

AAPG EXPLORER

May 2021



Chasing Net-Zero
See inside.

Coming to Denver

26 September – 1 October 2021



The American Association of Petroleum Geologists (AAPG) and the Society of Exploration Geophysicists (SEG) are excited to announce plans for joint annual meetings beginning 26 September to 1 October 2021, at the Colorado Convention Center in Denver, Colorado. This event will mark the first time the two groups' annual conventions have been held together since 1955.

The merger of ACE 2021 and SEG's 2021 International Exhibition and 91st Annual Meeting (SEG21) will result in one of the largest gatherings of earth scientists and energy professionals in the world.

The two events will be fully integrated, online and in-person, with a comprehensive technical program featuring more than 20 concurrent technical sessions and a joint exhibition featuring the latest geoscience products and technologies. One registration will give delegates access to the core technical sessions and exhibition and access to several ticketed training and social events. Exhibitors and sponsors will benefit from access to two audiences with a single engagement.

Watch for full program, exhibition and registration details coming soon.

ACE.AAPG.org



Innovation Causation

I've always loved to hear and tell stories. I come from a family of story tellers and musicians. Not a lot of it transferred to me but I inherited a few slices of it from my Oklahoma and Arkansas roots.

In the early 1900s my great grandfather and grandmother on my dad's maternal side lived in northern Arkansas along the scenic Buffalo River. It was difficult to make a living in these rocky hills composed mostly of Mississippian limestone cliffs. There were timber and sawmills, plus a little low-grade silver mining. Good farmland was at a premium, but my great grandparents were fortunate to have about 20 good acres that formed a bar along the Buffalo River. They also owned a small ferry at the only river crossing for miles. Between the land, ferry and local work they made just enough to raise their ten children. Those were still hard times and there were storms on the horizon.

Around 1917, just at the start of World War II and the so-called Spanish flu pandemic, my grandparents decided on a plan to migrate into Oklahoma to find better land and opportunity. It was a bold move – to pull up roots while the world was in turmoil.

But off they went. They moved 100 miles west to a town called Skiatook due north of Tulsa in Osage County, Okla. They were able to lease and farm good land. In addition, they found new income by pooling their mules and using them to skid heavy oil-field equipment. Because of their decision to move and innovate their work they were able to buy their farmland and build successful lives in farming and in the oil fields.

Good Stories

It is sometimes said that every good idea and every innovation needs a good story. After 2020 we are now re-writing our individual and collective stories.



It is said that “necessity is the mother of all invention.” If that’s the case, then as a corollary I say that “failure is the father of most innovation.”

Post COVID-19 reality has allowed AAPG members to reach beyond their normal geographical areas of influence. It is said that “necessity is the mother of all invention.” If that’s the case, then as a corollary I say that “failure is the father of most innovation.”

When AAPG’s face-to-face meetings failed, we looked for members and staff to develop new ideas. The first programs impacted were AAPG’s Distinguished Lecturer and Visiting Geoscientists.

Through new virtual technologies, staff took these popular face-to-face lectures worldwide and more than doubled participation. It should be noted that both programs are supported by the AAPG Foundation.

The ability to change direction is at the heart of innovation. When the economy and pandemic began hurting programs in the AAPG regions, they pivoted and developed new fascinating programs to attract young people and reach a broader audience

worldwide. For example, the Latin America and Caribbean Region has developed business programs and essentially mini-Hedberg conferences with participation from top leaders and scientists. The Europe Region developed several alternate-energy forums and now many of their virtual programs are reaching new scientists in eastern Europe. Some of the face-to-face luncheon programs in the Southeast Asia Region went virtual and viral to attract as many as 900 registrants worldwide. You can see many of these programs on AAPG’s calendar at AAPG.org/events/calendar.

Don’t Get Stuck!

Innovators are rarely stuck in a rut, they are always willing to change and if the opportunity arises, change again. Bob Merrill, AAPG’s editor, is one of those innovators. He redefined the editor’s position to have oversight over most of AAPG’s science output. He added special issues for the Bulletin and developed new emphasis on alternate energy and carbon capture, storage and utilization articles in the EXPLORER.

Some of the Bulletin special issues are focused on “super basins” based on a new idea by Bob Fryklund and Pete Stark with IHS. Charles Sternbach, Bob Merrill and others have further developed this concept into forums and papers. This innovation has provided us with new ways to understand the most productive basins in the world.

Speaking of Charles, I would be remiss if I did not note that another innovation, “Discovery Thinking,” is about to have its 25-year anniversary at the next annual meeting. Congratulations to Charles and all those who have made Discovery Thinking a great program for us to look forward to every year!

Latest Innovation Thinking

This year AAPG, under the leadership of past AAPG President Mike Party, Autumn Haagsma and Jack Pashin, developed a major CCUS conference with an incredible list of speakers. It attracted significant industry attention and sponsorship plus more than 500 participants from around the world. This CCUS program also provided AAPG with the first significant revenue from a conference in 2021.

AAPG’s Director of Innovation and Emerging Science and Technology Susan Nash’s “Pivoting” series has attracted numerous members and non-members to think about new opportunities, especially in the energy transition and in new technologies that can be applied to traditional and transitional activities. In addition, Susan worked with Doug Cook, Bill Ambrose and Bruce Cutright of the Astrogeology Committee to develop the very popular Mars programs with Kirsten Siebach and Michael Thorpe. Our last program, called “My Favorite Martian Outcrop” on April 22, had more than 600 participants.

Right now, AAPG’s Executive Director David Curtiss and Managing Director of Global Business Alan Wegener are putting the final touch on the memorandum of understanding to define the joint AAPG-Society of Exploration Geophysicists joint annual meeting. A lot of hard work and innovation went in to building this joint

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ON THE COVER: Prelude, Shell’s first floating liquified natural gas facility is expected to produce 3.6 million tonnes per annum of LNG, once operational. Shell’s new energy transition strategy includes a plan to shift the company toward gas production by increasing its natural gas share of total hydrocarbon output to 55 percent, with up to a 2-percent annual decline in its crude oil production. See Page 8.

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The Environmental Geosciences Journal Becomes Part of the AAPG Bulletin

AAPG has a long history as a proactive organization focused on advancing geology, especially as it relates to petroleum, natural gas, other subsurface fluids and mineral resources. As part of this focus, AAPG supports the vital role that AAPG geoscientists play in improving the human condition while minimizing environmental impacts as our members tackle the energy transition's immense challenges. To this end, future issues of the Environmental Geosciences journal are becoming part of the AAPG Bulletin.

Commencing in 2021, future issues

of the AAPG Division of Environmental Geoscience's publication in the Environmental Geosciences journal will become part of the AAPG Bulletin. This move aims to strengthen AAPG and DEG's focus on the principles of conservation, efficiency and sustainable development.

The publication Environmental Geosciences, founded in 1994, promotes



MERRILL



POPOVA

environmental stewardship from a geological perspective, transferring the profession's understanding of geological, geochemical, geophysical and hydrogeological principles and methodologies toward addressing environmental problems. The DEG editor will prepare a yearly special issue of the AAPG Bulletin dedicated to

environmental geosciences. The AAPG editor and the DEG editor will collaborate on publishing additional articles in the AAPG Bulletin. The DEG editor will continue to be responsible for reviews and manuscript acceptance.

This publication consolidation aims to strengthen AAPG's mission to promote the technology of exploring for, finding, and producing sources of energy and mineral resources in an economically and environmentally sound manner that are fundamental to sustainable development. 

Interpretation®

A journal of subsurface characterization



upcoming submission deadlines

Interpretation, copublished by SEG and AAPG, aims to advance the practice of subsurface interpretation.

SCHEDULED TOPICS

Visit <https://library.seg.org/page/inteio/Interpretation-special-sections> for more details about these sections.

MAY 2022

Recent Advances in Lacustrine Moderate-Low Maturity Shale Oil Exploration and Development

Submission deadline: 1 July 2021

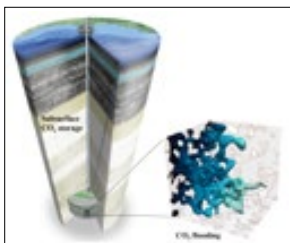
Special-section editors: Min Wang, Shu Jiang, Tongwei Zhang, Zhejun Pan, Tim Carr, Zhuoheng Chen, Guochang Wang, and Chunging Jiang

CO₂ geologic storage and utilization: Recent advances and future perspectives

Submission deadline:

1 August 2021

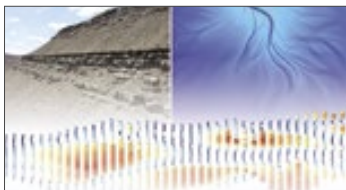
Special-section editors: Sahar Bakhshian, Rajesh J. Pawar, Joshua A. White, Reza Soltanian, Hassan Dashtian, and Dallas B. Dunlap



Machine learning for image-based geologic interpretation

Submission deadline: 1 August 2021

Special-section editors: Jiajun Jiang, Tao Lin, Scott James, Chaoshun Hu, and Bulbul Ahmmed



FEBRUARY 2022

Computational and analytical insights into stratigraphic processes and products

Submission deadline:

1 May 2021

Special-section editors: Fabien Laugier, R. Chadwick Holmes, and Lisa Stright

Russia: Recent Developments in Hydrocarbon Exploration and Production

Submission deadline:

1 May 2021

Special-section editors: Vsevolod Egorov, Olga Almendinger, Vladimir Verzhbitskiy, Anton Duchkov, J.T. (Han) van Gorsel, Igor Kerosov, Dmitry Modin, Boris Platov, Konstantin Osyov, Alexander Savitsky, Olga Shiganova, and Sergey Turuntaev

Arabian Peninsula in the spotlight

Submission deadline:

1 June 2021

Special-section editors: Oswaldo Davogusto, Bradley Wallet, Abdulmohsen Al Ali, and Saleh Al Dossary



SUBMISSION DEADLINES PAST DUE:

NOVEMBER 2021

Geoscience of Hydraulic Fracturing

Submission deadline: 1 March 2021

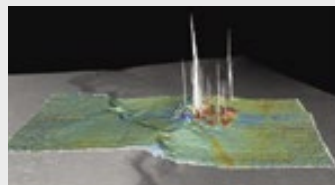
Special-section editors: Ishank Gupta, Vikram Jayaram, Chandra Rai, Timothy Carr, Dengliang Gao, William Harbert, Ge Jin, Adam Haecker, Kyle Haustveit, Manika Prasad, Mirna Slim, Vishal Das, Srinivasa Reddy Karri, and Dongxiao Zhang

Hydrocarbon Migration, Near-Surface Seepage, and Petroleum System Assessment

Submission deadline:

1 March 2021

Special-section editors: Jamshid "Jim" Gharib, Vsevolod Egorov, Michael Abrams, Harry Dembicki Jr., Roar Heggland, Benjamin Phrampus, and Jeffrey Beeson



Interpretation is a peer-reviewed journal copublished by SEG and AAPG to advance the practice of subsurface interpretation. Papers will be published online as they are accepted, edited, and composed, with issues printed quarterly in February, May, August, and November. Each issue contains at least one special section covering a topic of interest to interpreters. General submissions also are welcome in addition to submissions targeted to the topics above.

*E-mail interpretation@seg.org to inquire about submitting manuscripts past the submission deadline. Some sections may have increased flexibility regarding submission and review dates.

To submit a paper, visit <https://mc.manuscriptcentral.com/interpretation> and select the appropriate topic from the manuscript type options. For submissions not associated with a special section, select "Technical Paper."

Continued from previous page

venture agreement. Soon, AAPG and SEG volunteers will be working together to develop new ideas and programs to bring to the geologic community and beyond.

What's the Point?

I could keep going, but I hope you see my point. A lot of these innovations may have never happened without significant change and even failure of the systems we relied on to provide our normal programs. No thing – nothing is normal now.

Like my great grandparents, sometimes you just have to make a move! Your AAPG leadership is working hard to find the best moves for AAPG into the future. Please keep an open mind as we discuss new opportunities. Some of these may only be available during this time of upheaval and reorganization.

The good thing is that geoscientists tend to be optimistic and flexible. Thanks to all the innovators who recognize opportunities and bring them forward to make our professional lives more rewarding and productive.

M2C,
Rick

Rick's Pivot No. 10: Big Data, AI, GeoAnalytics, etc. (late 2010s):

This new process of "data digitalization and manipulation" represents an important paradigm shift in our industry. Geologists have so much unstructured data, it's important to capture as much as possible into structured forms. The best geologists are always able to see patterns. Machine learning and artificial intelligence are able to accelerate our pattern recognition and understanding of large amounts of information. I'm trying to learn as much as possible through reading and listening, as I know it is very important to our profession and my career. I especially listen to those innovators, like Deborah Sacrey with Auburn Energy, who have found ways to apply machine learning to their work, for example, using cluster analysis and pattern recognition software with artificial intelligence to make it easier to use and visualize data (I recommend "Machine Learning" with Deborah Sacrey; AAPG Energy Insights Podcast Episode 9). I also listen to a lot of young geologists who are using geoanalytics in building their careers. This is a very important pivot for geoscience. I have a lot to learn, but I hear you are never too old.

Have an idea for a section topic?

To suggest a topic for future special sections, e-mail interpretation@seg.org or contact one of the editors.

Exploring Mars with the Ingenuity Mars Helicopter

A series of articles in AAPG EXPLORER has been following the progress of the Mars 2020 Perseverance rover since its launch on July 30, 2020. Perseverance landed in Jezero Crater on Mars on Feb. 18, 2021 with an EXPLORER Live! panel and audience. Perseverance has been performing systems checks, executed its first drives, and zapped a few rocks for analysis with its SuperCam laser. Now we have witnessed the deployment of the Ingenuity helicopter for the first-in-history aerial, powered flight on another planet. Since landing, Perseverance has tested its new wheels on a winding course with about 900 feet of wheel tracks from where it landed to its current location monitoring Ingenuity.

Ingenuity is a small coaxial, drone rotorcraft. It is about half a meter high and weighs only 4 pounds. It has the potential to scout geologic locations of interest and to help plan routes for Mars rovers. The helicopter is capable of delivering terrain images ten times sharper than orbital images.

The difficulty of lift in an atmosphere 1/100 as dense as Earth's is only partially offset by Mars' gravity being one-third that of Earth. The helicopter's contra-rotating, carbon fiber, coaxial rotor blades are about 1.2 meters in diameter and rotate at 2400 rpm to achieve lift in the thin atmosphere.

Ingenuity is equipped with inertial sensors, a laser altimeter, two navigational cameras and a communication system to

relay data to the Perseverance rover. The downward-looking navigational cameras are high-resolution cameras for navigation, landing and science-surveying of the terrain.

Deployment

Ingenuity Mars helicopter chief engineer Bob Balaram explained deployment to The Robot Report, "The (Ingenuity) debris shield is jettisoned using a pyrotechnic cable cutter, then the helicopter moves into the actual drop spot."

"Then there is a cable cutter, which lets Ingenuity swing down towards vertical ... So once we are vertical, the same process releases two of our landing legs. There is another final cable cutter, which releases the remaining two landing legs. We then ask the rover to charge our lithium ion batteries to a full 100-percent charge because we want to make sure that we survive overnight if needed as the rover drives off. Until our solar panels are exposed, we don't get charge into our helicopter."

Ingenuity was successfully deployed from Perseverance to the surface of Mars from March 28 to April 7, 2021 (Sol 38-47).

Flight Course and Flight Plans

After deployment, Ingenuity's rotor blades were tested. Ingenuity's first flight was originally planned for April 8 but a "command sequence issue was identified on Sol 49 (April 9) during a planned high-speed spin-up test of the helicopter's rotors," according to a press statement issued by NASA.

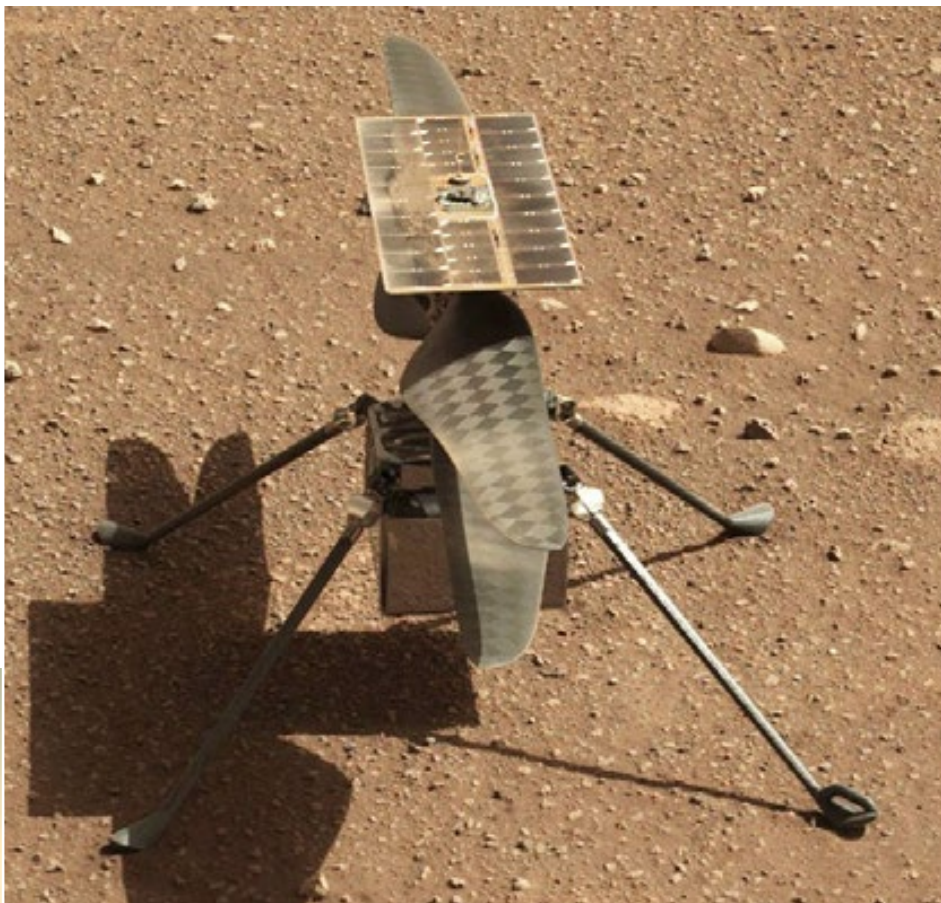
A complex flight software solution will be programmed and tested on Earth and then uploaded to Mars so that Ingenuity can boot up the new flight software.

The Ingenuity helicopter is planned to fly five times during its planned 30-day test period. The test flights will be at altitudes ranging from 10–16 feet above the ground, lasting up to 90 seconds per flight, and ranging as far as 160 feet before returning to its launch area. Ingenuity will use autonomous control programmed by operators at the Jet Propulsion Laboratory. Images and telemetry will be relayed to the Perseverance rover after each flight.

Perseverance will attempt to document Ingenuity's flights. "We plan to use our video capability and our telephoto capability," Perseverance Mastcam-Z principal investigator Jim Bell of Arizona State University said. "It'll be very exciting, and we're looking forward to those historic, aviation-first kind of movies."

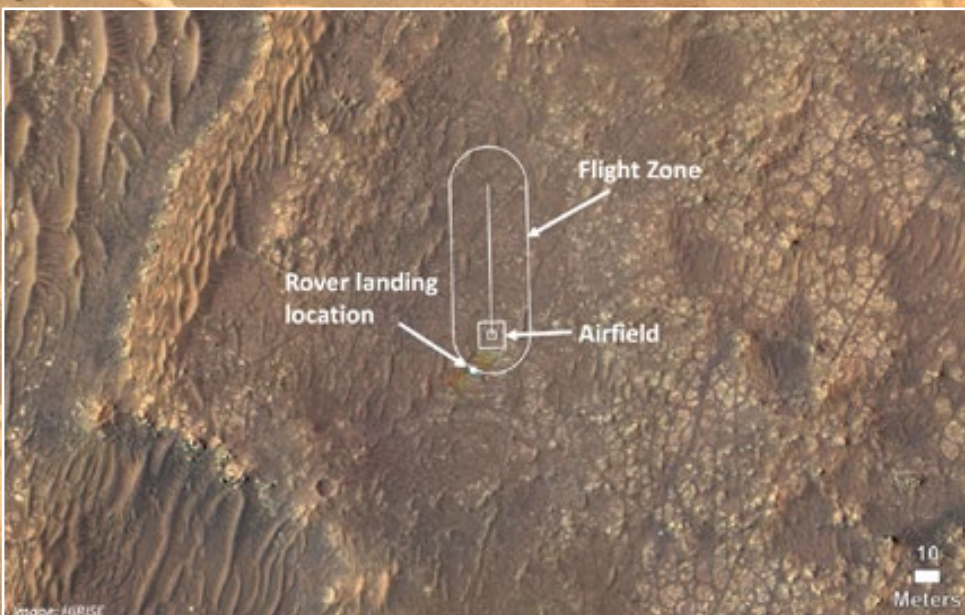
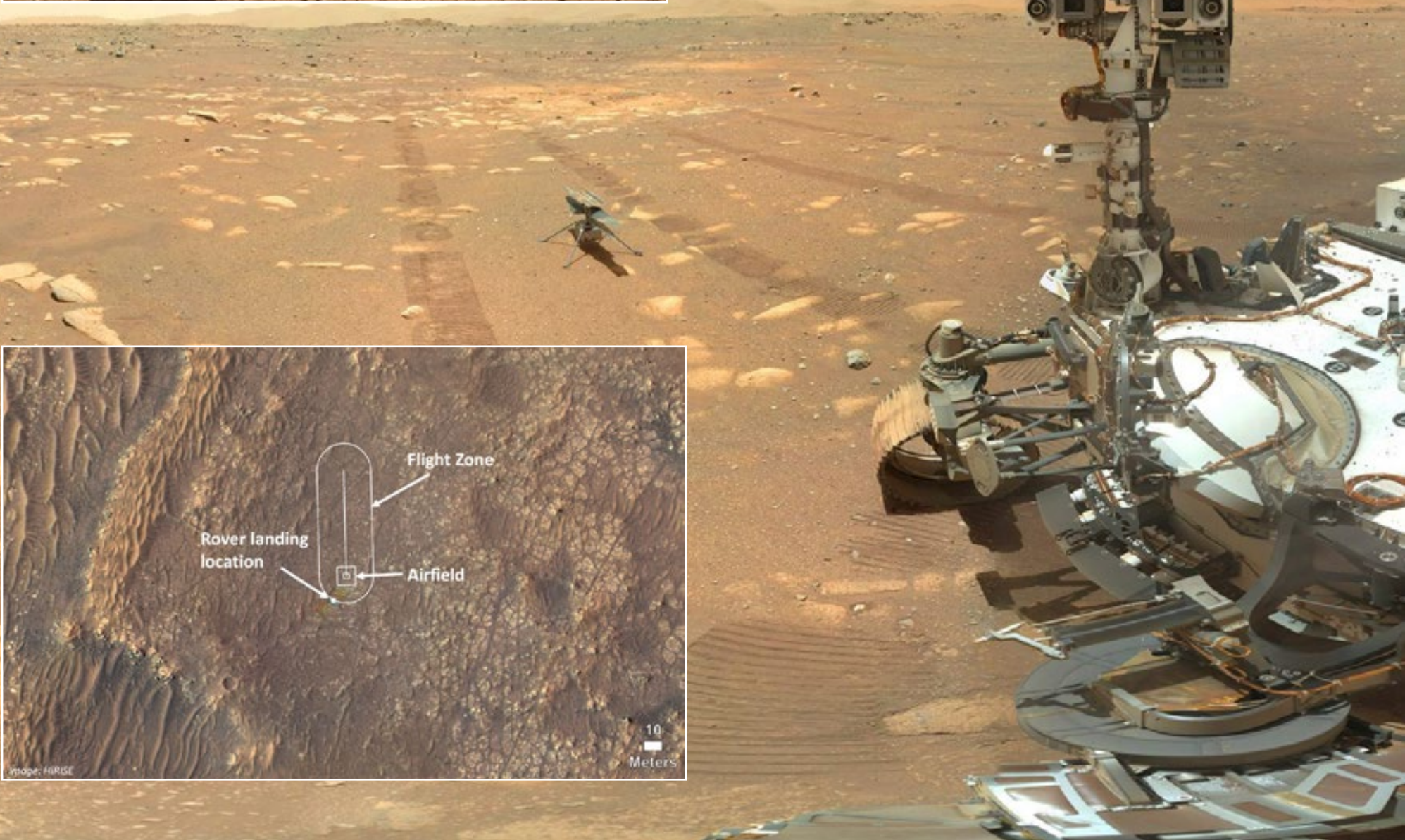
After Ingenuity's debut, Perseverance will begin geologic exploration of Jezero Crater. Perseverance JPL project scientist Ken Farley said, "The mission team has already mapped out a tentative traverse, which would take the rover through the delta region, up onto Jezero's rim and onto the plains beyond the crater."

