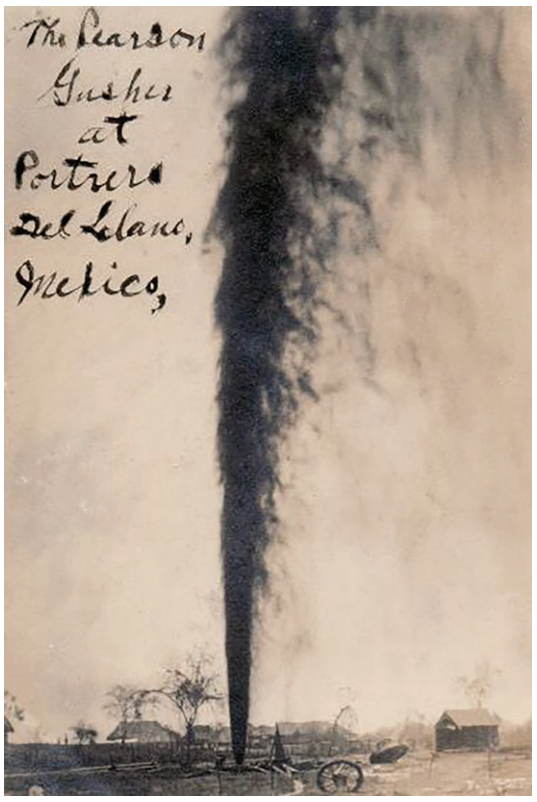
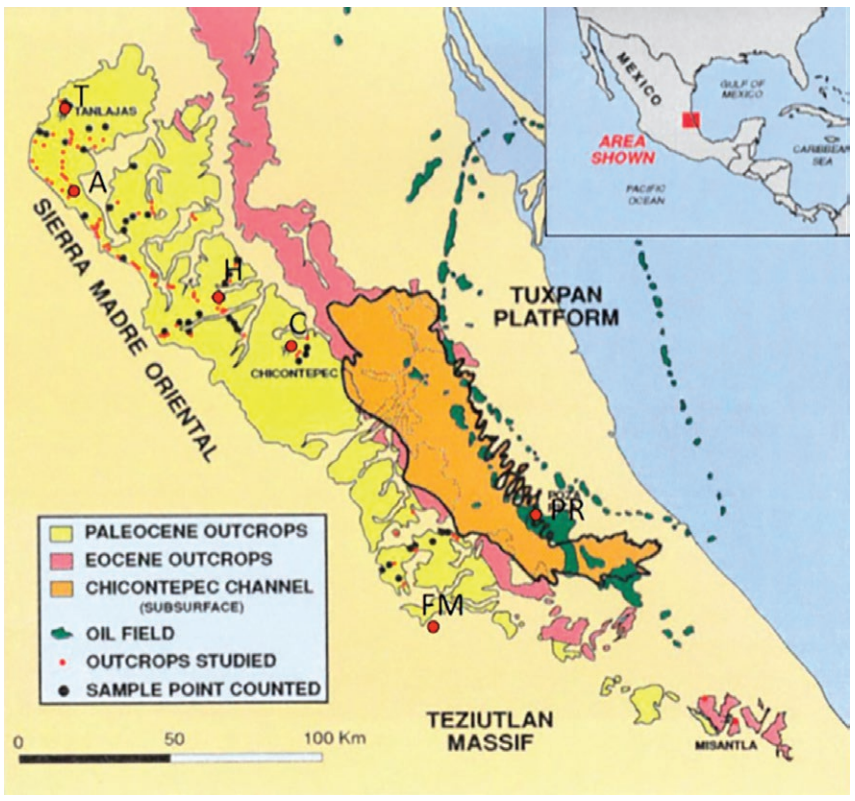
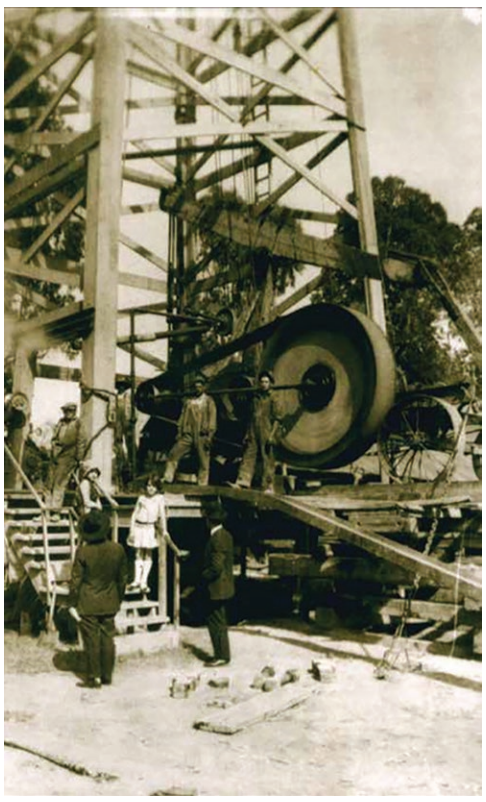






