Pauto and Floreña Fields: Adding Value from Uncertainty*

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Abstract

The lack of good quality seismic data increases the structural uncertainty in the already complex structure of the Llanos foothills. Nevertheless, Equion has reported either a new reservoir or an extension of existing ones nearly every year since 2011. The strategy behind this success has been to approach uncertainty as an opportunity. The detailed study of available static and dynamic data to update the structural model and thus predict new reservoirs has allowed an increase in the gas and oil resources of the Pauto and Floreña fields.

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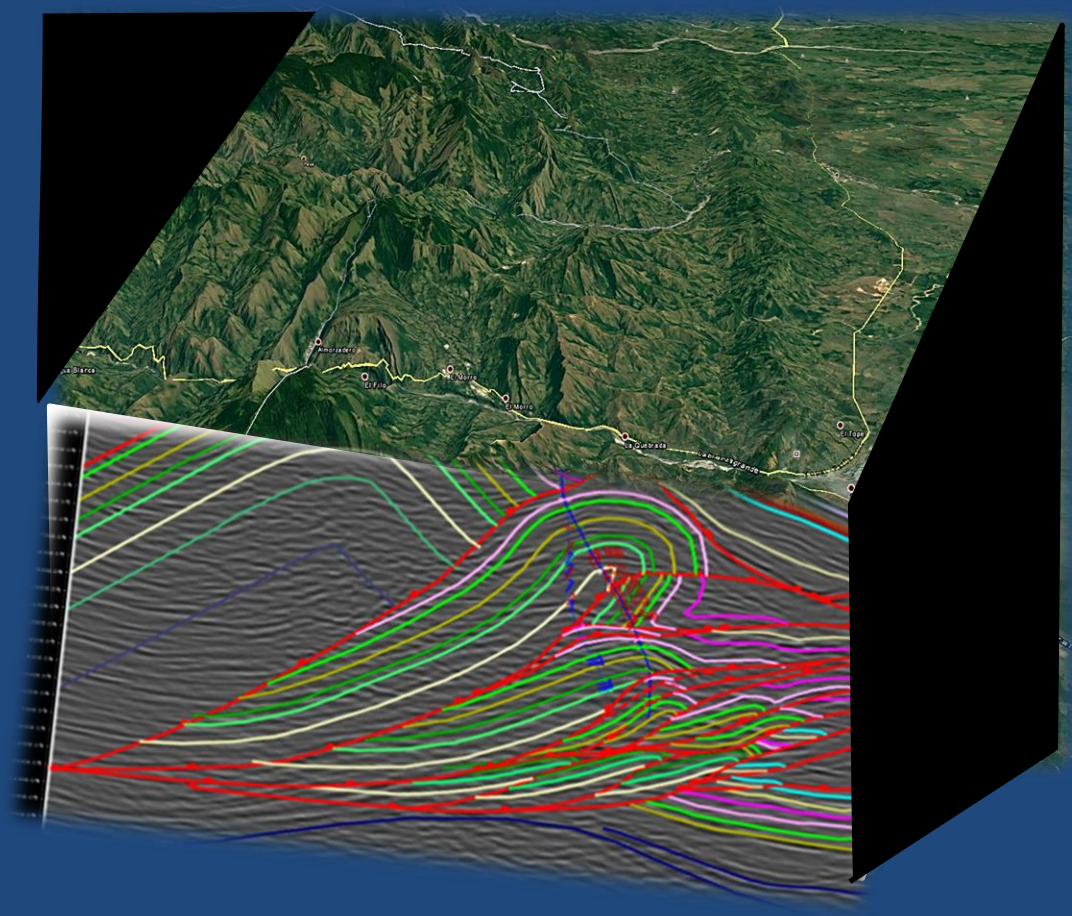
Pauto and Floreña Fields: Adding Value from Uncertainty

- Luis Enrique Soto A
  Equion Energía Limited

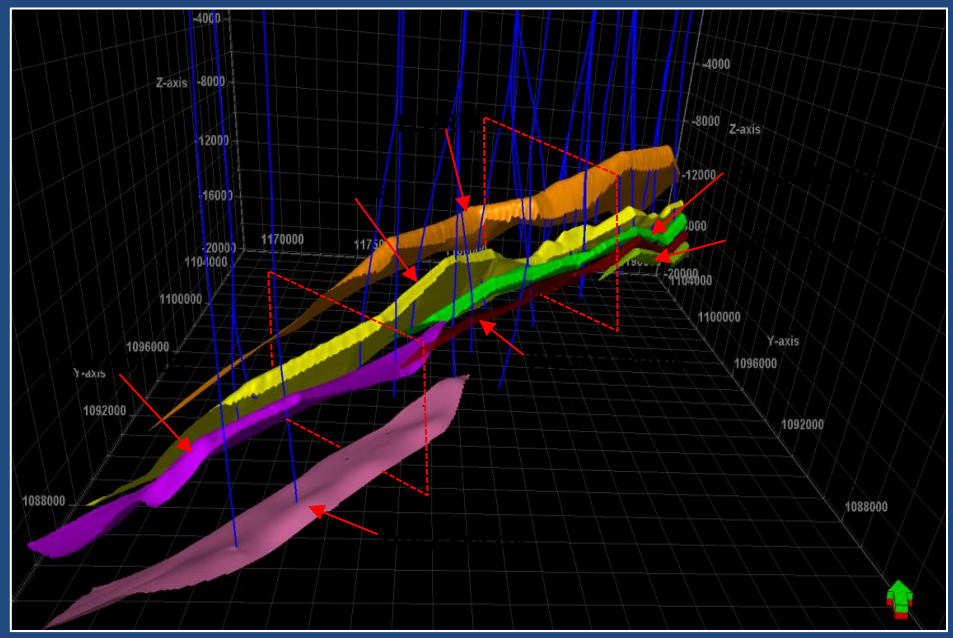
Almost a discovery per year

- 5 New reservoirs discovered in the past 6 years.
- This is the results of an area with high hydrocarbon potential developed with a successful strategy where the uncertainty is facing as an opportunity



Pauto and Floreña generalities

- Siliciclastic sandstone reservoirs. Mirador, Los Cuervos, Barco and Guadalupe
- Asymmetrical staked anticlines resulting from multiple thrusting events
- Matrix, Low porosity 1 to 6%. Very low permeability 0.01 to 10 mD
- Naturally fractured reservoir
- Up to 5 reservoirs per well
- Fluids. From gas condensate to volatile oil
- Pressure support. Gas expansion and partially gas injection
- Current commercial Production 45Kbopd. 100 Mpced



How bad is the Uncertainty?

