

EXPLORER

A black and white photograph of a man in a suit pointing at a chalkboard. The chalkboard contains handwritten mathematical equations and diagrams. The man is looking towards the board with a focused expression. The chalkboard has several lines of text and a diagram with arrows and lines. The equations include $\frac{d\sigma}{dt} = \mu \sigma$, $\frac{d\sigma}{dt} = K \frac{\sigma}{t}$, and $\frac{d\sigma}{dt} = K \frac{\sigma}{t^2}$. There are also some diagrams with arrows and lines, possibly representing a flow or a process.

Unconventionals and Peak Oil

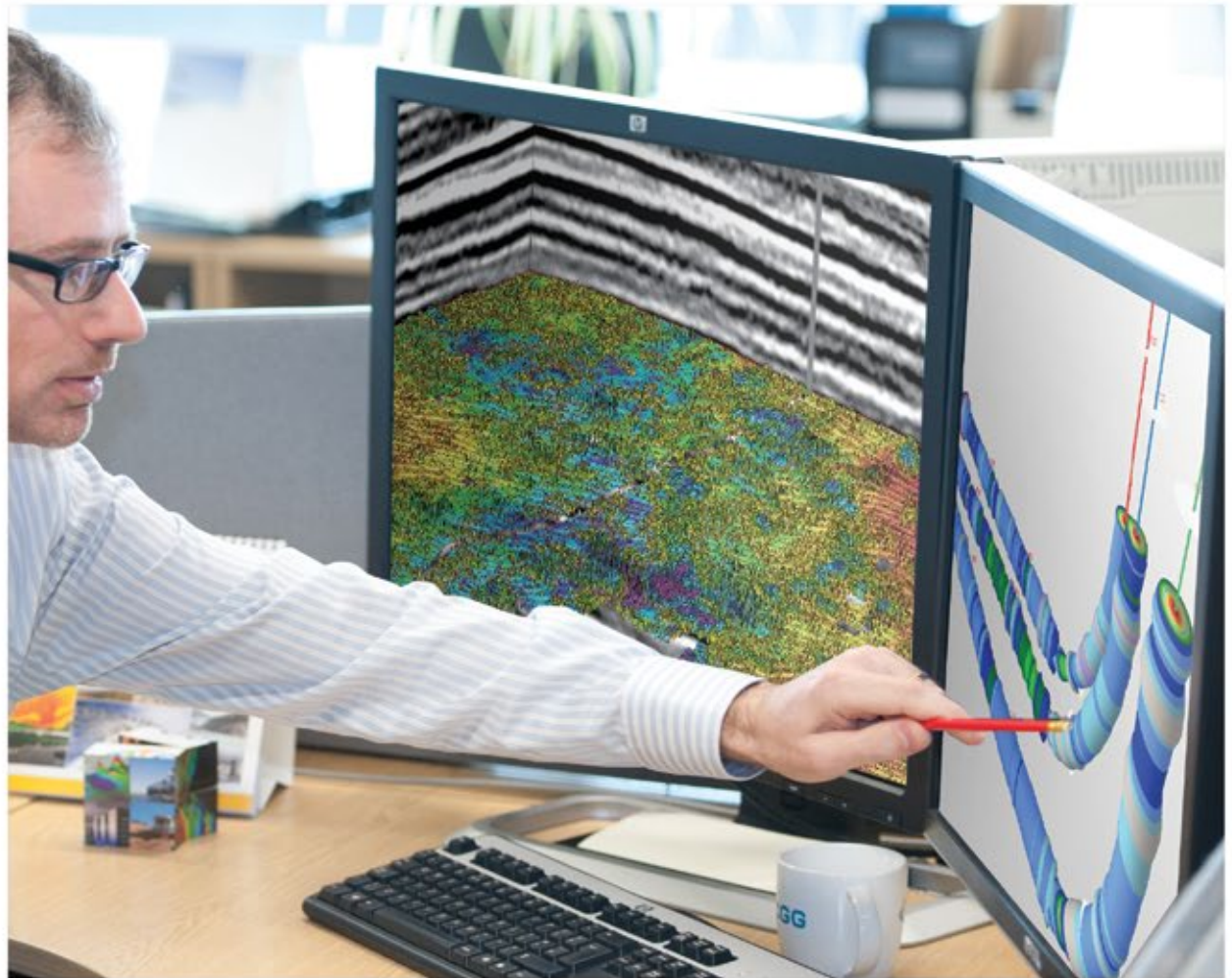
The future isn't what it used to be.

See page 8.

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PRESIDENT'S COLUMN

Going Where the Energy Is

BY CHARLES STERNBACH

I am very excited to be the new AAPG president for 2017-18. Thanks to past presidents and Executive Committees, whose dedicated work we build upon. Welcome to the incoming Executive Committee. It is an honor to serve with this great team of professionals and headquarters staff.

In my first column for the AAPG Explorer, I want to lay out strategic goals for the year.

I call my overall strategic goal "Going Where the Energy Is," which entails an enhanced focus on petroleum-based content in publications and conferences.

Petroleum is our lifeblood. Where oil and gas flow, so do the fortunes of our Members. Our industry and way of life depend on hydrocarbons. We must lead the way to find and produce energy. We must, in the words of Marlan Downey, "Think like oil."

The Bulletin is the flagship of the AAPG publication effort. I have the support of our current Editor Barry Katz on our shared observation that AAPG Publications would benefit from efforts to proactively enhance high interest content to today's (and tomorrow's) energy professional in hydrocarbon prone areas. We want to revitalize the AAPG publication system so that we can showcase that "Geoscience Matters."

I have found through my organization of AAPG Discovery Thinking Forums and DPA Playmaker Forums in the past few years that the best way to a "standing room only" audience is by inviting experts on new discoveries, hot plays, significant field studies, and integrated case histories of success. We plan to enhance valuable technology transfer through articles in the Bulletin and special publications, web posting of multimedia video presentations



STERNBACH

For AAPG to meet its mission of delivering science and professionalism, we need to be business-focused in our activities.

Region	Super Basin	Countries
Africa	Illizi	Algeria
	Sirte	Libya
	Niger Delta	Nigeria
Asia/Pacific	Bohai Gulf	China
	Songliao	China
	N. Carnavon	Australia
Europe	NW German	Denmark, Germany, Netherlands
	S. Caspian	Azerbaijan, Georgia, Iran, Turkmenistan
	Timan-Pechora	Russia
	W. Siberia	Russia
Latin America & Caribbean	E. Venezuela	Venezuela
	Maracaibo	Venezuela
	Neuquen	Argentina
	Tampico-Misantla	Mexico
Middle East	Oman	Oman
	Rub' Al Khall	Iran, Oman, Qatar, Saudi Arabia, UAE
	Zagros	Iran, Iraq, Oman, Syria, Turkey, UAE
	Central Arabian	Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi
North America	Anadarko	Oklahoma
	Appalachian	Pennsylvania, Ohio, West Virginia
	Gulf Coast	Texas, La., Miss., Ala., Fla., Mexico
	North Slope	Alaska
	Permian	Texas, New Mexico
	WCSB W Canada	Canada
	Williston	North Dakota, Montana, Canada

and slides.

Here is where AAPG needs you! Thanks to the Global Business Group headed by Alan Wegener and his team, AAPG annual conventions are clearly working well for the society. Future plans involve building business cases for timely, impactful meetings. AAPG conferences are greatly sought after by geoscientists because they combine networking with technology transfer. We are investigating a new conference idea for 2018 to highlight global "super basins" and to facilitate best-practice sharing of transformative technology in Houston, a venue with easy travel accessibility and many indigenous geoscientists.

Details will follow in future columns.

Membership Engagement

We are looking at ways of engaging experienced and future leaders. We are looking for volunteer leaders who can help AAPG step up our game. Members vote with their feet. They will participate (or not) based on their perception of valuable content. When I was president of HGS during the turn of the millennium, we had a very successful membership drive. This was in large part because we also had a major revitalization of technical program offerings. Membership engagement leads to greater membership recruitment, involvement, and enrichment.

Balanced Budget

Budget balancing efforts require new revenue growth ideas and strategic partnerships.

Another quote from Marlan: "Geology

Continued on next page

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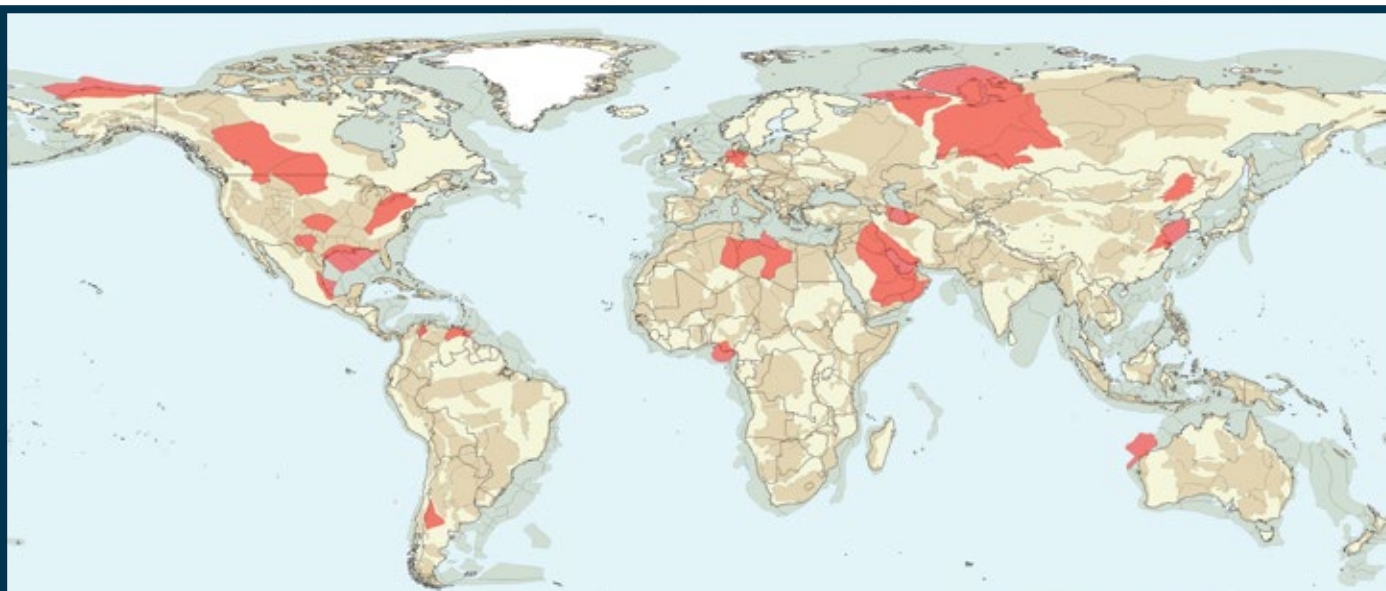
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ON THE COVER:

M. King Hubbert, of Peak Oil fame, lecturing at Columbia University, circa 1935. Photo courtesy of the American Heritage Center.

Left: Cuadrilla's hydraulic fracturing operation at Preese Hall in Lancashire, UK. See story on page 6.



Global super basins are in red.

Continued from previous page

is a science, exploration is a business.” For AAPG to meet its mission of delivering science and professionalism, we need to be business-focused in our activities.

AAPG has more than 30 committees, 10 special and technical interest groups, four divisions, six sections and six regions. These are all content engines (CE) that need to optimize both impact and financial outcomes. We will showcase the best each CE has to offer at a September leadership conference. This will be an opportunity to share best practices, benchmark bright spots and set goals to improve impact and profitability.

AAPG will continue our mission to deliver top quality geoscience and professionalism, and to boldly “Go where the energy is.”



Once a year 12 disciplines essential to successful exploration and development of unconventional resources meet to exchange ideas, technologies and processes.

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In the last four fiscal years we have dramatically cut costs and prioritized programs. We also thank the AAPG Foundation for their continued support. These efforts continue today.

But, as the saying goes, “you can’t save your way to prosperity.” Therefore, we need serious efforts to increase revenue. This might involve looking for strategic partnerships. Rather than reinventing the wheel, perhaps we can form alliances with Tesla dealerships?

This is an analogy of course, meaning that perhaps we can raise revenues for AAPG by working with industry partners and commercial interests who provide best-in-breed geoscience services and products. This way AAPG Members benefit from synergies and AAPG shares in incremental revenues.

By combining needed efficiencies (evolutionary) and innovative revenue growth (revolutionary), AAPG is setting a three-year course to long-term sustainability.

We call this 20/20 vision for 2020!

Innovation 101

This is a historical bridging year between AAPG’s first and second century. Officially, AAPG will continue to celebrate its 100th year until February 2018. Plans are under way to celebrate our continuing centenary this Oct. 15-18, 2017 at the International Conference and Exhibition (ICE) meeting in London.

Kudos to conference organizers for an outstanding program. Thanks to Paul Weimer and Jonathan Craig who will help me chair the 20th Discovery Thinking Forum celebrating giant new discoveries.

Our first Annual Convention and Exhibitin (ACE) in our second century will occur May 19-23, 2018 in Salt Lake City, Utah, known for great outcrops (Thrustbelt, Wasatch Range, Canyon Lands, Lake Powell and Grand Canyon) and its geologic innovation in fractures and resource assessment of petroleum systems. I hope you make plans to attend.

AAPG will continue our mission to deliver top quality geoscience and professionalism, and to boldly “Go where the energy is.”

Charles A. Stenboch



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What's Next for Frac'ing in the UK?

Activists, economics, possible Russian interference, impede development

By BARRY FRIEDMAN, EXPLORER Correspondent

As AAPG's International Conference and Exhibition heads to London this fall, it will coincide with an anniversary of sorts.

Almost a year ago to the day, back in October of 2016, the British government overturned a decision by local planners in Lancashire, a city 200 miles northeast of London, to allow Cuadrilla, a privately-owned British exploration company, to once again conduct hydraulic fracturing operations in the region. This follows a decision earlier that year by the government to allow another company to frac in North Yorkshire, meaning, for the first time in five years, there would be frac'ing on both sides of the Pennines, a range of mountains that separate northwest and northeast England.

To understand why there was a prohibition in the first place against frac'ing in Lancashire, you have to go back to 2011, when Cuadrilla had to case a well drilled at its Preese Hall site, due to an earthquake, for which the company didn't deny being "probably responsible," according to a company statement at the time.

After Preese Hall, frac'ing throughout the UK became even more contentious and regulated than it had been, which is saying something (more on that to follow), so this approval, along with four other sites approved by last year, seemed to indicate the government was now firmly behind shale/gas exploration,



Cuadrilla's operation at Preese Hall. Photo courtesy of Cuadrilla Resources.

which, some experts believe, could conceivably release 1,300 trillion cubic feet of gas.

(Cuadrilla officials say there may be 200 trillion cubic feet in Lancashire alone.)



SELLEY

Richard Selley, emeritus professor of petroleum geology and senior research fellow at Imperial College, will present "United Kingdom Shale Gas (& Oil) Exploration From 1875 to Now" during the AAPG-SEG International Conference and Exhibition (ICE), which will be held Oct. 15-18 in London.

"Without drilling several wells and putting them through long production tests, no one knows, but given the time and money spent by the operators, they obviously think it is a lot," said Richard Selley, emeritus professor of petroleum

geology and senior research fellow at Imperial College in London.

'Violent Opposition'

From the gov.uk website page "Guidance on fracking (sic): developing shale gas in the UK":

"The government believes that shale gas has the potential

to provide the UK with greater energy security, growth and jobs. We are encouraging safe and environmentally sound exploration to determine this potential. The UK has a strong regulatory regime for exploratory activities, and over 50 years of experience of regulating the onshore oil and gas industry nationally. We are bringing that experience to bear and measures are in place to ensure on-site safety, prevent environmental contamination, mitigate seismic activity and minimise greenhouse gas emissions."

Not so fast, said Selley.

He is happy, but not particularly sanguine, because that was written in 2013.

