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Carbon Capture: Is It Ready for Prime Time? See inside.



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'V' is for Volunteer



his month I would like to publicly thank and commend two groups. First, there is quite a long list of volunteers who have envisioned, codified and are now giving their final touches to a new set of proposed bylaws for AAPG that are more simple and streamlined, compared to our current tangled spaghetti of operational and procedural minutiae. As you read this, our House of Delegates should be wrapping up its informal comment period, leading to a final version

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Volume 45 Number 3 MAR 2024 Volunteers involved in the programs and committees are not easily able to mutually support each other. In fact, they might not even know that synergies with other volunteer activities exist.

step - see the accompanying sidebar

for the list of just the most recent set of

names. Please do thank them for their

REGULAR DEPARTMENTS

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by plugging the terms

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"carbon capture storage"

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into the AI systems DALL-E2

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and official House review commencing around the end of March. A huge amount of time, energy and talent went into every

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By CLAUDIA HACKBARTH

A visualization generated by artificial intelligence (DALL-E 3 AI) for the prompt "Businessmen and businesswomen in a big pile of messy spaghetti photorealistic"

Over the last 15 months, three separate teams of volunteers have given countless hours to create new proposed bylaws to help AAPG become fit for the future. Many thanks to each of the following:

Q12023 Presidents Ad Hoc Committee: Lee Krystinik and Andrea Reynolds, chairs; Robert Archer, Sarah Barnes, Lizbeth Calizaya, Maria Angela Capello, Femi Esam, Brigitte Petras, Justin Vandenbrink, Steve Veal.

Q4 2023 Presidents Ad Hoc Committee: John Hogg and John Kaldi, chairs; Jeff Lund, Valary Schulz, Kristie Ferguson, David Entzminger, Bill Houston, Bob Shoup, Jim McGhay, Ken Mohn.

Q1 2024 Constitution and Bylaws Committee: Dan Billman and Maren Blair, chair and vice chair; Richard Adams, Bill Bosworth, Cheryl Desforges, Bill DeMis, Patrick Gooding, David Entzminger, John Hogg, John Kaldi, Kristie Ferguson, Jim McGhay, Bob Shoup, and Valary Schultz.

dedicated service when you see them. Second, I recently attended the annual International Petroleum Technology Conference, which is a joint program of AAPG, the European Association of Geoscientists and Engineers, the Society of Exploration Geophysicists and the Society of Petroleum Engineers. There were more than 32,000 attendees(!) at the enormous exhibit floor, general assembly room and bank of 15 smaller technical meeting rooms, all overseen by hundreds upon hundreds of volunteers who ensured the meeting flowed smoothly. Volunteers also ran day trips before the meeting to provide visitors a fine overview of the area geology and general sights. Many thanks to all who gave their time and talents to this massive undertaking!

Reflection on Volunteering

For my main topic this month I would like to reflect on the history, meaning and rewards of volunteering. According to a Google search, organized volunteerism on a larger scale started in Britain around the 12th century with the establishment of hospitals for the poor and sick. Closely associated with religion, more than 500 hospitals were operated by volunteers.

The word itself is from the French, based on a Latin root meaning "willing; of one's own choice." But why would anyone offer to do something without being forced to do it, or without getting paid for it?

At least in modern times, there are a variety of benefits and any one of us likely has his own mix of motivations. Grouping them together, volunteering may give:

• A sense of purpose and a sense of belonging to something greater than yourself

• Opportunities to make new friends and/or new contacts that could help your personal advancement

• A chance to improve your social skills and/or gain new job skills

• A boost to your self-confidence and self-esteem for your accomplishments

A stress release from your day-to-day grind

• A chance to have fun pursuing your personal interests while also making a difference

Executive Committee Candidate Slate Has Expanded

he officer candidate slate for the 2024-25 AAPG Executive Committee has expanded to include a petition candidate, and voting is scheduled to begin later this spring.

Petition candidates, as defined by AAPG bylaws, were accepted through the end of January. This year brought an additional candidate who will stand for office, joining the six candidates previously brought forth by the EC.

This year's election slate includes voting for three offices, including president-elect.

The person elected present-elect will serve in that capacity for one year and then will be AAPG president for 2025-26. The terms for the vice president-Sections and treasurer posts are for 2024-26.

Complete biographical information for all candidates is available online and included in this issue of the EXPLORER (see pages 22-25). Video conversations with the candidates will be available on the AAPG website as the election begins.

Voting will open March 28 on the AAPG website. Voting ends May 15.

The candidates are:

President-Elect

P-E Term: 2024-25

President Term: 2025-26

- Jeff Aldrich, Sproule, Denver. Brian Horn, Hatteras Energy Group, Houston.

Vice President-Sections Term: 2024-26

- Julian Chenin, Bluware, Houston.
- Lorena Moscardelli, Bureau of Economic Geology, Austin, Texas,

Treasurer

- Term: 2024-26
- Rebecca Caldwell, Chevron, Houston. William Fairhurst, Riverford Exploration, Denton, Texas
- (petition candidate).
 - Juan Pablo Lovecchio, YPF S.A., Buenos Aires, Argentina.

Interpretation A journal of subsurface characterization

A joint publication of SEG and AAPG

upcoming submission deadlines

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

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NOVEMBER 2024

Understanding the subsurface helium system to advance helium exploration and development **Submission deadline:**

1 MAR 2024

Special-section editors: Christopher Smith, Sean Brennan, Jacinda Brown, Jake Cammack, Vsevolod Egorov, Duncan Mackenzie, Tim Rynott, David Seneshen, Steven Tedesco, and Melinda Yurkowski



• Energy diversification: Natural resources beyond fossil fuels **Submission deadline:** 15 MAR 2024

Special-section editors: Vsevolod Egorov, William Abriel, Sunday Amoyedo, Philip Ball, Kirsten

Bannister, Dallas Dunlap, Pablo Gristo Savornin, Sougata Halder, Nicole Hart-Wagoner, Rachelle Kernen, Russel Roundtree, Shane Smith, and Jennifer Turner



Image courtesy of the Saskatchewan Geological Survey and Advanced Hydrocarbon Stratigraphy

Mobile shales

NOVEMBER 2024

Submission deadline: 1 FEB 2024

Special-section editors: Juan I. Soto, Dallas B. Dunlap, Michael R. Hudec, Chris K. Morley, Mark R. P. Tingay, and Lesli J. Wood

SUBMISSION DEADLINES PAST DUE:

Geophysical survey field work,

courtesy of Koichi Hayashi

AUGUST 2024

Recent advances in reservoir characterization Submission deadline: 1 DEC 2023

Special-section editors: Runhai Feng, Dongfang Qu, Kenneth Bredesen, Sixue Wu, Andrey Klimushin, Satinder Chopra, and Klaus Mosegaard

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.

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."

President from page 3

I am sure every one of us has volunteered for something at some point what motivates you?

Streamlining and Synergy

This self-reflection is relevant to the proposed streamlined bylaws for AAPG because our ability to harvest the full benefits will depend upon our membership stepping up. Apparently, over the years as we added more and more detail, requirements and paperwork to our processes and procedures, we tended to hand them off to our paid staff to figure them out and make them run. And because even similar programs and committees are organizationally disconnected from each other, staff have to support each one individually; volunteers involved in the programs and committees are not easily able to mutually support each other. In fact, they might not even know that synergies with other volunteer activities exist. We have ended up with a large overhead cost to run a basket of activities that is highly dependent upon staff to operate.

The vision for AAPG in the new proposed bylaws includes simplification first, because it strips out many decades of accumulated must-dos. When the Procedures manual is updated, we can put back in only the minimum we need for now and the future. Since the Procedures document only needs the Board to approve changes, we will be much more nimble in making adjustments as needed. Member volunteers can focus on the "fun stuff."

Second, we can build a member interface that is more self-service oriented. Instead of picking up the phone or sending an email into headquarters, we envision an improved capability to figure it out or complete that task ourselves.

The proposed bylaws also include a reorganization around shared interests that transcend geographic boundaries. When all the related activities are grouped to roll up under the leadership of a director, the new transparency and organizational proximity enables member volunteers to find the synergies and help each other. And by seeing the program area as a whole, we can critically assess if we really need to continue all of our historical products and activities, or sunset some to focus on those most desired for today and into the future. What new products or activities will be attractive to the next generation of geoscientists and refresh our volunteer pipeline?

It might cause a bit of pain to let go of products and services that were important to us in our own early years, or "the way we have always done it," but it is time for a paradigm shift in how we run our business to make AAPG fit for the future.

If you are not currently actively volunteering. I hope that these changes will catch your attention and bring you back, for all the personal reasons in the list of bullets above and for the betterment of AAPG.

In sum, I hope you are following along as we progress the various improvement projects underway and will be ready for another "V" as well: to cast a vote - an informed vote - on new proposed bylaws around mid-year, if the House of Delegates allows them to move forward. As always. please do send your questions and comments to Reimagine@aapg.org - I read each one with care.

Until next month, Claudia Hackbarth

llaudia J. Hackborth



Image by Maria Maltseva/Pixabay (CC BY-NC)

MAY 2025 Humanosphere and near-surface geophysics

Submission deadline:

Special-section editors: Huyen Bui,

Ehsan Jamali Hondori, Toshinori

Kimura, Hitoshi Mikada, Kyosuke

Okamoto, and Veronica Pazzi

1 JUL 2024



THE INDUSTRY'S LEADING EVENT FOR CCUS MANAGEMENT AND DEVELOPMENT

LAST CHANCE TO REGISTER



Keynote Speakers



CHRIS KENDALL

President and CEO, Denbury Inc.



CHARLES MCCONNELL

Executive Director, Carbon Management and Energy Sustainability, University of Houston

AMANDA RADDATZ

Director, Carbon Transport and Storage U.S. Department of Energy Office of Fossil Energy and Carbon Management A growing desire for lower emissions and a sustainable energy future has unleashed record levels of private sector investment and government funding creating an unprecedented concentration of global carbon capture, utilization, and storage projects.

As hosts of Carbon Capture, Utilization, and Storage (CCUS) 2024, from 11–13 March at the George R. Brown Convention Center in Houston, Texas, SPE, AAPG and SEG, have engaged technical experts from all aspects of the carbon capture lifecycle to explore the latest CCUS work and address related challenges and opportunities.

Much like our industry, this event has sparked exponential growth doubling in size year over year since its inception in 2021 establishing one of the fastest growing events in the CCUS arena. CCUS 2024 in Houston looks to build upon this success and will continue to be the industry's leading event for CCUS management and development.

Register Today! Don't miss the best chance you'll have to gain insights into the technical and business aspects surrounding CCUS.

Register Now: CCUSevent.org

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The 'Necessity and Urgency' of CCUS

nternational commitments to reduce emissions, a continued reliance on fossil fuels, government regulations and economic incentives have increased worldwide interest in carbon capture, utilization and storage, the process of capturing CO₂ and repurposing it for other uses or storing it in geological formations like depleted oil and gas reservoirs or aquifers.

The thirst for CCUS expertise has attendees flocking to conferences like the AAPG, Society of Petroleum Engineers and Society of Exploration Geophysicists' CCUS Conference in Houston, which has doubled in attendance each year since its inception in 2020.

The 2024 event, coming to the George R. Brown Convention Center on March 11-13, provides a platform for industry, government and academic leaders to share insights and expertise for carbon management.

Each day starts with a keynote talk from speakers who have diverse backgrounds and career paths but agree on the necessity and urgency of deploying CCUS in the United States and beyond.

High-Profile Acquisitions

The opening keynote features Chris Kendall, former president and CEO at Denbury Inc., an independent Plano-based oil and natural gas company purchased by ExxonMobil for \$4.9 billion in July 2023.

Kendall joined Denbury in 2015 as chief operation officer and was appointed CEO in 2017. He led the company until the merger with ExxonMobil closed in early November 2023

Leading an early adopter of CO₂ projects was one of the most enjoyable parts of Kendall's tenure at the company, he said.

"While Denbury was small compared to many other energy companies, our unique focus on CO₂ enhanced oil recovery gave us an advantage over the entire industry in CO₂ expertise and infrastructure. This put Denbury in a position of leadership when CCUS policy incentives in the United States were increased to meaningful levels beginning in the 2019-2020 timeframe," he said. "I thoroughly enjoyed being part of a company that could truly make a difference in this important, new industry."

Denbury's entry into CCUS started in 1999 when CO₂ EOR became its primary focus. During the following two decades, the company developed deep surface and subsurface CO₂ management expertise, as well as the largest dedicated CO₂ pipeline network in the United States.

"CO₂ EOR is a key form of CCUS, so expanding into other facets of CCUS, such as CO₂ sequestration in deep saline aquifers, was a natural extension that leveraged Denbury's expertise and infrastructure," Kendall said. Joining forces with ExxonMobil will allow

efforts to expand exponentially, he said.

"Denbury's combination with ExxonMobil has the potential to significantly amplify and accelerate the CO₂ emissions impact that Denbury could have achieved on a standalone basis," he said.

Kendall said the high-profile merger sends broader message to the energy industry

"I think this transaction underscores what we've known for some time, that CCUS is a key tool for mitigating CO₂ emissions from many hard-to-abate industries that produce products that our society needs, and with the right policy incentives, it can be expanded meaningfully," Kendall said.

Opportunities for Geoscientists

The March 12 keynote speaker is Amanda Raddatz, director of carbon transport and storage at the U.S. Department of Energy. Over the past decade, Raddatz has



Center for Carbon Management in Energy UNIVERSITY OF HOUSTON



"We talk about CCUS as a commercially developing program, but it's not ... it is government sponsored, and there are all kinds of hooks. I think many companies are nervous about it, but they're concerned that if they don't get government money and their competitor does, they're going to get left behind."

contributed to a wide variety of carbon management activities, including site characterization, Class VI permitting, monitoring and risk management. She has supported the planning and development of carbon capture and storage sites on five continents.

Her current role at DOE involves providing strategic direction and coordination of carbon transport and storage projects and research.

Raddatz, geologist and former AAPG member, described her work in CCS as interesting, engaging and fulfilling.

"I get to apply my geology background in new ways, and I learn something new every day," she said. "It has been exciting to watch the industry grow and develop in recent years, and to be a part of building something from the ground up."

Raddatz said geoscience is vital to characterize CO₂ potential and ensure the safety of CO₂ storage operations, and geoscientists interested in pursuing CCUS careers find closely linked opportunities and challenges.

"We're seeing an unprecedented scale and pace of deployment since the Bipartisan Infrastructure Law and the Inflation Reduction Acts were passed," she said. "In this environment, geoscientists are facing the challenge and the opportunity to expand their skillsets to learn new tools, methodologies and new topics that were not a part of their repertoire previously."

Raddatz described CCS as "an essential piece of the carbon management puzzle," important for achieving global climate goals. She noted that the

technology has other applications beyond the oil and gas sector.

"CCS is a key part of decarbonization for power generation and also for the industrial sector, such as hydrogen, cement and steel," she said.

Raddatz said she looks forward to meeting with a variety of sectors at the CCUS event in Houston.

"This conference brings together organizations and individuals who share a passion for CCS implementation. Their skillsets and experience are important to ensure CCS projects are deployed safely and efficiently" she said. "This conference provides a wonderful opportunity to network, to share ideas, and learn from others. With participants from a wide variety of backgrounds including industry, government, academia and interest groups, there's an opportunity to learn about CCS from various perspectives."

Raddatz said while she is honored to share DOE's role in CCS deployment with this audience, she looks forward to hearing what others have to say.

"I hope to learn about the challenges project developers are facing and see some examples of how roadblocks have been addressed and overcome," she said.

Partnerships

Shared knowledge and multisectoral alliances are key themes in the March 13 keynote to be delivered by Charles "Chuck" McConnell, executive director for Carbon Management and Energy Sustainability at the University of Houston Center of Carbon Management and Energy.

The Center is designed to meet the lower carbon future energy transition challenges of the oil and gas, petrochemical and electric power markets through collaborative





multidisciplinary research.

McConnell said what he most enjoys about CCME are its linkages with industry and multidisciplinary approach to projects. "We're connected directly with the

marketplace and the actors that are interested in doing things, in actually making an impact," he said. "Our Center is about commercial deployment and technologies, so we're looking at pilots and commercial demonstrations. But we're also doing a lot of things that are non-technical, that are business, legal and policy related and have implications for all the projects. It isn't just about engineering and science but includes the other areas, so we're really looking at the entirety of the portfolio of what it's going to take to make projects work. I find that fascinating."

McConnell noted that the recent United States legislation, including the 2021 Infrastructure Investment and Jobs Act, CCUS tax credit changes in the 2022 Inflation Reduction Act and revisions to the Carbon Sequestration 45 Q tax credit have generated enthusiasm around CCUS projects.

"We have doubled the amount of people in our DOE-sponsored CCUS consortia. We now have over 70 organizations that are part of this this group," he said, "There's a lot going on and it's all basically good, but it's challenging."

McConnell said part of the Center's role is advising companies that have not worked with the DOE or other U.S. government agencies.

"We all know that there's no such thing as free money, right? There are responsibilities and requirements, nuances in the kind of labor you hire, the rates that you're paying and your ability to capture the full value of the government sponsored activity," he said.

"We talk about CCUS as a commercially developing program, but it's not commercial; it is government sponsored, and there are all kinds of hooks. I think many companies are nervous about it, but they're concerned that if they don't get government money and their competitor does, they're going to get left behind," he said.

McConnell's work with CCUS started 20 years ago when he oversaw energy business activity at Praxair, an industrial gas company that supplied carbon dioxide.

"I didn't know anything about geology or any of the issues associated with underground injection of CO_2 , but through that work, I got engaged in Regional Carbon Sequestration Partnership activity across the country," he said.

Continued from previous page

His connection with the Partnership led to a position as vice president of carbon management with Battelle and an introduction to the secretary of energy, who offered him a job.

"The next thing you know, I got an invitation to go to Washington, which was the last thing in the world I would have ever expected to do. But it was three years of a wonderful learning experience for sure," he said.

McConnell served as assistant secretary of energy of fossil energy from 2011-13 and later returned to Houston, where he has worked in industry and academia ever since.

Being Good Stewards

McConnell said his experience in business, government and academia has led to a pragmatic approach to emissions reduction.

"We can debate all day long about climate change and how much of it is from anthropogenic CO₂ and everything else. I choose not to get involved in those conversations because I believe it's just a good thing to do - to be good stewards of how much carbon you put into an atmosphere. Arguing about it to me seems like a colossal waste of time," he said.

"What I find more important is that many of these companies - and whether it's oil and gas or petrochemicals, electric power, cement or steel manufacturing - all of them have made commitments to their shareholders and the investment community that they're going to have a lower carbon footprint. It's on the radar screen for everybody. And after you do a few things that you can talk about easily, then it starts to get difficult. And the difficulty gets solved by transformative technology and transformative business approaches," he explained.

Developing those approaches is a key goal for the CCME and other educational institutions who are preparing the next

Centre, Islington, London.

business opportunities.

Technical/Commercial case histories.

Foundational Facts: Greater Houston Are

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generation of industry leaders.

"We're trying to get students and educational materials into the marketplace so the existing workforce can be better equipped so that students can get the jobs that they're going to move into: good jobs, important jobs, jobs that are going to change the world," McConnell, said.

"I've told many of our students, 'You don't have to go work for Google or Amazon to change the world. Go to work in these industries who are a part of it. That's where you're going to see the high tech, that's where you're going to see all the transformational automated intelligence we hear about. That's where emissions are

going to be reduced," he explained. During his talk at the CCUS event,

McConnell will share results from a CCME whitepaper that focuses on identifying the future need for infrastructure, workforce and supply-chain investment needed for CCUS development, based on different emission reduction targets for 2050.

CCUS as a Requirement

He also plans to share the message that CCUS deployment is no longer a choice for industry

"The International Energy Agency, the Intergovernmental Panel on Climate Change and all the other science based organizations that we're all supposed to pay attention to not just when it's convenient, but all the time - state that 15 to 20 percent of the world's emissions reductions must come from CCUS between now and 2050," he said, "That's not suggesting that CCUS is an option; what it's stating clearly is that it's a requirement."

Source: UH CCME December 2023

McConnell said that successful CCUS implementation requires an industry-wide, global focus.

"Moving the needle on emissions reduction requires all of our efforts to get

See CCUS page 13 ►

Show

Start planning your participation at the next edition of the Business & Exploration Opportunities Show (BEOS) taking place 26–27 March 2024 at the Business Design

BEOS is an important multifaceted platform at a critical time, to reach out to a

Exploration and Business development/New Ventures part of the Industry. The

two day show will cover the ongoing financial, commercial and people related Transition impact on Oil and Gas but as importantly allow for showcasing and marketing of opportunities and Exploration assets/prospects across two

streams each day. In addition, sessions will cover a variety of themes from Resource holder overviews to UKCS Fiscal updates, Panel Energy debates and

BEOS will bring together many of the Oil & Gas Majors, NOCs, Independents, E&P Companies and Governments. It also attracts attendees from many of

providing a unique and unmatched opportunity to network and develop new

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Stay tuned for more exciting announcements coming in the next weeks.

the world's leading banks, financiers, advisories, and law firms thereby

What Will It Take to Get CCUS Ready for Prime Time?

f countries begin to require CO_2 capture to help offset carbon emissions, is the energy industry prepared? Is carbon capture, utilization and storage ready for prime time?