Left: Early wildcat discoveries on the Golden Lane Potrero del Llano-4 (1910). Right: Poza Rica Field, ca. 1930's. Images are from the "2018 Mexico History of Oil Exploration."

The Permian Lookalike: Tampico-Misantla

Evaluating the potential of Mexico's super basin

Mountains, volcanoes and beaches. Colonial cities, farming communities, indigenous villages.

Central Eastern Mexico is full of diverse cultures and landscapes.

It is also home to the Tampico-Misantla super basin, a 25,000-square-kilometer area that has produced oil since 1869.

AAPG Member and consultant Alfredo Guzman describes the Tampico-Misantla, which includes the Chicontepec sub basin, as a "super-charged basin" that contains late Jurassic source rocks and produces from at least 10 geologic levels.

Guzman, a 35-year Pemex veteran, has worked in the basin since the late 1980s. He noted that, though well-known geologically, the basin has "extraordinary oil and gas potential that has not been properly considered."

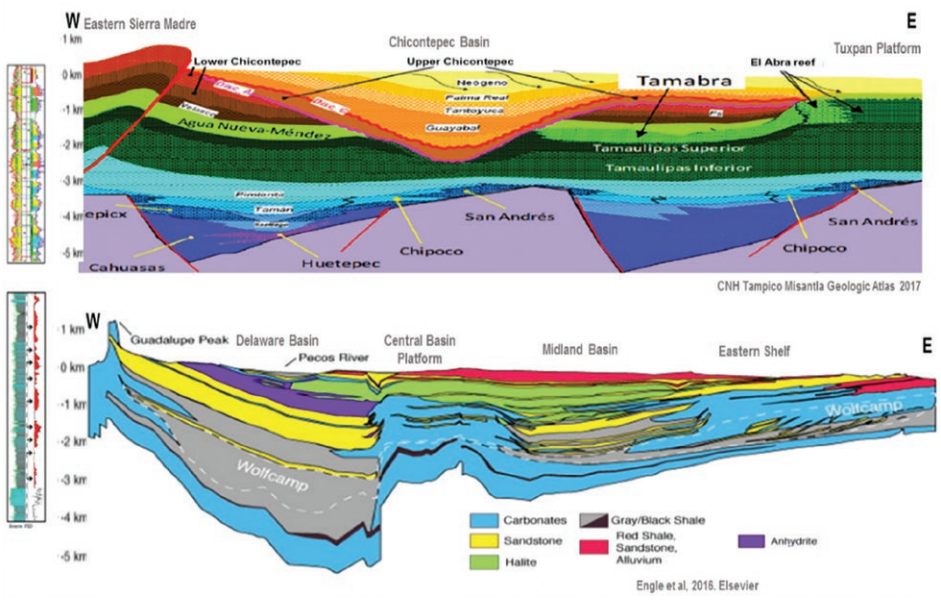
His estimates that Tampico-Misantla contains more than 150 billion barrels of original oil in place in conventional oil carbonate reservoirs, in tight oil siliciclastics and in unconventional shales. Of those, just 8 billion barrels of oil equivalent have been produced and 7 Bboe are considered reserves.

A Permian Lookalike?