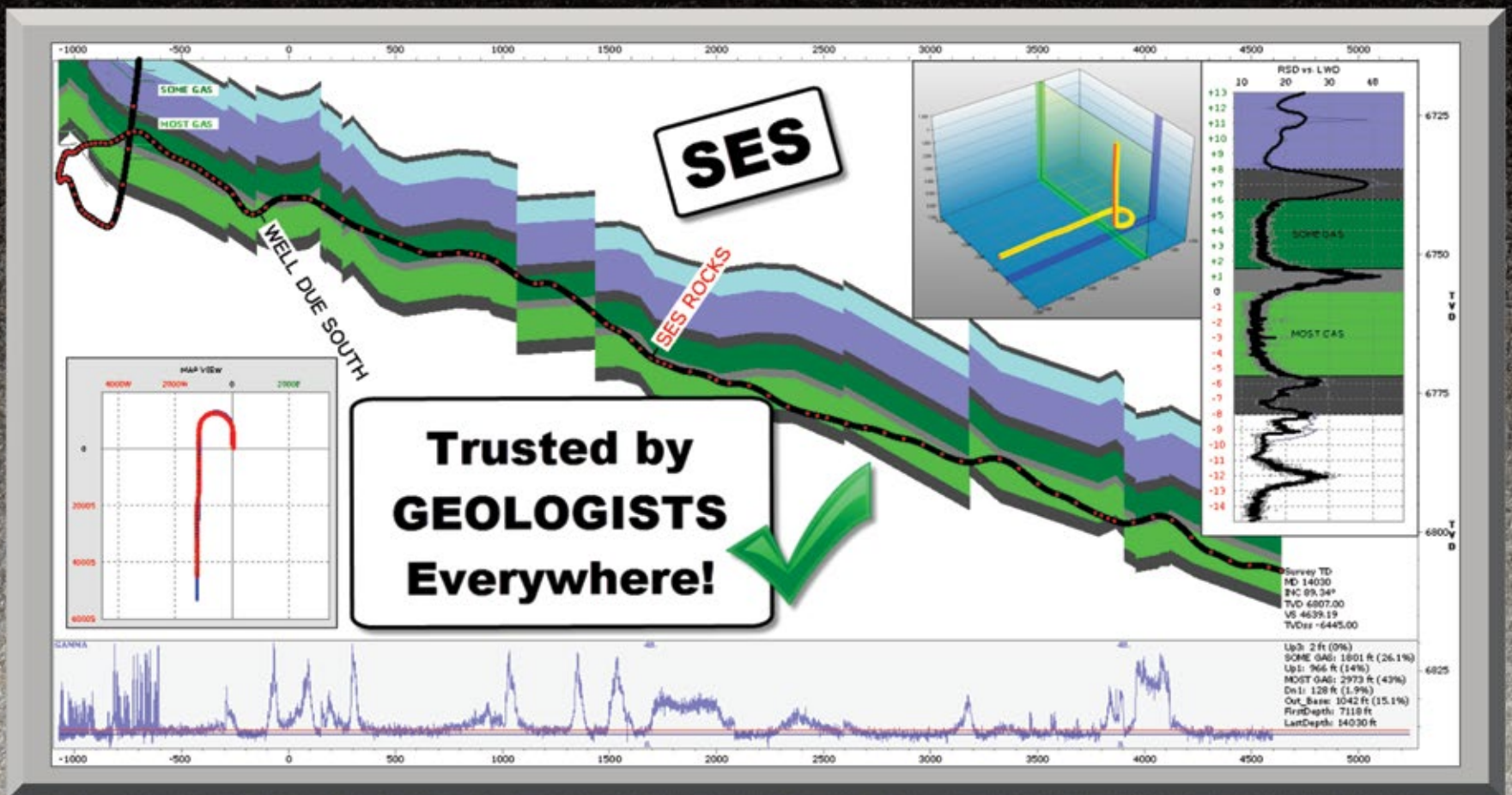
"Even if all opposition to hydraulic fracturing for shale gas and oil was to be suddenly lifted, there is no way that there will be a big impact on UK energy production for many years. There are not the drilling rigs, hydraulic fracturing units or personnel in the country," he said.

Selley, who has published more than 70 papers and has consulted on projects in Australia, Saudi Arabia, Vietnam, as well as America, said, "There is still violent opposition to frac'ing shale gas and oil" in the UK.

Worse, he believes, this sentiment never ends, even in the presence of scientific evidence.

See Russia, page 9

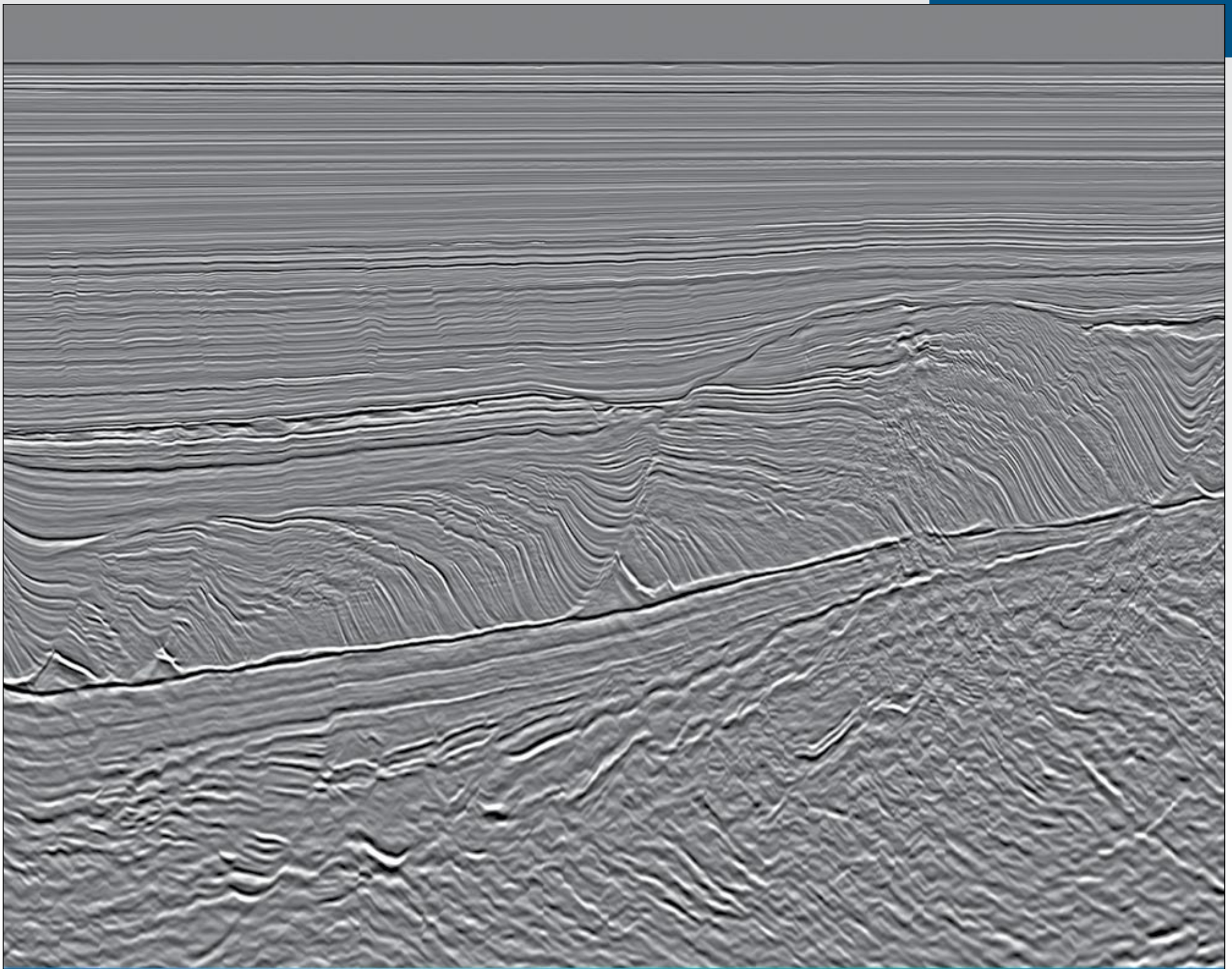
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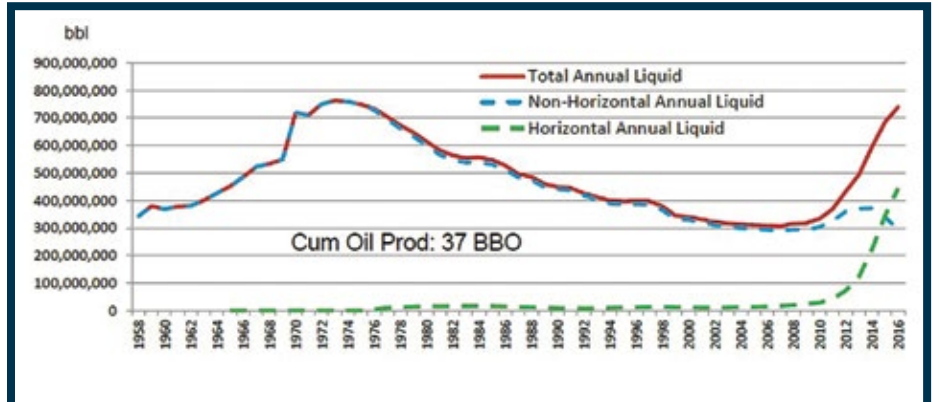
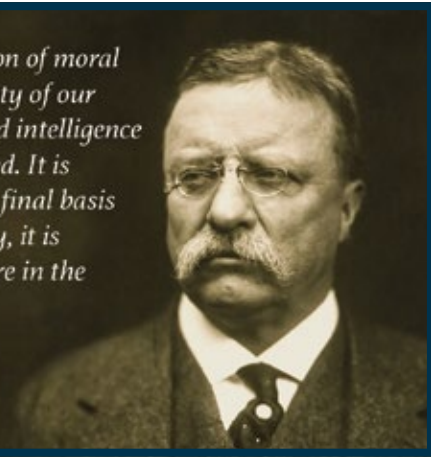
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"Disregarding for the moment the question of moral purpose, it is safe to say that the prosperity of our people depends directly on the energy and intelligence with which our natural resources are used. It is equally clear that these resources are the final basis of national power and perpetuity. Finally, it is ominously evident that these resources are in the course of rapid exhaustion."

— U.S. President Theodore Roosevelt, May 13, 1908

Franklin D. Roosevelt



Permian Basin miracle curve

The World Keeps Not Running Out of Oil

By DAVID BROWN, EXPLORER Correspondent

The world has anticipated the "rapid exhaustion" of crude oil supplies for at least 100 years.

Will it go on being close to running out of crude for the next 100?

"Peak Oil" – the idea that global oil production will soon reach a maximum and then begin to decline -- attracted a significant number of believers in the 1990s and early 2000s.

Then unconventional happened.

Unconventional resource production blossomed in the United States. With rising crude production, the U.S. stopped soaking up the world's excess oil supply.

Instead of cutting back crude production to balance the market, Saudi Arabia increased production to protect its market share.

And *ta-da!* – we got a global glut of crude and liquids, along with a truly major price collapse. Today, you are more likely to hear people talk about a possible worldwide peak in *oil demand* rather than a peak in oil production.

But the principal arguments for Peak Oil haven't changed much.

Prophets of a production maximum point out that the worldwide discovery of giant and supergiant oilfields peaked in the 1960s and has fallen off sharply since then. As more and more of those giant oilfields go into decline, they say, world crude production inevitably will decline also.

Also, recent international exploration results haven't been pretty.

"Oil discoveries declined to 2.4 billion barrels in 2016, compared with an average of 9 billion barrels per year over the past 15 years," the International Energy Agency (IEA) reported in its annual outlook.

"Meanwhile, the volume of conventional resources sanctioned for development last year fell to 4.7 billion barrels, 30 percent lower than the previous year as the number of projects that received a final investment decision dropped to the lowest level since the 1940s," according to the IEA.

Basins That Keep On Giving

Are we destined to see a global peak in crude production?

"Everybody thinks in terms of long cycle, which is the conventional route. Those include near onshore and deepwater," said Charles Sternbach. "We're seeing a boom in the short cycle."

Sternbach is president of Star Creek Energy in Katy, Texas, and, as of this month, the new president of AAPG. He noted the industry's shift away from conventional, long-term oil exploration and development projects that might take 10-15 years to



STERNBACH

"The Permian Basin is a phenomenon. It's the prototype of revitalizing superbasins around the world."



HUBBERT

come online and toward unconventional resource plays and other projects that can begin production in 3 years or less.

"In the old days, oil companies funded long-cycle projects," Sternbach observed. "Now we're seeing a proliferation of investment companies entering the industry. These efforts are for short-cycle, and that's substantially new for the industry."

These short-cycle projects aren't typical exploration and development efforts. Low-porosity plays produce high production immediately after drilling and completion, mostly with hyperbolic decline curves. They allow operators to drill thousands of wells in a play area and bring lots of oil and gas to market quickly.

As an example of this new approach, Sternbach cited the investment and the work that has boosted production in the Permian Basin in West Texas.

"The Permian Basin is a phenomenon. It's the prototype of revitalizing superbasins around the world," he said.

The basin appeared to peak out in production around 1976, when it topped 500 million barrels per year of crude-plus-liquids output. After that, production dropped steadily.

"It was on a dismal decline. It was downhill, downhill, downhill. And you thought, 'The party's over,'" Sternbach said.

Then, about 10 years ago, horizontal drilling and hydraulic fracturing brought a Permian Basin renaissance.

Production shot upward and eventually passed 2 million barrels per day, easily besting the 1976 peak. Estimated remaining recoverable reserves of over 80 billion barrels are more than twice the basin's cumulative production to date.

"One of the things I want to talk about as AAPG president is taking the industry to where the oil is, and that's the superbasins," Sternbach said.

He thinks exploration and development need more focus on "going back to the basins that keep on giving."

IHS Markit has done a promising study of superbasins and other large and potentially productive basins around the world, according to Sternbach.

"They've identified 25 global superbasins, and there are many other tier-two basins. The potential uptick is about 800 billion barrels of oil," he said.

Cheaper and Cheaper Production

Scott Nyquist is senior partner in global energy practice for consulting firm McKinsey & Company in Houston, and a member of the firm's board of directors.

"We've been doing these reports on oil supply and oil demand throughout my

career," said Nyquist, who has been at McKinsey for 30 years. "We never bought into the notion of true peak supply. We see a huge resource reserve out there."

At this moment, he said, the crux of the crude oil supply and price debate is between "lower-for-longer" and "lower-forever." Nyquist's personal view is that recent underinvestment by the oil industry will tighten the market and require some catching up in crude production.

But in a counter argument, he said, when other countries begin deploying technologies like horizontal drilling and hydraulic fracturing, there's "a perpetual story where every year we see a new low-cost source of supply coming on," and the industry keeps getting more efficient in producing crude.

"Deepwater costs have come way down, for example, as designs are simplified and efficiencies come on. There's also a more granular understanding of the reservoirs," he noted.

Prolific energy production, substitution for oil use by other sources and supply level uncertainties present another problem for long-cycle investment decision making, according to Nyquist.

"We call it 'the era of abundance.' There's lots of interfuel competition coming out that makes it difficult to plan longer-term projects," he noted. The uncertainty over switching and supply "just makes it difficult to plan investments for these long-cycle projects."

That doesn't mean the oil industry will or should abandon long-cycle exploration and development.

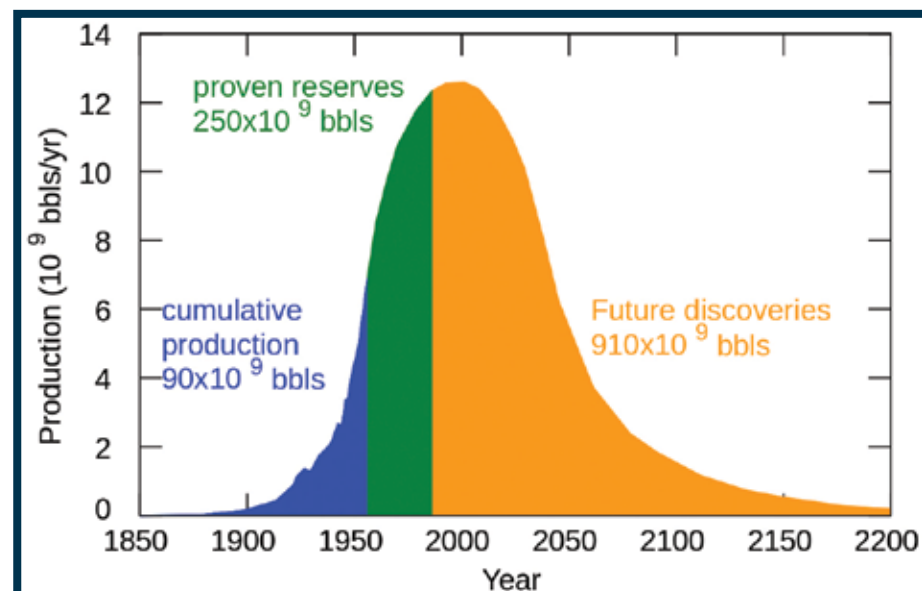
"There are a lot of conventional, long-cycle plays that have become available because of enhanced imaging," Sternbach observed.

In an AAPG Discovery Thinking presentation earlier this year, he noted that the world still holds numerous untapped, thick sedimentary deposits offshore and cited recent exploration successes in Atlantic conjugate margins.

"A lot of the really big global discoveries are affected by the Tethys Sea, which basically offers a Jurassic and a Cretaceous source rock, so there are multiple source rocks," he said.

Doomsday Averted

The concept of Peak Oil developed from a theory put forth by America geoscientist M. King Hubbert. Based on overall reserve estimates and the pattern and history of field discoveries in the United States,



Hubbert's Curve

Continued on next page

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Hubbert created a composite, mega-decline curve that predicted U.S. crude oil production would peak in the 1965-70 time period.

And U.S. oil production did reach a peak, a little later than the original Hubbert curve predicted. But with the discovery of North Slope oil in Alaska, production began to increase again. The domestic Peak Oil estimate was re-labeled as a Lower 48 prediction.


Now, it appears that Hubbert's approach predicts a profile for *conventional* oil production in a defined geographic area, when technological development and oil prices remain within limited bounds.

"When people ask, 'How much oil is there?' the answer is, 'At what price?'" Sternbach noted. "Things like tar sands could release huge amounts of oil at the right price."

Breakthroughs in technology, especially horizontal drilling plus hydraulic fracturing – call it "hydrozontal development" – combined with today's improved exploration and production tools have reversed the U.S. oil production decline.