The rover will look for signs of possible past life in Jezero crater's geology, where there is evidence that a lake existed 3.5 billion years ago. River channels filled the crater, created a lake and deposited deltaic sediments. The rover's instruments will test the geochemistry of crater sediments to select samples to be drilled, cached and returned to Earth by 2031 on a separate mission. [E](#)



Left: Ingenuity deployed and the rover rolls back. Preflight checks underway. NASA/JPL/Caltech.

Below: Ingenuity and Perseverance on Mars in Jezero Crater Sol 46, April 6, 2021. NASA/JPL/Caltech mosaic processed by Ken Kremer, SpaceUpClose





Keystone XL Cancellation: A Victory for the Environment?

Part 2 of 3

When the Biden administration effectively canceled the Keystone XL Pipeline as a first order of business in January, environmentalists all over North America celebrated a major victory.

"There was no magic to how we beat the Keystone XL Pipeline – it was grit, shared leadership and never forgetting who and what we were fighting for," said Jane Kleebe, chair of the Nebraska Democratic Party, as quoted in a January 2021 article in Politico.

But did they really know what they were fighting for?

The Keystone XL – a 1,200-mile addition to the existing Keystone Pipeline – was proposed in 2008 to increase exporting capacity from Canada's oil sands to U.S. refineries, many of which rely almost solely on Canadian heavy oil and bitumen. The pipeline was to be mutually beneficial for land-locked Alberta, which has long struggled with pipeline capacity, and the Gulf Coast refineries that have been losing crude supplies from Venezuela and Mexico.

What might seem like a victory to pipeline protesters may soon reveal itself to be a great loss. Without the Keystone XL, there is no question that Canada will rely more heavily on rail to move its product to the United States. In fact, statistics are already revealing a sharp uptick in rail shipments.

So, in exchange for a modern, safe and emissions-free pipeline, it is anticipated that both countries will see an increase in carbon emissions from diesel engines and greater risks for environmental incidents from this more precarious mode of transportation.

Serving the Narrative

In the oil and gas industry, it is widely believed that protests against pipelines are rarely about pipelines.

"The issue is the oil in the pipeline," said Chris Bloomer, president and CEO of the Canadian Energy Pipeline Association, speaking specifically of production in the

oil sands, which have long been targeted by environmentalists as a source of the most intense greenhouse gases. "This is the dirty oil campaign – an old narrative that environmentalists are clinging to."

However, the sands have reduced emissions by 21 percent between 2017 and 2019 and continue to do so, Bloomer said.

"That's not even being brought into the

environmentalists' analyses," he said.

Furthermore, 80 percent of oil sands production occurs in the subsurface, yet oppositionists focus on the 20 percent that occurs at the surface, broadcasting unsightly images of open sandpits, said John Hogg, past AAPG president, past

[Continued on next page ►](#)



◀ Continued from previous page

president of the Canadian Society of Petroleum Geologists and president of Skybattle Resources. He also noted that images of well pads in the boreal forest are shared by extremists as representations of all industry activities.

While the oil sands span nearly 55,000 square miles, the part that is mined is 1,650 square miles – just three percent of the total resource, he said, adding, “But that fact doesn’t make people raise money and protest.”

By linking false narratives and frightening photos to the oil sands, which hold the world’s third largest oil reserves, it is easy to see how extreme environmental groups could help convince the public, celebrities and policymakers to fight the pipeline that would have economically bolstered the oil sands’ production.

“How is it that pipelines, of all things, are now a major election issue?” said Vivian Krause, a controversial Canadian researcher and writer, in a June 2019 issue of Pipeline News. “They used to be out of sight, out of mind. No one ever had a pub conversation or dinner conversation over pipelines. But now we do.”

Kleeb confirmed as much to Politico: “Not a single farmer or rancher I know would have ever guessed that they would have been at the center of one of the largest climate battles of the last decade.”

As a new generation of environmental groups emerge – fueled by genuine concerns about climate change, yet gross mistrusts about the oil and gas industry that run rampant on social media – pipelines have become a bullseye in what is now a mainstream movement to handicap the industry.

Knowing that Canada places a heavy emphasis on support from indigenous groups on industry-related projects, many environmentalists invade those communities to “stronghold” them, said Gregory John, president of Four Peaks Business Development, which specializes in indigenous and stakeholder relations, and a citizen of the Métis Nation of Alberta, with family relations at Siksika Nation in Alberta and Lhtako Dene Nation in British Columbia.

“When environmentalists go and stir things up, it doesn’t reflect the true nature of discussions happening at the community level,” he said. “The dilemma occurs when the community’s true voice is drowned out by environmental groups not acting in their best interests. It is all about fear.”

After researching tax returns of charitable organizations in the United States, Krause learned that multiple, prominent foundations, including the Rockefeller Brothers Fund, were contributing to Canadian environmental groups. A grants database specified that certain donations were “specifically to cap tar sands production in Alberta,” she said in Pipeline News. She also shared that payments were made to indigenous groups that voiced opposition to pipelines.

Brad Hayes, director of the Canadian Society for Unconventional Resources and president of Petrel Robertson Consulting, said her theories are credible. “American interests don’t want to see competition from Canada so they are happy to back the environmentalists,” he said. “This is not conspiracy theory. It is evidence.”

Oil Is Still Moving

If environmentalists believe that axing the Keystone XL Pipeline will slow production in Canada’s oil sands, they need to think again.

In 2019, Canada exported 3.7 million barrels of crude per day to the United States – 98 percent of its crude exports, according to Natural Resources Canada.



HOGG

“We are moving toward 400,000 barrels a day. It’s being pulled by diesel engines in a less safe way with more carbon dioxide being sent into the atmosphere. That’s why the Keystone XL was approved the first time – it’s a cheaper and safer way to transport the oil and emits far fewer greenhouse gases.”

Many believe, even without the Keystone XL, the oil will continue to flow.

Despite it being a more costly way to ship crude, bitumen transport by rail is already on the rise: “For November 2020, the volume of Canadian crude oil exports by rail had soared 86.5 percent month over month to 173,095 barrels daily,” stated a January 2021 report from OilPrice.com. In December, the Canada Energy Regulator reported that the country exported 190,454 barrels per day.

“We are moving toward 400,000 barrels a day,” Hogg said. “It’s being pulled by diesel engines in a less safe way with more carbon dioxide being sent into the atmosphere. That’s why the Keystone XL was approved the first time – it’s a cheaper and safer way to transport the oil and emits far fewer greenhouse gases.”

Many find it difficult to forget past rail incidents. A 2013 explosion in Lac-Mégantic, Quebec killed 47 people. And the following year explosions and fireballs forced the evacuation of 150 people in Manitoba. While neither incident involved heavy crude or bitumen, the memories remain.

Studies have conclusively demonstrated that pipelines pose far fewer hazards in terms of spills and emissions.

Due in part to better technology and safety requirements, “pipelines are the safest and most efficient way to move large volumes of oil and natural gas,” states the Canadian Association of Petroleum Producers. “Nearly all – more

than 99 percent – of the oil and natural gas products transported through transmission pipelines reach their markets safely.”

Pipeline operators are required to design safety, emergency, security, integrity management and environmental protection programs as a means to anticipate, prevent and mitigate potentially dangerous conditions, according to CAPP. Operators also use sophisticated, computerized monitoring and control systems to provide continuous real-time information and conduct routine inspections and aerial patrols of pipelines.

In fact, the Alberta Energy Regulator reports that over the last decade, the number of pipeline incidents in Canada declined by 32 percent while the length of pipelines grew by 13 percent.

The Keystone XL – the most studied pipeline in industry history – would have served as a prototype for efficient and safe pipelines of the future. Its builder, TC Energy, pledged net zero emissions, a conversion to 100-percent renewable power, a \$1.7 billion investment in renewable energy, thousands of “green jobs” and “green energy” training.

Fueling the Transition

While there is no dispute that Canada, the United States and much of the world are working toward transitioning to renewable energy, there are wide-ranging thoughts as to when and how that will take place.

“Some people believe we are right at the end of the fossil fuel era,” said Mark Pinney, manager of markets and transportation at CAPP. “But the world is going to require decades yet of fossil fuels being the main staple of the energy mix. People are in denial about how quickly we can phase out.”

Referring to younger generations who get their news from social media and are saturated with messages about global warming, Hogg said these future leaders must be educated about the ongoing, critical need for hydrocarbons.

Speaking to the EXPLORER on a particularly cold day, Calgary-based Hayes said, “It’s -30 degrees Celsius now and the wind is not blowing, and the sun is not shining. There is nothing going on (regarding renewable electricity generation) and the demand for power is at its highest. You can’t possibly live here without fossil fuels. We have to progress, bring on new technology and we are nowhere close to it.”

Policymakers who shut down pipelines, ban drilling and systematically close the doors on the oil and gas industry could contribute to what Bloomer called “absolute chaos” in a February 2021 op-ed piece in the Calgary Herald.

“Some say they would like to see the oil and gas taps turned off tomorrow. Can you imagine what would happen?” Bloomer said. “Widespread power and heating shortages. No gasoline.”

“China and India are not changing their energy mix. In fact, coal, oil and gas are growing. If we shut down North American production tomorrow, we will be buying oil from the Middle East, Africa and Russia,” Hogg said. “We’re going to do the German experiment all over again: shut down the nukes and coal plants to go green. But the green grid did not work for them, and they built 26 new coal plants from 2007 to 2020.”

Some say it is time for the industry to speak up about its essential role both during and after the transition. “For the longest time, the average person wanted cheap fuel and a reliable supply of natural gas and to live life,” Hogg said, explaining the value of the industry did not seem necessary to justify its presence.

But today is a new day.

In his op-ed, Bloomer stresses that, “... we can’t flip a switch. And we can’t destroy the industry that is going to fund and fuel this change.” [E](#)

Excerpt of Part 3:

The oil and gas industry is finding new ways to move crude and bitumen, and its efforts to earn support from indigenous groups are paying off. But how does it convince younger generations that fossil fuels are still needed?

“The challenge to the industry is to understand how to engage in effective communication tactics that are respectful of our code of ethics and desire to be truthful while making impacts on people,” said Brad Hayes, director of the Canadian Society for Unconventional Resources and president of Petrel Robertson Consulting. “There has to be better communication.”

Global Energy Outlook: OPEC+, Energy Transition Are Key



The best-case outlook for the future of world energy looks highly positive for the oil and gas industry.

In that outlook, energy demand returns to pre-pandemic levels and production increases as the world's economies recover, giving the industry an opportunity for a strong rebound and years of attractive growth.

But other scenarios could put roadblocks in the way of exploration and production, some of them potentially coming from the energy industry itself.

OPEC+ definitely holds one key to the future, and the global energy transition appears to have picked up a considerable amount of momentum over the past year and a half.

"There's been a lot of water under the bridge since 2019. A lot of things changed during the pandemic," said Jim Krane, fellow for energy studies in the Baker Institute for Public Policy at Rice University.

"Here in Houston, it seems like there's more acceptance of the need to take climate action," Krane noted.

Many large companies, including oil majors, have put energy transition programs into operation. A majority of those are medium- to long-term, with target dates ranging from 2030 to 2050.

In April, Shell published its Energy Transition Strategy, a plan that will go to its shareholders for an advisory vote in May. The strategy commits Shell to reducing carbon dioxide emissions from 1.7 gigatonnes per year to net zero by 2050.

Earlier this year, General Motors Corp. announced "an aspiration to eliminate tailpipe emissions from new light-duty vehicles by 2035."

"To address emissions from its own operations, GM will source 100-percent renewable energy to power its U.S. sites by 2030 and global sites by 2035, which represents a five-year acceleration of the company's previously announced global



KRANE

"The geopolitics of energy as we go through this transition is changing. It's changing a lot."

goal," the company stated in a release.

For national and local governments, "resolve around cleaning up energy production strengthened during the pandemic. It seems that governments around the world have gotten a taste for dramatic and expensive policy maneuvers, and it seems like their citizens are okay with that," Krane observed.

"A lot of these (new government policies) include a green aspect. There just seems to be pressure coming from all over. The Chinese are at least starting to push coal out of their energy mix," he said.

Industry bench-marker S&P Global defines the energy transition as the "energy sector's shift from fossil-based systems of energy production and consumption – including oil, natural gas and coal – to renewable energy sources like wind and solar, as well as lithium-ion batteries."

In general, the transition is expected to produce a smaller percentage share for coal and crude oil in the global energy mix, and a substantially larger share for renewables. Expectations for other energy sources like natural gas and nuclear aren't as well defined.

Shell's new transition strategy includes a plan to shift the company toward gas production by increasing its natural gas share of total hydrocarbon output to 55 percent, with up to a 2-percent annual decline in its crude oil production.

Climate change efforts and the energy

transition have "gotten well beyond policy-making. It's become embedded in commercial activity and social mindsets," Krane noted.

"The energy system is so enormous, even if government policy-making is all on board, it's a huge life. But it doesn't seem like a mountain anymore," he said.

Shifting Geopolitical Landscape

"How much that affects energy demand in the short term is – not much," he added.

In the near term, OPEC+ most likely will continue to limit production and prop up world oil prices as needed, Krane said.

"They'll probably move back and forth between these bids for market share, then backing off to let prices rise," he predicted.

In the longer term, how extensive climate change efforts become and how Saudi Arabia and OPEC+ respond to that could be hugely consequential.

Krane is author of the book "Energy Kingdoms: Oil and Political Survival in the Persian Gulf." His research themes and special interests include U.S. relations with Middle East oil and gas exporters and global energy geopolitics.

With OPEC+, "I'm always stunned that so many countries can get together and agree on self-sacrifice. There aren't that many coalitions of countries that can get together and take that kind of collective action," he said.

An imminent reduction in future oil demand could induce OPEC+ to speed up monetization of its in-ground crude assets. What if Saudi Arabia eventually decides that selling its oil at a much lower per-barrel price is better than never being able to sell those barrels at all?

"If Saudi Arabia decides to monetize and oil prices go down, that makes things difficult for the smaller producing companies," Krane noted.

He sees the possibility of a more virtuous approach and a less virtuous approach for OPEC+ in the future.

"Some of the OPEC players have held a big share of the market and that hasn't changed much. A lot depends on their response to the energy transition," Krane observed.

It would be a major change "if OPEC added climate to its rationale for action, instead of handing out quotas based on countries' productive capacity. They could do it around other criteria," he noted.

Krane said "there's also a dark way, a negative effect" and "a race to the bottom" possible for Saudi Arabia and OPEC+. That could include extensive market manipulation, attempts at coercion, placing sanctions on rival producers and other "nefarious behavior."

"The geopolitics of energy as we go through this transition is changing. It's changing a lot," Krane said. "Right now, everyone is talking about Iran coming back (as an oil producer and exporter) and what that means. And Iran is already coming back."

Also, "the rise of China is a pretty big challenge for the United States," Krane said. He noted that China's autocratic approach to government appeals to many other countries.

"There is this whole outbreak of

Continued on next page ►

Prelude, Shell's first floating liquified natural gas facility is expected to produce 3.6 million tonnes per annum of LNG, once operational. Shell's new energy transition strategy includes a plan to shift the company toward gas production by increasing its natural gas share of total hydrocarbon output to 55 percent, with up to a 2-percent annual decline in its crude oil production.

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nationalism in the world. Democracy has been in retreat for a few years. A lot of that is happening through grassroots support of illiberal ideas, and a lot of that seems to be percolating up through the Internet," he said.

Advantages for Renewables

At present, and for the foreseeable future, the outlook for global energy security is still positive, according to Krane.

"Energy markets are still really open and free. Fossil fuels are 5 to 10 percent of all global trade by value, depending on the price," he noted. "It's pretty hard to find fault with the way fossil fuels are traded right now."

"As demand for oil levels off, oil availability will get more secure. Climate change has been great for oil security. It's an irony," he said.

He pointed out several reasons for the world's current oil and gas supply security:

- ▶ Demand growth isn't challenging oil companies right now.
- ▶ Lots of governments are sitting on large oil reserves.
- ▶ Oil and gas production has become more diversified.

Krane expressed more concern about the risks to the energy industry and the world from interruptions to exports of vital raw materials and capital goods. For example, he said, what if the Democratic Republic of Congo stops exporting cobalt, used in lithium-ion batteries, heat-resistant and hard alloys, and many other applications?

"If the price of materials and minerals suddenly spikes, that's going to make the price of equipment go up," he noted.

Energy sources like solar, wind and hydroelectric are primarily local sources, and Krane said that gives renewables the advantage for the global energy system of the future.

"In the system we have now, you have to bring in combustible fuels all the time. If that supply line is broken it's a disaster. With renewables, that doesn't happen," he noted.

"You don't have to have a constant supply of energy (inputs) to keep things going. If the intermittency problem goes away, you're going to see a huge advantage" for renewables, he said.

Wild Cards

The global coronavirus pandemic hasn't ended, and exactly how post-pandemic energy demand will evolve isn't yet clear, Krane said. Will there be fewer business travelers and less air travel? A reluctance to use mass transit and increased private vehicle driving?

At the moment, "nobody knows how all that will turn out," he said.

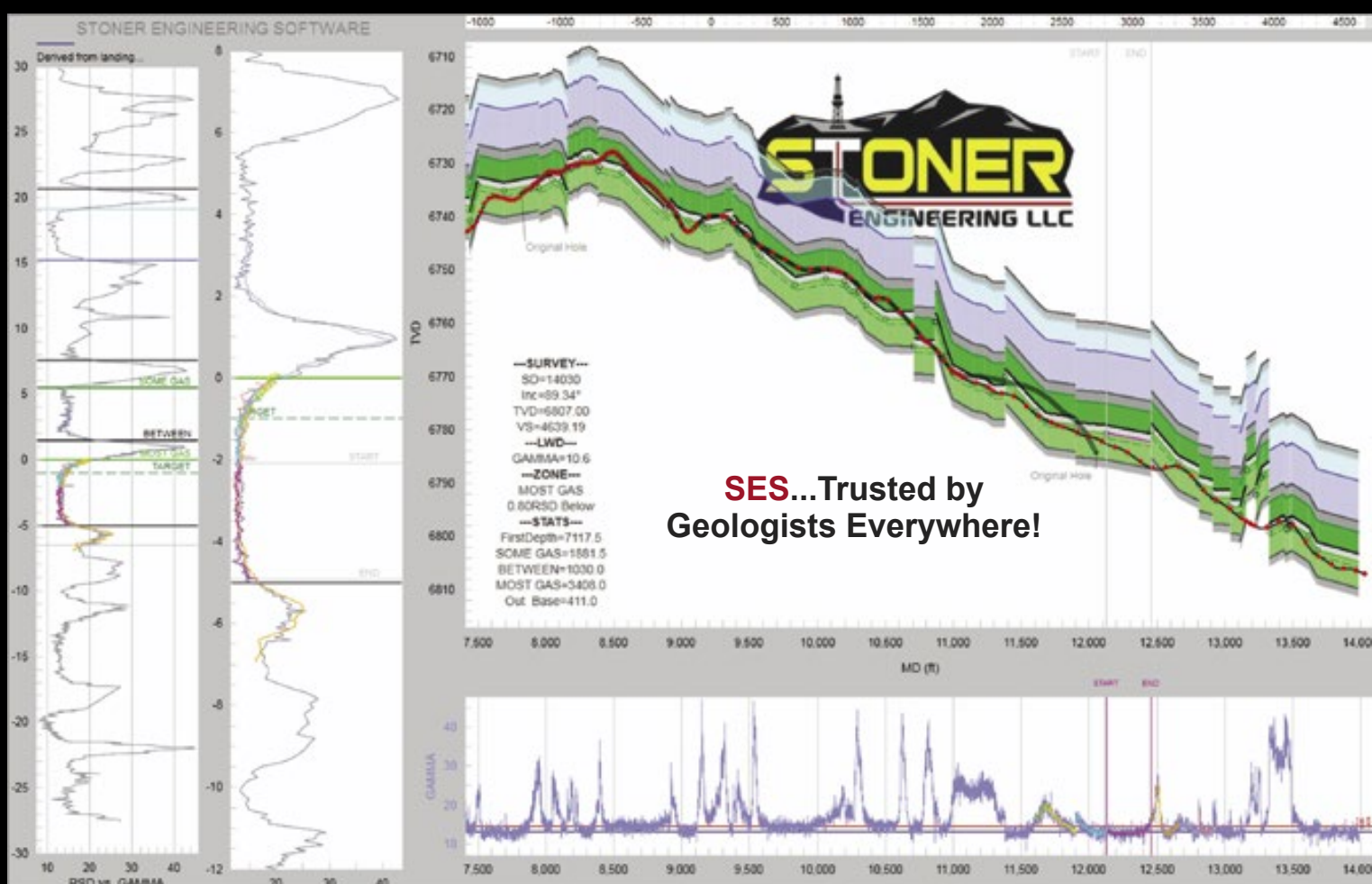
Shipping and other global transportation re-emerged as an energy issue during the past year and a half. In the United States, the Biden administration revoked the permit for the Keystone XL Pipeline's Phase 4 extension by executive order in January. In March, a container ship mishap interrupted oil tanker and other maritime transport through the Suez Canal.

It reminded the oil and gas industry and the world that getting energy from Point A to Point B can't always be taken for granted. Krane cited the interruption of electricity and natural gas deliveries in Texas during a severe February cold snap.

"Getting gas from one side of the state to the other turned out to be impossible in cold weather," he said. "Who knew?" 

