AAPG EXPLORER
AUGUST 2014

School of Rock

New technology shapes new paradigms in today's geoscience classroom.

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Vol. 35, No. 8
August 2014

PRESIDENT'S COLUMN

What Does AAPG Mean to You?

BY RANDI MARTINSEN

One of the things I became much more aware of during my years as a candidate and as president-elect is that AAPG means different things to different people.

Some people dominantly think of AAPG as a scientific association; some as a professional association; some as something that provides networking opportunities, and to some it is simply an association to which they belong.

Actually, AAPG is both a scientific *and* a professional organization. According to Article II of our Constitution, four of our seven goals are related to the science and three are related to professionalism – a nearly equal subdivision.

* * *

When I joined AAPG I didn't really have a clear idea of what being a professional meant, nor was I interested in voting or holding office or in any aspect of AAPG's governance. All I cared about was the science.

Furthermore, I didn't have a clue about the importance of networking (unlike our YPs, however, who appear to be much more savvy in understanding the importance of networking). It was through my membership in AAPG and my interactions with geoscience professionals that I learned what being a professional is all about and came to understand the importance of AAPG as both a professional and a scientific association.

So did AAPG's value to me change?

No. My perception of AAPG's value changed.

As president of AAPG I wonder how others view the value of AAPG membership – and if my progression from only valuing AAPG's science to valuing both the scientific and professional aspects is typical or atypical.

Understanding what things draw geoscientists to become members of AAPG – and what encourages geoscientists to maintain their AAPG membership, and what might attract geoscientists who are not AAPG members to join – is critical to AAPG's future, so I've been spending some time thinking about that. As have our staff.


MARTINSEN

> AAPG is both a scientific *and* a professional organization ... four of our seven goals are related to the science and three are related to professionalism.

* * *

Then there is the issue of governance.

Exactly how AAPG is governed and its governance structure didn't come on my radar until I was asked to be a delegate for the House of Delegates, and then a fuller understanding of AAPG's governance developed when I served my two-year term as treasurer.

It seems to me, however, that AAPG's governance is not a high priority for most of our members (including Members, Associates and Students). The fact that many Associate members who were eligible to become Members didn't suggests to me that becoming eligible to vote and to hold office are not sufficient incentives to completing the application for Member status.

(Now that the sponsorship requirement has been reduced from three to one sponsor, perhaps some of our Associates will complete their Member application.)

The fact that only about 30 percent of our Members who are eligible to vote actually *do* vote is further evidence that governance of AAPG is simply not a priority for most AAPG members.

However, there is a portion of our membership that is very concerned with AAPG governance, and some members regard participating in AAPG's governance as one of their most important professional activities.

I suggest that AAPG's governance should be on all members' radar, because the Members involved in it (HoD members, Executive Committee members, Advisory Council members) are in control of AAPG's future.

* * *

So, what does AAPG mean to you? What aspects of AAPG do you value?

AAPG's big audacious goal is to be "indispensable to all professionals in the energy-related geosciences worldwide." If we are to even come close to achieving that goal we need to know what AAPG means to you.

Is it the science that most attracts you?

Is it that AAPG is a professional organization that promotes professional development and maintaining professional and ethical standards?

Is it the networking opportunities AAPG provides?

Is it because AAPG is a forum to help educate the public and government officials?

How concerned are you about AAPG's governance?

Please send me your thoughts on what you value about AAPG – and perhaps what you don't – at rmartinsen@aapg.org.

If AAPG is to improve on doing what it does – advancing the science and promoting professionalism – AAPG needs your input.

Randi S. Martinsen

AAPG Officer Candidates 2015-16

AAPG officer candidates have been announced for the 2015-16 term.

The person voted president-elect will serve in that capacity for one year and will be AAPG president for 2016-17. The terms for vice president-Regions and secretary are two years.

Biographies and individual information for all candidates will be available online later this year.

Ballots will be mailed in spring 2015.

The slate is:

President-Elect

❒ **Paul W. Britt**, Texplore Inc., Houston.

❒ **Gretchen M. Gillis**, Aramco Services Co., Houston.

Vice President-Regions

❒ **Adebayo O. Akinpelu**, Fixital Ltd., Lagos, Nigeria.

❒ **Peter M. Lloyd**, Asia Pacific Training Ltd., Falicon, France.

Secretary

❒ **Heather L. LaReau**, Noble Energy Inc., Denver.

❒ **Nicole S. Morris**, FireWheel Energy LLC, Fort Worth, Texas.

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


Photo courtesy of Jeannette Wolak

REGULAR DEPARTMENTS

ON THE COVER:

Tennessee Technology University's geobiology field course students, led by AAPG Member Jeannette Wolak, pose in front of the Arenal Volcano, Costa Rica. Don't worry – those aren't gang signs they're flashing. That's the sign for "volcano."

Left: A TTU field trip to the Outer Banks, North Carolina. That's Wolak on the right. See story, page 24.

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Bigger, better, bolder

URTeC II: 'Not Your Father's Convention'

By KEN MILAM, EXPLORER Correspondent

Final preparations have been made and the program is in place for an important meeting that organizers say will be bigger, bolder and better than last year's successful debut.

The second Unconventional Resources Technology Conference (URTeC) will be held Aug. 25-27 in Denver at the Colorado Convention Center in Denver and comes billed as the industry's only integrated event for unconventional resource teams.

Last year's inaugural event drew more than 4,300 participants – and favorable reviews from those attending.

URTeC is sponsored by AAPG, the Society of Petroleum Engineers and the Society for Exploration Geophysicists as a showcase and information exchange for various key disciplines in unconventional plays.

This year's URTeC promises to have plenty of information and technology to share: "Overwhelming" was the word used by technical programs coordinators Alicia Collins and Terri Duncan to describe the response to a call for papers for the event.

And, according to surveys of last year's participants, 100 percent said they found the event useful to them in their jobs and 91 percent said it succeeded in creating sessions of interest across disciplines.

This year's URTeC will include more than 350 multi-themed technical sessions, topical breakfasts and luncheons, a plenary session, interactive panels and some of the industry's most respected speakers and thought leaders.

Last year's URTeC drew more than 4,300 people and rave reviews for its vast and varied exhibitions and technical programs. Expectations are even higher for this year.

The idea behind the conference is to bring together scientists, engineers and business managers to cross-pollinate ideas and encourage an "asset team" approach to exploration and production in fast-developing, unconventional plays.

Specifically, this year's format will mirror the industry's multidisciplinary approach to unconventional oil and gas through team presentations and panel discussions.

"We wanted to make it exciting and fresh. We're trying to spark some innovation in the content and how we are presenting it," said AAPG Honorary member R. Randy Ray, URTeC's SEG co-chair and consulting geologist/geophysicist of R3 Exploration.

"We want this to be a multi-disciplinary experience with inter-disciplinary communication," he added.

The technical program itself features 189 oral sessions, 117 e-papers and 27 team presentations. Cored rock from unconventional resource plays, including the Niobrara and Eagle Ford formations, from around the nation will be displayed in the exhibition hall.

"It's not like your father's convention," Ray said.

Once again, participants can expect to find a dazzling display of technology on the exhibits floor. Almost 200 exhibitors participated in last year's show.

Core exhibits – a popular attraction at last year's exhibition – also will return.

Cores from several unconventional reservoirs will be on display during exhibit hours, allowing attendees to view the actual rocks and compare analyses and results summarized by service companies that performed the studies. Cores are expected from Haynesville, Bossier, Eagle Ford, Marcellus, Utica, Woodford, Niobrara, Tuscaloosa and Bakken.

The opening plenary session will have a panel of experts addressing the topic of "Using Science and Integrated Technologies to Develop Unconventional Plays."

Other interactive panel discussions will include "Nimble Independents: 'Moving the Needle' With Innovation and Execution Excellence," (see related story page 6) "Converting Technology Into Dollars," "Emerging International Plays" and "Water Management and the Link to License to Operate."

In addition, various topical breakfasts and luncheons are planned along with several e-presentations, short courses and field trips.

For more information or to register, visit urtec.org.

Independents and unconventionals

Flexibility Rules in Shale Fields

By LOUISE S. DURHAM, EXPLORER Correspondent

Independent companies, both large and small, are widely acknowledged for spearheading the shale play phenomenon.

"Nimble" usually is the operative word here.

These players are known not just for their geoscience smarts but also for their speed in making critical decisions, quickness in snapping up desirable land positions and mineral rights, fast action in getting the wells down and more.

A big factor in the independents' commanding role in the shales goes back to the 1980s when the majors in general determined that the significant finds onshore the United States had pretty much been drilled up. They went chasing after the frontier regions like the deepwater Gulf of Mexico and the Arctic looking for the big, lucrative fields their budgets demanded.

When they did opt to get in on some of the hot shale action, it was late in the game. Most of the desirable acreage was taken and costs overall had risen.

BAEZ

> "In terms of being nimble, you may have better fracturing technology or a better understanding of an area ... getting in an area even when someone else is walking out isn't a bad thing, either."

Photo Courtesy of Conoco Phillips

Major players like Conoco Phillips have learned that success in shale means emulating smaller, more flexible oil companies.

Big Companies, Small Advantage

But some of the big folks hopped in, apparently believing it was better to be late than left out.

A few entered on their own and others through the acquisition of smaller established players.

Shell latched onto a sizeable chunk of the Eagle Ford in 2010. Things didn't pan out as planned, and the company recently sold its Eagle Ford stake to Sanchez Energy Corp. Shell president Marvin Odum was quoted as saying that the acreage doesn't have enough materiality for a company of Shell's size.

ExxonMobil acquired relatively small shale producer XTO Energy in 2010. Following the natural gas price collapse, the company began focusing on the liquids-rich areas, with a modicum of success.

A rarely talked about large company having a huge footprint in North American shales is Statoil, according to AAPG member Luis Baez, North American exploration manager at BG Group.

He noted that the Norwegian company has stakes in the Marcellus, Utica and Eagle Ford, as well as a huge position in the Bakken via its acquisition of small independent Brigham Exploration in 2011.

"Statoil is spread all over the Rockies doing exploration," Baez said.

He noted also that ConocoPhillips is doing well after cutting its shale teeth on acreage attained by acquisition of independent Burlington Resources.

"That's how they gained their expertise in the Eagle Ford," he said. "They realized they needed to act like a nimble independent.

"They just (announced) increased reserves from 1.6 Bbo to 2.5 Bbo," Baez noted. "That's enough to change a whole country."

It's been reported that BP will split its onshore U.S. oil and gas segment into a separate business with the idea that a more focused and nimble unit will be better prepared to hold its own among the smaller independents. BP controls sizeable resources in the Eagle Ford and elsewhere.

Still, the names that stand out in the shale plays are companies like Apache, Anadarko, Range Resources, Newfield and Pioneer, among others. They are among the non-major companies that jumped in early-on for the most part and made it happen.

"In terms of being nimble, you may have

See **Independents**, page 10

Determining the Origin of Stray Gas

By LOUISE S. DURHAM, EXPLORER Correspondent

Imagine it's early in the morning and you're collecting water from the kitchen faucet to start a cup of joe.

Suddenly, the water ignites.

Scary, huh?

Such far-out stories and more continue to circulate as foes of the myriad shale plays ratchet up their attempts to curtail drilling and, perhaps above all, hydraulic fracturing.

The principal oft-repeated storyline is that this oil patch activity is causing potentially flammable hydrocarbon gas to travel into fresh water aquifers.

This scenario remains unproven.

"When hydrocarbon gas is found in a public or domestic water supply in significant concentrations, determining the origin of that gas sometimes can be critically important to avoiding conditions that might threaten public safety," said AAPG member Mark McCaffrey, geoscience manager of interpretation services at Weatherford Laboratories.


McCAFFREY

> "Determining the origin of that gas sometimes can be critically important to avoiding conditions that might threaten public safety."

He noted that when this gas is found in groundwater in high enough concentrations to represent such a potential threat, the gas is called "stray gas," citing Fred Baldassare et al, 2014.

There are varied possible sources of hydrocarbon gas dissolved in groundwater, and they all must be considered at the start of an investigation.

The industry has a collection of tools to determine the specific origin of any such gas found in aquifers.

AAPG member Mark McCaffrey will speak on "Geochemical Methods for Determining the Origin of Stray Gas in Aquifers Near Oil and Gas Wells" at the upcoming Unconventional Resources Technology Conference in Denver.

McCaffrey, geoscience manager of interpretive services for Weatherford Laboratories, will be speaking at one of the topical luncheons set for Tuesday, Aug. 26.

Avoiding Assumptions

According to McCaffrey, the possible sources of the hydrocarbon gas in a given location can include:

- Naturally occurring biogenic gas, which is formed in the shallow subsurface via bacterial decay of sedimentary organic matter.
- Naturally occurring petroleum seeps containing hydrocarbons from deep beneath the subsurface. Seeps like these have guided geoscientists to explore for oil worldwide for more than 100 years.
- Modern petroleum development of coal mining activities in the area.
- Legacy conditions from discontinued past petroleum development or coal mining activities.
- Nearby municipal landfills where bacteria produce gases via decay of the organic matter present.

"Determining the specific origin of a stray gas typically requires an investigation in which geochemical, geological, engineering and/or historical data are integrated into a comprehensive, site-specific evaluation of the gas source," McCaffrey reiterated.

"In the geochemical portion of the study, the geochemistry of the stray gas is compared with the geochemistry of samples from each of the possible sources of the gas," he noted.

He tagged two types of geochemical parameters that are ordinarily measured in the gas samples:

- Molecular composition of the gas – how much of each gas species, such as methane, ethane, propane and others, is present.
- Gas isotropic composition – the ratio of specific isotopes of carbon and hydrogen that comprise the individual gas species.

These data can enable biogenic gas to be distinguished from thermogenic gas and also allow thermogenic gases of differing thermal maturity to be distinguished from each other, according to McCaffrey.

"A common mistake that some people make is to assume in advance that all naturally occurring hydrocarbon gases in aquifers are biogenic," he said, "and that all thermogenic gases in aquifers are related to petroleum

See **Stray Gas**, page 10

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Petrophysics of Unconventional Reservoirs (with URTeC)	Aug. 23, 2014 Denver, CO
Introductory Geochemistry for Shales/Tight Oil (with URTeC)	Aug. 24, 2014 Denver, CO

SHORT COURSES

Fractured Reservoirs: From Geologic Concepts to Reservoir Models (course plus field trip)	Sept. 8-12, 2014 Casper, WY
Practical Salt Tectonics	Dec. 8-11, 2014 Houston, TX

FIELD SEMINARS

Sedimentology and Sequence Stratigraphic Response of Paralic Deposits to Changes in Accommodation: Predicting Reservoir Architecture	Sept. 4-11, 2014 Book Cliffs, Utah
Fractures, Folds and Faults in Thrusted Terrains, Sawtooth Range	Sept. 8-13, 2014 Montana
Lacustrine Basin Exploration	Sept. 14-21, 2014 Utah
Complex Carbonate Reservoirs	Sept. 20-26, 2014 Italy
Folding, Thrusting and Syntectonic Sedimentation: Perspectives from Classic Localities of the Central Pyrenees	Sept. 22-26, 2014 Spain
Unconventional Petroleum Systems Field Trip (with SEG meeting)	Oct. 25-26, 2014 Colorado

E-SYMPOSIA

Fluid Migration and Accumulation within the Mississippian: Why 2% Oil Cut Here,15% One Mile Away	Sept. 9, 2014 2:00 pm, CDT
Concepts of Scale: Horizontal Development of Wolfcamp Shale Oil of the Southern Midland Basin	Oct. 2, 2014 2:00 pm, CDT

www.aapg.org/career/training/

AAPG Education

Stray Gas
from page 8

development activities.

"That assumption is commonly false.

"Naturally occurring thermogenic gases are quite common in the aquifers in petroliferous basins worldwide," he noted.

No Easy Answers

In determining the origin of stray gas, McCaffrey emphasized that it's essential for the investigator to consider all possible sources of the gas, rather than only the potential sources that may initially be identified most easily.

"The investigator should then attempt to I.D. geochemical characteristics that distinguish those discrete gas types," he said. "Then those data must be integrated with other data types, commonly geological, engineering and/or historical, in order to identify the stray gas source.

"In certain cases, consideration of the possible mechanisms of gas migration is essential to uniquely identifying the gas source," he added.

Which of the geochemical parameters will distinguish the gases from each of the potential sources is unknown until samples from each potential source are analyzed, according to McCaffrey.

"Parameters that are useful for separating the possible sources of gas in one location," he said, "are not necessarily the same parameters that would be useful in separating the potential sources in another location."

Independents
from page 6

better fracturing technology or a better understanding of an area that someone else doesn't," Baez said. "Being nimble in terms of getting in an area even when someone else is walking out isn't a bad thing, either.

"Strategy is changing, concepts are evolving," he noted.

"It's important to understand the perspective of how other people are doing things, including strategy and technology innovations," he emphasized, noting that this is one of the goals of the panel he will chair at the 2014 URTeC meeting.

Baez credits independents with creating a unique matrix of multidisciplinary integration, fit-for-purpose technologies, benchmark best practices and boots-on-the-ground execution to lead them to Tier I results.

Clouds Looming Over Shale

Well, you ask, are the shale operators set to move forward using cruise control?

The answer is clear if you have noticed the few storm clouds gathering on the horizon of all things shale.

Bloomberg News recently reported an analysis of 61 shale drillers revealed that shale debt has doubled during the last four years, while revenue has climbed a paltry 5.6 percent. This is despite the big move to liquids-rich and oil plays when natural gas prices cratered.

Initial production from shale wells often is gangbusters. But for completions that run true-to-form in most of the plays, this initial deluge tends to quickly dwindle precipitously.

In turn, operators overall must keep the drilling push going full speed, which might keep them running-in-place at best.

The interest incurred on the increasing debt load to finance this pricey activity can be burdensome, indeed.

And it's said to be rising.

Independent Goodrich Petroleum is working diligently to prove up the potential for the complex Tuscaloosa Marine Shale to become an economical play. The jury is still out, while the company reportedly is trying to reduce its well costs to *only* $11.5 million each.

Certain companies (and their investors) are shrouded in a cloud of doubt over their ability to keep financing new wells as production dwindles in their existing wells.

Depending on their lease holdings, this could spell opportunity for larger producers with deep pockets who can deal with the cost to acquire their struggling brethren.

According to Steve Farris, chairman, CEO and president of Apache Corp., the following challenges are in store to continuing U.S. unconventional oil production growth:

- Capital spending must increase significantly.

As production grows, more capital is needed to offset declines. Also, international firms and private equity must continue to invest.

- New plays must be discovered.

In 2013, the Eagle Ford and Bakken yielded almost 70 percent of unconventional oil production.

- Capital efficiency must improve.

Reserves and production must go up, costs per well must go down.

- Water availability.
- Industry must find and retain the next generation of employees.
- Regulations must be balanced; industry must be part of the solution.

AAPG member Luis Baez will be the moderator for the interactive panel session "Nimble Independents: Moving the Needle With Innovation and Execution Excellence," during the upcoming Unconventional Resources Technology Conference in Denver.

The panel will be held at 1:45-5:25 p.m., Monday, Aug. 25.

Baez, one of URTeC's three general chairs, will be joined by:

- AAPG member Doug Hazlett, vice president-exploration, Anadarko Petroleum.
- Joseph DeDominic, president and CEO, Anschutz Petroleum.
- AAPG member Michael Van Horn, former vice president-exploration, Newfield Exploration.
- AAPG member Joe Frantz, vice president-engineering technology, Range Resources.
- Trevor Sloan, manager director-energy research, ITG Investments.

Little Known TMS Play Sees Drilling Surge

By LOUISE S. DURHAM, EXPLORER Correspondent

As the shale evolution continues in The Patch, some plays tend to grab the spotlight far more than others.

Think of the high-profile Bakken and Eagle Ford, for example.

Meanwhile, there's a potentially Big One not widely talked-about, which has been drawing operators' interest and drilling money off and on since the early 1970s.

It's the Cretaceous-age Tuscaloosa Marine Shale (TMS), which occurs across central Louisiana and into southwestern Mississippi. It is age-equivalent to the now-famous Eagle Ford formation in Texas.

The early drilling efforts produced considerable frustration but not much oil.

It's a different story today with successful completions being reported.