In its June energy outlook, the U.S. Energy Information Agency forecast that U.S. crude production will reach an all-time high of more than 10 million barrels per day (b/d) in 2018, along with 4.19 million b/d of natural gas liquids and 1.02 million b/d of ethanol.

Instead of Peak Oil, the world has gotten a peek at a new energy future.

Innovation is "increasing the value of the resources and it's reducing the cost of getting to them. When those two things combine, you get to a sweet spot," Sternbach said. "That's a paradigm shift that creates waves of increased value." 

Russia from page 6

"As objections are shown to be unimportant, one by one, new objections are thought up," he said, concluding there are risks to hydraulic fracturing – fatuous ones.

The inanity, he said of the objections, is stultifying.

"These are becoming increasingly risible and reached a new high on October 10, 2015, when the environmental group 'Friends of the Earth' declared that hydraulic fracturing should be banned because it uses sand, which is a carcinogen," Selly explained.

So, he wonders, why don't they just issue warnings: "Do not take your kiddies to the seaside!"

The other reason for his skepticism, he said, has to do with economic factors already in play.

"As North Seas gas production declines, more shale gas had to be imported—from the US—which, he said, double negative effect on of loss of revenue and on the UK's balance of payments— issues beyond the concern of local protestors."

Speaking more specifically about the opposition to frac'ing in the UK – what's driving it – Selly, who has received a Certificate of Merit from AAPG, as well as a Coke Medal from the Geological Society of London, said it is coming from an unlikely source, but not an unthinkable one.

"Reliable sources in NATO and personal anecdotes have evidence that

the Europe-wide opposition to frac'ing is driven by Russia, especially Russia TV," he said.

It sounds crazy – he knows it does – but added, "Last year these reports might not have been believed, but after allegations of Russian 'dirty tricks' in the U.S. Presidential election, this is now more credible."

And, it's worth noting that Russia holds a longstanding monopoly on Europe's natural gas supply.

Dunning-Kruger Effect?

At the moment, and irrespective of the Russian involvement (if it exists), Selly would consider it a victory if those who didn't know what they were talking about when it came to frac'ing and its dangers listened to those who do.

"There is prevailing lack of trust in experts, there is mistrust of the veracity of reports evaluating the risks and rewards of hydraulic fracturing for shale gas and oil," he said, adding that even reports by independent academics – because these same academics also, at times, work as consultants and are being seen as biased and contaminated.

"It is argued that academics, or 'Fracademics,' as we are termed, can only know anything about the topic because we work as consultants and/or have research grants funded by the industry. Therefore we cannot be seen as independent. 'Fracademics' must have a conflict of interest," said Selly. "Following this argument to its logical conclusion, the government should commission reports on the

technical issues of hydraulic fracturing to geologists with expertise in dinosaur locomotion and engineers studying the tilt of the leaning tower of Pisa."

Work to Be Done

When it comes to the future of frac'ing in the UK, he sees it in somewhat of a unique position, especially as how it relates to Europe.


"In France, shale gas/oil resources have never been tested because they banned frac'ing from day one," he said, adding that the opposition might be because the country runs on nuclear power.

"Ditto for the Netherlands and Germany with strong green lobbies. Germany is now importing coal from the U.S. and re-opening opencast lignite (really dirty brown coal) mines generating the press headline 'Germany turns from green to black!'" he added.

It seems the UK, more than the rest of Europe, needs shale to be a robust part of the equation. There are some promising developments.

"In the Weald basin of southern England, there is excitement over possible production of shale oil. Wells drilled for conventional Upper Jurassic sand reservoirs have yielded significant flows of oil from naturally fractured limestones thinly interbedded with Upper Jurassic Kimmeridge clay source rock," said Selly.

There's hope, there's work to be done, and there's this:

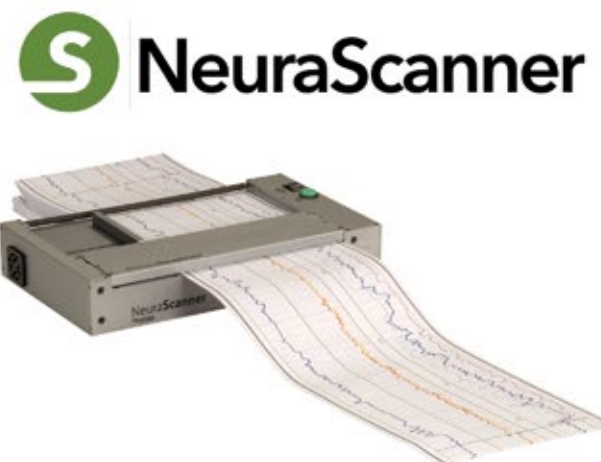
"I have been a cheerleader for UK shale gas since I identified the UK's resources 30 years ago." 



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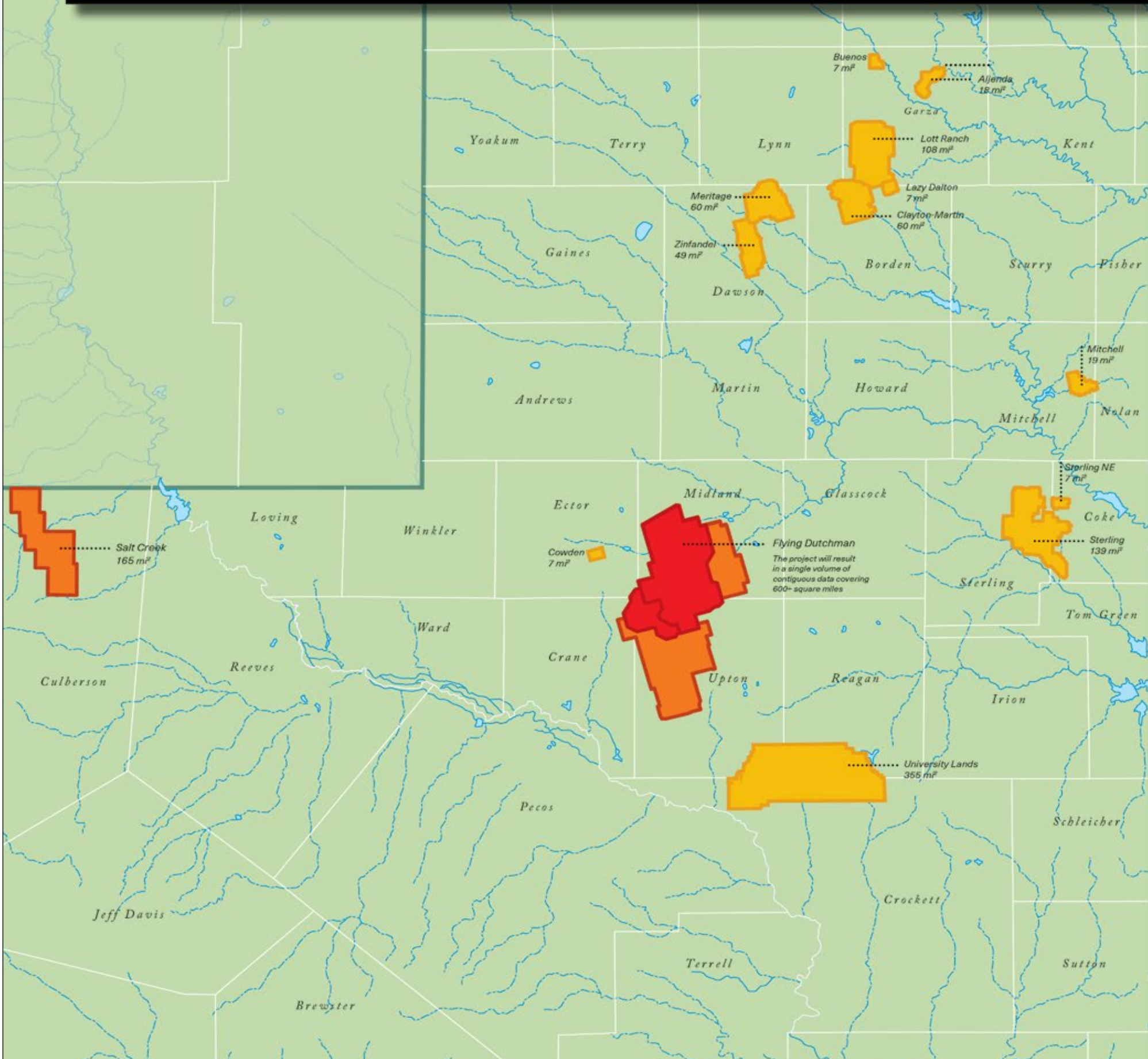
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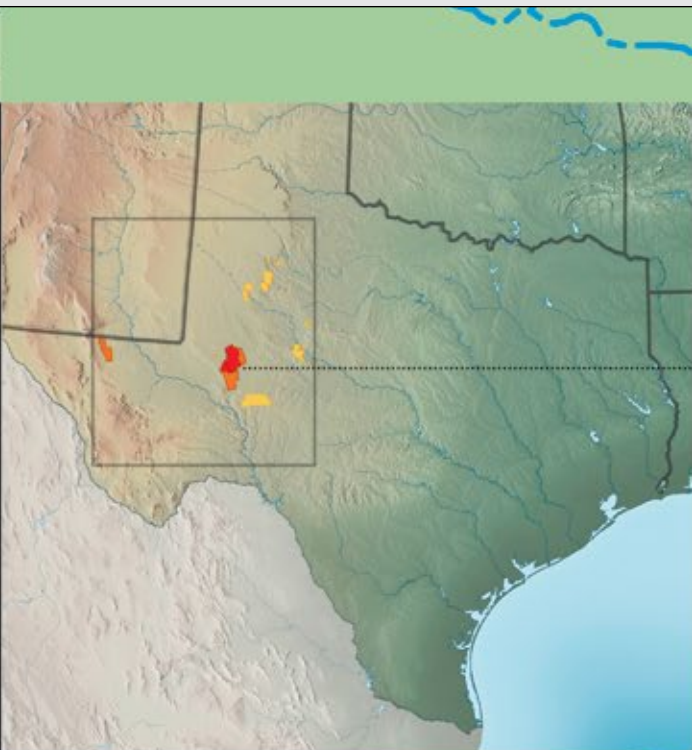
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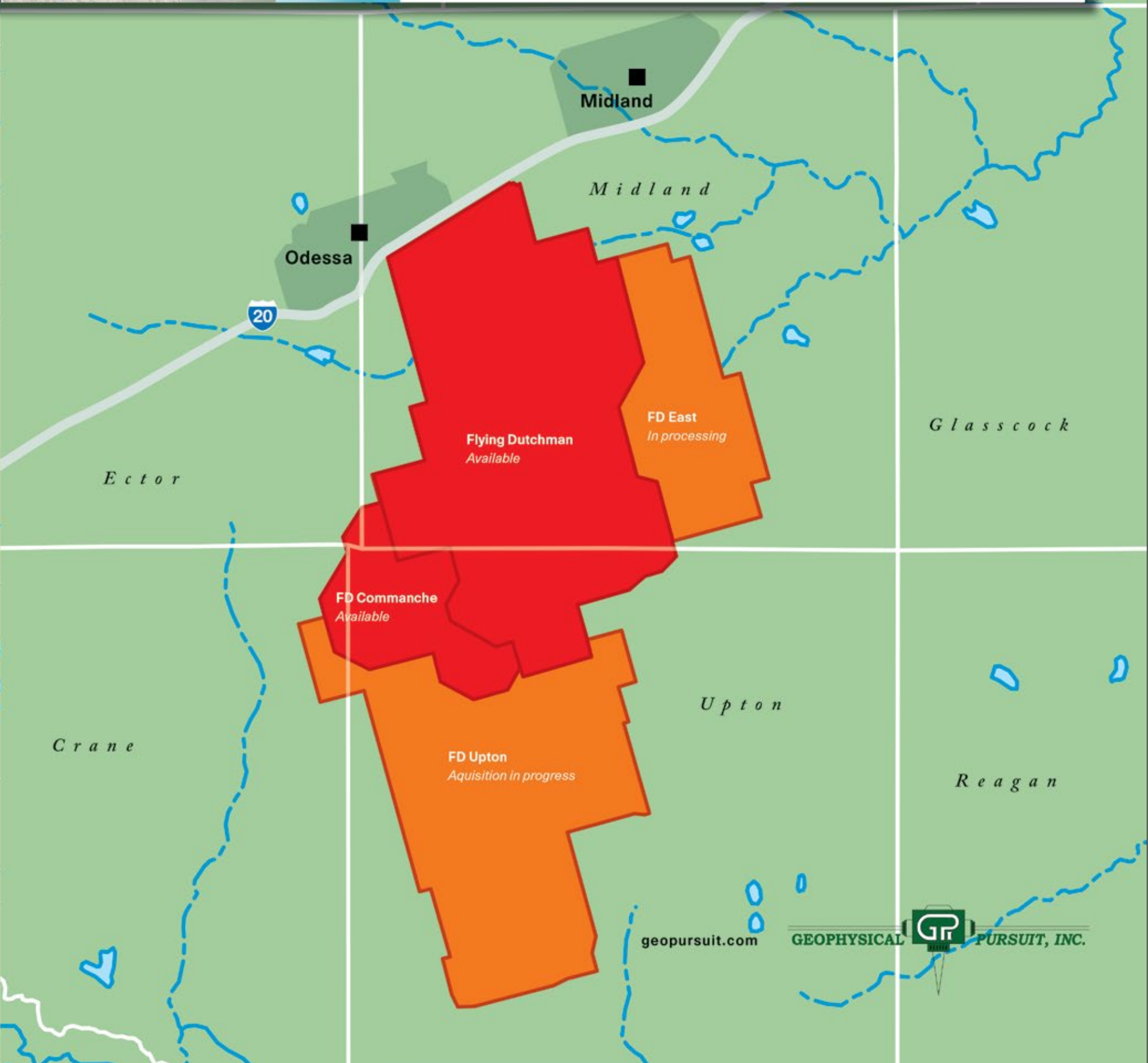




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The Flying Dutchman 3D program commenced in 2016 with final products available for the initial 350 square miles. In March 2017 GPI completed acquisition of Flying Dutchman East with processing currently in progress. The next phase of the program, Flying Dutchman Upton, is currently in progress with recording scheduled to commence in August 2017. The addition of Flying Dutchman Upton will result in a single volume of contiguous data covering 600+ square miles.

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Slow Injection For Better Well Re-Fracturing

By LOUISE S. DURHAM, EXPLORER Correspondent

The relatively recent spate of near-frenzied drilling and hydraulic fracturing activity in a plethora of unconventional reservoirs prompted the production of massive volumes of hydrocarbons.

Yet a good bit of this fast-paced drilling action was triggered by the need to retain lease holdings.

Along the way, an unwelcome combination of increased well spacing and inefficient completions became the norm in many areas. The adage “haste makes waste” soon came to plague the operators, given that their hurried efforts sometimes led to inadequate drainage of the target hydrocarbon-bearing reservoirs.

It was determined that the logical and obvious strategies to address this dilemma are to re-fracture the existing wells and drill infills.

It's widely known that refracturing a horizontal well can help to reduce the interaction between so-called parent and child wells by causing a high stress area around the refractured wells and diverting child well fractures away from the parent well.

This leads to improved productivity and recovery of both, according to Ripudaman Manchanda, research associate at the Department of Petroleum and Geosystems Engineering, University of Texas-Austin.

Biased Fluid Distribution

But we're talking a whole new game here, and challenges abound.

For starters, re-fracturing a partly depleted



MANCHANDA

Ripudaman Manchanda, research associate at the Department of Petroleum and Geosystems Engineering, University of Texas-Austin, will present “Overcoming the Impact of Reservoir Depletion to Achieve Effective Parent Well Re-fracturing” at this month's Unconventional Resources Technology Conference (URTEC) in Austin, Texas.

horizontal well can lead to ineffective re-stimulation of the depleted intervals,

even though diverting agents are employed with the goal to divert fluid and proppant to the non-depleted zones.

In large part, the problem is the geology. Reservoir heterogeneity, for example, plays a key role in preventing horizontal well fractures from being identical. Adding to the complexity, stimulation to create fractures is implemented in sections or stages along the laterals, which further encourages non-uniform depletion along the well.

During the refracturing procedure, the stimulation treatment entails injection of fluid slurry into the total well, meaning individual fractures are not isolated during this procedure. And diverting agents used in refracturing can accomplish only so much.

Low depletion areas harbor lower pore pressure and lower in-situ stress in the rock matrix adjacent to the fractures, Manchanda pointed out. Therefore, during the restimulation process, the injected fluid is attracted here, with the unwanted result being a biased fluid distribution.

This negates the refracturing process goal to stimulate un-depleted regions of the

reservoir, demanding a serious new look at this challenging scenario.

Enter: Multi-Frac

A possible solution to overcome the fluid distribution bias resulting from non-uniform depletion: slow injection.

Manchanda explained that this method involves injecting fluid – liquid or gas – slowly, for hours or even days, prior to pumping the scheduled refracturing operation.

Doing so helps to reduce the bias by inducing a kindred pore pressure adjacent to all of the well's fractures.

In other words, slow injection can at least temporarily mitigate the near-fracture and near-wellbore effect of depletion on fluid diversion and fracture initiation.

This unique slow-injection strategy was simulated using a fully 3-D poro-elastic geomechanics model called Multi-Frac, which is a PC-based and cluster-based simulator used to design and optimize hydraulic fracturing in pad-scale operations.

