

# Technological Evolution Creates Super Basin Renaissance

Some might recall when Mexico first discovered the Cantarell Field in the Campeche Basin in 1976. Practically overnight, it made the country a world-class exporter of crude oil, and Mexico has since exploited it well past its peak – or so many had thought.

When Mexico opened its borders to international investors five years ago, a host of new technology was brought in to re-explore. The most game-changing technology has been seismic data acquisition, processing and interpretation techniques, which has given a surprising second life to both the Campeche and the Gulf of Mexico Basin as a whole.

Now referred to as a “super basin” – a prolific petroleum system with more than 5 BBOE in recoverable reserves and past production of at least 5 BBOE – the Gulf of Mexico Basin has joined other top super basins in the world that, despite their maturity, have the potential or have proven to be significant new plays all over again.

The driving force behind this renaissance is, for a large part, the evolution of technology over the last two decades that has jumpstarted both offshore and onshore basins.

“The key technologies are enhanced seismic imaging for conventional reservoirs in the offshore and horizontal drilling and hydraulic fracturing for unconventional resources in the onshore,” said Charles Sternbach, past AAPG president and general chair for the AAPG 2020 Global Super Basins Leadership Conference in Sugar Land, Texas from Feb. 11-13.

## Gulf of Mexico 2.0

“The Gulf of Mexico is a super basin that is going to keep on giving,” Sternbach said. “There is a hidden world under the salt there, and all of a sudden the lights have turned on.”

Few know this better than John Snedden, senior research scientist and director of the Gulf Basin Depositional Synthesis Project at the Institute for Geophysics at the University of Texas at Austin, and co-author of the recently published book, “The Gulf of Mexico Sedimentary Basin – Depositional Evolution and Petroleum Applications.”

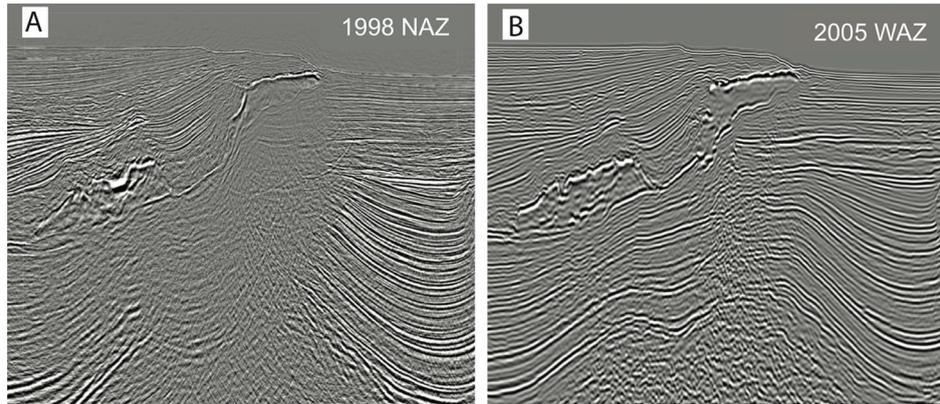
Blessed by two world-class source rocks, the Cotton Valley-Haynesville equivalent and the Eagle Ford equivalent, the Gulf of Mexico Basin has been prolific in both U.S. and Mexican waters. Yet new technology – specifically wide azimuth seismic data acquisition and processing workflows, combined with new drilling techniques and tools – have led operators to major discoveries on the Mexican side, Snedden said.

“The prize is the Cenozoic deepwater sandstone play in the Campeche sub-salt and near-salt,” he said, explaining that Mexico has mostly focused on Mesozoic carbonate plays. “It is one of the most geologically complex plays in the world.”

Cenozoic sweet spots in this area have long remained under the radar, as older seismic technology could not accurately image below complex salt structures.

“Seismic technology advances are the No. 1 reason we keep this basin going. It is the leading tool for exploration,” Snedden said. “It has allowed us to illuminate areas below and around the salt that we couldn’t see before.”

As a result of WAZ, a seismic data acquisition technique in which separate source vessels record seismic reflections farther out to the side of the recording spread, discoveries such as the Zama-1



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in 2017 and Cholula-1 in 2019 are reviving the Campeche Basin, which has been considerably less explored than other parts of the Mexico offshore zone. Considerable progress is also being made using full waveform inversion and more sophisticated velocity models to deal with complex subsalt trap geometries.

In deeper waters of the Gulf of Mexico, advanced drilling technology – such as special measurement-while-drilling tools and high-pressure blowout preventers – is aiding production that might never have happened under pressures of 20,000-plus psi and temperatures of 350-plus degrees Fahrenheit, Snedden added, citing the Norphlet play in the northern Gulf of Mexico.

