



World Oil[®] HPHT
DRILLING, COMPLETIONS & PRODUCTION CONFERENCE

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Averting Drilling Challenges in HP-HT by Customizing the DTW

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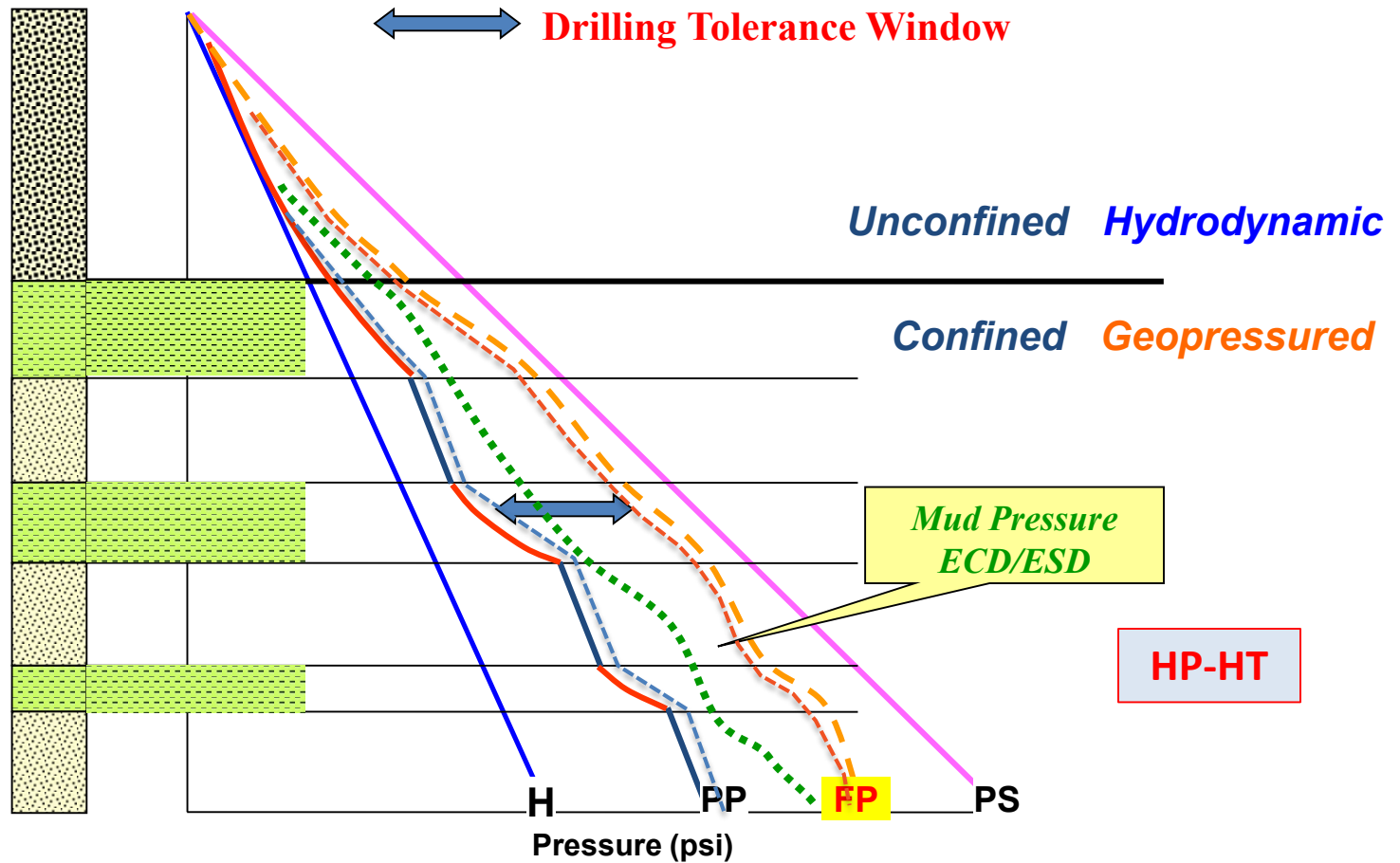
Geopressure **A**nalysis **S**ervices (**G.A.S**)

Content

- What is the Drilling Tolerance Window
- Estimating DTW before drilling
- Causes of narrowing DTW during drilling
- Customizing the ECD /DTW

Drilling Tolerance Window (DTW)

(Fracture – Pore Pressure) - Safety limits



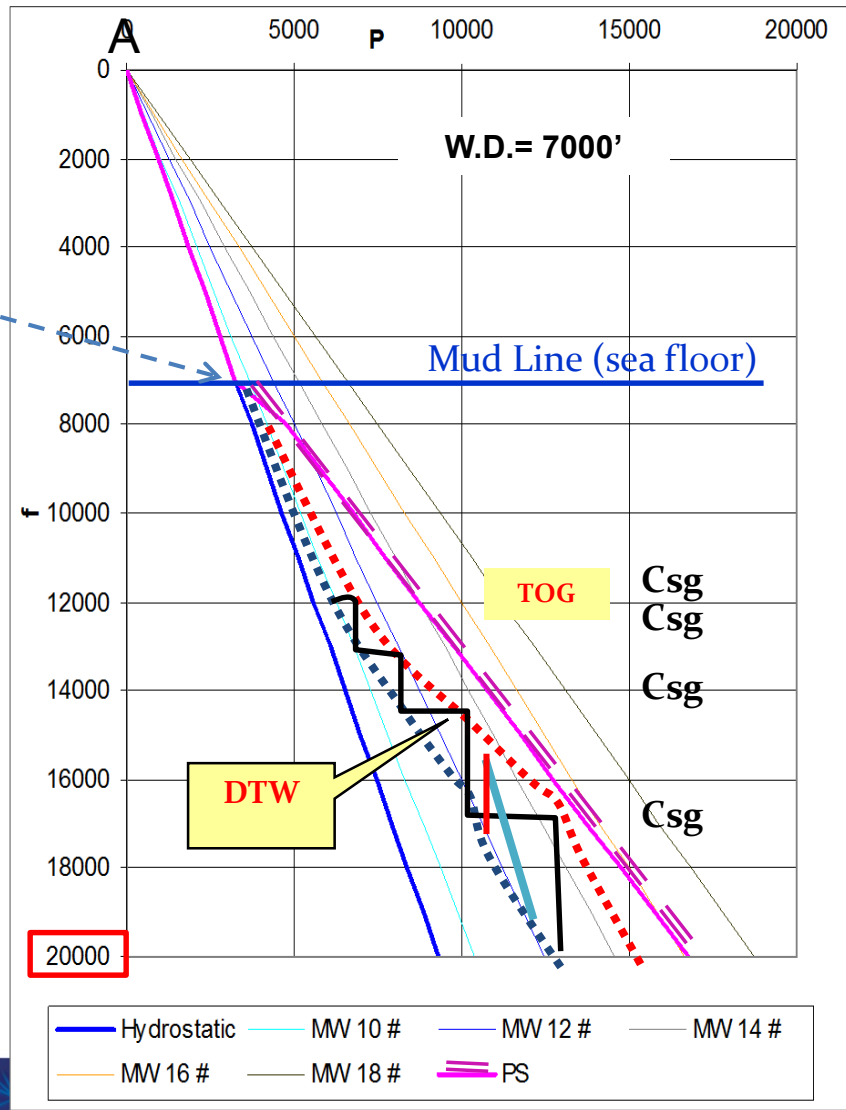
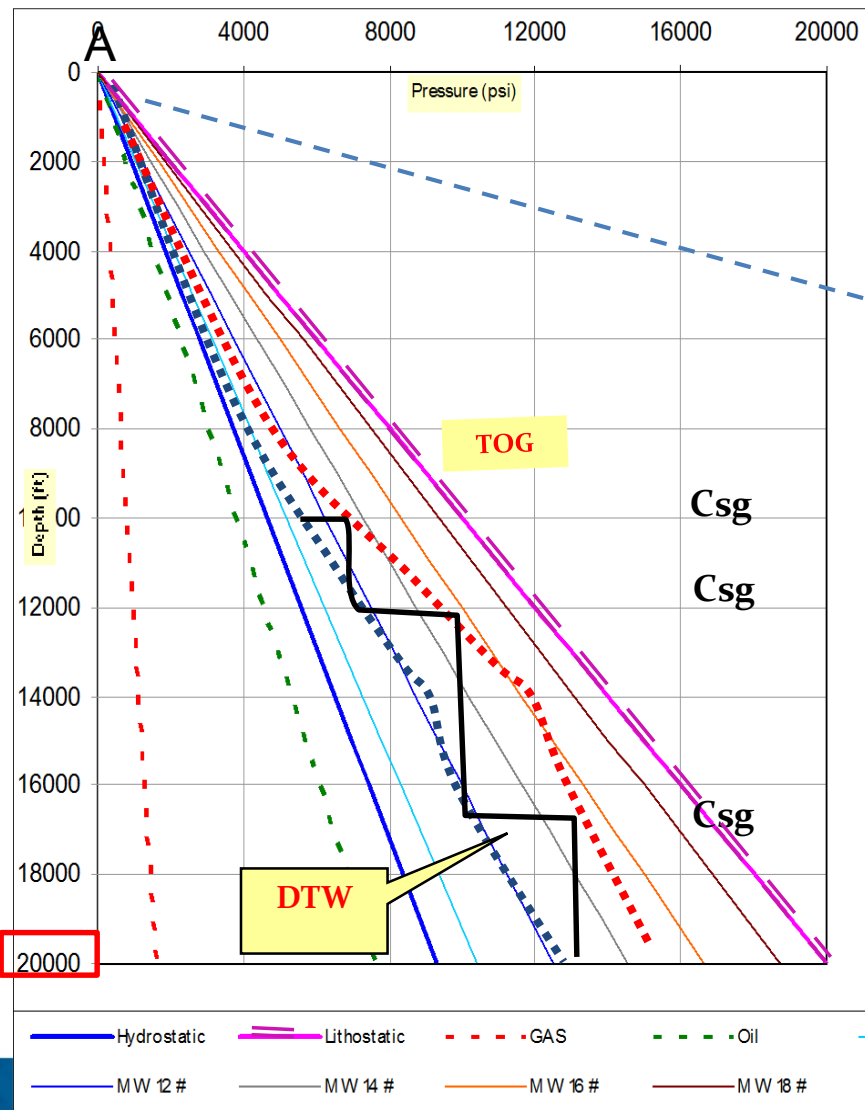
Safety Limits

