

Overview of the Deepwater Geology of the Mexican Gulf of Mexico – Round One of Bidding in the Energy Reform*

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Abstract

Round one in the energy reform in Mexico associates PEMEX with other operators for the first time. Numerous leads, lessons learned, and prospective resources based upon hydrocarbon systems analysis, seep analysis, and regional seismic studies indicate that the opportunities in Mexico's deepwater basins are large and underdeveloped. This presentation includes a discussion on unlocking these potentially prolific hydrocarbon trends in two primary deepwater areas: the Perdido Fold Belt and the Southern Deepwaters of Mexico.

The Perdido Fold Belt (PFB), is located in the Western Gulf of Mexico, it is a shared structural trend that runs across the U.S./Mexico maritime boundary. The belt is part of the Cenozoic compressional fold system in the Gulf of Mexico and is distinctive in deformation details and structural style. The PFB contains Upper Jurassic-Eocene age strata folded during the early Oligocene (36-30 Ma), with deformation most likely continuing into the Early Miocene. Formed by gravity sliding, the belt consists of a series of southwest-northeast-trending, parallel, megascopic-scale kink bands and flanks that are cut by reverse faults containing Cretaceous to Eocene sedimentary rocks.

The “reservoir” facies are:

- Lower Cretaceous fore-reef carbonate debris analogous to the major productive section in Poza Rica field, Mexico,
- Upper Cretaceous chalks, and
- Tertiary turbidite sands related to Wilcox and Frio delta systems from the Rio Grande embayment and the Rio Conchos, Rio Fernando, Rio Soto la Marina, and the Carrizales and Panuco rivers in Mexico.

The “Southern Deepwaters” is a largely untested trend located in the central to southern region of Mexico's deepwater region. Discoveries thus far have been Miocene in age and containing wet gas. There also exists surface geochemical data for this region. Included is a discussion on the exploration challenges found in deep and ultra-deep waters for Round One Bidding which is scheduled to take place in February, 2015.

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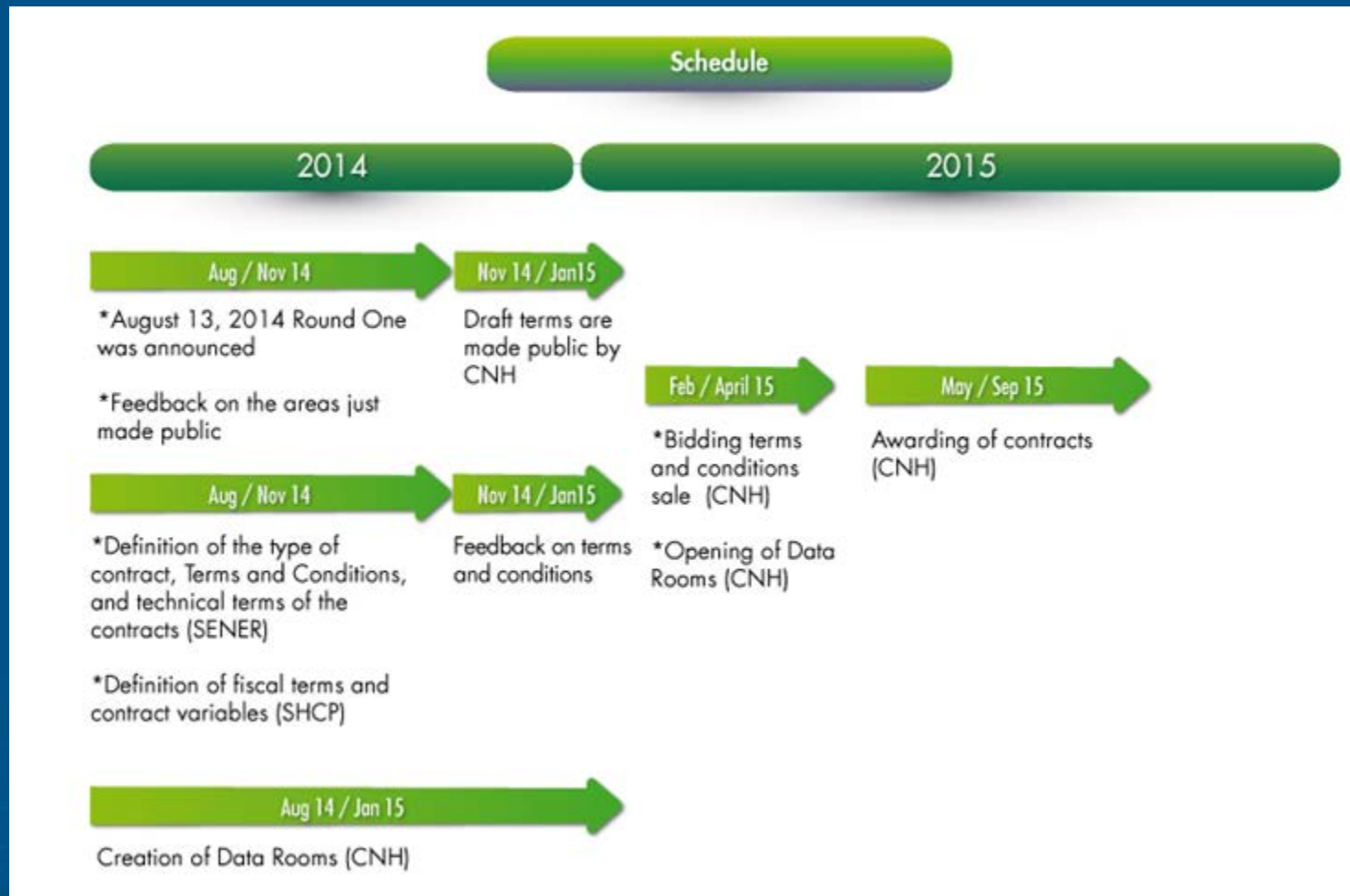
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Overview of the Deepwater Geology of the Mexican Gulf of Mexico -
Round 1 of Bidding in the Energy Reform