For Guzman, Tampico-Misantla shares many characteristics with the powerhouse super basin to the north, the West Texas Permian.

The 75-square-mile Permian Basin, including the Midland and Delaware sub basins, started producing oil in the early 1900s, and by mid-century was one of the United States' primary producing regions. Original production came from conventional reservoirs in carbonate rocks but now comes from fine grained detrital rocks deposited in the basins with organic matter by turbidity currents. Once considered source rocks only, the detrital rocks began producing with the advent of horizontal multifractured wells.

Guzman noted how the Midland Basin reservoirs were once considered the world's largest uneconomic oil field. Thanks to hydraulic fracturing and technological advances, the Midland now produces 2 million barrels of oil equivalent. The Midland and Delaware Basin together make the world's second largest producing region, which is expected to surpass Iran and Iraq.



Guzman explained that both the Midland and the Chicontepec sub basins are intracratonic depressions bordered by carbonate shelfs later filled by fine to medium grained sediments carried into the basins by turbidite currents. Both sub basins have similar permeabilities and porosities and multiple layers of mature rich organic matter sediments with characteristics of being source rocks and/or very tight reservoirs capable of sustaining commercial flow of oil though horizontal drilling and fracking technology.

Historical Production

Tampico-Misantla served as Mexico's primary producer until the 1970s when national oil company Petroleos Mexicanos (Pemex) discovered the Mesozoic Chiapas-Tabasco and Campeche Sound provinces.

"After that, exploration stopped in the basin, as in all the rest of the country, and the basin was all but abandoned as Pemex reallocated all its investments, rigs and technical personnel to the new oil provinces," Guzman said.

Because non-Mexican companies could not work in the country at that time, the basin was abandoned.

"In the 1980s, from a corporate point of view, limited resources needed to be deployed in its more profitable reservoirs, especially when all the production of the basin came to be only 3 percent of the national oil output, but for the country it meant the abandonment of one of the richest provinces of the world," Guzman said.

Guzman, who has studied Tampico-Misantla since the late '80s, cited National Hydrocarbon Commission estimates estimating that 107 Bboe have been found in the Basin and estimate that 144.3 Bboe have yet to be found. Despite the potential, only a fraction of the hydrocarbons has been discovered.

"Regardless of this huge endowment of oil and gas, only 7.8 Bboe have been extracted and only 7 Bboe are considered reserves (most of them in Chicontepec), which implies leaving in the ground at the end almost 93 Bboe of the original discovered," he said.

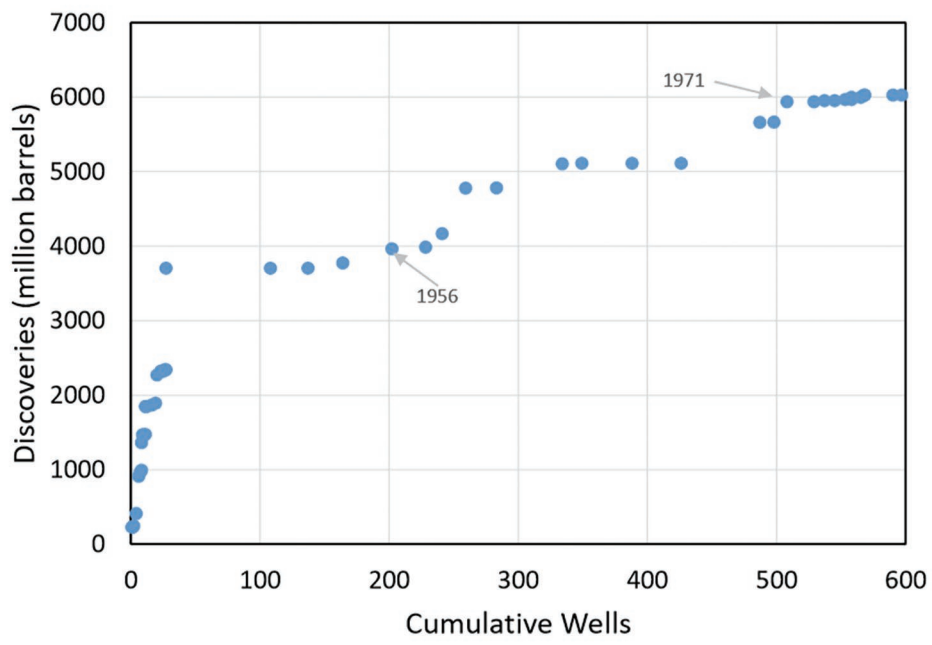
Studying the Super Basin

Companies inside and outside Mexico are taking notice.