Causes of DTW Reduction

- Water depth (mudline SS depth)
- Strong Pressure Transgression
- Hydrocarbon Column

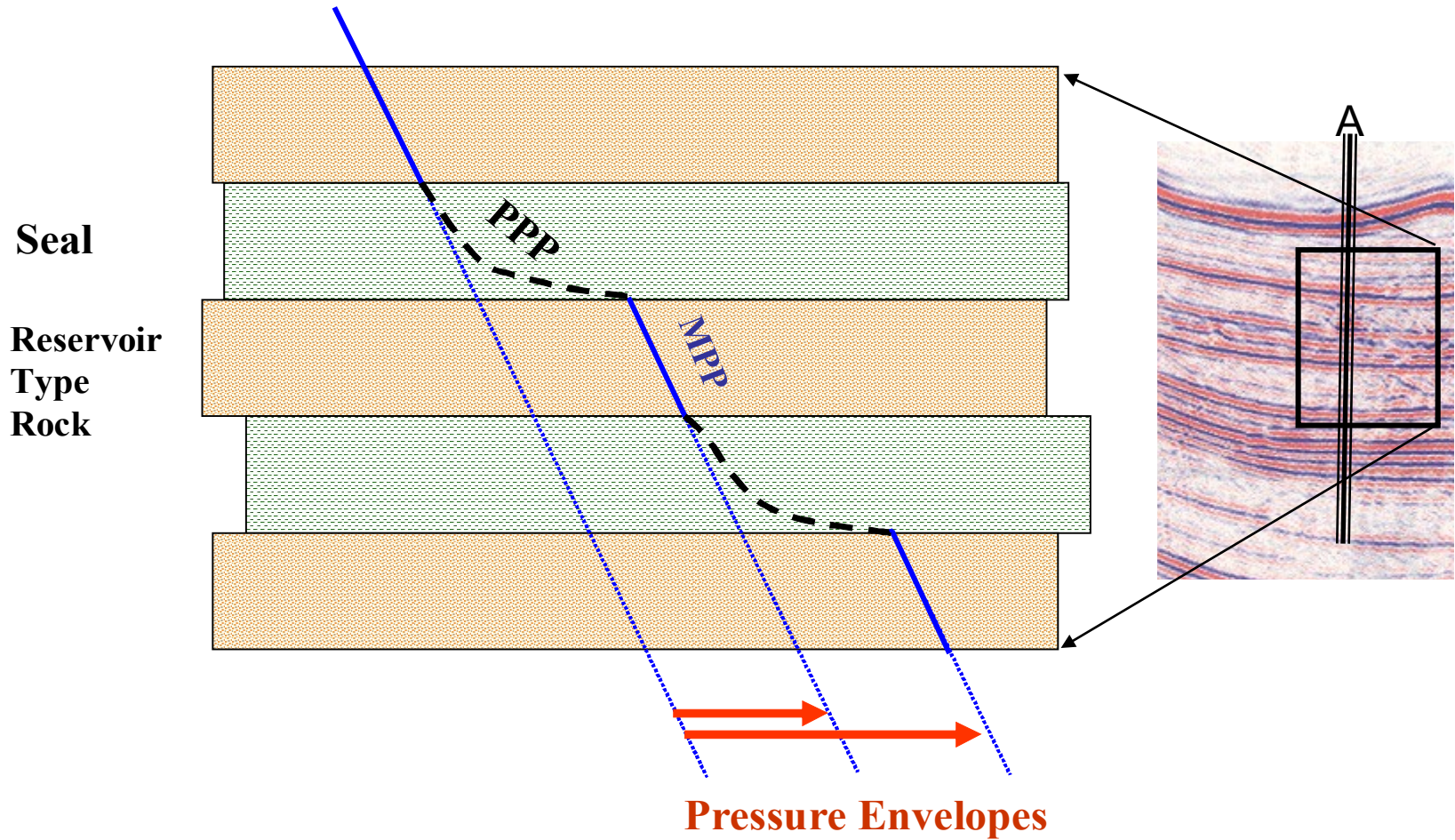
Impact of Mud line depth on DTW:

Shallow vs. Deep Water PP profiles:



