



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

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HPHTConference.com

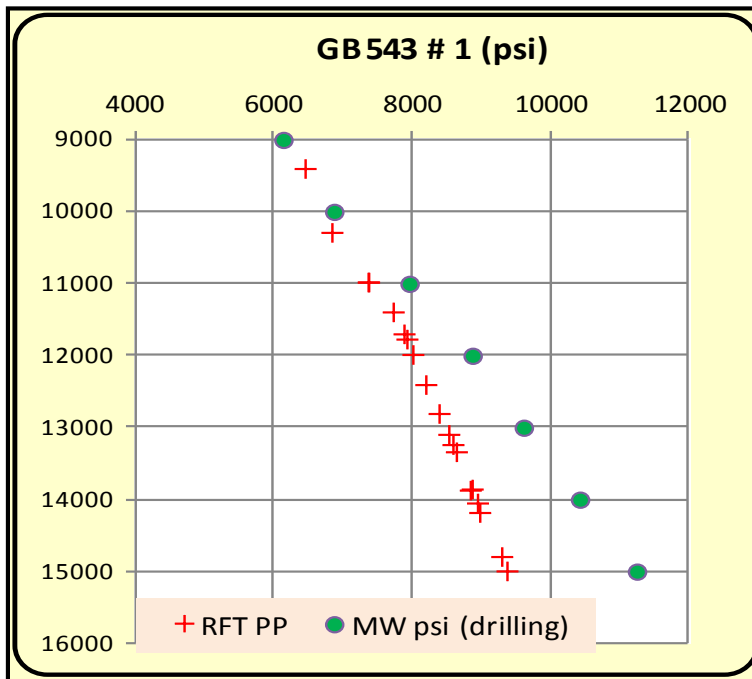
Corrected Geopressure Gradients (HPHT) for Drillers

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G.A.S

Introduction:

- Why reservoir Pressure in ppg mwe shows negative slope**
- Case Histories**
- Geopressure Compartmentalization in HP zones**
- Calculated PPG MWE using SCF**
- Gradient Correction applying GMC**
- PP prediction models calibration.**

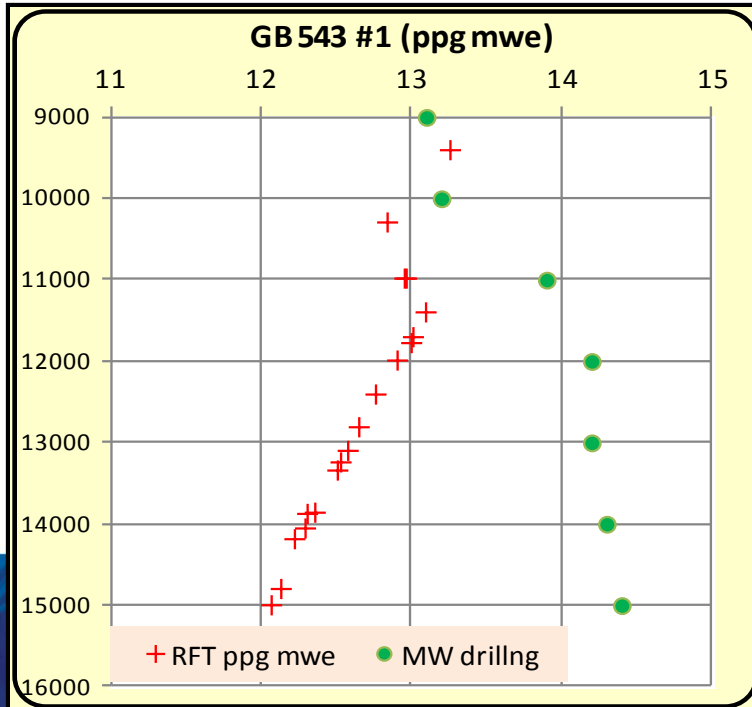
PSI



**Standard Conversion
Factor (SCF) 0.052**

From lb / gal to psi/ ft =
 $12 \text{ in}^3 / 231 \text{ in}^3 = 0.052$
 And vice versa = $1 / 0.052 = 19.2$

PPG MWE



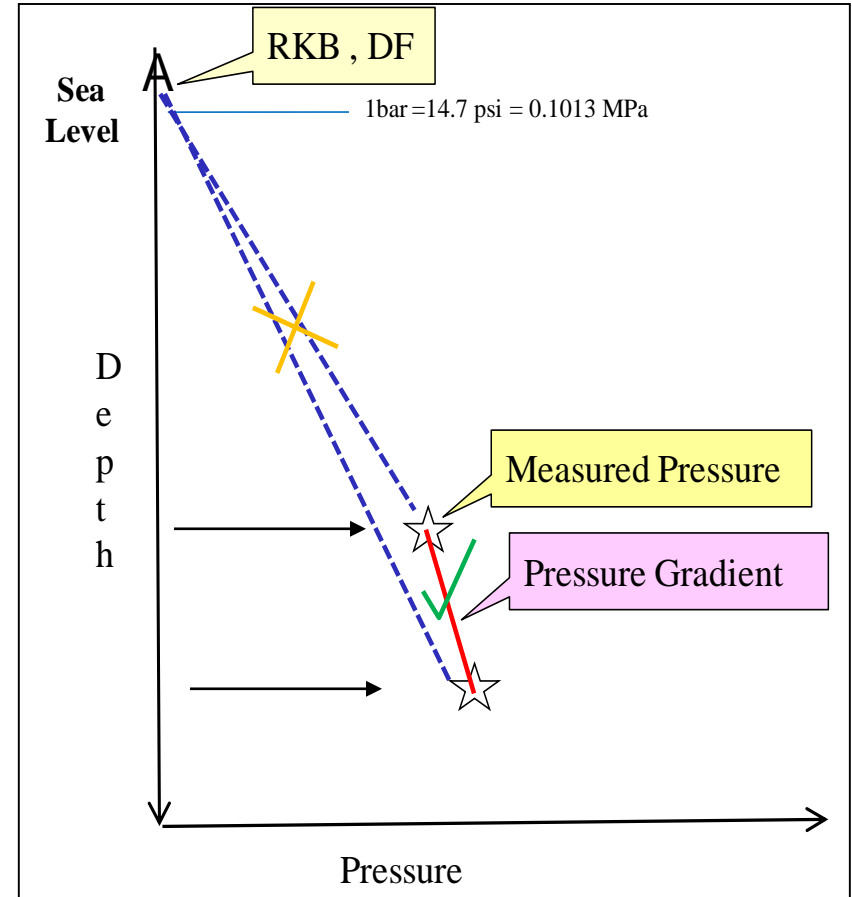
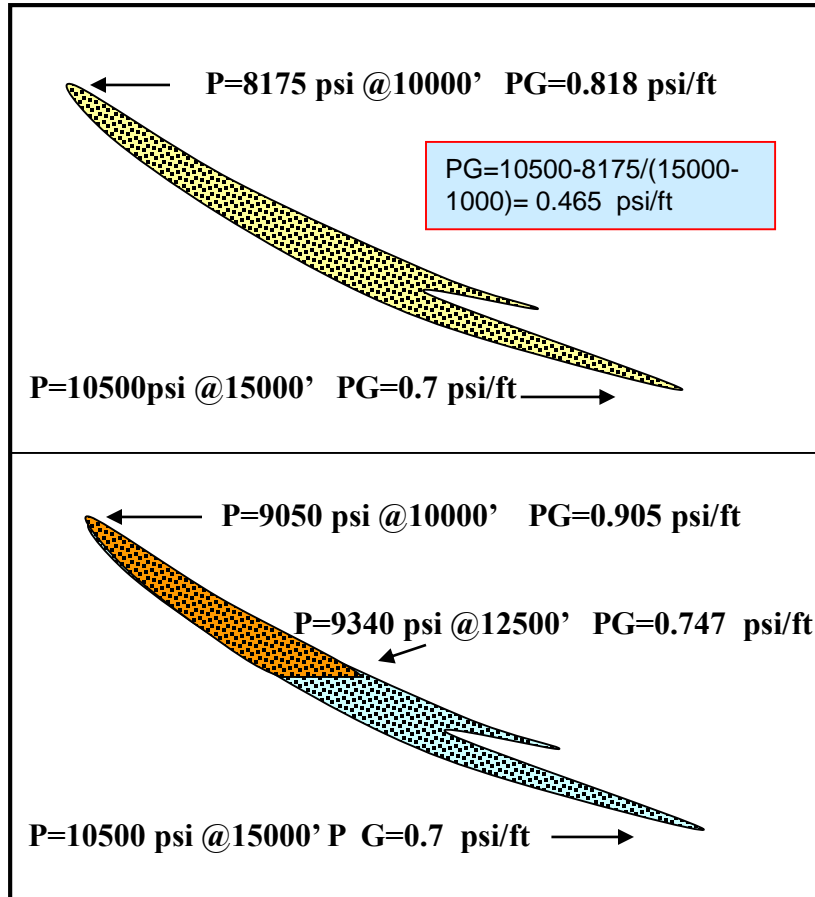
Depth	FP psi	FP ppgmwe
11695	7883	13.0091
11768	7925	12.9973
11982	8011	12.9037
12400	8198	12.7598
12802	8390	12.6486
13092	8530	12.5748
13234	8590	12.5274
13334	8640	12.5058
13852	8868	12.3558
13867	8841	12.3048
14046	8945	12.2909
14178	8977	12.2201
14790	9295	12.1294
14990	9371	12.0654