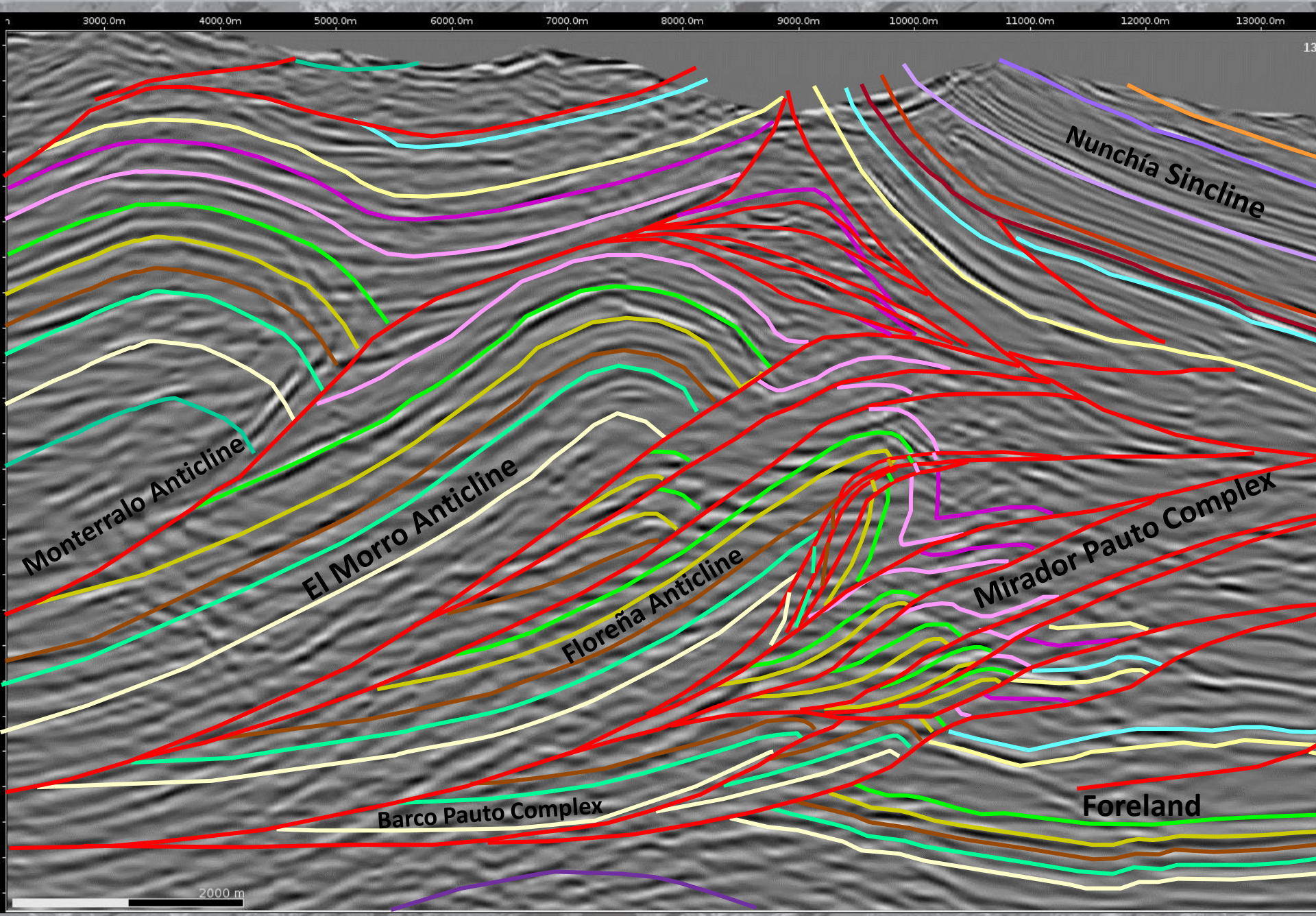
Uncertainty is a situation which involves imperfect and/or unknown information. The lack of certainty. A state of having limited knowledge where it is impossible to exactly describe the existing state, a future outcome, or more than one possible outcome.

From WIKIPEDIA

Measurement of uncertainty A set of possible states or outcomes where probabilities are assigned to each possible state or outcome – this also includes the application of a probability density function to continuous variables.

From WIKIPEDIA

Uncertainty is associated to risk as well as associated to opportunities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12000.0m
13000.0m
Nunchía Sincline
Monterralo Anticline
El Morro Anticline
Floreña Anticline
Mirador Pauto Complex
Barco Pauto Complex
Foreland
2000 m

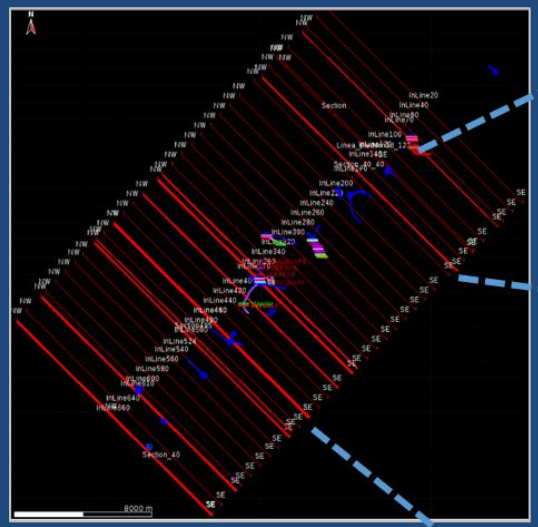
What are the Pauto and Floreña Uncertainties?

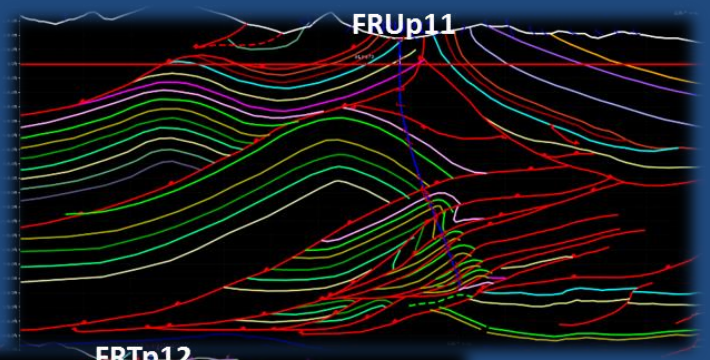
• **What is shape and size of the structure?**	Limits extension in dip and strike directions
• **How many thrust sheets are there?**	Addition of 3 new thrust sheets and 4 new reservoirs
• **Is there connection along the thrust sheet? (Compartments)**	Proved compartmentalization. Is it good or bad?
• **Where is the HWC?. Is it the same HWC in all thrust sheets?**	In 2012 were tested water at 14800 ft tvdss In 2015 were proved hydrocarbon at 15426 ft tvdss
• **Are we going to have good productivity well?**	Reservoir productivity ranking from 7000 bod to 500 bopd Matrix? Natural Factures?

