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EXPLORER

Next Generation

Increasing emphasis on STEM subjects signals bright future for geoscience education.

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Vol. 38, No. 9
SEPTEMBER 2017

100TH AAPG ANNIVERSARY
EXPLORER

PRESIDENT'S COLUMN

Fueling Prosperity with Bold Initiatives

BY CHARLES STERNBACH

As President John F. Kennedy famously said in his 1962 speech at Rice University in Houston, difficult challenges serve "to organize and measure the best of our energies and skills."

I am happy to report that the super basin concept I wrote about in my July column is working to focus energies and skills within AAPG. On March 1-2, 2018 the inaugural Global Super Basin Leadership Conference will be held at the Hilton Americas in Houston. Save the date! We have confirmed talks by Scott Sheffield, executive chairman of Pioneer; Scott Tinker, director of the Bureau of Economic Geology; Bob Fryklund and Pete Stark of IHS; and Greg Leveille, chief technology officer of ConocoPhillips.

Many of the industry's most outstanding explorers will discuss technological innovations that allow richly endowed petroleum systems to "keep on giving." Bulletin articles are in the works for at least eight super basins, with more to follow. Thus, AAPG will boldly focus on providing critically relevant geoscience.

As Michael Porter of Harvard Business School has said, "Energy fuels prosperity." The national benefit thus far from the recent energy renaissance has been a per capita GDP increase of $1,400 per year. There is a profound potential benefit from studying global super basins.

From left to right: Ray Thomasson, Gerry Friedman and Charles Sternbach during the 2000 ACE in New Orleans.

STERNBACH

AAPG is going to do an assessment of what the future geoscience workforce will need to know to be prepared.

AAPG's Geoscience Content Engines

Member engagement is one of my top priorities this year as AAPG president.

Did you know that early each year, AAPG's approximately 30-plus committees undergo committee changes and fine-tuning? This renewal enables committees to continue to provide valuable content for our Members. AAPG committees are assemblages of passionate people – they are nucleation centers of creativity!

I'd like to showcase a few exemplary examples that are representative of the talent collected in our committees:

- **100th Anniversary:** This committee has achieved far-reaching goals over the last 14 years. It will be deactivated after the International Conference and Exhibition (ICE) in London next month. Accomplishments include: GeoLegends videos, a very successful AAPG Annual Convention and Exhibition (ACE) in Houston, the Top 100 Papers exhibit, the Top Field Trips and the popular Discovery Thinking Forums. The Discovery Thinking Forums (co-sponsored by the Division of Professional Affairs) will continue on as a living legacy to the committee. Forums 19 and 20 are planned at the London ICE next month and Salt Lake City ACE next year, respectively. The content from this committee has been a rich legacy of papers, videos and presentations on Search and Discovery.

- **History of Petroleum Geology:** The committee continues to successfully organize and conduct very popular and well-attended sessions at ACE and ICE. More sessions are being planned for the London and Salt Lake City conventions. Hans Krause continues to solicit, edit, and submit well-received Historical Highlights articles on a monthly basis to the EXPLORER.

- **Astrogeology Committee:** These hardworking 20-plus members organize sessions at ACE meetings. They recently published Memoir 103 on Solar System Resources. They led a field trip to NASA at the 2017 ACE in Houston. In August this year, the committee organized a geologic field trip to view the solar eclipse with AAPG Members and astronauts Jack Schmitt and Jim Reilly.

Committees produce meaningful content for AAPG, they engage our members, and they impact AAPG's business. I encourage you to review the committees online and to get involved by contacting the chair. You will be glad you did. Benefits include rewarding experiences, valued friendships, and working on meaningful enriching projects. To learn more and get involved, visit aapg.to/allcommittees.

AAPG is also forming Special Interest Groups and Technical Interest Groups.

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ON THE COVER: Chris Bolhuis, the AAPG Foundation's 2013 Teacher of the Year, teaching a field course in biology with Wyoming's Grand Tetons in the background. Photo courtesy of Bolhuis.

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ICE in London Next Month

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

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

As an added bonus, the event will include special programming and recognitions to continue the celebration of AAPG's100th anniversary in 2017.

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

For more information, visit london2017.iceevent.org.

Students
from page 3

These are groups where individuals of common interests meet. To learn more, visit aapg.to/explosigstigs.

Student Involvement is Crucial to AAPG's Future

This month, many graduate and undergraduate geoscience students return to their colleges and universities to hit the books. I was president of the Sigma Gamma Epsilon science club 35 years ago at the geology department of Rensselear Polytechnic Institute, organizing geology student programs and talks. And today I am still at it! I plan on attending the AAPG Student Expo in Houston on Sept. 18 to meet students and look at their posters. Other expos are being held in Laramie, Wyo., Northridge, Calif., and in the eastern United States. AAPG is going to do an assessment of what the future geoscience workforce will need to know to be prepared. What are the skills recruiters and companies are looking for? I've appointed Steven Sonnenberg of Colorado School of Mines to chair an AAPG Blue Ribbon ad hoc committee on "Future Workforce Trends."

The Map That Changed the New World

Even though I am thinking about students, I am also working on my AAPG Eastern Section talk to be delivered Sept. 26 in Morgantown, W. Va. The title of the talk is "Amos Eaton and The Map that Changed the New World."

For a little background on my talk and how it relates to education: I am a big fan of William Smith, the geologist and mapper in England in the early 1800's. You probably read "The Map that Changed the World" by Simon Winchester about Smith's maps of the geology of Great Britain. These maps enabled England's engineers to mine the energy needed to fuel the industrial revolution.

For Americans, the New York State Erie Canal changed our world. The Erie Canal enabled cross-sectional outcrops of upstate New York. The sides of the Erie Canal became a window into the geology and resources of the northeast region. While discussing the importance of the Erie Canal with author Simon Winchester at the Denver ACE in 2015, Winchester told me "The Erie Canal made New York… *New York*." What he meant was that the Erie Canal made New York's harbor critical to opening up a continent. It is timely to celebrate the Erie Canal in 2017, as this year marks its 200th anniversary, its construction having begun in 1817.

My talk will focus on a famous historical person, Amos Eaton. Like William Smith, Eaton served time in prison where he instructed fellow inmates in geology and natural science. He was so helpful that he was released and became good friends with New York Gov. DeWitt Clinton and Stephen van Rensselaer. In 1824, Eaton and Rensselaer founded Rensselaer Polytechnic Institute, a new type of American school, built on field and laboratory work. Eaton changed the way geology was taught in colleges. He founded a new practical education system in which the professor worked with his students in the field, and professor and students learned from each other, instead of the professor primarily lecturing to the students.

Eaton and his students mapped the Erie Canal road cuts and riverbeds, creating much of the detailed stratigraphic column used today. RPI graduates who studied with Amos Eaton established many U.S. state geological surveys. My RPI doctoral professor, Dr. Gerald M. Friedman was a disciple of the Amos Eaton practical method of education when I learned geology. I will be remembering Dr. Friedman's lectures on Amos Eaton this month.

By the way, Dr. Friedman received AAPG's Sidney Power Memorial Award in 2000. I was very proud to be able to write and present his citation!

In next month's column, I will discuss "Managing AAPG with a Business Focus," which helps us meet our mission more effectively.

Charles A. Sternbach

New Developments Signal Hopeful Future for Geoscience Education

By DAVID BROWN, EXPLORER Correspondent

The big news in science education standards in the United States looks like good news for the geosciences.

To date, the recently developed Next Generation Science Standards (NGSS) have been adopted by 18 states, the District of Columbia and dozens of individual school districts, and have attracted interest from at least 22 other states.

You can find details about the NGSS at nextgenscience.org.

These standards set out a suggested approach to science teaching in three primary areas or disciplinary cores: Life Science, Physical Science and Earth and Space Science.

Having Earth science in a core area of study encourages geoscience teachers, who often feel they are playing second fiddle to other, more emphasized science subjects.

"One of things really prominent in those standards is that Earth science is at the same level as chemistry and biology, and that hasn't always been true," said Anne Egger, president of the National Association of Geoscience Teachers.

Egger, who will serve in the elected post through October, is associate professor of geological sciences and science education at Central Washington University in Ellensburg, Wash., and director of the university's Office of Undergraduate Research. She earned a doctorate in geological and environmental sciences at Stanford University.

The lack of K-12 Earth science exposure compared to other sciences, especially at the high school level, naturally has had an effect on students going on to university studies in the geosciences.

"Many students show up in college having not had a course in geoscience since sixth grade. We're starting at a deficit," Egger said.

Julie Mitchell, a geology teacher at Erie High School in Erie, Colo., is the 2017 AAPG Foundation's Teacher of the Year. The teaching award, funded and presented annually by the AAPG Foundation, honors and encourages excellence in geoscience education.

Mitchell, who has taught high school Earth science for more than 20 years, was chosen as the top teacher by a panel of national judges.

In her teaching experience in and outside of Colorado, Mitchell said she's found that geoscience is less frequently recommended by school districts and administrators than other, more-favored areas of study.

"This is true not just in Colorado. It's true in New York. You would have an honors biology. You would have an honors chemistry," she said.

Geoscience "should be something everybody is exposed to at this level of high school," she said. "It's been my one-woman mission to make that happen."

General education in the United States has placed an increased emphasis on studies in science, technology, engineering and mathematics, known as STEM.

However, much of the attention seems to have been directed toward math, tech and engineering courses, at the expense of general science. The NGSS could produce a broader and more integrated approach to science education.

Achieve, a nonprofit educational standards organization, undertook development of the new science standards with the National Research Council, the National Science Teachers Association, the American Association for the Advancement of Science and a consortium of 26 states.

At the high school level, the NGSS Earth and Space Sciences core concepts include five broad areas of study: space systems, history of the Earth, Earth's systems, weather and climate, and human sustainability.

Although Colorado has not adopted the NGSS, those and other suggested standards have influenced the way the state devises its K-12 science programs and curriculum, Mitchell said.

