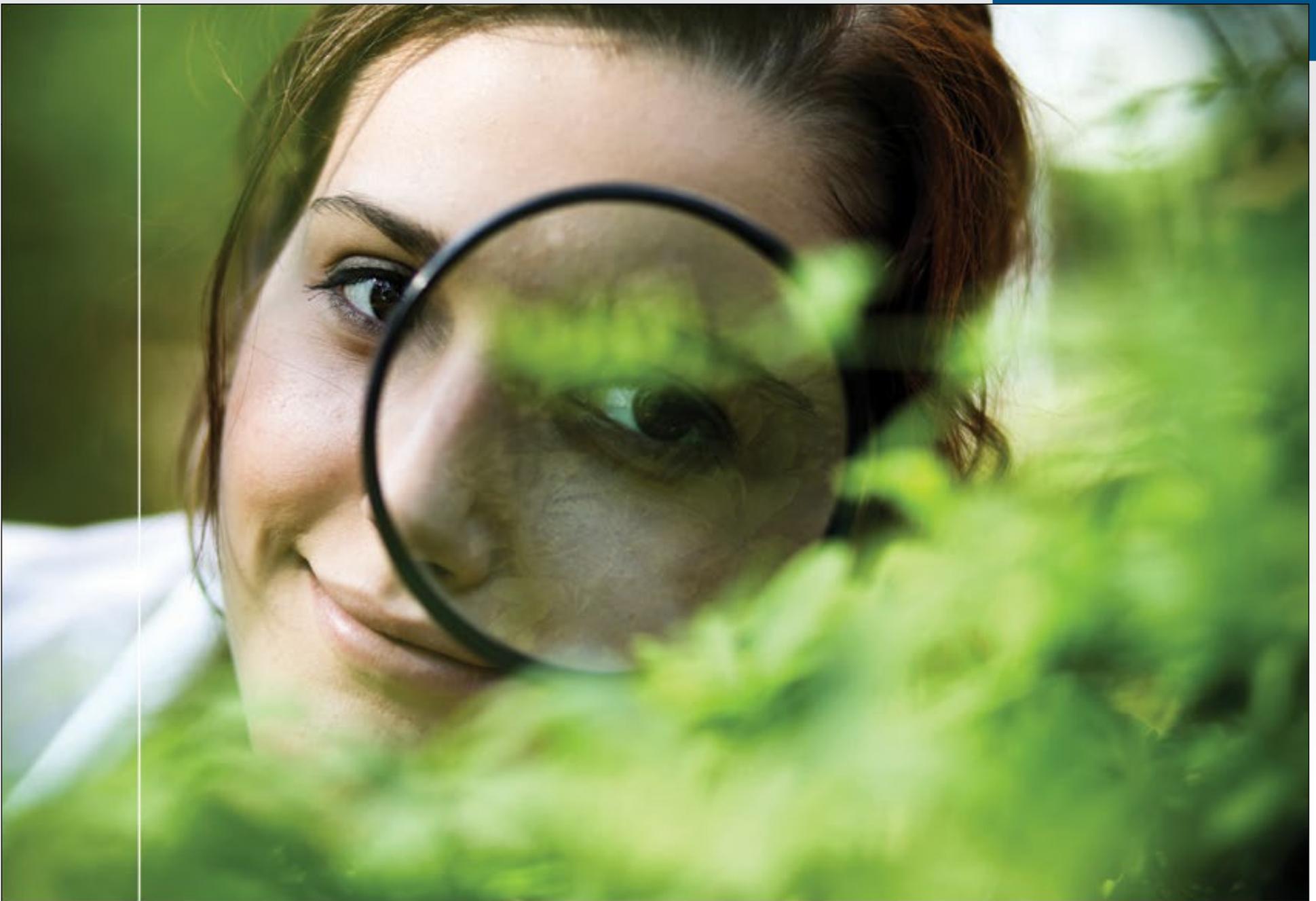
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Geoscience Higher Ed For the Next Century

By DAVID BROWN, EXPLORER Correspondent

Geoscience educators at the university level today face two difficult decisions in preparing for future decades: what to teach, and how to teach it.

That's not a joke. Recent history threatens to upend the way teachers prepare petroleum geology students for work in the industry.

First and probably foremost are the effects of the information revolution and the ubiquity of the Internet and Web, and the opportunities and problems that creates.

"There's so much information it's mind-boggling," said Roger Slatt, Gungoll Family Chair professor of petroleum geology and geophysics and director of the Institute of Reservoir Characterization at the University of Oklahoma.

Educators should begin spending less time telling students what the true answer is and a lot more time teaching them how to deduce the answer and assess the value of information, said Lesli Wood, Weimer Distinguished Chair and professor in sedimentary and petroleum geology at the Colorado School of Mines.

"One of the things I've had to do in the past five years or so is to think about how we're teaching students," Wood said.

She noted there's little point now in telling students to memorize the age of the Pennsylvanian when that information is "available at the touch of a finger."

"We need to be teaching students how to go out and mine this wealth of information," Wood said. "It's probably more important to teach them where the



With a new generation of "digital natives," institutes like the ConocoPhillips School of Geology and Geophysics at the University of Oklahoma must grapple with striking the right balance between applied knowledge and theoretical concepts. Pictured is the OU Bartell Field Camp, where the university holds its field courses.

information is, and how to go get it."

Slatt said so much information has migrated to the Web that today entire courses can be planned without reference to textbooks.

"That's been good in a way because of availability, but it's also caused more problems in plagiarism and things like that," he said.

One common and related complaint from geoscience educators involves the decline in writing ability among undergraduate students. Many students

"would prefer to cut and paste rather than write on their own," said Slatt.

"That's had an effect on writing skills," he added.

Wood recalled editing an 80-page paper intended for online publication and wanting to reduce its length, only to be told length didn't matter "because it's digital." She tries to teach her students to be concise in their writing.

"If you really want to get your science out there, you need to learn how to abstract ideas," she said.

Practical Versus Theoretical

Looking at the next 100 years of teaching geoscience, university educators also have to consider how much emphasis to put on practical working knowledge and skills and how much to focus on theory and conceptualization and research skills.

"That's a debate at many universities. At OU we are applied geology and geophysics," Slatt said.

Colorado School of Mines also emphasizes practical knowledge that students can immediately apply in the workplace, Wood said. She noted that companies no longer are willing to give new hires five years to develop professional experience.

"Now what you see is that young people are coming into the industry from school and they're getting a lot of work right away. Companies are trying to hold down costs," Slatt said.

The recent severe industry downturn has undoubtedly influenced today's widespread emphasis on applied knowledge in university-level geoscience education.

Professors understand that students will need practical skills if they want to find a job after graduation, but too much attention on applied geoscience can come at the cost of shortchanging knowledge-development and research skills, which is something that could have implications later in this century.

See A1, page 29

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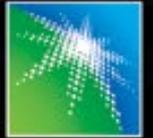
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Where Does Oil Go From Here?

A Pulitzer Prize-winning energy researcher weighs in

By BRIAN ERVIN, EXPLORER Managing Editor

“All happy families resemble one another; every unhappy family is unhappy in its own way,” reads the opening line of Leo Tolstoy’s novel “Anna Karenina.”

Similarly, “I guess you could also say every unhappy price collapse is unhappy in its own way.”

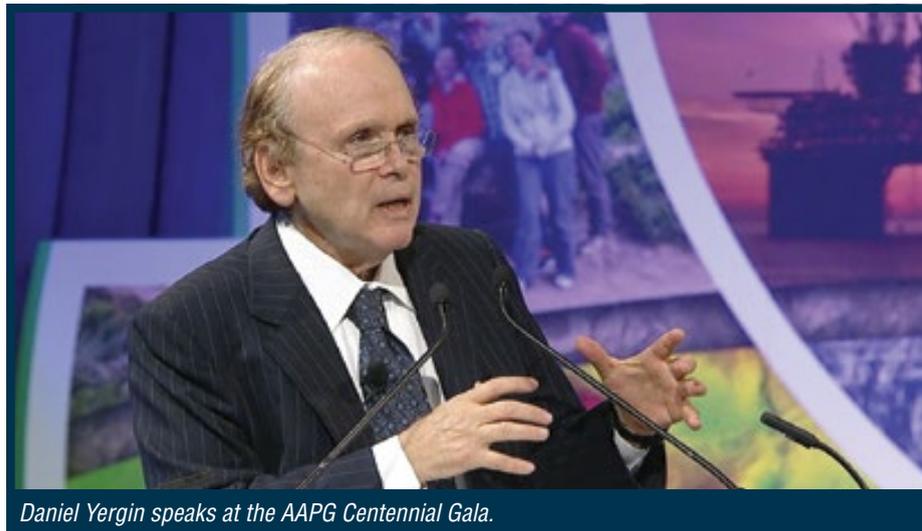
That’s Daniel Yergin. Along with being a fan of Russian literature, he also happens to be a world renowned energy scholar, economic researcher, co-founder of the IHS Cambridge Energy Research Associates and its eponymous CERAWEEK, vice chairman of IHS Markit, as well as a Pulitzer Prize-winning author for his bestselling “The Prize: The Epic Quest for Oil, Money and Power.”

And, Yergin also had the distinction of being the keynote speaker at the recent AAPG Centennial Gala during the Association’s 100th anniversary Annual Convention and Exhibition in Houston.

Addressing a packed ballroom of reveling geologists, Yergin shared his considerable expertise in oil market analysis to explore the question, “Where does oil go from here?”

The Great Stimulus of Pessimism

He noted that, according to his research, there have been five major shortages since oil became a global commodity in the early 20th century, and while each was “unhappy in its own way,” Yergin said they do share common features by which to make



Daniel Yergin speaks at the AAPG Centennial Gala.

reasonable predictions about the current unhappiness.

The first shortage followed pretty quickly after AAPG’s founding, when humanity at large first learned of oil’s true power and value during World War I, which, Yergin pointed out, began with horses and ground troops but ended with airplanes, trucks and tanks.

“It was that war that really turned oil into a strategic commodity,” he said.

Meanwhile, there was an automobile boom afoot in the United States, with only 1.8 million cars in 1914 but 9.2 million in 1920.

All of this quickly led to a severe shortage of oil, which created “an era of extreme pessimism,” Yergin said, which

was described by one official writing to U.S. President Woodrow Wilson that “lack of foreign oil supplies constituted the most serious international problem facing the United States.”

“I think we’ve heard something like that since, a few times,” Yergin quipped.

“Wilson’s reply was equally pessimistic. He said, ‘There seems to be no method by which we can assure ourselves of the necessary supply at home and abroad,’” he continued.

Wilson’s extreme pessimism was characteristic of the time, Yergin explained, because in the years immediately following AAPG’s founding, “the expectation of permanent shortage set in.”

“It was an early variant of Peak Oil,” he added.

The head of the U.S. Bureau of Mines officially declared in 1919 that, within less than five years, the oilfields in the United States would be “finished,” and the head of the U.S. Geological Survey warned of a “gasoline famine,” with the national supply exhausted in precisely nine years and three months.

As has unfailingly proven to be the case in the intervening decades, that shortage was a great stimulus for opportunity and innovation, which the newly formed knowledge-sharing community of AAPG was uniquely equipped to help meet.

The U.S. government encouraged oil finders to go overseas to explore for new supplies of oil, but the turning point came with discoveries in Oklahoma and east Texas, which Yergin described as “an incredible strategic reservoir that was critical to the success of the Allies in World War II.”

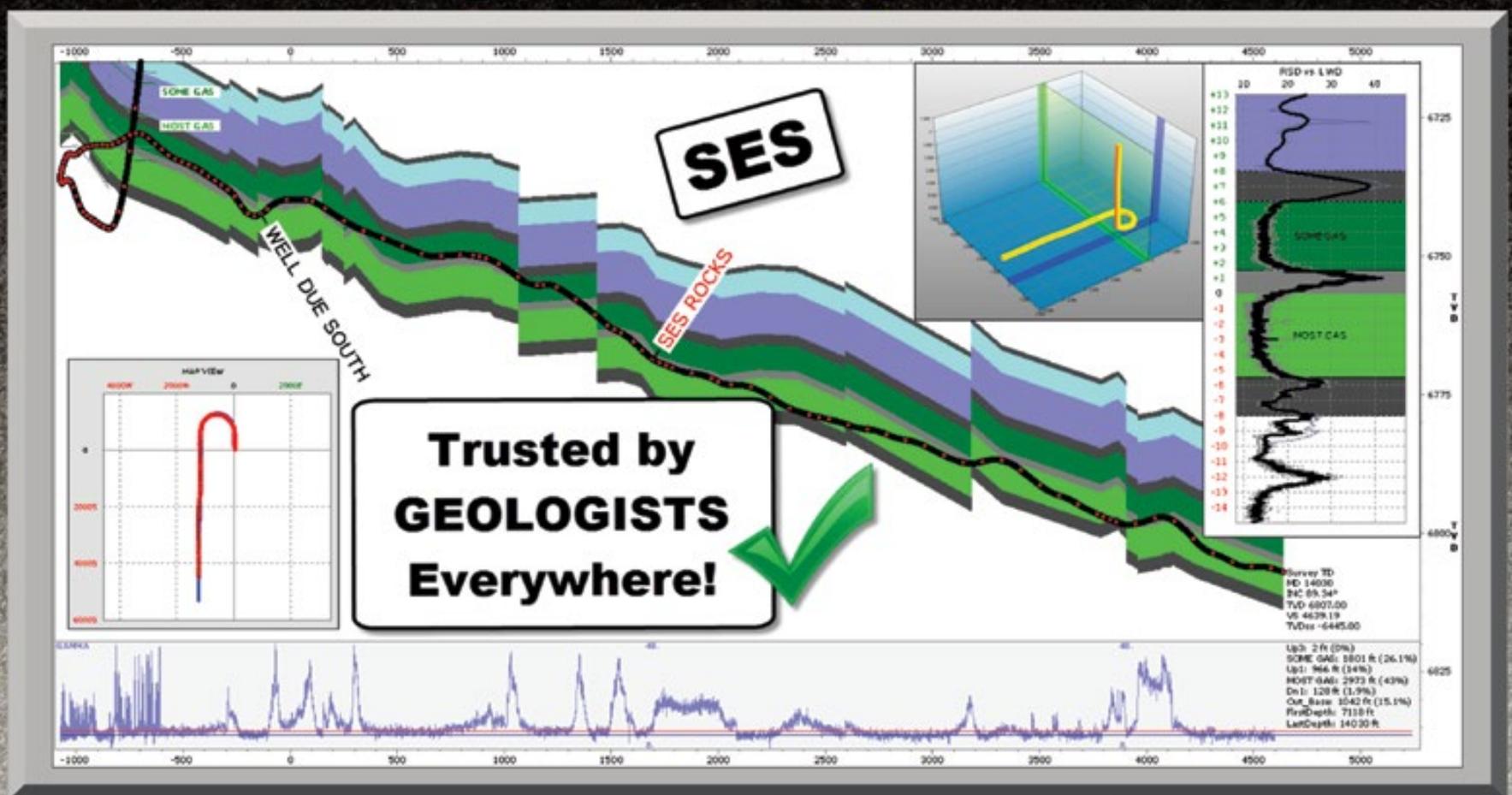
“Without those discoveries . . . it would have been a very different situation,” he added.

What was great news for the war effort soon became bad news for the oil industry. Right on the heels of a veritable national panic over shortages came a supply glut and a resultant price collapse to 10 cents a barrel.