Pressure Transgression

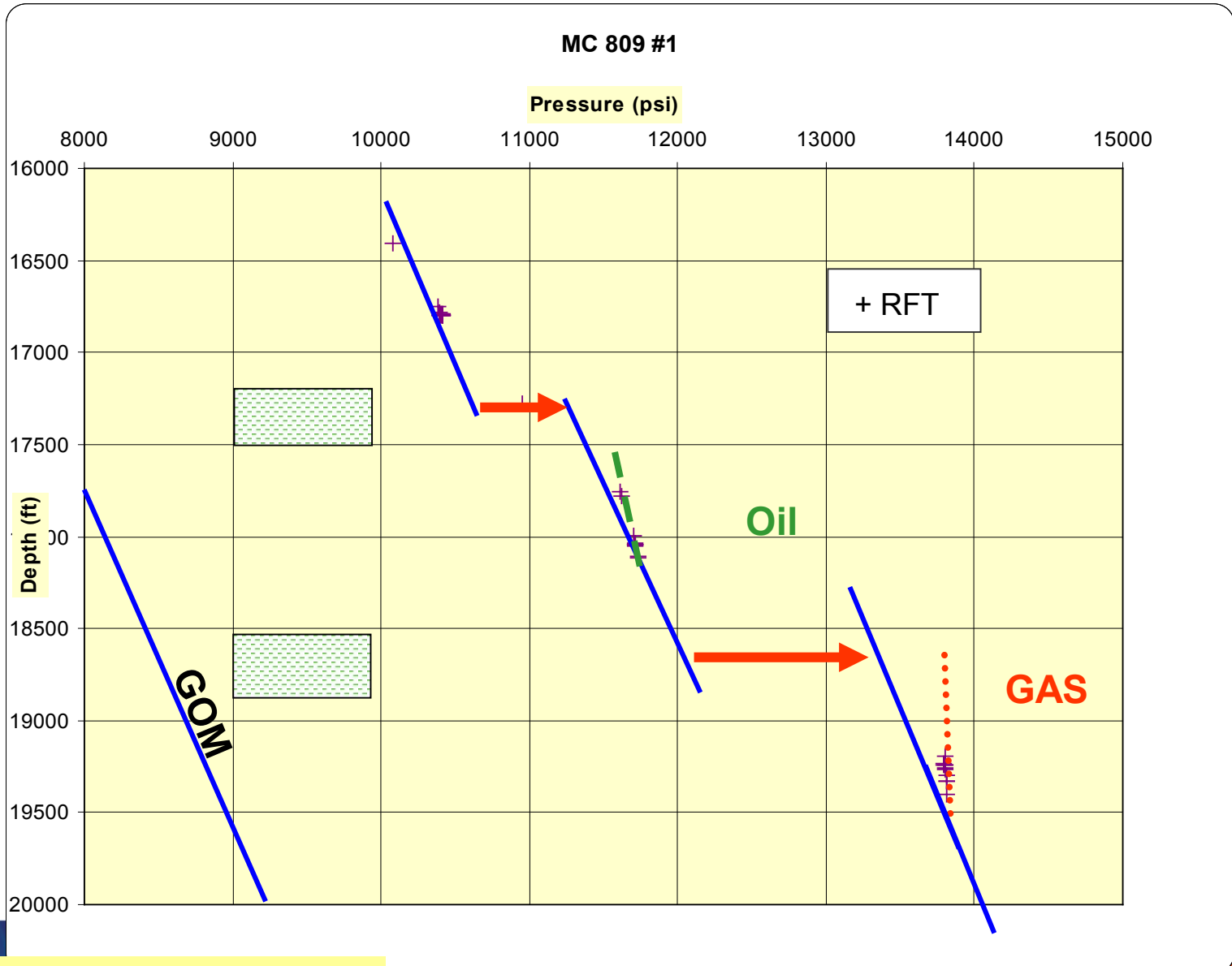
PP Profile in a Transgressive system



- Shaker, AADE Annual Convention, (AADE-12-FTCE-66)

P. Transgression + HC pressure

Transgressive (4000') system in Mississippi Canyon

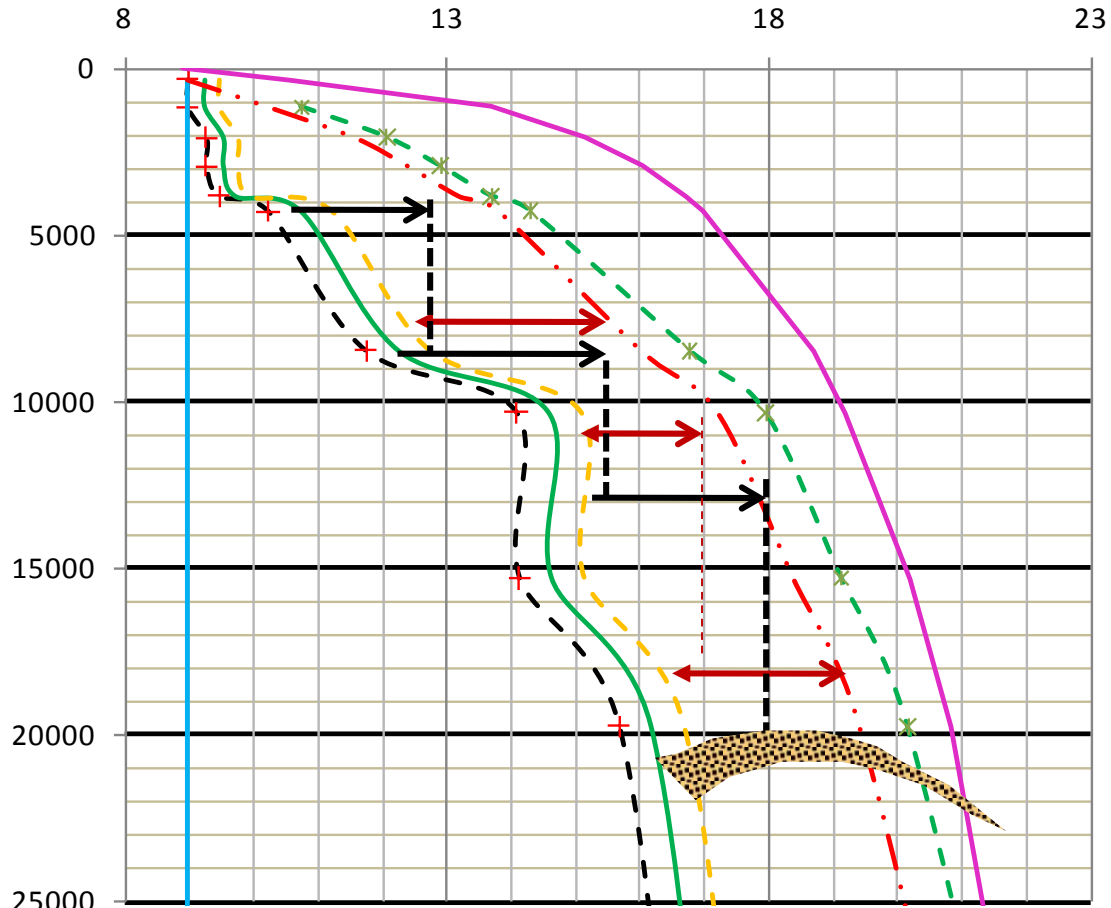


• Shaker, AADE Annual Convention, (AADE-12-FTCE-66)

PREDICTION of DTW , Mud and Csg programs Before Drilling (Seismic velocity – Pore pressure Modeling)