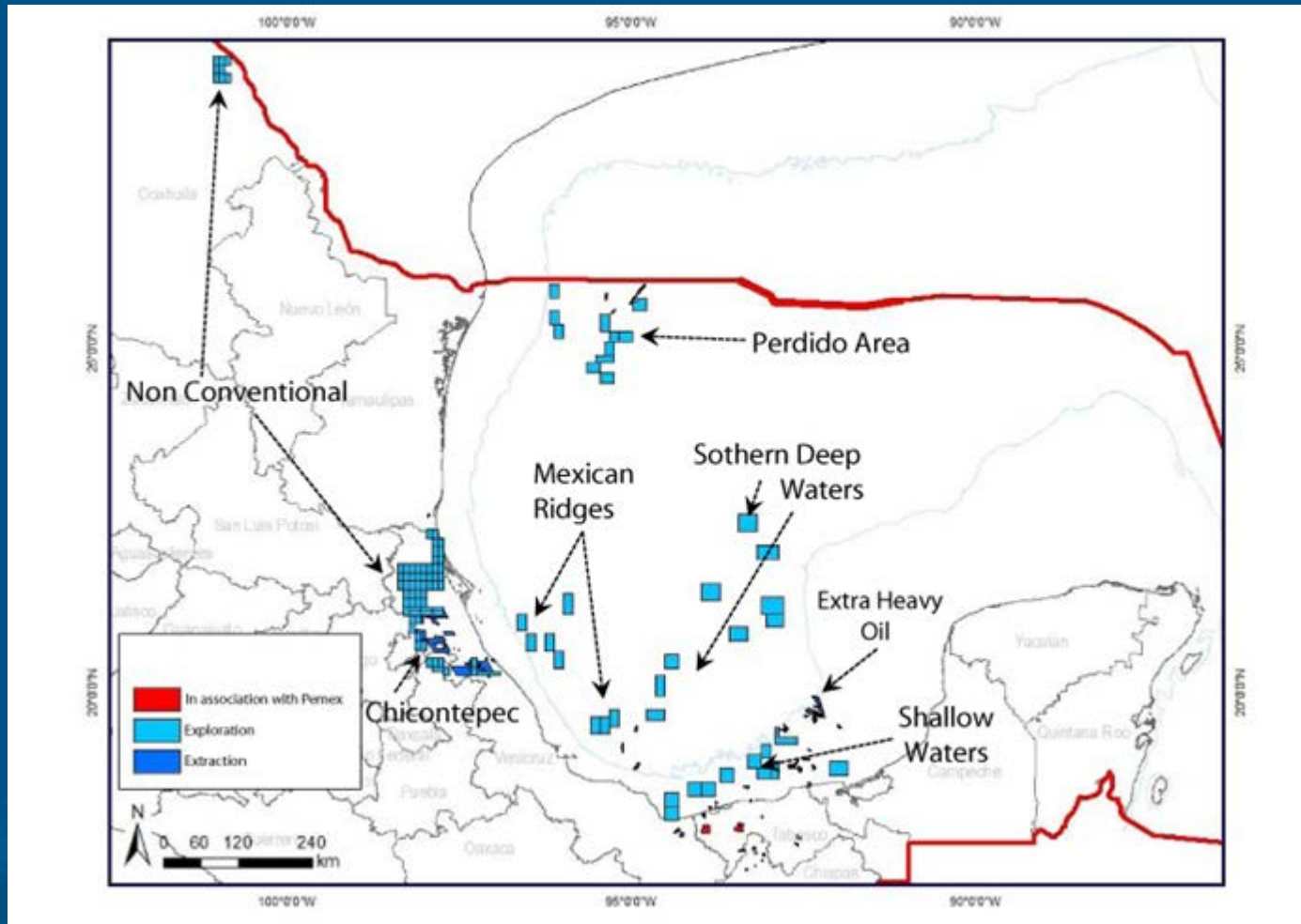
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Bidding, Round 1



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Regions of Interest



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Basins & Blocks Available

Round One

Farmouts with Pemex

Nov 2014 - Dec 2015

		Area	Type	Volume Mmboe	Blocks
Land Mature Fields	Rodador, Ogarrio, Cardenas - Mora	Perdido Deepwater	Prospective	1,591	11
		South Deepwater	Prospective	3,222	17
Offshore Mature Fields	Bolontiku, Sinan, Ek	Chicontepec and Non-conventionals	Reserve 2P	2,678	28
			Prospective	8,927	62
Offshore Extra heavy oil	Ayatsil, Tekel, Utsil	Land, Offshore and Extra heavy oil	Reserve 2P	1,104	32
Offshore deepwater gas	Kunah, Piklis		Prospective	724	11
Perdido area	Trion, Exploratus	Non-conventional	Prospective	142	8

• 169 Contact (Blocks)



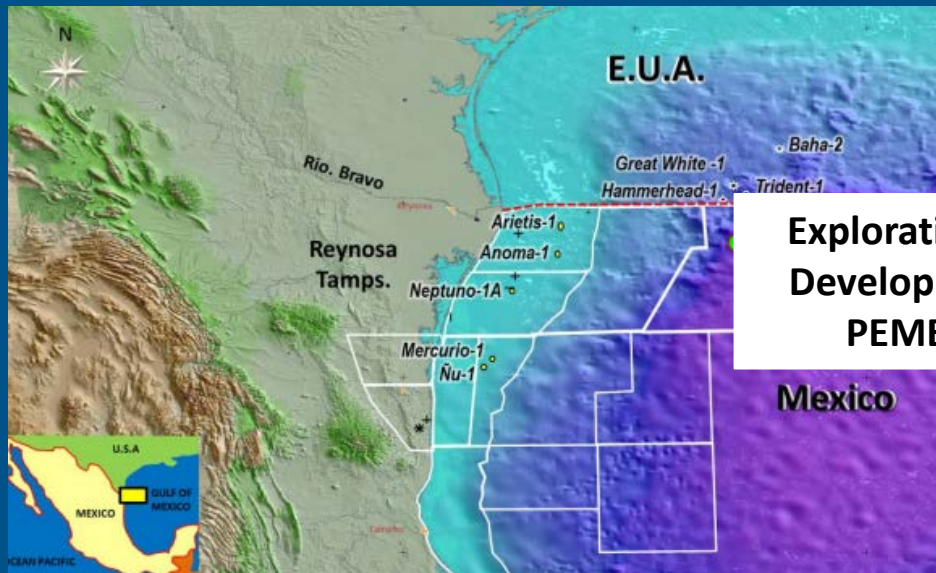
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Background