Despite years of research and investment, CCUS currently sequesters only a small fraction of the world's CO_2 output. Most scientists still see carbon capture as a work in progress.

"In the current landscape of CCUS, significant advancements have been made yet there remains ample room for further improvement," noted Nihal Darraj, CCS (carbon capture and storage) researcher at Imperial College, London.

"At present, the state-of-the-art in CCUS reflects a dynamic blend of progress and ongoing investigation across multiple fronts," she added.

Darraj will be the moderator for the panel discussion "Policies for Success in CCUS" at the AAPG-Society of Petroleum Engineers-Society of Exploration Geophysicists' 2024 CCUS meeting in Houston this month. The meeting's technical program shows just how much additional research is needed, in multiple areas, before carbon capture makes its prime-time debut.

Presentations at CCUS 2024 will include research into CO_2 capture methods, transport, storage site selection, reservoir analysis, seals, injection, sequestration geochemistry, pluming, seepage and leaking, modeling, monitoring and much more.

Cost Barrier

In addition to technical challenges, the expense of carbon capture is often cited as a significant obstacle for CCUS implementation. According to the International Energy Agency, capture costs can range from \$15 to \$25 per metric ton for industrial processes producing highly concentrated CO₂ streams.

But capture costs go as high as \$150 per metric ton of CO_2 for processes with more dilute gas streams, and direct air capture methods are even more expensive.

"Cost remains a critical barrier to widespread CCUS deployment, necessitating continued research and innovation to drive down costs and improve economic viability," Darraj observed.

"Additionally, regulatory frameworks and policy support play a crucial role in incentivizing CCUS adoption and fostering investment in carbon capture and storage infrastructure," she added.

Oumer Tahir, regional manager and energy transition specialist for Hunting Energy Services, will moderate the panel session "Challenges Across the CCUS Value Chain" at CCUS 2024. Tahir said twothirds of current CCUS project cost is from the dehydration or purification of pointsource CO_2 .

"That is mainly due to the bottleneck presented by transportation medium. Research is ongoing and needs further improvement with regard to storage wells being able to accommodate all sorts of chemistries and impurities, especially when CCS hubs are desired. New material choices are being presented to OpCos (operating companies) to consider," he said.

Other commercial aspects of carbon capture will be addressed at CCUS 2024, including the March 13 keynote presentation, "CCUS Commercial Deployment: What Will It Take to Make It Happen?" The scheduled speaker is Charles McConnell, executive director for carbon management and energy sustainability at the University of Houston.

"In addition to technical gaps, a solid



"Significant progress has been made in the development of robust and secure CO₂ storage solutions. (An) enhanced understanding of geological storage formations, coupled with advancements in monitoring and verification techniques, has bolstered confidence in the feasibility and safety of long-term CO₂ storage."

commercial model is the need of the hour for CCUS projects to kick off globally. At the end, it is business and numbers (that are) needed to make sense for capital markets and investors," Tahir said.

According to the latest report from the Global CCS Institute, 41 carbon-capture projects currently operate worldwide, with another 26 under construction and 325 in advanced and early development stages.

It reported that projects in operation have a CO_2 capture capacity of 49 million metric tons per year, while total potential capture capacity has expanded to 361 million metric tons per year. But not all of the proposed carbon-removal projects will be funded and completed. Wood Mackenzie, an energy consultancy and research firm, tracks 100 or so proposed, commercial-scale CCUS projects and estimates that about half have a good chance of progressing.

That 2023 capture capacity of 49 million metric tons compares to an estimated annual global CO_2 output of more than 37 billion metric tons, or in gigatons – 37.55 gigatons in 2023, according to the global data and business intelligence platform Statista.

New Technologies in the Works

The outlook is improving. Ongoing research has resulted in significant technical advances for CCUS, especially in capture technology and storage reliability.

Wood Mackenzie predicted that several novel carbon-capture technologies will enter commercial scale this year. The prospect of highly secure, long-term CO₂ storage is much more likely now than just a few years ago.

"One notable aspect of current CCUS efforts is the maturation of capture technologies, with various methodologies being developed and deployed at industrial scale. Advances in solvent-based, membrane-based and solid sorbent capture systems have showcased promising efficiency and scalability," Darraj observed.

"Additionally, emerging technologies such as direct air capture offer novel avenues for carbon removal," she noted.

However, direct air capture remains an extremely expensive form of carbon removal. The World Resources Institute has estimated DAC costs today at \$250-\$600 per metric ton.

"Significant progress has been made in the development of robust and secure CO_2 storage solutions. (An) enhanced understanding of geological storage formations, coupled with advancements in monitoring and verification techniques, has bolstered confidence in the feasibility and safety of long-term CO_2 storage," Darraj added.

Getting Ahead of the Learning Curve

One criticism of CCUS has come from fossil fuel opponents, who claim that CO_2 injection is being used primarily to enhance oil production. In a larger view, CCUS has the problem of costing money without many ways of generating revenue. But that might be changing.

"In terms of utilization, there has been

a growing emphasis on exploring diverse pathways for CO₂ utilization beyond traditional applications in enhanced oil recovery," Darraj commented.

"From the production of synthetic fuels and chemicals to the utilization of CO_2 in concrete and mineralization processes, the landscape of CCUS utilization is expanding, driven by innovation and market demand," she noted.

Some countries and regulatory agencies, including the European Union, are already considering carbon-capture requirements as part of their CO₂-reduction strategies. The proposals could involve a level of mandatory CCUS to help offset Scope 1 emissions, those from sources that a company owns or controls directly.

In early February, the European Commission released its new climate goals. It recommended that EU member countries reduce greenhouse-gas emissions 90 percent by 2040, compared with 1990 levels. An editorial in the journal "Nature" commented:

"The 2040 interim target was proposed by independent climate-science advisers to the EU, and it's good to see their proposal being implemented. But the advisers also cautioned that getting to 90 percent by including CCS technologies will be challenging. The biggest obstacle is that the technology is not ready."

Tahir said an issue with the current state-of-the-art of CCUS "is that we do not have (the) liberty of a learning curve." It will take a more extensive implementation of carbon capture efforts before that ladder becomes available.

"That is where the holdup is. Processes are slow. Permit applications are taking time. The whole value chain is being designed and crafted with a conservative mindset," he said.

Is CCUS ready for prime time? The answer appears to be, "Not quite yet."

Progress has been made in carbon capture, Darraj observed, but "ongoing research and development efforts are essential to address remaining challenges and unlock the full potential of CCUS as a viable climate mitigation strategy." MARCH 2024 EXPLORER.AAPG.org By BARRY FRIEDMAN, EXPLORER Correspondent

How to Make Carbon Sequestration Commercial

f there is any hope of reducing the concentration of CO_2 in the atmosphere and limiting additional emissions, CCS and CCUS will be "a critical component of any decarbonization strategy."

That is according to George Koperna Jr., vice president of Advanced Resources International, Inc.

To clarify, the difference between carbon capture and storage and carbon capture, utilization and storage is that the former is primarily concerned with the trapping of the carbon dioxide and sequestering it – typically deep underground, while the latter deals with how the sequestered carbon can be used in other, more productive applications.

The capture and sequestration industry in the United States has been around since 1972, and more than 50 years later, according to the Global CCS Institute, some 21 million tons of carbon - about 0.34 percent of the nation's emissions have been removed and stored. Most of it has been transported on the approximate 5,000 miles of CO₂ pipeline throughout the country. Estimates, though, are that more than 1 billion tons of CO₂ need to be sequestered here in the United States to get to a net-zero emissions goal. Internationally, according to Statista, a global data and business intelligence platform, the amount of CO₂ captured accounts for only 0.12 percent of annual global emissions.

Koperna, who is also an expert in both carbon storage and enhanced oil recovery, understands the enormity of the undertaking.

"The challenges are diverse," he said. How CCS and CCUS proceed and who will lead the way – who will do the heavy sequestering, if you will – depends on the ability and interest of the oil and gas industry, according to the Office of Fossil Energy and Carbon Management within the U.S. Department of Energy.

And that's where all the moving parts involved need to work together.

According to the DOE, "While significant progress is being made, the industry needs to see a strong business case for CCUS. In addition to developing policies that promote investment in CCUS, DOE is investigating new ways to extract an economic benefit or additional value from captured CO₂. At the end of the day, deploying CCUS commercially requires continued public/private collaboration."

The ABCs of CCUS

The very acronym – "CCUS" – is where the understanding of the process should begin, said Koperna.

He means that literally.

"Let's start with the C," he said. Koperna believes the carbon captured from low-purity sources like cement and power generation is the "holy grail."

"If you drive the costs down for this activity, we would be flush with CO_2 to store and use in products, as the low-purity sources (fossil fuel-based flue gases, for instance) tend to be higher-volume CO_2 emitters," he said.

(High purity CO₂ sources involve ethanol, ammonia, hydrogen, ethylene, and gasification production.)

The captured CO_2 is then compressed and transported by pipeline, ship, rail or truck to be used in other applications that can use the trapped gas.

If only it were that easy.

Both CCS and CCUS share the same three challenges:

First, the physical challenge: The sourcesink link. How far is the distance between the source and the sink? The greater the

First Leg – Knowledge and Experience

- The activity of storing CO₂ is much like that of storing CH₄.
- Similar exploration and characterization methods are used.
- Similar infrastructure (wells, injection/monitoring equipment, transportation).
- Differences are related to regulation, buoyancy, corrosivity, and scale.



Modified after Katz, D.L. and K.H. Coats, Underground Storage of Fluids, Ulrich's Books, 1968.



distance, the more extensive the operation. This leads to the second challenge: economics. The bulk of the cost structure is in the capture, the expense of which is

based on a function of concentration. Here's where CCS and CCUS differ most significantly. CCS has only costs (taking CO_2 off an industrial point source and sequestering), but without revenue opportunity other than, say, regulatory incentives, it isn't always cost-effective. CCUS, however, provides that value. The more sophisticated the technology, the more utilization can occur.

Regulation is the third challenge. Pipeline construction is difficult enough, having to traverse around a regulatory maze, but adding CO_2 injection and storage, which requires even more monitoring, verification and reporting adds even more challenging layers to the process.

Koperna knows the costs have to come down for any of this to succeed. He said the next hurdle in the CCUS chain is transportation of the carbon – the "T" in the CCUS paradigm.

There is no "T," obviously, in the acronym, but there should be.

"Costs are high here, too," he said of transportation, "but it's the non-technical issues that tend to be overwhelming. Storage tends to be the lowest on a cost per kilogram basis, so the CCS package needs to be cost effective under the incentive structure to make it go."

Koperna, who has more than 20 years of experience in evaluating subsurface reservoirs, explained that if the cost of supply-chain issues (compressors, steel tubulars for pipelines and wells, chrome tubulars for wells) on top of items that are already high cost, there are going to be significant challenges. These challenges are mitigated if you don't have to move the carbon.

"Where capture can be situated over storage, the cost component disappears (a good thing!) and there is no need to move the CO_2 via pipeline," he said.

That scenario doesn't always present itself, however.

Cutting through the Red Tape

He said it is in the non-traditional oil and gas areas, which align with where many of the ethanol producers are in the United States, that make CCUS the "lightening rod to the public."

More immediately, he said, "Regulatory efforts need to cut the time down for the industry."

To wit, at the present time, it is now taking states four years to garner primacy

from the U.S. Environmental Protection Agency. This would allow them to permit the wells rather than wait for federal approval. Specifically, with a Class VI UIC permits, states themselves could regulate injection of carbon dioxide for geologic sequestration purposes on their own. Currently, North Dakota has shown it can, with primacy, turn the permits around in about a year.

"So, state primacy may be the pathway to streamline the process," Koperna said.

"As more states get involved in CCUS, the regulatory process should 'streamline itself' and the timeframe will come down," he added.

The North Dakota success notwithstanding, he hopes it can be reduced to 18 to 24 months.

This CCUS landscape, all phases of it, will be discussed at this year's CCUS 2024 Houston, specifically in a session entitled "Challenges Across the CCUS Value Chain." Joining Koperna will be Fred Majkut, SLB; Rob Cordray, Rystad Energy; and David Mannon, IPT Well Solutions.

At the moment the pace of progress is picking up. Currently, according to the Congressional Budget Office, 15 CCS facilities are currently operational with an additional 121 facilities under construction or in development.

Persistent Prospects of the Permian

ots of geoscience remains to be done in the Permian Basin of West Texas and southeast New Mexico. Plenty of Permian prospects remain to be analyzed. And that might seem a little strange.

Production from the basin began more than 100 years ago. The Permian is one of the most explored and drilled regions of the United States. But somehow, this long-time oil and gas producing area has once more emerged with new promise.

Diamondback Energy hammered that point home again in February when it announced a \$26-billion deal with Endeavor Energy Resources LP to combine their Permian Basin resources.

Once the deal closes, Diamondback expects to have 816 million barrels of oil equivalent production per day and around 838,000 net acres. That includes approximately 6,100 prospective drilling locations with break-evens below a \$40 a barrel West Texas Intermediate oil price.

It was just the latest move in a sweeping Permian Basin consolidation. Last year, ExxonMobil agreed to buy Pioneer Natural Resources for more than \$60 billion. Occidental Petroleum then announced its acquisition of privately held CrownRock LP for \$12 billion.

All of that activity aims at building substantial positions in the Midland Basin area of the Permian, where Endeavor Energy's horizontal drilling operations focused on Martin, Howard, Midland, Glasscock, Upton and Reagan counties of West Texas.

Unconventional resources development brought new exploration life to the Permian Basin by 2010, earning it designation as a super basin. But that was only the first phase of the basin's resurgence.

During the following decade it became the mainspring of increased U.S. oil production, with most of the new crude output coming from the prolific Spraberry, Wolfcamp and Bone Spring formations, according to the U.S. Energy Information Agency.

Expanding Interest

Today, "you continue to see development of the Wolfcamp and the Leonardian sections" in the Permian, said Tim McMahon, tight oil resource assessment project manager and principal investigator for the Bureau of Economic Geology at the University of Texas at Austin.

"Certainly, those have been of interest for some time, but we see some interest now in expanding that, going up into the Avalon (formation) in the Delaware Basin," he noted

The Barnett formation below the Wolfcamp also has drawn attention recently, this time for oil production potential. That play now spreads over several counties in West Texas, in the Midland Basin. And "there's been some discussion: Do some of the Pennsylvanian rocks have potential in the deep basin?" McMahon said.

Above the Leonardian, "you also see some things going on in the Guadalupian section," in the Delaware Mountain Group, Artesia Group and San Andres, he noted.

Other Permian operators are targeting transition zone development, "where you get a lot of water but also a lot of oil," McMahon said.

"This is on the Central Basin Platform within the San Andres formation and includes both transition zones and residual oil zones. Companies are drilling horizontal wells to extract oil from the transition zone



on the formation, usually using (enhanced oil recovery) techniques as well," he observed.

"This has been going on since at least the mid-2010s, but shows how application of unconventional technologies can be used to produce additional hydrocarbons from older conventional fields," he added.

Ongoing Geoscience

Through its history, Permian exploration has demanded new rounds of geoscience. The Conventional Permian Basin lasted from about 1920 to 1970 and was analyzed using conventional interpretations.

As production went into decline, the Mature Conventional Permian emerged. Recovery geology and engineering began to dominate, until roughly 15 years ago. Then the Unconventional Permian Basin appeared, requiring a new approach.

Thirty years ago, Permian operators might dismiss formations that were too shaly or tight or wet. Today, some of those same formations are targets for development. In addition to recent work in the Barnett, potential zones of interest include the Avalon, Canyon, Clear Fork, Cline, Glorieta, Morrow, San Andres, Woodford, Yates and Yeso formations. Diamondback Energy had earlier



reported evaluating two shale intervals within the Clear Fork for potential horizontal development, while noting that conventional pay intervals in the Pennsylvanian Strawn and Atoka formations could add significant reserves.

"I know there are people looking at the Avalon in the Delaware Basin and they may be looking at the equivalent Clear Fork in the Midland (Basin)," McMahon said.

"Clear Fork is one of the areas where the nomenclature gets really weird," he added.

Disparity in stratigraphic nomenclature is nothing new in the U.S. Midcontinent region. In the Permian Basin, part of the issue involves the change from shelf to basin facies. McMahon said

"The Middle and Upper Clear Fork on the Northwest Shelf and CBP are supposedly the time-equivalents of the Lower and Middle Spraberry in the Midland Basin, with the Glorieta equivalent to the Upper Spraberry," he noted.

"However, you will see the interval above the Upper Spraberry - we use Upper Leonard for this - sometimes referred to as Lower Clear Fork shale, with Glorieta and Upper Clear Fork above the Middle Leonard," he added.

In the Pennsylvanian section, the Wolfcamp D designation is commonly used within the industry, "but stratigraphic nomenclature would have that as the Cline shale. Below that, the Cisco may be locally named Tannehill, Croton or Stockwether, with similar local names within the Strawn," McMahon said

"These changes make it difficult when mapping on a regional scale, which is a key component in evaluating resource potential and the focus of my group's research," he said. "Where you still need some work is sorting out the stratigraphy as you go from the deep basin to that upper shelf," especially with steep sides to an uplift.

Ongoing work for geoscientists in the Permian includes deciphering the basin's thermal maturity, which McMahon described as "challenging."

"The thermal history's a little bit unusual," for instance in the Delaware Basin, where the deepest zones may have been the hottest, he noted.

"It does appear to be uplifted, possibly tilted, and how does that affect how we look at it?" he said.

There's also the question of nailing down reservoir and play extent: "These things in the Permian Basin don't always have great lateral connectivity in the

See **Permian** page 15 ►

Bone Spring 3-D Model



Attend, Learn, Succeed! AAPG Global Training Events

4th Edition: Stratigraphic Traps of the Middle East

Al-Khobar, Saudi Arabia | 4–6 Mar. 2024

The workshop will continue to provide opportunity for attendees to receive up-to-date knowledge about stratigraphic trap exploration of the Middle East covering the prolific Gulf region and surrounding areas, exposure to regional and global stratigraphic case studies. It is also an opportunity for all professionals to share state of the art-technologies utilized to detect and produce these complex-yetrewarding traps.

Carbon Capture, Utilization, and Storage (CCUS) 2024

Houston, Texas | 11-13 Mar. 2024

As hosts of the Carbon Capture, Utilization, and Storage (CCUS) 2024, 11–13 March 2024 at the George R. Brown Convention Center in Houston, Texas, the Society of Petroleum Engineers (SPE), the American Association of Petroleum Geologists (AAPG), and the Society of Exploration Geophysicists (SEG), are excited to once again join forces to offer the industry's leading event for CCUS management and development. This meeting continues to be best chance you'll have to gain insights into the technical and business aspects surrounding CCUS. Help lead the way for successful net-zero operations, developments, and opportunities.

AAPG Spring Student Expo

Norman, Oklahoma | 15 Mar. 2024 The School of Geosciences, with support from the AAPG Foundation, will be hosting the AAPG Spring Student Expo on Friday, March 15 at the National Weather Center in Norman, OK. The Expo will feature short courses, a scientific poster competition and networking with industry professionals.

AAPG/GESGB – Business & Exploration Opportunities Show (BEOS)

London, UK | 26–27 Mar. 2024 The Business Exploration Opportunities Show (BEOS) is a two-day event jointly conceived by the AAPG and the GESGB, which brings together the best of ADBEX and DBOSDEV into any great

the best of APPEX and PROSPEX into one great show. BEOS is an important multifaceted platform at a critical time to reach out to a broad and diverse audience of stakeholders in the International Upstream Exploration and Business Development / New Ventures part of the Industry.

GCAGS/GCSSEPM's GEOGULF 2024

San Antonio, Texas | 10–12 Apr. 2024 AAPG Gulf Coast Sectional Conference in San Antonio, Texas. Technical Sessions, short courses, events, and field trips relating to most topics associated with Gulf Coast Geology.

Cross Regional Carbonates and Mixed Carbonate Systems Symposium *Palermo, Italy | 22–24 Apr. 2024*

This Symposium marks a collaborative event that brings together AAPG Europe and AAPG Middle East, with a central focus on carbonates and mixed carbonate systems worldwide, while highlighting their significance within these two regions. The primary objectives are an overview of controls that govern the evolution of these systems in time and space and the characterization and prediction of their properties across scales. Through overview presentations and case studies, the symposium will address these systems with emphasis on new scientific developments equally as on exploration and characterization of the subsurface in the era of sustainability.

AAPG Southwest Section Annual Convention Abilene, Texas | 27–30 Apr. 2024

2024 SWS-AAPG Annual Convention Join us in the key city for the 2024 SWS-AAPG Annual Convention hosted by the Abilene Geological Society. Stay tuned for more information coming soon.