The current surge of drilling activity is widely believed to have been triggered by a 1997 study estimating seven billion barrels of oil awaiting recovery via the drill bit. The study and ensuing publication originated at Louisiana State University's Basin Research Institute, which is now the Basin Research Energy Section of the Louisiana Geological Survey.

Despite its "fits and starts" drilling history, the TMS has begun to garner some respect – specifically, it appears to be on the brink of becoming a bona fide commercially productive play.

Halcon Resources recently announced the signing of a definitive agreement with credit funds and accounts managed by affiliates of Apollo Global Management LLC, which will invest up to $400 million in Halcon's wholly owned subsidiary, HK TMS LLC.

This is a major happening.

BARRELL

> "I think the TMS East, why it's working, is you have that siltstone influx that gives you the natural fractures, and that's key to productivity."

"That was the first big capital provider that's really blessed the play," said AAPG member Kirk Barrell, president of prospect generator Amelia Resources, based in The Woodlands, Texas.

East Side, West Side

Barrell has 24 years of experience in the Tuscaloosa Trend, which rose to industry fame in the 1970s for its humongous volumes of deep gas production.

Also an avid TMS blogger, he has come to be the go-to person for ongoing info.

The play is generally viewed as comprising two main areas, dubbed TMS West and TMS East.

To the west, the geology appears to be less attractive for drilling success – at least for now.

TMS East can be defined geographically as beginning in Avoyelles Parish and spreading eastward. It has proved to be the core area of the play.

"The key so far for the East is, at TMS

See **Tulscaloosa Shale**, page 16

Cracking the Code of the Tuscaloosa Marine Shale

By LOUISE S. DURHAM, EXPLORER Correspondent

There is considerable talk these days about "cracking the code" in the myriad complex shale plays, which vary geologically even within the same play.

According to AAPG member Kirk Barrell at Amelia Resources, the "code" for the Tuscaloosa Marine Shale might best be viewed as being comprised of three parts: drilling, completion and production.

It's a code that appears to be pretty much deciphered.

▸ Cost was the last barrier to increased activity in the eastern core area of the play, according to Barrell. That has changed as drilling days have declined in number, now tallying 25-28. This has been achieved by both Halcon and Goodrich Petroleum. Only a few weeks ago, 45 days was the norm.

"In the last eight weeks, there have been some significant strides made," Barrell emphasized. "A well-per-day drilling cost is about $100,000, so 20 days off is about a $2 million cost reduction; so that's considerable progress.

"Also, the point of access is the naturally fractured zone," he noted, "and it was giving a lot of headaches when they would build curve through those natural fractures.

"They changed the angle to about 70 percent, so that seemed to crack the code for the drilling side; you want to penetrate a minimal amount of that fracture zone when drilling that curve."

▸ Regarding completions, Barrell noted that the players figured out they have to land in the lower part of the shale. The laterals range between 6,000 and 7,200 feet, and about 575,000 pounds of proppant per fracing stage are the norm.

"I think they're very comfortable with their completion recipe," Barrell said, "and feel like they're getting very consistent results with that."

▸ When it comes to production, Barrell said that the decline curves are looking good.

"They're hyperbolic," he said, "and when flattening they're putting these wells on pump and seeing real good sustainable rates."

Photo by Thomas A. Ryer

Field trips like this one to the Ferron Sandstone outcrops of the Henry Mountains Basin in Utah are among some of the more popular educational offerings of AAPG.

AAPG Education and Professional Development

Evolving Education

By CHRISTOPHER STONE, EXPLORER Correspondent

AAPG's Education and Professional Development offers a wide array of short courses, schools, field seminars, Hedberg research conferences and education conferences.

It also organizes and operates the AAPG Foundation-funded Distinguished Lecture program, which literally takes geoscience to every part of the world.

But as impressive as those offerings are, even more impressive is the way the department has added new workshops, events and conferences over the past few years that have dwarfed the old offerings.

"We've expanded and changed quite a bit in the last few years, and we're passionate about developing educational events, research conferences, basically all types of professional development," said department director Susan Nash.

She and her eight-person staff are equally passionate about reaching out to individuals and constituency groups.

"If we can help facilitate the transfer of knowledge, and if people who attend have a chance of really connecting with information, training, techniques and technology that can quantum-leap them to a new level of effectiveness, we are very happy," Nash said. "We want all attendees to have a very positive return on investment – invest $1,000 in training, and yield $1 million in improved effectiveness. That is, albeit simplistically expressed, what we like to see."

Getting to this point has meant the department – and AAPG's entire geoscience education initiative – has had to evolve with the times.

"We have developed a number of new types of events," Nash said. "All of our events are 'hybrid' or 'Web-enhanced,' which means we make repositories of information available."

And in some cases, that means opportunities for ongoing discussions and social networking. Those would include:

- Geosciences Technology Workshops (GTWs) – Two- or three-day topic or theme-based presentations by experts and practitioners, with ample time for discussion.
- Forum Events – One-day "forum of experts" gatherings, focused solving a specific issue or problem.
- Research Exchange – Two-day research-focused workshop (basically a new directions-focused GTW).
- E-Symposia – One-hour webinars, with materials for self-study (to be completed in one day for CEUs if the student turns in the required work).

"With the advent of so much new technology and the opening of new plays that were previously unreachable – deepwater subsalt and shale plays being just two of them – we focus on understanding just how we can provide everyone who attends a kind of 'equipment for success,'" Nash said.

Q&A With Susan Nash

So what exactly is going on with the AAPG Education and Professional Development Department?

Department director Susan Nash took time for a Q&A with Explorer assistant managing editor Brian Ervin:

ERVIN: *What are the new things the Education Department is rolling out for fall 2014?*

NASH: Six of the 10 FEC courses in November are brand new ones for AAPG. We also have our first Research Exchange program, taking place in September. And two exciting Hedberg Conferences will take place in September and December.

Also, we'll be offering new courses for the first time at the upcoming Unconventional Resources Technology Conference in Denver.

ERVIN: *What are some of the exciting things you've done in the past?*

NASH: The GTW and Forum programs both have been created just in the past three years and have proven to be very popular. Our E-symposia offerings started just a few years ago and have grown to over 50 archived sessions.

ERVIN: *Where do you come up with ideas for courses and field trips and other offerings?*

NASH: We spend a great deal of time doing research, reviewing what operators are doing and what they need in order to accomplish their goals. We read journal articles, research studies and recently released publications, as well as new product descriptions and drilling results.

The "buzz" we hear from participants and instructors, current journals and articles, our Education Committee members and other ideas that get proposed to us through our Course Proposal System.

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Nash

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We also attend conferences, sessions, lectures and we listen to the talks and also to the questions posed to the speakers.

ERVIN: *How do you choose and recruit the experts to do them?*

NASH: We read publications, attend meetings, review abstracts and posters, and ask operators what they are seeing.

We particularly try to bring in experts from other disciplines in order to provide new perspectives. We know our attendees want to be able to implement the new knowledge and to get results, so we try to keep a balance of theory and case studies.

Once we've found really good material, we get in touch with the person who produced it. We reach out via email, phone, personal contact as well as through social media. LinkedIn is one very effective venue.

ERVIN: *What are some of the most popular programs you've offered over the years?*

NASH: Our Basic Well Log and Practical Salt Tectonics courses continue to be good sellers every year, as do our Modern Terrigenous Clastics and Deep-Water Siliciclastic Reservoirs Field Seminars, among others.

The GTWs that focus on different shale plays also have been very well subscribed.

ERVIN: *Has that changed over the decades? If so, how and why?*

NASH: Some topics have a "shelf-life," depending on current trends, exploration techniques and new technology, and a topic that was popular 10 or 20 years ago already may have served its purpose, so we retire courses when there is no longer a need for them.

Others, like our Basic Well Log course, present information that always will be important, so as long as there is an audience for something, we will try to keep offering it.

ERVIN: *What am I not asking that you think I should?*

NASH: We always are looking for new, cutting-edge content presented in exciting ways using unique examples and exercises.

If anyone is interested in teaching for AAPG and/or wants to propose either a short course, field seminar or wants to help convene a GTW or Hedberg Conference, they need to contact the AAPG education department for additional information.

Tuscaloosa Shale

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time you have an influx of siltstones coming from those deltas updip, so you have a very nice interbedded siltstone layer with the organic layer," Barrell said. "That's providing a nice mix of the organics and siltstones, giving you porosity for storage.

"My research indicates those siltstones are very correlative with the presence of natural fractures," he noted. "I think the TMS East, why it's working, is you have that siltstone influx that gives you the natural fractures, and that's key to productivity.

"As the hyperbolic (decline) curve flattens out, those siltstones have porosity in the matrix to contribute more reserves," Barrell added. "The West doesn't have that deltaic influence, so it will be a different lithology, a different mineralogy."

Even so, the two are age equivalent, and he noted that there may be sub-plays. Sustaining production there is a big unknown.

EOG and Indigo Minerals are partnering 50/50 to drill a well in the western area in Vernon Parish.

Blessed Time

Activity is on the rise in the eastern core region where Goodrich Petroleum, Halcon and Encana are the principal players.

Goodrich holds more than 300,000 acres in the play, where it has announced several completions. Part of the company's success can be attributed to its hybrid frac jobs. Goodrich president and COO Robert Turnham Jr. explained that this is a combo of slick water and gel, noting that they think the slick water provides some fracture complexity, and the gel transports the proppant out into the formation.

Currently, Goodrich is running three rigs in the TMS and announced recently that it intends to go to as many as five rigs by the end of the year, pending on continued success.

Halcon announced that it plans to spud 10-12 operated wells in the play, running an average of two rigs, in 2014. Additionally, the company expects to participate in 15-20 non-operated TMS wells in 2014.

Meanwhile, the play is beginning to attract the up-and-comers, such as Sanchez Oil and Gas, which has already spud a well, and Comstock Resources.

In an unusual twist to the long-reigning "tight hole" mentality adopted by industry operators, the TMS players are sharing information, according to Barrell. This approach no doubt will have a considerable positive impact on progress overall.

He noted that 3-D seismic is not being used. That may change soon given that operators are starting to talk about it, and 3-D vendors are showing interest.

Leasing is ongoing although it's late in the game, and the days of building a big, contiguous land position from the get-go are so over.

"I've been surprised to date that the Big Boys haven't shown up," Barrell said. "And I think we're going to see some interesting events in the next six months.

"I believe the play is getting blessed by the industry now," he added.

"There have been a lot of good results over the past few months, and for a late entry, from a value perspective, I still think it's one of the best value investments today, compared to other plays.

"This is due to the fact that the risk has declined," he said, "and the entry cost is still very reasonable.

"I'm as optimistic as I've ever been," he said.

Geoscience Communication

British TV Star Teaches Down-to-Earth Geoscience

By HEATHER SAUCIER, EXPLORER Correspondent

For all the courses that advanced degree students can take in the geosciences, one would have to study at Plymouth University in England to experience a class so unique it's touted as a breakout form of earth science.

"Geoscience Communication" is appealing to an emerging generation of scientists who are realizing that, in many cases, the value of their technical knowledge is only as great as their ability to communicate it – whether to their peers or to the public.

"This course will help you get a job more than any technical course you could take," said Iain Stewart, geologist and famed BBC science television host who created the class.

"An employer assumes your technical skills are there," he said, "but your ability to sell yourself and discuss technical subject matter with all types of audiences – that's what gets you the job."

When Stewart, a fellow of the Geological Society of London and president of the Royal Scottish Geographical Society, left teaching in 2002 searching for ways to more broadly share his interest in geology, he found his answer in television. As host of science programs such as "Journeys from the Center of the Earth" and "Fracking: The New Energy Rush," Stewart learned that the complexities of geology can be successfully communicated to the everyday person through common interests and common language.

In other words, drop the esoteric and drop the jargon, and you've got a home run.

"Companies often struggle because geologists come in with the same technical training, and everyone thinks the same way. Communication can become tainted by institution," Stewart explained.

"But having people being able to express themselves individually is really important," he continued. "A company will always need someone who can communicate. There are presentations, groups of people who need to be shown around.

"By being seen as a person who can communicate, you will get nudged to the front."

Photos Courtesy of BBC

Stewart filmed on location at Victoria Falls, a more than 300-foot high waterfall in southern Africa on the border of Zambia and Zimbabwe for his BBC series Rise of the Continents.

STEWART

> "Companies often struggle because geologists come in with the same technical training, and everyone thinks the same way. Communication can become tainted by institution."

Back to School

Stewart returned to academia in 2004 at Plymouth University with intentions of creating a course centered on all he had learned in front of a camera, transforming the nebulous facets of the geosciences into topics fit for popular public consumption.

In a non-scientific way, he grasped the baseline of the public's knowledge of geology and other earth sciences. He also experienced how the average person understands and responds to geosciences-related issues, such as earthquakes, avalanches, even the man-made effects of hydraulic fracturing.

After 10 years of teaching standard modules in structural geology and geohazards, the university accepted his proposal for a class in geoscience communication as an elective for master's students, and Stewart stepped onto the lecture floor as charismatic as he is on television.

Offered just twice to date, volumes of students have signed up to explore the mystery class.

"Kids beginning their undergraduate careers come in the door as freshmen, and we get the red pen out and tell them their writing should be objective, rational and technical. We train them from that moment in the scientific method," Stewart said. "Then, they come to my class and they say, 'We spent three years learning things this way, and now you want us to change?'"

As difficult as change can be for some, the class has received rave reviews.

After completing several assignments in blogging and designing a geology-related project for children about the formation of sedimentary, metamorphic and igneous rocks, Katherine Harris, who completed Stewart's course last spring, is completely sold on the concept.

"I really feel that the communication of earth science is massively undervalued at the moment," she said. "This class should be made available at every level."

The Real Thing

So, what exactly does the syllabus for Geoscience Communication look like?

- There are exercises to help a speaker win acceptance from his audience.
- Lively lectures provide valuable insight into the importance of being natural and genuine.
- Stewart demonstrates how to let go of technical jargon and speak in general terms.
- And, of course, he provides plenty of opportunities for practice, practice, practice.

For BBC's How to Grow a Planet, Stewart and his team filmed in other exotic locations, like here in the Garden of Edam rainforest in the Bo Trach district of Vietnam.

At some point during the class, students are spontaneously taken to the Plymouth City Museum and asked to interview members of the public on the spot about their knowledge of the geosciences. Then, students must explain complex geological concepts to them "in English."

Many young professionals communicate the way they believe their managers want them to communicate, Stewart said. Turning the tables around, he said those entering the workforce should find managers who support a flexible communication style – one that allows a person to speak knowledgeably from the heart, so a genuine impact on an audience can be made.

When making a formal presentation that deviates from the technical norm, "At first, you get this thing that you're going to be found out any minute, but you get more confident," Stewart said. "The best thing to do is to jump in there and make a few mistakes, and if they are small no one will notice and you'll quickly get better."

Stewart admits that "some get it, and others don't," but he's beyond satisfied with the results of his class, especially after reading students' comments that the course should be required for anyone studying science.

"It's really been taking off, and that's fantastic to me," he said. "The young ones really understand this part of the job. They don't see the need to keep up an academic front and be all self-important. They understand this is a way to package themselves differently and to connect with who they really are. It's OK to talk in general terms."

Former student Elliot Wood said the course helped him realize that thoughtful communication could help repair misunderstandings often caused by the gap between technical speak and the vernacular.

"In the U.K., we have a lot of fracing going on and there are protest movements against it," he said. "A lot of people don't understand the science behind it. This might be a failure on the part of the scientists."

Because there are few paths for actual careers in geoscience communication per se, Stewart encourages students to practice by blogging.

"But no one will read it," students often say of the proposed assignment.

"Exactly," Stewart responds. "It's a chance to just get better and then you will get discovered and get more attention."

It's a perfect training ground for careers in the oil and gas industry as well.

"We think the technical bits are the important bits when we are talking, but what's far more important is who we are and what we're about," Stewart said.

"The technical bits are covered. What you need to do is be yourself," he continued. "If an audience doesn't like the presenter, that's the end of it. You can say something that is completely correct, but if your body language is off, people will think this is a load of rubbish.

"The people who do really well," he said, "are the people who are completely genuine."

Geoscience for the masses

Prof-Turned-'Rock Star' Makes Geology Cool

By HEATHER SAUCIER, EXPLORER Correspondent

Call it a mid-life crisis. Call it geology on fire.

Whatever it was, something compelled Iain Stewart to leave his job as a college professor in London 12 years ago and essentially stay unemployed with a wife and two children while he figured out the next step in his career.

Passionate about earth science – most particularly Holocene geological change as it relates to earthquakes, volcanism, tsunamis and sea level changes – Stewart wanted to excite people beyond the confines of his classroom. As a former child actor in a 1978 television series called Huntingtower, a BBC Scotland adaptation of author John Buchan's 1922 novel of the same title, Stewart wanted to return to Scotland and get back into television.

He approached the BBC with an idea in 2002, and soon became a "rock star" in his own right in the United Kingdom and beyond.

The turn of events unfolded almost like a sitcom:

Television Executives: *"So, you want to do a series of programs about geology?"*

Stewart: *"Yes."*

Television Executives brainstorm about possible shows on ancient architecture.

Stewart, interjecting: *"It's not archaeology. It's about rocks."*

Television Executives, looking perplexed: *"You want to do a show about stones?"*

For Stewart, it was a defining moment.

"I realized how people saw geology – that it was just about stones. I spent 12 years teaching geology, and I never thought about it from the public's perspective before," he said.

"There are not too many geological programs on television," he added. "If people don't study this at a university, where will they get their information?"

The executives continued to listen to Stewart's proposal and became intrigued when he explained how the geosciences touch just about every aspect of human life. He reminded them that the Earth has 4.5 billion years of history, all filled with intriguing stories to tell.

Events and activities similar to the then-recent Japanese earthquake, Russian meteor strike, Florida sinkholes and the hydraulic fracturing boom began to turn into 60-minute episodes in the minds of the executives, and a handshake with Stewart sealed the deal.

All program makers needed to do was figure out a way to translate the technical into television.

Photos courtesy of BBC

Stewart and crew filming at Victoria Falls for BBC's Rise of the Continents. It was formed almost 200 million years ago from intense volcanic activity in an ancient landmass called Gondwanaland.

> It didn't take long before all citizens of Britain began learning about geology on their own terms.

Making a Connection

Stewart, having already left his post at Brunel University, took on the challenge of figuring out how to communicate information to the average person whose interests typically don't dial down into the specifics of deepwater drilling.

"The safety record in offshore technology is second to none. That might be interesting, but it's not going to make someone say, 'Oh, my God,'" Stewart said.

That's when Stewart's education began. He needed to establish a baseline for defining the public's understanding of the geosciences as well as spark an interest in the sciences in a brand new medium.

For this he relied on the BBC's mainstream program makers and plunged into his second career as a host for a major television series on nature, history and the state of the planet – all with geologic premises.

"People are skeptical to a certain extent, especially of those in the industry," he said, referring to experts formally discussing topics such as subduction zones and horizontal well casing on the news and in mainstream journals.

"We try too hard to bring people into our world," he added.

Part of the blueprint for Stewart's success occurs just as his show begins.

"The first five to 10 minutes of the programs are making me seem like I'm an interesting person and a friendly person that you would want to spend time with," he said. "Then, you have to connect with what people are already interested in."

While the average person may not care about the differentiation between sedimentary, metamorphic and igneous rocks, their attitudes may change when they learn those various rocks are responsible for the Egyptian pyramids, Greek columns and ancient Roman domes, Stewart said.

"I unravel the Earth's history," he said. "But pop TV can't be more than a shop window. There has to be a welcome sign that draws someone closer.

"My bit is very basic," he continued. "Academia and industry can provide the next level of access."

It didn't take long before all citizens of Britain began learning about geology on their own terms.

Neither did it take long for Stewart to receive recognition for his contributions to popularizing geography and earth sciences by the Royal Geographical Society in 2010. He was appointed Member of the Order of the British Empire in 2013 for his services to geology and science communication. That same year he received an Athelstan Spilhaus Award from the American Geophysical Union.

"You have to be willing to take risks," he said. "Geologists tend to know very specific areas of geology, but in television you've got to put yourself on the edge of geology and connect it to art, architecture and be a broad sweeping specialist," he explained.

"Television is linear and narrative. It's a whole new way of having to think."

Building Bridges

To date, Stewart has hosted a slew of science shows including, "Volcano Live," "How To Grow a Planet," "Earth: The Climate Wars," and "Earth: The Power of the Planet."