Yergin noted that there was such desperation to offload supplies that some

See [Recovery](#), page 16

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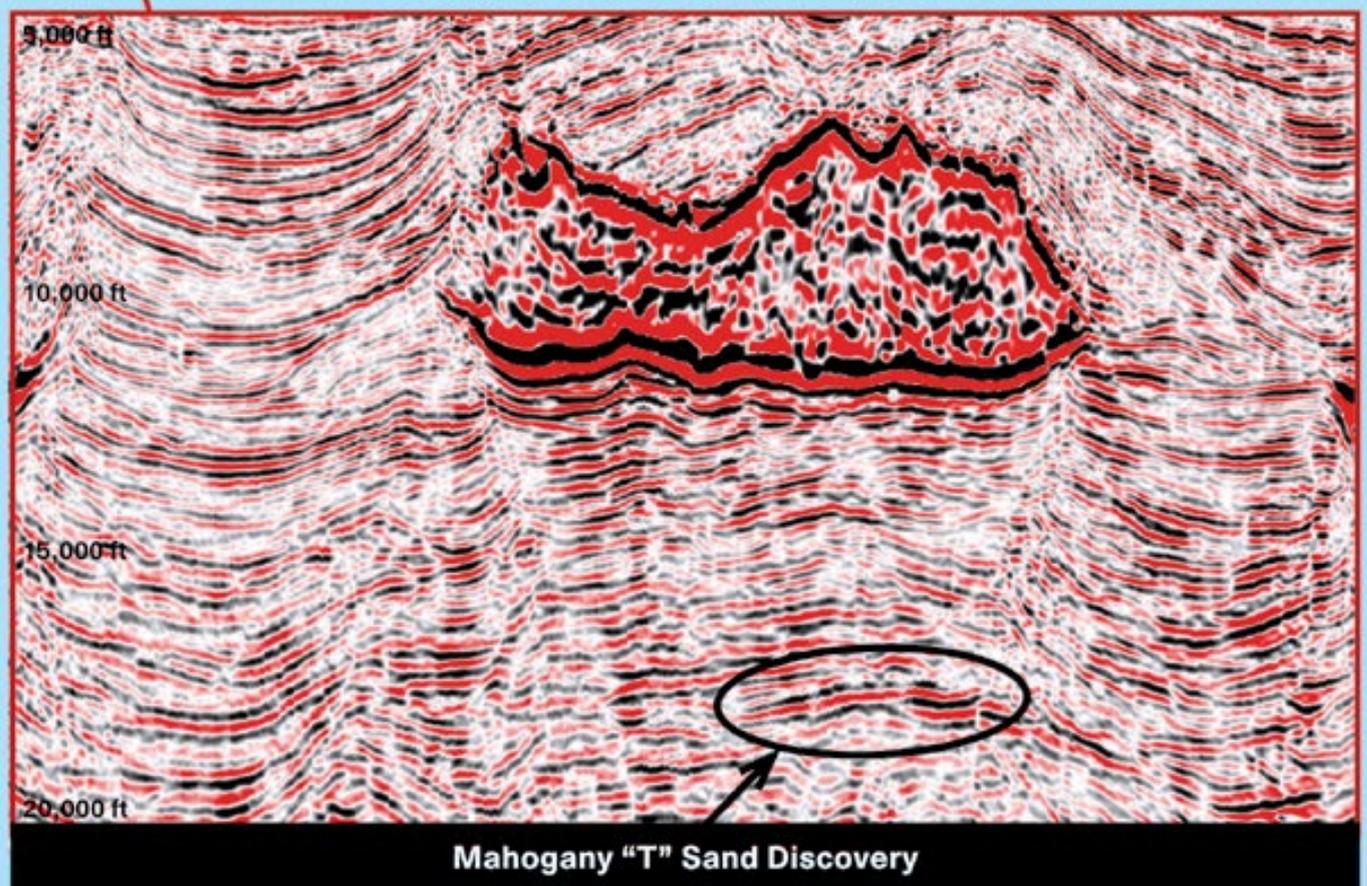
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o f M e x i c o

Exploration At a Lull, And So Are Salaries

By BRIAN ERVIN, EXPLORER Managing Editor

For this year's salary survey, there's some good news and some bad news.

The good news is that the bad news shouldn't come as a surprise to anyone, since it's a consequence of what everybody already knows: the industry is experiencing a prolonged downturn, which means there aren't very many job openings, which brings us to this particular bit of bad news: There is no salary survey this year.

Last year's survey is included for reference, but for the first time in decades, an updated survey isn't possible.

"I couldn't even fudge it. The numbers are just way too low," said Mike Ayling of MLA Resources in Tulsa, who has conducted the annual salary survey for AAPG since 1981.

He explained that the amount of data available for the survey is a function of how much hiring and job-searching is going on, and 2016 didn't see much of either.

"Industry activity has been so mild ... it would not be a valid survey," Ayling said.

"Virtually all of the people who are in the database I would normally include in the survey are guys with more than 30 years of industry service. That's one cell," he elaborated.

State of the Job Market

Ayling said he's short on data, but he does have some anecdotal information

Historical Averages Salary								
YEARS EXPER	2008	2009	2010	2011	2012	2013	2014	2015
0-2	\$ 83,600	\$ 87,600	\$ 93,000	\$ 98,700	\$ 100,500	\$ 103,400	\$ 102,900	\$ 103,900
3-5	108,000	105,600	102,300	109,400	101,000	114,500	114,900	110,900
6-9	118,400	121,700	127,800	137,300	127,800	145,400	148,300	141,500
10-14	121,900	123,500	139,100	153,400	147,000	147,500	165,600	164,600
15-19	139,400	150,800	151,000	193,600	190,300	179,200	189,000	176,600
20-24	176,800	180,300	191,000	199,200	211,600	219,500	234,300	264,700
25+	171,700	186,800	206,300	199,600	212,000	252,600	229,900	230,600

on the state of the industry, and he said the state of salaries this year is most likely a continuation of last year's story, "only worse."

Last year's salary survey saw very little change over the previous year, and Ayling suspects that would be true this year as well, if he had the data to analyze.

The good news, however, is that the worst of it appears to be over.

"I'm not seeing a huge number of layoffs anymore. I think we saw them a year or two ago, but I'm just not seeing a lot of hiring activity," Ayling said.

He said smaller companies are still doing some downsizing, but not nearly to the extent that they were in 2015 and 2016.

"In some cases where companies are in serious financial trouble, they may have asked people to take cuts, or they may have cut their more expensive people, but I don't have a lot of hard data to back that up," he said.

"That's the more typical story for the smaller companies," he added.



AYLING

"For the larger companies, I think they're involved in these horizontal plays that are producing from the wells they've drilled, and they're probably drilling more wells in the formations where they've had some success, but they're not doing a lot of exploring," Ayling added.

Of course, the Permian Basin has seen a lot of attention and activity this year, but Ayling said he hasn't seen any significant amount of hiring as a result, so it's likely that oil producers have simply diverted resources from other horizontal plays to handle the workload.

State of the Industry

Meanwhile, many of the people who were laid off a year or two ago are giving up the job search and leaving the profession.

"The ones that have been laid off have told me there's just not anything out there," Ayling said. "There was a guy with 10 years in the industry who told me, 'I'm sorry. I've got to give up on this industry and find something else to do.'"

Meanwhile, the lack of exploration activity spells a lack of skills development for those petroleum geologists who remain on the job.

"I'm really concerned for the profession that young geologists are largely being used to geosteer and not being trained in exploration," Ayling said.

"If you took one of these five or even 10-year people and set them out in a county in Oklahoma or west Texas and told them to look for prospects, they might not know where to start."

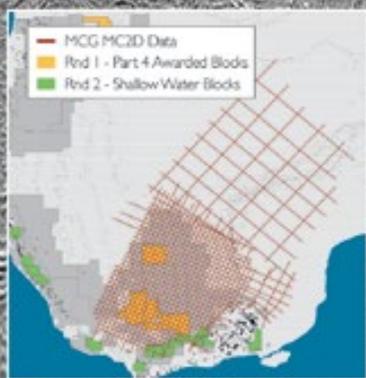
"If people are viewed largely as technicians to guide a drill bit in a horizontal hole, as opposed to explorers," he said it could have a long-term adverse effect on the industry's ability to find oil when the demand returns.

"That may not be universally true, but I seem to hearing a lot of that," he qualified.

Based on current trends, Ayling said there doesn't appear to be enough data on which to base a valid salary survey in 2018, either.

"If you want to tell people to contact me and tell me how they're doing, it might make it possible to do a survey next year," he said.

Ayling can be reached at MikeAyling@mlaresources.com.



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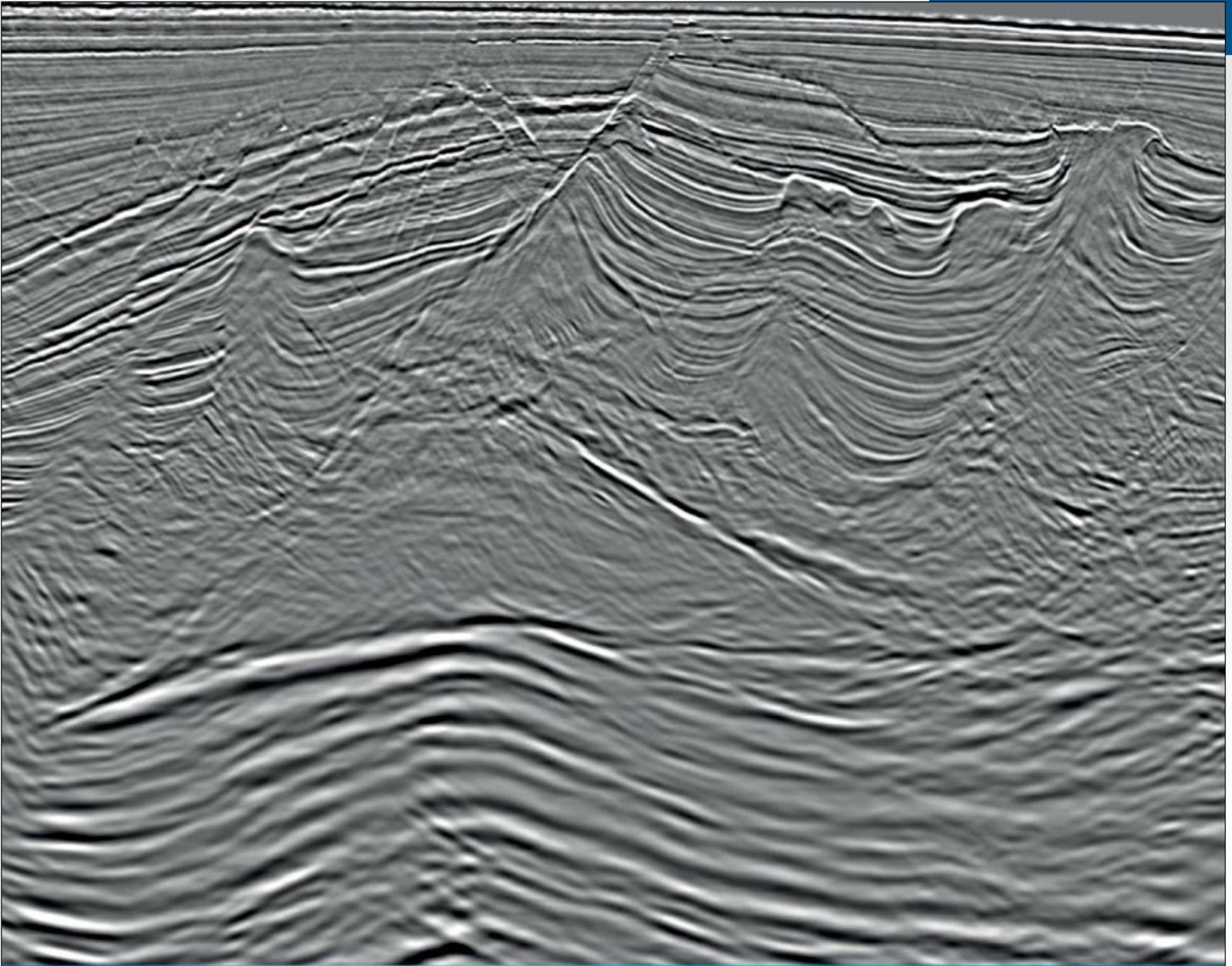
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'Bridesmaids' No More: University of Houston Wins IBA

By BARRY FRIEDMAN, EXPLORER Correspondent

When it comes to the AAPG's Imperial Barrel Awards, now in their 13th year, you expect to hear terms like "bridesmaids" from faculty advisers and students who participate year after year but never quite get to pose with the big check. Nobody is Susan Lucci here – these are all accomplished schools and programs, and winning isn't the only byproduct of IBA or why they compete – but one can start to detect some understandable frustration and disappointment.

"After John Castagna and I," said AAPG Member Paul Mann, a professor in the Department of Earth and Atmospheric Sciences at the University of Houston, "started co-advising the UH IBA team in 2012, our UH IBA teams had been the perennial bridesmaids of the Gulf Coast Section in 2012 (third place), 2013 (third place), 2014 (third place), 2015 (did not place), and 2016 (second place). In 2012 and 2014 we were third place in the Gulf Coast section behind University of Louisiana-Lafayette (ULL)."

But the team kept plugging, getting better. "With each year and completed data set, the team improved on data analysis, slide preparation and flow and how to sell their prospects or play concepts to a critical audience. Our earlier UH teams were always strong technically but remained weaker in the area of presentation and 'sealing the deal' – an area in which some of our Gulf Coast competitors like ULL (University of Louisiana at Lafayette) excelled at. Getting the second place amongst a strong field in the Gulf Coast section in 2016 showed that the UH team had merged their technical analysis



MANN

"Almost all of our UH IBA team members since 2012 are working in the oil and gas industry and demonstrate the practical value of the 'IBA experience'..."

with an exciting and convincing delivery and was ready to move up from its usual, third place position."

And this year, they did – all the way to this

year's IBA.

"The first big leap," Mann said, "was finally winning the Gulf Coast section on March 17," which meant beating perennial

powerhouse ULL. It's a tough region, anyway, the Gulf Coast, but up until this year, ULL was the Cleveland Cavaliers to UH's Indiana Pacers.

What made part of the 2017 competition more unique (and fun) for Mann and his team was that the AAPG Annual Convention and Exhibition was held in downtown Houston. It was, in every real sense, a home game, so to appear in the finals would be extra sweet.

They were ready – or thought they were.

Sealing the Deal

"Our team," said Mann of this year, "came out of the Gulf Coast semifinals with a high level of confidence and was primed to compete in the finals on April 1."

One of the quirks of the competition is that, according to IBA rules, after the semifinals are announced, no more modifications of the slide presentation are permitted. So, Mann and his team decided to spend what amounted to a two-week dress rehearsal, continuing to practice the existing slide presentation and working through long lists of potential questions that might be asked by the panel following their final presentation.

UH worked on the Taranaki Basin in New Zealand. The New Zealand minister of energy gave the team a boxed drive containing all of the subsurface oil-related data from New Zealand.

Each member had, at first, a specific role in the project, meaning the five-person IBA team had a basin modeler, geophysicist/

[See Specialties, page 28](#)

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Recovery from page 8

gas stations in Texas resorted to giving away free chickens to gasoline customers.

Lessons for Today

That cycle of shortage, glut and price collapse followed by recovery has been a recurring and now predictable pattern in the intervening decades. And, just as those past cycles have inevitably led to recovery, so is the current downturn plodding ever closer to a return to higher prices and opportunity, albeit in fits and starts.

"Recovery is here, but where does oil go from here?" Yergin asked.

Last year's OPEC production cutting agreement provided a "gentle hand at the wheel" to rebalance the market, but it's been

a shaky balance.

"We've seen a recovery, but it's been uneven and volatile," Yergin said.

(And, by the time this goes to print, the OPEC will have decided at its meeting in late May whether or not to extend or alter those production cuts.)

"But, what a change," he remarked. "A couple years ago, \$55 a barrel would have been derided. Now it's celebrated, because you've seen this kind of recalibration of the entire cost system of the industry. It's shale, it's conventional, it's offshore, and it's even oil sands."

The price is volatile in the short-term, but what about the long cycle?

"Those big, multi-year projects – the ones that are also interesting to geologists? There we've seen delays, postponements, cancellations," Yergin said.

This has cut upstream spending almost in half. IHS estimates that in 2019 it will be

about half of what it was in 2014, he said.

"Some of that is just lower service costs; some of that is cutbacks," Yergin said.

However, he said IHS estimates that U.S. spending will be up 25 percent this year. The rest of the world will be flat, or maybe even decline, but is expected to increase 15 percent in 2018.

And, Yergin said that will lead to an overall increase in costs of 2-4 percent, while costs for production of unconventional will increase about 10 percent, and costs in the Permian Basin will increase by 15 percent or more.

Shortage is Imminent

"Another feature of the current period is, of course, the alarming drop in oil discoveries, which is highly relevant to you all," Yergin continued.

And, that means the oil market will see

yet another recalibration in the next three or four years.

"This leads to what my colleagues Bob Fryklund and Pete Stark have called, in their Discovery Thinking papers, 'new thinking' about super basins – about existing super basins and as the new building block of exploration, and turning geological mastery, as they put it, into commercial mastery," Yergin said.