Garden Banks 543 # 1

The root cause of the negative slope in reservoirs pressure in ppg mwe

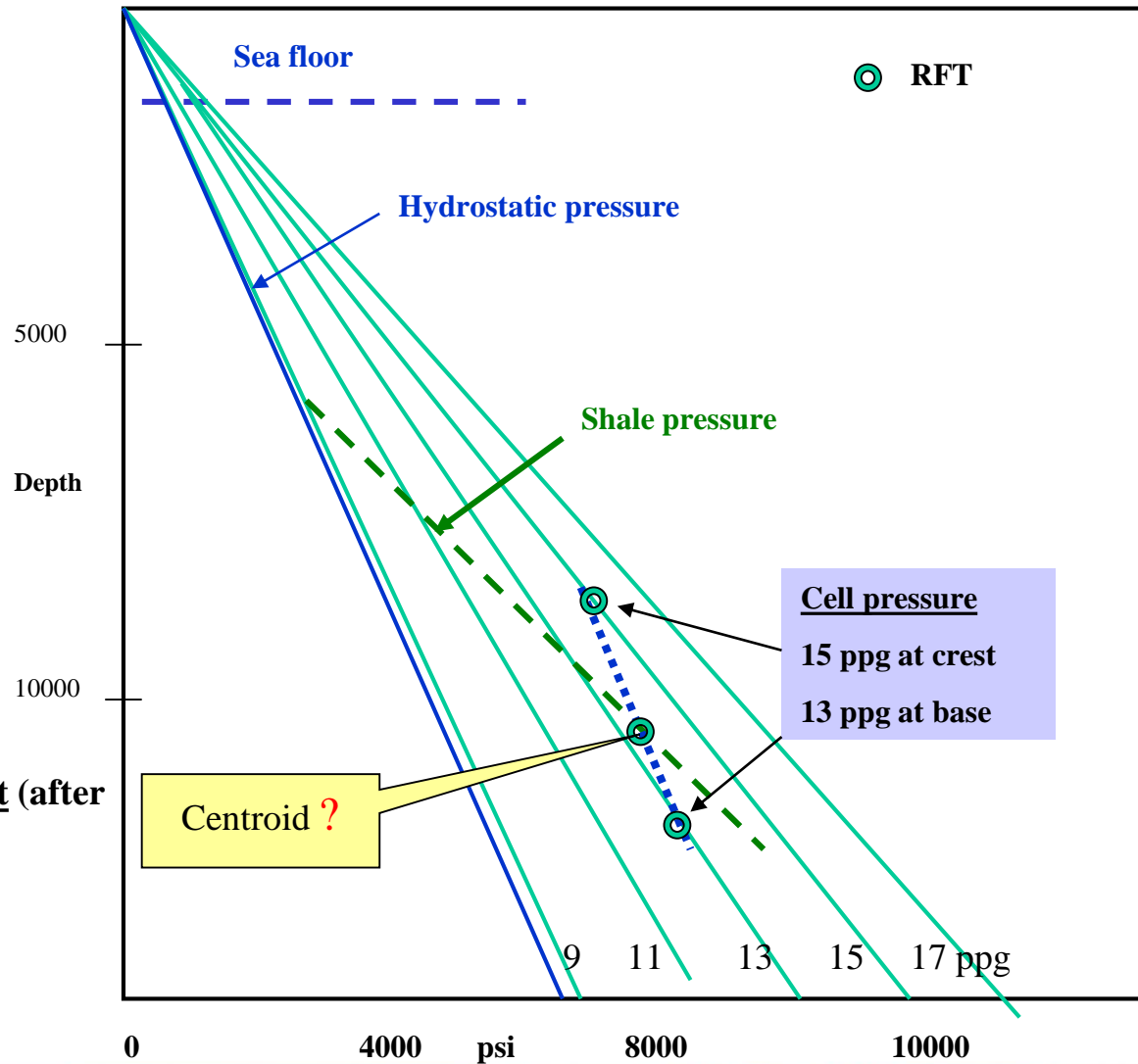
After Dickinson, 1953

Correct gradient



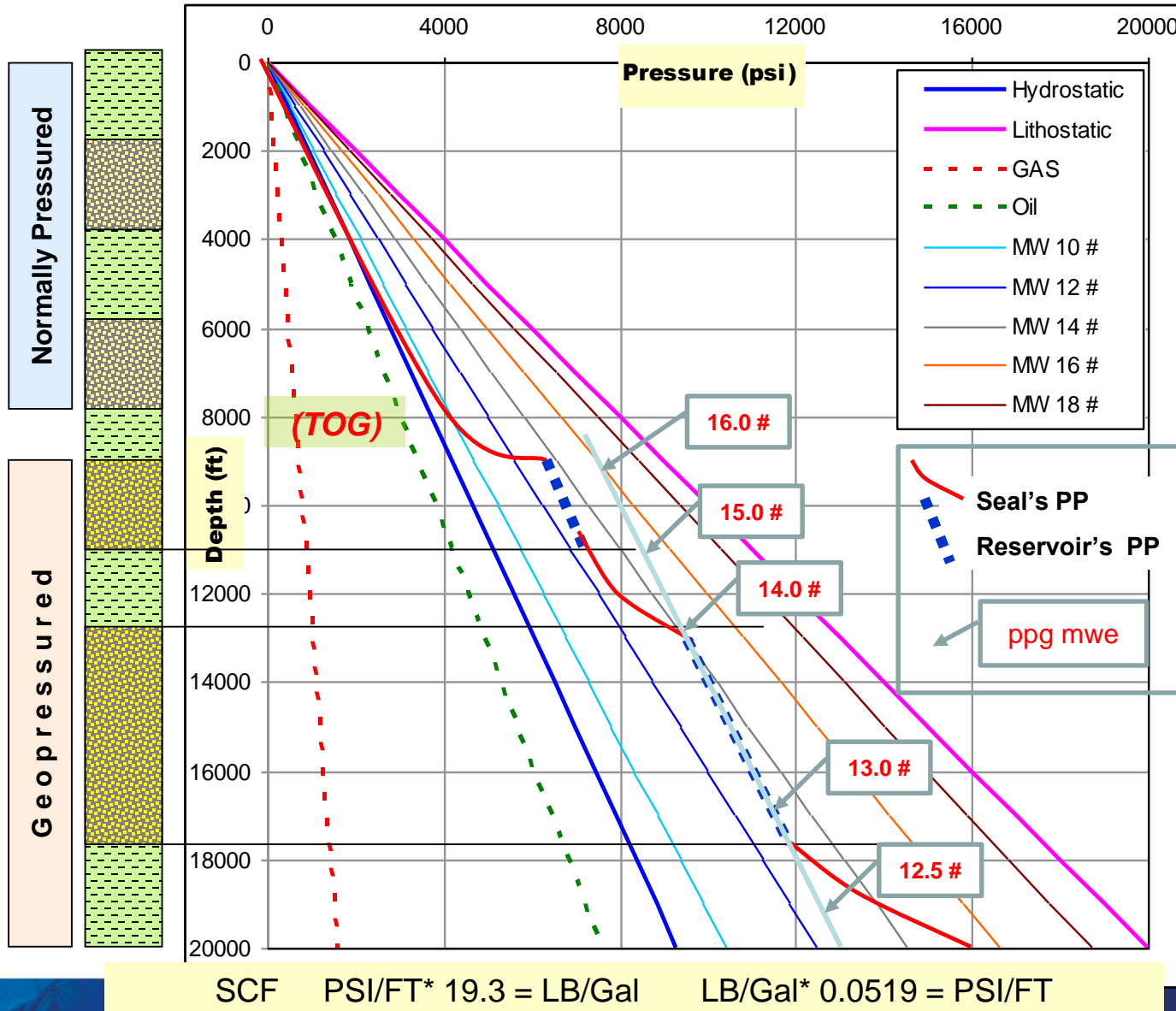
Calculating correct PG

The hybrid pressure plot (Using psi / ppg - D Plot)

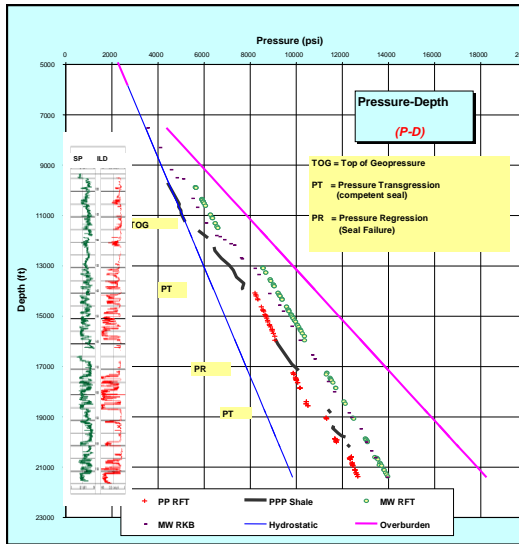


The Centroid Concept (after Traugott 1997)

Conversion from PSI to PPG MWE (SCF)