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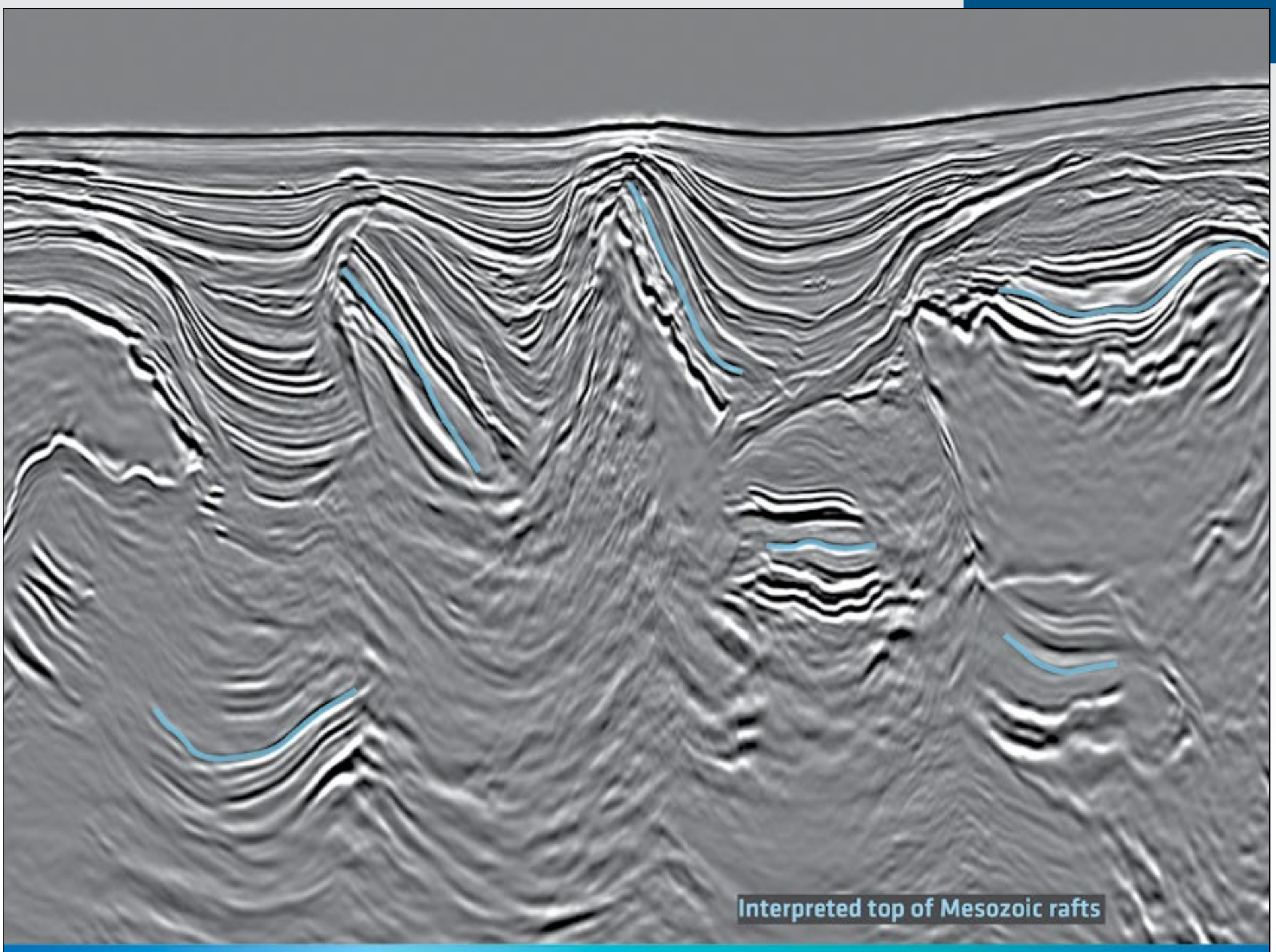


Science Curricula Under Threat?

By BARRY FRIEDMAN, EXPLORER Correspondent

The problem, according to those who think there is one, is in the first sentence of Florida House Bill 989.

"…allowing a resident of a county to challenge the use or adoption of instructional materials …"

This bill – and Gov. Rick Scott signed it into law – will allow any adult, in any school district, even if he or she doesn't have a child attending school in district – or, for that matter, any school district in the state – to lodge a complaint over the teaching methods or materials in Florida's public schools.

And while it could potentially pertain to any subject – Toni Morrison's "Beloved," for instance, has been called pornographic by some Florida parents who want it removed from public school curricula – the intent, critics contend, has to do with curtailing scientific inquiry, namely with regard to evolution and global climate change.

Sponsored by the Florida Citizens' Alliance, whose website construes the fight in nothing less than biblical proportions, casting itself as David against the state's Goliath, the organization purports to "advance a rebirth of liberty in Florida" and claims the bill is simply about choice and academic freedom.

Not all agree.

Jonathan P. Smith, president of Florida Citizens for Science, an advocacy group opposed to the measure, said HB 989 has ominous implications for education in the state.

BRANCH

> **"It's in the interest of petroleum geologists, as well as all scientists, to resist attacks on the integrity of scientific education."**

"This bill will allow anyone – and I mean anyone – to object for any reason to current text books used in the state," he said.

All Time Low

To Smith, that's chilling, not just for the quality of science education, but because students' familiarity and mastery of science skills, which are already sub-standard, will clearly get worse.

"In a nut shell, Florida's K-12 science education is at a all time low with around 52 percent of all students failing the unrevised (since 2008) standards," he said.

Glenn Branch, deputy director of the National Center for Science Education, said the legislation, which is not unique to Florida (more on that to follow), will have more of an effect on material and overall content than actual leverage on what a teacher says in the classroom, mitigating the Orwellian nightmares somewhat.

"So, yes," Branch said, "I think that there's good reason to believe that the mere introduction of such legislation tends, to some degree, to deter teachers from presenting the targeted topics – usually evolution and climate change – accurately, honestly and completely."

And that's because teachers will get spooked.

Branch cites a study done by his organization and Penn State University, which shows a connection between such bills and pedagogy.

"It was found, unsurprisingly, that what these teachers taught about climate change was correlated with the public attitudes toward climate change in their states and their counties, even holding their own attitudes constant. The introduction of such legislation tends to

See **Nationwide**, page 14

Bringing Geology to Life Online

By KRISTI EATON, EXPLORER Correspondent

When Daniel Minisini moved from Italy to Houston back in 2010 he looked around and no longer saw mountains. But while he was on his quest to discover mountains, he discovered something else: a large number of geologists in the city.

That inspired him to create a YouTube channel called "Mini Geology," on which he interviews and documents geologists from across the world.

"I discovered a resounding density of geologists in town," he said. "I just started chatting about mountains with them, and video-recording. I discovered that Houston is for geologists what Rome is for priests – they all come to the city at least once in their life."

A recent episode takes place at the University of Houston, where he asks people what they would like to know about geology.

"What the rocks say about history," one person said.

"Maybe how volcanoes change our world," another said.

Others said they'd like to know about the earth's layers, rocks and fossils.

"I love geology," one respondent said.

Another episode examined the differences between geologists and physicists.

"Geology won't go away," said Vic Baker, a professor at the University of Arizona, in the video.

Minisini said he chooses interviewees based on the relevance of their experiences. The interviews are informal – sometimes he interviews a geologist while collecting samples, other times the geologist might be sipping a beer on his porch.

Voices from the University of Houston, from the YouTube channel "Mini Geology."

"All the geologists I had the chance to interview have been extremely generous donating their time, knowledge, experience and suggestions," he added.

Born in Spain and raised in Italy and the United States, Minisini has a doctorate in sedimentology and stratigraphy and is now a regional geologist at Shell in Houston. He's also a marathoner.

"Professionally, I try to understand the genesis of mud and mudstone through different methods, at different scales and integrating multiple disciplines," he said.

A New Sub-discipline?

He said the interviews on his Mini Geology channel showcase how geologists approach problems – in their work and their life. In a way, he said, the interviews uncover the mindset of geologists – something that is not evident elsewhere, but which he believes should be a new sub-discipline. That discipline would examine scientific questions, methods of investigation, the ethics of publication, the efforts of the scientific outreach, the role the geologist plays in society and more.

He notes that the philosopher Seneca said the true voyage of discovery does not consist of searching for new landscapes, but of having a new pair of eyes.

"Following up this analogy," he said, "I'd say that I train my eyes listening to old folks, teasing youngsters, experiencing art and reading satire. The ideas emerge from this magma, shaping them like an historian and reshaping them like a journalist."

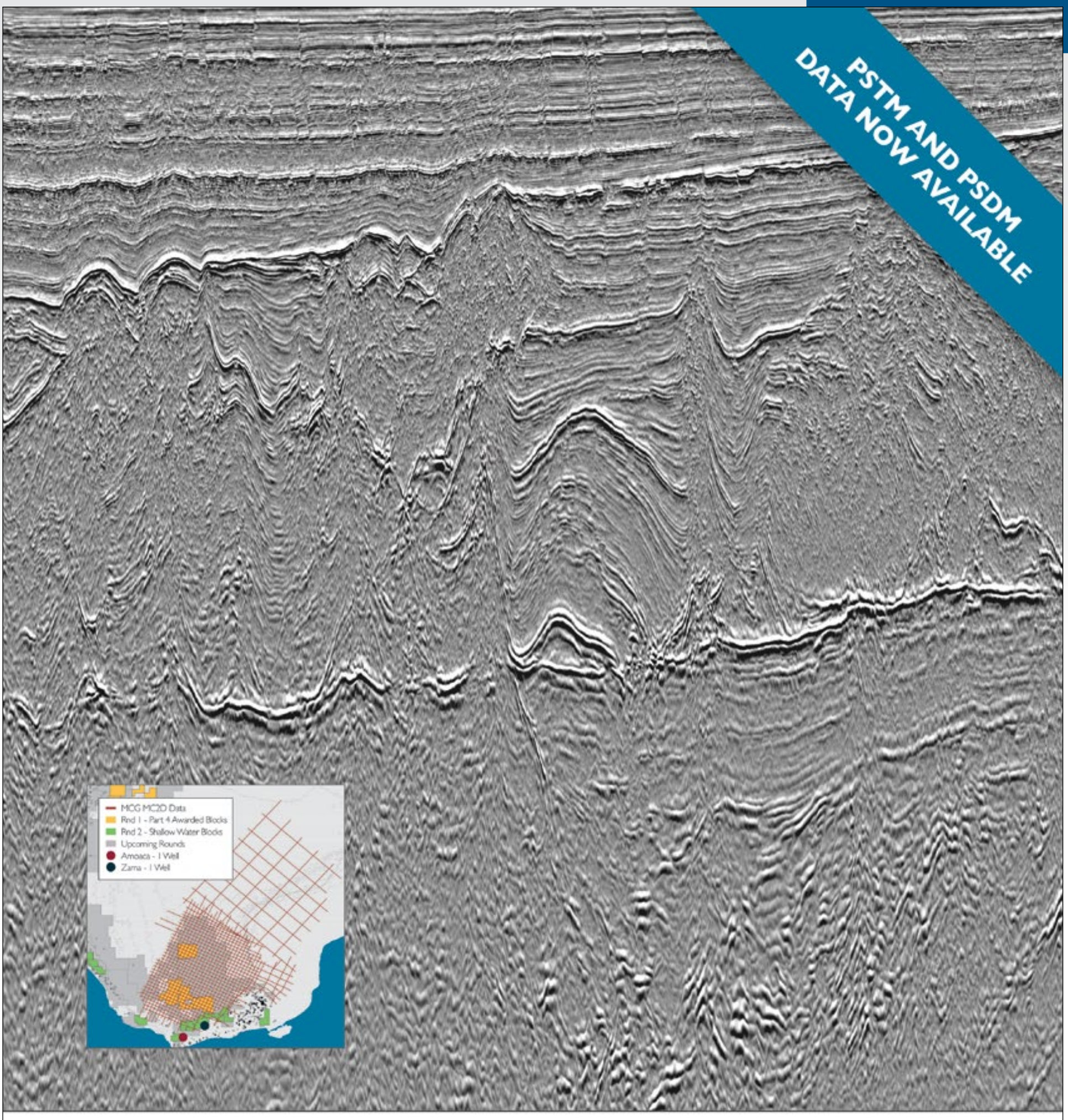
Educational Tool

Mini Geology is a not-for-profit venture that Minisini works on in his free time, he noted. He said he'd like to interact more with students and he's unsure about the impact it has as an educational tool.

However, several institutions have taken note. The Department of Geosciences at Rice University and the Bureau of Economic Geology have included a link to Mini Geology on their webpages, while the European Geosciences Union has covered the content. The Houston-based radio program KPFT hosts a monthly program about it as well.