Offshore Technology Conference (OTC) 2024 Houston, Texas | 6–9 May 2024

Since 1969, the Offshore Technology Conference (OTC) has served as a central hub convening energy professionals from around the world to share ideas and innovations, discuss, debate, and build consensus around the most pressing topics facing the offshore energy sector. Whether it's oil and gas, solar, wind, hydrogen, and other marine resources, these conversations will be centered around the innovations that could help shift and drive the world's energy mix.

Optimizing Exploration Workflows: Bridging Expertise between the Rockies and the Andes *Calgary, Canada | 9–10 May 2024*

AAPG's Canada and Latin America & Caribbean Regions invite you to join us for a geosciences technology workshop (GTW) that features a series of technical presentations, roundtable discussions, and networking opportunities with technical experts from throughout the Americas. The event is designed for geologists, geophysicists, technologists and business development professionals interested in exploring the potential for hydrocarbons and other resources in complex geological environments

Latin America Carbon Capture, Utilization, and Storage (CCUS) 2024

Rio de Janeiro, Brazil | 22–23 May 2024

Plan now to be a part of the first SPE AAPG SEG event focused on CCUS potential in Latin America! Join us in Rio for a multidisciplinary program featuring technical presentations, panel discussions, keynote talks and an exhibition highlighting work, future challenges and opportunities for energy professionals in Carbon Capture, Utilization and Storage.

2nd Edition: Geological Process-Based Forward Modeling

Abu Dhabi, UAE | 27–29 May 2024 This workshop will bring together invited experts and interested researchers from both industry and academia to concentrate on all technical aspects related to geological processbased forward modeling. Six sessions spread over a period of 3 days will be dedicated to key challenges, finishing with a concluding session to define the best practical way forward.

AAPG Europe Regional Conference 2024 Krakow, Poland | 28–29 May 2024

On behalf of the Organizing and Advisory Committees, we invite you to join us in Krakow, Poland, for the annual AAPG European Regional Conference, to be held from 28–29 May 2024. This meeting will have sessions which fit the general geological setting of the Carpathians and its foreland in Poland but also the broader East European Craton including various Ukrainian basins with highlights on the salt tectonics, clastic, carbonate reservoirs and structural geology. Call for abstract is now open.

Unconventional Resources Technology Conference (URTeC)

Houston, Texas | 17-19 Jun. 2024

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.

From Frontier to Discoveries: Namibia's Journey to Major Oil and Gas Discoveries Houston, Texas | 17–19 Jun. 2024

The Unconventional Resources Technology Conference (URTeC) continues to be the best opportunity y

SEG | AAPG International Meeting for Applied Geoscience and Energy (IMAGE) Windhoek, Namibia | 22–24 Jul. 2024

Plan now to join us from 22–24 July 2024 in Windhoek, Namibia for the AAPG Geosciences Technology Workshop, From Frontier to Discoveries: Namibia's Journey to Major Oil and Gas Discoveries.

AAPG International Conference and Exhibition (ICE)

Muscat, Oman | 30 Sept.-2 Oct. 2024 Hosted by PDO, ICE 2024 will bring together a global audience of technical professionals, decision makers, academics and government representatives working in both the traditional oil and gas sector as well as on energy transition and sustainable development initiatives. Organized for the first time in the Middle East, the event can leverage Oman's exploration and production plans and incredible geology and will offer a global and regional multidisciplinary technical program that covers the advance, innovation and discoveries in our industry.

AAPG/EAGE/SEG Digitalization in Geosciences Symposium

Khobar, Saudi Arabia | 21–24 Oct. 2024

The primary objective of this symposium is to facilitate knowledge sharing and collaboration among professionals who are engaged in implementing digitalization technologies and machine learning algorithms in geoscience applications. The joint effort of EAGE, AAPG and SEG societies aims to set up industry standards on reproducible AI and distribute key solutions on: data standardization and optimization, data quality, storage and model accuracy assessment, performance profiling, code optimizations, pervasive real-time and remote monitoring and more for advanced prototyping and delivery.

AAPG Mid-Continent Section 6th Biennial Field Conference

Fort Hays, Kansas | 18–20 Oct. 2024 AAPG, Fort Hayes State University Geosciences and Kansas Geological Society host the 6th Bi

AAPG Energy Summit 2024

Uruguay | 19–21 November 2024 Plan now to join us in Uruguay for the Latin America and Caribbean Energy Summit, an executive level event connecting decision makers working to provide reliable, affordable, and sustainable energy for communities throughout the Americas and beyond. Enjoy keynote presentations and panel discussions with industry and government leaders who will share insights about E&P activities, decarbonization strategies, and technological advances shaping the region's energy future. Meet privately with current and future partners at the Business-to-Business session held on-site during the event.

AAPG.org/events

Energy Economics and Technology: Did You Know There's a Committee for That?

or many years the Energy Economics and Technology Committee of AAPG's Energy and Minerals Division has been "a hidden resource under the AAPG umbrella," in the words of co-chair Jeremy Platt.

The Committee issues annual, sometimes biannual, reports. Because information relating to the Committee's purview floods in on a daily basis, Platt said, the group focuses on important recent or sometimes historical events, rather than trade news or forecasting.

With reports available dating as far back as 2005, "Our contributors have included, from time to time, individuals with remarkable reputations in energy analysis. Having myself spent a nearly 40-year career working alongside such individuals, our approach has been to tap fine minds regardless of individuals' geoscientific credentials or lack thereof," Platt said.

The Committee's latest submission, released late last year, is a departure of sorts, being both up to the minute and focused on one topic: "Energy and Inflation."

"The topic of inflation and connections to oil have been on people's minds for a long time, not least since the midsummer 2022 spike in oil prices," said Platt.

Pratt said it's no surprise that "as far as the general public is concerned and the tracking of big numbers, the story is dominated in most years and months by oil, by gasoline at the pump. Yet it is interesting to see how some of the components have changed since the pre-pandemic year of 2019."

"By components? Gasoline, natural gas, electricity," he continued. "My own background was deeply involved in fuels used for electricity - uranium, coal and for several decades, natural gas, which had once been shunned. So it was quite interesting to learn that, unlike oil and natural gas, from a consumer's point of view, electricity costs recently have just gone up and up, even though natural gas - to which its wholesale costs are joined at the hip -- have fallen sharply into its habitual very unattractive (from a producer's point of view) territory."

Origin Story of the Committee

The Committee began by the fall of 1998 after recommendations within EMD by Platt and Keith Murray and later executive actions. Its aim was to provide an avenue within AAPG to advance understanding of the interplay of energy markets and technologies of supply and demand. The means for doing this has been to tap experts with different backgrounds and perspectives, to organize topical sessions principally at annual meetings, and to develop annual reviews with commentary on selected themes and guidance on important references. The importance of providing this service owes to the essential need for energy in people's lives, the magnitude of shifting policies and fundamentals, the unease and uncertainty that never goes away, and the need to participate in discussions and learnings to stay on top of one's profession.

The group quickly began making significant contributions and has continued to do so in the decades since.

"The Committee's first big splash," Platt said, "was a full-day forum at the 1999 annual meeting on 'Gas in the New Electric Market.' Natural gas was beginning to play a central role in the economics of power generation ... The industries - oil, gas and electric power - were becoming tied together. Explosive advances in efficiency and cost-effectiveness of power generation technology, coupled with deregulation of that industry, led to



 All items - Energy

burgeoning growth in the use of natural gas." Hydraulic fracturing wasn't on the radar yet, he explained, while natural gas and coal

presented considerable uncertainties. "Many were surprised that reserves of

seemingly scarce natural gas were proving to be much greater than expected," said Platt. "Past AAPG President Bill Fisher was one of the first to document this. And as today, coal generation was widely seen to face waves of regulatory hurdles, even though coal supply had undergone shocking growth due to the phenomenal attributers of the Powder River Basin deposits. In a sense, the Powder River Basin had become, for coal, what the Permian Basin is today is for U.S. oil and gas, if not more so."

Understanding Energy Economics

Energy economics can only be understood by bridging separate fields, Platt explained, be it geology and economics, exploration and engineering, and "with the advent and urgency of mobile and stationary energy storage, such disciplines as solidstate physics, electrochemistry and the outlook for the costs of battery materials and EV penetration."

Still profound is the continuing interplay of natural gas and coal in the commodity market, both on a nearly seasonal basis and,

The Committee report is available on the AAPG website. Go to the 'Divisions' tab at the top of the page, and the EMD button is the second of the four listed there, then find the 'Committees' tab on the right side under 'Navigation.' Then click 'Energy Economics and Technology Committee' at the center of the page, then find the 'Activity & Reports' tab, under the Committee's reports can be found, the most recent being "Energy Economics and Technology Report: Energy and Inflation." Some of the key information in the report is as follows:

The Bureau of Labor Statistics is the arbiter of all facets of U.S. inflation. Broad inflation in 2022 as measured by the Consumers Price Index (CPI) reached 9.1 percent, the highest since the 1970s when the CPI hit 12.3 percent and 14.8 percent. Energy accounted for 33 percent of the growth in inflation by mid-2022 over the previous year. BLS' tracks of the raw components of energy are shown in this chart. The lion's share of energy's

within the past decade, in response to gas' superior economics.

The Committee has been a major force behind many important events, exploring emerging opportunities and controversies as they buffet the industry.

The Committee was a principal organizer of AAPG's 2012 Geosciences Technology Workshop in Golden, Colo., on "Hydraulic Fracturing - New Controversies, New Plays." It organized the panel, "Energy Transition: Oil and Gas in the Crosshairs," at the 2021 International Meeting for Applied Geoscience and Energy, bringing perspectives from Wall Street finance, the auto industry and the power sector.

And it was with great anticipation that it organized a workshop and field trip to examine the special markets of natural gas liquids, centered on the pre-eminent storage and price-setting hub just 30 miles east of downtown Houston, Mont Belvieu - only to be scuttled by the pandemic.

As these few examples attest, energy economics and technologies are constantly changing, and it should not be surprising that the purview of the Committee remains at or near the top choice in surveys of AAPG members. This situation is ironic since, like many volunteer organizations, the Committee has always had difficulty engaging members to conduct the actual work, thus relying on

contribution usually gasoline, Natural gas was important both last summer and into the winter, whereas electricity's share has shown little volatility, climbing steadily. Other BLS data compiled in the report quantify the relative importance of each of these components to the national CPI

The Committee addressed the principal questions about the energy transition toward decarbonization in its 2022 report. Drawing on current research and interviews, it summed up the key factors directly affecting the oil and gas industry in this fashion. Oil's fate is largely caught up in vehicle electrification and other means to reduce fossil fuel use. The power sector will struggle to run away from natural gas, which it has embraced as a game-changer over coal. Hydrogen gets much attention and might draw heavily on natural gas whose fate is caught up in what is portrayed as a horserace between methods of "reforming" natural gas or resorting to brute force electrolysis.

aforementioned experts from outside the geoscientific community, Platt said.

"The door is always open," he emphasized. "One of the most rewarding collaborations was when our Dieter Beike, a petroleum engineer with a rich industry background, jumped on board and soon became co-chair."

The Committee's "bread and butter" remains its annual reviews, he said. Beginning about 2000, and ending with its 2018 contribution, these were periodically co-published in the journal Natural Resources Research

Other major contributions from the Committee include 2022's review: "Transition Framework and Questions."

"That deep dive on the energy transition, as noted, was issued in November 2022. The review followed a very similar outline to one presented at the AAPG September 2021 annual meeting, when AAPG partnered with the Society of Exploration Geophysicists under the entity called 'IMAGE," Platt said. "That in turn was based on interviews and research throughout 2021, so that by November 2022 we had been pursuing this topic of the energy transition for over a year and a half and had exhausted all the lowhanging fruit and ourselves (and myself)."

"Another year has gone by, but I haven't seen anything to dislodge or replace the insights included in that major review," Platt added.

In the Market for Experts

The Committee's main goal, he said, is to "stay on top of a bucking bronco and remain relevant, continuing to advance understanding of complicated markets and other developments, and organize occasional topical sessions and other events."

"To do this, it will be important to find co-workers and successors to keep up the work." Platt reiterated. "Those who have the connections, or can make and sustain them, to experts across industry and the consulting community will be a great asset. With such individuals, the Committee will continue to serve as a forum for learning, doing the legwork for those who don't have the time or position to do this all themselves but appreciate the destination. The notion of symbiosis is at the heart of this, namely providing forums shaped by individuals' professional needs, where they

New Kitchen, Many Chefs, Missing Ingredients

Oil / Transportation

An EV story -- a mix of tech, regulatory-push and demand-pull Down the road? Fuel cells, Biofuels, Alternate mobility – at scale?

NG –

What to watch? Batteries and other approaches to range anxiety.

Nat. Gas / Power Gen.

A messy story

Tried and true: Fuel switching (NG for coal) and Renewables

A cauldron of approaches: H₂ blending,

low-C fuels, 4th Gen. (new) nuclear, Allam Cycle, transmission What to watch? Carbon capture, long(er) duration storage, H_2

Continued from previous page

can shape AAPG to serve their own evolving geoscientific/economic interests. Only then does AAPG remain a relevant priority in their lives," Platt said.

Predictions

What does the future hold for energy markets and technology?

"A short answer is 'more of the same, but different," answered Platt. "This means understanding the scale and extent of possible changes in transition, serving vital needs to bring perspective on such changes which are often nearly unrestrained fantasies produced by well-intentioned scenarios

quantified by vast computer models and data collections."

More specifically, Platt said that "hydrogen realities will need more attention. Autothermal reforming, the Allam Cycle in power generation, the promise and constraints on renewables, the faltering steps toward carbon sequestration, all these will need to continue to be tracked. Will they rise above the forest floor and make a difference?'

Embedded in this is appreciating the oil and gas industry's remarkable technical proficiency and the role that the private sector has played in transformations, he said.

"This is not a statement of capitalistic political philosophy but the reality of what it takes to steer investment at scale. How will the tension and promise of 'demand

pull' be reconciled with 'regulatory push' in any serious grappling with climate change?" Platt explained, citing the shale revolution as illustrative of this tension.

Landscape of oil and gas

in the energy transition

"One certain conclusion is that Big Oil's negative reputation has done it no good in making the case that it is a vital part of the solution, and not the problem," he added. "This has led to efforts to nip off fossil fuels at the bud, on the easy-to-snip supply side, without giving serious attention to the demand. Time and again, when demand gets ahead of supply, fuel insecurity and intolerable price escalation will take primacy over all other considerations. Anticipating this, tracking how this plays out, sticking to objective facts and data, and steering clear of advocacy will be central to sound understanding going forward. Not an easy course."

CCUS

CCUS deployed more broadly and to have global penetration, because doing projects in Europe and the United States is way too insufficient," he said.

"Unless we get this to places like Indonesia, India and China, we're not going to do anything with the climate. We will be a bunch of people in the developed world patting ourselves on the back for doing fun little science projects. That's not what it's about," he said.

McConnell said international energy companies could be a part of the solution to global emissions reduction.

"International energy companies have that footprint all over the world. They operate everywhere, not just in Houston," he said. "And many of these industries have many of the necessary capabilities and competencies to address issues associated with CO₂ emissions."

Kendall agreed.

"Considering the skills, tools and infrastructure needed to develop CCUS projects, I can't imagine an industry that is better suited to advance CCUS, whether it be subsurface modeling and analysis, drilling and operating CO₂ injection wells, or the development of pipelines and surface facilities," he said.

Kendall looks forward to sharing Denbury's story at the CCUS event in Houston on March 11.

"We are at a fascinating crossroads. Ever-increasing global energy demand is intersecting with the need to reduce global CO₂ emissions. CCUS can mitigate billions of tons of CO₂ emissions annually, but we are still in the early innings," he said.

"Our industry is set to lead in CCUS, and I'm excited to share perspectives with the conference attendees."

For information about the CCUS event and to register visit: CCUSEvent.org. 🔳

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EXPLORER MARCH 2024

Geophysical Corner Working with Imbalanced Data in Machine Learning Algorithms

Bridging the gap between real and optimal in seismic interpretation

hile scientists and workforces are becoming more at ease with the term "machine learning" and less reluctant to use these methods, there are still many uncertainties about their correct use and output understanding. Therefore, there is a need to explain what might be happening in the so called "black boxes" and the potential causes for high errors and misclassifications. If not well understood, these issues can lead to incorrect interpretations and economic losses.

We would dare to say that 80 percent of any machine learning method, especially unsupervised, relies on input data preparation: the principle of "garbage in, garbage out" applies. So, it needs to be understood not only what kind of data it is, but how it can be optimized. The amount of data, their relationships and quality are just a few aspects to consider in order to do this. The first aspect is in focus here, since disparities in data (imbalance) can result in significant errors.

The term "imbalance" in data refers to the differences in proportions between classes. In this sense, the class that has the majority of records or instances will be called "negative class," and the underrepresented or minority class will be named "positive class."

Most of the geological settings we are used to studying are indeed imbalanced. Imagine a deepwater setting in which channel complexes are usually surrounded by shales in a major proportion, or as another example, a setting in which salt tectonics dominate and salt bodies will represent that negative class. Since a perfect dataset would only exist in a utopian world, we need to understand our data and how to optimize results without biasing or overfitting our models.

To understand the impact of the class imbalance we need to first understand the degree of imbalance between classes, and second, we need to understand the overlap between classes. The degree of imbalance (also known as IR) is obtained by relating the total number of negative class examples and the number of positive class examples. Figure 1 shows an example of how shale facies represent the majority of a training dataset (also known as MTD) used to predict deepwater channel facies. Here, five facies are used as labels. If we relate background "shale" to any of the other facies we would see that it doubles or triples them, creating an imbalanced dataset.

However, when we sum up all the channel facies and MTD, they will be almost proportional to the background shale, suggesting that we should simplify our labels.

The type of machine learning technique we intend to use should also be considered. Supervised methods count on error metrics given by the fact that input and output are known. However, in the case of unsupervised ML techniques, only the input is known, and the selection of the right number of clusters is still under debate. So, we will provide general guidance based on our experience on what to do with each type of method for seismic facies interpretation.

Unsupervised Methods and Imbalanced Data

When using clustering algorithms, such as K-means clustering, self-organizing mapping (SOM) and generative topographic mapping (GTM), it is suggested to use seismic attributes suitable for the geological target. Analyze their statistical relationships and refine



Frequency Background shale 896803 Channel and 346343 Channel off-axis 163732 Channel margin 63473 MTD 157821

Figure 1. (a) Samples per facies histogram in a training dataset showing an imbalance between predominant shale facies and minority channel facies. (b) Feature relationship scatterplots showing that gray (shales) predominates and in some cases its range is wide, so it overlaps with other classes.

them if necessary, using a dimensionality reduction technique (for example, PCA, ICA, Shap values). Additionally, consider using a method such as an elbow plot to determine the optimal number of clusters. An elbow plot visualizes the relationship between the number of clusters and the explained variance, aiding in pinpointing where additional clusters yield diminishing returns in explaining the data's structure. An example is shown in figure 2, which depicts results and error using a ML technique (GTM) with three clusters where five

Gray cluster (shales) predominates and overlaps with other classes

were expected. Notice how error is reduced by using an optimal cluster number determined by an elbow plot. This suggests that, although

Continued on next page ►



Figure 2. The elbow plot indicates that the optimal number of clusters is three, and GTM results reveal MTDs in a light green geobody (GTM green), Shale in red geobody (Purple/blue in GTM), and channel facies combined in dark green geobody (orange in GTM). This demonstrates that not every cluster has to represent single facies. The elbow plot is a valuable tool for estimating the optimal number of clusters. The number of clusters may be related to the quality and resolution of the data and distinctive patterns found.

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KARELIA LA MARCA received a bachelor's degree in geological engineering from Universidad de Los Andes, Venezuela. Later, she earned a master's and

then a doctorate in geophysics from the University of Oklahoma. During her time at OU, she was a researcher for the Attribute Assisted Seismic Processing and Imaging Consortium with a primary focus on seismic attributes and machine learning techniques for deepwater seismic facies interpretation. La Marca currently works as an exploration geophysicist at BP. She also has previous experience as a geoscientist, having worked for Schlumberger, Murphy Oil, Tapstone Energy and Geophysical Insights. She is an active member of numerous professional associations, including the AAPG and the Society of Exploration Geophysicists. She has received many professional recognitions including securing first place at the geothermal competition awarded by the Department of Energy and the 2022 Oklahoma Geological Foundation graduate fellowship.

Continued from previous page

we intend to depict five facies, the data patterns end up forming three major clusters.

Interpreting these visually, we can see that one corresponds to the majoritarian shale facies, another represents the MTDs, and the third cluster represents the channel facies (axis, off-axis and margin) combined. It is important to remember that while we aim to identify all discrete facies, the properties of the seismic data (frequency, noise, resolution, etc.) and the type of seismic attributes used, as well as their parameterizations, play a fundamental role in the detailed or non-definition of different seismic facies.

Supervised Methods and Imbalanced Datasets

Supervised ML needs an input (labels, plus features) to train the model, allowing us to know the expected facies first and enabling numerical error estimation or performance evaluation.

