AADE

eSeis

Using Multiple Pore Pressure Prediction Techniques provides a way to mitigate the increased risk inherent in drilling near or below salt.

Roger Young

Question

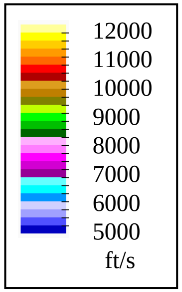
Why Introduce another Method?

Because velocity-based pore pressure does not provide an adequate solution.

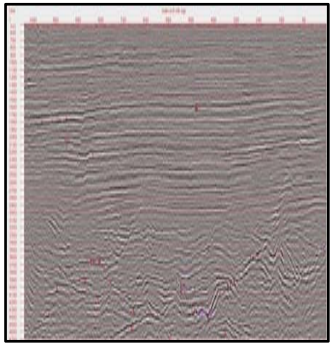
Some Challenges of V-Based PP

- *Data Quality*
- Velocity Responds to Lithology
  Two Log Methods

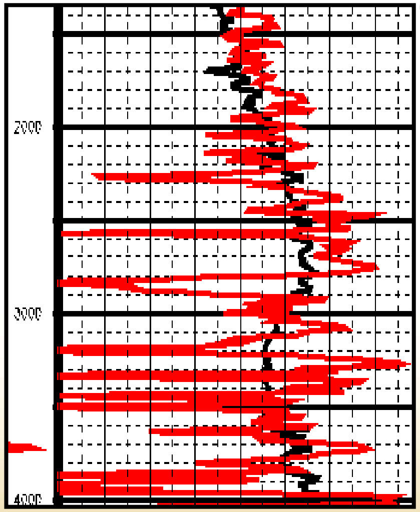
Interval Velocity from Seismic

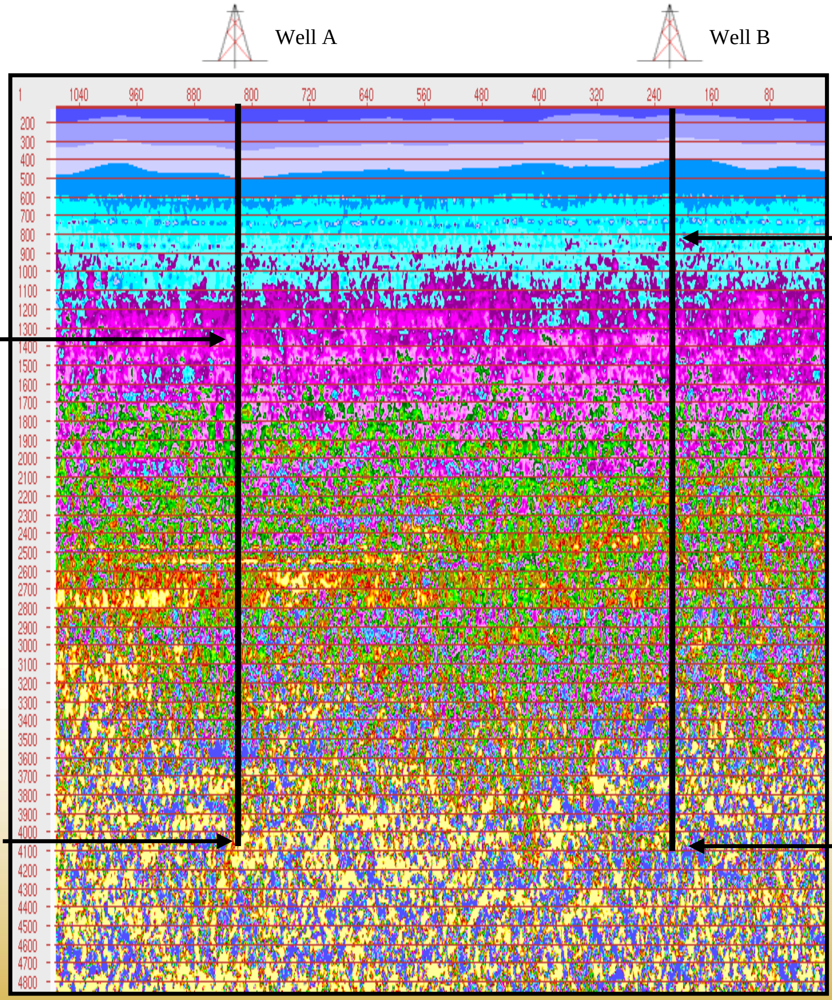


No Velocity Averaging