But, the ongoing and predictable cycle of the market isn't the only force shaping the fortunes of petroleum geologists.

"Politics goes in cycles, too," Yergin said. He noted that there have been 145 recent or new regulations under the Obama administration, and drew some applause when he referenced the new administration, which is expected to be more favorable to the oil and gas industry.

But politicians don't set policy in a vacuum, and Yergin noted cultural and social forces that are actively working against the industry, referencing, for instance, the anti-fracturing propaganda movie "Gasland," which is required viewing in some state school curricula, along with the broader efforts of the "Keep It In the Ground" movement and their efforts to choke-off pipelines, literally and figuratively, by choking off financing by banks and investment funds through regulation.

Factors like these could hamper the industry's capacity to find more supplies, but that can only exacerbate the inevitable increase in demand.

Yergin noted that broader dialogue within the industry has gone to from "Peak Oil" (supply) to "Peak Demand."

"When will oil demand reach its high point?" he asked.

Yergin noted that there is a wide range of opinions on the answer, from the end of the next decade to 2040 and beyond, but his answer is, "We don't know. It depends on many different things."

Technology, the kinds of cars people drive, environmental policies, urban and pollution policies in Asian megacities along with the growth of income, gross domestic product and population – all of these factors relate to that answer, he said, and it's a question IHS is working out in a research project called "Reinventing the Wheel," which is an effort to understand how the global changes in transportation will affect the oil and gas industry.

"One of the things that comes through is that much depends on attitudes, on values, toward cars," said Yergin, to which he added, "There are generational factors involved."

That said, he noted that according to the International Energy Agency, even if every other new car sold in the world between now and 2040 is an electric car, world oil demand will still go up, partly because automobile transportation is only about 35 percent of total oil demand.

Yergin concluded that, while all of the aforementioned factors will affect the future of oil and gas, "It also depends on how well the oil and gas industry tells its own story."

"I really want to emphasize that – the importance of not simply talking within one's community, but talking with other communities as well, and that emphasis on communication," he said.

"Certainly, the future depends upon the rocks, and what the rocks tell you and what you find out, and on technology," Yergin concluded. "But the future also depends very much on something else, which is you all, and people like you, because you are the people who visualize and make the future. Your training, your discipline, your creativity, your commitment and passion will be critical in shaping the century to come, for the AAPG, for the industry and what it all represents." 



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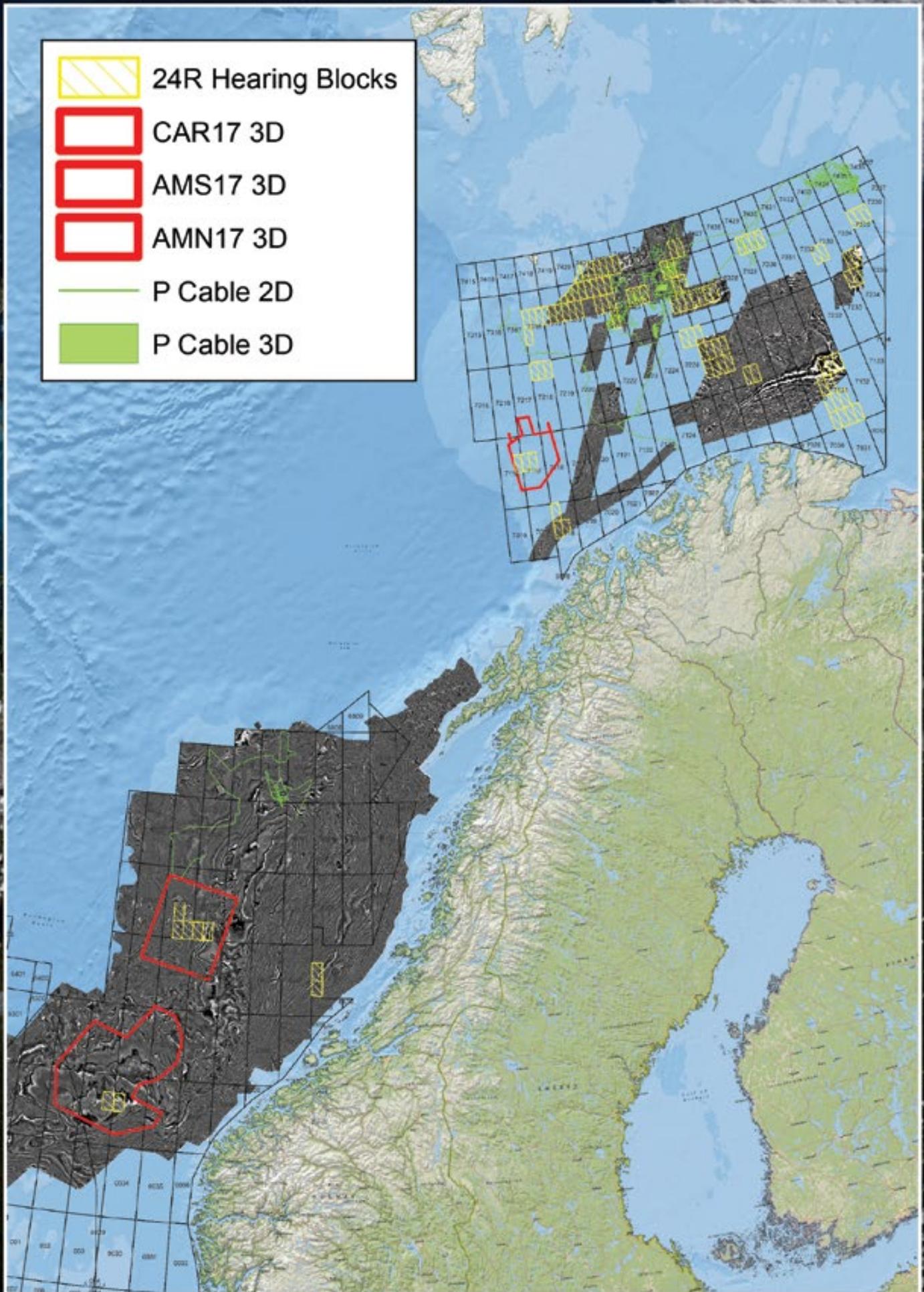
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Historical Highlights is an ongoing EXPLORER series that celebrates the “eureka” moments of petroleum geology, the rise of key concepts, the discoveries that made a difference, the perseverance and ingenuity of our colleagues – and/or their luck! –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

A Retrospective on Source Rocks as Reservoir Rocks

By KEITH KVENVOLDEN

In the Historical Highlights from the March 2017 EXPLORER, AAPG Past President Marlan Downey lamented that, as a petroleum geochemist with Shell Oil’s Bellaire Research Laboratory in Houston in the 1960s, he had not fully appreciated the idea that source rocks could serve as reservoir rocks for oil and natural gas.

He was not alone.

While Downey was at Shell, I was concurrently at Mobil’s Field Research Laboratory in Duncanville, Texas, working with Ellis Bray, Ernest Evans, Jim Cooper and finally Rodney Squires. During my five years at the Laboratory, much of my research dealt with aspects of source rocks. I knew that the amount of extractable organic matter (EOM) in source rocks could be very high, but recovery required organic solvents and a pulverized sample. I did not understand that the magnitude of the EOM could be significant. I was more interested in the molecular distribution of the normal paraffin hydrocarbons in the extracts and the relationship between these hydrocarbon distributions and those of the accompanying normal fatty acids. These interests distracted me from recognizing that source rocks could be reservoir rocks if one could just figure out how to create permeability in the in-place source rock.

Today, of course, that is known as hydraulic fracturing.

One reason petroleum geochemists at that time missed this idea is that we paid too much attention to the available petroleum geology textbooks. Source rocks and reservoir rocks were usually treated in separate chapters; ergo, source rocks and reservoir rocks must be different!

Geochemical Prospecting

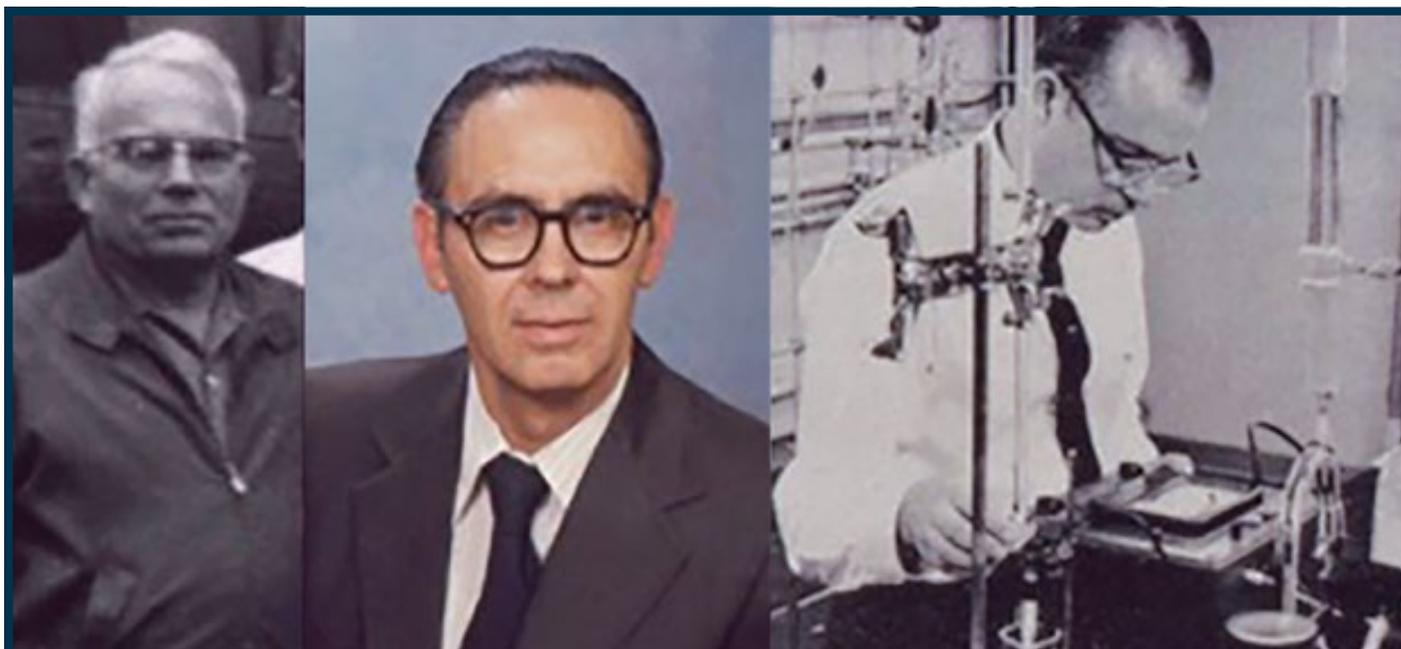
Although I missed the significance of source rocks as reservoir rocks, I did have an opportunity to consider petroleum geochemical prospecting. I was asked to review and evaluate the results of Mobil’s worldwide efforts to find petroleum deposits by this methodology. My report to management didn’t win me many points. I wrote that the company’s efforts were unfortunately a waste of time and money: there was scant evidence that geochemical prospecting had any impact on their finding petroleum. I pointed out that applying geochemical prospecting without recognizing the geological context of a prospect was a recipe for almost certain failure.

Management wasn’t happy with these conclusions.

Because of my report, I was given the “opportunity” to design a soil-gas geochemical prospect in a forest in Arkansas. I laid out the sampling grid to take advantage of the geological context of the area, and I used a sampling probe to penetrate the soil to about two feet, to suck up a gas sample. Colleagues analyzed each sample, using a gas analyzer, and they plotted the results on a map. The idea was that the soil gas would be combustible and be composed mainly of methane. Initially, I was quite surprised that some samples gave positive results, but then I noticed that the plotted results correlated with the location of pine trees in the forest. I further noticed that when the probe smelled of



(Left) The Mobil Oil Corporation Field Research Laboratory headquarters building in Duncanville on the south side of Dallas; (right) the office building for the geochemistry unit.



From left: Ellis Bray, Ernest Evans and Jim Cooper.

One reason petroleum geochemists at that time missed this idea is that we paid too much attention to the available petroleum geology textbooks.

terpenes (organic compounds commonly released from pine trees), the measured result was positive. I was able to predict accurately the analytical result before the gas measurement was made. I finally convinced my colleagues that we were mapping pine trees and not a petroleum occurrence.

A telephone call back to the Mobil laboratory was met with disbelief, but we were told to come home and bring a pine tree root with us. I wrote up my report titled “The Pine Tree Prospect in Polk County, Arkansas.”

Again, management was not happy, but the results were finally accepted.

Carbon Isotope Geochemistry

During my last year at Mobil I was assigned the difficult task of writing up

some of the data that Rodney Squires had generated. Squires, the isotope geochemist at the laboratory, worked diligently to create a huge database of carbon isotopic compositions of crude oil samples from around the world.

However, there were two problems.

First, he reported his data in absolute concentrations in parts per million of carbon (C^{13}) minus 10,000, instead of the conventional way of comparing the ratio of C^{13}/C^{12} of the sample to that of a standard.

Second, although he would interpret his data for company reports, he refused to publish in the open literature. Mobil had an enlightened policy that encouraged employees to publish non-competitive information in the open literature because this process gave management an important tool for evaluating its employees.

I was really uncomfortable having to write a technical paper for outside publication with Squires because I had not participated in any data generation and was not very familiar with the geochemical literature dealing with the carbon isotopic compositions of crude oils. Nevertheless, I was ordered to work with him and get a paper out.

The task was not easy for him or me.

The paper we wrote (AAPG Bulletin, v. 51, p. 1293-1303 (1967)) described the carbon isotopic compositions of 37 crude oils from the Ellenburger Group (Lower Ordovician) in the Permian basin of West Texas and eastern New Mexico. These isotopic values were compared with those obtained from 66 Permian basin crude oils ranging in age from Middle Ordovician (post-Ellenburger) through Early Permian (Wolfcamp).

The map (fig. 3) shows well locations from which the crude oil samples were obtained. Crude oils from the Ellenburger were arranged into five groups based on carbon isotopic composition, geographic position and stratigraphic relationships. One group of Ellenburger crude oils had unusually light carbon isotopic compositions relative to isotopic values

Continued on next page

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usually found in all other crude oils from around the world.

We concluded that the Ellenburger Group serves as a reservoir for oils of many geologic ages. Squires insisted we report the carbon isotopic compositions in his absolute units. I suggested that we publish using both his units and the equivalent conventional units. He refused and would not release the paper for publication.

Now at my wits' end, I talked to our mutual supervisor, John Zimmerman, who had directed us to work together, and I explained the situation. Zimmerman told me not to worry and to submit the paper for publication using both sets of units, and just ignore Squire's objections. A few days later, Squires called me and said that I could go ahead and publish the paper using both sets of units. Surprised, I asked why he had changed his mind. He responded that Zimmerman had told him that either he let me submit the paper for publication, or he would be fired.

He ended our conversation with "They never explained it to me that way before!"

Systems Analysis

During the time I was trying to get the paper on the carbon isotopic compositions of crude oils in the Permian basin published, I was asked by management to give up organic geochemistry and join a special group of three: a geologist, a mass spectroscopist, and me, to investigate systems analysis.

To sweeten the deal, I was moved from the office I shared with Jim Cooper, to a much larger, single, carpeted office in the headquarters building, symmetrically



KVENVOLDEN

Keith Kvenvolden grew up in Cheyenne, Wyo., and went to the Colorado School of Mines, graduating with a degree in Geophysical Engineering, and went to graduate school at Stanford University. He worked for about ten years with various affiliates of the Mobil Oil Corporation, including about five years, starting in 1961, at its Field Research Laboratory in Texas as a petroleum geochemist. In 1966, he left Mobil to join the NASA Apollo Program as an organic geochemist. Ten years later he moved to the USGS to pursue investigations of the organic geochemistry of continental margin sediments, including studies of methane hydrate.

A 65-year Member of AAPG, he published his first technical paper dealing with hydrocarbons in San Francisco Bay sediments in the AAPG Bulletin, 1962, v. 46, n. 9, p. 1643-1652.

located in the opposite wing wherein the manager of the entire laboratory resided. The three of us would meet in the generous space of my office to try to figure out what exactly we were supposed to do.

We did come up with an interesting, but impractical idea.