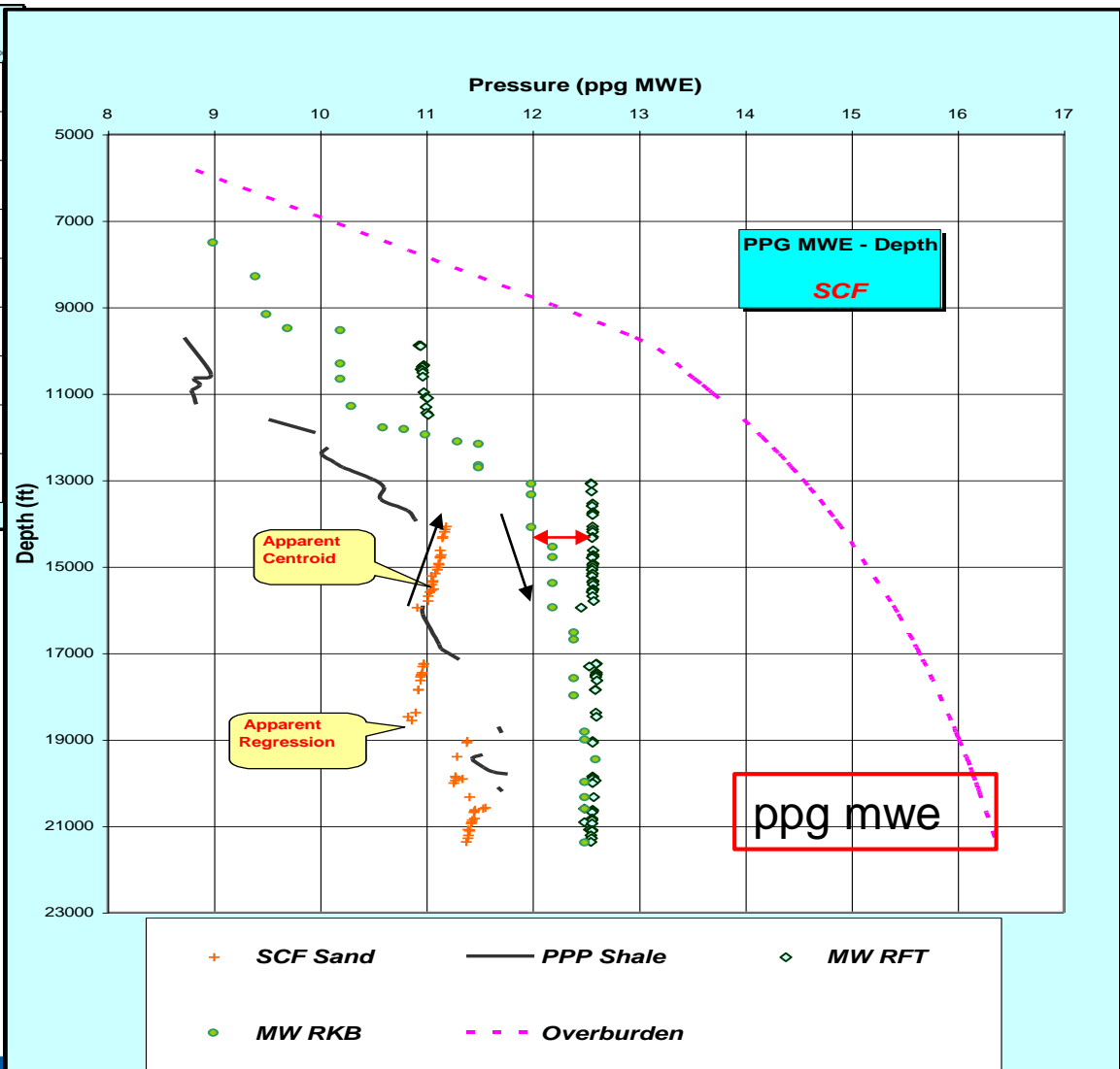


Case histories of converting from psi to ppg mwe (reservoir pressure gradient is negative ?)



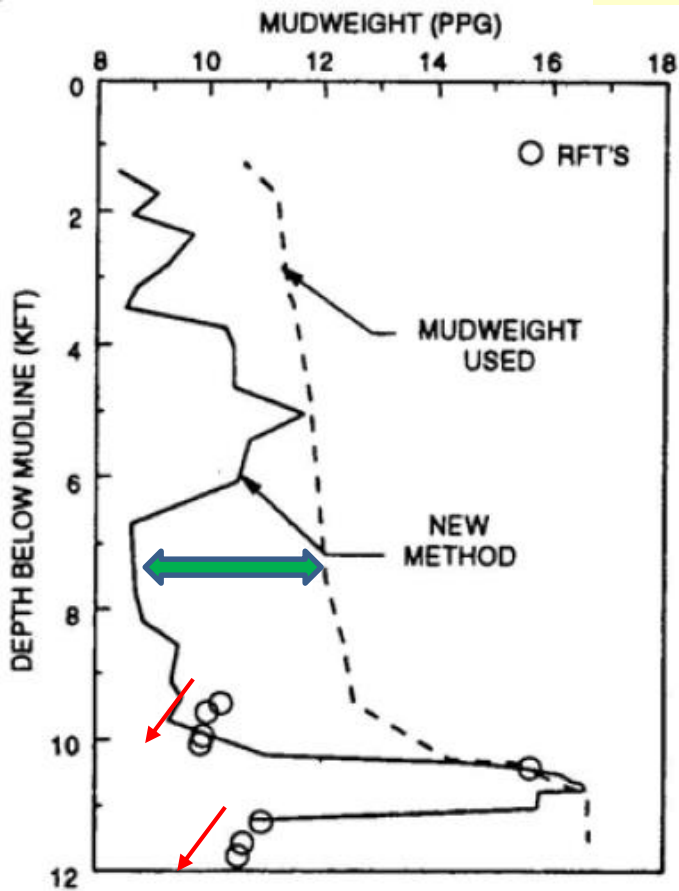
psi

KC # 255 GOM



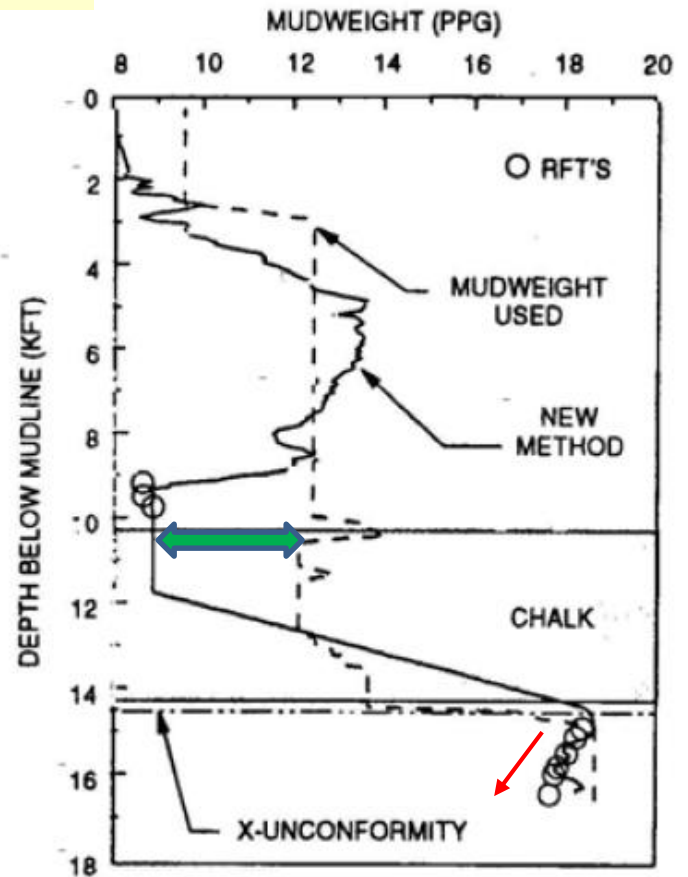
(SCF) $PSI/FT * 19.3 = LB/GAL$ $LB/GAL * 0.0519 = PSI/FT$

PPP modeling



(b)

GOM



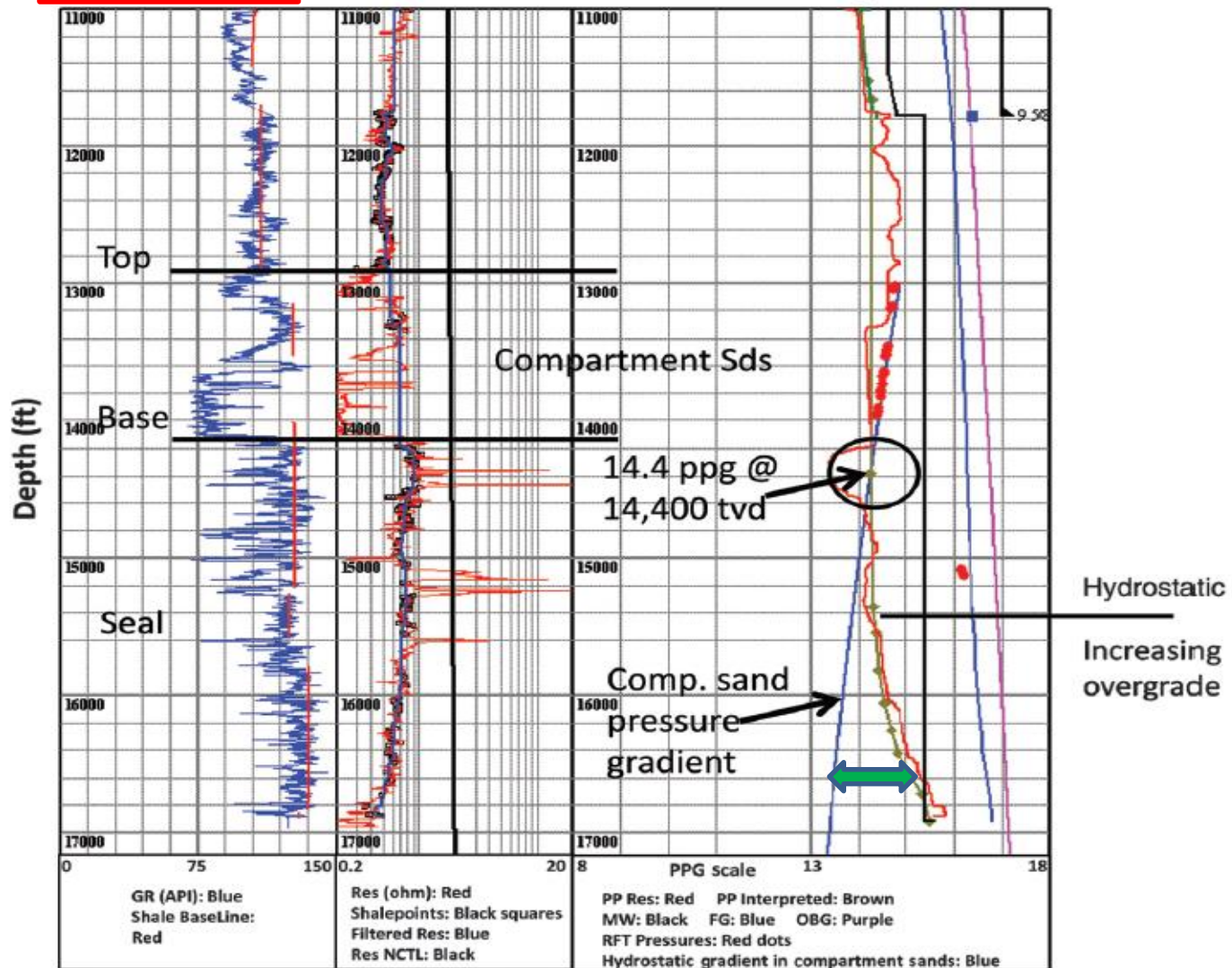
(b)