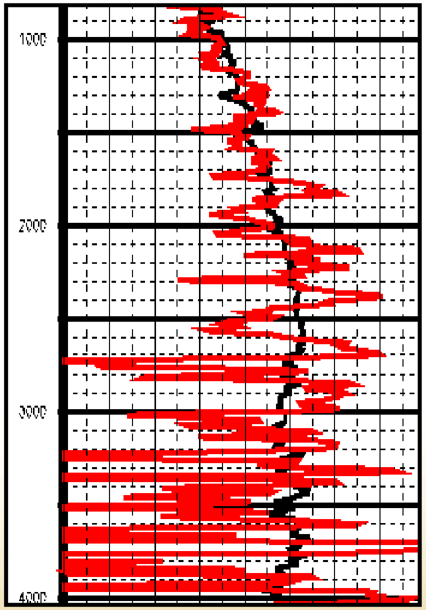


Smooth Sonic Log
Seismic Vint

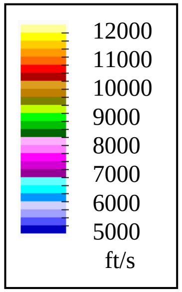


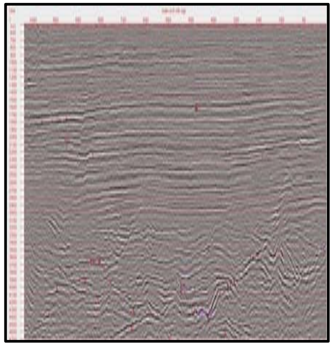


Smooth Sonic Log
Seismic Vint

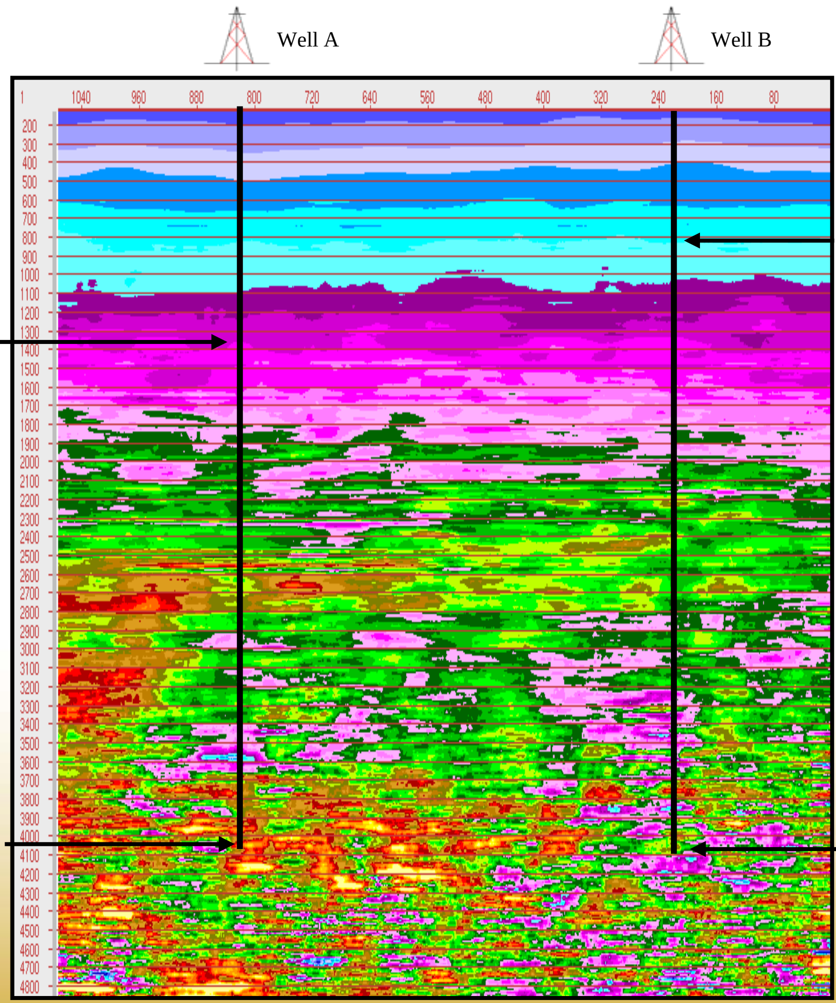


Interval Velocity from Seismic



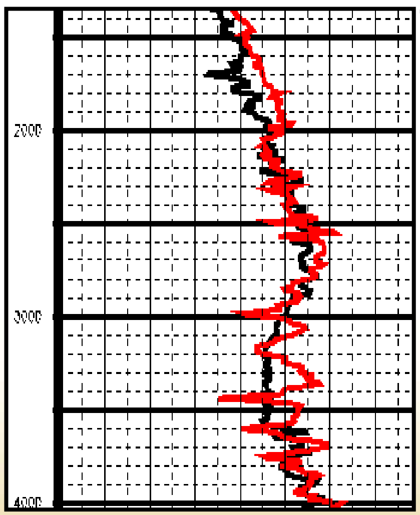


Velocity Averaging in Space



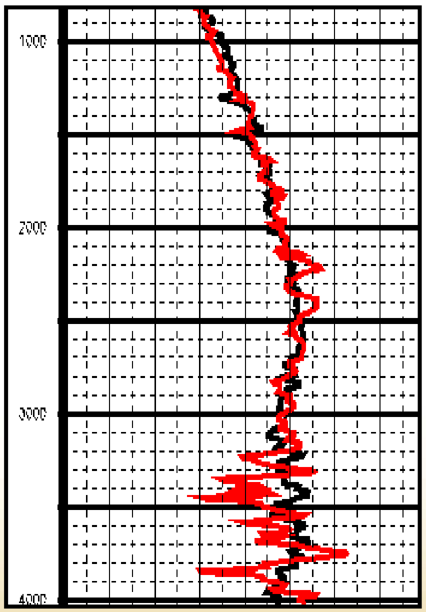
Smooth Sonic Log

Seismic Vint

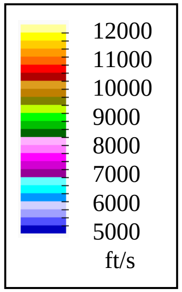


Smooth Sonic Log

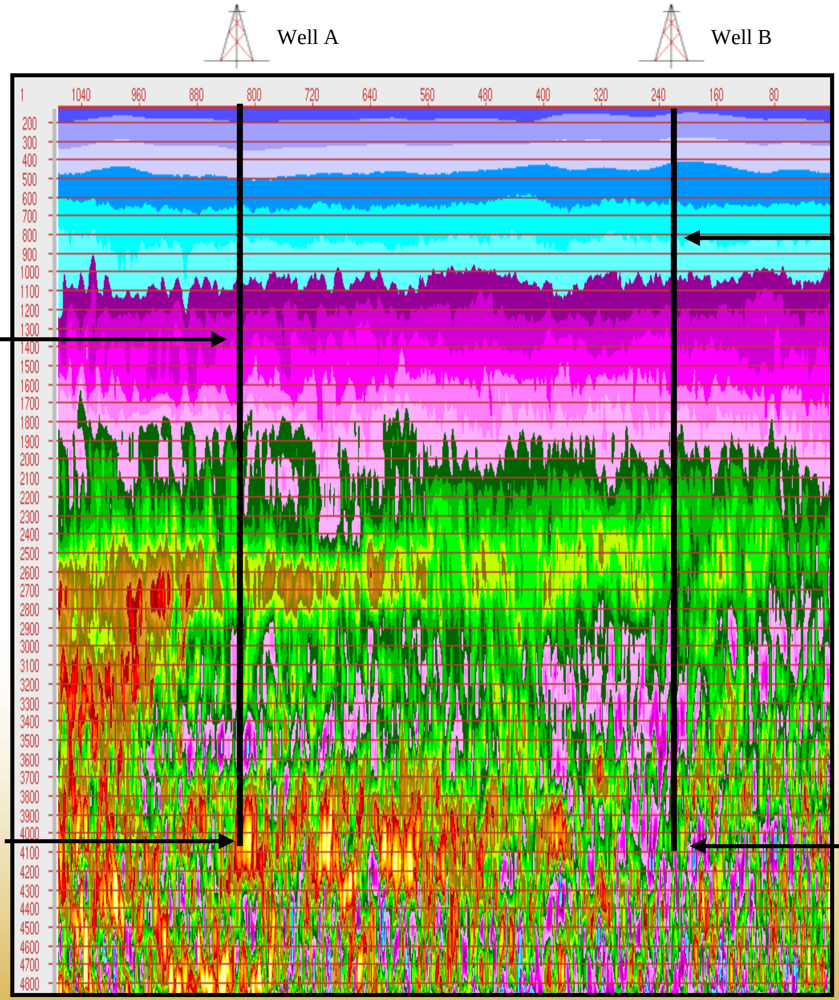
Seismic Vint



Interval Velocity from Seismic