We suggested that subsurface mapping could be facilitated by the application of computer technology. We envisioned that well logs could be displayed on the screen and horizon tops could be picked with a light pen; the depth and position of each pick could be plotted on a map, and the various horizons could be contoured automatically, giving the interpreter useful structural subsurface maps. This idea was impractical for the time because computers were very slow and data had to be loaded by punch cards.

When we had submitted our report to management, I happened to see the manager, Nelson Stevens, who was

responsible for my transfer from geochemistry and for the formation of our three-member team. I asked him what exactly he had in mind when he formed this team to investigate system analysis. He told me that he really didn't know, but that the term certainly had a "space age" ring to it!

Summary

In retrospect, my five years at Mobil Oil's Field Research Laboratory were quite rewarding in spite of the adventures described above. I was given an incredible

foundation in organic geochemistry that I applied in my later research with NASA and the U.S. Geological Survey. I will always be indebted to Bray, Evans, Cooper, and our Mobil support staff for their guidance and mentorship. This story is dedicated in their memories. 



Map of the locations of wells in the Permian basin of West Texas and eastern New Mexico from which crude oil samples were obtained for measurement of carbon isotopic compositions.

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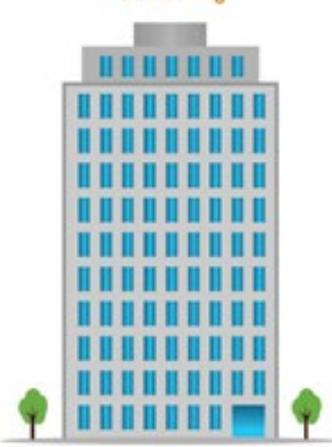
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Quantifying Shallow Seismic Anomalies

By RITESH KUMAR SHARMA and SATINDER CHOPRA

The determination of properties such as lithology, fluid content, porosity and permeability help us characterize a subsurface reservoir.

Such an exercise can be taken to the next step with the determination of petrophysical properties such as water saturation and volume of clay, which can aid the appraisal of a reservoir. All these properties can be obtained by lab measurements on core samples, or by carrying out petrophysical analysis on log curves, which are only possible at well locations. But as is generally the case, our goals are to characterize reservoirs not vertically, but spatially, and thus we turn to seismic data for their determination.

Impedance Inversion

The usual workflows for seismic differentiation between lithology and fluid content take advantage of their relationships between different elastic constants such as bulk modulus (measure of incompressibility of the rock), shear modulus (measure of rigidity) and Young's modulus (measure of stiffness), which can be seismically derived through the process of impedance inversion. Impedance inversion transforms seismic amplitudes, both prestack and poststack, into impedance values. There are different methods of impedance inversion, which we have described in our series of Geophysical Corner articles from May to July 2015.

In prestack seismic data, as the fluid/lithology information resides on the far offsets, or large angles of incidence, a promising approach is the analysis of impedance with respect to different offsets/angles. Such a workflow is referred to as elastic impedance, which we described with examples in our Geophysical Corner article of October 2012.

But when it comes to the determination of petrophysical properties such as water saturation, effective porosity and permeability, an extension of the elastic impedance approach, called "extended elastic impedance" is utilized. The basic idea behind this workflow is that though typically the incident angle range is 0 to 30 degrees, it can be mathematically extended to a greater angle range, and by modifying the Zoeppritz formulation, extended elastic impedance reflectivities at different angles can be generated. By cross-correlating these generated reflectivities with the desired petrophysical property, the optimum angle can be determined, which can then be used to derive the desired petrophysical property from seismic data.

Accounting for High Amplitude Anomalies

In last month's Geophysical Corner (May 2017), we described the characterization of shallow high amplitude seismic anomalies in the Hoop Fault Complex area of Barents Sea that hosts shallow and deep-seated hydrocarbon accumulations. In particular, the objectives were to explore for potential reservoir prospects within the Mid-

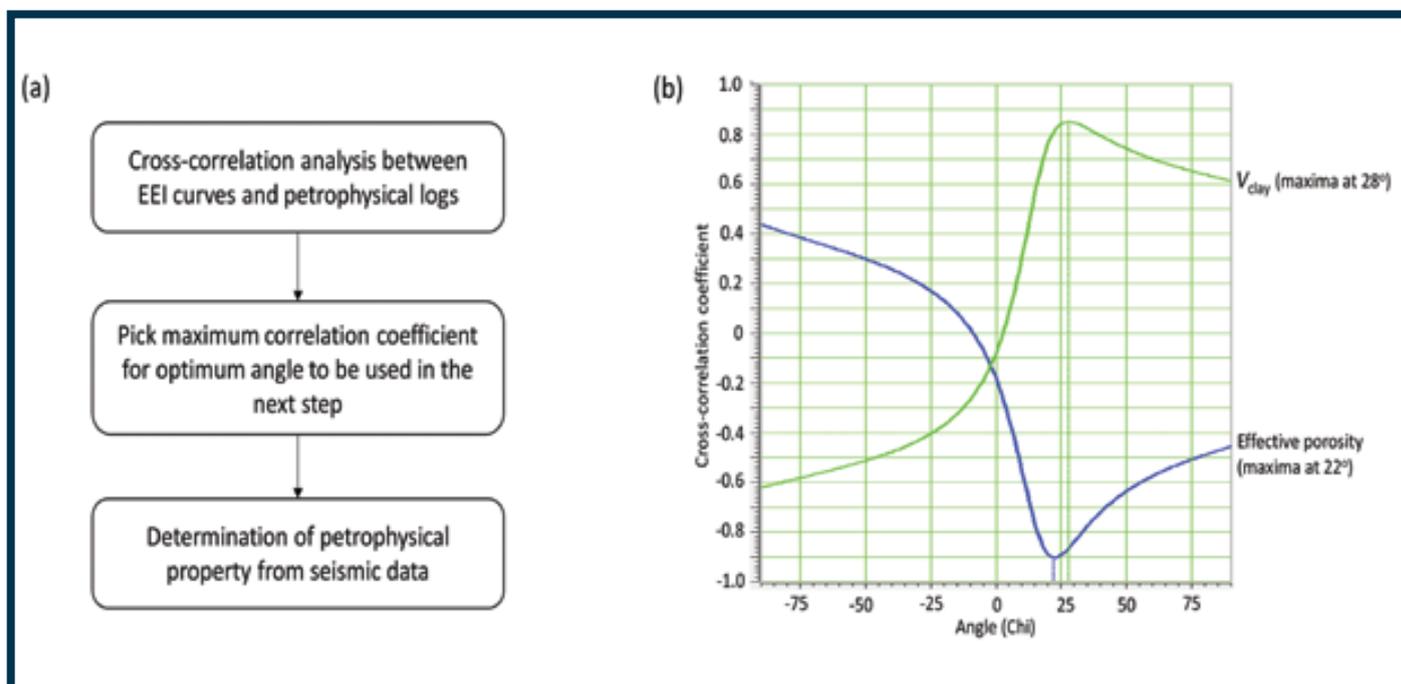


Figure 1: (a) Workflow for extended elastic impedance (EEI) approach for predicting the volume of petrophysical properties from seismic data. (b) Cross-correlation analysis for effective porosity (blue curve) and V_{clay} (green curve) with EEI curves. A maximum negative correlation is seen for effective porosity at 28 degrees, and a maximum positive correlation is seen for V_{clay} at 22 degrees.

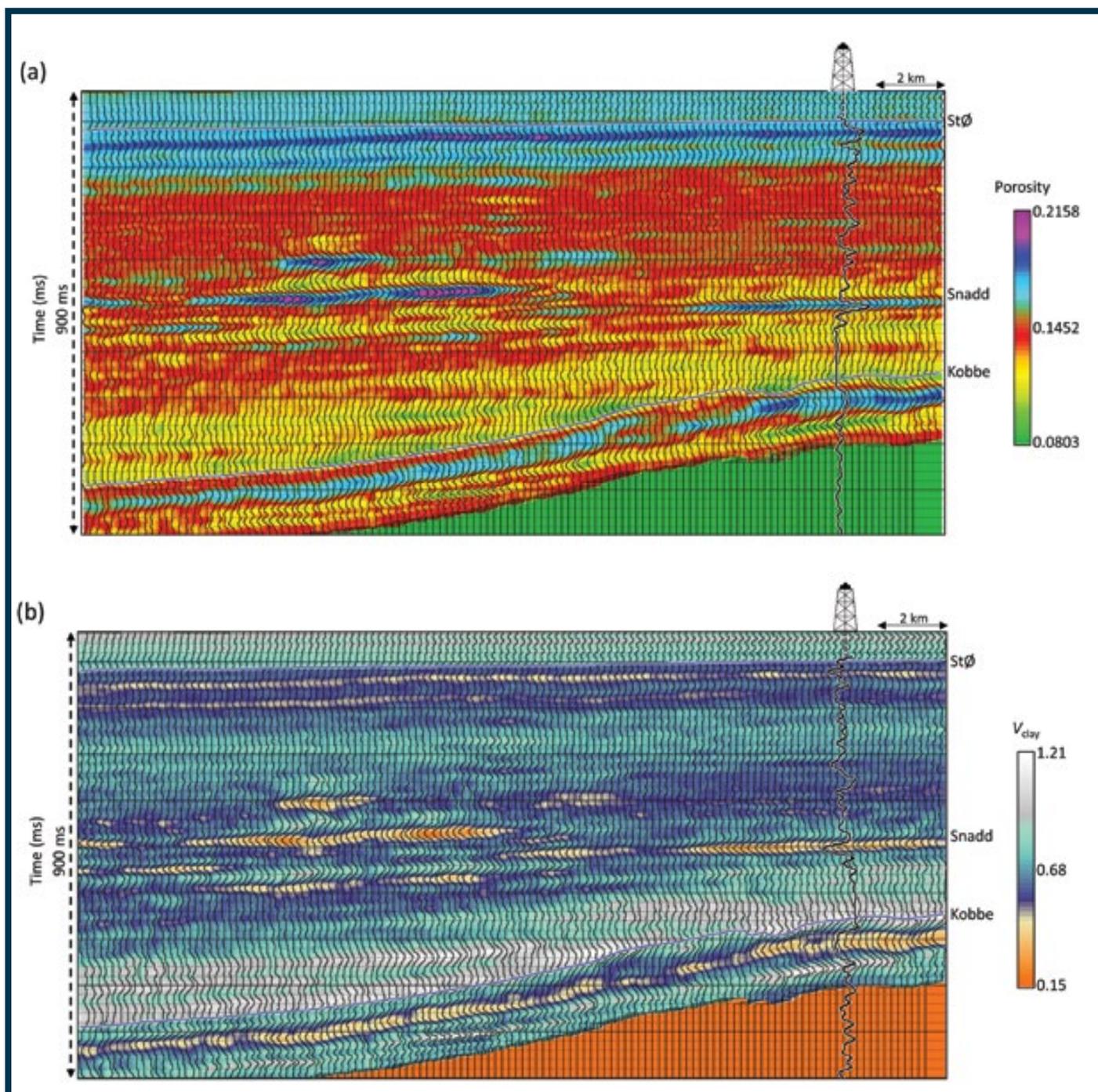


Figure 2: (a) A cross-line section from inverted effective porosity volume passing through a well. The overlaid effective porosity curve shows a strong correlation with inverted results. (b) Equivalent cross-line section from inverted V_{clay} volume passing through a well. The overlaid V_{clay} curve shows a strong correlation with inverted results. (Data courtesy: TGS, Asker, Norway)

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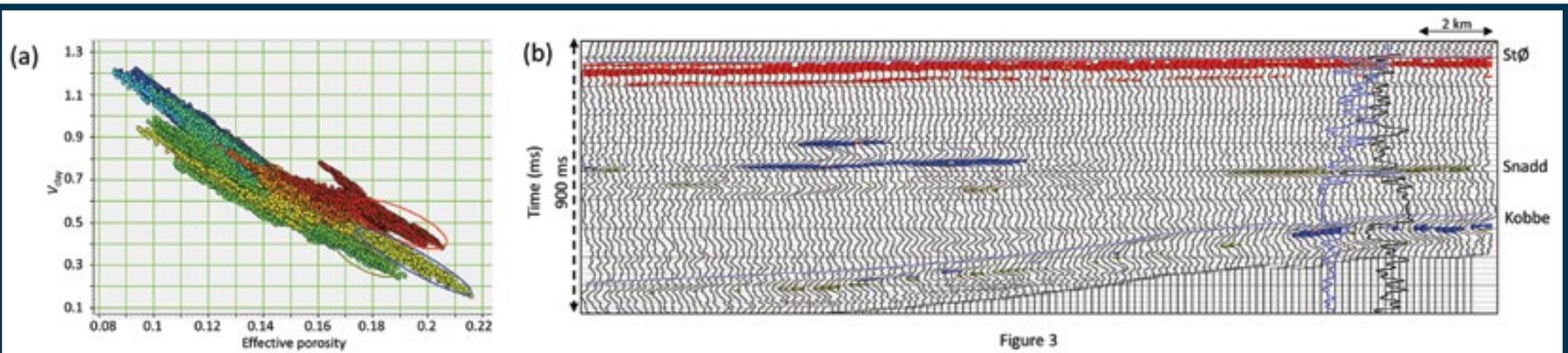


Figure 3: (a) Cross-plot of inverted effective porosity and V_{clay} volumes over the zone of interest. Cluster of points exhibiting high porosity and low V_{clay} values are enclosed by red, green and blue polygons. The back projection of these polygons on the seismic crossline is shown in figure 3b. Notice, we are able now to differentiate the potential reservoirs within StØ, Snadd and Kobbe formations.

Continued from previous page

Jurassic StØ and Mid-Triassic Kobbe formations, encompassing the Snadd formation in-between.

As we mentioned in that article, there could be various reasons for high amplitude anomalies to show up on seismic data, and it is our objective to distinguish those seismic anomalies that are associated with hydrocarbons from those that are not. We demonstrated the application of spectral decomposition as direct hydrocarbon indicator that qualitatively identifies the hydrocarbon bearing zones. We pursue that exercise further with the application of extended elastic impedance approach. In figure 1a we show the workflow followed in this exercise. As we cross-correlate the extended elastic impedance reflectivities with the desirable V_{clay} and effective porosity log curves for different values of the angles, we plot the correlation coefficients as shown in figure 1b. The



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maximum positive correlation coefficient of 0.85 for V_{clay} (green curve) is seen at 28 degrees, while effective porosity exhibits a negative correlation coefficient of 0.9 at angle 22 degrees (blue curve). These values of angle enable the determination of these properties from seismic data through the application of Zoeppritz equations.

In figure 2 we exhibit equivalent crossline sections from the effective porosity and V_{clay} volumes with the respective petrophysical log curves overlaid on them. A reasonably good

Determination of petrophysical properties such as water saturation, effective porosity and permeability, can be carried out using extended elastic impedance approach.

match between them is seen in both cases, which enhances our confidence in the application of the followed approach for the data at hand.

We take this analysis further and crossplot effective porosity and V_{clay} derived attributes as shown in figure 3a. Next, we enclose the cluster of points that exhibit high porosity and low values, or not-so-high values of V_{clay} with red, green and blue polygons, and back-project them on the vertical seismic. The latter step helps us understand where these cluster of points are coming



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from in the different zones of interest. In figure 3b we see the differentiation of the potential reservoirs within the three formations of interest, namely the StØ, Snadd and Kobbe formations.

Conclusion

In conclusion, we have characterized the direct hydrocarbon anomalies that we detected through the application of spectral decomposition, with more detailed analysis employing extended elastic impedance for deriving effective porosity and volume of clay from seismic data. The good correlation of these volumes with the available respective petrophysical well log curves has enhanced our confidence in their interpretation. [E](#)

Astrogeology Total Solar Eclipse 2017 Field Seminar 18-22 August 2017 | Casper, Wyoming

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- This unique event will be held in Casper, Wyoming, and features the chance to see the rare total solar eclipse on August 21, 2017. Attend and learn basic astronomy through presentations and star gazing. Jack Schmitt and Jim Reilly will be at the eclipse event to discuss the challenges of a manned mission to Mars, a return to the Moon and a new energy frontier with He-3 fusion.

- By attending, you will also have the opportunity for hands-on field geology at world-class paleontology sites and a documented terrestrial impact site. Make sure you take time to visit the historic petroleum geology sites around Casper, such as nearby Teapot Dome.

