MARCH 2017 | 100 AAPG ANNIVERSARY

EXPLORER

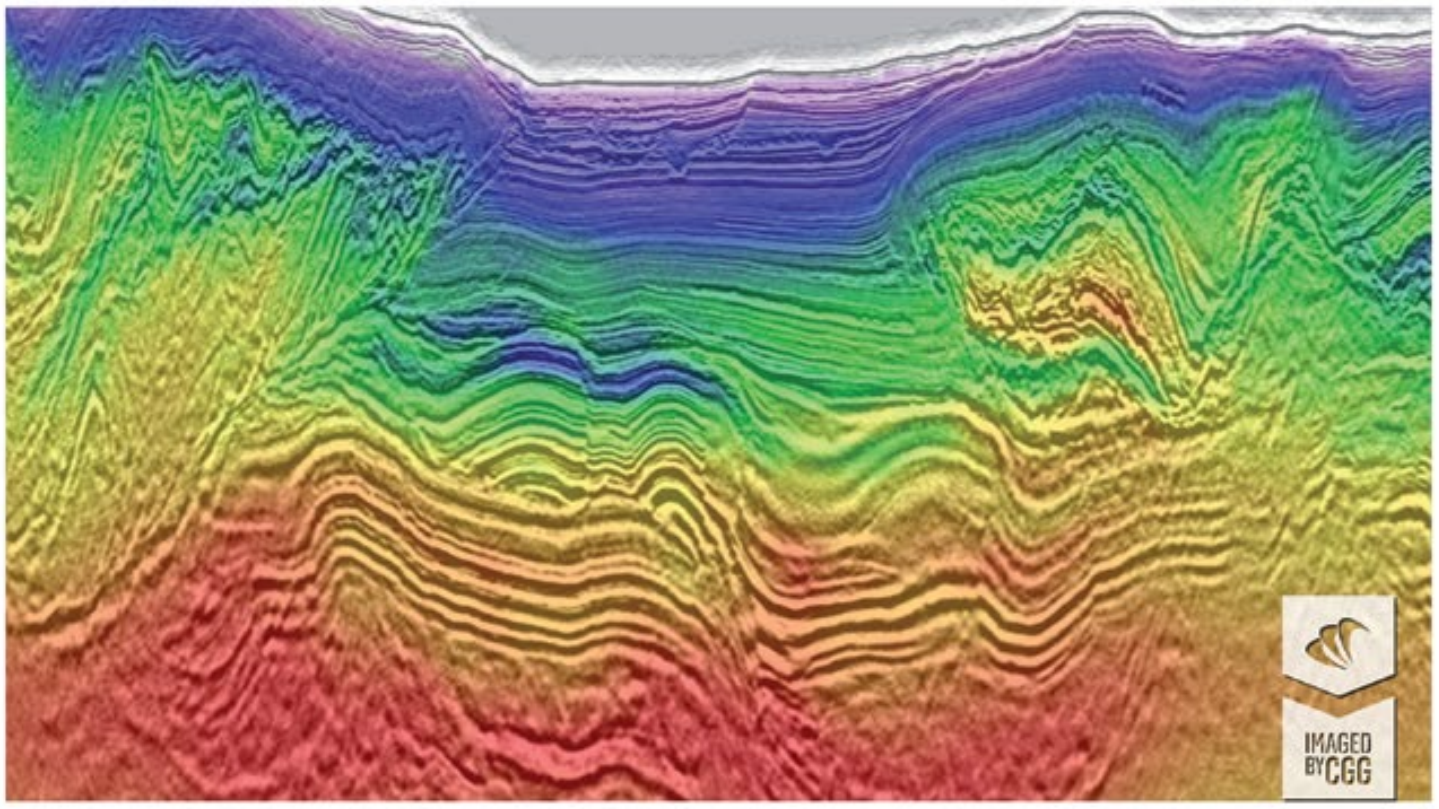
Annual Convention & Exhibition 2017

Celebrating A Century

Looking ahead to the next 100 years of AAPG

PRIME PROSPECT

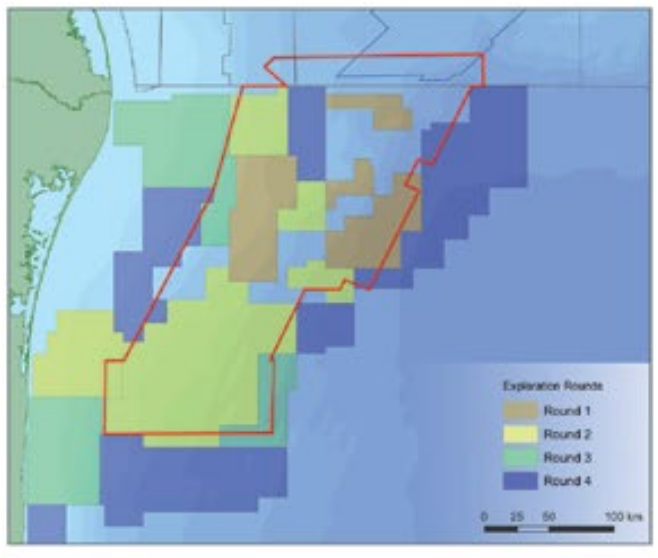
Mexico Encontrado
Wide-Azimuth Reprocessing



FWI resolves complexity of the Salt Front Thrust Belt.

Encontrado is an extensive wide-azimuth survey of over 38,000 km² in the Perdido fold belt, covering many of the blocks in the current and upcoming Mexico licensing rounds, with early-out RTM data available in February 2017.

It is currently being reprocessed through a state-of-the-art high-end sequence, including 3D deghosting, 3D SRME and advanced imaging, with multi-layer tomography and FWI velocity modeling.



Map showing Encontrado outline and the current exploration rounds.

The right data, in the right place, at the right time

Vol. 38, No. 3
MARCH 2017

PRESIDENT'SCOLUMN

Celebrating Two Centuries, Past and Future

BY PAUL BRITT

President Lyndon Johnson wrote the accompanying letter to commemorate AAPG's 50th anniversary in 1966.

The date in view for AAPG's beginning was a little different than our current reckoning, due to differences in determining the start of the organization.

In Tulsa in October 1915, J. Elmer Thomas separately, but with the same purpose in mind, " ... invited to dinner 30 friends who were active as petroleum geologists principally in northern Oklahoma, for the express purpose of fostering friendship within our ranks and of permitting the mutual benefits that would arise from the occasional exchange of data and ideas in a profession then quite new but expanding rapidly in the Mid-Continent oil fields."

The first meeting of this fledgling organization was held in Norman, Okla., Jan. 7-8, 1916, with about 60 geologists in attendance. For the purposes of the 50th anniversary, this was regarded as the first meeting of the Association, even though the Association was not yet formally organized. Geologists from Oklahoma, Texas and Kansas attended; prominent among them were Alexander Deussen, William Kennedy, R. C. Moore, Wallace E. Pratt, J. A. Udden and W. E. Wrather.

The Association was predicated on early oil field discoveries in Oklahoma and Kansas, which "did much to impress operators with the realization that geologists were equipped to find oil fields."

A Look at the Past Century

The aforementioned letter from the White House was published in the April 1966 issue of the AAPG Bulletin, which also documented the history of the Association from inception through the U.S. industry's formative years, which included the Great Depression, the incorporation of the airplane

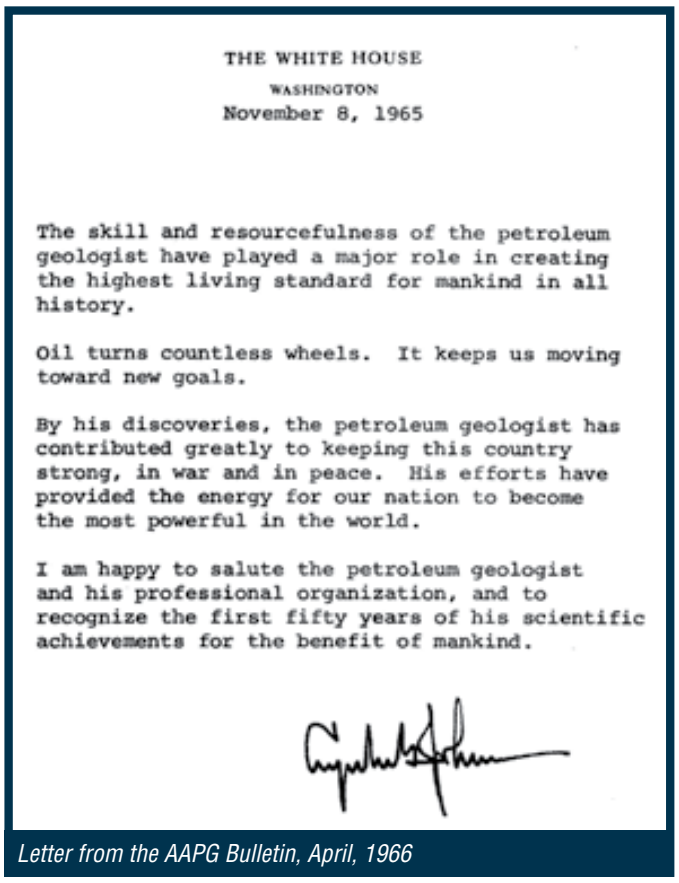
BRITT

in geology, "crooked" holes, a second World War, the formation of the Distinguished Lecture Committee in 1942, the establishment of the Code of Ethics, and many of the practices and committees that are active today. Other significant events have unfolded in the time since that milestone issue of the Bulletin: the oil embargo, the 1980s boom and bust, development of 3-D seismic and the onset of the unconventional shale plays.

It's important to understand what got us here today and what will be celebrated at the 100th anniversary Annual Convention and Exhibition (ACE) in Houston this April.

Besides the usual ACE events, technical sessions, Imperial Barrel Award competition, short courses and field trips, there will be many events dedicated to the 100th anniversary.

There is the 100th Anniversary Gala Dinner with keynote speaker and Pulitzer Prize-winning author Daniel Yergin; a



THE WHITE HOUSE
WASHINGTON
November 8, 1965

The skill and resourcefulness of the petroleum geologist have played a major role in creating the highest living standard for mankind in all history.

Oil turns countless wheels. It keeps us moving toward new goals.

By his discoveries, the petroleum geologist has contributed greatly to keeping this country strong, in war and in peace. His efforts have provided the energy for our nation to become the most powerful in the world.

I am happy to salute the petroleum geologist and his professional organization, and to recognize the first fifty years of his scientific achievements for the benefit of mankind.

Letter from the AAPG Bulletin, April, 1966

Preservation of Geoscience Data Display showing core displays representing the major reservoir and play types that have resulted in giant or significant oil and gas fields over the last 100 years; and a data display including examples of early logs and seismic on paper and film to show how the amount and format of data and information has changed. There are events and displays showcasing the GeoLegends interview series comprising 50 interviews with 62 key geoscientists who made game-changing discoveries, significant scientific contributions that were adopted by the greater geo-community, or people who made significant contributions in building companies or service to the profession, Pioneering Women in Petroleum Geology, and many other historical events and displays.

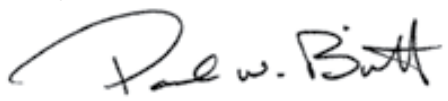
A Look at the Next Century

But we're not just celebrating the past 100 years. We're also celebrating the next 100 years, and the future of geoscience, in forums and special events. A display of the Digital Interactive Geology (DIG) program will be on display, which is a 3-D world model on which field trips and eventually other publications can be displayed in a Google Earth style model.

Finally, the industry and the Association are adapting to a world and environment that are changing at an increasingly rapid rate. Along that path are some twists and turns, as every one of our Members are experiencing in their own lives and careers, and the Association is doing everything it can to help along the way. AAPG expenses have been trimmed close, but the slump continues to impact revenue, particularly from events. There have been slow times and downturns in the past, and the current downturn is as tough as any prior, and will likely persist for a while. Your Association and the Executive Committee are taking the obstacles in stride.

Future technology is changing the way that the workforce performs its tasks, and the reliance on that technology will require a decided effort on the professional to stay current.

Stand with us as we proceed into the next 100 years. I am looking forward to seeing many of you at ACE next month.



TABLEofCONTENTS

REGULARDEPARTMENTS

ON THE COVER:

Field trips have always been a big part of AAPG gatherings since the beginning. This is an image from a time when the Association was young: a field camp party from Ohio State University at Lookout Mountain overlooking Chattanooga, Tenn.

Left: In recent years, the Grand Canyon has been ground zero in a cultural conflict between geological orthodoxy and religious groups claiming the Earth is only 6,000 years old. See story on page 32.

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Centennial ACE Boasts Record Abstract Submissions

By KEN MILAM, EXPLORER Correspondent

Last year, the extraordinarily high quality of the technical program was the talk of the AAPG Annual Convention and Exhibition in Calgary, and this was at an ACE with plenty of high points to talk about.

Along with the hard work and talent of the organizing committee, they also had the benefit of a record number of abstract submissions, which meant they could be highly selective.

The technical program for the 2017 ACE in Houston promises to be even better than last year's.

Craig Shipp, the 2017 ACE technical program chair, said the presentations, poster sessions, forums and special sessions are "very strong."

Shipp is principal technical expert in geohazards assessment for Shell International E&P.

Diversity and Quality

In addition to having a record number of abstracts submitted, Shipp said the theme session chairs, who put the technical program together, are a diverse group.

"We have a lot of gender and generational diversity on the program committee. It was wonderful to watch the whole process come together," he said. "I was very impressed with how hard everyone worked."

Shipp said almost 2,400 abstracts were submitted – a more than 30-percent increase over last year's record submissions.

An acceptance rate of about 50 percent helped ensure all the presentations are top-tier, he said, adding, "I think we've really been able to up the game."

Scheduling constraints limit the program to no more than eight concurrent sessions. There are 432 oral presentations planned.

"To take advantage of the large number of abstract submissions, the number of poster sessions was boosted from 600 to 700 this year," Shipp said.

He said organizers made a concerted effort to schedule interesting and significant sessions for each day of the conference.

"We want to keep people there," he said.

Special Attractions

While commending the quality of all the theme sessions, Shipp said some are especially different or significant for a number of reasons.

"We've made a concerted effort to target young career folks in the technical program planning process," he said.

A SEPM-AAPG research symposium on Tuesday, "How Seismic and Sequence Stratigraphy Have Advanced: 40 Years after AAPG Memoir 26 and 30 Years after SEPM Special Publication 42," is an effort to "commemorate two key publications that brought us seismic and sequence stratigraphy as we know it," Shipp said.

Two Discovery Thinking sessions, chaired by AAPG President-elect Charles Sternbach and Past President Paul Weimer, will highlight new ideas and new discoveries of significant global interest, he said (see related article on page 34).

"The Next 100 Years of Global Energy Use: Resources, Impacts and Economics" is a special event open to the public, in which "very high-end speakers" will address the challenges of meeting the world's increasing energy needs without compromising global environmental concerns with continued use of fossil fuels. The panel will discuss the global challenges in transitioning to a low-carbon energy future.

"Future of Energy: Previous Predictions and Future Trends" is co-chaired by Peter Carragher and James Courtier. "Carragher is a predictor; they will be benchmarking predictions from 10 years ago and what things will look like in the future," Shipp said.

Theme 10 is an integrated effort representing the various AAPG international Regions. Presentations by representatives from the various Regions will be devoted to characterizing the basins, the fields studied and ongoing basin developments, he said.

Theme 5 on Wednesday morning is "an important deepwater forum on major discoveries in the Gulf of Mexico," Shipp said (see related article on page 36).

Wednesday afternoon's Theme 11, "Future of Energy: Essential Tools for the Next Generation of Geoscientists," Shipp described as "very cool, with people everybody in our field knows" and "of special interest to Millennials in the industry."

A Wednesday afternoon session in the Theme 1 "Siliciclastics" consists of presentations by many former students of John Anderson from Rice University, Shipp noted. "A lot of people in the industry today were trained by this guy," he said.

Theme 7, "Energy and Environment," addresses induced seismicity, hydraulic fracturing, wetlands, climate risk, carbon dioxide storage and other relevant current issues.

While some of the topics being presented touch on some hot-button political issues, Shipp said none of the sessions are aimed at controversy.

"Every subdiscipline in AAPG has stuff 'on the edge' ... conference attendees want to see data, and AAPG Members pride themselves on data-driven presentations," he said.

After the Great Crew Change

By DAVID BROWN, EXPLORER Correspondent

The oil and gas industry is facing a tidal wave of retirements as the Great Crew Change occurs, but the challenges of replacing technical professionals might not be as difficult as you think.

On the other hand, they might be considerably worse.