Based on what he has learned, the art of communicating science has become a new discipline that, in Stewart's mind, could become an integrated part of science education in the distant future.

"The issue of geosciences literacy is under-researched," he said. "However, with major issues such as hydraulic fracturing, radioactive waste disposal and carbon capture and storage looming large, it seems it is more and more important to appreciate what ordinary people's baseline awareness is of our unfamiliar world in the subsurface.

"There is much to be gleaned from psychologists, anthropologists, geographers and sociologists about the way that individuals and communities understand and respond to geosciences problems," he said. "But it is still too early to establish 'geo-cognition' as a coherent discipline.'"

To help pave the way, an inspired Stewart returned to the academic world in 2004 at Plymouth University in England and worked for 10 years to establish a one-of-a-kind elective course for master's-level students called Geoscience Communication.

In a nutshell, he is teaching students that there is more to geology than geology. Being able to effectively communicate their passion is the first step in sharing its relevance with the public and showing people why they should care.

Currently working as both a professor and television host, Stewart has done his part in building a bridge between academia and popular culture. After his brief stint away from the academic world while working with BBC officials, Stewart admitted returning to university life was more difficult than he ever imagined.

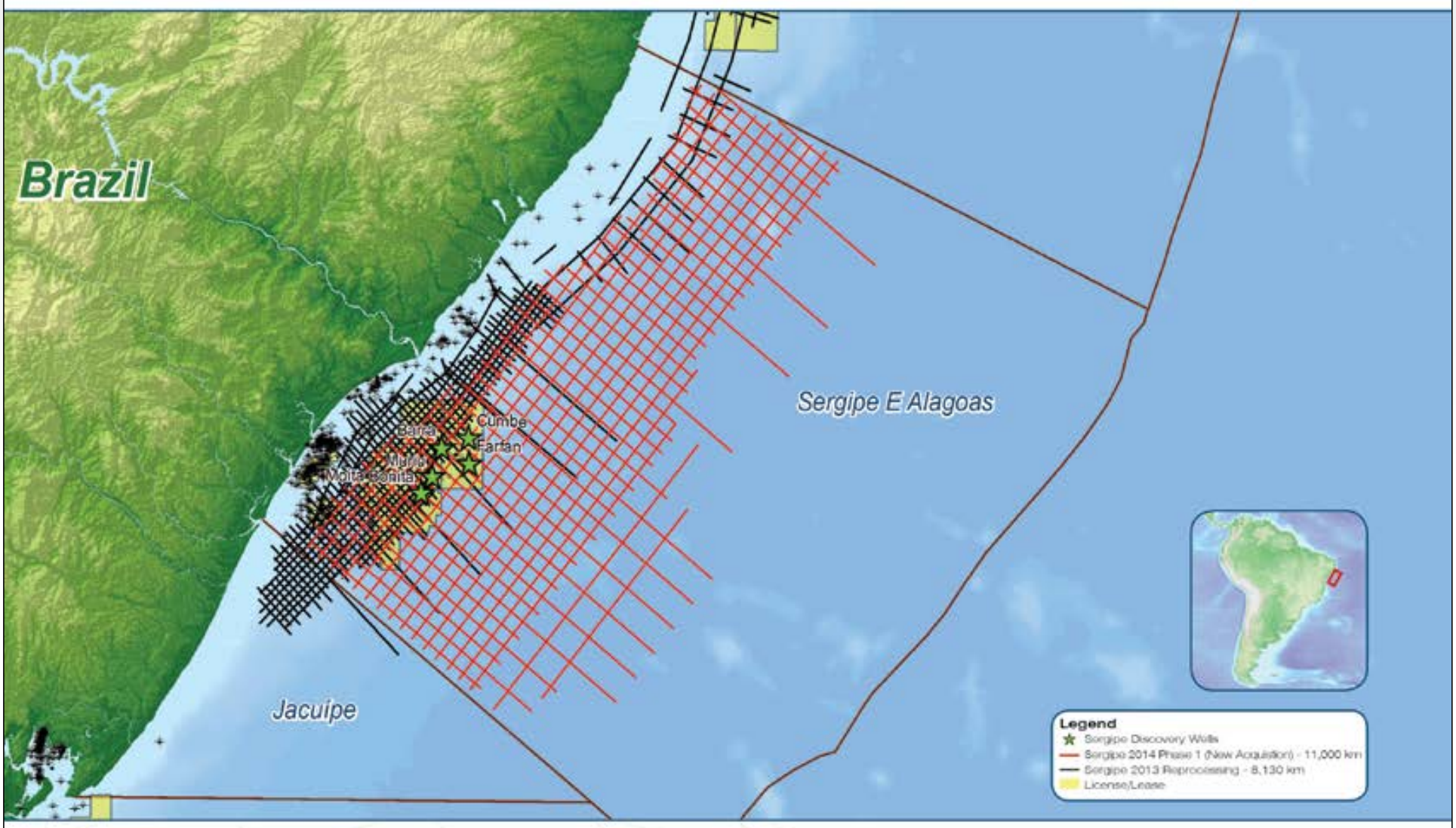
"Several universities wouldn't touch me with a barge pole," he said, explaining most were interested in scientific research he had done while away. Television practically tainted Stewart.

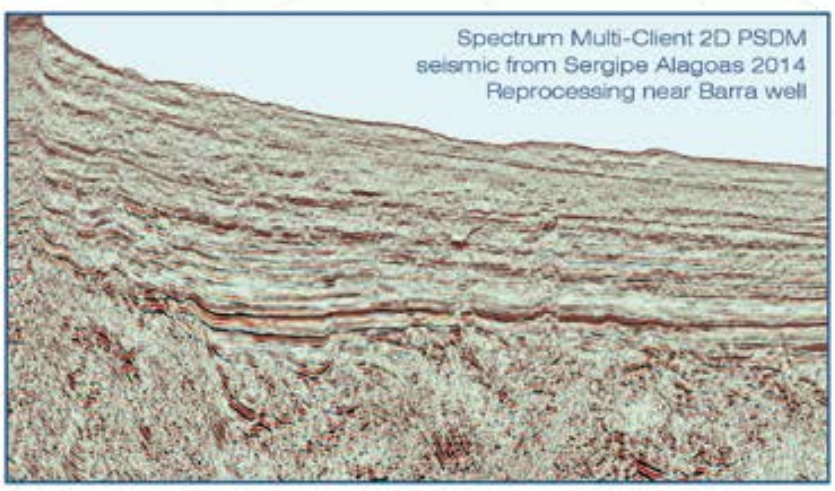
"Now, I would hope scientists wouldn't have to give up their jobs to do what I did," he said. "We scientists choose to study what we do because it's fascinating, it's really amazing and it enriches people's lives.

"We need to develop these career pathways," he said. "It is part and parcel of what a geologist does."

Brazil: Sergipe Alagoas

New 2D Multi-Client Seismic Data Available




Spectrum Multi-Client 2D PSDM seismic from Sergipe Alagoas 2014 Reprocessing near Barra well

Spectrum has commenced a 11,000 km Multi-Client 2D seismic survey offshore Brazil in the Sergipe and Alagoas Basins along the Eastern Margin of Brazil. The new acquisition program will tie key wells in the Basins, including the recent Barra, Muriu, and Farfan discoveries. PreSTM and PreSDM data will be available in Q4 2014.

To supplement the new acquisition in this active exploration area, Spectrum has completed the reprocessing of 8,130 km of data through both PreSTM and PreSDM and is offering this data to industry in order to get a head start on the expected upcoming round in 2015.

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Spectrum

$4.5 million investment

UK Creates Centre of Doctoral Training

By HEATHER SAUCIER, EXPLORER Correspondent

For the first time in a generation, oil and gas doctoral programs in the United Kingdom have received a surge of financial support from the Natural Environmental Research Council (NERC), the main governmental funding body for academic research and training in geosciences in the United Kingdom.

The funding will support a new Centre of Doctoral Training (CDT), which will allow 31 new doctorate students to begin research at 17 different universities this year.

The $4.5 million investment, which was offered to a consortium led by Heriot-Watt University (HWU) in Edinburgh, Scotland, marks NERC's increased commitment to applied geosciences in hydrocarbon-related fields.

"The NERC Centre for Doctoral Training is a truly game-changing initiative and represents the most exciting development in the provision of training for the energy industry in the UK that has occurred during my career," said AAPG member Keith Gerdes, chair of the CDT's Industrial Advisory Board.

Gerdes, a global exploration adviser at Shell International, also serves as AAPG's European Region president.

The NERC funds will directly support 10 doctorate students, while HWU and its partners will contribute an additional $9.5 million to enable a total of 93 new doctorate students to begin their work over the next three years.


GERDES

> "The NERC Centre for Doctoral Training is a truly game-changing initiative."

The HWU group competed against three other university groups for the CDT funding – an effort led by AAPG member John Underhill, chair of exploration geoscience at HWU.

A call for funding from the industry remains open, Gerdes stressed.

"Never before has NERC invested so heavily in this area," said Underhill, who also is a past AAPG Distinguished Lecturer, Matson Award Winner and the 2013 recipient of the AAPG Grover E. Murray Memorial Distinguished Educator Award.

"We look forward to working directly with those in the industry who will place students' interests at heart and serve the best interests and all aspects of the oil and gas research and training in the United Kingdom and beyond," he added.

Primary areas of research will include:

- Effective Production of Unconventional Hydrocarbons.
- Extending the Life of Mature Basins.
- Exploitation in Challenging Environments.
- Environmental Impact and Regulation.

The CDT will include a training academy, funded to date by BP and Shell (funding opportunities remain open). The academy will be geared toward primary areas of oil and gas research so that individual doctorate projects can be properly contextualized to address today's issues of energy demand and environmental responsibility.

Students will have regular access to academic, governmental and industry experts to ultimately produce innovative ideas for the future, Underhill said.

Each year, top students will have a chance to showcase their research and findings to sponsors in the oil and gas industry as part of an annual conference, where they will meet with industry professionals, identify research links and new projects, and possibly pave a path for recruitment, he added.

"The inclusive nature that is at the heart of this collegiate construct is extremely attractive to many members of the industry and will create a 'one stop shop' for industry and academic engagement for both research and recruitment," Gerdes said.

"I am delighted to be involved in such an innovative, student-centric project designed to attract and train top postgraduate talent for the future energy industry."

The HWU group consists of six core partners (the British Geological Survey and the universities of Aberdeen, Durham, Manchester, Oxford and Imperial College) and 12 associate partners (the universities of Birmingham, Cardiff, Dundee, Exeter's Camborne School of Mines, Glasgow, Keele, Newcastle, Nottingham, Royal Holloway, Southampton and Strathclyde, as well as National Oceanographic Centre).

Details on the CDT can be found at www.pet.hw.ac.uk/research/nerc-cdt-oil-gas-academic-partnership.htm and www.pet.hw.ac.uk/research/nerc-cdt-oil-gas-studentships.htm, or by contacting John.Underhill@pet.hw.ac.uk.

Photos courtesy of Jeannette Wolak

Wolak leads a 2013 geobiology field course in northwestern Washington State.

Seismic in the classroom

Ahead of the Curve

By DAVID BROWN, EXPLORER Correspondent

Jeannette Wolak earned her doctorate in earth sciences at Montana State University, started her career as a deepwater sedimentologist and went to work as a research geologist with Marathon Oil Corp. in Houston.

WOLAK

When she thought back on her college education, what she had learned and what knowledge she lacked, she came up with this perfect response to the university professors who had shaped her studies:

She became a university professor.

Today, Wolak, an AAPG member, is an assistant professor in the Department of Earth Sciences at Tennessee Tech University in Cookeville, Tenn.

"Our class sizes are less than 15 students, so I get to work with students one-on-one," Wolak said. "I really enjoy working with students. And, I really appreciate my time with Marathon."

At Marathon, she worked with open-source software for seismic evaluation. The oil and gas industry began experimenting with non-proprietary seismic software packages in part because of their flexibility and adaptability, she said.

Wolak thought the open-source software resource would be a good fit for Tennessee Tech and decided that some experience with seismic was essential for students considering a career in oil and gas.

That decision was influenced by decade-old research conducted by AAPG member Chris Heath, identifying the skills most important to geoscientists in the North American petroleum industry, she noted.

Heath ranked more than 150 skills and capabilities in determining what industry required from employees working in the geosciences. The top three specific knowledge sets were geology, geophysics and computer science.

Wolak knew her students would carry a knowledge gap into the petroleum industry workplace, or even into graduate studies, if they had no experience with geophysics.

"For a university like Tennessee Tech, we don't offer geophysics. So the students are already at a disadvantage when they graduate," she said.

Another reason for introducing undergraduate students to seismic was to help them visualize subsurface geology in three dimensions.

"I thought, 'Let's bring seismic data. Let's start using this in the classroom the same way we would the field aspect,'" she said. "You can see things in outcrop. You can see them in the field. Now let's take it into the subsurface, and use seismic to do that."

Exposed

Wolak chose software she was familiar with from Marathon, the OpendTect seismic interpretation platform from dGB Earth Sciences in the Netherlands. Last year, the company said more than 2,600 students at 300 universities had used its open-source software.

Universities have free access to OpendTect – a distinct advantage for software used in an academic setting, Wolak said.

In addition to the open-source software platform, dGB offers Open Seismic Repository, a free database of seismic datasets with interpretations.

Using that and other freely available seismic sets, Wolak began introducing her students to 2-D and 3-D seismic interpretation. At one point, she said, the students were surprised to see a curving fault.

See **Seismic**, page 26

Wolak in front of a carbonate teepee structure, Carlsbad, N.M.

Seismic

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"They didn't realize faults could curve. When you look at faults in the field you don't necessarily see that curve," she said.

Wolak found that her students not only enjoyed working with seismic, but also proved to be very adept at writing quick programs and finding online apps to help them with the data.

"The feedback I'm getting from students is very positive. They want to look at more seismic than I can offer them," she said.

She has no illusions about the depth of learning her students will come away with. Her course is very much an exercise in concept familiarization, introducing ideas like time versus depth.

"It's very basic," Wolak said. "These students are not getting a degree in geophysics. But, they are being exposed to seismic."

A Tech-Savvy World

And, becoming familiar with exploration concepts is an important goal for students in the course. She described it as a practical, résumé-building offering for students who might consider a career in mining or oil and gas.

"Half a semester focuses on mining and exploration, and the other half focuses on the petroleum business," she said.

The course mostly attracts senior-level students but does include others, and the only requirement is an introductory geology class, Wolak said. The less-experienced students benefit from a strong "camaraderie" in the program, she noted.

"If they haven't had (a course in) structure and they really don't know what's going on with faults, say, there are other students who've had structure and can help," she said.

Wolak finds her students quite able in the physical aspects of geology, in petrology and sedimentation and stratigraphy. The same can't be said for the numerical aspects of the geosciences.

"Our biggest challenge is developing quantitative skills. Students today are very afraid of math and quantitative challenges," she observed.

But where the students shine is in computer knowledge and using software tools, and Wolak emphasizes the importance of those skills.

"I tell my students we have a geologist on Mars," she said.

We don't talk to that geologist in English or French or Chinese. We talk to it with software, and it responds with streams of data.

Her advice to other geoscience professors:

"Embrace today's technology," she said. "That's one of the hardest parts. We (professors) don't want to keep learning new software, but our students are so adept at it."

Wolak, who just finished her second year of teaching, still expresses amazement at the software and technology savvy her students bring with them.

"They are so good at software. They write little tools that even I don't know how they work," Wolak said. "It's kind of shocking to see them just go. It makes me wonder where we'll be in 10 years."

On challenges and changes for educators

Geology, Interrupted

By DAVID BROWN, EXPLORER Correspondent

Big changes in the world have brought big challenges for university educators in the geosciences.

Four professors – all of them AAPG members, and all winners of AAPG awards for teaching – described the realities of geoscience education today. They are:

- Joe Cartwright, professor of earth sciences, University of Oxford in Oxford, England.
- Bob Goldstein, associate dean of natural sciences and mathematics and professor of geology, University of Kansas in Lawrence, Kan.
- Andrew Hurst, professor of production geoscience, University of Aberdeen in Aberdeen, Scotland.
- Roger Slatt, professor of petroleum geology and geophysics, University of Oklahoma in Norman, Okla.

These professors found common ground in discussing the challenges now facing geoscience education, the importance of geological fieldwork, and the ideal qualities for geoscience students.

SLATT

> "It is somewhat unfortunate, but true, that the computing environment sometimes lends itself to building a geologic model that is geologically unrealistic, but that looks nice."

Challenges

Cartwright, who won AAPG's Grover E. Murray Outstanding Educator Award in 2013, sees educators being pulled away from core concepts, and struggling to teach an increasingly broad area of knowledge.

"The biggest challenge comes from the breadth of the subject and the increasing dilution of core geological topics like structure and stratigraphy because of the need to teach more oceanography, atmosphere stuff," he commented.

He said students' concentration spans are shorter today, so projects where absorbing detailed literature is important are less well done.

Slatt, an AAPG Honorary member who won the Murray Award in 2005, listed the four major challenges in geoscience education as overcoming:

- Entitlement mentality.
- Cell phones in the classroom.
- Ear pods.
- Nintendo geology.

"I was first introduced to the term 'Nintendo geologist' by a petroleum industry professional who saw that the 'new school' geoscientists were relying more on computer graphics than on geologic thought," Slatt said.

"It is somewhat unfortunate, but true, that the computing environment sometimes lends itself to building a geologic model that is geologically unrealistic, but that looks nice," he observed.

Slatt commented that the use of cell phones and ear pods in the classroom indicates a general lack of enthusiasm or interest. He said banning cell phones, media players, tablets and such in class is relatively easy, but he chooses not to.

"My preference is to present my material and if students want to listen, they can, and if they want to use cell phones/iPods, etc. that is fine also. In other words, they have to make their own decisions about what they want out of a class," he said.

Goldstein, who earlier this year won the AAPG Foundation's Professorial Award, noted that today's students are used to digging in and finding the information they need.

"Do they need us to lecture to them in those introductory classes, imparting much of the information they could have learned on their own, or do we need to be their guides to take them to higher levels of learning?" he asked.

"The days of the professor simply lecturing to impart information so the students will remember are passing away. There is still room for some of that, but the opportunity we have is to take advantage of the availability of that information to guide students to higher levels of learning," he said.

Hurst, who also won the Murray Award in 2011, said in his experience only a few students have a natural aptitude for observational science, which he considers essential for geologists.

"Since computer games, 3-D imagery and instant information have become commonplace and acceptable I believe that most pre-university students, independent of their intelligence, are ill-prepared for geology," he said. "Their minds are now conditioned to focus on other things."

Hurst offered a few additional observations, including:

- "In the countryside students know exactly where they are but have no idea where that is on a map."
- "Very few students find thinking in 3-D easy to learn, and most never learn."
- "Students rarely understand contours and have weak skills with maps."
- "Transposing 2-D information into a 3-D mind-model and vice versa is a very unusual skill."
- "Most students are computer

Continued on next page

Continued from previous page

literate but lack numerical skills. They are computer jockeys but they don't know anything about the horses that they ride."

Fieldwork

The educators strongly emphasized the importance of students working and gaining insights in the field, not only in the classroom. A general concern is that fieldwork is being curtailed.

"Those of us who experienced field camp all know that the total immersion method of gathering your own data, reading the rocks, thinking through multiple hypotheses, testing them, and overcoming obstacles is transformative for students," Goldstein said.

"Students go into that experience feeling like students, and they come out feeling like geologists," he observed.

"In the United Kingdom science has become diluted. HSE regulations now make it difficult for high-school students to carry out lab and/or field work," Hurst noted.

"Learning from mistakes is considered a safety hazard, which it is, but avoiding learning from mistakes cancels learning. Do we really think that we nearly know all that there is to know about science?" he said.

"In recent years, cuts in academic funding, normally by state governing bodies, have forced universities to curtail some important geologic educational activities, the most important being the field experience, be it the traditional field camp, or just weekend or class time in the field," Slatt observed.

"'Seeing is believing' is important in the geosciences," he added, "and the reduction in such activities as field study has led to enhancement of unrealistic computer models of earth processes and products, and has led to more Nintendo geologists."

Students learn how to read the rocks during the 2014 AAPG field seminar to Spain, Play Concepts and Controls on Porosity in Carbonate Reservoir Analogs. Co-instructor Goldstein is pictured in center.