Mexican operators Pemex, Diavaz, Petrolite and Latina, foreign operators Renaissance and Vitol and service companies Halliburton, Baker Hughes, a GE company, currently work the Chicontepec tight oil reservoirs.

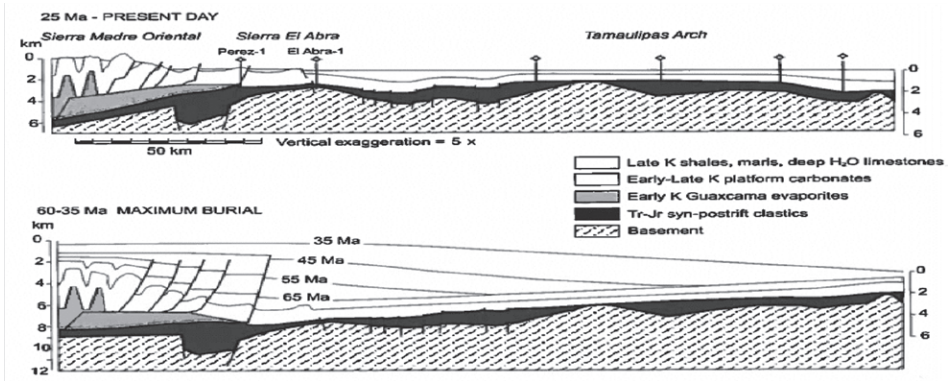
Other companies like Sierra Oil and Gas, an independent oil and gas company based in Mexico, are studying the Basin's potential.

Mark Shann, subsurface director, and



Creaming curve, Tampico-Misntla superbasins.

See Poza Rica page 14 ▶



Poza Rica

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Ana Vázquez, senior geologist, have spent four years studying the basin for Sierra. Though the company does not currently have any blocks there, they recognize the basin's oil potential and have evaluated the exploration and field development license rounds.

Vázquez grew up Poza Rica, in the heart of the Tampico-Misantla region.

"The history about this city is great and highly related to oil discoveries made pre-nationalization in the Golden Lane, and then post-nationalization, the development of Poza Rica field itself," she said. "This region has a huge potential to be reactivated in the oil industry, as well it has been played main roles for key decisions in the history of Mexico."

Shann worked on the basin in the 1990s as part of a technical study between Pemex and BP and then as part of the Apertura process.

"The exciting components of the Tampico-Misantla Basin are threefold: two mature world class source rocks of Jurassic age, one within the rift phase (Oxfordian Santiago Formation), and one post-rift (Tithonian Pimenta Formation); the carbonate reservoir story associated with the Tuxpan Platform, both in terms of exploration history and subsequent karstification; and the evident structural tilting of the basin geometry since the Eocene from an Early Tertiary foredeep to the Sierra Madrid mountains to its current gentle dip eastwards into the present-day Gulf of Mexico," he said.

Shann and Vázquez note that, despite the Tampico-Misantla's classification as a super basin, operators lack clarity on how much potential is present, in part because of the lack of recent discoveries.

"Challenges to future exploration success are to find a new conventional play concept to chase. Researching the last 50 exploration wildcats shows that no material oil discoveries have been made despite continued drilling through the 1990s onward," they said.

Potential Today

For Guzman, the success of the basin will be measured by the sheer amount of hydrocarbon produced, particularly through nonconventional techniques. He noted that, just like the Permian Basin, Tampico-Misantla can reach new production levels with investment and new technologies.

"Thanks to horizontal drilling and fracking in the Permian Basin today, oil is produced with very low porosities and permeabilities. That means that downgraded volumes in Chicontepec will be reconsidered under the light of the application of the new technologies and development plans and investment," he said. "The original oil and gas in allocated to the Chicontepec sub basin is less than half of what many experts always said to be, and the reserves are less than 10 percent of that. If technologies being used in the Permian Basin were considered, the original volumes and reserves would be much larger."