AAPG Member Jim Handschy wrestled with the problems of the Crew Change before retiring as global chief geologist for ConocoPhillips. The pertinent questions included:

- Will the geoscience skills needed for the unconventional resources revolution be the same as those needed before?
- In a competitive market, how will the industry find enough high-quality geoscientists with the necessary education and skills?
- If the graduates hired don't have the necessary skills, what is the most effective mix of training – classroom versus on the job – to get them up to speed as quickly as possible?
- How can the industry effectively capture knowledge before it leaves with retirees?
- What are the differences in the behavior, needs and desires of Millennials compared to previous generations of geoscientists?

And what about the characteristics of Generation Z (or whatever you want to call the group of people born in the year 2000 or later)? They will become the industry's technical leaders later this century.


HANDSCHY

> "As long as we believe nonconventional North American plays are cost-competitive, I don't think we need to swap out 100 percent of the retirements."


RYAN

Downsizing Expectations

Today, Handschy is an adjunct professor of geology for Indiana University and teaches at the school's famed Judson Mead Geologic Field Station in Montana. He's already seen a shift in the nature of geology graduates.

"In 2011 and 2012, and even in 2013, it was very much an entitlement mentality. They wanted jobs that met their interests. Since 2013, that's changed," he said.

Maybe because students were seeing a tough job market as the effects of the post-2008 recession took hold, they developed a new outlook, he noted.

"I think you're starting to see attitudes shift back to what kids were like when I was in college," he said.

Handschy sees the unconventional resources revolution and the effects of the anti-fossil fuel movement as the two big forces at work in the industry as the Crew Change unfolds.

"The big issue today is, 'How has the unconventional revolution in North America changed the need to go out and get geoscience professionals?'" he explained.

"If you do the unconventional plays efficiently, they don't require as many geologists," Handschy said. "You have a large area with a large number of drill sites which are basically de-risked with very little further work."

So a major consideration for the industry's post-Crew Change reality is whether or not we will live mainly in a world of unconventional resource plays.

"As long as we believe nonconventional North American plays are cost-competitive, I don't think we need to swap out 100 percent of the retirements," Handschy said.

A second important factor for the post-Crew Change world is possible expansion of non-carbon/climate change sentiment. Lighter demand for geoscientists might not be a bad thing if the anti-fossil fuels movement continues to grow.

"The other thing that argues against full replacement is the Green Revolution – the social pressure to replace fossil fuels with energy sources that do not put carbon into the atmosphere," Handschy noted.

"The majority of university programs are quite anti-fossil fuel right now. I would say the biggest impediment to getting students into our programs is the non-geology education they're getting in college," he said.

Baby Boomer Brain Drain

Recent industry layoffs have magnified the effects of an aging professional workforce, according to Robert Ryan, AAPG Member and vice president of global exploration for Chevron Upstream.

"We do see retirements under way, as predicted for years now, and they have probably been accelerated by last year's industry downsizings and the recent increase in interest rates that impact employees' retirement plans," he said.

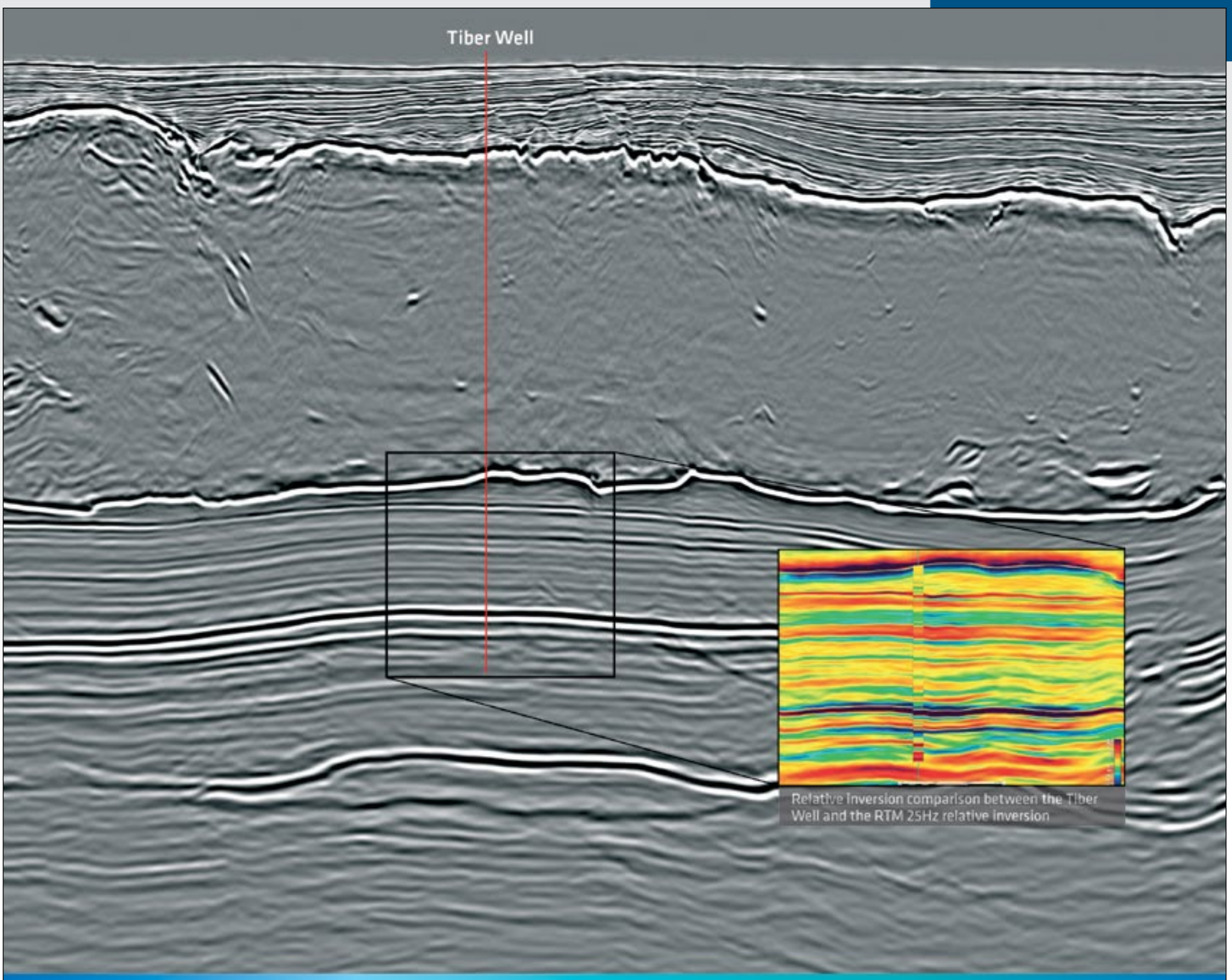
Ryan has no doubt that the oil and gas industry will require capable technical experts into the next century, and will struggle with retaining and developing expertise.

"Energy companies will need technical professionals for decades to come, and the challenge will be maintaining senior staff for both experience and mentoring while developing technical staff members that are earlier in their careers," he observed.

"Hiring of experienced personnel will continue as well, though at a lower level, as it will be focused on subject matter experts and unique skill sets that may have been lost by retirements," he said.

The Great Crew Change resulted from a confluence of three realities. First came the skyrocketing birth rate following World

See **Realities**, page 18



Relative Inversion comparison between the Tiber Well and the RTM 25Hz relative inversion

The Future is Automated

But drone technology still faces obstacles in the oil field

By BARRY FRIEDMAN, EXPLORER Correspondent

The future of drone technology, especially considering its promise for the oil and gas industry, has a link, albeit a small one, to the past. According to Harper's Magazine, the Obama administration spent $2.2 million training former coal workers to operate drones in the future.

There's serendipity in that.

Clearly something is happening.

Drones, sometimes called unmanned aerial vehicles (UAV), unmanned aircrafts (UA), unmanned aerial systems (UAS) or remotely piloted aircrafts (RPA), are on the cusp of fundamentally changing the way things are done in the 21st Century – and that includes how things are (and will be) done in the energy sector.

According to two experts in the field, Ian Smith and Jeff Campbell, before something can happen, something else has to get out of the way.

The federal government.

"Currently," Smith said, "drones are in a bit of a limbo stage of automation. The hardware and software are both quite capable of autonomously operating. Think, a weatherproof, solar-powered box which holds the drone inside of it – every morning the drone emerges from the box, flies around, captures data of the assets or designated area, and returns to the box for uploading data to the Internet, recharging of batteries and safe-keeping."

The Robota Eclipse Professional UAV provides high resolution aerial mapping. Photo courtesy of Robota, LLC.

Regulatory Hurdles

"But it has not been successfully commercialized yet," he added.

And why is that?

Smith, who works in business development for DroneDeploy and hosts a podcast for Commercial Drones FM, a company that specializes in promoting the drone industry, said it's partly because of regulation, namely that the Federal Aviation Administration (FAA) isn't comfortable yet with all these machines flying around on their own.

"An operator has to be able to take control, stationary, on the ground."

Is that so bad?

Smith doesn't say it's not a deal-breaker, but admits it is currently illegal to operate a drone beyond visual line of sight (BVLOS) from the operator, and that can be a problem.

"This means that the scenario of a drone taking off based on a schedule, every single morning from that box, would require an operator to be there, maintaining unaided, visual line of sight with the drone," Smith said.

For his part, Campbell, a managing partner for Vertical Aspect, a mapping and consultation company, said he doesn't disagree with the regulations *per se*, especially on the BVLOS, but does understand the pitfalls along the way.

"FAA regulations, if implemented in a well thought out but timely manner, can both generate innovation and provide a guideline for safe, efficient operations. If the regulatory bar is set too high, everyone will just walk under it; too low and it gives the false impression of orderly conduct and safety," he said.

"We are getting closer," Smith said of the BVLOS waiver, "in other countries and in fact, in the United States, a commercial drone operator who wants to deploy a system like this, could absolutely apply for a waiver from the FAA – but getting their permission is not guaranteed."

In fact, he doesn't know anyone who's received a waiver.

Effects on the Workforce

Another aspect of drone technology – and this is of key concern for every sector, not just oil and gas – is the effect it will have, once it takes off, on the job markets throughout the affected industry.

Smith said the answer is complicated, and perhaps not what you think.

"Oil and gas is a cool industry," he said, "and drones are, at the moment, just an extra thing in the tool box."

But he sees it as an important tool that will be used more as it becomes more available.

"You have these installations – this static infrastructure that could stand to gain a ton from drone flights. Easy, cheap, repeatable

See **Infrastructure**, page 10

This aerial map of a quarry is one of the many examples of how drones can benefit the industry. Images courtesy of Vertical Aspect.

This Point Cloud aerial map of a quarry is one of the many examples of how drones can benefit the industry.

Infrastructure

from page 8

and constant aerial views and imagery that normally you can't get."

One example – which is being used industry-wide – is the detection of leaks in pipelines.

"You have miles of pipeline, zig-zagging around – and so some of the uses for the drones would be to stick a laser methane detection sensor on a drone and have it fly all around that pipeline. Instead of having a person walk up and down the length of the pipeline – or in a truck, or helicopter, which is done now and takes a long time and is expensive – you could send that person off to do other things (that are) more valuable."

He envisions a drone taking GPS readings and measurement, a few times a second.

"Then all of a sudden you can start pinpointing where the highest levels of methane, where the leaks are, and if you do this every day or every week, you can start developing trends as to where the weakest points are along these lines," Smith explained.

Drones will help with surveillance and security measures as well, including predictive maintenance and providing real-time data and overall monitoring of pipelines.

"For the foreseeable future," he said, allaying fears of mass firings and dislocations, "there will be many jobs (whether due to location, weather or aerial obstructions), that will best be performed by traditional surveying methods."

The theory is that once drones are employed, costs go down, productivity rises and safety (likely) increases.

"The workers," Smith said, "who normally would have been manually surveying, inspecting and patrolling an area could then do what humans do best and find patterns, provide more expert advice on how, specifically, to fix a problem and put in action the next steps to fix it."

Technological Limitations

Campbell said, presently, there are two main obstacles to greater drone use:

- Battery life: Drones, like cars and their corresponding miles per gallon, don't all get the same "mileage." Fixed-wing drones get the best battery life – up to 60 minutes – while heavy single-battery multi-router drones with big payloads are in the 10-minute range.
- Collision sensors: While improving, they're still not good enough, Campbell said, "to prevent flying into a single power wire or branch."

And, while drones have moved beyond being a hobbyist's experiment to become a valid and efficient tool, they are still somewhat in their infancy. Both Smith and Campbell think it's a growing process, like any new technology.

Smith joked about the reluctance of some people to accept these machines flying overhead.

"As a society, we have to get used to things," he said.

He laughs when he talks of the sometimes violent reaction some have when seeing them fly over their homes.

"It's a federal crime to shoot down a drone, whether it's carrying diapers or nothing," he said.

Campbell, too, understands the new technology will be something of a learning curve for many, but doesn't see the transition as being a difficult one – and, here, oddly (or maybe not), he gives a shout out to Lady Gaga.

"Lumping all types of unmanned aircraft into the same category is no more valid than lumping stealth bombers and light recreational aircraft together," he said, but added, "incorporating the swarm of 300 choreographed drones into the opening segment of Lady Gaga's Super Bowl halftime show was a welcome, highly public, positive use of drones."

Meckel lecturing at AAPG school in Houston, 2000's

Austin Chalk field trip in the 1990's

The Passion and Precision of an 'Explorationist'

Larry Meckel Wins Sidney Powers Memorial Award

By BARRY FRIEDMAN, EXPLORER Correspondent

"So what?"

Larry Meckel, this year's AAPG Sidney Powers Memorial Award recipient, has always had his eye on the prize: the discovery.

In his long career, going on 50 years, he routinely asks that question, not to dismiss, but to challenge both students and co-workers.

He is presently an adjunct professor at the Colorado School of Mines where he teaches graduate level courses in advanced petroleum geology, recent sand models, unconventional petroleum systems, and geology and seismic signatures of reservoir systems.

"Classroom and field trip courses," said Meckel, specifically about academia, "are only valuable if the observations can be used to answer the critical question of how do you use that information to find oil and gas."

He has a name for people who ask such questions – a name for people like himself.

"The one word I would use to describe myself is 'explorationist,' regardless of what the target is," said Meckel.

He calls it his first love.

It's where his passion is and has always been, and he sees how it motivates others.

"To solve problems and to explore, be it for a new good restaurant, a new hiking trail or a new field is exciting," he said.

But it is precise work, he noted, and it takes a laser-like focus.

Meckel, who also won the 2011 Grover E. Murray Memorial Distinguished Educator Award, said, "Maybe that is why running critiques has always been a practical, hard hitting" journey, one where he has always tried to "connect the dots."

A Career of Discovery

Meckel grew up in the refining town of Baytown, Texas, along the Houston ship channel, and like many geologists, his love of the science began early.

In his case, it began on family vacations, collecting rocks.

He went to Rice University where he earned a bachelor's in geology in 1959, graduating with honors and a membership in Phi Beta Kappa. He then attended Johns Hopkins University for graduate studies. More importantly – and more on this in a minute – he met his future wife Barbara, also a geologist.

(Of their four children, incidentally, two are also geologists.)

After graduation, he spent time with Shell as a research geologist and then managed its Geologic Research Department in charge of geological, geochemical and seismic stratigraphy research. He was a partner and vice president of Sneider and Meckel Associates Inc. before forming his own company, L D Meckel & Company in 1981.

Along the way, he has been a Member of AAPG, the Society of Exploration Geophysicists, Society of Economic Paleontologists and Mineralogists, Rocky Mountain Association of Geologists and the Mexican Geological Society. During his career, in which he has published more than a dozen papers and authored more than 60 in-house studies and reports on various basins, stratigraphic units and play opportunities, Meckel has worked in almost every basin in North America and several on other continents.

"I am fortunate to have been party to major discoveries in all three main North American countries: Canada, the United States and Mexico," said Meckel.

Milestones

To that end, he said, there were watersheds along the way that changed his life and career.

But there was one year in particular – 1974.

Larry Mecktel

Elmworth.

"At that time, my work gradually shifted to a new and not very well understood type of play – the unconventional tight gas accumulations. I was part of the large Hunter-SMA team that did the work leading to the giant Elmworth Field in the Alberta Basin. That success was indeed a career changer," Meckel recounted.

Elmworth, the largest gas accumulation in Canada, he said, came along via log evaluations which showed that the Lower Cretaceous Falher sands in more than 50 existing dry holes covering more than 60 townships in the deep part of the Alberta Basin had movable gas at economic rates and no water.

"Facts like this are stubborn things, even in light of early unsuccessful wells. However, perseverance paid off and the discovery well was in 1976," he said.

He tells a great story about doing helicopter outcrop mapping in British Columbia of part of the basin to accurately extend the trends emerging in Alberta. It was a new exploration fairway maybe 100 miles across.

"We identified the key beach conglomerates (sweet spots) in the same units in outcrop and could now draw a, 'best bet' lease line across the new area," said Meckel.

