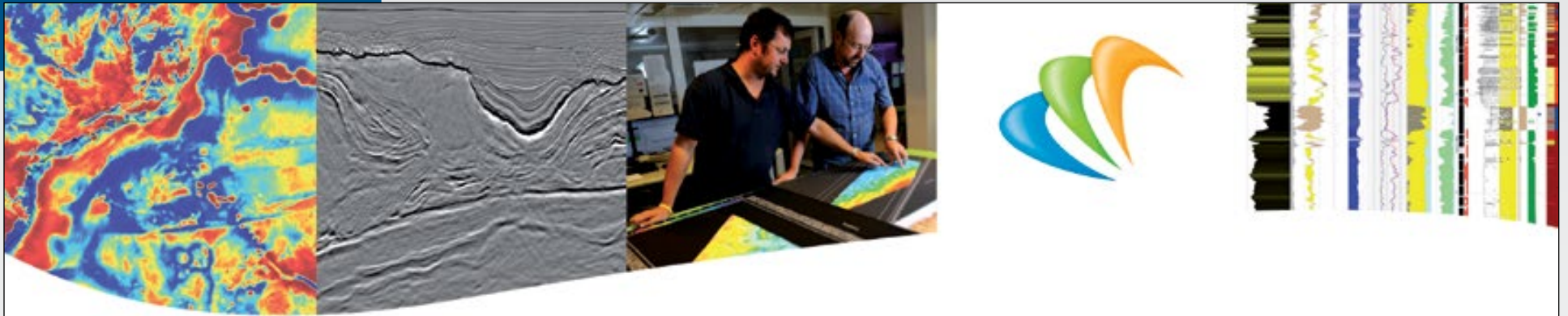


EXPLORER



Ending Global Energy Poverty

See page 6.



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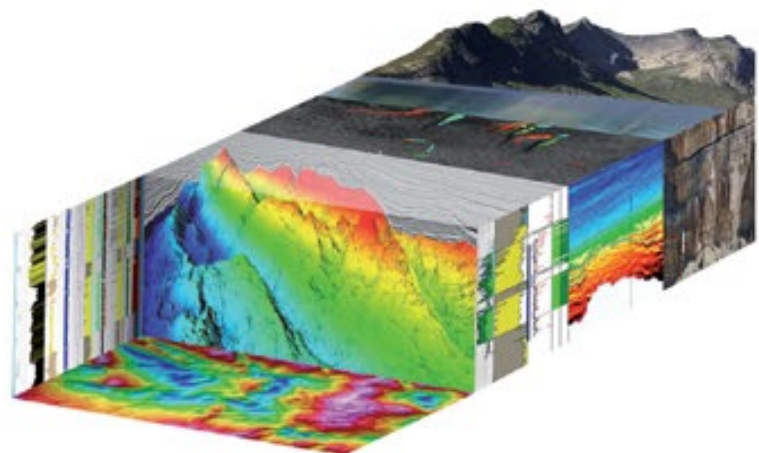
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PRESIDENT'S COLUMN

100 More Years of Science Fueling the Next 100 Years of Prosperity

BY CHARLES STERNBACH

This month, AAPG will hold our International Conference and Exhibition (ICE) in the ExCel center in London, England. The theme of the event is "100 Years of Science Fueled by 100 Years of Prosperity."

Kudos to the London ICE organizers for an outstanding program!

One session in particular I recommend attendees mark on their calendar is the Discovery Thinking Forum which will be held on Monday afternoon, Oct. 16, in the conference center Capital Suite. I will be at my usual podium spot co-chairing the forum along with past AAPG President Paul Weimer and past AAPG European Region President Jonathan Craig.

Discovery Thinking Forums began in 2007 and I have spoken about them before. It was a program initiative created by the 100th Anniversary Committee that featured geo-discoverers telling stories about finding new fields or creating new play concepts.

During Discovery Thinking in London, we plan to feature four game-changing play discoveries (see article on page # for the full story). In addition, I plan to feature several brief representative vignettes of previous presentations spotlighting valuable exploration lessons. In the decade since inception, 19 Discovery Thinking Forums have been hosted at both Annual Convention and Exhibition (ACE) and ICE events. More than 100 speakers and their co-authors have presented discoveries they know well commonly to standing room only audiences. We owe these "100 who made a difference" heartfelt gratitude as we celebrate the AAPG centenary. They have generously gifted us with hard won and costly insights leading to significant discoveries. We pay tribute to the 115 men and women who have participated in these Discovery Thinking forums.

I was inspired by meeting the renowned



STERNBACH

AAPG is dedicated to providing valuable geoscience and professional content to fuel prosperity in AAPG's second century

geologist Hans Ronnevik at the 2014 Discovery Thinking Forum. He talked about the process leading to the 2010 discovery of the giant Johan Sverdrup Field on the Utsira high, in the central part of the Norwegian North Sea. The Norwegian North Sea was considered exhausted after more than 40 years of disappointing exploration drilling before Ronnevik's team re-assessed the area. Reserves would become 1.7-3.0 billion barrels of oil. The discovery was the result of a breakthrough of systematic geoscience integration that made use of improved broadband seismic data. I encourage

people to see Hans Ronnevik's 2014 talk and that of his colleague Arild Jorstad in 2012 in the AAPG Discovery Thinking Video Vault. The discovery methodology is also published in AAPG Memoir 113 "Giant Fields of the Decade 2000-2010" edited by myself and Robert Merrill.

Bob Merrill and I are already working on a proposed 2010-2020 AAPG Memoir of Giant Fields. Let us know if you have a giant field discovered in that timeline you'd like to write about! It is fun to see the sequence of giant fields unfold over the past century of AAPG. It is clear to me that AAPG and other

professional societies have played a major role in the technology transfer that continues to fuel global prosperity.

What's Next?

We are presently working out details for the two-day Global Super Basin Leadership Conference previously announced for Feb. 28-March 2, 2018 at the Hilton America Hotel in Houston. This new conference will share best practices on energy, economics and the environment.

AAPG is dedicated to providing valuable geoscience and professional content to fuel prosperity in AAPG's second century, through both publications and events. Since 2010 there has been a technology-led energy renaissance to revisit the world's most richly endowed super basins. David Gee of Boston Consulting Group will present how

[See President, page 15](#)

Message to Hurricane-Affected Members

AAPG Members in Houston, Miami and other cities and towns along the Gulf Coast and Caribbean have endured a harrowing and disruptive experience over the past weeks. Our thoughts and concerns are with them and their neighbors as they continue to deal with the devastating and potentially life-changing impact of Hurricanes Harvey, Irma and Maria.

As all AAPG Members know, Houston is both an important location for the energy industry as well as an important part of the AAPG family. With 5,330 members, the Houston Geological

Society is AAPG's largest affiliated society – comprising 18 percent of our total membership. AAPG's regional presence is even broader when adding the other areas impacted by the storm, with 7,267 members in the Gulf Coast Section. We all have colleagues and friends who are based there – often very good friends we've known for decades – and watching the images of the destruction caused by this storm has been horrifying.

For the people of this region the pain and suffering is real. As Texas Gov. Greg Abbott said of what's yet to come, "We need to recognize it will be a new

normal – a new and different normal for this entire region."

But Texas is resilient; Florida is resilient; and the Gulf coast is resilient. The process of recovery is already underway, and I encourage you to find ways to help and support the recovery of this region that is so vitally important to our industry and profession.

As a global community of petroleum geologists, AAPG stands with the people of the Gulf Coast and the Caribbean.

*Charles A. Sternbach
AAPG President 2017-18*

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TABLE of CONTENTS

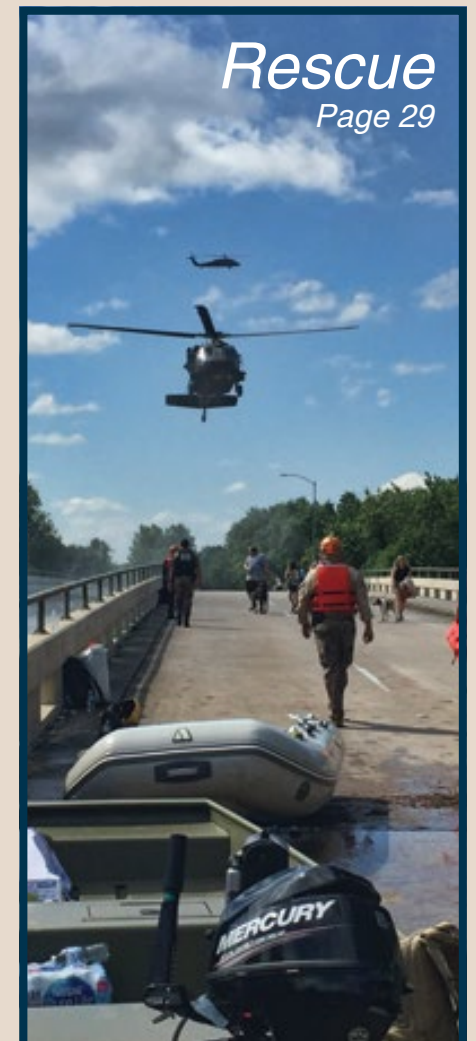
- 6** The Next 100 Years: The energy industry has an important role to play in raising the **quality of life of the more than one billion people in the world who suffer under energy poverty.**
- 10** **Hurricane Harvey and the Oil Market:** What are the implications of having so much of the nation's **oil and gas infrastructure** concentrated in **Houston?**
- 14** Geology of a Storm: a look at what happened before, during and in the aftermath of **Hurricane Harvey.**
- 24** According to a presenter at this month's International Conference and Exhibition (ICE), **offshore Somalia** is one of the last remaining frontier **continental margins for oil exploration.**
- 25** Energy and Opportunity: the **Discovery Thinking Forum** at this year's ICE is as much about future opportunity as past successes.

REGULAR DEPARTMENTS

- Historical Highlights 20
- Geophysical Corner 22
- Foundation Update..... 30
- Classified Ads 32
- In Memory 33
- Director's Corner 34
- Divisions Report (DPA) 34

ON THE COVER:

Approximately one billion people in the world lack access to electricity and other energy resources, which experts hope to alleviate by 2030. This image from the NASA-NOAA Suomi-NPP satellite shows many of those energy-impooverished areas, which are indistinguishable from unpopulated areas.



Rescue
Page 29

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Past AAPG President Eddie David speaks at the latest fundraising dinner.

Energizing and Educating New Mexico's Future Scientists

By JACK SWICKARD

Two of New Mexico's titans of education work in offices far from the state's major universities.

To most observers, they are employed in oil and gas exploration and development. But to people in the know, Bill Owen and past AAPG President Edward K. "Eddie" David are extraordinarily successful, high-dollar fundraisers for college scholarships and educational training.

David and Owen call on sponsors every four years to help fund a major scholarship dinner at the Roswell Convention and Civic Center.

This year's dinner raised \$202,000, of which \$180,000 went to university scholarships and student and teacher training, bringing the total raised at three scholarship dinners over a nine-year period to \$425,000.

This resulted in \$375,000 going to scholarships and training programs. Additionally, half the seats at the events were donated to students and educators.

David, who served as AAPG president in 1997-98, is president of David Petroleum Corp. of Roswell. Owen, a certified professional landman and 30-year member of the American Association of Professional Landmen, is vice president and exploration manager at David Petroleum.

The scholarship dinners began almost as a fluke in 2008.

David wanted to bring AAPG Honorary Member Lee C. Gerhard back to Roswell to speak about global climate change. Gerhard had started his geology career in Roswell and held the Getty Chair in geological engineering at Colorado State University in Fort Collins.

Initially, the talk was planned as a presentation to the Roswell Geological Society, but it took off after David and Owen decided it should be an industry-wide event.

So David invited Gerhard to talk at the Roswell Civic Center, which can accommodate a large audience.

As far as David was concerned, it was to be a one-time presentation before an audience of industry people. However, he then decided to add the element of education.

"It just made sense to make it all petroleum, which brought in Roswell and Artesia oil and gas operators and independents," David said. "You throw in education and it's staggering.

"It was well-received," David said, adding that 268 people attended the talk.

That year, the dinner raised \$57,000 for scholarships and training programs.

Owen recalls David coming up with the scholarship concept while planning the Gerhard talk.

"It was Eddie's idea. He knew Dr. Gerhard, who is an expert on global climate change. It seemed like an idea that would appeal to the industry as a whole. When we started putting the event together, Eddie thought of doing one, big meeting.

"Then Eddie started thinking of raising scholarship funds. That's when it took hold, and was well received by the industry. A small committee, with Gerri Harrington as chairman, was formed and a date was set," Owen said.

"In our industry, we don't do a very good job of educating the public about what goes on in the industry. We felt this would be something larger than a meeting within the industry.

Birth of an Institution

"To me, what was interesting, it was a one-time event in 2008," Owen said. "We were thinking, 'Let's put this thing together and see how it works.' It was never intended to be a repeating event. It took a lot of people.

"One year went by, then two years went by. Four years later, Eddie said: 'Remember the event we did in 2008?'"

See Spill, page 15

“ WITHOUT *knowledge* action IS USELESS AND *knowledge* without ACTION IS *futile*. ”

Abu Bakr

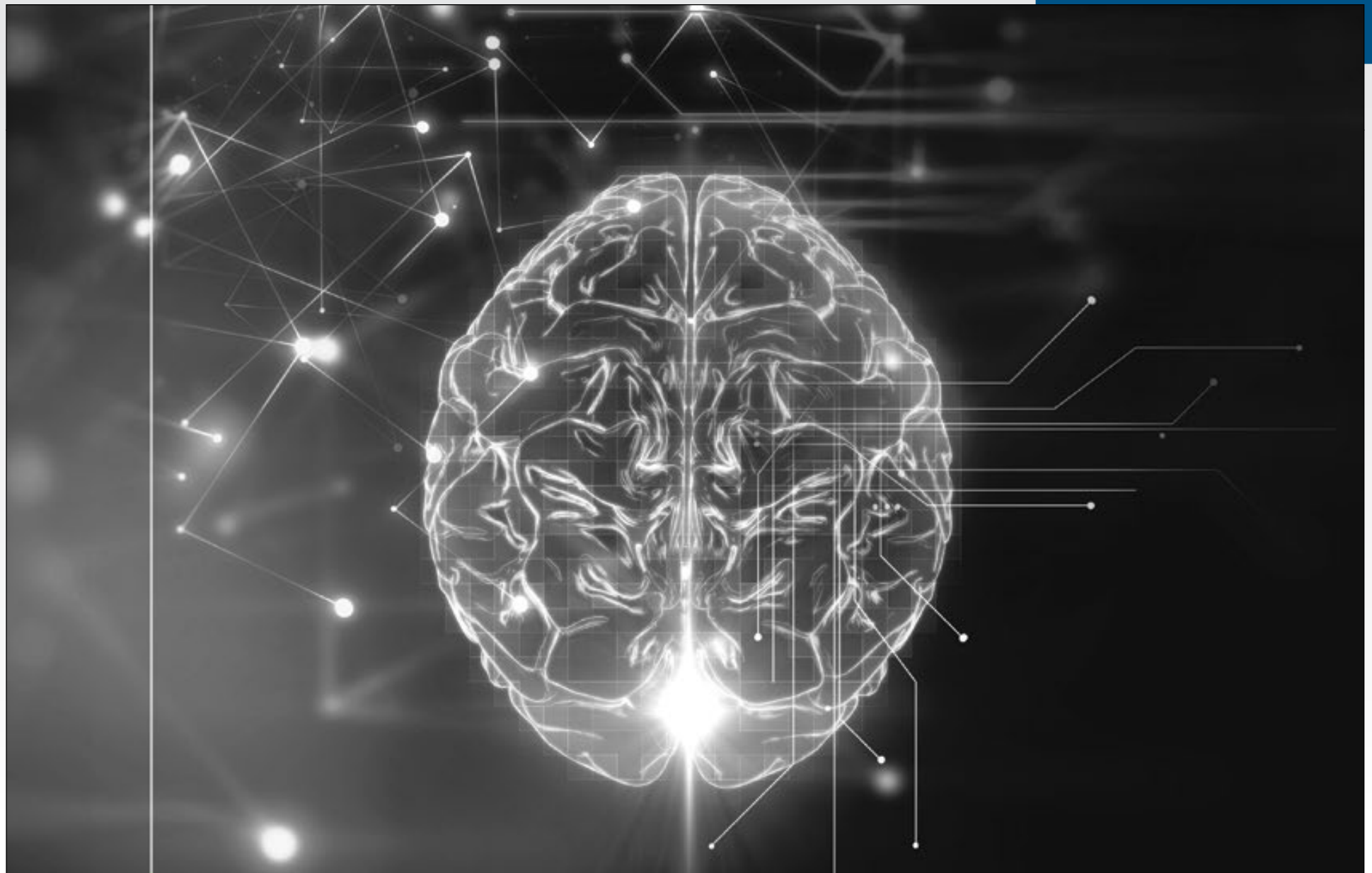


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The Next 100 Years: Combating Energy Poverty

By DAVID BROWN, EXPLORER Correspondent

The biggest challenge for the energy industry in the next 100 years involves more than just discovering where the resources are.

It's also about where they aren't.

Energy poverty affects populations around the world. According to a World Bank study released in April, more than a billion people have no access to electricity.

Another 3 billion without access to fuel rely on dung, wood or other biomass for cooking and heating, resulting in indoor and outdoor air pollution that causes about 4.3 million deaths each year.

The problem is "typically defined as a lack of access to modern energy services, but there are degrees of energy poverty," said Kenneth Medlock III.

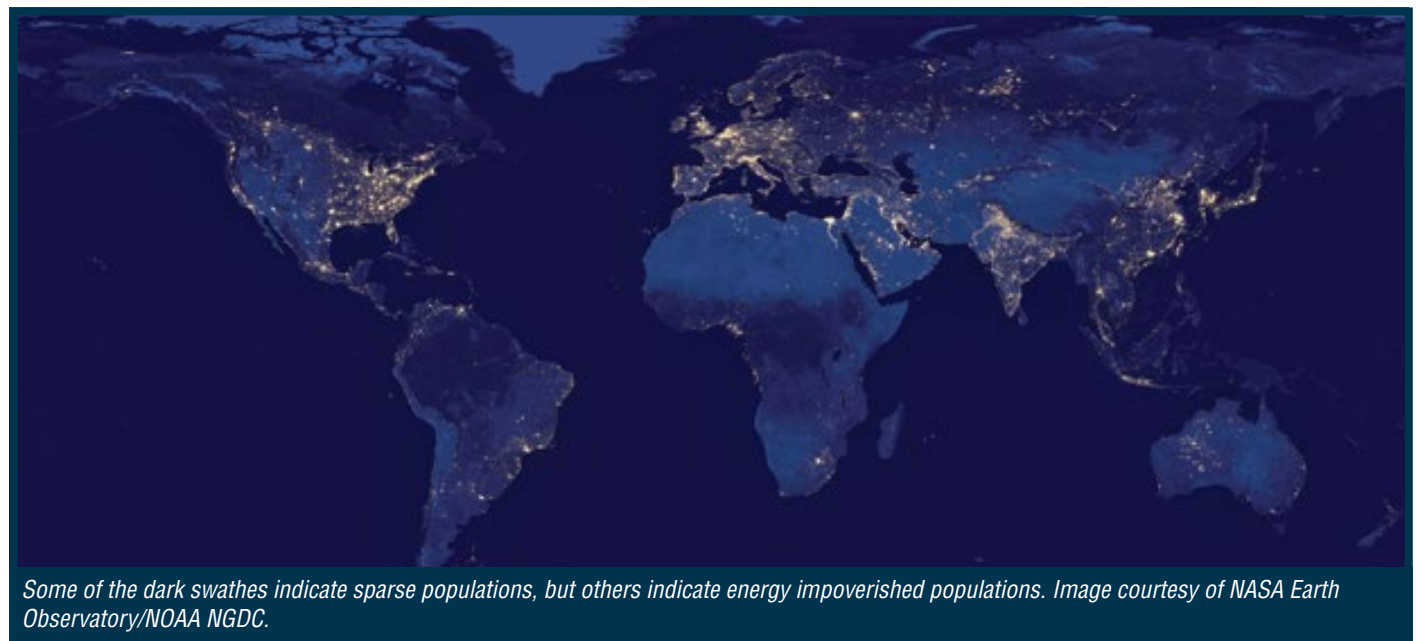
Medlock is a fellow in energy and resource economics and senior director of the Center for Energy Studies at the Baker Institute for Public Policy at Rice University in Houston.