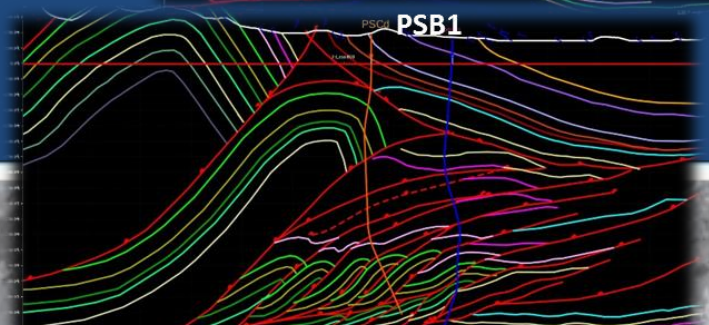
Structural Uncertainty

Multistory stacked thrust fronts

- Poor seismic quality
- Stacked arrange changing from south to north
- Unclear structure limits

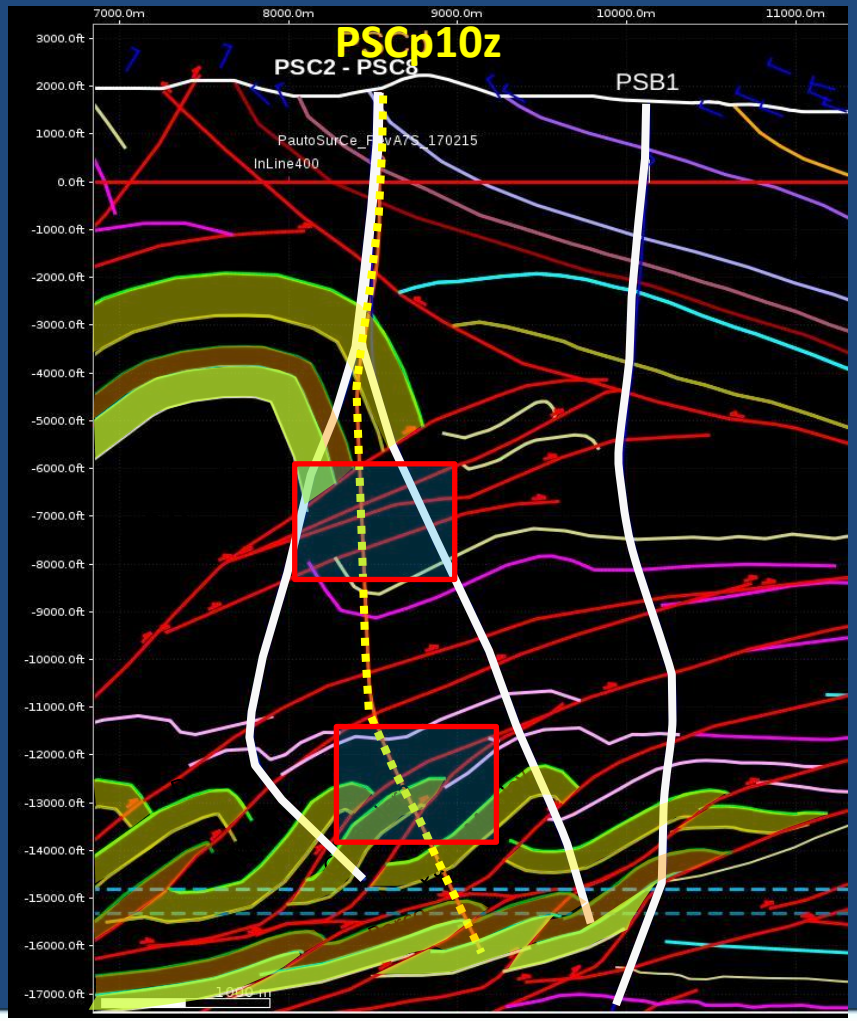




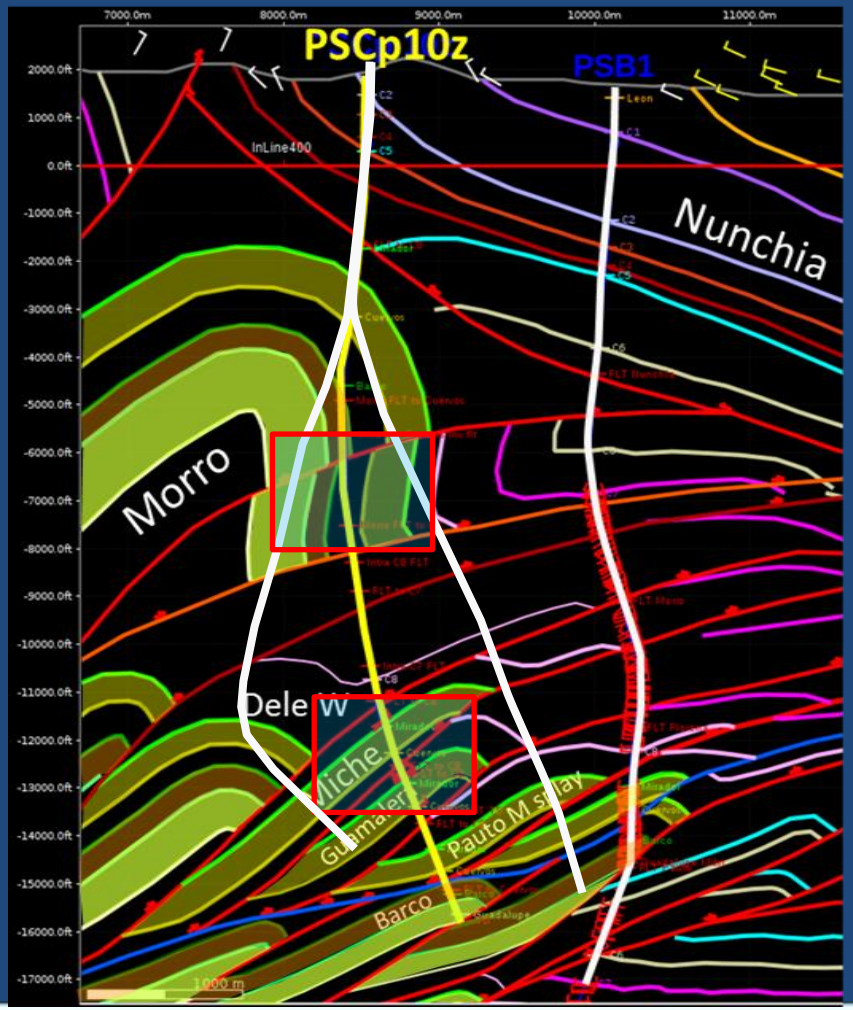


Structural Uncertainty. What we do

Moeld 1

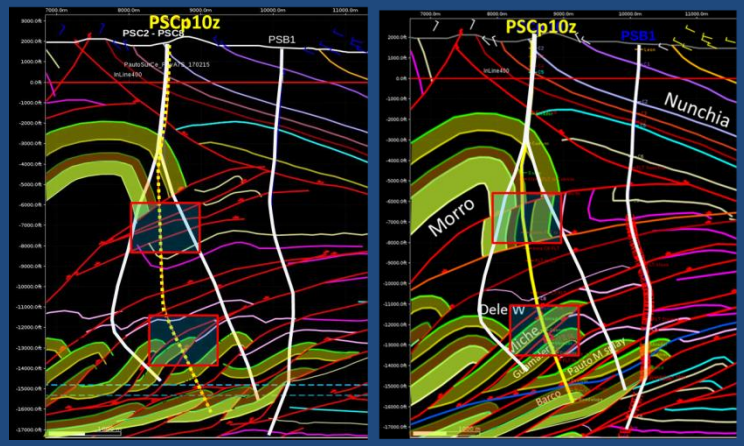


Model 2

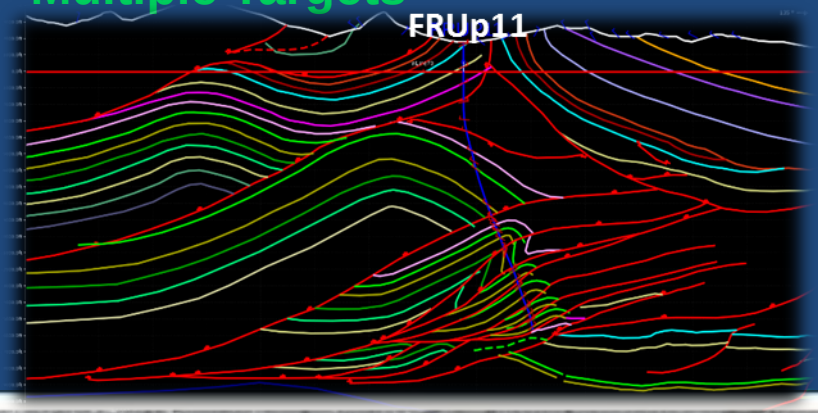


Structural Uncertainty. What we do.