Figure 2 displays a distribution of training data. By contrasting seismic attributes used as features, it becomes apparent that there is an overlap between shale and most of the channel facies. This overlap will result in misclassification of these facies with shale. One potential solution is to explore other features that create greater distinction between classes or to perform a resampling of the data.

Some of the methods we can employ to address imbalanced datasets include:

▶ The use of simple algorithms such as DBscan or K-means clustering with realistic labels or minimum classes: Another option



Heather Bedle is an assistant professor in the School of Geosciences at the University of Oklahoma. As principal investigator of the Attribute Assisted Seismic

Processing and Imaging Consortium, she is passionate about mentoring aspiring scientists and exploring the complex intersections of Earth, energy and environment. Holding a doctorate from Northwestern University, she leverages her industry and academic experiences to lead a prolific research group recognized for their interdisciplinary approach, seamlessly combining geoscience and data analytics to tackle complex scientific questions.

be considered as indicating a poor classifier. It's important to note that these methods are designed for binary problems and not multiclass scenarios, which are common in seismic facies. When dealing with multiclass scenarios, we may need to evaluate ROC or AUC per class, and it becomes sensitive to class skew, as the negative class would be a combination of N-1 classes.

Conclusions

To summarize the recommendations provided here, we have created an easyto-follow workflow (figure 3) that could be helpful for interpreters who are beginners in dealing with imbalanced data.

No dataset will ever be perfect, so very accurate models should arouse suspicion because they will probably reflect bias or overfitting problems. Also, not every imbalanced dataset will necessarily result in poor training data. As geoscientists, we need to use the tools such as seismic attributes and ML techniques intelligently, be aware of our data's limitations, apply best practices, including parameter optimization and, most importantly, recognize that in geology, nothing is perfect. Our understanding of the geological context and subsequent inferences still needs to be carried out. We believe that machines can't fully replace us, at least not yet. 🔳

(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.)

Permian from page 19

reservoirs. You may have it, and you may not," McMahon said.

And as always, results may vary. The Third Bone Spring sand in the Delaware Basin has been targeted for development but its Midland Basin equivalent, the Dean formation, doesn't draw as much attention, McMahon noted.

"The Dean might not be as good as the Third Bone Spring sand, which is the equivalent but might not have the same degree of prospectivity," he said. In development drilling, the Permian has seen the same shift to longer laterals as other unconventional areas. So-called "horseshoe laterals" extend from a well then make a 180-degree turn and double back, to create a parallel lateral.

to achieve the same proportion or balance. However, this method could introduce its own

potentially hinder learning.

set of problematic consequences, which can

> The use of correct statistical metrics:

understanding and evaluating classification

problems. It compares actual or original vs

predicted values. The main diagonal shows

where and to what extent misclassifications

occur. While accuracy is normally the metric

rare classes. This can make it challenging for

when evaluating imbalanced datasets. In such

cases, it is recommended to use the F score,

precision and recall. There is also a G score

that, instead of a harmonic mean, uses a

and area under the curve: ROC is used to

deometric mean.

which is a weighted harmonic mean between

Receiver operating characteristic curve

analyze classifier performance by comparing

the false positive rate on the x-axis versus the

true positive rate on the y-axis. The closer the

curve is to the upper-left corner, the better the

classifier is. By calculating AUC, we can obtain

a score for the classifier. A higher AUC score,

closer to 1, indicates a good classifier with a

top-left ROC curve. AUC lower than 0.5 can

evaluated in confusion matrices, it places

more weight on common classes than on

a classifier to perform well on rare classes

the samples that were classified correctly,

while the other fields help us understand

A confusion matrix is a popular tool for

"Operators have been experimenting with new development techniques. People are starting to drill U-shaped wells (in the Permian), with the idea that you get more lateral in the area you're drilling," McMahon said.

Investments and Acquisitions

While the Midland Basin has gotten most of the recent attention and

investment, operators continue to eye other prospect areas in the Permian, particularly in the less drilled and developed Delaware Basin.

The Delaware is typically defined as including all or parts of oving, Winkler, Ward, Reeves and Pecos counties in West Texas and Eddy and Lea counties in southeastern New Mexico, although parts of adjacent counties are sometimes included.

McMahon said his agency had created a comprehensive, color-coded chart of wells drilled in the Permian by year.

"You've got a lot more blank space in the Delaware (Basin). Even where it's been drilled, the density isn't as great," he said. In U.S. oil production, an obvious and maybe inevitable 2024 headline would read, "The Permian Basin Re-emerges -- Again." Because of the basin's status as an exploration and production hot spot, companies have found it hard to put together any meaningful Permian acreage position without buying another operator.

McMahon said he knows of one company from outside the United States that made a substantial effort to build a position in the basin, but ultimately was forced to give up. That bodes even more consolidation to come, with deeper pockets and deeper expertise driving future Permian Basin development.





Technical Presentations

THURSDAY MORNING, APRIL 11

Wildcattin' Ain't Dead Yet: The Next Wave of Prospecting on the Gulf Coast, USA

Co-chairs: Jon Rotzien and Laura Pommer, MAGNOLIA ROOM

- 8:00 Deborah Sacrey, INVITED Cindy A. Yeilding Honorary Lecture in Giant Discoveries: Geronimo Wilcox Exploration Project
- 8:25 Barry Rava, INVITED Houston Explorers Club Honorary Lecture: Subtle faults and future wildcats in the onshore Gulf Coast
- 8:50 Christopher Murley and Machelle Johnson, INVITED Peter J. Lellis Memorial Lecture in Petroleum Geology: Achieving growth in a "Brownfield": 7900' sand development in the Main Pass 41 Field
- 9:15 Robert Pascoe, INVITED Roger M. Slatt Memorial Lecture in Deepwater Stratigraphy: The deep Miocene potential of the outer west Louisiana Shelf: An underexplored play
- 10:15 Richard Sears, INVITED Cheryl Collarini Honorary Lecture in Exploration Economics and Risk: Exploration and wildcatting – risk in our business and what it really means
- 10:40 Chad Williams, David Lee, and Danny Williams: Technology triggered stranded assets, the new Wildcattin'
- 11:05 Selim Shaker: Exploring the missing blind zone in the Gulf of Mexico Shelf

Structure and Geomechanics of the Gulf Coast PECAN ROOM Co-chairs: Molly Turko and John Cannon

8:00 David Ferrill, Gary R. Walter, Kevin J. Smart, and Adam J. Cawood: Fault zone control on groundwater flow in the Glen Rose Formation within the Hidden Valley fault zone, Comal Co., TX

- 8:25 Kevin Smart and David Ferrill: Geomechanical modeling of injection-induced deformation in the Eagle Ford Formation: Importance of mechanical stratigraphy and stress state
- 8:50 Selim Shaker: Geomechanics and drilling challenges in deepwater salt thrust fields, case histories from GOM
- 10:15 Selim Shaker: Pore pressure prediction geology and assessment
 10:40 Adam Cawood, David Ferrill, and Kevin Smart: Mineralogy controls normal fault displacement and height in mechanically
- layered rocks at Hoover Point, central Texas 11:05 Roberto Wagner Alvarado, Scott Wilkins, Stephanie Cook, Robert Holman, Robin Pearson, Abbey Hale, Grant Loxton, Jonathan Woolley, Jennifer Roberts, Wei Zheng, and Vincenzo De Gennaro: Advanced geomechanical modeling of stimulation induced stress change for casing deformation analysis

Critical metals (and Lithium) exploration value chain ELM ROOM Co-chairs: Swapan Sahoo and Graham Spence

- 8:00 Eric Wolff: Introduction to exploration and mining of uranium in South Texas
- 8:25 Julie Bloxson: Understanding the lithium content trends in the Smackover Formation: Potential influencing factors in the Ark-La-Tex Region
- 8:50 Shailee Bhattacharya, Shikha Sharma, Michael C. Dix, Albert S. Wylie, and Tom Wagner: Potential lithium enrichment in pyrite from organic-rich shales
- 10:15 Christopher Smith, Timothy Smith, Patrick Gordon, and Michael Smith: Stratigraphic analysis of helium and other volatiles in legacy core samples; Lessons learned on exploration applications and how helium moves
- 10:40 Roxana Darvari, Jean-Philippe Nicot, Bridget R. Scanlon, J. Richard Kyle, and Brent A. Elliott: Lithium in oilfield waters in Texas and neighboring states

11:05 Alex Zumberge, Graham Spence, and Swapan Sahoo: The history and future of critical metals: Knowledge integration and future business direction

THURSDAY AFTERNOON, APRIL 11

Wildcattin' Ain't Dead Yet: The Next Wave of Prospecting on the Gulf Coast, USA

--SPECIAL DISCUSSION--

Co-chairs: Jon Rotzien and Laura Pommer, MAGNOLIA ROOM

1:00 - 2:15 Cindy Yielding and Susan Morrice: The wildcatter's mindset: Come on cats what will it take to bring out the "wild cat" is each of us?

Geology of the Gulf Coast (Part 1) Co-chairs: Tom Ewing, MAGNOLIA ROOM

- 3:15 Kelly Hattori and Robert G. Loucks: The Early Cretaceous Sligo shelf margin of East Texas: Facies and depositional settings
- 3:40 John Snedden, Chris M. Lowery, Timothy F. Lawton, and Tim Whiteaker: The End of the Cretaceous: Depositional paleogeographic reconstruction of the Gulf of Mexico and adjacent areas just prior to the Chicxulub impact
- 4:05 Peter Flaig, Katherine Garcia, Chris Denison, Thomas Demchuk, Jorge Spangenberg, Neil Campion, Sebastian Castletort, Lorena Moscardelli, and Nikhil Sharma: Evidence for the Paleocene– Eocene Thermal Maximum in outcrops, Bastrop Co., Central TX
- 4:30 Thomas Ewing: Tectonic setting and petroleum systems of the Seno Mexicano (South Texas and northeastern Mexico) - an initial synthesis

Geology and Exploration Opportunities of the East Texas Basin Co-chairs: Hunter Carr and Casey Clawson, PECAN ROOM

- Will Pollard: Educated development of conventional reservoirs 1:00 1:25 Qigi Wang, Robert H. Lander, Linda M. Bonnell, and Stephen E. Laubach: Modeled rock properties through time and implications for fracture attributes development in Travis Peak Formation Sandstone, East Texas
- Pukar Mainali, Casey Clawson, Nikechi Odumodu, and Santhosh 1:50 Narashimhan, Ben Chen, and Simon Hughes: Geochemistry and geomechanics to improve selection of horizontal landing zones-A case study in the Haynesville
- 2:15 Amanda Calle, Fritz Palacios, David L. Carr, Raymond L. Eastwood, Shuvajit Bhattacharya, and Tim McMahon: Basin-wide Haynesville-Bossier lithofacies distribution, north-central Gulf of Mexico Basin
- 3:15 William Ambrose: The shelf-to-lower-shoreface transition in the Upper Midway Group in southeast Texas
- 3:40 Jeffrey Bridges and Julie Bloxson: Stratigraphic analysis of the Buda Limestone with implications on hydrocarbon production constraints: Madison and Houston Counties, TX
- Richard Denne, Joshua Davidson, Marissa English, and Samantha 4:05 Patterson: The Lower Cenomanian Maness Shale of East Texas: Depositional patterns and hydrocarbon source potential
- Robert Loucks, Kelly D. Hattori and Colton S. Spears: 4:30 Stratigraphic and lithofacies framework of the Lower Cretaceous Pettet Formation (Wright Mountain Field) on northeastern flank of the East Texas Basin

Environmental and Geotechnical Technologies and Advancements Chair: Jack Sackrider and Bryan Freymuth, ELM ROOM

- 1:00 Mustafa Saribudak: Adding value to client projects: A geophysical consultant's field guide
- 1:25 James Slone: TCEQ Edwards Aquifer Protection Program Geologic Assessment: Methods, expectations, and a smooth review
- Rebecca nunu, F. Paul Bertetti, Ronald T. Green, and Gordon 1:50 Wittmeyer: Application of a geochemical framework for water resources management in a semi-arid, karst landscape: San Solomon Springs, Texas, USA
- 2:15 John Sharp: Subsidence caused by hydrocarbon production in the Rose City and nearby fields, Southeast Texas

Geologic Carbon Storage on the Gulf Coast (BEG- Gulf Coast Carbon Center) Chair: Alex Bump, ELM ROOM

- Maria Paula Madariaga and Carlos A. Uroza: Assessment of the 3:15 Wilcox Group for CO2 storage potential, in an area onshore South Texas
- 3:40 Alex Bump: Pressure Space: The key subsurface commodity for CCS
- 4:05 Timothy Mcmahon, Shuvajit Bhattacharya, Qiqi Wang, and Katherine Yut: Potential for carbon sequestration in depleted Eagle Ford Shale Reservoirs
- 4:30 Jose Ubilius Alcivar: Laboratory experiments and modeling of the impact of small-scale heterogeneities on geologic carbon storage.

FRIDAY MORNING, APRIL 12

Eagleford and the Austin Chalk: Gifts that keep on giving! Co-chairs: Toti Larson and Eddie Valek, MAGNOLIA ROOM

- 8:00 David Tonner, Andreina Liborius, Carl Symcox, and Carolina Mayorga: Enhancing reservoir characterization and well Placement optimization using chemical elemental compositions: A Texas case study
- 8:25 Wahid Rahman: Geochemistry and petroleum systems analysis of the Eagle Ford Shale from South Texas to East Texas
- 8:50 Richard Denne: The Woodbine-Eagle Ford depositional system revisited: What is the Woodbine?
- Evan Sivil, Robert G. Loucks, Lucy Ko, and Toti Larson: A regional 9:15 examination of the East Texas influence on Eagle Ford Group deposition across Dewitt County

- 10:15 Jana Bachleda, Shuangyu Ge, Muqing Jin, Jiang Wu, and Faye Liu: Geochemical reservoir evaluation and DRV Analysis of Austin Chalk and Eagle Ford - case studies and DFH statistics
- John Cooper: The Eagle Ford outcrops of Cibolo Creek, 10:40 Northeastern San Antonio area
- 11:05 Sean Kimiagar: Eagleford: An activity and M&A update

Geology of the Gulf Coast (Part 2)

Co-chairs: Tom Ewing, PECAN ROOM

- 10:15 Robert G. Loucks, Robert M. Reed, and Privanka Periwal: Interpretation of the Upper Cretaceous Pilot Knob Volcano associated McKown Limestone; Shallow-water beach or gravity flow deposit?
- Robert Reed and Rieko Adriaens: Compositional variations 10:40 of tuffs of the Late Cretaceous Volcanic Play of the Balcones Igneous Province, Texas and their effect on volcanic-hosted reservoirs
- 11:05 Mustafa Saribudak: Near-surface geophysical mapping of Upper Cretaceous submarine tuff mounds of Williamson Creek and St Elmo within the BMP, Austin, Texas, USA

Emerging geothermal energy resources and technologies Chair: Joseph Batir, ELM ROOM

- Peace Eze and Alex Blizzard: Machine learning-based imputation 8:00 of bottom hole temperature for enhanced geothermal resource assessment in the US and Canada
- 8:25 Joseph Batir: Why the Gulf Coast will be the geothermal evolution capital of the world
- 8:50 Ken Wisian and Malcolm Ross: The potential of rural geothermal development - Presidio County Texas case study
- 9:15 J. Eric Stautberg and Stephen A. Sonnenberg: Geologic controls on the spatial and temporal distribution of sedimentary geothermal play types along the Texas Gulf Coast

ML and AI to accelerate Gulf Coast development Chair: David Thul and Shuvajit Bhattacharya, ELM ROOM

- Rabindra Chakraborty, Catherine Donohue, and Hani Elshahawi: 10:15 Intuition AI to estimate reservoir fluid properties in a more definitive way
- 10:40 William Hagan, Jeremiah Myers, Robert Foster: Ensuring wellbore quality and integrity in real time
- 11:05 Dallas B. Dunlap, Shuvajit Bhattacharya, Sergey Fomel, Xavier Janson, Jacob Covalt, and Zoltan Sylvester: The generation of benchmarked sub-surface datasets for improved AL and ML development.

FRIDAY AFTERNOON APRIL 12

New things to old fields in deep-water stratigraphic intervals Chair: Andrew Pepper, MAGNOLIA ROOM

- Anish Kumar, Adaobi Irogbele, and Elizabeth Ruiz: Modern 1:00 borehole images unravel non-stop impacts of mass-transport deposits on deepwater sands in the Gulf of Mexico
- 1:25 Mia Rudin, Wesley R. Brown, Robert B. Finkelman, and Ignacio Pujana: Magnetic particles extracted from a deep-sea manganese nodule: Preliminary Observations
- Cathrine Donohue, Alex Zumberge, and John Zumberge: Can we 1:50 teach old oils new tricks? Reanalyzing oil samples in Deepwater Gulf of Mexico
- 2:15 Selim Shaker: Subsurface formation pressure gradient vs. slope: Perception and pitfalls
- 3:15 Gabriel Gil: Reservoir identification with phase decomposition 3:40 Dan Jarvie: Major Cretaceous and Jurassic source rocks of East
- Texas, Gulf of Mexico, and Mexico 4:05 Andrew Pepper: Nawaz Bugti, Lara Heister, and Dan Jarvie: Much more to it than 'Tithonian': anatomy of the Jurassic-Cretaceous deepwater Gulf of Mexico source rock

Geology of the Gulf Coast (Part 3) Co-chairs: Tom Ewing, PECAN ROOM

- 1:00 Mustafa Saribudak: Inner structure of Pilot Knob submarine volcano in the BMZ (Austin, Texas) revealed by electrical resistivity tomography and magnetic surveys
- 1:25 Mark Thompson: Upper Cretaceous Bigfoot Erosional Unconformity: a tool to identify the exact position of the Mid-Maastrictian shoreline in South Central Texas
- 1:50 Paul Lawless and Ryan Weber: Upper Cretaceous erosional features and the K-Pg Boundary in the northern GOM subsurface of Louisiana and Mississippi
- 3:15 Jacob Margoshes and Michael L. Sweet: Rapid incision and filling of the Mississippi Canyon during the Late Pleistocene in the northern Gulf of Mexico
- Harold Rogers, III and William Ambrose: Revelations of the lower 3:40 and middle Frio Formation along the South Texas Coast
- 4:05 R. Larell Nielson, Taylor Carranza-Watson, and Andrew Henry: Comparative analysis of ripple marks in the Hickory Sandstone along Crabapple Creek, Gillespie County, Texas with ripple marks on the beach at Follett

Funding oil and gas ventures: Using your geo-logic to climb the charts Co-chairs Lee Billingsley and Michael Mazzella, ELM ROOM

- Bill Fairhurst: Strategic decisions for petroleum geologists 1:00
- Debrah Sacrey: Marketing geosciences skills to become a 1:25 successful consultant
- Lee Billingsley: Funding conventional oil and gas prospects: 1:50 potential sources and deal structure
- 3:15 Micheal Mazzella: The independent's playbook for joint ventures - from sourcing to signing on the dotted line for large onshore exploration projects
- Ryan Birkenfield: Prospect evaluation criteria for a large family 3:40 office
- 4:05 Donald Downey: Saratoga chalk update II: Bias in petroleum economic evaluation

THURSDAY / FRIDAY, APRIL 11 and 12

-POSTER SESSIONS-

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- David King and Richard Esposito: Review of some hydrogen emanations from semi-circular, shallow depressions of enigmatic origin at selected places in the world
- Yijie Zhu, Marie Mckechnie, Sophie Boulter, and Tianyu Chen: CO2 storage site screening for depleted fields in Texas Gulf Coast - An integrated approach
- Vic Chevillon and Alf B. Hawkins: Basin analysis: Metals and petroleum exploration contrasts
- Randy Bissell: Texas' Llano Mesteño: Improving our
- understanding of the holocene evolution of the South Texas sand sheet
- Mariana Olariu, Lorena Moscardelli, Maria Antonieta Lorente, and Vann Smith: Low-amplitude, high-frequency climatically-driven sea-level changes in the Lower Wilcox
- Mikaela Garcia, Shuhab D. Khan, Nastassia Simon, and Ozzy Tirmizi: Quantifying erosion at Sargent beach, Texas using remote sensing
- Rubin Olivares, Pousali Pathak, Harshad V. Kulkarni, and Saugata Datta: Freshwater challenges at the Texas-Mexico Border implications of unmonitored private wells for human health
- Noah Klitus and J. M. Cannon: Somewhere between Texas and Mexico: Contextualizing the Laramide of Big Bend, Brewster County, Texas via structural restoration and forward modelling Corrinne Kotara and J.K. Haschenburger: Terrace sediment
- volumes in the lower San Antonio River, Texas 10 Jack Butcher and Julie Bloxson: Geochemical insights into porosity and permeability controls of the San Andres Formation on the Central Basin Platform from Andrews and Gaines County, Texas, USA

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From Outcrops to the Champs-Elysées: Petroleum Exploration in the Paris Basin

The Paris Basin, the 'Island of France'

Seismic vibrators on the Champs-Elysées, downtown Paris, source Elf Aquitaine, Photo J. Chatin, 1986

he Paris Basin is one of the world's few basins that has been explored for petroleum for more than a century. Its exploration history is the second longest in France, after the Aquitaine basin. Despite modest 2P reserves of 345 million barrels of oil, 22 fields with reserves greater than 2 million barrels have been discovered and produced, thanks to the industry's sustained interest. It has a fascinating philosophy and strategy of exploration and its story traverses many well-known Paris locales and other settings famous for their tourist sites, cheeses (Brie, Coulommiers) and for Champagne.