At the extremes, energy poverty can deprive communities of sanitation, of heating and cooling systems, of safe lighting, of accessible transportation, of water purification.

"All of this together – especially the indoor air quality from burning biomass – is horrible for human health," Medlock said.

In the global picture, energy poverty appears to be both concentrated and widespread, immediate and extremely long-term in complexity.

Nearly three-quarters of the global population without clean cooking facilities live in just ten countries, according to the International Energy Agency.



Some of the dark swathes indicate sparse populations, but others indicate energy impoverished populations. Image courtesy of NASA Earth Observatory/NOAA NGDC.

Most people in energy poverty live either in sub-Saharan African or developing Asia, and around 80 percent are in rural areas, the IEA reported.

"We're not talking about something that's fixable in 10 years," Medlock observed.

He described the energy poverty problem as "decadal," in the sense that it will take decades – probably many decades – to address the full scope of the challenge.

How to Get from Here to There

With no quick-fix solution in sight, there's plenty of debate about how to get fuel,

electricity and other forms of energy to the world's most impoverished areas.

"You get into discussions of rule of law, of institutional and regulatory frameworks, of the existence of markets," Medlock noted.

"One model is to think about how it occurred in the developed world. What institutions were in place to attract capital into energy infrastructure? The developed world didn't just jump into capital inflows and infrastructure investment," he said.

Medlock identified three basic requirements necessary for countries to alleviate energy poverty:

- ▶ An energy infrastructure backbone
- ▶ A proper regulatory environment

- ▶ Supportive government involvement

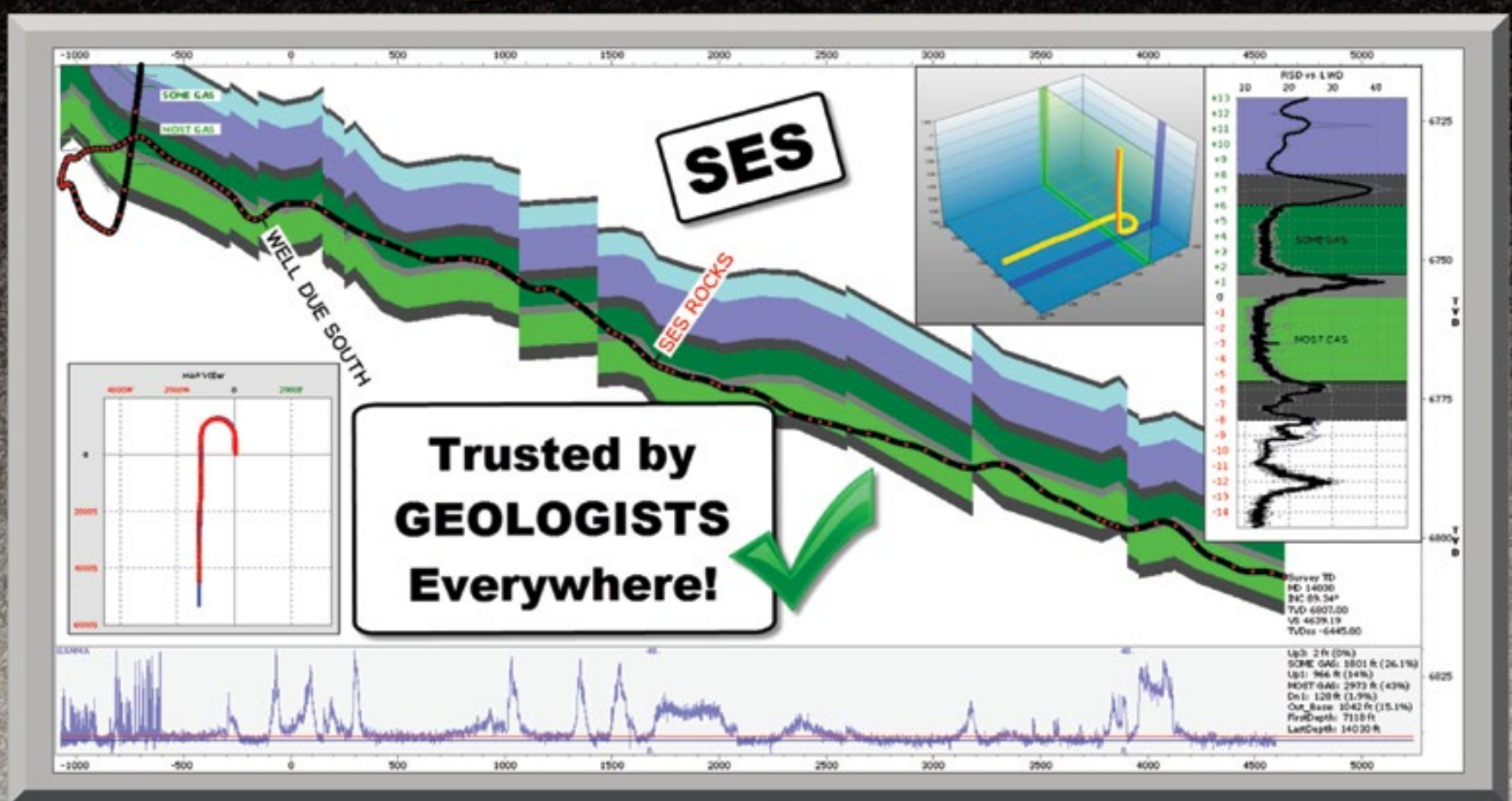
Infrastructure backbones allow the build-out of laterals and extensions to bring energy to wider areas, Medlock said. An electricity backbone might be a grid or even a primary transmission line, a natural gas backbone a main pipeline.

The role of government should be to facilitate energy development, to create and sustain an effective and non-limiting regulatory environment, and to enforce the rule of law.

"You need infrastructure backbone,

See Progress, page 8

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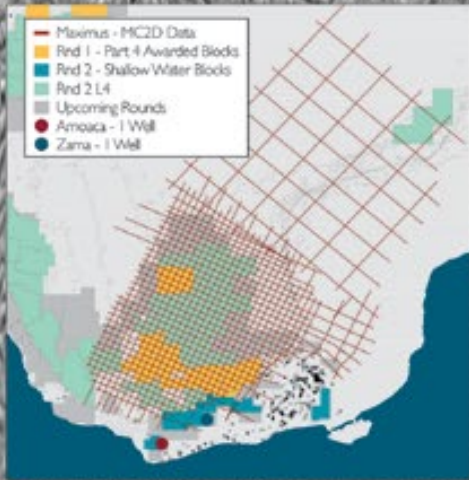
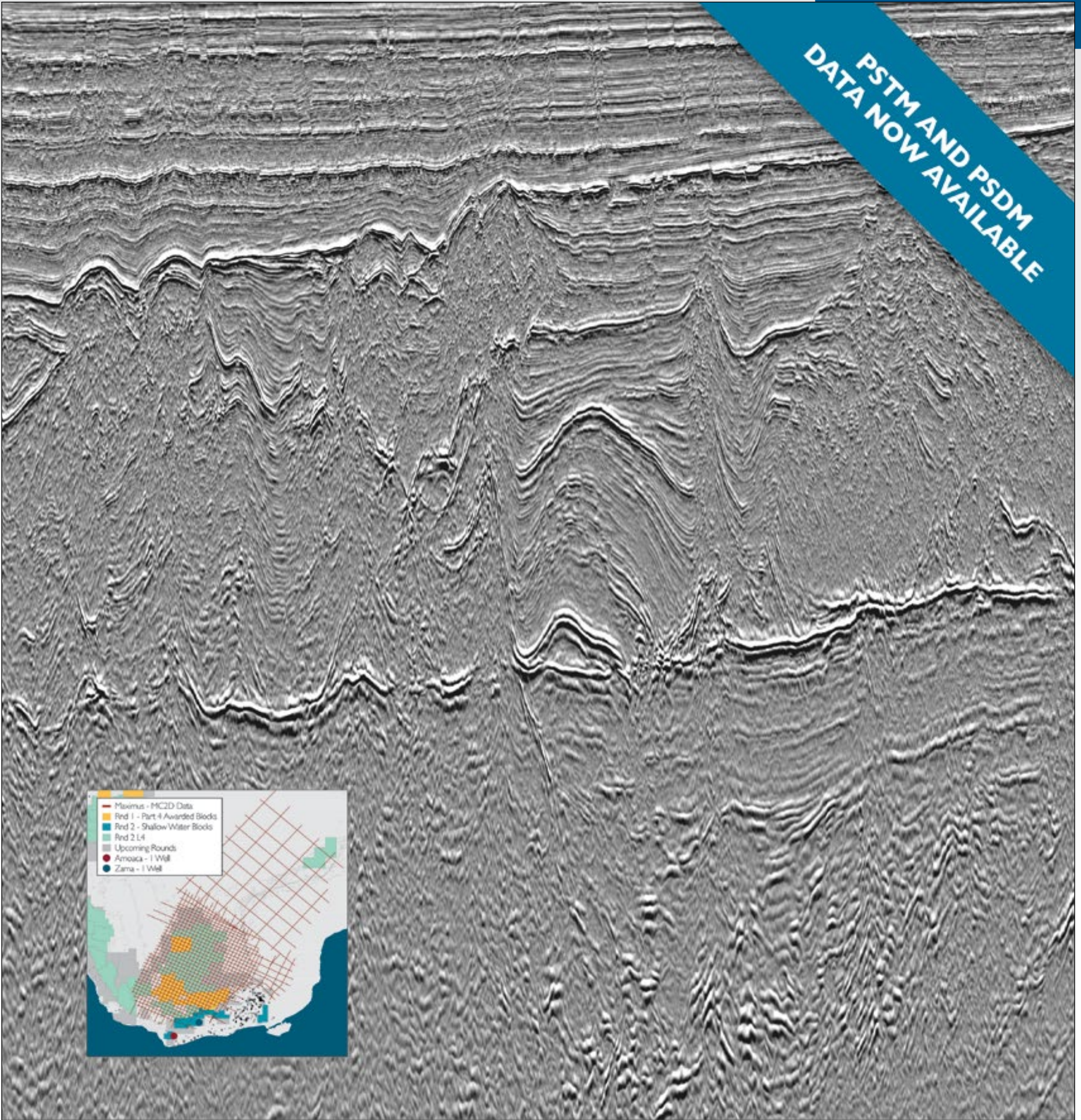


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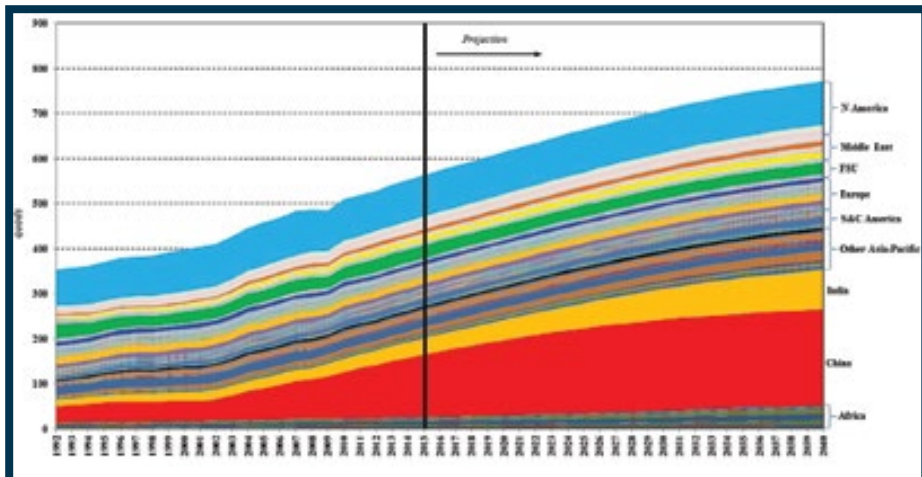
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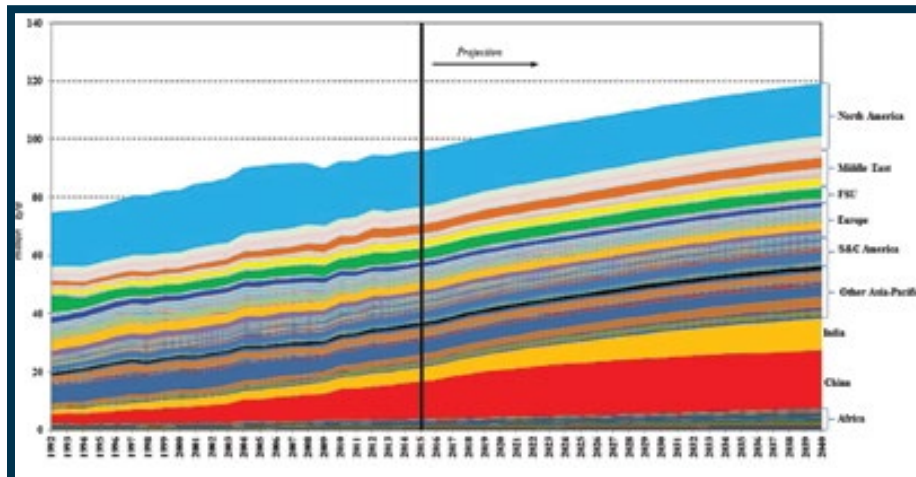
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Total primary energy requirement by country. Data Sources: IEA, BIPP CES



Oil demand by country.

Progress from page 6

the proper regulatory environment and government involvement to ensure adequate long-term investment," Medlock said.

"Once the backbone is in place, it should create demand pull as accessibility rises, and that's a signal for more capital investment. That's where you get a 'virtuous circle' going," he added.

Energy investment is key, and governments have a critical role in fostering the right environment for capital inflows, Medlock said.

"If you aren't earning revenues from the delivery of energy, you aren't earning a return on investment. This is important to attract capital and it requires institutions in place that allow for bill collection. For this you need, at the end of the day, the ability to enforce the rule of law," he said.

Progress So Far

An infusion of foreign aid can help jump-start energy development, but aid doesn't replace the need for ongoing, substantive and successful investment in energy services, according to Medlock.

"Aid can't ever be a crutch. Government has to say, 'This aid is good. It helps us move down the path, but it's only a first step,'" he noted.

Despite the challenge of funding, the world has made some progress in alleviating energy poverty in recent years

The United Nations has set a goal of universal access to electricity by 2030. The World Bank reported that an estimated 200 million people in energy poverty gained access to energy services between 2010 and 2012, although such successes are tempered by the growth of global population.

"The amount of people getting access to energy services is actually going up. This is positive news," Medlock noted.

And the oil and gas industry has

brightened the picture with recent discoveries near under-served areas, especially in east Africa and in Pakistan and other parts of Asia.

"At this point it really gets into educated opinion-making. Kenya is a great example. In Kenya they had a very specific goal of eliminating energy poverty and bringing electricity to 100 percent of the population," Medlock said.

By contrast, he described failed attempts at energy development in India. The large segment of India's population in need of access to electricity enticed investment in power build-out for the country, he said. But at the time, India lacked the governmental and regulatory systems that might have facilitated development of extensive energy infrastructure and brought power to poor rural areas.

"If those institutions had been in place, a lot of those people would have reliable electricity today," Medlock said.

India's government now has adopted a "Power for All" objective that aims to bring

electrical connections to some 50 million rural households without electricity.

The outlook for alleviating energy poverty varies around the world, according to Medlock.

"It depends on where you are. If you're in sub-Saharan Africa, it's pretty bad," he said.

Severe economic poverty, often hand-in-glove with energy poverty, complicates attempts at a solution.

That creates a dilemma where the poorest need access to energy to rise out of poverty, but remain in energy poverty because of their economic impoverishment.

"Too often people will focus just on energy poverty, but to address that you need to focus on poverty in general," Medlock observed.

"I tell my students, if you want to be against something – if you want to stand up and be against something – be against poverty," he said.

When the focus shifts to addressing poverty, Medlock said, "everything else falls by the wayside." [E](#)

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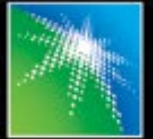
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Harvey's Reach Extends Far Beyond Houston

By DAVID BROWN, EXPLORER Correspondent

When Hurricane Harvey brought disastrous flooding to the U.S. Gulf Coast, it threatened more than Houston residential neighborhoods.

A significant part of the nation's energy infrastructure is located in and along the 29 Texas counties on or just inland from the Gulf of Mexico, and a network of production platforms and offshore pipelines stretches eastward from there to Louisiana and beyond.

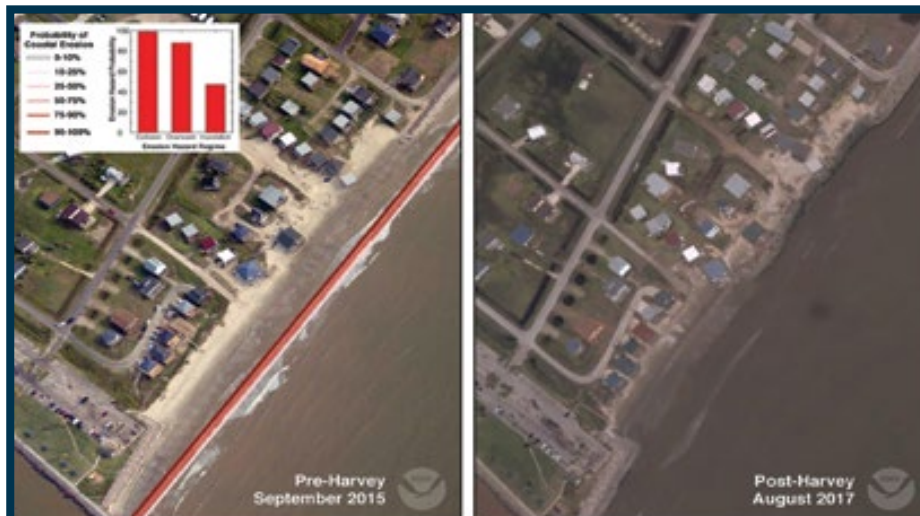
Anything that threatens this crucial area will have consequences in numerous states – and even other countries.

"When you have a hurricane like Harvey, and others we had a decade ago, it creates an impactful situation in terms of gasoline supply, in meeting distillates demand. The short answer is, it had a significant impact," said Sandeep Sayal, senior director in the downstream group for IHS Markit in Houston.