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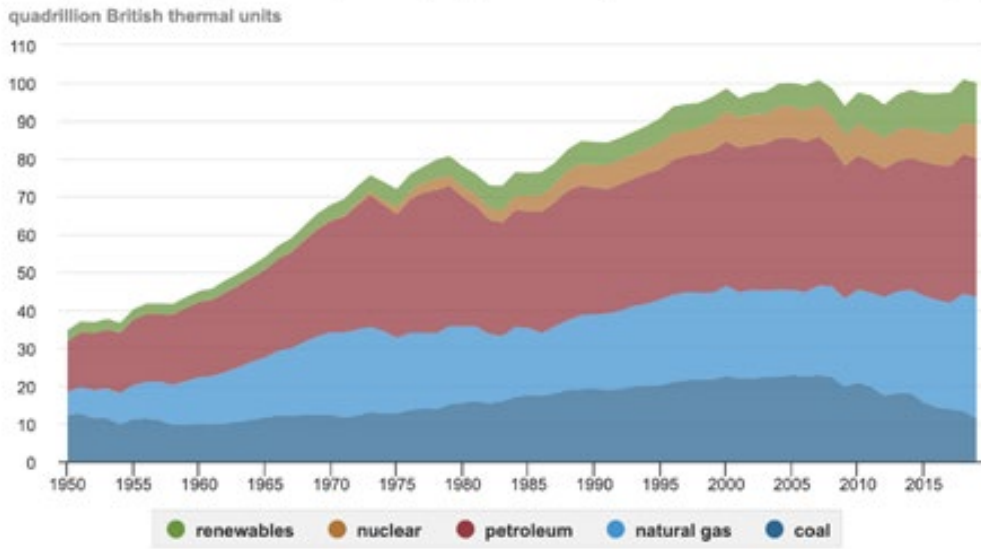
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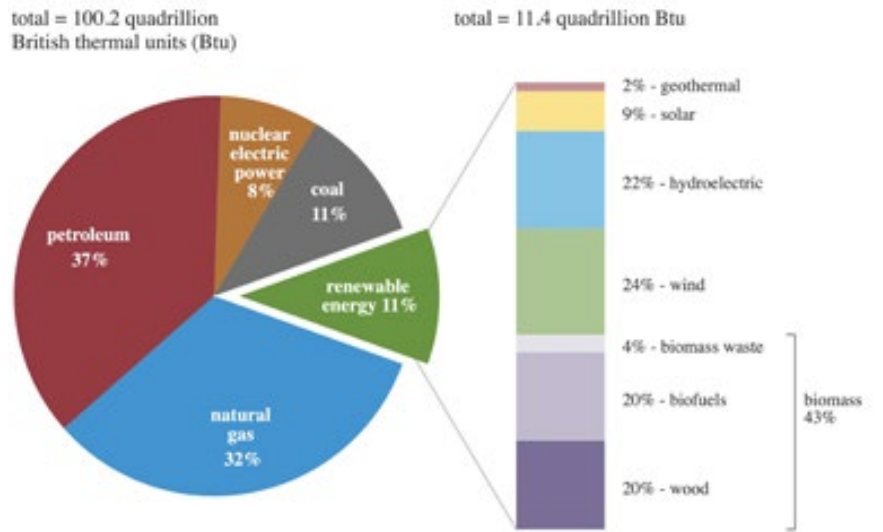


U.S. primary energy consumption by major sources, 1950-2019



Note: Petroleum is petroleum products excluding biofuels, which are included in renewables.
Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3, April 2020, preliminary data for 2019

U.S. primary energy consumption by energy source, 2019



Note: Sum of components may not equal 100 percent because of independent rounding. Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2020, preliminary data

Net-Zero Emissions by 2050? Not Without Nuclear

Part 1 of 2

In the quest to reach net-zero emissions of energy-related carbon dioxide by 2050, a longtime goal of the United States, other world governments and energy agencies, no one is even close to achieving it.

Despite 2020's largest decline in emissions as a result of less energy usage during the COVID-19 pandemic, the U.S. Energy Information Administration anticipates "a rapid rebound in energy demand and emissions" this year.

Furthermore, the EIA projects that by 2050, U.S. energy-related emissions will be 5-percent higher than 2020 levels.

Globally, emissions also are expected to increase by at least 0.6 percent each year through 2050.

"What happens to energy demand and emissions in 2021 and beyond will depend on how much emphasis governments put on clean energy transitions in their efforts to boost their economies in the coming months," the agency stated in a March 2 report titled, "Global Energy Review: Global Emissions in 2020."

In an effort to turn the emissions curve downward more quickly, President Joe Biden announced at the April 22 Leaders Summit on Climate that the United States should aim to cut 2005 level emissions (which peaked at just under 6 billion tons of carbon dioxide) by half by 2030.

It's a lofty goal, leaving many to question whether or not it's doable.

Fossil Fuel Dominance

Fossil fuels currently dominate the global grid because the world needs energy and its population continues to grow toward a projected 10 billion, said AAPG Member James Conca, a 33-year Earth and environmental scientist and consultant for federal and state environmental and energy agencies as well as industry.

While it might seem ironic, access to energy will be the world's best environmental protection. Studies, such as the United Nation's Human Development Index, have shown that 3,000 kilowatt hours per person,

per year, results in lower birthrates.

"People become prosperous enough to not depend on their children to feed them in their old age," Conca said. "You can't save people and the planet without energy."

Yet that energy must be clean, sustainable and – at this point – include a significant presence of nuclear power, said Conca, who is also a member of the [Uranium Committee of AAPG's Energy Minerals Division](#).

Moving backward in its goal to reach net-zero emissions by 2050 and 3 billion tons by 2030, the United States must play a major game of catch-up.

The Intergovernmental Panel on Climate Change, the International Energy Agency, the U.N. Sustainable Development Solutions Networks and the Global Commission on the Economy and Climate are encouraging tripling the amount of nuclear energy in the world to stabilize global carbon emissions.

After five decades of significant strides in safety, efficiency and cost, nuclear is a major key to making net-zero emissions more than "a pie in the sky" idea, said Conca, who

specializes in geologic disposal of nuclear waste, energy-related research, planetary surface processes and radiobiology.

Although wind and solar have dominated mainstream discussions about clean energy, nuclear has been quietly advancing to become a power fuel that can most effectively serve large and growing populations while simultaneously lowering emissions.

Catching Up

The United States' primary energy mix relies on 37 percent petroleum, 32 percent natural gas and 11 percent coal – a total of 80 percent dependence on fossil fuels, according to the EIA.

While fuel for electricity generation varies more, coal produces roughly 30 percent; natural gas, 34 percent; nuclear, 20 percent; hydropower, 7 percent; wind, 6 percent; and others, 3 percent.

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Gross Electricity Generated in Each State by Nuclear Power

Net Electricity Generated in Each State by Nuclear Power



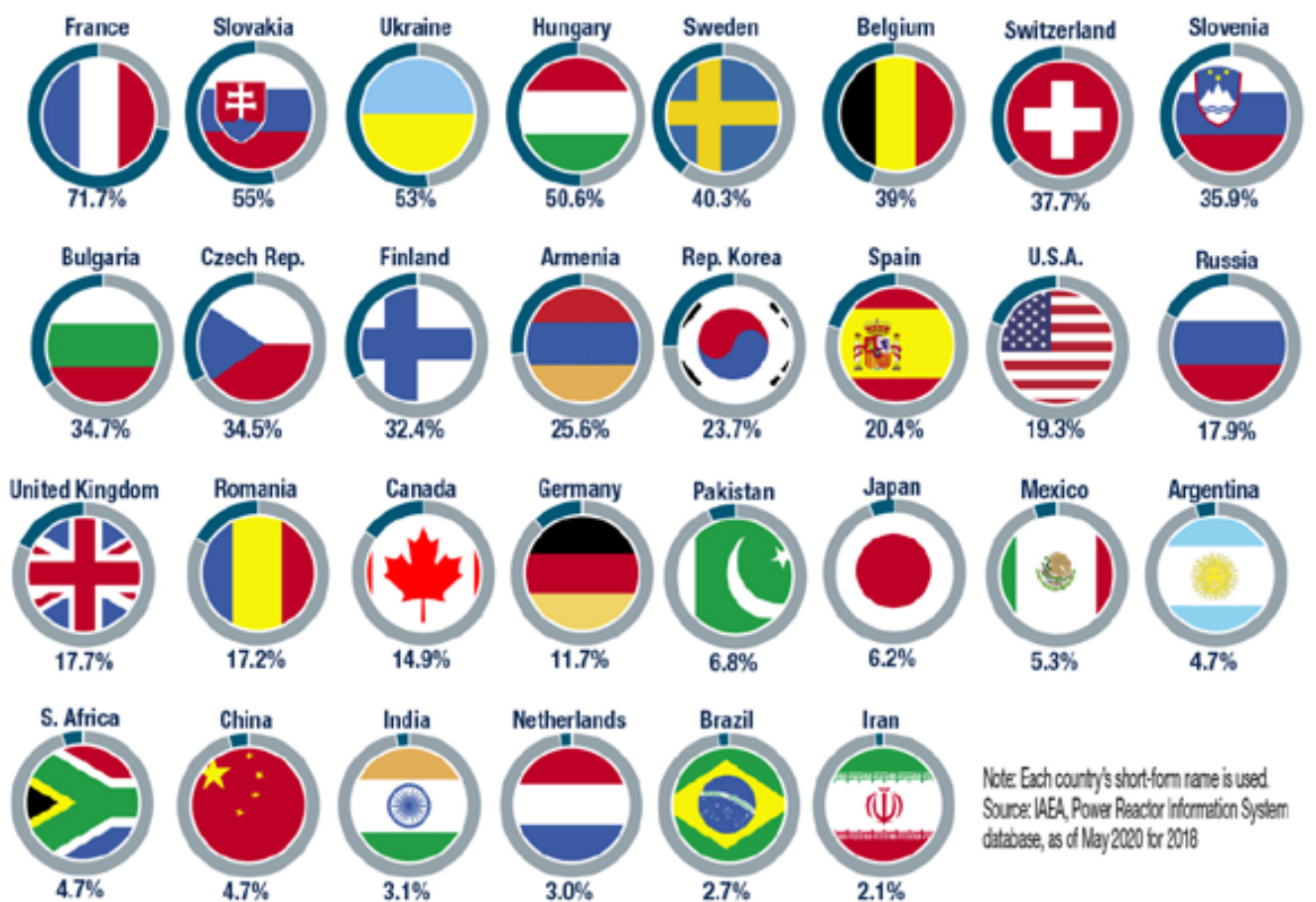
Table 1: Total Nuclear Power Generated by State (in thousands megawatt-hours)

State	Total Nuclear Generated	% of Nuclear Electricity
Illinois	97,191	53%
Pennsylvania	63,199	39%
S. Carolina	54,344	58%
Alabama	42,651	42%
N. Carolina	42,374	33%
New York	42,167	33%
Texas	38,581	9%
New Jersey	34,032	45%
Georgia	33,706	26%
Michigan	32,081	29%
Arizona	32,340	31%
Tennessee	31,617	40%
Virginia	30,533	34%
Florida	29,146	12%
California	17,901	9%

Table 2: Total Nuclear Power Generated by State (in thousands megawatt-hours)

State	Total Nuclear Generated	% of Nuclear Electricity
Ohio	17,667	15%
Connecticut	15,499	68%
Louisiana	15,409	16%
Maryland	15,106	44%
Minnesota	13,904	24%
Arkansas	12,691	21%
Kansas	10,647	21%
New Hampshire	9,990	67%
Wisconsin	9,648	15%
Washington	8,128	7%
Missouri	8,304	10%
Nebraska	6,912	20%
Mississippi	7,364	12%
Massachusetts	5,047	16%
Iowa	5,213	9%

Nuclear Share of Electricity Generated by Country



Note: Each country's short-form name is used.
Source: IAEA, Power Reactor Information System database, as of May 2020 for 2018

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To get even remotely close to net-zero emissions and Biden's 2030 goal, Conca calculated that the United States must immediately:

- ▶ Stop building new fossil fuel plants.
- ▶ Stop closing existing nuclear power plants that have been deemed safe by the Nuclear Regulatory Commission.
- ▶ Build wind turbines to generate an additional 500,000 megawatts.
- ▶ Install rooftop solar panels on all new buildings to generate an additional 800 billion kilowatt hours.
- ▶ Double hydroelectric power using existing dams to reach 600 billion kilowatt hours.
- ▶ Secure sources of lithium, cobalt, iron and other metals needed to build batteries for fully electric vehicles.
- ▶ Produce a fleet of 150 million fully electric vehicles and 100,000 charging stations along all roadways.
- ▶ Streamline the process to site and approve high-voltage transmission lines to support this abundance of renewables.

Even if the United States could attain these high-reaching goals, neither Biden's 2030 proposal nor net-zero emissions can be achieved without a significant nuclear energy component, Conca said.

Currently, the United States has 94 operating nuclear power reactors in 28 states, according to the EIA. These reactors generate approximately 20 percent of the country's electricity.

The United States would need to build an additional 100 standard reactors (1,000 megawatts) to generate 40 percent of the nation's power and, combined with existing operating reactors, support approximately 132 million people, Conca said.

In lieu of large commercial reactors, the United States could build 2,000 small modular reactors – a type of advanced nuclear reactor designed to operate with accident-tolerant fuels that won't melt down, explained Paul Goranson, CEO of Encore Energy Corp, a U.S. uranium company.

Private companies are currently testing the country's first commercial SMRs, and many expect them to become an accepted and pervasive form of electricity generation throughout the country and the world.

SMRs are ideal for small markets, Goranson said, pointing to states with small populations, such as Wyoming and Alaska, that would need just a handful to generate 1,000 megawatts of power. Underserved markets in California would also benefit from SMRs.

SMRs are considered by those in the industry to be "small, safe and manageable," and they require minimal waste handling, Goranson said.

Two thousand SMRs would provide electricity for an estimated 132 million people.

Conca said both options would cost about \$1.6 trillion – "pretty much the same as installing windfarms to produce the same amount of energy."

"When you get to these numbers, whatever the energy source, material availability becomes critical," Conca said. "Whether it's steel or neodymium, replacing our 4 trillion kilowatt-hours per year will take a lot of materials, and the amount differs widely between renewables and thermal."

As it stands, natural gas plants require the least amount of concrete and steel (with wind farms requiring the most), making them financially attractive, but a step backward in reducing emissions, he said.

A Case for Nuclear

Over the past four decades, the operation of nuclear reactors in the United States has been "a safer source of energy by far than in generating oil and gas, coal and renewables," said AAPG Member Michael Campbell, chair of the EMD's Uranium Committee and senior principal and chief geologist/chief hydrogeologist at I2M Consulting, LLC, in Houston and Seattle.

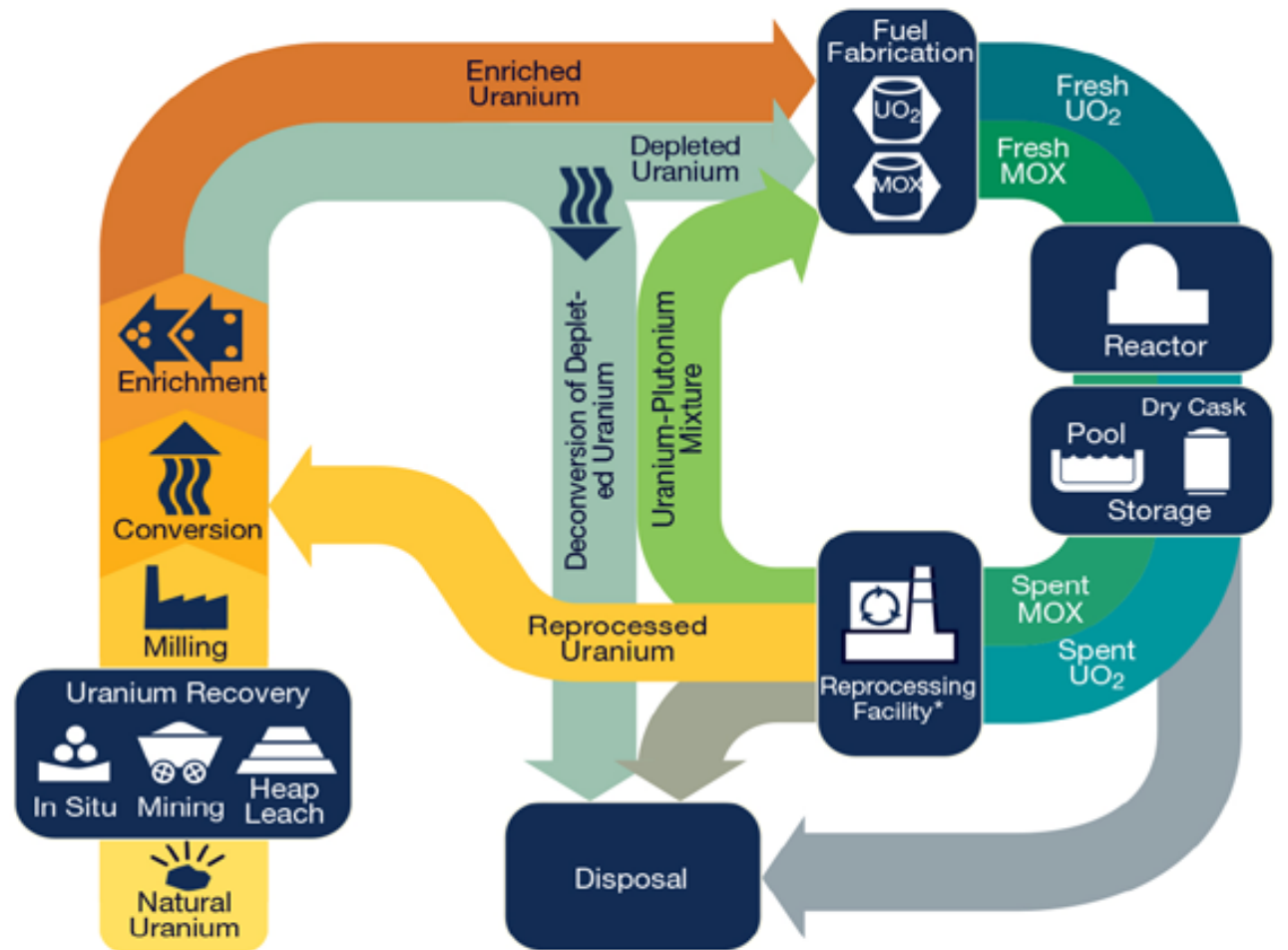
More than 8 million people died in 2018 from fossil fuel pollution, according to research from Harvard University, in collaboration with the University of Birmingham, the University of Leicester and University College London, published in the April 2021 issue of the journal *Environmental Research*. Researchers estimated that exposure to particulate matter from fossil fuel emissions accounted for 18 percent of total global deaths in 2018 – just shy of one in five people.

Deaths from non-fossil fuels tend to be accident-related and much lower, with nuclear power holding the lowest death rate, Conca said.

Unlike wind and solar, which provide only intermittent power, nuclear energy is a consistent power source that can easily be turned on and off, Campbell said.

Many renewables rely on natural gas as a back-up fuel when nuclear would better serve that function. "Natural gas has long been touted as a bridge fuel to a non-fossil future beyond this century. But that is nonsense," Conca said. "We don't have a century. And if a lot of new gas plants are built, especially to

The Nuclear Fuel Cycle



Reprocessing of spent nuclear fuel, including mixed-oxide (MOX) fuel, is not currently practiced in the United States. Note: The NRC has no regulatory role in mining uranium.

Excerpt for Part 2:

Nuclear scientists have learned how to build nuclear reactors for power generation that won't cause meltdowns experienced at Three Mile Island, Chernobyl and Fukushima, said AAPG Member Michael Campbell, chair of the Energy Minerals Division's Uranium Committee and senior principal and chief geologist/chief hydrogeologist at I2M Consulting, LLC, Houston & Seattle (see (2020).

"Small module reactors are coming on strong," he said. "That's the new nuclear industry that's approaching. They are built not to fail and not to produce radiation. I foresee them all over." (more).

load-follow wind and solar, then we lock ourselves into gas for a long, long time."

Furthermore, as recently constructed wind and solar projects mature, it's been discovered that the cost of electricity they are producing increases rapidly, Campbell said. This is because of low conversion production efficiencies and the fact that operation and maintenance costs were either overlooked or underestimated, he said, see (more).

A quick glance at California underscores this fact, as consumers struggle with rising electricity costs, blackouts and power interruptions because the renewable systems cannot produce sufficient power.

Uranium fuel costs represent just 5 percent of the operating cost of a nuclear power plant, while fuel costs for power plants using natural gas are much higher. The volume of fuel needed is the principal difference in that 1 fuel pellet of uranium contains the energy equivalent of about 17,000 cubic feet of natural gas, Campbell said.

"Not only is nuclear power climate-friendly," he added, "it has the potential to create thousands of high-paying jobs."

More reactors are operating in the world today, so there is growth in nuclear power, Goranson said. But there is no new production in the United States.

"The point of the Cold War was to scare people, and it worked," Conca said, acknowledging that incidents at Three Mile Island, Chernobyl and Fukushima Daiichi exacerbated a longtime fear of nuclear energy. "But it was supposed to scare people about nuclear weapons and not nuclear power."

People need to get beyond negative perceptions of nuclear power, Campbell added, emphasizing that scientists have learned how to prevent such incidents from reoccurring.

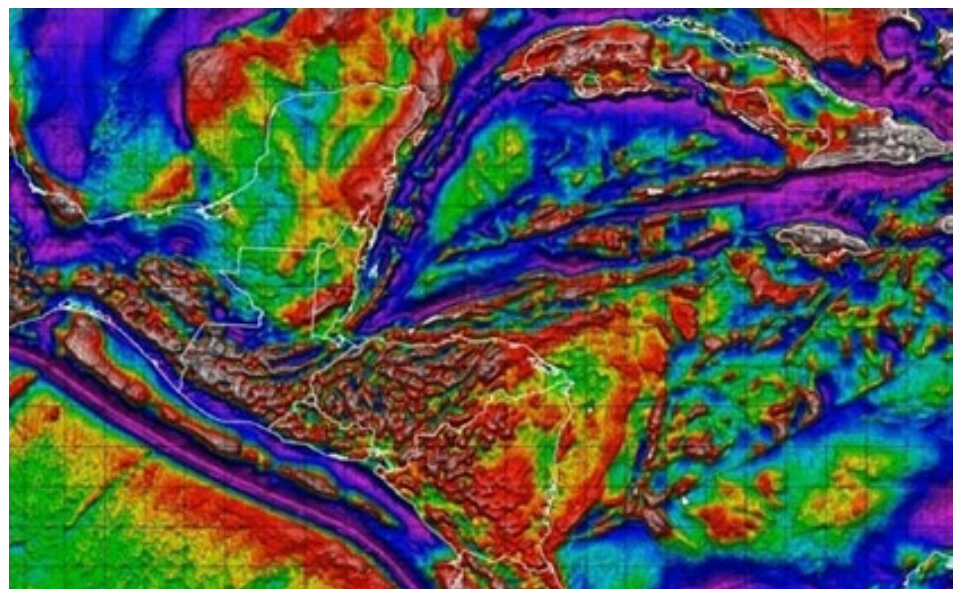
In the race to slow the rate of warming, and with nuclear energy rising as a viable, indispensable option, will the United States and other countries be able to get on board?

"Companies are spending huge amounts of money trying to hit the market first" as the dominant provider of green energy, Campbell said. "Like any capitalist venture, if you can produce a product and service that is good, safe and cost effective, you will win. Nuclear is starting on a new track in the United States." ■





Map showing the Main Cape license area, including the Main Cape 1 well drilled in 1974 and the Akna play test locations on the Chortis plate. Image courtesy of CaribX.



Basin types and basin scale present across the Nicaraguan Rise, Chortis Plate. Gravity image analysis provided by Mark Longacre, MBL, Inc.

Hunting Hydrocarbons Offshore Honduras

CaribX restarts exploration and appraisal activity after a 48-year pause

In the 1960s and '70s, many oil companies collectively drilled 50 wells in the Chortis plate, an arrow-shaped, large segment of continental crust projecting into the Western Caribbean from onshore Honduras and Nicaragua, 1,000 kilometers east toward Jamaica.

Three-quarters of the wells drilled recorded either source rocks or hydrocarbon shows, and four wells tested live hydrocarbon columns, including Union Oil's Main Cape discovery, drilled in 1973.

Civil unrest and a deteriorating investment climate in Central America halted offshore exploration in the early 1980s and the area remained largely unnoticed while companies focused on Mexico, Venezuela and Colombia.

Taking a New Look

Decades later, the Chortis plate caught the attention of Chris Matchette-Downes, a petroleum geochemist and entrepreneur with a history of finding commercial exploration opportunities in Europe, East Africa and, more recently, the Caribbean.

After founding and then selling a company focused on East Africa, Matchette-Downes met an official from the Petroleum Corporation of Jamaica and soon started working in Jamaica and surrounding areas. He found this new area both refreshing and exciting.

"The high entry price required in Africa at the time and fierce competition to secure acreage opportunities encouraged me to look elsewhere," he said. "It was clear that the Western Caribbean had all the geological ingredients for prolific petroleum systems and there was no one else there at the time."

"The Western Caribbean is bigger than it seems, and I am convinced it could hold the next oil major province, south of Mexico and north of Venezuela."

Focus on the Source Rock

Chris Matchette-Downes founded CaribX in 2009 with the mission to "Follow the oil seeps and source rocks." He worked in Jamaica, Haiti and the Dominican Republic before learning about the opportunities in Honduras.

"A geochemist friend gave me a business card from a conference, and just said, 'You will need this.' I rang the number and got through to the Honduras government agency tasked with managing Honduras' minerals, mines and hydrocarbons," he said.