He needed to relay the information, but there was only a bank of public telephones.

This was a big deal.

How to express his excitement while being discreet?

Meckel working on Shell's clastics project, 1965

"I needed to convey that info back to John Masters (the late geologic legend), at the time, quickly and the only available phone was rather public with others standing by to report in to their companies. So I had to gamble and simply told John, 'I can hear the goddamn seagulls,' hoping he would understand, referring to the exact statement he once made to me on a field trip standing on the beach at Galveston Island. He understood and hung up without a goodbye. That brief incident was later picked up and quoted in The Wall Street Journal," Meckel said.

There were other seminal moments as well. In the early 1980s, Sandy McCormick in Houston connected him to the very early thinking and technology of horizontal drilling, the first necessary breakthrough to really efficiently produce these tight gas sands.

"Multistage fracs would come a decade later," he noted.

The 'I' in 'We'

Inevitably, and somewhat parenthetically, when all AAPG award winners are contacted for stories like this – it's almost a template – they talk about the help and support of people in the industry. Nothing wrong with that, obviously, but Meckel sends a list clearly delineating who's responsible for what.

The list includes: Barney Bernard and Rufus LeBlanc (for research); Bob Sneider, J.T. Smith, John Masters, Jim Gray and Fred Meissner (for exploration); and Bob Weimer (for teaching).

Precision.

There are others, of course who inspired and molded him, but one stands out: Barbara Meckel, who he said has been an "absolute critical element all along" and someone who is his colleague, adviser and enthusiastic supporter. They are very much a team. Barbara, in fact, runs L D Meckel with him. Hearing him talk about her reminded me of something his close friend Edward Dolly, this year's Michel T. Halbouty Outstanding Leadership Award, said about such partnerships.

"There's an 'I' in 'We.'"

One imagines that when Meckel receives the Sidney Powers in Houston in April, looking out at Barbara, who will no doubt be looking back, will be his greatest award.

Honoring the 'I' in 'We'

Michel T. Halbouty Outstanding Leadership Award: Edward D. Dolly

By BARRY FRIEDMAN, EXPLORER Correspondent

Edward D. Dolly, this year's Michel T. Halbouty Outstanding Leadership Award winner, isn't comfortable talking about himself.

"I try not to, but I know I have to, to some extent."

He wasn't even 100-percent sold on the idea of doing this interview.

When you win such an award, though, people want to hear from you, want to hear how it all came about, so he immediately puts his achievement, his success – this award – in perspective.

"I know each of the previous Halbouty Award winners personally (there have been 11), and to be included among that group of unique and dedicated leaders is further testament to the value I attach to this award," said Dolly.

And to the award's namesake.

"I had the pleasure of hearing Mr. Halbouty speak several times at various AAPG functions. He was a dynamic, powerful, eloquent and fiery speaker who commanded the undivided attention of his audience while delivering his message, and he was an impressive leader," he recalled.

"When he spoke, people listened."

Ed Dolly and Norm Foster standing by Trap Spring No. 1 pumping unit, discovery well, Trap Spring Field, Nye County, Nevada. The well pumped 1,246 bopd and the prospect was generated by Dolly and Foster for Filon Exploration Corporation.

The Benefits of Teamwork

Dolly understands the interconnectedness in his success and why he's being honored.

"I have always talked about myself as an 'I' in 'We' – the 'I' came out now and then."

Born in Davenport, Iowa in 1940, Dolly grew up in central Illinois. By the time he was in the eighth grade, he was already helping his dad in oil fields in the southern part of the state.

By junior high school, Dolly said, he was hooked and knew he wanted to be a geologist.

He received a bachelor's degree from the University of Illinois and a master's and then a doctorate from the University of Oklahoma.

Early in his career, Dolly earned the reputation of being a first-rate oil and gas finder.

He liked being on the hunt. He liked the adventure of chasing the unknown.

"I never wanted to be a manager," he said from his home in Colorado where he, now retired, lives with his wife, Karmen.

"I preferred to practice the profession I spent so many years studying, to be a geologist and work the data. I was in my element working with teams, developing ideas and concepts that led to drilling prospects," said Dolly.

He understands how that's not always possible.

"Working alone was also necessary at times, but in most companies, teamwork made things progress faster, and a team could be working on several projects at the same time with each member contributing specific talents and unique ideas."

DOLLY

Dolly, a past Levorsen Award winner, has no regrets, but he laughs when he thinks about what might have been. He has helped organize AAPG's 100-year anniversary celebration and talks about what he learned putting together the GeoLegends series, a video collection of interviews he did (along with Paul Weimer) of 50 legends in the profession.

"Throughout the 10 years I've worked on this project, I've had fun learning a new trade – film production," he said.

"My interview style," Dolly said, "was to prepare before each interview with an outline of questions, for both the subject and myself, so that during the videotaping, the subject could tell his story without interruption. I would only ask questions to expand on a specific point or to keep the flow going, and then only if necessary."

"Working with cinematographers Pax

See **Association**, page 16

Larry Meckel and Ed Dolly hard at work filming GeoLegends

Ed Dolly at the Pinedale flare pit

Association
from page 14

Harris and Sam Carrothers of Medium Films has been a pleasure. They taught me the basics of digitizing maps, well logs, cross sections and photos, as well as how to edit the interviews," he added.

Dolly considers his part in the production of the GeoLegend interviews to be his contribution to AAPG to honor those interviewed and to provide valuable information for AAPG Members.

Impact on AAPG

Dolly has a confidence that asserts itself freely and openly, but without approaching cockiness. His business DNA is important to him, and he easily reels off his partnerships, especially with Norm Foster and Paul Weimer, and his friendship with this year's Sidney Powers' winner Larry Meckel (see related story on page 12).

There's a lot of "I" in "we."

About that 100th year celebration, he said, "I took on this task because I felt it would be a way to give back in a lasting and significant manner to an organization that has supported geoscientists for 100 years. Charles Sternbach initially chaired the (100th Anniversary) Committee; I later served as the chair, followed by Paul. In the final months prior to the anniversary, the three of us are jointly co-chairing the Committee."

For all his successes, he left his mark on AAPG, especially the Rocky Mountain Section, where he served as both president and AAPG Advisory Council representative. For decades, he has espoused the benefits of participation in professional societies – he believes it's a life force for any industry. He has served as both president and counselor of the Rocky Mountain Association of Geologists and served on nine RMAG committees, two of which he chaired. For AAPG, he's been chairman of the House of Delegates and participated on 18 committees, six of which he chaired or co-chaired.

AAPG's Impact on Dolly

In the profession, in the field, he was an explorer. He took risks. Most paid off.

"After four years spent learning the business with Shell Oil in Denver and taking a number of training courses through Shell's lab in Houston, I left Shell to join the first of what became a series of independent oil and gas companies," he said. "The participants in each of those companies in one manner or another built up oil and gas reserves which were then sold to larger companies for a significant payday."

Are there regrets?

"I now joke," he said, "that after interviewing all these GeoLegends and hearing the stories of the thought processes and exploration techniques they used, those who found billions of barrels of oil, I should have worked on such a project before starting my career. With that added knowledge, I might have done even better in my exploration efforts."

He's now an elder statesman of sorts.

Dolly is an optimist, but there are dynamics on the horizon in the profession and within the AAPG Membership that trouble him.

"Perhaps it's a sign of the times, the digital world, but we're losing people. The young people are not renewing their memberships," he lamented.

He thinks it's a mistake, he said, because he knows what those relationships and educational opportunities afforded by membership in associations have meant to him.

He gives advice, if asked. He's asked.

"Never stop learning."

And then to those just now entering the profession, he advises specific steps to take.

"Attend every talk, short course, field trip, symposium and convention possible – continuing throughout your career. Join professional societies, study groups, and above all, participate in them, both locally and nationally. Network continually, be a people person, keep abreast of new scientific ideas and the latest techniques," he said.

In conclusion, in retirement, he and his wife, Karmen, are generations-deep into a shared passion - genealogy.

"Our single most significant discovery is the fact that we have an ancestor in common eight generations back!"

Sound familiar?

It should. It's the "I" in "We."

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Beijing, China

Newest Hedberg Set for China

AAPG's newest Hedberg Conference, "Fundamental Controls on Shale Oil Resources and Production," will be held April 28-30 in Beijing, China.

The conference will shed light on new ideas and collaborative ventures between industry and academia that could accelerate the exploration and development of shale oil resources in mature petroleum source kitchens in petroliferous basins.

Such advances are likely to be some of the most important developments in the oil and gas industry in the next decade due to the depletion of conventional petroleum traps and the inefficient recovery factors of unconventional resources.

Technical themes of the conference will include petroleum generation, primary expulsion and secondary migration; shale and mudrocks as reservoirs; hydrocarbon enrichment mechanisms in shale and mudrock systems; geophysical technologies related to shale oil exploration; multistage fracturing for shale and mudstone reservoirs; innovation production techniques; and production allocation.

A variety of oral and poster presentations will be made throughout the conference by leading experts in the field while conversation will be encouraged to develop and share new ideas for the industry.

To learn more about the conference, visit http://aapg.to/hbfundcontrch.

Realities

from page 6

War II, known in the United States as the Baby Boom. That put a very large cohort of future workers into the employment picture.

Next came a surge of college students studying petroleum-related disciplines, especially petroleum geology and petroleum engineering, in the 1970s and early '80s. Stable growth and good salaries in the oil and gas business were magnets for enrollment.

Third, the industry entered a prolonged period of layoffs and mergers after the 1980s collapse, and essentially stopped hiring technical professionals for more than a decade.

The result was a significant age gap between senior employees and the next generation of hires. The oil and gas industry had become stocked with Baby Boom technical graduates of the 1970s, and that large group of senior professionals will go on retiring for the next 10 years.

A wealth of experience and knowledge will be leaving with them.

"At ConocoPhillips we put a huge amount of effort into getting our impending retirees into teaching and mentoring," Handschy recalled.

"We were trying to do a lot to get one-on-one transfer of knowledge, as well as an intentional effort to capture that knowledge. And I can tell you, that was one of the first things that got shut down when prices collapsed," he said.

Bridging Generations

Handschy thinks the industry is missing an important opportunity by not doing enough to acquire and retain knowledge from those retiring geoscientists.

"It's one of the big challenges for the industry and I think in 10 years or 20 years, the industry will look back at this big Crew Change and say, 'One of the things we did the worst was capturing this knowledge,'" he said.

Another key consideration for the oil and gas industry after the Crew Change will be the availability of graduates with technical degrees and the ability to attract them as employees. Competition with other industries for technical professionals could be intense.

"Ensuring that there are enough students in technical fields will be critical as hiring will continue from college campuses, although at a lower level for the near-term, to maintain a steady flow of technical experts into companies as the demographics change," Ryan said.

Because the current and oncoming generations of college students are sharply different from each other and from previous graduates, Handschy believes the industry will have to make "much more progress in compensation and benefits."

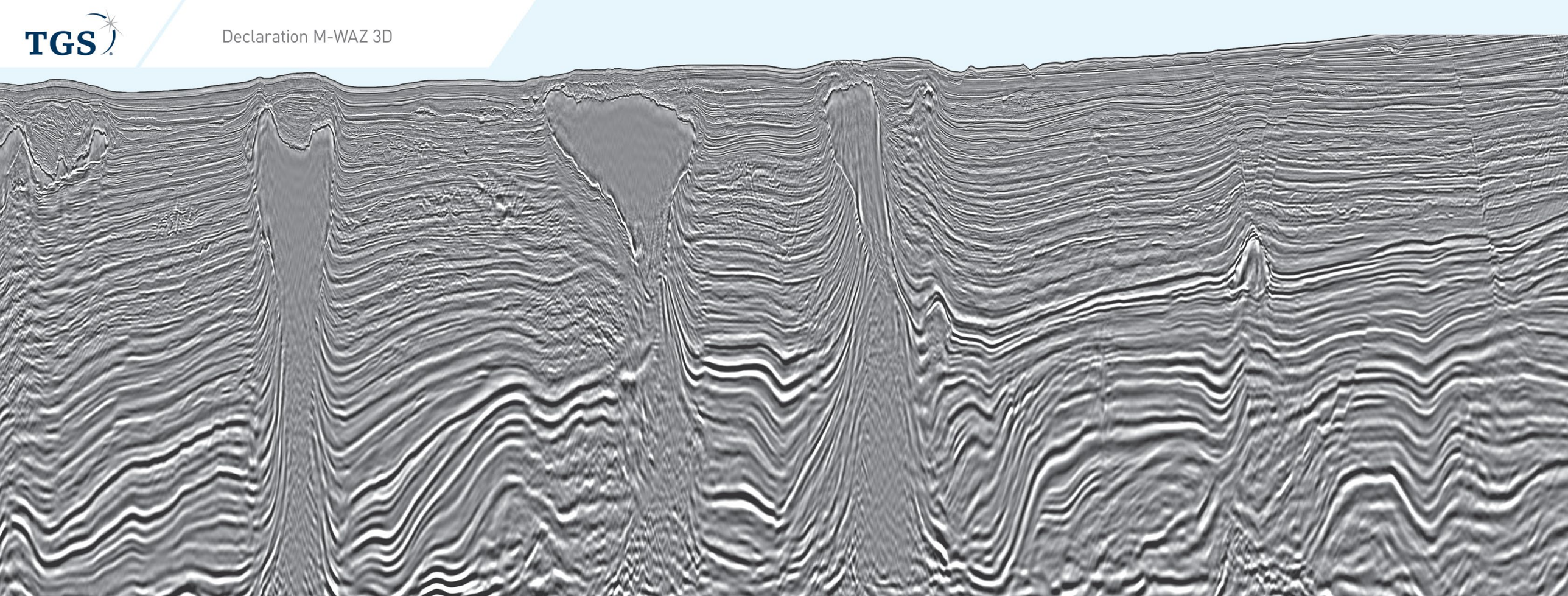
He contrasted today's graduates with his own generation.

At one time, "people actually took pride in not using their sick leave. Millennials see all their time off as something they should use," he said. "Even if all the skills and experience are there, I'm not sure the willingness to work overtime is there."

But Handschy doesn't see the latest rounds of layoffs deterring graduates from entering the industry.

It's always been a cyclical business, he noted, and the industry needs professionals who labor more for love than for money.

In the 1970s, "you got a lot of people who had no passion for the science – they were just in it for a job," he said. "The best petroleum geoscientists have always been people who are outstanding geologists, geoscientists (and) geophysicists, because they have true passion for the science."



This article is reprinted from the Explorer Special Issue: A Century.
Below: Meeting of the Southwestern Association of Petroleum Geologists at Kendall College in Tulsa, Okla., Feb. 10, 1917.

They Came, They Saw, They Started Something Special

The birth of AAPG

By DAVID AVERILL

From around the world, and often from different stations in life, they all joined together to turn a vision into reality.

Miraculous? Perhaps, but despite varied backgrounds and the different courses they would later take, these men had much in common.

They were for the most part young, middle class men, many of them still in their 20s, educated at Midwestern or Eastern colleges.

They poured into Oklahoma, Kansas, Texas, New Mexico and Mexico by the hundreds.

They were infused with excitement over the budding science of petroleum geology, and the romance of pioneering jobs in an area that was still something of a frontier.

They were about to become the founders of American Association of Petroleum Geologists. The late Robert H. Dott Sr., former executive director of AAPG, and before his death in 1988 one of the Association's best sources of historical information – remembered those early days.

"The future was all ahead of us then – the future of finding reserves," he recalled in a 1985 interview. "We were interested in geology and in the excitement and romance of the job. They were good jobs with some excitement and some physical dangers. Some of the jobs and their working and living conditions were comparable to those of the early railroad location engineers."

Front Page News

"Geologists Meet in Tulsa Today," read the front-page headline in the Tulsa Daily World on Feb. 9, 1917. The brief story reported that geologists from "every school and firm in the state" and from surrounding states would convene at the Hotel Tulsa for two days of lectures and technical paper presentations and for an evening social event. Another brief story revealed that 25 students from the University of Oklahoma in Norman would "take a special car to the meeting."

That wasn't the biggest news in the World that morning.

Instead, the big stories were devoted to preparations for America's impending entry into World War I, and to Germany's submarine torpedo attacks against British and American ships. "Still No Cause to Declare War," intoned the major headline. The United States formally declared war on Germany less than two months later, on April 6.

On the home front, 45 state legislatures had ratified the 18th (Prohibition) Amendment to the U.S. Constitution, meaning the country was about to go dry. The National League Boston Braves were making plans to call up minor leaguers if a threatened players' strike occurred (it didn't), and American League president Ben Johnson announced that players wishing to join the military service would receive immediate releases.

"Contracts will not stand in the way of those who wish to fight in defense of their country," Johnson said.

