The Perdido and the Southwestern Gulf of Mexico*

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Abstract

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. 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, it 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 & Frio delta systems from the Rio Grande embayment.

A technical review of the Perdido Fold Belt in the Southwestern Gulf of Mexico. Included is a discussion on unlocking this potentially prolific hydrocarbon trend through the Energy Reform in Mexico and how it will affect the ultra deepwater exploration in this area.

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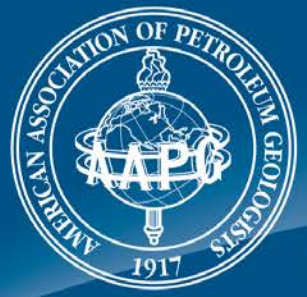

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Fifth Annual AAPG-SPE Deepwater Reservoirs, Geosciences Technology Workshop

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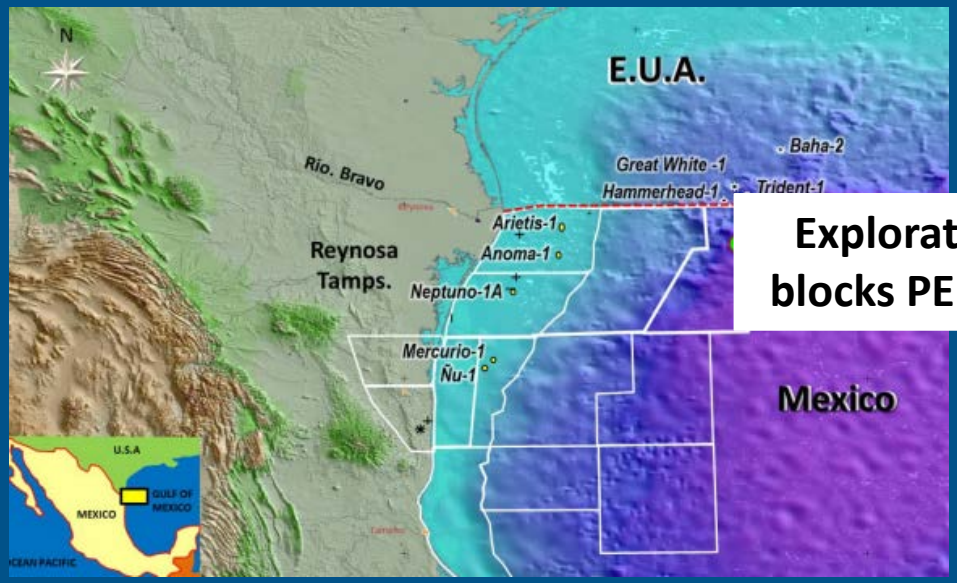
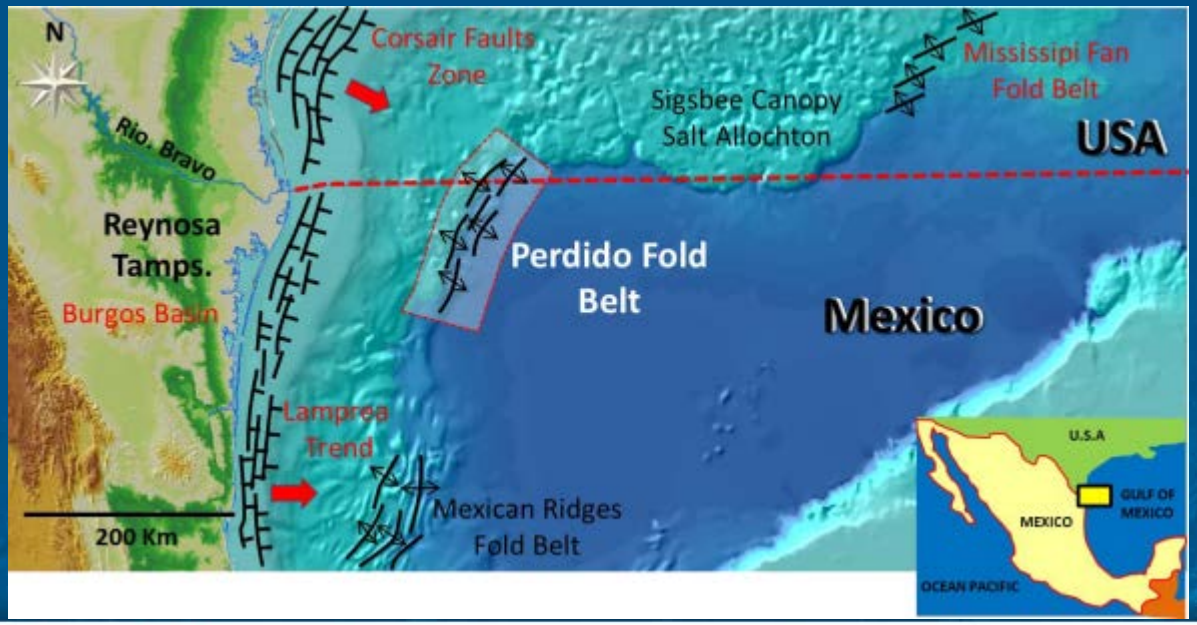
Milena Colmenares,
January, 2014