Ideal Qualities

Cartwright listed literacy, numeracy, flexible thinking, critical analytical ability and the ability to think laterally as important qualities in geoscience students. He worried that "numeracy and literacy are under threat" because of changes in education.

Hurst looks for "openness of mind, and the spirit to fall in love with geology." He said students should have a "curiosity about the natural and physical character of Earth," coupled with a solid background in math and physics and some working knowledge of chemistry and biology.

"In the UK too many geologists have weak science backgrounds and are unwilling to undertake remedial physics and maths at university," he said.

But the one word that most often appeared as an ideal quality was "enthusiasm."

"When I recruit graduate students, I put a great amount of weight on a strong work ethic, inquisitiveness and enthusiasm. Most of the students who apply to our graduate program are very bright, but some have other skills that help them rise above the others and excel in school and in their careers," Goldstein said.

"Those are students well-versed in the principles of working very hard on a problem," he noted. "That includes a certain aspect of mental toughness to help them think about all angles of a problem and general inquisitiveness to motivate them."

"To me, the most important qualities are enthusiasm and an inquisitive nature for what makes the earth the way it is, more so than getting a degree and a good-paying job," Slatt said.

"With a sincere enthusiasm for geosciences, a student will seek out answers concerning the nature of geology and the Earth, be it for petroleum, ground water, tectonics, igneous petrology or any of the disciplines within the earth sciences. With enthusiasm and inquisitiveness will come a personally rewarding career."

The educators cited job-chasing and a desire to get good grades instead of an education as negative qualities in today's geoscience students.

"In the petroleum area, high-paying jobs have led to a greater number of students seeking geoscience degrees in order to get a high-paying job, rather than an overriding enthusiasm for geosciences," Slatt commented.

However, Goldstein said he sees many programs around the nation focused on governmental and environmental careers, where students don't seem aware of the opportunities available to them in oil and gas.

"There is an opportunity for us in AAPG to more broadly educate students about the opportunities in our industry," he said.

Another common theme was the importance of core science in geoscience education at a time when some students consider only two kinds of research: Google it or look it up in Wikipedia.

"It is a privilege to be an educator, but societal changes make basic educational needs challenging to deliver," Hurst said. "Wiki-life is a problem, so as educators I think that we need to look after the basic foundations of our subjects."

Moving beyond sitcom science

Raising the Bar on Science Awareness

By BARRY FRIEDMAN, EXPLORER Correspondent

"These days, shows like The Big Bang Theory seem to pass for science content."

That's Scott Sampson, one of this year's AAPG Geosciences in the Media Award winners.

(Ouch! We kind of like Sheldon.)

Sampson's point, though, is that for all the talk about how educators in American schools need to re-emphasize and prioritize themselves to the teaching of science, it more often than not is just that – talk.

"You would think," said this vice president and chief curator of the Research and Collections Division of the Denver Museum of Nature and Science, "in an age where we face a sustainability crisis, there would be a high demand for good science programming. But the converse seems to be true.

"In a media scene dominated by reality television, science-based programming is fighting hard to maintain a foothold," he said.

For many reasons, then, Sampson decided to do something about it.

Dinosaur Planet, a four-part Discovery Channel series that aired back in 2003, is just one of them. It was a show he both hosted and helped create.

"Each of the four episodes told an exciting story based around Cretaceous-aged dinosaurs from different parts of the world – for example, velociraptor and protoceratops from Mongolia, and daspletosaurus and einiosaurusfrom from the western United States," he said.

SAMPSON

> "In a media scene dominated by reality television, science-based programming is fighting hard to maintain a foothold."

"I was interjected multiple times into each episode," he said, "to convey the science behind the stories."

Following Planet came Dinosaur Train (2009), aimed at younger children – mostly in the range of three to six years of age, which was produced by the Jim Henson Company and featured daily on PBS KIDS.

And what would seem like a tough sell, teaching science to kids this young (forget the AAPG award; he should be getting a medal), Dinosaur Train is finishing up its third season of episodes.

"Last I heard, the show was airing in over nine million U.S. households per month," he said, "and in over 100 countries worldwide."

At the Tipping Point

For Sampson, who also is a paleontologist and evolutionary biologist, the key to teaching science to anyone, but especially to children, is passion and engaging stories.

"Best of all are settings where children get to exert some control over what they choose to study," he said. "That is, they 'co-create' their curriculum with teachers who, in mentor-like fashion, offer more questions than answers and allow kids to engage with nature firsthand."

In the show, Sampson serves as science adviser and host, appearing at the end of each episode as "Dr. Scott the Paleontologist" to talk about the scientific content and make connections to the present day world.

His tagline at the end of every episode is, "Get outside, get into nature and make your own discoveries!"

It's more than just a theme line.

Sampson thinks we are at a tipping point in history – a tipping point that intersects both history and science.

"Now, more than ever before, we need an abundance of good science communication," he said. "At this pivotal juncture in history, we find ourselves in a precarious position, with critical tipping points looming and minimal time to make the necessary adjustments."

Clearly that involves the ability to understand science, the ability to teach science and the persistence to promote science.

The AAPG award puts him in very good company – company, incidentally, he idolizes.

"My sense of gratitude only increased when I saw the list of previous recipients," Sampson said in talking about the AAPG honor, "which includes many distinguished individuals, including the famed evolutionary biologist Stephen J. Gould."

Seeking an Understanding

There it is, the third rail.

You do a show about dinosaurs, as Sampson does, the question of evolution comes up. You currently serve as the lead researcher in the Grand Staircase-Escalante National Monument in southern Utah, as Sampson does, the question of evolution comes up. You do field work on the ecology and evolution of Late Cretaceous dinosaurs in Kenya, Zimbabwe, South Africa, Madagascar, Mexico, as well as the United States, as Sampson has, the question of evolution comes up.

And when it does, Sampson, who also has written Dinosaur Odyssey: Fossil Threads in the Web of Life, is ready.

Surprisingly, though he is as

See **Sampson**, page 38

Making sense and synergy

Student Expos See Exponential Growth

By BARRY FRIEDMAN, EXPLORER Correspondent

It made sense.

You bring together members of the industry, academia, students and, of course, AAPG, in hopes of ensuring a brighter, more secure future for the profession.

That was the plan and the philosophy behind the AAPG-SEG Student Expo.

And it worked.

AAPG Honorary member Martha Lou Broussard, presently the alumni coordinator at Rice University, saw that vision back in 1998, when she was on AAPG's Executive Committee. Along with others, she had an idea of an exposition specifically designed for students, where they could gather on an annual basis and meet others in the industry – especially recruiters.

BROUSSARD

> "Even during slowdowns in the industry, recruiters keep coming, because they like being able to not have to pay to send people all over the country to find good students."

The synergy was one of the goals, but mostly, she said, "We felt like we needed to get to the geology majors early."

This was important to let them know there was life after graduation. And that meant jobs.

"When we started the first expo, we had 69 students and nine companies," she said.

And now?

This year's expos are expected to attract at least 700 students and 33 companies.

"It has grown," she said, "exponentially.

"Even during slowdowns in the industry, recruiters keep coming, because they like being able to not have to pay to send people all over the country to find good students," Broussard said.

"They want a backlog of people to hire when things go well," she added. "We've never had a year when we had fewer people or fewer members of the industry."

Broussard, who has been honored for her work by both AAPG and SEG, said that when you think of the benefits for industry, students and AAPG, "It's a win-win-win.

"It's important what we're doing for the next generation," she said. "We certainly find jobs for the kids."

Something of Value

Clearly, AAPG student expos have become valuable benefits for all who participate because, first, students benefit by networking with recruiters, sharing résumés, presenting research papers and interviewing with multiple employers.

Companies, meanwhile, enjoy cost-efficient and timely recruiting from a diverse and talented student population.

Student expos bring students to the companies and companies to the students.

See **Student Expos**, page 36

AAPG Student Expos have expanded from a single, small program in the United States to an annual event held in numerous areas around the world.

The annual Student Expo calendar – including the four upcoming events set in locales across the United States – includes:

Spring

- University of Oklahoma in Norman, Okla.

Late Spring

- In Europe at varying locations.

Fall

- AAPG/SEG Student Expo, Sept. 8-9 at the George R. Brown Convention Center, Houston.

The last day to register for the event is Aug. 29.

- The Rocky Mountain Rendezvous, Sept. 26-29 at the University of Wyoming in Laramie, Wyo.
- The AAPG-SEG West Coast Student Expo, Oct. 2-4 at California State University in Northridge, Calif.
- The Eastern Section AAPG Student Expo, Nov. 2-4 at the Erickson Alumni Center in Morgantown, W.Va.

For registration and more information go to: www.aapg.org/events/expos/student-expos.

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Student Expos

from page 34

And this last point, Broussard said, is key.

"That was the whole point of the expo," she said, "to find students at out-of-the-way smaller schools – not in petroleum centers, but places that would never see recruiters, including from New England."

The size of the events and even a bit of the expo character varies from location to location. The upcoming AAPG/SEG Student Expo in Houston has grown to such large proponents that it is now held at the mammoth George R. Brown Convention Center.

Some of the other expos, especially those out west (see sidebar), are smaller affairs, attracting more local flavor, government bodies and environmental concerns – that, too, is by design.

But all expos have a lot in common: Receptions, field trips, poster sessions (intended to let students showcase their skills and talents) and plenty of networking opportunities – with their peers and with industry representatives.

The students who attend these expos come largely from the AAPG student chapters of the various schools – and that, too, is no accident.

What follows, then, are some thoughts from those attending this year's student expos – those who have benefitted, those who helped make them work, those who put them on.

University of Oklahoma

"Our AAPG student chapter is incredibly active at OU. They have a mixture of both geologists and geophysicists working together through networking events, community outreach and combined research initiatives.

The chapter also works very closely with our other two student groups – SEG and Pick and Hammer. They are a tremendous asset to the department when it comes to departmental events and recruitment activities.

The officers of the club are the prime example of how we would like the department to be showcased.

> "That was the whole point of the expo, to find students at out-of-the-way smaller schools – not in petroleum centers, but places that would never see recruiters, including from New England."

They often bring in speakers who are in the professional business, and many of them connect with those company representatives for internships while still in school, or for full-time positions once graduated.

Our AAPG/SEG Spring Break Expo will be in its 12th year in 2015, and it's a unique opportunity for the University of Oklahoma to bring such an important event to our campus. This year, we had 380 student participants from 88 universities attend.

With 21 company sponsors, we also had the largest number of abstracts submitted and judged to date – 100. It's a great event to network with students from around the world and connect with companies that are hiring and want to get their information out to students.

Another note, on the plus side for our university, is that we are able to showcase our campus resources and grounds for potential graduate students, thus bringing in the brightest students.

Devon Harr
Special Events and Donor Relations
ConocoPhillips School of Geology & Geophysics

West Virginia University

Last year was the first year that the ES-AAPG undertook a standalone expo. We coupled that with a student chapter summit

See **Universities**, page 38

West Coast Student Expo Set For October

By BARRY FRIEDMAN, EXPLORER Correspondent

As one of the newer locations for the AAPG-SEG Student Expo, California State University, Northridge, embodies the new feel, the new energy of such annual events.

"I knew that the expos were important for job-seeking graduate students at CSUN, and so we made an effort to encourage students to go to the ones in Houston and Oklahoma," said AAPG member Kathleen Marsaglia, professor in the school's Department of Geological Sciences.

"It just seemed that there was a real need to provide more job opportunities for California students," she said, "especially those from graduate programs in the California State University System (like CSUN) where companies did not traditionally recruit."

CSUN is one of 23 general campuses of the California State University system, and its expo was meant to serve not only its students, but students from smaller and larger institutions in the area.

"It provides an introduction to the industry for undergraduate students and taps local graduate talent at UCLA, Cal Tech, USC, UC Santa Barbara, UC Riverside and UC San Diego (Scripps)."

It began with help and encouragement from AAPG and SEG – and training from those who had organized and run the Oklahoma and Houston events.

"It is small and personal," Marsaglia said of the West Coast event, "and offers a more relaxed expo style that recruiters and students seem to appreciate."

And this is important, she said, for it mirrors the synchronicity between expositions and student chapters going on throughout the country.

"Our chapter developed along with the expo," she said. "Its main event is the expo, as the students volunteer and help with every aspect of the event."

This year's AAPG-SEG West Coast Student Expo will be held Oct. 2-4.

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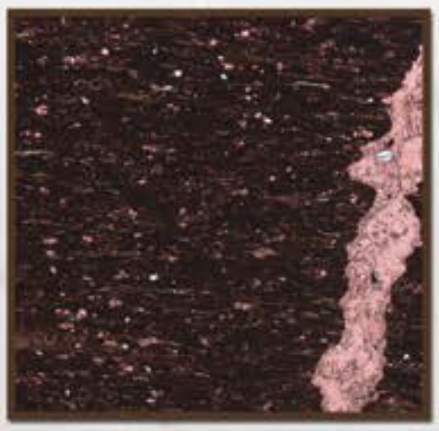

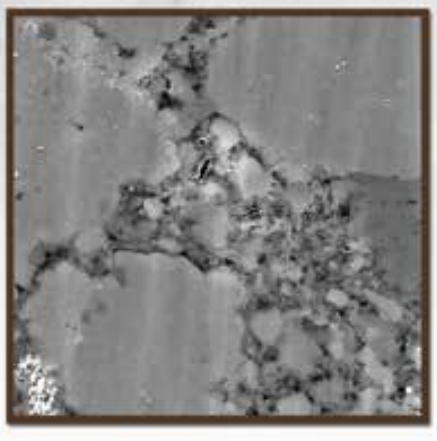

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Sampson
from page 32

understanding of the passion on the "other side" as he is certain they are wrong, Sampson appreciates the diplomacy scientists need to show in addressing doubters, but he is exasperated by having to.

"Regarding evolution, polls continually show that about half of Americans do not accept evolution," he says.

First, though, he wants to make a distinction.

"I prefer to use 'accept' over 'believe' in this context. After all, we don't ask people if they 'believe' in gravity."

The 50 percent figure, Sampson believes, is key to the problem.

"This figure stands in stark contrast to the greater than 99 percent of scientists who fully accept biological evolution," he said. "I don't try to tell anyone what to believe; we all have free choice in that regard. My goal is to convey our best understanding of the science of evolution in a way that is easily digestible by non-scientists.

"Do I expect everyone to accept evolution as the guiding theory of biology? Not anytime in the near future," he added.

Until then, Sampson, who said through the shows he will continue to be a proponent of science – in his words, "real science."

Neil deGrasse Tyson once said, "The good thing about science is that it's true whether or not you believe in it."

Sampson agrees.

"It is important to expand the numbers of those who embrace evolution, since a sustainable future for humanity will depend on us making decisions based on an accurate understanding of how the world works. Of course, science must play a central role if we are to resolve the sustainability crisis in the near future.

"Equally important," he added, "is the need to connect people to their local places. After all, why would we ever become sustainable unless we care about where we live?"

And then he talks about reconnecting kids to that very notion – their lives, their homes, their environments.

"We must counter the current trend of keeping kids indoors staring at screens and instead raise them with a strong emotional connection to nearby nature founded on direct experience," he said.

They can always watch The Big Bang Theory when they come back inside.

Universities
from page 36

– and the turnout was great. I had to cut it off at 90 students because I just did not have the space or companies to interview.

For the Eastern Section the expo is extremely important because of the large number of schools in the ES that are not on the standard schedule for company interviews. School such as Vermont and Georgia, Bowling Green, Smith, Indiana, the University of Pennsylvania and Brooklyn College have geology departments, but do not receive interviewers.

I do not think any section has as many geology departments as the ES. This year we will undertake the student expo at Ohio State University and couple that with a student chapter summit.

Tim Carr
Professor of geology
West Virginia University

University of Wyoming

I started the Rocky Mountain Rendezvous of Geoscience Students and Employers (RMR) in conjunction with the RMS-AAPG section meeting that was held in Laramie in September 2002.

I wanted to return the Job Fair to the Rockies where it started, but the fact that it was doing well in Houston led AAPG to want to keep it there, at the center of the oil patch.

While there are a lot of companies based in Houston – and so a Houston venue is easy for them – it's the students that have the shallow pockets, and I felt a regional job fair would benefit a lot of students as well as Rockies-based independents, so I went ahead with a job fair.

The early "Rocky Mountain Rendezvous" were annual gatherings organized by a fur trading company at which mountain men could come and sell or trade their goods, replenish their supplies and mingle with one another. Rendezvous were known to be lively, joyous places, where all were allowed.

So, referring to our job fair as the Rocky Mountain Rendezvous (of Geoscience Students and Employers) seemed the perfect title.

The RMS-AAPG Foundation provided financial support. Also at the time about 10 companies (majors and large independents) came to the University of Wyoming to recruit.

I asked each of the recruiters: If we did this job fair, would they support it? And they all said yes.

Since then, support and attendance for the event has grown both in terms of companies and students. We now get students from across the Unites States (and sometimes from Canada). Our goal is to make it the most satisfying experience for both students and recruiters and to have lots of "outside the interview box" face-to-face time so that the stress of the interview experience is minimized (at least for the students).

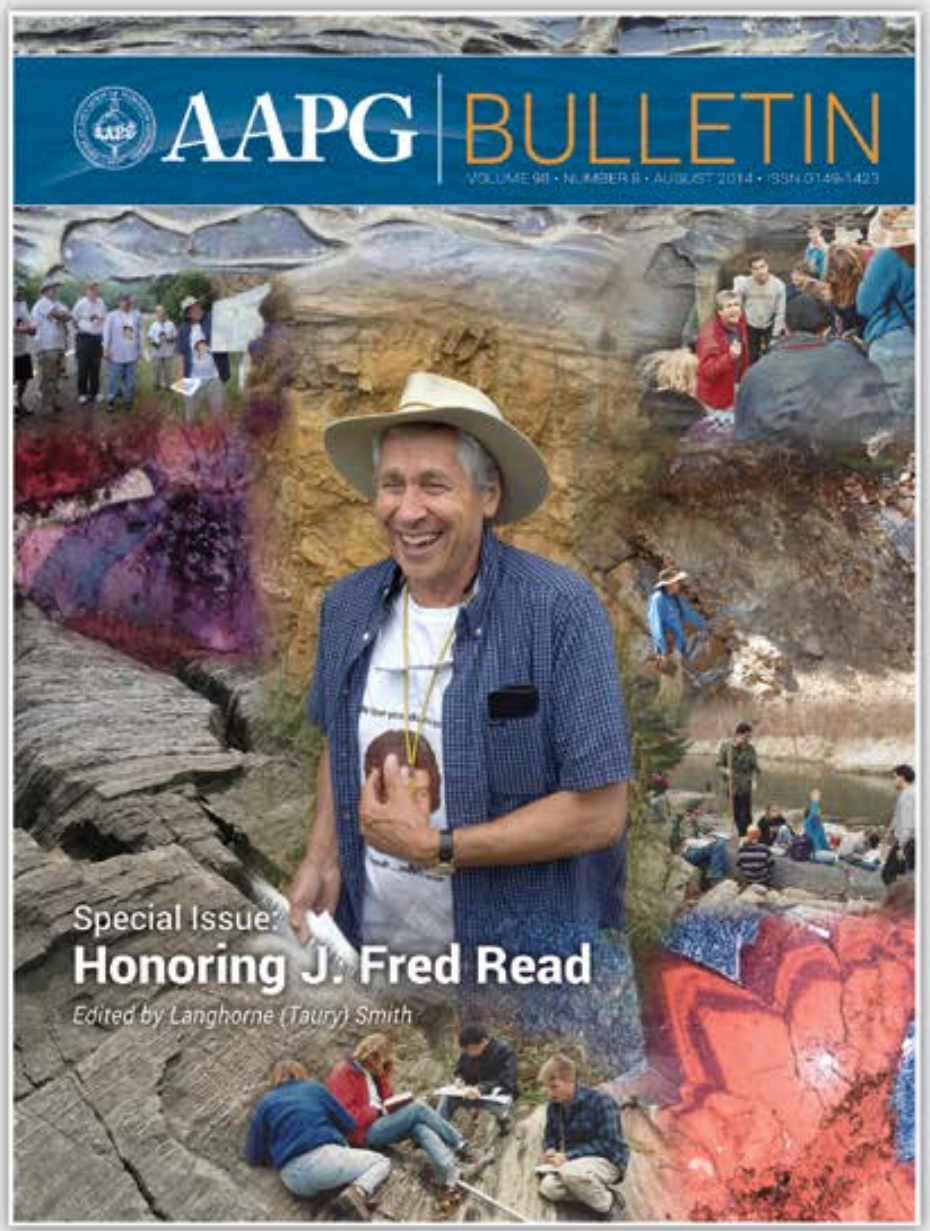
The idea for the RMR was mine and I'm the official chair, but it could never have been done without the support of the University of Wyoming Department of Geology & Geophysics staff and students. The G&G staff for years gave up nights and weekends to handle the logistics of the RMR.

