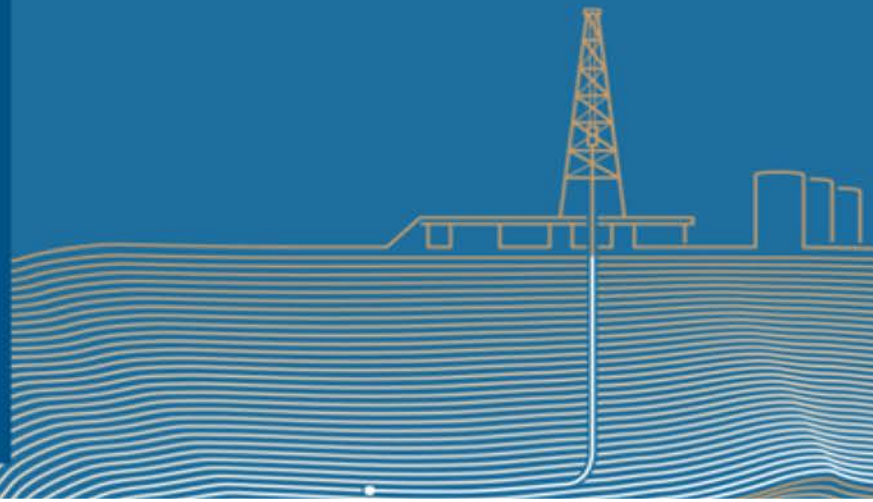
AAPG's GLOBAL SUPER BASINS 2019
The Permian



The Tampico - Misantla Super Basin, Look Alike to the Permian Basin?