“We often regard Mexico as an old area, but it’s really a new area because it wasn’t previously open to international exploration,” he said. “New technology is allowing us to properly evaluate the subsurface potential now that the doors are open.”

## Permian Prototype

As the Gulf of Mexico Basin booms, practically an arm’s length away the Permian Basin is experiencing its own renaissance, leading the pack as the prototype of all super basins in the world, Sternbach said.

“The Permian is where we established the spirit of taking risks and benefitting from those risks,” he said, referring to a plethora

of new technology that operators have used during countless trial-and-error endeavors.

In fact, its success has paved a smooth path for other super basins to develop.

“All of the other super basins can leapfrog and jump ahead because they don’t have to spend 10-15 years doing all of the hard work,” Sternbach said.

The rebirth of the Permian began in 2007 when the Texas Railroad Commission allowed the comingling of oilfields, specifically the Wolfcamp and the Spraberry, said Mike Party, AAPG president and president of Beryl Oil and Gas. That change in regulation prompted a significant influx of private equity and a subsequent drilling frenzy of vertical wells in the unconventional play.

Roughly a decade ago, horizontal drilling began to dominate the Permian in full force. When Schlumberger introduced its PeriScope real-time bed boundary detection technology in the Delaware Basin, operators were able to drill straighter and faster, especially in the Third Bone Spring, Party said.

“We saw everything take off in 2010 and 2011,” he said. “Today, the Permian produces more than 4 million barrels a day. If it were its own country, it would be the fifth largest producer in the world.”

Since that time, technology has only improved. Hybrid fracs of gel and slick water along with longer laterals have optimized production – even though oil prices have hovered between \$55 and \$60 a barrel during the last few years – and led to the Permian revolution, Party said. In some areas, operators are on their fourth and fifth generation of fracs, with each generation improving the economics.

Unlike other unconventional basins in the world, the Permian rose to super basin status in part because of its infrastructure, which has enabled operators to produce at lower costs. In fact, additional pipelines for oil and gas continue to be needed in the ever-producing play, Party said.

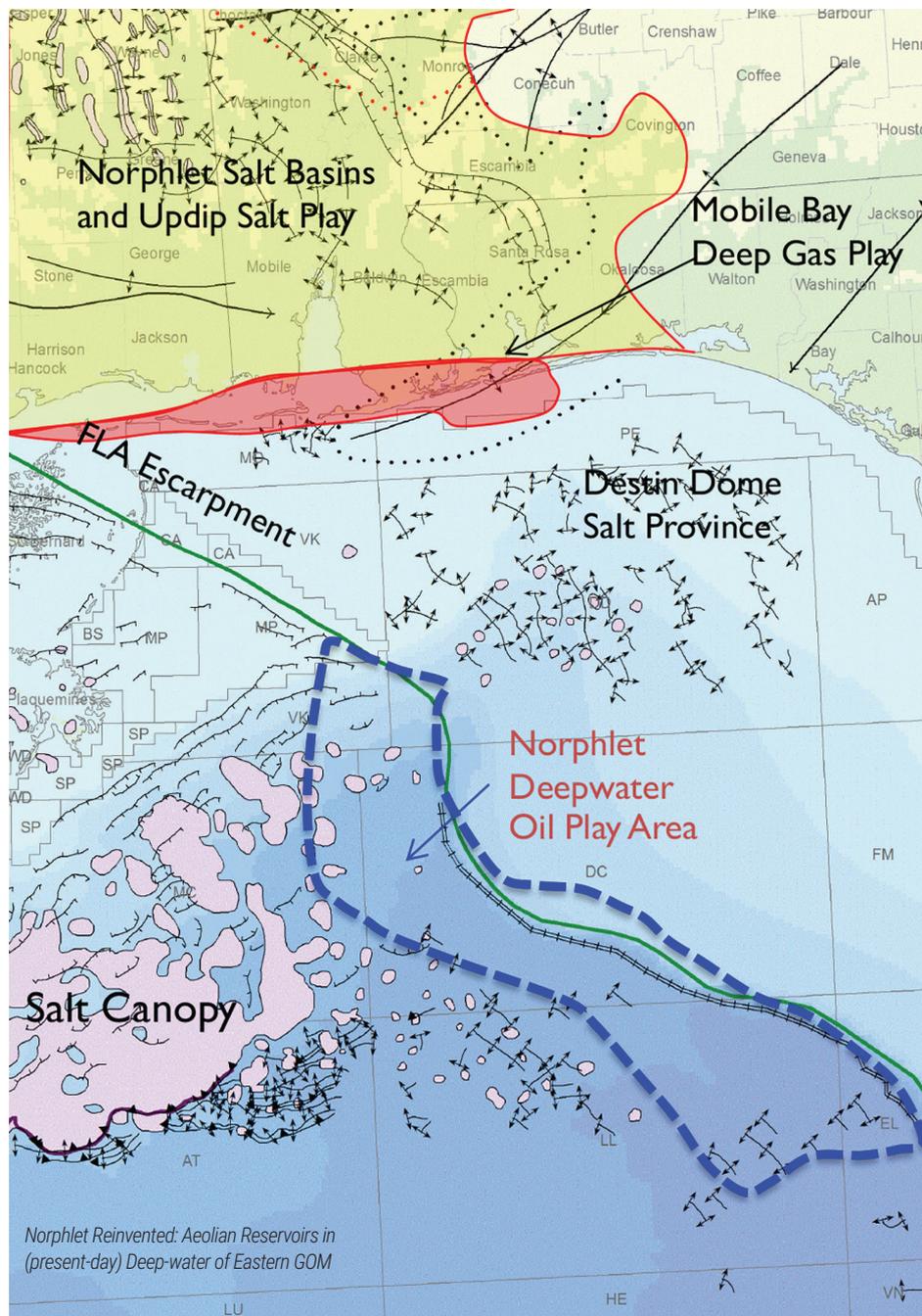
“The Permian Basin has become the prototype for all other super basins,” Sternbach said. “The question to answer now is how far along are the other super basins on this technology track?”