Guzman added that unconventional oil and gas volumes considered recoverable from the Pimienta and Agua Nueva source rocks are just two to three percent of the total quantity estimated to be contained in the rocks.

"Everything being used and done in the Midland and Delaware basins may be exported to Tampico – Misantla," he said. "The Basin could produce 2 to 3 MMboe in less than ten years, which would take Mexico back to its position as one of the main world producing countries, as is the case of the US, thanks to the Permian Basin."

Opportunities

So how can Mexico bring this investment and technology to the Tampico-Misantla?

See Reform page 24 ▶

Regimes

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"We are seeing more, not less, countries opening up their offshore waters to exploration," Lidsky said, which means the socio-economic-political environmental constraints are becoming all the more important to today's explorationists.

"Deepwater exploration targets are multibillion dollar and multidecade long projects. Any snafus in the above-ground risk environment have long-term implications – not the least of which is any recent history of expropriation of assets. Countries with a long history of stable fiscal regimes are much more competitive in drawing the exploration dollars of the world," he explained.

In 2017 (excluding the United States) there were 146 deepwater blocks awarded across the globe. Regionally, western Europe led the list with 50, followed by west Africa (18), Australasia (16) and Mexico (12).

In 2018 the number has jumped to 378 due largely to a successful bidding round in Norway that let 182 blocks with the Barents Sea taking the largest share of this with 39 blocks. Looking out to 2020, there are 605 deepwater blocks planned to be offered (excluding Faroe Islands, Mexico and United States).

Lidsky said, comparing the availability of licensing today in all regions of the world, compared to previous times, while the factors may have stayed the same, the stakes are higher.

This is complex, difficult and volatile thing to measure and Lidsky said his company, Drillinginfo, "Maintains a global network of scouts and industry professionals who continuously monitor and gather activity from countries and companies."

"In the global explorationists's eyes, attractive countries certainly include the United States, Norway, Brazil, Australia and certain areas in Africa," he said. "Frontier exploration certainly follows infrastructure, so countries with a long history of E&P with frontier opportunities will certainly rank towards the top of the list." E

Reform

from page 14

Mexico's Energy Reform, adopted by President Enrique Peña Nieto's administration in 2013, opened the country to foreign investment for the first time in 75 years.

The Reform brought significant change but requires a series of phases for full implementation.

The country's energy industry has faced uncertainty during the transition from the pro-business Peña Nieto government to that of left-leaning President Andres Manuel Lopez Obrador, who took office in December.

"The Energy Reform opened the door for the eventual exploitation of the enormous oil and gas potential in the Basin, but it not known how the new administration that just started will proceed," Guzman said.

Shann and Vázquez noted that while offshore exploration areas have been released for independent oil company (IOC) participation, most of the onshore areas, including Chicontepec and the unconventional Pimienta potential, remain under state control.

"Some service contracts were awarded in the early 2000s, but ultimately these proved less commercial than expected. Onshore nominal block sizes are also small by comparison to offshore blocks, and this may restrict IOC involvement to pursue new play concepts," they said.