Minisini, for one, hopes he is spreading information about geologists and what they do, showcasing their talents and skills.

"I am convinced that if the congresses around the world would have more geologists sitting on those chairs, the world would spin around in a different, better way," he said.



Julie Mitchell speaking at the 2017 ACE in Houston.

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"A lot of what are the Colorado standards are similar to the proposed national standards. It's pretty powerful in terms of getting kids into the STEM, sci-tech piece," she noted.

Science of Learning

Science education has seen a number of other advances in the past 10 years or so, especially in research into the ways students learn.

"There has been a lot of growth in the last 15 years in geoscience education research, in bringing cognitive scientists together with geoscientists," Egger said.

She cited the third annual Earth Educators' Rendezvous, held in New Mexico in July, as an example of a professional meeting for teachers that included a broad scope of investigations and presentations, from preparing for an academic career to several workshops and sessions devoted entirely to geoscience education research at the K-12 and university levels.

"We have some challenging concepts in our science," including deep time, systems thinking and three- and four-dimensional thinking, Egger noted.

"In the past there's been this belief that you either have three-dimensional thinking skills or you don't," she said.

But research indicates those things can be taught, Egger said, and today's belief is that all students can benefit from Earth science instruction, even in the most challenging areas.

Adapting to the Times

Mitchell said another change in science education has been the movement away from learning a fixed set of answers, and toward applying information and thought to developing answers.

"I think the piece that's shifted tremendously is rote memorization," she said.

"It's imperative to teach students to know where the information is coming from. I try to hit home with the scientific method, the scientific process," she added.

At the same time, "I still make my students identify minerals," Mitchell said. "They still have to know something. They still have to have something in their brains to apply."

Modern technology has changed students as well as education, as cell phones are now a ubiquitous potential distraction in every classroom.

"To me it's a challenge. It's not necessarily their fault," Mitchell said. "Honestly, I've been teaching for more than 20 years and I truly have found that students are more engaged in the real-world environment than they were 20 years ago."

She's tried to embrace new technology and social media and has even set up her own Instagram account for the benefit of students, "so they can tag me."

Egger said, "You can also make use of the fact that everyone in the room has a phone. You can ask questions and see everyone's response in real time."

"And then balancing that, we do make completely digital maps now, and you can do a lot in the field with an iPad that you couldn't do otherwise," she observed.

All in all, teachers have learned to accept and adapt to the presence of cells phones in class, sometimes with a dose of resignation.

"People aren't going to turn them off. So, you might as well make use of them," Egger said.

Hopeful Future

As geoscience education has broadened its scope and reach, increased interest in sustainability issues, climate change and environmental problems has begun to attract more students to Earth science.

"Where we're seeing a lot of growth is in climate science, in environmental science. That's happening a lot in

See **Teachers**, page 14

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what were traditional geoscience departments," Egger noted.

"We're still a relatively small part" of the science education picture, she said. "But I think the expansion of climate science, of environmental science, of system sciences is bringing about an expansion."

Egger works with university students who are considering a career in geoscience education.

Science teachers are in high demand in most states, but "it's pretty hard to get a job teaching just Earth science. I advise people to get a dual degree," she said.

"Within the geosciences we have a really strong teaching community. We have a coherent community that's very interested in advancing geoscience education," Egger said. "The big challenge in moving the field right now is funding. A lot of funding is going away. Data sources for research are going away."

Still, she sees a positive outlook for Earth science at the K-12, university and graduate levels.

"I'm actually at a time of hopefulness" about the future of geoscience education, Egger said.

"I'm incredibly hopeful," Mitchell agreed. "If we embrace the technology and apply it to the geosciences, the students can take this to any level.

Nationwide
from page 8

create the misimpression, both among teachers and administrators and among members of the public who may then pressure teachers and administrators, that evolution, climate change, and so on, are scientifically controversial and should be presented as such or should even be 'balanced' with supposed alternatives."

This is a story, he insists, that's been going on for decades.

"It's a little difficult to describe it as a trend," Branch said, "though, since it's been going on, in fits and starts, since 1921, when the first anti-evolution bill was introduced in the Kentucky legislature."

Proponents, like Rep. Byron Donalds (Republican, Florida District 80), who sponsored the bill, do not think it is anti-science.

"One of the key things about this bill and why I think it passed, is that we didn't target any one subject matter," he said to a local news outlet.

Branch isn't buying it.

"NCSE – along with the scientific and science education communities in general – is not swayed by the argument that these bills and resolutions aim only to broaden the horizons of students, to improve their critical thinking skills, to afford academic freedom for science teachers, and so on; these are all clearly mere rhetorical legerdemain intended to distract," he said.

Nationwide Trend

At the moment – and Branch said this is a moving target – there are about a dozen or so similar "academic freedom" bills at various stages in their respective state legislatures.

He said the problem with all these bills is not just the plain reality, but the unknown consequences.

In Florida, for instance, Branch explained, they will have formal proceedings – the state requires school boards to hire the Orwellian-sounding "unbiased hearing officers" – to govern instruction materials, text books and curriculum. But, when it comes to something a teacher said in the classroom, any parent can fire off an email or make a telephone call.

And then it's anyone's guess how far the matter escalates.

There are approximately 15,000 local school boards across the country, so this can get unwieldy. Florida, however, only has 60 or 70, and most are large professional organizations. Branch, then, is more worried about states like Ohio, which has over 600 such boards, many in small communities, and may be more prone to intimidation.

At the moment, the two piñatas in the wheelhouse of these so-called "academic freedom" bills are global warming and evolution.

"In many cases, legislation – including non-binding resolutions – is introduced to satisfy some legislators' core constituency, so when it passes, it has something of a calming, numbing effect on those voters," said Branch.

They are intended to send a message and they do – to like-minded voters.

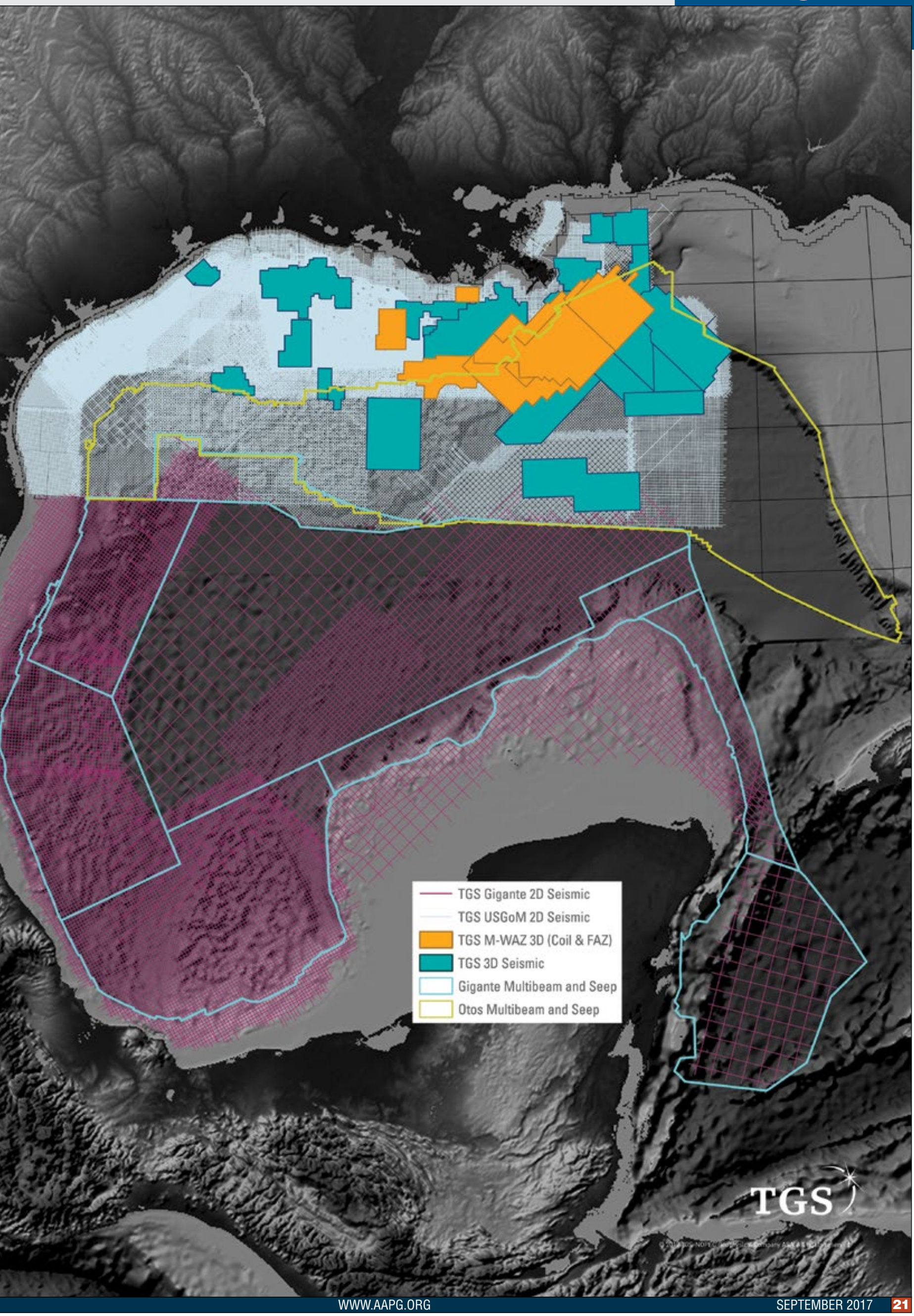
"These academic freedom bills," he said, "originally started off just targeting evolution, but then a parish school board in Louisiana came up with policy that listed evolution, biological evolution, chemical evolution/origins of life, global warming/climate change and human cloning," even though nobody really teaches cloning.

Branch calls the past 100 years of fighting science in public classroom, "a long, rich, inglorious tradition."

The anti-evolution bills come, as you'd expect, from religious groups, whether they admit it or not, and the anti-climate change groups come largely from what Branch calls "extreme free-market ideologies."

Branch thinks the two should be kept separate.