"I had just launched CaribX with

the intention of securing assets in the Caribbean, in shallow water and in stable countries with evidence of oil. The Union Oil Main Cape oil discovery offshore Honduras passed the screening test," he continued.

Matchette-Downes flew to Honduras and met with government representatives to discuss proposals, then made follow-up trips to collect data and oil samples from the 1973 discovery.

"To my mind, a robust source is key; everything else follows. Oil to the surface is of course a good sign, and I was able to get samples of the Main Cape tested oil early on," he said.

Need for Partnerships

Matchette-Downes said members of the government were very interested to hear about the work he'd done and the potential he saw for reviving exploration activity in Honduras. At the time, CaribX was just starting out.

"It's a typical problem – countries prefer to work with the majors," he said. "The majors in turn like to see prior groundwork in place, particularly in frontier areas. The way forward was to bring in the right partner early on, and this happened with the British Gas Group. Then after BG's merger with Shell and their subsequent withdrawal from Honduras as part of Shell's strategic portfolio reorganization, this allowed CaribX to grow into the leading Western Caribbean oil exploration company we are today."

Today CaribX is a 55-percent holder of the Main Cape license along with UK-based operator High Power Petroleum.

Staying Committed

Throughout operator changes, the COVID crisis and the subsequent economic downturn, Matchette-Downes has remained committed to the pursuit of technical and commercial success offshore Honduras.

"We have not drilled yet, but we have established that the 1973 oil discovery in the shallow water was of material scale. We have also identified billion-barrel class prospects in the deepwater Cayman Trough borderland basins, and we have determined that there is both an Upper Cretaceous and Eocene source rock and charge systems active," he said.

In the past 10 years, CaribX has conducted an extensive review of the hydrocarbon potential of the 17,180-square kilometer Main Cape license area. The work was enhanced by bringing in experts like Mark Shann, former subsurface director of

Sierra Oil and Gas and participant in the 670 mmb recoverable Zama oil discovery in the Southern Mexico's Sureste basin in 2017.

Shann joined CaribX as a technical adviser and investor in 2019.

"I always wanted to investigate what was present on the adjacent Chortis plate and the giant field scale of the Akna prospect in the Patuca basin was very appealing," Shann said. "Like Zama, there is top-down evidence of a working petroleum system and the carbonate reservoir geometry is analogous to the karstified Mesozoic carbonate fields I have seen in Mexico."

Exploring the Potential

Mark Shann has spent the last two years increasing his understanding of this Western Caribbean area included in CaribX's Main Cape license.

"Chortis has had an intriguing plate history," Shann said. "In the Mesozoic, it was located farther west adjacent to Mexico's Maya plate in the Yucatan, and as such was affected in the Late Cretaceous by Laramide 'Sierra Madre thrust and fold belt' folding. It then moved east into the Caribbean during the Cenozoic on a strike slip plate boundary, hence the dominant structural fabric affecting Chortis is one of sinistral strike-slip."

Shann noted that the Main Cape license includes two primary play types.

"The northern section comprises the southern borderlands to the Cayman Trough transform margin, which are a series of strike-slip basins with a clear Miocene structural carbonate play. To the south, the block covers the northern part of the Eocene Mosquitia rift basin, which has proven prolific Eocene rift basin source

rocks and their time-equivalent associated carbonate shoal reservoirs," he explained.

Shann works alongside Senior Geoscientist Joel Corcoran integrating reservoir/seal integration of the Main Cape 1 log data to seismic structural and facies mapping, they identified a fault-bounded 40-square kilometer structural high called "La Loma" located east of the original Main Cape 1 well drilled in the Mosquitia Basin. La Loma is an area of stacked Eocene nummulite-shoal type reservoir potential, where up to five additional carbonate reservoir/seal pairs may be present, updip of proven oil at Main Cape 1.

"The La Loma subsurface work has really come together over the last year founded on revisiting old legacy data with a forensic approach, applying new ideas and taking advantage of modern software to integrate all the data we can," Corcoran said.

The CaribX team is leveraging new technology to prepare for their appraisal of Main Cape. In addition to seismic mapping, biostratigraphic analysis, basin modeling and DST test analysis, they are using virtual reality to integrate global outcrop analogues to Main Cape 1 well logs and seismic at the same scale.

Plans for 2021-22 include options for an appraisal well in the Main Cape La Loma structure and a deepwater play test of the Akna prospect in the Patuca Basin, part of the Cayman Trough borderland basins in the north.

Getting Down to Business

In addition to significantly expanding CaribX's technical profile with world-class experts, Matchette-Downes brought in team members to strengthen the company's financial and strategic position.

Rory Scott Russell, a Shell veteran with Caribbean experience, assumed his role as CEO in 2018. During his tenure, he has organized funding and developed a consortium of institutional and private investors to fund the company's work program obligations, business development and regional growth plans.

Under his leadership, the CaribX management team also gained two new members. Ivan Sandrea, former CEO and founder of Sierra Oil and Gas (acquired by Wintershall DEA in 2019) joined the advisory panel, as did former senior BP executive and PEMEX board member Octavio Pastrana.



Chris Matchette-Downes in the field with Honduran colleagues

Continued on next page ►

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A Small Team with Big Results

"We may be, relatively speaking, a small company, but we punch above our weight, particularly in our technical capabilities across all disciplines. We also know that patience, a forensic attention to detail and data, and of course an appetite for hard work is essential for success in all this new frontier work we do. For example, hunting down and acquiring all the 1970's data available from governments, public and private sources takes years to achieve," said Scott Russell. "All the patience, investment and hard work is now paying off."

Scott Russell noted that the project to appraise the Main Cape-1 discovery would involve drilling the first offshore well in Honduras in more than 40 years.

"Main Cape-2 will appraise an existing discovery of over 100 million barrels (mean oil recoverable), with the potential for a large exploration upside," he said.

He noted that evaluating the discovery and moving the field to commerciality, safely and in full and transparent consultation with all local stakeholders, will be significant for Honduras and for the neighboring countries that lack indigenous hydrocarbon sources.

"We believe strongly that a lack of access to cheap energy is a fundamental barrier to economic development in the region," he said.

Benefits for Honduras

Scott Russell said that discoveries in Honduras will provide significant social, economic and environmental benefits to Honduras and its people.

A 2020 study from the UNAM Renewable Energy Institute states that more than 70 percent of Hondurans live in energy poverty, without reliable access to basic energy services, like clean cooking facilities. According to the U.S. Energy Information Administration, half of the country's total energy needs are met by burning biomass, mostly firewood, contributing to deforestation and habitat loss.

Scott Russell also noted that Honduras imports 90 percent of its total non-biomass energy supply. He cited an International Trade Centre report noting that in 2018 alone, the country imported more than 25 million barrels of oil and

refined oil products, costing the economy \$1.6 billion, or 17 percent of the country's total imports.

"As a result of government-subsidized fuel prices, the state directly funds the difference between the cost of import and the retail price of fuel, making the Honduran economy particularly vulnerable to oil price volatility," he said.

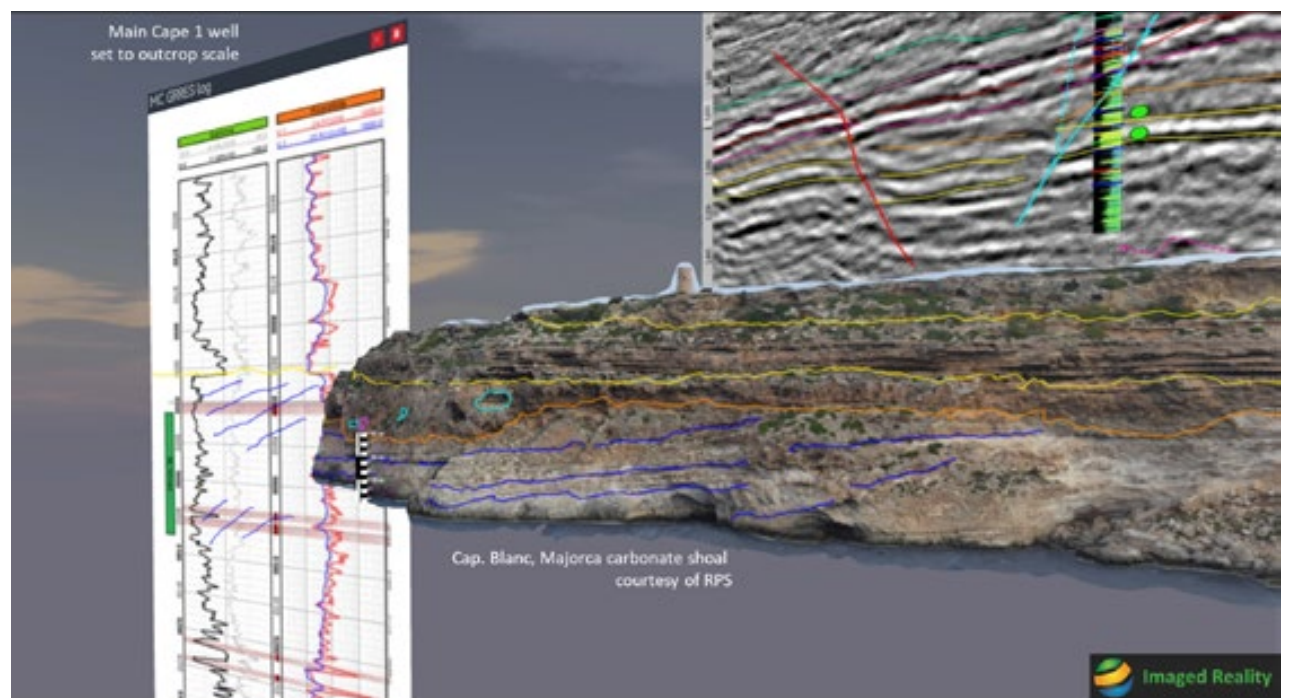
"However, the country could hold, in the waters off its Caribbean coast, a highly material energy supply in the form of untapped oil and gas resources. The potential discovery and development of these resources, depending on project outcomes and drilling success, could produce direct government revenues of anything between US\$350 million and \$3.5 billion per year by the end of the decade," said Scott Russell.

He noted that developing an indigenous resource will help Honduras offset the burden of oil importation and vulnerability to oil shocks, provide energy security and help to alleviate energy poverty and reliance on biomass and firewood.

"An oil and gas export business would diversify the economy and provide an opportunity to develop a skilled workforce in the high-technology science and engineering sectors," he said, noting that the CaribX team is committed helping the country develop its potential.

"The whole team takes this undertaking very seriously, including our commitments to all local stakeholders. We are honored to be part of such a historic project in Honduras, and we are impressed by the state's professional and transparent approach as we continue to make the project a success," he said.

Matchette-Downes echoed these sentiments and said he is grateful to all those who helped the company reach its current position: "I would like to thank to thank the co-founders of CaribX, all the consultants that helped found and build CaribX and the new CaribX members that have continued to manage and refine the offshore Honduras project." ■



Imaged Reality software is used to integrate outcrop to well log and advance understanding of the Main Cape carbonate reservoir type and what can be expected in its forthcoming appraisal.



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June 28 - Dr. Rick Sarg Short Course
June 29 - Social Event at Whiskey Ranch and Distillery
June 29 & 30 - Full Day Technical Talks
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June 28th Convention Short Course

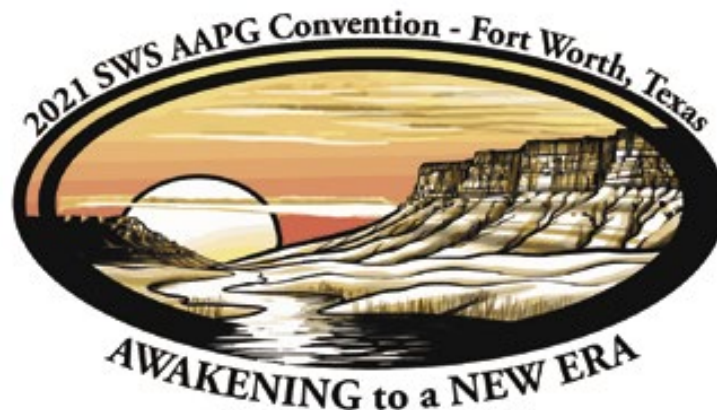
Presented by Dr. Rick Sarg
Colorado School of Mines
Sequence Stratigraphy and Reservoir
Characterization in Mixed Systems -
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Includes virtual field trip video with field guide

Historical Highlights



A journalist's working instruments are simple: pens and notebooks, a camera and a typewriter. Rintoul got his first typewriter in 1937; then his wife gave him a Royal Standard typewriter in 1955, which he used for 35 years, thus having written all of his books on this manual typewriter. In 1990, his son Jim bought him an Apple Mac, which he used right away and loved, even though he sometimes missed the clicking sounds of his loyal manual typewriter. Photos taken in 1958 and 1990, courtesy of James Rintoul.

William Rintoul: the Encyclopedia of California Oil History

The Los Angeles Times once called William Rintoul "one of the West's most unusual writers." Oil field journalists are indeed rare and are becoming even rarer. Nevertheless, their contributions are not to be ignored. Petroleum history is a chronicle of the largest industry that has shaped the modern world for the past 150 years or so. Lighting, heating, transportation (on land, on the sea and in the air), rocket propulsion, petrochemicals and medicines are all gifts of this black gold. There have been many authors of the history of the oil and gas industry, but William Rintoul, who died 20 years ago next month, on June 26, 2001, was different. He crystallized in his lifelong work the very history of the oil and gas industry in California. For five untiring decades, he wrote thousands of articles on this subject.

It is impossible to decouple California's petroleum history from Rintoul's legacy.

A Kern County Patriot

The third and youngest son of his family, William Thomas Rintoul was born on April 30, 1922 in Taft, Calif. His father, Henry Ward Beecher "Pete" Rintoul, was born in Canada in 1887, but grew up in San Francisco, and graduated in civil engineering from the University of California in Berkeley in 1911. Beecher Rintoul first worked for the Southern Pacific Railroad and then for the Western Water Company (largely associated with oil fields), becoming the company's general manager in 1940. He married Deane Gertrude O'Connor in 1917 when they both worked for the Southern Pacific Railroad. They raised three sons: Henry Ward Beecher, Jr., John David and William. Both the younger Beecher and John David graduated in mechanical engineering from UC Berkeley. Beecher worked for the Southern Pacific Railroad, and John David for the Standard Oil Company.

The city of Taft (named after U.S. President William Taft) is located in the foothills of the San Joaquin Valley, in Kern County, Calif. Bakersfield, another oil town in Kern County where Rintoul spent most of his life, is only 32 miles east of Taft. This setting in the midst of prolific oil fields had a lifelong pull on Rintoul's life. While a teenager,

Rintoul became interested in boxing and wrote articles on famous boxers for magazines in the United States, Canada and Europe. One of these heavyweight boxers, Max Marek from Chicago, who promoted himself as "The Man Who Beat Joe Louis" after having done so in the Golden Gloves finals in Boston in 1933, was a book lover and sent Rintoul a list of his favorite novels. Consequently, Rintoul became a voracious reader: he read Sinclair Lewis, Upton Sinclair, Zane Grey, John Steinbeck and other renowned novelists. While a senior in high school, Rintoul also worked in oil fields near Taft on some weekends.

When John Steinbeck's "The Grapes of Wrath" was published in 1939 (the year Rintoul finished high school), the book was banned (and burned) for a while in California, but Rintoul was proud to say that he had already read it. In this novel, Kern County is depicted as the final destination for the Joad family's arduous migration during the Great Depression. The Joad family represented the plight of many people from Texas,

Oklahoma and Arkansas who went to the Golden State in search of jobs.

In 1940, Rintoul went to UC Berkeley to study journalism. After graduation in 1943, he joined the U.S. Army and served in the 89th Infantry Division in Europe, later earning a Bronze Star. In 1946, Rintoul returned to Taft, then took a year to travel in Mexico and Central America. During Christmas of 1947, he returned again to Taft, where he met Frankie Jo Miller. They married on June 19, 1948. For a while, Rintoul worked as a roustabout for Standard Oil, but his passion lay in writing. Using the G.I. Bill program for the returning World War II veterans, Rintoul returned to school and obtained a master's in journalism from Stanford in 1949. He soon began working for The Bakersfield Californian as a stringer in Delano, Calif., where his daughter Susan was born. Rintoul's early assignments were to report on anything making news – fires, crimes, weddings, etc. But when the Californian decided to launch an oil column, Rintoul was picked as their writer.

In 1950, Rintoul moved his family to Bakersfield where their son James was born a year later. Based in his home office on 2721 Beech Street, Rintoul continued his freelance writing for the Californian and numerous other periodicals for the rest of his life.

Rintoul was proud to be from Taft and Kern County. He was Taft's Oildorado Grand Marshal in 1980. (In 2020, Taft's 10-day party and parade, Oildorado, celebrated the 110th anniversary of the city.) James Houston, author of "Californians: Searching for the Golden State," in which Rintoul was featured, called Rintoul "a Kern County patriot" and "a living encyclopedia of petroleum lore." During the second oil shock of 1979-80, Rintoul was proud to say that Kern County was the fourth largest oil-producing area in the United States.

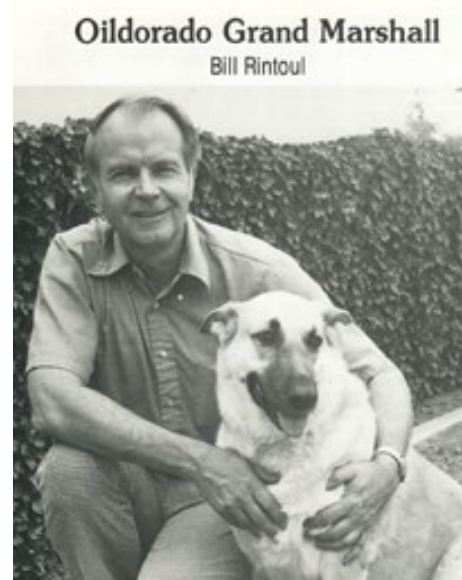
Chronicles of California's Oil

Rintoul was a six-day-a-week "Oilfields" columnist for The Bakersfield Californian; he wrote this popular column for 51 years, from 1949 until his retirement in May 2000. For more than a decade, Rintoul was also a regular contributor to The Los Angeles Times, San Francisco Chronicle, The Sacramento Bee, the Tulsa World and Pacific Oil World, and often wrote for magazines such as Petroleum Week, Drilling Contractor, Well Servicing Magazine, Oil & Gas Investor, Oil & Gas Journal, Offshore Magazine, Westways, California Business, California Crossroads, Sports Illustrated, Popular Mechanics, Nation, and so forth.

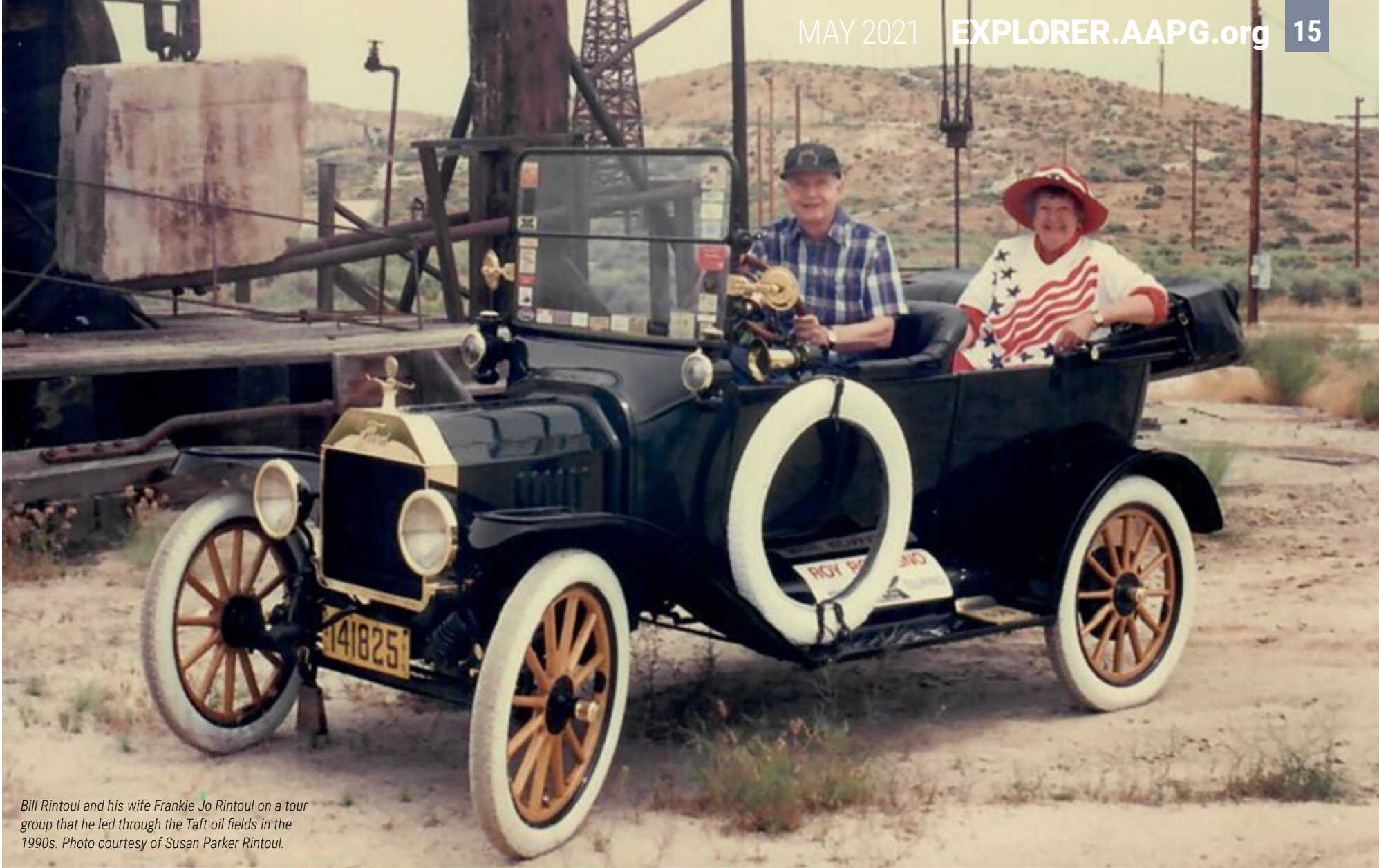
From 1976-81, Rintoul published three illustrated books that are indispensable to any student of California's oil history: "Spudding In: Recollection of Pioneer Days in the California Oil Fields," published by the California Historical Society in 1976; "Oildorado: Boom Times on the West Side," published by Western Tanager Press in 1979; and "Drilling Ahead: Tapping California's Richest Oil Fields," published by Western Tanager Press in 1981. Reading through these and his other writings, one finds a continuous thread in his craft: oil is humanized. Rather than simply writing



Left: Bill Rintoul on the cover page of Bakersfield Lifestyle Magazine in April 1986 with a long interview featured in the magazine. Recall that 1986 witnessed one of the worst oil market crashes in history. To the question about the future of the oil industry, Rintoul answered, "I think that the oil industry is going to be here for a long, long time." Why? "Because it is our number one energy source." Right: Rintoul with his dog Woofie. This photo was included in the Taft Oildorado 1980 brochure, when Rintoul participated as Oildorado Grand Marshall in the parade. Rintoul loved animals, and his daughter Susan remembers how one day Rintoul brought home a stray cat who gave birth to five kittens, all of which the family kept and cared for.



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Bill Rintoul and his wife Frankie Jo Rintoul on a tour group that he led through the Taft oil fields in the 1990s. Photo courtesy of Susan Parker Rintoul.

◀ Continued from previous page

about rigs, drill bits and gushers in a dull and dry language, Rintoul focused on people – their lives, dreams, struggles, pains and joy. For instance, after narrating the 1899 discovery of the Kern River oil field in California, Rintoul concludes with this line from "Spudding In": "Hundreds of men came from all over the West to see the Elwood discovery well. At one time a picture was taken of two hundred men in the lobby of Bakersfield's Southern Hotel. An agent for the Southern Pacific bought oil from the Elwoods for use in the line's locomotives."