Multiple Structural Models

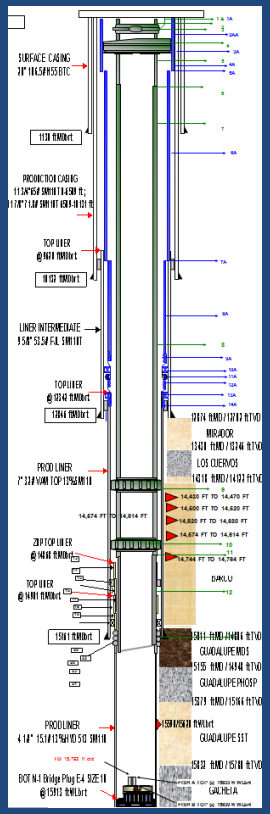


Multiple Targets

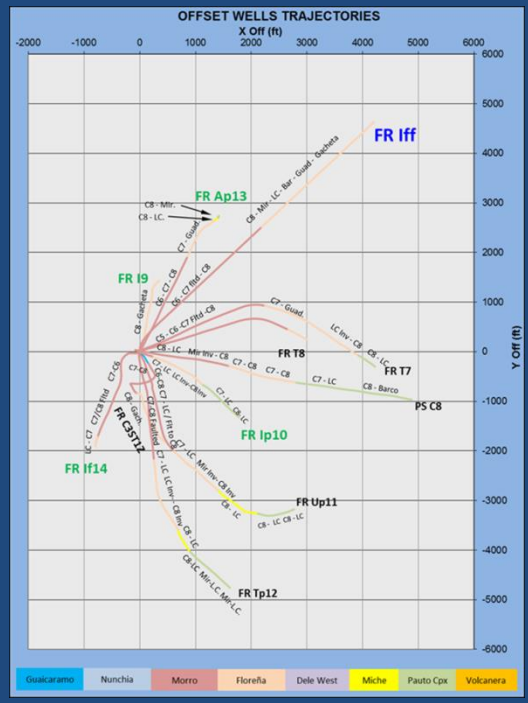


Flexibility in Well Design

Completion



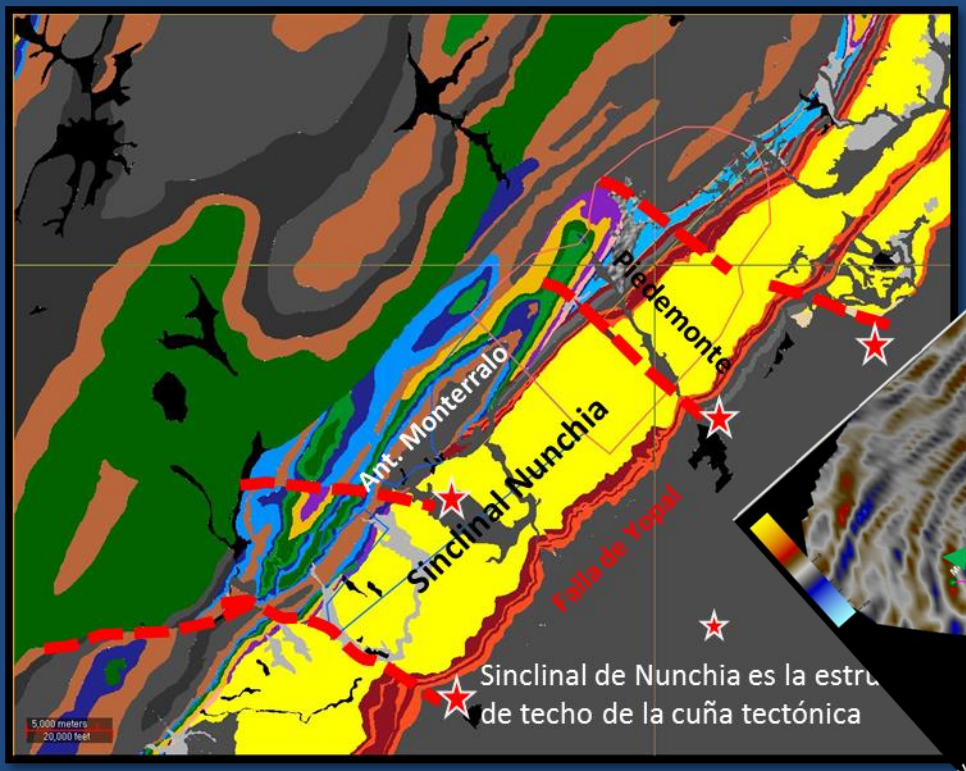
Trajectory