And at the Majestic Theater in downtown Tulsa, the touring play "The House Built Upon Sand," starring Lillian Gish, answered the question, "Should a woman who is used to luxurious ease be compelled to give it all up because of her husband's station in life?"

It was an exciting time for the oil and gas industry in Oklahoma, and for geology. Tulsa had become an oil center, due largely to discovery of the nearby Glenn Pool and Cushing fields years before. A year and a half earlier, in June 1915, the federal government, through an agreement between the Department of the Interior and the Osage Nation, opened Osage lands northwest of Tulsa to the granting of oil leases.

Geology had only recently proven itself as a valuable tool for finding oil, and it would prove to be particularly valuable in the Osage.

Dott recalled geologists pouring into Tulsa and the surrounding territory, to places like Bartlesville, Pawhuska, Sapulpa, Ponca City, Okmulgee and southern Kansas, many of them recruited by oil companies right off college campuses – before graduation.

"The use of geology brought a lot of geologists here to Tulsa," Dott said. "They liked to talk and compare notes, even though the industry as a whole was very secretive."

Some were college-educated geologists. Some were civil engineers or surveyors, Dott said, smart enough to apply their skills to the search for and mapping of indications of the occurrences of oil and gas structures.

Some were hard-knocks graduates who learned their trade in the oil fields.

And some were flimflam men.

"There were lots of doodlebugs of different kinds," Dott recalled. "Someone found a psychic who claimed he could divine oil beneath the surface."

James H. Gardner, a founding member of the AAPG, told at an early meeting of encountering a man who claimed he became nauseated every time he walked across an undiscovered oil field.

"Gardner laughed and said he sometimes became nauseated when he didn't discover oil," Dott said, "but never when he hit a producer."

The desire to compare notes and share their theories – and to weed out the con men and flimflammers – were among the reasons the young geologists met at the Hotel Tulsa that cold February morning to launch their new organization.

Proof Positive

Everett Carpenter, who was 33 years old at the time of the 1917 meeting, was one of the men responsible for geology's

Continued on next page

First Executive Committee, 1917-1918, from left to right: J. Elmer Thomas, president; Alexander Deussen, vice president; Maurice G. Mehl, secretary-treasurer; and Charles H. Taylor, editor.

AAPG quickly grew in numbers and branched out geographically. Shown here, the 1923 meeting in Shreveport, La.

Continued from previous page

growing reputation.

Carpenter became intrigued with the anticlinal theory of osil and gas accumulation while he was a student at the University of Oklahoma. He spent his summers working for the Oklahoma Geological Survey and the U.S. Geological Survey. He worked for the government for a time after his graduation in 1911, then took a job with the Quapaw Gas Co. of Bartlesville. Quapaw was among the companies owned by Henry L. Doherty that later became part of the Cities Service Oil Co.

Carpenter was dispatched to Augusta, Kan., to investigate some wells that had gas showings at shallow depths. He carried about $50 worth of instruments – a Brunton compass, a six-inch hand level and an aneroid barometer. Carpenter applied through channels for an alidade and tripod – instruments then worth about $100 – but he was turned down. He tricked a company purchasing agent into buying them for him, and for his efforts later received a reprimand from his superiors.

Carpenter's work at Augusta led to the successful discovery of oil and gas in 1914. Reconnaissance studies then were begun of the El Dorado Dome north of Augusta and west of El Dorado, Kan., and a discovery was made there a year later.

Dott said that until the Augusta and El Dorado discoveries, "most of the operators either ignored or ridiculed geology." But those finds "both turned out to be giant fields, and that gave the oil industry the idea that there was something to this geology."

DOTT SR

> **"We were interested in geology and in the excitement and romance of the job."**

Carpenter became the chief geologist of the newly formed Empire Gas and Fuel Co., and his department soon grew to 250 employees. Carpenter and several of the geologists who worked for him were involved in the founding of AAPG – in fact, seven of AAPG's eventual presidents were his associates.

Carpenter was involved in several other important discoveries over the years, published a number of papers and worked as chief geologist for several firms before his retirement.

He died in Oklahoma City in 1968 at the age of 84.

Gift of Mirth

John Elmer Thomas, who was elected the group's first president at the founding meeting in 1917, was only 25 at the time, and already chief geologist for Sinclair Oil and Gas Co. Thomas graduated from the University of Chicago in 1912 with a reputation as a brilliant geology student.

Dott remembered Thomas as "a very gregarious fellow" who had a talent for satiric comedy – "kind of a clown," Dott said.

At an early meeting of the Association, Thomas and another Member, R.B. Whithead, composed and performed a takeoff on a popular song of the day, "My Alice Blue Gown." Among the stanzas of "When They Strike Oil on My Daddy's Farm," was this one:

I'll buy sister an organ brand new, Get Charlie a buggy or two; Will brace up the barn, be slickers, goldarn, When they strike oil on my daddy's farm.

Thomas became a well-known consulting geologist and an acknowledged expert on petroleum economics and oil conservation, serving as an appointee to a number of governmental commissions and boards.

From the early 1930s until his death in 1949, except for the war years, he spent much of his time exploring for oil in Europe.

Field camp party from Ohio State University, July 1935, on top of Lookout Mountain overlooking Chattanooga, Tenn.

International Influence

In addition to owning the most unwieldy name of all the founders, Willem A.J.M. van Waterschoot van der Gracht, at 44, was one of the old men of the group – and already a distinguished geologist.

Born in Amsterdam, Holland, van der Gracht received a doctor of law at Amsterdam University in 1899 and a degree of mining engineer from the University of Freibert in 1903. He was multilingual. Before coming to the United States, he was director of the Geological Service of the Netherlands, and worked as a consulting mining engineer in the East Indies, Africa, South America, Russia, Romania, Belgium, Portugal, Spain, Germany, England and Canada.

At the time of AAPG's founding meeting in Tulsa, van der Gracht was president of Roxana Petroleum Co., a producing subsidiary of Royal Dutch/Shell. In the 1920s he was vice president of the Marland Oil Co. of Delaware and president of Marland Oil Co. of Texas, and then research director for the entire Marland organization.

He returned to the Netherlands in 1929, where he wrote and, as a consultant engineer, explored for oil and coal in western Europe. He was director of the Netherlands' Bureau of Mines from 1932 until his retirement in 1940.

As World War II engulfed his homeland, van der Gracht continued his scientific pursuits, especially "a renewed investigation of the subsurface of the Netherlands."

In a 1941 letter to friends in the United States, he wrote:

"Scientific work keeps me in reasonably good cheer and detracts one's mind from too many depressing thoughts. Food gets very scarce, but an old man does not need much; yet one thinks with considerable regret of the fare that we used to give our drilling crews in the oilfield camps! Would it not be nice to have that just for one day?"

AP's No. 1

One of the roots of AAPG dates to early in 1915, when Everette Lee DeGolyer, chief geologist of the Mexican Eagle Oil Co. at Tampico and a graduate of the University of Oklahoma, suggested to the head of OU's geology department during a visit to Norman that there was a need for a geological society in the southwest.

That led to a pre-organizational meeting in January 1916, of 50 geologists in Norman, and an agreement to hold another meeting during the next winter in

See **DeGolyer**, page 31

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.

Source Rock as a Reservoir: A Personal Odyssey

By MARLAN W. DOWNEY

In 1965, G.T. Philippi, a Shell geochemist, published a remarkable paper "On the depth, time and mechanism of petroleum generation." Philippi made the novel proposal that petroleum was generated from organic matter in sediments that had been buried deeply enough to be exposed to warmer earth temperatures, converting the organic matter, with heat and time, to petroleum.

At that time, nearly every geologist believed that oil was contained in shales and squeezed out into adjacent reservoirs. Indeed, in 1952, P.V. Smith of Esso announced that large amounts of hydrocarbons were extractable from recent sediments of the Orinoco Delta. Unremarked at the time was the fact that hydrocarbons observed in recent sediments were not petroleum molecules. Those hydrocarbon molecules found in shallow sediments are merely detritus of recently living matter.

Most geologists – indeed, most Shell geologists – continued to argue for a local origin of petroleum, as Philippi, a brilliant but irascible organic chemist, found it difficult to answer criticisms of his work.

From left: Albert Bally, Marlan Downey and Ray Thomasson at Shell's Bellaire Research Lab in 1965.

Origin and Migration of Hydrocarbons

Chemists at Shell and Mobil Field Research in Dallas established that petroleum was a natural mixture of hydrocarbons that could only be produced by thermal cracking of organic matter, clearly supporting Philippi's theory.

In 1964, a team of Shell geologists and chemists, J.T. Smith, Peter Moore and Bernie Ferris, conducted a thorough review of Phillipi's work over the past 30 years and recommended to Shell's head office in New York that a major research project be established at Shell's Bellaire Research Lab to evaluate the usefulness of Philippi's ideas, proposing that knowledge of the origin and migration of oil could provide competitive advantages in exploration and production.

Shell's research project, "Origin and Migration of Hydrocarbons" was funded at 35 man-years per year and benefitted from such geologic talents as Gordon Rittenhouse, Bob Heacock, Fred Meissner, Tim Schowalter, John Castano, Les Magoon, Ies Havenaar and Kees de Groot. (Dietrick Welte spent a post-doctoral year with the Shell group). I became involved with source rocks in 1963, when a Shell vice president remembered my early degree in chemistry.

Archie Hood, a marvelous scientist and a wonderful man, was leader of the research group. After my second year in the group, Archie asked me to come into his office on a Friday afternoon. He closed the door behind us, and formally suggested that I sit down.

I took a deep breath. I knew what was coming – times were tough and I was the junior person on the project.

At least, I thought I knew what was coming.

He said, "Marlan, I've talked to the VP. We think you can manage the project better than I can. Monday, you will be in charge of the project. I will be working for you, and will go back to doing science. Have a nice weekend."

What a mentor! Is there anyone like that around nowadays?

My direct supervisors and friends, giving me unqualified support, were Ray Thomasson, and later, Bert Bally.

We wondered, what characteristics define a great source rock?

With regard to source rock candidates, was 1,000 feet of 1 percent organic matter as good as 100 feet of 10 percent organic matter?

Since we found that a significant amount of generated oil is retained in rock pores, all good oil source rocks need to contain a high percentage of organic matter to provide any surplus oil to expel.

Good source rocks needed to have very significant richness, of a particular kind of organic matter, heated in the earth for a known time and temperature. The generation process was governed by the Arrhenius equation: time, temperature and type of organic matter are variables.

Shell's work established that hydrogen-rich organic matter was needed to create oil, and humic, hydrogen-deficient organic material could only produce gas.

As maximum temperature was so important in the maturation of organic matter, considerable effort was expended to provide operating units with tools to measure maximum temperatures of rocks.

Work by Chris Gutjahr in the early '60s created a spore carbonization color chart, calibrated to coal rank. Color comparison charts were widely distributed to operations units using progressively charred sugar particles, shaded from pale yellow to black. Jack Mase made a chart for conodont color alterations, useful in settings where other types of organic matter were rare. We visited M. Teichmuller, learning about her vitrinite reflectance (VR) work on coals, and modified the coal procedure to use organic matter extracted from rocks. The vitrinite reflectance measurements adapted from coal petrographers seemed to be the most quantitative and useful method of determining temperature history of source rocks, and in 1966, John Castano supervised the installation and standardization of VR labs throughout Shell's operating offices.

Archie labored to create a Level of Organic Metamorphism (LOM) scale, to inter-compare descriptions of spore coloration, coal rank, VR, etc. for use in identifying the onset of oil generation, and to determine the likely expulsion product at each level of organic metamorphism.

Standard techniques of measuring carbon did not differentiate between "live" carbon or "dead" carbon, nor whether the "live" carbon was hydrogen-rich or hydrogen-poor. We recognized that a significant portion of organic matter in rocks is "dead" carbon, endlessly recycled, and we emphasized the measurement of reactive organic material in source rocks; first supplying operating units with pyrolysis-fluorescence equipment in 1963, later using more quantitative pyrolysis-FID analytical devices ("Rock-Eval" is a name for such now-commercially available services).

In 1966, I was encouraged to test our growing quantitative skills and provided a material balance charge oil calculation for the Woodford Shale in the Anadarko Basin of Oklahoma. I collected and analyzed hundreds of samples of the Woodford shale, measuring temperature history, thickness, type and amount of organic material by calculating volume of expected-to-be expelled oil versus known oil. Results suggested that several times more oil should have been generated than I could account for in all known fields.

In 1967, my source rock work moved from Shell's Bellaire Lab to Denver

Continued on next page

DOWNEY

Marlan Downey was raised in rural Nebraska and took his graduate degrees in geology from the University of Nebraska after returning from service in the U.S. Army in Korea. He joined Shell Oil in 1957, retiring in 1987 as president of Pecten International, Shell Oil's international subsidiary. He founded Roxanna Oil in 1987, and then returned to corporate life in 1990 to serve as president of Arco International, retiring in 1998. He then joined the University of Oklahoma as Bartell professor and chief scientist of the Sarkeys Energy Center. He was elected president of AAPG in 2000 and awarded the Sidney Powers Medal in 2009. He remains active, serving on three oil company boards, chairing Roxanna Oil and actively consulting around the world.

Continued from previous page

operations as chief geologist. Dave Baker drilled a seismic anomaly in the Uinta Basin that resulted in the Shell wildcat well penetrating 8,000 feet of Green River oil shale; immature in the shallow hole, gradually becoming mature, oil-bearing and finally gas-generating at the bottom of the hole. It was an in-situ oil generation model. Very little reservoir rock was recognized by our reservoir engineers, but the source rocks were oozing oil and gas! Few realized that source rocks with, say, 8 percent organic carbon (by weight) represented about triple that amount of kerogen (by volume) in the source rock. The kerogen was concentrated in layers, and as the rock matured and the kerogen liquefied, the rock fabric altered and the fluid pressure greatly increased.

At that time, we knew we had oil retained in the source rock, at high pressure. We thought we needed to have the source rock interbedded with some conventional permeability rock to extract significant oil volumes at useful rates.

I would like to have been the genius who said in 1968, "We know the oil is within the source rock; we merely have to get it out!" None of us were that wise, and industry continued to move very slowly to the concept of a mature source rock as a desired reservoir.

Source Rock as Reservoir

A first step was extracting methane gas from coal beds. Few thought of coals as useful sources of methane; coal miners considered the contained methane as a dangerous nuisance. Safety-inspired work by the Bureau of Mines showed the usefulness of lateral bore holes for draining potentially explosive methane from coal in advance of mining. With temporary assistance from government price subsidies, thousands of wells proved the efficiency of the horizontal drilling technology to produce coal bed methane.

The remarkable persistence of George Mitchell's team in drilling long laterals in the Barnett gas source rock, and combining those long laterals with effective fracturing, jump-started the shale gas reservoir revolution. Mitchell taught the industry what focused engineering and management persistence could do to solve source rock reservoir problems.

After Mitchell's success, industry attention re-focused on the concept of gas source rock… as a reservoir. To my surprise, I found that Shell had mislaid much of its former knowledge; many companies were struggling to learn about the characteristics of source rocks. Since 2000, my company, Roxanna Oil, has helped companies expand their expertise in locating and evaluating shale gas and shale oil reservoirs.

Gas shales require an abundance of organic matter, as well as a high temperature history. Not only does the organic matter generate the gas, it modifies to provide internal micro-porosity during the metamorphism of the organic matter (J.T. Smith, in 2001, in one of his last scientific acts, provided Roxanna Oil his insightful analysis of the benefit provided by micro-porosity created as a side effect of the thermal metamorphism of organic matter).

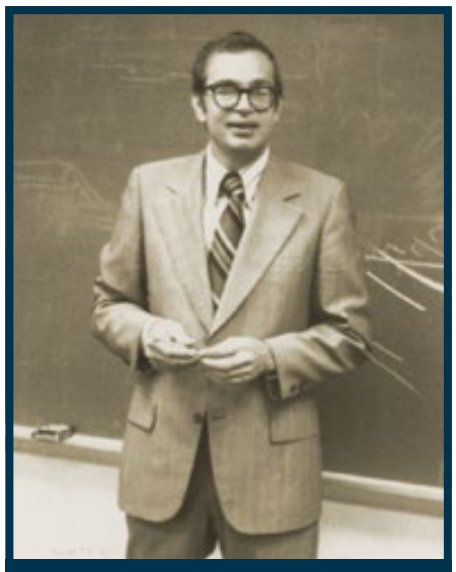
As difficult as creating a producing shale gas reservoir has been for the industry; creating flow paths allowing oil production from an oil shale source rock reservoir is at least 10 times more difficult. The problems of moving a methane molecule to a borehole are dwarfed by the task of extracting a much larger oil molecule from an oil source rock.

In selecting the Bakken oil shale formation, wise explorers recognized an extremely rich oil source rock, with local interbeds of more transmissive material. The successful Bakken Shale effort owes much to its rapidity of improvement; well production rates increased linearly with time, with technology and industry persistence consistently driving increased flow rates and profitability.