Exploration blocks PEMEX



Perdido Fold Belt US & Mexico

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Rigzone, J. Zamora 2013

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 chalks, and
    - Tertiary turbidite sands related to Wilcox & Frio delta systems from the Rio Grande embayment.

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on Frederic Blickwede, T. A. Queffelec

AAPG, 1988, Trudgill et al., 1999, AAPG, Camerlo and Benson, 2006, AAPG

The Perdido Production facility, Operated by Shell

Deepest oil development, deepest drilling & production platform, and will produce from the deepest subsea well (Tobago 9,627') in the world, Tobago online since November, 2011.

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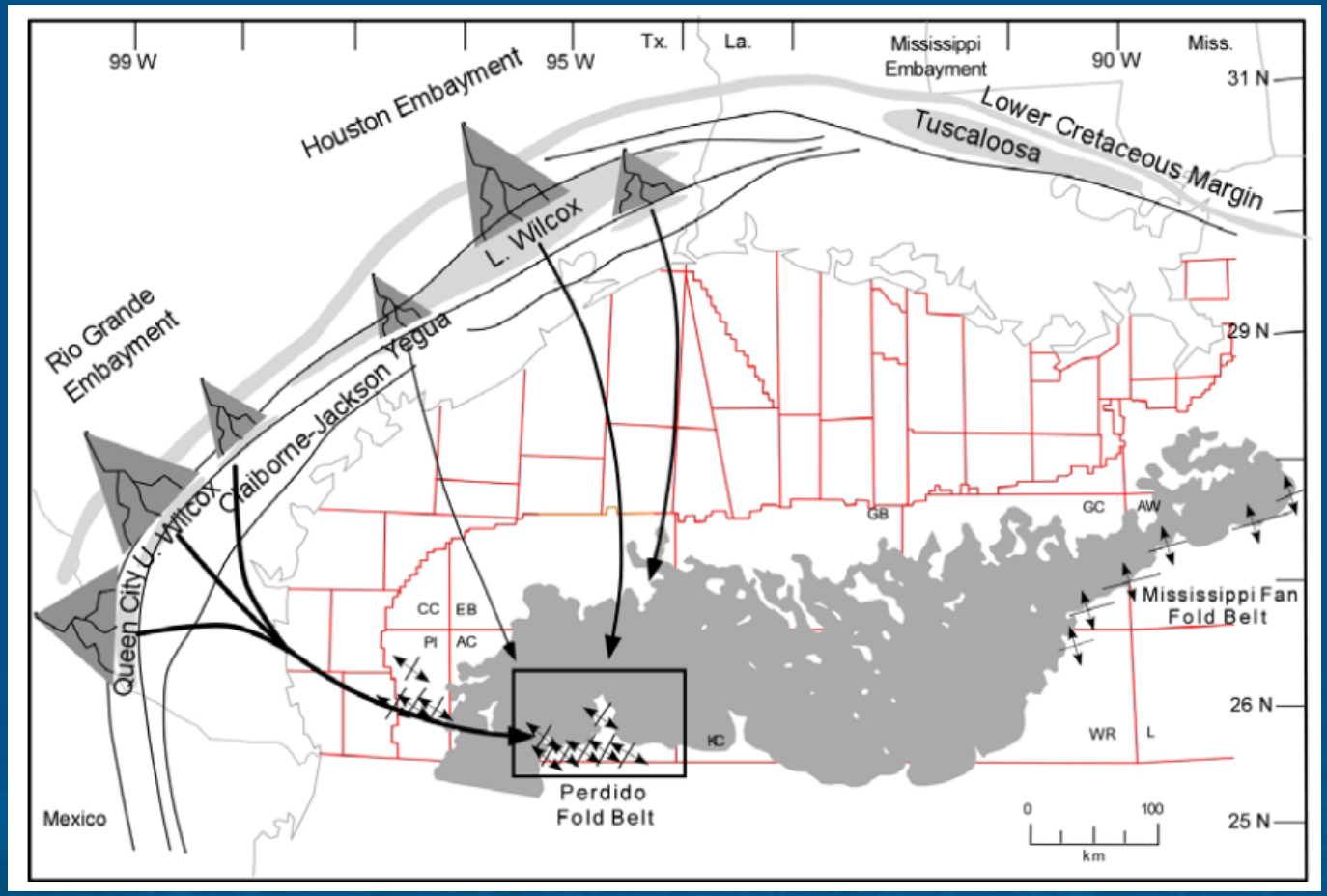
SubseaIQ, 2011, Popular Science, 2009, EnergyWire, 2012