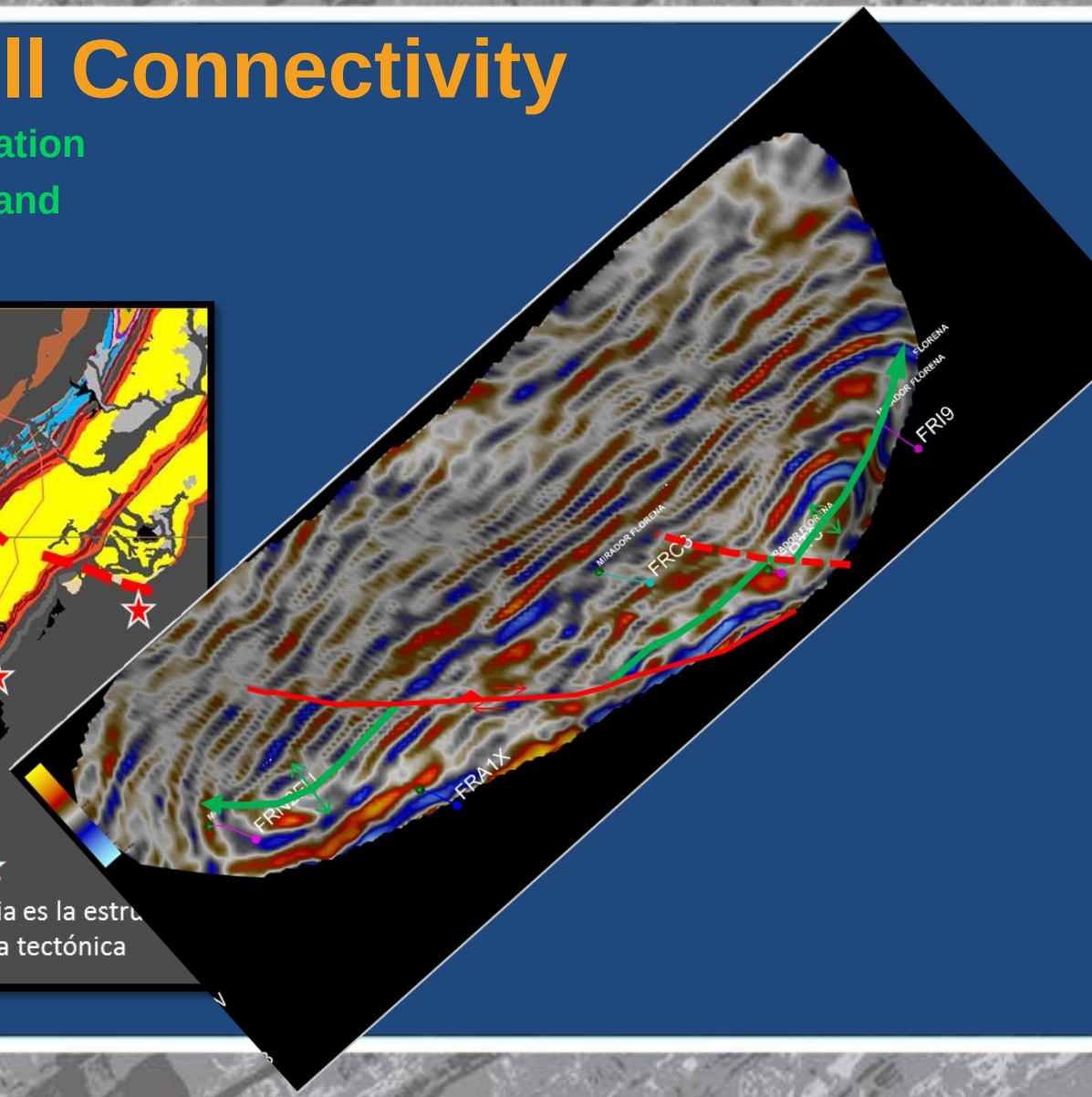


Well Connectivity

Reservoir Compartmentalization

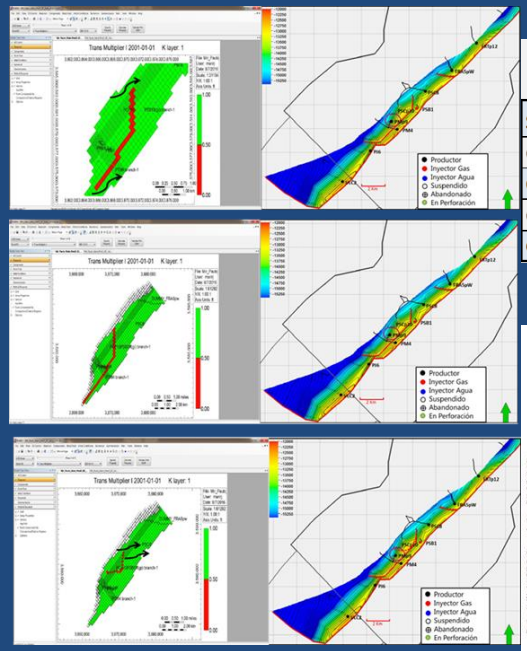
Tear Faults present on surface and subsurface



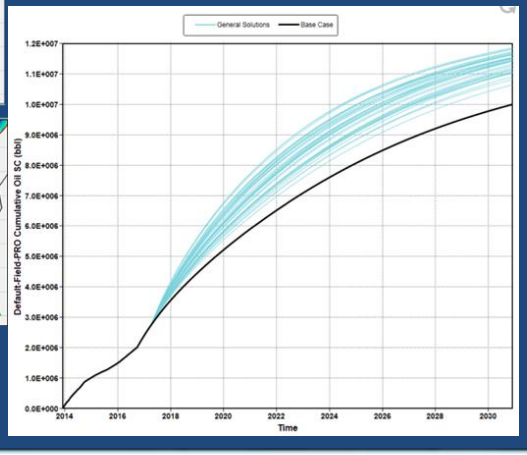


Well Connectivity… What we do?