Recovery efficiencies for oil shale reservoirs are likely less than 15 percent; a lot of oil remains in the source rock reservoir. A new industry is gathering – one based on re-stimulating older wells to access additional production. Visualize a fracture network outward from a long lateral, and remember that the only oil that has been taken out is from rock within a few feet of a fracture. Any undrained source rock a few feet from a fracture retains most of its original pressure, and its original content of oil. On re-fracturing, the fluid first fills any currently open fractures, and then seeks the weakest portion of the reservoir; the weakest rock is now the undrained portion, reflecting its unrelieved high pore pressure.

Source rocks, as oil and gas producing reservoirs, are largely a North American activity today, but most of the world's source rocks reside in other countries, which are undeveloped. Wise development of the worlds' source rock reservoirs will require the attention of the best and brightest of our grandchildren.

Great source rocks make great source rock reservoirs.



Marlan Downey at the research lab in the early 1960's.

The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, chief geophysicist for Arcis Seismic Solutions, TGS, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer.

What Causes those Annoying Stair Step Artifacts on Coherence Volumes?

By TENGFEI LIN and KURT J. MARFURT

Since its original introduction 20 years ago, coherence remains, along with bright spots, to be one of the most popular seismic attributes used by interpreters. During this time, there have been significant advances in algorithmic implementation, data preconditioning and most importantly, interpretation workflows. Nevertheless, the stair-step artifacts seen on many coherence volumes has haunted its developers and annoyed interpreters throughout this time.


MARFURT

Specifically, while time slices through coherence volumes provide excellent images of the continuity and orientation of faults, the lateral location of these faults are often shifted from one manually picked on vertical slices through the seismic amplitude data by a human interpreter.

Eigenstructure-, semblance-, variance-, and gradient structure tensor-based coherence as well as Sobel-filter estimates of discontinuities are all computed in an oblique window centered about each voxel consisting of five or more traces and zero to as many as two dozen time samples. Since the size of the analysis window is oriented vertically along traces, folk wisdom has been that the stair steps are caused by the vertical extent of the analysis window, where larger vertical extent results in larger, smoother stair-step artifacts.

For this reason, a best practice is to limit the vertical analysis window to approximately the dominant period of the seismic data, thereby avoiding mixing discontinuities from deeper or shallower horizons. For listric faults, the stair-step artifacts become worse than annoying, with the gentler stair steps intersecting a time slice multiple times, resulting in a broad incoherent zone rather than in a single sharp image of the fault.

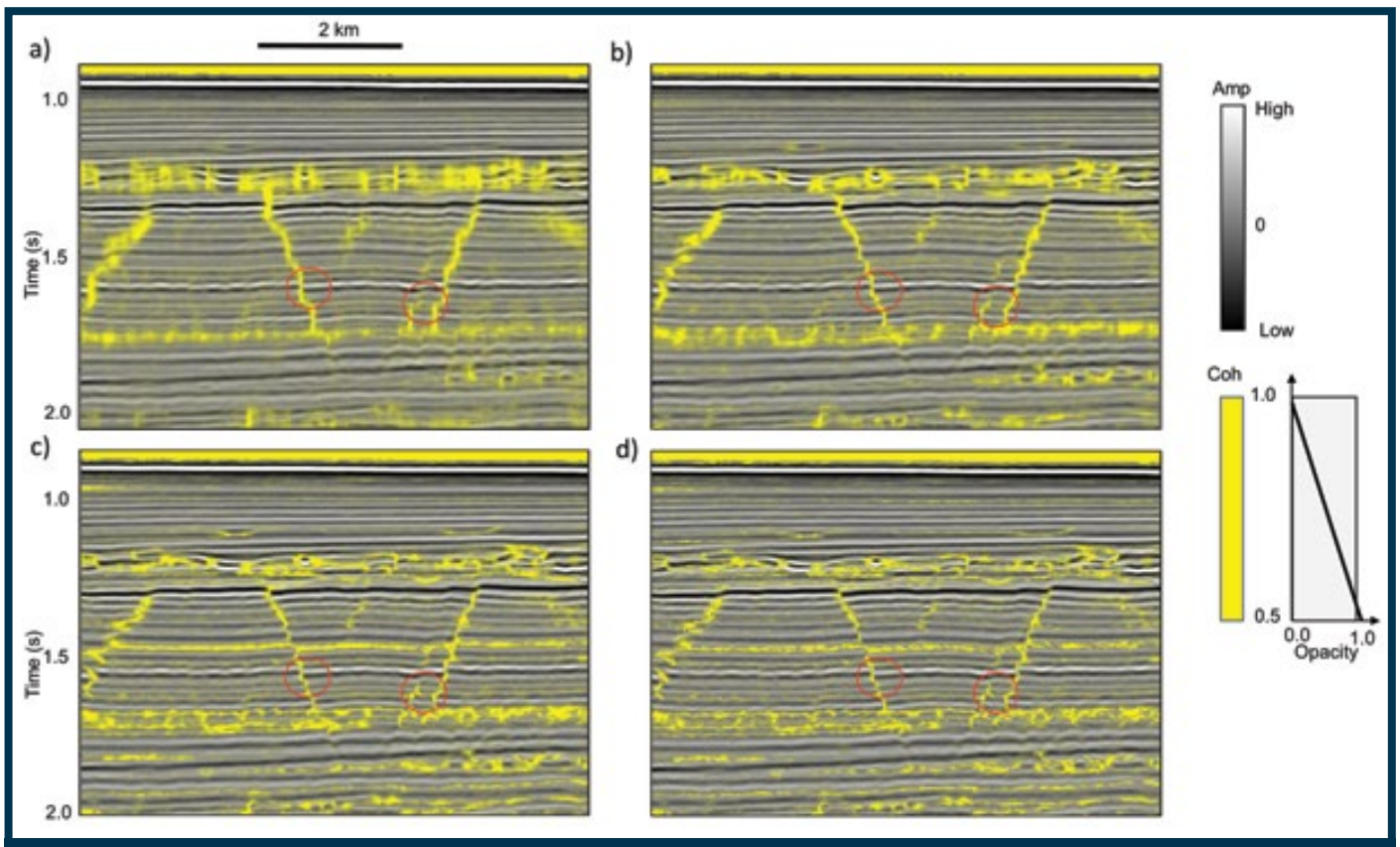


Figure 1. A suite of vertical slices through co-rendered seismic amplitude and coherence volumes where the coherence was computed using five traces and (a) ±40 ms, (b) ±20 ms, (c) ±4 ms and (d) ±0-ms vertical analysis windows. Sample increment = 4 ms, bin size =12.5 m x 25 m. Note the stair-step artifacts indicated by the red circles. The stair-step anomalies shifts the location of faults seen on coherence time slices laterally. While such inaccuracies on the time slices are not catastrophic, it can be quite annoying. Folk wisdom attributes the stair-step anomalies to the size of the vertical analysis window, which while oriented along structural dip, typically consists of vertical trace segments. However, note that the stair step persists even when the coherence window size is a single sample, as seen in (d). In each image, the stair step is due the vertical orientation of the seismic wavelet, perpendicular to the nearly horizontal reflector. (Data courtesy of NZPM.)

Attempted Remedies

We evaluated two remedies to this problem, neither of which worked. First, we balanced the amplitude of each sample vector within the analysis window to have approximately the same contribution. Such balancing reduced, but did not eliminate the contribution of the stronger discontinuities within the analysis window. Second, we reduced the vertical size of the analysis window. As shown in figure 1d, even a window size of 1-sample results in a stair-step artifact, which suggests the artifact is due to the seismic amplitude data and not to the size of the coherence window.

Recent publications by the diffraction imaging community have provided some insight into the cause of these artifacts. While the typical migration algorithm assumes that each subsurface image point is a point diffractor, those algorithms that explicitly include an obliquity factor actually assume each subsurface point is part of a specular reflector. In prestack migration, the obliquity factor is a function of the unit vector from the source to the image point, p_s, the unit vector from the receiver group to the image point, p_g, and the normal to the hypothesized reflector, n (figure 2). In diffraction imaging, one explicitly computes n, defining the normal to the reflector dip, from a previous image of specular (or conventional) imaging. In this case, the obliquity factor, Ω, is simply the mean of the vectors p_s and p_g times n, which geometrically gives the cosine of the angle between the average of the angle of incidence and reflection and the normal. Examination of figure 2 shows that for specular reflections, the angle of incidence equals the angle of reflection about the normal, such that $\Omega = 1$.

Furthermore, migration ray pairs, p_s and p_g, skewed to the left of the specular angle will generally be accompanied by migration ray pairs skewed to the right. In most migration algorithms, the seismic image is built up point diffractor by point diffractor. The net result is that the seismic wavelet will be oriented perpendicular to the reflector, parallel

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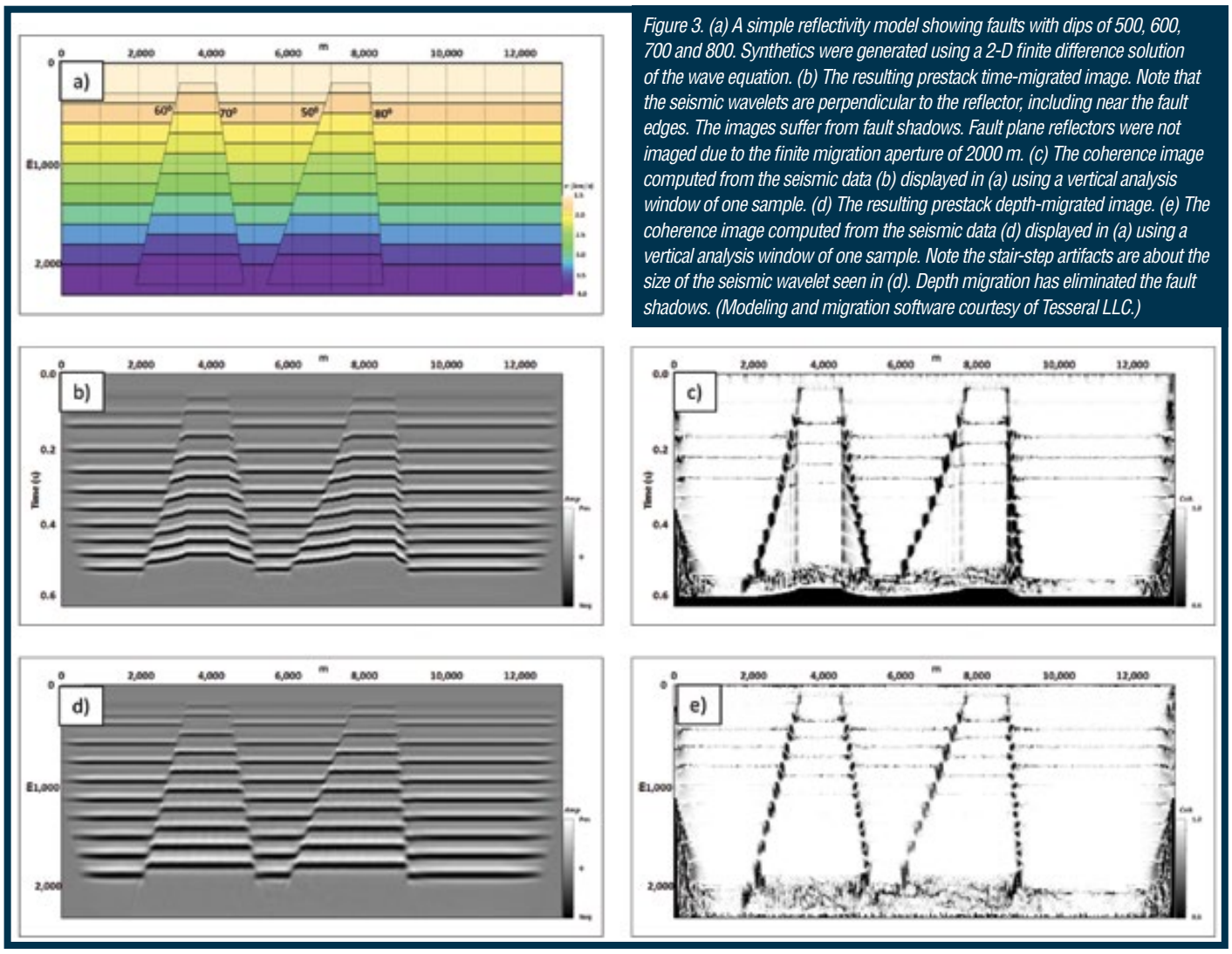

Figure 3. (a) A simple reflectivity model showing faults with dips of 500, 600, 700 and 800. Synthetics were generated using a 2-D finite difference solution of the wave equation. (b) The resulting prestack time-migrated image. Note that the seismic wavelets are perpendicular to the reflector, including near the fault edges. The images suffer from fault shadows. Fault plane reflectors were not imaged due to the finite migration aperture of 2000 m. (c) The coherence image computed from the seismic data (b) displayed in (a) using a vertical analysis window of one sample. (d) The resulting prestack depth-migrated image. (e) The coherence image computed from the seismic data (d) displayed in (a) using a vertical analysis window of one sample. Note the stair-step artifacts are about the size of the seismic wavelet seen in (d). Depth migration has eliminated the fault shadows. (Modeling and migration software courtesy of Tesseral LLC.)

Kurt Marfurt is an AAPG Member and professor of geophysics at the University of Oklahoma.

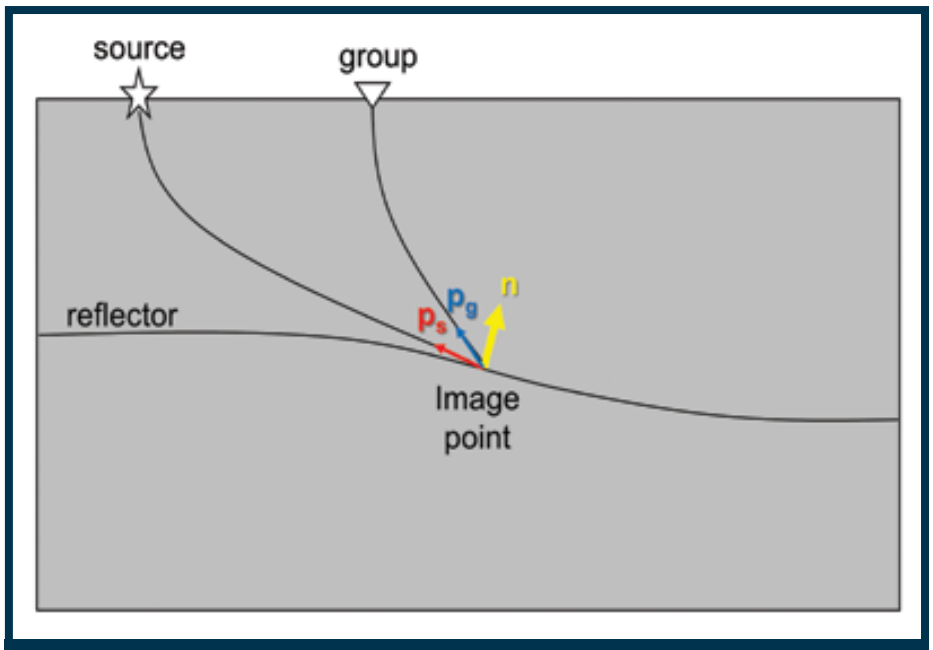

Figure 2. The geometry of seismic migration, using the notation of the diffraction imaging community, n defines the normal to the hypothesized reflector at the image point. If no hypothesis is made, most algorithms assume n to be vertical, while some eliminate the obliquity factor completely. p_s and p_g define unit vectors at the image point. The obliquity factor is the cosine of the angle between the yellow vector and the average of the blue and red vectors.

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to n. The root cause of the problem is that the earth is composed of a sparse collection of reflecting interfaces. Interpreters recognize faults by alignment of discontinuities in the reflections. Discontinuities in these interfaces are represented by a seismic wavelet normal to the interface, not parallel to the (unimaged) fault plane.

Since we do not believe this phenomenon is well recognized by most interpreters, we generate a suite of synthetic shot gathers using a finite difference algorithm, prestack migrate the results to obtain images in both time and depth domain, and compute coherence (figure 3). Note that the seismic wavelets near the fault edges are aligned perpendicularly to the horizontal reflectors. Since these terminations occur at discrete layer boundaries, the result is a discrete stair step, with the vertical extent of the stair step defined by the size of the seismic wavelet.

There is no easy algorithmic solution to this problem. The best solution is to improve the resolution of the seismic data, thereby imaging more fault discontinuities at weaker reflectors. Barring this option, one can "enhance" the fault discontinuities by smoothing coherence anomalies parallel and sharpening coherence anomalies perpendicular to the fault as described in a previous article in this column. In spite of our disappointment in fixing footprint artifacts, recognizing its root cause may help more clever developers to construct a solution.