With a disruptive major hurricane along the Gulf Coast, "the effect is going to be worldwide," he observed.

To understand the potential impact, consider a report prepared by ICF International for the U.S. Energy Information Agency (EIA).

"The Gulf Coast is the largest petroleum refining region in the country, producing 7.5 million barrels per day of transportation fuels in 2014, or nearly half of total U.S. refinery production," the report found.



SAYAL

"At the end of the day, all the world markets are impacted. It's a global market."

Supply Shift

Because the region's transportation fuel production is three times its consumption, the Gulf Coast area is a major exporter of gasoline, distillates and jet fuel.

Movement of refined fuels between the Gulf Coast and the East Coast "represents

the largest movement of such products in the United States," the report stated.

The five largest oil refineries in the United States are on the Texas and Louisiana Gulf Coast, and the two largest refineries in the country are in the vicinity of Houston.

As of last January, the 29 petroleum refineries in Texas had a capacity of more

than 5.4 million barrels of crude oil per day and accounted for 31 percent of total U.S. refining capacity, the EIA said, with 17 of those refineries on or near the Gulf Coast and vulnerable to storm disruption.

Harvey knocked out an estimated 4.8 million barrels per day of distillation capacity, or 27 percent of the U.S. total. A week later, around 2.9 million barrels per day were still offline.

This huge complex of refining capacity also has a major supply effect on the rest of Texas and the mid-continent. Dallas-area fuel prices increased almost 70 cents a gallon on average after Harvey's landfall. Tulsa's gasoline prices were 30-40 cents higher for weeks after the hurricane struck.

Overall, "the U.S. average regular retail gasoline price increased 28 cents per gallon, from \$2.40/gal on Aug. 28, 2017 to \$2.68/gal on Sept. 4, 2017," the EIA reported, reflecting the widespread effects of Harvey's disruption.


Two major interstate pipeline systems originating on the Gulf Coast, the Colonial Pipeline and the Plantation Pipeline, are critical to supplying gasoline and other fuels to the southwest and New England.


The 5,500-mile-long Colonial Pipeline – the largest refined fuels pipeline in the United States – begins in Houston and takes fuel supply to nine southeastern and mid-Atlantic states, then extends into Pennsylvania and New Jersey, terminating near the New York Harbor area.

See [European Market](#), page 12

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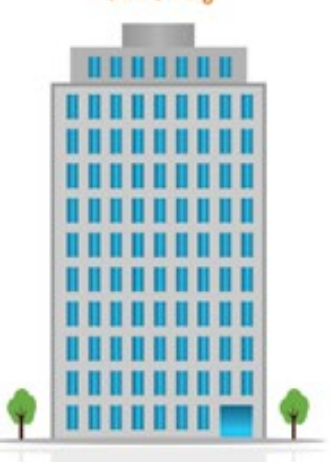
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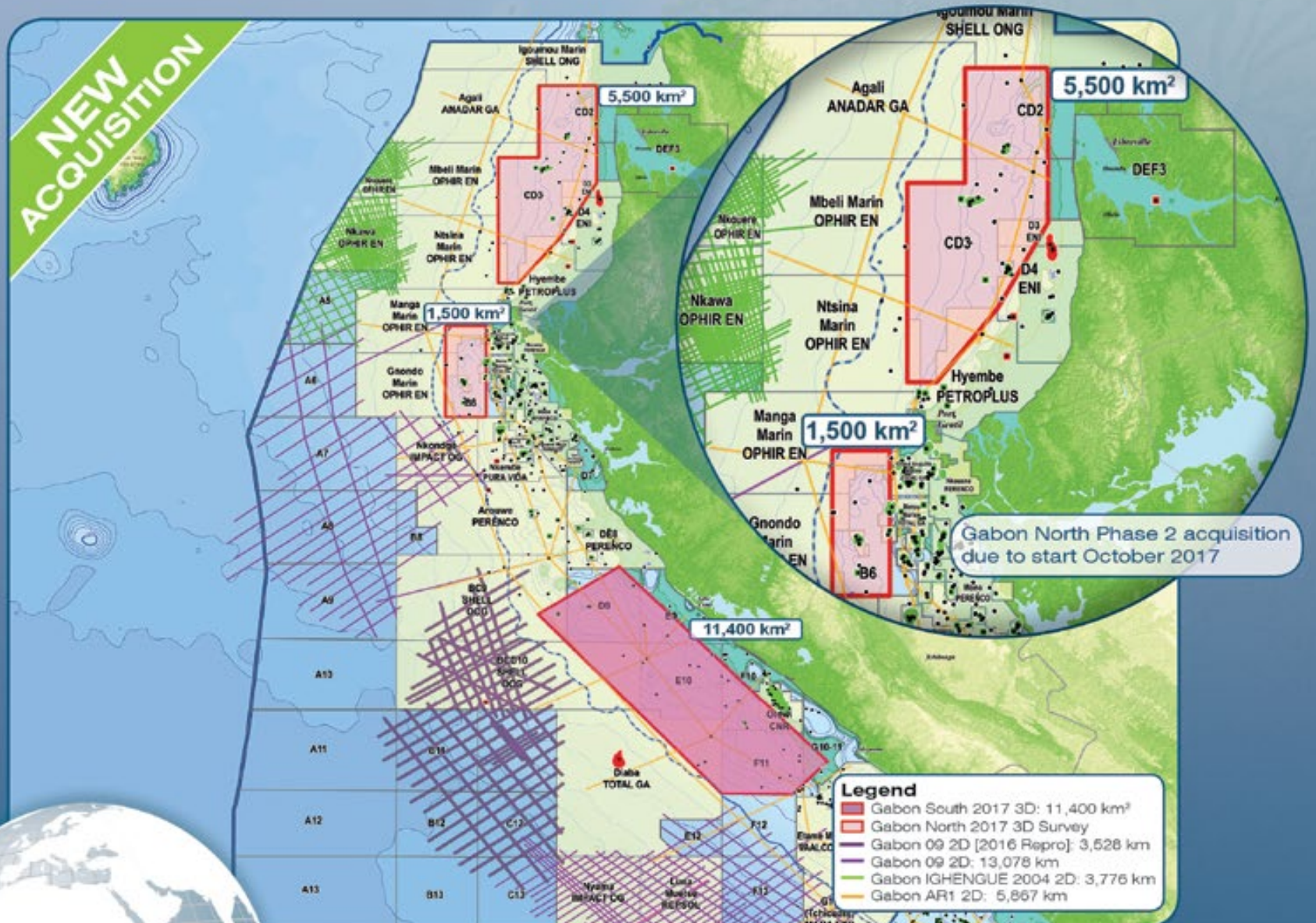
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The 11,400 km² Gryphon 3D survey in southern Gabon is now complete. In addition, acquisition of a 5,500 km² 3D survey over open acreage in Northern Gabon is due to begin October 2017.

Data is expected to start becoming available toward the end of 2017 ahead of anticipated future licensing rounds.

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USGS scientist Tom Pistillo wades through the waters of Barker Reservoir, a flood control structure in Houston.

European Market from page 10

"Both the pipelines were impacted by the hurricane, so the East Coast had to depend more on imports from the European refiners," Sayal said.

For the European distillates market, that meant higher gasoline prices and much stronger refining margins, he noted.

"At the end of the day, all the world markets are impacted. It's a global market," Sayal said. "The impact was definitely felt across the board, from oil to gasoline to LNG to chemicals."

Fuel shipments from Gulf Coast ports move to Florida and other southeast ports on coastal compliant tankers and barges, and to markets primarily in the Atlantic basin on foreign-flagged ships.

"A lot more of the European cargoes also got into the Florida market," Sayal noted.

Many Eggs in One Basket

"Designed to take advantage of the region's deepwater ports, the Texas Gulf Coast's 17 refineries and associated infrastructure are heavily concentrated in three logistics clusters along the Texas coastline, making them particularly vulnerable to disruption from hurricanes, tropical storms and associated storm surge," the ICF report said.

Having so much downstream infrastructure located on or near the Gulf Coast has both supply and security implications for the U.S.

"Over the long term, the energy sector will have to consider the costs of additional hardening of the infrastructure

on the Gulf Coast versus moving to a different location like the Eastern Seaboard," noted Michael Webber, deputy director of the Energy Institute at the University of Texas at Austin.

The EIA's report following Hurricane Harvey "illustrates very clearly the impact that Harvey has had on the U.S. oil operations," IHS Markit reported.

Domestic production fell by 750,000 barrels per day, while consumption of crude dropped almost 3.3 million barrels per day because refineries were forced to shut down.

For the first time in many years, the United States is a crude oil exporter and those shipments also were disrupted by Harvey.

"We were exporting about 1 million barrels of crude a day before Harvey and I think the exports dropped down to 200,000 to 300,000 barrels a day," Sayal said.

Lone Star Impact

Harvey brought unprecedented rainfall to parts of the Gulf Coast, where many areas received more than 40 inches of rain. In Texas, at least 82 people died, more than 1,000 homes were completely destroyed and another 17,000 sustained major damage.

Operations at oil and gas company facilities in west Houston's Energy Corridor and other parts of the city were disrupted by the hurricane. ConocoPhillips' Houston main campus was closed for almost two weeks, until Sept. 11, and its Energy Center 3 remained closed due to high water.

Hurricanes that strike Texas bring a direct threat to the nation's oil and gas production capacity as well as its refining operations.

According to the latest data from the EIA, Texas ranks first in the nation in the production of crude oil, natural gas and electricity. It leads all states in total proved oil reserves, with recent gains coming mostly from the Eagle Ford shale play and tight formations in the Permian Basin.

Last year, Texas produced about 1.156 billion barrels of crude oil and condensate, or just under 3.167 million barrels per day, the Railroad Commission of Texas (RRC) reported. The state's annual natural gas production was about 8.169 trillion cubic feet.

With so much downstream, midstream and upstream infrastructure in place, the Gulf Coast region has become a key storage area for crude oil and petroleum products.

As of March, 49 percent of total U.S. working crude oil storage capacity and more than 40 percent of working storage capacity for both motor gasoline and diesel fuel were located in the Gulf Coast, the EIA reported.

Petrochemical infrastructure in the U.S. also is concentrated along the Gulf Coast, and operations at more than a dozen petrochemical plants were disrupted and then curtailed by Harvey.

According to the American Chemistry Council, about \$85 billion worth of petrochemical projects have begun or been completed across the country since 2010, nearly all of them in the Gulf Coast region, where significant additional investment is planned.

Half of the nation's natural gas processing capacity is located in Gulf Coast states, according to the EIA. Texas alone has 166 gas processing plants with a total of 21 billion cubic feet per day of processing capacity.



Despite huge strides in cancer research, the odds of getting cancer are still unfavorable. Men have a 1-in-2 risk of developing cancer; women, 1-in-3 during their lifetimes, according to the American Cancer Society*.

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* Cancer, Facts & Figures, 2016

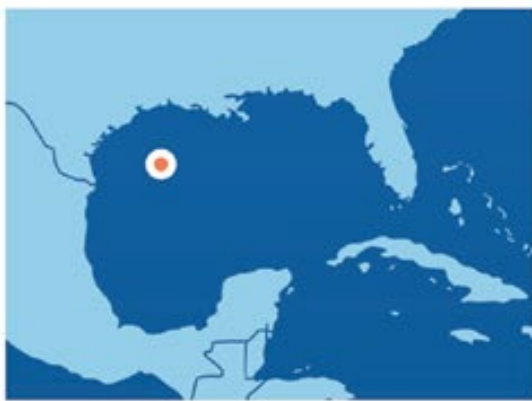
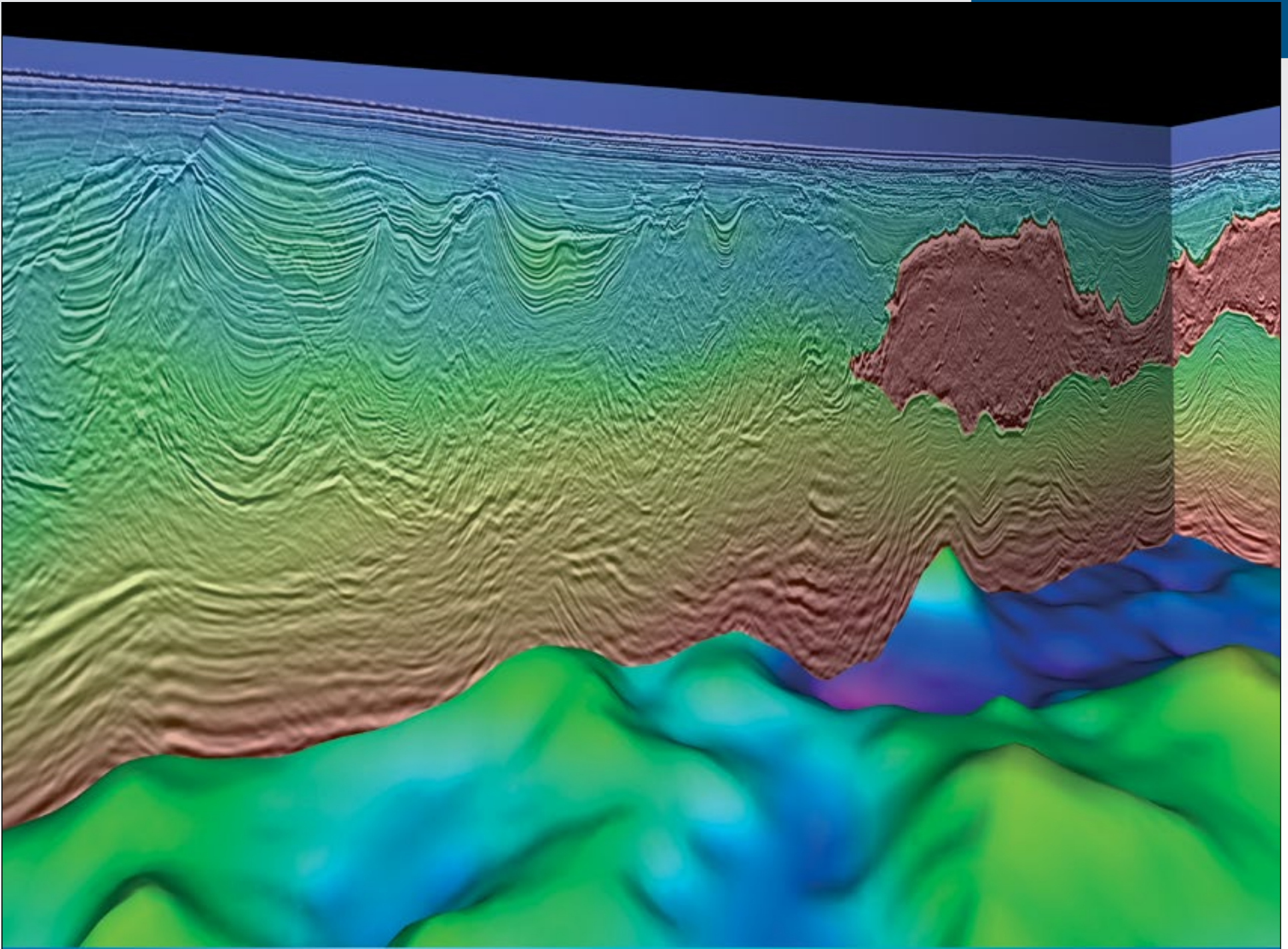
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*** 5 Years (2 years in GA, 12 months in TX, 6 months in CA, ME and NH)

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Gulf of Mexico Crystal C

Exploring the Northwest Deepwater GOM

PGS is pleased to announce the availability of its newly reprocessed and re imaged Crystal C 3D Wide Azimuth survey in the western deepwater Gulf of Mexico. The original acquisition of these data was completed in 2010 and covered 485 OCS blocks in the East Breaks and Alaminos Canyon protraction areas.

The new data provide improved imaging of the slope to basin-floor elements of the Wilcox depositional system, for which the Deep Nansen well in East Breaks 645 is a crucial control point.

Base deliverables include RTM and high-resolution Kirchhoff depth products. PGS expects this survey to be indispensable for exploration in the Wilcox play in the western Gulf of Mexico for the foreseeable future.

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Geology of a Storm

Before, during and after Hurricane Harvey

By KEN MILAM, EXPLORER Correspondent

As hurricanes Harvey and Irma laid waste to huge swaths of Texas, Florida and other states in the southeastern United States, geologists were swept up in a whirlwind of research before, during and after the storms.

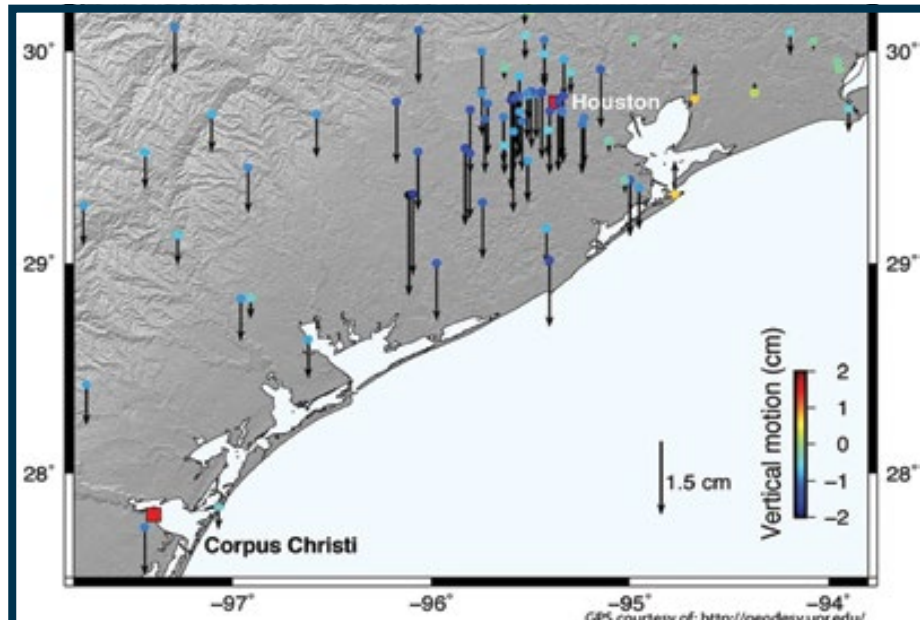
U.S. Geological Survey hurricane response crews worked as the storms approached to install storm-tide sensors at key locations.

Housed in vented steel pipes a few inches wide and about a foot long, the sensors are installed on bridges, piers and other structures that have a good chance of surviving a storm surge during a major tropical storm. The information they collect helps define the depth and duration of a storm-surge, as well as the time of its arrival and retreat.

That information helps public officials assess storm damage, discern between wind and flood damage, and improve computer models used to forecast future floods, according to the USGS.

In the case of Harvey, five crews from the USGS Texas Water Science Center were deployed to install scientific instruments in advance of the storm, according to Lynne Fahlquist, a hydrologist with the center.

Some of the equipment will measure the height and intensity of the storm surge while other instruments, such as streamgages, will monitor real-time water levels of inland rivers and streams, Fahlquist said. The field crews gather



Chris Milliner of the Jet Propulsion Laboratory tweeted this map showing that the Earth's crust in the Houston area was pushed down roughly two centimeters from the weight of the rainfall.

scientific data from the instruments immediately after the storm has passed, which will provide critical information needed for accurate flood forecasting.