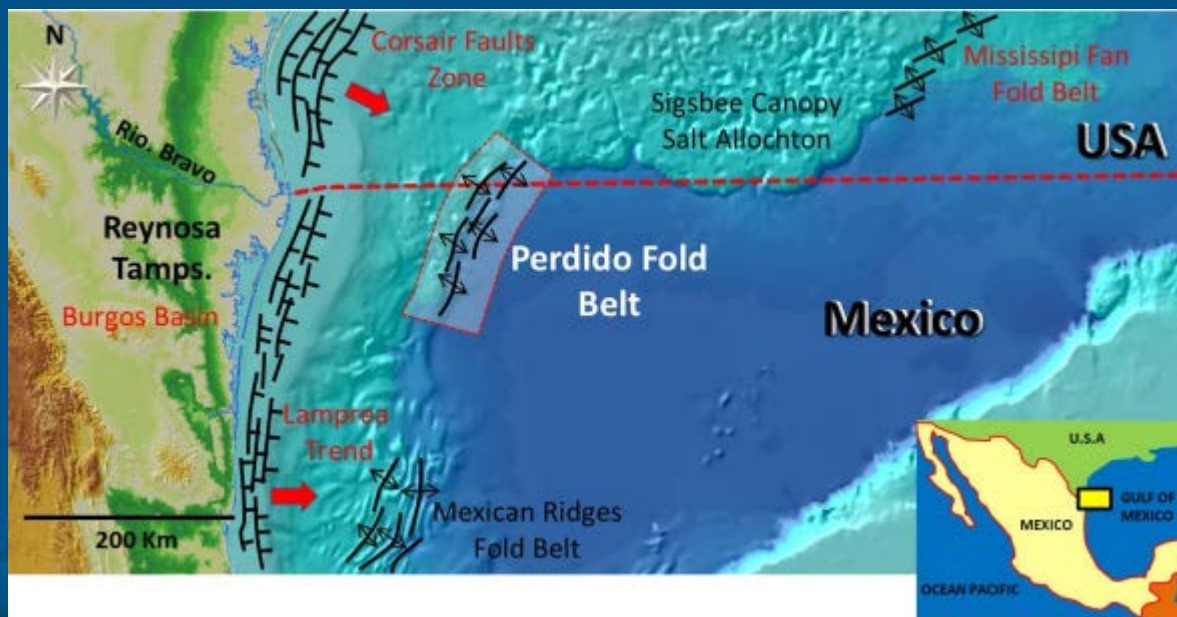
- **Perdido Foldbelt (PFB) is located in the Western Gulf of Mexico.**
 - Is part of the Cenozoic compressional fold system in the Gulf of Mexico and is distinctive in deformation details and structural style.
 - Contains Upper Jurassic–Eocene age strata folded during the early Oligocene (36–30 Ma), with deformation most likely continuing into the early Miocene.
 - Formed by gravity sliding, it consists of a series of southwest-northeast-trending, parallel, megascopic-scale kink bands and flanks that are cut by reverse faults.
 - Contains Cretaceous to Eocene sedimentary rocks. The “reservoir” facies are:
 - Lower Cretaceous fore-reef carbonate debris analogous to the major productive section in Poza Rica field, Mexico,
 - Upper Cretaceous chinks, and
 - Tertiary turbidite sands related to Wilcox & Frio delta systems from the Rio Grande embayment and several rivers in Mexico.



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**Exploration & Development
PEMEX**