AAPG Global Super Basins, The Permian Conference

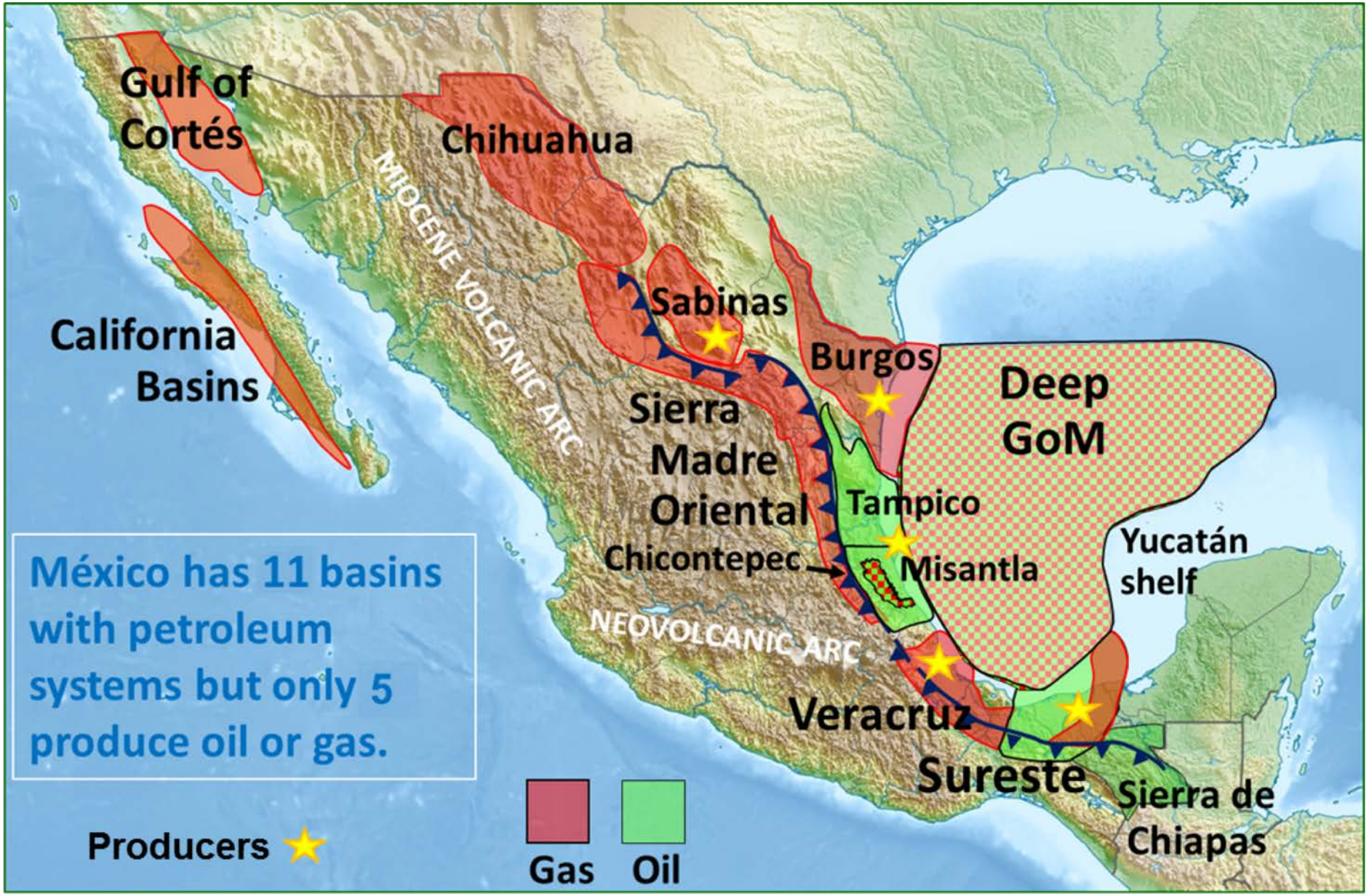
Sugarland, Texas

Alfredo E. Guzman

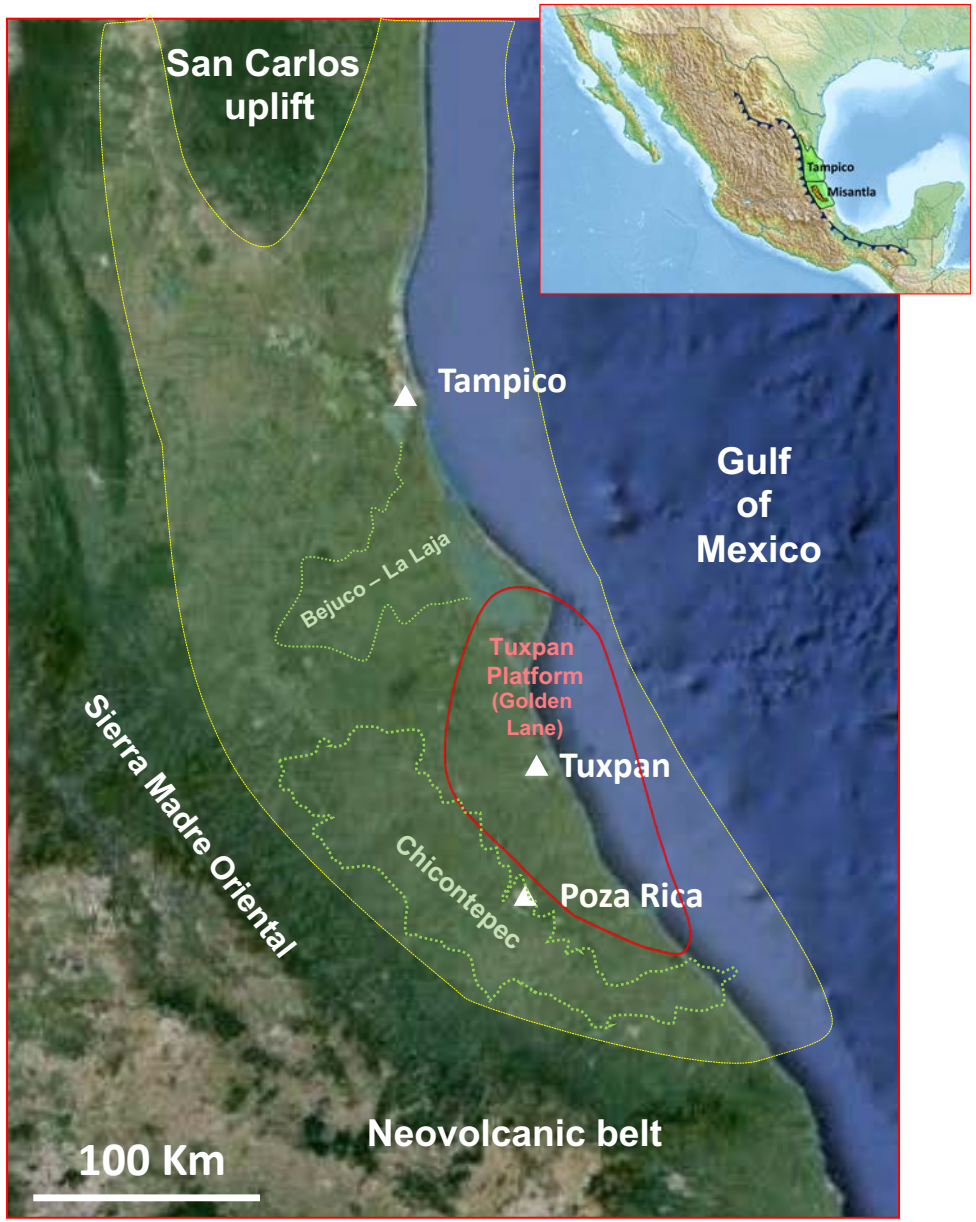
MPC
MEXICO PETROLEUM COMPANY
AN EXPLORATION AND PRODUCTION COMPANY

January 23, 2019

Mexico's oil and gas basins



The Tampico - Misantla Basin



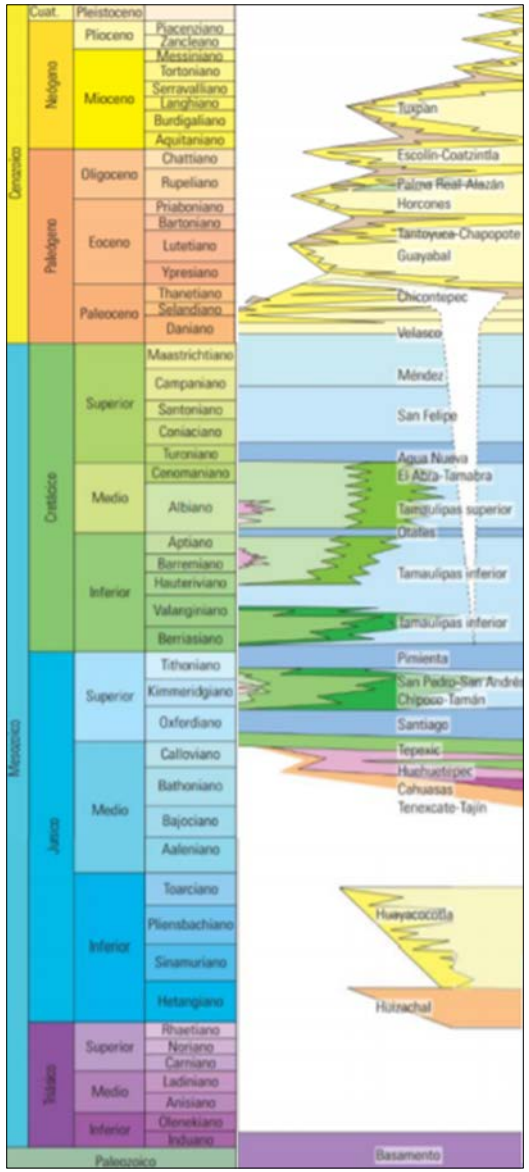
- 51,200 Km²
- Limited by:

  W: Sierra Madre Oriental
  E: Gulf of Mexico
  S: Neovolcanic belt
  N: San Carlos uplift

- Main geologic features:

  Tuxpan Platform
  Chicontepec paleochannel