Predicted MW and Casing

PPP ppg mwe from IV



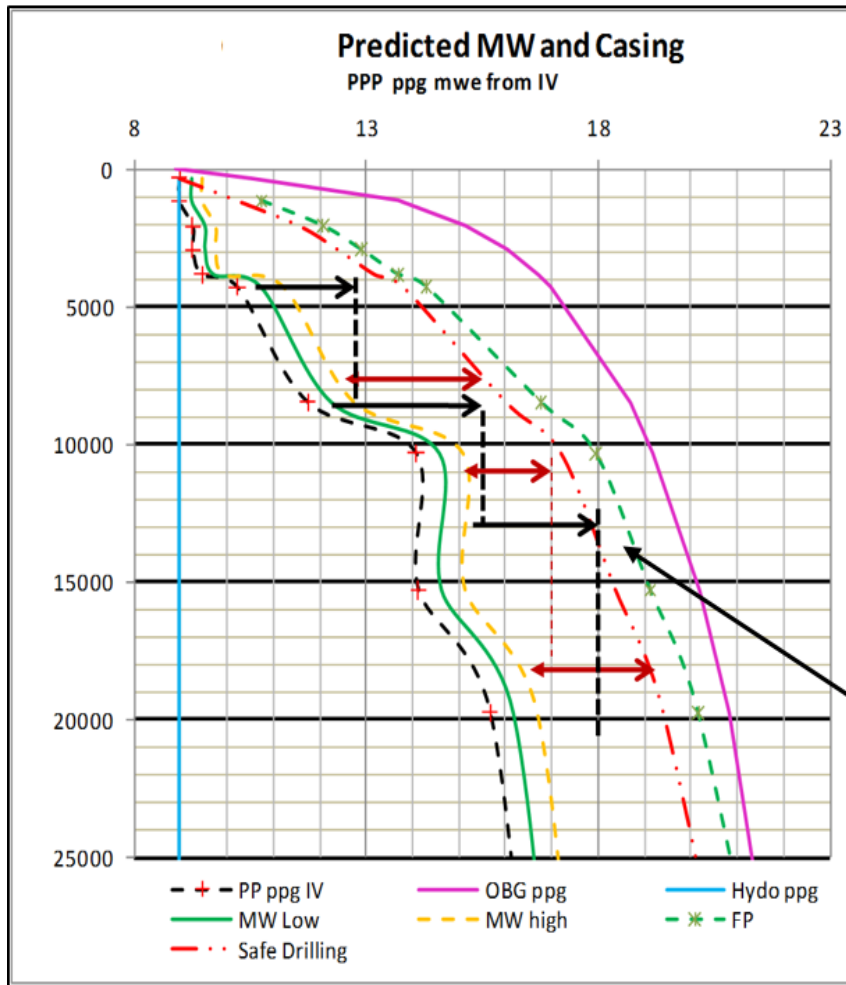
→
Casing setting in
trouble-free drilling

↔
Casing setting in
case of several mud
cuts and kicks

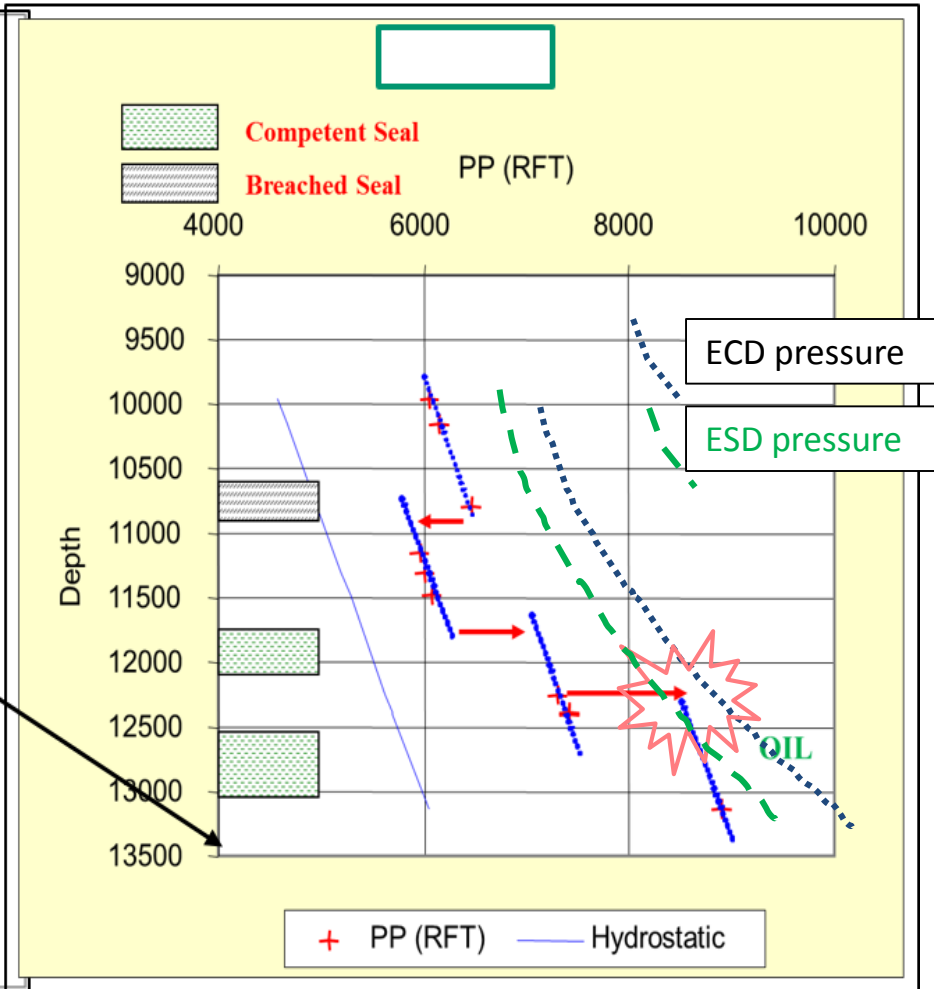
- + - PP ppg IV
- MW Low
- . . Safe Drilling
- OBG ppg
- - - MW high
- FP
- Hydo ppg

ECD vs. ESD in compartmentalized HP-HT

Before drilling from Seismic



After drilling



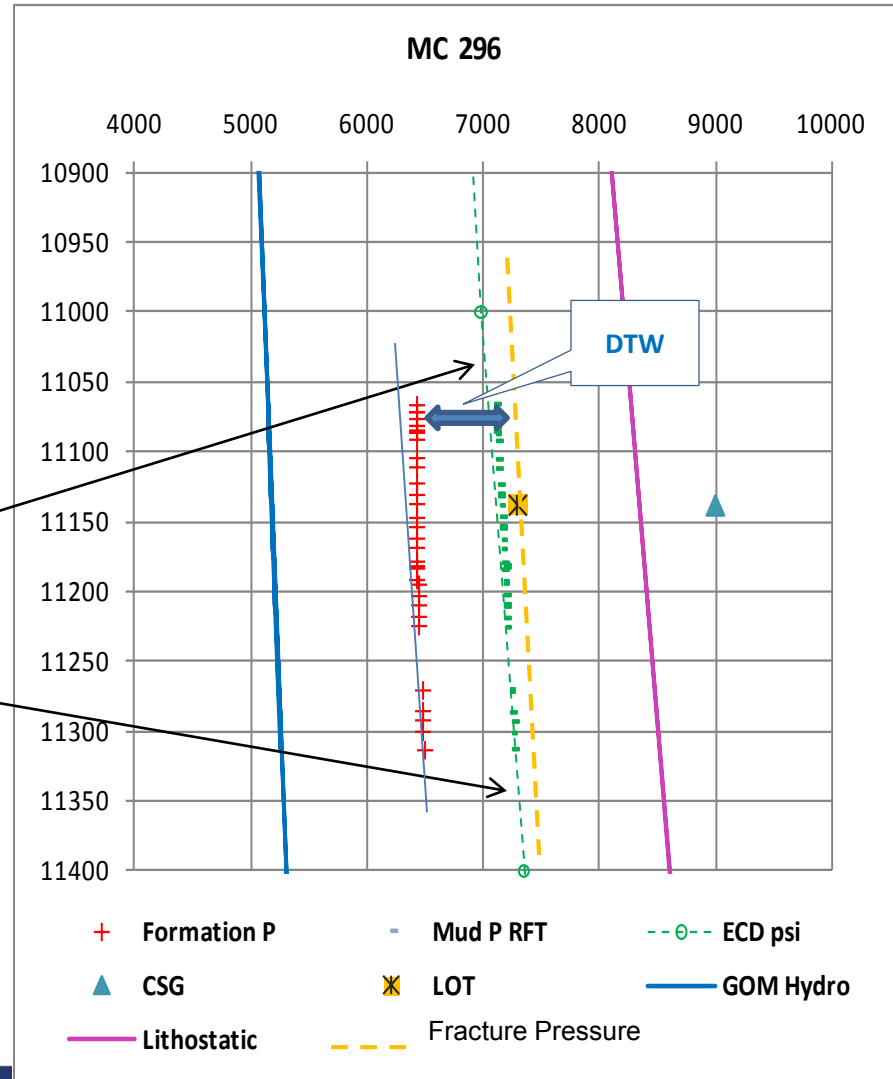
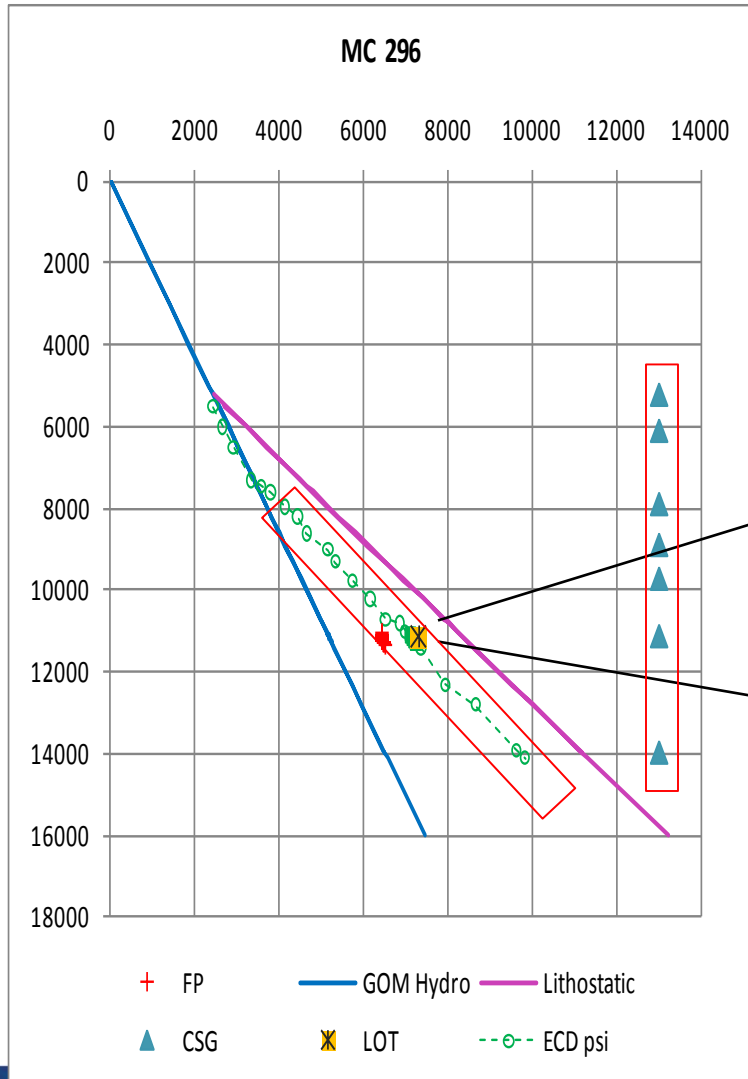
Blow-out (Algeria)