LIN

Tengfei Lin received a bachelor's in seismic exploration from the China University of Petroleum in Huadong, a master's in geophysics from the University of Oklahoma (OU), then a doctorate in geophysics, also at OU. Between 2011 and 2015, he completed three internships at the China National Petroleum Company. His research interests include seismic processing, velocity analysis, attributes analysis of time-depth domain seismic data and anisotropy analysis.

DeGolyer
from page 27

Tulsa with the northeastern group.

Not only was DeGolyer instrumental in founding the Southwestern Association of Petroleum Geologists – the forerunner of AAPG – he became probably the bestknown of all the group's members.

DeGolyer was to organize and serve as chairman of the Amerada Petroleum Corp. He later left the firm to become a successful independent oil producer and consultant.

Bennett Cerf, the noted author and publisher, once wrote that "Probably the most colorful figure in all Dallas is Everette Lee DeGolyer, pre-eminent geophysicist, key man in oil administration in Washington during the war, and owner of a fabulous library of works on the Southwest."

A newspaper feature service in 1950 profiled DeGolyer in a series of stories "detailing the rags-to-riches success of a modern-day Horatio Alger in an America which proves still to be the land of opportunity."

When he died in 1956 at the age of 70, the Associated Press called him "the petroleum industry's Number 1 geologist."

DeGolyer was born in a sod house on the Kansas prairie and ultimately selected the location for the famous Potero del Llano No. 4 in the Golden Lane fields of Mexico while still a student. That cemented his fame and launched his career.

In addition to his huge successes in the oil business, DeGolyer was a collector of rare books and served as the chairman of the board of the Saturday Review of Literature.

In 1950, a newspaper reporter asked a friend of DeGolyer's to explain his accomplishments. "The wellsprings of his curiosity have never dried up," was the response. DeGolyer himself suggested another epitaph: "He hired good men."

Crusading Against Pseudo-science

Geologists tackle young Earth creationism at the Grand Canyon

By ANGELA EVANS, EXPLORER Correspondent

According to basic geology, planet Earth is roughly 4 billion years old.

This was established in the 1950s by use of radiometric dating and the application of uranium-lead methods.

For about half a century, though, some groups in the United States, known as "young Earth creationists," have insisted that the Earth is closer to 6,000 years old, based on their interpretation of the biblical account of creation and, specifically, the story of Noah's flood. They promote so-called "flood geology" to argue that large-scale geological features like the Grand Canyon were formed relatively recently during the year of Noah's flood about four or five millennia ago.


WOLGEMUTH


An aerial view of the Butte Fault trending to the north, revealing upturned strata to the right of the fault. Photo by Wayne Ranney.

"How badly is the United States affected by the low level of understanding of geology? A 2014 poll by the Associated Press found that four out of 10 people in the United States have doubts about the validity of a 4.5-billion-year history for the Earth."

That's Ken Wolgemuth, a geoscience professor at the University of Tulsa in Oklahoma and a longtime AAPG Member with more than 35 years' experience as a petroleum geologist.

There are important social implications to what he called "the degradation of science," he explained, which demands a response from the scientific community.

"We could not remain quiet while this pseudo-science continued to be propagated in churches across America," he said.

So, a few years ago, Wolgemuth joined with 10 of his fellow scientists whose backgrounds include paleontology, biology and geology, to oppose the growing popularization of flood geology and the notion of a "young Earth."

And, while they have some common cause with high profile atheist/agnostics like Bill Nye "the Science Guy," who debated famed young Earth creationist Ken Ham in recent years, Wolgemuth and most – but not all – of his collaborators are self-described Bible-believing Christians, who are motivated by their faith at least as much as by their love of science.

The fruit of their efforts is a 240-page volume published last year, "The Grand Canyon – Monument to an Ancient Earth: Can Noah's Flood Explain the Grand Canyon?"

In it, they explain how geology establishes that the Earth is orders of magnitude more ancient than young Earth creationists maintain, using the geology of the Grand Canyon as evidence.

"Our intention in writing the book is to give a good, solid modern geology description of the Grand Canyon," said Wolgemuth. "We wanted to show how we do science: we ask questions, gather observations and data, and then make the best inferences about what happened in the past, just like cold-case detectives solve murders."

'Bloodied at the Canyon'

They focused their efforts on the Grand Canyon specifically, he explained, because it's such a major focal point of young Earth creationists' efforts to influence the culture: flood geologists leading tour groups of young Earth creationists are a regular feature at the Grand Canyon. Young Earth creationist organizations will take theologians on trips through the Grand Canyon and espouse their theories based on books they've written. They host bus tours that will drive along the rim, providing information that misrepresents the geology of the canyon.

"For us as authors, this book is desperately needed because the creationism folks are so anti-science, with the result that 'Christianity is bloodied' at

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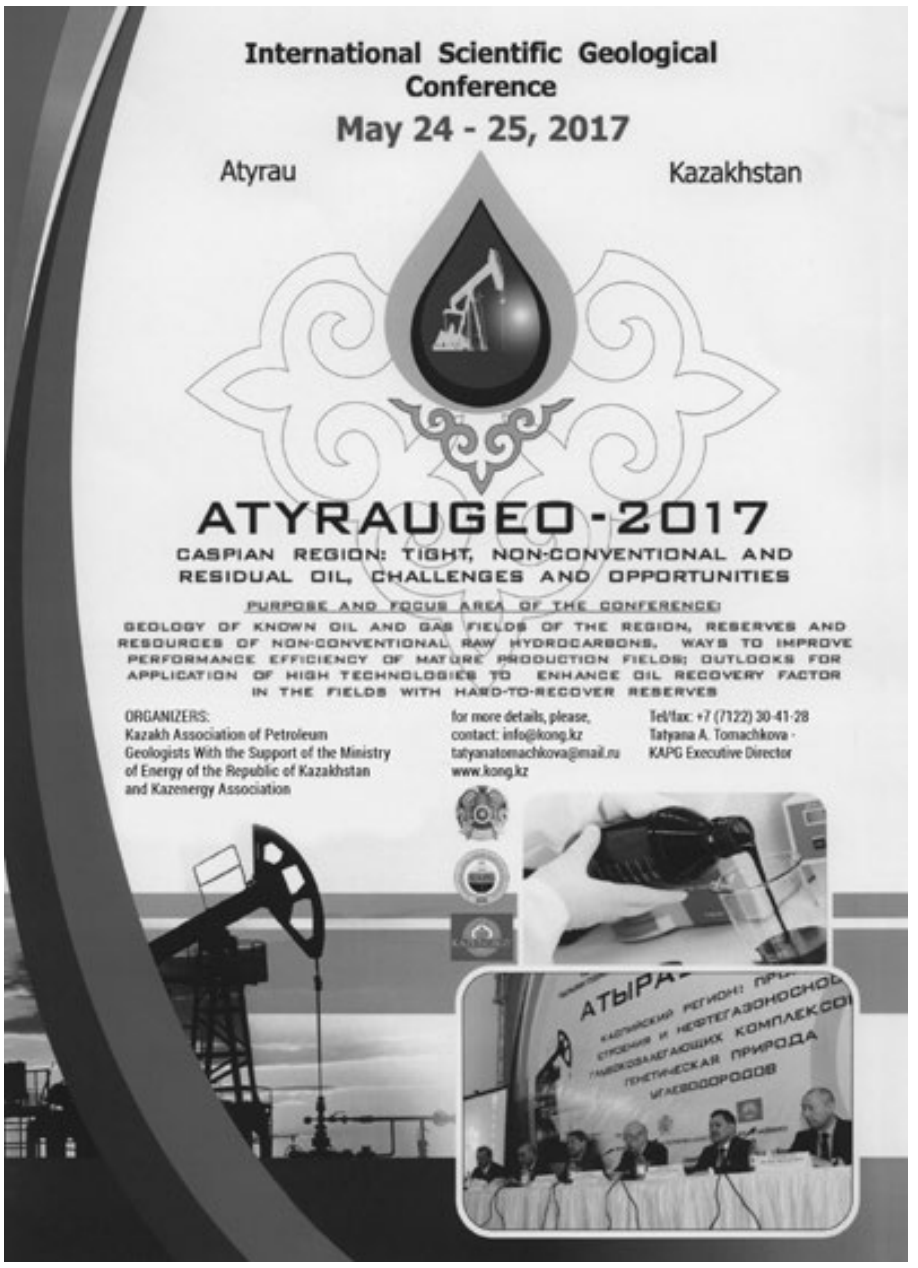


SIGs and TIGs: How to Get Involved

You've heard about them, and perhaps even thought some of them would be fun – and maybe valuable – to join.

Unfortunately, you probably didn't know how.

We're talking about TIGs and SIGs – or, for those more formal, Technical Interest Groups and Special Interest Groups, respectively – the new group organizational model created by AAPG.

TIGs and SIGs are designed to encourage greater Member participation in specific topics or interests – and to enhance Member engagement with other Members, and with AAPG.

But what is the current roster of TIGs and SIGs – and who do you contact to join their fun?

For general information on the programs, contact HQ staff Susan Nash (snash@aapg.org) for TIGs and Vern Stefanic (vstefan@aapg.org) for SIGs.

For specific information, here's the list of active groups to date, with contact information – with more due in the coming months:

TIGS

- CO_2 Enhanced Oil Recovery

Best practices and emerging technologies for economically recovering oil using CO_2 enhanced oil recovery methods – Jesse Garnett White (white.jesse.garnett@gmail.com) and Mike Raines (mike.raines@whiting.com).

- Geochemistry in Exploration

Exploring the latest technologies and innovations in geochemistry to more successfully identify exploration targets, create basin and reservoir models, and develop fields – Michael Abrams (m.abramstx@gmail.com).

- Drones and Drone Data

Technology and techniques (equipment, software, workflows, survey designs) to help explorers enhance their capabilities with data obtained from drones and drone surveys – Karl Osvald (kosvald@blm.gov) and James McDonald (jmcdonald121@gmail.com).

- Surface Geochemistry

Best practices and technologies, including theory of vertical migration, optimal sampling methods, caveats, statistical analysis of data, radiometrics, iodine, soil gas, petroleum fluorescence, microbial, XRF and trace metals to locate areas of micro-seepage – Steve Tedesco (steven.a.tedesco14@runningfoxes.com).

- Reservoir Revitalization

New techniques, products and technologies for revitalizing reservoirs and finding financing – Bill Fairhurst (bfairhurst@riverford-resources.com).

- Geology of Cuba

To improve dissemination of Cuba's geological information – Paul Crevello (p.crevello@gmail.com).

- Reservoir Development

To support, promote and disseminate knowledge about best practices and emerging technologies for reservoir development, from a wide array of reservoirs – Sochi Iwuoha (sochi.iwuoha@mail.com).

- Petrophysics

Provide a platform for petrophysics as an integrated discipline of AAPG, with interdisciplinary knowledge sharing and keeping up with petrophysical innovation – Matt Boyce (matt_boyce@swn.com).

SIGS

- Young Professionals

Pitched to geoscience professionals aged 35 and younger, providing opportunities for networking, career guidance, learning, enhancing professional competence and entertainment activities – Jon Allen (jonathan.allen@chevron.com).

- PROWESS (Professional Women in Earth Sciences)

A group interested and involved in increasing participation and advancement of women in earth sciences and the energy industry, with an emphasis on education, outreach, support, leadership development, forums and networking opportunities – Barbara Tillotson (barbaratillotson@hotmail.com).

Continued from previous page

the Canyon, as one staff member (at the Grand Canyon) told me," said Wolgemuth.

"The people who are being influenced by flood geology are primarily in the church environment. The value we wanted to bring with this book, for those of us who are Christians, was to explain – yes, we totally believe in the doctrine of creation and that God did it. But, the 'flood geology' description is inadequate and fails to accomplish all the things that flood geology scientists have been teaching," said Wolgemuth.

The book identifies some of the fallacies of the flood geology perspective in a convenient question and answer format, addressing questions like:

"Could the Grand Canyon's rock layers have formed in a single year of Noah's flood?"

"Why are there no dinosaur, bird or mammal fossils in the Canyon's layers?"

"How do we know that radiometric dating methods are reliable?"

"Is Young Earth Creationism really biblical?"

Faith Held Hostage

That last question addresses one of Wolgemuth's major concerns with young Earth creationism. The danger, he explained, is the framework from which flood geology is being touted: "The young Earth community leadership presents Earth-age issues as 'If you don't believe that this is what is being described in the early parts of Genesis, then how can you believe any part of the Bible?'"

In other words, it holds all of Christianity hostage to a biblical interpretation that isn't actually demanded by the Bible.

"The biblical text has credibility; it's not just a human construct. The flood story in the Bible, to me, is a localized flood, described by the people who lived in that particular area, likely the Middle East," said Wolgemuth. "I'm comfortable that the

See **Genesis**, page 35

Discovery Thinking: Strategies for the Next Decade

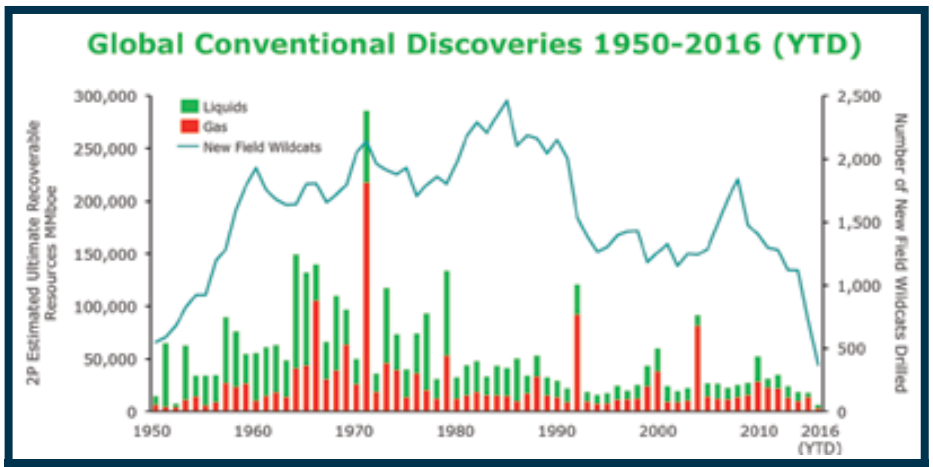
By EMILY SMITH LLINÁS, EXPLORER Correspondent

Deep water and tight rocks.

These terms define most new discovery trends taking place across the globe today, according to Bob Fryklund, chief strategist for upstream at IHS Markit.

Fryklund spends his time working on industry and clients' "big questions" – studying the future of upstream and exploration and what business models will be the most successful. He also helps companies with portfolio restructuring, leadership mentoring, valuation and deciding where to go next.

He noted how most frontier new ventures today come from deepwater conventional exploration projects, particularly in the Atlantic. At the same time, unconventional tight rocks are gaining ground, offering projects with a shorter business cycle.



Over the last twenty years the number of giant fields discovered has waned significantly and the majority of volumes discovered are from gas prone fields. Conventional oil discoveries in 2015-16 might be the worst since 1952.

Business Models

Fryklund said the current exploration reality means companies must be careful about the business models they will pursue.

"There is a flight to lower cost barrels and barrels whose margin can be expanded with technology or lowering cost via efficiencies," he said. "So the question is, where does exploration fit in a world focused on short cycle, low cost barrels?"

Fryklund noted that options for exploration have grown, so companies must determine their preferred mix of new venture exploration versus tight rocks and decide how much they will rely on field growth versus organic growth.

The emergence of "super basins" like the Permian leave companies trying to decide what role proven basins play as compared to frontier basins, he said.

Cycles and Strategies

Fryklund divides exploration discovery cycles into "mega trends" and "mini trends."

Mega trends result from major new hydrocarbon province discoveries like the Brazilian pre-salt, East African deep-water plays and Egyptian carbonate build-ups.

Mini trends occur when geology and available space cap production at five billion BBOE per basin. Examples of mini basins include the Kwanza pre-salt play, Bay du Nord in Canada, Albertine graben in the East African Rift System, Sergipe Alagoas and the Gulf of Mexico Shenandoah play.

Fryklund said companies involved in frontier new venture exploration need to deal with the "mini basin dilemma." "Due to (the basins') limitations, companies exploring frontier mini basins, need to re-think strategy," Fryklund said, "Go in big and early or pay more to acquire after the basin/plays have been de-risked."

Fryklund said he has seen discovery strategies change over the past two years.

"More companies are rethinking old geologic paradigms," he said, "How they explore and for what. They are reexamining areas like the South Atlantic margin south of the Walvis ridge, large carbonate build ups and what role proven basins will play."

These new strategies and business models will shape how industry will operate in the next 10 years.

Sharing Strategies

Fryklund will highlight his finds in "The Future of Exploration – The Next Decade," a talk at the Discovery Thinking Forum to be held Monday, April 3 at the AAPG Annual Convention and Exhibition (ACE) in Houston.