  Bejuco – La Laja paleochannel

Tampico – Misantla a Super Basin



CNH / Pemex

Source Rocks

Reservoir Rocks

Main Plays / Fields:

Tantoyuca (Neogene)

Chicontepec (Paleogene) **Unconventional tight oil**
- Agua Fría-Caopechaca-Tajín, others

Agua Nueva (Upper Cretaceous) **Unconventional carbonate**
- Ébano-Pánuco, others

El Abra (Middle Cretaceous)
- Faja de Oro fields

Tamabra (Middle Cretaceous)
- Poza Rica
- Tres Hermanos

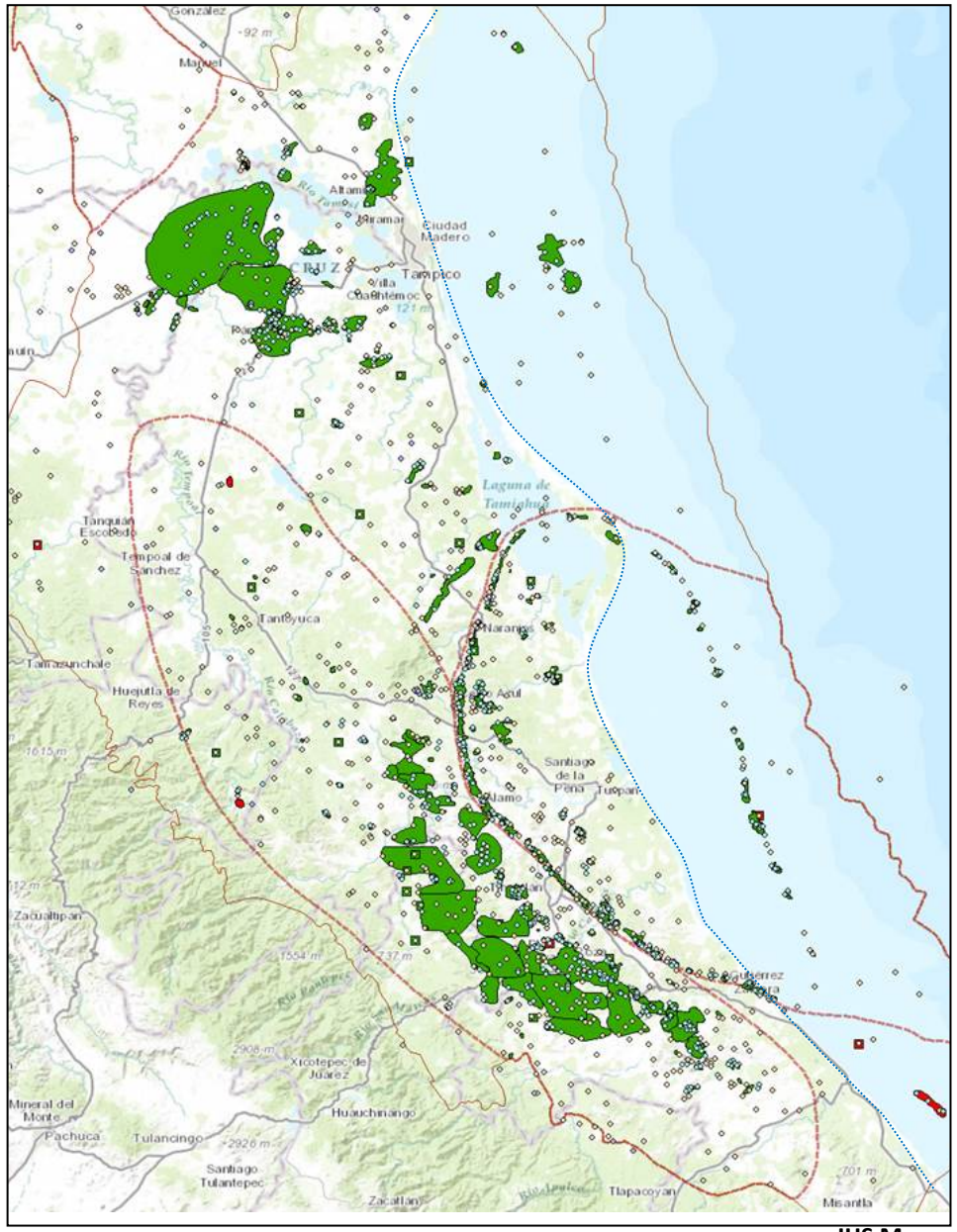
Tamaulipas Inferior (Lower Cretaceous) **Unconventional carbonate**
- Barcodón
- Arenque
- Tamaulipas