Erosion Effects

After the storm, researchers at the University of Texas Institute for Geophysics, prepared to resurvey Lydia Ann Channel and Aransas Pass with

marine geophysical instrumentation and collect sediment samples.

"Researchers believe that these locations have been subjected to substantial and measurable erosion and sediment transport associated with the storm surge and its ebb, and that investigating these locations will provide valuable insights into the impact of storm surges on barrier and estuarine systems," said Institute spokesman

Anton Caputo.

This work was scheduled for September. University of Texas researchers previously surveyed these areas in 2009, Caputo said.

"As geologists, we are highly interested in understanding how a storm impacts the sediments, and thus foundation, of the coastal zone, said Jeff Goff, senior research scientist at the institute.

"Most particularly, we are concerned with how storms either remove or add sand to the barrier island system, and thus affect such island's long-term viability for supporting communities and protecting the estuarine ecosystem. Sand can potentially be eroded from the shoreface and then transported into the bays by storm surge, or sent out to sea on the ebb of the surge. In either case, substantial volumes of sand may be removed from the barrier islands by storms, negatively impacting the coastal zone unless sand is replenished by either natural or artificial means," Goff said.

"From post-storm imagery, we can see in some areas where the storm moved sand from the shoreface, over the barrier island and toward the bay. Farther south, however, particularly around Port Aransas, San Jose Island and Matagorda Island, we see more evidence that water flowed seaward, eroding the

[See Survey, page 16](#)

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In conjunction with:



Spill from page 4

That was the cue for David and Owen to begin work on their next big scholarship dinner, inviting W.C. "Rusty" Riese, a Distinguished Ethics Lecturer for AAPG and Honorary Member, to speak about the BP oil spill.

Riese, at the time an adjunct professor and lecturer at Rice University and an adjunct professor at the University of New Mexico, was a good fit for the Roswell dinner. He had received his bachelor's in geology from New Mexico Tech, and his master's and doctoral degrees in geology from the University of New Mexico.

Furthermore, Riese had served as a consulting geologist for BP.

A committee was established. James C. Manatt, president of Providence Technology in Roswell, was elected dinner chair.

Besides addressing a dinner audience at the Roswell Convention and Civic Center, Riese spoke at student workshops throughout Roswell and Artesia. He ended up speaking to more than 3,000 students, teachers and members of the public at eight events over two and a half days, Owen said.

The 2012 dinner raised \$141,000, of which \$105,000 was earmarked for scholarships and training programs. That year, 467 people attended the dinner.

The Desk and Derrick Club of Roswell, the Roswell Geological Society and the New Mexico Landmen's Association were designated hosts for the event. Each of the three organizations was given \$21,000 to provide college scholarships.

Additionally, the National Energy Education Development (NEED) program and the Citizens' Alliance for Responsible Energy each received \$21,000 for educating students and teachers.

Three years later, David and Owen began thinking about putting together a third scholarship dinner.

David knew the first thing he needed to do was recruit "a good speaker. Not just a knowledgeable speaker, but someone who is interesting."

The speaker who fit this description was Allen Gilmer, CEO of Drillinginfo Inc., an energy exploration data analytics company serving more than 3,200 firms worldwide from its Austin, Texas, headquarters.

David knew he had a good fit with the southeastern New Mexico oil and gas industry.

"The industry here is very generous," he explained. "When you get to Roswell and Artesia, you're working with people whose handshake is their word. People in the industry are good citizens."

Robert G. Armstrong, president of Armstrong Energy Corp. in Roswell, was named chairman of the April 20, 2017, dinner.

The dinner – dubbed "State Trust Lands: Energizing New Mexico" – was dedicated to the State Land Office, which manages lands granted by Congress to New Mexico in 1898 and 1910 as a means of generating revenue to support public schools, universities, hospitals and other institutions.

The State Land Office holds these lands in trust. Revenues from these lands go into the New Mexico Permanent Fund, which supports education in New Mexico. Approximately 94 percent of the Permanent Fund comes from oil and gas production.

Armstrong said the theme "emphasized the importance of the oil and gas industry to the State of New Mexico in funding education at all levels through the State Permanent Fund.

See **Education**, page 16

President from page 3

this energy revolution has profoundly improved the U.S. economy, created jobs and benefitted the environment.

The Permian and Gulf Coast basins are prototype super basins with more than 5 billion barrels of oil equivalent (BBOE) produced, 5 BBOE future reserves, multiple source rocks, many pays, infrastructure and well established service sectors. The top 25 "super basins" around the globe have potential energy resources of more than 800 BBOE, according to data provided by Bob Fryklund and Pete Stark of IHS Markit. Choices made by host countries of super basins will play a key role in future energy prosperity.

Let's Get Networking

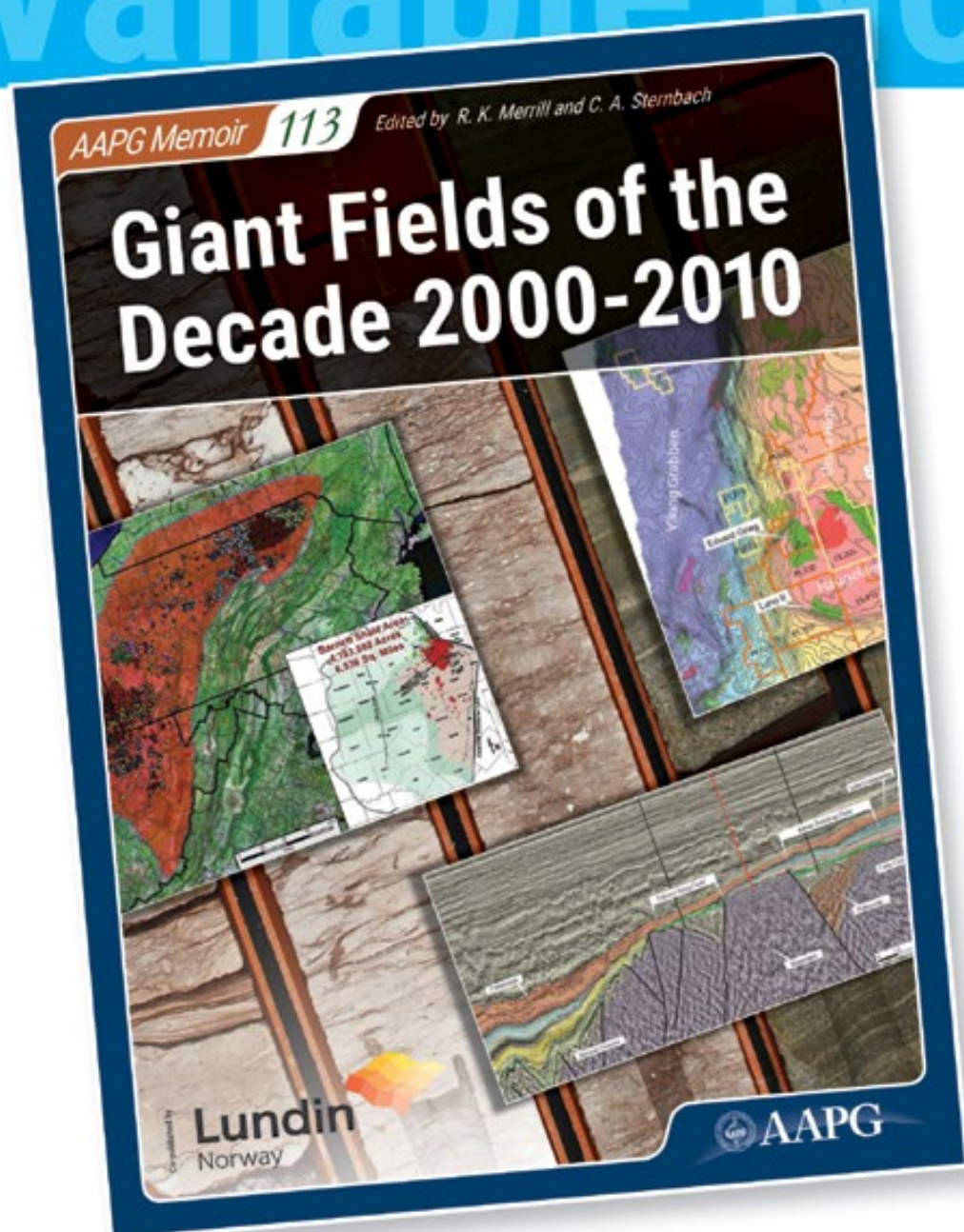
Fall meeting season kicks off right now for AAPG Sections and Regions. I'd like to ask everyone to think of the value of AAPG in facilitating the opportunity for us to meet interesting and inspiring people. Please tell me about someone you met and shook hands with that made an impact. Back in 2011, during the Houston ACE, Steve Levine asked me to moderate the "Taking Geoscience to Greater Heights" All Convention Luncheon (aapg.to/ace2011vidacl). That was a wonderful program of several generations of astronauts, including Apollo moonwalker and AAPG Honorary Member Jack Schmitt and space shuttle veteran Jim Reilly. I expect a few of you reading this were there with me. Scott Carpenter represented

the Mercury NASA astronaut generation. Shaking Scott's hand was a special moment for me. With a twinkle in his eye, he told me about shaking President John F. Kennedy's hand. For some reason I think about that often. I shook past AAPG President Michel T. Halbouty's hand many times. I often wonder about connections between Halbouty and past explorers? Patillo Higgins, Glen McCarthy, Dad Joiner, AAPG's founders?

What's your story? I am interested and would like to know. Send me an email at carbodude@gmail.com, or come tell me at one of AAPG's many fine upcoming meetings.

Charles A. Sternbach

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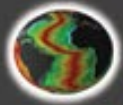
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- ◆ Geoheritage



Other Conference Activities:



- ◆ Pre-Meeting — Salt Tectonics Course

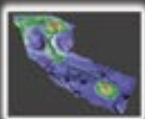
Instructor: Mark Rowan



- ◆ Post-Meeting — Salt Tectonics Field Seminar

Cape Breton, Nova Scotia

Instructor/Leader: Ian Davison



- ◆ Core Workshop

- ◆ Geophysical and Geological Data Room(s)

Planned Field Trips

All Field Trips Subject to Minimum Levels of Participation



- ◆ Pre-Meeting 2-Day Field Trip — Petroleum Systems of the Paleozoic and Mesozoic basins of Atlantic Canada

Trip Leaders: Grant Wach, David Keighley, Ricardo Silva



- ◆ Pre- and/or Post-Meeting One-Day Field Trips

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Extended abstracts with key figures are also welcome.

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KEY DATES

Short Abstract — 1 March 2018

Extended Abstract — 1 May 2018

Website: www.conjugatemargins.com

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Survey
from page 14

beach foredunes in the process. We hypothesize that, in these areas, either that the ebb of the surge, or wind-driving of bay waters out to sea on the back side of the storm, caused significant seaward transport of coastal sediments. Our upcoming survey around Port Aransas is intended to search for submarine evidence of these processes," he said.

"We found one important time line for geologic impact in the Port Aransas tide station. It indicated a slow buildup, over about 24 hours, of water height to about five feet above normal, but then a very rapid loss of nearly that entire amount over a span of just three hours. This asymmetric record shows that the seaward-directed flow was far stronger than the landward-directed flow, and thus a basis for predicting a net loss of sediment out to sea," he said.

"While geography probably plays a larger role than geology in determining where the worst flooding is likely, information like sediment grain size distribution and identification of areas with dunes capable of protecting a stretch of coastline could potentially be coupled with surge models to predict sediment transport in a storm," Goff added.

"Areas with significant dune systems whether manmade or natural can provide natural barriers to storm surge and thus mitigate flooding," according to Sean Gulick, a research professor with the institute.

The regional geology in the Houston area comprises thick, rich surface soil inter-bedded with clay and fine-grained silt. As a low-lying city with minimal topography, the geology of Houston is not conducive to immediate recharge into the aquifers underlying the region. Therefore, in a storm in which 35 inches of rain fell in just over 48 hours, most of the rain could not be absorbed, explained Fahliquist.

'Heavy' Storm

The enormity of the Texas flooding was evidenced in a Labor Day tweet by Chris Milliner of the Jet Propulsion Laboratory. It was a map visualizing data from the Nevada Geodetic Laboratory. It showed that GPS data from special stations around Houston detected that the whole area had been pushed down roughly two centimeters by the weight of the water that fell during Hurricane Harvey, which – by estimates of as much as 33 trillion gallons of rainfall at 8.34 pounds each – was more than 137 billion tons, which deformed the

Education
from page 15

"The Permanent Fund currently exceeds \$15 billion and it is estimated that in fiscal year 2017 the Fund will pay approximately \$688 million to the beneficiaries. The beneficiaries include New Mexico public schools and eight universities, and several other public-related organizations."

Nearly 600 attended, setting a record for diners at the Roswell Convention and Civic Center. They included New Mexico oil and gas professionals, high school students and teachers as special guests, representatives of institutions that benefit from State Land Office income, and members of the public.

Additional attendees included AAPG President Paul Britt and members of AAPG



USGS scientist Charles Hartmann installs a storm-tide sensor in preparation for Hurricane Harvey in Carancahua Bay, Texas. Photo by George Umphres, USGS.

Earth's crust.

However, Mother Earth will bounce back.

"Any additional load on a section of crust requires an accommodation by that crust. However, if the load is only temporary, as is the case in a flood, then the accommodation (in this case downward) is also only temporary," Gulick said.

USGS scientists responding to Hurricane Harvey include hydrologists, geologists, hydrologic technicians, computer scientists, geographers, physical scientists and more, Fahliquist said.

Geoscientists from the Institute for Geophysics taking part in the storm assessment included those in the areas of sedimentology, geomorphology, coastal processes, ocean modelers and more.

Student Chapters from New Mexico Tech, New Mexico State University, Texas Tech University and University of Texas at El Paso.

The Roswell Model

David has some rules for implementing what he terms the "Roswell model."

"The first step is to seek, identify and secure a messenger who not only has the credentials and reputation to effectively speak before our petroleum industry's 'choir,' but also has the ability to easily and clearly communicate our theme message to the majority of an audience who are outside of the 'choir.'

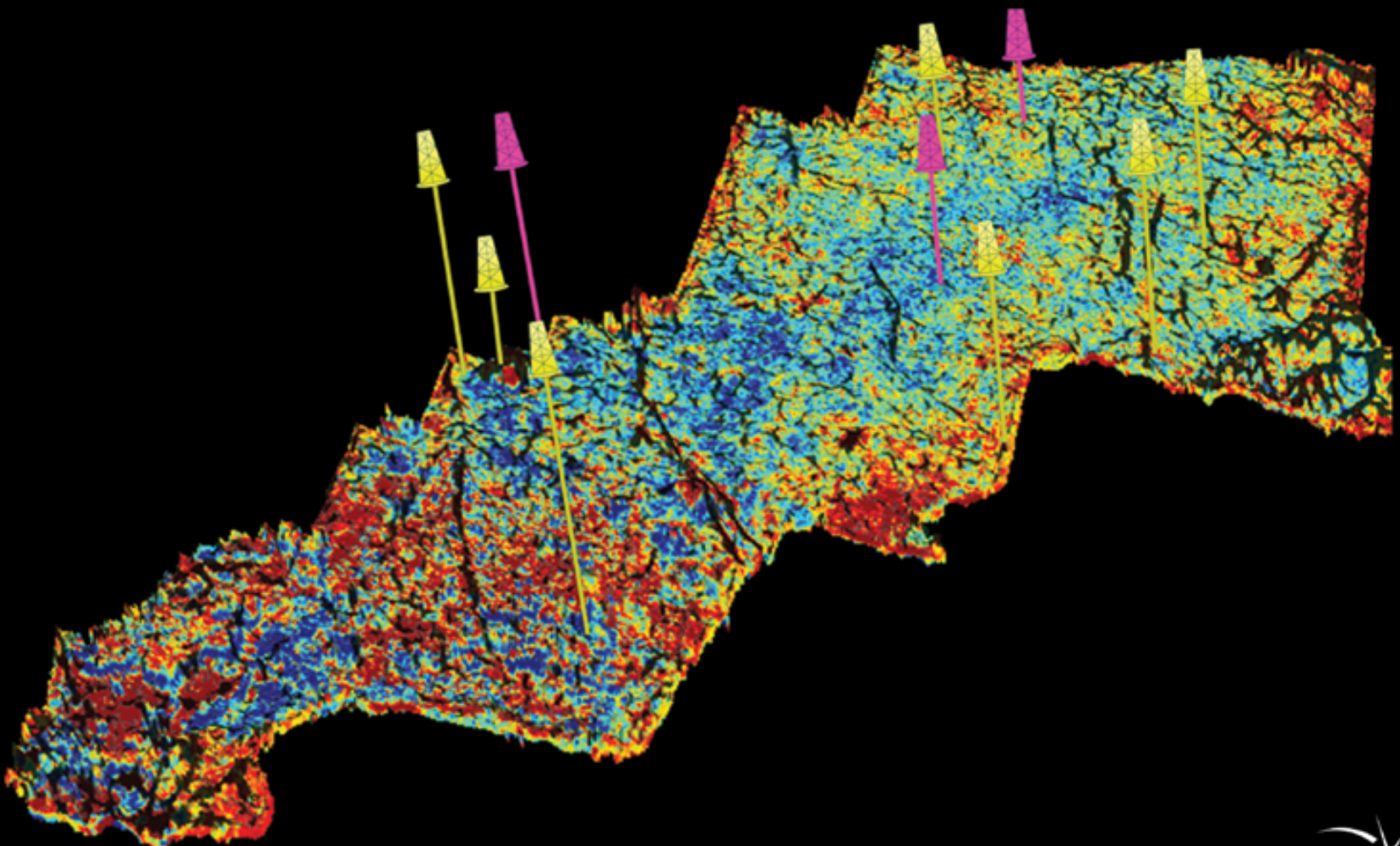
"The selection of an outstanding speaker is of the utmost importance to the success of a meaningful event."