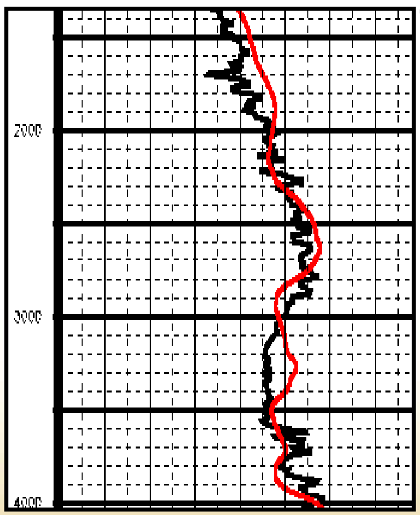


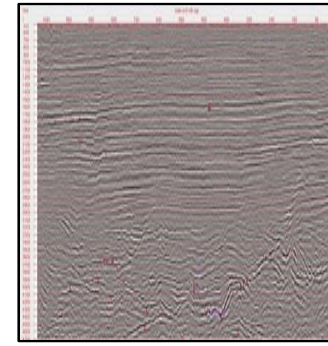
Velocity Averaging in Time



Smooth Sonic Log

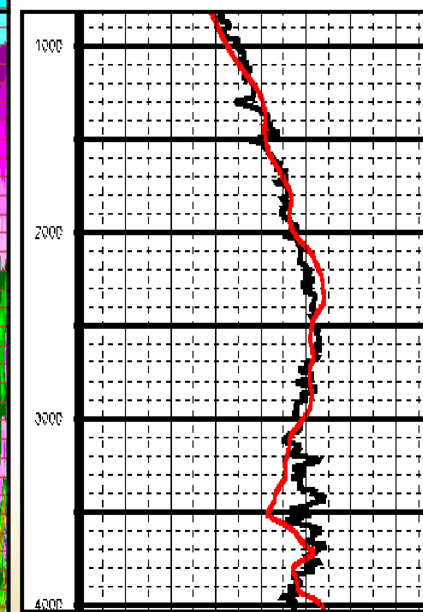
Seismic Vint



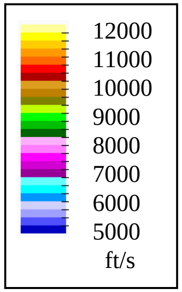


Smooth Sonic Log

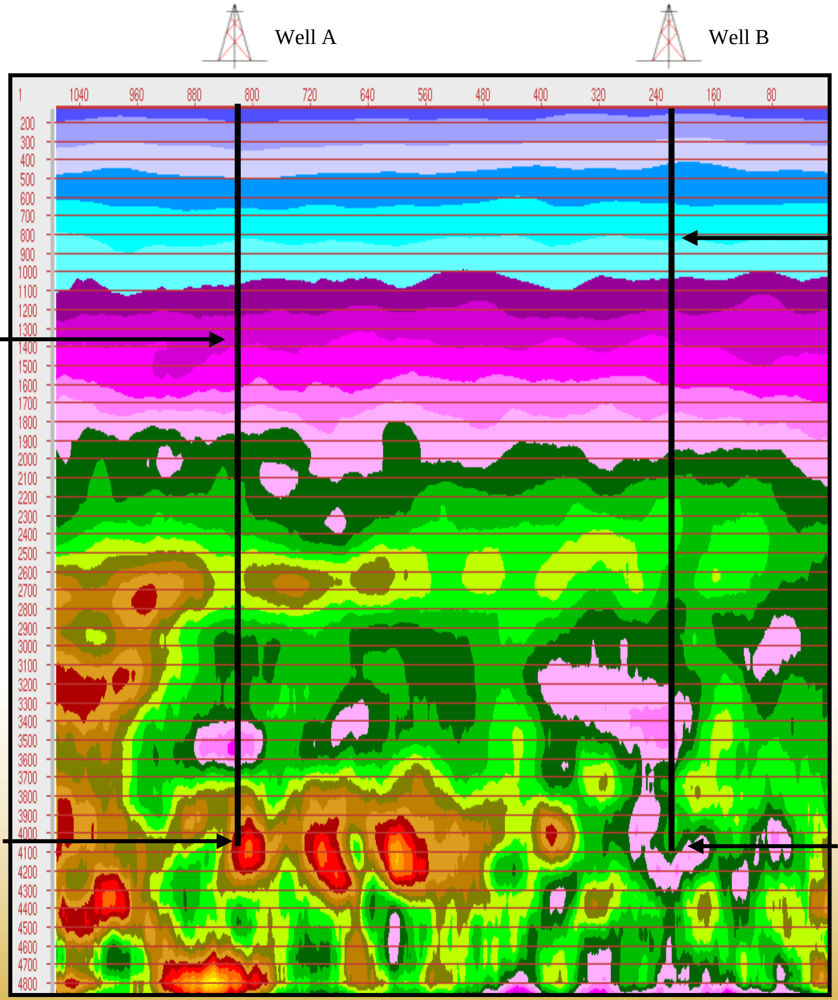
Seismic Vint

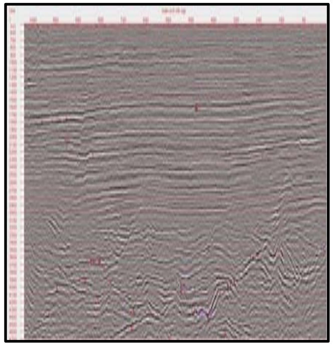


Interval Velocity from Seismic



Velocity Averaging in Time and Space





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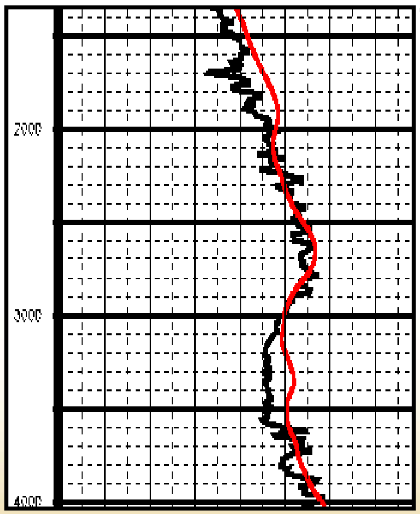
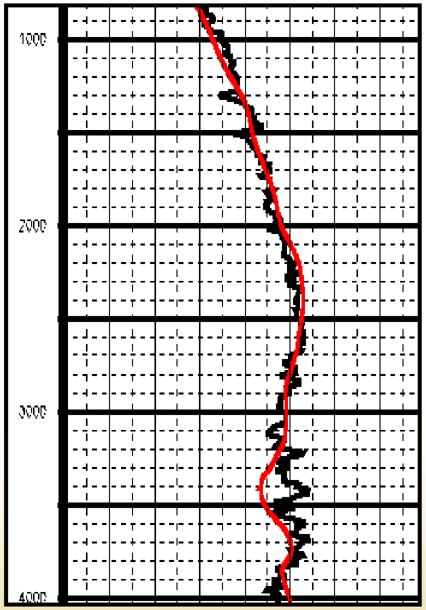
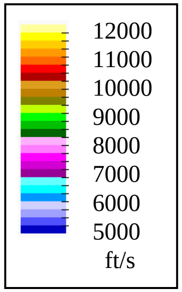
Seismic Vint