"The future of science, not to put too fine a point on this," said Branch, "depends on the younger generation getting a clear idea of scientific methods and results, un-compromised and uncontaminated by anti-science ideologies, so it's in the interest of petroleum geologists, as well as all scientists, to resist attacks on the integrity of scientific education."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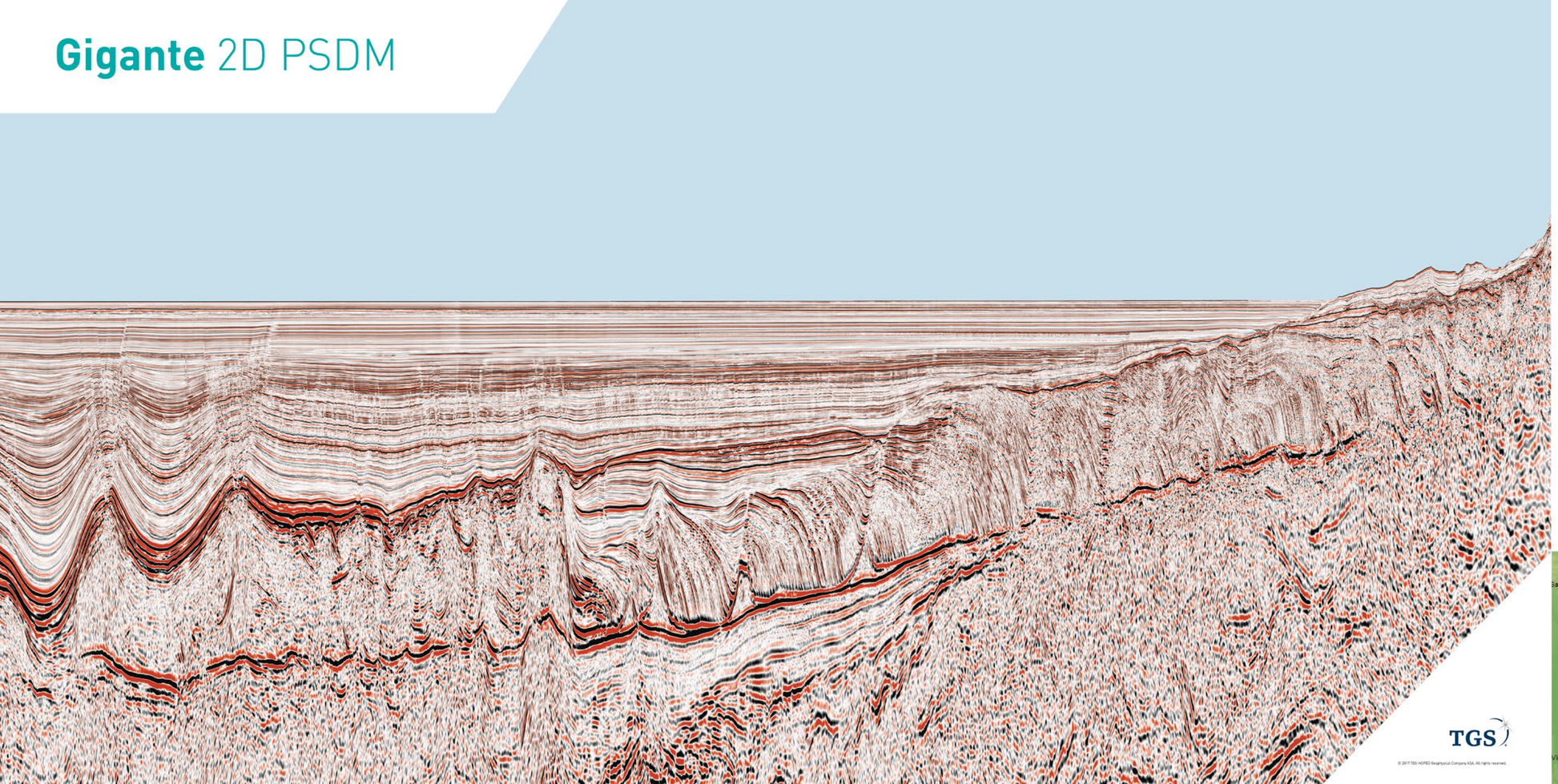


TGS

Gulf of Mexico

Gigante

Gigante is the single largest 2D multi-client seismic survey in the world, consisting of 186,250 km long offset 2D data spanning the entire Mexican offshore sector, and ties to TGS's existing regional US datasets. This ambitious survey provides the industry with unprecedented continuous coverage across the entire Gulf of Mexico rift basin, enhancing regional context and understanding of depositional systems and prospective regions. The grid ties known petroleum systems as well as vast underexplored areas of the basin as a springboard for new exploration. The seismic survey is complemented by potential field data and over 600,000 km2 of multibeam with coring and TGS' interpretation study utilizes all available datasets and aims to deliver a complete regional tectono-stratigraphic interpretation of the Mexican offshore.

Declaration

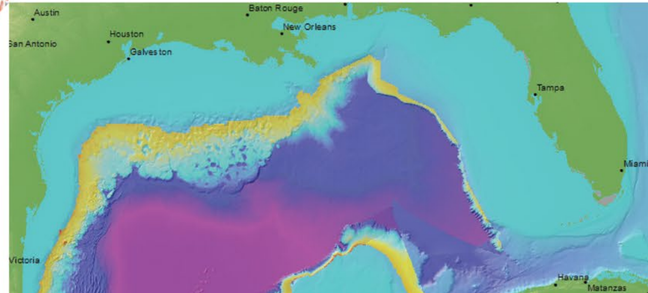
Declaration M-WAZ 3D survey covers 8,884 km^2 (381 OCS blocks) in the Mississippi Canyon, DeSoto Canyon, and Viosca Knoll protraction areas of the Central Gulf of Mexico and was acquired to better image deep structural elements while improving subsalt and salt flank illumination.

Fusion

Fusion is a new M-WAZ multi-client reimaging program that uses the latest TGS data and processing technologies as input to create a continuous, seamless volume utilizing one velocity model. The reprocessing project comprises data covering more than 1,300 Outer Continental Shelf (OCS) blocks (~30,000 km^2) from 3D WAZ programs, previously acquired by TGS, and covers the Mississippi Canyon, Atwater Valley and Ewing Bank areas. This area is a highly prospective salt province and has multiple discoveries with recent leasing activity. The final deliverables from the first phase of the Fusion reprocessing will be available from the end of Q4 2017.

Otos

The Otos Multibeam and Seep program covers 277,737 sq km (107,234 sq mi) of the US GoM, all water depth of over 750m (2,461 feet) and include 375 cores with geochemical analysis. Following the success of the Gigante Multibeam and Seep study in the Mexican Gulf of Mexico, Otos will complete the picture with the same acquisition techniques and approach to sampling.



Earth Science Week 2017 Examines Human Activity

By GEOFF CAMPHIRE

Earth Science Week marks its 20th year in 2017 by exploring the theme of "Earth and Human Activity," promoting public understanding of the geosciences and the ways people influence – and are influenced by – Earth systems. The part you play in this celebration, naturally, is vital.

Throughout the week of Oct. 8-14, 2017, petroleum geologists will join millions of others worldwide in studying, teaching and learning about Earth science. Earth Science Week has been organized by the American Geosciences Institute (AGI) with the support of AAPG each year since its inception in 1998. Now is your chance to play a leadership role.

It's easy to become part of the campaign that reaches more than 50 million people annually. AGI hosts a website (www.earthsciweek.org) that offers lots of instructional resources, ideas and activities. For instance, the brief and exciting "Big Ideas of Earth Science" videos cover nine key concepts of the geosciences. Online links provide related activities for exploring these ideas in classrooms, science centers, and other settings.

In addition, a treasure trove of new informational resources, activities, and programs also are being introduced to celebrate this special anniversary.

Find Your Focus

To zero in on your niche interest, participate in activities emphasizing various areas of the geosciences during "Focus Days":

- **International EarthCache Day,** Sunday, Oct. 8, allows EarthCachers worldwide to participate in geocaching "treasure hunts."
- Held on Monday, Oct. 9, **Earth Science Literacy Day** focuses on videos illustrating the field's "Big Ideas" and related activities.
- Activities on **Earth Observation Day,** Tuesday, Oct. 10, engage students and teachers in remote sensing as an exciting and powerful educational tool.
- **National Fossil Day,** focusing on paleontology, takes place at schools, parks, and other sites across the country on Wednesday, Oct. 11.
- On **Geoscience for Everyone Day,** Thursday, Oct. 12, geoscientists like you share the excitement of their careers with young women, minorities, and others.
- Celebrate **Geologic Map Day,** Friday, Oct. 13, which promotes awareness of the importance of geologic mapping for education, science, business, and policy.
- Saturday, Oct. 14, caps Earth Science Week with the celebration of **International Archaeology Day.**

Compete for Prizes

One great way to participate is to enter – or help a young person to enter – one of Earth Science Week's contests in visual arts, essay writing, video production and photography.

Students, geoscientists and the general public are invited to participate in the photo contest. For the "Earth and Human Activity Here" contest, entries must be composed of original, unpublished material and show ways people affect or are affected by, Earth systems in their communities.

Field trips such as this one to the Omya Middlebury Marble Quarry in Vermont are a regular feature of Earth Science Week.

What's Happening

The 20th annual Earth Science Week offers new opportunities to celebrate. As a petroleum geologist, you're invited to join the fun:

- This year's Photography Contest features the **"Earth and Human Activity Here" Photo Map,** located on the program website. Select contest entries will be included on the map, linked to the location of origin. This new educational resource shows "crowdsourced" examples of human interaction with natural systems.
- The **Education Resources Network** of AGI's Center for Geoscience & Society now provides the widest collection of free Earth science curricula, education activities, professional development, science education standards, virtual field trips, teaching ancillaries and more. To visit, go to the Earth Science Week homepage and click "Resources."
- Earth Science Week **Citywide Celebrations** will take place in Houston, Denver and (in December) the Washington, D.C. area, including special events and kit donations to local schools. Aligned with these events, AGI staff will take part in Energy Day Festival events in Houston and Denver.
- The U.S. Geological Survey is cooperating with AGI and the National Park Service to host an event on Thursday, Oct. 12, at **Great Falls Park** in McLean, Va. Stop by for a guided geologic tour, and learn about geology from expert geoscientists on site.
- Under a new price structure, the **Earth Science Week 2017 Toolkit** is free and available for the cost of shipping and handling. (To receive the toolkit, order online or call 703-379-2480.)

"People and the Planet," this year's visual arts contest, is open to students in kindergarten through grade five. Essays by older students must address the idea of "Human Interaction With Earth Systems." Finally, AGI invites people of all ages to enter the "Earth Connections" video contest by submitting a brief video that shows viewers how people affect Earth systems or vice versa.

How You Connect

If you're a petroleum geologist who wants to enhance young people's education, see "Visiting Geoscientists: An Outreach Guide for Geoscience Professionals," a handbook co-produced by AGI and AAPG's Youth Education Activities Committee.

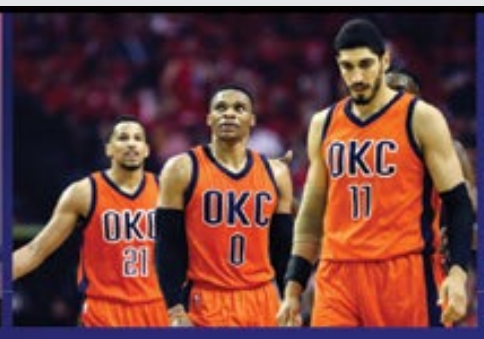
Geoscientists can visit schools and lead field trips, especially at the K-12 levels, providing unique insights based on their training, experience, and firsthand knowledge of the workplace. The handbook offers strategies, resources, sample activities and more. Download it at www.agiweb.org/education/aapg.

To lead a hands-on geoscience activity, search the Earth Science Week website's collection of more than 120 learning activities that support the Next Generation Science Standards. There are 24 searchable categories of Earth science topics, from energy and environment to plate tectonics and weathering.

Geoff Camphire is Earth Science Week Program Manager at the American Geosciences Institute. For more information, visit www.earthsciweek.org or email info@earthsciweek.org.

Students are led on a field trip by visiting geoscientists.






The
2017 AAPG MID-CONTINENT SECTION MEETING

Thomas Cronin, General Chair:

"The Fun Begins In Less Than Three Months !"