North Sea

Modified after G. Bowers , IADC/SPE, Dallas,1994

GC 236 chev2

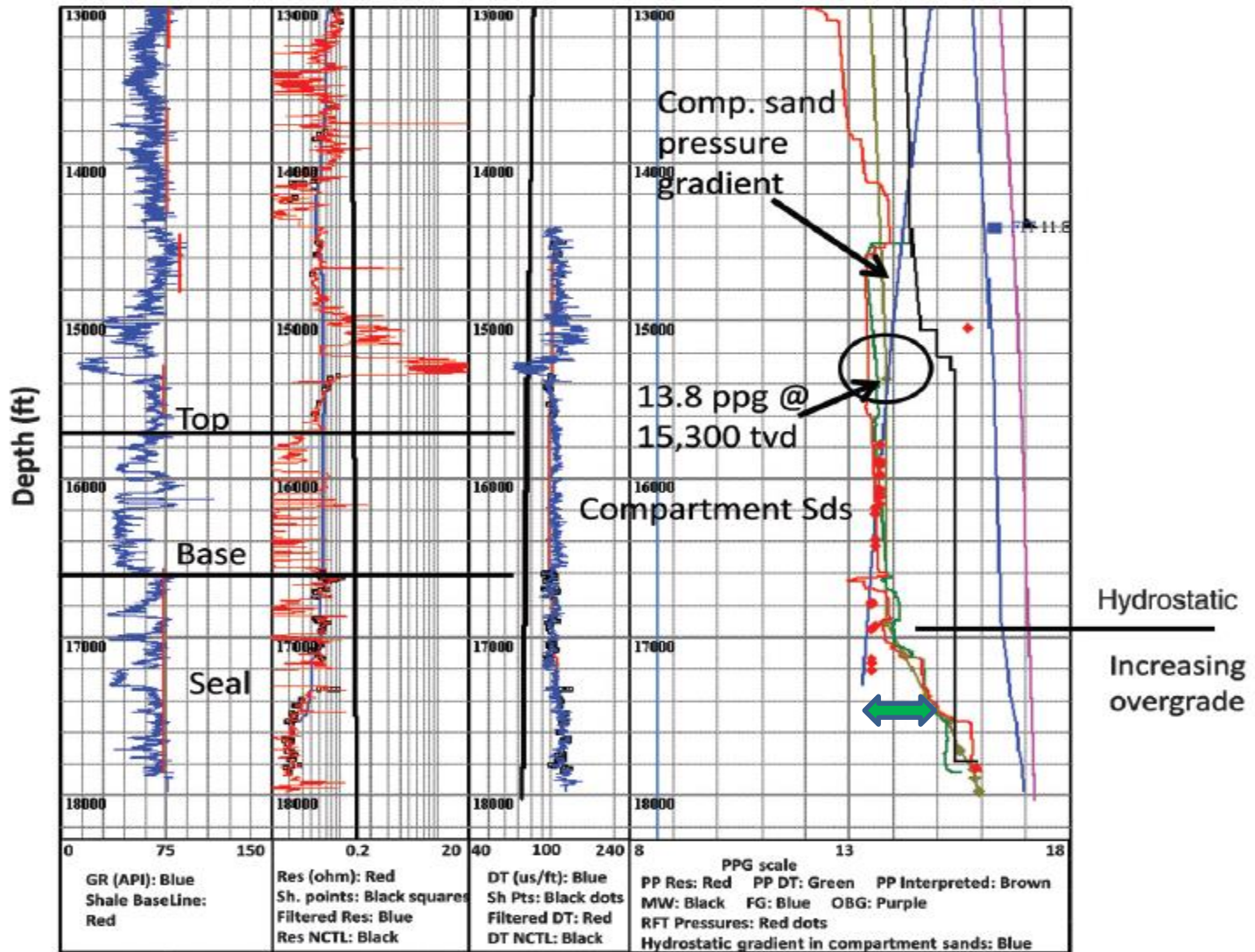
Uphrown well



After K . Hall et.al., Interpretation / Feb. 214 SB27

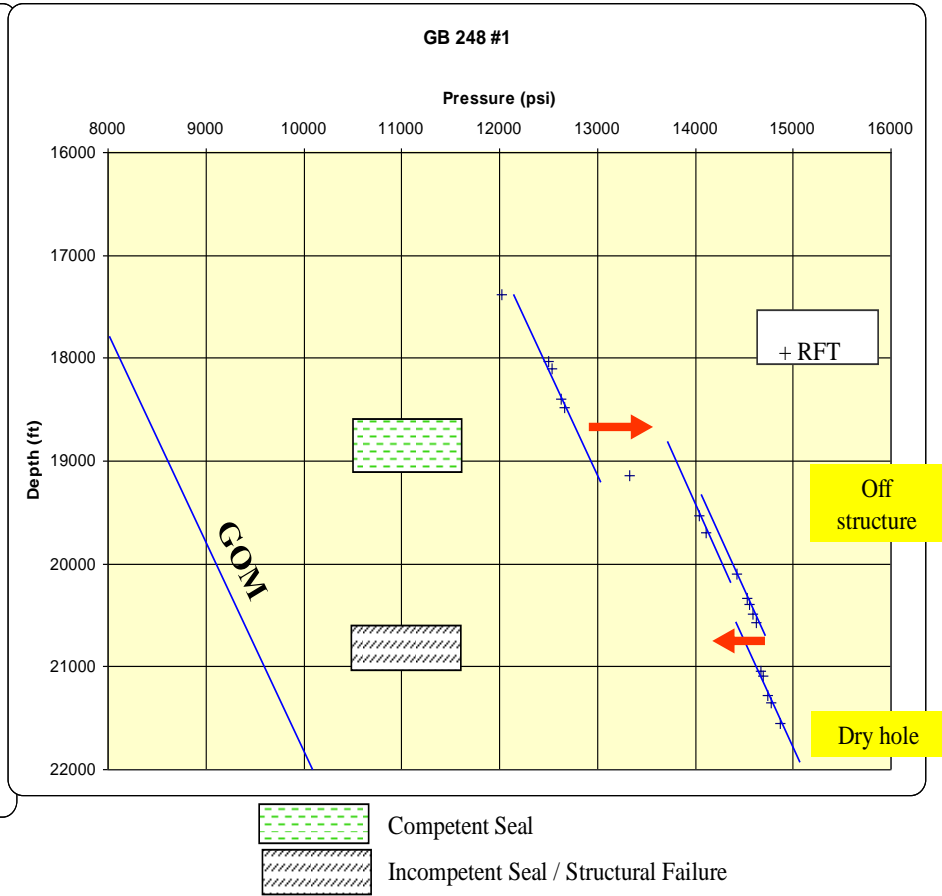
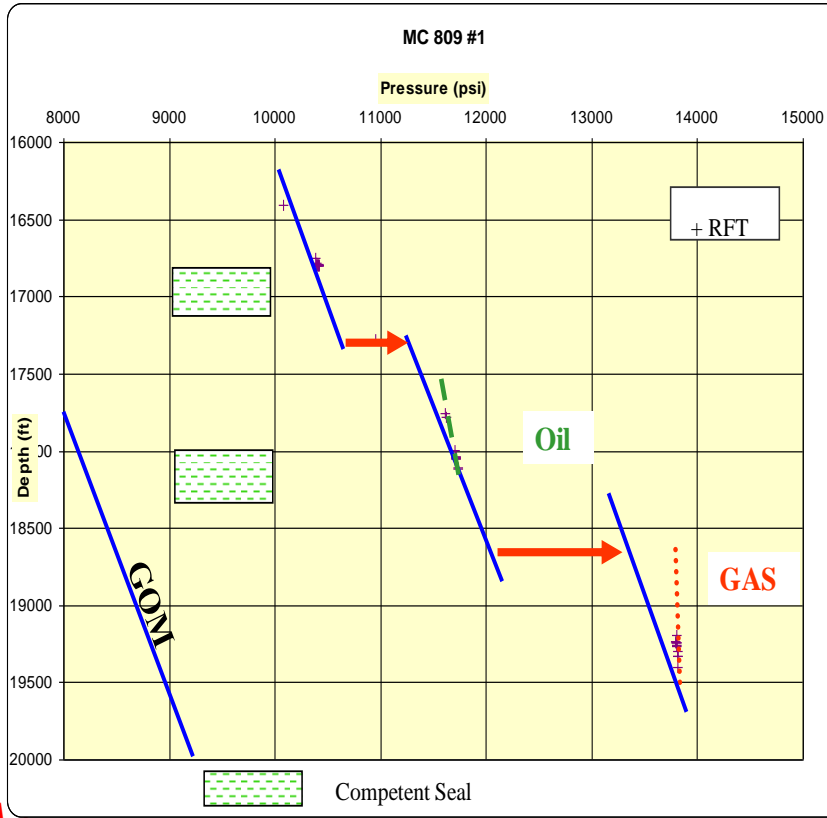
GC 237 chev3