San Andrés (Upper Jurassic)
- San Andrés
- Tamaulipas
- Arenque

Pimienta (Upper Jurassic) **Unconventional oil shale / carbonate**
- Paso de Oro, others

Tepexic (Upper Jurassic)
- Tepexic, Huehuetepec

Oil and Gas in the Tampico – Misantla Basin



IHS Map

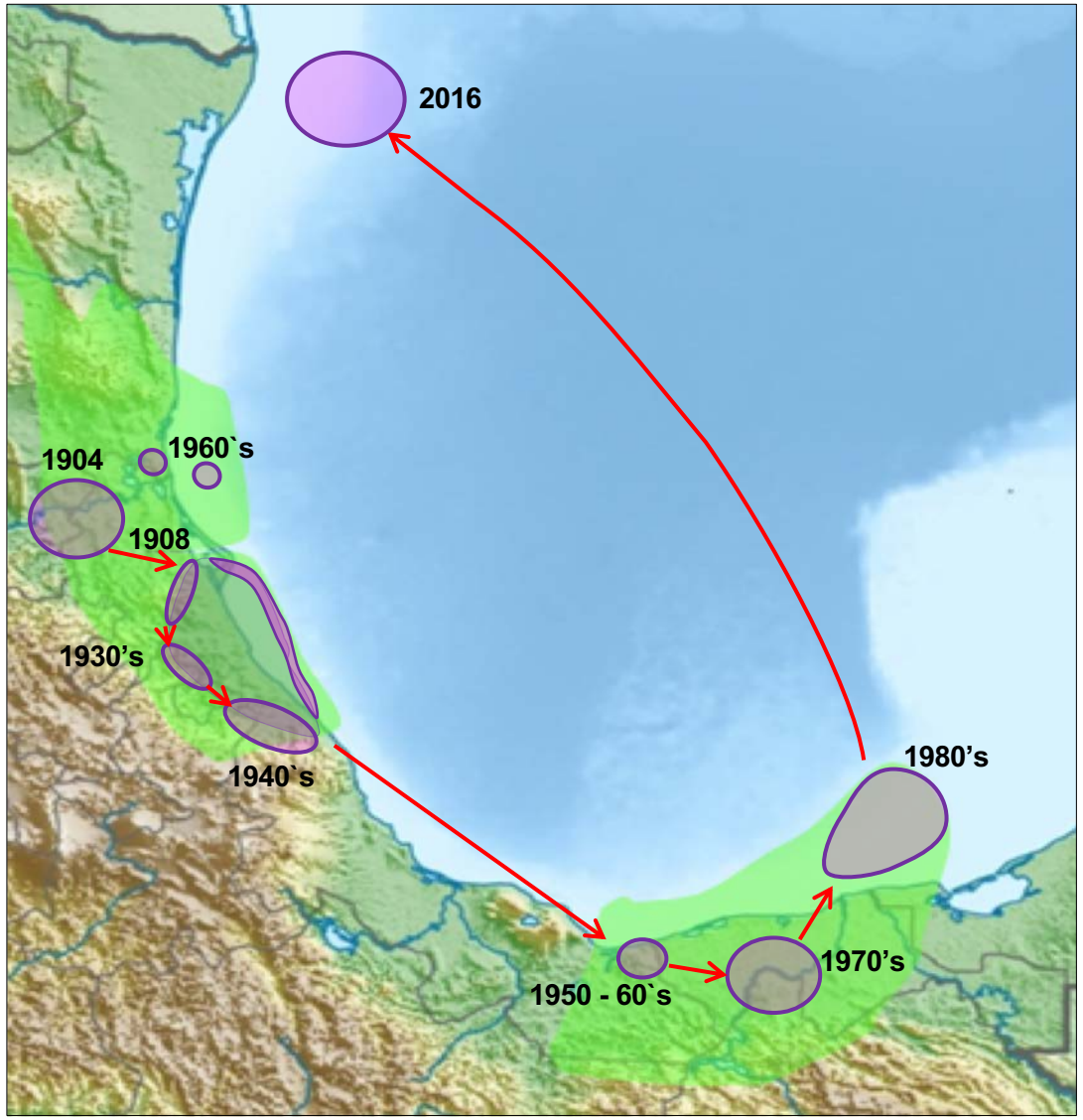
	Original Volume		Cumulative Prdn.		3P Reserves		Resources	
	OOIP Bb	OGIP Tcf	Bb	Tcf	Bb	Tcf	CONV. Bboe	UNCONV. Bboe
Tampico – Misantla	31.8	49.8	5.5	7.7	0.7	0.7	2.4	34.8
Chicontepec	59.0	31.6	0.3	0.5	3.9	11.0		
	90.8	81.4	5.8	8.2	4.6	11.7		