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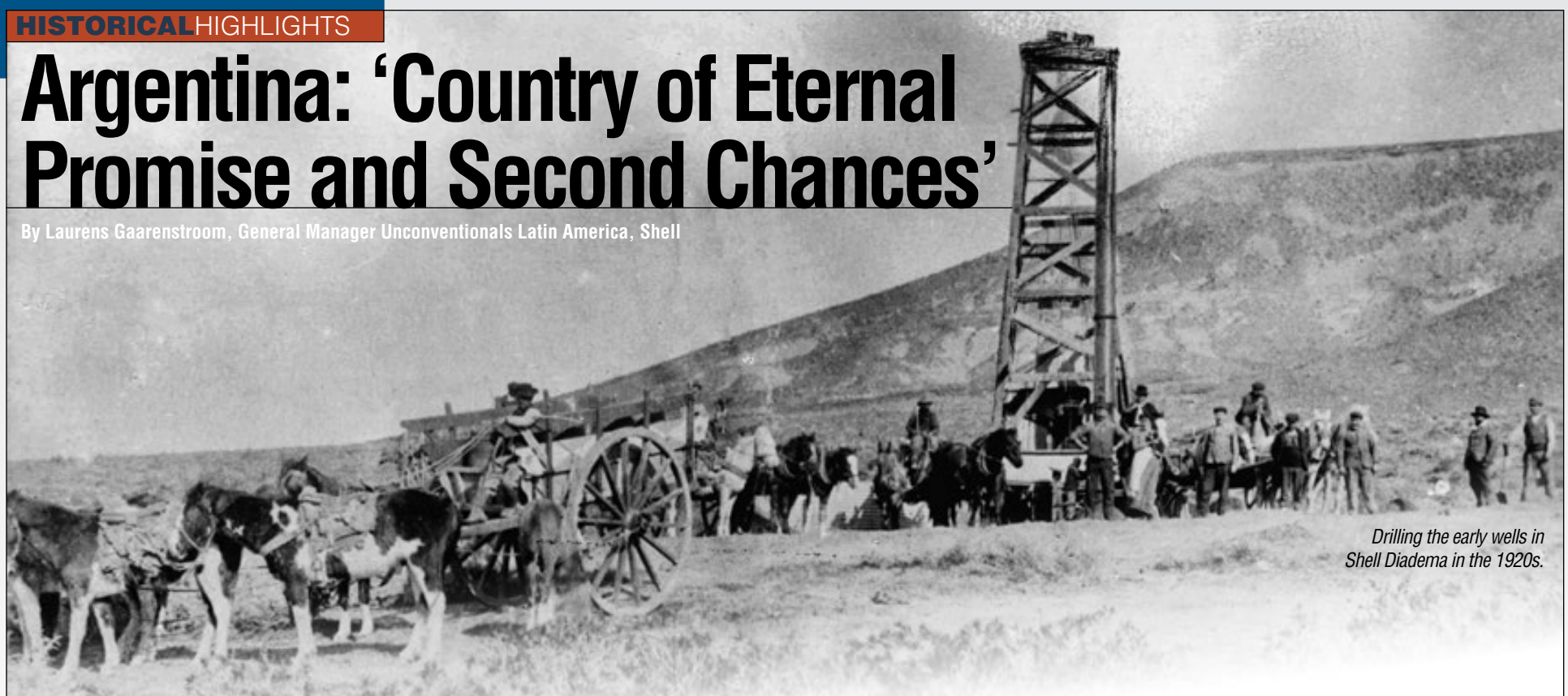
www.2017AAPGMCSMeeting.org




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.

Argentina: 'Country of Eternal Promise and Second Chances'

By Laurens Gaarenstroom, General Manager Unconventionals Latin America, Shell



Drilling the early wells in Shell Diadema in the 1920s.

I read the words of this headline in a local paper in Buenos Aires on my way to Neuquén to celebrate the official inauguration of the first Shell-operated Early Production Facility in Vaca Muerta. These words have since stuck with me, as I can personally identify with them. My father was stationed in Argentina as a Shell seismologist in the early 1960's, during which time I attended my first years of elementary school there. Childhood memories of visiting a seismic field camp, playing soccer on dusty street corners in General Roca near Shell's field office and raising the Argentine flag every morning at school have left me with a sense of belonging for this special country. Its potential is undeniable, but opinions have been, and probably will remain, divided on how to realize it. A combination of stamina and faith will be required, not unlike the traits of true explorers.

To illustrate this, let's look at the 100-year history of Shell's oil and gas exploration efforts in Argentina.

In the early years of the last century, Argentina ranked seventh on the global GDP chart. Walking in Buenos Aires, one can still imagine the grandeur of cities like Paris and Rome carried over the Atlantic by the immigrants during the 19th century. Energy needs in those heydays were largely met through the import of expensive coal, kicking off the search for domestic oil.

Exploration and Discovery in Argentina

The first discovery was made accidentally on Dec. 13, 1907 in the San Jorge Basin in southern Patagonia: the Bureau of Mines found oil while drilling for water. This fortuitous event is still celebrated every year as the "Dia del Petroleo."

By 1910, the Argentine government had created a State Oil Enterprise with preferential rights and authority over all hydrocarbon resources in the country. This would lead to the founding of the world's first entirely state-run national oil company, Yacimientos Petroliferos Fiscales (YPF), in 1922.

In 1914, Shell established an office in Buenos Aires and the first shipments of bitumen and other oil-derived products soon arrived. Just three years later in 1917, geologists from Shell visited the San Jorge basin, where oil production was ramping up. Drilling was done by percussion and prospect mapping was done on horseback. Following several years of negotiation, Shell – one of just a few private enterprises – was granted a lease of 9,000 hectares near the settlement of Diadema and started drilling in 1922. Diadema became part of Shell's official name in Argentina. By the time of the first commercial discovery in 1925, Shell had built a small village to house some 500 operators and their families. Shell also built a refinery in 1930 in Buenos Aires to process the crude, and expanded its retail network. In 1955, Shell drilled the then deepest well in the basin (D-129) and penetrated the rich, lacustrine source rock, which had charged most of the oil discoveries. This lower Cretaceous source rock is since known by the name D-129.

Shell Diadema drilled its last production well in 1960, producing up to 150 million barrels (MMb) until 1977, when it sold the field to Companias Asociadas Petroleras SA (CAPSA); the field is still in production. The San Jorge basin has yielded over four billion barrels of oil (Bbo) for more than 100 years with nearly 20,000 wells. Shell made a brief return to the offshore extension of this prolific basin in the early 1980's. After shooting 2-D seismic and drilling two dry wells, it seemed that the prolific D-129 source rock was largely confined to the onshore part of the basin.

Laurens Gaarenstroom (left) has worked for Shell for more than 35 years. He has had assignments as a geoscientist and exploration leader in Holland, Spain, United Kingdom, Nigeria, the United States and now Argentina. In this photograph he hands his father, Laurens Sr., a copy of the commemorative book on 100 years Shell in Argentina issued in 2014. His father worked as seismologist in Argentina during his 36-year career with Shell, but left a few months before the 50-year celebration in 1964.

Politics and Exploration

As Shell started production at the end of the 1920's, Argentina had slid down on the GDP table and a prolonged period of populist governance began, punctuated by several military coups. In the late 1950's, during the democratically elected government of President Arturo Frondizi, some foreign companies returned, including Shell. Frondizi called for the "Battle for Oil" to eliminate the expensive imports that had crippled the Argentinian economy. Shell signed contracts with YPF in the Colorado Basin (1959-61) and the eastern Neuquén basin (1961-64). The former was deemed a risky venture, but was deemed a strategic entry into a country with significant oil and gas potential. After shooting 2-D seismic and drilling seven dry wells, Shell exchanged the license for 20,000 square kilometers of Neuquén acreage. Shell moved its field operations base from the Atlantic village of Carmen de Patagones to General Roca in Rio Negro province and shot more than 4,000km of seismic lines.

Whereas the official focus on oil and gas exploration helped triple domestic supply in just over two years, President Arturo Illia annulled the contracts with foreign companies over concerns that YPF would be deprived of adequate returns for its exploration investments. Shell thus packed up in 1964 before it could drill any wells on the recently shot seismic. For me personally, this meant saying farewell to my friends.

In 1966, Illia was removed from power by a military coup. Nevertheless, conditions were still adequate at times for business in this large, still under-explored country with steadily growing energy needs. Offshore oil and gas exploration started to make inroads. In 1970, Shell shot over 12,000 kilometers of marine seismic (12-fold coverage) from the Salado basin in the north to the Austral/Magallanes basin in the far south, using its own airgun-equipped vessel, the Lady Glorita. Incidentally, my father happened to be the seismologist on board.

By the end of the 1970's, Shell had entered into offshore contracts in these basins, drilling 24 wells and discovering one large accumulation in the inhospitable offshore of Tierra del Fuego. However, the relatively large gas proportion rendered it uneconomic in those days.

Following this disappointing offshore campaign, Shell geologists in Houston, The Hague and Buenos Aires studied the onshore basins again and decided to try their luck once more in the Neuquén Basin. Meanwhile, democracy was re-established in 1983 with the election of President Raul Alfonsin. During the late 1980s and early 1990s, Shell drilled a few wells in the Neuquén Basin and made one oil discovery. Regrettably, the promising production of the drill stem test watered out just hours after the telex with the happy news had reached head office.

Until then, Shell's exploration focus had been mostly on oil, not least to provide feedstock for its refinery in Buenos Aires, which had grown to a capacity of 100,000 barrels per day. However, in the 1990s gas became increasingly important as markets in Brazil, Chile and Argentina were developing quickly. Shell's explorers looked at the northwest basins, including the extension of Bolivia's prolific, gas-prone Tarija Basin. This area in Salta and Jujuy was already known for its seeps and bituminous marls in the 1860s and YPF had started the first oil production there in 1927. Large discoveries of gas in the early 1950s (Campo Duran and Madrejones) led to the construction in 1960 of a pipeline all the way to Buenos Aires. However, the

See **Vaca Muerta**, page 29

multi-client seismic

GABON

Offshore Gabon

New Multi-Client 3D Seismic in Open Acreage + Regional 2D

Spectrum, in collaboration with the Direction Générale des Hydrocarbures (DGH), are undertaking a series of 3D Multi-Client seismic acquisition programmes offshore Gabon. These programmes, located in under-explored shallow water open blocks, have already secured significant industry support and will offer the most up-to-date 3D imaging in the area. To accelerate exploration, data will be made available for future license round evaluation, facilitating immediate activity when the blocks are awarded.