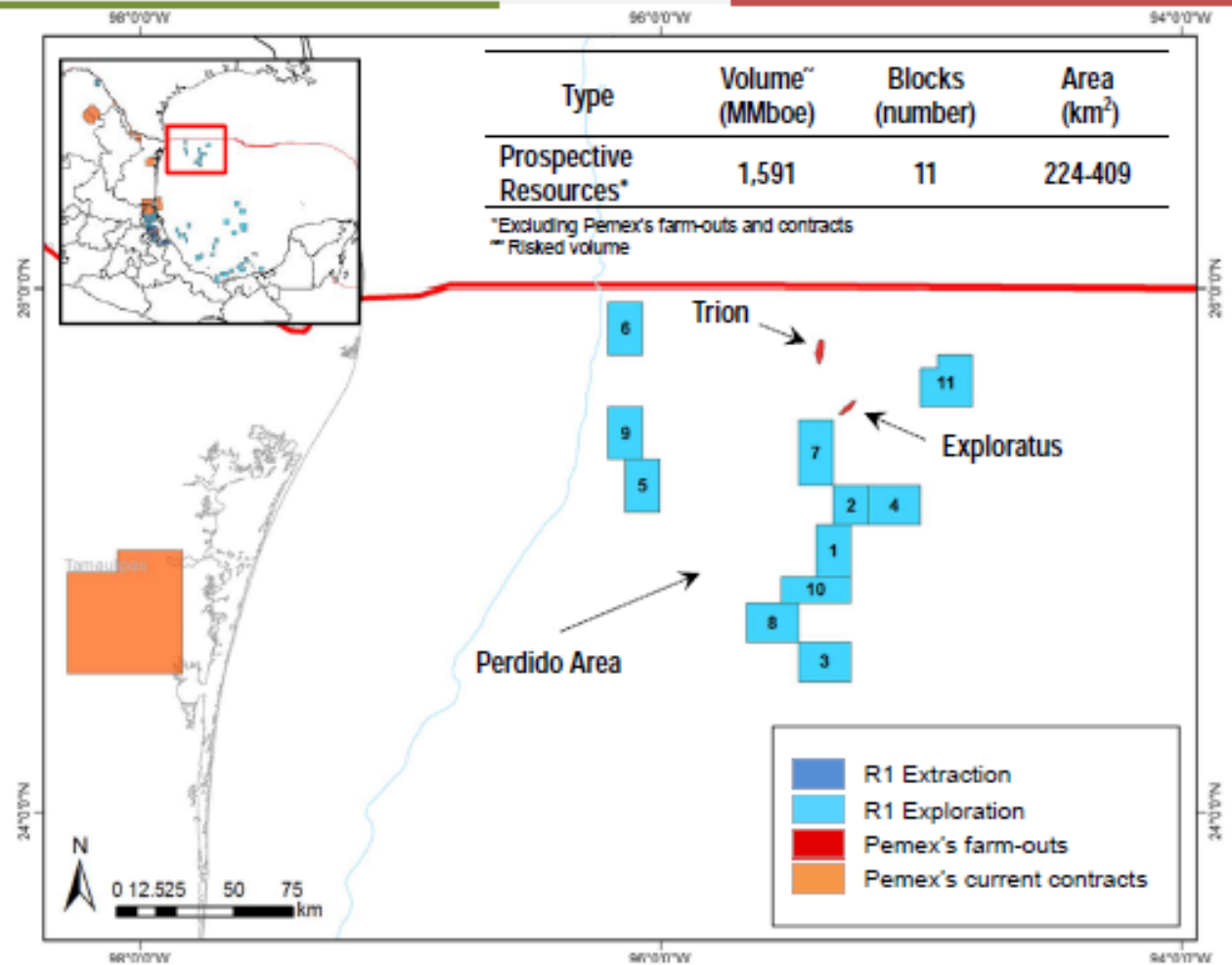


**Perdido Fold Belt
US & Mexico**



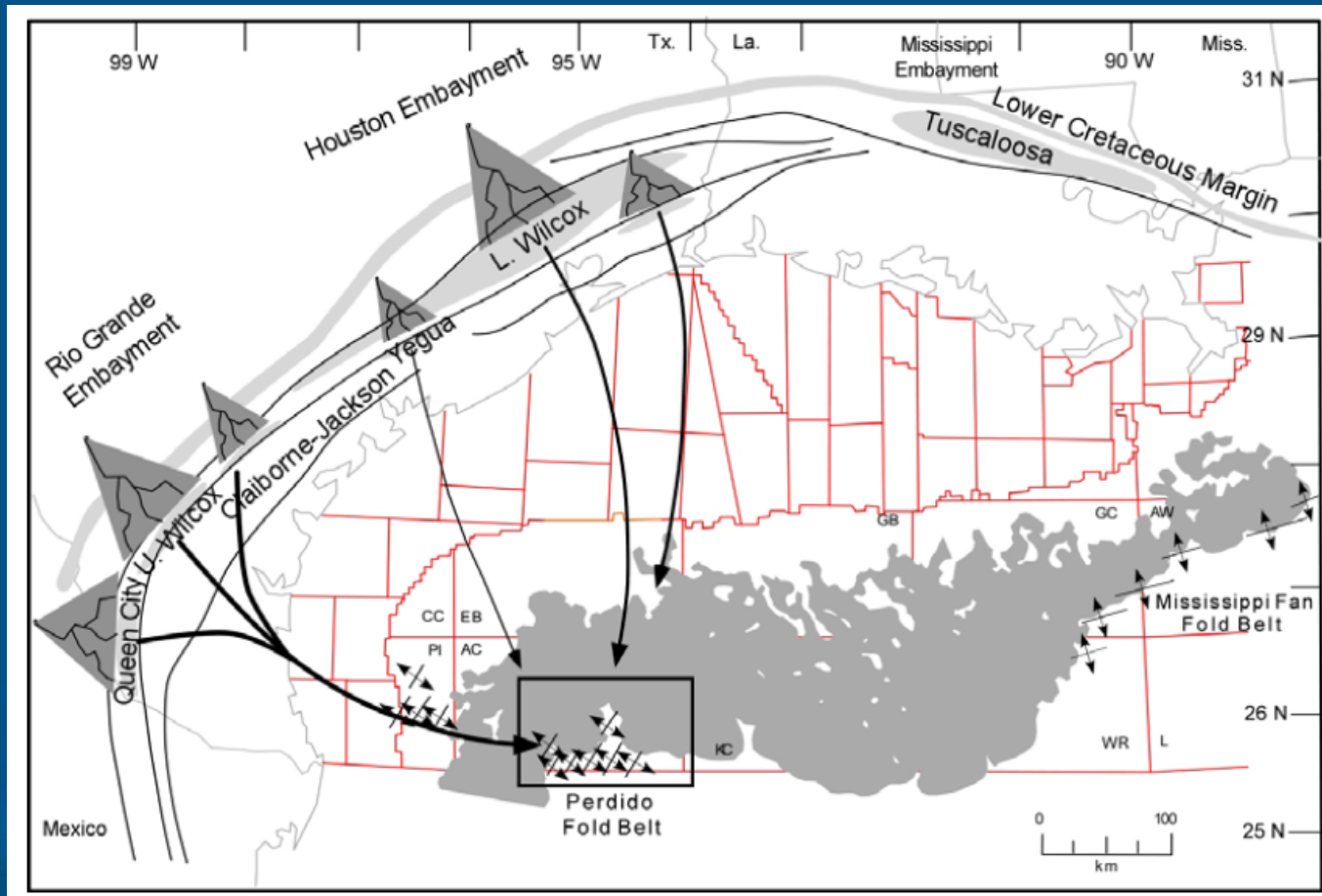
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Deepwaters: Perdido Area General Map



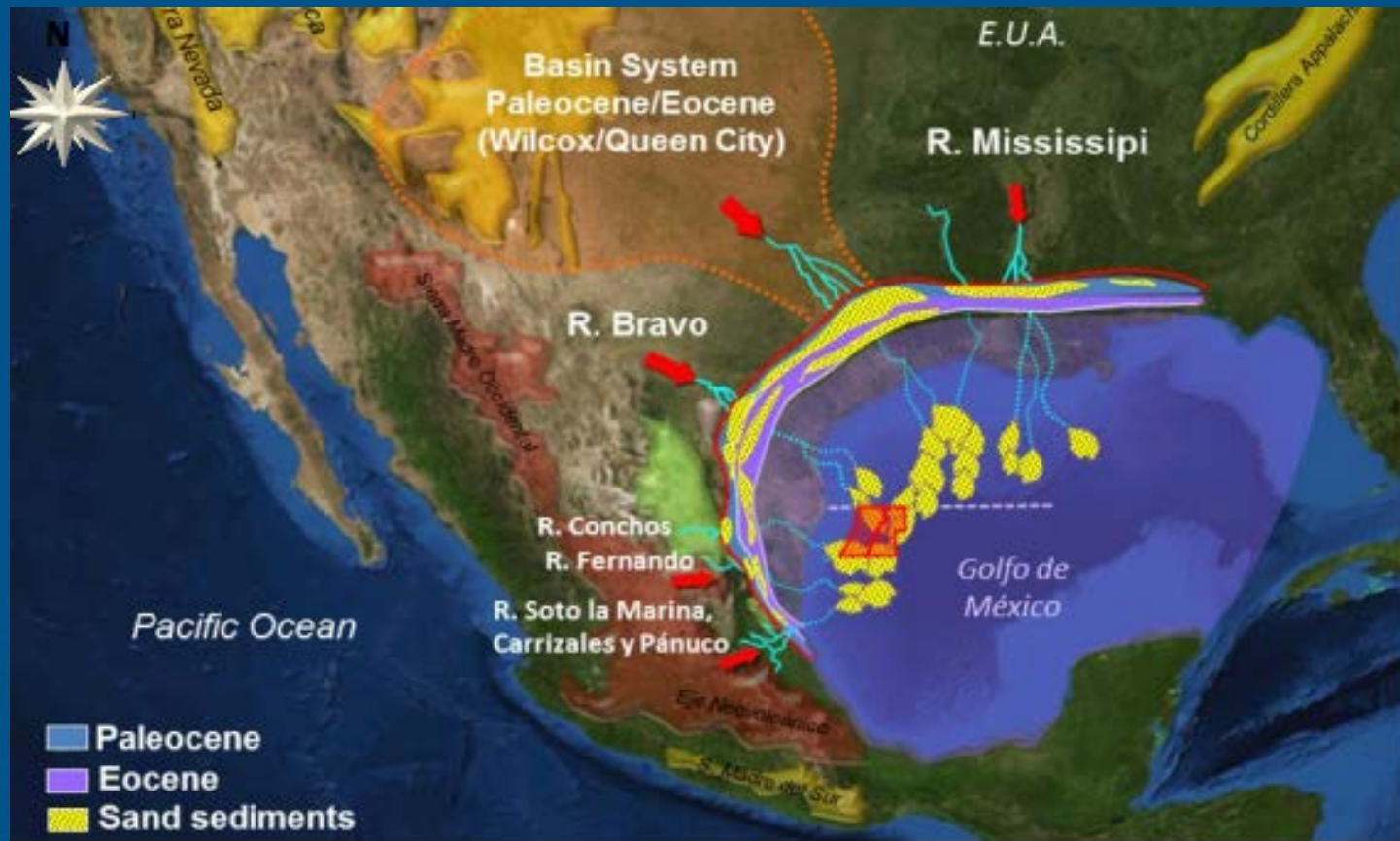
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Paleogeographic Cenozoic Map showing Depocenters for the Perdido, US