Downtrown well



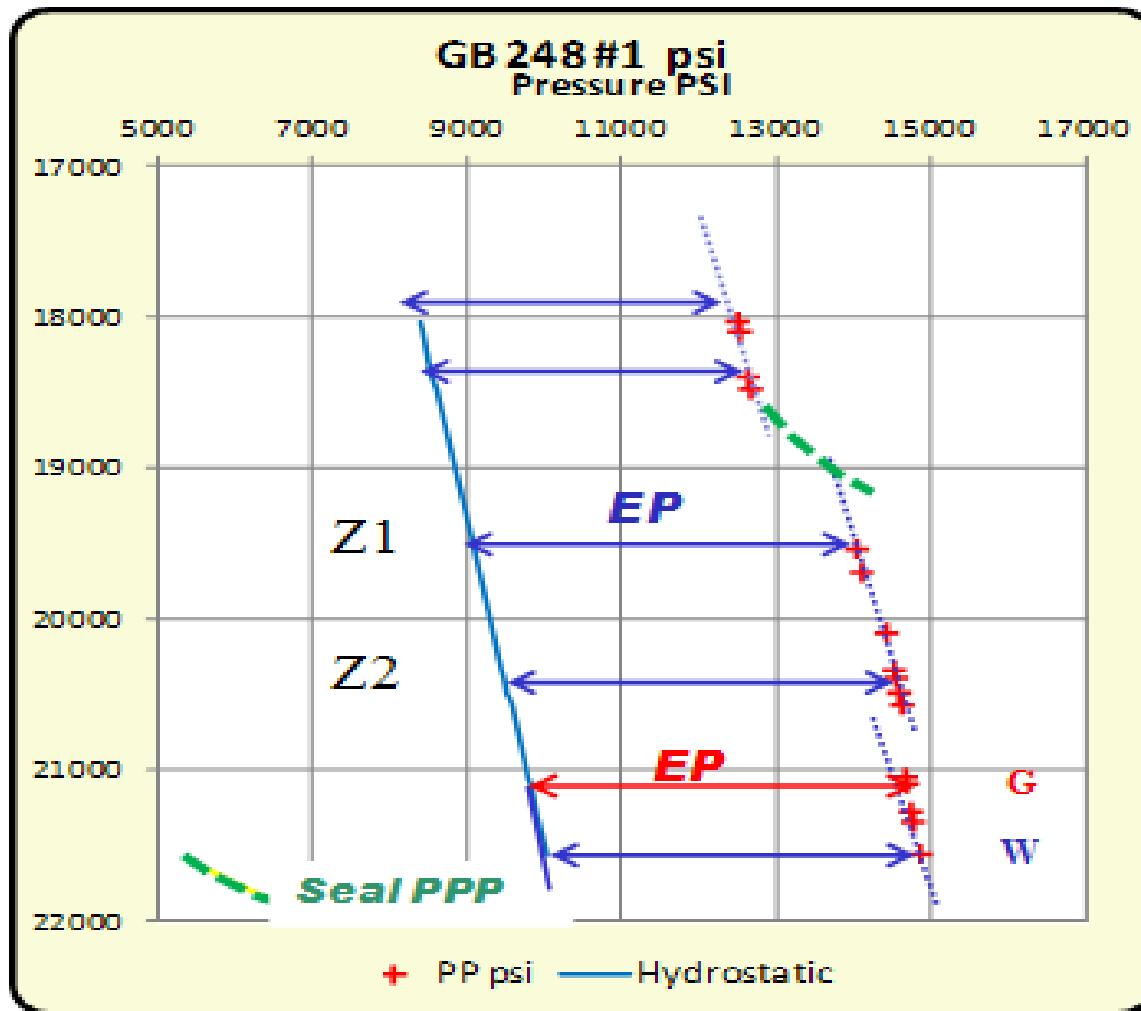
After K. Hall et al., Interpretation / Feb. 214 SB27

Compartmentalization in HPHT Vertical Transgression vs. Regression



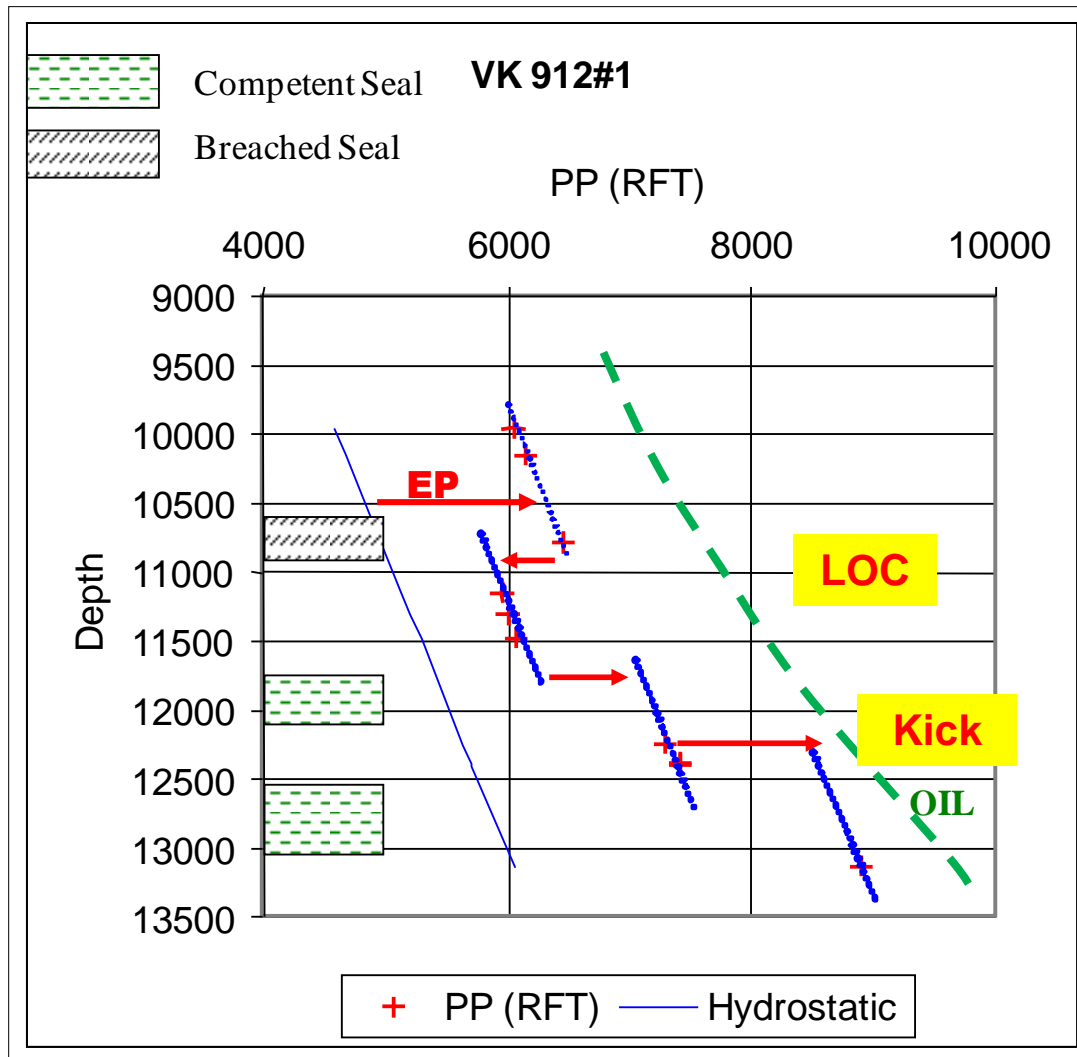
G.A.S.