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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in association with DGH

Spectrum

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

Organically-Rich Sweet Spot Determination in Utica Shale

By SATINDER CHOPRA, KUMAR SHARMA, HOSSEIN NEMATI and JAMES KEAY

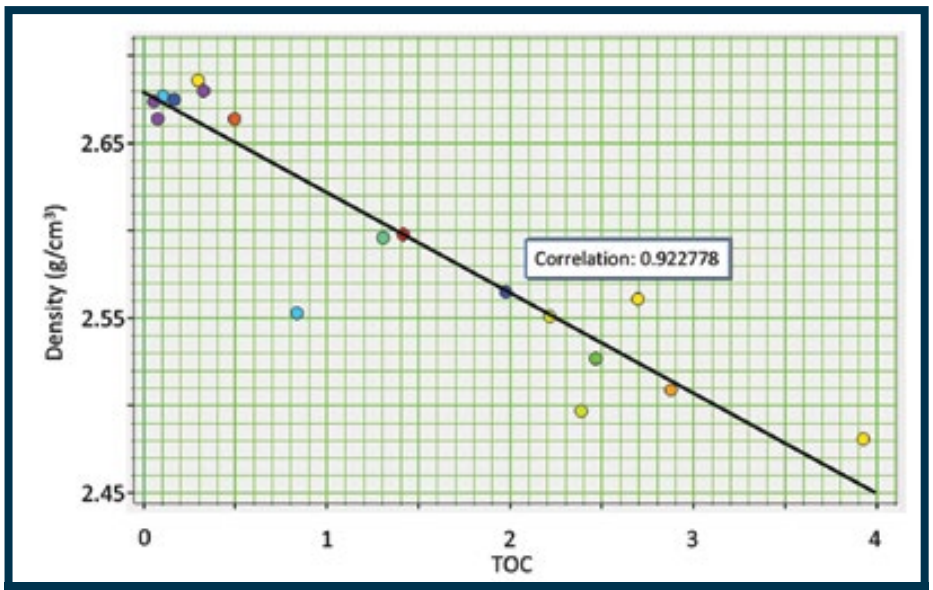
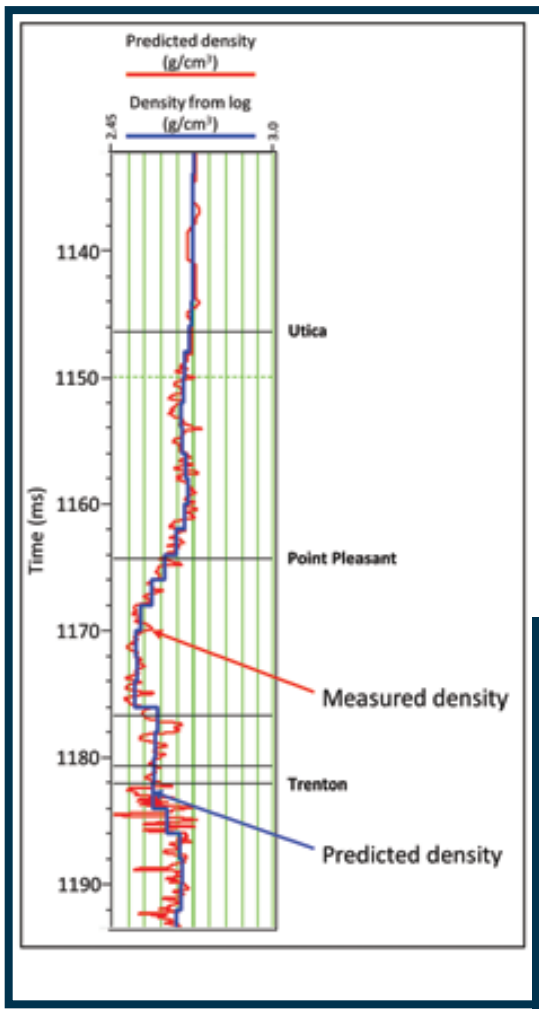


Figure 1: Cross-plot between measured log density and TOC as determined from core data in the Point Pleasant interval. A good linear relationship is seen between the cross-plotted variables.



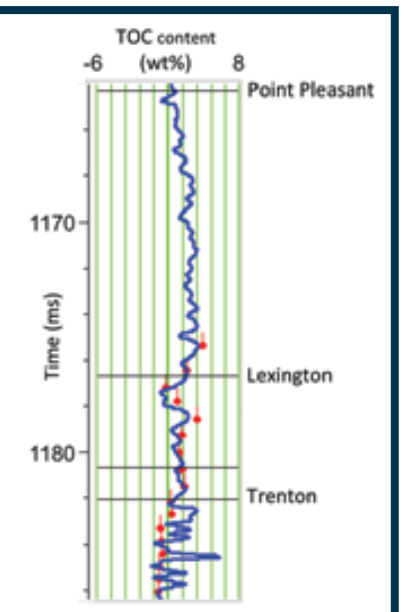


Figure 2: (a) The density trace predicted with neural network application compared with the measured density log curve at the location of well W-7. The two curves overlay well and thus enhance our confidence in neural network density prediction. (b) The neural network TOC predicted curve for the well wherefrom the core samples were available. The red dots are the TOC determined from the core samples. A reasonable match between the two is seen, and thus enhances our confidence in the used approach.


CHOPRA


SHARMA

Utica shale is one of the major source rocks in Ohio. Its organic richness, high content of calcite and development of extensive organic porosity make it an attractive unconventional play that has gained the attention of the oil and gas industry. The primary target zones in the Utica trend include the Utica, Point Pleasant and Trenton intervals.

In this article, we demonstrate the identification of organically rich sweet spots within the Point Pleasant interval using 3-D seismic data, the available well and core data. The organic richness is determined through the TOC (total organic carbon) content, which is determined from the available core samples in a well. The measured density log and these TOC values are cross-plotted to derive a relationship between them, which is then used to transform the inverted seismic density volume into a TOC volume. As the available seismic data did not have the long offsets (angles) required for determination of density from prestack simultaneous impedance inversion, neural network approach was followed to compute density using seismic data.

The correlation of the TOC sweet spots identified based on the seismic data with the available core data emphasizes the aspect of integration of seismic data with all other relevant data.

Sweet Spot Determination

The main goal for shale resource characterization is usually the identification of sweet spots, which can represent favorable drilling targets. Such sweet spots are zones and areas in the target formation that exhibit high total organic carbon (TOC) content, high porosity, as well as high brittleness or fracture toughness measures. The organic richness in the shale rocks influences properties such as compressional and shear velocities, as well as density. Therefore, attempts have been made to detect variation in TOC from the surface seismic response using impedance and other attributes such as V_P-V_S ratio, Lambda-rho, Mu-rho etc.

In this study, the density and TOC measurements made on the core samples in the Point Pleasant interval were cross-plotted as shown in figure 1. A strong linear relationship is seen between them. This suggests that the density attribute would be required if the organic rich zones in the Point Pleasant interval are to be determined from seismic data. Once that is obtained, TOC volume could be computed using the determined relationship from the cross-plot.

As stated above, because the offset/angle of incidence range was not favorable for computing density from seismic data through simultaneous inversion, we turned to neural network analysis for its determination. There are two aspects to our motivation for the use of neural network method here. The first has to do with the fact that there were more wells located on the 3-D survey that had the density log curves available, and so could be used in the neural network analysis. The second aspect has to do with the generation of robust low-frequency models that can be generated. For more details on simultaneous inversion, please see the Geophysical Corner in the June 2015 issue of the Explorer, and for low-frequency models, please refer to the September 2015 issue. Even though other methods exist that could possibly use a non-linear minimization of error approach, their applications are still not common. Therefore, we decided to determine density with probabilistic neural network analysis, employing amongst others some of the attributes determined from simultaneous inversion.

Density Prediction Using Neural Network Approach

The probabilistic neural network (PNN) implementations have been applied to a variety of geophysical problems. In such an approach, a

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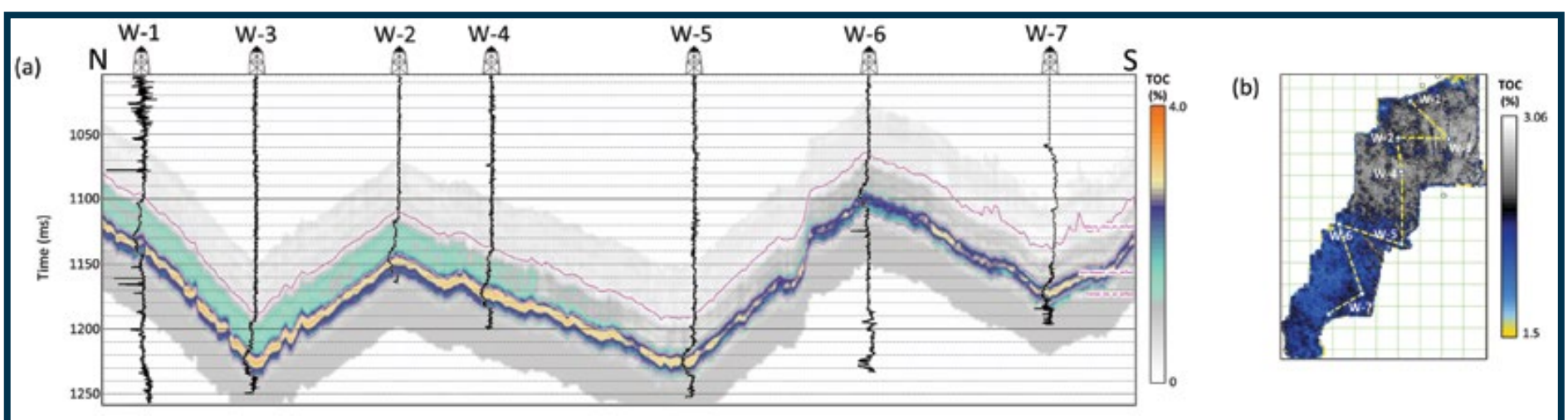


Figure 3: (a) An arbitrary line from the TOC volume and passing through wells W-1 to W-7. (b) A horizon slice at the Point Pleasant level from the TOC volume. The path followed by the arbitrary line through the different wells is also indicated. The TOC content appears to be more on the northern side of the line and gradually decreases to the southern side, even though the TOC values displays are between 2 and 3 everywhere on the display, which are favorable. (Data courtesy: TGS, Houston)

Continued from previous page

non-linear relationship is determined between seismic data as well as its various attributes and petrophysical properties. The determined relationship is then used to predict the desired properties away from the well control. For the present study, a multi-attribute linear regression and PNN are implemented to predict the density volume for estimating the TOC volume. We first derive the relevant attributes for our study by applying a prestack simultaneous inversion to conditioned gathers using partial-angle stacks, a reliable low-frequency model and angle-dependent wavelets. The attributes derived from the simultaneous inversion are P-impedance, S-impedance, Lambda-rho, Mu-rho, E-rho, and Poisson's ratio volumes. A combination of these different attributes is the input to the multi-attribute regression and PNN process to predict density. An important aspect of this method is the selection of seismic attributes to be considered in the neural network training. To that effect, a multi-attribute stepwise linear regression analysis is performed using the available uniformly distributed wells. An optimal number of attributes and the operator length are selected using the cross-validation criteria where one well at a time is excluded from the training data set and the prediction error is calculated at the excluded well location. The analysis is repeated for all wells, each time excluding a different well. An operator length of nine samples exhibited the minimum validation error with six attributes, namely Poisson's ratio, E-rho, relative impedance, absolute P-impedance, S-impedance and a filtered version of the input seismic data. Using these attributes, the PNN was trained. A correlation of 98.12 percent was noted between predicted and measured densities at the well locations. After training, a validation process was followed, which showed a correlation of 93.59 percent at the well locations. Such a match enhanced our confidence in the analysis of density prediction. A variation of density values within the zone of interest was noted as we go from the northern to the southern side of the 3-D survey. In figure 2a we show how the predicted density compares with the measured density at the location of well W-7. The good match between the curves enhanced our confidence in this approach.

Density/ TOC Transformation

Once the density volume was determined from neural network analysis, the next step was to use the linear relationship shown in figure 1 to transform it to a TOC volume. We first transformed the density trace at the location of the well wherefrom we received the TOC data determined from the core samples. In figure 2b we show the match between predicted TOC and that measured from the core samples. A reasonable match between them endorses the relationship, which is then used to transform the predicted density volume into a TOC volume. An arbitrary line passing through the different wells on the 3-D seismic volume is shown in figure 3a. High TOC content is noticed in the northern part of the survey, which is consistent with TOC trend observed in the Utica-Point Pleasant play.