Pricing:

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AAPG

Learn more at aapg.to/fs2017eclipse

Upcoming Calendar Events:

Big Data & Deep Learning in the Oil Industry: Basics and Applications
22 May 2017

Drones and UAVs: Solving Problems, Finding Resources
23-24 May 2017

Online Opportunities with CEUs:

Introduction to Shale Gas

Geothermal Energy Basics: A Renewable Energy Certificate Course

Leadership and Strategic Thinking in the Oil & Gas Industry

Save \$20 / Archie 2: Application of Resistivity-tool-response Modeling for Formation Evaluation

Product #831 Sales price \$49 (reg \$69)

Understanding resistivity-tool response and resistivity-log interpretation for formation evaluation is vital for the matching of the reconstructed deep-reading resistivity logs with the field log curves. Written for geoscientists, engineers, petrophysicists, and reservoir engineers, AAPG Archie 2 introduces the fundamental concepts required. Resistivity-logging-tool physics and measurement accuracy are reviewed, and forward- and inverse-modeling resistivity-tool responses are introduced. In the case studies presented, well-deviation, shoulder-bed, bed-thickness, borehole, mud-resistivity, and invasion effects on resistivity-log responses are discussed.

Save \$12 / Memoir 33: Carbonate Depositional Environments

Product #656 Sales price \$47 (reg \$59)

Using a systematic treatment of the entire subject of carbonate depositional environments, this unique book is specifically designed for use by the non-specialist -- the petroleum geologist or field geologist -- who uses carbonate depositional environments in facies reconstructions and environmental interpretations. This classic work, covering settings from non-marine to deep water, focuses on the recognition of depositional environments with extensive use of color diagrams and photographs of sedimentary structures and facies assemblages.

Save \$15 / Memoir 86: Global Resource Estimates from Total Petroleum Systems

Product #782 Sales price \$24 (reg \$39)

Presented in this publication are the results of a major study of the petroleum resources of the world as analyzed by total petroleum systems. The distribution and volumes of resources available in these 149 systems and their constituent assessment units in 128 provinces and 96 countries are critically important for the future of the world's economies.

Save \$30 / Memoir 93: Shale Tectonics

Product #1023 Sales price \$69 (reg \$99)

This Memoir documents shale tectonics from a variety of basins around the world, including the southern Beaufort Sea; the Krishna-Godavari Basin, India; eastern offshore Trinidad; offshore Brunei; and along the westernmost portion of the Mediterranean Sea. The book also provides information on the petrographic framework, behavior, geometries, and geodynamic models of shales. Publication of this Memoir coincides with a growing interest in shales as hydrocarbon reservoirs, and will add to the body of literature that significantly addresses both extrusive and intrusive shales.

Save \$30 / Memoir 94: Thrust Fault-related Folding

Product #1065 Sales price \$65 (reg \$95)

Thrust fault-related folds form numerous important hydrocarbon traps in sub-aerial and deepwater fold and thrust belts as well as in inversion fold and thrust belts. This Memoir presents 16 papers on new advances in the analysis and understanding of thrust-related fold systems including detachment folds, thrust-fault propagation folds, wedge thrust-related fold systems, and basement-involved fold systems. Theoretical, geometric, numerical, and analog model studies of thrust-related fold systems combined with new seismic and field case studies highlight the challenges and new strategies needed to understand and to explore for hydrocarbons in fold and thrust belt systems.

Save \$30 / Memoir 96: Uncertainty Analysis and Reservoir Modeling

Product #1097 Sales price \$99 (reg \$129)

This Memoir presents a comprehensive survey of cutting-edge approaches used by industry to quantify the uncertainty in both conventional and unconventional reservoirs. Balanced between case histories and theory, the chapters in this volume equip experienced practitioners and those just entering the field with the theory, workflows and case history examples needed to make better reservoir management decisions in the uncertain world of the modern oil and gas field.

Save \$60 / Memoir 97: Shale Reservoirs: Giant Resources for the 21st Century

Product #1116 Sales price \$84 (reg \$144)

Shale reservoirs are not new. The first commercial hydrocarbon production in the United States was from a well drilled in 1821 in a shale gas reservoir. By 2000, more than 28,000 wells had been drilled in shale gas reservoirs. Now the exploitation of shale reservoirs is turning to natural gas liquids, condensate, and oil. Far from being isotropic and homogeneous, as once naively envisioned, shale reservoirs are complexly layered accumulations of fine-grained sediment. This Memoir focuses on the fact that shale reservoirs remain largely geologic plays - not merely lease plays or strictly engineering plays made possible by improvements in drilling and completion technology.

Save \$25 / Memoir 98: The Great American Carbonate Bank

Product #787 Sales price \$159 (reg \$184)

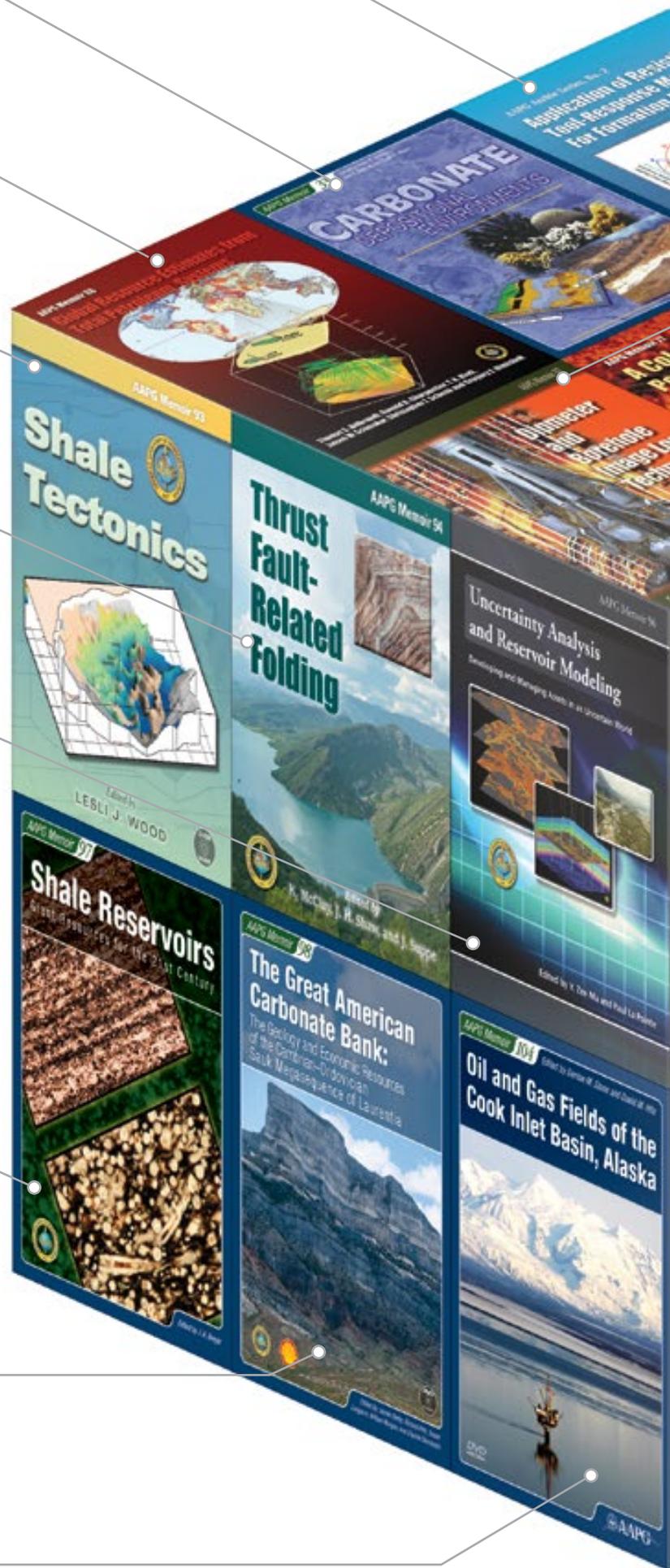
With a total of 1206 print and digital pages, this Memoir describes the biostratigraphy, ichnology, stratigraphy, depositional facies, diagenesis, and petroleum and mineral resources of the Great American Carbonate Bank (GACB). Comprised of the carbonates (and related siliciclastics) of the Sauk megasequence, which were deposited on and around the Laurentian continent during Cambrian through earliest Middle Ordovician, the GACB is one of the largest carbonate-dominated platforms of the Phanerozoic and this Memoir provides the basis for interpreting depositional patterns and the evolution of the Bank.

Save \$25 / Memoir 104: Oil and Gas Fields of the Cook Inlet Basin, Alaska

Product #1026 Sales price \$54 (reg \$79)

Designed to showcase the geo-technical elements of oil and gas fields of the Cook Inlet Basin of southcentral Alaska, this volume serves as a key reference to the petroleum geology of the Cook Inlet Basin for a wide audience including oil and gas explorers, technical professionals, students and those seeking more information about the origin and habitat of oil and gas in the area.

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Memoir 92: Dipmeter and Borehole Image Log Technology / Save \$30

Product #832 Sales price \$69 (reg \$99)

Borehole imaging is among the fastest and most accurate methods for collecting high resolution subsurface data. Recent breakthroughs in acquisition, tool design, and modeling software provide real-time subsurface images of incredible detail, from the drill bit straight to a workstation. Associated interpretation workflows offer the high level of detail that is needed to make operational decision and to increase the predictability of subsurface models. This Memoir portrays key applications of dipmeter and image log data across the exploration and production life cycle. It illustrates the value of integrating high-resolution dipmeter and borehole image data with seismic, well-log, and geological knowledge in order to construct integrated subsurface models. It provides the fundamentals of the technology for novice and specialist geoscientists and petroleum engineers alike, as well as introducing state-of-the-art applications.

Memoir 77: Color Guide to Petrography of Carbonate Rocks / Save \$13

Product #649 Sales price \$35 (reg \$48)

Carbonate petrography can be quite complicated. Changing assemblages of organisms through time, coupled with the randomness of thin-section cuts through complex shell forms, add to the difficulty of identifying skeletal grains. This book is designed to help deal with such challenges. It includes a wide variety of examples of commonly encountered skeletal and nonskeletal grains, cements, fabrics, and porosity types. It includes extensive new tables of age distributions, mineralogy, morphologic characteristics, environmental implications and keys to grain identification. It also encompasses a number of noncarbonate grains, that occur as accessory minerals in carbonate rocks or that may provide important biostratigraphic or paleoenvironmental information in carbonate strata. With this guide, students and other workers with little formal petrographic training should be able to examine thin sections or acetate peels under the microscope and interpret the main rock constituents and their depositional and diagenetic history.

Studies in Geology 53: Seismic Interpretation of Contractional Fault-related Folds / Save \$20

Product #731 Sales price \$49 (reg \$69)

This AAPG Seismic Atlas serves as an instructional guide and resource for the interpretation of complex structures imaged in seismic reflection profiles using quantitative fault-related folding theories. The emphasis is on contractional fault-related folds, including fault-bend folds, fault-propagation folds, detachment folds, shear fault-bend folds, imbricate thrust systems, and structural wedges. These types of structures form the majority of the large hydrocarbon traps in both orogenic and passive-margin fold and thrust belts worldwide.

Practical Enhanced Reservoir Engineering / Save \$40

Product #827 Sales price \$85 (reg \$125)

Published by PennWell, this book is a modern and very practical guide offering reservoir engineering fundamentals, advanced reservoir related topics, reservoir simulation fundamentals, and problems and case studies from around the world. It is designed to aid students and professionals alike in their active and important roles throughout the reservoir life cycle (discovery, delineation, development, production, and abandonment), and in the various phases of the reservoir management process (setting strategy, developing plan, implementing, monitoring, evaluating, and completing).

Studies in Geology 59: CO2 Sequestration in Geological Media / Save \$25

Product #739 Sales price \$64 (reg \$89)

The concept of storing or permanently storing carbon dioxide in geological media has gained increasing attention as part of the important technology option of carbon capture and storage within a portfolio of options aimed at reducing anthropogenic emissions of greenhouse gases to the earth's atmosphere. AAPG Studies 59 presents a compilation of state of the science contributions from the international research community on the topic of carbon dioxide sequestration in geological media, also called geosequestration.

Studies in Geology 63: Anatomy of a Giant Carbonate Reservoir / Save \$35

Product #1140 Sales price \$124 (reg \$159)

Using the Fullerton Clear Fork Field, Permian Basin, Texas as the case study, this publication documents, in detail, the necessary steps required to develop and test methodologies for improved imaging, measurement, modeling, and prediction of reservoir properties in carbonate reservoirs. The multidisciplinary study integrates geology, geophysics, petrophysics, engineering, and reservoir modeling to define reservoir architecture and the distribution of remaining oil in one of the largest carbonate reservoirs in the Permian Basin. The methods and results detailed here provide an excellent basis for improved characterization and remaining resource targeting that can be applied to all carbonate reservoirs.

Hydrocarbon Seepage: From Source to Surface / Save \$20

Product #1228 Sales price \$45 (reg \$65)

With the increased resolution power of many geophysical methods, we are seeing direct evidence of seeps on a wide variety of data, including conventional seismic. Published jointly by SEG and AAPG, this publication presents new methods and technology that have evolved to better measure and detect seeps and their artifacts and reservoir charge and to map migration and remigration routes. In addition, the importance of the detection of seepage is discussed in regard to minimizing the risks associated with shallow gas drilling hazards, ensuring platform stability, and preventing well blow-outs.

Studies in Geology 61: Sediment Transfer from Shelf to Deep Water: Revisiting the Delivery System / Save \$11

Product #1081 Sales price \$89 (reg \$100)

The topic of hyperpycnal flows and their deposits, hyperpycnites, has recently emerged as the latest in a long list of hotly debated topics on deep-water sedimentary processes, environments, and deposits. This collection of chapters offers important new insights into the sediment delivery system to deep-marine waters.

Studies in Geology 64: Heavy-oil and Oil-sand Petroleum Systems in Alberta and Beyond / Save \$40

Product #1187 Sales price \$95 (reg \$135)

Oil sands, including the Athabasca Oil Sands in northern Alberta, are the second largest hydrocarbon resource on earth. In the last decade, engineering technology has evolved that can now economically produce the bitumen resource in the oil sands. This volume showcases the geology of oil sands from around the world. It highlights the Athabasca Oil sands of northern Alberta and the geochemistry of the associated bitumen resource, but points directionally toward the development of other oil-sand deposits in the world. The papers, from authors employed in the industry, academic researchers, and government scientists, provide new updates and insights into the regional geology, nuances of detailed depositional systems, reservoir modeling, and emerging sustainability issues.

AAPG

Preparing the Next Generation of Geoscientists

By TAMRA CAMPBELL, Administration Team Coordinator

The AAPG Foundation is committed to the next generation of geoscientists, from introduction of geology through hands-on programs to grants and scholarships that aid students with their studies.

That support includes Foundation grants to university students through such high-profile programs as the L. Austin Weeks Undergraduate, Grants-in-Aid and the Deana and Paul Strunk Military Veterans Scholarship programs.

But support also goes to programs aimed at K-12 students and teachers.

In fact, the Foundation's Board of Trustees reviews proposals throughout the year from different individuals or organizations for geoscience projects – and thanks to the generosity of AAPG members, friends and colleagues, the Foundation has discretionary funding to give grants to programs that promote geology and geoscience to the next generation of geoscientists.

Here are two programs that the AAPG Foundation recently provided grants aimed at opening the eyes of the young to the possibilities of geoscience.

The Jack and Catherine Threet Quarry Geologic Guide Program

The Jack and Catherine Threet Quarry at Camp Cullen in Trinity, Texas, part of the YMCA of Greater Houston, introduces campers (ages 7-17) to geology through hands-on educational programming.



A Geoforce field trip to McKinney Falls State Park

This programming has a built-in level progression system that challenges them to expand their knowledge, and to deepen their interest in and passion for earth science.

One of the camp's unique features is an old quarry that was mined to build a logging railway in the 1890s. This quarry was traditionally used for large, nighttime campfires, but the staff at Camp Cullen had a bigger vision: They saw the sandstone and conglomerate layers with large-scale channels, cross bedding and pieces of petrified wood as a learning opportunity.

In the spring of 2014, Sam Houston

State University created a program guide for campers to walk independently through the quarry learning about the geology. Five large weatherproof posters funded by TGS enhanced this walk.