“The results helped with understanding the impact this slow injection phase has on the pressures and stresses that develop during depletion and re-pressurization,” Manchanda said.

“This helps to design the rate and duration of the slow injection to efficiently re-fracture depleted wells,” he emphasized.

The University of Texas is the sponsor of the Multi-Frac development. In fact, the tool is based on the Framework for Research and Operations in General Geomechanics (FROGG) libraries, developed at UT-Austin over the course of the past 15 years, according to Manchanda.

Designed to be used by completions, production and reservoir engineers, Multi-Frac has been used a number of times in the field. It has proven to optimize both fracture spacing and sequencing along with well spacing for some notable unconventional plays. These include the Bakken, Eagle Ford, Barnett and Marcellus, along with Permian Basin locales.

Typical of new technology, Multi-Frac has been a long time in the making.

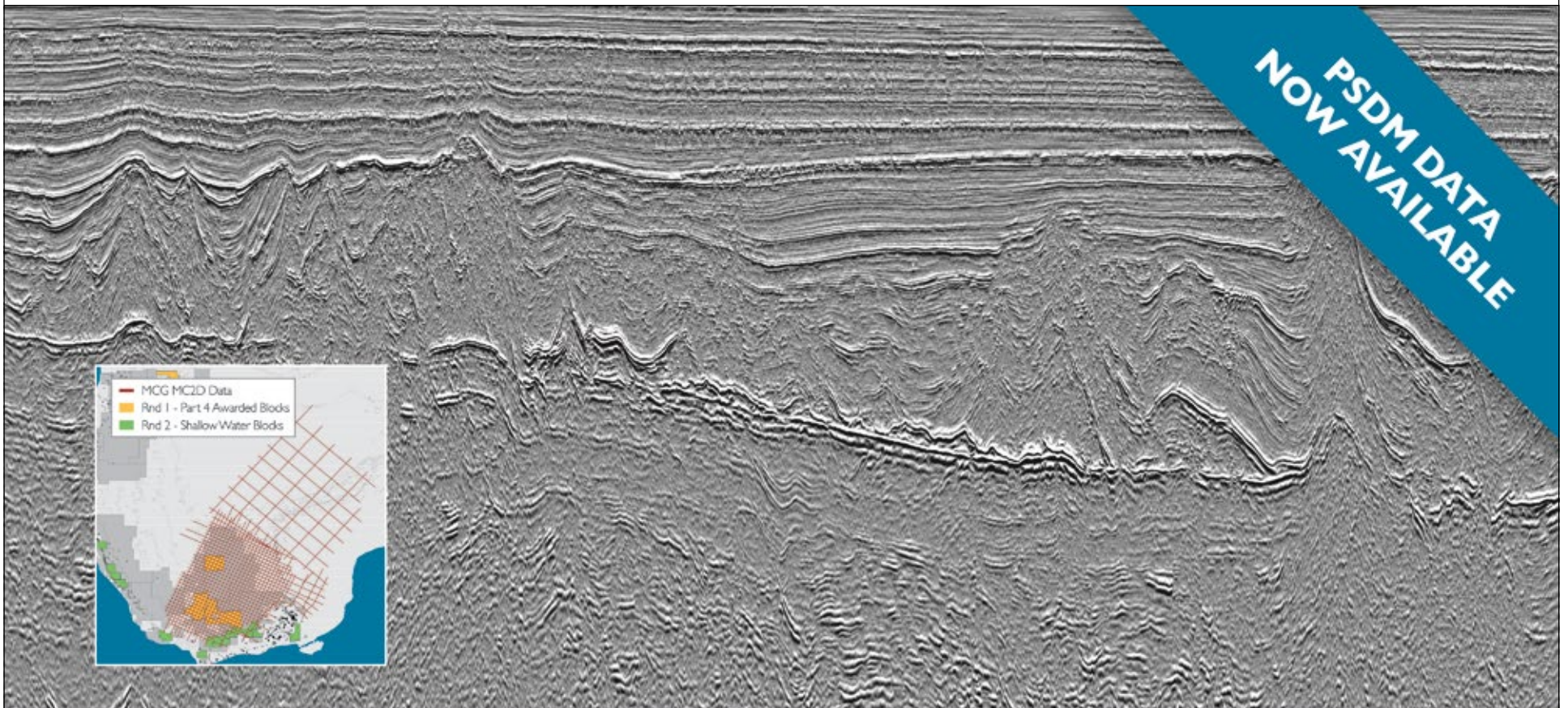
“What we have in place now is the work of about 10 years,” Manchanda emphasized.

“The first field project I was involved with using technology similar to Multi-Frac was about 2010,” he said. “The project was in the Barnett and lasted about two years; we did several wells and used this to plan for fracturing future wells.”

So, even though it was developed inside UT, there's documented proof that it works in the field.

And it's available – just not off-the-shelf.

“People come to us to get help, and that's when they're able to use it, so we continuously do projects with companies who provide us with funding,” Manchanda said.



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Jordan Kone, lab tech with the Reservoir Engineering Technology team at the Aramco Houston Research Center, uses a scanning electron microscope (SEM) to view isolated kerogen from different source rocks to visualize and measure pore size distributions. Photo courtesy of Aramco Services Company.

Beyond the Monte Carlo Approach Unconventionals in Saudi Arabia

By EMILY SMITH LLINAS, EXPLORER Correspondent

In low-price periods, unconventional resource producers measure success largely by their ability to keep operating costs low.

But for Dan Georgi, team lead for reservoir engineering technology at the Aramco Houston Research Center, the best strategy moves beyond tweaking fluids and well design.

"In the North American unconventionals market, companies tend to take a Monte Carlo approach: drill a hole, frac and see what happens," he said. (The Monte Carlo reference refers to a statistical method that measures risk by using a large number of random variables.)

"There is a tendency to focus more on how to do a better job of frac'ing and reducing costs than thinking about what's there and what is going to be produced," he said.

Georgi is seeking a more scientific approach to the unconventional development model in his work at Aramco, where he leads a multi-disciplinary team that uses simulation and research to help to optimize production in shale and tight gas formations.

The team employs a combination of high-resolution imaging, nuclear magnetic resonance, vapor absorption, geochemical analysis and core analysis to identify potential productive source rock reservoirs and quantify hydrocarbons in place. They also use reservoir simulation to estimate flow rates and predict estimated ultimate recovery.

"We are focused exclusively on research to support the Kingdom of Saudi Arabia's push to reduce the reliance on liquid fuels for local energy needs and to provide petroleum feedstock for a growing petrochemical industry," he said.

Unconventional resources are seen as a key contributor to Saudi Arabia's domestic energy source for electricity generation and water desalination.

The project receives support from the Aramco Research Center in Houston as well as Saudi Aramco headquarters in Dhahran.

More Science and Finesse

Georgi, who started working with unconventional resources at Baker Hughes in 2005, said that while unconventional work in the Kingdom benefits from experience in North America, Saudi Arabia has some significant differences.

"Given the fact that there are fewer well penetrations in Saudi Arabia than in North America, locating and optimizing production with the drill bit is more challenging for the development of unconventional rock reservoirs," he said.


Georgi said his team hopes to help Aramco minimize the number of fractures and still be effective. Their success will be measured by their ability to help operators avoid fracturing wells that would be unsuccessful because they don't have the right properties.

"If we are successful, we will be able to say 'This well will be productive, and this won't,'" he said. "If we're really successful, we can say 'drill to this depth and then go horizontal.'"

While the team's work focuses on Saudi Arabia exclusively, they are gaining experience that can be applied elsewhere.

"Service companies for years have talked about geometric frac'ing. Why haven't we gotten away from it? We don't have anything smarter right now?" he said. "The prevailing thought has been, 'If we don't know where we should frac, we might as well space wells equally.'"

Georgi said his team aims to "put more science and finesse into the process" and to be able to provide an intelligent recommendation of where to put stages in fracturing horizontal wells.

"We've got some early results, and I'm proud of them," he said. 

Dan Georgi, team lead for reservoir engineering technology at the Aramco Houston Research Center, will present "Aramco Research in Support of Unconventionals" at the Unconventional Resources Technology Conference (URTEC) this month in Austin, Texas.

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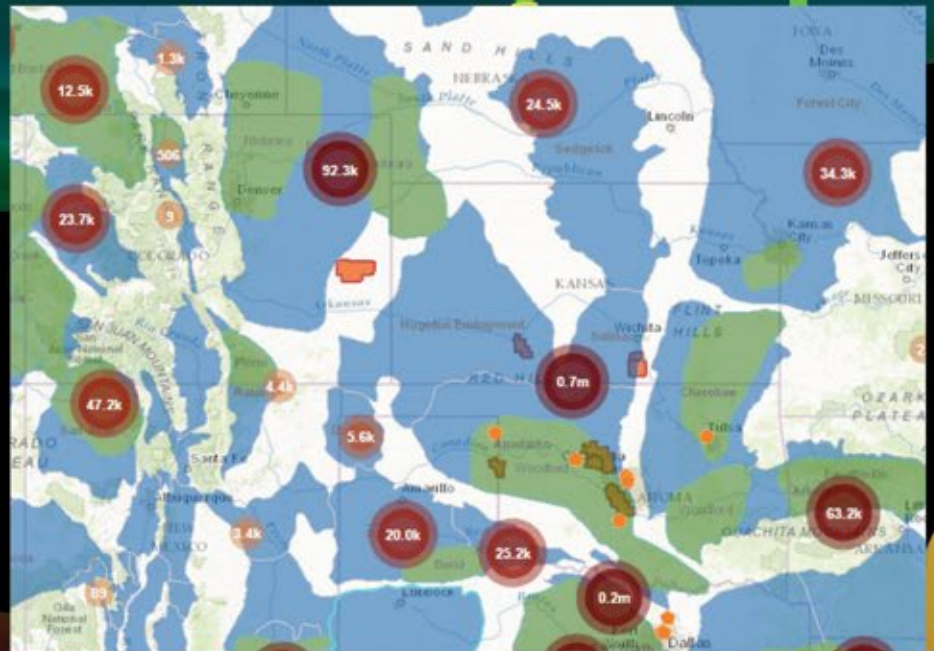
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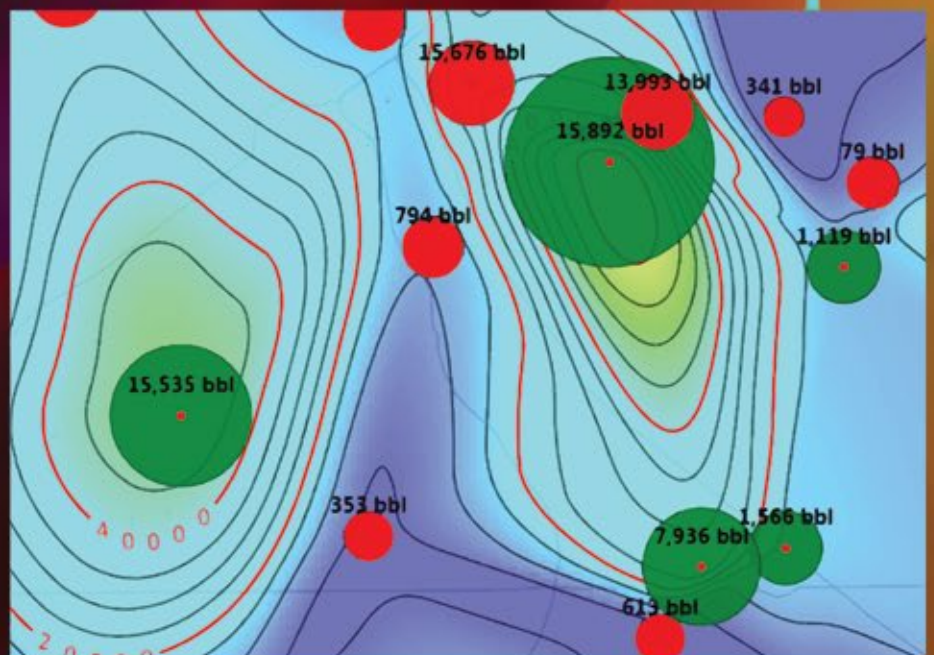
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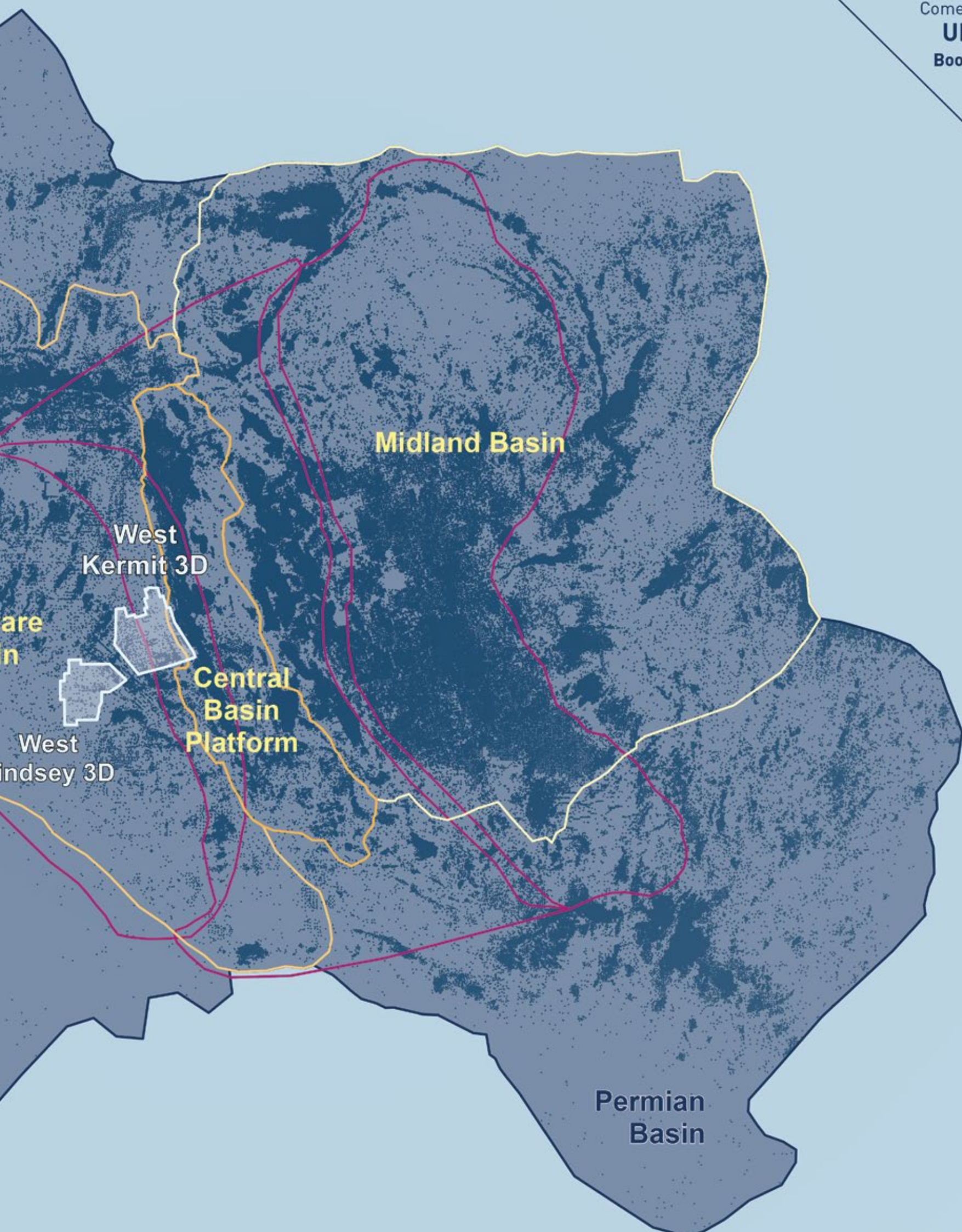
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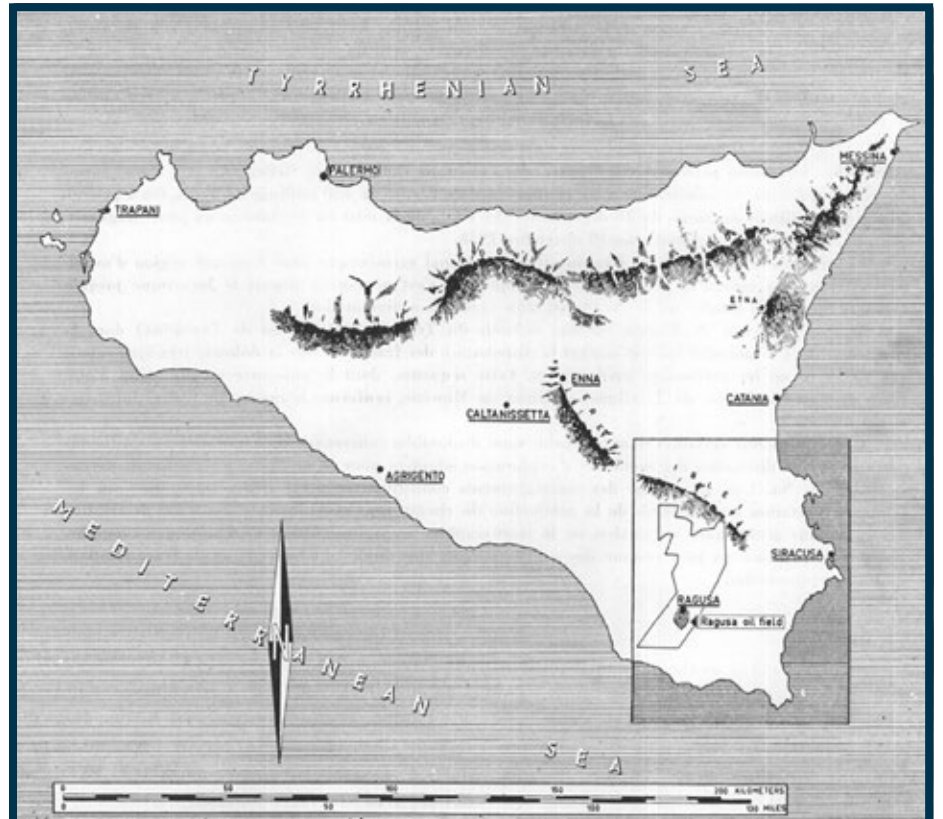


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Historical Highlights is an ongoing EXPLORER series that celebrates the “eureka” moments of petroleum geology, the rise of key concepts, the discoveries that made a difference, the perseverance and ingenuity of our colleagues – and/or their luck! –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



Eduard Trümpy with his family circa 1948.
Photo is courtesy of his granddaughter, Bettina Mazzolini.