## Arabia’s Rich Systems

The Arabian Plate is home to indisputable super basins with a unique history also steeped in an evolution of technology. Replete with conventional resources, Saudi Aramco chose to invest early in geosteering technology at a time when many other operators in the industry focused on geometrically placed wells with fixed angles.

“Today, our professionals are capable of simultaneously placing tens of wells horizontally – continuously in real time and remotely while drilling – in the best part of the HC zones from their state-of-the-art Geosteering Center in Dhahran, Saudi Arabia,” said Misfir AzZahrani, executive director of exploration for Saudi Aramco.

Over the years, the national oil company has developed in-house technology, including its DrillCAM project, which is a fully-integrated surface and downhole acquisition and processing technology platform that enables and integrates seismic, formation descriptions, drillstring monitoring and automated drilling – all in real time, AzZahrani said.



Norphlet Reinvented: Aeolian Reservoirs in (present-day) Deep-water of Eastern GOM

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# Serve Environmental Geosciences through DEG

Every year both the AAPG and its divisions call on its members to step forward into leadership roles as they are able. As the Immediate past president of the Division of Environmental Sciences, one way that I serve the Division is to seek officer candidates for open positions in 2020-21. Open DEG positions are the president-elect, vice-president and editor. While we have written descriptions of each office and its duties (available upon request), let me share my observations on these officer positions.

The president-elect makes a longer commitment to the Division, as that person will become DEG president the following year. The most important job the president-elect does is to observe the Division, interact with the DEG officers and Advisory Council, and understand the greater role that environmental geosciences can and do play in AAPG. You are planning out your presidency for the following year. The DEG presidency does not consume a great deal of time, and understanding our Division and how to plan your year will allow you to be a much more effective leader. Immediate past presidents, current presidents and the president-elect are committed to helping each other understand the duties and roles of the DEG president and the Division as a whole.

The DEG vice-president is a one-year position. That person's main role is in reach out to the sections and regions by serving as the DEG Advisory Board's chair. Active members of the Advisory Council can assist sectional, national and international meeting planning committees by helping to arrange quality environmental geosciences programs.



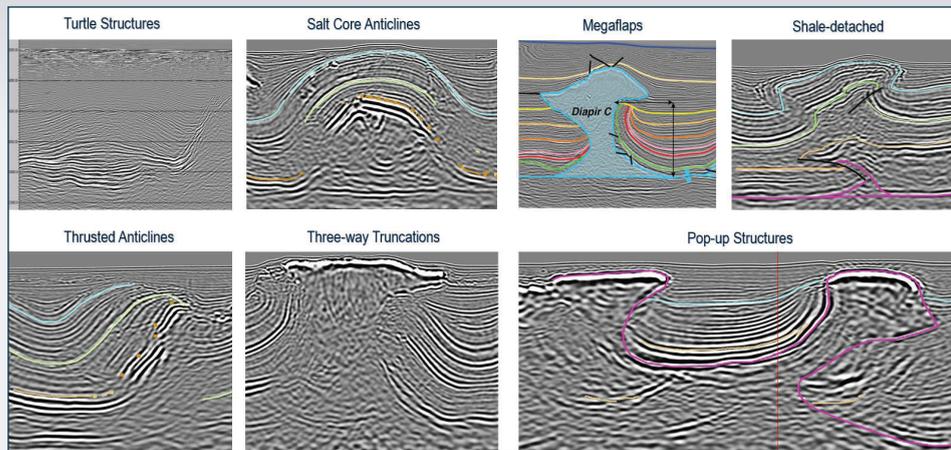
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The VP also acts as the Awards Committee chair. Dan Jackson, 2018-19 VP, played an active role in assisting the ICE 2019 planning committee in putting together environmental geosciences-related talks. Current VP Autumn Haagsma

helped organize CCUS-related talks given at both the AAPG Eastern Section and 2019 ACE meetings to be published in the DEG's journal.