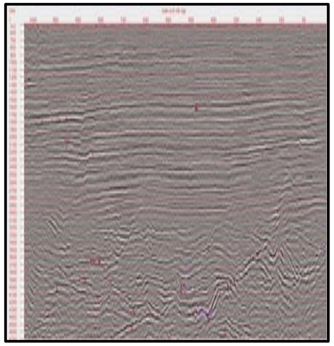
Smooth Sonic Log
Seismic Vint



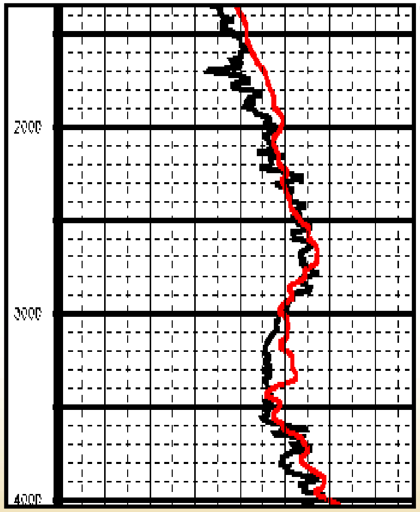
Interval Velocity from Seismic

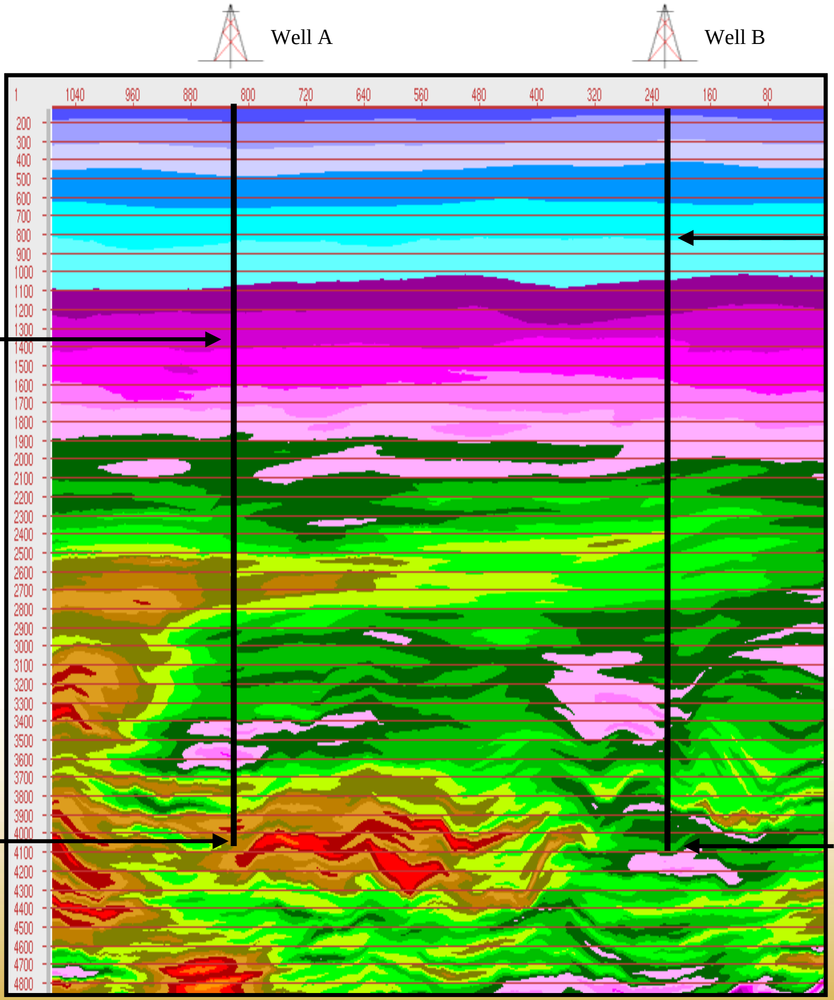


Velocity Averaging along Structure

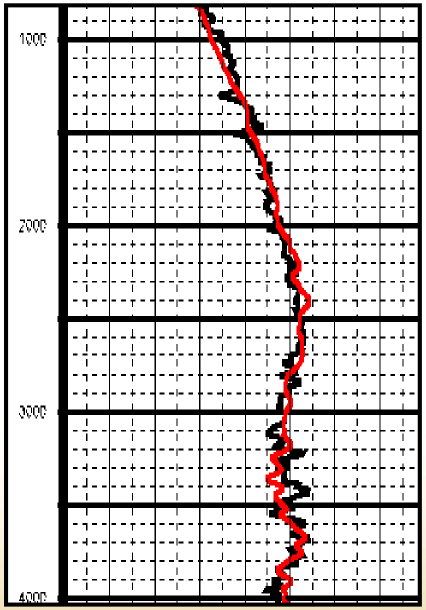


Smooth Sonic Log
Seismic Vint

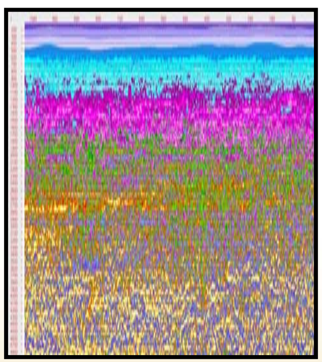




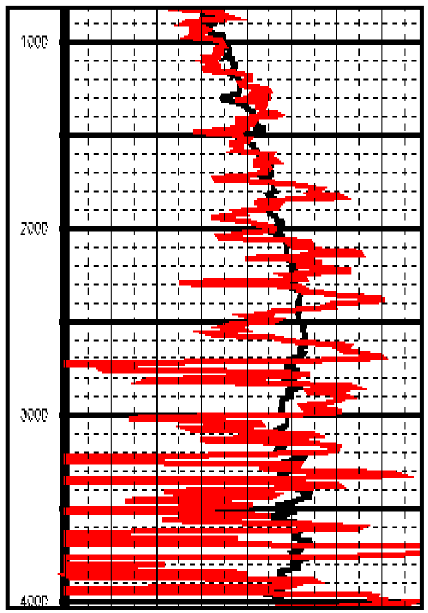
Smooth Sonic Log
Seismic Vint



Interval Velocity from Seismic

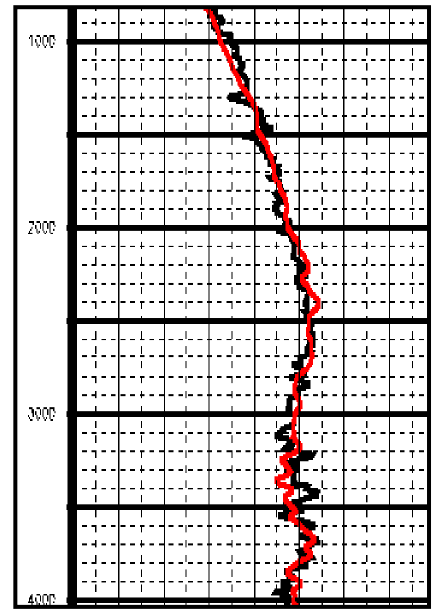


Smooth Sonic Log
Seismic Vint

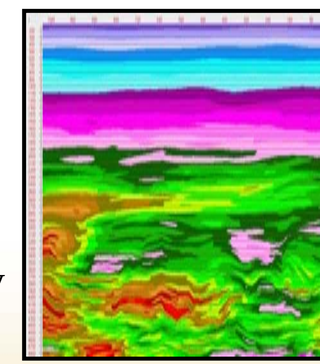


Seismic interval velocity with *low and high* frequencies

Smooth Sonic Log
Seismic Vint



Seismic interval velocity only *low* frequency



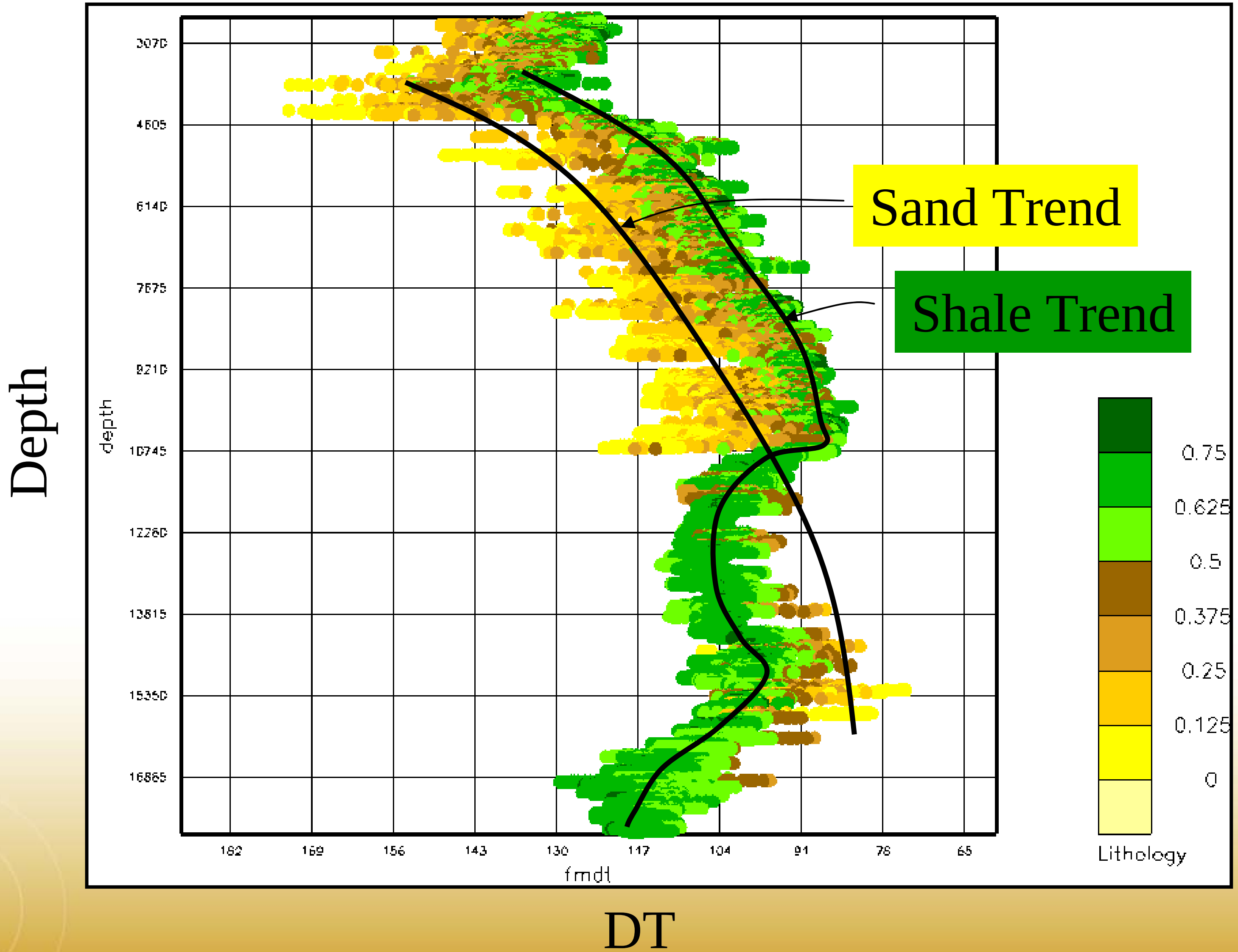
Conclusion: Seismic low frequency interval velocities (trend) can be reliable but the high frequency component is not.