Defining the Excess Pressure (EP) in the Geopressured HP Zone

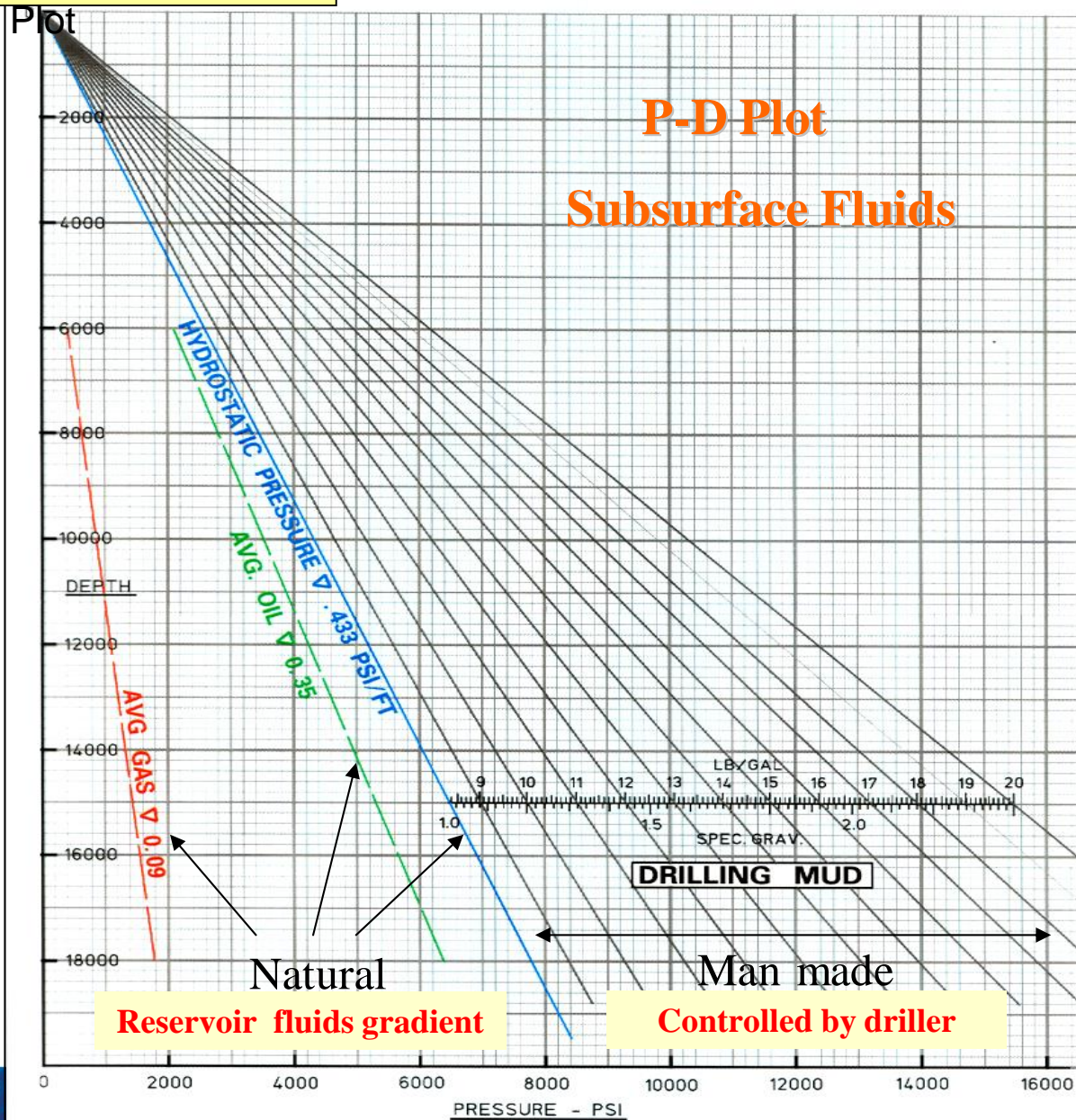


RFT measurements in HP/HT Zones

ECD monitoring in Transgression vs. Regression in Reservoirs



Subsurface Fluid's Pressure

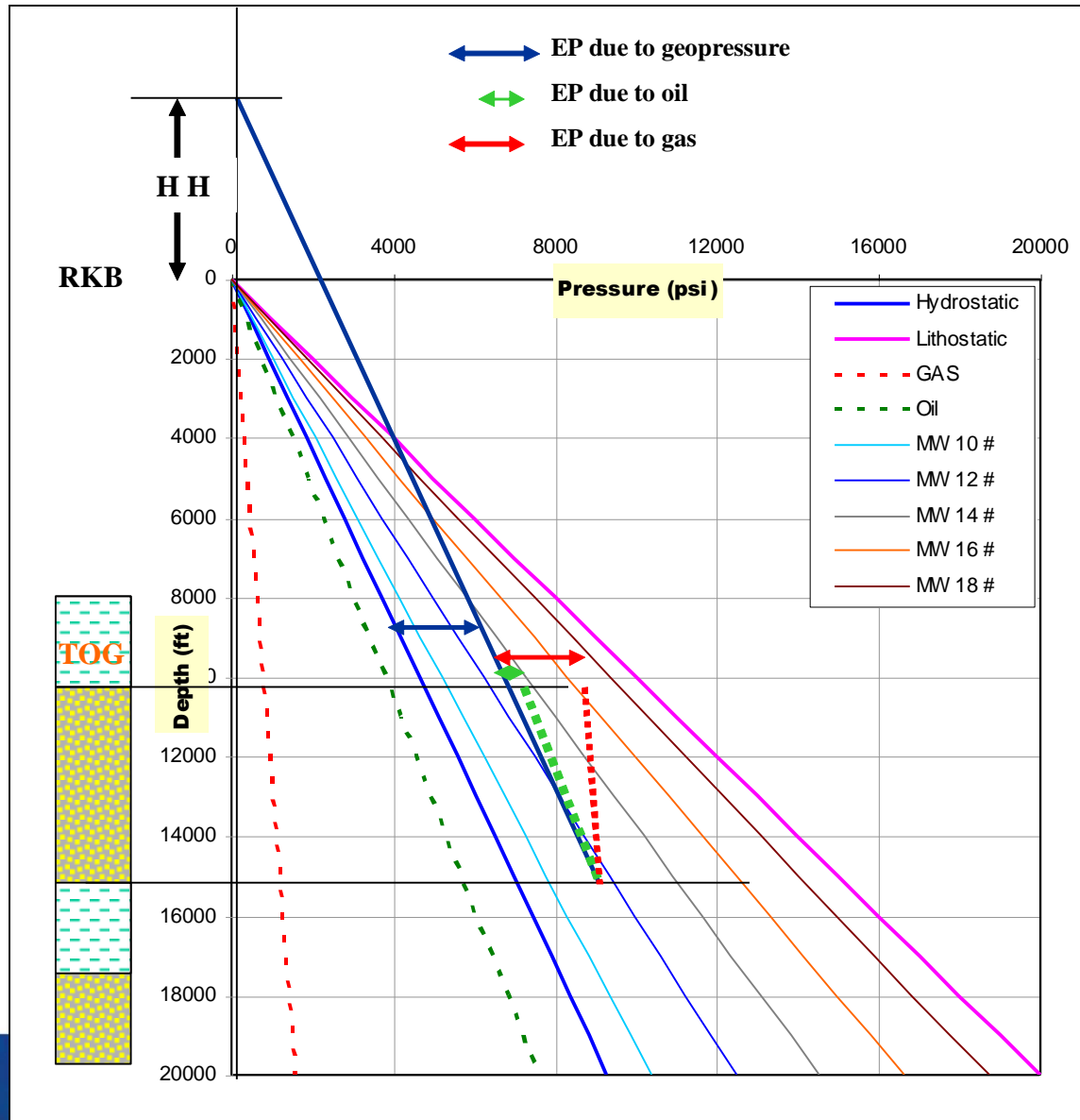


Reservoir's Hydraulic Head in HP

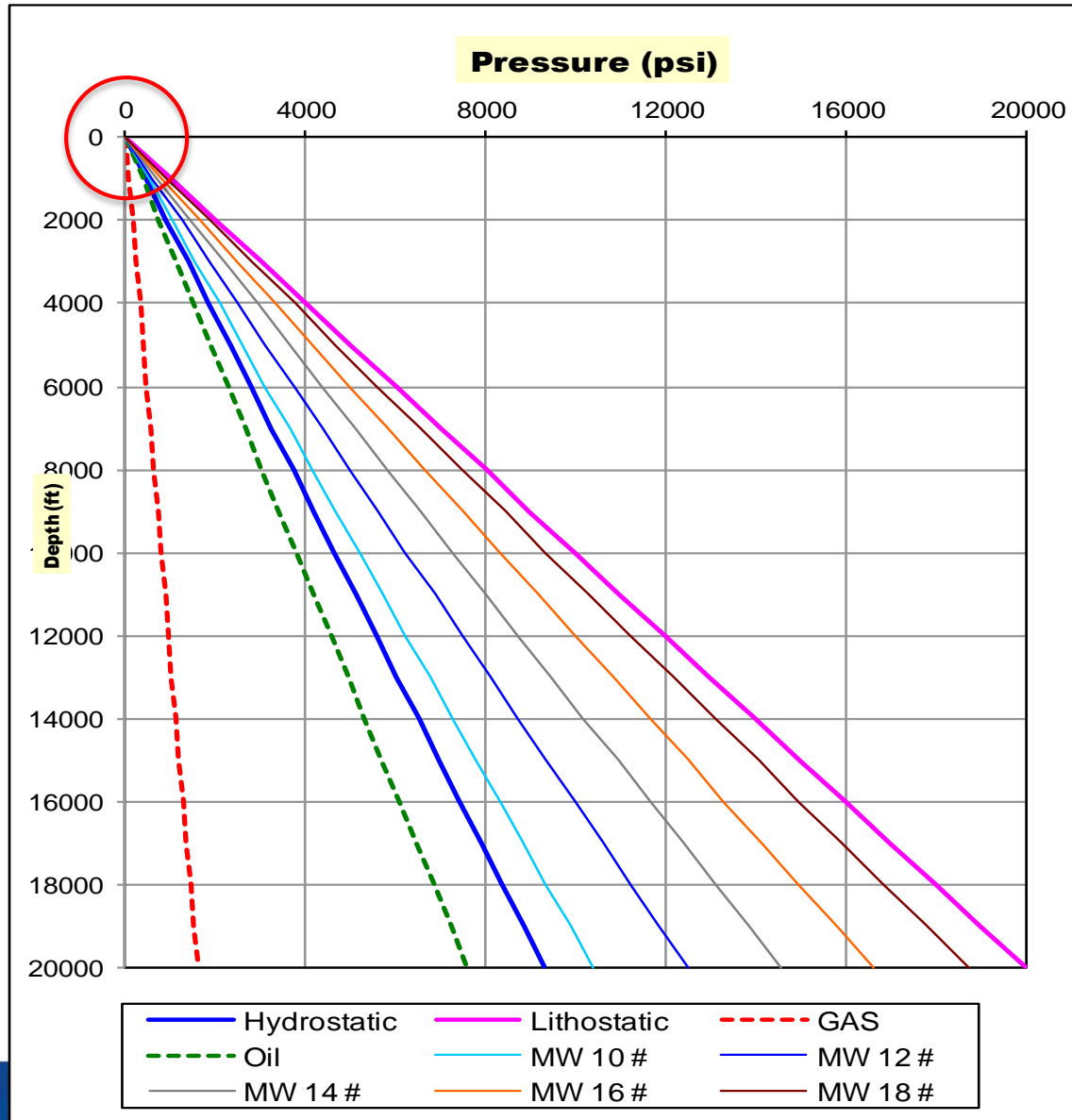


After Boots and Coats (Algeria)