In 2015, Camp Cullen launched its Summer Geology Camp program, and more than 1,400 campers explored the area on guided tours led by geology counselors who helped ignite the campers' interest in studying rocks.

A grant from the AAPG Foundation provided funding to assist with staffing and program development.

Local geology students and professors from SHSU are now on hand

to staff the quarry – not only during summer camp, but also on weekends throughout the year when family camps, Adventure Guides, and other groups are present. They are able to share their knowledge and skills to educate and inspire children, teens and young adults to consider a career in geoscience.

GeoFORCE Texas

GeoFORCE Texas is an outreach program of the Jackson School of Geosciences at the University of Texas at Austin, designed to encourage high school students in southwest rural Texas and inner city Houston to tackle rigorous math and science curriculums in pursuit of higher education with an emphasis on geosciences.

It's all designed to help prepare students for tomorrow's high-tech workforce; the Foundation has provided annual grants for this program for a number of years, helping young people enter the field of geoscience.

More than 1,500 students have participated in the program since its inception in 2005, with 618 graduates – and 98 percent of them going to college.

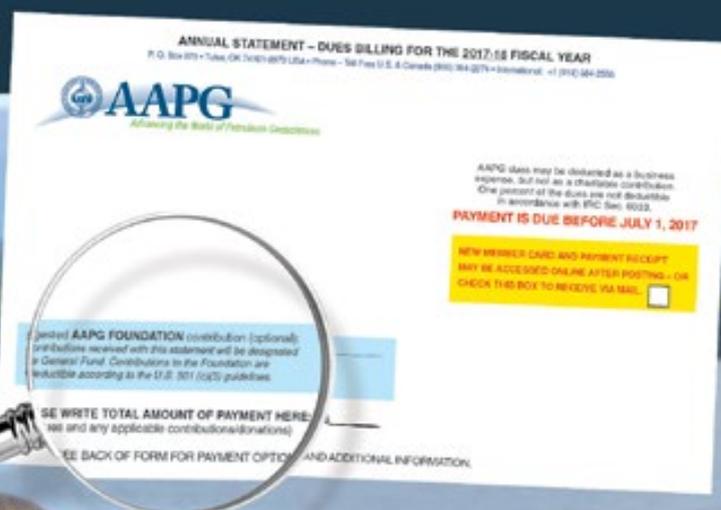
The academic content and rigors build each year, and summers are devoted to valuable field experiences:

- Ninth graders travel to Austin

Continued on next page

Enhance the future of geosciences by paying it forward.

It's easy. Support AAPG Foundation as you pay your dues. Simply locate the AAPG Foundation Contribution box and add your donation.*



Pay your dues through AAPG's website and designate your gift to your favorite geoscience fund. Donations made by mail will be designated to the General Fund.

Learn more on how your contributions to the AAPG Foundation help promote the geosciences by visiting

foundation.aapg.org

*Contributions to the AAPG Foundation are tax deductible according to U.S. 501 (c)3 guidelines.



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

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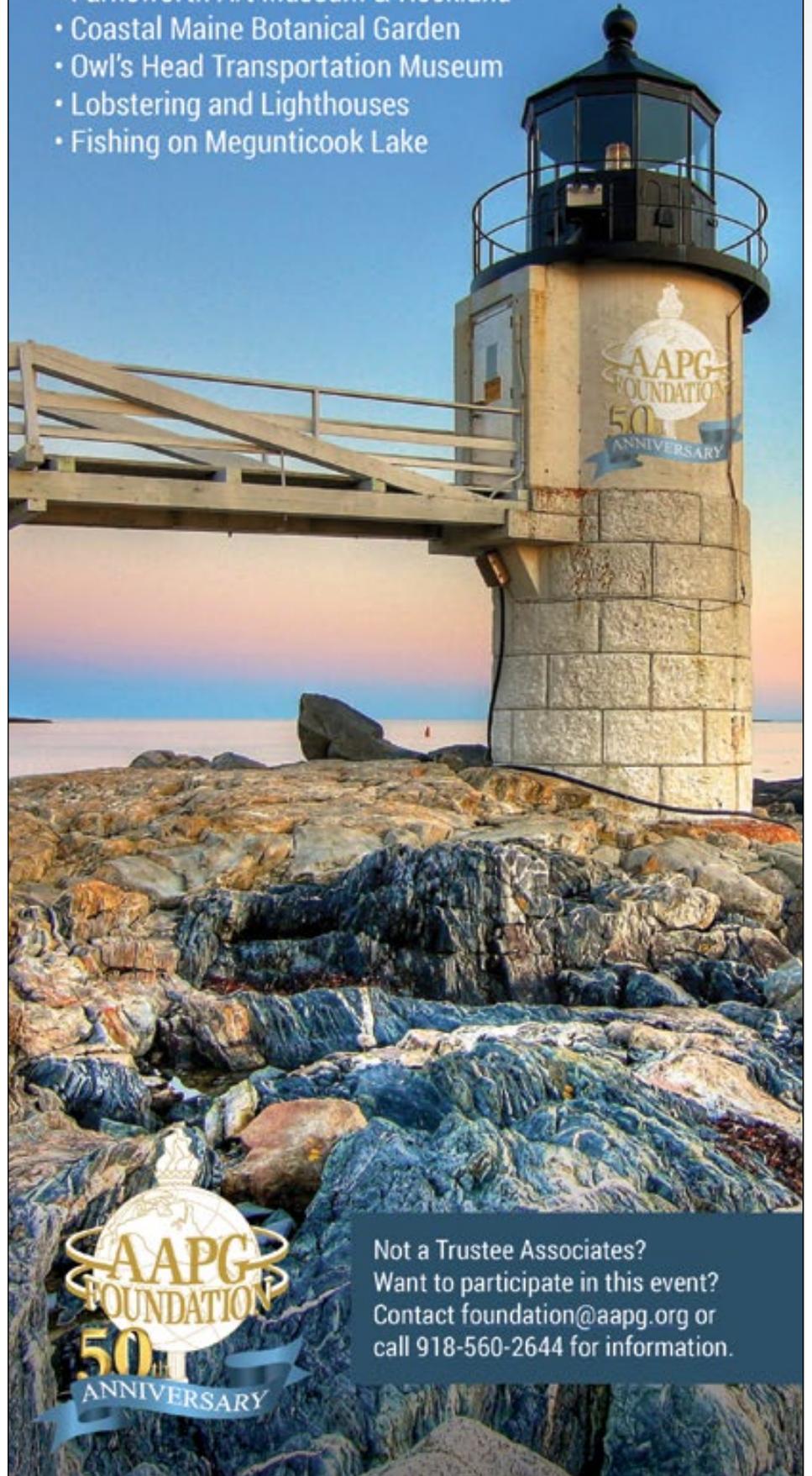
—Bev and David Worthington



40th Annual Trustee Associates Meeting
Samoset Resort, Rockport, Maine
September 20-24, 2017
Registration opens in June.

Learn about Foundation business and activities while exploring the Rockport area. Field trips and tours to:

- Bar Harbor and Acadia National Park
- Henry Knox Museum & Marshall Point Lighthouse
- Farnsworth Art Museum & Rockland
- Coastal Maine Botanical Garden
- Owl's Head Transportation Museum
- Lobstering and Lighthouses
- Fishing on Megunticook Lake



Continued from previous page

and Florida to study the sedimentary processes.

► High school sophomores go to Arizona and Utah, visiting the Grand Canyon and Zion national parks to study layered rocks and geologic time.

► Juniors travel to the Pacific Northwest to study tectonics and volcanic rocks, including visits to Mount St. Helens, Mount Hood, Newberry Crater and Crater Lake.

► Seniors traverse the Appalachian Mountains, learning about structural geology and metamorphic rocks.

GeoFORCE does not end with high school – mentoring continues into college, along with PSAT and SAT prep, and assistance with college and financial applications. GeoFORCE also

provides scholarships and internship opportunities for program alumni and training workshops for high school teachers.

AAPG Foundation has provided annual grants for this program for a number of years helping young people enter the field of geoscience.

* * *

These are just a few of the efforts of the AAPG Foundation to prepare the next generation of geoscientists.

You can read more about all programs supported by AAPG Foundation grants on the Foundation website and in the Foundation's annual report.

And to stay current on Foundation activities, update your AAPG profile to include "Foundation" news. [E](#)

ICE Set for London

The AAPG-SEG 2017 International Conference and Exhibition will be held Oct. 15-18 at the ExCel convention centre in London, UK.

The theme is "100 Years of Science Fueling 100 Years of Prosperity," and the event will gather geologists, geophysicists and other petroleum industry professionals from more than 60 countries to develop their knowledge, learn about new innovations and network with peers.

As an added bonus, the event will



include special programming and recognitions to continue the celebration of AAPG's 100th anniversary in 2017.

This is the fourth year that the event will be presented by both AAPG and the Society of Exploration Geophysicists.

For more information, visit london2017.iceevent.org.

Register For URTeC 2017

There's still time to register for the annual Unconventional Resources Technology Conference (URTeC) to be held July 24-25 at the Austin Convention Center in Austin, Texas.

Sponsored by AAPG, the Society of Petroleum Engineers (SPE) and the Society of Exploration Geophysicists (SEG), plus eight of the world's leading professional organizations, the cross-disciplinary conference and exhibition has become one of the leading events for unconventional exploration, drilling and production.

Last year's URTeC saw more than 2,500 attendees from more than 40 countries, nearly 300 technical presentations and 125 exhibiting



companies.

As the oil market begins to recover after a long downturn and the upstream industry is poised to reposition itself, this year's URTeC promises to be even bigger than in previous years.

For more information, visit urtec.org/2017.

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► Broadband seismic data

Submission deadline: 1 March 2017

Special-section editors: Benjamin Loidl, Mikael Garden, Christian Hanitzsch, Adriana Citali Ramirez, and Ehasan Naeini

► The Niobrara Petroleum System, a multi-basin resource play in the Rockies

Submission deadline: 1 March 2017

Special-section editors: Stephen A. Sonnenberg, R. Randy Ray, Denton O'Neal, Ben Dellenbach, Elena Finley, and Marcus Hinricher

► Time depth imaging of land data?

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Special-section editors: Gabriel Perez, Rob Vestrum, Paul Ware, William Hill, Hector Alfonso, Peter Cary, and Dennis Yanchak

FEBRUARY 2018

► Characterization of hydrocarbon and geothermal resource potential and carbon sequestration opportunities of the Pannonian Basin

Submission deadline: 1 May 2017

Special-section editors: Balazs Nemeth, Gábor Bada, Michal Kovac, Csaba Krezsek, Dejan Radivojevic, Bruno Tomljenovic, and Gábor Tari

► Low-permeability resource plays of the Western Canada Sedimentary Basin: Defining the sweet spots

Submission deadline: 1 June 2017

Special-section editors: Per Pedersen and David Eaton

MAY 2018

► Geocellular models

Submission deadline: 1 August 2017

Special section editors: Sharma Dronamraju, Michael Pycrz, Michael King, and Kurt J. Marfurt

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Submission deadline: 1 September 2017

Special section editors: Guangfa Zhong, Xiaomin Zhu, Marcilio Castro de Matos, Dallas B. Dunlap, and Huaqing Liu

AUGUST 2018

► Multiphysics imaging for exploration and reservoir monitoring

Submission deadline: 1 October 2017

Special section editors: Yunsong Huang, Aria Abubakar, Daniele Colombo, Kai Gao, Jungho Kim, Marco Mantovani, Maxwell Azuka Meju, Changsoo Shin, Aldo Vesnaver, Rui Yan, Min Yang, Peng Yu, and Luolei Zhang

Specialties

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petrophysicist, tectonics/structural geologist, seismic stratigrapher/sedimentologist and overall seismic interpreter/team captain/whip-cracker. Each team member started the process of building a 25-minute presentation by contributing the necessary slides on his or her specialty area.

Mann said, "By the end of the eight weeks, the divisions between specialties start to blur as each member begins to understand the roles of their teammates," which is by design, actually.

There were some hiccups.

"We lost one of our five members (Andrew Steier) as the best man at his brothers wedding on the same day as the IBA finals – but the man down didn't really matter in the finals. The other four members were able to step up, cover his presentation role, and ably handle the judges questions on his specialty area," Mann recounted.

Specifically, the UH team consisted of five EAS doctoral and graduate students: Delaney Robinson (pursuing her doctorate), Walter Reed (master's), Eric Lunn (doctoral and team captain), Andrew Steier (master's), and Leiser Silva (master's). The team's faculty advisers include Mann, Castagna, Julia Wellner and Kurt Rudolph. Industry advisers include Mike Liebelt and Mark Richardson.

Mann said half the winnings – \$10,000 – will be split evenly among team members.

"This amount per team member is consistent with the amount received by our UH winner for the 2017 AAPG Best Student Poster award, Lucia Torrado, who received a \$2,000 poster prize payment." (See related story.)

"The \$10,000 balance of the IBA funds will go our UH AAPG student chapter, the Wildcatters, to help support their activities in coming years that include invited speakers, field trips, student travel to present at meetings, short courses, and other activities," said Mann.

Not Just a Game

The point of all of this is preparing students for future work in the industry.

"Almost all of our UH IBA team members since 2012 are working in the oil and gas industry and demonstrate the practical value of the 'IBA experience' at UH. Our challenge now," he said, "is to continue to produce consistently strong UH teams year after year – and attempt to win the Gulf Coast region and world finals for a second time."

He mentioned how only one team has won the IBA finals twice since the start of the IBA program in 2006. You guessed it. University of Louisiana, Lafayette.

Get ready for the rematch in 2018.

Visit <http://library.seg.org/page/Interpretation-special-sections> for more details about these sections.

*E-mail interpretation@seg.org to inquire about submitting manuscripts past the submission deadline. Some sections may have increased flexibility regarding submission and review dates.

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

AI from page 6

"If you walk down a hall in a company anymore, you hardly ever see a microscope. It's all on the computer screen," Slatt noted.

Humans Needed

He's also concerned about a move away from fieldwork for geology undergraduates and the shrinking number of schools offering petroleum geology education.

We seem to be in a period when Earth sciences of all types are increasing in importance for the world, but diminishing in attention and esteem.

"Fewer universities offer summer field courses as part of the curriculum. Some have cut it out completely, some universities have cut way back," Slatt observed.

"There are also fewer universities offering petroleum geology degrees. We get a lot more applicants than we can accept into our petroleum geology program," he said.

Developments in artificial intelligence have led to talk about creating a "computer geologist" or a "virtual geologist" – an AI program that can carry out the functions of a professional geologist, Wood noted.

She said one reason that won't work is "computers won't be asked the innovative questions." Woods thinks future geologists need more training in asking the right questions in an organized approach to solving problems.

"One of the things we don't teach enough, at the elementary to high school level and even at the undergraduate level, is an organization process for scientific examination," Wood said. "We teach students to look for answers, but we don't teach them to identify the pertinent questions."

Another problem with a strictly computerized approach to geoscience is the over-reliance on massive, generalized, unbiased data, she said, citing engineers who believe that reservoir models can be conditioned simply by amassing data.

"I tell my kids when they graduate they're getting paid to bias the data – with good ideas and good approaches to selecting well sites, for instance, instead of just plotting points on a map," Wood said.

"There's something to be said for siting a well and putting down a hole and testing your scientific knowledge," she added.

Enter Generation Z

In the long run, over many decades, knowing what to teach is more of an adjustment than a commitment to known science. Consider that 30 years ago it would have been perfectly acceptable to teach that extremely low-porosity formations like tight sandstones or shales couldn't be commercially productive reservoirs.

Oops.

"You always have to recognize that technological advances happen, and what isn't productive today may turn out to be a huge reservoir tomorrow," Wood said, giving methane hydrates as an example of a too-often overlooked resource that could become a vital energy source in the future.

Two other important considerations will affect the future of geoscience education. One is the type of students entering universities, their background knowledge, their experiences and expectations, their generational characteristics.

Slatt said he's already seen a significant difference as millennials have entered and graduated from the university. Now some post-millennials, or members of Generation Z, are starting their undergraduate years.

"The millennials who are entering the work force, their motto is 'quality of life.' That's going to cause some real changes in the workplace," he noted.

Also, university geoscience courses of the future promise to be less male-dominated, bringing about another kind of change. Yes, there will be more women in geoscience.

"As you see more parents encouraging their daughters to go into any occupation they want to, we're beginning to see the end of this pigeonholing of women" into certain fields, Wood said.