Map of Sicily and the Ragusa Oil field

J. Elmer Thomas, Sicily and the Ragusa Oil Field

By ALBERT W. BALLY

The AAPG has always played an important role in my professional life. Early in my career, I had the good fortune to have met J. Elmer Thomas, the founding president of the AAPG. This was an important event in helping me down the early paths of my profession.

Some time between 1930 and 1933, Thomas presented some of his ideas about the oil resources of Sicily to representatives of the Italian government. At the time I was 7 and 8 years old, attending a German school in Rome, and was daily exposed to life under Benito Mussolini and the frequent visits of Nazi dignitaries.

After 1933, Thomas himself no longer pursued any direct contacts in Italy. However, in 1948, two years after I began my doctoral work in central Italy, Thomas requested exploration permits in Sicily for SIARP (Società Italo Americana Ricerche e Prodotti di Petroleo), which were subsequently transferred to the American International Fuel and Petroleum Company (AIFP Co.).

In early 1949, Eduard Trümpy, then at Gulf Oil, asked me to take a break from my doctoral thesis research to map the surface geology of southeast Sicily. I accepted the job only after my professor, Wolfgang Leupold, assured me that his earlier offer to become his well-paid teaching assistant at the ETH (Swiss Federal Institute of Technology) in Zurich remained open for me when I returned from Sicily.

A Wild Summer in Sicily

During the very long, hot summer of 1949, I mapped the Ragusa-Pachino Plateau of southeast Sicily, i.e. the area of Thomas' exploration permit.

On our way to Ragusa in southeast Sicily, Trümpy and I first stopped by the Istituto Geografico Militare in Florence to pick up the topographic base maps of southeast Sicily. After arriving in Rome, I stayed with my parents



Ragusa Plateau looking northwest

while Trümpy checked into a nearby hotel.

I vaguely remember briefly meeting with Thomas in the Hotel Ambasciatori in Rome where, together with Trümpy, we all met with Avvocato Pignatelli, Gulf

Oil's representative in Rome. Later, we also met with Ramiro Fabiani, a professor at the University of Rome. Fabiani was of critical importance to our enterprise, as he had taught at the University of

Palermo from 1925 to 1943.

At the time, aside from being fluent in Italian, my principal qualification was that I had been mapping in the central Apennine Mountains for my doctoral thesis area (today, my entire thesis area has become the «Parco Nazionale della Maiella»). Alas, at the time, I did lack some other important qualifications – I was unable to drive a car, so Trümpy had to drive me into the field every day and pick me up in the evening.

An amusing anecdote: we drove a very long car designed for funerals (“pompe funebre” in Italian, i.e., a hearse). One advantage of this hearse was that there was enough space to hold all our field gear. Also, at the end

Albert “Bert” Bally, an AAPG Honorary Member, was born in The Hague, The Netherlands, and spent his early years in Indonesia, Italy, and Switzerland. At the University of Zurich (where he specialized in paleontology) he wrote his doctoral thesis on the mapping of an area in the Central Apennines.

For a major part of his career, Bally worked for Shell Oil. While with Shell Canada, he spent several summers mapping the Rocky Mountains and foothills of Alberta. Later he became their chief geologist, then transferred to Shell USA and progressed from manager of geologic research to chief geologist to senior consultant. In 1981 he joined Rice University as chairman of the Department of Geology and Geophysics. He was also appointed the Harry Carothers Weiss Professor of Geology, a position he still occupies.



BALLY

Continued on next page

Continued from previous page

of the mapping season, I was able to transport key samples of measured sections for further micro-paleontologic studies back to Switzerland.

One time, just after Eduard dropped me off in the field, I was arrested by the police ("polizia"), who had been waiting for me because they thought I was the guy who in the previous few weeks had stolen chickens in the area. It was my good luck that during the previous week, Trümpy and I had driven to Palermo and met with the Franco Restivo, who at the time was the president of the then Autonomous Region of Sicily. So, soon after my arrest, I was released after the police had called the authorities in Ragusa.

And, speaking of the "good old days," note that at the same time, the legendary bandit Salvatore Giuliano was roaming in area south of Palermo.

Luckily, at the time, my qualifications for the job far out-weighed my significant "disqualifications." My English was non-existent at that time because, while attending high school in Switzerland, I was given the opportunity to study another language, and I chose Italian because I was already fluent. (Of course, as a "gymnasium" student, I also had to take Latin). Thus, after long days in the field in Sicily, my boss asked me to

write my progress reports in English during the evenings, assisted only with a German-English dictionary and Lahee's classic on Field Geology. Trümpy, most graciously, then took time to edit my reports for the Gulf Oil supervisors in London.

On the other hand, as a well-trained micro-paleontologist, I was able to diagnose the "macro -forams" and other macro fossils that I had collected in the field.



THOMAS

Discovery

At the end of my long spring and summer of 1949, I had to rank all of the prospects that I defined in my mapping. Among the dozen prospects, the Ragusa structure was at the top of list because it coincided with the Ragusa Asphalt Mines. Four years later, in 1953, the Ragusa prospect became the 300 million barrel Ragusa Oil field

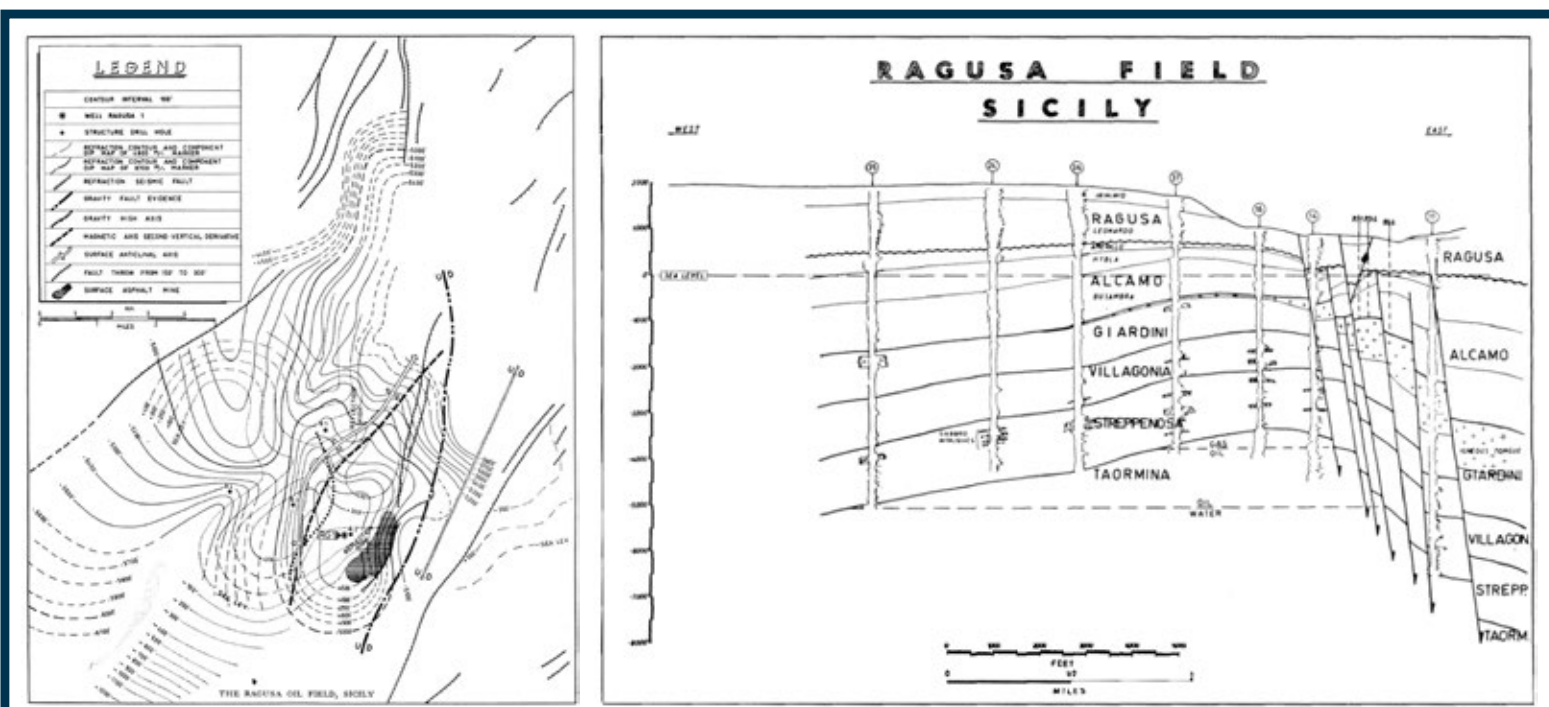
Just imagine Thomas, who passed away late 1949, receiving this good news while resting in "the happy hunting grounds."

The good news was that for my work in Sicily, \$300 (U.S.) was deposited in my

bank account in Switzerland one month later. Thus, I was able to save a sizable amount of money prior to drawing a good salary as a teaching assistant at ETH. In addition, I was paid for mapping in the Swiss Alps on a project related to the construction of a large hydro-electrical power station project.

All these activities allowed me to get married and start raising a family. I owe a great debt to J. Elmer Thomas for the great role he played in helping me launch my career.

(For an early report on this discovery, see "The Ragusa Oil Field, Sicily," by F. T. Kafka and R.K. Kirkbridge.)



Left: Original structural contour map of the field. Right: Cross section after field discovery and initial development.

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Futuristic Efforts to Characterize Shallow Anomalies

By SATINDER CHOPRA, RITESH KUMAR SHARMA, GRAZIELLA KIRTLAND GRECH and BENT ERLEND KJØLHAMAR

The last two Geophysical Corner articles have focused on characterizing shallow high amplitude anomalies in the Barents Sea, first qualitatively, and then adopting an alternative workflow with different tools that lower the uncertainty in the characterization process. In this article, we discuss other efforts that being directed at performing an integrated assessment for the prospects in the Barents Sea, and lowering exploration risk in the future.

Besides improving the quality of the existing seismic data through reprocessing (with the latest algorithms) and their integration with borehole data, the state-of-the-art acquisition of fresh data with more powerful acquisition technology are being carried out in the Barents Sea. To improve the quality of the data being used for interpretation and analysis as well as effectively de-risk the prospects ahead of drilling, the state-of-the-art technology is being used for its collection. Besides this, diverse data types, both geological and geophysical, are being brought together to come up with an integrated assessment for the prospects. Multibeam seafloor mapping and sampling is also being done by some of the operators in that area. Plans are also under way for integrating all this data for mitigating exploration risk.



CHOPRA



SHARMA

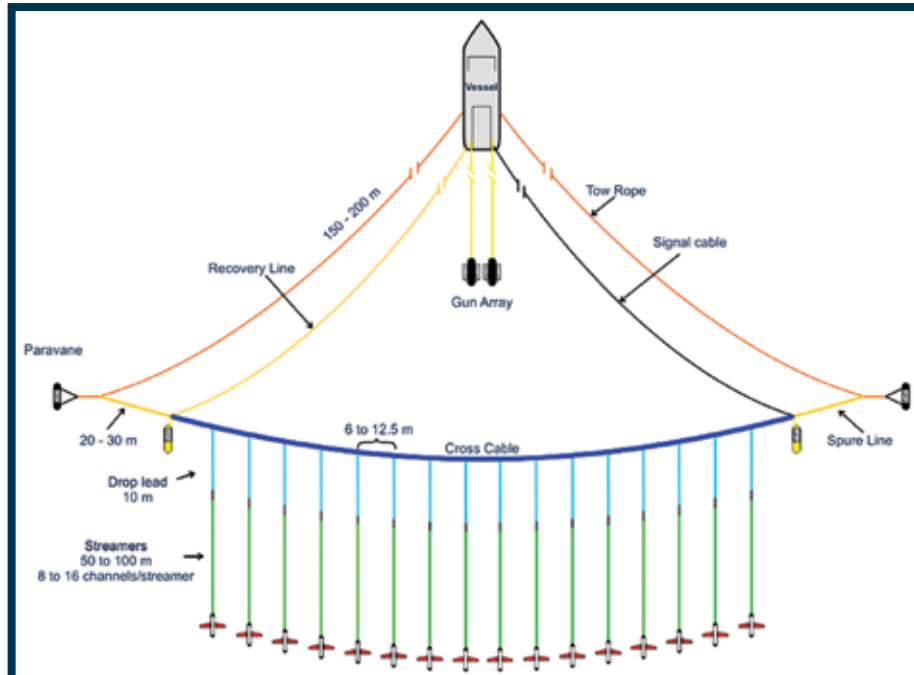


Figure 1: A typical configuration of a P-cable acquisition layout. Image courtesy of P-cable 3D Seismic AS

Bent Erlend Kjølhamar holds a master's degree in geology from the University of Oslo, and has been working for TGS for the last 20 years. He is TGS director of project development for Europe and Russia.

Graziella Kirtland Grech holds a doctorate in exploration geophysics from the University of Calgary, Canada. She has more than 20 years' industry experience in both technical and leadership roles. Since 2012 she has been the director for processing and reservoir services at Arcis (a TGS company).



KJØLHAMAR



GRECH

enhancement of the resolution in (b) and more so in (c), and the advantages that accrue with it in terms of interpretation.

CSEM Data

The P-cable seismic data acquisition technology discussed above is a seismic

method that uses the sensitivity of the seismic wave velocity and density of the medium for generating the data. The controlled source electromagnetic (CSEM) method measures the electrical conductivity of the medium and serves as an independent source of information generating a volume of subsurface

resistivity that can help locate pockets of hydrocarbon fluids. In that sense the two are disparate exploration techniques, where the processed data are interpreted separately and the results integrated. Case studies have been published where combining the information from the seismic, CSEM and well data greatly benefits in the understanding of the anomalies, despite the shortcomings in the methods or the uncertainties in the results. Alternatively, joint inversions of such data are also being carried out using different approaches.

In figure 3 we show segments of an intersecting inline and crossline from seismic data and overlaid with the equivalent lines from the CSEM survey. Notice how the peak resistivity anomalies from the EM survey fall over the seismic amplitude anomalies, lending confidence to their interpretation as being hydrocarbon charged.

The CSEM data is being extensively used by some companies for identification of play fairways for de-risking their prospects.

Multibeam Sea Floor Mapping and Sampling

Natural hydrocarbon seepage on the seafloor could be due to vertical leakage of light oil or gas from charged reservoirs in the subsurface, or a result of hydrocarbons that have travelled long lateral distances through vents or via porous zones or faults and reached the seafloor. Such seepage out of the seafloor can alter the physical and biological characteristics of the water-bottom sediments. Sometimes the seepage of light hydrocarbons may not be physically detected, but as they diagenetically alter the rocks or shallow sediments through which they pass, they can be detected chemically. If such seepage is physically

P-cable Seismic Data

Among the more powerful 3-D marine seismic data acquisition technologies available in the industry today, the patented P-cable multistreamer seismic system holds promise in terms of resolution on the processed data that is much greater than conventional 3-D seismic data. The system consists of a seismic cable towed perpendicular to the vessel streaming direction (figure 1), and which contains communication control units as well as the navigation hardware. For a normal configuration 8 to 24 streamers with 6.25 to 12.5 meters spacing are attached to this cable. The length of the streamers usually varies between 50-100 meters with small group intervals (3 meters), and as the source-receiver distances are short, all the near offset signals are recorded. The acquisition of seismic data with such a geometry results in high resolution, typically 1-2 meters vertical and 3-6 meters horizontal on the final processed data. The P-cable acquisition can be carried out with small vessels and lighter equipment, and is therefore cost-effective and space-efficient.