- **Hydrocarbon resources:**
  - 107 Bboe discovered
  - 2.4 Bboe conventional YTF
  - 34.8 Bboe shale

  } **144.3 Bboe**

- **Only 6% of the oil, and 10% of the gas extracted in 115 years!**
- **93 Bboe considered uneconomic (mostly in Chicontepec).**
- **In Chicontepec only 0.5% of the oil, 1.6% of the gas have been produced. EUR is 4.2 Bbo and 11.5 TCF (7% of the oil and 36% of the gas originally in place).**
- **Without Chicontepec, reserves are 0.7 Bb (2% of the oil) and 0.7 TCF (1.4% of the gas), for an estimated EUR of only 19% of the oil and 17% of the gas, leaving behind almost 25 Bb and 41 Tcf, way less of what should be expected for conventional reservoirs and logic only because Pemex stopped investing in E&P in the basin in the 1980´s.**

Why so much remnant oil and gas



The "Bitten Apple" Syndrome

A. Lajous (Former Pemex Chairman)

"When a new, more productive province was discovered, previous ones were pretty much abandoned." This was valid strategy for one oil company but not for a whole country.

Ébano – Pánuco

↓

Northern Golden Lane onshore

↓

Southern Golden Lane – Poza Rica Trend onshore

↓

Golden Lane offshore – Jurassic fields

↓

Tertiary fields onshore, Southern Basin

↓

Mesozoic onshore, Southern Basin

↓

Mesozoic offshore, Southern Basin

↓

Deep water northern Gulf of Mexico

When the Mesozoic in the Southeast basin was discovered, the basin was practically abandoned. Its oil was costlier and its wells less productive and produced only 3% of Mexico's total. These discoveries also resulted in the exploration of México being drastically reduced for the next 30 years.

Tight oil in the Chicontepec sub basin

Chicontepec was certified by D&M in the 1960's to have 137.3 Bb and 63 Tcf with 3P reserves of 17 Bboe. This was confirmed in the early 2000's also by D&M and by NSAI, but after 2010 these volumes were downgraded to 59 Bb and 31.6 Tcf with 3P reserves of only 6.3 Bboe.

Pemex Exploración y Producción, Región Norte
Reservas de hidrocarburos al 1 de enero de 2011

	Volumen original		Reserva de hidrocarburos					Reserva de gas	
	Aceite	Gas natural	Petróleo crudo equivalente	Aceite	Condensado	Líquidos de planta *	Gas seco **	Gas natural	Gas seco
	mmb	mmmpc	mmbpce	mmb	mmb	mmb	mmbpce	mmmpc	mmmpc
Totales (3P)	166,663.0	146,030.6	18,883.6	11,915.9	25.1	1,854.9	5,087.6	34,632.0	26,460.5
Aceite Terciario del Golfo	137,289.4	63,045.8	17,098.2	11,379.1	0.0	1,754.4	3,964.7	28,294.4	20,620.1

Source: Pemex

Comisión Nacional de Hidrocarburos

Volumen original, reservas y producción acumulada de hidrocarburos al 1ro. de enero de 2016