The second consideration is a highly important question with an unknowable answer at this point: Where will the great geoscience teachers of the future come from?

"There's a strong need for good teachers who like to work with people," Wood noted.

What would she say if one of her students expressed an interest in university-level geoscience education as a career?

"I'd ask them, 'Do you like to write? Do you like to read other people's writing?' Because that's what you spend a lot of time doing," she said. "I'd ask them, 'Do you like to see other people grow into their own success?'" 

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UH Student Wins Poster Competition

By BARRY FRIEDMAN, EXPLORER Correspondent

Lucia Torrado, who is currently pursuing her doctorate in geology at the University of Houston with the Caribbean Basins, Tectonics and Hydrocarbons (CBTH) Consortium, had been here before.

And “here” was the AAPG Student Poster Competition, held yearly at the AAPG Annual Convention and Exhibition.

She had come in third place in 2013, but this year, the competition, she said, had a “vibe” to it.

Apparently so. She won.

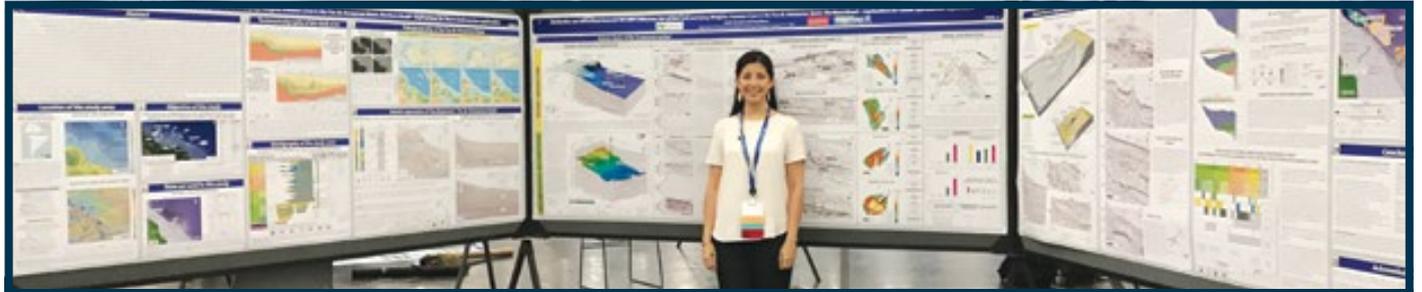
“Yes, this time it felt a little different,” she said to the atmosphere this past April. She chalked up the aforementioned “vibe,” in part, to the fact that her classmates at the University of Houston were also in the process of taking home the grand prize at the IBA. (See related story.)

“The meeting was bigger than any other AAPG (meeting) that I have ever attended, with more people from the industry, which also meant more feedback and networking opportunities,” said Torrado.

It was a good time to shine.

The Winning Poster

Torrado's poster was “Similarities and Differences Between the Late Cretaceous Fan Complex and the Overlying Neogene Amazon Cone in the Foz do Amazonas Basin, Northern Brazil – Implications for Future Hydrocarbon Exploration,” which studied the northernmost basin offshore Brazil, the deep-water portion of the Foz do Amazonas basin, which includes the Amazon delta (or Amazon Cone).



Lucia Torrado won the AAPG Student Poster Competition for “Similarities and Differences Between the Late Cretaceous Fan Complex and the Overlying Neogene Amazon Cone in the Foz do Amazonas Basin, Northern Brazil – Implications for Future Hydrocarbon Exploration.”

“I compared two deep-water systems within the basin from a seismic stratigraphic point of view: a Late Cretaceous turbidite system versus the modern example of the Amazon delta, and estimated their quality as reservoirs,” she said.

This is of particular importance, as this Late Cretaceous turbidite system has become a play that has been recently drilled along the Mid-Atlantic margin (with good success). Her study, she believes, will shed light over this potential play in northern Brazil.

“I conducted a 1-D model for hydrocarbon generation, and considered the consequences of the existence of a massive delta like the Amazon Cone, not only in terms of oil and gas generation, but also for the future drilling campaigns that are going to take place in this area in the near future,” said Torrado.

Stiff Competition

It's a tense undertaking, these poster competitions, for they attract more than

100 abstracts from students throughout the country. Of those, 15 get chosen.

“The main challenge presenting this poster was trying to convey a clear message in a short amount of time to geoscientist who may – or may not – be familiar with the topic and/or the area,” she said.

Which is exactly the point. The competition is designed for students to convey an idea (along with their technical knowledge) to a group of people in an informal setting, as well as create an opportunity to network through interaction between author and viewer, all with the goal of being able to communicate the skills they would bring to an employment opportunity.

Torrado submitted her abstract back in September and learned that her poster was chosen to compete in early November.

That's when the work really began.

“From that moment,” she said, “I knew that I would be participating in the competition.”

“Every Friday our research group had a meeting, so I would present to my fellow

students and supervisor the progress that I had made so far with my poster, including new figures, mock-ups, interpretation or the overall design of the poster. Their feedback helped tremendously through this process.”

(Also of some note, abstracts from three other students from the University of Houston were in the competition.)

The Winning Strategy

Looking back on her poster, to further explain the “vibe,” Torrado thinks a couple of factors went into her victory.

“The strength of my poster was that I had good visual aids like big, clean, colorful figures – that included high-resolution seismic – and it was also easy to read from a distance,” she said, referring to the details in the figure, as well as the color palettes, scales, units, location, orientation, etc.

“Each sections of the poster included major key points and were numbered consecutively, so it was organized in a way

[See Goal, page 33](#)



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How to Get a Job in Petroleum Geology

By COURTNEY CHADNEY, EXPLORER Correspondent

Summer break is fast approaching. For most university students, this means freedom and fun, but if you're hoping to be a petroleum geologist, you should be spending those long-awaited vacation days at an internship instead of by the pool.

This is according to recruiters at Chevron, BHP Billiton and Marathon Oil.

In fact, they say, with the job market more competitive than ever – both for the employer and prospective employee – internships are key.

"Candidates we consider hiring are more involved than candidates from previous years: seeking internship opportunities earlier in their academic careers; building, maintaining and fostering professional networks, and taking initiative to sculpt an experience base and skillset that places them in a competitive position," said Dan Oakes, Marathon Oil's petrotech development and university relations supervisor.

"We take a strategic approach in leveraging the opportunities we have to interact with a candidate prior to offering a full time position. This ultimately results in almost all new university graduate hires coming from our intern pool," he added.

Internships demonstrate students' technical experience and abilities in oil and gas applications, but also allow students to ensure the company and work are a good fit, explained Amy DeGeest, Chevron's development geologist for major capital projects. She emphasized that students' hectic schedules are no excuse to delay seeking internships, as Chevron will work with students and faculty to be more flexible on timing.

BHP Billiton won't recruit graduates who haven't gone through their particular internship program first, explained Paul McIntosh, the company's vice president of geoscience for petroleum.

His career with BHP Billiton began with the company's 1989 graduate/ internship program based in Melbourne, Australia. BHP Billiton internship applicants must also have a master's or doctorate or be currently in the process of obtaining their degree before they can be considered. Once accepted, their interns undergo a two to three-year program with on-the-job experience involving two or three rotations to broaden their experience, and they are required to take guided course trainings during the process.

"People seeking a petroleum geology position have a unique advantage of a few extra years in school compared to other petrotechs (i.e. engineers) as a master's degree is soon (if not already) becoming a requirement," said Erin Roehrig, a geologist with Marathon Oil.

However, this should not be seen as an opportunity to delay the pursuit of employment," he added.

He advises students to build their resume during their undergraduate studies by participating in local geology chapters and seeking summer internships in the field.

"As a freshman or sophomore it may be difficult to find an office job interning as an exploration geologist; however mudlogging and geosteering positions are available and are a great place to start," he added.

In summary, petroleum geologist job requirements for all companies are essentially the same:

- ▶ Strong technical backgrounds in Earth Science; master's/ doctorate required
- ▶ Ability to communicate topics to diverse groups clearly displaying methodology, results and impact
- ▶ Willingness to work collaboratively on cross-functional teams and demonstrating leadership and teamwork

However, applicants differentiate themselves by:

- ▶ Starting early
- ▶ Researching companies recruiting methods and internship/ job requirements thoroughly, including: timelines, requirements, company statistics and culture.
- ▶ Being consistently visible (participating in organizational meetings, local society chapters, job fairs, AAPG events and submitting applications online)
- ▶ Communicating clearly with a polished resume at events; leaving a lasting impact in 15 minutes or less
- ▶ Practicing for interviews
- ▶ Gaining internship and field experience
- ▶ Remaining flexible to locations and positions; specifically, having a willingness to work in more locations means more possible positions

Recruiting Process

For summer internships, the process of interviewing prospects on campuses and at student expos begins in the early fall the year prior, and positions are typically full by November. As different companies have varied methods of recruitment, McIntosh recommended that students need to be proactive in their research.

For example, BHP Billiton only visits the campuses of the University of Texas, Texas A&M, the University of Oklahoma, Colorado School of Mines and Stanford University to recruit. Meanwhile, Marathon Oil relies heavily on technology for their recruiting, beginning with online posts to narrow the candidate pool via minimum GPA and other basic requirements, followed by a round of virtual interviews.

For students whose schools might not be visited by Chevron, BHP Billiton and Marathon Oil, these companies mentioned recruiting from AAPG/SEG events like the Fall Student Expo in Houston or the Rocky Mountain Rendezvous at the University of Wyoming.

Getting Prepared

At recruiting events, companies expect students to be prepared to discuss their research and technical backgrounds, answer questions about workplace behavior and articulate their interests in the industry.

McIntosh noted the importance of being able to communicate all of the above, plus career interests and passions, in 15 minutes or less.

See Presentation, page 33

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PROTRACKS

YP Co-Chairs' Wild Ride

By JONATHAN ALLEN and MEREDITH FABER, YP SIG Co-Chairs

This ProTracks marks our last column as chairs of the Young Professionals Special Interest Group (YP SIG). We have been involved with the YPs for a collective 15 years (Meredith for 9; Jonathan for 8).

It has been a wild ride, having been involved in the YPs' evolution from an inactive and relatively unknown membership committee 10 years ago to the first SIG of the Association. We both felt a great weight of responsibility taking over the YPs from the outstanding leadership of Natasha Rigg and Nick Lagrillière, and we hope our tenure has been productive for the Association and our members.

Looking Back

The YPs have accomplished a great deal in the last 10 years and we have an ambitious plan for the future. Today, the YPs have a significant presence in every Section and Region, with at least one YP SIG coordinator managing the area's members and providing them with programs that include technical skill development in the form of lectures, short courses, and fieldtrips, leadership training, networking, and community involvement. The YP Meet and Greet at the Annual Convention and Exhibition (ACE), the International Conference and Exhibition (ICE), and many of the Region/Section meetings has connected thousands of AAPG members across the globe. The relationships we have built within the Association, such as with education, student chapters and the Division of Professional Affairs, as well as with affiliated organizations like the Society of Petroleum Engineers, Young Professionals in Energy, Canadian Society of Petroleum Geologists and others, have resulted in cross-organizational partnerships with a diverse set of offerings and attendees. We are hosting local YP technical conferences, field trips and technical sessions at ACE and ICE, and consistently communicating the value of AAPG to our members.

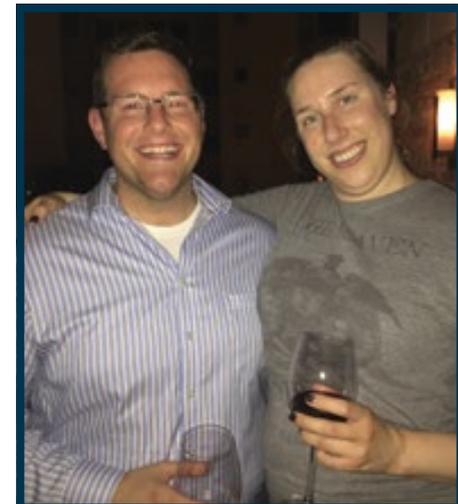
YP Leadership Summit

Most importantly, we have created a talent pipeline for the Association through our most valuable program, the Young Professionals Leadership Summit (YPLS).

Now in its eighth year, the YPLS has had 65 people consistently attend and participate since 2010. Aimed at introducing YPs to the Association and providing attendees with the tools, information and contacts needed to be successful leaders, the YPLS has produced an impressive group of active and engaged members of our Association.

Along with the aforementioned consistent, committed participation, let's look at YPLS by some other numbers:

- ▶ There are 18 AAPG committees with YPLS participants.
- ▶ There are 15 HoD Delegates or Alternates with YPLS participants.
- ▶ YPLS boasts 11 participants who are national AAPG Honors and Award Recipients (Distinguished Service, Matson, Levorsen, Young Professionals Exemplary Service).
- ▶ There are 10 YPLS participants who are current committee leaders.
- ▶ There are nine YPLS participants who are



Region/Section officers including president, vice president, secretary, and treasurer positions.

- ▶ There are seven DPA members from YPLS.
- ▶ One YPLS participant is a Division president and Advisory Council member.

This list doesn't include the involvement of this group as leaders within their local societies, members of the organizing committees of regional, national and international AAPG meetings, or a myriad of other volunteer work they have done as Members of this Association. Nor does it account for the many other YPs that are actively involved with AAPG.

Looking Ahead

We have been encouraged to see that the work of the YPs has not gone unnoticed. Several Sections and Regions now have awards recognizing the valuable contributions of their YP members. It was a proud moment to see four of our past YPLS participants take the stage at the 2017 ACE, celebrating AAPG's 100th anniversary and accepting the first ever Young Professionals Exemplary Service Awards. While some might think that the YPs are part of the "everyone gets a trophy" generation, there is no questioning the dedication and commitment these members have shown to the Association.

We're excited to see what the incoming chairs of the YP SIG, Robynn Dicks and Ryan Lemiski, have planned for the YPs. We're excited to see our YP SIG members grow and become the leaders and stewards of an organization that has given us so much. Through our involvement with AAPG, we have gained innumerable friendships, experienced many late-night shenanigans, and seen our careers grow technically and professionally. This is the goal we have for all our YP members in AAPG and we're grateful for the journey that has brought us to this point.

Celebrating the 100th Anniversary at ACE

One last note: the Young Professionals SIG hosted a series of events including the popular YP Meet & Greet, YP Networking Reception, and partnered with DPA to host a special session on the Future of Energy: Essential Tools for the Next Generation of Geoscientists. A very special thank you to Noble and Shell for sponsoring the YP activities. We're looking forward to Salt Lake City!

Goal from page 30

that it had a nice, easy flow. Some people would come up to my poster and read by themselves without any extra explanation required, so it was basically self-explanatory. I tried to make the best use of the three panels that we were given, finding a good balance between texts and figures, which translate into an effective poster."

"I also kept in mind that this was an AAPG meeting, so I included the direct impact of my research in the oil and gas industry."

There was one more important consideration, aside from the posters and graphs and vivid colors.

"Having a three to five-minute speech prepared is crucial too," she said, "along

with being open to any type of questions and feedback."

Torrado, who was born in Colombia, said that being selected in this session was an honor in itself, but knows there's something more important in front of her, even more than winning.

"My main goal in the near future is to obtain my doctorate in geology by fall of 2018," at which point she hopes to have a "couple of papers published and at least three more papers under review."

Her goal, not surprisingly is to work in exploration for an oil and gas company where she can apply the knowledge and skills obtained while pursuing graduate studies.

"In the long-term, I would like to grow with a company where I can continue to learn, gain experience, take on additional responsibilities, and contribute back as well," she said. 

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Presentation from page 31

"Most recruiters have already interviewed or spoken to ten people before you, so you need to be brief and leave a lasting impression," he noted.

Students should also show up to career fairs, events and informational sessions with a polished resume, taking advantage their campus career centers beforehand. DeGeest explained that "recruiters get a lot of resumes, and while we try hard to review all of them thoroughly, having a short conversation with a student where they can walk us through the key points really helps."

She recommended making sure resumes highlight the most important characteristics and experiences without burying key details; in other words: quality over quantity.

Presentation and speaking skills are one key characteristic Chevron looks for that students might not recognize as important.

"Just like grant-funded research, companies have limited amount of capital to spend, and ideas and concepts must be vetted and compared to other opportunities. In order to progress ideas, get effective feedback and develop concepts, we must be able to efficiently and effectively share our work with a wide range of audiences from technical peers to upper management" elaborated DeGeest.