This humanization of the oil industry is also evident in the photographs Rintoul included in his books. The vast majority are pictures of ordinary men walking or working in oil fields. Rintoul often described oilfield work as hard, dirty and dangerous, and appreciated the work of these men.

Rintoul also captured the dynamics of life in oil towns and oil fields of California in short stories published in more than a dozen magazines. Some of these were collected in two books: "Rig Nine" and "Roustabout," published respectively in 1983 and 1986 by a small press, Seven Buffaloes, in Montana. Two of the stories in "Roustabout" were translated into Russian and included in an anthology of American writers entitled, "I Believe in Humanity," published in Moscow in 1986. The book's Russian editor noted that Steinbeck would have written like Rintoul, had he written about oil fields. In 2011, 10 years after Rintoul's death, his children, Susan and James, published "The Collected Stories of William Rintoul" in a hardcover volume; it contains 45 short stories.

Rintoul's last book was a "big history." He was commissioned to write the history of California's Division of Oil and Gas for its 75th anniversary. Rintoul used it as an opportunity to write a succinct chronicle of California's oil. The result was "Drilling Through Time," a profusely illustrated "coffee-table" book published in 1990. Rintoul ends his book with the hope that many of the wells "would still be making contributions to California's oil production

on into the next century." Now in that next century, the petroleum industry is facing many economic, environmental, and technological challenges, and historical perspectives like the one Rintoul documented will offer some aid with these challenges.

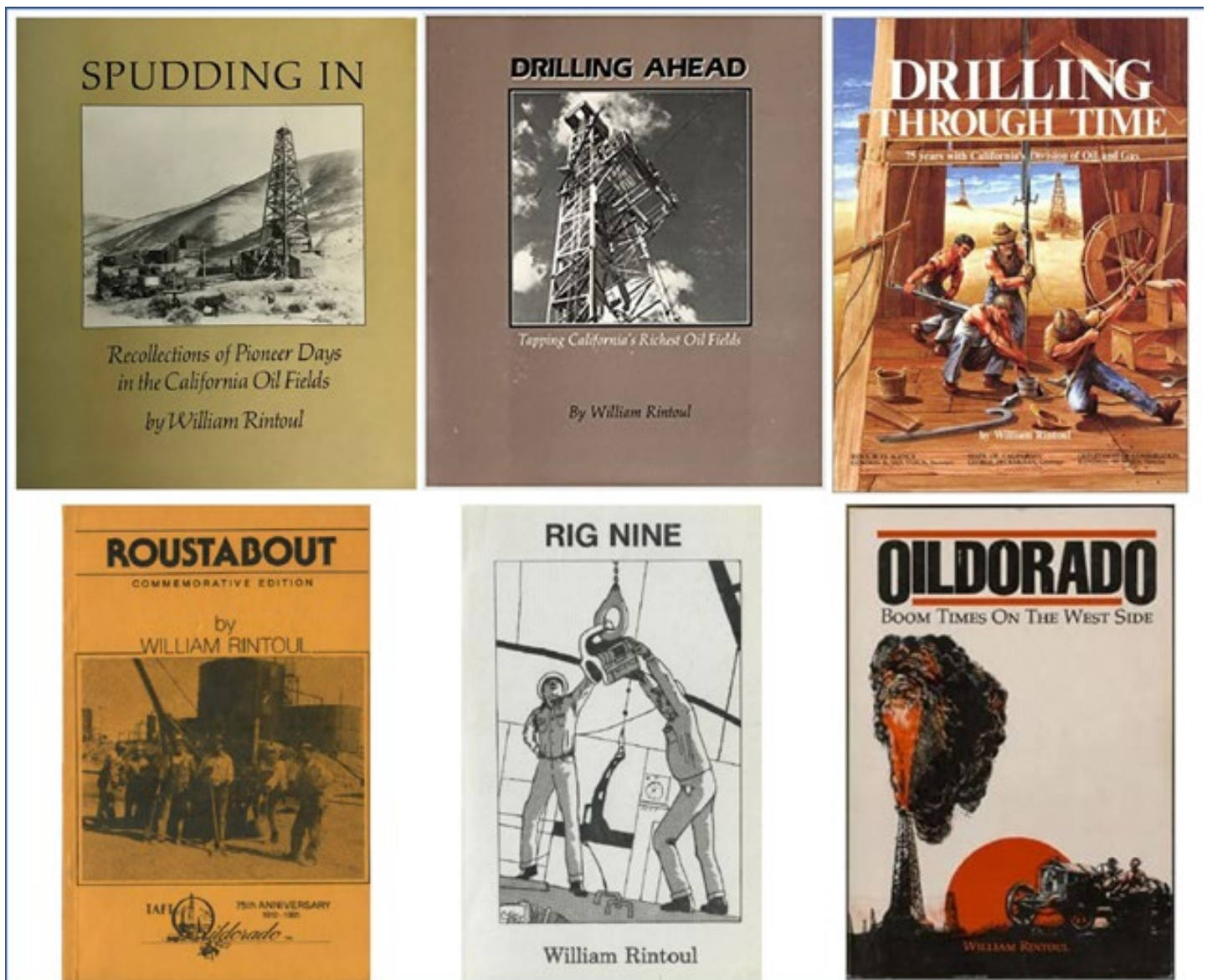
Although Rintoul largely focused on Kern Country's oil industry, his freelance

journalism took him to many other places both in the United States, such as Colorado, New Mexico, Texas, the Gulf of Mexico and Alaska, and overseas, such as Scotland and Saudi Arabia, among others.

Rintoul was also a sought-after speaker, and he gave more than 150 speeches. As for the topics, "the standing family joke," recalls his daughter Susan, "was that his topic was

always: 'the changing oil scene.'" She also remembers her father in these words: "We never went out to dinner without people in the oil industry buttonholing my dad to ask about what was happening in the oil fields. He always knew."

See HH page 17 ▶



Cover pages of Rintoul's six books, all of which he dedicated to family members or colleagues.

Geophysical Corner

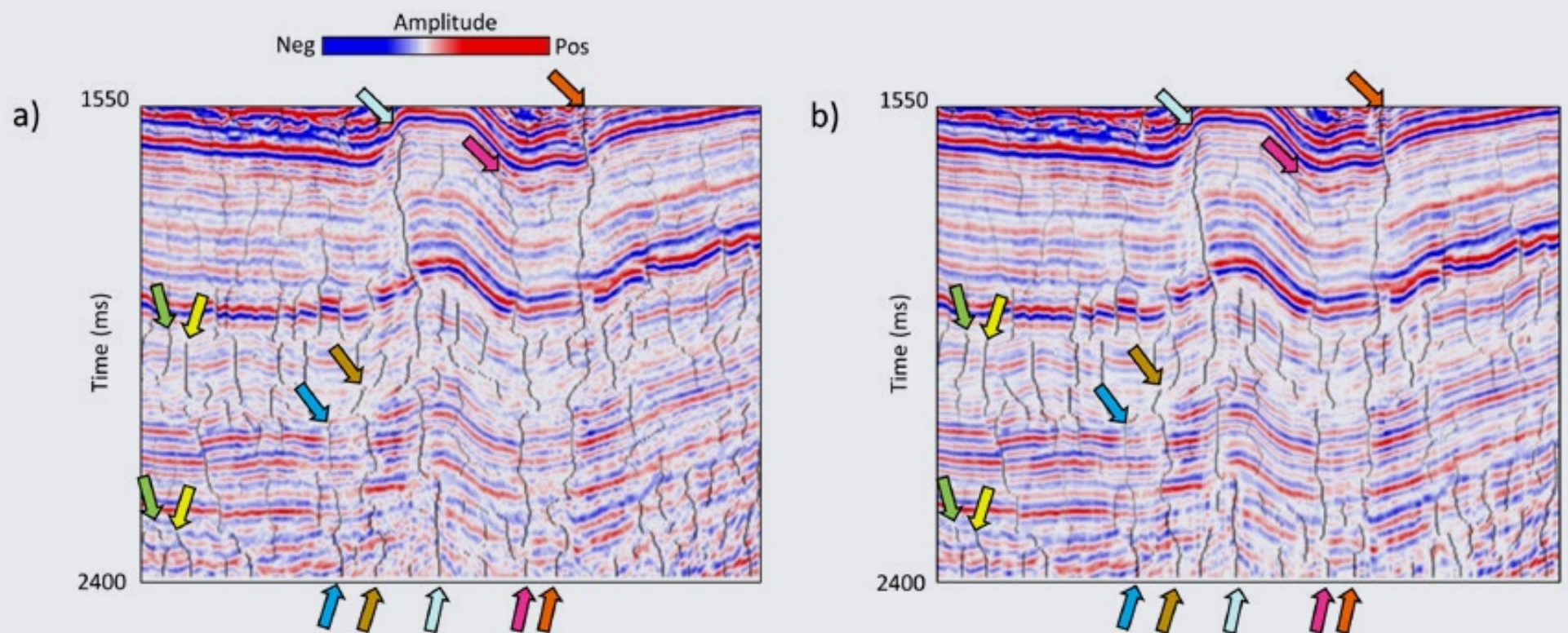


Figure 1: Segment of a section from (a) input seismic data, and (b) the equivalent section from the seismic data volume after putting it through structure-oriented filtering and sharpening via Kuwahara filtering. Both displays have been co-rendered with fault-likelihood attribute. Notice, the seismic display after preconditioning exhibits higher signal-to-noise ratio, the fault lineaments appear to be straighter at places and more continuous as well. Data courtesy of New Zealand Petroleum and Minerals.

Enhancing Interpretation with the Fault Likelihood Attribute

Post depositional faulting results in shifted, but similar reflector patterns across the fault. Syndepositional faults are somewhat more complicated. In some cases, greater accommodation space results in layers that are thicker on the hanging wall side of the fault. In other cases, there is little deposition or even erosion on the footwall side of the fault, resulting in a totally different suite of reflectors on the hanging wall.

Whatever the style of faulting, manual interpretation of faults on vertical seismic sections is traditionally a laborious and time-consuming process. Seismic attributes such as coherence, variance and Sobel filters accelerate the fault interpretation process, in particular by allowing the interpreter to name and assign color to faults on time slices before picking them on vertical slices oriented perpendicular to the fault strike, resulting in a suite of fault segments or “sticks” on a grid of lines, which are then merged into fault surfaces. Fault-sensitive attributes can be further subjected to image enhancement methods such as swarm intelligence (for example, “ant tracking”), Radon transforms, and smoothing and sharpening filters aligned parallel and perpendicular to the fault attribute anomaly. One such development is the fault likelihood attribute, which we will describe in this article.

Preconditioning By Filtering

Any fault interpretation exercise begins with preconditioning of the input seismic amplitude volume by use of structure-oriented median or other filtering. Many articles have been published in the Geophysical Corner column demonstrating

the advantages of doing so (see October 2014, January 2016 and February 2017, for instance). Another process that is particularly beneficial for fault interpretation is to bring in the sharpening of the fault segments by running Kuwahara filtering on the input seismic data (see the August 2016 installment of Geophysical Corner). Seismic

data after such preconditioning are amenable to more accurate fault interpretation as can be gauged from the two displays shown in figure 1. The fault likelihood attribute overlaid on the displays is described below.

A fault surface can be described by its strike, dip and the direction of the slip vector as illustrated in figure 2. In 2003, Dave Hale introduced the computation of fault likelihood, strike and dip from the 3-D seismic amplitude volume. In this approach, the first step is to compute a reflector dip-oriented coherence attribute volume. Next, the fault likelihood is computed by scanning over the negative and positive fault dip angles (where no fault angle corresponds to vertical faults), as well as strike. An examination of the results after this step usually exhibits the fault likelihood coinciding with the faults on the seismic data. Finally, the fault likelihood images are again examined, preserving only their local maxima, and setting other values to zero. This process thins the fault likelihood image, and thereafter the fault surfaces can be extracted from the 3-D images of fault likelihood by using quadrilateral meshes and linking them.

Although this approach performs well for single fault extractions, intersecting faults

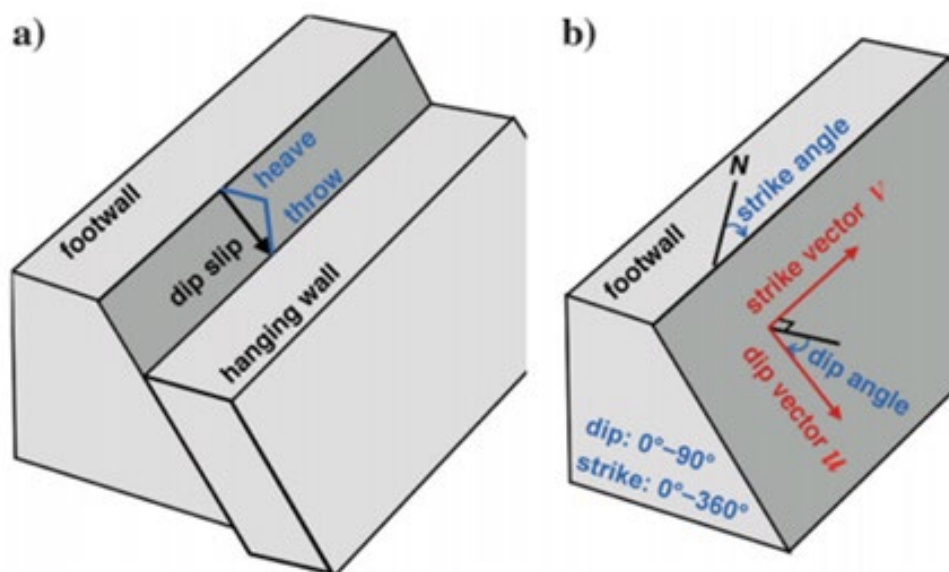


Figure 2: (a) Fault dip slip is a vector representing displacement in the dip direction of the hanging wall side of a fault surface relative to the footwall side. Fault throw is the vertical component and fault heave is the horizontal component of the slip. Fault strike and dip angles with corresponding unit vectors are defined in panel (b). After Wu and Hale (2016).

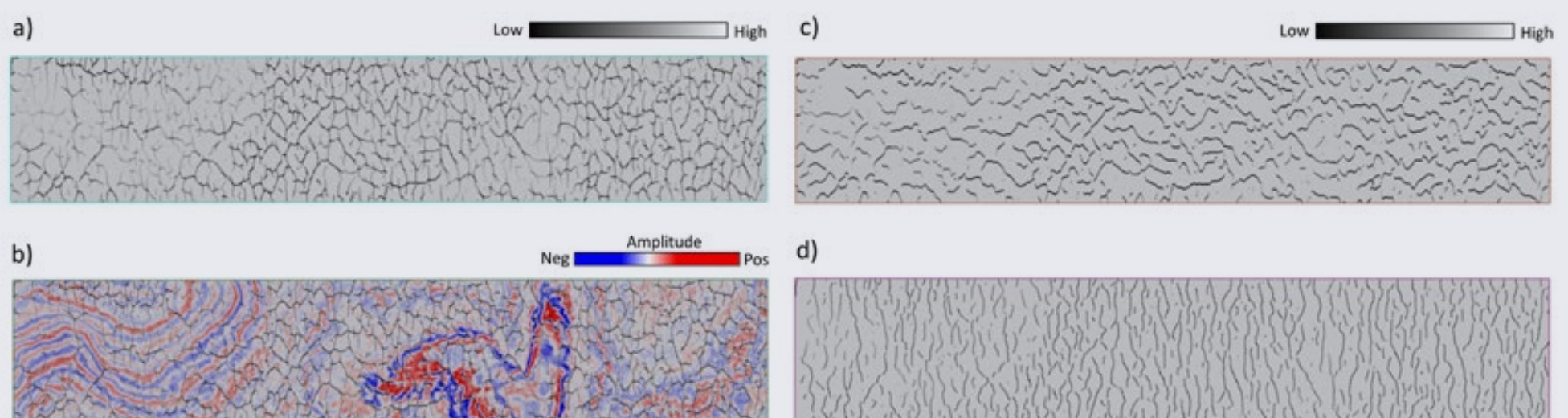


Figure 3: Time slices at 1900 milliseconds extracted from the (a) fault likelihood volume, (b) fault likelihood volume corendered with seismic volume, (c) fault likelihood volume with lineaments filtered parallel to the inlines, and (d) fault likelihood volume with lineaments filtered parallel to the crosslines. Data courtesy of New Zealand Petroleum and Minerals.

Continued on next page ►

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pose a problem. Near the fault intersections, which reflectors should be correlated for the estimation of the fault slip becomes tricky, producing holes in the resulting fault surfaces.

One solution to filling these holes is to filter the likelihood images in the inline and crossline directions and then add the two filtered results.

In figure 3 we show a set of time slice images at $t=1900$ milliseconds through a fault likelihood attribute volume computed from 3-D seismic survey acquired offshore New Zealand. Figure 3a shows a system of polygonal faults. A corendered display of seismic amplitude and fault likelihood is shown in figure 3b, where the breaks in the seismic amplitudes are seen to align with the fault likelihood lineaments. Figure 4a shows the fault surfaces, where block arrows indicate holes near fault intersections. Figure 4b shows the same surfaces after the fault likelihood has been filtered parallel to the inline and crossline directions. The fault likelihood and fault surfaces can in turn be corendered with the seismic volume for ease of interpretation, or these volumes could be utilized elsewhere for other applications such as making geological modeling more meaningful, as well as reservoir modeling and simulation.

Conclusion

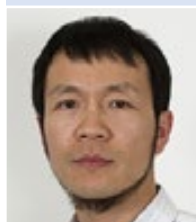
The fault likelihood attribute helps in the manual interpretation of faults on workstations, and it provides a useful input for software designed for automatic extraction of fault planes. With the desired orientation of linear geologic features enhanced with such an attribute, their



Kurt Marfurt serves as research professor of geophysics at the University of Oklahoma in Norman's Department of Geosciences.



Renjun Wen is the founder of Geomodeling Technology Corp. He has a doctorate in petroleum geology from Norwegian University of Science and Technology. He is a registered professional geologist in Alberta, Canada.



Rongfeng Zhang has a doctorate in geophysics and is a senior geoscientist with Geomodeling Technology Corp. based in Calgary, Canada. He has worked for more than 15 years in the development of different technologies such as spectral decomposition, volume curvature and other seismic attributes.

interpretations can be carried forward to the next step in terms of their correlations with production data.

(Editors Note: The Geophysical Corner is a regular column in the EXPLORER, edited by Satinder Chopra, Founder and President of SamiGeo, Calgary, Canada, and a past AAPG-SEG Joint Distinguished Lecturer.)

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Irreplaceable Legacy

In an interview with the renowned writer Gerald Haslam (also from Kern County), Rintoul expressed his feelings about his profession as freelance journalist: "The advantage of working as I have worked is, I'm my own boss. The disadvantage is a total lack of security." Nonetheless, he worked hard, made a successful career, and supported his family – a life lesson to the members of any generation who may be thinking that life is hard only to them.

Aside from journalism, Rintoul also taught classes in writing at Fresno State University and Bakersfield Junior College. He was an active and a lifetime member of the Kern Press Club, the Petroleum Club of Taft, the San Joaquin Chapter of the American Petroleum Institute and the Petroleum Production Pioneers. For his contributions to petroleum journalism and historiography, Rintoul received a number of awards, including the Pacific Section AAPG Journalism Award in 1986, the Oil Baron Award from the American Petroleum Institute's San Joaquin Valley Chapter in 1989, AAPG's Journalism Award in 1990 (presented to him during AAPG's annual convention in San Francisco), the Lifetime Achievement Award from the Independent

Oil Producers' Agency in Bakersfield in 1995 and the Lifetime Achievement Award from the California Independent Petroleum Association in 1996.

Rintoul died in 2001 at age 79, after a year and a half-long battle with Alzheimer's disease. Newspapers in California, including The Los Angeles Times, Bakersfield Californian and Daily Midway Driller, all published his obituary. Many "letters to the editor" from readers, well-wishers and colleagues honored his life and contributions. One person remarked that Bill Rintoul was irreplaceable. Indeed, since his death, no journalist has filled his shoes. Rintoul is a Kern County and California legend.

Acknowledgements: I express my gratitude to Susan Parker Rintoul and James Rintoul for sharing their time and information sources and documents on the life and career of their beloved father.

(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 Matthew Silverman at silverman_matthew@yahoo.com.)



Rasoul Sorkhabi is a research professor at the University of Utah's Energy and Geoscience Institute. An AAPG certified petroleum geologist, he has served as a member of AAPG's Committee on the History of Petroleum Geology, vice president of the Petroleum History Institute and is the former editor of PHI's Oil-Industry History. He edited "Faults, Fluid Flow, and Petroleum Traps," AAPG Memoir 85 in 2015. This is his fifth contribution to the EXPLORER's Historical Highlights series.

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- Application of Data Analytics, Machine Learning, and AI to the Petroleum Industry
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Eliminating Fossil Fuels is 'Aspirational, Not Practical,' Says Sen. Joe Manchin

If you care about the climate, elimination is not the way to go. Innovation is."

That was Senator Joe Manchin, D-W. Va., chairman of the Senate Energy and Natural Resource Committee, at a forum sponsored by General Electric and hosted by the news website Axios on the eve of President Joe Biden's global climate summit last month.

That the summit was held during Earth Day was not a coincidence.

The forum, which also included as guests, Southern Company Chairman, President and CEO Thomas Fanning, and

GE Chairman and CEO Larry Culp, was part of the media company's "Energy Forward" series, which focuses on politics and policies surrounding sustainability, energy efficiency and new technologies in the coming decades.

On that very subject of America at the crossroads of a new energy frontier, Manchin said, at the present, we are still torn between what's doable and what's fanciful.



MANCHIN

"We don't have a practical approach, we have an aspirational one," he said.

And Manchin, whose state of West Virginia is second only to Wyoming in coal production, wants to underscore that trying to do away with the energy source, as many want to do, is economically indefensible, environmentally precipitous and linguistically lazy.

"It's called global climate change, not U.S. climate change," Manchin said.

In West Virginia, according to the state's Office of Miners' Health Safety and Training office, coal occurs in 53 of the state's 55 counties, is responsible for

approximately 30,000 direct jobs, including miners, contractors and coal preparation employees, provides 99 percent of the generated state electricity, and contributes more than \$3.5 billion annually in the gross state product.

For Manchin, this fight is not just personal – it's territorial.

"You cannot eliminate the carbon we have in our midst," he said. "If you try to eliminate fossil (fuels), it's not going to happen."

Manchin, who is seen as something of a dealbreaker on the president's new \$2 trillion infrastructure bill – which includes a number of energy provisions, said he has always tried to look at the best options available, even when it comes, for instance, to the TransCanada Keystone Pipeline.

"I'm never an obstacle. The oil is coming one way or another. I took a practical approach on it," he said, adding that, specifically, as far as the Keystone XL is concerned, "it's safer than it coming on trains or cars."

That infrastructure bill, incidentally, would include new spending on climate change, including thousands more electric vehicle charging stations, millions for new energy-efficient homes, and help pave the way for the president's goal for carbon-free power generation by 2035 and net-zero emissions by 2050.

Fossil fuels, Manchin maintains, can be used in the most efficient and cleanest way – and that should be the country's focus, he said.

Comparative Coal Consumption

And, in fact, it is, the senator said.

"If you believe we should be energy independent, then we have to work in the world of reality. Bottom line is we cleaned up more than any other country. Our coal plants are the cleanest," said Manchin.

All of which brought the senator, during the forum, to reiterate his opposition to the Paris Climate Agreement, which Biden joined within hours of taking the oath of office on Jan. 20, and from which President Donald Trump officially withdrew as one of his last acts last November. Biden has since promised to cut greenhouse gas emissions at least in half by the end of the decade (or approximately 50 percent from 2005 levels), which is almost double the 26 to 28 percent target to which the nation committed under Obama.

Manchin pointed to what he sees as the agreement's flaws.