Some Challenges of V-Based PP

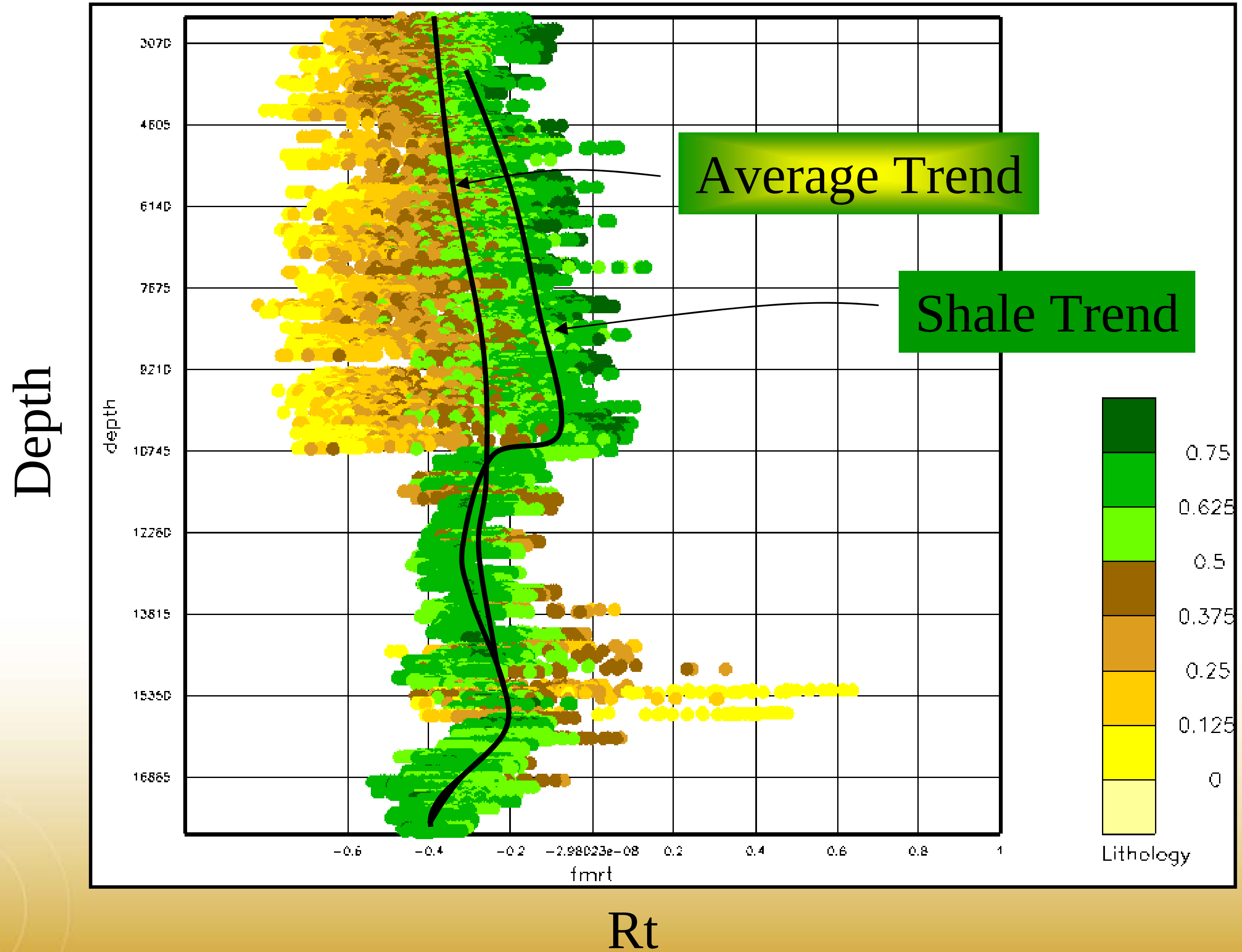
- Data Quality
- *Velocity Responds to Lithology*