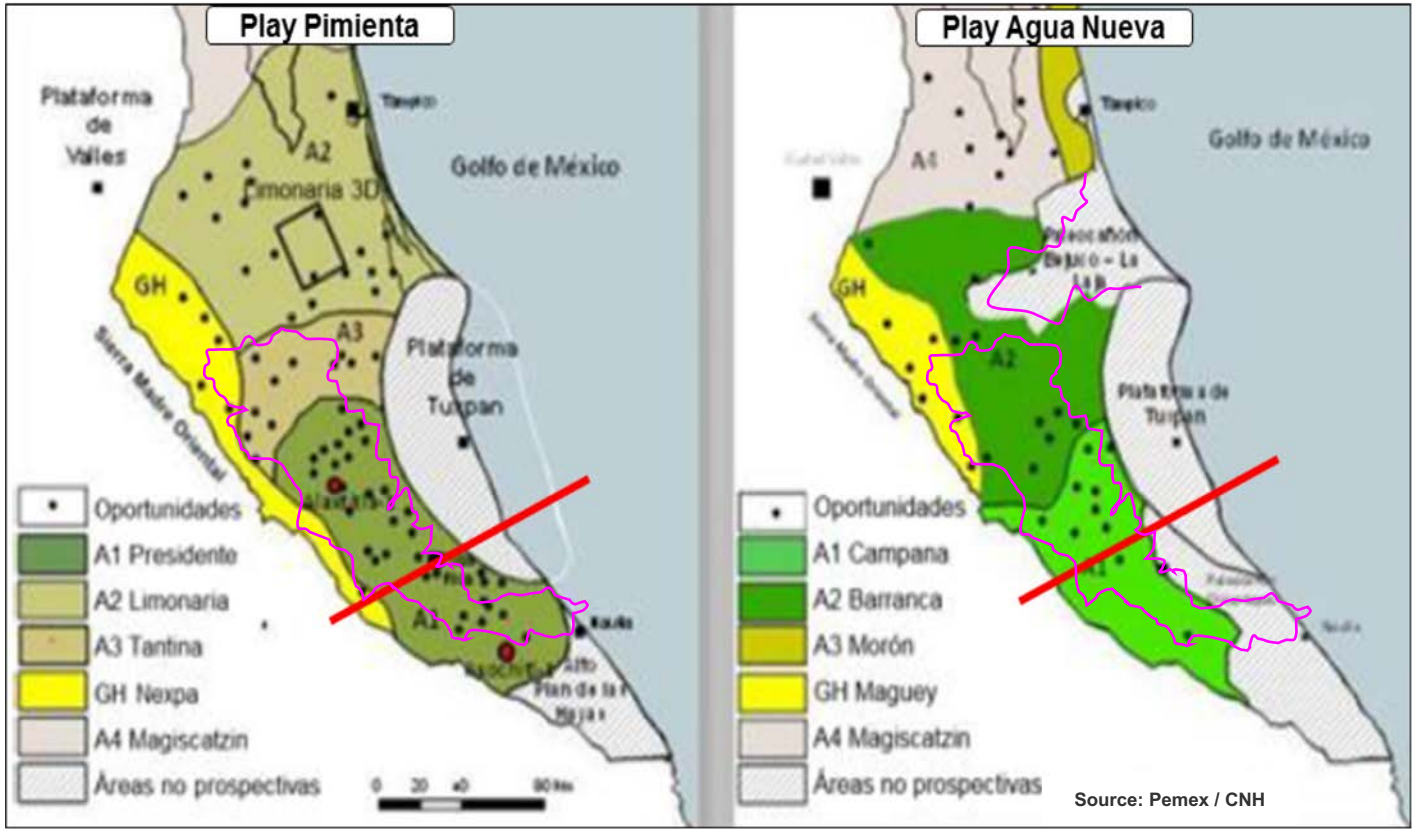
Región /Activo	Volumen original 3P*		Producción acumulada			Reserva remanente								
						Petroleo crudo equivalente			Aceite			Gas		
	Aceite	Gas	PCE	Aceite	Gas	1P	2P	3P	1P	2P	3P	1P	2P	3P
	mmb	mmmpc	mmbpce	mmb	mmmpc	mmbpce	mmbpce	mmbpce	mmb	mmb	mmb	mmmpc	mmmpc	mmmpc
Norte	92,393.2	115,819.1	9,406.1	5,953.3	26,083.9	1,293.0	4,580.7	7,831.7	758.9	2,722.6	4,630.3	2,726.7	9,037.0	15,407.4
Aceite Terciario del Golfo	59,043.8	31,554.1	406.3	287.2	592.8	687.0	3,658.6	6,257.4	515.5	2,346.8	3,880.2	834.8	6,127.9	10,968.5