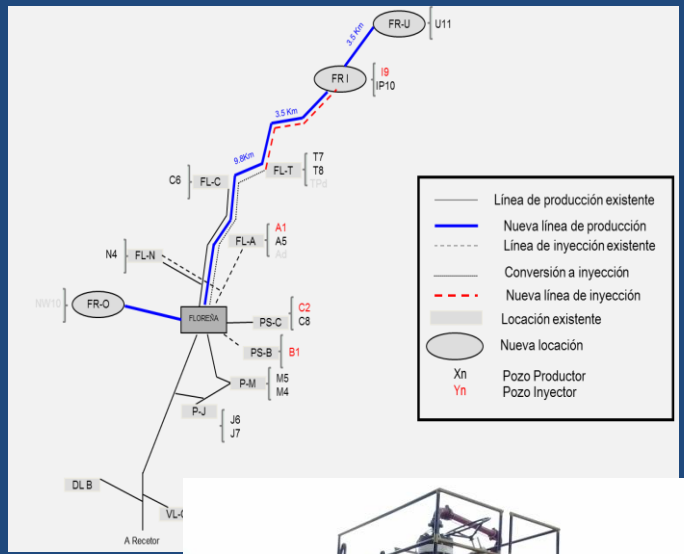
Project evaluation use multiple sensitivities



	EoL MMstb	LoF MMstb
Sin Falla	0,54	1,00
Con falla Abierta	0,54	0,56
Con falla Cerrada	0,35	0,00
Can Falla Corta	0,65	0,69
Granadillo	0,47	0,35

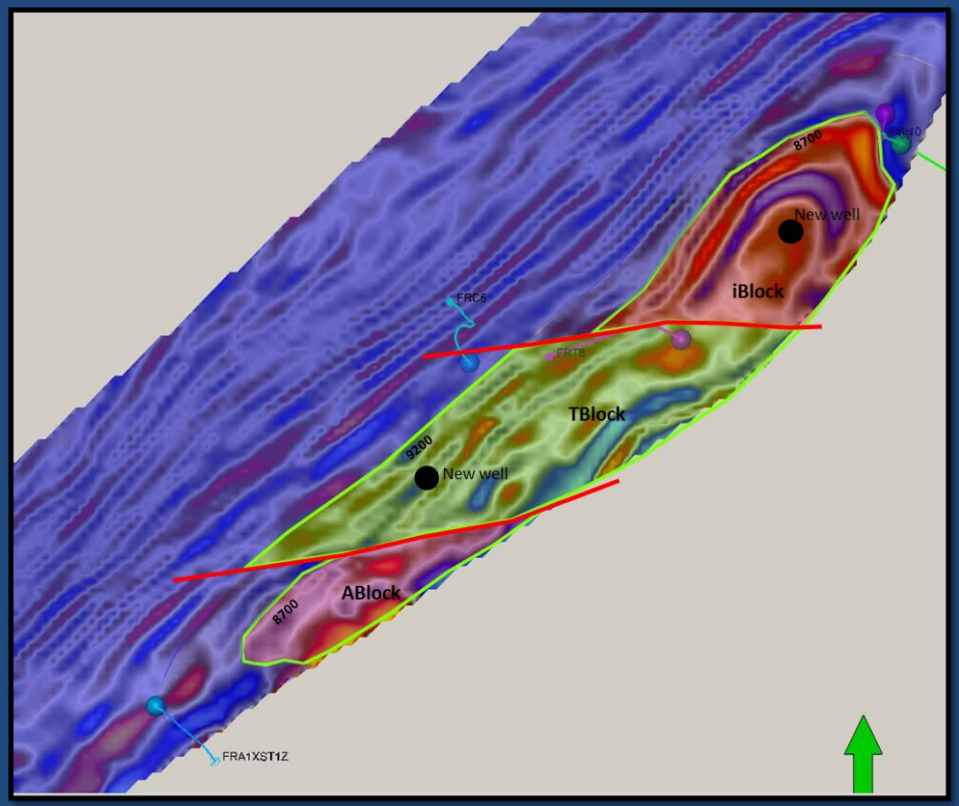


Flexibility in well service as producer or inyector



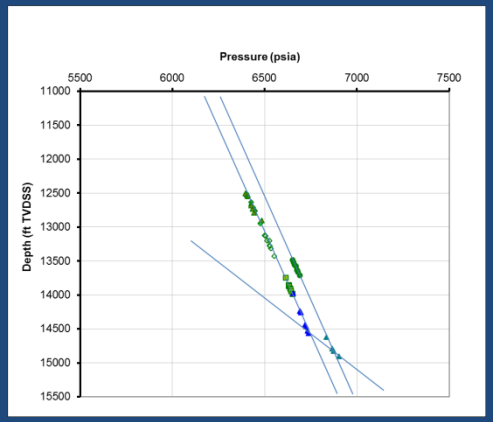
Where is the HWC?

- In Pauto Complex were proved water production from 2 wells at 14800 ft TVDSS.
- What can justify look for hydrocarbons in Pauto Complex in deeper reservoirs?
- A proved HWC can be extrapolate laterally or vertically to other compartments?