Paleogeographic Cenozoic Map showing Depocenters for the PFB, US



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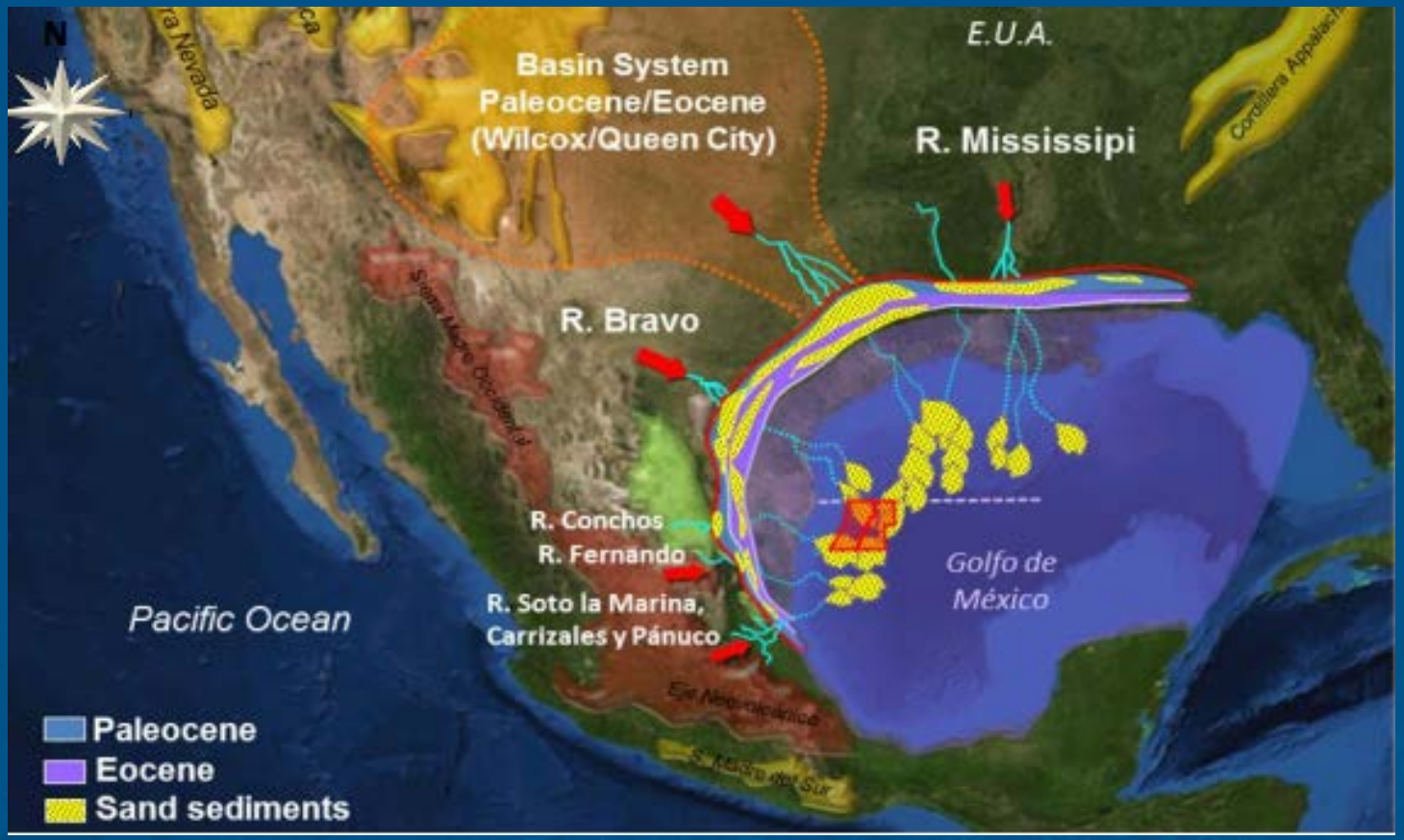
Waller, 2007, Texas A&M