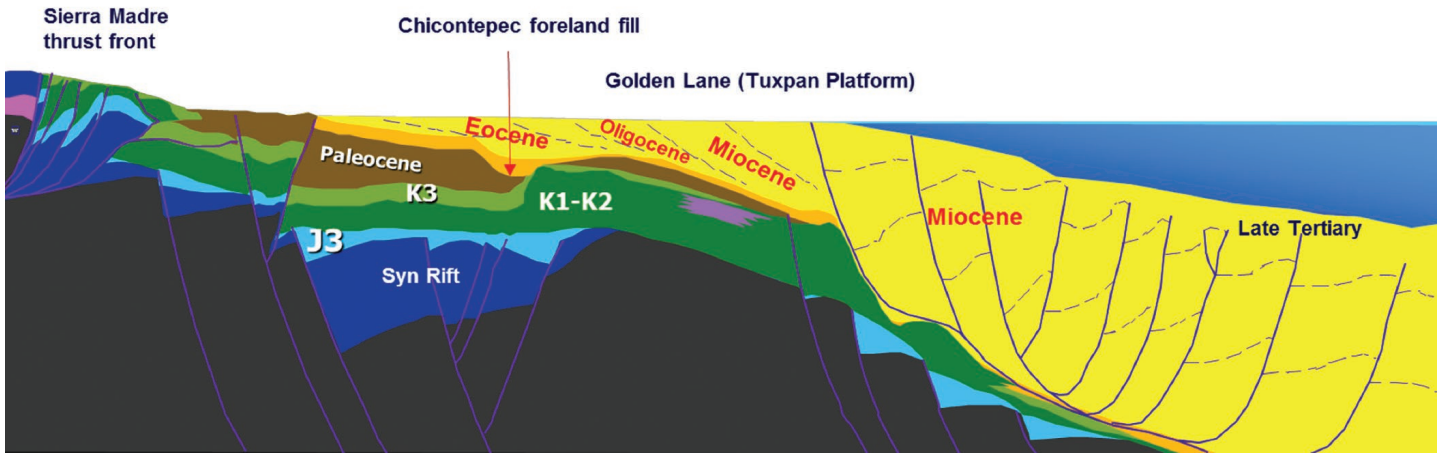

Image from the Mexican Association of Petroleum Geologists' "Introduction to Petroleum Basins of Mexico."

Challenges

In addition to contractual issues, companies operating onshore in Mexico face social and political challenges.

Groups like the Mexican Alliance Against Fracking includes 43 local, state, national and international associations demanding that hydraulic fracturing be prohibited in Mexico. The local member, No Fracking Tamulipas, teaches the community about the possible negative impacts of the practice.

"These groups have to be educated and convinced as to the benefits and real risks," Guzman said. "The new administration has been listening to these groups, and it is possible that it will call for a moratorium in the use of the technologies needed. The previous administration promoted the continued use of frac'ing just keeping safe distances from communities. It is still not clear what will happen."

Since taking office, the López Obrador administration has taken steps to curtail onshore exploration in Mexico.

On Dec. 11, Mexico's energy secretary cancelled two bid rounds scheduled for Feb. 14. The rounds included 37 onshore blocks and nine unconventional blocks. During a tour of the Chiapas state, Energy Secretary Rocio Nahle announced that the bid round would not take place and that the government "is going to wait."

Hope for the Future

Despite current uncertainty, many operators maintain hopeful that in the long term, Mexico will embrace its hydrocarbon potential and Tampico-Misantla will be a part of the country's success story.

"The basin has a very rich exploration history at the beginning of the oil era and a well-developed oil infrastructure and ample well data today," Shann and Vázquez said. "These types of basins, under the right investment conditions, can have the ability to re-invent themselves with the application of new technology, new ideas and new improved well completion practices. Tampico-Misantla should be able to do this, and we strongly believe that there is a prolific future potential to be gained."

Vázquez said her home region, also known for its agriculture and citrus production, could benefit from additional economic opportunities.

"The general feeling from the population is a bit depressed, as the economy in this region has dropped off recently. People in Tampico-Misantla have been working for many years in the oil industry and they know it very well and more bid rounds would help stimulate growth," she said.

"The cities of Poza Rica and Tampico are good examples of where future conventional and unconventional hubs can be developed in Tampico-Misantla. The relative quick access to the U.S., Tampico port, the continuity of oil play fairways, plus the option to find new plays could be a good stimulus to investors and companies to reactivate the oil industry in the region."

For Guzman, the sooner conditions are met, the more the region and the country Mexico will benefit.

"It is necessary to promote the potential of the basin at a time when output is declining, the new offshore production won't come online until after 2022," he said, adding that "no basin, regardless of its potential, will become another Permian unless the economic, social and political conditions are right."

Guzman will deliver the talk, "Tampico-Misantla Super Basin, Look Alike to the Permian Basin?" at AAPG Global Super Basins 2019 conference taking place in Sugar Land, Texas on Jan. 22-24.

For more information and to register visit SuperBasins.AAPG.org. E