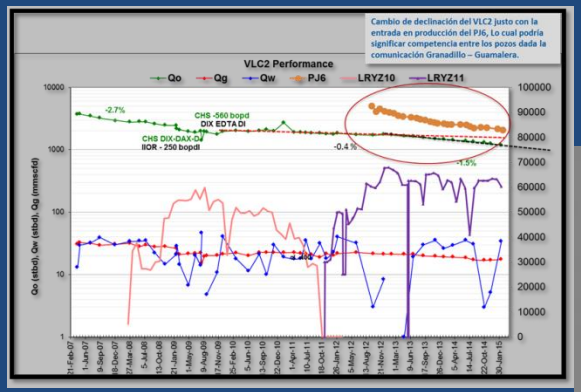


HWC. What we do

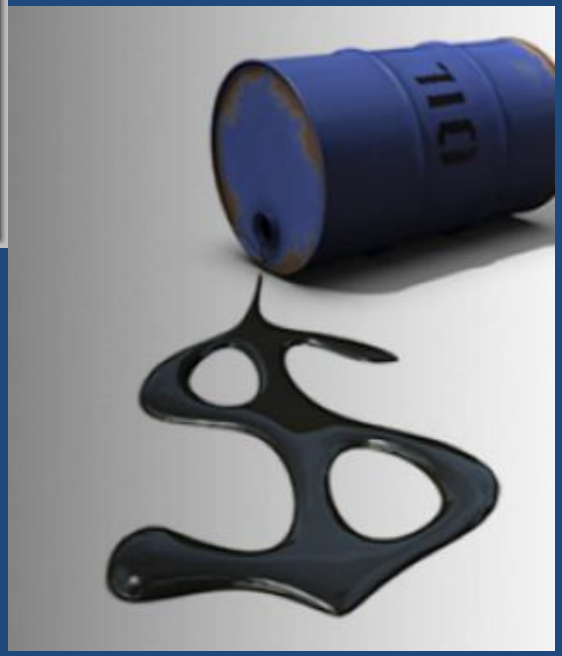
Regional Understanding



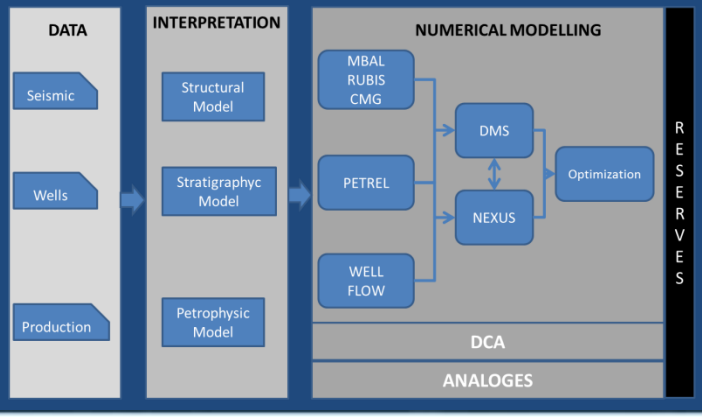
History Integration



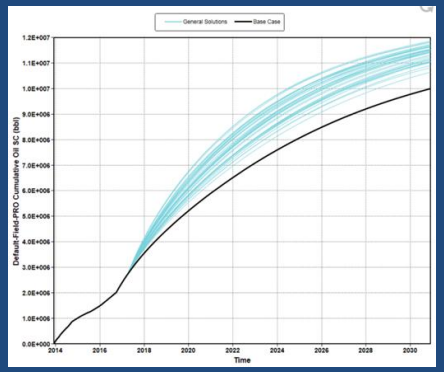
Opportunity Value



Static & Dynamic data Coherency

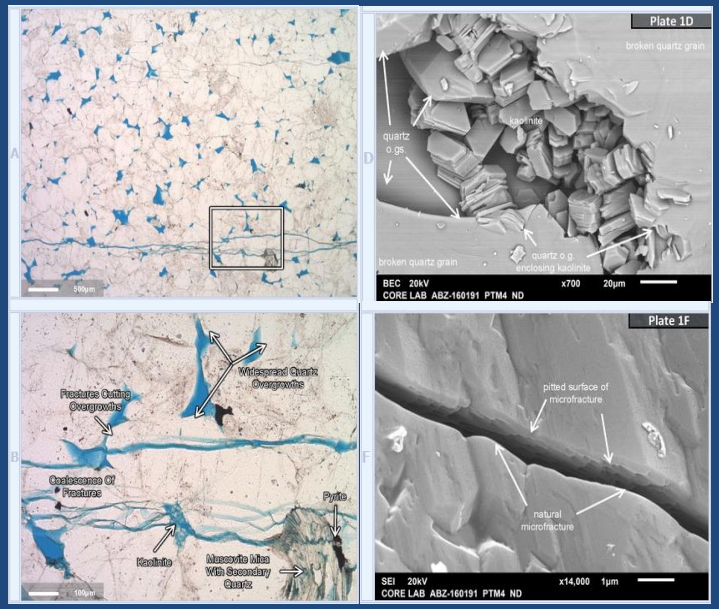


Sensitivity HDT



Well Productivity

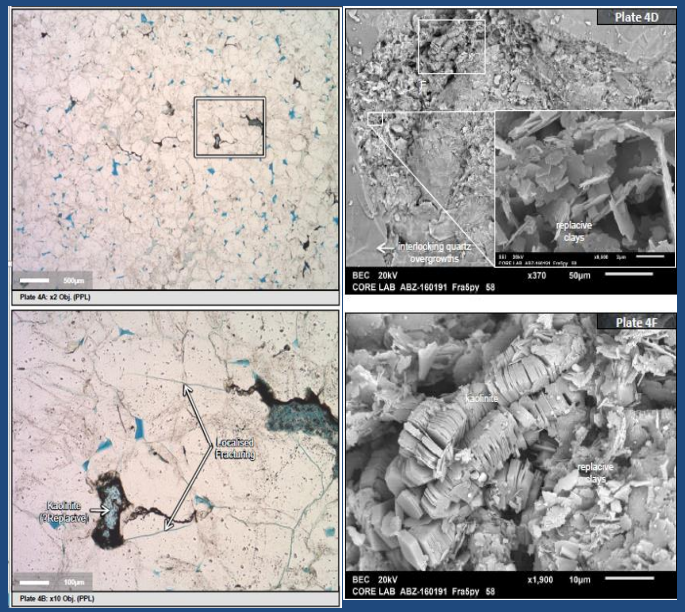
Good Quality Rock



- Porosity 2 to 6 %
- Permeability 0.01 to 10 mD
- Productivity

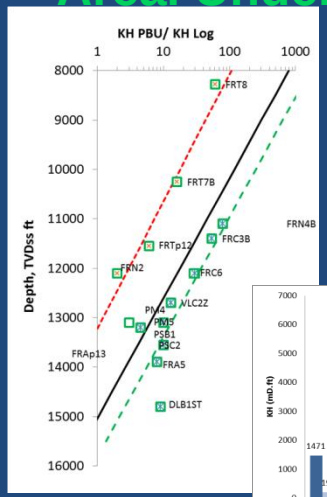
- Rock quality. Is there a rock quality pattern? Can be predicted?
- Skin damage. What is impacting skin damage?