"China shouldn't be given a pass. It's not a developing nation. They have not let up and they are the largest emitter of greenhouse gasses," said Manchin, adding the accord has "No teeth."

(At the virtual summit, to which 40 world leaders were invited and participated, Canada, Japan, Great Britain, and even Brazil all agreed to cut their emissions by varying degrees. Chinese President Xi Jinping promised his country would "phase down" coal consumption in the second half of this decade, which environmentalists regarded as a welcome development. In 2020, according to the South China Morning Post's "China Macro Economy" page at SCMP.com, the country produced 3.84 billion tons of coal, its highest output since 2015, and 90 million

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- Split screen display allows you to scroll through the Bulletin article and article figures simultaneously
 - Full text on the left side of the screen, and large, browsable images on the right
 - Text and figures can scroll independently
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 - Tab structure integration of the text allows for quick navigation through article sections
- Faceted searching capabilities will allow you to search not only on title, author, year published, and full text, but also...
 - By article type (ex. Geologic Note, Discussion/Reply, etc.)
 - By GeoRef subject and categories, (ex. geologic age, stratigraphy, sedimentary structure, etc.)
 - By Eon, Era, Period, Epoch, and Age
- Integrated search features with map view search results, allow the user to limit searches by geographic location
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Continued on next page ►

Seeing Through the Dark Clouds

YP Connect

Like many of my age cohort, I often listen to podcasts on my daily commute to work. One of my favorites is Motley Fool's "Rule Breakers," a stock market-oriented podcast by Motley Fool co-founder David Gardner. One of the common refrains he uses to describe his stock-selecting philosophy is that he looks for "dark clouds I can see through." The premise is simple: if a company has been beaten down for a good reason, but you have line of sight on that issue being resolved, there exists an opportunity to acquire at a good value and profit from the recovery.

Can we see through the dark clouds that hang over the industry today, to a brighter future?

Dark Clouds All Around

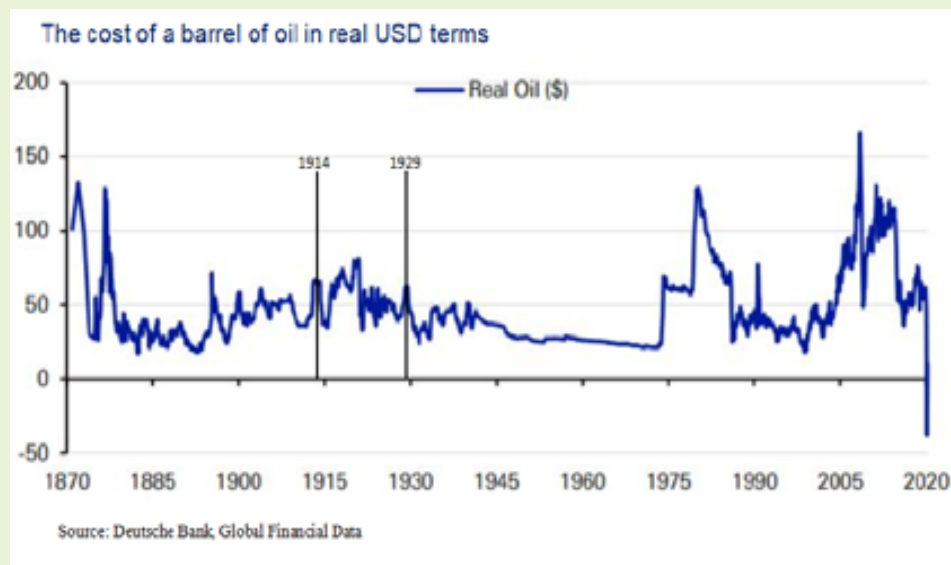
As a representative of AAPG's Mid-Continent Section, which includes Kansas and Oklahoma, the stormy weather metaphor to describe the industry today seems appropriate. As I write this – coming up on Oklahoma's tornado season – the industry has seen a slate of metaphorical dark clouds. Last year we saw a global pandemic and a Saudi-Russia price war that coalesced with soaring production growth from the U.S. onshore sector to result in a severe shock to the supply/demand balance. Looking ahead there is long term demand pressure from the energy transition to renewables.

Spotting the dark clouds is the easy part, however. The challenge resides in the attempt to see through them. The oil and gas industry is often described as "boom and bust," so I turned to history's lessons from some of the great busts for clues on how to see through our current situation. According to Mark Twain, history doesn't repeat itself, but it often rhymes.

Can we find any rhymes to our current circumstances?

Lessons from Oklahoma's Early Oil Fields

There has been a plethora of oil price crashes over the industry's 150-year



history, but not many of them match the severity of the "one-two punch," to quote Warren Buffett, of an oil price war-driven supply shock and COVID-19 demand shock. The closest I could find happened to be right down the road from where I'm sitting as I write this: the Oklahoma City field. Like many of the early oil busts, the discovery of this new large oil field resulted in a drilling frenzy and subsequent flood of supply when it was discovered in 1928. What makes the story of the Oklahoma City field relevant today was the onset of the Great Depression following Black Tuesday in October of 1929. Here you had a demand shock from the Depression and a flood of supply entering the market simultaneously, causing prices to crash to 25 cents per barrel. The crash was severe enough that the Oklahoma governor sent in the National Guard in 1931 to halt the oil production until prices recovered to a dollar per barrel.

Imagine yourself as a Young Professional in the industry during that time. You entered the industry during the Roaring '20s as the stock market boomed. Times were good and there was plenty of oil to be discovered. Then the industry you are a part of becomes a victim of its own success as the new production floods the market. To top it off, the entire nation was hit by a severe

economic downturn.

Sound familiar? It's hard not to feel a sense of camaraderie with the geologists of that day, like Dean McGee. McGee was a 26-year-old YP when he began working the Oklahoma City field for Phillips Petroleum. I try to imagine what he would have thought as he watched the oil glut grow, the world economy crater, and then the governor sent in the military to prevent production. Talk about unprecedented!

Eventually the economy recovered, the Oklahoma City field peaked then declined, and the oil glut subsided, although it took several years. Dean went on to great success in the oil industry as the McGee of Kerr-McGee.

The long-term transition to renewables presents a structural change that hasn't really been seen before with oil. Previous energy transitions (wood to coal, coal to oil, etc.) happened more gradually and organically over time. The massive intervention by the world's governments to speed the transition is what is unprecedented about the current environment. The closest analogy I can think of to this level of government activity in the oil markets would be the various OPEC interventions. While these market activities initially accomplished their goal, there were often unintended long-term consequences. Production cuts



Will Cains is a geologist with the Devon Energy Corporation in Oklahoma City and the Mid-Continent Section YP representative. He holds a bachelor's and a master's in geology from the University of Arkansas, as well as an MBA from Oklahoma City University.

designed to increase prices did indeed drive up oil prices but resulted in non-OPEC production gains and lost market share. Current policies designed to reduce carbon emissions could very well create supply shortages in the future.

Is the history of the Oklahoma City field analogous to the current industry? As sure as the United States emerged from the Great Depression, it is likely that we will emerge from the COVID-19-driven demand slump. On the supply side, the price war has seen a cease-fire and even surprise production-cut extensions, along with capital discipline from U.S. shale companies.

What about the energy transition?

Government intervention will almost certainly result in significant disruptions to the supply/demand balance. It's commonly said that the cure for low prices, is low prices. Unfortunately, we seem to keep redefining what "low prices" actually means, as seen by the April 20, 2020 unprecedented closing price of -\$37 per barrel. The inflation-adjusted 150-year chart of oil prices shows that we have discovered a new low for prices, sending the necessary signal to reduce investment until balance is achieved. The rebalancing is painful, but inevitable.

A lot of perspective can be gained by studying history. As the story of the Oklahoma City field shows us, our time may be unprecedented, but there exists a precedent for getting through the unprecedented times. Adhering to that, it can be said that today's industry does have dark clouds, but with the right perspective, maybe one can see through them. [E](#)

◀ Continued from previous page

CCUS is Key

One of the keys to future success, Fanning said, is carbon capture, utilization and storage and how fast technology moves in that direction. On this point, Manchin agreed, pointing to the more than \$35 billion dollars allocated to CCUS and other related research in last year's energy bill that he supported.

"We can do carbon capture sequestration," he said. "It is the thing that needs to be done."

"People have to remember that things that are out of the mind today," said Fanning, referring to the technological challenges, "will be in the mind tomorrow. I think carbon capture is so important because gas will not go away; therefore, capturing whatever emissions come out of it is necessary."

General Electric's Culp, too, said the country should move quickly on carbon elimination and invest in sustainable technology.

"I'm excited to see the administration organize the summit and hoping real action will come," he said.

Toward a 'Coherent Energy Policy'

When asked if United States "has any credibility left" in developing a worldwide energy blueprint, considering that the Paris Accords and Keystone XL, as two prime examples, have been alternately rejected and supported by incoming administrations, Culp said he's heartened by the new dynamic.

"You can't debate the commitment of this administration. Business is a full partner and what the world will see is a full-throated effort to lead and a sustainable partner," he said.

Like Fanning, Culp doesn't believe there will be a single silver bullet approach.

"We're going to need gas, in combination with renewables," said Culp, bringing up the promise of offshore wind generation, which he believes will be "a great step forward."

"Offshore wind makes a very big difference," he said.

And while acknowledging that Europe was ahead of the United States in developing this technology, he believes the gap has been closing.

"We have taken important steps. Clearly, we need to do a lot more, though, and have some catching up to do," said Culp.

tons more than 2019. It also imported another 304 million tons.)

In America, coal is trending in the opposite direction. According to the U.S. Energy Information Administration, since 2007, U.S. coal consumption has been on the decline. In 2019, coal generation was at a 42-year low, dropping by a record 16 percent, and, exacerbated by low energy prices due to COVID-19, fell even further during the first half of 2020. Renewable electricity output, by contrast, rose 5 percent in the first half of 2020, and natural-gas generation, which grew by 9 percent in the lower 48 states.

Fanning said Southern Company, which is the second-largest utility company in the United States, is all-in on the importance of the coming energy transition, promising, as well, to have net-zero emissions by 2050, if not sooner.

On coal, he was less sanguine about its future than Manchin.

"Coal will be winding down along the way. Coal was at 70 percent when I started; 17 percent now," he said.

A bright spot, he said, was GE's Haliade-X, the world's most powerful offshore wind turbine, located in Rotterdam-Maasvlakte, in the Netherlands, which came online last year. According to the company, one rotation of the turbine, which stands at a total height of 853 feet, could power a UK household for more than two days.

Fanning, too, believes that whatever the future looks like, there is no going at it alone if we want to have a coherent national energy policy, pointing to the fact that 80 percent of the country's energy grid – more than 7,300 power plants and transformers and 450,000 miles of transmission lines – is owned by the private sector.

"We'll need all the help from the administration and all the arrows in the quiver, which means a big emphasis will need to be placed on renewables, tax incentives for hydrogen, as well as storage technology. We all have to work together. See the battlefield and react to it," he said.

For his part, Manchin, talking about both the infrastructure bill and the how important it is for the country to get energy right.

"God help us if we can't get together on that," he said. [E](#)

Adapting to Change

15 Years of the Imperial Barrel Award

In 2007, the first AAPG/AAPG Foundation Imperial Barrel Award competition was held at the AAPG Annual Convention and Exhibition in Long Beach, Calif. The program was the brainchild of AAPG Honorary Member Steve Veal, who was at the time director of the Europe Region office, located in the Geology Department of Imperial College, Royal School of Mines, University of London. Professor Howard Johnson had invited Veal to be a member of a panel to judge an internal technical competition called the Imperial Barrel Award, with teams from the petroleum geology master's degree program. The "barrel" in the title was not a barrel of oil, but a barrel of beer, which was given to the winning team by the Petroleum Society of Great Britain, an AAPG affiliated society. Teams were provided with a seismic and well database, and were charged to analyze the basin, hydrocarbon system and prospects they identified.

Veal recognized the potential for expanding the program globally under the auspices of AAPG and, together with Johnson, wrote a proposal to the AAPG Executive Committee, detailing how the program might work. The EC embraced the proposal and assigned the AAPG Student Focus Coordinating Committee the responsibility of organizing the first competition. They faced many challenges in expanding the program beyond Imperial College. Those challenges included generating student and university interest, scalability, availability of adequate datasets and, of course, funding. Veal so believed in the importance and viability of this fledgling program that he diligently worked to acquire funding to hold the inaugural competition in Long Beach. Teams from seven universities participated, despite uncertainties surrounding the new program and the commitments required.

Mobilizing Membership and Mentors

The program has grown dramatically since 2007, aided by the impact of IBA experience on a student's résumé for many corporate recruiters. Having had experience on a team working with a real exploration dataset differentiates IBA alumni from many of their peers. IBA teams have access to training materials provided by leaders in petroleum geology and geophysics, and participants acquire invaluable technical and interpersonal skills while working with subsurface datasets that challenge their knowledge and ingenuity. Over time, the program has transitioned the emphasis and focus from the competition



aspect to the goal of training and developing future petroleum geoscientists in an environment where there are only winners.

The complexity of the IBA program demands the time and energy of numerous volunteers and AAPG staff around the world. Participating universities are in different time zones and have differing schedules and course lengths. All teams have a faculty adviser to provide guidance. Some universities incorporate the IBA program into their curricula and many run internal, multi-team competitions in order to select the team representing them at the semifinals.

Mentors have always played a critical role in the success of the IBA. In the last two years the IBA Committee has kicked off a Global Mentor Program, which pairs highly skilled explorationists, including Young Professionals, with universities that don't have an oil patch in their backyard or an alumni network to rely on. This initiative has attracted more than 70 mentors in 2021 from multinational exploration companies, independents, consultants and retired professionals. This has been a great addition to the countless mentors who have supported their alma mater or favorite university over the last 15 years.

Evolving Technology

Delivering data to universities around the globe on time was critical in the early stages of the program. Data were initially compiled

on large external drives that could be lost or misplaced in delivery, which happened on a few occasions. Today this task is much easier as all the data can be downloaded via an file transfer protocol site managed by AAPG. This deliverability has allowed a more level playing field and has greatly reduced delays in accessing data. Other logistical issues are ongoing, such as slow internet speeds in some locations and arranging global travel and obtaining student visas during "normal" program years.

All region and section semifinals were initially conducted face-to-face, with student teams presenting their work to a judging panel. As the number of participating teams increased, the regions began to adopt virtual semifinals to solve issues with large-scale, international travel and funding limitations. Restrictions from the COVID-19 pandemic in 2020 required all semifinals to be held virtually, which will continue in 2021. Travel expenses and visa issues also favor virtual semifinals. That said, the experience of facing an expert panel of judges in person and the opportunity to meet other teams from around the world is important for the Global Final, and we hope to resume a face-to-face Global Final at the 2022 ACE.

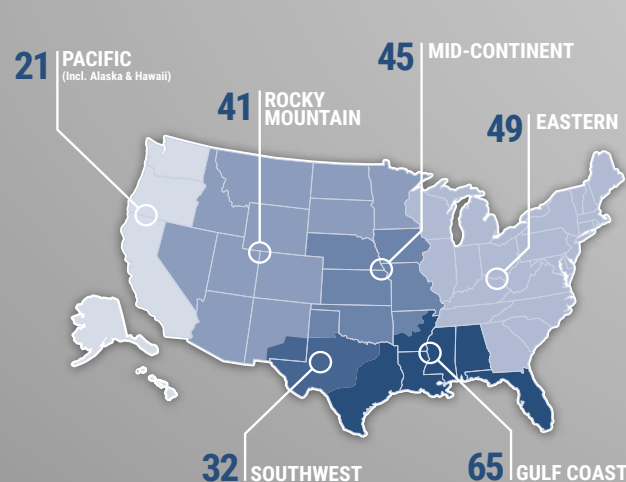
Future of the IBA Program

The industry downturn and COVID pandemic caused a significant decline

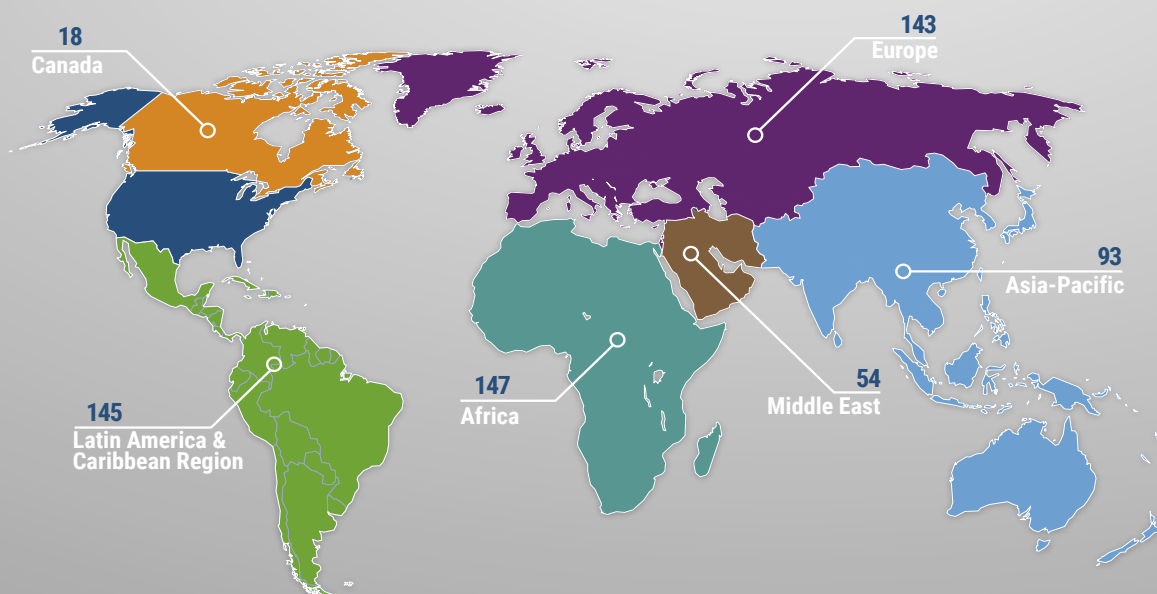
in university participation and corporate sponsorship. The decline in financial support has been addressed by increasing the virtual aspect of the program, which turned out to be essential during the pandemic. The number of universities taking part still declined by a third, with U.S. sections declining nearly two-thirds. In the future, we may see a further decline as petroleum geoscience courses are abandoned or transformed into those with broader energy and sustainability-related curricula. The IBA Committee is working on changes to the program in response, broadening the scope with more emphasis on sustainability. New datasets need to be continually acquired and financial and non-financial (such as software, training, mentoring, and organizing) sponsorship maintained. The program needs to continually evolve in order to maintain its impact and the interest of students, universities and sponsors.

The AAPG/AAPG Foundation IBA Program is an outstanding educational program for students, and its future success will result from adapting to the changing conditions of the energy industry and its workforce. Furthermore, it will depend upon the energy and enthusiasm of numerous volunteers fulfilling roles on the IBA Committee and as coordinators, mentors and judges, and also our dedicated headquarters staff. Please follow the AAPG Student Program pages on social media for the latest news, updates and results. [E](#)

853 Overall Participating Teams (2007-2021)



Sections



Regions

Elevating AAPG's Women's Network from a SIG to a Division

Over the Past year, the AAPG Women's Network has been working on a proposal to move the AAPGWN from a special interest group to a new technical division of AAPG. The previous co-chair of AAPGWN, Terra George posted an article on LinkedIn which brought attention to the need for a formal transition to a division.

She posted "An Open Letter to AAPG" (LinkedIn.com/pulse/open-letter-aapg-terra-george/) on May 5, 2020 and it has since received 453 reactions, 87 comments, 28 reshares and more than 5,000 views. Since Terra's letter has been posted, AAPGWN has engaged in many activities to serve the greater energy geoscience community in an effort to accelerate culture change within the AAPG. Only now, because of Terra's candid letter to AAPG's leadership, along with the tremendous effort from the AAPGWN leadership and volunteer base, does AAPGWN have enough momentum and leadership to strive for division status.

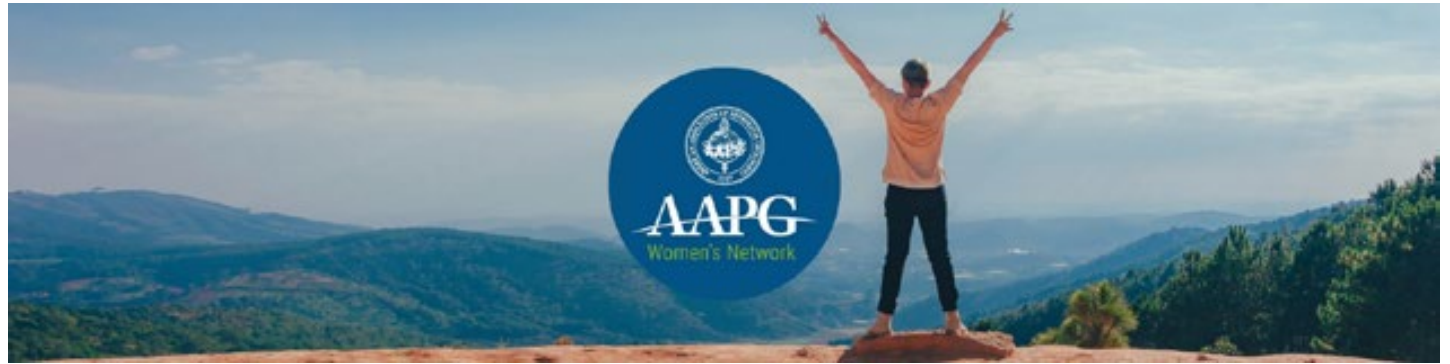
According to Article VIII, Section 4 of the AAPG bylaws, upon recommendation of the Executive Committee, new technical divisions of AAPG can be established by a two-thirds vote of the House of Delegates at its annual meeting. The AAPGWN has secured the recommendation of the Executive Committee and the Advisory Council but now requires a two-thirds vote of the House of Delegates, which will take place on May 23, 2021.

Women's Network Programs and Projects

The AAPGWN, formerly PROWESS, has a long history of enhancing AAPG programming through events at the Annual Convention and Exhibition and the International Conference and Exhibition. The AAPGWN made huge strides in offering online programming during the COVID-19 pandemic. In 2020 alone, our dedicated leadership team volunteered more than 6,000 hours to provide opportunities for the technical and professional development of AAPG members. We hosted more than a dozen online events, including technical sessions at ACE and professional development webinars, and developed a formal mentoring program, started a funded research consortium and had our first publication about gender and diversity equity accepted in AAPG's Bulletin Geohorizons volume (which is the first of its kind for AAPG). In addition to these initiatives, we have built a thriving social community, the impact of which upon the geoscience community is harder to quantify or measure. We have also seen many women grow and develop their leadership skills, and we hope our efforts will continue to reach and support all the members within AAPG's organization. In 2020, we were also recognized by Experience Energy/ALLY by Pink Petro as a GRIT Awards Team/Affinity Group Winner for our efforts to enhance diversity and inclusion in the energy industry.

Here is what some of our participants have to say about our programs:

"Today's AAPGWN lunchtime talk was presented by Katie Smye, Isabelle Pelletier and Elizabeth Horne, each of whom discussed some excellent research they are in the process of putting together investigating induced faults in the Delaware Basin. This is a subject that I had heard about in passing, but mostly in other basins and not here. I never knew that the problem was so critical, nor the need for this kind of project and the extensive amount of information gathering required to put a study like this together. It was amazing to see just how much information they gathered on the subject. The project is still ongoing, and I am excited to see where they take this basin-wide interpretation in the future. They



are just scratching the surface of where this study can go when it comes to overpressure, maximum stress and even fracture stimulation in the future. Thanks for such an enlightening discussion," said Nick Nelson.

"Great matching done by the AAPGWN of the mentor-mentee constellation in my case; the mentorship agreement and other tools (goal tracking, planner, help resources, etc.) are very useful and keep progress tangible (which is both motivating and rewarding; it aids in keeping track not only of the defined goals but also to re-assess on a regular basis the mentoring relationship, one's engagement, etc.); my mentor is great and I cannot stress enough how much I gain from this program personally and professionally (and I hope he does, too!)," said Laura Bührig.