PFB Sediment Supply, Mexico



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J. Zamora, 2013

US Drilling History & Discoveries

- Since the deep test at BAHA in 2001 other wildcat discoveries have been drilled in the PFB, which include
  - Trident AC 903 in 2001,
  - Great White AC 857 in 2002, and
  - Tobago AC 859 in 2004.
- More discoveries have been drilled and and many lessons learned.
  - These three wells are used as analogues for the structural alignment, the depositional system, and the hydrocarbon type of the Mexican discoveries.

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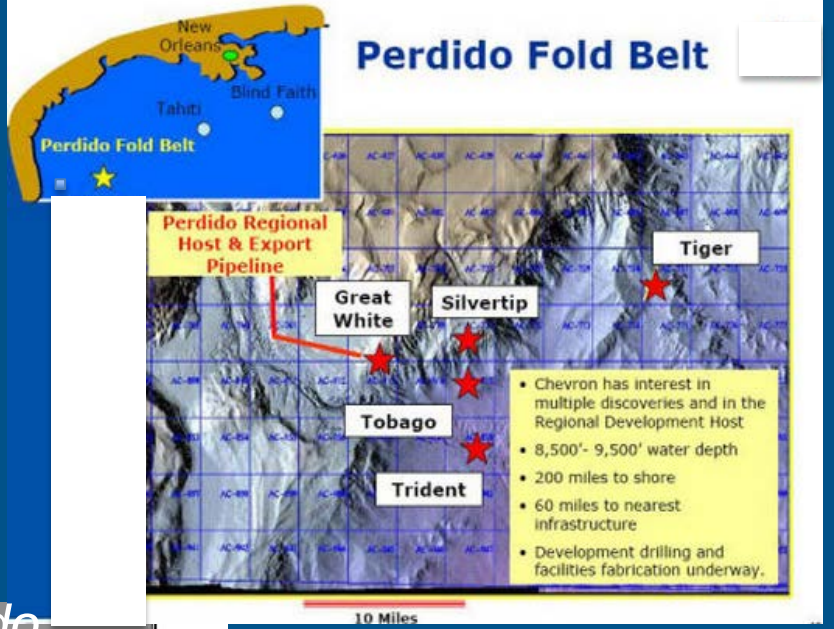
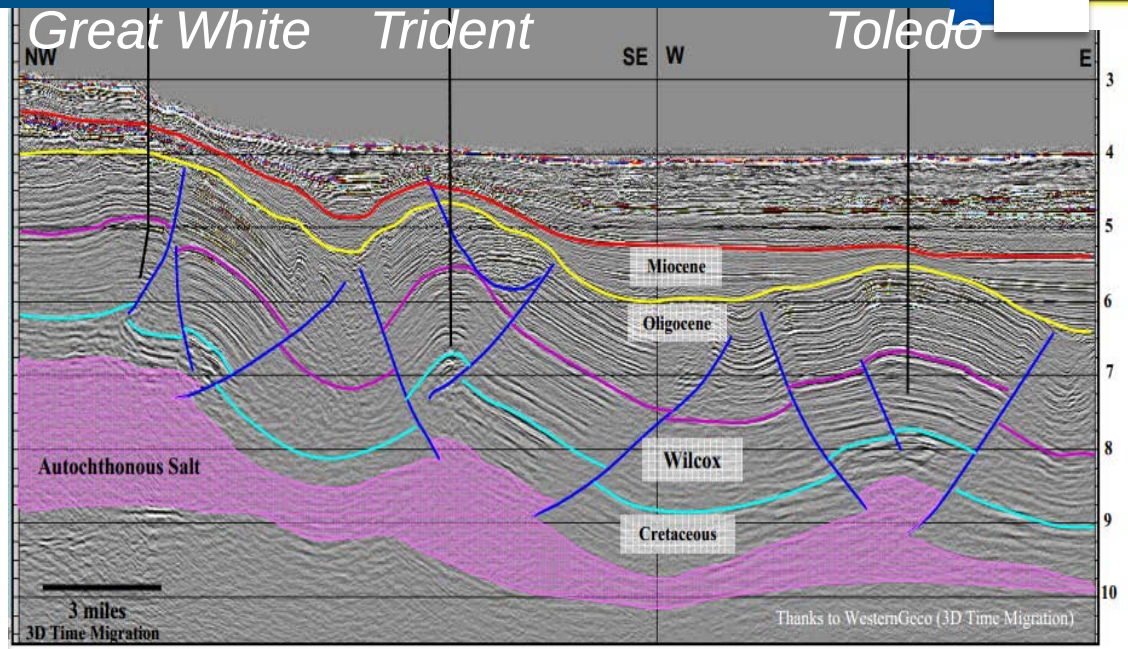
L. Zarra, 2005 et al., Chevron.

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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Chevron & SEPM, Rosenfeld and Pindell (2002, 2003, & 2007.

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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J. Lewis et al., 2007, P. Santogrossi ; personal communication, 2014