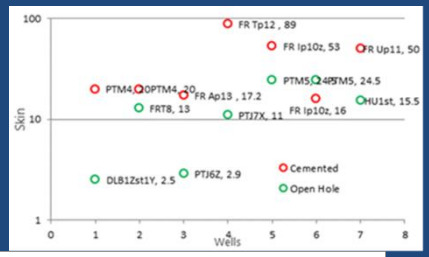
Good Quality Rock

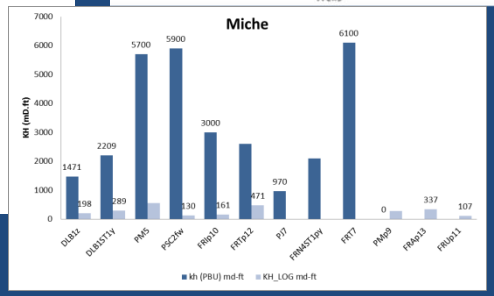


Well Productivity. What we do

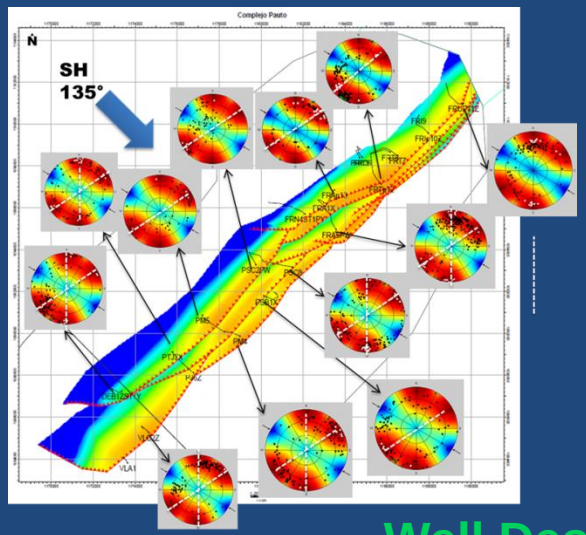
Areal Understanding







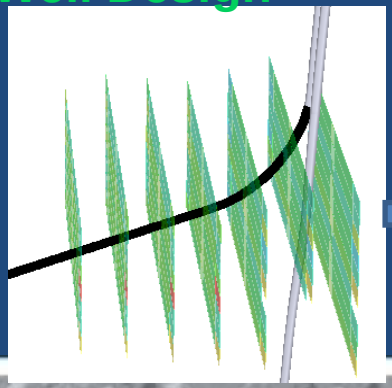
Nat Facts Orientation



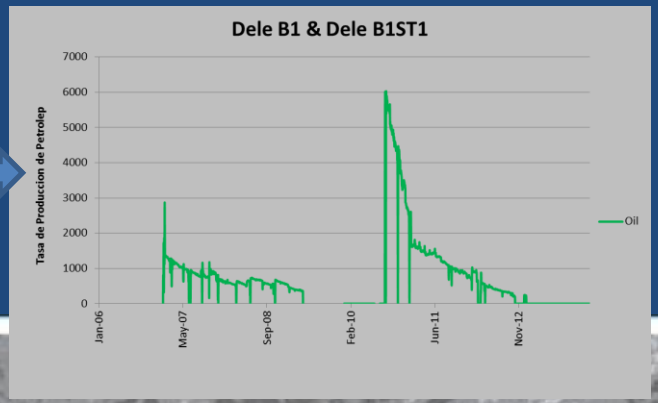
Well Design Portfolio

- Open hole completion
- Hydraulic stimulation
- Design of drilling fluids with low interfacial tension
- Prevent undesirable fluids reaction on the well bore face

Well Design

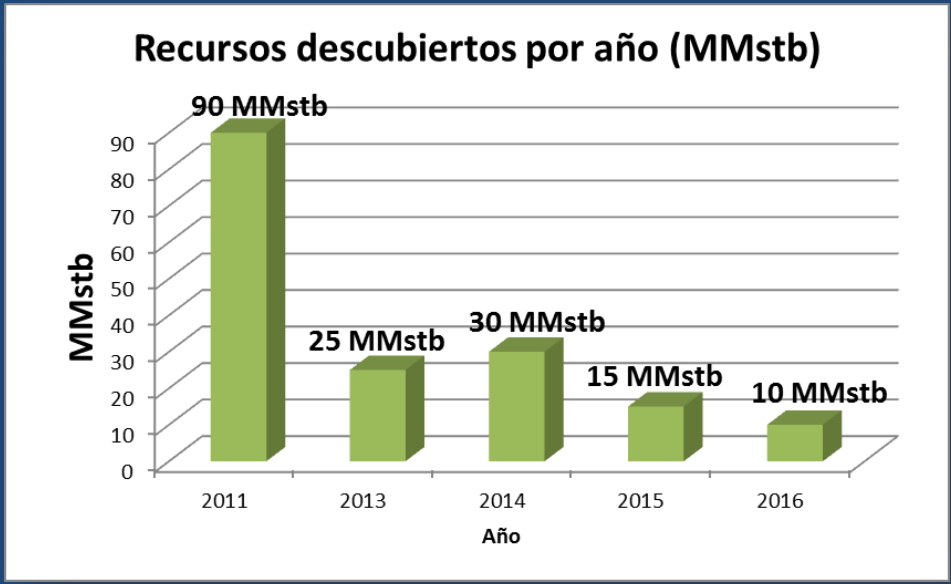


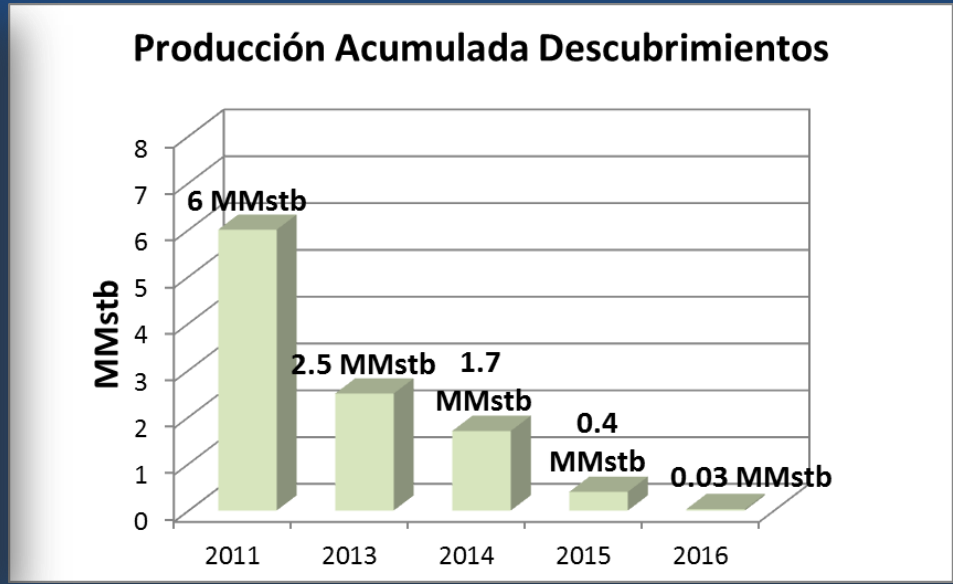
Trayectoria en la dirección 240° para mayor probabilidad de intersectar FN y alejarse del *tear fault*,



Adding value from uncertainty

Additional discovery. 170 MMstb





5 new reservoirs discovered

Proved commercial oil production from reservoirs previously tested without success.

Discovery hydrocarbons at high depths

What are the remains potential to be discovered?

Thank you