The DEG editor is a two-year position. The main work of the DEG editor is responsibility for the content and quality of material published in the division's quarterly journal, Environmental Geosciences. Dr. Olga Popova, the current DEG editor, has successfully overseen the EG journal, including a special edition on carbon capture, utilization and storage and the geosciences. She has served as a leader to other DEG officers and members to promote and attract high quality environmental geosciences manuscripts for our journal.

It is an interesting and challenging time in the environmental geosciences, especially as applied to the role of the petroleum industry in developing natural resources in a responsible manner. DEG is not a large group, but our impact through meetings and our journal are significant to the AAPG membership and the larger environmental geosciences community. Please consider how you can serve. Write me at [mbarrett@centenary.edu](mailto:mbarrett@centenary.edu) if you are interested in knowing more about these offices.



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"This and other innovative solutions have pushed our upstream capabilities to newer and higher levels," he said.

Presently, the company is developing technology for wireless seismic acquisition, real-time monitoring and data transfer, processing simulation, smart well completion and nanotechnologies that will enable faster and more efficient exploration and development, AzZahrani added.

Looking forward, the company plans to build integrated geoscience solutions with the latest Fourth Industrial Revolution (4IR) capabilities.

"Subsurface digital twins, life earth models, intelligent remote sensing and AI-prospecting are some examples of the next generation capabilities that will soon be enabled by our 4IR in-house platforms," AzZahrani said. "Considering the age and health of Saudi Arabia's offshore and onshore basins, much more oil and gas is there to be extracted and yet to be discovered from both conventional and unconventional resources."

AAPG will host the 2020 Hedberg Conference in Mexico City from Feb. 5-7. The conference will focus on the Gulf of Mexico super basin, specifically the geology and hydrocarbon potential of the circum-Gulf of Mexico pre-salt section. For more information, please visit: [www.AAPG.org/events](http://www.AAPG.org/events).

AAPG will also host the third of three global super basin conferences at the 2020 Global Super Basins Leadership Conference in Sugar Land, Texas from Feb. 11-13. Approximately 17 onshore and offshore super basins will be highlighted to provide attendees and decision makers access to numerous resources and information to help develop their own basins. For more information, please visit [www.AAPG.org/events](http://www.AAPG.org/events).

While technology has no doubt played a pivotal role in giving mature basins new life, AzZahrani reminded that technology is only as good as the people who employ it.

"Technology, inherently, is only a tool. A tool is only of value in the hands of the right people," he said. "People are the real asset of any business."



# [SUBMIT NOW]

**Deadline: 6 February 2020**

The American Association of Petroleum Geologists (AAPG), in conjunction with the Association of Spanish Geologists and Geophysicists of Petroleum (AGGEP), is proud to host the 2020 International Conference and Exhibition (ICE) at IFEMA – Feria de Madrid in Madrid, Spain, 28 September–1 October 2020. Now is the time to share your knowledge, insights, and research to help guide our geosciences community to expand frontiers and unlock resources for future generations.

The Technical Program Committee invites you to submit abstracts under the following theme/subthemes that have direct application to the industry. In particular, abstracts that deal with the hottest, most relevant play areas, both domestic and international, are most desirable. The committee also encourages case studies that illustrate the successful implementation of new techniques and technologies. In addition, student participation is a priority – AAPG ICE is an invaluable opportunity to showcase graduate research that advances the industry.

TECHNICAL PROGRAM THEMES

- Theme 1: Basins and Petroleum Systems**
- Theme 2: Unconventional Resources**
- Theme 3: Structural Geology, Tectonics, and Geomechanics**
- Theme 4: Stratigraphy and Sedimentology**
- Theme 5: Geophysics**
- Theme 6: Development Geosciences and Mature Fields**
- Theme 7: Energy Transition**
- Theme 8: Digitalization in Geosciences**

### For More Information Contact:

**Terri Duncan**  
 Technical Programs Coordinator  
 Phone: +1 918 560 2641  
 Email: [tduncan@aapg.org](mailto:tduncan@aapg.org)

**Jan Simpson**  
 Technical Programs Coordinator  
 Phone: +1 918 560 2631  
 Email: [jsimpson@aapg.org](mailto:jsimpson@aapg.org)



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