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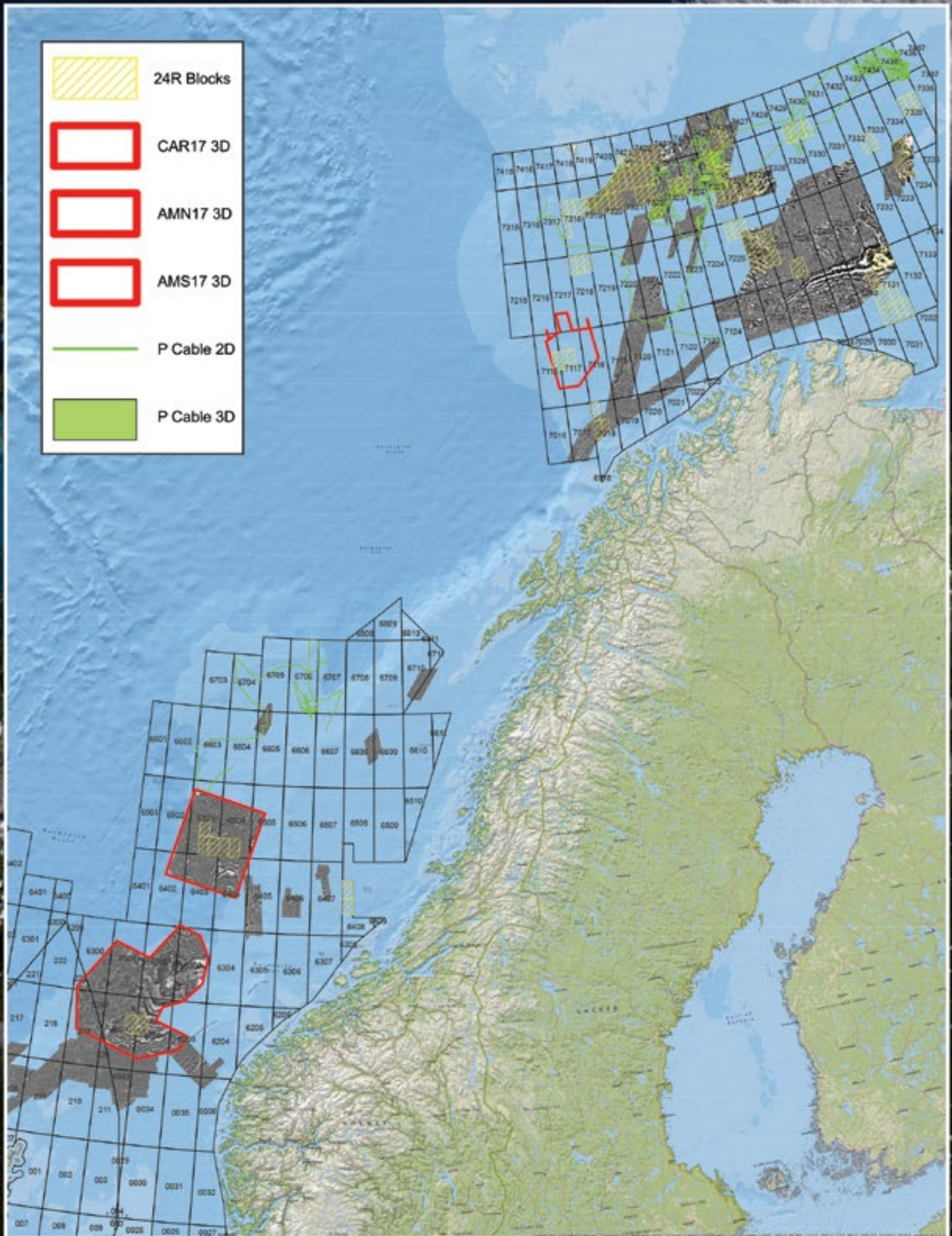
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Historical Highlights is an ongoing EXPLORER series that celebrates the “eureka” moments of petroleum geology, the rise of key concepts, the discoveries that made a difference, the perseverance and ingenuity of our colleagues – and/or their luck! – 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.



Left: Esther Richards in the field in 1923 near Meridian, Miss. She is wearing her “puffy panties” and high leather boots, a novelty for females in the deep South. Photos by Patty Kellogg, Esther’s granddaughter. Right: Esther and Alva organized many field trips to collect samples, believing surface work was necessary to understand the subsurface. From left: Esther Richards, John Suman, James L. Ballard, Alva Ellisor and colleagues (likely William A. Baker and W. F. Bowman) at Hidalgo Bluff near the Brazos River Bottom.

Three Women, One Breakthrough

Unsung heroines who transformed oil exploration

By ROBBIE RICE GRIES

What do you think was the first profound, wide-reaching, economically effectual technological breakthrough in petroleum geology?

Was it the anticlinal theory?

No, though debated for over 40 years, it was not embraced until the 19-teens and ‘20s, and even then, it was still not universally applied or viable.

Was it surface mapping?

Recognized as important in the early 1900s, it was slow to be accepted and was of no use in complex stratigraphic and structural subsurface environments such as the Gulf Coast.

The first major breakthrough was foraminiferal micropaleontology – made by three young “girls” in 1921, which, within three years, created oil industry jobs for 300 micropaleontologists and gave rise to micropaleontology courses in 31 geology departments.

And, it profoundly affected the economics of drilling, as 75 percent of all wells drilled and completed in the United States came to rely on micropaleontology.

But, fewer than 20 years after this breakthrough, when famous paleontologist Cary Croneis of the University of Chicago gave his presidential speech to the Society of Economic Paleontologists and Mineralogists (now the Society for Sedimentary Geology, but still abbreviated “SEPM”) on the history of micropaleontology in 1941, he downplayed their role and over-emphasized the role of his male colleagues.

By the time my mentor and hero, Edgar Owen, wrote the “Trek of the Oil Finders” in 1975, his discussion of foraminiferal discoveries ignored the women’s role entirely and he gave praise to the “men whose influence was most pervasive in its adoption – J. A. Udden, Edwin T. Dumble, Joseph A. Cushman, and Jesse J. Galloway.”

These four men had themselves failed to identify foraminifera as the clue to detailed biostratigraphy and were only convinced by scientific work done by the women. Yet, the men were given the credit. All four men were deceased by 1975, but I imagine at least some would have had the decency to roll over in their graves.

Charles Schuchert, a Yale paleontologist,

did understand their role when in 1924 he wrote, “the ladies have it” a year before their seminal paper was published.

He commented that they had not only identified the short ranges of foraminifera and more distinct species characteristics, but were identifying and applying important foraminiferal faunal assemblages that were critical for detailed biostratigraphy.

To really appreciate the monumental impact of their work, it is incumbent upon today’s exploration geologist to use his or her imagination and place himself back into the pre-foraminifera days and try to delineate the stratigraphy of a complex salt dome area or the coastal down-warping and highly faulted Gulf basin margin, or even the midcontinent mountain-front stratigraphy in Oklahoma – imagine working without the benefit of any well logs! And, continue to imagine exploring without the benefit of any seismic!

The only tools the subsurface exploration geologists had were lithologic data and, at that time, this was poorly collected, erratically prepared, and under-utilized. More sophisticated stratigraphers sometimes combined the lithologic data



GRIES

Robbie Gries is a member of the History of Petroleum Geology Committee and recently published “Anomalies – Pioneering Women in Petroleum Geology: 1917-2017.” She is a past AAPG president and is president-elect of the Geological Society of America.

with broken pieces of macrofossils found in well cuttings.

Will a Woman Do?

The story of these female paleontologists story begins with E. T. Dumble, former head of the Bureau of Economic Geology in Texas and, in the early 1900s, the vice president and general manager for Southern Pacific Company and its subsidiary Rio Bravo Oil Company. Their large task was to supply the Southern Pacific railroad with fuel oil, as they had recently converted from coal-fired engines. By 1915, Dumble had hired and trained the largest petroleum geology department in the world.

Much of his work was done from their San Francisco office, and the rest in their Houston office for the Texas and Louisiana Gulf Coast. When California

privatized its oil lands, he turned his focus back to Gulf Coast exploration. He was convinced that the key to working out the chaotic Tertiary stratigraphy of the Gulf Coast was paleontology. But, it was macropaleontology that he had in mind. The conventional wisdom of the day among micropaleontologists was that single-celled animals, such as foraminifera, could not possibly have the short life span or the physiological complexities required for effective and detailed stratigraphic correlations.

Between 1918 and 1919, Dumble put together a consortium in Houston, consisting of his own Rio Bravo, The Texas Company, Humble Oil Company and Gulf Oil Company, all of whom agreed to hire a paleontologist to work on macropaleontologic solutions to the troubling Gulf Coast stratigraphy. While in San Francisco he called the geology department at the University of California at Berkeley and asked Bruce L. Clark to recommend a man for the paleontology job.

According to Esther’s autobiography, Clark said, “I don’t have a man, will a woman do?”

Dumble, to his credit, said, “I don’t see why a woman couldn’t do it better.”

Dumble enlisted graduate student Esther English Richards to come to Texas in the summer of 1919 to work for him, not letting her know that this was a “test” for her permanent hiring as the consortium’s paleontologist. She passed the test and returned with her master’s degree a year later to set up the paleontology lab at Rio Bravo, starting on Labor Day in 1920.

A month later, much to both Dumble and Richards’ amazement, Wallace Pratt hired Alva Ellisor from the University of Texas at Austin to set up a lab for Humble Oil. However, Pratt assured Dumble that Humble would stay in the consortium and would encourage the women to work together – which worked out greatly, as the two soon found an apartment together in downtown Houston off Main Street.

Both women came to realize that macrofossils were just not going to work for detailed stratigraphy – the samples were broken and poorly preserved in cable



Hedwig Kniker, Esther Richards and Alva Ellisor in 1927

Continued on next page



Typical laboratory attire for the pre-air-conditioned laboratory in the 1920s (per Shell Oil retiree, Ed Picou). From left: Kniker, Richards and Ellisor.

Continued from previous page

tool wells, and were even more thoroughly destroyed with the new rotary drilling technology.

Applying new sample-washing techniques learned from J. A. Udden at the Bureau of Economic Geology, they began recording and comparing their observations on the microfossil assemblages. In the meantime, the Texas Company, under the management of Raymond Baker, hired another UT graduate, Hedwig Kniker, to set up a paleontology lab for them in Houston – but also agreed that the women would collaborate. Kniker moved into the downtown apartment with Richards and Ellisor. It was a collegial arrangement and Richards later wrote that they often talked long into the night about their work. They sometimes went to Ellisor's mother's home in Galveston on weekends or entertained other geologists with dinner parties in their apartment.

Exciting News

Ellisor is credited with the first breakthrough, in 1921, though Richards says she was working on the same samples and ideas when it was announced. Anyway, the story is that Ellisor showed Wallace Pratt what she could do using Tertiary foraminifera for well-to-well correlations. He was so excited, he at first told her not to share this information with anyone! He thought they could use this to Humble's advantage. However, by the time Ellisor got back to the apartment that very night, Richards and Kniker greeted her with congratulations: "Wow ... we hear Pratt loves the use of forams for stratigraphy and we all have the go-ahead

to pursue it!" they said.

Apparently, Pratt was so excited, he couldn't keep the news to himself, plus, collaboration was probably obligatory under the consortium's agreement.

"Dr. Dumble wanted to spread the news that (simple-unicellular forms ... were supposed to live on, unchanged, through many geologic time periods) and that these simple organisms did change as rapidly in time as their more organically complicated macro-fossil relatives," said Richards.

He immediately wrote a paper, "Recent Geological Work in the Gulf Coast Oil-Fields" in December 1921 and, interestingly, he listed himself as the only author, but sent Richards, accompanied by Ellisor, to Amherst, Mass. to present the material at the Geological Society of America, where he knew many micropaleontologists would be in attendance. Richards delivered the talk: five pages, double-spaced and never published, but Richards' granddaughter, Patty Kellogg of Gloucester, Va., has preserved a copy of it.

When the very nervous young Richards finished delivering the presentation, Jesse J. Galloway, a professor at Columbia University stood and said, "Gentlemen, here is this chit of a girl right out of college, telling us that we can use foraminifera to determine the age of formation. Gentlemen, you know it can't be done."

Undaunted by this criticism, Richards and Ellisor, with Rio Bravo's and Humble's encouragement, lingered through the Christmas holiday on the East Coast to meet and talk with other leading paleontologists, including J. A. Cushman at Columbia and William H. Dall of the U.S. Geological Survey. And, significantly, they also met

See [Published](#), page 27



Alva Ellisor preparing foraminifera for her microscopic work and identification, 1946, the year before she retired. Photo by F. W. Rolshausen and R. D. Woods of The Dolph Briscoe Center for American History at the University of Texas at Austin.

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Target-Oriented Parameters for Curvature Attributes Computation

By LEE HUNT, BAHAA BESHRY, SATINDER CHOPRA and COLE WEBSTER

Curvature has long been used by geologists to predict the density of natural fractures from outcrop. Sand box experiments show that correlations between curvature and strain can be significant, which is supportive of the curvature-strain-natural fractures supposition inherent in the use of curvature to predict natural fractures. Seismic horizon-based curvature estimates have been shown to be potentially effective in the same manner as that of geologic map approaches. This was followed by volumetric seismic curvature, which has largely replaced horizon-based curvature estimates perhaps due to the elimination of picking a horizon in data not well suited to horizon picking, or not having a pickable horizon in our zone of interest.

The first author and others have found statistically significant correlations between volumetric most-positive curvature and natural fracture density indicated from high-resolution image log data along horizontal wells. One of the methods of computing seismic volumetric curvature attribute involves Fourier filtering, and has gained widespread acceptance. There are other methods for generation and filtering of curvature that are available in our industry. We examine the impact of specific curvature parameter selection— an interpreter level detail rarely discussed in the literature— on fracture density prediction.

The Falher F tight sandstone of the deep basin in Alberta, Canada, is gas charged, deeply buried at about 3,200 meters true vertical depth, and over-pressured with gradients of about 14.5 kilopascals per meter. The net horizontal stress in the Falher F is quite low, which makes the drilling mud window narrow. Compounding this operational challenge is the fact that the sand has abundant natural fractures, which can lead to mud losses or gas kicks depending on the management of the mud weight. Either the loss of too much mud or the uncontrolled production of too much gas can lead to catastrophic operational failure in this over-pressured system.

Case Study

We assessed the best curvature parameterization as being the one in which the hazard presented by the natural fractures was most clearly interpreted from map and line views, and had the highest correlation to fracture density. We argue that the interpretive objective, or target, should generally be given primary consideration when choosing curvature parameters. Our study area is depicted in figure 1, and has four horizontal wells, depicted as wells O, A, B, and C. Well O and Well A both encountered numerous open fractures, suffered uncontrolled losses of drilling mud and were abandoned due to related operational concerns. Well C had no discernable operational issues, although some fracture infill material was reported by the wellsite team. The



CHOPRA

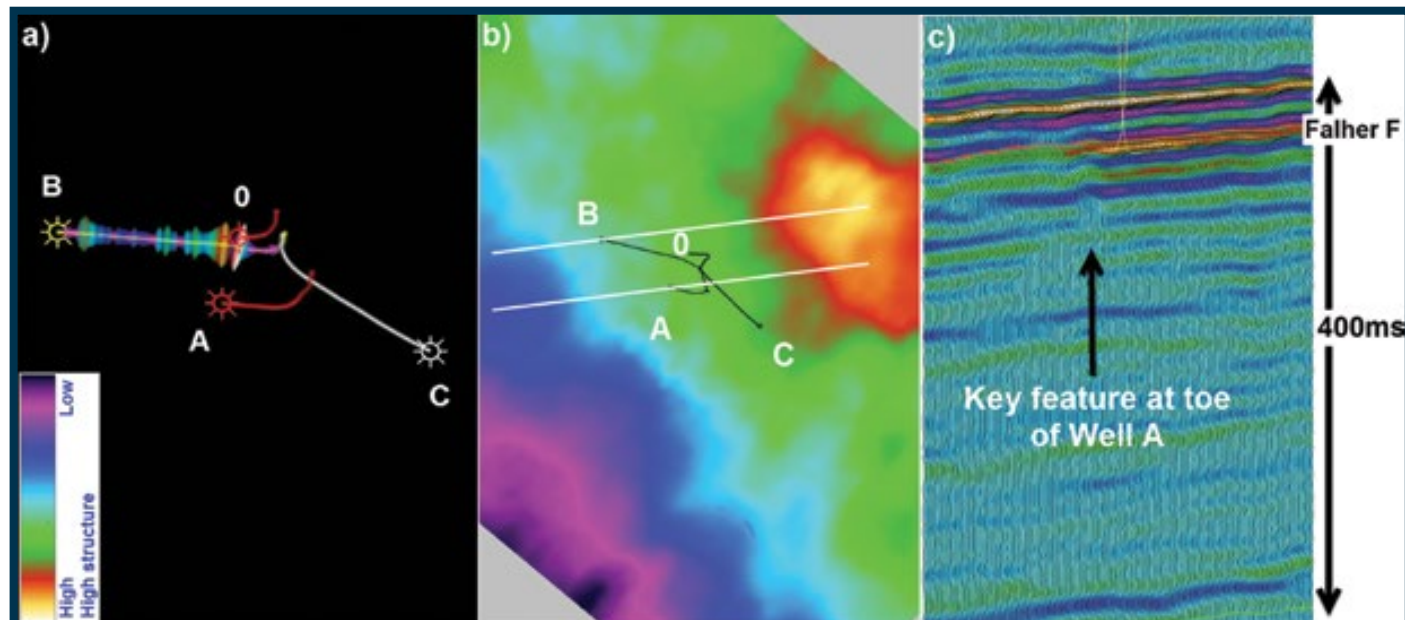


Figure 1. Maps depicting the key elements of the case study. (a) A 3-D perspective view of wells O, A, B, and C. Well B has an image log estimate of fracture density. The fracture density is displayed as rings whose size is linearly proportional to density. Well O and Well A both encountered numerous open fractures, suffered uncontrolled losses of drilling mud and were abandoned due to related operational concerns. Well C had no discernable operational issues, although some fracture infill material was reported by the wellsite team. (b) A time structure map of the Falher F for a portion of the study area. The two seismic lines to be used in the line analysis are shown as the white straight lines. (c) The southernmost of the two indicated seismic lines. The toe of Well A is indicated by an arrow, and coincides with a structural feature. All seismic data images are arbitrarily cut and rotated, with exact scales hidden, to protect the confidential nature of the data. The same color bar is used for all the images.

operational failure of wells O and A suggest that a high density of fractures must exist near the end of those wellbores. Well B has image log fracture density data, which is displayed in figure 1a. Figure 1b shows a larger area around the wells with two evaluation lines displayed in white. The lower seismic line is depicted in figure 1c. A reasonable but uncertain interpretation of the events from these wells is that a trend of high density fractures exists in a curve or line going from the toe of Well O, past

the high fracture density area of Well B, to the toe of Well A. The lateral length of Well B is just over 1,500 meters. Exact scales and the direction of North are not given to protect the confidentiality of the data.

Method

While an interpreter defines surface patches of a given size (xy) and appropriate software algorithms then fit with a mathematical quadratic surface, second-

order derivatives are estimated from a cuboid of data (xyz) for volumes. Different curvature measures are then computed from the coefficients of the quadratic surface or second-order derivative measures. For a more detailed description of how surface and volumetric curvature attributes are estimated from seismic data, please see the Geophysical Corner columns in the November and December 2007 issues of the Explorer.

As the most-positive and most-negative curvature attributes are found to be the easiest measure to visually correlate to the features of geologic interest, a series of most-positive curvature were created on structure-oriented filtered seismic data. The estimates of most-positive curvature using different methods varied by their parameters and are described by:

- ▶ Whether the estimates are based on horizon or volumetric estimation methods.
- ▶ The size of the cuboid that is used in the initial estimate of the derivatives (x and y-size are in traces, z-size is in milliseconds).
- ▶ The type of filtering applied to the curvature values, which is workflow dependent. This refers to unfiltered curvature estimates, Gaussian filtering or Fourier filtering.

The estimates of the most-positive curvature were derived from four separate industrially offered applications. The Gaussian size is given only by two numbers, the first defining a proxy for the x and y size, and the second number defining the z size. Qualitative comparisons were made based on the map interpretation of curvature and the two lines described in figure 1. Quantitative evaluation of curvature was made by linear regression with the upscaled fracture density from the image log of the 1,500-meter long lateral of Well B.