In figure 2 we show a comparison of seismic sections passing through Apollo well and (a) extracted from conventionally processed data at 4 ms sample interval, (b) reprocessed data at 2 ms sample interval with a proprietary attenuation correction, and from (c) P-cable seismic data volume again with proprietary attenuation correction. Of notice is the

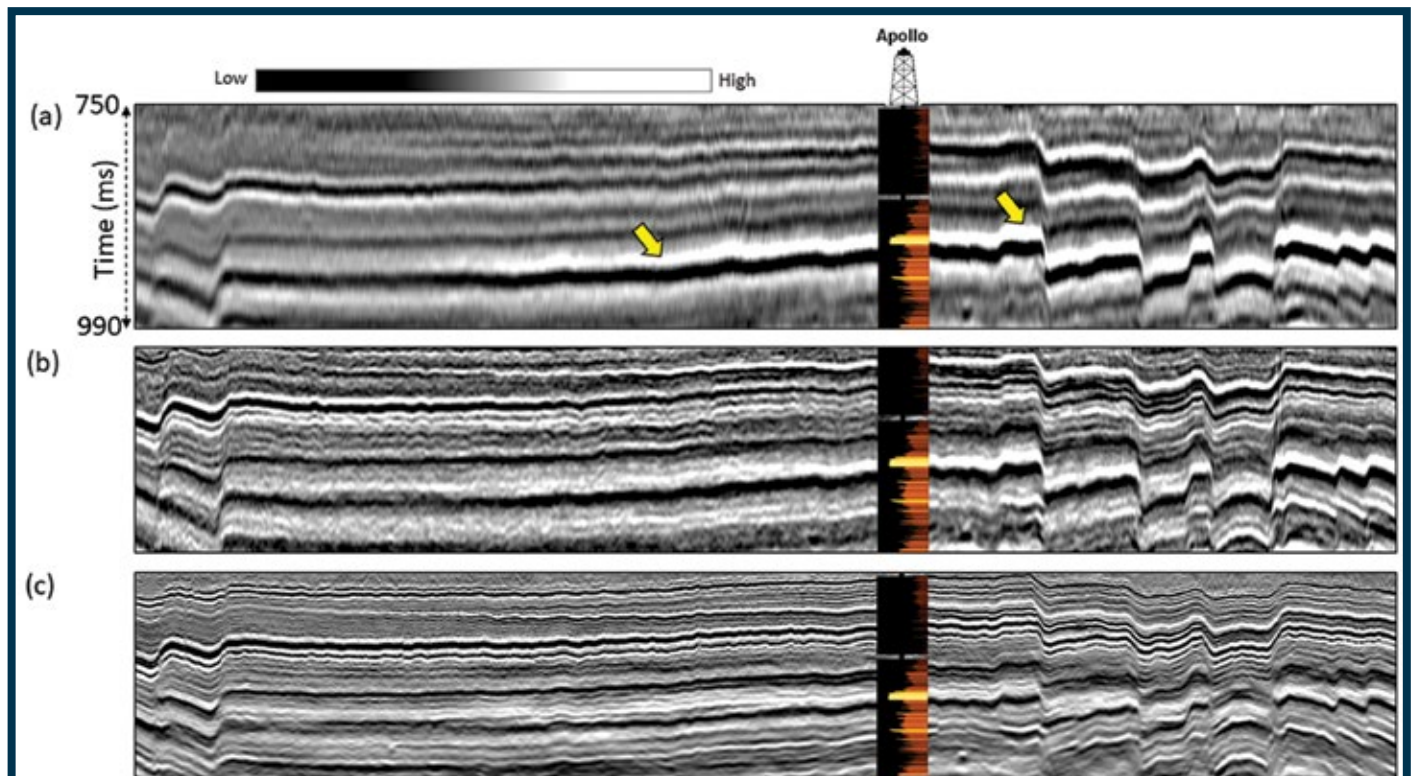


Figure 2: Segments of an inline (23 km in length) passing through the Apollo well from the (a) conventionally processed seismic data volume at 4 ms sample interval (SI), (b) reprocessed seismic volume at 2ms SI and with the proprietary attenuation correction process applied, and (c) P-cable seismic volume processed at 1ms SI and with the proprietary attenuation correction process applied as in (b). The yellow blob in the well represents the Sto formation. Notice the enhanced resolution of the data in (b), and even higher resolution is seen in (c). The bright amplitude on the closure as indicated with the yellow arrows is seen on the conventional section shown in (a), but disappears in (b) and (c). Perhaps its appearance in (a) is due to the tuning effect.

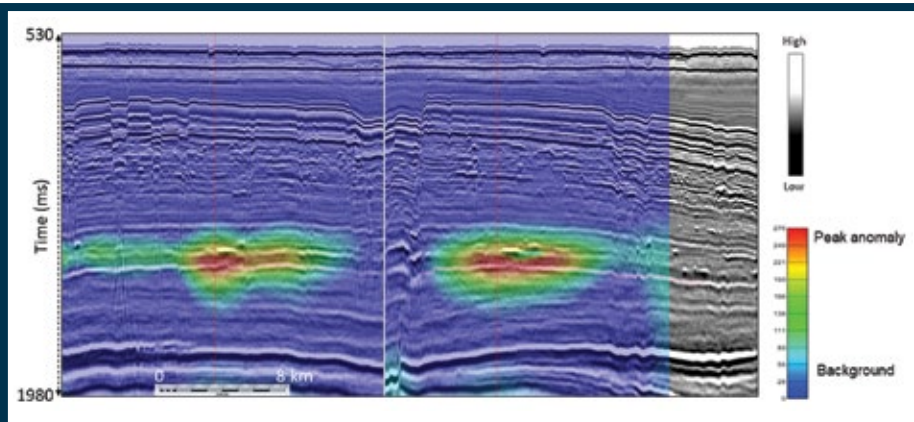


Figure 3: Segments of intersecting inline (left) and crossline (right) from the reprocessed seismic data volume with a proprietary attenuation correction. Overlaid on the seismic lines are the equivalent lines from the EM survey. Notice the peak resistivity anomalies from the EM survey fall over the seismic amplitude anomalies, lending confidence to their interpretation as being hydrocarbon charged. The scale bar displayed to the lower left shows a length of 8 km.


Continued from previous page

detected on the seafloor, it could serve as a direct hydrocarbon indicator. Biological buildups at the seafloor, and pockmarks or mud volcanoes created by the seeping oil or gas are some of the indications that can be detected on the seafloor.

Tools such as multibeam sonar and piston coring are being used these days to cost-effectively and efficiently evaluate the hydrocarbon prospectivity of the offshore areas. Multibeam sonars transmit sound waves at frequencies less than 100 hertz and record the reflected waves off the water-bottom. These returning sound waves would exhibit a monotonous seafloor signature and thus is used for bathymetric image reconstruction. However, the sound waves are back-scattered off the pockmarks or buildups on the seafloor which will alter the intensity of the returning sound waves. This data

after processing allows the identification of anomalous features that could be related to seepage of hydrocarbons. The resolution of the reconstructed images is good, being from 10-100 meters laterally, and less than 5 meters vertically.

Similarly, seafloor geochemical cores can be collected using a grid spacing pattern over the area of interest, and analyzed. Depending on the water depth and type of corer used for the purpose, core samples up to 30 meters or more may be retrieved.

The presence of near-surface migrated hydrocarbons can provide strong evidence on whether an active petroleum system is present, as well as critical information on source, maturity and migration pathways. Such work is being carried out in the Barents Sea, and integration of more such data with other types of data will help with the exploration work in the area. 

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War on Religion, or War on Science?

Creationist geologist sues over religious discrimination

By BARRY FRIEDMAN, EXPLORER Correspondent

This past April, after a three-year protracted argument with the U.S. National Park Service at the Grand Canyon over access to do his research, Australian geologist Andrew Snelling sued park administrators, as well as the Department of Interior, which oversees all national parks, for not allowing him to gather 50-60 rock samples from four locations.

Snelling is convinced these rocks will support his belief that a global flood approximately 4,300 years ago was responsible for rock layers and fossil deposits around the world.

If you're thinking, "Global flood...? He doesn't mean Noah and the ark, does he?"

Yes, he does, and that is the basis of his lawsuit: authorities dismissed his proposal only because he's a Christian – namely a young earth "creation scientist" who believes God created the Earth in six literal, 24-hour days a mere six millennia ago, and that the Grand Canyon was formed during Noah's flood.

While the theory is virtually universally dismissed by mainstream scientists, Snelling is unmoved, writing on his website, TrueOrigin.org:

"I am resolute in being available to the Lord to do His bidding as He directs, whatever the consequences, and even if we don't appear successful in the world's eyes. The Lord calls us to be faithful - the success is up to Him as He sees fit so that He gets all the glory."

Snelling has worked for Creation Science



KARLSTROM

"Unlike all valid science proposals, he assumed what the result would be ahead of time rather than test alternate ideas with new evidence."

Foundation and is director of research for Answers in Genesis as well as acting geologist for Ken Ham's Creation Museum.

However, he cannot be easily dismissed, as he has a doctorate in geology from the University of Sydney, so he has – on paper at least – the scientific chops to be taken seriously.

Basis for Rejection

This has become an uncomfortable moment for the nation's scientific gatekeepers.

On one hand, should any inquiry be discounted or disabused, no matter how outlandish? Isn't discovery, after all, the basis of all scientific work?

On the other, without discrimination, fatuous, sloppy and junk science will get the credibility its proponents crave if given an official imprimatur from such organizations.

One person involved in Snelling's 2013 peer review, which rejected his initial proposal (Snelling reworked his proposal

in 2016, which included more peer reviews and requested fewer samples, which was also denied) was Karl Karlstrom, professor of structural geology and tectonics at the University of New Mexico.

"Basically his (Snelling's) proposal to the park was not a valid science research and collecting proposal and the work he proposed to do did not have to be done in the Grand Canyon in any case. Based on peer review, including mine, the park science office decided appropriately to not issue a science permit," he said in an email.

Even more blunt were the comments of Peter Huntoon, emeritus professor of geology and geophysics, University of Wyoming, who was also involved in the peer review, and who brought the produce.

"At the time I flagged this proposal as junk science when asked to review it. End of story," he said.

However, Gary McCaleb, senior counsel at the Alliance Defending Freedom, who represents Snelling in the lawsuit, said, "The government isn't allowed to discriminate

against someone based on their viewpoint, and National Park officials have absolutely no legal justification in stopping a scientist from conducting research simply because they don't agree with his views."

Just Go to the Gift Store

Ken Wolgemuth, an adjunct professor of geoscience at the University of Tulsa, and an AAPG Member with more than 35 years' experience as a petroleum geologist, believes that the GCNP rejected Snelling's application strictly for scientific reasons – not religious discrimination.

His reason for thinking so?

Just go to the gift store.

There you'll find "The Grand Canyon, Monument to an Ancient Earth," written primarily by Christian scientists – including Wolgemuth as a co-author. The book tackles the very issues of Noah, the flood, and formation of the canyon ... and is available at the Canyon bookstore.

Of the book, Davis Young, a geologist and a Christian, wrote, "... they have utterly demolished the flood hypothesis with an avalanche of geologic evidence sufficient to fill a canyon."

Moreover, the GCNP does, in fact, allow Snelling to conduct river tours through the park in which he explains his theory that "catastrophic flooding" deposited the sediments, and then "catastrophic erosion"

Continued on next page

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Learn more at aapg.to/fs2017eclipse



The Grand Canyon has become ground-zero in a legal dispute that raises sticky questions about the balance between religious freedom and scientific rigor. Photo by Tim Helble.

Continued from previous page

after Noah's flood formed the Grand Canyon.

Neither Snelling nor park officials will comment because of the lawsuit, but it is known that officials did make two additional requests on Snelling between his first and second proposal: that he provide GPS coordinates from where he wanted to remove the rocks, and he consider finding another place entirely.

The suggestion that he should provide the park with GPS coordinates infuriated Snelling.

"The park has routinely authorized applications proposing far more aggressive sampling without the demand that the researchers first conduct an independent trip to locate each sampling site with specific GPS data," said Snelling in his complaint.

Karlstrom simply saw protocol.

"It is routine (not out of line) for the Park science office to request specific GPS coordinates for proposed sampling. We go through this each year for sampling we do in remote areas and the Snelling request was for sampling on a heavily visited area along the river corridor. He apparently goes down the river more than once a year on non-science trips, so I don't see why he would have trouble specifying the exact sample locations," he said.

Specifically, Karlstrom, who has had his own proposals rejected during similar peer reviews, said he believes Snelling is being disingenuous.

"Snelling has proposed to show that monoclines of the Grand Canyon and Colorado Plateau formed when the sediments were still soft (unlithified). Hence, unlike all valid science proposals, he assumed what the result would be ahead of time rather than test alternate ideas with new evidence," he explained.

"The faith-driven motivation involved in his thinking is that all the Paleozoic rocks in Grand Canyon formed during Noah's flood in the last few thousand years, hence any folds of those layers would have to have formed during the flood, too. But these folds exist all across the Colorado Plateau and if he was really interested in studying folding mechanisms and timing (valid research topics), there are better examples to study in numerous locations such that sampling the hard-to-get-to ones in Grand Canyon is not needed," he elaborated.

Not a 'Frivolous Lawsuit'

For his part, Karlstrom wants to emphasize his reasons for rejecting Snelling's application.

"I did not recommend rejection of

Snelling's efforts based on his Creationism (his brand of Christianity). In our country people are entitled to believe in any creation myth or religion they want to. I recommended rejection because the proposal was not a valid science proposal commensurate with standards for formal science research," he said.

From boaters to environmentalists to Native American tribes to mining concerns, national parks get sued all the time, so there's nothing particularly unique about this one, except that Karlstrom fears the baggage attached to it.




Snelling

"To a non-lawyer, this lawsuit from a legal standpoint seems frivolous and harassing to an underfunded, understaffed park under stress from virtually every viewpoint – all while trying to handle record numbers of visitors with declining budgets," he said.

"However, in reality this lawsuit is not frivolous: it is part of a well-planned and persistent effort by well-financed groups to undermine science by blurring the distinction between religion and science, and hiding this intent under a superficial, insidious claim of 'equal access,' 'welcome all viewpoints', etc. sort of claim."

Another wrinkle – and this, somewhat remarkably, is cited in Snelling's lawsuit – is President Trump's executive order of May 4 of this year stating "all executive departments and agencies shall, to the greatest extent practicable and to the extent of permitted law, respect and protect the freedom of persons and organizations to engage in religious and political speech."

All of this worries Karlstrom.

"Are we heading back into another Dark Ages?" he asked, adding, "I believe that AAPG has an increasingly important role to play in discussions of science and religion and politics." 

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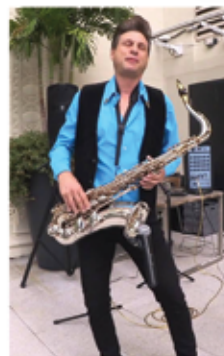
Steve Wyatt,
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Financial, Sunday's Opening
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Oil and Gas Technology
Center, Oklahoma City;
Monday Afternoon's
Energy Forum



Steven Agee, Ph.D.
Dean and Professor of
Economics, Meinders School of
Business, Oklahoma City
University; Tuesday
Afternoon's Energy Forum



'The Next 100 Years of Global Energy Use' Presentations Available Online

There was a lot going on at the 100th anniversary Annual Convention and Exhibition (ACE) in Houston earlier this year, but one of the stand-out events was a forum by AAPG's Division of Environmental Geosciences and the Energy Minerals Division: "The Next 100 Years of Global Energy Use: Resources, Impacts and Economics."

The forum was to celebrate the 100th anniversary of the founding of AAPG and to address the future challenges of the oil and gas industry to supply the world's increasing energy needs without compromising global environmental concerns with continued use of fossil fuels.

And, it was packed, since it featured half a dozen rock stars and luminaries from the energy industry and academia.

The panel included the following presentations:

- ▶ Part 1: Energy Security and Energy Poverty, by Scott W. Tinker, director of the Bureau of Economic Geology, past AAPG president and founder of the Switch Energy Project

- ▶ Part 2: Global Population, Energy Demand, and Future Technology, by Steven E. Koonin, professor of Information and director of the NYU Center for Urban Science and Progress


- ▶ Part 3 Outlook: 2120 – Global Petroleum Resources and Transportation Fuel Options, by Cindy Yeilding, senior vice president of BP America

- ▶ Part 4: The Global Power Fuel Mix and Carbon Transition, by Mark A. Snell, president of Sempra Energy

- ▶ Part 5: Density, Key to Fake and True News about Energy and Environment, by Jesse H. Ausubel, director of the Program for the Human Environment and senior research associate at Rockefeller University

- ▶ Part 6: The Grand Energy Challenge: Energy Diversity and Economic Realities, by Kenneth B. Medlock III, senior director of the Center for Energy Studies at the Baker Institute for Public Policy of Rice University

It was one of those events that attendees talk about for years to come and people who didn't attend regret missing for just as long.

Well, there's good news for both groups: all of the content from those presentations is available online at <http://aapg.to/next100sd>. 

PROTRACKS



Crawfish Boil Serves Up More Than Food

CLIFF MAURONER, Southwest Section YP


The Dallas Geological Society (DGS) hosted its 18th Annual Crawfish Boil this year on April 20 at Winfrey Point on Dallas' White Rock Lake.

Attendees from all over north and east Texas were treated to a night of great food, live music and networking with industry colleagues. In total, there were nearly 250 attendees at the event with sponsorship support provided by 30 local companies and organizations. These sponsors helped offset the cost of the event along with providing raffle gifts, a lively photo booth, live music from a local five-piece jazz band to set the evening's tone, and even hand-rolled cigars.