Formation water hydraulic head (HH) vs. MW pressure **RKB**



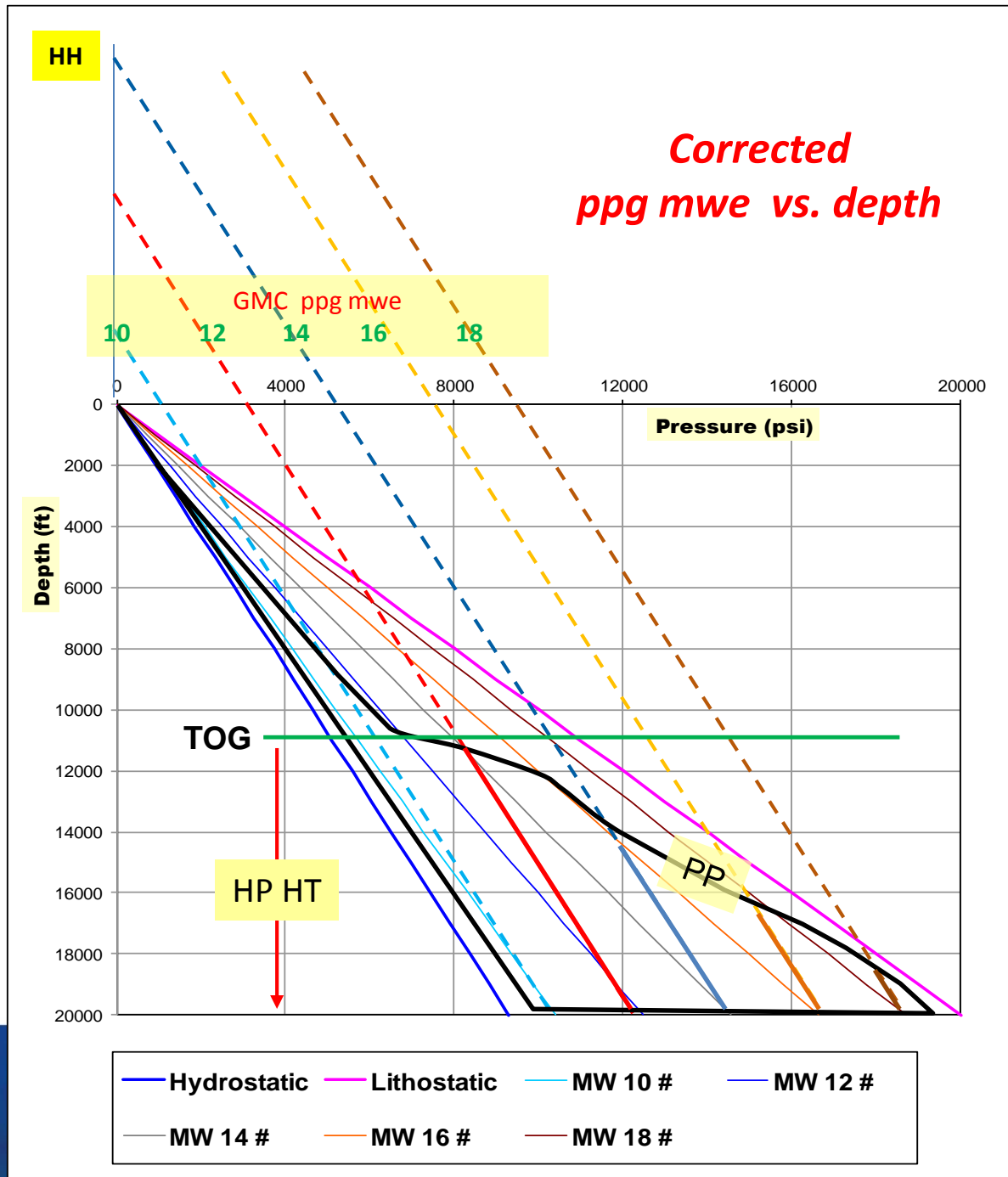
Mud Fan of the Hybrid PSI / PPG – Depth plot ?



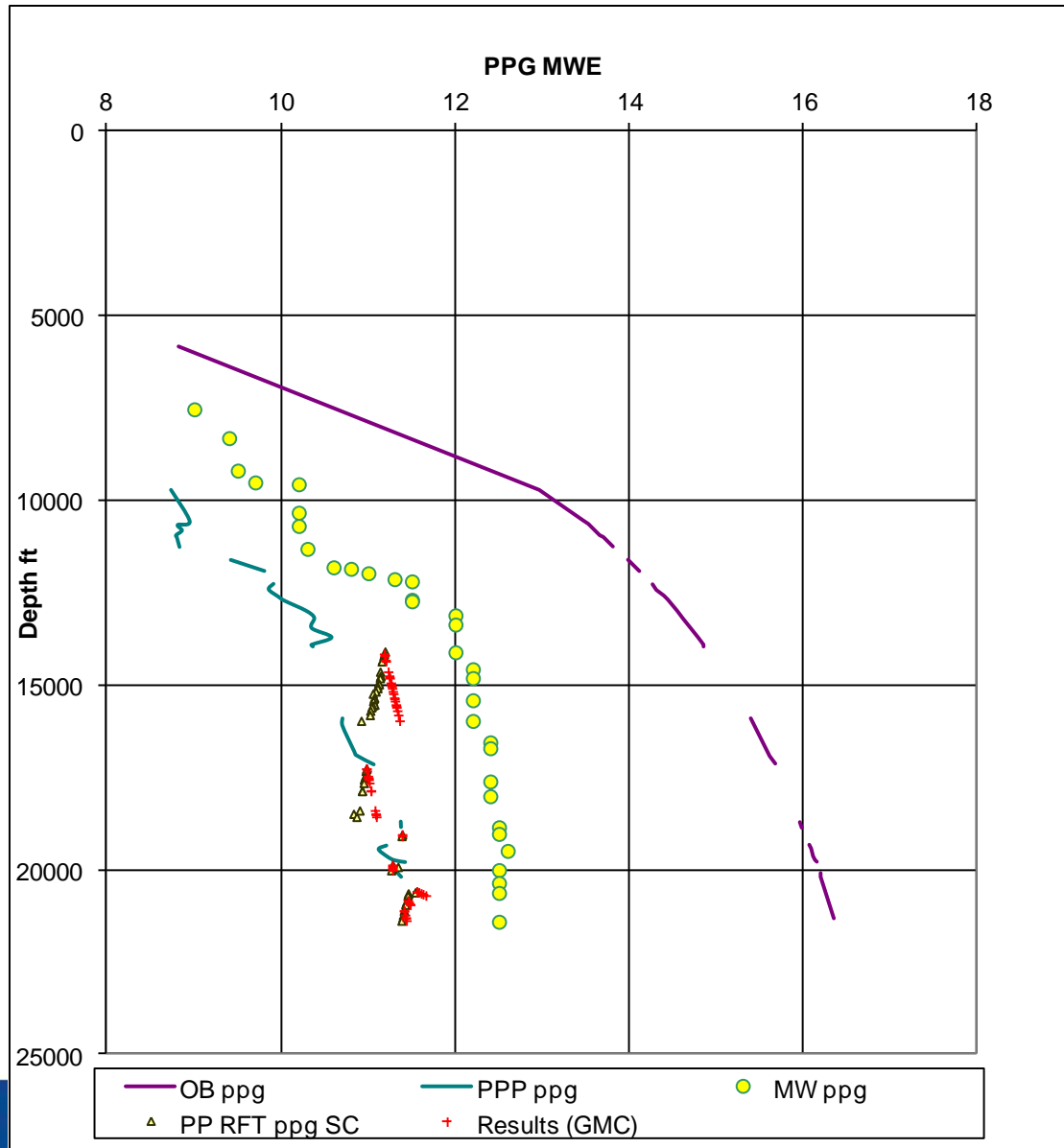
Corrected
MWE
Slope/Gradient
in KC #255
Basin