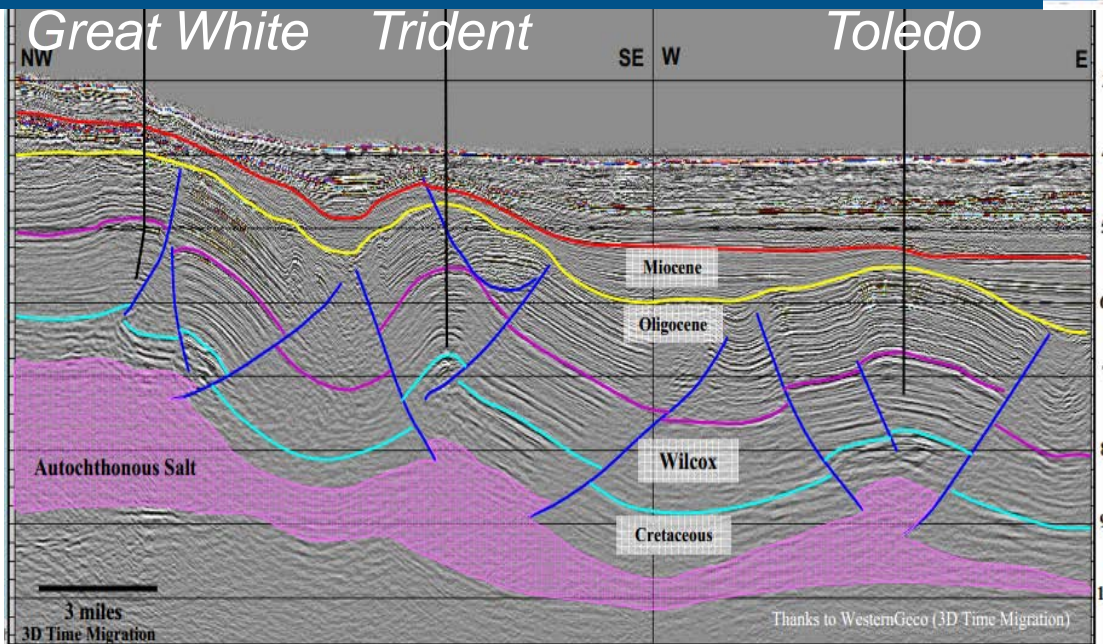
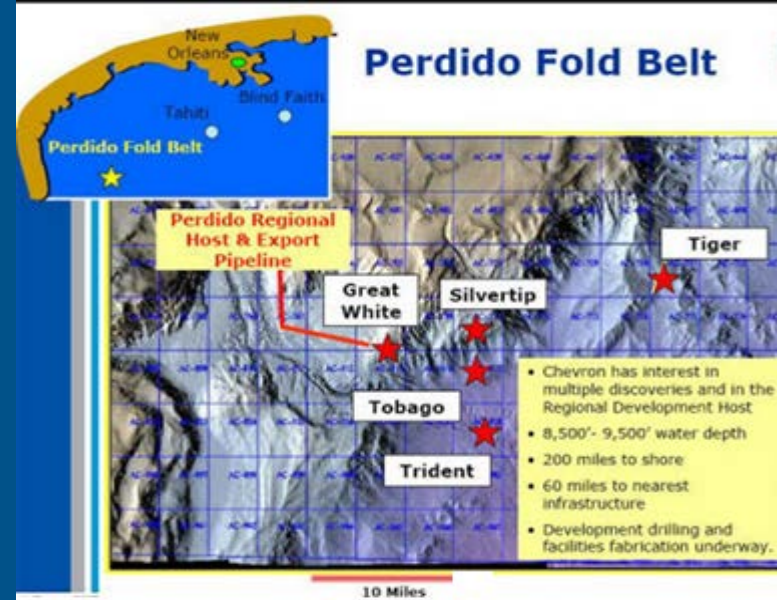
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Sediment Supply, Deepwater Mexico



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The presence of thick, widely distributed, and massive Wilcox sandstone reservoirs in the deep-water Gulf of Mexico is attributed to a several thousand feet Paleocene sea-level drop.



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Wilcox Reservoir Characteristics

Very fine grained - coarse silt to fine sand

Moderately to poorly sorted feldspathic litharenites

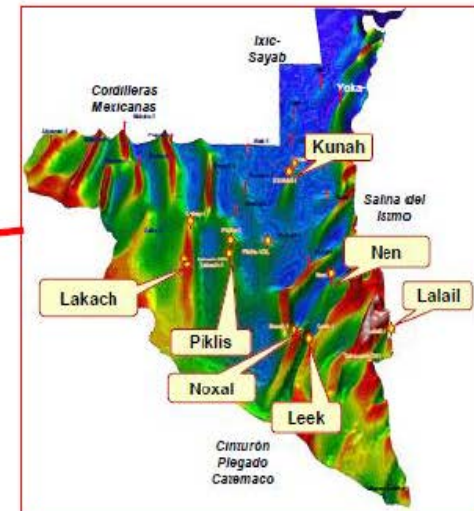
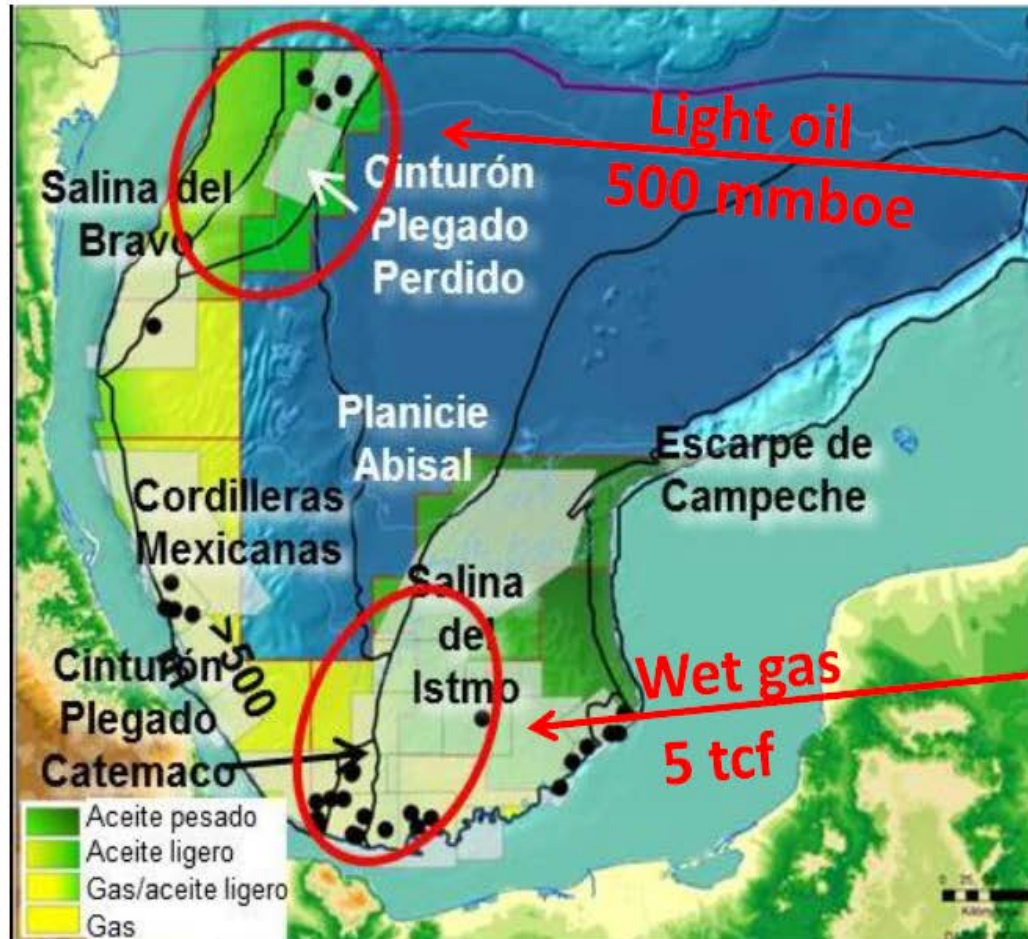
Wilcox 1 (upper): unconfined inner, middle, and outer distributary fan; high perm tractional facies have best sorting, grain size; compaction of ductile grains.