After boots and coots

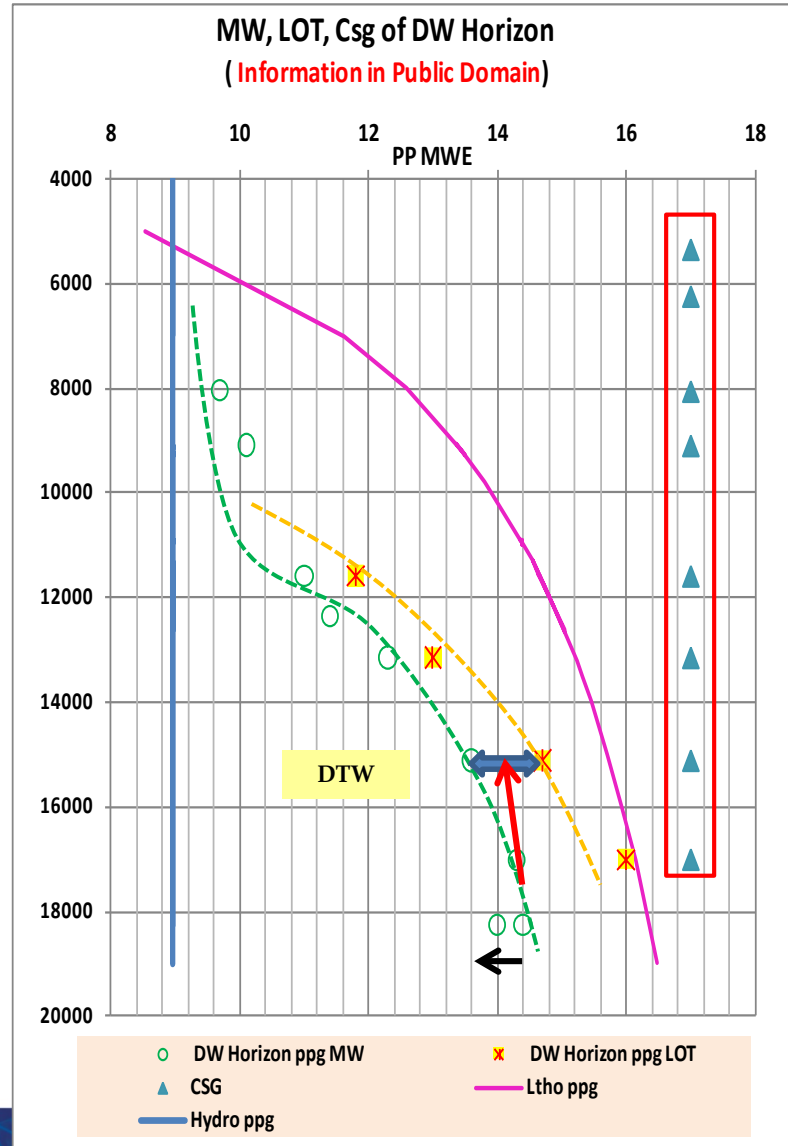
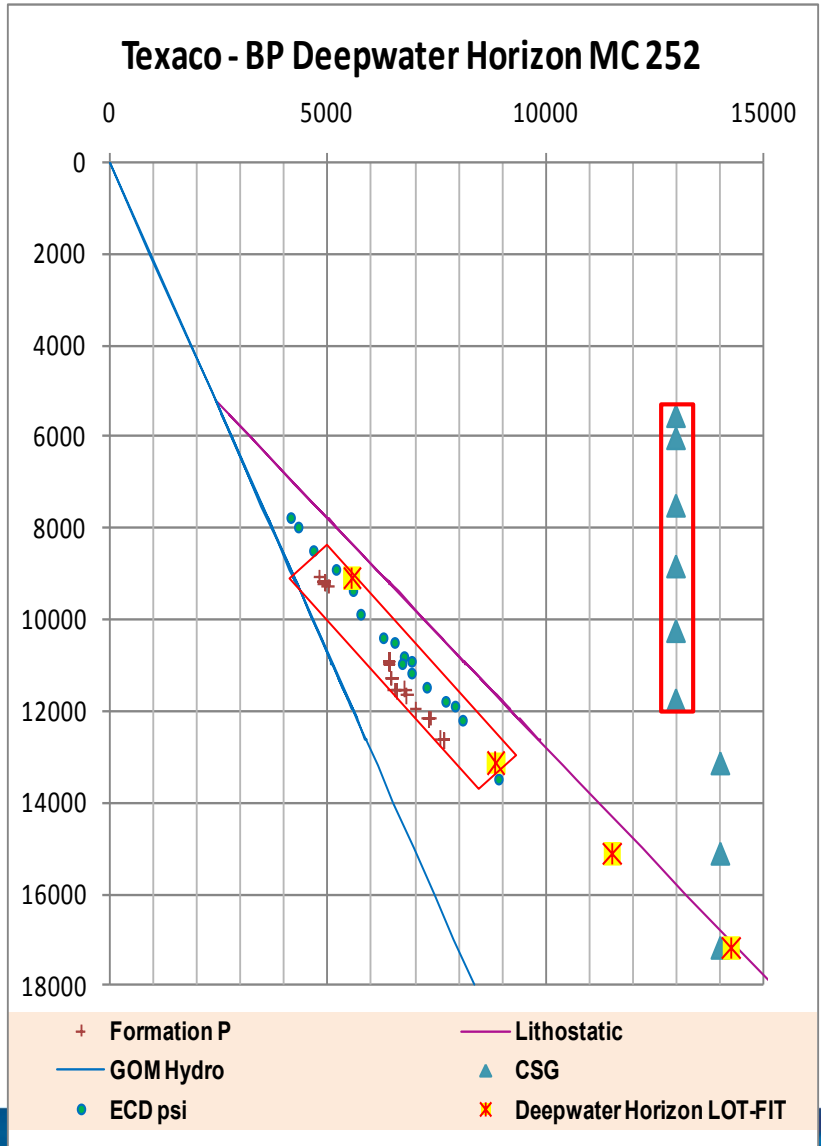
➤ The Impact of HYDROCARBON on the DTW