To map the variation of TOC content laterally, a horizon slice from its volume over a 10 millisecond window in the zone of interest is generated as shown in figure 3b, low TOC zones are indicated by yellowish and bluish colors, whereas black and grey colors represent high TOC zones. Note that the northern part of the survey exhibits a higher TOC content than the southern zone, which is consistent with the prior information available regionally and matches the available production data.

As the state reported data is not as detailed as required for this type of correlation, it is not being shown here. However, the match seemed convincing.

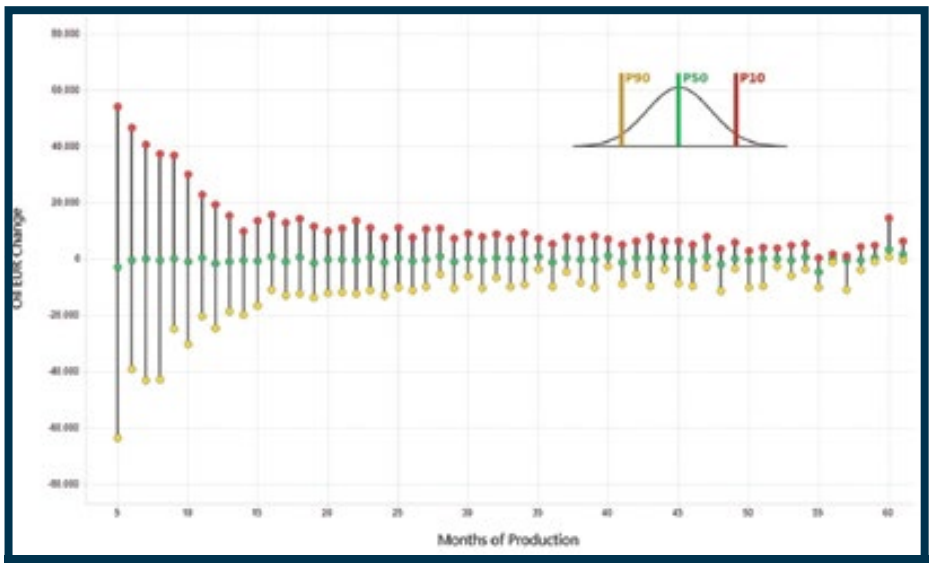
In conclusion, when the density and TOC values are measured from core samples in the shale interval of interest, they can be cross-plotted to determine a relationship between them. As density is an attribute that can be determined from seismic data, it can then be transformed into a TOC volume using the relationship determined from the core samples. Appropriate tests may be carried out to check the accuracy of the predicted attribute, which if found satisfactory, should also correlate with production data.

Mohammad Hossein Nemati is with Arcis Seismic Solutions, Calgary, Canada.


NEMATI

James Keay has more than 30 years experience in international oil and gas exploration, development and operations, onshore and offshore. He has extensive experience in business development and operations management in North America, Latin America and the Middle East and has performed integrated reservoir studies in Canada, Colombia and Kuwait. He holds a Texas professional geoscientist license. As chief geologist, NSA, Keay is responsible for providing geoscience evaluations to grow TGS's investment and sales activities.


KEAY



P10 to P90 ranges of oil EUR change from prior forecast versus months of production when forecast was made; data gathered from 2,420 Midland Basin horizontal wells and 20,281 discrete forecasts.

Getting the Most Out of Public Oil and Gas Data

By KEN MILAM, EXPLORER Correspondent

Mountains of oil and gas data production data are available, but many in the industry distrust and disregard it because of imperfect information and poorly regulated reporting standards.

Despite these misgivings, Sean Clifford, an operations support reservoir engineer at Apache Corp., says public data can become a valuable tool.

He and colleague Tim Torres developed a methodology to exploit public data to refine their analysis of multi-fractured horizontal well performance in the Midland Basin. They presented their findings in a paper entitled "Using a Systematic, Bayesian Approach to Unlock the True Value of Public Data; Midland Basin Study" at the recent Unconventional Resources Technology Conference (URTeC) in Austin.

The project employed outlier identification, probabilistic forecasting tools and Bayesian calibration to refine the researchers' analysis of multi-fractured horizontal well performance in the Midland Basin.

The researchers had access to higher quality data for better estimation and calibration of the public production data set. They continually updated their forecasts as new data became available.

"The public data is believed to be dishonest and unreliable because of the production allocation method that relies on imperfect well test data and unregulated reporting standards. E&P operators are not incentivized to provide accurate well-level production data, and they are in fact strongly against sharing such data to protect competitive advantages," Clifford said.

This can make it difficult for third-party companies to accurately allocate lease-level production volumes to the well-level, given limited data and no way to calibrate the allocation model, Clifford said.

"Public production data sources typically provide well-level monthly production volumes and all pertinent well header information. In addition, they can provide well test data used in the allocation process and descriptions of their allocation method. The allocated monthly production volumes are most useful to us to predict well performance for each well in the population, however we rely heavily on the additional well test and well header data as well," he said.

Compensating for Weaknesses

Clifford said one of the major challenges in the study was convincing technical staff members to trust the validity and accuracy of the project's results because of the generally poor reputation of public production data. Gaining confidence in the third-party production allocation algorithm was also a challenge, he said.

"I believe the most surprising conclusion is how accurately we are able to match our internal estimates at a field-level for horizontal wells in the Midland Basin using the public production data set," Clifford said.

That doesn't necessarily mean public data is more accurate than people think it is.

"(Public data) is very commonly wrong at the well-level, but I believe that it is possible to use the data responsibly in order to derive well performance estimates at an aggregate level where the allocation uncertainty is reduced significantly." he said.

"We are alluding to the use of the public production data in this way as the 'true value' in the paper title. Our evaluation technique does not correct any weaknesses in the public data set, however our machine learning forecasting algorithm minimizes the influence from such weaknesses by fitting a calibrated physical model to the rate-time data."

In the paper abstract, the authors said their research indicated that recently drilled wells (c. 2015–16) are forecast to recover significantly more reserves — nearly twice as much in some areas — as compared to early asset developments, according to the paper.

Clifford said companies with access to higher quality data sets would be able to apply similar techniques, "However any party invested in the oil and gas industry should benefit from improved reserve estimation practices like these."

"The biggest takeaway from the study is our ability to establish confidence in estimation by providing a performance track record of forecast accuracy and stability. We have been tracking our predictions since February 2016, and we continue to do so every month as new data is incorporated," he said.

"We feel this research is valuable because many evaluation experts and organizations do not provide a track record of prediction accuracy. It is difficult to make a confident investment decision without understanding the underlying uncertainty or accuracy associated with a prediction. This paper demonstrates a workflow to support and improve decision making by conveying confidence in future predictions," he said.

Shell seismic party in the Neuquén Basin in the early '60s.

Vaca Muerta

from page 24

technical complexity and high operating costs in this tropical and mountainous terrain delayed further exploration until the late 1970s, when YPF discovered the large Ramos Field in the Silurian-Devonian rocks. This discovery demonstrated that the tight, quarzitic Devonian sandstones of the Huamampampa formation could be excellent reservoirs in the core of the anticlines of the eastern fold- and thrustbelt of the Andes due to an extensive, interconnected fracture system.

In 1998 Shell acquired a 22.5-percent share of the northern Acambuco block, operated by Pan American Energy. This block contained two fields under appraisal, which, to this day, steadily produce gas (albeit at slowly declining rates). Later that year, Shell acquired a 55-percent working interest and operatorship of the Valle Morado gas discovery, until then the deepest hydrocarbon discovery in Argentina in the fractured, uppermost Cretaceous shallow water carbonates of the Yacoraite Formation. Shell managed to put production facilities in place in less than a year in this challenging environment, but the high rate discovery well (35 million standard cubic feet per day) watered out in a few months. That led to a decade without any Shell E&P operated activity in Argentina.

Argentina's Super Basin

In 2012 and 2013 Shell farmed in to several exploration blocks in Neuquén to pursue the Vaca Muerta unconventional oil and gas shales. Since the discovery of oil at Plaza Huincul in 1918, this basin has continued to deliver a steady stream of oil and gas discoveries, including the giant Loma la Lata Field in 1977. This basin is an exceptional case study for sequence stratigraphy: the extensive subsurface dataset, coupled with excellent outcrops of most formations along the margins of the basin, make a geoscientist feel like the proverbial kid in a candy store! More than five billion barrels of oil equivalent (boe) have been produced to date from multiple plays and layers. Now, thanks to shale resources, it is likely to deliver at least another five billion boe more, branding the Neuquén Basin as one of the world's 25 "superbasins" by IHS Markit in 2016.

Following encouraging results, Shell has meanwhile increased its footprint to some 200,000 net acres. Recently, Shell inaugurated its first Early Production Facility and over the next two years, results of this and other pilot projects will inform Shell's decisions on larger scale developments, such as we see today, for example, in the Permian Basin. This will also allow for some time to let operating costs come down to global competitive levels, and for reforms and infrastructure promises made by the current government to take hold.

Argentina has thus found itself at a crossroads once again. During the past 100 years it has become clear that explorers and Argentinians have much in common: they are resilient, perseverant and, above all, optimistic. But, both sometimes fail to confront their historic track record without bias and can be prone to repeat mistakes. Nevertheless, the oil and gas shale resources of this country are truly world-class: now is the time to grab this second chance and help Argentina develop to its true potential.

Esser Earns Trustee Associate Service Award

By TAMRA CAMPBELL, Administration Team Coordinator

Bob Esser, a longtime AAPG Foundation Trustee Associate who for nearly 25 years has kept the group informed and often entertained regarding the current state of the petroleum industry, has been named the recipient of the 2017 Trustee Associates Service Award.

Esser, who had a long career in the industry – first as a geologist with Mobil Oil and then, starting in 1989, with then-Cambridge Energy Research Associates (now IHS CERA) – has been an AAPG Member since 1961 and a Trustee Associate since 1992, when he joined at the invitation of Paul Dudley and William Ammentorp.

One year later he was asked to give an "energy forecast" at the Trustee Associates annual meeting in Point Clear, Ala., and the experience was the start of what became an annual highlight for the event. Since 1993 he has given his presentation 23 times, missing only one meeting (in 2010) when he was unable to attend.

He retired in 2009 as an IHS CERA senior consultant and director, but has remained current in his discipline of long-range global oil and gas capacity forecasts.

His knowledge and insights into long-term oil forecasts have gone far beyond the world of AAPG – once, famously, when he was cited by Pulitzer Prize-winning author Daniel Yergin in a Washington Post article titled "It's Not the End Of the Oil Age."

Yergin wrote of the then-fear of an imminent fuel shortage as he quoted Esser:

"Yet this fear is not borne out by the fundamentals of supply. Our new, field-by-field analysis of production capacity, led by my colleagues Peter Jackson and Robert Esser, is quite at odds with the current view and leads to a strikingly different conclusion: There will be a large, unprecedented buildup of oil supply in the next few years. Between 2004 and 2010, capacity to produce oil (not actual production) could grow by 16 million barrels a day – from 85 million barrels per day to 101 million barrels a day – a 20 percent increase. Such growth over the next few years would relieve the current pressure on supply and demand."