These are not geoscientists – they are secretaries, IT people, editors, accountants.

Randi S. Martinsen
AAPG President
Laramie, Wyo.

SPECIAL ISSUE

AUGUST 2014 HONORING J. FRED READ



AN EXTRAORDINARY OIL AND GAS PLAY

John Grotzinger and Zuwena Rawahi

Microbial facies and their associated clastic-textured carbonates can form reservoirs of significant lateral extent in both shallow and deeper-water settings. In the Ara Group of Oman, platforms of microbalite reservoirs, broken up during salt tectonics, are separated and surrounded by salt.

COMPLEX DIAGENETIC EVOLUTION

James W. Bishop, David A. Osleger, Isabel P. Montañez, and Dawn Y. Sumner

VDiagenesis modified lithologies, depositional fabrics, and pore systems in the Middle Permian Capitan backreef facies of the Yates Formation, Slaughter Canyon, New Mexico. Early diagenesis was dominated during sealevel lowstands by meteoric cementation and stabilization.

IMPROVED GEOLOGICAL SIMULATION MODELS

Nasser Al-Ghamdi and Michael Pope

High-resolution carbon isotope date were integrated with core descriptions and gamma logs to be used as a correlation tool to refine the sequence stratigraphic framework of the Shu'aiba Formation in Saudi Arabia. This process should lead to better models for reservoir characterization.

RELIABLE TIMELINES

J. Garrecht Metzger, David A. Fike, and L. B. Smith

Carbon isotope data from well cuttings and core generates chronostratigraphic logs of Late Ordovician-aged strata from subsurface samples in New York State. It is possible to correlate time-equivalent strata on a basin-wide or larger scale, even cutting across lithologies.

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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.

Persistence Paid Off for Liuhua – Eventually

By BOB ERLICH

The discovery of giant oil fields in new basins typically occurs only after multiple exploration periods and numerous unsuccessful wells. The first explorers might or might not have the right technical concepts, but for various reasons they fail to find the big prize.

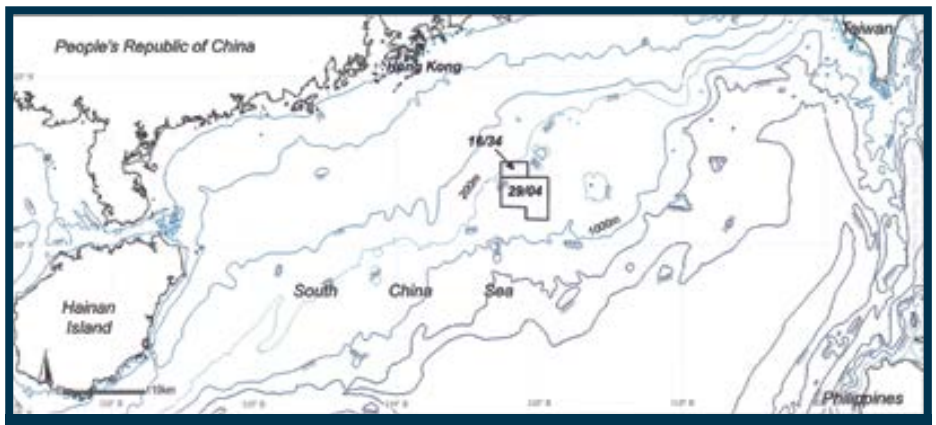
This pattern was repeated prior to the discovery of the giant (in place) Liuhua 11-1 Field, Pearl River Mouth Basin, South China Sea.

Fortunately, the persistence of a highly experienced exploration team and key decisions by management led to one of Amoco's largest international oil discoveries.

The field, located 120 kilometers southeast of Hong Kong in 370 meters of water, contains a STOOIP of 1.3 billion barrels. Development was sanctioned in 1993; the field was produced via 25 horizontal wells with ESP's (electrical submersible pumps).

Production started in March 1996; at its peak late that year the field produced 65,000 bopd through an FPSO.

Production dropped off rapidly, and along with the newly connected 4-1 Field, it now produces about 2,200 bopd.



Location of the original 29/04 and 16/34 contract areas.

AAPG member Bob Erlich is currently vice president of exploration and new ventures for PanAtlantic Exploration. He's held a number of senior technical and executive positions during his 34-year career with major multi-national and small independent oil and gas companies such as Amoco, Burlington Resources, BP, Petrolifera and Hess. His assignments included work in Trinidad, Peru, Colombia, Venezuela, Argentina, Suriname, Brazil, Costa Rica, Panama, Guatemala, Equatorial Guinea, the United Kingdom and the People's Republic of China. Erlich received his doctorate in paleoceanography from Vrije Universiteit in Amsterdam, Netherlands, and has published extensively on the geology of northern Latin America with an emphasis on Cretaceous petroleum systems.

A New Play Concept

A summary of key events leading to the discovery of the field and the geology of the Pearl River Mouth Basin were discussed in Willis Tyrrell and Harry Christian (1992).

To paraphrase Tyrrell, the story involved numerous "ups and downs," but the persistence of a few dedicated explorers eventually paid off.

Amoco formed a veteran team in 1979 to prepare for the first exploration bid round in the basin. They focused their efforts on prospects in the shallow water, siliciclastic section, but also discovered a large carbonate platform in the more distal marine parts of the basin.

The "Whale" structure was mapped over a regional basement uplift (the Dongsha Massif) and was presented to management as a risky secondary (but large volume) prospect. Located in 300 meters of water, it was nearly 40 kilometers distant from what was believed to be the source kitchen for the basin.

Recognizing this risk, management still authorized a bid for the 29/04 contract area, which covered most of the Whale.

When the results of the first round of bids were announced in 1982, however, Amoco had not won a single shallow water block. The team was very disappointed and management ceased negotiations for the 29/04 area.

Amoco Orient was downsized and the basin was put on "monitor" status.

Persistence Pays Off

Following the first bid round, Christian and a small exploration team remained in Amoco Orient to prepare for the second bid round in 1984, when they finally captured a large, shallow water contract area (04/29).

Christian continued to monitor the basin for any evidence that might reduce the technical risks still surrounding the Whale, and his persistence was rewarded when, in 1985, the ACT Group (Agip-Chevron-Texaco) announced that their Huizhou 33-1-1 well discovered light oil, testing at a rate of 2,589 bopd from two zones.

The significance of this discovery was immediately apparent to Harry: 33-1-1 was drilled 10 kilometers from the center of the source basin and on a regional structural nose that led directly to the Whale.

The pay was within the regional Zhuhai Sandstone carrier beds, meaning the risk of long-distance migration was now significantly reduced!

Tyrrell and Ed Shaw recommended and received quick approval from Houston management to capture 29/04, and their successful presentation to Chicago senior management allowed Mike Reavey to re-open negotiations with CNOOC. Amoco finally was awarded contract areas 29/04 and 16/34 in January 1986. Two additional large contract areas located west of 29/04 (28/11 and 29/16) were captured in the third bid round in January 1989 (Bob Dudley, current BP CEO, was my teammate for this presentation in Chicago).

Amoco's large acreage position demanded a big investment in 3-D seismic, so a 120 hertz (cycles per second), zero-phase dataset was acquired over 29/04 and 16/34 during April-June 1986. Structural mapping was completed in late 1986 and the 11-1-1 well was spud in December. Unfortunately, the well encountered mechanical trouble 17 meters above the top of the objective and had to be abandoned with no shows.

Nerves in Chicago were frayed – but Harry and the team persisted. With the support of George Bell, the division manager, and Bob Blanton, Houston region VP, Amoco continued the program with the 11-1-1A well.

The rig was moved 50 meters and drilling started again.

In January 1987 management's concerns were answered. The 11-1-1A well drilled 75 meters of net oil pay in the Zhujiang carbonates, overlying 149 meters of very porous and permeable water-bearing Zhuhai Sandstones.

The elation of the exploration team was short-lived, however, when results from the first RFT in the pay section arrived. That first sample and subsequent testing confirmed the oil was biodegraded, and instead of the light oil found by ACT to the north Amoco had to deal with 16-22 degree API crude!

Amoco soon realized that development of this giant in-place oil field would be technologically and commercially challenged, even though the well tested 2,240 bopd.

To complicate matters, the second well (11-1-2), drilled on a separate structure to the east was abandoned as a non-commercial dry hole. Although long-distance migration had worked, charge volume was insufficient to fill all the available traps in the 29/04 contract area.

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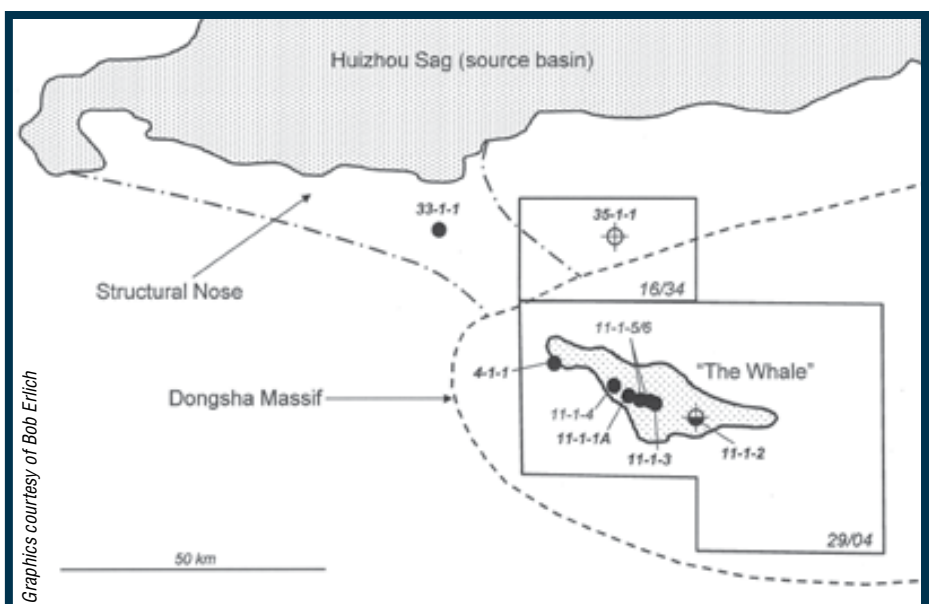
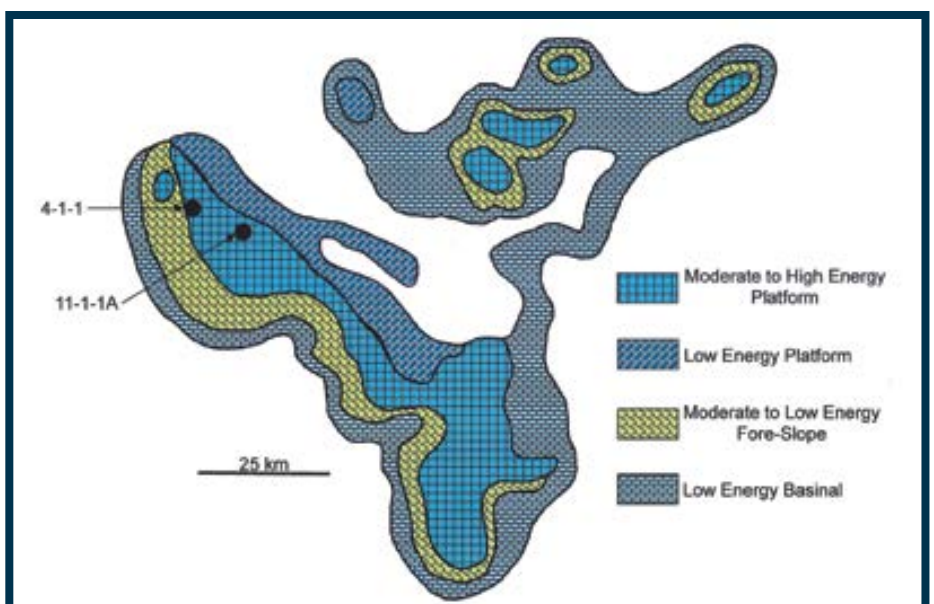


Graphics courtesy of Bob Erlich

"The Whale" structure as mapped in 1982; key wells were drilled after 1984. Adapted from Figure 10 of Tyrrell and Christian (1992).



Liuhua carbonate platform depositional environments as interpreted in 1989. Modified from Figure 8 of Erlich et al. (1990).

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Field Appraisal and Additional Exploration

Amoco moved to the west to drill the 4-1-1 well, a pinnacle reef on the windward edge of the Liuhua carbonate platform. It was successful, but was 11 kilometers distant, meaning a standalone development was unlikely to be commercial.

The company then came back to the 11-1 block and drilled east of the 11-1-1A to confirm the extent of the field. The 11-1-3 well was a successful appraisal of the original discovery, so a new team was formed to evaluate further opportunities in the area.

I joined the project in 1987 while the 11-1-3 well was drilling, and was responsible for seismic sequence stratigraphic mapping of the Liuhua area. Working with geophysicists Chris Stiteler, Ed Shaw, Ed Chau, David Ternes, Grant Goodyear and Jorgen Risum, we mapped the contract areas and picked locations for the 11-1-4, 11-1-5, 11-1-6 and other wells.

Drill stem tests of the 11-1-3, 4, and 5 were good, but the low gravity oil and high permeability of the carbonates meant we coned water quickly at high flow rates. Initial reservoir geological interpretations done by Neil Turner led to a decision to drill the 11-1-6 as a horizontal well in the upper carbonate pay interval.

An ESP was used, and although the well still produced water, it also produced more than 900,000 barrels of oil in 30 days. A reservoir model was constructed and formed a basis for future development well locations.

I was also responsible for the interpretation and evaluation of our other contract areas. Each area came with drilling commitments, and the 04/29 area unfortunately came with multiple well obligations.

After two months I communicated the unhelpful news to Harry Christian and George Bell that I could not find a drillable location within the contract area. They reminded me we had to drill at least one well, and had to technically justify the location to Nanhai East or they would require us to drill a second well.

I finally recommended a location that had some technical merit, although I was certain it would fail.

I was correct; 32-1-1 was drilled in a very sandy, seal-poor area 120 kilometers northeast of 29/04 and was indeed a failure, with no shows.

Fortunately, however, we were able to demonstrate that the well successfully evaluated the license, so our remaining obligation was waived. For the achievement of drilling a dry hole and saving the company from a second well I was given a special corporate award.

It's the only time in my career I've been rewarded for drilling a dry hole!

Ahead of Our Time?

The discovery of Liuhua 11-1 Field involved solid geoscience work, intuition and persistence. Unfortunately, Amoco's next three exploration wells in the 16/34, 28/11, and 29/16 contract areas failed, with the latter well drilled on a prospect I was certain would be successful (a story for another time). Only Amoco's 11-1 and 4-1 areas ever yielded commercial oil, certainly a disappointing result.

I left the project in 1989, as a new team arrived to move Liuhua through development.

Despite all the good geoscience and engineering work, Amoco ultimately was the victim of low oil prices and bad timing; had it been discovered 10 years later, Liuhua 11-1 Field would have been a robust commercial success instead of a marginally economic project.

The company also intentionally focused only on oil prospects to the exclusion of gas, and that directive meant we bypassed the numerous large gas prospects we observed on seismic. Now, a burgeoning mainland gas market will probably reward those bold enough to take that risk.

Nevertheless, the discovery of Liuhua 11-1 Field opened up deepwater exploration in the South China Sea, and set the stage for everything that followed.


Photo courtesy of Neil Turner

Amoco Nanhai East Team at Sanya Beach on Hainan Island

The Hieropolis-Pamukkale ancient quarries, hot springs and travertine deposits are among the sold-out field trips offered at this year's ICE.

ICE 2014: History in the Making

There's still time to register for a historic conference that promises to bring together the best of the worlds of science and industry.

This year's AAPG International Conference and Exhibition (ICE) will be held Sept. 14-17 in Istanbul, Turkey.

The theme for the meeting – hosted by the Turkish Association of Petroleum Geologists and the AAPG Europe and Middle East Regions – is "The Spirit Between Continents: Energy Geosciences in a Changing World."

ICE 2014 marks the first time an AAPG international conference will be held in Istanbul – but that's not the only new dynamic being offered.

This meeting also marks the first time the APPEX Regional meeting will be held in conjunction with an ICE.

In other words, the best of the world's science and cutting-edge technology will be presented along with opportunities to take advantage of that in practical ways.

APPEX is an exploration-themed conference and exhibition, specifically dedicated to the E&P sector, which provides a venue for upstream E&P principals, senior managers, business developers and new venture managers to network and do business with NOCs, governments, financiers and global E&P deal-makers.

In addition to the networking and deal-making potential, APPEX also offers a variety of talks and sessions dealing with exploration opportunities in Turkey, the Black Sea region, Russia, Poland, Croatia, Montenegro, Iraq and other areas in the eastern Mediterranean and central-eastern Europe regions.

Organizers expect APPEX Regional to complement the ICE technical program, which itself was developed from a record number of 820 abstracts and will provide the latest in science – not only for regional plays, but also geological advances from around the world.

The technical program themes include:

- New and Emerging E&P Provinces.
- E&P in Mature Basins.
- Regional Geology and Tectonics.
- G&G Integration.
- Unconventional Resources.
- Conventional Resources.
- Petroleum Systems and Geochemistry.
- Siliciclastics and Carbonates.
- Structural Geology and Traps.
- Health, Safety, Environment Geology and Hydrogeology.
- History of Petroleum Geology.

Several special forums are planned, including:

- Technical Innovation and Collaboration – Keys to Affordable Energy.
- Tethys Evolution.
- Sessions honoring the careers and work of AAPG legendary geologists Peter Ziegler and Dave Roberts.
- The newest presentation of the Discovery Thinking Forum, this time offering specific talks on northern Iraq, India's Barmer Basin, Yemen's Habban Field and Oman's Mabrouk deep gas discovery.

The conference is expected to get off to an exciting start – Turkey's Minister of Energy and Natural Resources Taner Yildiz is scheduled to be speaking, along with other regional and international officials.

This year's topical luncheon will feature professor A.M. Celal Sengör, from Istanbul Technical University, talking about "Was the Geology of the Aegean Responsible for the Rise of the Human Civilization?"

Complete ICE details and registration information can be found online at ice.aapg.org/2014.

Online pilot course takes off

Teaching Earth Science Well

By Brian Ervin, Assistant Managing Editor

Thanks to a $48,000 grant from the AAPG Foundation, 17 teachers from across the country recently completed an online pilot course on "Teaching Earth Science at the High School Level," which is expected to expand to help meet a growing national need in geoscience education.


DODGE

"It's designed to make sure that earth science, in the states where it's taught at the high school level, is taught really well," said Rebecca Dodge, AAPG Member and associate professor of geosciences at Midwestern State University in Texas.

Dodge developed and taught it, having adapted the five-week online course from a previous five-day course she developed and taught for two years through the American College of Education.

"When I came here to Midwestern State University, I knew they were going to start teaching earth science at the high school level, and I asked around in the school districts here, 'Who's going to teach this high school earth science class?' and everybody was saying, 'Oh God, I hope it's not me,'" she related.

"So I thought, 'They hoped that because they don't have the foundational skills – they don't have the basic earth science concepts, so I developed the class and I offered it here in Wichita Falls with funding from the North Texas Geological Society. They gave scholarships for teachers to come take it in a five-day, weeklong eight-hour workshop."

The course caught the notice of the American Geosciences Institute, which sent a proposal to the AAPG Foundation asking for scholarships to support teachers wanting to obtain the fundamentals needed to teach to a high school audience.

"This is why this course was designed: In many states, they don't certify high school earth science teachers. You can get a broad field certification that says you should be able to teach earth science, or you can get certified in chemistry or biology, but not in earth science," Dodge explained.

"So, two years ago when they started teaching earth science at the high school level, who was teaching it? People like… the coach who teaches chemistry or, in most cases, a really good science teacher, but who has no geoscience background at all.