Wilcox 2 (lower): perms generally higher in channelized fan system; more quartzose, chlorite coatings preserve poro/perm, cementation as overgrowths on quartz grains.



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Petroleum Systems in Mexico

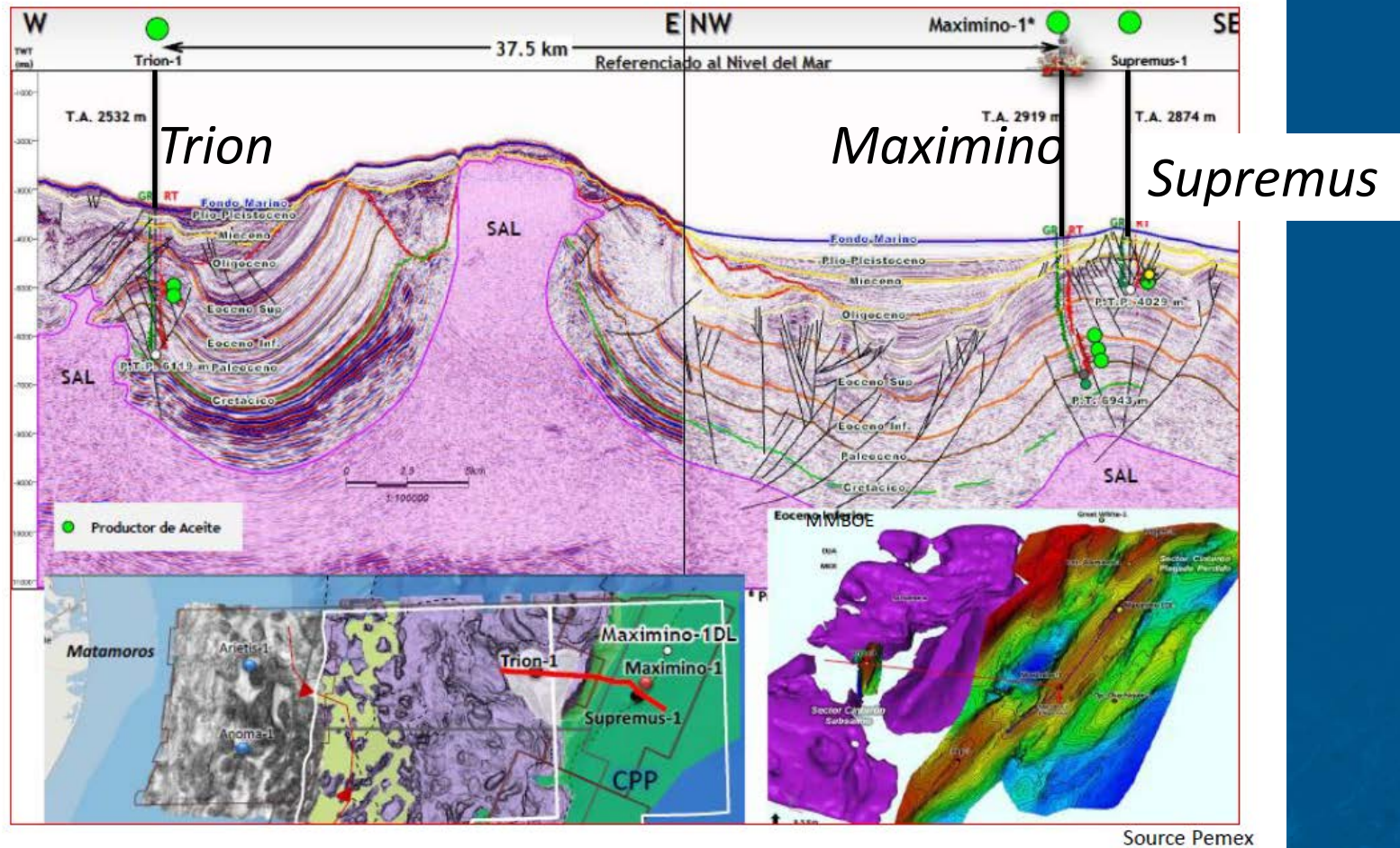


Source Pemex



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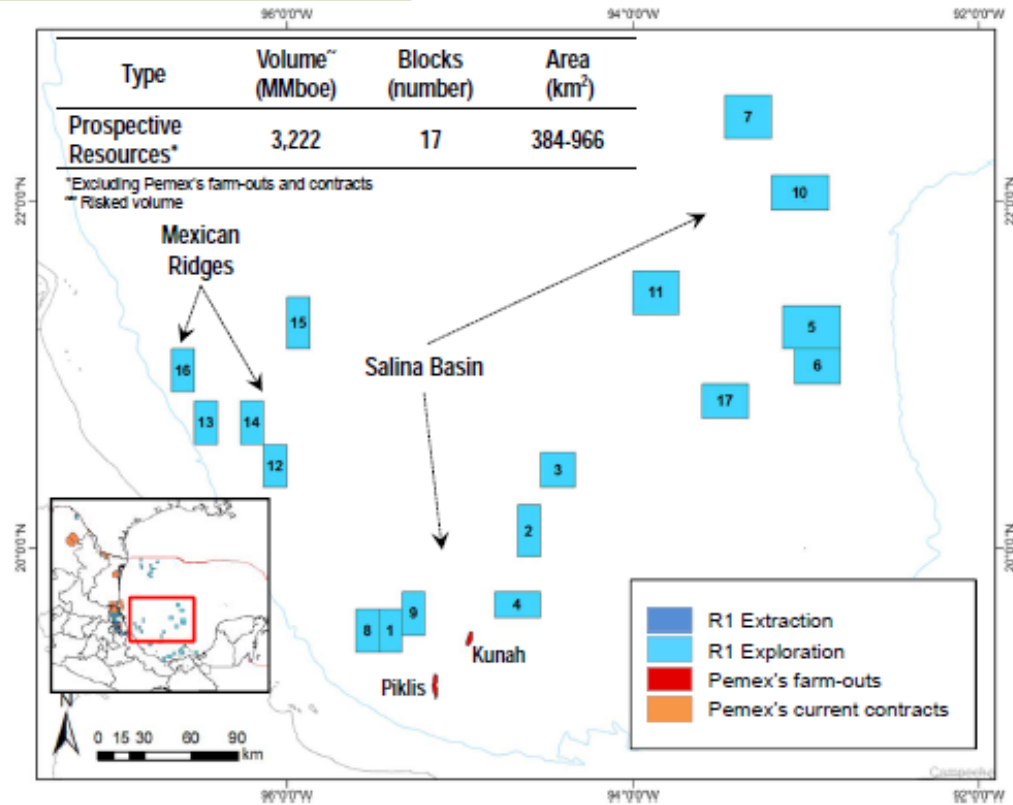
Mexican PFB Discoveries