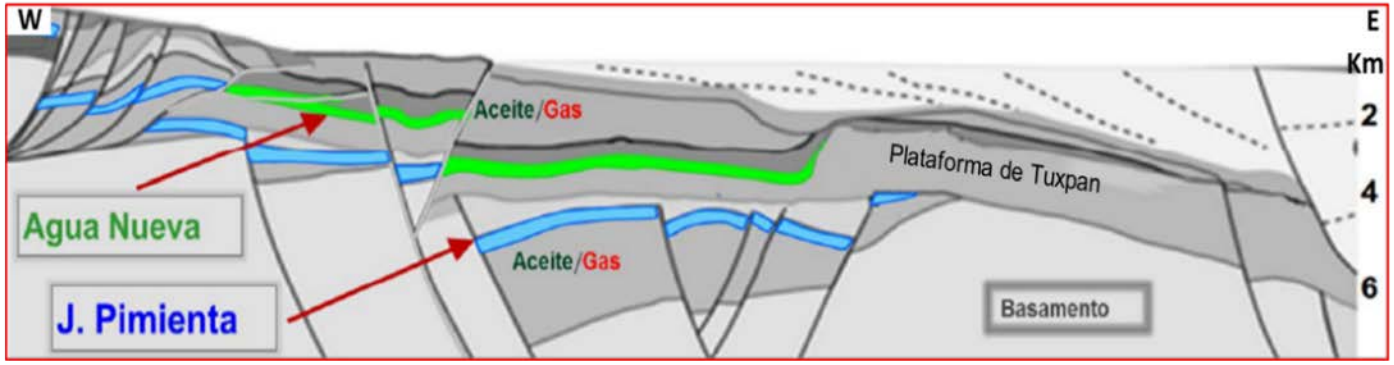
Source: CNH

These volumes should be revised considering Permian Basin best practices.

An attempt to develop Chicontepec was undertaken in the early 2000´s with vertical drilling and single fracs, but the costs per barrel could not compete with the Southeast and when the oil prices collapsed, its development by Pemex was suspended. Parts of the basin were expected to be tendered under the Energy Reform, but no bid rounds were called for unconventionals.

Shale oil in the basin





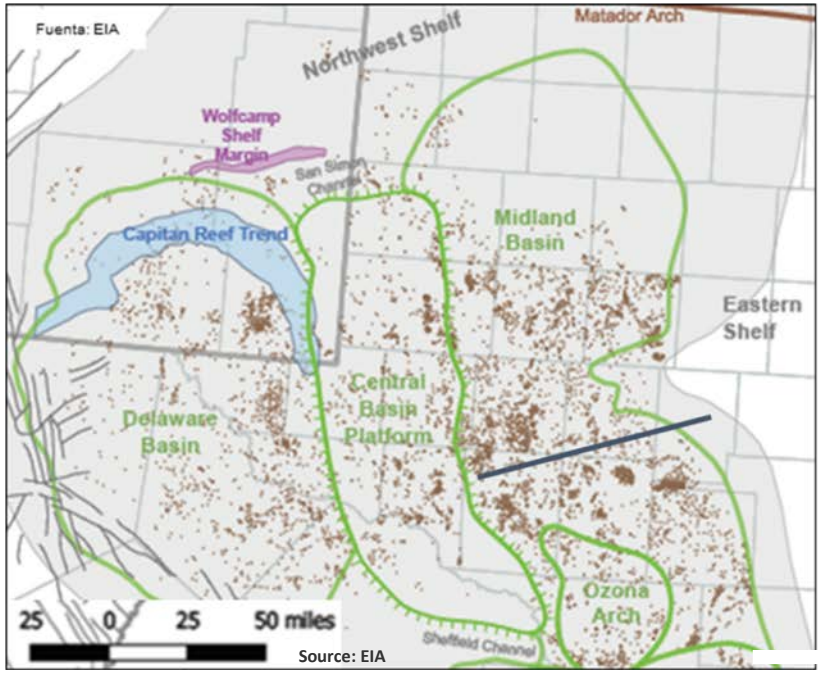
Source: Pemex J. A. Escalera

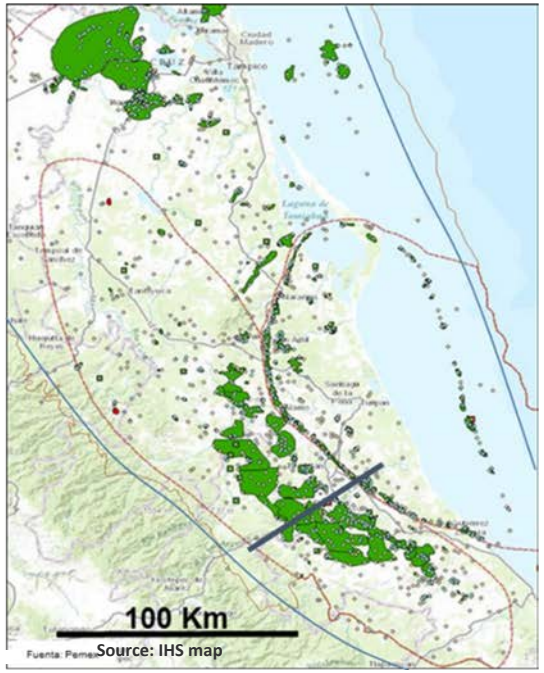
The Tithonian and Oxfordian rocks are organic rich calcareous shales and the Turonian are shaly limestones.