In announcing the honor, Trustee Associates chair David Worthington commented that Esser's background gives him the firsthand knowledge required for forecasting, and that his "enthusiasm and passion for forecasting are evident in his presentation."

Rarely is it an easy task; Esser begins tracking data months before each of his presentations, knowing that huge changes are always near.

Continued on next page

Teachers Get an ACE Experience

Thanks to a generous AAPG Foundation Grant, 52 middle and high school educators from 14 school districts – predominantly in the Houston region – participated in the 2017 AAPG Convention and Exhibition (ACE) Earth Science Educator Program in celebration of AAPG's 100th anniversary.

The Educator Program was designed by a committee of educators – including two AAPG Foundation Teachers of the Year – and industry professionals to focus on educators rather than students.

The attendees – educators from private, magnet and public school systems – participated in activities aligned with the ACE theme, "100 years of Science Fueling 100 Years of Prosperity," and with the Texas Essential Knowledge and Skills science standards.

The program elapsed four days and included two field trips – one titled "Ground Penetrating Radar (GPR) of the Hockley Fault, Northwest Houston," and another to study the "Morphology and Sedimentary of Panther Creek, Montgomery County Preserve."

A full-day symposium with concurrent 90-minute sessions concentrated on technical content the educators could integrate into their curricula.

Additional activities included participation in the ACE opening reception and other convention events, a technology demonstration at a local petroleum company and a mentor program that paired industry professionals with educators.

Organizers applauded the fact that the initiative underscored the educators' connection with AAPG and maximized their interaction with convention attendees through various activities with geoscience professionals.

The program also provided continuing education and gifted and talented credits.

The result: It is estimated that through their continued work in the classroom over the next decade, participating educators will bring information about the geosciences and the petroleum industry to approximately 80,000 students.

The program was designed as a model that can be adapted for future conventions.

Grants for programs like these would not be possible without the generous gifts given by AAPG Members – an outpouring that Foundation leaders praised and thanked.

A recap of the program's progress was presented to the AAPG Foundation by Stephanie Shipp, chair of the ACE Teacher Education Program Committee.

The full report is available at foundation.aapg.org.

From left, AAPG Foundation Board of Trustees Chair Jim Gibbs, Gail and Bob Esser, AAPG Executive Director David Curtiss.

Continued from previous page

On some occasions the data changed so drastically that he had to recast his presentation right before the meeting.

A graduate of both Yale and Stanford universities, Esser was previously honored for his promotion and service to the AAPG Foundation with the group's prestigious Chairman's Award.

Esser and his wife Gail have been active participants at Trustee Associates meetings, supporting and promoting the activities of the AAPG Foundation.

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DEG
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might also benefit from our exporting of low cost natural gas.

Implementing the Plan

Back to the plan: the essential elements include strategic deregulation and eliminating certain policies such as the Climate Action Plan and the Waters of the United States Rule. It is claimed by the Trump administration that this would increase wages by more than $30 billion over the next seven years. The coal industry will be revived, and the oil and gas revolution will be embraced while removing some of the restrictions on federal lands. The revenues in part will be designated for infrastructure rebuilding. Less expensive energy will also have a positive impact on the agricultural industry.

One can imagine the opposition to this plan from those who oppose just about everything associated with the burning of fossil fuels.

This plan is a big deal.

And it did not go unnoticed that the plan also expresses the need for responsible stewardship of the environment, which is intended to remain a high priority and includes refocusing the EPA to its essential mission of protecting our air and water.

It's a plan – a huge plan.

As we move forward, it is my view that as a professional community we must remain cognizant of our role in being good stewards in protecting the environment and taking a leadership role in communicating what good environmental stewardship is, what it looks like, and how to implement it both domestically and internationally. From an environmental perspective, we have a very important role to play as the nation's America First Energy Plan comes into focus. We as a society remain a petroleum hydrocarbon-based society, which will continue for decades to come. "The Donald" still wears the "Make America Great Again" hat, although he is now President Trump, and we as a nation have a new plan.

A lot goes into a plan, and implementing it is another matter.

The change in the political climate has created somewhat of a unique opportunity to – and to use a term from President Trump's predecessor – "transform" the nation's climate and energy policy.

I am optimistic about our nation's energy future, and the planet as well (I am confident the planet will get along just fine with or without us), but it is up to us to assure strong environmental stewardship.

In the meantime, I am thinking about buying a new hat with some messaging, and thinking about AAPG's plan in promoting sound environmental leadership and stewardship - this is a good time to revisit the important role we can play. There's a lot that has to happen to make this new energy plan a reality.

So in the immortal words of anonymous, "If your Plan A doesn't work, the alphabet has 25 more letters. Stay cool!"

DIRECTOR'S CORNER

Holding on to Our Sense of Wonder and Awe

By DAVID CURTISS

Just days ago we, here in North America, experienced a full solar eclipse. As daylight turned to twilight in midday, outside temperatures fell, and we witnessed one of the grandest celestial dances as the moon slipped between Earth and sun.

Awe and wonder is a natural and human response to such an event. It's hard to escape the reality that we are flying through space on a small planet in an infinite universe. It creates perspective.

This sense of wonder about the natural world is what drew many of us to geology in the first place. Galaxies and planets, mountains and oceans – we wanted to understand how they formed, how nature actually works, and how they changed over time. Understanding the cosmos might just give us a deeper understanding of our place within it.

Rewind a few centuries and it was these same questions that motivated the observations that set the foundation for modern geology.

James Hutton, living and working in Scotland in the 18th century, used both careful observation and reasoned analysis to develop the theory of uniformitarianism: that the planet changes through time due to natural geological processes.

In the 19th century, Hutton's work was expanded and popularized by Charles Lyell, who published "Principles of Geology," a volume that influenced the thinking of Charles Darwin on the evolution of both planet and species. Between the two, William Smith, known as the "father of English geology," produced the first geologic map of a part of Great Britain – the renowned "map that changed the world."


CURTISS

AAPG exists ... for just these times. We need each other. We can't do this alone.

Event of the Century

The British have played a pivotal role in geology and continue to do so. And so it is fitting that the 2017 International Conference and Exhibition (ICE) in our 100th anniversary year is in Great Britain. London, to be precise, and we'll be there Oct. 15 -18.

Under the leadership of Honorary Chair Jonathan Craig and general co-chairs Gabor Tari and Ken McClay together with general vice co-chairs Fiona MacAuley and Sa'id Al-Hajri, a stellar organizing committee has developed a program of technical and social events to support AAPG's dual missions to advance the science of petroleum geology and to connect the global petroleum geoscience community as we seek to find and produce the hydrocarbons that fuel the modern world.

The technical program committee led by Mike Simmons, Andy Whitham and Helen Cromie has carefully selected oral and poster presentations to present the best in petroleum geoscience, organized around twelve themes:

- 100 years of global exploration: regional geoscience,
- Polar petroleum potential (3P),
- Exploration and production in mature basins,
- New and emerging exploration basins,
- Deepwater exploration and production,
- Integration of geophysics with geology,
- Reservoirs: siliciclastic, carbonate, and mixed,
- Unconventional exploration and production,
- Traps and structural geology,
- Petroleum systems and basin modeling,
- Health, safety, security, and environment, and
- History of petroleum exploration.

Staying abreast of what is happening in petroleum geoscience and understanding how our science and our business are evolving in the current market environment are essential to remaining competitive as a professional. But it's not just technical know-how that's needed to build your career. It's also about uncovering and creating opportunities, and that's where community comes into play.

It's through professional relationships and connections that you are able to remain plugged into the industry. And that's not always simple. But, by networking with other professionals in London, you'll more readily encounter the possibility of a new opportunity.

Even as the downturn in oil and gas prices persists, it seems that world is becoming increasingly unstable and chaotic. Recent months have seen growing social unrest in the United States, terrorist attacks in Europe, nationalism, populism, economic collapse and growing authoritarianism – hardly the recipe for economic growth and resulting growth in energy demand.

We're all waiting and hoping for a rebound, but this instability may be with us for longer than we'd like or can imagine. AAPG exists as a global association of petroleum geoscientists for just these times. We need each other. We can't do this alone.

And amid the chaos, let us hold on to the sense of wonder and awe that drew each of us into geology. Let us remember the sense of discovery that motivated Hutton, Smith and Lyell to spend their years observing and studying our natural world. Let us remember our place in the cosmos, and let that be our lodestar, pointing us toward home.

DIVISIONS REPORT: DEG

It's a New Day, It's a New Plan

By STEPHEN M. TESTA, DEG President

It's a new day all right. It's a new president, a new administration and a new, albeit different, way of managing and communicating our nation's business. It's a new plan too! As a candidate in 2016, "the Donald" unveiled his platform and message with the new "Make America Great Again" hat. It came in red and white and became symbolic of the message he wanted to convey. Trump was seen just about everywhere wearing this hat. The message was an indication of the change in direction to which the wearer hoped this country would move. As a component of that message, "The Donald," as a candidate, also introduced a new plan: his "America First Energy Plan." There was not a hat for this soundbite.


TESTA

From an environmental perspective, we have a very important role to play as the nation's America First Energy Plan comes into focus.

Becoming a Global Energy Power

We have had major legislative acts pertaining to energy going back to the 1920s, with a multitude of energy-related legislation in the 1970s following the fuel shortages, some of which you might remember. Topics like the development of unconventional oil and natural gas, alternative and renewable fuels, sustainability and energy conservation – these were not even a part of the national energy policy jargon. The natural gas industry is now venturing out in developing a world market, the military is experimenting with alternative and renewable energy sources and corporations are "going green" and marketing conservation.

The transition from carbon-based fuels has been what some analysts refer to as the "long transition." Controversy persists over when or if this will happen, and at what pace, but what is undeniable is that society depends on energy to maintain and sustain the quality of life we all enjoy, and since the 1970s, the goal has been to achieve some form of energy independence.

Could it be that we are no longer obsessed with moving from carbon-based fuels, and moving beyond the lofty goal of energy independence?

Energy independence is a simple concept. It is the goal of reducing reliance on imports of various forms of energy, such as petroleum, from foreign sources – notably unstable sources. It was not very long ago when simply becoming energy independent appeared insurmountable to many. The United States has relied on imports of oil and natural gas since the 1950s. In early 2011, the situation took a turn when the U.S. Energy Information Administration reported that the nation had become a net exporter of non-crude oil petroleum and refined petroleum products, and within a decade it is estimated that we could finally become a net energy exporter. The shale revolution and development of new technologies along with improving old ones, a couple of decades of entrepreneurship, federal investment in new technology and the ability to overcome challenges have led to this new outlook and transformation.

Now, just as we are potentially becoming energy independent as a nation, the transformation continues even beyond beyond that toward making the United States a global energy power again. This is a remarkable turn of events considering all of the the potential pitfalls of the last few decades, such as excessive regulation and the near extinction of the coal industry, and I would be remiss if I did not mention the environmental issues and concerns related to the shale revolution.

Since energy policy does not stop at the coastline, nor for that matter immediately offshore, international issues related to overall national security and energy policy are multi-faceted and complicated – global marketing, fuel switching, carbon emission reduction (in the United States electric power sectors are at their lowest levels since the early 1990s), national interests, among others. Should we reach the goal of becoming a major energy exporter globally it remains unclear whether the market for substantial volumes elsewhere exists. Countries such as Poland and Lithuania will benefit greatly from our natural gas exports; whereas, China, India and South Korea – all of whom rely heavily on coal for their power and industrial needs –

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