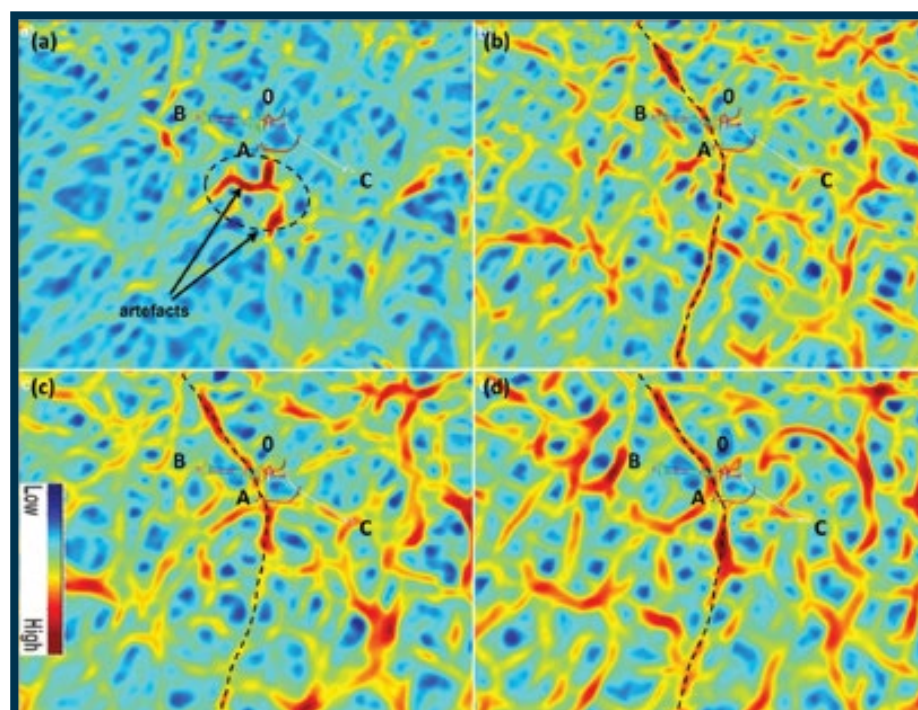


Figure 2: Most-positive curvature attribute estimates at the Falher F surface. Image log fracture density data along Well B are shown as discs proportional in size to the fracture density. (a) The 9x9 horizon based method has artefacts (shown enclosed in a circle) which are the dominant feature of the image. The expected arcuate feature connecting the toes of Well O, Well A, and the high fracture densities from Well B is shown with a black dashed curve on images (b) to (d). (b) The 9x9x98ms, unfiltered volumetric method appears reasonable. Shorter time windows appeared unstable and were more difficult to interpret. (c) The 2x9 Gaussian filtered volumetric method is not materially dissimilar to the unfiltered result. The Gaussian size has a complex definition. (d) The 5x5x22ms Fourier filtered with an alpha value of 0.2 has better preservation of curved features in map view, which may be implementation related.

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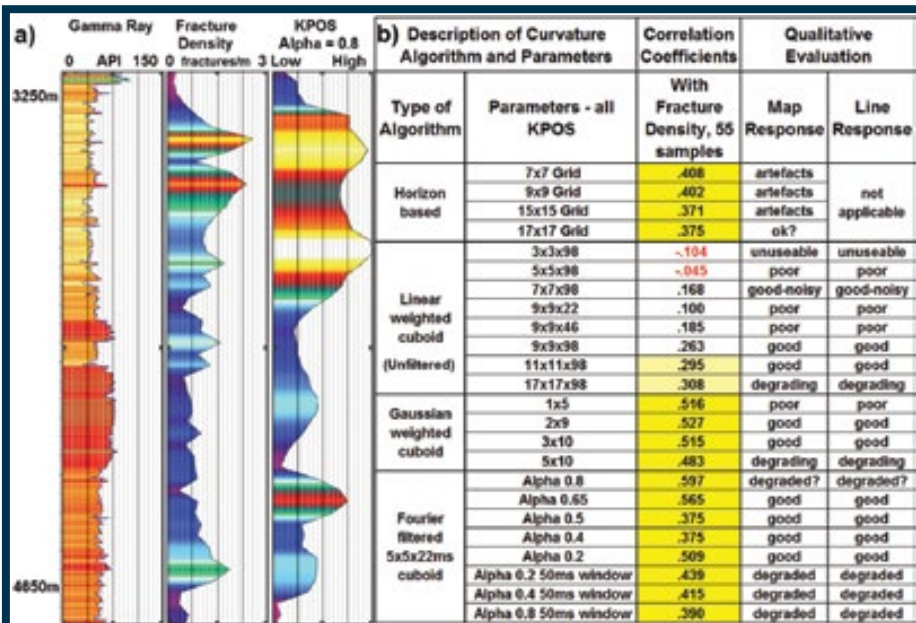


Figure 3. Selected results. (a) Gamma Ray log, upscaled fracture density from image log data, and most positive curvature with Fourier filtering and an alpha value of 0.8 for the horizontal length of Well B. (b) A results summary with a roll-up of the correlations to fracture density as well as the qualitative line and map based evaluations. Correlation coefficients passing the 1 percent p-test for significance are colored dark yellow.

Continued from previous page

Results

Only a small subset of the results is shown in this article though the comparison was carried out on both vertical lines as well as horizontal displays from the attribute volumes.

Figure 2 depicts a subset of the map comparisons. The image log fracture density as shown along the lateral of Well B along with the position of the toe of Wells O and Well A are important considerations in this figure, as interpretability was based on the expected arcuate or linear curvature feature connecting the toes of Well O, Well A, and the high fracture densities from Well B. All the results, except for the horizon-based one, show the expected high most-positive curvature trend, although some details change in the complexity of the trend. The horizon based map of Figure 2a was considered poor as it was dominated by pick-based artefacts (enclosed in a circle). The main arcuate feature mentioned above is shown in black dashed curve and overlaid on the images in (b) to (d). The unfiltered 9x9x98 milliseconds volumetric result of figure 2b appears quite interpretable on map view, although smaller

time (z) windows gave poor results. The Gaussian filtered volumetric result is shown in figure 2c, and is considered good. The Fourier filtered result (with a fractional index parameter alpha=0.2) is shown in figure 2d, and is considered excellent, especially in its preservation of curved features.

Linear regression was performed between the most-positive curvature maps and the fracture densities from the image log along the lateral of Well B. Figure 3 shows the log comparison, the correlation coefficients, and rolls up the overall evaluation of the parameter test. Figure 3a shows the correlations of curvature and fracture density in a log format. The entire set of results is summarized in figure 3b. The Fourier filtered results were the most robust to parameterization and were stable at small cuboid sizes. The Gaussian filtered results seemed decent for all but the smallest and largest parameters tested. The unfiltered volumetric approach required large time windows, which was concerning to the localization of the interpretation for fractures. The horizon-based method suffered from pick based artefacts in most comparisons.

See Filtering, page 27

Lee Hunt was the 2011/2012 Canadian Society of Exploration Geophysicists Distinguished Lecturer, and was one of the founding members of the CSEG Value of Integrated Geophysics (VIG) steering committee. He has drilled over 350 wells in most of the play types within the Western Canadian Sedimentary Basin. His work has won several awards and distinctions. He is an Ironman triathlete, and an enthusiastic sport rock climber.



HUNT



BESHRY



WEBSTER

some of his work includes drilling and geo-steering of 25 horizontal wells. His work focuses on depth and geo-hazard predictions, AVO analysis, 3-D curvature, VVAz, and the prediction of lithology, porosity, using geological parameters.

Cole Webster graduated from the University of Saskatchewan with a bachelor's (honours) in geological science in 2005. He began his career at Encana and spent nine years there before moving to Jupiter Resources where he has worked the last three years. Webster is currently senior geologist at Jupiter with a focus on development in the Resthaven area.



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Exploring 'the Last Frontier' of Offshore Somalia

By BARRY FRIEDMAN, EXPLORER Correspondent

One of the important goals of this year's AAPG International Conference and Exhibition (ICE) in London is for industry leaders and professionals leading the various short courses and field trips to introduce members, young professionals and students to the new geologic potential around the world.

In the "Identifying the Play" seminar, possibilities in the East Shetland Platform, the UK's Rockall Trough, Morocco, North Falkland Basin and Senegal will all be discussed.

As will one other place you might not expect.

Somalia.

Cobbled together in 1960, when both British and Italian Somaliland were granted independence, the country, not surprisingly, has been engulfed in almost constant civil war. It carries with it the scars and death of such strife, especially since the 1980s. The country, as it turns out, is also a place of unrealized, yet substantial resources, and that's what will be discussed.

Douglas Paton, who is chair in structural geology and basin analysis at the University of Leeds, wants to reintroduce Somalia to professional geologists. To that end, he will be offering a short course called "Somalia: The Last Remaining Exploration Frontier," as part of the "Identifying the Play" technical program.

"Offshore Somalia," he said, "is one of the last remaining truly frontier continental margins for hydrocarbon exploration."



PATON

"Exploration in frontier basins is a challenge at the best of times, but this is increased where there have been very little documented studies with even fundamental questions"

Land of Challenge and Opportunity

From approximately 1950 to the mid '80s, most of the exploration in Somalia had been onshore, Paton said, and "only two exploration wells have been drilled in the entire offshore region."

Exploration stopped for many reasons – the civil wars mostly – when all licensed acreage was declared under *force majeure*. Up until a few years back, Somalia remained inaccessible and many of the country's geological and geophysical data were either lost or destroyed. Since 2012, however, as the country slowly achieved something resembling stability, a willingness to re-invest in the region has emerged, starting, Paton said, with two regional 2-D seismic surveys offshore.

"We anticipate the imminent announcement of a new offshore licensing round," he added, alluding to two surveys: one completed in 2014, the other in 2016.

A current project, which will be discussed in the course, is a joint effort amongst Basin Structure Group, Paton's research group within the University of Leeds, Spectrum and the Somali government. Paton said it will

be "collaborative" and include "people with many years experience in exploration and prospect generation, academics, but also PhDs and other graduate students, and the Ministry in Somalia."

Although the current focus is on the forthcoming license round of the process, Paton anticipates the project will form between the Somalia government and the country's universities.

And it is the future about which Paton is particularly excited, citing the books and lab equipment that have already been sourced and donated to help establish geoscience graduates within the country.

Paton is under no illusions, however.

"Exploration in frontier basins is a challenge at the best of times, but this is increased where there have been very little documented studies with even fundamental questions such as the nature of the crust being uncertain," he said.

Cracking the Margin Mysteries

He said the goal, then, is to increase the understanding, de-risk future exploration


investment and help the Somali government maximize the opportunity available.

"This is best achieved with such a collaboration that merges the best and most recent academic insights with world-class industry data and industry insight," said Paton.

"These data provide an unrivaled insight into evolution of the crustal geometry and basin development on this margin that has far-reaching implications on plate reconstructions and conjugate areas," he added.

Paton said that the possibilities of the offshore Indian Ocean margin of Somalia represent one of the final truly frontier margins globally, for little is known about either its tectonic evolution or basin-structure configuration.

"To date this has severely impeded hydrocarbon exploration in the mid-shelf and deepwater areas of the more than 1,500-kilometer long margin. Recently acquired long offset 2-D reflection data by Spectrum has revolutionized our understanding of the margin architecture which has significantly de-risked future exploration," he explained.

Ultimately, said Paton of Somalia, what will come of such exploration, as well as a forthcoming report on exploration prospects, are "new views on the process of crustal stretching, interaction of transform margins and volcanism which will have far-reaching implications of these processes on other margins and which lead to a suite of co-authored publications in both the industry and academic literature." 

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Energy and Opportunity

Discovery Thinking Forum, ICE 2017

By BARRY FRIEDMAN, EXPLORER Correspondent

AAPG President Charles Sternbach likes to quote the late Marlan Downey, a past AAPG president, about the secrets to a successful career in the profession.

“Go where the energy is.”

And in London, during the Discovering Thinking seminar at this year’s International Conference and Exhibition (ICE), Sternbach, along with others, will revisit the world’s most petroliferous basins with new technology.

And showing where that energy is.

“Fundamental to AAPG energy-relevant content strategy,” said Sternbach, “are plans for publications and programs on super basins. These are infrastructure-rich basins that keep on giving.”

As an integral part of the seminar, Paul Weimer, another past AAPG president and the Bruce D. Benson endowed chair at the Department of Geological Sciences of the University of Colorado, will teach a short course on the very notion of what comes next – specifically, what’s out there to be discovered.

The problem is, he’s not very good at it.

At least, according to him.

“I have worked around this industry for almost 40 years, and one thing that I’ve learned is that I’m not particularly gifted at predicting its future,” said Weimer.

But it’s not like he doesn’t have some clues.

“It strikes me that our industry is going through a long-term major reorganization, similar to the decade-long one from the mid ‘80s to mid ‘90s. Technology and the markets continue to make activities more efficient,” which, he added, is both a blessing and a

curse, as there is an oversupply of oil, which he does not think will decrease in the next three to five years.

The New Force of Independents

The way Weimar, who is director of the Energy and Minerals Applied Research Center (EMARC), sees it, there are really three global industries today.

“One focuses on conventional accumulations onshore and in the offshore shelf regions; the second industry focuses on deepwater; and the third, which is limited primarily to the U.S. and Canada, focuses on the development of unconventional reservoirs,” he explained.

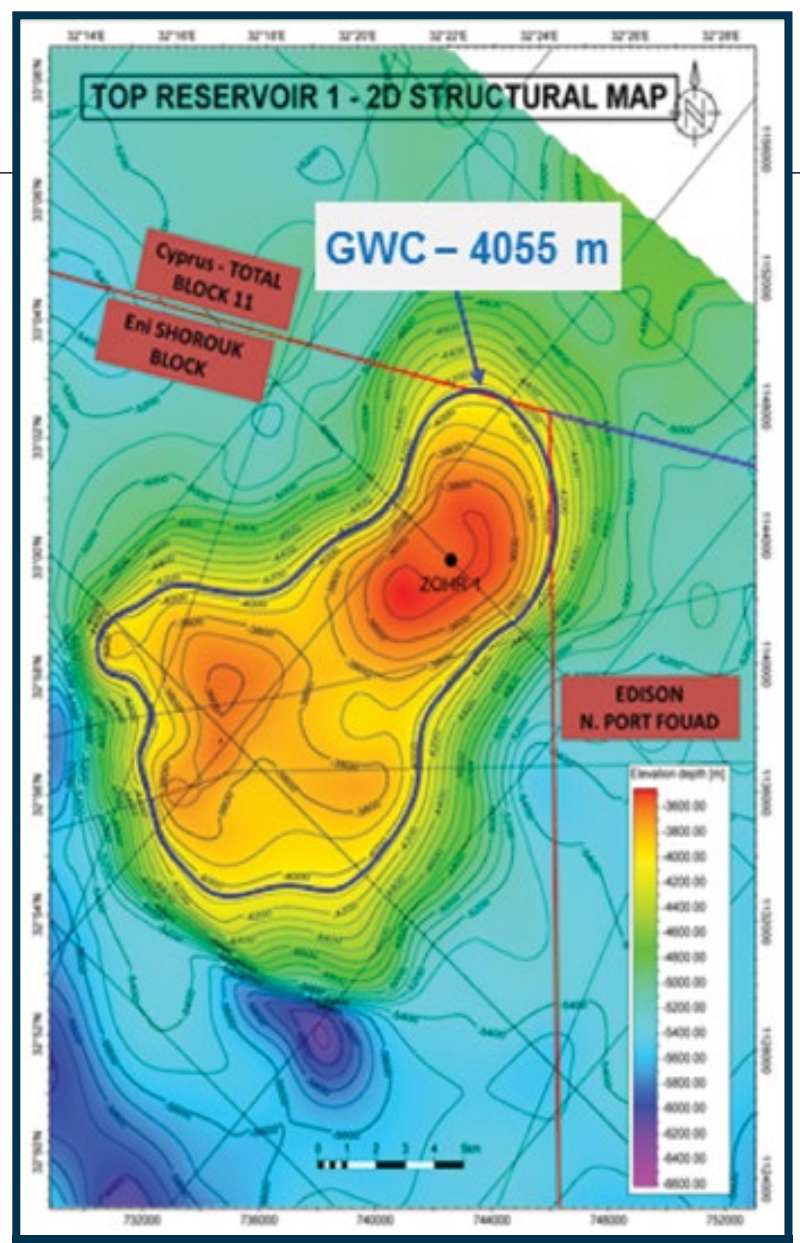
And while there are some limitations on unconventional resources – and Weimer said Argentina is the most obvious example – he thinks the potential for development of unconventional plays is high in many countries.

In the United States, a new force is leading the industry.

“Unconventionals have now become so large in the United States that independents are increasingly becoming the initial employer for students,” whereas, traditionally, major companies used to be.

“In some schools, graduate students are now trained primarily on unconventional resources and do not necessarily have a background in conventional accumulations,”

Continued on next page



Zohr Field in Egypt is one of the super basins to be discussed.

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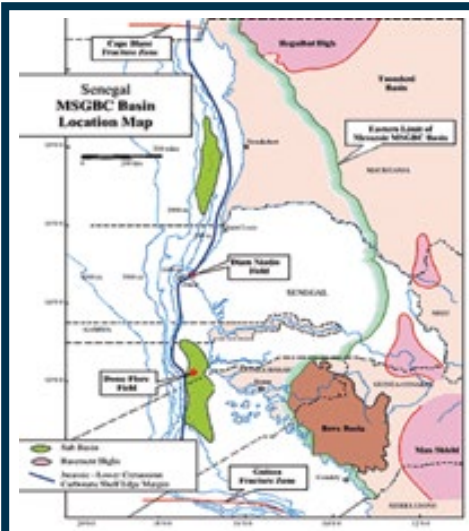
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Discoveries in Senegal are reported to be significant oil reserves in shelf sandstone reservoirs in intermediate depths of the African margins.

Continued from previous page

he added.

Weimer said that with the rapid evolution of unconventional, the collective geologic knowledge database has probably tripled during the past decade. What that means for students and young professionals is that they will continue to have a steep learning curve throughout their careers – not that there's anything wrong (or new) with that.

"Everyone needs to grasp that continuing education is always an ongoing and significant part of a professional career," said Weimer.

To that end, in London, he will lead interpretation exercises in the class, covering new frontiers, as well as instruction in seismic data and wireline logs.

"One exercise deals with developing new resources on older fields, one addresses the recognition of deepwater prospects in terms of traps and reservoirs, and a third addresses the basic concepts in unconventional resources," said Weimer.

Evolving Role of Professional Societies

In determining the four main areas on the horizon – rejuvenation, resurgence, frontier exploration and future plays – he said to keep an eye out on that last one.

"Future opportunities are largely controlled by commodity prices and access to lands; different basins and play types need a different minimum price to encourage development, so it is somewhat difficult to predict where the greatest opportunities are," something,

he said, which also varies by country.

"For example, in deepwater exploration, sustained oil prices in the \$55-60 range are necessary for it to be profitable. This is also the price range for some unconventional plays. However, the current level of oil prices is clearly economic to encourage the extensive drilling in the Permian and Anadarko Basins," he explained.

Weimer sees less anxiety going forward.

"A delicate balance in prices has evolved in the market between global supply and demand," he said.

Outside the classroom, outside the job site, he still sees a place for professional organizations like AAPG.

"I think the entire concept of professional societies is undergoing a major transition in geosciences as well as all disciplines," said Weimer. He recalls that scientific societies developed in the mid-17th century when like-minded people could meet both to socialize and to discuss science – something he believes hasn't really changed much during the past 300-plus years.

"However, I do think that the Internet has fundamentally changed the dynamics in terms of how we access scientific information. This change is significantly affecting how professional societies will operate in the future, and all societies are grappling with this currently. Societies like AAPG still provide much needed opportunities for mentoring, networking, and science, that, to a large degree, is inaccessible to non-members," he explained.