  Two Log Methods

Velocity Responds to Lithology

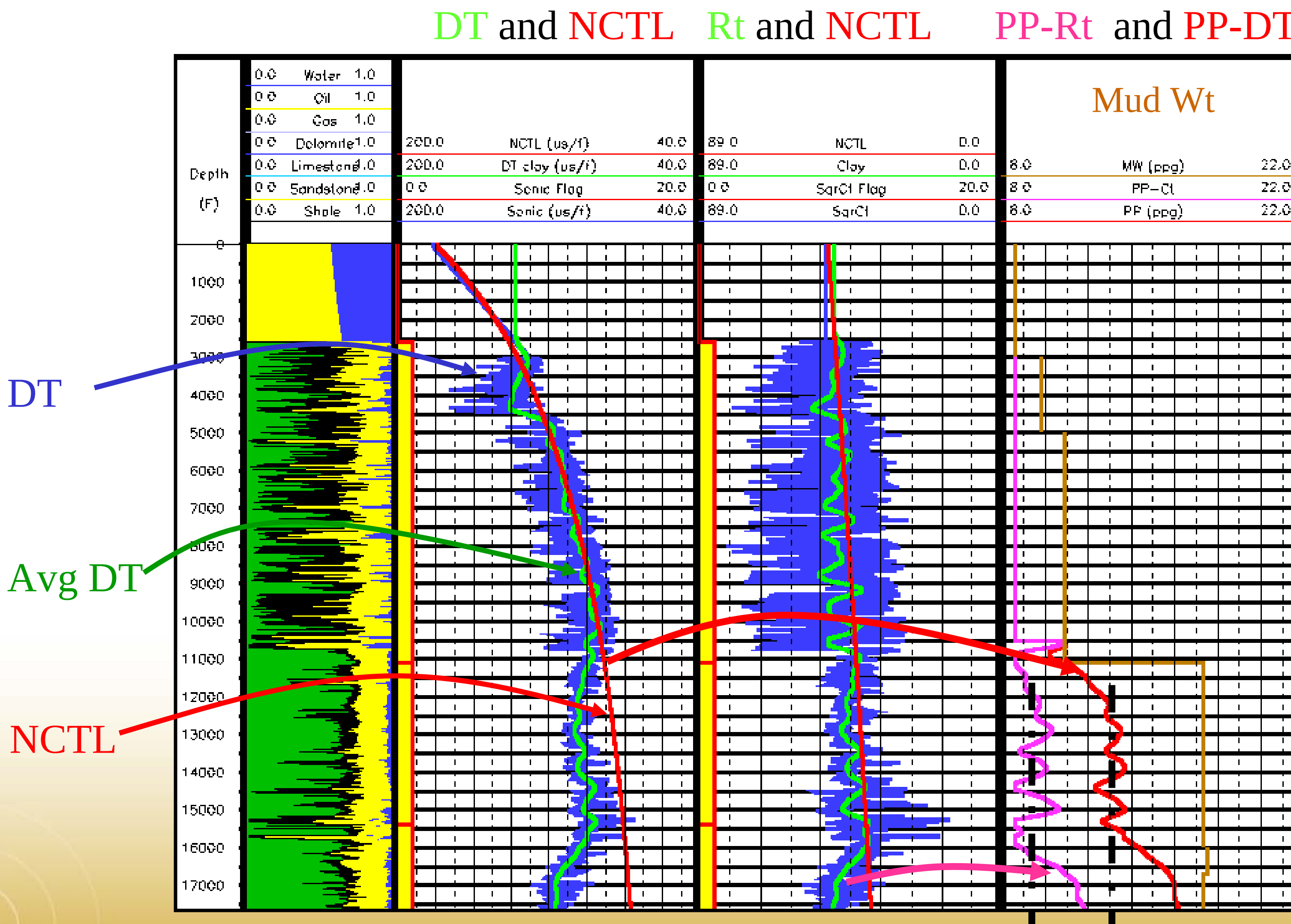


Rt Responds to Lithology



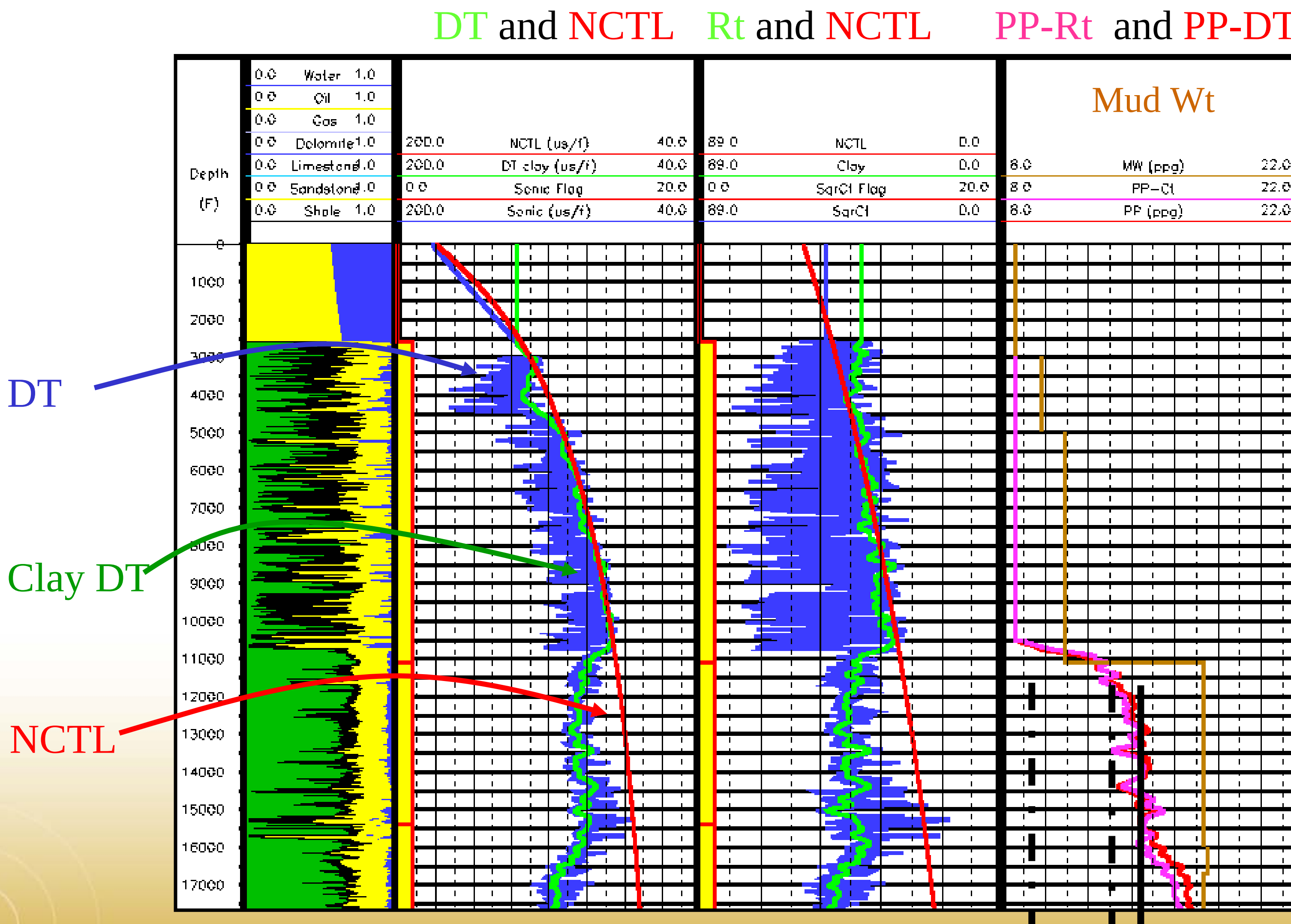
Logs Respond to Lithology

Contaminating the Trend needed for PP



Two methods *do not* agree

Eliminating the Lithologic effect



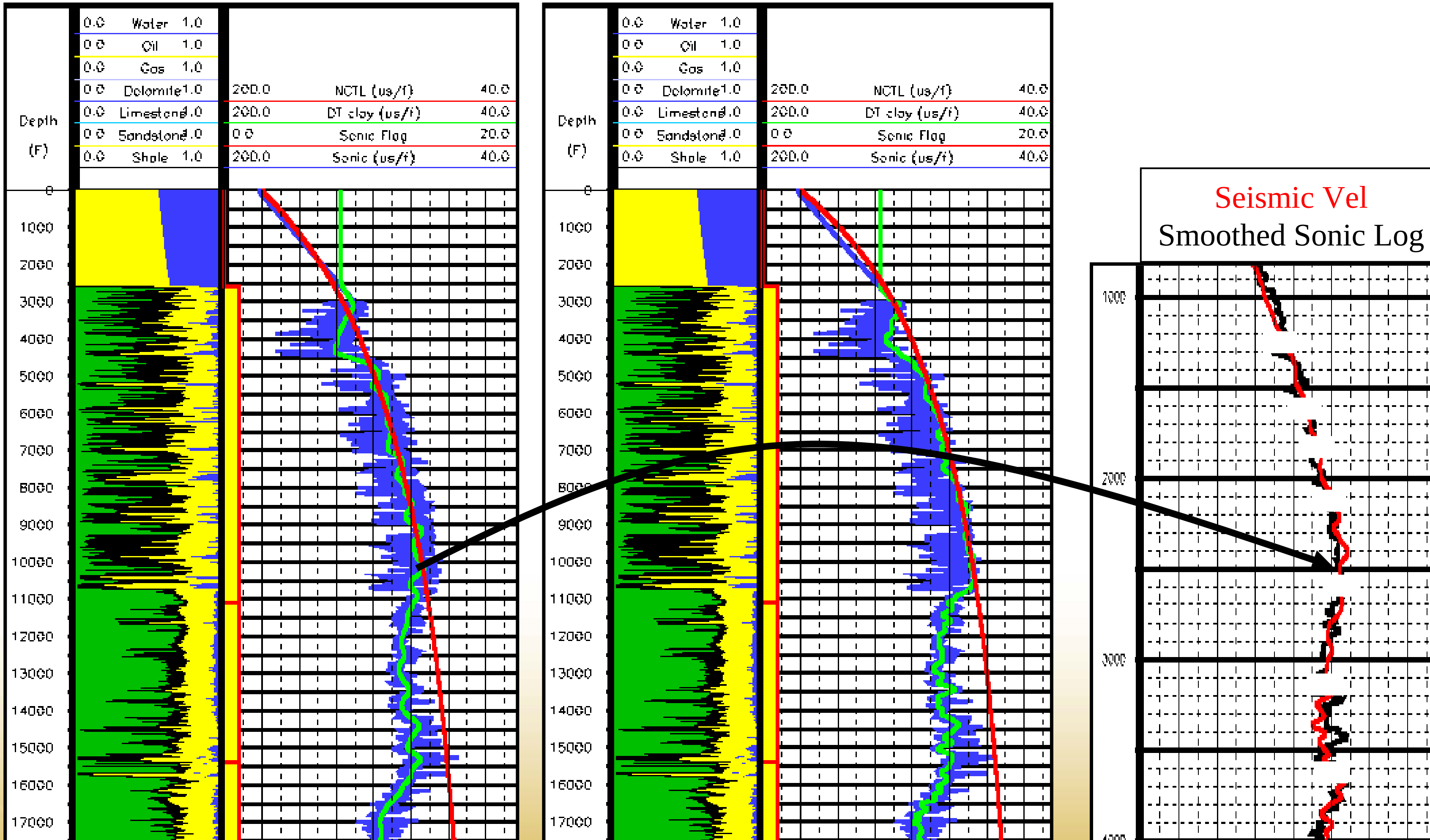
Two methods *do* agree

2 & 4.5 PPG

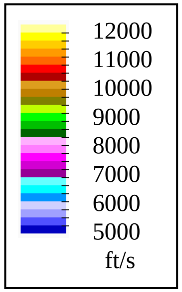
Lithologic Contamination in Seismic Velocities