Obstacles to Development of the Perdido Fold Belt

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

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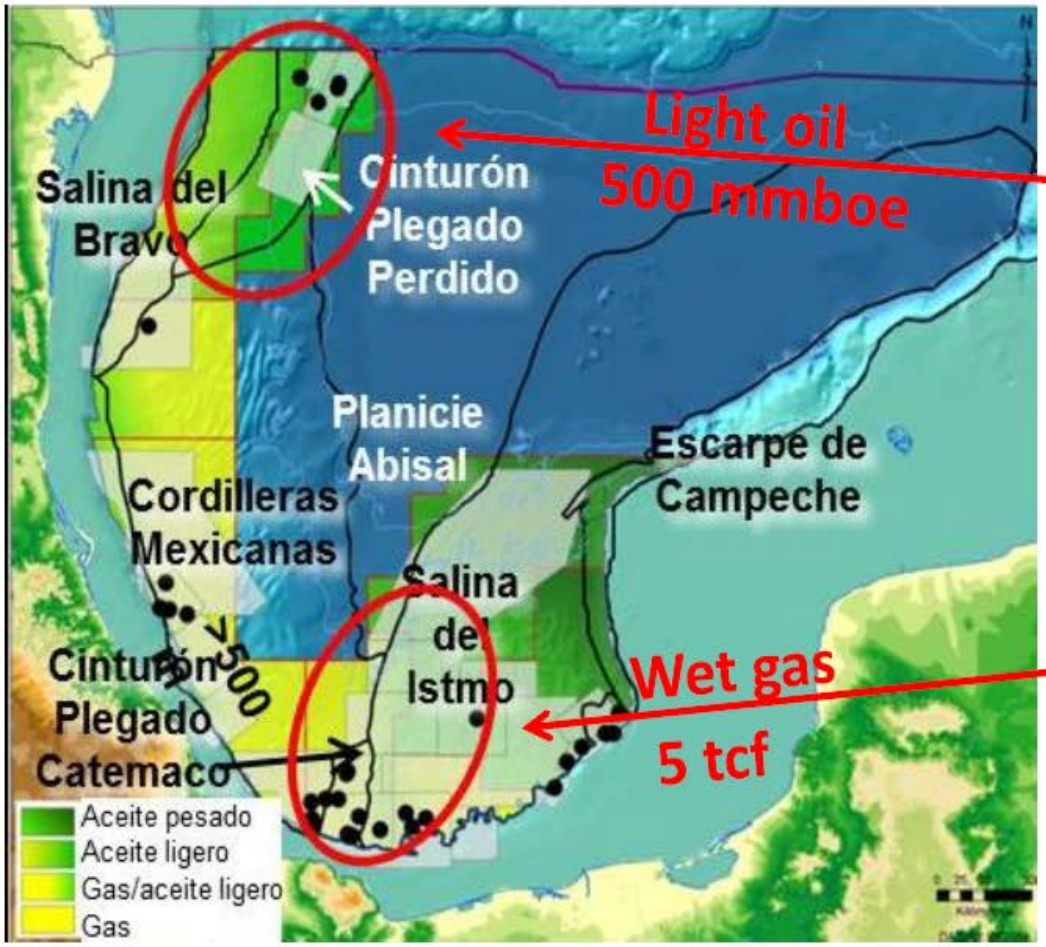
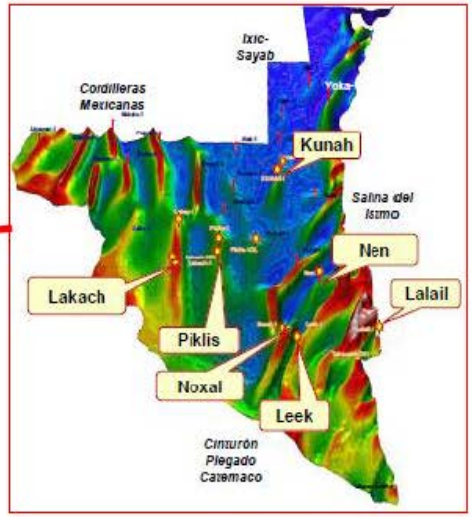
Camerlo & Benson, AAPG 2006, Leipin He and Poling, AAPG, 2010, L. Zarra 2007