And, there are other features companies look for, like the ability to collaborate on teams and see from

different perspectives. Also, McIntosh recommended showing leadership skills outside of your technical subject, through other clubs or leadership bodies on or outside of campus.

Roehrig further pointed out that recruiters love to see a candidate's personality: "looking for stand-out experiences that can be non-industry related, like studying abroad, hobbies and personal passions," which may even be the deciding factor in selecting one candidate over another.

DeGeest noted that students should be aware that companies are aiming to increase efficiencies in this low price environment, meaning that many have reduced the number of interviews and time spent on campuses. However, she assures future petroleum geologists that there are opportunities with a range of technical focuses beyond just direct studies on oil and gas, and thus it is important for them to be flexible.

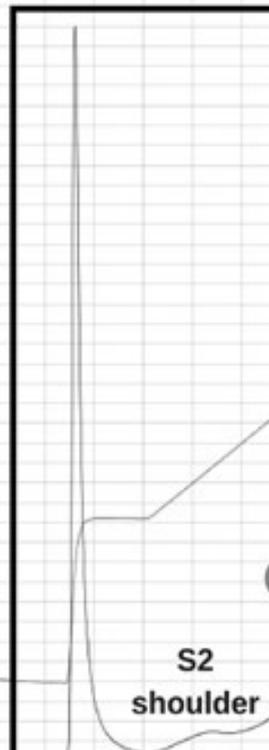
"We are looking for excellent students with a strong drive to understand Earth science, ask questions, and solve problems collaboratively," she said. "We have a variety of roles for Earth scientists that range from those working in existing field operations all the way to strategic R&Ds," long as students articulate the impact of their work and how these experiences can be applied to oil and gas exploration and production, there are many job spaces available in their future.

Finally, as someone who has been successfully navigated the process and is now on the other side of it, McIntosh said, "Start early! If you've waited until you've graduated, then you are already too late." 

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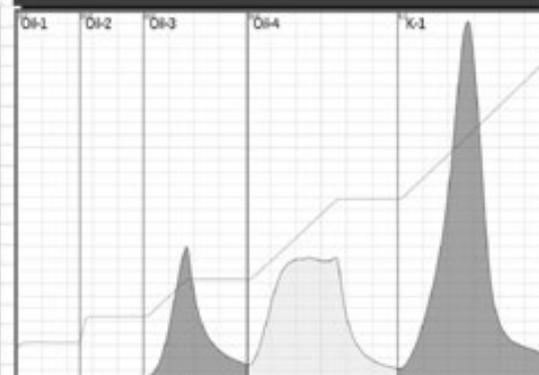
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All Eyes Are on Unconventionals

By DAVID CURTISS

The Federal Reserve Bank of Dallas is one of twelve regional Reserve Banks in the U.S. Federal Reserve System, the nation's central bank. Its jurisdiction covers Texas and parts of Louisiana and New Mexico, and because of that it has a strong interest in oil and gas activities in the region and their impact on the economy.

Each month the bank publishes its Energy Indicators newsletter. The May 2017 edition details increased production, employment and rig activity, particularly in the Permian Basin.

Nearly 40 percent of rigs operating in the U.S. are now active in the Permian Basin, and as a result, Texas has seen increases in direct and indirect oil and gas employment in each of the last three months. This increased activity is showing up in production numbers with April showing an increase of 61,200 barrels per day (b/d) to 2.36 million b/d in the Permian and an increase of 26,000 b/d to 1.21 million b/d in the Eagle Ford.

As U.S. production continues to grow, all eyes are focused on OPEC and its recent May 25 meeting to determine whether to keep production cuts in place in an effort to maintain oil prices.

An Integrated Approach

But as both OPEC and non-OPEC producers are realizing, the drive for efficiency and lower costs in basins with unconventional resources in the U.S. is a



CURTISS

"The anecdotal stories we hear back from industry are compelling validation that this approach to conferences is directly meeting a specific need ..."

significant influence on global oil markets, and it is going to be a significant focus next month at the Unconventional Resources Technology Conference (URTeC).

URTeC is a joint conference organized by the Society of Petroleum Engineers (SPE), AAPG, and the Society of Exploration Geophysicists (SEG), along with nine supporting organizations, representing a broad array of engineering and science disciplines. Accurately described as the premier integrated event for unconventional resources teams, we're headed to Austin, Texas from July 24-26. What makes URTeC different is our commitment to creating a conference that facilitates multi- and interdisciplinary learning and approaches to solving exploration and production challenges for unconventional resources.

This will be the fifth installment of URTeC and the anecdotal stories we hear back from industry are compelling validation that this approach to conferences is directly meeting a specific need. Speaking

to executives at companies active in unconventional plays, the word we receive is that their technical folks want to be at URTeC, rather than at a discipline-specific conference. If geoscientists and engineers are working together as a team to develop an unconventional resource, it stands to reason that attending and presenting together at a conference focused on these issues is attractive.

The technical program committee co-chaired by Tom Blasingame of Texas A&M University, Shawn Maxwell of IMA&E and Doug Valleau of Hess Corporation has developed a stellar program, with more than 200 oral presentations, more than 100 ePaper presentations, four panel sessions, nine topical breakfasts and luncheons and eight short courses. In addition, we have more than 100 exhibitors signed up to attend URTeC this year, showcasing the new technology and services.

The expanding influence of unconventional resources has the world's attention, and URTeC in Austin is the place

to learn the latest on new and emerging plays, new insights and understanding about unconventional resources and to connect you with other professionals. I hope to see you there!

Welcome to the New Executive Committee

A final note: June marks the end of our fiscal year. That obviously means our accounting team is as busy as ever closing the books on the past year. But it also means we say goodbye to outgoing members of our Executive Committee and welcome new members: Denise Cox as incoming president-elect, David Cook as incoming vice president of Regions, and Laura Johnson as incoming secretary.

Please join me in thanking President Paul Britt, Vice President of Regions Peter Lloyd, Secretary Heather LaReau and House of Delegates Chair Jim McGray for their dedicated service to the Association and its members.

What most members never see is the amount of time and energy that our Executive Committee devotes to guiding and directing AAPG's path. We owe them a debt of gratitude, and it's been a privilege to work with each of these dedicated leaders.

David H. Curtiss

DIVISIONS REPORT: DEG

Appreciation for a Year of Service

By TIMOTHY MURIN, DEG President

Appreciation: "the recognition and enjoyment of the good qualities of someone or something."

This defines all of the research done by the scientists and others who volunteer their time serving the Division of Environmental Geosciences.

One hundred years... a milestone for AAPG. Indeed, an accomplishment, especially given the cyclicity of the petroleum industry!

Although the DEG is much "younger," our goal is to continue serving AAPG's membership, and the public, regarding environmental issues related to energy development.

This effort was showcased at 2017 ACE, where the DEG was involved in:

- ▶ Three Oral and Poster Sessions, and two Forums (one each co-sponsored with the

- Energy Minerals Division and Division of Professional Affairs)

- ▶ Luncheon, co-sponsored with the EMD

- ▶ DEG awards (see accompanying list)

Ongoing research is a priority of the Division. Three publications related to CO₂ sequestration appeared in the March issue of the Environmental Geosciences journal. They include:

- ▶ "A revised assessment of the CO₂ storage capacity and enhanced oil recovery potential in the major oilfields of Ohio," J. Hawkins, S. Mishra, R. Stowe,



MURIN

"Always remember, good science is paramount to solving problems, and ignorance is not bliss."

Bylaws

K. Makwana, J. Main.

- ▶ "Geologic carbon sequestration potential of the Ordovician St. Peter Sandstone, Michigan and Illinois Basins, USA." D. Barnes, K. Ellett, J. Rupp.

- ▶ "Characterization of porosity and pore-size distribution using multiple analytical tools: Implications for carbonate reservoir characterization in geologic storage of CO₂." C. Medina, M. Mastalerz, J. Rupp.

The recipients of DEG awards include:

Public Outreach: Stephen Testa

Research: Angela Goodman, Christopher Lombardi

Teaching: Rachel O'Brien

Corporate Award for Excellence in Environmental Stewardship: Chesapeake Energy

Honorary Membership: N.J. Anne Fix

Certificate of Merit: Francois Marechal

Best Poster: N. D. Webb: "The

Division's Executive Committee has approved amending its bylaws. The changes include adding another administrative committee (Honors and Awards), and eliminating the three Standing Technical Committees (Hydrogeology, Environmental Geophysics and CO₂ Sequestration).

Instead, to comply with AAPG's Executive Committee's request, less structured ad hoc technical committees will

Mississippian Thick Cypress Sandstone: A Nonconventional CO₂-EOR Target in the Illinois Basin."

Best Paper (tie): K. MacLennan, G. Nieuwenhuis, V. Ramadoss, M. Wilt, M. Wilkinson: "Imaging CO₂ Sequestration at an Enhanced Oil Recovery Site Using the Depth-to-Surface Resistivity Method." A. Wendt, Z. Li, C. You, M. Gonzales, F. Wu, S. Brantley: "Data Mining Techniques Applied to Marcellus Shale Gas Development in Northeastern Pennsylvania."

be formed to address current topics facing the petroleum industry. Research papers will be developed and/or identified for presentations at meetings, in the Division's newsletter (Spheres of Influence), the Environmental Geosciences journal, special publications, the Bulletin or the Explorer. The "Hydraulic Fracturing" white paper, on our website, is an example of one of the topics that will be addressed.

The revised bylaws will be sent to both AAPG's Executive Committee and the DEG members for their final approval.

Appreciation

As my term ends on June 30, I want to give sincere thanks to those that served on our Executive Committee and Advisory Board. Of course, the AAPG staff should be recognized too. In particular, to Diane Keim, who always provided the much-needed support to the Division, and also to Vicki Beighle, Bryan Haws, Brian Ervin and David Curtiss.

I have very much enjoyed representing the Division as its president. It has given me the opportunity to work with all levels of AAPG membership in the United States and internationally. AAPG is truly a global organization.

If our efforts over the past year have helped AAPG members to better appreciate potential environmental issues while exploring for, and producing, fossil fuels, we have been successful. Always remember, good science is paramount to solving problems, and ignorance is not bliss!

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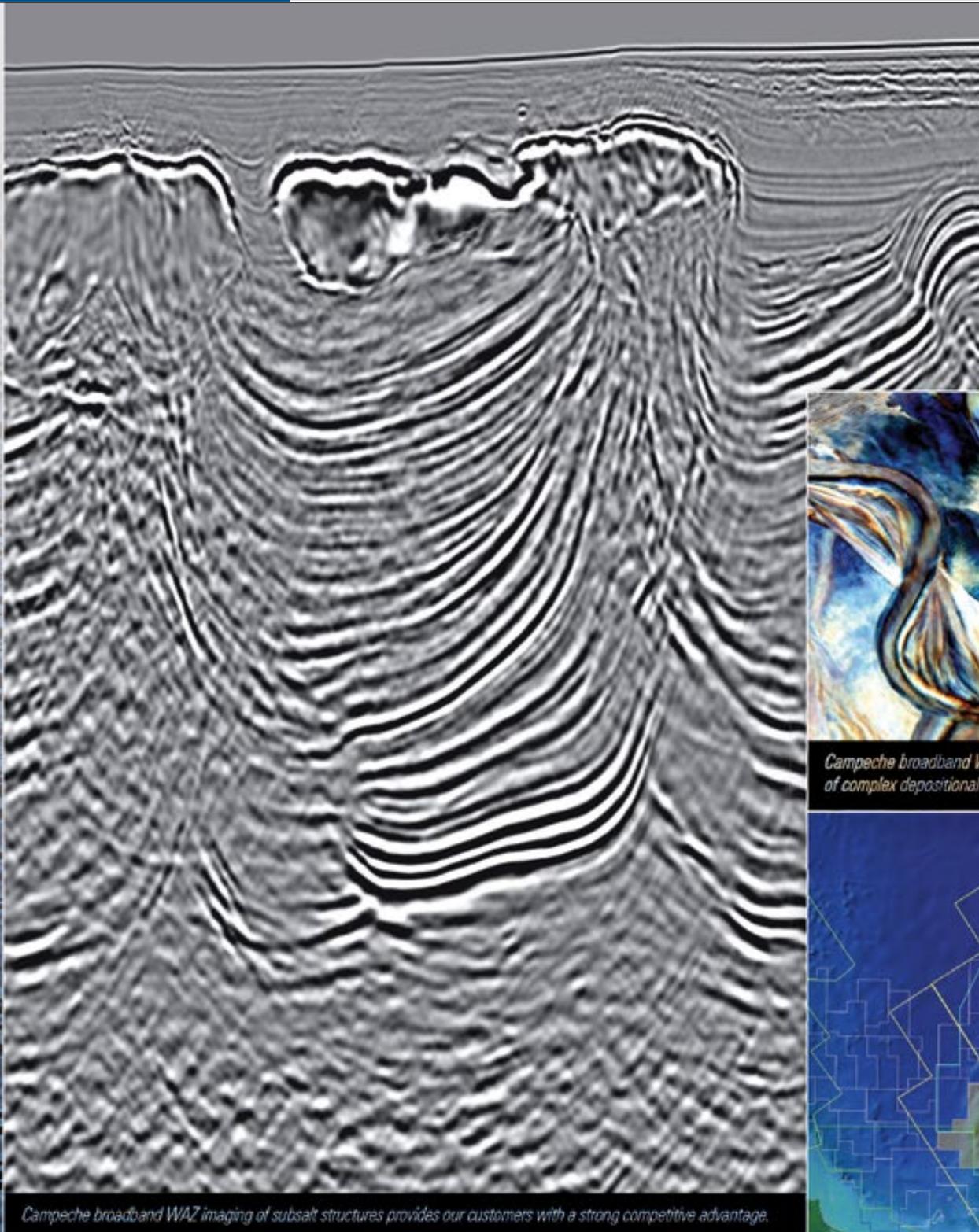
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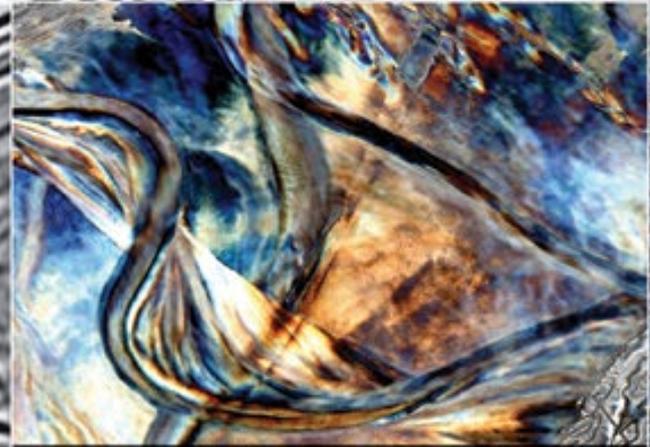
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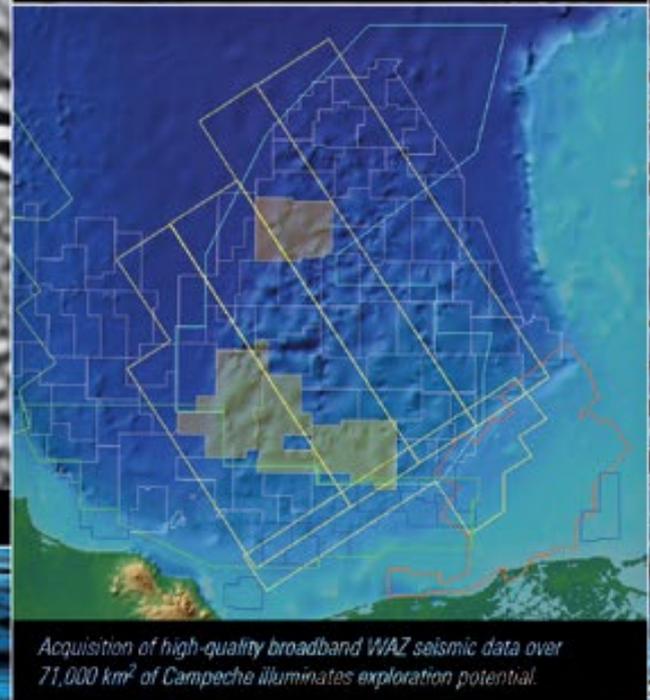
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