On a personal note, he said that many of the most important professional relationships and colleagues with whom he has worked began in professional societies.

"That is something that one cannot understand at the start of one's career."

Where the Opportunities Are

With regard to the broader industry, Weimer is an optimist, within reason.

"Industry today is markedly different than the one of 40 years ago. The major reorganization of the mid '80s was primarily a long-term transformation due to production in new areas, the introduction of new technology (such as 3-D seismic), etc. The confluence of all these factors resulted in a significant decrease in the number of geoscientists who were needed. I believe we are undergoing a similar generational change currently, and we're only in Year Three of what is likely an extended period of time," Weimer said.

However, he does not believe the demand for geoscientists is going to remain as high as it has been in the past.

"This does not mean there are not many opportunities. My experience has taught me that there are always opportunities for those who have imagination, vision and initiative. Consider that twelve years ago, no one predicted the effects that the development of unconventional resources has had on the global markets," he said.

And, the Discovery Thinking Forum is all about looking to past successes to find those opportunities.

"What makes the Discovery Thinking Forum so exciting," said Sternbach, "is that we are showcasing discoveries that

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Continued on next page

Published from page 21

with Julia Gardner, the queen of Tertiary coastal biostratigraphy, and stayed at her Washington, D.C. home for several days. They forged lifelong friendships and working relationships.

When Richards and Ellisor returned to Houston, invigorated and motivated, they – along with Kniker – began, in earnest, their work sorting out the coastal stratigraphy. All three felt strongly that their subsurface work had to be closely tied to surface “ground truth” and initiated many field trips into central Texas. Richard took yet another trip around the north and northeast Gulf Coast collecting samples. She also conducted frequent meetings with drillers – constantly instructing them on sample-catching techniques as well as their washing and preparation for the laboratories. Dumble also took an interest in Richards’ personal life and sent her out into the field often with his bachelor field geologist, Paul Applin. The matchmaking was successful and they were married by 1923.

In 1925, the three women published their epic work and landmark AAPG paper which, according to retired Shell Oil micropaleontologist Ed Picou, established the basic framework of benthic zonation in the Gulf Coast: “Subsurface Stratigraphy of the Coastal Plain of Texas and Louisiana.”


A Transformed Industry

Very quickly, micropaleontology was a necessity for every oil company and drilling venture. Initial skeptic J. J. Galloway, in 1928, noted, as stated earlier, that more than 300 micropaleontologists were using this tool to work out stratigraphy and structure. Galloway had himself capitalized on their discovery and, within a year of their Amherst paper, was consulting for oil companies using foraminifera.


Not until the 1930s did electric logs start making a presence in Gulf Coast wells. Micropaleontology kept its dominance in exploration, while being combined with electrical logs and eventually seismic, for decades.

Ellisor’s career with Humble (ExxonMobil) exemplifies the impact and scope of these early lab managers – she started the Humble lab with herself and one sample washer. By 1946, Humble Oil reported in their company magazine, The Humble Way, that they had:

- ▶ 12 micropaleontologists
- ▶ two paleontologists
- ▶ 20 sample washers
- ▶ several clerks
- ▶ 220,000 samples washed annually.

It is past time to give credit where credit is due and honor these three female scientists who changed the course of stratigraphy and the economics of petroleum exploration forever. 

unfiltered approach was most problematic to effective interpretation, requiring bigger time windows for stability. Evaluation of the best parameterization of curvature required the use of objective correlations to the interpretive target as well as more subjective map and line comparisons. Based on the interpretation of fractures, there appeared to be a sweet spot size for the cuboid or filtering for each of the volumetric approaches. A rational approach to choosing the parameters for curvature requires the consideration of the interpretive objective or target, as “best” is inextricably bound by purpose.


Acknowledgements: Seismic data is owned or controlled by Seismic Exchange, Inc.; interpretation is that of Jupiter Resources Inc. We thank SEI Canada for permission to show certain images of data licensed from them. 

global implications.

▶ The Senegal discoveries are reported to be significant oil reserves in shelf sandstone reservoirs in intermediate water depths of the African margins.

▶ Successes and exploration efforts have been reported in the east African rift basins in Ethiopia, Uganda, Kenya, Mozambique and Madagascar.

The Forum will also feature a brief presentation of highlighted vignettes of exploration insights from the decade-long Discovery Thinking program. This will be a tribute to more than the 115 men and women presenters (or co-authors) to this enduring and popular program.

“These 100 who made a difference,” said Sternbach, “are a proud part of the AAPG 100th Anniversary legacy. We are thankful for their generous contributions to make our exploration heritage better than ever before.” 

Filtering from page 23

Conclusions

The interpretation of the distribution and density of natural fractures was affected by the curvature parameters. The volume-based approaches seemed better in map evaluation than the horizon-based estimates, although the smallest xyz cuboid size of the volumetric estimates tended to bear greater similarity to the horizon solutions. Filtering of the curvature results was also material to the evaluation of the risk from natural fractures, with the Fourier based filtering showing the most robustness to different parameterization. Of the volume-based methods, the

Continued from previous page

are basin and play openers. These are rare and wonderful finds with game changer impact to their regions and to the world.”

To that end, the Forum will also discuss:

▶ Goliat was the first oil field to come on stream in the Barents Sea, and reports by ENI indicate that the platform has a storage capacity of almost one million barrels, which could be, according to Sternbach, a “significant game changer” for the Barents Sea and for industry exploration of remote and challenging areas.

▶ Of Zohr, in the eastern Mediterranean, ENI reports that reservoirs are Cretaceous Rudist reefs and Miocene Carbonates, where the nature of its gas may indicate a paradigm shift with both local and



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Review of applications will begin on November 3, 2017, and continue until the position is filled. SFA is an equal-opportunity employer. This is a security-sensitive position and will be subject to a criminal history check.





Huge portions of Houston's transportation infrastructure were submerged in the wake of Hurricane Harvey. Photos by David Clay.

In the Wake of Harvey

AAPG YPs lend a hand

By BARRY FRIEDMAN, EXPLORER Correspondent

David Clay is a geologist for Ames Energy in San Antonio, which is about 200 miles from Houston. And he's an AAPG Young Professional member.

For the moment, that's not important.

He has a boat.

For the moment, that is.

"Tim McGovern (another San Antonio-based geologist and AAPG Member) and I had a quick conversation," Clay said, after they both saw horrendous images of people in need in and around Houston after Hurricane Harvey, "about how we both have boats but felt helpless in San Antonio

without much direction on how to help."

Clay also had a young baby at home, so he couldn't very well bring his wife along while he went off to Houston to help strangers.

Or could he?

"About thirty minutes after discussing with Tim and realizing that it would be tough to figure out a way to get into Houston, Tim's wife, Chelsea, calls me," Clay recounted. "So you're taking the boat to Houston? Let's do this!"

That was settled in a hurry.

Clay's wife, who would stay home with their baby and also encouraged him to go, posted on Facebook she needed vests, water and care packages, and that's what they got. At 4 a.m. the next morning, Clay kissed his wife and his baby and left for Harris County, along with a group of fellow San Antonio geologists, including the McGoverns, Tanner Bowersox and others (some non-geologists).

Houston, We Have a Problem

"Upon getting the boat ready," Clay said, "I realized that since last duck season I had not replaced the worn trailer tires, and had not attended to my trailered boat quite enough. The engine started up just fine, but the steering cable had rusted shut. The boat was useless if I couldn't steer it."

YouTube is a wonderful thing.

"I decided to unhook the steering wheel and cable from the motor. I then bolted on a three-foot piece of wood that would serve as the tiller. The boat was officially even more redneck approved than before! In fact, while out in the middle of Buffalo Bayou, a member of the Cajun Navy commended me on wooden tiller rig. It was the greatest compliment," he related.

Clay, along with friends Nils Granger and Justin Brim, soldiered on.

OK, they limped on.

At the Home Depot in Seguin, Texas, Clay met up with the McGoverns, Bowersox and the rest.

"In Schulenburg, Texas (about 90 minutes from Houston), I realized," said Clay, "the trailer tire was low and then upon filling it up, discovered that the tire tread had completely ripped off. So the boat was riding on two (worn) tires and one spare that only had half of the tread remaining on it too."

"We prayed! We prayed and then kept on going," said Clay.

And their prayers were answered.

Well, for about 15 minutes they were answered. Then the right tire blew.

It was 6.30 a.m. at this point and nothing was open.

Of course nothing was open.

Wait – something was.

"Finally found a tire shop in Sealy that was open and had an extra trailer tire. I told them to be ready for us! The shop 'NASCAR'ed' that boat trailer and we paid and were out in 10 minutes," he said.

The Positivity of Human Nature

After meeting up again with the McGoverns, the trip continued.

"Driving in on I-10 the city (Houston), was quiet, but you really didn't see much of the flooding since you are up on the interstate."

Continued on next page

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Citizen volunteers joined the National Guard in rescuing flood victims.

Continued from previous page

Clay noticed about five other boats scrambling to find out how to help. FEMA officials, he said, weren't of much help, but then Justin, one of this "shipmates," got a lead from his Facebook newsfeed that said boats were immediately needed off of Memorial drive and Kirkwood.

Upon racing to the location, Clay said he and his crew "came to the intersection to a wall of water going down Kirkwood towards the bayou and a Cajun Navy member locked eyes with me, saw my boat and signaled for me to back in right there in the intersection."

"We launched the boat, surveyed the area and tried to get a grasp of underwater obstacles: trees, stop signs, fire hydrants. My buddy Nils and I grew up in Houston and fortunately spent lots of time driving on Kirkwood. He knew every turn and median to cut through," Clay added.

He continued, "We were instructed to go to the second bridge and pick up individuals and transport them back to higher ground. My depth finder was reading six to eight feet in the middle of Kirkwood. We got out into the bayou and at one point the depth was reading over 38 feet!"

"The section between the launch point and the second bridge had already been evacuated. It was (on) the other side of the second bridge where people were either wading to the bridge or being rescued and brought to the bridge. It was a rallying point for them to get picked up by us and transported down Kirkwood to higher ground. There were National Guard helicopters landing on the bridge 50 yards in front of us," Clay explained.

He said the helicopter responders prioritized people with health risks "and then people would run underneath them across the bridge, then another would land."

"That went on for hours it seemed like. By the time the early afternoon rolled around, there were about 40-plus boats on the water," he added.

There were so many boats, in fact, the National Guard asked Clay and his crew to get out of the water. They did so and headed to NRG stadium to drop off the supplies they had gathered, but the facility

was at capacity and could not take any more donations.

The stadium can hold and park up to 80,000 people. And it was full.

"You cannot grasp something of this magnitude happening," he said.

Clay saw schools with no roofs, barns gone, power out, water shortages and other hallmarks of a natural disaster.

But he also saw something else.

"Every corner going through town had a barbecue pit, a grill or a mobile food truck helping feed people! It was something that brought tears to your eyes because there were people of all races and religions out there just to help others out. Grandparents passing out food or behind the grill. Their kids putting together barbecue plates and serving the sides and their kids passing out water. Generation to generation to generation showing their kids and grandkids what it means to serve others. It was incredible to see such giving people."

And some of those giving people include people who never left San Antonio, but someone for whom he works, namely Gene Ames, III.


"I did not ask him to leave work, I simply told him I had to go and he was OK with that. In fact, without my knowing he sent out an email to a group of industry friends requesting donations to fund our efforts in Houston. There was such a willingness to donate to our expenses that I was able to donate the remaining funds to the RebuildTX Fund and the J.J. Watt Fund. We can call it the Geologist Houston Recovery Fund."

Clay calls what he experienced, what he saw, "The positivity of human nature."

"There is no judgment of your race, religion, age, sex or anything else. It was simply people helping people."

Some you don't know, some you do.

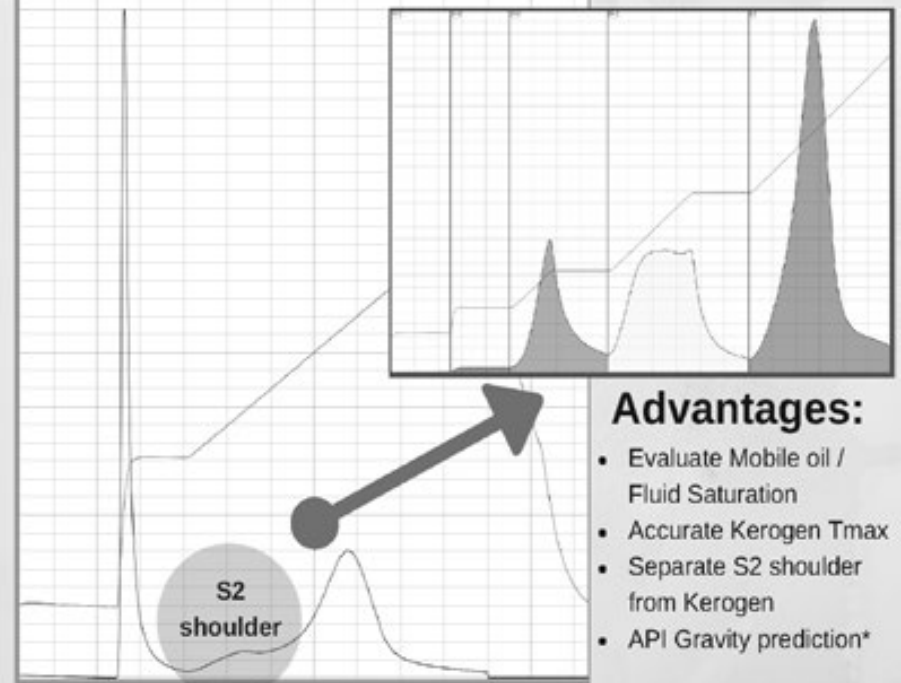
"My brother's neighbors were in such an emotional state that they had no idea where to start the clean-up phase. Having three outsiders show up and throw out all of the ruined items that they couldn't separate themselves must have been heartbreaking. All they could do was cry for a few minutes, get past it and start the cleanup process. They had no other option," he said.

Clay went back to Houston the following week. 

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The ConocoPhillips School of Geology and Geophysics, part of the Mewbourne College of Earth and Energy, has a large, vibrant faculty with a broad range of research activities. The School and College maintains strong ties with the petroleum industry. The world's first School of Petroleum Geology was established here a century ago; furthermore, members of our School contributed to the first application of reflection seismology in petroleum exploration. Our research facilities are detailed at <http://www.ou.edu/content/mcee/geology/Research.html> and include computer labs with PC and Linux platforms networked to a dedicated cluster within the OU supercomputer center. The School maintains a comprehensive pool of geophysical equipment including wired and wireless seismic acquisition systems, active seismic sources, GPR, ERT, magnetics, and gravimetrics, as well as extensive rock physics characterization laboratories.

Review of applications will begin immediately and the search will continue until the position is filled. The anticipated starting date is Fall semester 2018. Applicants can apply online at <http://apply.interfolio.com/44266>. Applicants are requested to submit a cover letter, complete vital/resume, statement of research and teaching interests, and a list of five references who can be contacted, including phone numbers, e-mail addresses, and mailing addresses. Questions, information requests, and nominations should be addressed to Dr. John Pigott, Chair Exploration Geophysics Search Committee, University of Oklahoma, Sarkeys Energy Center, 100 E. Boyd Street, Room 710, Norman, OK 73019 or ougeophysicssearchchair@ou.edu.

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IAGD: Overcoming Physical Barriers to the Geosciences

By CHRIS ATCHISON, Founder and Executive Director of IAGD

The geosciences have always attracted people with a sense of adventure, a mind for problem solving and the propensity to travel to remote areas and work in physically challenging landscapes. In the early days of geology, the capacity to traverse rugged terrain was an important requisite to employment in the geosciences. As the geoscience workplace has modernized, however, there are now many career opportunities that do not require the physical ability to explore the landscape on foot. Yet, the perception that the study of geology must be interwoven with physical challenges still acts as a barrier to participation for students and practitioners with disabilities in the geosciences.

The International Association for Geoscience Diversity (IAGD) works to change that perception.

I was inspired after working on a project that provided students with mobility disabilities the opportunity to study the Mammoth Cave system in Kentucky. These students were just as engaged and excited to learn about the Earth, but were never given an opportunity to do so. I became driven to help shift the traditional focus on physical or sensory ability being a requisite skill to be a geoscientist.

Today, that vision has evolved into the IAGD: a 501c3 non-profit I founded with the mission of promoting inclusive instructional practices, creating research opportunities for students with



The students, research faculty and support team for the IAGD's most recent inclusive field experience in Ireland.

disabilities and raising awareness for improving access and engagement in the geosciences for students and professionals with disabilities. The IAGD is led by an executive committee of volunteers from academia and industry who are passionate about making the study of the Earth a more inclusive endeavor. By supporting a range of activities from teacher training workshops to field experiences for students with disabilities, the IAGD has become instrumental bringing attention to the challenges of access in the geosciences, as well as working to address those challenges with innovative solutions.

What the IAGD Does

Student members of the IAGD have found mentors and opportunities to strengthen their geoscience skills through inclusive programs and accessible field study experiences. For some of these students, their participation in geoscience research activities also sends an important message to the broader scientific community. Student ambassador Sean Thatcher describes his participation in IAGD-sponsored field experiences as a place where "everyone is engaging with each other and working with each other and learning from each

other – it not only builds inclusion but it also lets people understand that people with physical disabilities or intellectual disabilities are not only capable of doing research ... but they are capable of contributing to the community at large, to something bigger than themselves."

During a recent study, students with various physical disabilities participated in field-based research experiences through the use of mixed-ability team collaboration and digital communication in the complex geologic landscapes of western Ireland. This project combined two aspects of the IAGD mission by creating a unique opportunity for students with disabilities to participate in collegiate level fieldwork and also created an opportunity for groundbreaking research into accessible approaches to field learning.

The diverse membership of the IAGD comes from almost 30 countries around the world and includes students, faculty and industry professionals. Support and training for instructors and mentors working with students with disabilities are crucial to success in bringing them through a degree track in the geosciences and into the workforce. Additionally, support is needed for current geoscience practitioners who have acquired disabilities either through accident, illness or the normal aging process. Keeping these knowledgeable and talented people engaged in the

See Foundation, page 32

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In memory of James Oliver Salvesson
John and Kate Spaid
In memory of D. Robert Brogdon
Robert J. Webster

John F. Bookout, Jr. Military Veterans Scholarship Fund

Robert Wayne Duke

E.F. Reid Scouting Fund

Richard E. Deery
Terri Duncan
Bryan Haws

Visiting Geoscientist Fund

Samuel Arthur Friedman
In honor of Jim Gibbs and Carl J. Smith

L. Austin Weeks Undergraduate Grant Fund

Borden Roger Putnam, III

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

REMEMBER WHO INSPIRED YOU?
Time to say thank you.

Julie Mitchell
2017 Teacher of the Year



Sharon Milito
2017 Teacher of the Year



Heather McArdle
2014 Teacher of the Year



Karen Waterburg
2016 Teacher of the Year

Nominate a Deserving K-12 Educator
For Teacher of the Year

They're the ones who bring something special to their jobs. They educate, they innovate, they inspire – and the AAPG Foundation is proud to recognize and honor their efforts.