The sediments of the Paris intracratonic, oval or "saucer-shaped" basin, start with units of the Carboniferous and Permian (the Sarre-Lorraine basin). They become younger from the Mesozoic outcrops at the edges to Tertiary/Pleistocene strata approximately at the level of the city of Paris, in the Île-de-France region (the Island of France). The maximum thickness of 9,800-11,500 feet is found in the depocenter in the Brie area.

Getting Started

The story began with a well drilled in the 1920s in Normandy (on the western side of the basin) on a surface anticline along the deeply rooted Bray regional fault. It had no real positive indications of hydrocarbons. Then everything of interest happened in the post-WWII period.

In 1951 the Bureau de Recherches Pétrolières, a state agency, contracted the French Petroleum Institute (IFP) for geological field studies and a complete gravimetric survey. The elements of the petroleum system, a concept established later in the 1980s by Alain Perrodon, Gerard Demaison, Leslie Magoon and Wallace Dow, were anticipated by this field work. Bernard Duval, an engineer by training, was involved during the summer of 1956 as an intern in a field study conducted by Compagnie Française des Pétroles, now TotalEnergies. He and a team of three geologists studied outcrops all around the basin margins under party chief Jean-Marc Aymé. The work consisted of establishing a finely tuned stratigraphy (a practice new to Duval) and rock sampling for laboratory analysis, mostly from quarries. His effort focused on the Dogger carbonates and the



France geological map, source Bureau de Recherches Géologiques et Minières (after BRGM)

Liassic organic-rich formations including the "Schistes Carton," which was visible, for example, in the fresh trenches of a freeway under construction at the time. It was a thankless, tedious job indeed.

elfaquitaine

Seeing him work passionately during a field visit, the chief of the Basin Studies Department, Jacques Dupouy-Camet, who was to become the exploration vice-president of the company, said to him, "My young friend, if you can withstand and even enjoy so much what you are doing here, so different from the grandiose and eventful geology of your Alpine training ground, you will surely become a petroleum geologist for many years to come!"

The VP got it right.

Interpretation of the field studies and a gravimetric survey suggested that Jurassic reservoirs that were Dogger, Hettangian and Rhaetian in age, and a good Liassic source rock could be expected in the 11,500-foot-thick sedimentary series resting on the Paleozoic.

In the euphoric period of its Saint-Marcet probe in the Aquitaine Basin (see Historical Highlights, May 2022), Régie Autonome des Pétroles was granted the 7,300-squaremile Chalons-sur-Marne permit. Société Nationale des Pétroles d'Aquitaine, which had just discovered the Upper Lacq oil field, was chosen for the Lorraine permit in the easternmost area.

RAP conducted seismic surveys and drilled a stratigraphic test well in 1953. They drilled Courgivaux-1 on a supposed gravimetric and seismic anomaly with oil shows in tight series of Bajocian and Rhaetian ages. Some geologists familiar with the Paris Basin would recall that this well exhibited an extended summary of its petroleum plays. RAP came back to the

Continued from previous page

Bray area in 1954, recognizing the 1000-foot downdip location of the 1920s well, and Paysde-Bray-101 found oil in a lenticular Jurassic reservoir. It produced only for a couple of months.

Late '50s: First Wave of Discoveries

Fresh licenses were granted to newcomers, including Petrorep, southeast of Paris, and CFP and FROPEX-CEP in the southern part of the basin. SNPA decided to concentrate its efforts on the Triassic series. They found oil shows in Muschelkalk carbonate formations (Forcelles-1) and finally decided to partly relinquish their Lorraine permits in the eastern part of the basin.

This was a time for disappointments, but there was still a hint of optimism. Poor exploration results led the companies to calibrate near-surface seismic-velocity variations by using up-hole travel times from nearby shallow core holes. This enabled them to map structure more accurately by removing the effects of shallow low-velocity horizons.

This pragmatic approach became successful with modest discoveries in three plays. Dogger carbonates yielded field discoveries at Coulommes, 1958 (16 million barrels of oil); Chailly-en-Bière, 1958 (10 million); Villemer, 1959 (5 million), Brie-Chartrettes, 1959 (4 million) in the vicinity of Chailly; and other fields (less than 2 million). Saint-Martin-de-Bossenay (11 million barrels of oil) was discovered in 1959 and took off again in 2007 with horizontal wells and production of 1,000 barrels of oil per day.

Rhaetian siliciclastics hosted the Grandville field (5 million barrels of oil), discovered in 1958. Neocomian siliciclastics produced a surprise of reservoirs that were absent in outcrop. Château-Renard (1958) found wet Dogger carbonates but discovered unexpected shallow, oil-bearing Neocomian reservoirs in a pinchout play (7 million barrels of oil; 30 million including satellite fields).

A widely spaced seismic grid was completed in 1958 in the basin. However, the presence of seismic multiples, mandatory surface corrections and lateral velocity variations remained huge technical challenges. Defining prospects with subtle vertical closures of a few tens of meters (at best) was a recurrent problem.



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Paris Basin regional geological cross section, source A. Perrodon, J. Zabek, Elf Aquitaine, AAPG Memoir 51, 1990

A Depth Record and a Second Wave

A two-decade period followed with no great success. Several drilling campaigns were completed, all leading to negative results except for one well whose deepening led to a small gas flow in Triassic sandstones (Trois-Fontaines).

Château-Renard field was put on stream then with look-alike satellites but efforts to find Neocomian pinchout reservoir analogs were all negative. Château-Renard remained unique.

In the Lorraine blocks in the eastern part of the basin, SNPA reinterpreted its acreage and drilled dry holes, among them Gironville-101 that was completed in the Carboniferous at 18,645 feet. That well has held the Paris Basin depth record since 1964.

In the early 1970s more fresh licenses were granted to newcomers, among them Esso REP which was trying to diversify exploration from its rewarding Aquitaine position. Potential targets were identified, particularly at Triassic levels.

The seismic problems, however, were still evident, and many failures were due to adverse surface conditions and very poor static corrections. For example, Esso REP drilled 20 dry wells on their Brie permit. A database covering static corrections was

implemented by CGG to help solve those problems step-by-step.

Eurafrep applied for an area Elf-Esso had relinquished and discovered the Trois-Fontaines commercial gas field in 1982 in the Lower Triassic sandstones, 20 years after the Trois-Fontaines 101's small gas flow. Triton applied in the late 1970s for a license covering the Montmirail wells that had been drilled in the 1950s with oil shows. Herbert Brewer. Triton's senior vice president for Europe (and a former Esso REP chief geophysicist) used the recipe: go updip for a seal.

After several attempts at producing existing wells, Triton chose an updip location jointly with Total-CFP. The sequence of events from 1981 to 1986 leading to the discovery and appraisal-exploitation of the Villeperdue field illustrates the remarkable case of an unexpected Dodger stratigraphic trap containing 53 million barrels of 2P reserves. (See Chapter 15 of AAPG Memoir 54.)

A Vibroseis program concluded in mapping a transverse-faulted four-way closure of 4 square miles in area. VPU-1 was drilled in 1982 and completed in a Dogger reservoir for 430 barrels of oil per day. The appraisal drilling program showed by the end of 1983 that any significant four-way dip structure seemed to disappear. This left

room for progressive reinterpretations to a westward plunging nose, determined from both well data and velocity corrections. Ultimately, an updip permeability barrier was inferred from additional wells drilled in the east and southeast parts of the field in 1986, as well as trapping enhancement by artesian hydrodynamic flow.

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The flip side of geophysical difficulties like substantial velocity changes over short distances on gentle, low-relief structures is that there is always room for improvement, as well as for considerable tolerance in structural interpretation. Stratigraphic traps have been, and still are, often found fortuitously.

The Basin's 'Giant'

During the late 1970s, several companies increased investment in the Paris Basin, taking advantage of methodological improvements in seismic acquisition and processing, petroleum systems with Rock Eval to identify source intervals (pioneered by J. Espitalié), and modelling software developed by IFP. In 1981 Esso REP found Donnemarie, a modest oil field in the Brie

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Far left: Paris Basin stratigraphic and petroleum chart, source Géologie du Pétrole, J.J. Biteau, F. Baudin, Dunod, 2017. Middle: Villeperdue, Exploration to Appraisals 1083-1986. From a closure to a nose helped by facies variations and hydrodynamic flow Source B Duval, P Arbin, Total, AAPG Stavanger International Conference and Exhibiton. Above: Chaunoy discovery, "Dallas near Paris" (Newspaper clipping from 1983, the height of popularity for the American TV show "Dallas," Vermilion LinkedIn post, 2023)

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processing provided by Exxon's worldwide

Chaunoy is the basin's largest field at

90 million barrels of 2P reserves. The size

of the structure compensates largely for

from this discovery is that, once again in

the profession, the alliance of technology,

moving forward all the time, together with

Serge Matesco, who oversaw Total's

failures, may well pay off in the end.

petroleum rights in France, said that a

euphoric frenzy took hold of the industry

in the early 1980s. It was triggered by the

large discoveries and the hope for a fruitful

perseverance despite numerous discouraging

the 200-foot oil column. A great lesson

Paris Basin, petroleum fields location map, source Géologie du Pétrole, J.J. Biteau, F. Baudin, Dunod, 2017

experts.

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region, in fluvial to deltaic, near-lake Keuper sandstones, sealed by intraformational shales of the same age. This drew attention to these reservoirs that had produced oil since 1967 in Chailly.

In 1983, Esso REP discovered Chaunoy Field on a northeast-southwest elongated anticline that is 9-miles long by 3-miles wide, with oil pay at the crest of the faultrelated structure. This fault is difficult to identify on seismic, which might partly explain why the prospect was missed by the previous seismic grid that was spaced too widely. The anticline could be mapped accurately thanks to advanced new statics



Carte Structurale du Chaunoy -

Chaunoy Oil Field top reservoir isobath (structure) map, source Vermilion REP

marriage of advanced technology and new ideas. This led companies to quickly acquire dozens of permits. Fifty companies were present in 1987, including CFP Total which had an interest in 40 permits. The work commitments reached unacceptable levels and a lot of seismic and several wells followed with poor rewards. The craze for French petroleum acreage disappeared, paving the way for newcomers, mostly independents from the UK, who carried out parts of the ongoing programs.

As the excitement decreased, some companies persisted with modest but rewarding drilling success. Elf Aquitaine discovered Itteville Field, the last significant new field, in 1990. Its 2P reserves of 25 million barrels are reservoired in a Dogger stratigraphic trap, like Villeperdue. The main 2000s event was the significant increase of Champotran production and reserves (25 million barrels?) with contributions from southern extensions and a nearby eastern structure.

Seismic on the Champs-Elysées and Wells in Paris and Versailles

During the Late 1980s, Elf Aquitaine, Total and BP jointly applied for the large "Ile de France" permit covering the City of Paris and its suburbs, the only unexplored area. CGG completed a spectacular Vibroseis acquisition

Continued on next page ►



Right: Paris Basin Geopetroleum play section from Esso REP

Below: Ivry 101 drilling site, deviated well in Paris suburbs, source Elf Aquitaine, Photo A. Huneau, 1988

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Continued from previous page

program in downtown Paris in 1986. Ivry-101D was drilled deviated to reach a prospect right below urban buildings and produced Parisian oil for four years. Finally, in 1994 a delineation well was drilled at Itteville in the vicinity of the Versailles-Chevreloup arboretum using light equipment to reduce surface impact. It was dry.

The majors began to withdraw. ExxonMobil and Total-Elf Aquitaine sold their permits/concessions to Coparex (then Lundin, later International Petroleum), Geopetrol and Vermilion. These remaining operators as well as SPPE and Petrorep recorded successful exploration results nearby including Champotran-La Torche (Vermilion), La Motte-Noire Rhaetian and Merisiers Dogger (Coparex).

In the late 2000s Toreador and others began exploration for Liassic source-rock hydrocarbons with little success. The potential for unconventional hydrocarbons has been defined in the Liassic kitchen (Brie-Champagne) by geochemical data and the thermal history, but no resource estimate should be relied upon until pilot tests are carried out, which is so far unattainable due to the French ban on hydraulic fracturing operations.

Permian oil shales that were mined in the past in the small Autun half-graben in east-central France may also become unconventional oil and gas targets if there prove to be similar pre-Mesozoic grabens below the Paris Basin. However, France's political attitude towards shale oil and gas seems to be: "Non!"

A Last Wink at the Petroleum System(s)

The Paris Basin's 345-million-barrel 2P reserves are reservoired in 65 fields, of which 22 have reserves greater than 2 million barrels of oil. Only eight are greate than 10 million, and two are larger than 50 million. The top five are Chaunoy (90 million), Villeperdue (53 million), Château-Renard and satellites (30 million), Itteville (26 million), Champotran (25 million). The unique Trois Fontaines gas field has reserves of about 35 billion cubic feet. The Paris Basin's end-2022 total cumulative production is about 330 million barrels of oil. Current oil production is about 7,800 barrels of oil per day and declining. A considerable proportion of the traps (30 percent of the total reserves) have stratigraphic and

hydrodynamic components (Villeperdue, Itteville, Château-Renard and satellites).

du Pétrole

The three main reservoir-seal pairs (plays) include the Dogger/Oxfordian play, Callovian-Bathonian oolitic and bioclastic limestones with a complex facies distribution and diagenetic effects (cementation and fracturing). The main producing level at the top of the Callovian Dalle Nacrée formation is sealed by Callovian-Oxfordian marls.

The Rhaetian/Upper Rhaetian and Base Lias consists of **r**egionally extensive fluvio-deltaic sandstones with fair to poor petrophysical characteristics. Lias and Rhaetian shales are the corresponding seals.

The Intra-Keuper Formations/intermediate seals play includes heterogeneous and discontinuous fluvial sandstones with good reservoir characteristics diagenetically modified by dolomitic cements. The Donnemarie, Chaunoy, Vert-Le-Grand, Chalain and Boissy formations are sealed by intraformational shales.

The main proven source rock corresponds to the clay-marly levels of the Lias subdivided into three organo-types: Toarcian, Pliensbachian-Lotharingian and Sinemurian-Hettangian. Located between the Dogger and



Jean-Jacques Biteau graduated from Ecole Nationale Supérieure de Géologie (ENSG Nancy) as a geologist engineer in 1977. He worked for Elf Aquitaine then Total (now TotalEnergies) at

various exploration positions between 1979 and 2019. Biteau was Total's exploration vice president from 2009 to 2015. Now retired, he serves as associate professor at TotalEnergies Professeurs Associés.

Bernard Duval

graduated in 1954 as an engineer from École Polytechnique and as a petroleum geoscientist from École Nationale Supérieure du Pétrole et des Moteurs (ENSPM, now IFP

School). He received a degree in geology from Grenoble University in 1956. Duval worked for CFP (TotalEnergies) at various positions between 1958 and 1995 and was Total's senior vice president of exploration from 1985 to 1995. He is now associate professor at the IFP School and at TotalEnergies Professeurs Associés. Keuper petroleum reservoirs, this is a very efficient hydrocarbon sandwich.

The source rock kitchen extends into the depocenter of the Brie area. Carboniferous layers are marginal sources in the Trois-Fontaines Muschelkalk gas field (where Storengy is the current operator) and the Forcelles Lettenkohle oil field (Replor, current operator).

The impact of the work done on the Toarcian, the historical reference for type-2 source rocks, has gone far beyond its geographical limits (although such detail is not well known even within our profession). It was studied intensely by Bernard Tissot, a mining engineer and longtime researcher at the IFP, a member of the French Academy of Sciences and an internationally recognized expert geochemist. This source rock served as the model for his pioneering work on the genesis of hydrocarbons through thermal degradation of organic matter, the characterization of kerogens and the kinetics of generation and migration. Last but not least, it played a key role in the development of Rock Eval, the well-known tool used worldwide by generations of petroleum geoscientists.



Jean Laherrere graduated in 1953 as an engineer from École Polytechnique and as a petroleum geoscientist from École Nationale Supérieure du

Pétrole et des Moteurs. He received a degree in geology from Grenoble University in 1954. Laherrere served at CFP in various exploration positions between 1954 and 1991. He was the coauthor with Colin Cambell of "The End of the Cheap Oil," published in 1998. He is the founder of ASPO France, the Association for the Study of Peak Oil and Gas.



Jean-Marie Masset graduated from ENSG Nancy as a geologist engineer in 1971. He worked for Elf Aquitaine, then Total, at various exploration positions between 1976 and

2009. He was appointed Total E&Ps senior vice president of geoscience-exploration-reservoir from 2000 to 2008. Masset is now retired.

Exploration Philosophy and Key Messages

Although a modest petroleum basin by world standards, the Paris Basin offers contrasting periods of discoveries and failures. It provides a rich spectrum of messages for explorers that reaches well beyond the expected regional interest. Major companies made most of the discoveries, but smaller independents like Petrorep and Vermilion, a Canadian company, are still active today.

Numerous dry wells drilled throughout the exploration programs bear witness to the necessity of persistent effort by the petroleum industry. This was encouraged, of course, by the need to relieve, even modestly, the level of French dependance on foreign sources of oil.

This reliance on domestic drilling success led the French industry to go through two main cycles of discoveries separated by a 20-year period of discouraging drilling endeavors. Only during the second cycle in the 1980s were two "Parisian giants" found. Their true size, at least for one of them, became apparent through an appraisal program and (to be frank) thanks significantly to serendipity.

Most of the structures have low relief. Combined with the complex problems of seismic statics due to the irregular thickness of a shallow chalk formation, this has impaired exploration. However, a message here is that such uncertainty

leaves room for optimism when looking at this kind of play, thinking of the glass as half full rather than half empty. Technology played its role and seismic

has improved through time, for instance by using more powerful sources, more traces and a huge statics correction database. Evaluating this type of play in various mature areas of the world might provide strategic avenues at a time when the lack of prospective targets is becoming increasingly obvious.

(Historical Highlights is an EXPLORER series that focuses on the history of petroleum exploration and production. Topics broadly related to our work in the geosciences, the critical advances of science and technology, the key discoveries and the saints and sinners among our colleagues are all welcome. Narratives that illuminate the E&P process or its context in geopolitics and energy economics are encouraged. If you have such a story or know someone who does, please contact Matt Silverman, the series editor, at silverman_matthew@yahoo.com.)



Oil production statistics of the Paris Basin, sources Bureau Exploration-Production des Hydrocarbures and Comité Professionnel



The officer candidate slate for the 2023-25 AAPG Executive Committee, which has expanded to include a petition candidate, is now final and will be open to member voting in late March. Petition candidates, as defined by AAPG bylaws, were accepted through the end of January. The petition candidate will join the six candidates previously brought forth by the Executive Committee.

Candidates for AAPG office have been given the opportunity to respond briefly to the subject: "Why I Accepted the Invitation to be a Candidate for an AAPG Office." Their responses and biographical information were edited only for grammar, spelling and format.

This information will be available online and included in the March Explorer through the election period. Online balloting will begin

March 28 and end on May 15 at midnight CDT.

As in past years, voting will be handled and maintained by Survey & Ballot Systems. All voting will be online, although paper ballots will be mailed to members without an email address, or by special request.

PRESIDENT-ELECT (TERM: 2024-25) PRESIDENT (TERM: 2025-26)

JEFFREY B. ALDRICH

Region)

Committee

House of Delegates

Principal Geoscientist Sproule Denver

and Coalbed Methane committees

2008-09 - EMD Council (Africa Region)

2006-09 - ICE Organizing Committee

Delegates (Africa Region)

2000-05 - Mentor Committee

Section), House of Delegates

Website 2000) Committee

AAPG Honors and Awards

2018- Honorary Membership

2018 - DPA Best Paper Award

2016 - EMD Certificate of Merit 2008 - AAPG Certificate of Merit

2002 - Distinguished Service Award

Selected Publications and Presentations

2009 - "Seismic Interpretation Distribution and

on Block 2 of the Orange Basin Offshore South

Africa," 11th SAGA Biennia Technical Meeting

2000 – "A Win-Win Commercialization of Marginal

Fields in Indonesia by Pertamina, Migas, and YPF-

Maxus Energy," International Oil and Gas Ventures:

Java Sea, Indonesia," I.P.A. Proceeding of the 26th

A Business Perspective, AAPG (co-author)

Annual Convention (co-author)

Petroleum Society (co-author)

1998 - "Petroleum Systems of the Asri Basin,

1995 - "Paleogene Basin Architecture of the

Sunda and Asri Basins and Associated Non-

of the International Symposium on Sequence

Stratigraphy in S.E. Asia, Jakarta (co-author)

Exploration Well, Tikaboo Valley, Nevada: Proof

of Thrust Tectonics," Annual Field Guide, Nevada

1979 - "Hydrothermal Alteration of Remnant Arc

the IPOD-DSDP Leg 59, vol. 59 (co-author)

Basalts: DSDP Site 448, Leg 59," Initial Reports of

1992 - "The Stratigraphy of the Hi-Lo #1

Marine Sequence Stratigraphy," I.P.A. Proceeding

Numerical Modeling of Natural Gas Leakage

A selected list of peer-reviewed titles.