"Somebody who taught biology for 12 years and is an excellent biology teacher, her principal came up to her in May and said, 'Oh, by the way, you're teaching earth science next fall,' and of course she said, 'Yes sir,' and then went home and cried. So, that's why this course was developed."

The pilot program ran June 16-July 18 and was hosted by the Illinois Institute of Technology.

AGI will be handling the national rollout next year.

"We're teaching it for the first time this summer. We'll tweak it and make it better and offer it again next summer and we'll still have money left to give scholarships," said Dodge.

PROFESSIONAL newsBRIEFS

Farouk El-Baz was honored by the Arab-American Civil Rights League with their Fight for Justice Gala award. El-Baz is research professor and director of the Center for Remote Sensing at Boston University, Boston, Mass.

Nathan Meehan has been named president of the Society of Petroleum Engineers for 2016. Meehan is senior executive adviser at Baker Hughes, Tulsa.

Lee Muncy, to vice president of geosciences, TransAtlantic Petroleum, Addison, Texas. Previously retired and former vice president of exploration for the Bass Companies, Fort Worth.

Martin J. Oldani, to development and exploration manager, Apache Corp., Midland, Texas. Previously department exploration manager-Khalda Petroleum JV, Apache Egypt, Cairo, Egypt.

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

Employment Pipeline Eyed By Policymakers

By EDITH ALLISON, Geoscience and Energy Office Director

Over the course of the House Natural Resources Committee, chaired by Doc Hastings (R-Wash.), or its Energy and Mineral Resources Subcommittee, chaired by Doug Lamborn (R-Colo.), hosted seven hearings celebrating energy education and employment.

Hastings pointed out that the committee supports development of all American energy sources; the committee also champions science, technology, engineering and math (STEM) education.

An additional subtext for these hearings, Hastings mentioned, is that the government needs to increase access to federal lands for energy development.

The late June hearing may have been the most relevant to energy professionals that are concerned about attracting and educating the next generation of workers for an expanding industry that is about to experience significant retirements.


ALLISON

> Speakers at two other hearings described what could be a new trend – high schools that focus on oil and gas technology education.

American Energy Jobs: Opportunities for Education

The focus of the June 24 hearing was on how the nation's two-year and four-year colleges are rapidly expanding educational and training programs to meet the growing needs of energy industries. These institutions work with industry to tailor their curricula to job offerings and assure that students are studying the latest technologies.

Most of the witnesses focused on two-year colleges, reflecting on how half of oil and gas industry workers are skilled and semi-skilled blue-collar workers.

Marlene S. McMichael, associate vice chancellor for government affairs at Texas State Technical College (TSTC), noted that the college is a major source of underrepresented populations for potential energy employment, with 62.82 percent minority enrollment (53.94 percent Hispanic, 7.41 percent black, 1.47 percent other minorities). In addition, the student body is comprised of 39 percent females – significantly higher than the composition of the current workforce.

McMichael attributes much of the college's success to its strong partnership with industry that advises on curriculum, mentors students and donates state-of-the-art equipment for training labs.

Mark Volk, president of Lackawanna College in Scranton, Pa., attributed the success of the two-year college in part to collaboration with and funding from Cabot Oil & Gas Corp., which allows the college to help offset tuition costs for disadvantaged students and use the latest technologies in its labs.

Witnesses from Utah State University's Bingham Entrepreneurship and Energy Research Center in Vernal, Utah, and South Dakota School of Mines and Technology in Rapid City, S.D., stressed two components of their successful programs: collaboration with industry to address current technology needs and issues, and student involvement in scientific research to provide new technology to both the industry and the workforce.

The South Dakota School of Mines and Technology witness also pointed out that active collaborations with numerous federal agencies as well as private industry are necessary to support their research.

Matthew M. Kropf, director of the American Refining Group/Harry Halloran Jr. Energy Institute and assistant professor of petroleum technology and energy science and technology at the University of Pittsburgh at Bradford, commented that the current energy boom creates significant educational opportunities in both the short and long term.

"In the short term, we can help replace an aging workforce with workers proficient in the application of modern technologies," Kropf said. "In the long term, we can create a STEM-educated workforce capable of wielding advanced technologies to create the innovations necessary to arrive at energy security."

American Energy Jobs: Opportunities for Skilled Trade Workers

In the April 29 hearing, witnesses praised the skilled trade apprentice programs, bemoaned the federal regulations that impede energy growth and suggested ways to get more young people interested in the energy industry.

Monica Martinez, president of Hispanics in Energy, suggested four principles that can help industry find workers and underrepresented minorities find existing and future job opportunities in energy:

- General dissemination of energy opportunities to educators, parents, community leaders and the general public.
- Student engagement at all levels – including elementary through high school, and technical and college level students.
- Expanding the network of engagement by energy providers and companies to create a pipeline of

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prospective workers.

▸ Assessing outcomes by utilizing data, analysis and benchmarks.

Speakers at two other hearings described what could be a new trend – high schools that focus on oil and gas technology education. The schools mentioned are the Utica Shale Academy in Ohio and the Houston Energy Institute High School.

* * *

The other hearings considered the opportunities for energy employment for veterans, women and minorities, and the benefits to manufacturing and state and local economies:

▸ Feb. 26, American Energy Jobs: Opportunities for Veterans.

The subcommittee heard testimony from workers who had made the transition from the military to the energy industry explain how the private sector is facilitating this transition for other workers.

▸ April 8, American Energy Jobs: Opportunities for Women and Minorities.

Witnesses noted the low representation of women and minorities in the oil and gas industry and suggested the need for industry to educate young people about the opportunities and advantages of working in the industry.

▸ May 20, American Energy Jobs: Opportunities for American Manufacturing.

Subcommittee chairman Lamborn stated the hearing theme: A key factor in the current trend of U.S. companies bringing manufacturing jobs back from overseas is the abundance of affordable natural gas and energy.

▸ June 6, American Energy Jobs: Opportunities for Innovation.

Lamborn summarized the hearing as presenting "the ways private industry promotes innovation in the workplace and how they recruit and train the next generation of innovators to continue this good work."

▸ June 18, American Energy Jobs: Opportunities for States and Localities.

Witnesses described the benefits that revenues from oil and gas production bring to states, local governments and communities. They also described the challenges that come with increasing population and traffic.

All hearings webcasts and written testimony are available at the committee webpage.

Make your plans now to join members of AAPG and other geoscience organizations in Washington, D.C., on Sept. 16-17 for Geoscience Congressional Visits Day – an opportunity for you to help raise visibility and support for the geosciences, and to discuss the science behind the energy issues important to you and other AAPG members.

Constructive visits from citizen geoscientists – centered on the importance of geoscience and the science behind energy issues such as hydraulic fracturing – are the most effective way to inform and influence federal policy.

Here's how it works:

▸ Participants will spend the first afternoon at a workshop learning how Congress works, how to conduct congressional visits and about relevant legislation and federal programs.

▸ The second day will consist of visits with members of Congress or congressional staff on Capitol Hill.

Fact sheets and talking points for shared geoscience concerns will be provided – and you can plan to bring impacts and examples from your experience to your congressional district.

All scheduling and logistics for the workshop and visits will be arranged by the AAPG and its sister societies.

To participate in Geo-CVD, contact Edith Allison, eallison@aapg.org before Aug. 15.

For more information, see www.americangeosciences.org/policy/GEO-CVD.

– EDITH ALLISON

AAPG EXPLORER
GEOPHYSICAL CORNER

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer. This month's column asks: Is automated 3-D channel interpretation using spectral decomposition attributes a valid concept?

Spectral Decomposition for 3-D Geomodeling

By BRAD C. WALLET

Spectral decomposition attributes use a localized time-frequency decomposition within individual traces to characterize seismic data by its spectral content.

Since localized spectral content can be linked to physical phenomena of channels such as fill velocity and thickness, such techniques have been popular in the past decade for characterizing and interpreting of fluvial systems including turbidites.

The original work using spectral decomposition focused upon qualitative interpretation upon time slices and/or phantom horizons with a goal of broad scale interpretation and reservoir description.

In recent years, however, a number of workflows have been developed to use spectral decomposition for 3-D geomodeling to extract architectural elements such as channels. Most of these methods are proprietary – and, to my knowledge, few have been documented or published.

A typical workflow might involve the use of the instantaneous frequency attribute to determine the dominant frequency associated with a channel. Once this information has been ascertained, an interpreter then might use some spatially associated thresholding (i.e. amplitude clipping) method to extract the channel.

These results then would undergo further processing, such as smoothing or denoising, to produce a final interpretation.

* * *

Figure 1 illustrates how a workflow like this would be constructed:

- Figure 1a shows a time slice of seismic amplitude data presenting a portion of a channel system from the West Cameron block of the shelf region of Louisiana.
- Figure 1b shows a vertical slice cutting across this system (line A-A') perpendicular to the direction of paleo-flow. At this location, there is one distinct channel (channel a) and two closely associated channels (channels b and c) with a narrow inter-fluvial region.
- Figures 1c and d show time and vertical slices through the instantaneous frequency attribute at locations matching those shown in figures 1a and b, respectively.

An examination of these images suggests that the channels might be associated with frequencies in the 40-60 Hz range. This relationship is much stronger for channels "a" and "c," which have better defined tops than channel "b."

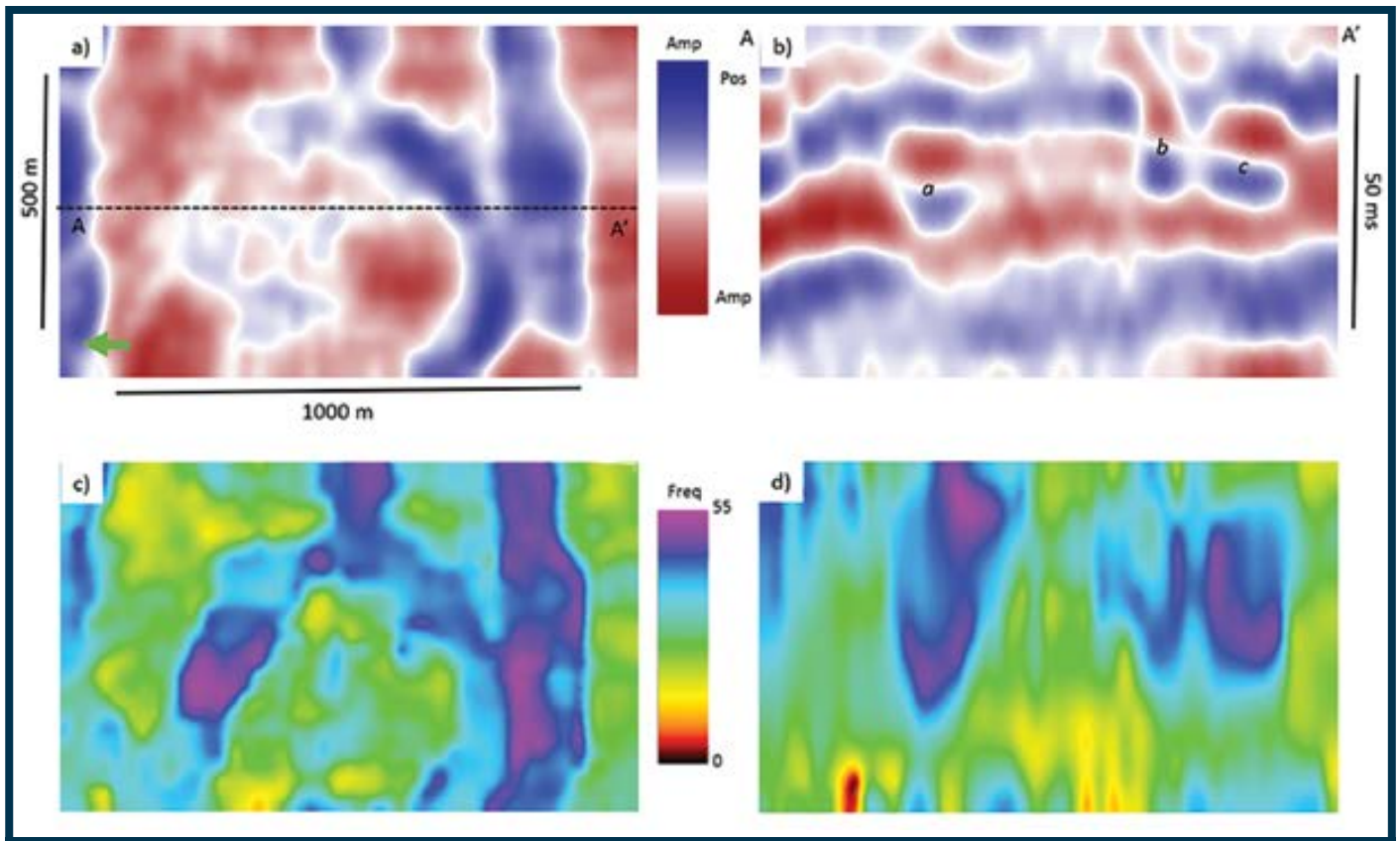

Figure 1 – Panel a) shows a time slice of seismic data containing channels, and b) shows a vertical slice of the same seismic data taken perpendicular to the paleo-flow of the channels. Three channels – a, b and c – are identified. Panels c) and d) show the instantaneous frequency attribute for the views shown in a) and b), respectively. These images suggest frequencies in the 40-60 Hz range are likely associated with the channels.


WALLET

My question: Are these channels completely and properly isolated vertically using spectral decomposition attributes?

Note that 50 Hz corresponds to a period of 20 ms, which is the approximate trough to trough thickness associated with all three channels.

One possible pitfall is related to the spatial uncertainty associated with spectral attributes. Specifically, since spectral content is calculated using a vertical window, the calculated spectral information might be too imprecisely positioned to allow for good modeling in a vertical sense.

This is further compounded by the inclusion of spectral phase, which might allow for the fitting of a rotated wavelet that is not properly centered upon the architectural element of interest.

The net result of these problems could be an extracted model that looks geological but that is not properly located vertically. Better understanding of the vertical localization of spectral decomposition attributes is necessary to better understand if this is a true concern.

* * *

To assess whether a 3-D geomodeling workflow was feasible and valid, I decided to look at the vertical characteristics of some spectral magnitude attributes for my channels of interest.

My primary question was, "Are these channels completely and properly isolated vertically using spectral decomposition attributes?"

One aspect of the vertical localization will depend upon the algorithm, as there are a number of methods to calculate spectral decomposition attributes. For the purposes of my study, I chose to use a matching pursuit (MP) algorithm, which is regarded as having superior localization.

MP spectral decomposition works by decomposing a seismic trace into a set of time-shifted wavelets selected with replacement from a library of pre-computed wavelets. The decomposition is done iteratively by fitting component wavelets and calculating residuals until the residuals are sufficiently small.

Figure 2 shows some spectral magnitude attributes as calculated using a MP spectral decomposition algorithm calculated using a library of Ricker wavelets.

- Figure 2a shows the same vertical slice of seismic amplitude data shown in figure 1b. In this slice, I have shown an interpretation of the bottom of the channels picked at a trough (green horizon) and a pick of the top based upon a peak (yellow horizon).

Note that the trough-to-peak distance for all three channels is approximately 30

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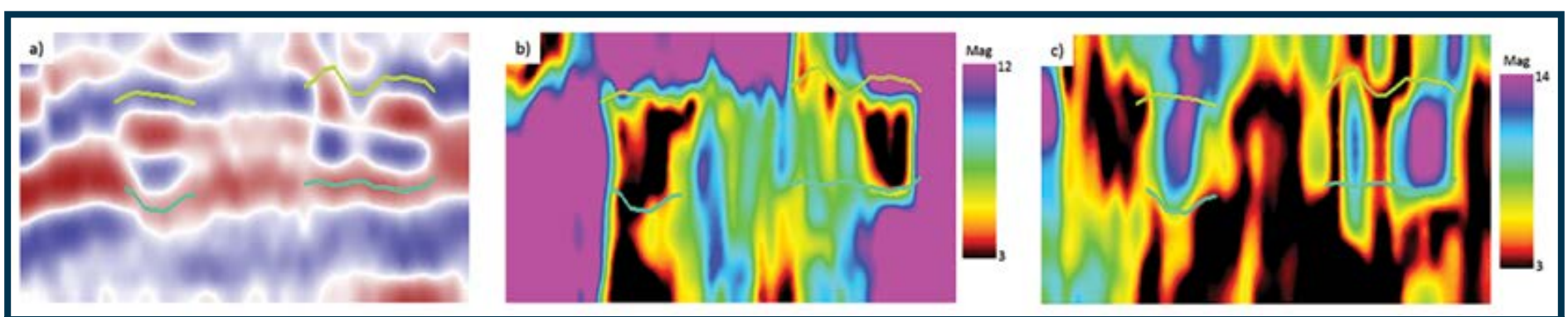

Figure 2 – Panel a) shows the same vertical slice of seismic data shown in figure 1b with an interpretation of the channels based upon a top peak and a bottom trough. Panels b) and c) show the 30 and 50 Hz spectral components, respectively. Note that the channels are generally well interpretable in the spectral components, though some ambiguity exists in various cases.

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ms, while the trough-to-trough distance in these channels, as previously noted, is approximately 20 ms. These correspond to frequencies of approximately 30 Hz and 50 Hz, respectively.

Figure 2b shows the 30 Hz component. In this, channels "a" and "c" are relatively well defined by a low magnitude region. This region is especially well defined for channel "c." Channel "b" is not as well defined.

A low magnitude region matches our intuition for a peak-to-trough region when decomposed using a unimodal wavelet with an internal peak and trough as the internal components will destructively combine when convolved with the two positive sides of the wavelet.

Channel "c," while well defined, is not delineated to its proper top.

Figure 2c shows the 50 Hz component. In this, all of the channels are relatively well defined, this time by a high magnitude region.

Again, channel "c" is particularly well defined. However, there is some less well defined regions along a portion of the top of channel "a." Either channel b's top or bottom would be somewhat misplaced spatially, depending upon the choice of cutoff for segmenting.

Additionally, the inter-fluvial region between channels b and c is sharply defined by a particularly strong low magnitude event.

* * *

In conclusion, these results show that there is a promise to algorithms using spectral decomposition attributes to do 3-D geomodeling of channels.

In the case of the 50 Hz decomposition, the theoretical analysis of the wavelet is based upon the consideration of the bottom of the channel and an internal reflector, while the highlighted region appears to cover the full range of the channel.

I believe this has to do with the phase of the fit wavelets. This is a conjecture that suggests future work to better understand the role of phase in modeling channels.

Finally, while the results do show vertical localization, all of the images of the attributes are noisy. This emphasizes the importance of good post-processing workflows to provide parsimonious and geologically sound models.

Additionally, as some boundaries are misplaced vertically, it is my belief that naïve algorithms will give less desirable results than one that incorporates some heuristical processing to ensure geologically and geophysically consistent models.

* * *

I would like to thank Victor Aarre and AAPG members Kurt Marfurt, and Roger Slatt (Honorary) for many insightful discussions concerning this and related topics. Additionally, I would like to thank Schlumberger for providing the data used in this work.

Finally, I would like to thank the sponsors of the Attribute Assisted Seismic Processing and Interpretation (AASPI) Consortium for their ongoing support.

(Editor's note: Brad Wallet is director of the Crustal Imaging Facility at the University of Oklahoma, Norman, Okla.)

Inbox Flooded? We Can Help!

By JANET BRISTER, AAPG Website Manager

The American Association of Petroleum Geologists does a lot – and it's assumed that the membership wants to know all about any and everything that is happening.

And, we know: At times this assumption seems presumptuous when your inboxes become overloaded with AAPG information.

But here's some good news: You can control the communications you receive from AAPG.

Behind your AAPG profile is a place to edit your preferences about information you want delivered.

(Likewise, in the footer of every email is a link to what I'm about to describe.)

From the website log in and go to your profile. Look for the orange button on the right that reads "CONTACT PREFERENCES."

This shows what is currently checked in your record, based on current membership involvement and previous events and training attendance.

All of these preferences are now editable at any time by clicking the large orange button at the top that reads "EDIT CONTACT PREFERENCES."

Before you do, look at the sentence above that where you will see displayed the email AAPG is sending to. If you want to change that email you will be able to modify that, too.

For example, a division member will have their division selected; a person who has attended an annual meeting will have the Annual Convention & Exhibition checked, and so on.

Push the Button

Here's how you update these preferences.

Upon clicking "EDIT CONTACT PREFERENCES" you are in the multi-tabbed interface to edit your profile.