PFB in Mexico





Source Pemex

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Alfredo Guzman, 2014,
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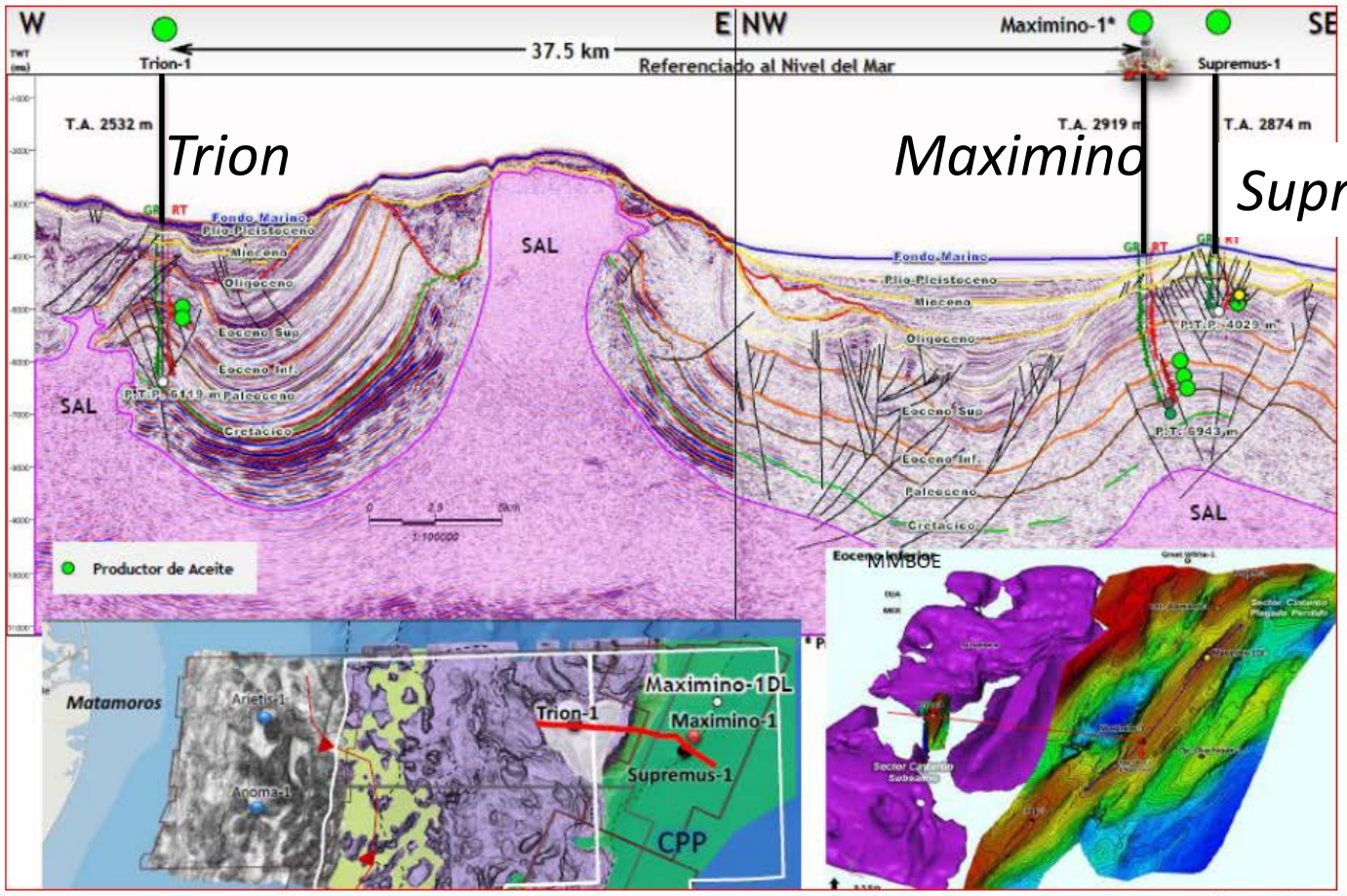
Mexican PFB Discoveries



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Alfredo Guzman, 2014, AAPG.

Energy Reform Will Impact Deepwater Exploration

- **Reform signed into Law in December 2013.**
- **Article 27: "**The oil and gas resources fully belong to the Nation nevertheless the ***State may contract with third parties for their exploration and production***. Hydrocarbons in the subsurface belong to the Nation which will be explicitly expressed in all licenses and contracts.
- **Article 28:** Even though the E&P of hydrocarbons are strategic activities they will no longer be carried out exclusively by the state as a monopoly. ***A trust fund will manage the after tax profits generated by the licenses and contracts***. "
- ***There will probably be bid rounds as early as 3Q, 2014.***
- ***There will be numerous business opportunities*** **for the geosciences community in particular and for the upstream industry in general. "**

Conclusion:

The success of the PFB is promoted by the energy reform in Mexico and will further extend the knowledge of the Wilcox trend in the ultra-deepwater. The Challenge is set.

Image: James Island Sunset, La Push, Washington US, Ryan Manuel, 2012

Thank You

Special thanks to Patricia Santogrossi & Susan Nash for their collaboration and encouragement.

Milena Colmenares, January, 2014

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Image: NASA

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