Mississippi Canyon 296 (ENI)



The thick HC column led to more reduction of the DTW

The narrow DTW on Mississippi Canyon 252 (Deep Horizon BP)



The Narrow DTW in addition to the presence of hydrocarbon led to serious drilling challenges
 Shaker, 2011 AAPG

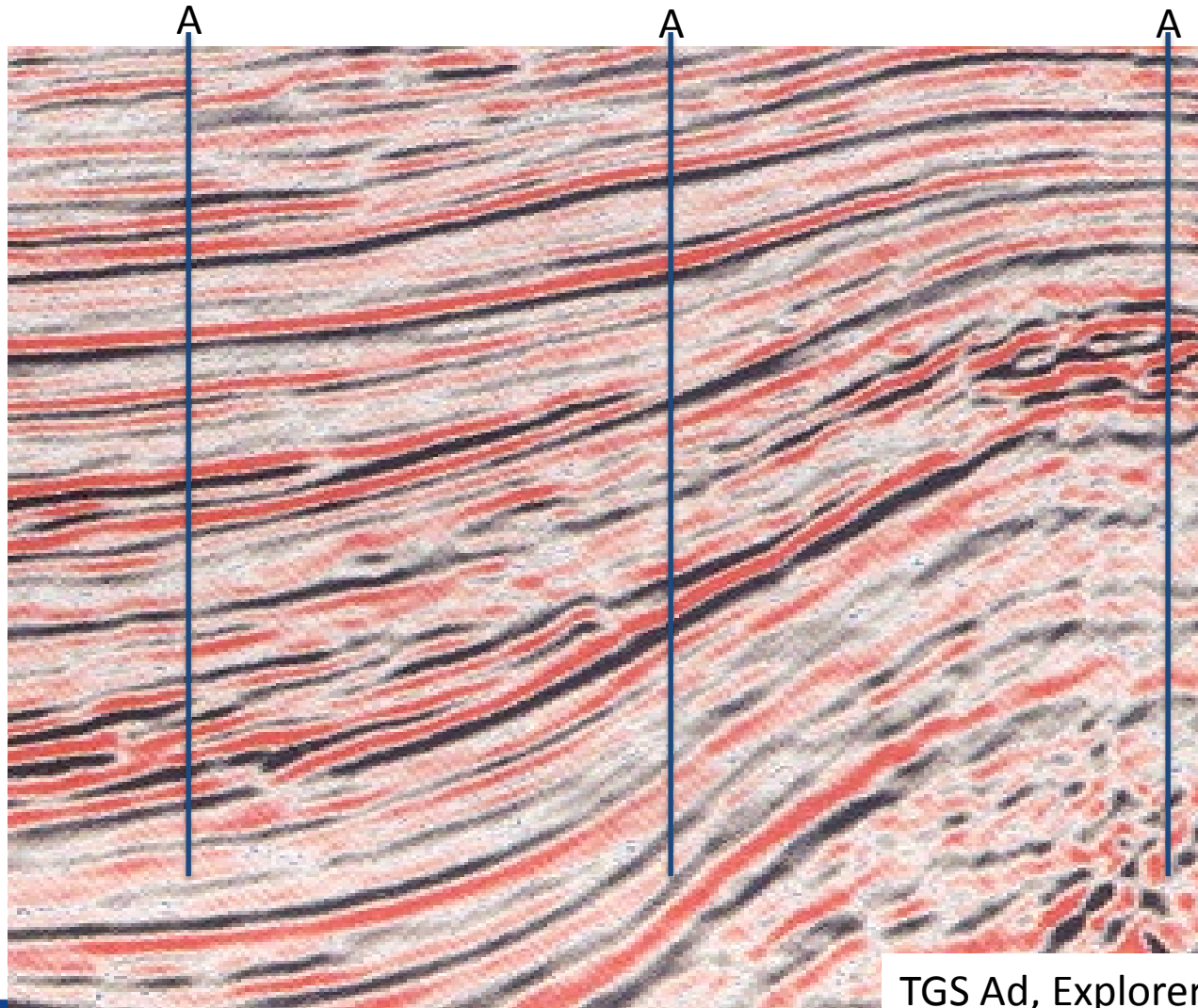
Deep water horizon (GOM)



Use the Geological building blocks and Stress Vectors to predict DTW configuration

- Sequence stratigraphy
- Salt displacement and emplacement
- Rocking basins
- Faults
- Diapirs
- etc.