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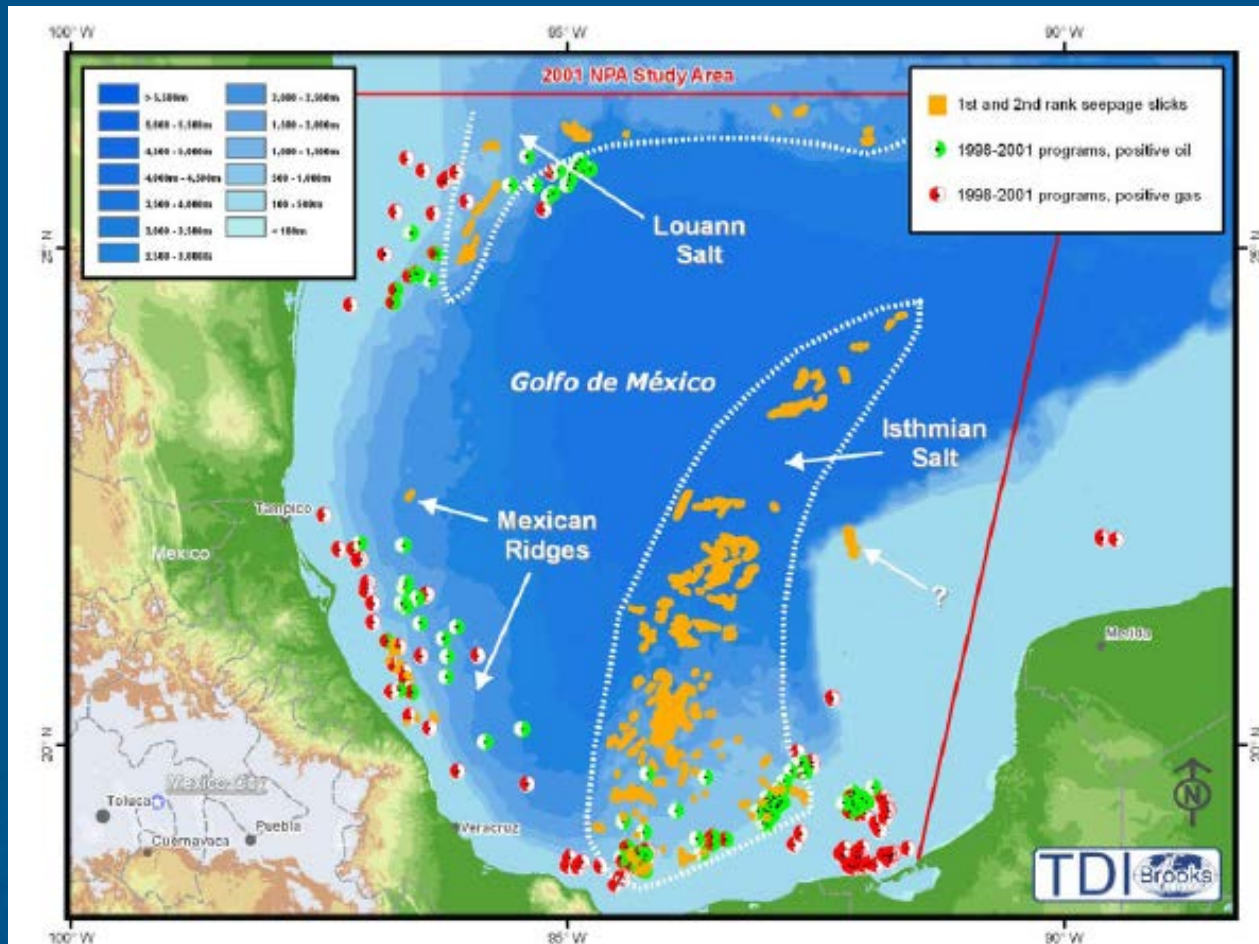
Southern Deepwaters

Deepwaters: South General Map



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Seep Studies in Southern Deepwaters