On the right just under these tabs is the field "Email Address," where you can change the email address we are using.

You should make note of the six tabs for this window. Each of these tabs has a save button unique to its information.

To save changes to your email address, scroll to the bottom of this tab's window and click "SAVE."

This is required to update your record.

The "Contact Preferences" tab contains an exhaustive list of all the information AAPG might communicate with you.

By selecting each option applicable to you, you are adding or removing your name from that email list.

These are organized into broader topics to help you make your selections.

If you are only interested in receiving information about the annual meeting, for example, you would find the "events" topic and select "Annual Convention & Exhibition" while de-selecting any other option in that section.

However, should you want to know about any call for submitting papers there is an option to select that would make sure a notice about a call for papers for any event would land in your inbox.

After you've completed all your selections, scroll to the bottom of this window and click the "SAVE" button.

At any time you may return to your profile to review and edit your contact preferences.

Check the Fine Print

Another place you may access the interface described here is in the footer of every email.

Here is not only the link directly to the Contact Preferences landing page, but the options that were selected that specifically caused you to receive the email you are reading.

Now you may modify the specific preference to tell us to stop sending that information to you, while other preferences stay intact.

To sum up, you are invited to exercise the option to remain in a list – opt-in or be removed out of a list – opt-out – anytime by updating that preference when you visit the AAPG website and when you receive an email from the AAPG.

Good browsing!

PROTRACKS

Joining AAPG – Good Idea, or Great?

By EMILY FISHER

When you join a new company, they provide a lot of resources for a budding career. As a result, you might question why you would need AAPG, let alone need to volunteer for the Association.

Actually, there are several reasons AAPG can be good for you.

For one, you get to meet geoscientists outside of your company. These relationships not only provide a valuable perspective on the industry as a whole, but also allow you to build your personal network. In our line of work, it's the "who you know" that can further your career goals.


FISHER

Beyond that, volunteering gets you to the next step of leadership and those ever-important soft skills (FYI: soft skills get you promotions). The bottom line is:

If you are a YP and want to advance your career, you should volunteer in AAPG.

Demonstrate that you can not only attend a networking event, but also run one. Organizing an event develops the skills that will help you organize other aspects of your professional life. You also will get a chance to learn teamwork and leadership in a way that can be directly applied to your job and your life.

When you serve on a committee with someone or organize a technical session together, you develop a deeper relationship – truly, many of my committee comrades are now my best friends.

If you haven't figured it out yet, this is a small world and an even smaller industry. You will work with these people in the future, and that volunteer committee work from 10 years ago may, for example, help you fall into an exciting team dynamic when you and a fellow committee member work together.

AAPG President Randi Martinsen encourages all YPs to participate in Association business:

"Become an active contributor to AAPG's leadership by joining a committee or helping organize and run a conference. Actively joining in and working with other leaders will allow you to demonstrate your leadership, communication, organizational and various other skills and also improve upon them. In addition, it can often be a lot of fun."

* * *

Already a member of an AAPG committee?

You can – and should – support YP participation. And if you nominate committee members, you need – and should want – YPs as part of your team.

The first notion people have when placing YPs on any AAPG committee is to think they belong specifically on the YP Committee.

"They're young. They belong with YPs and we have a committee for that, right?"

That would be like taking all the new geologists at your business, putting them in one unit without direction, or a boss, and expecting great work.

Is that the model we have at our workplace? I hope not. At companies, we provide mentors, assign manageable tasks and set increasingly larger goals with greater responsibility.

See **YPs**, on next page

YPs
from previous page

This is why YPs should not only be on committees other than the YP Committee, but also hold normal offices. They then have a chance to learn the AAPG structure, watch Robert's Rules of Order in action and contribute a little bit at a time to build up their skills.

I've had a marvelous opportunity to be part of the Pacific Section while starting out in AAPG volunteerism. The Pacific Section is relatively small and has let YPs hold office along with more experienced members.

This was the perfect environment to simultaneously learn and contribute. Having experienced professionals on the "team" – including one who chaired my committee the year before – provided guidance and much-needed advice.

They also stopped running for that office. Yes – the mentors now advise from behind the scenes! It was a huge vote of confidence and respect and a major investment in the future of the organization.

* * *

The joy of AAPG is that you can build something spectacular with a great idea, a network and hard work. Many experienced AAPG volunteers have built amazing programs that have benefited thousands of members, including myself.

I want to see this good work continue.

We need the next generation to learn how these programs work and prepare to carry that torch. I don't want to see great programs die. And I really don't want to see AAPG become irrelevant.

We need to be transitioning now, and have experienced professionals work *with* YPs. It will make our current work better and AAPG will be better for it in the future.

President Martinsen already is endorsing the appointment of YPs to leadership positions:

"Many studies have shown that diversity (gender, ethnicity, age, etc.) in a corporation's or organization's leadership results in increased performance and higher levels of success. Diversity promotes creativity, fosters communication and thus facilitates achieving the goals of the AAPG organization and best serving its members.

"It is especially important that AAPG seek out young professional members for leadership roles with the 'great crew change' looming before us."

In order to have YPs around to volunteer, they need to learn and be heard. We've got to make a little room and give a little guidance.

In 15 years, don't we want someone who was the convention chair to still be available to volunteer and mentor someone?

* * *

So how do we begin?

For now: Talk to each other. When you're considering appointing a committee, think of the YPs at your company and those who have attended AAPG events. Ask them if they are interested. They may not have been asked before.

And to the YPs: Go for it! Fortune favors the bold! It's rewarding experience and good for you. Get a sponsor and become a Member. You need to do this to chair a committee – and it helps your Section or Region get representation to the House of Delegates.

Currently, AAPG is working to make the committee appointment process more streamlined. With the new website, you will soon be able to edit your profile, state your interests and indicate if you want to be asked to volunteer (and I sincerely hope you will). The committees will be able to access this list of interested individuals whenever committee positions come available.

Look for these changes in the near future!

(Editor's note: Emily Fisher, with Aera Energy in Bakersfield, Calif., is a YP member, member of the Professional Women in Earth Sciences and vice chair of the AAPG Student Chapters Committee.)

Asia-Pacific Region Sees Continued Growth

By PETER BAILLIE, AAPG Asia-Pacific President

AAPG Asia-Pacific Region membership continues to grow, and we now have more than 5,300 members, divided almost evenly among Members, Students and Associate members.

The five countries with largest membership are Indonesia, India, Malaysia, China and Australia.

Our Asia Pacific Student Chapters continue to be very active and successful – we have opened several new chapters – and they continue to make us proud.

In fact, they swept the top three awards, including the top prize for Most Outstanding International Student Chapter, at this year's AAPG Annual Convention and Exhibition in Houston.

Those individual winners were:

- University of Pembangunan Nasional "Veteran" (winner).
- Gadjah Mada University (honorable mention).
- Diponegro University (honorable mention).

AAPG Vice President-Regions John Kaldi, newly elected chair-elect of the House of Delegates Bob Shoup, Herman Darman, Bob and Santi Morley and myself met with students at the annual convention of the Indonesia Petroleum Association (IPA) held in Jakarta in May 2014.

* * *

Since the beginning of 2013, one GTW and two joint-society workshops have been held in the Region:

- A GTW on "Deepwater Plays: Exploration and Production" was held in Brunei in March, an event supported by PetroleumBRUNEI that attracted 110 participants.

Associated activities included a combined field trip and core workshop.

- A joint workshop with EAGE on "Profits and Pitfalls of Shallow Seismic Reservoirs" held in Kuala Lumpur in June, had 84 participants and was supported by PETRONAS and Geological Society of Malaysia.
- A joint workshop with SPE on "Optimizing Production by Understanding the Reservoir: Reservoir Quality, Architecture, Petrophysics, Rock Mechanics" was held in Ho Chi Minh City, Vietnam, in May.

And this month, a joint conference with the Myanmar Geosciences Society on "Tectonic Evolution of Myanmar and its Basin Development with Special Reference to its Petroleum Occurrences" will be held in Yangon.

Sincere thanks to all those people who have either been associated with the organizing or have contributed to these events; without that support, these events would not be possible.

* * *

Future regional events currently are being planned for Malaysia, Australia and New Zealand. Watch the AAPG website/ Event Listings for more information.

They include:

- The 2015 AAPG International Conference and Exhibition will be held in September in Melbourne, Australia. Already the Planning Committee has had several meetings; full details will be announced later this fall, following the upcoming AAPG ICE in Istanbul, Turkey.
- Three new Geosciences Technology Workshops (GTWs) are in the pipeline :

Coal Seam Gas
Brisbane, Australia
12-13 February 2015
Convenor: Andrew Garnett, University of Queensland

Tectonics and Sedimentation of South China Sea Region
Kota Kinabalu, Malaysia
26-28 May 2015
Convenors: Ioannis Abatsiz, CCOP Denmark and Herman Darman, Shell, The Hague

Modern Depositional Systems as Analogues for Petroleum Reservoirs
Wellington, New Zealand
21-24 April 2015
Convenor: Dr Mac Beggs, New Zealand Oil & Gas Ltd.

- We'll be continuing with our series of "lunch and learn" talks – three events already have been held at PETRONAS, Kuala Lumpur and one in Brunei hosted by our new affiliate society, the Geological Society of Brunei.

- We will be continuing to build on our success of starting and strengthening our Young Professionals networks in the region (a new YP chapter recently was started in Kuala Lumpur).

Of course, continuing these Asia-Pacific success stories will benefit from even more of you joining us in the effort. Specifically we need:

- Conveners and committee members for new GTWs and conferences.
- Short course providers.
- Assistance with setting up Student Chapters and Young Professional chapters.

To join the effort, or just for more information, contact Adrienne Pereira, at apereira@aapg.org. E

Geo 'Firsts' – Remember When?

By APRIL HASTINGS, AAPG Foundation Program Coordinator

Chances are if you've always been innately passionate about earth science, you probably remember one or more of your geological "firsts."

Do you remember the first time you picked up a rock and wondered what it was made of, and where did it originate? Do you remember from this first initial spark, the other firsts that led you to where you are today? You may remember after graduating and landing your first job being pleased as punch (or happy as a lark) to work in a field that you'd trained for doing something that you loved.

Every day across the world geoscience students experience similar firsts. Students today are able to utilize research and technology in fantastic new ways, largely thanks to the exploration accomplished and chronicled by geoscientists like you.

Some of the challenges along their path, however, remain the same. University level students continue to be confronted with funding obstacles due to increasing costs of tuition and research expenses, and are often faced with the reality of limited-to-no access to the tools critical for success.

Reducing Financial Burdens

Tuition expenses continue to rise disproportionately to the salaries available for geoscientists who are planning to enter the workforce. Rising costs continue to put an undue burden on students eager to gain a foothold in their respective industries and academic fields. With the help of many generous supporters, the Foundation aims to help manage the challenges that these costs present, and promote the talents of young professionals so they may focus their efforts on their interest and skill set – enhancing earth sciences.

> **Students today are able to utilize research and technology in fantastic new ways, largely thanks to the exploration accomplished and chronicled by geoscientists like you.**

Keys to Success

In an effort to remove challenges and afford opportunities to aspiring geoscientists, the Foundation has established and maintained programs that support undergraduate and graduate level research. Interested in helping champion the cause? Donors can support university departments and graduate level geoscience students one of two ways:

- Funding a Grants-in-Aid research scholarship.
- Funding a scholarship through the Military Veterans Scholarship Program.

Grants-in-Aid

The **Grants-in-Aid** program has long been heralded as one of the Foundation's most respected and valuable programs. Since 1967, the program has advanced geoscience education by funding students who are the best and brightest in their fields. The first named Grants-in-Aid fund was initiated in the early '70s when friends of the late Hugh D. Miser established a fund to give an annual grant in his name. They designated the award, requesting it be given to a qualified student working on the geology of Oklahoma and/or Arkansas. They did so to honor Miser's favorite part of the country – he happened to have been instrumental in producing the first geologic maps of both Arkansas and Oklahoma.

A known pillar of educational support, the Foundation now manages 91 named grant funds, many of which bear the names of pioneers in the energy industry.

In the spring of 2014, the Foundation awarded $207,750 in funds for research projects around the globe. These funds provide much needed support to students pursuing masters and doctoral level geoscience research, empowering students to conduct thesis-based field work during the summer between their academic years. The demand for assistance, however, exceeded our ability to award funds – receiving 373 applications and only able to grant awards to 24 percent. While the program grows steadily, there are still many students in need of research dollars.

A Grants-in-Aid fund may be established by a company, an institution, an individual or a group. The fund may be designated with a one-time contribution of $25,000, enabling AAPG-F to award $1,000 annually. Established funds may be augmented with an additional gift of $12,500, allowing the Foundation to award $500 more grant dollars each year. Grants given range from $1,000 to $3,000 annually.

Military Veterans Scholarship Program

Understanding the physical environment of the Earth is often second nature to veterans of the armed forces. Following their generous gift of service to the United States, men and women of the armed forces are primed for a successful transition from service to being ready to fine tune their new knowledge of geoscience. Those transitioning from service to civilian life naturally excel in subjects involving field surveying and ground-level investigation. The brand new **Military Veterans Scholarship Program** (MVSP) aims to make transitioning from service to civilian life easier for veterans, enabling them to pursue and finish degrees, paving a smoother path towards securing employment in fields of Earth sciences.

To further appreciate the value of this scholarship program, it is important to note that veterans are currently underrepresented in the workforce. They are more likely to begin college than the general public,

See **Military Veterans**, page 55

Grants-in-Aid Reaches Near and Far

Nora Nieminski, a third year Ph.D. student at Stanford University, was a recent recipient of the **Mruk Family Named Grant** through the Grants-in-Aid program. This generous grant recognizes her research in Namibia, the focus of two-thirds of her thesis.

Fieldwork in Namibia is not for the faint of heart, to say the least. By undertaking this project, Nora has opened up a poorly studied, remote area that is new to her research group. She still remains the only Stanford student to be working in the area and said that although many would never brave to venture to her remote field area (in the second least densely populated nation in the world), the Namib Desert is where she feels most alive.

Nora shared her experience and said she enjoyed the fieldwork immensely. She spent long days measuring stratigraphic sections, correlating these sections across folds, collecting samples. She ended each day with a hearty dinner cooked in a traditional poitjie pot over the fire. Each night she spent time going over the day's notes, planned her next day, and sat under a canopy of brilliant stars, contemplating the universe. Sometimes weeks went by without seeing another person, and she often fell asleep to the sounds of hyenas and other African wildlife.

The AAPG Foundation is proud to support scientists and explorers like Nora.

Nora expressed special thanks to AAPG Foundation supporter Denise Cox. Cox set up the Grants-in-Aid scholarship to honor her family, the Mruks. Nora pledged that in her work, she would incorporate the high standards of excellence and passion for which the grant was endowed.

To create a scholarship in your or a loved one's name and advance the future of geoscience, contact the AAPG Foundation.

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Direct Line: 918-560-2644
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Toll-Free Number
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Editor's note: AAPG Honorary member, past president and Sidney Powers medalist Marlan Downey presented these remarks at last year's AAPG Mid-Continent annual meeting in Wichita, Kan.

Commentary

Downey: Thinking Like Oil

By MARLAN DOWNEY

I would like to suggest that far too much of the technical work purporting to guide exploration for petroleum is trivial, redundant and has little of use to offer toward finding new oil and gas accumulations.

All geology is interesting; some geologic work is novel; damn little of the work we see is useful in finding new oil and gas fields!

All sorts of "interesting" work is being published in sedimentation, stratigraphy, structural analysis, geochemistry, petrophysics and geophysics. Try to remember that only academics are being paid for their advancement of science; you are being paid to find oil and gas.

In exploration, you will be looking at data many already have seen; you need to think what no one else has thought!

As Oklahoma's famous humorist Will Rogers said, "It ain't what we know that gives us trouble, it's what we know that ain't so!"

Recently, I attended an international conference, and in my summary comments I said, "In 35 presentations, I saw ONE illustration, in one talk, that gave useful guidance to finding oil."

It is very, very hard to find buried treasure (new oil and gas fields); the search needs our best talents, our brightest and most innovative people, and the search needs to be focused, like a laser, on locating underground oil and gas.

There are a few simple laws that govern where oil forms, how it moves, and where it chooses to reside.


DOWNEY

> **Oil knows where it can and cannot go. Shouldn't YOU? Since oil always follows the rules, shouldn't you know the rules?**

Do you know the rules?

Let's pretend oil can talk – and let's listen.

In oil's origin, migration and current residency, oil always obeys rather simple chemical and physical laws. Since oil always obeys these laws, shouldn't you know them?

Oil knows that we need to start with abundant, naturally accumulating organic matter, which has been buried to depths sufficient for the earth's temperature to transform the solid organic matter to oil and gas.

As the solid organic matter is cooked to oil, it expands, creates high pressure, pushing oil into very fine pores and into adjacent rocks.

After moving into connected, largely water-filled pore space, the oil moves upward by buoyancy, with buoyancy force provided by the difference in density of oil versus water, multiplied by the height of the connected oil column. The larger the connected oil column, (the oil buoyancy force), the smaller the void openings that can be entered by the migrating oil.

If you are searching for new oil fields, do you know where the oil came from? The direction? The depth? The source horizon? Oil might say (if it could talk) that it is important to know where and when it was created – if you're looking for where oil has gone.

Have you identified the rock layers that transmitted the oil? The seal that confines the migrating slugs of oil? The structural form of that horizon that is "roofing" migration? Have you noted any structural "noses" that may be perturbing the migrating oil? Have you noted any down-dip fields that are filled-to-spill?

You know to look up-dip from fields filled-to-spill, since any field, filled-to-spill has … spilled.

Do you have any idea how hard it is to recognize an oil field when you have drilled through it with a wildcat well?

Electric log interpretations can be very accurate after calibration, but well logs in wildcats often give equivocal data. Sidney Powers Medalist Bob Sneider made a study of field histories, and came to the astounding conclusion that it took, on average, three wildcat penetrations before a 500 million barrel field would be recognized!

How many fields have YOU drilled through, without recognizing them?

Oil (if it could speak) might remind us that traces of oil remain in any rocks that it moved through, while migrating to its resting place. Do you understand that recognizable traces of oil always remain in migration zones? Do you understand the concept of "snap-off?" Have you looked for migration "shows?"

If we were listening, oil might "whisper" to petrophysicists and geophysicists that its presence in pore space alters rock physics and chemistry in a predictable manner. Do you know the magnitude and character of those modifications? Can you model the effect of fluid substitutions on acoustical and resistivity properties?

A conversation with oil might reveal that part of the created oil always remains in its source rock. It has taken us a hundred years to recognize that about as much oil remains in the source rock – as has ever left it!

(If you had "listened to oil" earlier, YOU might have been the first person to produce oil from the Bakken!)

When you find oil in the very tiny pores of source rocks, what does such presence

Continued on next page

Military Veterans

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but less likely to finish. Supporting this program will ensure that men and women of the armed forces will have the chance to transfer their valuable experience from the field to the classroom, and later to gainful employment.

Donors interested in funding this program may create a named scholarship by making a one-time gift of $50,000. This gift will afford AAPG-F the opportunity to distribute $2,000 in funds annually to deserving veterans to offset college expenses, covering college tuition, books and fees. Thanks to many generous supporters, the Foundation hopes to reach and exceed its $500,000 threshold this year to open the program to applicants in need early in 2015.

Why It Matters

The common denominator between those who have advanced successfully into Earth science careers and those who are aspiring to reach that achievement is a love of the Earth and all of its wonders. Geoscience exploration at the university level is a tie that binds – it is a passing of a torch from those who are excelling in their careers to those who aspire to join their ranks, all in the spirit of advancing the science.

To name a scholarship for graduate level research or for veteran students, please contact the Foundation at foundation@aapg.org, or call toll free 1 (855) 302-2743. Students today need names that they can look up to – it is our hope that one of those names is yours.

Learn more about our programs by visiting our website at foundation.aapg.org. Again, know that every gift *of any size* is always appreciated and may be applied to a fund of your choice.

Together we can further the AAPG Foundation's standing success and lessen financial challenges for the best and brightest future geoscientists. We are thankful for all that you do!

Continued from previous page

of oil in very tiny pores mean? The oil within those very, very fine pores provides an actual measurement of the expulsion pressures created by the transformation of solid kerogen to liquid oil.

It takes thousands of pounds of pressure to force oil into such tiny pore throats.