Not Corrected For Lithology

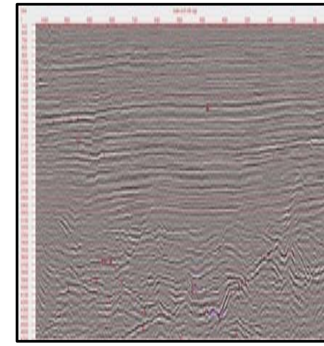
Corrected For Lithology



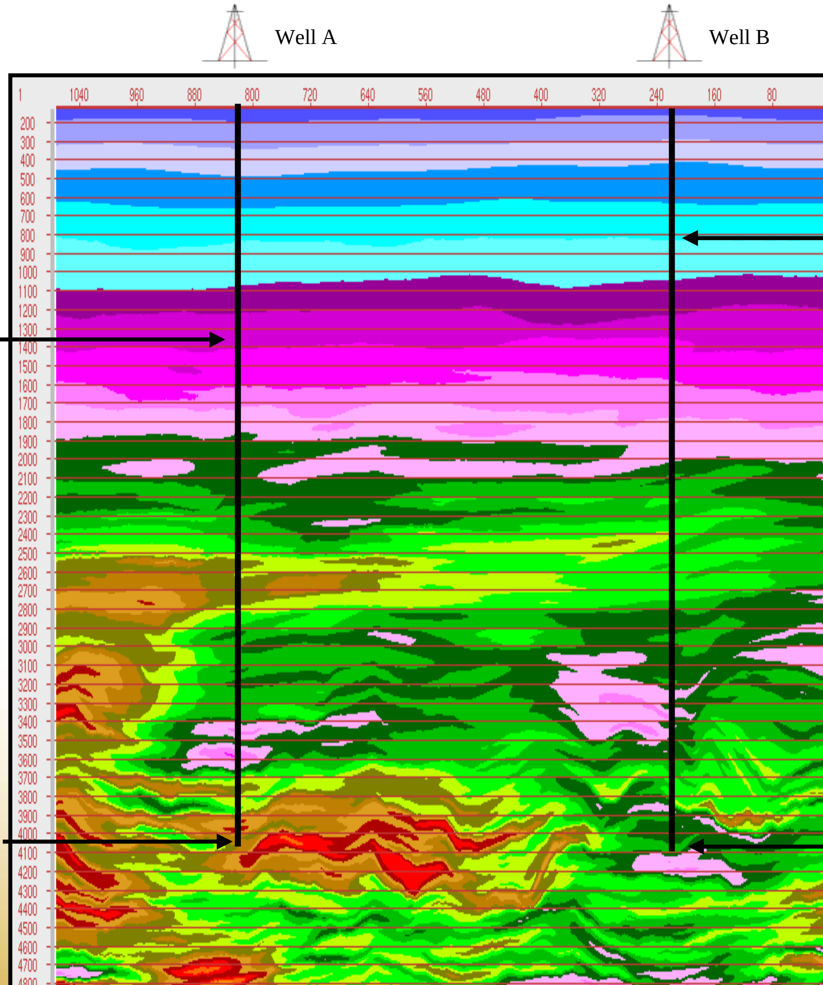
Interval Velocity from Seismic



Velocity Averaging along Structure



Smooth Sonic Log
Seismic Vint



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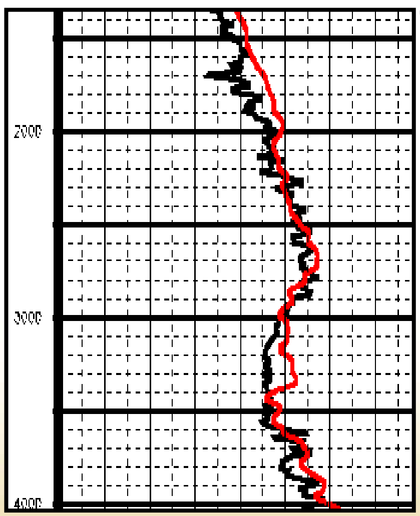
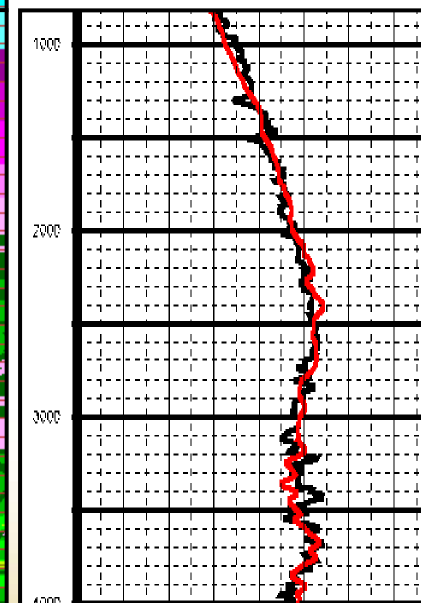
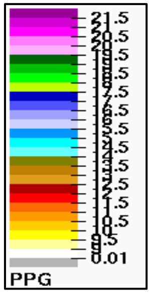
Seismic Vint