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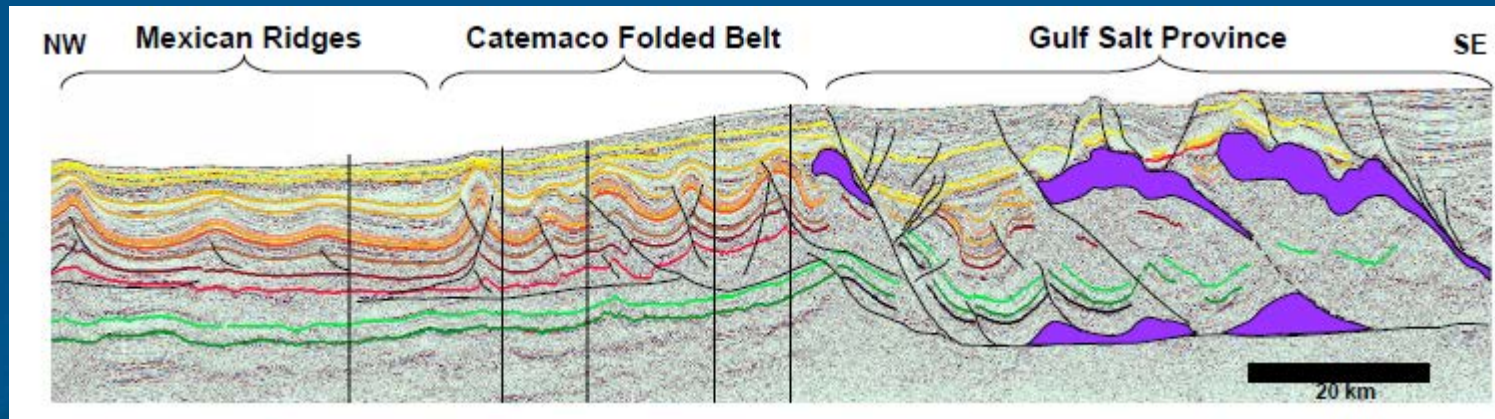
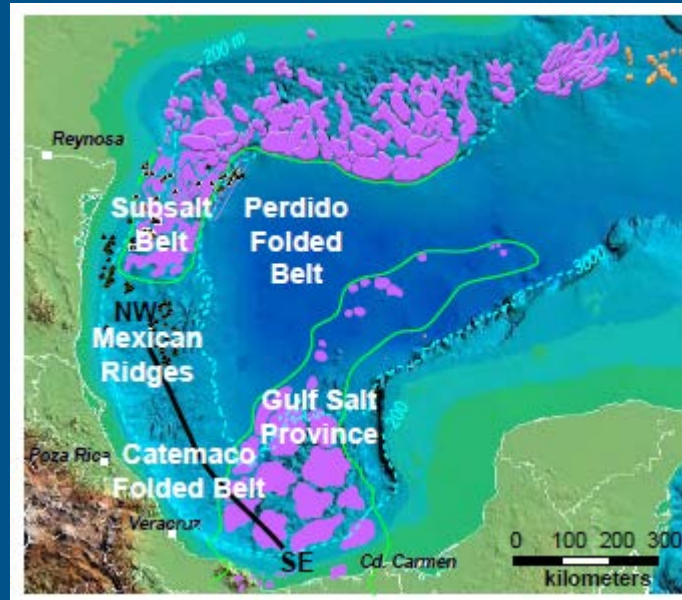
Obstacles to Exploration & Development in Gulf of Mexico

- Seismic imaging
 - Complex structures include fold dominated kink bands and angularly folded strata
- Reservoir quality e.g. Wilcox play shows low porosities & permeabilities
- Ultra deepwater environment
- Salt
- High temperature / high pressure regimes



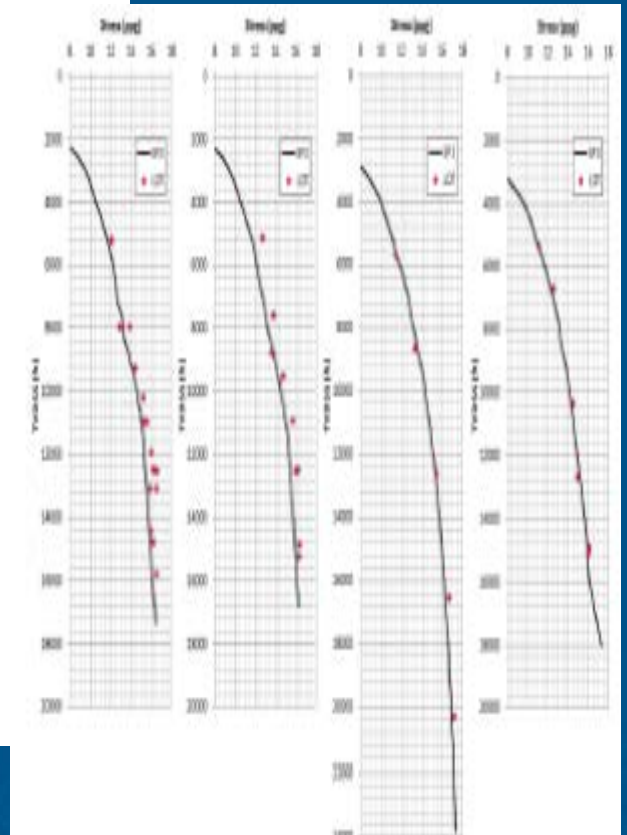
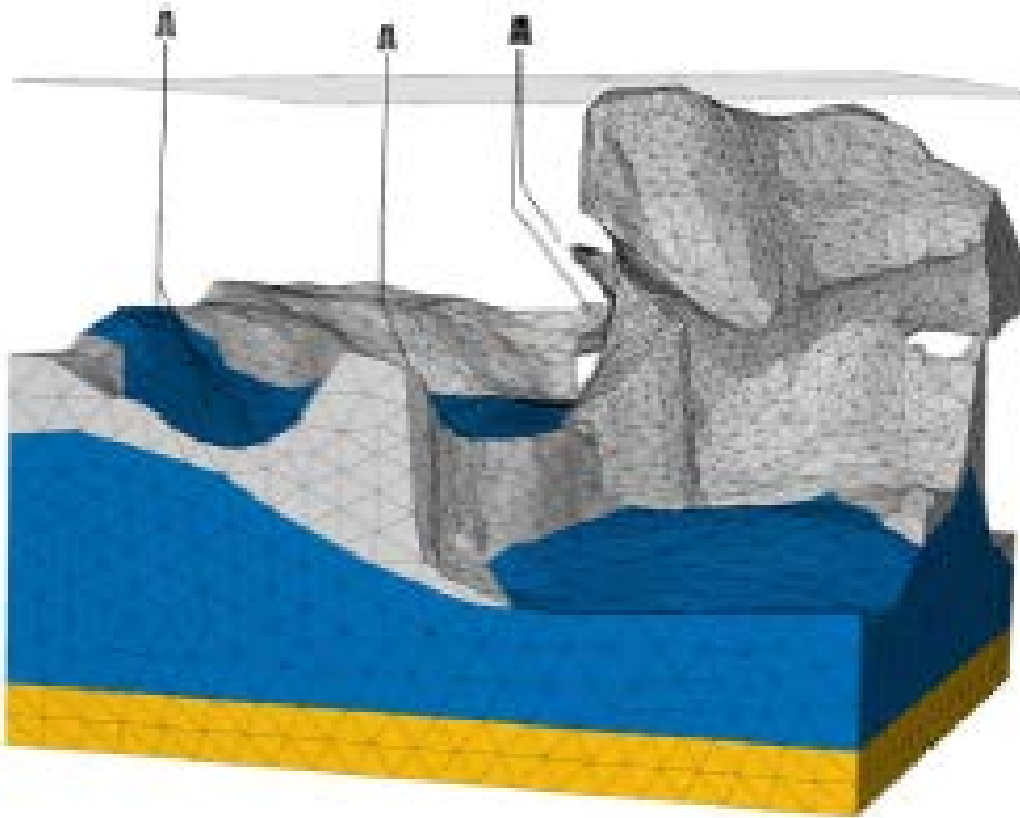
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Location of Salt bodies



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Salt Challenge



Finite Elemental Solution to Salt



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Conclusion

Round One brings Mexico in association other operators. With numerous leads, lessons learned, discoveries, and prospective resources based upon hydrocarbon systems analysis, and regional seismic studies, the opportunities in Mexico's deepwater basins are large and underdeveloped.

The sweeping changes in the Energy Reform allow these plays to be accessible starting with Round One.



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