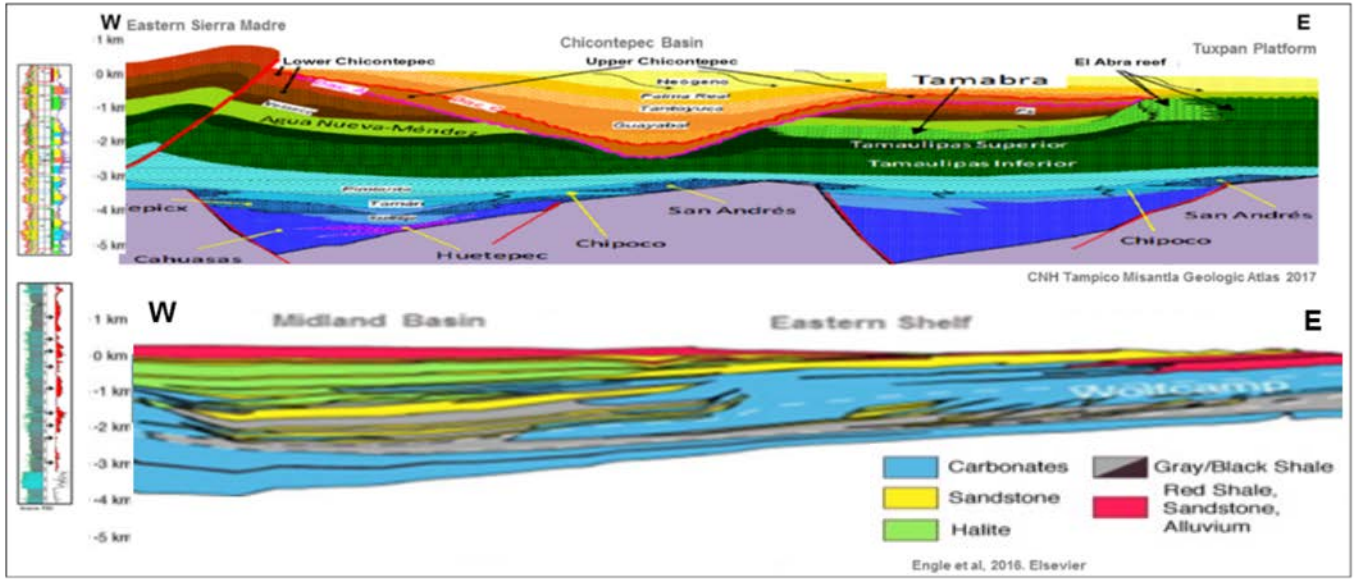
The Turonian Agua Nueva Formation has produced over a billion barrels of oil in the Ébano-Pánuco fields.

The Upper Jurassic rocks have been tested succesfuly by Pemex in several unconventional wells but there has yet to be a full fledged effort to develop them.

The Midland and Chicontepec Sub Basins



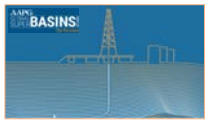




Both are intracontinental sub basins surrounded by carbonate plataforms and filled by siliciclastic turbidites and are underlain by rich organic shales and have similar petrophysical characteristics.

Tampico – Misantla has the same type of reservoirs than the Permian:

- **Conventional carbonates**
- **Tight silts and dirty sands**
- **Rich organic shales**



Permian Basin vs. Tampico – Misantla Basin

Permian Basin Pioneer / EIA / USGS	Tampico – Misantla Basin Pemex / CNH	
Original Oil and Gas in Place > 150 Bboe	Original Oil and Gas in Place > 107	
Daily Production 3.6 MMbo	Daily Production .08 MMbo	
Cumulative Production > 37 Bboe	Cumulative Production 7.4 Bboe	
Recoverable > 122 Bboe	Recoverable (Reserves) 6.9 Bboe	> 44 Bboe
	Conventional and Unconventional Recoverable (Resources) 37.2 Bboe	
Midland Sub basin	Chicontepec Sub Basin	
Daily Production > 2 MMbo	Daily Production 0.04 MMbo	
Cumulative Production > 2 Bboe	Cumulative Production < .300 Bboe	
Active Rigs ~ 500	Active Rigs 3	
Total wells > 130,000	Total wells < 3,000	

Final remarks

- The Tampico - Misantla Basin has all the requirements to be considered a prime super basin.
- Both Tampico - Misantla and the Permian basins have oil and gas trapped in conventional carbonate reservoirs, in unconventional tight reservoirs and in unconventional oil shales.
- Differences between the two basins are not that much in the volumes of oil and gas in place in each, but they reflect the levels of activity and investment in each.
- To increase the production in the Tampico – Misantla Basin to a level that even comes close to that of the Permian Basin would require investments in drilling, completions (fracking), facilities, etc., similar to those of the US basins as well as an administration that is fully commited to its success.