Nominations open Sept. 15 for the Foundation's next Teacher of the Year: A U.S.-based K-12 teacher who has demonstrated outstanding leadership in the field of geoscience education. The award includes \$3,000 for personal use by the teacher and \$3,000 for school use under the teacher's supervision – plus an expense-paid trip to the AAPG Annual Convention and Exhibition in Salt Lake City, May 20-23, 2018, to receive the award.

Application Deadline:
11:59 PM (PST), Jan. 15, 2018

To learn more, visit: foundation.aapg.org

To donate in support of this program, go to foundation.aapg.org/donate





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Collins College of Business

The School of Energy Economics, Policy and Commerce within the Collins College of Business at The University of Tulsa seeks candidates for a full-time faculty position in energy business operations and management starting January 1, 2018. The successful applicant will teach face-to-face and online courses in the College's undergraduate and graduate energy business programs, pursue a productive research portfolio in energy business, broadly defined, and engage in appropriate professional and service activities.

The University of Tulsa is an Equal Opportunity Employer and is especially interested in candidates who can contribute to the diversity and excellence of the academic community through their research, teaching and/or service.

Apply here: <https://utulsa.edu/about/working-at-tu/available-positions/faculty-position-energy-business-operations-management/>



AAPG
Asia Pacific Region

Geosciences Technology
Workshops 2017



Oil and Gas Resources of India: Exploration and Production Opportunities and Challenges

Mumbai, India • 6-7 December, 2017

The program for this 2-day multidisciplinary workshop will include a 2-hour Expert Session on "Modelling 3-D Facies Distributions with Geostatistics" by Professor Olivier Dubrule of Imperial College London. Keynote addresses will be presented by See Hong Ong of Baker Hughes, Debnath Basu and Subrata Chakraborty of Schlumberger and Kalachand Sain of CSIR-National Geophysical Research Institute India.

24 technical oral papers and more than 30 static posters will provide up-to-date geo-scientific and technological information and address the scientific, technological and commercial issues faced by the companies and industry at large.

Register for Early Bird rates before 25 October 2017.

For more information, contact apereira@aapg.org

aapg.to/APgtwOilGas

Take the Advantage with the AAPG Career Center

By VICKI BEIGHLE, AAPG Administration Team Lead

Thinking about your career? If so, think about this: AAPG members have a distinct advantage over the typical job seeker thanks to the AAPG Career Center, an online employment service designed to match your talent, skills and experience with the employers who need what you can offer.

The AAPG Career Center includes a professional profile that enables members to easily and effectively present themselves and their accomplishments to potential employers.

By using the Career Center, AAPG members have access to:

- ▶ Free (and confidential) résumé posting.
- ▶ Uploading up to five career-related documents.
- ▶ Automatic email notifications.
- ▶ Access to job-seeker resources.
- ▶ Creating a "job agent" to automatically receive updates when new jobs matching your criteria are posted.

u Automatic notifications when a preferred employer posts a new position. Also, the Career Center allows

members complete control of how personal information is stored and shared.

Good for Employers, Too

Obviously, the site is a great stop for employers as well – this is where you'll find a professional talent pool that can fill any geoscience need that arises.

For employers, the Career Center offers:

- ▶ Targeted advertising options.
- ▶ Full résumé access.
- ▶ Job activity reports.
- ▶ Advertising enhancements.
- ▶ Email notifications.
- ▶ Member discounts.

When it comes to finding qualified geoscience professionals, where better to look than the association that represents them?

Members, strengthen your professional profile; employers, find the talent you need.

Visit the AAPG Career Center today, at <http://careercenter.aapg.org/>.

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Beautiful handmade globes for gifts, office or lab. See explanatory notes online at

www.realworldglobes.com

Foundation from page 30

workforce is no less important than any other aspect of this global organization.

Working at both ends of the workforce spectrum, the IAGD offers professional development workshops and accessible field courses to instructors and teaching assistants in higher education and K-12, and industry personnel who engage and include all students and geoscientists with diverse physical and sensory abilities in the various classroom and workplace environments.

Support from the AAPG Foundation

Recently, the leadership of the IAGD began to notice that as the organization has grown and evolved, their web-presence was beginning to lag behind the vision for the organization.

We want to be the go-to source for

faculty looking for innovative ideas and resources for inclusive teaching practices, as well as a community of support and opportunity for students and professionals with disabilities in the geosciences, but our outdated website and online resources were simply not up to the task.

Now, thanks to a generous donation from the AAPG Foundation, a full overhaul of the IAGD website is under way, along with updated resources to support persons with many disability types, including new information to accommodate those with Autism and Post-Traumatic Stress Disorder (PTSD). Once completed, the website will continue serve as an information hub for anyone interested in accessibility in the geosciences and across all STEM disciplines, designed with the latest inclusive design practices for ease of navigation and accessibility for all users.

For more information about the IAGD, please contact me at director@theiagd.org or (513) 556-3613.

IN MEMORY

Paul Ache, 90
Houston, Texas, March 19, 2017

Victor Andresen, 74
Bellingham, Wash., Jan. 25, 2017

M. Lee Allison, 68
Tucson, Ariz., Aug. 16, 2016

Sidney Anderson, 90
Grand Forks, N.D., May 30, 2017

Richard Banks, 86
Tulsa, Okla., June 4, 2017

Gail Bloomer, 82
Spring, Texas, Jan. 12, 2017

Joseph Brewton, 73
Pearland, Texas, Sept. 17, 2017

William Bridges, 89
Dallas, Texas, Dec. 4, 2016

William Bridges, 83
Sand Springs, Okla., May 26, 2017

Charles Brinkley, 87
Humble, Texas, July 27, 2016

Curtis Conley, 85
Westminster, Colo., March 17, 2017

Sheridan Conley, 96
Little Rock, Ark., August 5, 2017

Michael Davis, 95
Rensselaer, Ind., April 23, 2017

Edward Dillon, 91
Brackettville, Texas, May 22, 2017

William Edmondson, 87
Colorado Springs, Colo., Jan. 5, 2017

William Edwards, 90
Houston, Texas, Dec. 18, 2016

Robert Fendley, 89
Simonton, Texas, July 14, 2017

Peter Flawn, 91
Austin, Texas, May 7, 2017

John Galloway, 87
Pleasant Hill, Calif., April 2017

Robert Ginsburg, 92
Miami, Fla., July 9, 2017

Peter Gray, 85
Lafayette, La., May 18, 2017

Tom Harrold, 65
Oologah, Okla., March 18, 2015

Bernard Hill, Jr., 92
River Ridge, La., July 15, 2017

Robert Hudson, 92
Casper, Wyo., March 16, 2017

Lawrence Jamison, 82
Cypress, Texas, Feb. 21, 2017

Robert Johnson, 84
College Station, Texas, July 26, 2016

Vincent Larsen, 88
Billings, Mont., March 26, 2017

Ross Lessentine, 92
New Orleans, La., Dec. 8, 2016

Truman Logsdon, 93
Edmond, Okla., Nov. 20, 2016

Eugene Luzietti, 57
Bellaire, Texas, Dec. 25, 2016

George Macauley, Jr., 91
Lenexa, Kan., Jan. 7, 2017

Louis Macchi, 63
Cheshire, UK, June 8, 2017

Robert Messinger, 87
Wichita, Kan., Feb. 27, 2017

Alexander McGregor, 93
Newport Beach, Calif., Feb. 28, 2017

Daniel Merriam, 90
Lawrence, Kan., April 26, 2017

John Moore, Jr., 92
Houston, Texas, Oct. 8, 2016

James Norris, 65
Kingwood, Texas, March 10, 2017

James O'Neill, 91
Bakersfield, Calif., July 18, 2016

Howard Patton, 97
Houston, Texas, Feb. 18, 2017

Alan Peckham, 76
Las Vegas, Nev., June 3, 2007

Joseph Roeder, 92
Abilene, Texas, March 15, 2017

Luther Rogers, Jr., 84
New Orleans, La., Nov. 24, 2016

Arthur Saltmarsh, 66
Eagle River, Ala., May 17, 2017

Robert Smith, 89
San Antonio, Texas, Aug. 14, 2017

James Steidtmann, 79
Laramie, Wyo., April 15, 2017

David Wilson, 63
Beggs, Okla., April 28, 2015

Charles Wolf, 70
Corpus Christi, Texas, Oct. 25, 2016

George Young, 84
Forth Worth, Texas, July 16, 2017


(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.)

DPA

from page 34

With the changes in Washington D.C. we may have a much friendlier environment to our industry. The Washington office has been closed. However a Special Interest Group headed by Pete MacKenzie has been put in place to continue our educational efforts in Congress. Participation in the DPA-sponsored Congressional Visit

Days is an important event through which we can keep our lawmakers informed about energy issues and the impact of regulation. For the first time in a decade, there is a new direction possible in Congress, but we need to help direct our lawmakers to make the right choices for the country. I hope you will join us on these visits. You can get involved and make a difference.

Please contact me at jhill@oilguys.com with any of your thoughts and ideas; the DPA is a living organization with our members being its lifeblood. 



Applied Geoscience Conference



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Wednesday PM	Session 2 - Engineering Applications
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Thursday PM	Session 4 - Case Studies

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Here's How You Can Help in the Wake of Disaster

By DAVID CURTISS

The sense of awe and wonder many of us in the northern hemisphere experienced during August's solar eclipse, which I wrote about in last month's column, has since given way this month to shock and horror as the natural world demonstrated its awesome power in other ways.

Heavy monsoon rains inundated parts of India and south Asia, leading to building collapses and people killed.

Hurricane Harvey slammed into Houston, dropping nearly 52 inches (about 132 cm) – an estimated 33 trillion gallons (about 125 trillion liters) – of rain along the Gulf Coast.

Florida was battered shortly thereafter by Hurricane Irma, and as I write this column Hurricane Maria has pummeled Puerto Rico as it wends its way through the Caribbean.

Meanwhile, two earthquakes rocked Mexico, resulting in loss of life and property.

From southern Asia to Florida, from the Caribbean to the Gulf Coast, as an international organization, AAPG has members in all of these locations – members who have been directly and personally affected by these tragic events.

As President Charles Sternbach wrote to AAPG members in the aftermath of Hurricane Harvey, Houston and the Gulf Coast are home to nearly a quarter of our members.

We know of members who have lost everything, who have been rescued by boat as floodwaters filled their homes, and others who are sheltering family and friends whose homes and possessions were destroyed. Some of our members are working remotely since their offices are not yet reopened.

It is difficult to fathom the level of disruption that our colleagues have and are experiencing.



CURTISS

Recovery and rebuilding is a process that will take years, not days or months. Resolving and healing the emotional effects of this disaster will similarly take time.



Homes, businesses and places of worship for hundreds of thousands of people were flooded during Hurricane Harvey. Photo by David Clay.

AAPG's Response

In response to these events, AAPG's Executive Committee has taken two specific actions.

First, it has formed an ad hoc committee to connect AAPG members in Houston and along the Gulf Coast who are in need of assistance or who are able and willing to assist others in recovering from Hurricane Harvey. Our goal is to support the communications and connections to allow members to help members.

The second is that AAPG is launching a crowd-funding campaign, matching dollar-for-dollar all donor contributions up to \$25,000. The funds we raise during this campaign will be donated to one or more charities seeking to support Houston and other affected communities in their rebuilding efforts. More details on this campaign will follow by email. If you want to participate, please login to the AAPG website and ensure your contact details are updated.

Recovery and rebuilding is a process that will take years, not days or months.

Resolving and healing the emotional effects of this disaster will similarly take time.

But the folks that I've talked to in Houston have shown resolve and resilience in the face of misfortune that will stand them in good stead during the recovery process.

It's not just inspirational for those of us not directly affected. It's also instructional.

My family and I live in a part of the United States known for severe thunderstorms and tornadoes. Several years ago, after a particularly devastating set of tornados hit Moore, Okla., just south of Oklahoma City, my wife and I went to help her work colleague whose house had been devastated. As we salvaged possessions not destroyed by wind or rain, I came face-to-face with my own vulnerability.

Be honest: are you prepared to deal with a natural disaster that could touch your life? How about a political or terrorist attack?

In most parts of the developed world we take for granted that systems work and will always be there. You know – basic amenities like electricity, cellular and mobile networks, delivery of food and fuel, and the Internet. But if these were not available, how long could you or your family survive?

Now is the time to think about that. And to recognize that our colleagues and fellow members in Houston and around the globe need our support – physical, emotional and financial.

When it's my time to need help, I sure hope someone is willing to lend a hand.

David H. Curtiss

DIVISIONS REPORT: DPA

Texas Strong!

By JIM HILL, DPA President

Most columns in the Explorer from the division presidents focus on what is going on within their division and upcoming events.

However, this has truly been a challenging year. AAPG Members in Houston and towns along the Gulf Coast have suffered over the past few weeks from the devastating effects of Hurricane Harvey. With more than 18 percent of the membership based in and around Houston, if we haven't been directly impacted by the storms ourselves, many of us have friends and colleagues who have been. Our thoughts and prayers are with them as they continue to deal with these devastating events.

Houston is "Texas Strong" and the process of recovery is already underway. I encourage you to reach out to help and support the recovery processes however you can. Sometimes just an expression of support and concern brings comfort to those affected.

Provisional Members

As a division president, it is important



HILL

I encourage our members to look at the YPs you know and talk with those who now qualify to become members of the DPA.

to develop a focus for the year and do what is needed to put plans into action. Within the Division of Professional Affairs, the focus for this year is our new member status for Young Professionals (YPs), "Provisional Member." This was discussed in my last article, but it bears repeating.

This level of membership is focused at those active AAPG members that currently meet the requirements for DPA membership, except for the eight years of experience needed for certification. Although this is neither a certified nor a voting classification, the "Provisional" class does provide the same level of discounts and 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 DPA mentors to help guide personal development paths and career advice. Provisional members will have access to the membership directory, can serve on committees and attend meetings at the discretion of the DPA president, where their contributions will be welcomed. I will be attending as many of the YP meet and greet events as possible to help spread the word.

I encourage our members to look at the YPs you know and talk with those

who now qualify to become members of the DPA. This is our chance to tell them about this new membership opportunity and become familiar with all that the DPA offers its members.

I hope you will encourage them to join the DPA and to participate on our committees. Dues for the new level are only \$25 per year. Discounts to various DPA events alone will more than make up the cost of membership. The application for membership can be found on the DPA website at aapg.org/divisions/dpa.

Looking Ahead

The year ahead is bright with the upcoming Annual Convention and Exhibition (ACE) in Salt Lake City, the International Conference and Exhibition (ICE) in London and section meetings in Morgantown, Oklahoma City and San Antonio. I am planning on attending all these meetings and I look forward to meeting each of you and learning more about each section.

See DPA, page 33

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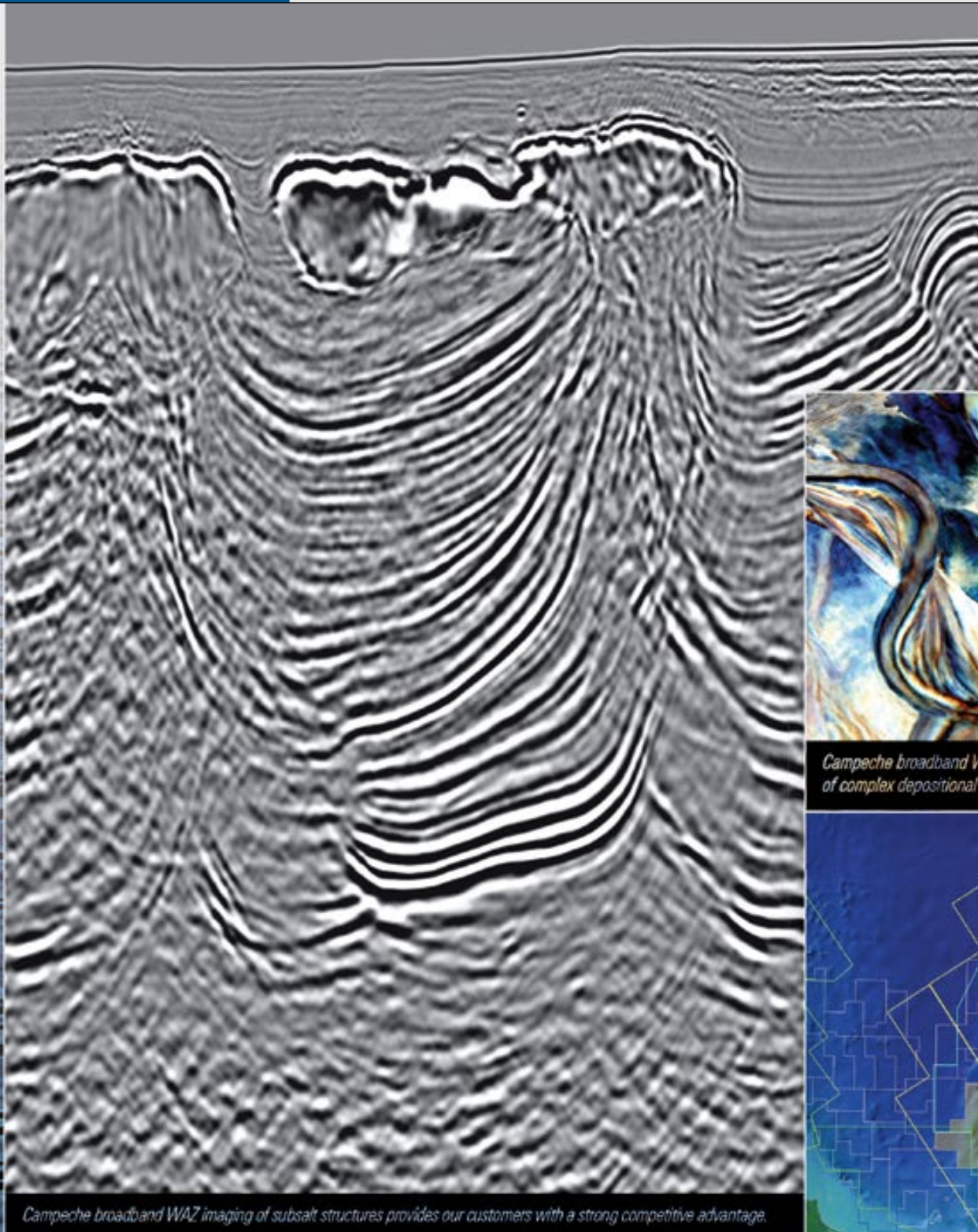
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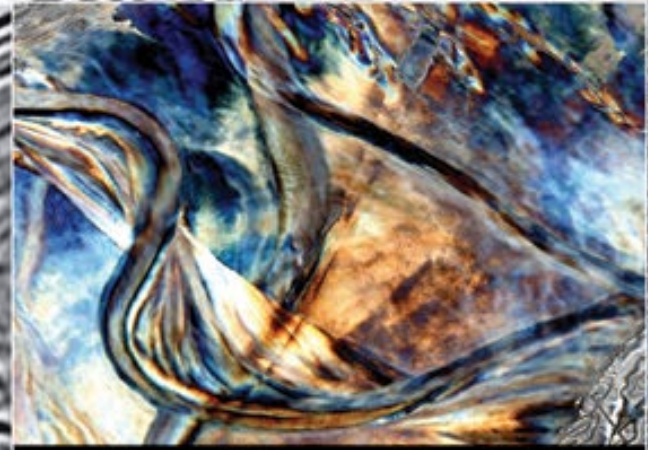
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