Seismic Sequence Stratigraphy and Velocity

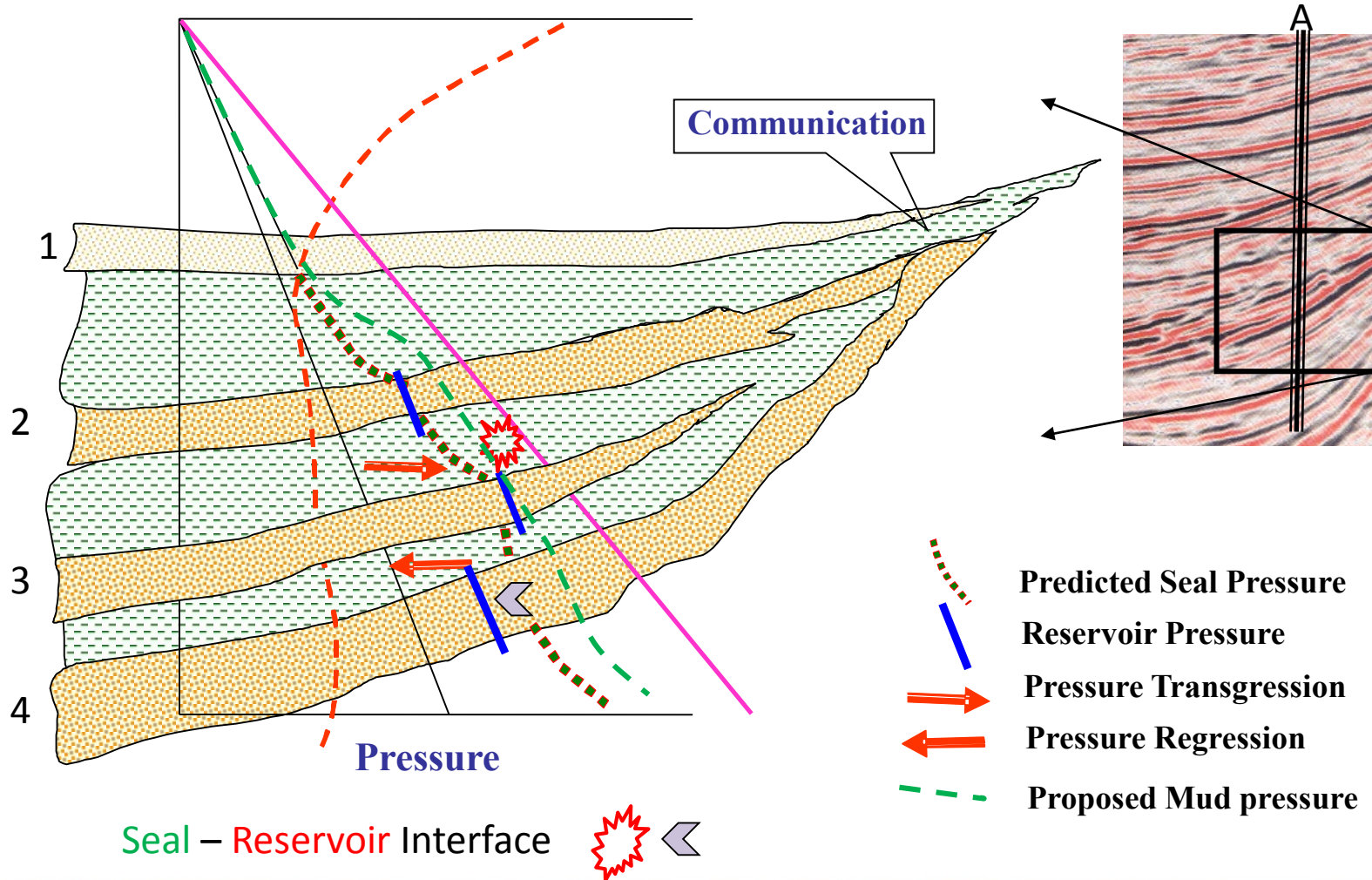


TGS Ad, Explorer

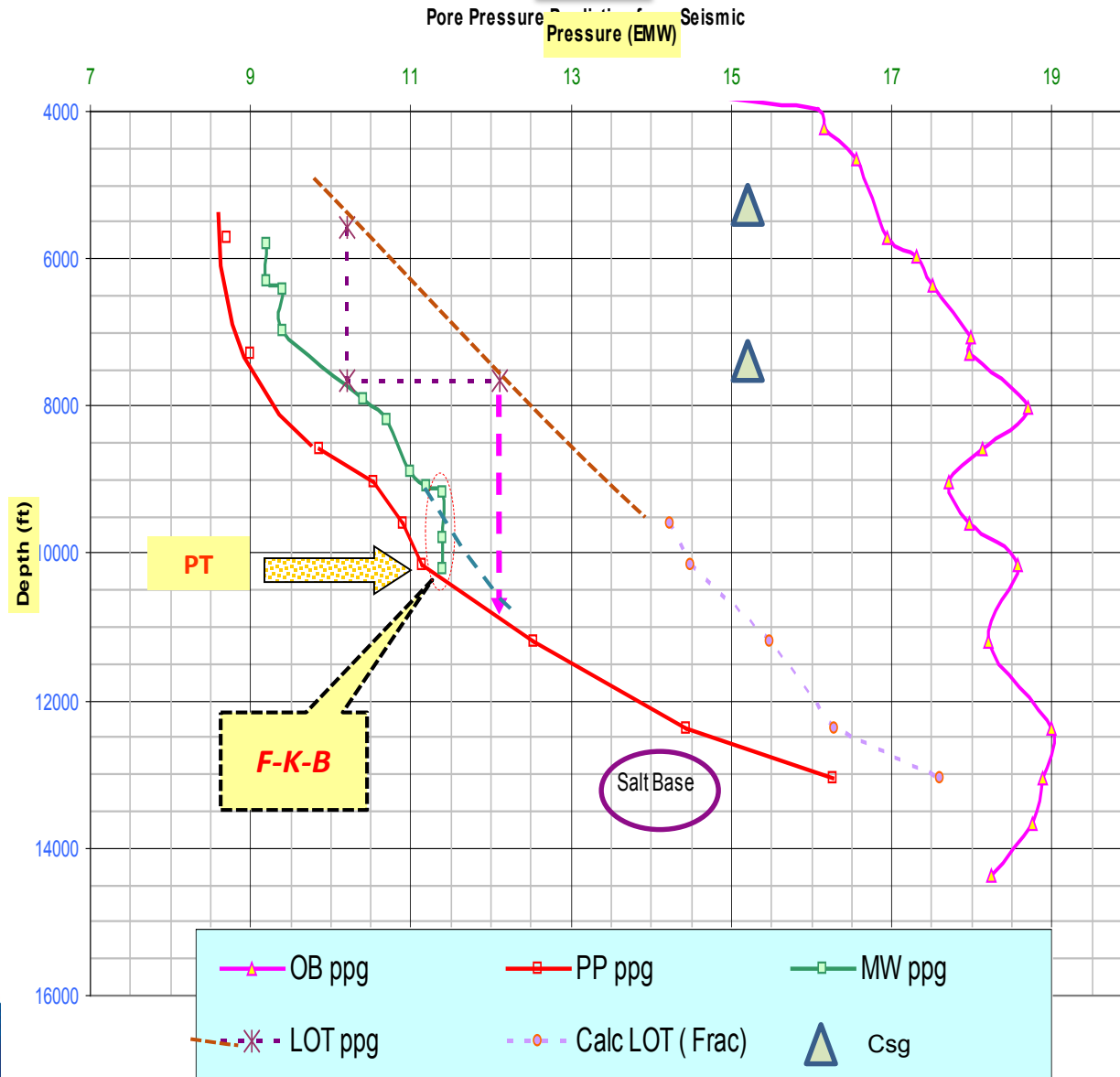
Disparity between MPP (sand) and PPP (shale).

Deposits geometry and facies changes

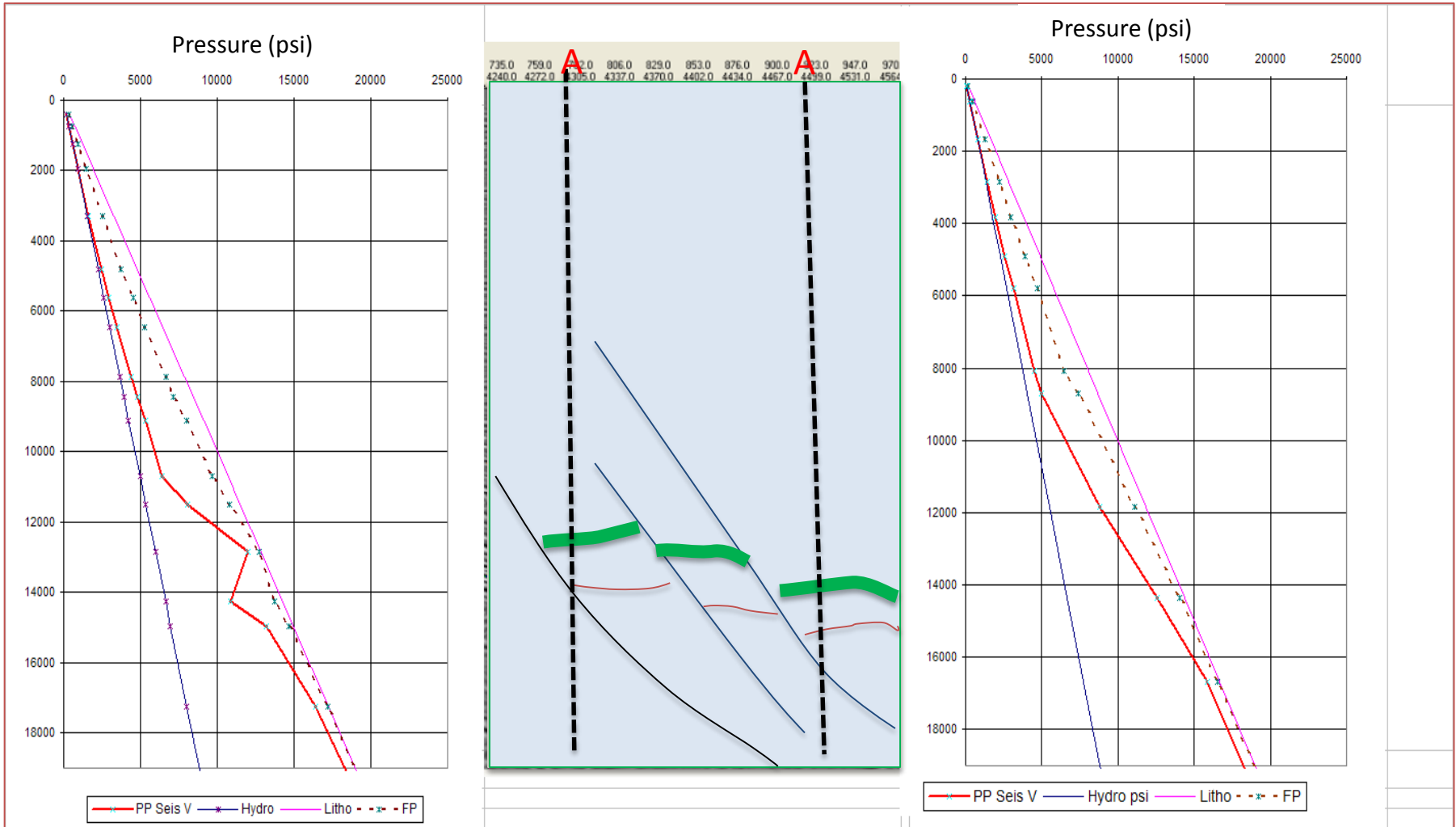
Velocity (Porosity Index)