2000 - AAPG Certificate of Merit

1991- AAPG Certificate of Merit

2009 (co-author)

Delegates

2004-07 - Delegate (Alternate), House of

1990-93 - Delegate (alternate, Southwest

1990-91 – Twenty-First Century Committee

1989-96 - International Regions Committee

1989-1991 - Geological Computing (merge/

1987-90 - Delegate, Gulf Coast Section, House of

2011-14 - DEG Advisory Board (Asia Pacific

2010-11 - Delegate (alternate, European Region),

2009-11 - EMD Oil Shale, Shale Gas and Liquids,

2008 - Co-Chair, ICE, Cape Town, South Africa

1999-2001 - Vice Chair, Membership Committee

1992-93 – Headquarters Management Committee

2008-16 - EMD Energy Economics and Technology

Academic Degrees

1983 - M.S., Geology, Texas A&M University, College Station, Texas

1977 - B.S., Geology, Vanderbilt University, Nashville, Tenn. Certifications - Texas Board of Professional

Geoscientists; Louisiana Board of Professional Geoscientists: Association of Professional Engineers and Geoscientists of Alberta

Experience

2023-Present - Principal Geoscientist, Sproule, Denver

2019-23 - Senior Geoscientist, Sproule, Denver 2013-19 - Partner, Vice President, MHA Petorleum Consultants, Denver

2012-13 - Portfolio Manager, Dart Energy, Singapore

2011-12 - Head of Exploration, Dart Energy, Singapore

2008-11 - Executive Vice President, Greenpark Energy, Chesterfield, U.K.

2005-08 - Chief Geologist, PetroSA, Cape Town, South Africa

2004-05 - President, Energy Resource Advisors, Denver

1998-2004 - Chief Geologist, Forest Oil

International, Denver and Houston 1993-98 - Geoscientist, Maxus Energy, Jakarta, Indonesia

1990-93 - Geoscientist, Maxus Energy, Dallas 1979-90 - Geologist to Senior Geoscientist, Pennzoil E&P, Houston

AAPG Activities

Joined AAPG 1979 Certified Petroleum Geologist Honorary Member – AAPG Member DEG, DPA, EMD

2022-Present- Delegate, Rocky Mountain Section, House of Delegates

2021-23 - Chair, Datapages Board

2020-Present - Co-Chair, Committee on Resource Evaluation

2019-Present - Visiting Geoscientist SIG

2019-Present - Helium Resource Committee

2019-20 - Sustainable Development Committee

2019-20 - Student Expo Committee 2018-20 - AAPG Executive Committee, Vice

President-Sections

EC Liaison - Geophysical, Education, Research, Global Events, Resource Evaluation and Audit Review committees, and PROWESS SIG

2015-16 - AAPG Advisory Council

2015-16 - Vice Chair, ACE Organizing Committee 2015-19 - AAPG PROWESS International Concerns

Subcommittee

2014-17 - DEG Executive Committee (President, 2015-16)

2014-17- Professional Women in Earth Sciences (Honorary Member)

2014-15 - Vice Chair-EMD, ACE Organizing Committee

Why I Accepted the Invitation to be a Candidate for AAPG Office By JEFFREY B. ALDRICH

Being connected is a necessary human condition; being connected and being challenged is necessary for growth. Being connected, challenged and held accountable while at the same time finding ways to create

See ALDRICH page 5



Academic Degrees

Ph.D. - Geology and Geological Engineering/ Reservoir Engineering, Colorado School of Mines, Golden, Colo.

MSc - Geology, University of Colorado, Boulder, Colo. Bachelor of Applied Science - Geology,

University of Colorado, Boulder, Colo.

Experience

Leader/Technical Evaluation, Strategy, Portfolio Analysis, Hatteras Energy Group, Houston 2021-2023 - Head of Exploration, Cairn Oil and

2020-21 - Senior Geoscience Advisor, Cairn Oil

Geologist, ION E&P Advisors, Houston 2009-10 - Exploration Manager-GoM and North America New Ventures, Maersk Oil, Houston 1993-2009 - Senior Geologist-Exploration, Production and Reservoir Characterization, BP, Houston

Member EMD

2024 - Technical Co-Chair, IMAGE 2023-Present - Delegate, House of Delegates 2018-20 - Convener, HGS-PESGB Africa Conference 2011 - Co-Convener, 33rd GCSSEPM Research Conference 2007-18- AAPG Associate Editor

Why I Accepted the Invitation to be a Candidate for AAPG Office By BRIAN W. HORN

As a second-year college student playing soccer I took my first course in geology. That summer I had the great fortune to work as a geotech, where my friend (from the soccer team) worked as a geologist and helped me get the job. I began working in the Williston Basin and I learned how to interpret seismic, "slip" well logs and contour a map.

My mentor told me, "Brian, you can't just be a geologist in this business, you need to be an explorationist. You must develop your skills in geology, geophysics, petrophysics, reservoir engineering and commercial negotiation."

This counsel provided the basis for how I have pursued my education, professional career and my career path in the energy industry.

I joined AAPG as a Junior member when I was at university. I was excited to be part of a great organization that provided opportunities to learn, network and engage with the people whose names I saw in print from articles I had read. I often tell people, if someone would have given me a piece of paper and asked me to write out my career path, the people I have met, places I have been and friendships I have made, I never in a million years would have had the creativity to write the career path that I have experienced. I am fortunate to say my professional career has and continues to bless my life.

Given this context and all my great experiences as an AAPG member, I wanted to volunteer for a role **AAPG Honors and Awards**

2020- John W. Shelton Search and Discovery Award 2018- Jules Braunstein Memorial Award (ACE,

Salt Lake City) 2008- George C. Matson Memorial Award

Selected Publications and Presentations 2021- "Two Decades and Five Paradigm Shifts Gleaned from AAPG's Giant Fields Database," AAPG Memoir 125, Giant Fields of the Decade: 2010-2020 (co-author)

2020 - "Advances and Perspectives on Stratigraphic Trap Exploration - Making the Subtle Trap Obvious," Interpretation (co-author) 2018 - "Chronostratigraphy Across a Conjugate Margin Source-to-Sink: Uruguay and Namibia – Why Stop at Basement?" ACE Salt Lake City (co-author)

2015– "Access and Exploration Opportunities – A View of the Potential in Frontier and Mature Basins," First Break (January)

2014- "Rapid Outer Marginal Collapse of the Rift to Drift of Passive Margin Evolution, With a Gulf of Mexico Case Study," Basin Research 2015- "Hydrocarbon Potential of the Southern Deep Offshore Tanzania Basin Context of East Africa's Transform Margin," Tanzanian Petroleum Development Corporation, Fourth Annual Deep-Water License Round

Managing Director The Hatteras Energy Group Houston

Candidates were asked to limit their biographies to 350 words and responses to 500 words.

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in leadership and contribute to the organization that has supported my professional development. My "bottom-up" growth in the industry and value that AAPG has brought to my academic, professional and personal life is what motivates me to serve the membership as we chart a way forward in the

coming decades. Emotions and passion for the future of our organization run high, and many members are concerned about where AAPG will be in the future and what role it will play representing the energy industry in society. I believe leadership must make sound choices for our organization and seek to be inclusive and collaborative with all earth science disciplines and people. Geoscientists must be a leading voice in the discussions on energy, generate new ideas, and provide technically sound and science-based rationale for the future of AAPG and its role in the energy transition.

Listening and collaboration are critical aspects of leadership. It will be my goal to engage as many people and communities as possible to make our organization vibrant, sustainable, diverse and focused on future success.

We must continue to train and mentor new entrants into the industry and share the wisdom and knowledge of our outstanding AAPG members. Growth and innovation will be found in developing new concepts providing the message and platform to deliver our ideas and insight globally.

2023-Present - Managing Director/Exploration

Gas, Gurgaon, India

and Gas, Gurgaon, India 2010-20 – Senior Vice President/Chief

AAPG Activities Joined AAPG 1981

BRIAN W. HORN

VICE PRESIDENT-SECTIONS (TERM: 2024-26)

LORENA MOSCARDELLI Principal Investigator and Research Associate Professor State of Texas

Principal Investigator and Research Associate Professor State of Texas Advanced Resource Recovery (STARR) Program, Bureau of Economic Geology, Jackson School of Geosciences, Austin, Texas

Academic Degrees

2007 – Ph.D. Geological Sciences, the University of Texas at Austin 2000 – B.Sc., Geology, Universidad Central de Venezuela, Caracas

Experience

2021-Present - Principal Investigator and Research Associate Professor, State of Texas Advance Recovery Program, Bureau of Economic Geology (BEG), Jackson School of Geosciences, Austin, Texas 2013-21 - Principal Researcher Exploration, Statoil/Equinor (multiple assignments in research, exploration and field development in United States, Norway and Canada) 2007-13 - Research Associate/Lecturer; co-director and co-founder of the Quantitative Clastic Laboratory Consortium at BEG, Jackson School of Geosciences, Austin, Texas 2003-07 - Graduate Research Assistant, BEG, Jackson School of Geosciences, Austin, Texas 2001-03 - Exploration Geologist, Petroleos de Venezuela PDVSA, Caracas, Venezuela

AAPG Activities

Joined AAPG 1996 Member EMD

2013-Present – AAPG BULLETIN Associate Editor

2023 – Panel Chair, "Exploring the Hydrogen Rainbow: From Source to Market," Energy Opportunities 2023, Mexico City, Mexico 2022 – Theme Chair, "Exploring the Potential of Hydrogen Energy in Latin America and the Caribbean," Hydrogen Virtual Technical Symposium

2021-23- Distinguished Lecture Committee 2021 - Panel Chair, "Sustainability in Energy: The Role of the Energy Transition in Latin America and Caribbean Region;" also theme chair, "Energy, Society and Environment" and "Brazil Atlantic Margin E&P," ICE 2021, Cartagena, Colombia

2021- ICE 2021 Organizing Committee 2021- Panel Chair, "Potential for Carbon Use and Storage and Hydrogen Generation in Latin America and the Caribbean," Energy Opportunities 2021 (Virtual)



2019-22 – Astrogeology Committee 2019 – General Chair, AAPG Annual Convention and Exhibition (ACE), San Antonio 2017 – Theme Chair, Deepwater, ACE, Houston 2016-19 – Astrogeology Committee 2012-15 – Astrogeology Committee 2010 – ACE Session Chair, "Mass Movements and Their Consequences for Deepwater Exploration and Production," New Orleans 2006 – ACE Session Chair, "Recent Advances in Deepwater and Shelf Siliciclastic Facies Models: Implications for Reservoir Characterization, Houston

Selected Publications

Twenty-three published papers in scientific journals, including:

2024 - "Hydrogen Storage Potential of Salt Domes in the Gulf Coast of the United States," Journal of Energy Storage (co-author) 2024 - "Market-based Asset Valuation of Hydrogen Geological Storage," International Journal of Hydrogen Energy (co-author) 2023 - "Subsurface Storage in the Mississippi Salt Basin Domes: Considerations for the Emerging Hydrogen Economy," AAPG BULLETIN (co-author)

2023 – "The Role of Salt Tectonics in the Energy Transition: An Overview and Future Challenges," Tektonika (co-author)

2019 – "Mixed Siliciclastic-Carbonate Systems and Their Impact for the Development of Deepwater Turbidites in Continental Margins: A Case Study from the Late Jurassic to Early Cretaceous Shelburne Sub-Basin in Offshore Nova Scotia," AAPG BULLETIN (lead author) 2016 – "Morphometry of Mass-Transport Deposits as a Predictive Tool," GSA Bulletin (lead author)

2012 – "Shelf-Edge Deltas Along Structurally Complex Margins: A Case Study from Eastern Offshore Trinidad," AAPG BULLETIN (lead author) 2008 – "New Classification System for Mass

2008 – "New Classification System for Mass Transport Complexes in Offshore Trinidad," Basin Research (lead author) 2006 – "Mass Transport Complexes and

Associated Processes in the Offshore Area of Trinidad and Venezuela," AAPG BULLETIN (lead author)

Why I Accepted the Invitation to be a Candidate for AAPG Office By LORENA MOSCARDELLI

I joined AAPG in 1996 as an undergraduate student in Caracas, Venezuela. Since then, AAPG has played an important role as part of my professional development and networking activities.

I have served AAPG in different capacities – as general chair of the 2019 ACE meeting in San Antonio, as technical chair for sessions and themes on a multitude of conferences, as a member of various committees, and as reviewer for the AAPG BULLETIN. Over the years, AAPG engagement has allowed me to meet colleagues that have become good friends. I believe that AAPG has played, and will continue to play, and important role as an organization that enables growth of the geoscience profession.

I bring more than 20 years of experience, both in academia and industry, that I offer to put to the service of AAPG as vice president-Sections.

In my current role as Principal Investigator of the State of Texas Advanced Resource Recovery (STARR) program at the Bureau of Economic Geology (BEG), I have routinely supported the participation of our researchers in AAPG Section activities, including the most recent 2023 AAPG Southwest Section meeting. We plan to make contributions to the upcoming GeoGulf and to the Southwest Section meetings in 2024. I believe that organizations, in particular professional societies, are highly dependent on the commitment of their members to support and organize activities that allow us to lift professional standards and to make a difference "out there."

Despite the many challenges that AAPG is currently facing, AAPG Sections have kept activity levels and enthusiasm in high gear. These communities keep organizing high quality technical meetings and generating great content for publications and newsletters.

There is a reason for this: Business happens at a community level within the sections. Each of these technical meetings and conferences agglomerates individuals that are not only talking the talk but also walking the walk. In these events, deals and connections are made that allow us to keep our focus sharp – that is, to promote technology and exploration efforts for finding and producing energy resources in an economically and environmentally sound manner.



Academic Degrees

Experience

Houston

Bluware, Houston

Resources, Houston

Advisors, Houston

AAPG Activities

Joined AAPG 2017

Oklahoma, Norman, Okla.

2020 - M.S, Geophysics, University of

Geophysics, University of Houston

University of Oklahoma, Norman

Member, Energy Minerals Division

2024-Present - Co-Chair, DEI, IMAGE

2018 - B.S., Geology (Honors), with a minor in

2021-Present - Geophysical Data Scientist,

2020; 2019 - Geophysics Intern, Oxy, Houston

2019-20 - Graduate Research Assistant,

2018 - Associate Geoscientist, Bluware,

2017-18 - Geoscience GIS Analyst, CAP

2016 - Geoscience Intern, Dynamic Global

JULIAN CHENIN

Geophysical Data Scientist Bluware Houston

> 2024 - Member, Latin America & Caribbean Student and YP Leadership Summit Committee, Santa Marta, Colombia 2023-Present - Co-Chair, AAPG Sustainable **Development Committee** 2021-Present - Chairman, AAPG Global Young Professionals 2018-Present - Member, AAPG Sustainable **Development Committee** 2020-23 - Co-Host, AAPG Sustainable **Development Podcast** 2023- Member, Latin America & Caribbean Student and YP Leadership Summit Committee, Mexico City, Mexico 2022 - Session Chair, Science and Technology, **IMAGE 2022** 2020-21 - Member, University of Oklahoma Student Chapter Committee 2019-21- Member, Young Professionals and Students Program Committee, GEO Bahrain 2018-19 - Member, AAPG Wildcatters Committee 2018- Co-Chair, Student Activities, AAPG ICE 2018, Cape Town, South Africa

Why I Accepted the Invitation to be a Candidate for AAPG Office By JULIAN CHENIN

I am deeply honored and thankful for being nominated as a candidate for vice president-Sections. AAPG has helped me grow tremendously throughout my academic and professional career, while giving me the pleasure of meeting and learning from many scientists from around the world.

I chose to stand for office as I want to not only give back to our geoscience community, but to continue creating a shared voice among our United States Sections – one that is diverse, resonates with inclusivity, champions sustainability, and pushes the technical frontiers of our discipline.

To accomplish this, I plan to reinforce relationships between academia and industry, create more leadership opportunities for students and young professionals (YPs), and host more technical, networking and mentorship opportunities.

The energy landscape is rapidly evolving, with the new generation of incoming geoscientists playing a critical role within it. This will require different perspectives and subsurface characterization skills from many disciplines and backgrounds. As the chairman for the AAPG Global Young Professionals (YP), I have been collaborating with the Regions and Sections to reestablish YP initiatives. By connecting local leadership with engaged geoscientists, we are working to bolster YP engagement while delivering robust geotechnical and networking opportunities for our members.

We also collaborated with the AAPG Latin American and Caribbean Region to bring back the International Student and YP Leadership Summit this year. Attendees from 13 different countries gathered to learn about leadership, share lessons learned, and strengthen their geoscience network on a global level. I intend to leverage these experiences to unite the various local associations and create a network that will help us become further engaged with our members as a shared voice; one that is "glocal" (global and local) and serves as the voice for the current and future generation of geoscientists.

Geoscientists are faced with solving a dual challenge – meeting the growing demand for energy while lowering our carbon footprint. The AAPG Sustainable Development Committee is actively showing how geoscientists are addressing this challenge and are pivotal in advancing sustainability. As one of the committee's co-chairs, we have worked together to create a variety of programs under a global platform that empowers geoscientists. The Sustainable Development in Energy Contest has been running for a third year now and is enabling the next generation of geoscientists to develop and implement their innovative, sustainable projects across the globe.

Having graduated and working for a few years within the energy industry, I plan to leverage my diverse experiences as a young professional to help our Sections further develop new and diverse geotechnical programs while strengthening our engagement within the geoscience community.

Over the years, I have come to know AAPG as a passionate community that advances our science through innovation, collaboration and technical veracity. As our energy landscape changes, we are shaping a future where geoscience will deliver sustainable energy for generations to come. AAPG has helped me grow in countless ways, and I hope to be a part of the change that continues building upon the Association's bright future.

The geoscience profession is facing many challenges today; societal pressures to decarbonize energy systems have increased exponentially during the past few years. Unfortunately, negative perceptions and associations between our profession, fossil fuels and global warming are hurting AAPG. I believe that we can help mitigate these issues by increasing the visibility of Section activities, by diversifying the content of our technical meetings, and by increasing outreach efforts to help educate society on energy matters. I believe that this approach will:

- Help us increase business, since new opportunities are rapidly arising within the context of emerging energies.
- Attract new talent so that we can address the generational gap.
 Help strengthen the financial health of our
- Help strengthen the financial health of our local societies.
- Take AAPG to the next chapter, and to a brighter future.

2023 - Session Chair, IMAGE 2023

2022 – Session Chair, IMAGE 2022

Women's Network

Committee

Exploration Geoscientist, Chevron Houston L. CALDWEI EBECCA I 2

> Academic Degrees Ph.D. (expected, 2024) Business Administration and

Experience

University, Stillwater, Okla.



President Riverford Exploration Denton, Texas Exploration, Denton and The Woodlands, Texas FAIRHURST 2003-Present - Licensed Professional Geologist, State of Texas 2017-20 - Manager, Industry Engagement, and Principle Investigator/Manager, Tight Oil Resource Assessment, Bureau of Economic Geology, Jackson School of Geosciences, University of Texas, Austin. 2009-15 - Vice President/Chief Geologist, Land and Exploration, Eagle Oil and Gas, Dallas and Midland, Texas 2002-09 - President and COO; Vice President Land and Exploration; Chief Geologist, Independent Exploration and

Offshore Exploration Leader, YPF SA Buenos Aires, Argentina

WILLIAM "BIL

Academic Degrees 2017 - Ph.D. Geological Sciences/Geosciences, Indiana University, Bloomington, Ind. 2013 - M.S., Geological Sciences, Boston College, Chestnut Hill, Mass. 2010 - B.A., Environmental Studies and Geology, University

of Pennsylvania, Philadelphia, Pa.

Experience

2023-Present - Exploration Geoscientist, Gulf of Mexico Business Unit, Chevron, Houston

2020-23 - Research Geoscientist & Basin Analyst, Basin Framework Team, Chevron, Houston

2017-20 - Research Geoscientist, Reservoir Management Strategic Research Team, Chevron, Houston

2013-17 - Research Assistant and Associate Instructor,

Indiana University, Bloomington, Ind. 2010-12 – Research Assistant and Teaching Assistant, Boston College, Chestnut Hill, Mass.

2010 - Data Management Intern, Delaware River Basin Commission, Trenton, N.J.

2009-10 - Paleontology Curatorial Assistant, Academy of Natural Sciences, Philadelphia, Pa.

Management (finance dissertation), Oklahoma State

1989 – MBA, Finance, University of Houston, Houston

1984 - MS, Geology, University of Missouri, Columbia, Mo.