"The Women's Network mentoring

program gave me the opportunity to hone my mentoring skills and learn from one of AAPG's shining stars, Autumn Haagsma. The program helped me research and consider carefully the advice I offered. I say it's a big win and thank the organizers for so many hours of effort to achieve this success," said Gretchen Gillis.

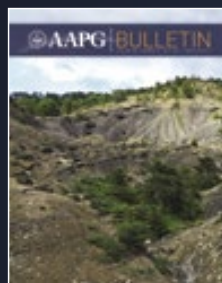
"AAPG Women's Network has been instrumental in providing support for women like myself to achieve new heights in industry. It has helped provide knowledge I need and encouraged me to aide my passion of pushing the industry forward, to deliver data that optimizes reservoir understanding and financial stewardship of E&P companies while helping me support other women and men in their own innovative ideas along the way," said Faye Liu.

AAPGWN's leadership has spent many long Zoom meetings after our day-time jobs organizing and planning how we will continue to elevate and support women and minorities longterm through AAPG's organization. We sincerely thank all of the AAPG members who have supported us on our journey and those who directly volunteer for the AAPGWN-related activities. What we do and plan to do in the future would not be possible without the support of our advocates and volunteers.

If you have any questions about our division proposal or wish to help support us in this effort, email us at aapgwn@gmail.com. Become a member today at AAPG.org/womens-network. Visit our new YouTube channel (search for "AAPG Women's Network") for access to our webinars.

AAPG | BULLETIN

Read Up on the Latest in Geoscience



Recognized as one of the most respected, peer-review technical journals in existence, the AAPG Bulletin provides our geoscience community with the latest research, science, and information as it relates to petroleum, natural gas, other subsurface fluids, and mineral resources.

See the May 2021 AAPG Bulletin content online now. Articles for this issue are listed below. To view an article abstract, scan the QR code with your mobile device. A login is required to view the entire article. Locate the login options under "Welcome Guest" in the top right corner of the abstract viewing screen.



GEOHORIZON

Use of global analogues to improve decision quality in exploration, development, and production

Shaoqing Sun, David A. Pollitt, Shengyu Wu, and David A. Leary



Prediction of the gas-generating characteristics of the Qiongzhusi and Longmaxi Formations, Yangtze Platform, southern China, using analogues

Brian Horsfield, Caineng Zou, Jian Li, Shengyu Yang, Nicolaj Mählstedt, David Misch, Doris Gross, Ma Wei, Yifeng Wang, and Jingqiang Tan



ARTICLES

Predicting unconventional reservoir potential from wire-line logs: A correlation between compositional and geomechanical properties of the Duvernay shale play of western Alberta, Canada

Marco Venieri, Per K. Pedersen, and David W. Eaton



Magnetic susceptibility variations in lower Paleozoic shales of the western Baltic Basin (northern Poland): A tool for regional stratigraphic correlations and the decoding of paleoenvironmental changes

D. K. Niezabitowska, J. Roszkowska-Remin, R. Szaniawski, and A. Derkowski



Resource potential of the Jurassic gas system, northern margin of the Qaidam Basin, northwestern China

Zeqing Guo, Zengye Xie, Jian Li, Jixian Tian, Xu Zeng, and Wei Ma



A method to predict the resistivity index for tight sandstone reservoirs from nuclear magnetic resonance data

Liang Xiao, Yujiang Shi, Gaoren Li, Haopeng Guo, and Junran Li



Thermal history reconstruction from apatite fission-track analysis and vitrinite reflectance data of the Bongor Basin, the Republic of Chad

Lirong Dou, Renchong Wang, Jingchun Wang, Dingsheng Cheng, Paul F. Green, and Xiaodong Wei



From seep carbonates down to petroleum systems: An outcrop study from the southeastern France Basin

Jean-Philippe Blouet, Patrice Imbert, Anneleen Foubert, Sutieng Ho, and Gerard Dupont

aapg.to/bulletinMay2021

Foundation Update

Sabrina Ewald is the AAPG Foundation Teacher of the Year

You could call it destiny – Sabrina Ewald's family history, after all, is dominated by those who either worked in the oil industry or were teachers.

"My father worked at an oil refinery, my uncle had a career in oil exploration and extraction, and even my grandmother worked on an offshore oil platform," she said. "My mother was a teacher, and I had many family members who were teachers at all levels of academia."

Add in frequent family trips spent hiking in the Ozarks and Rocky Mountain National Park – plus her own love of collecting rocks and minerals.

"These experiences shaped my plan for the future, and I always had two ideas of what I wanted to do with my life – geologist or teacher," she said.

Guess what won out?

Trick question. The immediate answer is "both": Ewald has been a high school science teacher for her entire career – and for the past 16 years for the Frisco (Texas) Independent School District, bringing science and, specifically, geology and energy education to high school students in Clinton and Denton counties, covering Frisco, McKinney, Plano and Little Elm, Texas.

But the winner in the bigger picture is not just her, and not even just her students. "What" is winning is best described as perhaps the entire contemporary initiative to bring via the ripple effect a deeper and more complete understanding of energy to the entire world.

Ewald's teaching method and purpose is designed specifically to help students "have a better understanding of why fossil fuels are so imperative and so important to the economies all over the world" – and to help them be informed and energy-aware when, as adults, they make decisions.

For her passionate, comprehensive and experience-driven efforts – and for being exceptionally creative in a difficult year of pandemic-forced virtual learning – Sabrina Ewald is this year's AAPG Foundation Teacher of the Year.

"I am beyond humbled and honored to be selected for doing what I love most, teaching



Earth science and helping students make real-world connections by engaging in hands-on learning," Ewald said when notified of the award. "I am fortunate to teach about what I am most passionate"

"It is a blessing to be recognized for my work in the classroom in helping students to see the value and importance of geology," she added.

Preparing for Tomorrow's Challenges

Having the perfect family background to help her prepare for a career that includes teaching and geology is a tip of the hat to her parents. The excellence that she brings to the job, however, is all hers.

Several factors are considered for awarding any teaching honor, but TOTY recipients are typically recognized for at least two important factors: what they teach, and how they teach it.

Ewald's Energy Unit Portfolio, then, is an online piece of geoscience education art – a creative yet practical and engaging learning experience that lets students learn at their own pace, including opportunities to make conclusions and personal observations about the material they just studied.

Her goal: For all students to ultimately create the best energy plan for the city of Frisco, Texas (home for many of the students), based on what they learn in the units about the energy industry – considering personal needs, society's needs, economic realities and environmental concerns as factors in their decisions.

To help them prepare their recommendations Ewald provides curriculum that is both entertaining as well as educational, dealing with:

- ▶ Mining (How much land is needed to sustain your lifestyle? Other than food, can you name one thing in the room that isn't connected to mining?)
- ▶ Energy Resources and Production (How much energy is needed for you to take a shower?)
- ▶ Fossil Fuels and Production (What country is producing what? What country is consuming what?)
- ▶ Oil Production Methods (Comparisons galore – like, how much energy is needed to operate an electric car versus an internal combustible engine car? And ... frac'ing?)
- ▶ Nuclear Energy (What are the pros and cons?)

- ▶ Renewable Energy (What? There might be environmental impacts here, too?)

It proved to be not just educational, but an eye-opener for all.

Before taking the course, "they didn't have a whole lot of solid information or knowledge about any of this," Ewald said, despite being residents of a region associated with oil production.

"I would say 90 percent of them (students) admitted that their opinion changed dramatically about fossil fuels," Ewald said, especially in considering "the balance of moving forward (toward renewables) ... it's going to be a slow transition, and one that they still support, but they have a better understanding of why fossil fuels are so imperative and so important to the economies all over the world."

The Teacher Gets Taught

Ewald's approach to geoscience education for her entire career has been "hands-on engagement," trusting that students both comprehend and also retain information faster and longer when they are exposed to that learning experience.

Then came the 2020 pandemic.

"When virtual learning became our reality," she recalled, "the challenge pushed me into new and scary territory. I re-evaluated my teaching practices to find innovative ways to design activities that would still allow students to be in charge of their learning and be engaging."

It wasn't easy.

"It has taken every ounce of my experience in the classroom to adapt to our new reality in education," she said of the challenge, but added "I am passionate about the subjects I teach, and that is what drives me to continuously improve and push myself out of my comfort zone so I can evolve my classroom practices."

First, she spent hours learning how to implement new online tools and programs.

See [Foundation page 25](#) ▶

Foundation Contributions for March

General Fund

Olajide Awokunle Aworanti
John Lyng Cosgrove
William J. Fritz
Richard Herbert
David A. Johnson
Jun Li
Rebecca Matecha
Kassie Mobley
Thomas Martin Parris
Idrus Puassa
Roland G. Robertson
Haley Rohead-O'Brien
Dorothy A. Satterfield
Mark A. Sutcliffe
David J. Thul
Michael A. Tryggstad
Chase S. Watkins
John A. Weissenberger
Oliver Welte

E. F. Reid Scouting Fund

Bryan Haws

Imperial Barrel Award

Mark A. Sutcliffe

K-12 Education Fund

Susan Smith Nash

L. Austin Weeks Undergraduate Grant

Andrew L. Brill

Military Veterans Scholarship Fund

Ernest and Dorothy LaFlure
In honor of Jack Threet

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

Sabrina Ewald, a high school science teacher for the Frisco (Texas) Independent School District, is the 24th recipient of the AAPG Foundation's Teacher of the Year Award, presented annually to promote, celebrate and honor geoscience education.

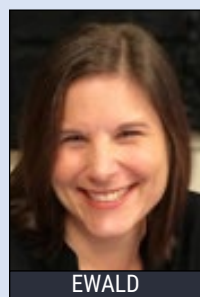
The prestigious award includes a cash prize of \$6,000 – half of which is for the teacher's personal use, the other half for the respective school under the winning teacher's supervision.

Receiving word of the honor, she admits, sent her "over-the-moon" – the dream of having a career filled with teaching and geology have been her passions since childhood – and she called acknowledgment of her efforts "such a bright moment during this very difficult year."

"Geology and geosciences are a critical part of the modern world," she added, "and it is important that students have an opportunity to explore these fields of science."

Supporting geoscience education in a variety of ways is at the core of the AAPG Foundation's mission – and it may have been even more crucial this past year.

"Teachers, like all of us, had to make huge adjustments just to do their jobs during the pandemic," noted Jim Gibbs,



EWALD

chair of the AAPG Foundation Trustees and himself a passionate supporter of geoscience education. "Sabrina not only adjusted her approach, but she also excelled in finding creative, inspiring ways to make geoscience

education come alive for her students.

"Especially impressive was her understanding of the realities, both economic and environmentally, impacting today's energy industry," he added. "Her students, thanks to her effective and informed approach, are much better prepared for not just facing but also for making informed decisions regarding tomorrow's energy demands."

"Of course, we're able to honor and celebrate teachers like Sabrina thanks to the generous contributions we receive from our donors to fund creative educational programs and curriculum," Gibbs said. "That's one of the most important goals that we have for the Foundation."

Details for hearing directly from Ewald – virtual or in person – are pending and will be announced as they become available.

Also honored were the other finalists for this year's TOTY, each of whom received \$500 from the Foundation. They are:

- ▶ Kristina Hight, Granite Park Junior High School, Salt Lake City.
- ▶ Sergio de Alba, R.M. Elementary School, Los Banos, Calif.
- ▶ Kent Hups, Northglenn STEM High School, Northglenn, Colo.

Do you know a geoscience teacher who is making a positive difference?

If so, add a reminder to your calendar that nominations/applications for the 2022 TOTY award will begin in the fall later this year. And you can be part of the program:

- ▶ Submit an application: administrators, colleagues, students, parents, faculty members ... and you can nominate a teacher!
- ▶ Support the AAPG Foundation. Contributions to the Foundation are your way of continuing the legacy of excellence in geoscience education.

More information is available on the Foundation website or email AAPG Foundation at TOTY@aapg.org.

Celebrating the Loyalty of Membership

We all know 2020 was an unprecedented year, on all levels. For AAPG, we were challenged as never before to fulfill our purpose – we learned, adapted, modified our ways of doing business and then worked diligently to implement new innovations and technologies to meet the needs of our membership.

But even as we seek to creatively and

effectively advance the geosciences, we remain focused on why we do what we do: You have supported us with your membership, and we're here to support you in your professional development and growth.

That's proven to be a valuable relationship.

And each month we enjoy the chance to not only thank all of you for your ongoing

support but also to publicly recognize those who are celebrating milestone anniversaries with AAPG.

Below are the names of the great members who are celebrating their 45-year anniversary with AAPG. For AAPG (and we hope for you!), 1976, was a very good year.

As always, certificates of membership are accessible on the website via the Member Portal and we encourage each

member to log in to their Member Profile and print a certificate, which we hope will be framed and displayed with pride.

More milestone anniversary celebrations will be held throughout the year in the EXPLORER. Our members remain our greatest strength, and we proudly thank you for your contributions to the science, the industry and the Association.

Congratulations to you all. 🎉

John M. Agasie
Woods Wilkinson Allen Jr.
Robert Campbell Anderson
Karl F. Arleth
Ralph Wayne Baird
Alfred Harry Baker Jr.
Kandiah Balachandran
Thomas Edward Ball
Bobby H. Bammel
Charles William Barrows
Kurt Bayer
Gene Kenneth Behrens
Madelyn Bell
David George Benscoter
Kenneth John Bird
Raymond Neil Blackhall
Michael Wayne Bourque
Jeffrey W. Brame
Mark Broadaddus
James Richard Broome
Umberto D. Brovedani
Timothy Scott Brown
Owen Louis Broyles
Martin S. Buckley
John Clyde Burger
Arthur Wallace Butler III
Scott Ralston Byrum

Michael Richard Canich Jr.
Phillip Mark Caserotti
Ibrahim Cemen
Thomas Campbell Chidsey Jr.
Mark Rolland Cole
W. Kevin Coleman
Douglas J. Collins
Philip Lamar Cook Jr.
Tillman Webb Cooley Jr.
Stephen Peter Cossey
Joe Howard Cox Jr.
Charles Mark Crawford
Paul Daniel Crevello
Ronald Wayne Crockett
John Blair Curtis
Jene C. Darmstetter
Katherine Renee Davis
David Nicholas De Verteuil
Johnny Ross Dean
Alan Lee DeGood
Carlos Arturo Dengo
Taylor W. Dillard
Ralph Joseph Dobbins
John William Dolman
Terry W. Donze
Nancy S. Dorsey
Richard Alan Drabish

James Alan Drahovzal
John Garvin Drake
Paul Dexter Dubois
Joseph Patrick Dugan Jr.
Dean Alan Dunn
David Eugene Eby
David Leroy Eddy
Robert Michael Egbert
Rodney John Eichler
Marcia Ann Engle-Moore
Duane Kendall Estelle
John Jacob Faulhaber
Flavio Feijo
Michael Neal Fein
Thomas Francis Fiorito
Michael Albert Fouke
Raymond Alan Foutch
Stephen G. Franks
Wilbert P. Gaston
Nancy Murphy Gilbert
William TRUE Goff
Carl W. Goldwater
Robert F. Grabb Jr.
Jack Louis Groth
Kathleen Wiltenmuth Haggar
Gregory James Halvatzis
Michiel Jack Hanou

John A. Harrell
Hilmer Anthony Hauglum
Thomas John Heck
Dennis Eugene Hedke
Kenneth Franklin Hersh
Steve H. Hill
George Andrew Hillis
Gaylord Carlyle Hinshaw
Murray Walter Hitzman
Paul F. Hoffman
Melody Ruth Holm
Jack Eugene Holton
Harry T. Holzman Jr.
Matthew Reed Hoovler
Paul S. Horvath
Charles Livingston Howbert
Richard Gary Howe
James Douglas Huggard
Mark Dudley Hughston
Robert Geoffrey Ice
Ayorinde Olusegun Idowu
Robert Louis Immel
Jerry Edman Irwin
Christopher H. Jackman
David Henry Jagnow
Susan Wunderlich James
Wayne Russell Kemp

Steven C. Kirkwood
M. L. Korphage
Carl William Kuhn Jr.
James Richard Kyle
David R. Lammlein
Mark Clinton Lawyer
Michael Ledet
Hannes Edmund Leetaru
Leonardo Legarreta
Loren Michael Leiker
Robin Hugh Lemberger
Robert Barry Lieber
Graham Burford Livesey
John Reed Ljung
Kenneth Norman Loeber
Billie Fred Long
Shane Lough
Everett William Lueck
Heloise Bloxsom Lynn
Joseph C. Lysonski Jr.
Frederick Victor Majocha
John Malloy
William Charles Manthey
Archie Hugh Martin III
Peter John Massion

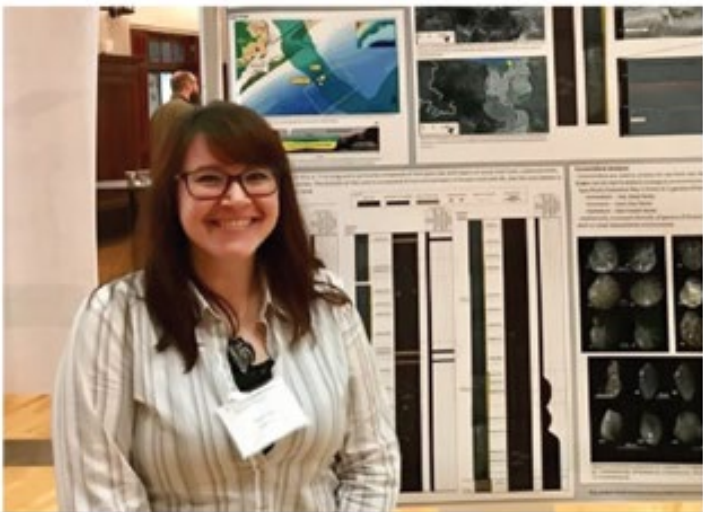
See **Membership** page 25 ▶

Deana and Paul Strunk MILITARY VETERANS Scholarship Program



APPLICATION DEADLINE - 15 MAY

The Foundation awards scholarships ranging from \$2,500 to \$5,000 to cover the cost of attending a four-year accredited college or university. Scholarships are available to both active U.S. military service members (including National Guard and Reserve) or veteran members separated from active military service who have been honorably discharged, and are entering or re-entering a post-secondary undergraduate program in a field of geoscience full time or part time. Eligibility also includes military dependents (spouses and children) for the following categories: deceased, disabled, active and veteran.



For more information or to apply, visit www.aapg.to/fdnmvsp

Regions & Sections

AAPG Regions Meet Global Challenges through Local Innovation

Following the 2015 price downturn, AAPG faced serious challenges. Declining membership and revenues forced the Association to draw down its cash reserves and to lay off staff – both painful and drastic steps. By last year, the Association had largely adjusted to the low-price environment only to be hit by the twin black swan events of another price collapse and the coronavirus pandemic.

AAPG President Rick Fritz has laid out in his column much of what the Association has been doing to survive in these trying times. The AAPG regions are also taking their own individual approaches to meeting these challenges. In addition to the trying times we're all facing, each Region faces additional, localized challenges that need to be overcome to keep the Region, and the Association, viable.

Changing Landscape

U.S. companies are heavily focused on unconventional exploitation and on the transition to sustainable and green energy. Attendant with this focus is a diminishing role for geoscientists. This in turn presents an ongoing challenge for AAPG and our U.S. members.

International regions are also increasing their efforts in at unconventional exploitation and energy transition. However, they still have a strong focus on conventional exploration. Most countries are targeting 2 to 4-percent GDP growth. Governments are aware that for them to achieve economic growth, they must be able to access affordable energy, and to do that, they will need to continue to access fossil fuels. Fossil fuels will play an important role in energy for many decades. As such, AAPG is increasingly relevant in the international regions, and the regions are more relevant than ever to AAPG.

Credentials

Each Region is unique, facing unique challenges, and offering unique opportunities, both for the Association and its members. Each Region encompasses multiple countries, cultures and languages. Furthermore, each Region has a diverse portfolio of opportunities.

One of the challenges for the Association is to help our members, particularly our international members, showcase their credentials to the industry and to the world as a whole. There are many very good universities around the world, many providing a better education in the geosciences than some of their western counterparts. Yet, these universities are largely unknown outside of their Region, and in the larger regions, even within their Region.

The Division of Professional Affairs, along with the Executive Committee, are looking at several initiatives to help our members assure the industry, as well as the various regulatory agencies, that they meet the skills and ethical standards expected of a professional geoscientist. In addition to certification and board certification, the DPA and the Continuing Education Committee are in the process of developing criteria to recognize subject matter experts.

Engagement

One of the most important efforts of the Association is to engage our members in a way that enhances both the Association and



SHOUP

The AAPG regions are a significant part of AAPG. Today, the regions' membership is almost equal to the U.S. membership. It is safe to say that the regions will play an increasing role in the viability of the Association. More importantly, the innovative steps taken by the regions to thrive in the current crisis offer the Association as a whole hope for our industry.

our members – a challenge exacerbated over the past year by the inability to have in-person meetings as a result of the pandemic. The challenge is even greater for our international members, given the diversity of cultures and languages. But, one constant that seems to persist across the regions is the passion our geoscientists have for geology, and for AAPG.

The regions have all found ways to address the specific needs and demographic

challenges of their members. They have done an excellent job of adapting to the COVID world to improve and broaden the skills of our members across the world, especially students. They worked closely with the Distinguished Lecture and Visiting Geologists programs to virtually expand the reach of those programs. Likewise, all of the regions have successfully adapted to virtual Geotechnical Workshops. These

are small meetings – typically fewer than 100 attendees, addressing topics that meet the needs of the Region as well as helping develop and broaden the technical skills of our members.

Although most of us look forward to the days when we can once again meet in-person, the ability to meet virtually has been a blessing to the regions, allowing each of them to reach out to the entire Region and to offer cost-effective topical programs.

The AAPG regions are a significant part of AAPG. Today, the regions' membership is almost equal to the U.S. membership (9,371 versus 10,128). It is safe to say that the regions will play an increasing role in the viability of the Association. More importantly, the innovative steps taken by the regions to thrive in the current crisis offer the Association as a whole hope for our industry. 



Latin America & Caribbean Region Virtual Research Symposia

As just one example of some of the innovations and adaptations implemented by the AAPG regions, the AAPG Latin America & Caribbean Region launched its Virtual Research Symposia last year to reach the Region's geoscience community during the COVID-19 pandemic. These high-quality, low-cost events were designed to attract geoscientists from industry and academia and were held online via Zoom with registration and marketing provided at the AAPG website. The content of each is available at the individual event websites listed below:

- ▶ Southwest Caribbean Basins, covering Colombia, Venezuela and Panama, was held July 22-23 (aapg.to/swcaribbean2020)
- ▶ Andean Basins, covering Bolivia,

Argentina, Colombia, Chile and Peru was held Aug. 20-21 (aapg.to/andeanbasins2020)

▶ Southeast Caribbean-Guiana Basins, covering Barbados, Trinidad and Tobago, Guyana and Suriname, was held Sept. 17-18 (aapg.to/secaribbean2020)

▶ Pacific Basins, covering Colombia, Ecuador, Peru and Chile, was held Oct. 22-23 (aapg.to/pacificbasins2020)

▶ Mexican Basins was held Nov. 19-20 (aapg.to/mexicanbasins2020)

▶ South Atlantic Basins, covering Argentina, Brazil and Uruguay, was held Dec. 3-4 (aapg.to/southatlantic2020)

The series saw more than 1,200 participants from more than 288 companies, 240 universities and almost 40 countries and were lauded for their

accessibility, quality of content and usefulness in industry.

"The LACR series of Virtual Symposia has impressed me. In a handful of months, you made something manifest out of thin air. That speaks to your dedication, perseverance, connections, plus a willingness to experiment, improvise and improve," said Bill Dickson, vice president of technology for Dickson International Geosciences. "These symposia spurred me to advance DIGs' projects despite the industry slump. My reward has been not just a better understanding of the geology of my project areas, but new connections across a range of early, mid- and mature-career geoscientists on four continents."