Discovery Thinking consists of nine talks delivered in two sessions: "New Discoveries in the Western Hemisphere and Gulf of Mexico" and "Significant Global Discoveries."

The event starts with "Lessons in Exploration Creativity from a Decade of Discovery Thinking Forums," delivered by Charles Sternbach, AAPG president-elect and forum chair, who started the Discovery Thinking series 10 years ago.

Fryklund said he agreed to participate in Discovery Thinking for two main reasons.

"It fits into my world of 'What will be the future of exploration?' and second, as an explorer involved in multiple discoveries including one super giant, it's good to share with others some insight just as folks did with me during my career," he said.

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Lava flows from the western Grand Canyon. These occurred after the canyon was formed and have been dated to an age within the last several million years. Photo by Tim Heible.

Genesis
from page 32

intention of the description is not a globe-encircling flood."

He elaborated by noting that "inclusive and hyperbolic language is common in Scripture."

He cited Genesis 41:57 as an example, which reads that "people from all over the world" came to Egypt to buy food from Joseph, seeking relief from what the account describes as a worldwide famine.

"This was the known world at the time, and it's unlikely humans came from Australia to Egypt," Wolgemuth explained.

Regarding the flood itself, he said, "I believe that wicked mankind was destroyed as stated in Genesis, and these people were in the Tigris-Euphrates river basin."

Target Audience

"It's not just about getting correct information out to the general populace. We're trying to reach leadership – seminary presidents and teachers," said Wolgemuth. "The homeschooling community in particular is caught up with this material, so we're reaching out to Christian schools and homeschool associations."

He said it was also written for fellow geologists and AAPG Members.

"As an AAPG Member, you are probably aware of people in your community who are trapped in creationism. This book is written for them, and you can tell them it is written by mostly scientists active in their faith community," said Wolgemuth.

Based on a number of reviews, from geologists and Christians alike, the book has generally been met with a respectful response, Wolgemuth said, despite the contentiousness of the issue.

"This book offers grace, tact and kindness toward people trapped in the 'young earth' idea marketed by AiG (Answers in Genesis)," wrote one reviewer on Amazon.

But when he does receive some stronger, emotional opposition, he likes to take the time to talk to them personally.

"If I can chat eyeball-to-eyeball over coffee, I can often diffuse their fear or anger and can have a good conversation," he said.

Wolgemuth will be available to discuss the book at this year's AAPG Annual Convention and Exhibition in Houston next month. Look for him on the exhibit floor.

Continued from previous page

AAPG Past President Paul Weimer, Discovery Thinking co-chair, said sharing insight is precisely the point of the forum.

"Exploration geology is a science that, in part, is done by analogy," he said. "Seeing what other geoscientists are doing in recent exploration can be extremely important in terms of how they might apply their own work. We can never place a value on an idea or what a talk might spark for someone in the audience."

The Forum

The opportunity to meet and mentor new explorers is what motivates Sternbach and Weimer to organize the forum every year.

"These Discovery Thinking forums are always among the best attended technical sessions at every ACE and ICE," Weimer said. "Members vote with their feet, meaning there is a clear demand for continuing to organize these sessions because Membership values them."

They keep a running list of potential talks, speak with people across the world and monitor exploration activities and emerging trends and try to assemble a diverse number of topics for each session.

"Some of the talks have been on our radar screen for a few years, and we have to wait until the companies are in a position to present information," Weimer said.

That was the case for several of the 2017 talks, which highlight projects in Bolivia, Australia, the Colorado mineral belt, the Utica shale, Africa and Australia.

Fryklund said he hopes his presentation will challenge participants to think differently and challenge old paradigms.

"I would like to stimulate the industry to increase its challenge of old concepts and to take a look at basins as a whole," he said.

He added that industry's focus on future science and business models should include a focus on future generations who will make the projects possible.

"We need to become better at selling our role to young people and the importance of the societies and face-to-face networking," he said. "And we need to encourage the younger generation to ask 'Why?' more often."

The Discovery Thinking Forum will be held at the George R. Brown Convention Center Monday, April 3, starting at 8:25 am.

Slides and videos from previous Discovery Thinking sessions are available online at http://aapg.to/aapgdiscthink.

‘Educational Gold’ in Deepwater GOM Fields

By LOUISE S. DURHAM, EXPLORER Correspondent

Among the array of not-to-be-missed technical sessions at the upcoming 2017 AAPG Annual Convention and Exhibition (ACE), the Wednesday morning session focusing on major deepwater fields in the Gulf of Mexico is grabbing its share of attention.

“Major Deepwater Fields of the Offshore U.S. Gulf of Mexico” will be co-chaired by AAPG Members Clint Moore and Mark Shuster.

The topic itself signals a significant departure from the industry’s continuing intense focus on onshore unconventional shale plays, where hydrocarbons can be coaxed out of the reservoir far more quickly and inexpensively than in the deep waters in offshore environs.

Perdido is the world’s deepest spar and the second-deepest oil and gas production hub after Shell’s Stones development. Perdido is operated by Shell Oil in the Gulf of Mexico at a depth of about 8,000 feet. Photo courtesy of Shell.

The Lineup

But how deep is deep, really?

“I tend to think of it as beyond 500 feet, where the shelf drops off steeply, and jackup rigs cannot be used” said Moore, vice president at GulfSlope Energy Inc., which explores the offshore subsalt on the outer shelf and upper slope regions in the Gulf. He noted that some industry participants place the depth at 1,000 feet, but 600 feet is a common number.

This is light years beyond the first commercial offshore oil well drilled in 14 feet of water in the GOM Ship Shoal area off the southeast Louisiana coast.

Water depth aside, the principle focus of the current action encompasses extraordinarily complicated territory.

It’s subsalt country for the most part, containing many massive horizontal allochthonous salt sheets originating from Jurassic-age salt, often coalescing together. Both high and low pressures, temperatures and permeabilities pose an unending test of industry know-how. Thanks to the sometime multi-mile thick salt sheets, seismic data acquisition, depth image-processing, and interpretation is a challenge all its own.

In contrast, over the course of the first 40 years of offshore GOM exploration, all petroleum reservoir objectives were suprasalt, or above all sheets or beds of salt, explained Moore.

Being a professional geologist with a longtime interest in spreading knowledge of important discoveries to fellow scientists, this is not Moore’s first rodeo.

Among other similarly-themed events in previous years, he organized a daylong session for the 2015 Gulf Coast Association of Geological Societies annual convention, which included 11 deepwater fields.

“Many of my fine colleagues have answered my call to present because they share my excitement to show and see what discoveries look like.” Moore added.

He detailed his rationale for choosing the fields to be presented at the upcoming AAPG annual meeting.

“When I selected these giant and historic fields to be invited to present at this key session,” he said, “I looked at several factors:

- “Were they exciting and significant geologic stories to tell?
- “Were they subsalt or salt related?
- “Could today and tomorrow’s explorers and developers gain critical knowledge from understanding their exploration and development geology?”

Some familiar names made the cut.

“Several of the biggest fields in deepwater GOM history – Perdido, Jack-St. Malo and Thunderhorse – will be presented by their super-major operators,” Moore noted. “And the super-independents will be showing three – Stampede, Lucius and Gunflint – of the most exciting subsalt fields discovered, developed and produced to date in the GOM deepwater.”

The Long View

It’s an impressive picture, but a pertinent consideration is that current offshore action overall remains relatively subdued these days despite oil prices

Continued on next page


MOORE

Several of the biggest fields in deepwater GOM history ... will be presented by their super-major operators.

Continued from previous page

hovering around $54. Personnel layoffs were being announced as recently as early February owing in large part to idled rigs.

Given all of the inherent challenges, the offshore segment of the oil industry is a world unto itself in numerous respects, especially in the deep waters.

The timeline for the major finds in these environments can stretch out as long as a decade from prospect status to production. As a result, such costly efforts must ignore commodity price cycles for the most part. In turn, these long-term projects typically harbor the huge reserves necessary for years-long production once they come online. The U.S. Energy Information Administration recently projected year-end 2017 offshore GOM oil production at 1.9 mmbod, much of which is producing from deepwater fields, like these special six to be showcased in this technical session.

Chevron-operated Jack-St. Malo fields, 280 miles south of New Orleans in the subsalt Lower Tertiary Trend, aptly demonstrate both the extensive timeline for such programs and the important contributions these discoveries can deliver to the domestic supply.

Water depth is 7,000 feet, give or take, and the reservoirs, which are 25 miles apart, lie about five miles below the water surface, according to Chevron. First oil was produced in 2014, yet St. Malo was discovered in 2003 and Jack the following year. The planned production life is 30 years with 500 million barrels of oil tagged to be the expected recovery using current technology.

The two fields are being developed simultaneously with subsea completions flowing back to a semi-submersible floating production host platform sited between them. Electric seafloor pumps boost the produced fluids to the host.

Chevron noted the combined Jack-St. Malo investment, sanctioned in 2010, had an initial development budget of $7.5 billion.

The upcoming opportunity at ACE to listen to an array of operators sharing technical knowledge and experience acquired over the course of discovering such fields and bringing them to the production stage can prove to be invaluable to explorationists and their collaborators.

"Field talks are like educational gold and champagne," Moore said, "because we all are more successful in finding future fields by knowing what the existing ones look like."

AAPG Foundation Celebrates 50 Years

By TAMRA CAMPBELL, Administrative Team Coordinator

The AAPG Foundation celebrates its 50th anniversary this year – a milestone that coincides with the 100th Anniversary of AAPG. It is a big year and a great time to reflect on our mission, purpose and where we are headed.

While AAPG and the AAPG Foundation are separate entities, they are dependent on each other.

Five decades ago, Michel T. Halbouty, then president of AAPG, birthed the idea for the Foundation to provide support for AAPG programs that benefit the profession and educate the public. In February 1967, the Foundation was granted legal status as an Oklahoma trust and Dean A. McGee, Morgan J. Davis and W. Dow Hamm were appointed as Trustees. In 1986, the AAPG Foundation became an Oklahoma non-profit corporation and the Members of the Corporation was formed. Today a Board of Trustees led by chairman Jim Gibbs governs the Foundation.

Halbouty backed his belief in the Foundation by becoming its first donor. Since then, thousands of AAPG Members have joined him in giving back and sharing their love of the science. Through the AAPG Foundation, they have created a way to support programs that boost geological literacy across the globe and will sustain the petroleum geosciences well into the future.

Over the years, the programs supported by the Foundation have changed due to technical advances and developments in how the science is delivered. But, no matter how the times change, the fundamental purpose of the Foundation remains: to prepare the next generation of geoscientists to advance the science and tackle the challenges confronting an energy hungry world.

Ongoing Activities

In 2016, the AAPG Foundation gave $1.8 million in grants and program support to do just that. Here are the some of the Foundation's recent activities and programs:

- The L. Austin Weeks Undergraduate Grant Program enables undergraduate students like Celeste Cunningham from the University of Western Ontario, and the AAPG Student Chapter of the University of Pembangunan Nasional "Veteran" Yogyakarta, Indonesia to purchase equipment and get into the field. Ron Nelson provides stellar leadership of the L. Austin Weeks Undergraduate committee responsible for reviewing and scoring the applications from students and student-led organizations. The committee will review nearly 250 applications in this round awarding $85,000 in grants.
- The Grants-in-Aid Program, one of the Foundation's oldest programs, assists graduate students like Sarah George, a University of Texas doctorate candidate, who received the Gordon I. Atwater Memorial Grant, to fund thesis research. Sarah used her grant to fund fieldwork in southern Ecuador on basin segmentation and trap formation.

Celeste Cunningham, University of Western Ontario, 2016 L. Austin Weeks Undergraduate Grant Recipient.

This program has achieved tremendous growth over the years, thanks to AAPG Members, family and colleagues who have chosen to leave a lasting legacy by establishing more than 80 named/memorial grants. Today, more than 400 applications are received annually for this program and a 70 plus member committee under the guidance of Mike Unger provides program critiques, review and application scoring. In 2016, 116 graduate students were awarded a total of $258,000. The 2017 application cycle recently closed Feb. 15, and the committee is in the midst of reviewing the applications.

- The AAPG Foundation's newest program, the Deana and Paul Strunk Military Veterans Scholarship Program, awards U.S. military veterans with scholarships that provide needed financial assistance as they return to school to pursue an education in the geosciences.

Wesley Weisberg, a 2016 scholarship recipient shares, "The award funds will assist my family and me by relieving some of the financial burden during my transition from undergraduate to graduate school to obtain my master's in geology."

The Foundation would like to thank Don O'Nesky for his service and guidance for chairing the Military Veterans Scholarship Committee through the development stages of the program and two rounds of scholarships. Heather Anderson has accepted the challenge of leading this committee and it will be fun to see the program grow under her energetic leadership.

- The Foundation renewed its support of partnership with SEG's Geoscientists Without Borders (GWB) program. GWB fits nicely with the Foundation public outreach objective as the program partners with universities around the world to engage students in the development of solutions for humanitarian relief using geoscience.
- At AAPG's Annual Convention and Exhibition in Houston, two documentaries will be shown in celebration of AAPG's

Continued on next page

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

Foundation Contributions for January 2017

General Fund
Ronald F. Broadhead
In memory of Julie LeFever
G.W. Brock
Elizabeth B. Campen
In memory of Edward B. Campen
Mr. and Mrs. Jack C. Cartwright
In memory of Tracy P. Clark
Chevron Matching Employee Fund
Matching gifts given by Donald Burch
TaliaFerro Cooper
John C. Dolson
Leonard I. Eisenberg
David R. Feineman
In memory of Parke A. Dickey
Jack C. Fikes
James H. Frasher
Steven L. Getz
Kenneth S. Harding
Edward F. Haye
William A. Heck
William J. Imler
Alfred James III
Jon R. Jones
Thomas E. Kelly Jr.
Raphael V. Ketani
David T. Lawrence
Nikolas Michael
Sally M. Murray
In memory of Dr. Grover E. Murray
Robert L. Neman, PhD
Joseph C. Ogden
John L. Redmond, PhD
In memory of Frank Conrad
David G. Rensink
Ramon G. Reyes
Julius M. Ridgway
John F. Rogers
Hector F. San Martin
In memory of David Wyman
Jack S. Sanders
Charles E. Savrda
Isaac J. Smith
Robert K. Steer
In memory of E. Parker Mosley
Russell N. Taylor
A. Kurt Tollestrup
In memory of Paul Heller
Harshad "Harry" Trivedi
In memory of R.C. Slocum

Digital Products Fund
Oregon State University
Chevron Matching Employee Fund
Matching gifts given by John Kachelmeyer

Education Fund
Paula L. MacRae
In memory of Maureen MacRae
Louis J. Mazzullo
Bonnie Milne-Andrews and James Andrews
In memory of Brian Glemister, Richard Hoppin, William Furnish and Sherwood Tuttle
Gordon and Sandra Start
Lisa M. Towery
April R. Wisebaker
Daisy M. Wood
In memory of P.W.J. Wood

Grants-in-Aid Fund
Frank E. Kottlowski Memorial Grant
Ronald F. Broadhead
In honor of Edward C. Beaumont
Fred Tietz Named Grant
Frederic August Tietz
In memory of Elwin Peacock
In memory of Ron Harlan
Harry and Joy Jamison Named Grant
Dan and Jeanne Jamison
In honor of H.C. Jamison
Meckel Family Named Grant
Marlan and Marea Downey
Ohio Geological Society Named Grant
SM Energy Company
Matching gifts given by Steven Zody
Thomas Groves and Paulette Groves
Grant from Thomas Groves and Paulette Groves Charitable Fund at Schwab
M. Ray Thomasson Named Grant
M. Ray Thomasson and Merrill Shields

James A. Hartman Student Leadership Summit Fund
Chevron Matching Employee Fund
Matching gifts given by Richard Ball

Imperial Barrel Award Fund
Devon Energy Corporation

Military Veterans Scholarship Fund
Jerry W. & Marianna Box
Jerry W. and Marianna Box
Dhreoma R. Burford
In memory of Dr. Arthur E. Burford
Scott Cameron and Penny Bowen Grant from Cameron/Bowen Family Charitable Fund at Fidelity Charitable;
In honor and recognition of Jack Threet
John P. Carr
Helen L. Foster
Mr. and Mrs. B.L. Hill Jr.
Albert Hrubetz
Karen and Cecil Rives
In memory of Robert S. Moehlman
Betty M. Robertson
In memory of Clifford G. Flittie
William E. Semmelbeck
James R. Small
Frederick L. Stead
In memory of Betty L. Stead
Mark A.W. Sutcliffe
In memory of Alan "Tip" Brian
William Wolodarsky
William V. York

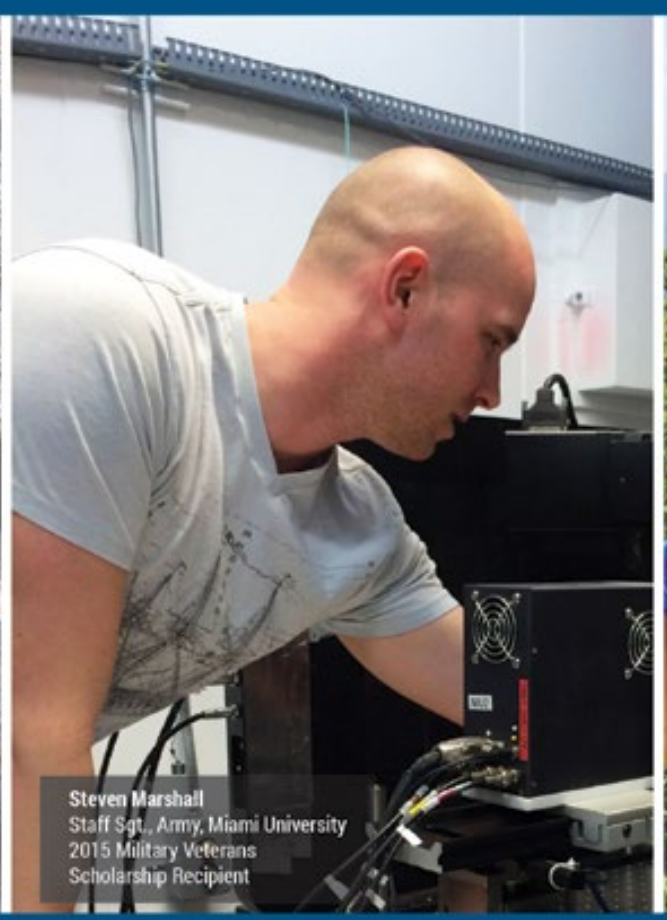
Continued from previous page

centennial anniversary. The documentaries "AAPG GeoLegends" and "Pioneering Women in Petroleum Geology: 100 Years" both showcase historical figures important to the history of AAPG and the profession of petroleum geology. The AAPG Foundation is proud to be a part of preserving this history by providing grants for the production of these films.