Well abandonment in DW TX due to the proximity of Mud and Formation Pressures

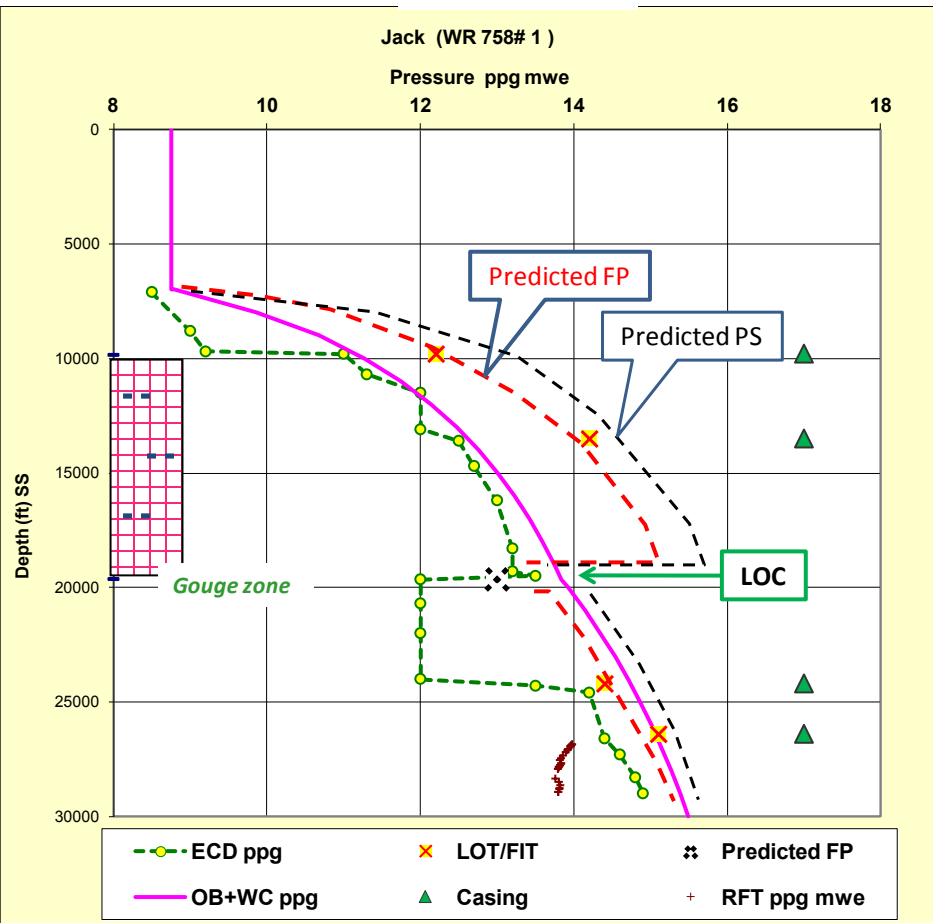


Fault's Impact on DTW

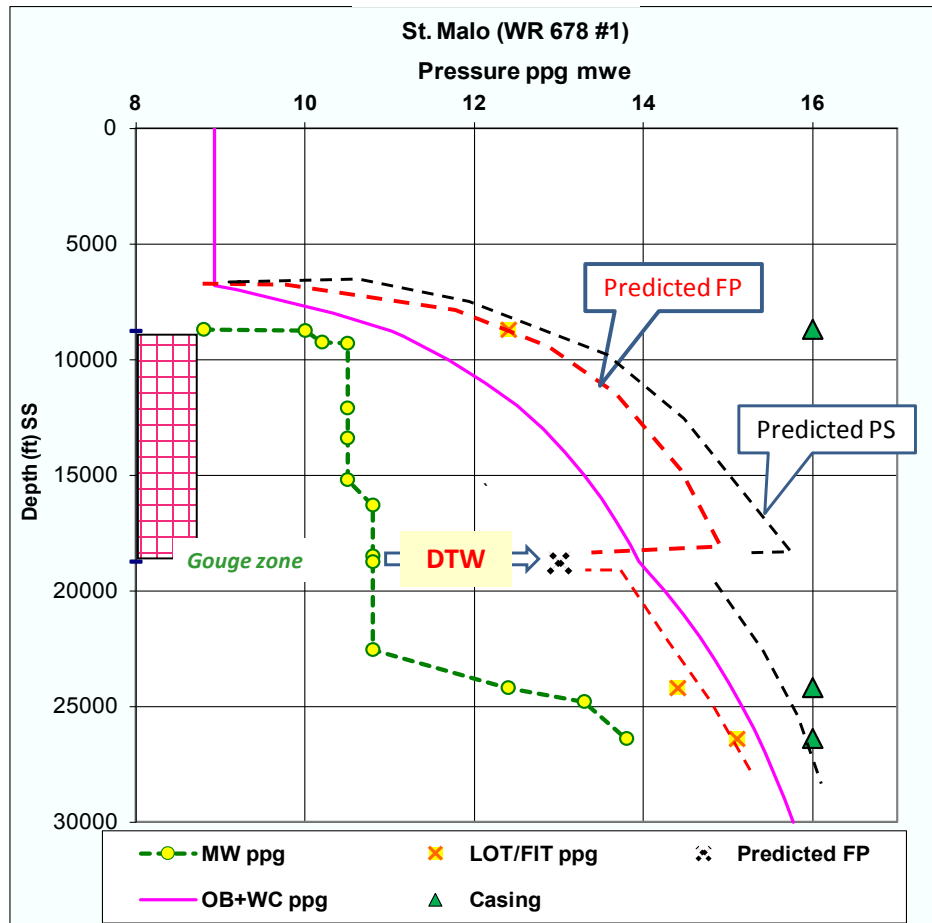


Impact of Stress vectors and Salt emplacement on DTW

Jack



St. Malo



After Shaker, 2016 (AADE-16-FTCE-16)

Summary

- Most of hard kicks at beds interface.
- Connections (from ECD to ESD)
- Narrow DTW caused by Water depth, Transgression and HC column.
- Modifying the Predrilling ECD using Sequence Stratigraphy and Seismic Velocity
- Hydrocarbon column integration

Acknowledgement

World Oil HPHT

Myron Malek

Q and A

Thank You