1979 - BA, Geology, Economics-Business Management,

2003-Present - President/Chief Geologist, Riverford

Ohio Wesleyan University, Delaware, Ohio

AAPG Activities

Joined AAPG 2012 Member Energy Minerals Division Member AAPG Women's Network

2019-Present - Member, Women's Network 2014-16 - President, AAPG Student Chapter, Indiana University

AAPG Honors and Awards

Delegates

House of Delegates

House of Delegates

Award, GCAGS

including:

GCAGS, San Antonio

AAPG Honors and Awards

Committee

2023 - AAPG Distinguished Service Award 2022 - Certificate of Merit (Session Chair, IMAGE 2021) 2014 - Recipient, Richard W. Beardsley Named Student Research Grant

2020-Present - Director, Technical Programs, AAPG

2021 - Chair, Siliciclastics Theme, IMAGE Organizing

2020-Present - Member, Young Professionals

2022-23 - Chair, DEI, IMAGE Steering Committee

2019-Present - Foundation Trustee Associate

Society and Geological Society of China

2015-18 - Chair, Reservoir Revitalization TIG

2012-15 - Member, DPA Reserves and Resources

2016 - Lead AAPG Representative, 8th International

Symposium on Tight Sandstone and Shale Plays, State Key

Lab, Chengdu University of Technology, Chinese Petroleum

2013-15 - Delegate (Alternate), Dallas Geological Society,

1987-90 - Delegate (Alternate), Houston Geological Society,

2021- Thomas A. Philpott Excellence of Presentation

Sixty-four published papers/presentations in scientific

2024 - "Strategic Decisions for Petroleum Geologists,"

2024 - "Creativity and Innovation Are Under-Estimated

Positive Indicators for Energy Outook," AAPG Academy

2023 – "Geologic Concepts That Opened Economic Development of the West Texas (Permian Basin), 1915-

journals and meetings, and 90 invited presentations,

Selected Publications and Presentations

Selected Publications and Presentations 2022 – "Deepwater Depositional Environments," Applied Deepwater Sedimentary Systems, Elsevier (co-author) 2021 – "Process-Based Computational Modeling of Sedimentary Systems: Improving Prediction Capabilities for Exploration and Reservoir Characterization," invited talk, AAPG geology webinar, University of North Dakota (virtual) 2021 – "Deltaic Processes, Morphology, and Stratigraphy: Insights from Numerical Modeling and Field Studies of Modern Deltas," invited talk, South Dakota School of Mines

depositional systems course (virtual)

2020 - "Coastal Flooding Will Disproportionately Impact People on River Deltas," Nature Communications (co-author) 2020 - "Novel Semi-Automated Fault Interpretation Technologies," presentation, Chevron Subsurface Forum (co-author)

2020 – "A Global Delta Dataset and the Environmental Variables That Predict Delta Formation on Marine Coastlines," invited talk, World Large River and Delta Systems Source-to-Sink NCSU seminars (virtual) 2019 - "A Global Delta Dataset and the Environmental Variables That Predict Delta Formation" Earth Surface Dynamics (co-author)

2019 – "Deepwater Distributary System Avulsion Processes and Geomorphic Signatures," American Geophysical Union Fall Meeting, San Francisco, Calif. (co-author)

2019 - GSA Annual Meeting, "The Influence of Grain Size on Fluvio-Deltaic Response to Sea-Level Signals," GSA Annual Meeting, Phoenix, Ariz. (co-author)

2019 - "Time Stratigraphy of River-Dominated Delta Deposits," AAPG Annual Convention & Exhibition, San Antonio (co-author)

2018 – "Linking Deepwater Fan Depositional Processes and Stratigraphic Architecture Using Computational Stratigraphy," GSA Annual Meeting, Indianapolis (co-author) 2016 - "Morphodynamic Stratigraphy of River-Dominated

Deltaic Bars," AAPG Annual Convention & Exhibition, Calgary,

See CALDWELL page 4

1925," IMAGE, Houston (co-author) 2023 - "Exploring Entrepreneurship: GeoGulf 2023," July 2024 - Delegate, Fort Worth Geological Society, House of AAPG EXPLORER

2023 - "West Texas (Permian) Unconventiopnal Resources: Fifteen Years of Exploration, Discovery, Development and Production - What We Have Learned and Where We Are Headed, SWS Annual Meeting, Wichita Falls, Texas 2021 - "West Texas (Permian) Super Basin Unconventional Resources: Exploration, Discovery and Development," Giant Fields of the Decade 2010-2020, AAPG Memoir 125 2021 - "West Texas (Permian) Super Basin, United States: Tectonics, Structural Development, Sedimentation, Petroleum Systems, and Hydrocarbon Reserves," June AAPG BULLETIN (co-author)

2021 - "West Texas (Permian) Super Basin: Prototype and Analog," GCAGS, Austin, Texas (Thomas A. Philpott Excellence of Presentation Award)

2020 - "The Perfect Unconventional Resource Portfolio," Unconventional Resources Technology Conference (URTeC), Austin, Texas

2019 - "Permian Basin Wolfberry and Wolfbone Discovery of World-Class Resources in a Mature Basin and New Insights," AAPG Annual Convention and Exhibition (ACE), San Antonio 2019 - "Advanced Simultaneous Formation Evaluation and Completion-Oriented Rock Classification in the Midland Basin Using Integrated Analysis of Well Logs, Core Measurements and Geostatistical Data," URTeC, Denver (co-author)

2019 - "Reconstructing the Permian Basin for Wolfberry and

See FAIRHURST page 4

Selected Publications

www.researchgate.net/profile/Juan-Lovecchio

Why I Accepted the Invitation To be a Candidate for AAPG Office

By JUAN PABLO LOVECCHIO I accepted the invitation to be a candidate for AAPG

treasurer because I look forward to the opportunity to give back to AAPG and to have a role in shaping a modern, more diverse and global professional organization that will continue to impact lives in the years to come.

In my 15 years in AAPG, I have participated in AAPG activities at almost all levels. I joined in 2008 as a student member in Córdoba, Argentina, when I was working toward my B.Sc. degree. Then I served as student chapter president at IFP-School (in 2010-11) during my M.Sc. studies in France.

In 2012, I returned to Argentina and received a job with YPF, the national Argentinean oil company. In 2013 I reactivated the Argentina YP Chapter, where I served as president until we could guarantee continuity, and have been involved with AAPG activities in the country since then.

provided support for several Geoscience Technology Workshops (GTW) in Argentina as well as to several ICE events in the Latin American and Caribbean

See LOVECCHIO page 4

Academic Degrees

AAPG Activities

Joined AAPG 1980

Hunt, Dallas, Houston, Denver

Certified Petroleum Geologist

2018 - Ph.D. Geology, Sorbonne University, Paris, France/ Universidad de Buenos Aires, Argentina 2011 - M.Sc., Petroleum Geosciences, IFP-School, Rueil-Malmaison, France

Production Oil and Gas, Dallas, Houston, Midland and Denver

1996-2002 - Exploration Manager/Chief Geologist, Petro-

1981-96 - Exploration Geologist to Manager, Marathon Oil

Experience

Buenos Aires, Argentina

2022-23 - Principal Exploration Geologist, Offshore Exploration. YPF SA, Buenos Aires

2018-20 - Stratigraphy and Basin Analysis Specialist, Exploration, YPF SA, Buenos Aires

2012-18 - Senior Exploration Geologist, Offshore Exploration, YPF SA, Buenos Aires

2011 - Exploration Geologist (intern), Unconventional Resources, Total E&P, Paris, France

2008-10 - Exploration Geologist, Pluspetrol SA, Buenos Aires, Argentina

2007-08 - Teaching Assistant, Stratigraphy, National University of Córdoba, Argentina

AAPG Activities Joined AAPG 2008

2022 - General Chair, AAPG South Atlantic Conjugate Margins Virtual Technical Symposium 2021-22 - Theme Chair, International Conference and Exhibition (ICE) Organizing Committee

finals 2020 - Chair, AAGGP Special Student-YP Session, Latin America URTeC (virtual) 2020 - Organizing Committee and Session Chair, LACR

2021-Present – Distinguished Lecture Committee

2020-21 - Judge, Imperial Barrel Award LACR semi-

South Atlantic Basins Virtual Research Symposium 2020 - Organizing Committee, LARC Andean Basins Virtual Research Symposium

2019 - Imperial Barrel Award Industry Advisor to

Universidad Nacional de Córdoba Team 2019-21 - Secretary/Treasurer, Latin America & Caribbean Region

2018-19 - Organizing Committee, Field Trip Co-Chair,

Students and YP Activities Coordinator, ICE 2019 2017-19 – AAPG House of Delegates

2017-19 - Treasurer, AAPG Young Professionals-Argen-

tina Chapter

2016-Present - Visiting Geologist Program (VGP) 2016 - GTW Organizing Committee, "Moving Toward the

Prediction of Unconventional Plays"

2015-17 - President, AAPG YPs-Árgentina Chapter

2010-11 - AAPG Student Chapter President, IFP-School

Presentations

More than 50 oral and poster presentations at AAPG ICE and ACE meetings, IAPG, Argentinean Geological Congresses, and student meetings in Latin America, the United States and Europe.

Member DEG, DPA, EMD

Co., Houston, Lafayette, La., and Tyler, Texas

2009 - B.Sc., Geology, National University of Córdoba, Argentina

2023-Present - Offshore Exploration Leader, YPF SA,

ALDRICH from page 1

lifelong friendships is something truly unique and thus, worth finding ways to share.

I have found that the AAPG has, as a professional association, connected me to more outstandingly knowledgeable people then I could ever have found on my own – and once these connections were made, these same individuals could review my work, question my research, challenge my assumptions and, in the process, make me a much better geoscientist. When I have allowed myself to be challenged by some of the brightest minds in the world, I have found I have opened myself up to wonderful friendships and become better for it as a person.

Yet every one of us has seen the data and knows the trends of both decreasing membership and sponsorships in AAPG. There is not one single reason driving these trends, but the AAPG that I joined when I was in college and the industry that hired me when I left university is not the same as it was; nor should it be. The world has changed and is still changing – thus, for any organization to stay relevant, there are parts of it that must change as well. The key is knowing what are things that must change and what are the parts that are foundational.

AAPG will continue to be relevant if it stays true to the purposes as spelled out in its Constitution:

"The purposes of this Association are to advance the science of geology, especially as it relates to petroleum, natural gas, other subsurface fluids, and mineral resources; to promote the technology of exploring for, finding and producing these materials in an economically and environmentally sound manner; to foster the spirit of scientific research throughout its membership; to disseminate information relating to the geology and the associated technology of petroleum, natural gas, other subsurface fluids, and mineral resources; to inspire and maintain a high standard of professional conduct on the part of its members; to provide the public with means to recognize adequately trained and professionally responsible geologists; and to advance the professional well-being of its members."

Over my career I have had to adapt to change, from salt domes to shale gas and now to helium, hydrogen and carbon capture and storage. I have learned that, in this special association, we are uniquely trained and skilled for the characterization of pores in sedimentary strata and how fluids (liquid or gas) move through them. These skills apply to hydrocarbons, helium, carbon dioxide, water, lithium brines and any number of other fluids.

We, the AAPG, need to promote this message across the academic community as we combine the

science, the technology and the economics. We, the AAPG, need to promote the message to businesses that it is in their best interest to have certified, well-trained geoscientists who have large networks with deep connections to help unravel the next level complex problems that will arise. We need to build our Association during which hydrocarbons will still play a major role and our skills will still be needed – but so will our skills be needed in so many other areas.

And it is not just our individual skills but also our collective abilities, for we accomplish much more together than as individuals, and what we do is critical for the well-being of society. Therefore, it is incumbent on us to do this in the most professional manner possible.

To me that means finding ways to return our Association to a sound financial status in order that it can better support our membership in both its scientific and professional endeavors.

CALDWELL from page 3

Alberta, Canada (co-author) 2015 – "Fluvio-Deltaic Avulsions During Relative Sea-Level Fall," Geology (co-author) 2014 – "The Effects of Sediment Properties on Deltaic Processes and Morphologies: A Numerical Modeling Study," Journal of Geophysical Research (co-author)

> Why I Accepted the Invitation To be a Candidate for AAPG Office By REBECCA L. CALDWELL

I accepted the invitation to be a candidate for AAPG treasurer for two reasons: First, I care deeply for the membership and greater geoscience community, and second, I recognize the power of AAPG to positively influence society and advance the energy industry. It is this passion that drives

FAIRHURST from page 3

Wolfbone Unconventional Resource Assessment," AAPG Global Super Basins: The Permian, Sugar Land, Texas.

2017 – "Time For a New Wave of Conventional Resource Activity," Dallas E&P Forum: Conventional Success in an Unconventional World, Society of Independent Professional Earth Scientists and Dallas Geological Society, Dallas

2016 – "Resource Reservoirs and Hydrocarbon Source Rocks Defined by Depositional Time-Intervals and Tectonic Basin Types Within the United States" (U.S. keynote address), Eighth International Symposium on Tight Sandstone and Shale Plays Exploration and Development, Chengdu, China 2016 – "Getting Started Acquiring or Evaluating Assets, Assembling Teams, Financing Options, Acquiring the Right Data – New Thinking and Value Propositions in Exploration and Production: Proactive Steps Now," AAPG Geosciences Technology Workshop (GTW), Houston 2015 – "Are Geologic/Reservoir/Completion

Models Properly Constrained in the Permian Basin?" Revitalizing Reservoirs-Rocky Mountains, Midcontinent, Canada, International Focus, AAPG GTW, Golden, Colo.

2015 - "Stealth' - Exploration and Serendipitous Exploration for the Texas Woodford," AAPG Woodford Shale Forum: Focus on Optimization, Oklahoma City, Okla., and Midland, Texas 2015 - "Exploration Insight and Input That Changed Organizational Focus, Strategies and Economic me to contribute my time, efforts, and skills to the AAPG Executive Committee.

I chose a career in the energy industry because it represents a direct role that the geosciences play in sustaining society and the earth, and I am driven to help our community accomplish those goals to the best of our abilities. AAPG makes this possible – by supporting, educating, connecting and growing our diverse community.

I have benefited directly from these aspects of AAPG, making connections across the industry that have strengthened my career and technical work, allowing me to have a greater impact. Creating these opportunities for others has thus been a focus throughout my leadership roles with AAPG, while also developing a deep understanding of AAPG, our membership, and our fit within today's world.

As a member of the IMAGE Steering Committee (2022, 2023) and Technical Program Committee (2021), I put great effort into learning the needs of our diverse membership and guiding teams (2022

Outcomes," International Shale Plays, AAPG GTWs,

2013 - "Wolfbone Oil-Saturated, Super Sweet Spot,

Exploration to Geologic/Reservoir Modeling and

Field Development," URTeC, Denver (co-author)

West Texas: An Emerging Frontier; An Oil-Rich

Unconventional Resource," AAPG ACE, Long Beach,

2002 – "The Perfect Éxploration and Development Investment Portfolio," AAPG ACE, Houston

2001 - "Petro-Hunt Perspectives, The Executive

Perspective on the Energy Odyssey of the 21st Century," May AAPG BULLETIN (co-author)

of Upper Cretaceous Horsethief and St. Mary

1983 - "Stratigraphy, Sedimentology and Petrology

River Formations, Western Montana, March AAPG

Why I Accepted the Invitation

To be a Candidate for AAPG Office

By WILLIAM "BILL" FAIRHURST

I am honored and appreciate the support of

AAPG members and many current and past leaders

of AAPG in running for the office of AAPG treasurer.

I have been a member of AAPG for over 40 years.

educational opportunities through field, core and

As an AAPG member, I have benefited from the

2012 - "Evolution and Development of the

Wolfbone play, Southern Delaware Basin,

California. (co-author)

BULLETIN

Southern Delaware Basin: Integrated Approach from

Houston and San Antonio (co-author)

and 2023 DEI committees; 2021 Siliciclastics Theme) to deliver high quality, impactful programming. In my role as the AAPG Women's Network technical programming co-chair (2020-24), I coordinate volunteers to deliver technical and career development content, focusing on meaningful engagement of our global membership.

AAPG has so much to offer geoscientists, and I am dedicated to utilizing my skills in listening to members, developing focused strategies, and turning them into action, to benefit and grow our membership.

My strong record of leadership, experience in stewarding financial resources, and collaborating with diverse teams to align on action-based strategies will support AAPG's role within the global energy evolution. In addition to sustained leadership within AAPG, my roles in other geoscience societies have afforded me opportunities to build valuable skills and relationships that I will bring to the AAPG Executive Committee:

In my role on the GSA Foundation Board of

classroom courses, excellent technical programs during conferences, our societies' networking opportunities, past service on committees, and being an international representative for AAPG. Along the way, I have made many professional contacts and personal friends.

Over the last 20 years, I have been asked to run for various leadership positions for AAPG. Because of my geologic, other technical, and leadership roles and commitment to employers and industry organizations, I focused my time and effort on service within those roles. Over the last 10 years, I also have focused on geologic and petroleum industry knowledge transfer. These contributions include providing 11 university courses and guest lectures, 18 professional courses, five peer-reviewed publications, three magazine articles, 12 published interviews and mentions, 44 published abstracts and presentations, and 90 invited presentations, many of these for AAPG programs. Several of these have obtained high research interest scores, including a Super Basin paper in the top 5 percent of all research since its publication. Having completed these, I am now available, committed and focused on service for AAPG as treasurer.

Over the past decade, AAPG has faced many challenges. It has addressed some of these challenges but has left many unanswered. The office of AAPG treasurer provides multiple opportunities for awareness, information and assisting the Executive Committee in delivering solutions for these challenges that need to be addressed during 2024-26. The office of treasurer is Trustees, I work with fellow board members to ensure cost-effective operations, prudent fund management, and strong stewardship of financial resources utilized to enact the society's priorities.

As a member of the AGI Board of Directors, I collaborate with board members and Member Society representatives from a broad range of geoscience societies to drive the organization's strategic plan and mission, and to provide guidance on fundraising efforts and initiatives.

Through these roles, I've demonstrated both mission-based financial acumen and a strong ability to collaborate with large teams composed of diverse viewpoints – skills that I plan to use to benefit AAPG through the role of treasurer.

In short, I accepted this invitation to further support my community – AAPG and its members – in growing and thriving within an evolving world, and I am confident in my abilities to do so.

unique among the Executive Committee positions. The oversight for AAPG and headquarters as treasurer requires specific technical training and expertise that most petroleum geologists have not yet obtained.

I started my first business before college and was doing double-entry journal and accounting ledger balances within a year. Academically, I have over 20 hours of accounting courses, over 100 hours of finance, economics and other general management courses, and industry training programs in these specific business skills. Over the past 20 years, I have done all the accounting and finance for several oil and gas companies and an aviation organization. As president of one firm, I taught an entire accounting department new to the industry, including the CFO, on the principles and practice of oil and gas accounting.

My commitment to training and learning in geosciences and the business of oil and gas is exemplified by my current pursuit of a Ph.D. in business administration, which is in its final stages.

These academic and practical experiences, as well as 25 years in senior executive positions in oil and gas upstream organizations, provide the technical ability to understand and clarify AAPG accounting, finance and budgeting issues, cooperatively work as a member of the Executive Committee to solve unaddressed problems, and set the organization on a path for future financial success and stability.

LOVECCHIO from page 3

Region (LACR), notably the 2019 ICE event that took place in Buenos Aires.

I also was deeply involved in 2020 in the organization of a series of virtual technical conferences we created in the LACR to continue supporting our members in the Region throughout the COVID pandemic. I not only enjoy collaborating with the organization of events in the Region, but also have presented my research in several of these events. I strongly believe that professional associations such as AAPG need to be led by volunteers who are not only enthusiastic but can also demonstrate technical excellence and professionalism at all levels.

I have gone through a path within AAPG that allowed me to better understand how the Association operates both regionally and globally. I have been appointed Region delegate at the HoD and secretary of the LACR and, as mentioned above, one of the most important milestones in my service to AAPG was the successful organization of ICE Buenos Aires 2019, an event that attracted more than 1,500 geoscientists from around the world.

I recognize the value of future generations. I enjoy working with YPs and students; I have served as industry mentor for several IBA teams throughout the years, and more lately as an IBA judge; and I collaborate with the AAPG's Visiting Geoscientist Program (VGP), teaching lectures not only in person but also virtually for student chapters across the Region, as a way of strengthening AAPG's investment in the future generations.

Furthermore, I have served in the local association AAGGP (Argentinean Association of

Petroleum Geologists and Geophysicists), first as secretary (2018-20) and then as president for two periods (2020-22 and 2022-24). I believe that synergies between local and global associations are a key for success in these challenging times, especially to grow AAPG's presence in the international Regions.

I believe that my experience, together with my technical expertise and my professional network, have prepared me to serve AAPG now at a global scale.

Foundation Update AAPG Foundation, Boy Scouts Connect Young People to Geology

he AAPG Foundation continued its longstanding connection to geological outreach when it once again sponsored the Geology Merit Badge program at the latest Scout Jamboree last summer, a 12-day adventure typically held once every four years. This event attracted nearly 15,000 Scouts, Venturers and Explorers to the Summit Bechtel Reserve Scout Camp near Beckley, W.Va

The Jamboree is sponsored by the Boy Scouts of America. The 2023 event, held in July, was the first in the post-pandemic era.