These are just a few of the programs supported through the AAPG Foundation in support of others as they pursue careers in the geosciences. More activities can be found on the Foundation website, foundation.aapg.org.

Will you join us once again, as we build a better foundation for the next 50 years?


April Knox,
2015 Kenneth H. Crandall Memorial Grant Recipient, University of Alaska Fairbanks


Steven Marshall
Staff Sgt., Army, Miami University
2015 Military Veterans Scholarship Recipient


James Campbell
Spc., Army
University of Massachusetts Amherst
2015 Military Veterans Scholarship Recipient

100th Anniversary Committee Offerings at ACE

By PAUL WEIMER

In the forward planning for this year's AAPG centennial celebration – at the Annual Convention and Exhibition (ACE) in Houston and beyond – the 100th Anniversary Committee was organized in 2004 as an *ad hoc* committee per the suggestion of current AAPG President-elect Charles Sternbach.

The purpose of the committee was to organize an ambitious series of events and create products that can be used by the Membership as part of their daily workflow and for the training of future generations of petroleum geoscientists.

Charles served as the founding chair of the committee and convened annual planning meetings from 2004 to 2010 with broad-based committee members to discuss projects and deliverables for Membership. As the committee matured, Ed D. Dolly (this year's Michel T. Halbouty Outstanding Leadership Award recipient) became the chair in 2010, and then Steve Sonnenberg and I served as co-chairs beginning in 2013.


WEIMER

Five main products from the 100th Anniversary Committee will be highlighted at the 2017 ACE:

- Since 2008, Discovery Thinking sessions have been held at every ACE, and at every International Conference and Exhibition (ICE) since 2012. These sessions' purpose is to present talks that summarize the most recent important discoveries globally and the scientific and business thinking involved during the process. Speakers have been an all-star cast, including two Sidney Power medalists, six Michel Halbouty recipients, and nine Norman Foster Explorer Award recipients. In total, 115 men and women have either been presenters or co-authors fulfilling a decade long promise to spotlight "100 who made a difference."

This speaker series (co-sponsored by the Division of Professional Affairs) have proven to be incredibly popular with conference attendees and are typically among the best-attended sessions at each year's ACE and ICE. The lasting contributions of the series for Membership have been the willingness of the speakers to post their slides on Search and Discovery, and, when approved, videos of their presentation. These videos have been available to Membership since 2008 with tens of thousands of views. Sternbach, Dolly and I have been the organizers.

For information on this year's Discovery Thinking forum at ACE, see the related story in this issue on page 34. To learn about past sessions, see http://aapg.to/AAPGdiscThink.

- The GeoLegend interview series comprise a series of 50 interviews with 62 key geoscientists who made game-changing discoveries, significant scientific contributions that were adopted by the greater geo-community, or people who made significant contributions in building companies or service to the profession.

The interviews highlight the thought processes involved with their work. Some of the interviews have been shown at various regional and national conventions. They will go live on the AAPG website in April with the first set of interviews and will be showcased at the AAPG booth on the exhibition floor at ACE.

Interviews include 16 Sidney Power medal awardees, five Michel Halbouty medal recipients, and eight recipients of the Norman Foster Outstanding Explorer Award.

Dolly and I produced this interview series with extensive editorial effort by Pax Harris and Sam Carothers.

- "Outcrops that change the way we practice petroleum geology" is a celebration of the importance of field geology in the education and enlightenment of all geologists.

Following a conversation between Sternbach and Andrew Hurst at the 2008 ACE in San Antonio, a concept was born for a volume that presents high-quality field trips of significance to global E&P for hydrocarbons. Development of powerful, portable tablets allowed the volume to develop as an immersive, interactive digital product. The digital format enables greater flexibility for user applications while representing a foundation for future digital publishing. Chief editors Hurst, Jeroen Kenter and Stephan Graham perceive "Outcrops" as a step-change in geological publishing with AAPG making a forward-looking contribution to the health of geology worldwide.

- AAPG Past President Randi Martinsen has overseen a major compilation of a list of the most influential papers in the different disciplines in petroleum geology. These lists include the seminal papers that introduced concepts that are now routinely used by geoscientists. Input was gathered from 20 sub-committees.

The list will be distributed at this year's ACE.

- Steve Sonnenberg and Rick Fritz have compiled a list of the top 100 Field Trip Guides that are accessible on the Datapages and Search and Discovery sites.

The list includes field guides from the past 70 years from more than 30 different professional societies. The list, including more than 50 sedimentary basin, will be distributed at the convention in April.

PROTRACKS

The ABCs of DPA for YPs

By the Young Professionals Special Interest Group

One of the first things you learn as an industry new hire is that working in the petroleum business is a lot like learning a new language: pigs and slugs aren't animals, casing doesn't refer to sausages, tops aren't fashion or toys and everything has at least one acronym.

The latter phenomenon isn't unique to the energy industry, but deciphering the alphabet soup that is an investor presentation when you don't know your LOE from your LRP (lease operating expense and long-range plan) can be a unique challenge.

Knowing how to speak the language of geoscience is one thing; fluency in petroleum geoscience as a profession is another.

Fortunately, AAPG has a resource to improve professional proficiency and it's an acronym every Member should know: DPA.

DPA, or the Division of Professional Affairs, is the oldest of the four AAPG Divisions and dedicated to upholding the ethics and integrity of the practice of petroleum geoscience. Candidates for DPA membership and certification must be AAPG Members, hold a degree in geology from a recognized institution, have a minimum of five to eight years of industry experience (based on your most advanced degree), demonstrate the highest level of professional and ethical standards and obtain the endorsement of three certified Members of the Association.

Benefits of Membership

In short, you've received a degree in geoscience, but membership in the DPA gives you the opportunity to prove that you know how to use it.

"Once I met the requirements for DPA membership," said Andrea Reynolds, Shell Appalachia technical manager and the AAPG Annual Convention and Exhibition (ACE) DPA vice-chair, "I never thought twice about applying for board-certification, as it provides recognition and validates my experience and credibility, particularly when dealing with external or government entities."

However, you don't need to be a Certified Petroleum Geologist to benefit from interaction with the DPA. According to Shell vice president and DPA president Chandler Wilhelm, the purview of the DPA "includes topics such as government affairs, training, mentoring of young professionals, providing high quality content such as Discovery Thinking and Playmakers forums, ethics courses, ongoing monitoring and influencing of the requirements for licensing for geoscientists in all 50 states, standards for the reporting of hydrocarbon resources and reserves, and the certification of the professional standards and ethics of DPA members. All stress the importance of geoscience as not just a scientific field, but also as a field of professional practice."

In addition, the DPA offers young professionals (YPs) and students opportunities for continuing education, career development and networking, including the popular "Pass the Baton" events co-hosted by the DPA and the YP Special Interest Group (SIG).

Richard Ball, vice president of geology for Detring Energy Advisors and general vice chair for ACE, said it's a valuable career investment: "For me, joining DPA was a natural part of the AAPG membership cycle. From Student to YP to DPA member, AAPG has afforded me infinite opportunities to strengthen my technical and professional development. Anyone trying to achieve their maximum potential should strongly consider applying for DPA membership. DPA is the highest level of professional membership offered by AAPG."

For more information, visit aapg.org/divisions/dpa.

Also, check out the ACE Technical Program for all the DPA-sponsored sessions and events.

For information on the YP SIG, visit aapg.org/youngpros or find us on social media. Like for us on Facebook at AAPG Young Professional Special Interest Group and follow us on Twitter and Instagram @ aapgypsig.

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DIRECTOR'S CORNER

A Milestone for Our Tribe

By DAVID CURTISS

We all have milestones in our lives – those times that, in retrospect, we recognize as formative or transitionary, in which one chapter of our lives ends and another begins.

Commencement is a significant milestone for many of us. Over the next several months, celebrations of new beginnings will occur at universities across the globe. After toiling through university lessons, freshly minted graduates are ready to start their professional lives. They're certainly filled with eager expectation, as are their parents.


CURTISS

> I like to say that, for geologists, the entire planet is our laboratory.

The Planet is Our Laboratory

This June will mark 59 years since Colin L. Powell, retired general and statesman, completed his degree in geology from City College of New York and was immediately sworn in as a second lieutenant in the U.S. Army. The son of Jamaican immigrant parents, Powell forged a remarkable career in the military and then shifted to civilian leadership serving as the first African-American U.S. secretary of state, fourth in line to the presidency.

As I mentioned last month, the NAPE partners had the good fortune of hosting Powell at the NAPE Charities luncheon in Houston.

He never worked as a geologist. But, as he told the gathered crowd at NAPE, his knowledge of geology and how the Earth works informed his entire career. Whether it was moving troops over rugged terrain or the delicate balancing act of the geopolitics of oil and natural gas, his understanding of the planet helped him navigate these challenges.

If ever there was an endorsement for studying the geosciences – even if you want to pursue a career outside of traditional geological professions – look no further than Colin Powell.

I like to say that, for geologists, the entire planet is our laboratory. Even if we are looking at nanofossils or kerogen reaction kinetics, in order to do our job we place these events into their larger context. Our science demands we look at the big picture.

Learn from the Master at ACE

Speaking of the big picture, December 1990 was a milestone for our industry.

It was that month that a more than 900-page history of the petroleum industry was first released, and to great acclaim: "The Prize: The Epic Quest for Oil, Money, and Power" by Daniel Yergin chronicles the history of our industry from the 1850s through 1990.

Broad in scope and filled with the rich detail and colorful personalities of the oil and gas business, "The Prize" went on to win the Pulitzer Prize for general non-fiction.

Yergin followed that book with "The Commanding Heights: The Battle for the World Economy" and most recently "The Quest: Energy, Security, and the Remaking of the Modern World," picking up where "The Prize" left off.

Yergin is a master of seeing the big picture, and he is speaking to us next month at the AAPG Annual Convention and Exhibition (ACE) during the 100th Anniversary Celebration gala dinner.

I hope you can join us for this special event, which foreshadows the third milestone I'd like to talk about this month.

Last month, on Feb. 10 to be exact, we celebrated the 100th birthday of the American Association of Petroleum Geologists (see the full story on page 26 for more details).

I wonder if anyone in the room back in 1917 seriously contemplated what the world would look like a century later and whether AAPG would still exist. But here we are, continuing to serve as a global hub for petroleum geoscience, an international community of geologists who play an essential role in fueling the world, approaching 100 million barrels of oil per day.

As we gather in Houston for our centennial ACE, we are going to look back at the past, but even more so, look ahead to the future. Through the robust technical program, celebratory events and the opportunity to connect with your professional colleagues – "your tribe," as ACE General Chair Dave Rensink likes to say – we want you to come away reinvigorated as a petroleum professional, equipped to meet the challenges you face.

Our science has changed, our understanding has evolved, and yet we're still finding oil and natural gas reserves and getting ever better at producing those resources left in the ground.

It's a daunting task. It's a global task. But the world is depending on us.

DIVISIONS REPORT: DEG

State of the DEG

By TIMOTHY MURIN, DEG President

Now that my term is two-thirds over, it seems an appropriate time for a brief summary of the current state of the Division: what it has accomplished and what accomplishments are planned for the next four months.

The Division of Environmental Geosciences continues with its two quarterly publications:

- The journal Environmental Geosciences is a peer-reviewed publication of scientific papers relevant to environmental issues. The majority of subjects for 2015-16 dealt with carbon sequestration, shale gas, structural geology and topics related to methane.
- The Spheres of Influence newsletter addresses current environmental events in the oil and gas business and includes the popular "Beauty in Geology" articles.


MURIN

> Environmental concerns related to energy development are not going away ...

Recent Events

The DEG, the Division of Professional Affairs (DPA) and the Energy Minerals Division (EMD) co-sponsored the Eastern Section Meeting's All-Division Luncheon, held in Lexington, Ky., and the DEG and EMD co-sponsored the Rocky Mountain/Pacific Section Meeting's luncheon in Las Vegas, Nev.

The DEG's Executive Committee approved Skyler Smith as secretary-treasurer to fulfill the remainder of Sean Kimiagar's term through June 30, 2017. Thanks to both of you for serving on the Division's Executive Committee.

As a member of AAPG's Advisory Council, I have had the opportunity to work with the other Council members on electing the recipients of the annual honors and awards to be presented at ACE and also discussing budgeting matters and cost saving measures that will assure the continued success of AAPG. The recommendations of the Advisory Council have been submitted to AAPG's Executive Committee for consideration.

We have initiated the process of modifying DEG's bylaws to restructure the standing committees, and also to form two new ad hoc committees. Of the current six standing committees, three are administrative (Annual Meeting, Publication and Nominating) and three are technical (Hydrogeology, Environmental Geophysics and CO_2 Sequestration). An Honors and Awards Administrative Standing Committee will be added, and two new ad hoc technical committees will be formed to include Fugitive Emissions and Induced Seismicity to address these issues facing the petroleum industry.

ACE 2018 – Salt Lake City

Work has begun on DEG activities for the 2018 Annual Convention and Exhibition in Salt Lake City, Utah. Many of the program themes have already been identified, and DEG's President-elect Stephen Testa has agreed to be involved with organizing the Division's technical program. Much coordination is required to sponsor activities at meetings, so please contact Stephen if you are able to help out.

Advisory Board Member John Kaldi from the Asia/Pacific Region (Australia) has been nominated as a candidate for President-elect of AAPG.

Joining DEG

DEG membership is currently at 925.

Environmental concerns related to energy development are not going away, so please give serious consideration to joining the DEG. The annual dues for AAPG Members is $25, Student AAPG members are free (yes, free!). There are always positions available to serve on one of the committees, the Advisory Board (representing six Sections in the United States, six Regions internationally and two at-large Members) or the Executive Committee.

100th Anniversary ACE in Houston

We have a strong lineup of events at ACE 2017, primarily due to the efforts of Bryan Byrd (technical chair) and Jeff Aldrich (DEG's immediate past president).

Activities include:

- Two forums: "The Next 100 Years of Global Energy Use: Resources, Impacts and Economics" (with the EMD) and "The Future Best Practices for Extraction Industries in a Lower Carbon Environment" (with the DPA).
- Oral and poster sessions:
  - Climate, Environment, and Challenges to the Industry
  - Fuel Demands, Environmental, and Mitigation Best Practices
  - Induced Seismicity, Hydro Fracturing, and other Oil Recovery Best Practices
- A short course: "Monte Carlo Methods – The Need-to-Know Practical Primer."
- A luncheon co-sponsored with the EMD: The speaker will be Dr. Bridget Scanlon, director of the Sustainable Water Resources Program at the Bureau of Economic Geology in Austin, Texas. The annual DEG awards will also be presented.

I am looking forward to meeting many of you at this historic event, and am delighted to be representing the Division.