Membership

from page 23

James E. Mathewson
Robert L. Mathis
Bruce Irvin May
John Henderson
McCandless
Dan Ralph McClellan
Rayford Lynn McCoy
Kent Charles McDonald
Richard L. McDonald
David Albert McMahon Jr.
Michael R. McWilliams
Sally J. Meader-Roberts
Armando Medina
Bernard Mervoyer
John Curtis Miller
Eric M. Moeller
Patrick A. Monahan
Dudley Paul Montero III
Gary Lance Moore
Steven L. Mueller
Charles Howard Murrish
Ronald Alan Nelson
Leon Henry Neuens
Kerry David Newell
Joseph Alan Newhart
Geoffrey E. Nicholson
Peter H. Northrop
David George Nussmann
Robert Kenneth Olson
Jack Mote Oswalt
Thomas Anthony Pasquini
Freddie John Pellegrin
Glen T. Penfield
Clarence Michael Perkins
Miles L. Peterson
Michael Paul Plamondon

Mark Steven Przywara
Clement K. Ramroop
Fred Eugene Ray
Christopher H. Reed
Chase Savage Reid
Robert Lafount Richards
M. Bradford Rine
Christopher Rivett-Carnac
John Patrick Rolla
Victor Joseph Rosato
Edward Michael Rothman
John H. Rountree
Lance Ruffel
Sandra Weil Rushworth
Deborah K. Sacrey
Barry Lee Sauve
Gregory Thomas Schmidt
Frank J. G. Schulte
Victoria Schurer Fuchs
Bernard Neil Schwartz
Phyllis K. Scott
William J. Sercombe
Charles Lee Sharpe II
David Carl Shatzer
Ronald Willis Sherwood
Terrel Lee Shields
Steven W. Sinclair
John Joseph Sisler
David Daniel Skeels
David Kent Skidmore
Keith Skipper
Michael Alexis Smith
Wayne Fredrick Smith
Larry Frank Smyers
Parke D. Shavely
Ronald Wayne Snyder
Donald Henry Sobba
Andrew Charles Spencer
Patrick John Spicer
Douglas A. Sprinkel
Richard Graham Stanley

Robert Donald Stewart
Roger B. Stickney
Robert M. Stuart
Joseph Robert J. Studlick
J. Bryan Tapp
Frederick W. Taylor
Scott James Taylor
George L. Ten Eyck
Mark Alan Thomas
Carl Brent Umstead
Douglas Nelson Valleau
Mary Louise Van Der Loop
William Arthur Van Wie
John A. Vance
Paul Joseph Wagenhofer
Frederic Douglas Walsh
Johnnie P. Wanger
Alex Thomas Warmath
Robert Edward Warmbrodt
Bevan Jon Warris
John P. Watkins
Robert Edward Webster
Brent R. Weis
Leon A. Wells
Keith R. Whaley
Kenneth Ray Whaley
Neil H. Whitehead III
Joseph Walter Wildeman
John Thomas Williams
Margaret (Peggy) Williams
Patrick Odus Williams
Steven Michael Wilmoth
Larry Keith Wipperman
Michael R. Wisda
Rolf Woods
James Gregory Work
Richard Hallam Young
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23-24 November 2021 • An Online Event

Optional Field Trip/Universiti Teknologi PETRONAS CO₂ laboratory visit on 25 November 2021

Submit your abstracts now for this exciting two-day AAPG/EAGE Geosciences Technology Workshop (GTW) focused on best practices, risk-based planning, and the role geoscientists and engineers will play in these changing times.

KEYNOTE SPEAKERS



DR. CHRIS CLAYTON
Beicip Franlab, Asia



NORAINI YATI MOHAMED
Malaysian Petroleum
Management, PETRONAS



PROF. JOHN G. KALDI
School of Petroleum
and Energy Resources,
Adelaide, Australia



DR. LINDA STALKER
CSIRO, Perth,
Australia



DYLAN MAIR
IHS Markit, Singapore

- **Variable Control of CO₂ Concentration in the Malay Basin** | Dr. Chris Clayton, Beicip Franlab Asia, UK
- **Future of CCUS in Malaysia** (Tentative) | Noraini Yati Mohamed, Malaysian Petroleum Management, PETRONAS, Malaysia
- **Carbon Capture, Utilization and Storage: What are the big issues and opportunities facing the Petroleum Industry in Malaysia?**
Professor John Kaldi, Australian School of Petroleum and Energy Resources, Australia
- **Contaminated Fields: A Question of Cost or Opportunity?** | Dr. Linda Stalker, CSIRO, Australia
- **Paper title forthcoming** | Dylan Mair, IHS Markit, Singapore

Supported by:



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Foundation

from page 22

Second, she spent hours more converting her lessons to the new virtual platforms.

"With these new skills and programs, I was able to convert many of my activities in our natural resources and energy production unit to virtual activities," she said.

Next, she found resources that were current, creative and content-driven.

Participating in a variety of teacher field experiences helped, including mining workshops and the Geology Camp for Teachers with Texas A&M. ("I developed a deeper understanding of geology, more so than from some of my courses in college," she said.)

Also, last July she participated in a five-day workshop with the University of Texas' Petroleum Technology and Science Institute –

an in-depth look at petroleum engineering, the global energy market and current technologies used in oil production and energy extraction.

It proved to be relevant information for today's high school students whose insight into energy is largely gleaned from political sources.

"The advanced technologies work to minimize environmental damage and the instructors addressed the integrating of renewables with existing fossil fuel use," she said. "Once again, I was able to enhance my knowledge and comprehension of fossil fuels, and I have been using these resources to create new virtual, learner-centered assignments.

"All of these efforts reflect back on my philosophical approach to teaching," she said: "Being the best teacher I can for my students and giving them a caring and engaging educational experience by delivering student-centered inquiry and investigations." 

Classified Ads

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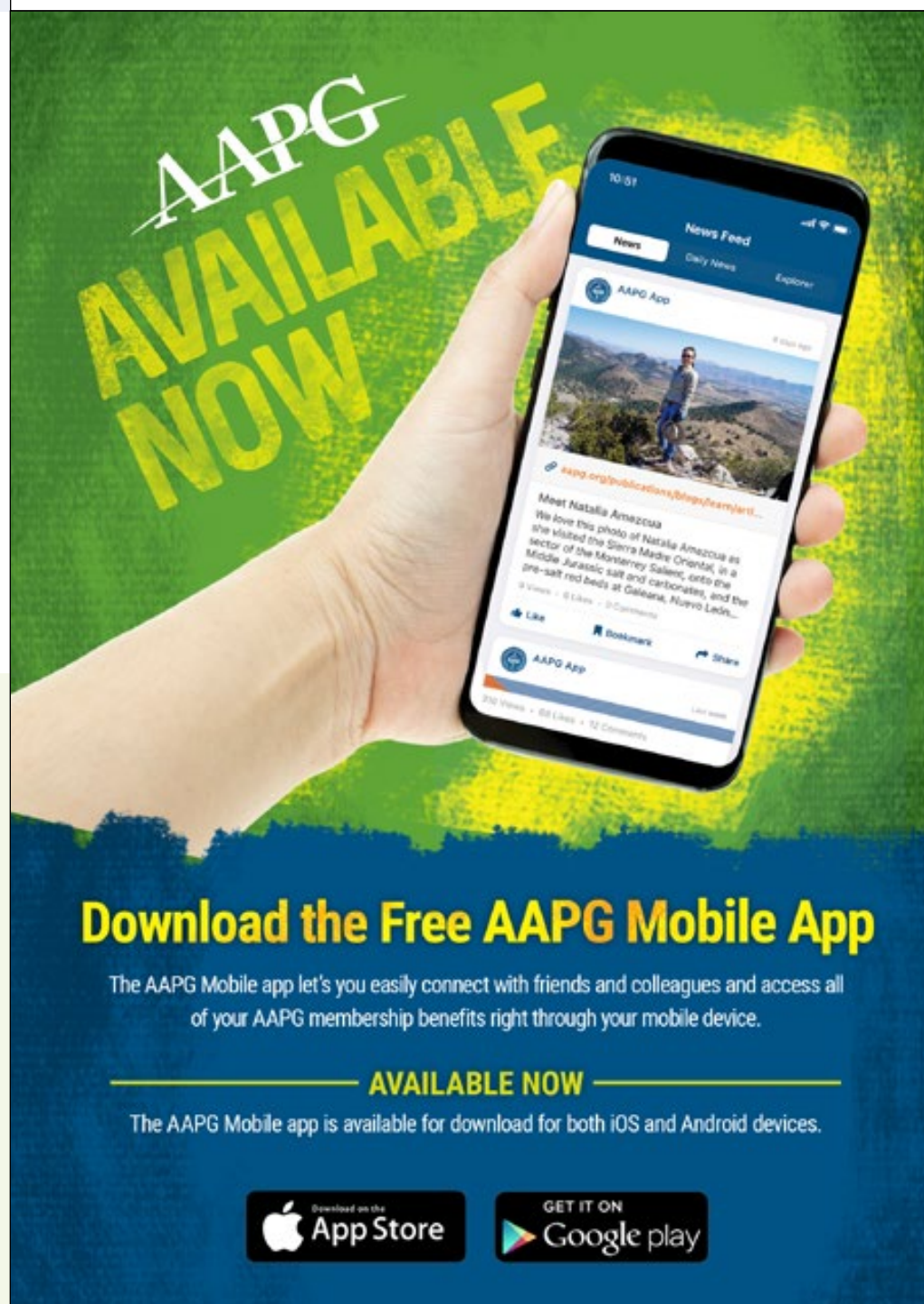
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CLASSIFIED ADS

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



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Director's Corner

The Other Side of Languishing

How are you doing? I was telling a friend recently that I feel like Sylvester Stallone's Rocky Balboa in the boxing ring. We've reached the final round, and I'm battered and bruised, my sharp jabs and uppercuts replaced by exhausted flailing. The big question – the only question – is whether this is the first fight of the film where I end up face down on the canvas, or whether it's the second with the referee lifting my gloved hand into the air as Bill Conti's film score soars.

How about you? As the months of this pandemic drag on, how are you doing?

It turns out there's a name for what many of us are feeling these days: "languishing." And as psychologist, author and Wharton professor Adam Grant wrote last month in a New York Times piece, as we learned that masks and social distancing slowed the spread of the coronavirus, and as vaccines roll out in some countries, the acute concern that many of us experienced at the onset of the global pandemic has given way to a chronic case of the "blahs."

It's not depression, but neither is it flourishing – the ends of the spectrum that define mental health. It's the in-between and, as Grant puts it, it's "the absence of well-being." We're languishing.

Part of the problem is that we want a return to normalcy. But we're not sure what "normal" will look like when it gets back. And let's be honest, some of what we learned about ourselves and our ability to be productive during this pandemic was not just positive, but downright impressive. I, for one, don't want to lose those positive effects, but the whole package needs to be sustainable.

The New Normal

A recent report by Microsoft on trends affecting the workplace of the future

You don't end languishing in one fell swoop. You do so by chipping away at it, one goal or project at a time, each achievement of flow helping rekindle the fire that moves you toward flourishing.

suggests that the hybrid workplace is here to stay. In fact, they predict that the way organizations manage this transition will determine their ability to retain and attract talent.

The report, entitled, "The Next Great Disruption Is Hybrid Work – Are We Ready?" identified seven dominant trends:

- ▶ Flexible work is here to stay – employees want it all: the ability to work remotely, but also time with their co-workers and teammates. Flexibility is going to be key.
- ▶ Leaders are out of touch with employees and need a wake-up call – surveys show that seasoned veterans and business leaders are faring better than their employees during this downturn, with single employees, new employees, frontline and younger workers, and working mothers particularly impacted.
- ▶ High-productivity is masking an exhausted workforce – using data collected from users of Microsoft Office, our employees are spending more time in (online) meetings, chatting, sending and receiving more email, and collaborating on documents. Technology has enabled us to collectively keep our industry running. But I'm concerned about sustainability as the growth in volume and pace is relentless.
- ▶ Gen Z is at risk and will need to be re-energized – our youngest workers, those ranging in age from 18 to 25, need help.

They're most likely to be single, isolated and separated from the natural networking opportunities – the ability to observe and be seen – in an office setting. We need to find better ways to integrate and empower them in a hybrid world.

▶ Shrinking networks are endangering innovation – as our teams came together to focus on the immediate challenges confronting our businesses, it was at the expense of cultivating and investing in our broader networks – the very places where new ideas, insights and opportunities might crystallize.

▶ Authenticity will spur productivity and well-being – nothing has humanized our colleagues and our shared work experience more than a meeting interrupted by a diaper-clad toddler or barking dog. That doesn't usually happen in my conference room at work; it does on Zoom.

▶ Talent is everywhere in a hybrid work world – this is good news for employees who have opportunities they'd otherwise lack unless they were willing to move; it's also good news for employers who can identify and attract talent from anywhere. What it might mean for both groups is a time of upheaval and change. The study cites a survey indicating that 40 percent of the global workforce is considering changing employers.

One takeaway from the report is that

there is much to look forward to, but that "we're all learning as we go." This suggests that it might take a while for a new definition of "normal" to come into focus. So what to do in the meantime, especially if you're languishing?

You Need the Flow, the Flow to Grow

Grant suggests that "a concept called 'flow' may be an antidote to languishing." First popularized by psychologist Mihaly Csikszentmihaly, flow is the state that emerges when someone is fully engaged in a task that requires their focus and concentration. If you've ever been gotten involved in a project that was so engrossing that you looked up and hours have passed, you've experienced flow. It's typically accompanied by a state of deep enjoyment and contentment.

But you need to create time for these activities, and it has to be uninterrupted time, because a key element of entering the flow state is an ability to focus. If you can't focus, because you're distracted by email, chat, social media, etc., you're going to have a hard time getting into flow.

Grant also recommends picking some small projects to start. You don't end languishing in one fell swoop. You do so by chipping away at it, one goal or project at a time, each achievement of flow helping rekindle the fire that moves you toward flourishing.

"Languishing is not in our heads – it's in our circumstances," Grant concludes. You can change circumstances, rediscovering energy and enthusiasm in the process.

Can you hear the music? Cue Bill Conti.

David H. Grant

By URSULA HAMMES, EMD President

Divisions Report: EMD

Motivation and Resiliency

What motivates you? How do you keep going? I have been thinking about how we have been keeping motivated over the past year while most of us have been coping with working from home, juggling office space and taking care of children, along with job losses, health crises, and few (if any) interactions or in-person networking opportunities.

I know that many of you have been experiencing all or some of those situations and, unfortunately, it is not over yet!

Online Offerings

Our members have shown a lot of resiliency to stay motivated by attending pivot webinars organized and championed by Susan Nash, AAPG's director of innovation, emerging science and technology. By focusing on new technologies and providing information on transitioning into other industries, these efforts provide support to members looking for new career options.

The Energy Minerals Division has been instrumental in putting on webinars ranging from "Fundamentals of shale-gas/oil reservoirs," conducted by myself, and a free workshop on "Freeware



HAMMES

We asked, you answered, we listened. Thank you so much for answering our member survey about how to serve our membership better. We are happy that your priorities are lining up with our goals to serve our membership.

for freelancers," organized by EMD's President-Elect Justin Birdwell and Vice President Mike Bingle-Davis. The latter will have a second edition next month because of great demand. Please also check out our EMD YouTube channel where this webinar was posted.

See Each Other at ACE 2021

Resiliency and motivation are needed to keep engaged in our profession, and after a year of attending webinars, virtual volunteering and networking over Zoom, I think we are all ready for in-person meetings again! Although ACE 2021 will not happen in May, it will be even better when in September we meet for an in-person/virtual meeting in

conjunction with the Society of Exploration Geophysicists. The Theme 9 program, organized by our chair and EMD Secretary Claudia Hackbarth, will be very exciting with several EMD sessions and two special panel sessions: "What's new in energy minerals" with our esteemed EMD commodity committee chairs giving us an overview of the newest developments regarding their respective resources; and a special session on "Questions of transitions – forum of leading thinkers."

We hope you are planning to attend in person this fall!

Member Survey

We asked, you answered, we listened. Thank you so much for answering our

member survey about how to serve our membership better. We are happy that your priorities are lining up with our goals to serve our membership.

Here are a few highlights: overwhelmingly you would like us to communicate new technology and geoscience concepts through virtual communication. The most interesting committees to you were Critical Minerals, Energy Economics and Technology and Tight Oil and Gas, followed by Geothermal, in which we will keep expanding and conducting workshops and webinars to disseminate information and new concepts.

We have also been exploring our budget shortfalls that we might remedy with a small fee. It seems most of you wouldn't mind contributing less than \$30 per year to keep EMD going!

As always, please contact me or any of the EMD committee chairs at AAPG.org/Divisions/EMD if you'd like to get involved in this exciting organization. It has been a pleasure to serve as president of this interesting and forward-thinking organization and I am looking forward to stay involved as past president next year! 📧

Access Global Expertise at These Training Events

IN-PERSON

AAPG Geosciences Technology Workshop – Mixed/Hybrid Systems (Turbidite, MTDs and Contourites) on Continental Margins *Lisbon, Portugal | 25–26 May 2021*

This two-day conference aims to bring together diverse experts working on modern and ancient turbidite, MTDs, contourite and hybrid/mixed systems in order to improve the present-day knowledge, models and predictive power.

Unconventional Resources Technology Conference (URTeC) 2021 *Houston, Texas | 26–28 Jul. 2021*

Jointly organized by SPE, AAPG, and SEG, URTeC connects the key technical and business professionals deciding where, how and when plays will be developed and wells drilled every day. It's the only event leveraging expertise from all technical backgrounds and focusing on the asset team approach to successful field development.

AAPG Geosciences Technology Workshop – Structural Styles and Hydrocarbon Prospectivity in Thrust Belt Settings Around Europe and North Africa *Barcelona, Spain | 7–8 Sept. 2021*

The Workshop aims at bringing together experts from academia and industry on different disciplines to share experiences, new approaches, new data and new ways of integrating information that can help in reducing the uncertainties related to the exploration activities in Europe and North Africa Thrust Belt Systems.

AAPG/SEG Joint Annual Meeting 2021 *Denver, Colorado | 26 Sept.–1 Oct. 2021*

The American Association of Petroleum Geologists (AAPG) and the Society of Exploration Geophysicists (SEG) are excited to announce plans for joint annual meetings at the Colorado Convention Center in Denver, Colorado. This event will mark the first time the two groups' annual conventions have been held together since 1955. The merger of ACE 2021 and SEG's 2021 International Exhibition and 91st Annual Meeting (SEG21) will result in one of the largest gatherings of earth scientists and energy professionals in the world. The two events will be fully integrated,

online and in-person, with a comprehensive technical program and a joint exhibition featuring the latest geoscience products and technologies. Watch for full program, exhibition and registration details coming soon.

GEO: 14th Middle East Geosciences Conference & Exhibition *Manama, Bahrain | 4–7 Oct. 2021*

For 26 years, the GEO exhibition and conference has been at the forefront of petroleum geoscience. GEO has fast become a next generation energy event, hosting major NOCs, IOCs, manufacturers, technology providers and service companies – all of whom play an active role in the global energy value chain.

AAPG Geosciences Technology Workshop – Evaporite Processes and Systems: Integrating Perspectives *Salzburg, Austria | 19–20 Oct. 2021*

The aim of this workshop is to improve our understanding and predictive ability by addressing evaporite systems in an integrated manner, all the way from precipitation to structuration, and exploring the multiple properties of evaporite sequences.

AAPG Geosciences Technology Workshop – 3rd Edition - AAPG/EAGE Hydrocarbon Seals of the Middle East *Muscat, Oman | 29 Nov.–1 Dec. 2021*

This three-day workshop has the primary goal to share knowledge, case studies, techniques and workflows pertaining to the understanding and prediction of hydrocarbon seals for exploration and production in the Middle East. The workshop has a rich program of oral presentations and posters covering a variety of seal aspects. It will present integration cases of seismic, special core analysis, petrophysical, geochemical, pressure, and production data.

ONLINE TRAINING

AAPG Short Course – Naturally Fractured Characterization for Basement and Carbonate Reservoir Exploration & Development *Web-Based Participation | 18–19 May 2021*

This short course aims to address the major needs in fracture evaluation of basement reservoirs in the different phases of a field's life. All types of data that add value to fracture assessment, as well as data acquisition strategies, will be presented. Natural fracture interpretation techniques, along with examples, will be fully discussed. Case studies from Southeast Asia and other parts of the world will be examined. Exercises will be also given, allowing participants to gain practical interpretation skills. At the end of the course, attendees should expect to have a clear picture of data requirements and the techniques for properly characterizing natural fractures and faults, so that they will be better equipped with the knowledge and tools needed for successful drilling of more productive basement wells, thereby enhancing the hydrocarbon recovery factor in a basement field's development.

AAPG Technical Symposium – Optimizing Exploration and Development Opportunities in Brazil's New Regulatory Scenario *Web-Based Participation | 22–23 Jun. 2021*

AAPG's Latin America & Caribbean Region and the Brazilian Association of Petroleum Geologists (ABGP) invite you to explore Brazil's new scenario at the Brazil 2021 Virtual Technical Symposium, a specialized event bringing leading scientists and industry practitioners together to share best practices, exchange ideas and explore opportunities for future collaboration. Join us on a journey from north to south, from the deep water and shallow water opportunities in the post-salt and pre-salt, to mature field opportunities onshore, to technological advances transforming all aspects of E&P.

AAPG Short Course – How to Approach Carbonate Reservoirs *Web-Based Participation | 29–30 Jun. 2021*

This short-course covers a systematic step-by-step methodology for approaching carbonate reservoirs. It commences with the identification of carbonate platform type in seismic data, discuss reservoir distribution through a virtual tour of modern reefs in Bali and proximal ramp deposits in Kuwait and Abu Dhabi. After covering carbonate platforms, the course will discuss carbonate factories, cyclicity, and the relationship between mechanical stratigraphy, diagenesis and bioturbation.

The Stratigraphy of Sundaland: Current Perspectives and Future of the Science *Web-Based Participation | 5–6 Oct. 2021*

The workshop aims to share, discuss and explore many of the new ideas regarding the stratigraphy of the hydrocarbon-bearing basins throughout Sundaland. The workshop also will provide a virtual platform for discussion and knowledge sharing, bringing workers and scholars on stratigraphy from different backgrounds together.

Energy Opportunities Conference 2021 *Web-Based Participation | 10–11 Nov. 2021*

AAPG invites you to participate in the Latin America and Caribbean Region Energy Opportunities Conference being held online 10–11 November 2021. The 2021 Conference builds on the success of Energy Opportunities 2018, when industry and government leaders representing 86 companies and 21 countries met in Cartagena, Colombia to learn, network, and explore business opportunities in the region's energy sector. This executive-level conference combines high-level plenaries featuring world-renowned industry leaders and innovators with topical workshops covering finance, technology, and the environment.

AAPG Geosciences Technology Workshop – High CO₂, High Contaminant Challenging Fields and Alternative Energy - Impact and Monetization *Web-Based Participation | 23–24 Nov. 2021*

High CO₂ fields and marginal fields (due to high levels of contaminants) are some of the challenges that are prevalent in the Asia Pacific petroleum industry. Join AAPG Asia Pacific for a two day workshop focused on best practices, risk-based planning and the role geoscientists and engineers will play in these changing times.

AAPG.org/events

The integrated event for unconventional resource teams

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The Premier Science and Technology Event Focused on the Optimization of Unconventional Resource Plays

The Unconventional Resources Technology Conference (URTeC) continues to be the best opportunity you'll have to exchange information, formulate strategic ideas and solve problems to manage and optimize your unconventional resource plays. Leveraging from all technical backgrounds and disciplines, URTeC is critical to you and your business by delivering the science, technology, and commercial opportunities on what's working with our current business environment. Plan now to attend URTeC 2021, **26–28 July in Houston, Texas** to connect on and discuss all things unconventional.

Sponsoring Organizations:



Endorsing Organizations:



Learn more at:

URTeC.org

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