The event, limited in size due to BSA budgetary concerns, drew more than 12,000 Scouts - including more than 1,500 girls, who can now participate in Scouting units.

Of note, this event marked the first time girls participated in the Jamboree's offer of working toward a Geology Merit Badge.

AAPG Contribution

The AAPG Foundation's role includes financial support for the expenses in providing materials and in forming a "team" of AAPG volunteers who help Scouts work toward earning the Badge.

The 2023 initiative included four AAPG members who volunteered their expertise and sharing spirit to help the Scouts - Ron Hart of Tulsa, Gary Robinson of Aurora, Colo., Bill Haworth of Bush, La. and AAPG



Distinguished Award-recipient Bob Webster of Irving, Texas, who also is an AAPG Foundation Trustee Associate

Other participants included a "home team" - those who helped prepare for the event but didn't attend - including AAPG members Rick Erickson of Tulsa) and Bill Underwood of Oklahoma City.

The AAPG members teamed with six geologists from the West Virginia Survey including AAPG member James Britton and Randy Toth, who attended the 2013 as a Scout and earned the Geology Merit Badge

- and together they taught geology to the Scout-aged youth and helped introduce them to the local geological setting and area's mineral resources.

"Our assignment was traditional - our team organized a classroom and science museum experience, designed to teach youths about geology," Hart said.

The geology classroom was a wellplaced tent located among a cluster of other merit badge tents.

"We hosted twice-daily classes, a rock and mineral collection for visitors to inspect



and touch, and a continuous stream table to demonstrate erosion, deposition and stream processes," Hart added

Team members also were able to answer questions that were specific to the locale, including many about coal mining, hydraulic fracturing and local geology.

"Scouting certainly gives us exposure to many outstanding young citizen-scientists in the 14-18 age range," Hart said, "just

Continued on next page



Trustee Associates 2024 Annual Meeting Asheville, NC

Online Registration is Now Open!

Make plans to attend this year's Trustee Associates annual meeting at the beautiful and magnificent Biltmore Estate in Asheville, N.C., May 19-22.

The historic French Renaissance-styled castle is situated amid 8,000 acres in the scenic Blue Ridge Mountains and promises to be a spectacular setting for reconnecting with old friends and meeting new friends.

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- Private tours to areas of the Biltmore, which are closed to the public.
- Private excursions to the Biltmore's world-famous gardens and acclaimed Biltmore Winery.
- Field trip through the scenic Blue Ridge Mountains to Kings Mountain.

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Teacher of the Year Award Bruce and Carol Appelbaum

E. F. Reid Scouting Fund James A. Gibbs In memory of E. F. "Bud" Reid Bryan Haws

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In memory of my friend and mentor Pete Rose

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> L. Austin Weeks Undergraduate **Grant Fund**

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AAPG Foundation Military Veterans Scholarship Fund William & Pamela Stephens

In memory of Col. William C. Stephens

Military Veterans Scholarship Fund David G. Morse Matthew Edward Vavro

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

Continued from previous page

starting to formulate their career path and education plans."

In all, the tent attracted nearly 250 visitors, with 151 Scouts earning their Geology Merit Badge.

How to Get Involved

Details of the next Jamboree are pending - but whenever it is held, BSA officials said it will once again be held at the Summit Bechtel Family Reserve.

And odds are, AAPG and the AAPG Foundation will once again be leading the way to help young people learn about and connect with geology - AAPG has been

part of the outreach for decades. Interested in being part of the team?

For more information on contributing to the Foundation's support of the program, visit the Foundation website at foundation.

For more information on the program itself and how you can volunteer your time and expertise to help bring geology to a new generation of explorers, contact Ron Hart at ron_hart@cox.net.

"The Team is always looking for a few good men and women," Hart said. "If you can handle 12 days of Scout camp food, tent camping, lots of fresh air and sunshine, and plenty of fun - drop us a line."





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In Memory Remembering Don O'Nesky

Donald A. O'Nesky Jr., a former longtime deputy director of both AAPG and the AAPG Foundation and an awardwinning member of the Trustee Associates, died Jan. 29 in Longwood, Fla. He was 88.

O'Nesky, though not a geologist, had an active and influential career for AAPG in leadership roles and as an active member of both the Foundation and the Foundation TAs.

A native of Haileyville, Okla., O'Nesky entered the U.S. Air Force after graduating from Oklahoma State University in 1957. His active duty included tours in Southeast Asia, Holland, Japan, Italy and Vietnam, and while serving he earned a master's degree from Troy State University.

He retired from the Air Force in 1978 and was hired by AAPG as member services manager at the Association's headquarters in Tulsa, overseeing operations during a time of rapid membership growth and technological changes.

He was named deputy executive director of both AAPG and the AAPG Foundation in 1985. In 1997 he was appointed executive director of the Foundation, serving in that capacity through 1999.

During his term as the Foundation's executive director he oversaw the establishment of the Members of the Corporation, an important advisory group



for the Foundation's leadership. He himself was elected a Member of the Corporation in 2019-21, when he requested to step down from his position. He became a Trustee Associate in 1998 and continued his influential role in Foundation leadership, serving

as the TAs vice chair in 2008-09 and as chairman in 2011-12. Because of his contributions to and service for the Foundation, in 2002 his friends and colleagues established in his honor the Donald A. and Mary O'Nesky

Named Grant, part of the Foundation's Grants-in-Aid Program that provides grants to graduate students. In doing so, his colleagues observed that though he had never taken a formal course in geology, Don had earned "a degree by association."

In a role close to his heart, he helped lead development of AAPG's Military Veterans Scholarship Program (now officially the Deana and Paul Strunk Military Veterans Scholarship Program), serving in 2012-16 as chair of the MVSP Committee, which oversees selection of the scholarship recipients on an annual basis. He continued to serve on the committee through 2019. Other AAPG leadership roles of note

included:

Trustee Associates Nominating Committee (member).

Ed Picou, Jr. Passes

Edward B. "Ed" Picou Jr., an AAPG Honorary Member who was involved in AAPG support and activities throughout his entire career, died Jan. 30 at his home in New Orleans. He was 91

Picou, who joined AAPG in 1955, was a longtime paleontologist for Shell Offshore, where he supervised the exploration paleontology staff for almost three decades. He

retired from the company after 34 years as an exploration consultant, the company's highest technical rank.

For AAPG, Picou was elected treasurer for 2000-02, and in 2002 he was awarded Honorary Membership. He also was a member of the Foundation Trustee Associates, and in 2007 he funded the Foundation's Ed Picou Grant-in-Aid scholarship, designated specifically for geology students at his beloved alma mater, Louisiana State University.

Picou received an AAPG Distinguished

▶ TA Site Selection Committee

(member) Foundation Fundraising Advisory

Committee (member). ▶ AAPG Membership Career Services

(vice chair). AAPG Public Outreach Committee

(vice chair).



Service Award in 1999. He also was a Distinguished Member of the House of Delegates, where he served for multiple terms, and a member of both the Division of Environmental Geosciences and the Energy Minerals Division.

Other accomplishments included honorary memberships in SEPM, the

Gulf Coast Section-SEPM, GCAGS and the New Orleans Geological Society, where he was affectionately known as "Mr. NOGS." An early advocate for digitizing technical publications, he was instrumental in having all of the NOGS publications digitized by AAPG Datapages in 2003, the first local society to do so.

A fellowship grant for Earth science graduate students was named in his honor by the Gulf Coast SEPM, and in December 2023 he was awarded an honorary doctor of science degree from LSU. 🔳

In 2016 he received the Foundation's Chairman Award, presented in recognition of those who have made extraordinary contributions (monetary and/or service) to the Foundation.

He had retired to Florida with his wife, Mary, who survives, along with his son, Donald A. "Skip" O'Nesky Jr. 🔳

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MARCH 2024 EXPLORER.AAPG.org **David Worthington** Passes

David W. Worthington, a Foundation Trustee Emeritus and recipient of the Foundation's highest honor, died Feb. 1 at his home in Naples, Fla. He was 82.

Worthington, the former CEO of TSG-Calibre and chairman of TGS-NOPEC, was a significant contributor to the AAPG Foundation and an officer and leader of the both the Foundation and Trustee Associates.

He received in 2015 the L. Austin Weeks Memorial Medal, given in recognition of extraordinary philanthropy and service in advancing the AAPG Foundation's mission. It is the Foundation's highest honor.

Worthington, who was a member of the Foundation's Members of the Corporation since 2013, was a Foundation Trustee from 2015-18, during which time he was the Trustee secretary. He was named Trustee Emeritus in 2019.

A Foundation Trustee Associate since 2001, Worthington served as both vice chairman and secretary-treasurer for the group, as well as chair of the 2014 Trustee Associates Site Selection Committee.

He and his wife, Beverly, also

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reasonable and accurate predictions of where and when such events are likely to occur. Such predictive models enable early warning systems to alert communities to impending hazards, providing critical time for evacuations and emergency response preparation and implementation. By simulating different scenarios and assessing the potential impact of human interventions, AI can assist environmental geoscientists with helping policy makers and urban planners develop more resilient infrastructure and land-use policies.

Climate Change Monitoring and Adaptation

I think more people today realize that climate change poses one of the most pressing challenges of our time, as it impacts ecosystems, weather patterns, sea levels and biodiversity worldwide. Environmental geoscientists can rely on Al-driven climate models to simulate the complex interactions between the atmosphere, oceans, land and ice, and of human influences (i.e., pollution) upon them, thereby gaining insight into future climate trends and potential impacts on our planet. Al algorithms can be used to analyze historical climate data to identify trends, detect anomalies and forecast future climate scenarios with greater precision than traditional methods. Gaining a better understanding of how climate change affects different regions and ecosystems enables environmental geoscientists to help policymakers develop targeted adaptation strategies to mitigate adverse effects and promote sustainability.

Sustainable Resource Management

Efficient management of our natural resources - including water, minerals and energy – is essential to ensure the long-term health and prosperity of human society and the environment. Al technology plays a crucial role these days in optimizing resource extraction processes, minimizing

established two named grants with the Foundation's Grantsin-Aid program – the David W. Worthington Named Grant and the David W. Worthington Family Named Grant, both created and awarded annually to graduate students studying paleontology.

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A native of Worcester, Mass., Worthington received a bachelor's degree in geology

from Marietta College in Marietta, Ohio, and a master's degree in geophysics from Virginia Tech University. He joined AAPG in 1982. He began his professional career with a 13-year stint at Shell Oil, eventually

becoming exploration manager of Shell's Gulf of Mexico and Atlantic Division. He left Shell to form his own offshore exploration firm, which transitioned into TGS Geophysical Co.

That company later became TGS-Calibre and, through a merger, TGS-NOPEC, where Worthington served as chairman from 1999-2004, remaining on the board through June 2007. 🖪

waste and promoting sustainable practices across various industries. As an example, AI-powered algorithms can be used to analyze geological data to identify promising sites for renewable energy developments such as wind farms and solar installations. Optimizing the placement and operation of such renewable energy infrastructure assists environmental geoscientists in accelerating the transition to a low-carbon economy while minimizing environmental impacts.

A Paradigm Shift

The integration of AI into environmental geoscience offers a paradigm shift in our ability to understand, monitor and manage the Earth's natural systems. Harnessing the power of Al-driven analytics, predictive modeling and data-driven decision-making offers opportunity for the environmental geoscientist to be better equipped to address the complex challenges we and our planet face. As scientists continue to innovate and refine AI technologies, I hope the potential for collaboration between human expertise and AI will equate to a brighter, more sustainable future for generations to come. If you're presently utilizing AI in an environmental geoscience application, I'd appreciate learning how. In closing, I hope many of you will

be attending the Carbon Capture, Utilization and Storage 2024 conference in Houston on March 11-13, hosted by AAPG along with the Society of Petroleum Engineers and the Society of Exploration Geophysicists. I again thank our membership in the Division of Environmental Geosciences for permitting me to serve as your 2023-24 DEG president, and I acknowledge the service of my current fellow DEG officers: Mattias Imhof, president-elect; Sherilyn Williams-Stroud, vice president; Disnahir Pinto, secretary-treasurer and Autumn Haagsma, editor. Our DEG will soon need to identify candidates for the upcoming 2024-25 term, so if you're a DEG member who has interest in serving as an officer of DEG, please let us know.

I can be reached at hvogler@kleinfelder.com. 🖪

2024 SOUTHWEST SECTION AAPG ANNUAL CONVENTION



Hosted by the **Abilene Geological Society**

Abilene Convention Center April 27th – April 30th

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Convention Details

Saturday April 27th – Field Trip led by Angelo State Faculty and friends Stops in Taylor, Nolan, Mitchell and Coke counties will feature Permian-age San Angelo & Leonard Formations, Cretaceous reef & shoal deposits and fluvial-estuarine sandstones. A highlight will be exploring the Cup and Saucer, a crater or sinkhole exposing Triassic Dockum Group and Quaternary volcanic ash.

Sunday April 28th – SWS-AAPG Convention Short Course Reservoir Engineering for Geologists - Introduction to Reservoir Engineering, Past and Future By: Dwayne Purvis, P.E.

Sunday April 28th Evening Icebreaker – 5 to 8 pm Help us kick off the 2024 SWS-AAPG Convention with entertainment and networking

Monday & Tuesday April 29th-30th – Technical Sessions We look forward to an exciting schedule of speakers and posters related to all aspects of "Energy Stratigraphy – Layers of Energy" Keynote Speaker – Charles Ivey – "Energy of Yesterday, Today & Tomorrow" DPA Luncheon - Charles Sternbach & Dick Bishop "Giant Fields of the Permian Basin" All Convention Luncheon – Doug Robison "Future of Atomic Energy"

Monday April 29th Evening Social – 6 to 9 pm Join us in Downtown Abilene at the Peacock Patio for dinner, drinks and some great entertainment, then take a walk through downtown and enjoy the sculpture gardens and the other nightlife!

To Register for the convention or learn more visit: https://www.zeffy.com/en-US/ticketing/cce83163-b704-49c4-87b7 9bf7711ccd9e



EXPLORER MARCH 2024

Director's Corner Biden Administration Hamstrings LNG Potential

n late January, the Biden administration shocked the energy sector with its announcement that it was temporarily pausing any pending approvals of liquified natural gas exports to countries that do not have a current free trade agreement with the United States.

The move is ostensibly to allow the U.S. Department of Energy to "update the underlying analyses for these authorizations," as the current authorizations were last updated in 2018 and "no longer adequately account for considerations like potential energy cost increases for American consumers and manufacturers ... or the latest assessment of the impact of greenhouse gas emissions."

Three weeks later, Shell released its global LNG outlook forecasting a nearly 50-percent growth in demand by 2040. Their analysis suggests that while natural gas demand in some regions has peaked, that global demand will continue to grow, peaking in the 2040s.

"China is likely to dominate LNG demand growth this decade as its industry seeks to cut carbon emissions by switching from coal to gas," said Steve Hill, executive vice president for Shell Energy. "With China's coal-based steel sector accounting for more emissions than the total emissions of the UK, Germany, and Turkey combined, gas has an essential role to play in tackling one of the world's biggest sources of carbon emissions and local air pollution."

The role of LNG in European energy security continues to be important, according to Shell's analysis, with new regasification plants coming online and delivering additional supply, despite the fact that overall gas demand in Europe fell in 2023.

Shell's outlook also points to the

While natural gas demand in some regions has peaked, that global demand will continue to grow, peaking in the 2040s.

important role that natural gas plays in stabilizing electrical grids supplied with significant amounts of intermittent renewable energy.

Industry Reaction

The response from the business community to the president's action was swift.

"This is a win for Russia and a loss for American allies, U.S. jobs and global climate progress," said Mike Sommers, president and CEO of the American Petroleum Institute. "There is no review needed to understand the clear benefits of U.S. LNG for stabilizing global energy markets, supporting thousands of American jobs and reducing emissions around the world by transitioning countries towards cleaner fuels."

"Over the past two decades, America's energy landscape has completely transformed because of natural gas," wrote Marty Durbin, president of the Global Energy Institute at the U.S. Chamber of Commerce. "As our nation unlocked shale reserves and dramatically increased natural gas production, we went from a posture of energy scarcity to energy abundance and opportunity. The development has allowed the United States to provide affordable, reliable, and cleaner energy both at home and to our allies abroad." Up on Capitol Hill, House Republicans joined by 9 Democrats passed H.R. 7176, the "Unlocking our Domestic LNG Potential Act," to repeal the Biden administration's restrictions.

Sen. Joe Manchin, D-W Va., chair of the Energy and Natural Resources Committee, said the move was "unjustified" and "should be reversed." But Senate Democrats have no interest in taking up the House bill and little appetite to squabble with the president on this issue, though there's a chance that the Senate could attach a provision to another bill.

What is the impact of Biden's move? David Braziel, CEO of RBN Energy, LLC, wrote in a Feb. 15 blog post that they expect this pause in permitting to affect current LNG projects in the Gulf of Mexico, one project in Mexico that was going to use imported natural gas from the Permian and Eagle Ford, as well as boost several Canada projects using non-U.S. natural gas, as well as other major LNG exporters, such as Qatar, Russia and Iran.

Braziel observes that these moves are obviously bad for LNG project developers but also for LNG consumers, including Germany and UK.

He noted that "natural gas production and consumption in the U.S. and elsewhere has, in almost every instance resulted in lower GHG emissions because gas replacing higher-emissions alternatives." And while U.S. LNG exports would reduce supply available to U.S. consumers, "RBN projects that U.S. E&Ps would be able to increase their gas production to meet the incremental demand."

Suspected Motive

So where did this surprise White House action come from?

Writing in the Wall Street Journal on Feb. 9, Benoît Morenne and Andrew Restuccia reported that President Biden's decision followed an orchestrated effort by environmental organizations who enjoy the financial backing of the Rockefeller Foundation, Michael Bloomberg and other benefactors and are committed to eradicating fossil fuel use.

A skeptical Sen. Manchin suggested the move was political. In his opening statement to a Senate hearing he called to solicit testimony on the pause he said, "unfortunately, it seems the White House has already sided with climate activists determined to block any more LNG exports, and I am deeply concerned the White House will put its thumb on the scale at DOE to get the political outcome they want."

At the hearing Deputy Energy Secretary David Turk did not provide specific guidance to Manchin and his colleagues on the timing for removing the pause, but did suggest it would take "months, not years."

To which, according to Axios, Alaska Sen. Lisa Murkowski wryly observed, "My guess, and I think it's probably a pretty welleducated guess, (is) that it will conveniently not be concluded prior to the election."

David K. Ent

By HERBERT "BERT" A. Vogler III Divisions Report: DEG Some Thoughts About Unlocking the Power of Al for Environmental Geoscientists

he intersection of artificial intelligence and science has in recent years sparked a wave of innovation that is fundamentally transforming how scientists understand and address scientific challenges in general. I was asked recently whether AI really means anything for an environmental geoscientist? So, I decided to investigate this.

As we environmental geoscientists know, we work routinely to decipher complex Earth systems. There are indeed Al-driven tools and techniques available to enhance an environmental geoscientist's work involving monitoring, analysis, prediction and mitigation efforts, among other tasks. From monitoring climate change to assessing natural hazards, Al is proving to be an invaluable ally to environmental geoscientists in our quest for a sustainable future. Here are some lessons I've learned about how Al might aid the environmental geoscientist in four specific areas:



As scientists continue to innovate and refine AI technologies, I hope the potential for collaboration between human expertise and AI will equate to a brighter, more sustainable future for generations to come.

Data Analysis and Interpretation

One significant contribution of AI to environmental geoscience lies in AI's ability to analyze vast amounts of data with unprecedented speed and accuracy. I can attest firsthand that an environmental geoscientist deals with a plethora of data coming from a range of sources, including satellite imagery, geological surveys, weather data, analytical laboratory data and more. Natural Language Processing algorithms can be applied to help environmental geoscientists extract

valuable information from unstructured textual data such as research papers, reports and field notes. NLP techniques can also be used to automate literature reviews, summarize scientific findings and facilitate knowledge discovery. I've been told that AI algorithms are especially great at recognizing patterns and anomalies within datasets. This application enables the environmental geoscientist to extract meaningful insights that might otherwise remain concealed. As examples, machinelearning algorithms are capable of processing satellite imagery to identify changes in land cover, track deforestation rates, monitor urban expansion and assess the impact of human activities on ecosystems. Additionally, AI can be used to assist in monitoring and ensuring compliance with environmental regulations by analyzing data and identifying areas of concern. By automating the analysis process, AI empowers environmental geoscientists to focus our efforts on interpreting results and making informed decisions based on actionable intelligence.

Predictive Modeling and Risk Assessment

Al-driven predictive modeling is revolutionizing how environmental geoscientists assess and mitigate various natural hazards, including floods, landslides, earthquakes and wildfires. By leveraging historical data, weather forecasts, terrain characteristics and other relevant factors, Al algorithms generate MEWBOURNE COLLEGE OF EARTH AND ENERGY SCHOOL OF GEOSCIENCES The UNIVERSITY of OKLAHOMA



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