The level of support for this year's event shows that Dallas/Fort Worth-area companies have a positive outlook for 2017 and beyond.

Not only is the crawfish boil one of the marquee events on the DGS calendar each year, it also stands out as the seminal event planned by young professionals and driven by student volunteers. Some of our sponsorship came from individual YP contributors and volunteers from Southern Methodist University's and University of Texas-Dallas' GeoClubs helped ensure the event ran smoothly.

The AAPG Southwest Section YP group provided additional sponsorship of the event, which went to cover the cost of the live music, keeping the positive energy going through the night. More importantly, however, the generous contribution enabled and encouraged the attendance of students and unemployed recent graduates in the area who otherwise might not have attended. Such events are beneficial to AAPG YPs and prospective YP SIG and Association members alike. They provide a forum not only for students seeking advice on career paths, for recent graduates looking to build their professional networks, and for mentors of AAPG student chapters to meet and interact with established members of the local geological community, but also for promoting the local geological society, AAPG, and the YP SIG.

Thankfully, the unpredictable Dallas spring weather cooperated, offering perfect conditions for taking in a sunset view of the downtown skyline. All in all, it was another successful crawfish boil with a positive turnout signaling brighter times ahead for the oil and gas industry in Dallas/Fort Worth area. 

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COMMENTARY

Debating Trump's Regulatory 'Twofer'

By LEANNE BURNETT

At the end of January, President Trump rolled out a 2-for-1 Executive Order 13771 (EO), "Reducing Regulation and Controlling Regulatory Costs."

The EO claims a twofold purpose: eliminate two existing regulations for each newly enacted regulation and keep total incremental costs of all new and repealed regulations in fiscal year 2017 less than zero dollars.

Reduce federal regulations and cut costs? Sounds great!

Who can't get behind efficiency and economy in the regulatory state – especially in today's oil and gas industry, where every bit of profit makes a difference?

Well, the devil is in the details.

Point-Counterpoint

The idea was immediately dubbed by some as "ridiculous."

Public Citizen Inc. promptly filed a lawsuit against Donald Trump (Case No. 1:17-ev-00253, United States District Court for the District of Columbia) challenging the EO as facially arbitrary, capricious and an abuse of discretion.

Others highly favored the EO.

Fourteen States filed an *amici curiae* brief in the lawsuit supporting the EO, pointing out that numerous presidents, Democratic and Republican alike, issued executive orders seeking to reduce the number of federal regulations and the overall regulatory burden. Proponents maintain the notion of eliminating one or more existing regulations for each new regulation in order to reduce costs is nothing new. The Netherlands, Canada, Australia and the United Kingdom have all previously enacted similar policies. The UK currently has a three-for-one policy.

In counterpoint, the Union of Concerned Scientists filed another *amicus* brief in support of Public Citizen Inc. and challenging the EO.

One paragraph from the brief pretty much summarizes their argument:

"It is important to note, as Executive Order 13771 acknowledges, that agencies are already required, where not prohibited by law, to ensure that the benefits of regulations exceed their costs. Thus, the only impact of the Executive Order is to prohibit agencies from promulgating regulations whose benefits exceed their costs, unless they eliminate two other regulations whose benefits also exceed their costs. This is the definition of unreasoned decision-making. It is also a thumb in the eye of Congress, which enacted public health and environmental statutes in order to benefit the public."

Opponents argue the EO is not about regulatory reform, but a transparent attempt to halt environmental regulation in its tracks without regard to the benefit those regulations provide. This order is a cost-only analysis – by definition, an approach that ignores the public benefits of the underlying statutes. Thus, the "savings clause" cannot save the EO, because there is nothing left to save.

Proponents extol the EO's savings clause that says no existing regulations can be repealed where prohibited by law.

Therefore, regulations expressly required by law without the consideration of costs cannot be repealed pursuant to the EO. Opponents provide a brief regulatory law primer: Existing regulations are established law!

The details of the EO are still vague.

The reduction of regulation is tied to controlling costs, and excludes many regulations, including: those concerning "a military, national security, or foreign affairs function of the United States;" regulations related to an agency's organization, management or personnel; or "other category of regulations exempted by the Director."



BURNETT

LeAnne Burnett is an attorney at Crowe & Dunlevy, where she is the co-chair of the Energy, Environment and Natural Resources practice group.

Unanswered Questions

In a working paper, "Implementing a Two-for-One Regulatory Requirement in the U.S." (Dec. 7, 2016), by Marcus Peacock, a research professor at George Washington University's Regulatory Studies Center, Peacock states that the EO's approach raises a number of issues, including:

- ▶ The definition of a "new" regulation
- ▶ How to measure offsets
- ▶ Regulatory workload
- ▶ Enforcement challenges
- ▶ Survivability in future administrations

Certainly the two-for-one policy presents administrative and procedural challenges.

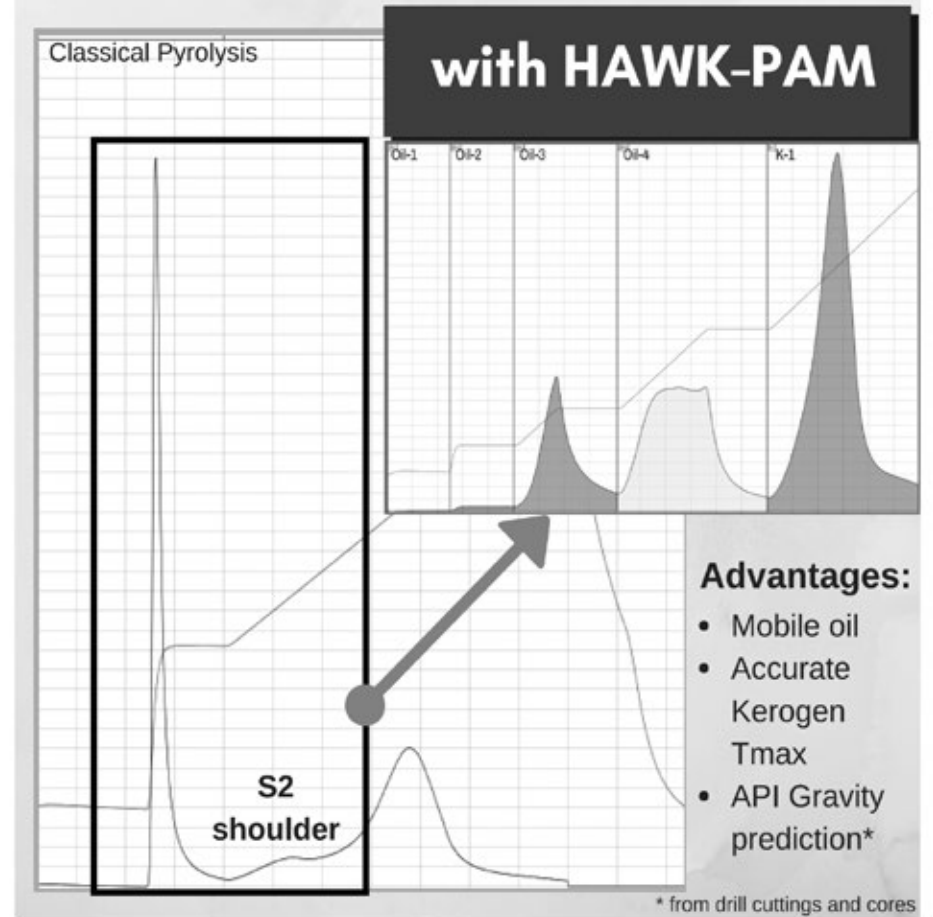
There is the sticky problem of estimating costs, as the EO is intended to address total opportunity costs (opportunities foregone by society as a whole: workers, businesses, consumers, households, etc.), and not simply business compliance costs. In addition, the repeal of existing regulations must be done in accordance with the Administrative Procedures Act, which itself can be time consuming and costly.

Some speculate that regulation reduction might result in regulations that are longer and more complex. The more elements attached to a proposed regulation, the less likely it is to succeed in the review process and come out as law. Consider regulations in the context of aerodynamics: smooth of purpose, efficient in flight, and they will eventually become law. If the engineers start attaching all sorts of external elements, weight and drag will slow flight and the craft is more apt to crash.

A smaller, more efficient regulatory state is a laudable goal. This EO, like many others in this administration, has already resulted in less efficiency and more litigation. We'll have to wait and see how this EO holds up after court scrutiny.

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Announcing Weeks and MSVP Recipients

By AUDREY CORTE and KATIE McELHANEY, AAPG Program Team Coordinators

The AAPG Foundation recently announced the awarding of more than \$100,000 to undergraduate students, geoscience student-led groups and seven military veterans, all part of its initiative of supporting geoscience education.

Specifically, the awards were presented through the Foundation's L. Austin Weeks Undergraduate Grant and the Deana and Paul Strunk Military Veterans Scholarship programs.

Providing funds annually for geoscience education around the world is a significant part of the Foundation's mission, especially those that "directly and indirectly benefit the geologic profession and the general public."

L. Austin Weeks Undergraduate Grant Program

The Foundation's L. Austin Weeks Undergraduate Grant Program provides \$500 grants to geoscience students and local student-led groups – typically, student chapters and similar organizations – that are intended to support their "educational endeavors," including tuition.

The grants also are intended to help students gain access to "important experience via field trips, field work, field equipment and professional society attendance to support their education."

It also demonstrates "the importance of professional society involvement in their careers."



The Suez University AAPG Student Chapter was one of the recipients of this year's L. Austin Weeks Undergraduate Grant.

Ron Nelson heads the committee tasked with determining the awardees, which this year received nearly 300 applicants.

The end result: LAW awarded \$85,000 to 170 students and student organizations around the world.

A complete list of LAW recipients can be found on the Foundation website, at foundation.aapg.org/students.

Deana and Paul Strunk Military Veterans Scholarship Program

Now in its third year of existence, the Deana and Paul Strunk Military Veterans Scholarship Program promotes education and career opportunities for veterans who are transitioning to a career in the

geosciences.

The MSVP Committee, headed by Heather Anderson, this year awarded a total of \$20,000 to six full-time and one part-time students.

They are:

- ▶ Nicholas Ferry, E-4, U.S. Marine Corps (Northern Illinois University)
- ▶ Nicholas Shaw, E-4, U.S. Army (Western Michigan University)
- ▶ Margarita Wilhelm, E-5, U.S. Army (Texas A&M-Kingsville, Texas)
- ▶ Matthew Brice, E-5, U.S. Army (University of Texas at San Antonio)
- ▶ Ryan Rea, E-7, U.S. Navy (North Carolina State University)
- ▶ Jahleel Stone, E-4, U.S. Air Force (University of South Carolina)

▶ Roberta Thompson, E-8, U.S. Air Force (University of Tulsa)

* * *

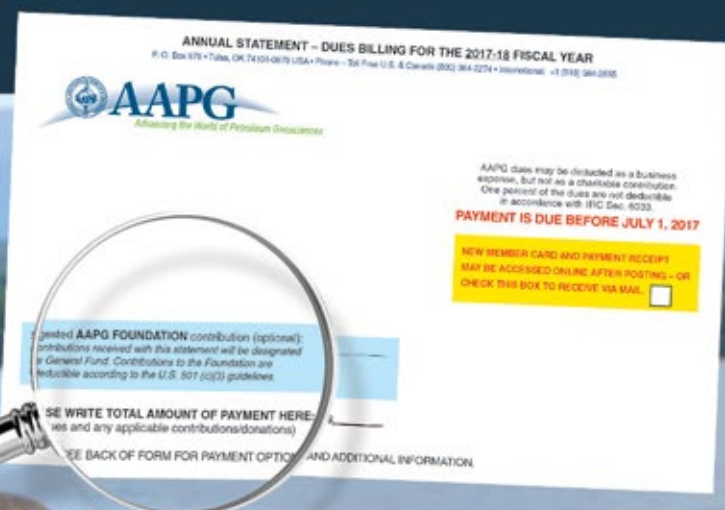
The Foundation funds that make both of the above programs possible were started by the generosity of people such as L. Austin Weeks, Marta Weeks-Wulf and Deana and Paul Strunk – but they continue through the contributions of many others who also want to help ensure the future of geoscience education.

For more information on the programs or how to contribute to the funds, visit the Foundation website at foundation.aapg.org.

(Editor's note: Also contributing to this report was Tamra Campbell, AAPG Administration Team coordinator.)

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Jonathan E. Funk
*Norman H. Foster
Memorial Grant*

Randi S. Martinsen
Vincent Matthews, III, PhD
Peter G. Moreland
*Ohio Geological Society
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James McDonald
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Memorial Grant*

Teresa E. Jordan
*Robert K. Goldhammer Memorial
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Arthur C. Mullenax
Nick B. Pollard
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Donna S. Anderson
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In memory of Ruth Weimer

Randi S. Martinsen
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In memory of Ruth Weimer

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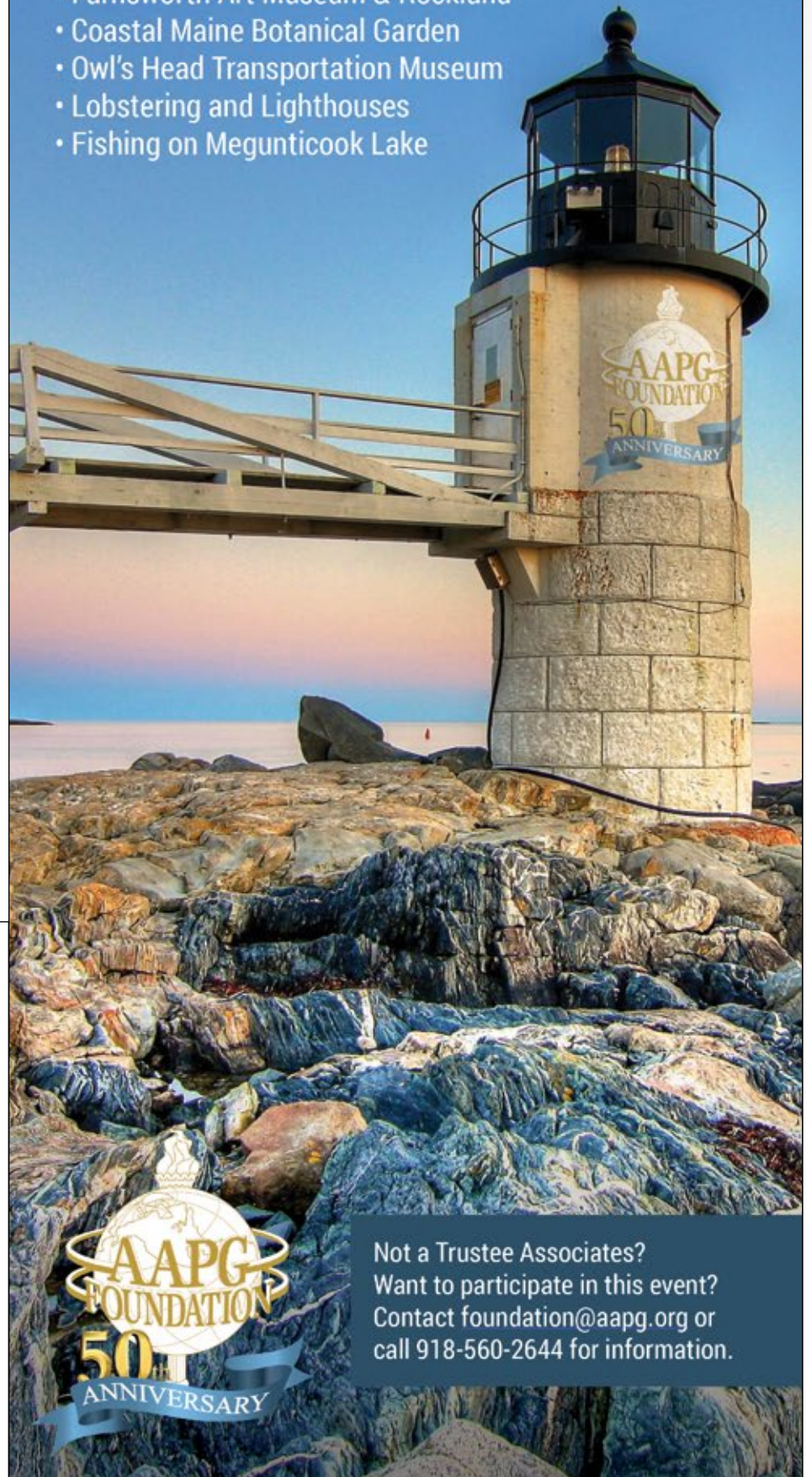
—Bev and David Worthington



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Mike Bidgood, GSS Geoscience
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- 3 **Advanced Sequence Stratigraphy for E&P Professionals (SEPM)**
Vitor Abreu, Abreu Consulting and Training
Howard Harper, SEPM
- 4 **Basin and Petroleum System Modeling in Conventional and Unconventional Petroleum Exploration (AAPG)**
Ken Peters, Schlumberger and Stanford University
Noelle Schoellkopf, Schlumberger Software Integrated Solutions
- 5 **Fundamentals of Salt Tectonics (AAPG)**
Mark Rowan, Rowan Consulting
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One of the men in this photo needs no introduction; the other is Ronald Reagan, the 40th President of the United States.

AAPG Giant Marlan Downey Passes

By BRIAN ERVIN, EXPLORER Managing Editor

The Association has lost one of its legends with the recent passing of Marlan W. Downey.