As oil moves away from its source rock birthplace and migrates in permeable rocks to its resting place in a reservoir, oil always obeys the law of gravity. When oil is immersed in water, gravity produces the force of buoyancy. In the most general description, the difference in density between oil and water, multiplied by the height of the connected oil column, gives the buoyancy force.

When oil moves through pores, what laws govern which pores it can push its way into – and whether oil stops, or continues to move? Do you know those laws? Do you understand why pore entry pressure measurements are important to understand?

It's why oil goes here … and not there!

Let's ask oil: Does it care whether it resides in carbonate rocks or sandstones? In barrier bars or river channel sands? In Ordovician or Tertiary-aged rocks? In reef or back reef environments?

LISTEN! OIL DOESN'T CARE!

Oil cares about the size of HOLES and the portals connecting them – not the name of the rock.

Oil doesn't care about environments of rock deposition, or how old the rock is or what name geologists use to anoint the rock framework.

Oil will fill ANY pore or crevice presented to it, as long as the buoyancy pressure of the oil column is greater than the entry pressure of the pore throat. What IS the buoyancy pressure exerted by the migrating oil slugs typically seen in your exploration province? Do the oil reservoirs in your area of interest reflect oil buoyancy pressures of five psi? Fifty psi? Five hundred psi?

Pore entry pressure measurements of reservoirs are a thousand times more relevant to finding oil than, say, descriptions of ancient environments of deposition! Indeed, much of the environment-of-deposition work done has relevance ONLY because it may have a second-order connection to rock pore entry pressure.

Understand what the migrating oil considers to be an "acceptable" pore throat size for entry in your area of interest. Perhaps you may have observed that adequate pore throat size is only found in alluvial channel sandstones? Then, (and only then) you may usefully concentrate efforts on mapping alluvial sandstone environments to locate oil reservoirs.

Oil knows where it can and cannot go. Shouldn't YOU?

Since oil always follows the rules, shouldn't you know the rules?

Perhaps it's time to concentrate our professional attention on the factors that actually influence where oil will be, and save our studies of peripheral phenomena for our personal entertainment?

Herbert Hunt shared with me the response he received after announcing to his legendary father that he wanted to be a geologist:

"You'll cost us millions; you'll be wanting to test ideas instead of finding oil!"

Herbert always has remembered that his task was to find oil, not to test ideas or prove concepts.

Pay less attention to geologic peripherals. Although all geology is interesting, damn little is useful. Focus your efforts on following oil from source to trap.

Geology is a science; geophysics is a science; successful exploration is a business, requiring a ruthless focus on essentials.

THINK LIKE OIL.

EMD

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representatives, the Canadian Association of Petroleum Producers (CAPP) and a First Nations Aboriginal Group in Alberta.

A meeting of this scope and format will provide an intimate environment free of competing session content. The symposium also will provide those in attendance with the opportunity to interact with presenters, and there will be dedicated time for group panel discussions.

Information on registration and numerous sponsorship opportunities to support this event, with updates are at www.cspg.org/conferences.

The AAPG and CSPG local organizing committee are looking forward to see you in Calgary this fall.

CLASSIFIED ADS

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

CLASSIFIEDADS

POSITION AVAILABLE

Research Scientist Position in Structural Geology

Schlumberger-Doll Research, in Cambridge, Massachusetts, USA, invites applications for a structural geology research scientist position. The candidate will join the Geology Program of the Reservoir Geosciences Department.

The candidate will help develop the next generation of quantitative structural geology methods and workflows for unconventional field exploration and development.

Responsibilities

- Understand fundamental structural geology principals of stress, strain, and deformation mechanisms from the grain to reservoir scale.t
- Understand structural interpretation methods using well, seismic, and other physical measurements.
- Develop, implement, and test structural workflows and use these to develop interpretation and answer products related to market needs.
- Document findings and results in reports and communicate to peers, management and to other Schlumberger research, engineering, and operations centers.

Qualifications

- A PhD in the field of structural geology is required, although an advance degree in related disciplines will also be considered.
- Experience and skills in quantitative interpretation and modeling of faults, fractures, stress, and strain.
- Experience in any of the following areas will be considered a plus: geomechanics, structural restoration, unconventional resource characterization, quantitative modeling for well placement, hydrofracture optimization, or completion design.
- Strong technical and communication skills, as well as the ability to foster effective working relationships with fellow scientists and engineers.
- Strong preference will be given to candidates with 5-10+ years of industry experience. Candidates with less experience will be considered for an Associate Scientist position.

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Schlumberger is the world's leading supplier of technology, integrated project management and information solutions to customers working in the oil and gas industry worldwide. Employing approximately 123,000 people representing over 140 nationalities and working in approximately 85 countries, Schlumberger provides the industry's widest range of products and services from exploration through production. For more information, visit www.slb.com.

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Petroleum Geology and Basin Analysis

The Department of Earth and Environmental Sciences at the University of Kentucky invites applications for a tenure-track (nine-month) faculty position in the broad field of petroleum geology, to begin January 2015 or soon thereafter. Exceptional candidates at all ranks will be considered. We seek candidates who will expand the department's growing program in petroleum geosystems, and complement existing strengths in sedimentary geology, tectonics, geophysics, and paleontology. Collaboration with the Kentucky Geological Survey (KGS) and UK Center for Applied Energy Research expands opportunities for research and resources. A Ph.D. is required; post-doctoral and/or industry experience is essential.

The research specialty for this position will focus on basin analysis and petroleum exploration. Expertise in one or more of the following will be deemed highly desirable: subsurface mapping, formation evaluation, exploration seismology, reservoir characterization, geological modelling, seismic stratigraphy and/or structural geology. Candidates who emphasize computational methods and actively integrate seismic reflection and well-log data into research and teaching will be given preference.

We welcome applications from scientists that possess a record of publication in high quality, peer-reviewed journals, and who have developed, or show the potential for developing, a nationally recognized research program. A record of, or a demonstrable capacity for collaborating with partners in the energy industry is critical to the mission of this position. The successful candidate will have the ability to mentor graduate and undergraduate students, and must be committed to field and classroom-based instruction at both the undergraduate and graduate levels.

The department maintains well-equipped stratigraphy, sedimentology, radiochemistry, near-surface geophysics, stable isotope geochemistry, electron microprobe and detrital provenance laboratories. The KGS, housed on the UK campus, maintains an active petroleum research program, complete with a visualization laboratory and core repository, as well as facilities for XRD, XRF, organic geochemistry, and organic petrography.

Interested applicants should submit a merged PDF to the Petroleum Search Committee, c/o Ms. Adrianne Gilley (Adrianne.gilley@uky.edu). The document should include a cover letter, curriculum vitae, brief statements of research and teaching interests, copies of relevant research publications, and contact information for at least three references. We will begin review of applications on September 1, 2014; applications will be accepted until the position is filled. The University of Kentucky is an Affirmative Action/Equal Opportunity university that values diversity and is located in an increasingly diverse geographical region. Women, persons with disabilities, and members of other under-represented groups are encouraged to apply. The University also supports family-friendly policies. Additional details of the Department of Earth and Environmental Sciences and the University of Kentucky may be viewed at our web pages: www.as.uky.edu/ees and www.uky.edu.

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Petroleum Geologist

The North Dakota Geological Survey announces a permanent position opening for a geologist. Successful applicant will be responsible for conducting geologic studies and investigations to generate maps and reports on the oil-producing horizons in the Williston Basin of North Dakota. Applicants must have a master's degree in geology.

Applicants should have strong written and verbal communication skills. Preference will be given to applicants with experience in reading, interpreting, and correlating petrophysical logs, describing oil well core, and generating contour maps. The successful applicant will be hired as a Geologist III with a starting annual salary between $55,000 and $85,000 plus benefits, dependent upon the level of schooling and applicable experience. The State of North Dakota has a very competitive health insurance and retirement plan. Apply online through the State of North Dakota online job application system at:

https://www.cnd.nd.gov/psc/recruit/EMPLOYEE/HRMS/c/HRS_HRAM.HRS_APP_SCHJOB.GBL?FOCUS=Applicant&SiteId=11000

Include a cover letter, resume, references, and college transcripts. Contact Mr. Fred Anderson: North Dakota Department of Mineral Resources, 600 East Boulevard Ave., Bismarck, ND 58505. Phone (701) 328-8000 for more information. Deadline for applications is September 1, 2014, but the position will remain open until it is filled.

If unable to fill at a Geologist III level, the job will be filled as a Geologist II which requires a master's degree in geology or a bachelor's degree in geology with three years of petroleum industry experience. For more information about the North Dakota Geological Survey, see https://www.dmr.nd.gov/ndgs/. The North Dakota Geological Survey is an Equal Opportunity Employer.

Petroleum Geologist

The North Dakota Geological Survey in Bismarck, North Dakota is advertising for a subsurface geologist to conduct geologic investigations of the oil-producing horizons in the Williston Basin of North Dakota.

Petroleum Geologist

The North Dakota Geological Survey is currently advertising for a subsurface geologist to fill a vacancy in their Bismarck office. This is a

Continued on next page

READERS' FORUM

My IBA Experience

The Imperial Barrel Award competition was the best academic experience I had in graduate school, for several reasons.

▸ First, it helped me see the value of teamwork in a challenging situation.

Everyone has to work in a team at some point in their academic career, but never to this level. Working on the IBA project made me realize that an individual could not complete the work required to excel at the task at hand, but rather a team could succeed by cooperating and contributing to a common goal while focusing on individual pieces of the project.

This has led me to be open about the advice and guidance that I've been given since then, which I believe has made me more successful.

▸ Second, the IBA looks great on a résumé, because the experience you get in IBA is hard to replicate in a classroom.

Companies know that and having IBA on your résumé makes you stand out among a crowd of other applicants. It is hard work and long hours, but at the end of the day it is well worth it if you put forth a product that makes your team proud.

▸ Finally, the absolute number one reason you should do IBA is because it is the best way to experience a career in energy.

Since doing IBA I've had the pleasure of interning in Houston – an internship that I most likely got because of my IBA experience.

I can honestly say I would have been half as prepared for my internship had I not done IBA. Examples are from small things such as being able to use industry terminology correctly and fluidly in a conversation, to overall arching principles such as how to begin evaluating prospects and the workflow that goes into a prospect from beginning until end.

I learned more about the petroleum industry in one semester of competing in IBA than my entire undergraduate/graduate education combined.

And that's why everyone interested in a job in the petroleum industry should be fighting for a spot on an IBA team. It's the most real and rewarding experience you will have before you graduate.

Sarah Allen
Fort Worth, Texas

(Editor's note: Allen was a member of the 2014 Texas Christian University IBA team, which won the Southwest Section competition.)

Risky Business?

The recent article quoting Nathan Meehan ("Amid Boom, Shale Secrets Remain Elusive," July EXPLORER) is somewhat amusing to me.

As a longtime explorationist, I found that if we quit drilling dry holes, oil would be a lot cheaper. According to him, now we must quit drilling the marginal wells and quit fracturing zones that may not be prime targets.

This would put an end to risk in our business, too, and I am all for that, except oil might be a dime a barrel and I would be out of work.

Harrison Townes
Tulsa

Continued from previous page

permanent, full-time position which will be filled at the Geologist III level.

The successful applicant will be responsible for conducting geologic studies and investigations to generate maps and reports on the oil-producing horizons in the Williston Basin of North Dakota.

Salary Range: $55,000 to $85,000 per year with fully paid family health insurance

To apply: https://www.cnd.nd.gov/psc/recruit/EMPLOYEE/HRMS/c/HRS_HRAM.HRS_APP_SCHJOB.GBL?FOCUS=Applicant&SiteId=11000

North Dakota Industrial Commission, Department of Mineral Resources – North Dakota Geological Survey, Bismarck, North Dakota.

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Assistant Professor
Sedimentology/Basin Analysis
Denison University

Denison University invites applications for a tenure track position in the Department of Geosciences, to begin in August 2015. We seek a broadly trained scientist engaged in the study of Sedimentology and/or Basin Analysis. Successful candidates are expected to be outstanding teacher/scholars, and contribute to the continued growth of the Department and College. Candidates must have a Ph.D. at the time of appointment.

We require a colleague who is committed to teaching excellence in the liberal arts tradition, is field-based, has broad interests beyond their individual specialty, and will provide a balance of classroom, field, and laboratory experiences for our students. Candidates must have the desire and ability to teach courses at all levels of the curriculum. In addition, successful candidates are expected to maintain a vibrant, ongoing research program that actively incorporates undergraduate students.

Denison University is a highly selective, private residential liberal arts college enrolling approximately 2100 undergraduate students from across the country and around the world. The college is located in the village of Granville, Ohio, 25 miles east of Columbus. For more information about Denison, visit our website at www.denison.edu.

All application materials will be handled electronically at https://employment.denison.edu. Applications must include: 1) a letter of application addressing the position requirements listed above; 2) a curriculum vita; 3) academic transcripts of undergraduate and graduate course work (unofficial acceptable); 4) a statement of teaching philosophy and experience; and, 5) a statement of your research program in a liberal arts context. In addition, please include the contact information for three persons who know you well, who will then be requested to upload reference letters. Completed application materials submitted by October 27, 2014 will receive full consideration, and evaluation will continue until the position is filled. We plan to meet with selected candidates at the 2014 GSA Annual Meeting in Vancouver, BC, Canada.

Denison University is an Affirmative Action, Equal Opportunity Employer. To achieve our mission as a liberal arts college, we continually strive to foster a diverse campus community, which recognizes the value of all persons regardless of religion, race, ethnicity, gender, sexual orientation, disability, or socioeconomic background.

MISCELLANEOUS

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Cybersecurity Is Critical Infrastructure

By DAVID CURTISS

Earlier this year I received a notice from the bank that issues a credit card that I carry. It almost went straight into the shredder as I figured it was simply an advertisement. But, for whatever reason, I opened it and read that I was soon going to receive a replacement credit card in the mail.

There was no evidence that my card number had been stolen, but the bank was taking this step as a precautionary measure because in late 2013 I had purchased items at large U.S. retailer Target.

Just after Thanksgiving, with the Christmas shopping season in full swing, 40 million credit card numbers and 70 million names, addresses, phone numbers and other information were sucked from Target's servers – the biggest hack the retail industry had ever seen, reported Bloomberg Businessweek Technology on March 13.

The type of breach to which Target fell victim is becoming increasingly common, with more than 800 million data records stolen last year, according to The Economist, which dedicated a special report in its July 12 issue to the subject of cyber-security.

In reading this special report, what I found most astonishing about the Target breach was that the firm "spent a fortune each year on cyber-security, but was attacked via a heating and air-conditioning supplier whose defenses were apparently not robust enough to keep the hackers out."

That gives new meaning to the concept of supply chain vulnerability.

And retailers aren't the only targets in the ever-more-connected world we live in. The energy industry is also looking at its vulnerability to cyber-attack.

Back in 2001, shortly after the terrorist attacks of Sept. 11, I found myself in


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Washington, D.C., working on energy and cyber-security issues for former Rep. J.C. Watts Jr. (R-Okla.), who at the time was chairman of the House Republican Conference, a member of leadership of the U.S. House of Representatives.

The nation was reeling after the attacks, trying to understand what had happened, and where we were vulnerable to subsequent attack. And here I was, a young geologist serving as a Legislative Fellow funded by the American Geosciences Institute, tasked with helping my boss and our nation's lawmakers understand the chinks in the armor of U.S. energy systems.

I recall sitting in a meeting listening to a telecommunications CEO recount the story of his company's role in rebuilding the fiber optic and communications systems to enable the New York Stock Exchange to resume operations within a week of the collapse of the World Trade Center.

But, he warned, our communications systems were designed principally for usability, and not with security in mind, resulting in very porous defense systems.

One sobering example he gave was a SCADA system – the supervisory control and data acquisition system – used to monitor the U.S. electricity grid. At the time of the 9/11 attacks the security measure in place to protect the website used to access this system was a simple alphanumeric password.

The ability to crack that password would reveal to a hacker the state of the nation's electrical grid, particularly those nodes under the stress of peak load that could be tempting targets.

Mindful of these vulnerabilities, the Idaho National Laboratories of the U.S. Department of Energy began to focus on energy security, particularly SCADA systems. Its Aurora project conducted in 2006 is one such effort, The Economist reports.

A group of would-be hackers remotely gained control of a large diesel generator through a SCADA system and proceeded to destroy it. A quick Google search takes you to a video as the generator begins to heave, seize and smoke – a vivid example of what we don't want to have happen in an energy installation.

Just because you can do it doesn't make it easy, The Economist is quick to point out, noting that "squirrels and falling branches have done more damage" to the U.S. electrical grid.

Still, it is a risk.

And, according to a report by the U.S. Department of Homeland Security, 40 percent of the cyber-attacks the department handled last year targeted the energy sector, reported The Hill in a July 15 article.

Recall, too, as The Hill reports, that in 2011 many international energy companies around the world were targeted by hackers based in China, and in 2012, Saudi Aramco was the target of a massive cyber-attack.

This is not an abstract risk. It's real.

In response, our industry last year established the Oil and Natural Gas Information Sharing and Analysis Center (ONG-ISAC). It's a membership-based organization where firms join in order to share and obtain information on cybersecurity and threats.

Membership is open to oil and natural gas companies, both upstream, midstream and downstream, as well as the service industry that supports these firms and appropriate associations. As its website states, there are four cornerstones around which ONG-ISAC is built:

- Anonymous submissions
- Authenticated information sharing
- Industry owned and operated
- Protection from Freedom of Information Act (FOIA) disclosures and anti-trust violations

It is an industry-lead initiative to protect itself from cyber-attacks.

How are you working to protect your company's information systems and physical assets?

How are you working to protect your own digital information and assets?

Both are critical infrastructure.

DIVISIONS REPORT: EMD

Symposium to Address Science, Social Responsibility

By FRAN HEIN, EMD President

It is estimated that 5.6 trillion barrels of bitumen and heavy oil resources occur globally in more than 100 countries, with most of that resource occurring in the western hemisphere.

This is a massive resource that faces considerable challenges.

In the past decade, significant advances in the development and production of these resources have occurred, along with an increase in public perceptions of resource development and social license concerns.

To address some of what appear to be competing issues, the Canadian Society of Petroleum Geologists (CSPG) and the AAPG will host a joint, multidisciplinary technical symposium on oil sands and heavy oil. This symposium "Oil Sands and Heavy Oil Symposium: A Local to Global Multidisciplinary Collaboration" will be held Oct. 14-16 at the Metropolitan Centre in Calgary, Canada.

The symposium's goals are to highlight:

- The global nature of the resource.
- Advances in recovery technologies.
- The contributions resource geoscientists are making to address the challenges of environmental protection and social license, as well as driving prosperity and better standards of living for all through


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This multidisciplinary technical symposium takes a holistic approach to the various multifaceted aspects of the oil sands and heavy oil resources. The six half-day sessions focus on geology, geophysics, engineering, environment and regulatory aspects, including:

- The International Resource Base: Oil sand, heavy oil and bitumen occurrences and prospects around the world.
- The Elephants in the Room: Large-scale characterization, including geology, geophysics, outcrop, core work and geo-modeling.
- Eating the Elephants: Medium to micro-scale within-reservoir characterization, including detailed studies of compartmentalization, bitumen and reservoir fluids, fluid segregation within reservoirs, geo-modeling and petrophysics.
- 21st Century Geology for Production and New Prospects: New drilling, completion and production technologies, conformance issues for in-situ development; new prospects and other issues related to surface mining.
- Focus Session on Public Safety and In-Situ Recovery: Caprock definitions, description, integrity assessment, identification of faults and fractures, casing integrity and other factors influencing caprock integrity, its prediction and steam-chamber containment.
- Striking the Balance: Geoscience for better integrated resource management in a changing social and political climate.

This oil sands and heavy oil symposium will follow a three-day, single-track format including core/poster sessions and three panel discussions. Dedicated core and poster presentations will give an opportunity for all participants to be able to have a hands-on viewing of these important world resources.

What is unique about this conference is the integration of geology and engineering with issues of environmental, social and economic outcomes, providing the critical link of the geoscientists and engineers as producers of resource wealth to their scientific and professional responsibilities to achieve broader outcomes for the sustainability of oil sands and heavy oil development.

More than 30 invited speakers will be in attendance, including presenters from the United States, Canada, Venezuela, China, Russia and other European countries.

Other keynote and luncheon speakers include presenters from the Alberta Department of Energy, worldwide industry

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