0.00001234

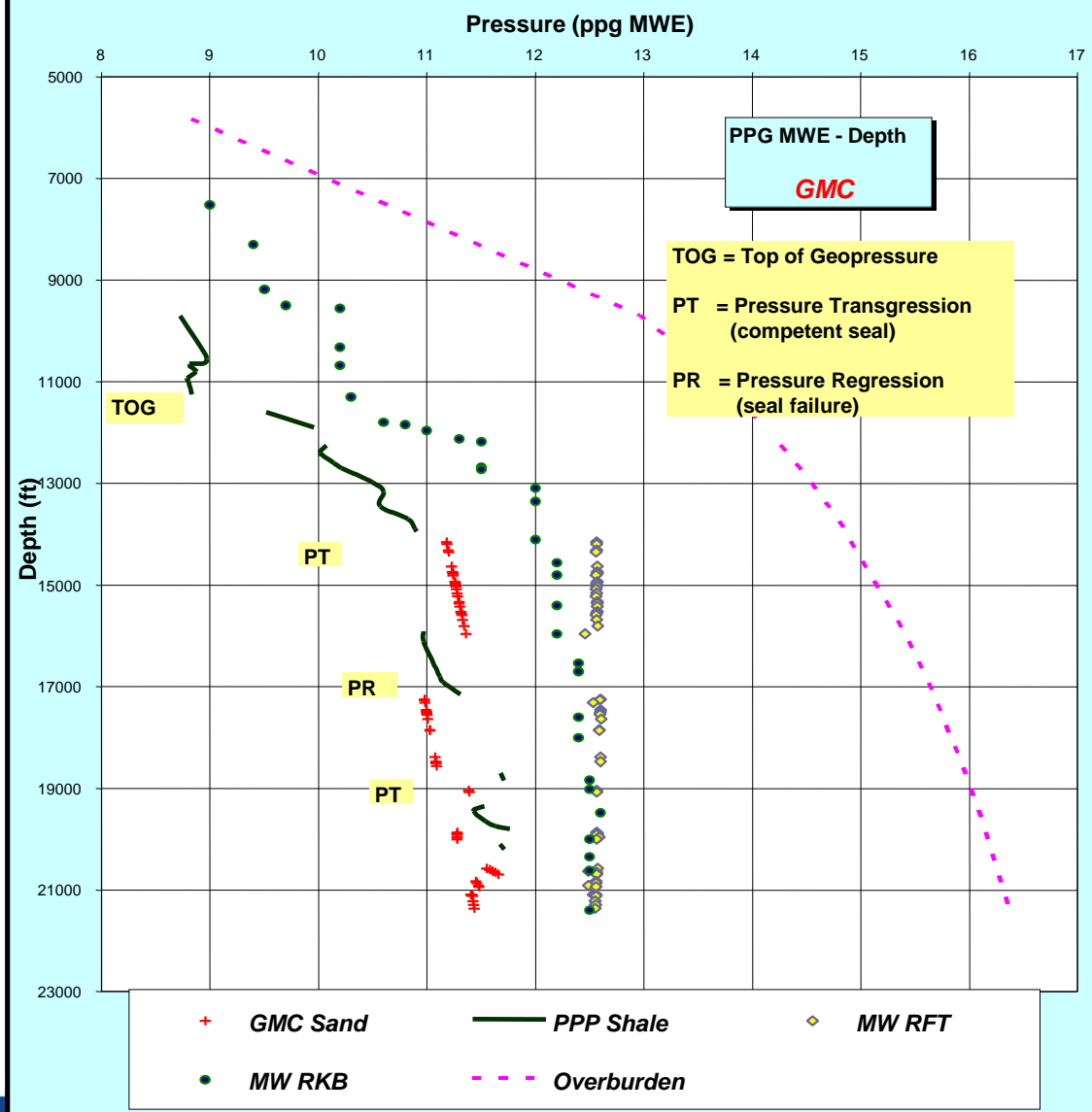
0.00001404



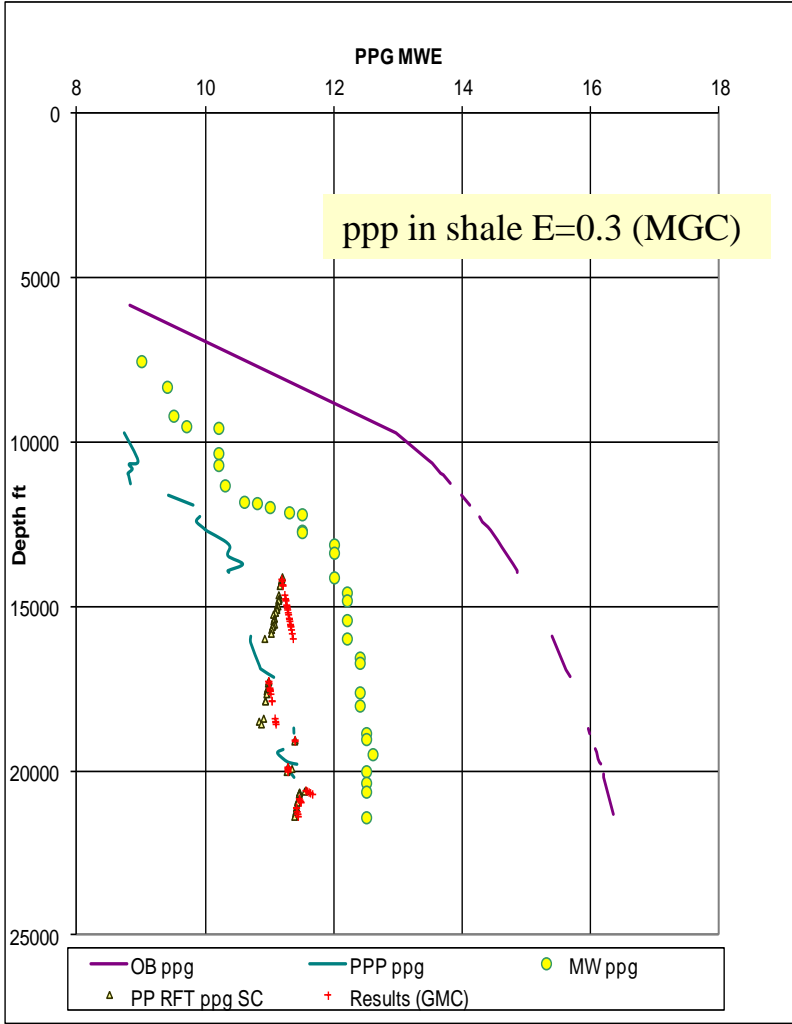
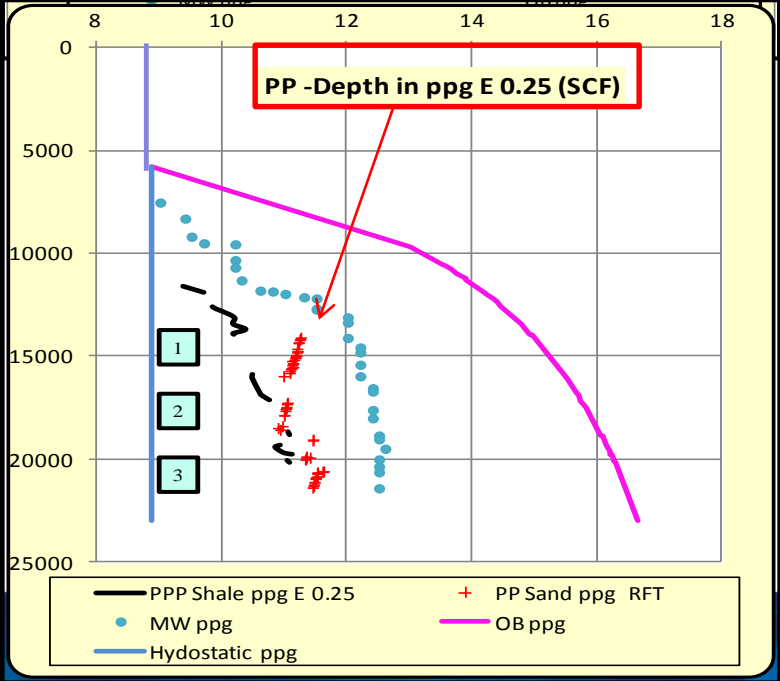
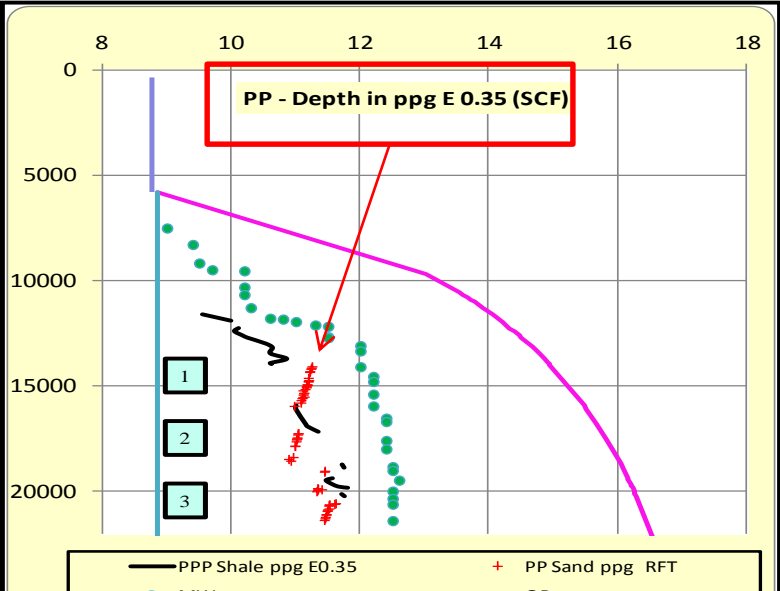
Results of implementing the GMC conversion



PPG MWE- D (GMC) Plot



Pore Pressure Prediction Modeling



Conclusions :

- The SCF (0.052) leads to a negative gradient with depth in HP (geopressured) reservoirs
- Calculating Pressure gradient relative to depth in HP reservoirs is deceptive
- PPG MWE should increase with depth to compensate for deeper PSI pressure rise
- Hydraulic Head (HH) should be the reference point to MWE calculation and not RKB
- Defining Subsurface Compartmentalization is essential for calculating ESD and ECD in order to avoid Kicks and LOC (GMC)
- PPP modeling should be performed with a unique compaction trend
- Using the hybrid plot psi / ppg vs. depth is misleading

Thank You

Q&A

Reference:

Introductory paper was published by S. Shaker “The controversial pore pressure conversion factor: PSI to PPG MWE,” December 2003, The Leading Edge, SEG.