He died peacefully on Memorial Day, May 29, in Dallas at the age of 85, surrounded by his wife, Marea, and their six children. He was laid to rest on June 1 in Dallas and a celebration of his life was held on June 24.

He was elected president of AAPG in 2000 and received AAPG's highest honor, the Sidney Powers Medal, in 2009.

Along with the enduring impact he made in petroleum geology and within the Association, Downey was a man who made a lasting and positive impression on everyone he encountered.

In the words of some of those who knew him best:

"AAPG has lost one of our finest. I had the great benefit of knowing Marlan since I was a toddler," said past AAPG President Scott Tinker.

"He was a man of few words; but when he spoke, we all listened! Marlan was not free with his praise, so if it came, it really meant something. After my term as AAPG president, Marlan wrote a two-sentence email to me. It is a treasured sentiment that I will hold onto for life. I will miss him dearly," Tinker added.

"Serving with Marlan on the AAPG Executive Committee was one of the best

experiences of my volunteer life," said Robbie Gries, who before she became AAPG's first woman president served as president-elect during Downey's presidency. "His management model and astuteness regarding business were things I tried to retain. Plus, he was just a very kind person."

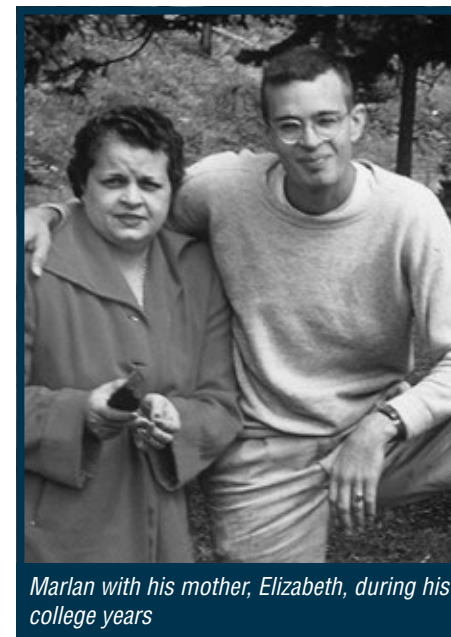
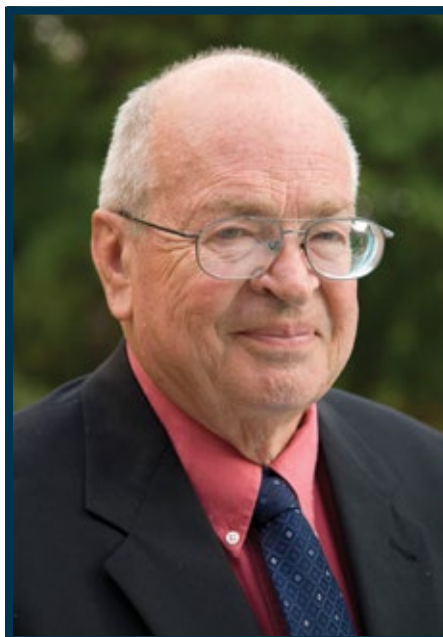
"Marlan, indeed, was an amazing guy; quite appropriate that he received the Powers Medal in 2009," said past AAPG President Paul Weimer.

Andrew Hurst, AAPG Member and chair of production geoscience at the University of Aberdeen, related how he met Downey 20 years ago when he was part of a group from the University of Oklahoma visiting the University of Aberdeen on an academic mission.

"That visit and a return visit to Dallas and Norman a few months later became the seed for a lively and always enlightening professional relationship and, a close personal friendship," said Hurst. "I have no idea what Marlan saw in me but his care and mentoring surely made me a better professional and a better man."

"I will forever miss 'Well pardner, you may like to think about that from another perspective ...' and 'Why don't you write something about exploration risk, Andy?'"

Continued on next page



Marlan with his mother, Elizabeth, during his college years

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Continued from previous page


I am confident that people will find your thinking interesting," he added. "Marlan and I shared thoughts and ideas freely and I suspect that it will be challenging to find a similar relationship elsewhere. What a great man and what a privilege to have his friendship."

Downey was born in Falls City, Neb. on Oct. 2, 1931, where he grew up.

Upon graduating Peru State College with a degree in chemistry, he was inducted into the U.S. Army and served in an artillery unit during the Korean War.

After two years in the Army and an

honorable discharge, Downey earned a master's in geology from the University of Nebraska.

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, 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 remained active, serving on three oil company boards, chairing Roxanna Oil and actively consulting around the world. 

IN MEMORY

- John Avila, 92
Russell, Ky., July 8, 2016
- D. Robert Brogdon, 85
Houston, Texas, Dec. 9, 2016
- Rodger Espy Denison, 83
Dallas, Texas, July 8, 2016
- Guillermo Houghton, 70
Loveland, Colo., March 18, 2017
- Earl Edward Gaertner, 56
Fredericksburg, Texas, April 27, 2017
- Raymond James Kirker, 90
Calgary, Canada, May 2, 2017
- Elizabeth H. Gierlowski-Kordes, 59
Athens, Ohio, May 17, 2016
- Madhurendu Bhushan Kumar, 75
Baton Rouge, La., Feb. 2, 2017
- Eugene Lipstate, 88
Lafayette, La., Feb. 19, 2016
- Robert McReynolds, 90
Dallas, Texas, Feb. 19, 2017
- Walter Charles Miller, 88
Santa Rosa, Calif., Dec. 15, 2016

- Russell Howard Nordwell, 90
Westborough, Mass., Aug. 25, 2016
- Noel D. Rietman, 83
Santa Fe, N.M., March 4, 2017
- Theodore Dwight Sheldon, 86
Cherry Hills Village, Colo., Jan. 8, 2017
- Clifford H. Sherrod, Jr., 87
Midland, Texas, Feb. 21, 2017
- Ray S. Sugiura, 71
Fountain Valley, Calif., Jan. 30, 2017
- Lawrence Van Ingen, 63
Durango, Colo., Nov. 30, 2016

(Editor's note: "In Memory" listings are based on information received from the AAPG membership department. Age at time of death, when known, is listed. When the member's date of death is unavailable, the person's membership classification and anniversary date are listed.)

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Let Your Life Be in Harmony with Your Words

By DAVID CURTISS

AAPG is about community, and it has been since our founding Members gathered together in Tulsa, Oklahoma more than 100 years ago.

Gathering together is an important way that we build the AAPG community. The marvels of modern communication – email, social media, and the like – certainly make it easier to stay in touch. But nothing replaces getting together to meet, to talk and to build relationships, friendships, and trust.

In fact, while the reason we get together is to talk about science and how best to discover and develop oil and natural gas resources, when you look just below the surface, the reason AAPG was formed was to build professional relationships and connections. In a business like ours, there are few enterprises more important than establishing trust. And AAPG's commitment to integrity and professionalism is why we're structured as a professional association, not simply as a scientific society.

Integrity is "the quality of being honest and having strong moral principles; moral uprightness" or "the state of being whole and undivided." The value of integrity in relationships has been known for millennia.

Writing to a young man named Lucilius in ancient Rome, the Stoic philosopher Seneca the Younger observed, "... it exacts of every man that he should live according to his own standards, that his life should not be out of harmony with his



CURTISS

It's about community here at AAPG. It always has been.

words, and that, further, his inner life should be of one hue and not out of harmony with all his activities. This, I say, is the highest duty and the highest proof of wisdom – that deed and word should be in accord ..."

The title of this letter – one of 124 that Seneca wrote to Lucilius – is "On Practicing What You Preach." And his admonition to Lucilius is to evaluate how his words and actions measure up. It's easy to be a talker, far more difficult to be a doer.

Opportunities for Community

In terms of AAPG members gathering in community, this has some important implications.

First, we place a premium on scientific integrity. At AAPG meetings, our members and other professionals share their best understanding of the science underlying a particular topic, play or prospect. Those listening in the audience expect that the speaker's work is their own and that data and concepts first presented by others are

duly acknowledged.

Second, all of our attendees at an AAPG event can expect that they are entering a professional environment, one that is safe and conducive to learning, the exchange of ideas and fostering relationships built on trust. AAPG does not discriminate on the basis of gender, race, color, creed or sexual orientation; all are welcome to engage at our meetings. This diversity actually strengthens our community.

As a professional association it is our responsibility – both individually and corporately – to uphold the values and model the behaviors conducive to accomplishing our strategic goal of advancing the science of petroleum geology. We need to do so in session rooms and on the exhibition hall floor, and we need to do so when we are visiting socially, in receptions in the convention hotel or at an offsite location.

As professionals, even when it's off the clock, we need to conduct ourselves in a professional manner. This is what Seneca

is talking about – aligning our words and actions.

Over the next several months we will have some spectacular opportunities to gather as a community of geoscientists and discuss our science and profession:

▶ Later this month we'll be joining SPE and SEG for the 5th edition of the Unconventional Resources and Technology Conference in Austin, Texas.

▶ In August the Summer NAPE show in Houston will showcase prospects and deals from across the United States and beyond.

▶ Many of AAPG's Sections will have their annual meetings in the months of September and October.

▶ AAPG is headed to London in mid-October for the International Conference and Exhibition, where a global organizing committee has developed a showcase event for you.

It's about community here at AAPG. It always has been.

Won't you join us at one of these events?

Share your knowledge, build friendships and professional relationships, model professionalism and help us forge a culture that is welcoming, safe, productive and where we practice what we preach.

DIVISIONS REPORT: DPA

Changing of the Guard

By JIM HILL, DPA President

This is my first article in the Explorer as president of the Division of Professional Affairs and I hope it conveys my deep appreciation to the membership for placing your trust and confidence in my abilities to assume this important office.

First, I must acknowledge the exemplary contributions of the outgoing President Chandler Wilhelm and Past President Mike Canich, whose efforts during this past year have greatly contributed to the Division. Their hard work, along with that of many devoted volunteers, resulted in a very successful year that included DPA events at the Annual Convention and Exhibition in Houston and Playmaker forums in Midland and Oklahoma City.

'Provisional Member' Status

A new president is asked to state what the "theme" of his presidency will be.

I have truly never had a theme to think about before, except for maybe survival during the hard times, so I put some thought into the concept.

What will have a significant impact on the DPA and advance the continuing health of the organization?

After attending several section meetings and talking with many people, it became clear.

The DPA now has more than 2,300 members worldwide with over 93 percent more than 50 years of age. The loss due to retirement in the next 5-10 years



HILL

The new category of "Provisional Member" is for those young professionals that meet all the requirements for certification except for the years of experience.

will be critical and life threatening to the organization.

It has, therefore, become obvious to me that we need to engage early-career professionals and provide them with a membership class that would allow them to become part of the DPA earlier than the currently required eight years of professional experience. To meet this objective, the Board has drafted and approved changes to the bylaws to create a new DPA membership status aimed at recruiting early-career professionals.

The new category of "Provisional Member" is for those young professionals that meet all the requirements for certification except for the years of experience. Although this is neither a certified nor a voting class, the Provisional class does provide the same level of discounts or free access to events, website content, publications, Playmaker and Discovery Thinking forums as full-certified Member status. It also attempts to provide an increased

level of career planning by providing access to mentors to help guide personal development paths and provide career advice.

Provisional members will have access to the membership directory and can serve on committees and attend meetings at the discretion of the president, where their contributions will be welcomed.

Applications for this new member status will soon be available on the website and I encourage all who meet the requirements to join and become familiar with all that the DPA has to offer its members and the AAPG as a whole.

Membership Benefits

It has long been asked what value DPA membership and certification bring to its members?

Certification by your peers that you are technically competent and follow a code of ethics and is of great value, as it has certainly been for me over the years.

However, in my case, the additional

opportunity to network and have regular contact with my peers around the world has had a great impact. Before the Internet, being a geologist in California did not build a large knowledge base in the state of Texas. When I was contracted to work a project in Texas, it was important to get up to speed as fast and as cheaply as possible. Where do you acquire logs, histories, geologic data, seismic information as well as a good base map from which to work?

Being a member of the DPA was the answer. After I called one of our members, I had a list of available resources and even some invaluable regional and local information on what was going on in the play.

The contacts that can be made as a member of the Division can be priceless. My participation in the DPA-sponsored Congressional Visit Days has continued to expand my contacts to Washington, D.C., and beyond. Walking the halls of the U.S. Capitol and speaking with Congress members and staff has convinced me that we as geoscientists can directly affect the decisions our government makes for the better of the country. Don't just complain – get involved and make a difference.

Like any organization, the effort someone contributes to making things happen will have a positive return, sometimes for a lifetime. This is your chance to become involved and maybe better your professional career. Join the DPA! It has worked for me and I am sure it will for you as well.

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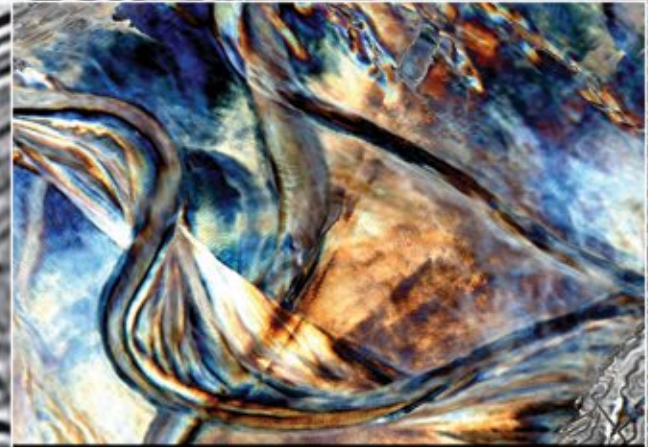
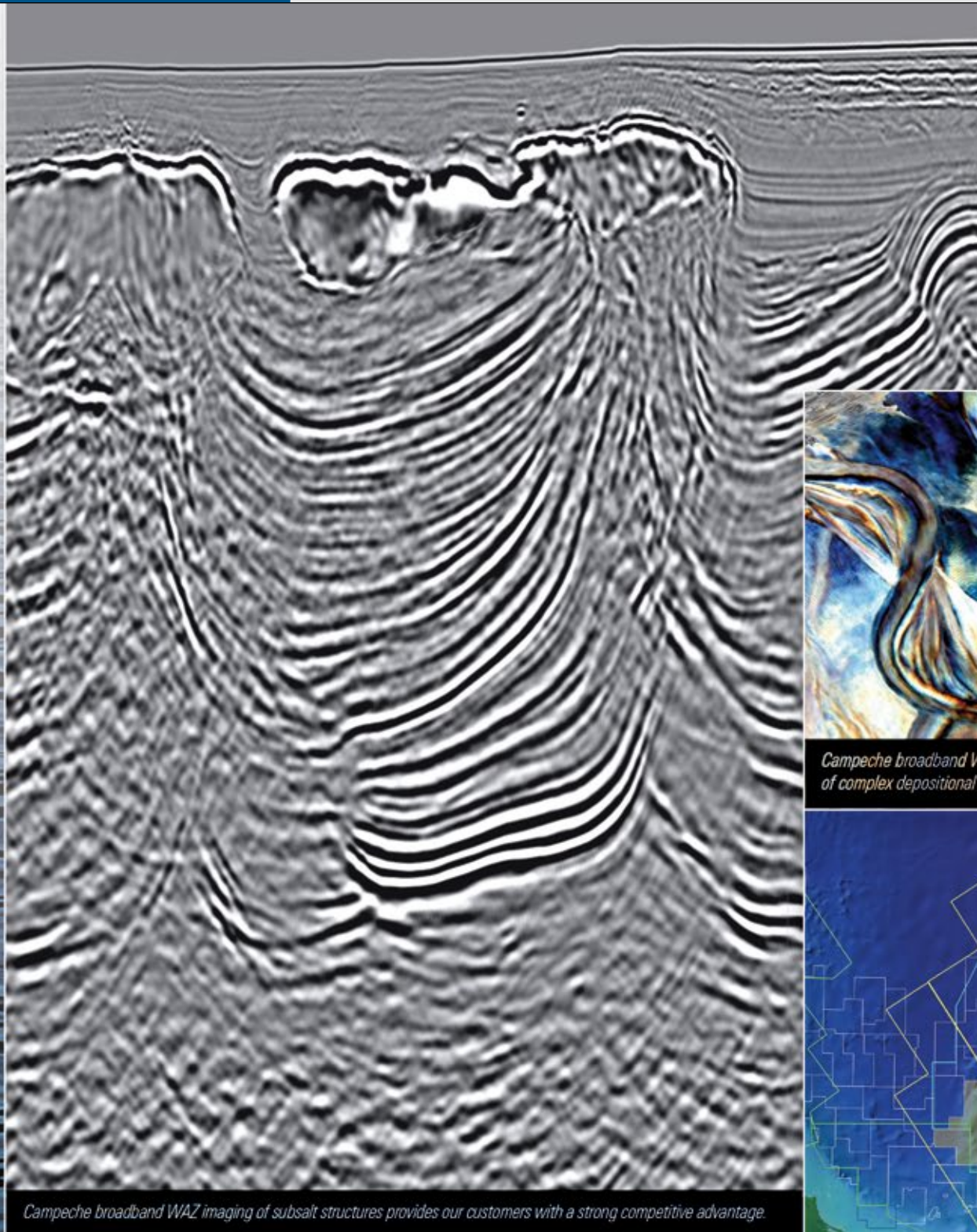


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