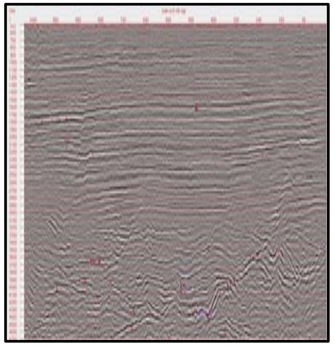




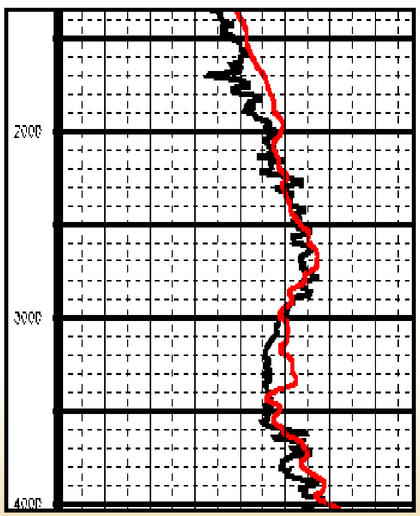
Shale Pore Pressure from Seismic

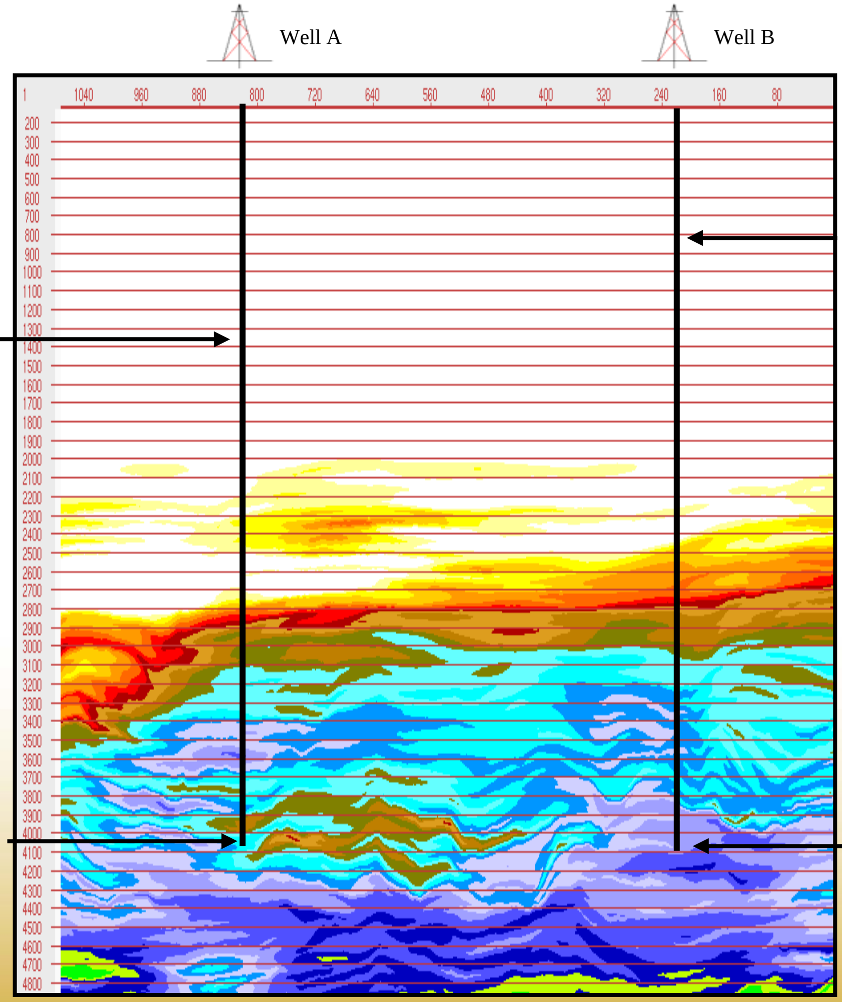


Velocity Averaging along Structure

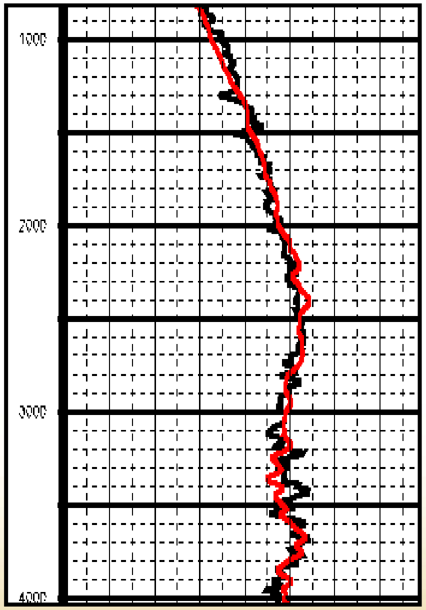


Smooth Sonic Log
Seismic Vint





Smooth Sonic Log
Seismic Vint



Calibration Implications

eSeis

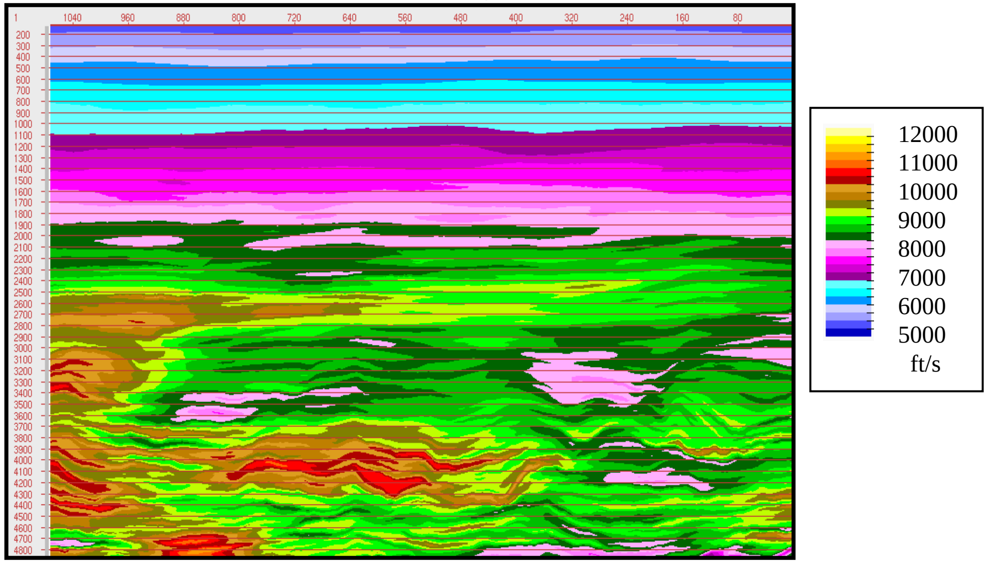
1) Calibration masks lithology-induced error
2) Therefore calibration assumes a constant lithologic trend
3) So if calibration is in a shaley area and proposed location is sandy the prediction will be wrong
4) And still assuming perfect velocities…

What do we need?

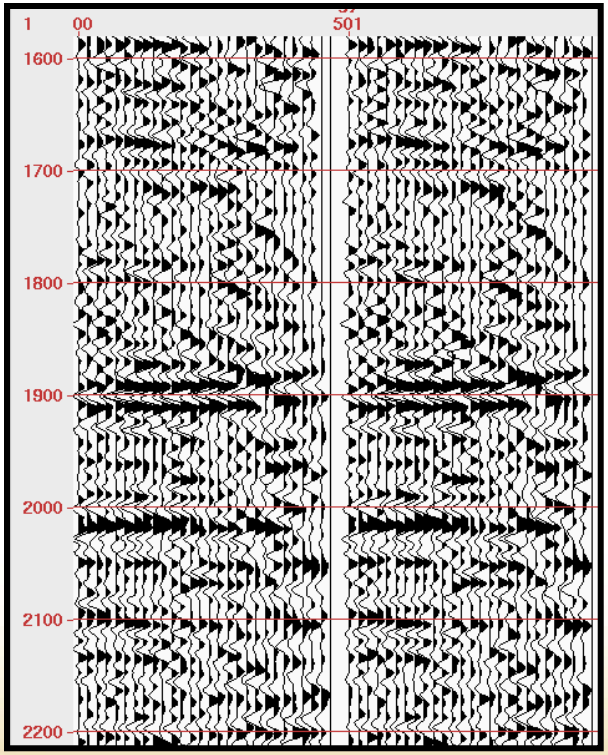
1) Seismic attribute that is more stable than velocity
2) And less sensitive to lithology
3) And more sensitive to pore pressure

Seismic Processing Outputs

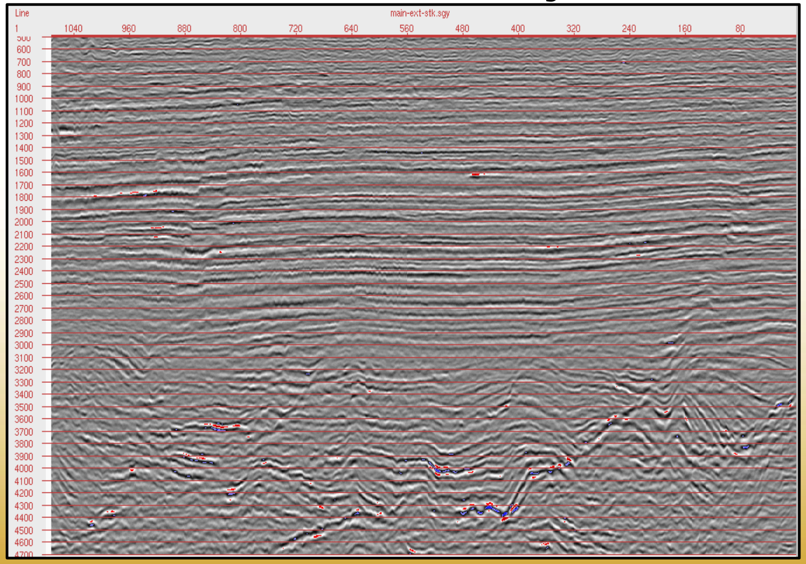
Velocity



Gathers



Reflectivity



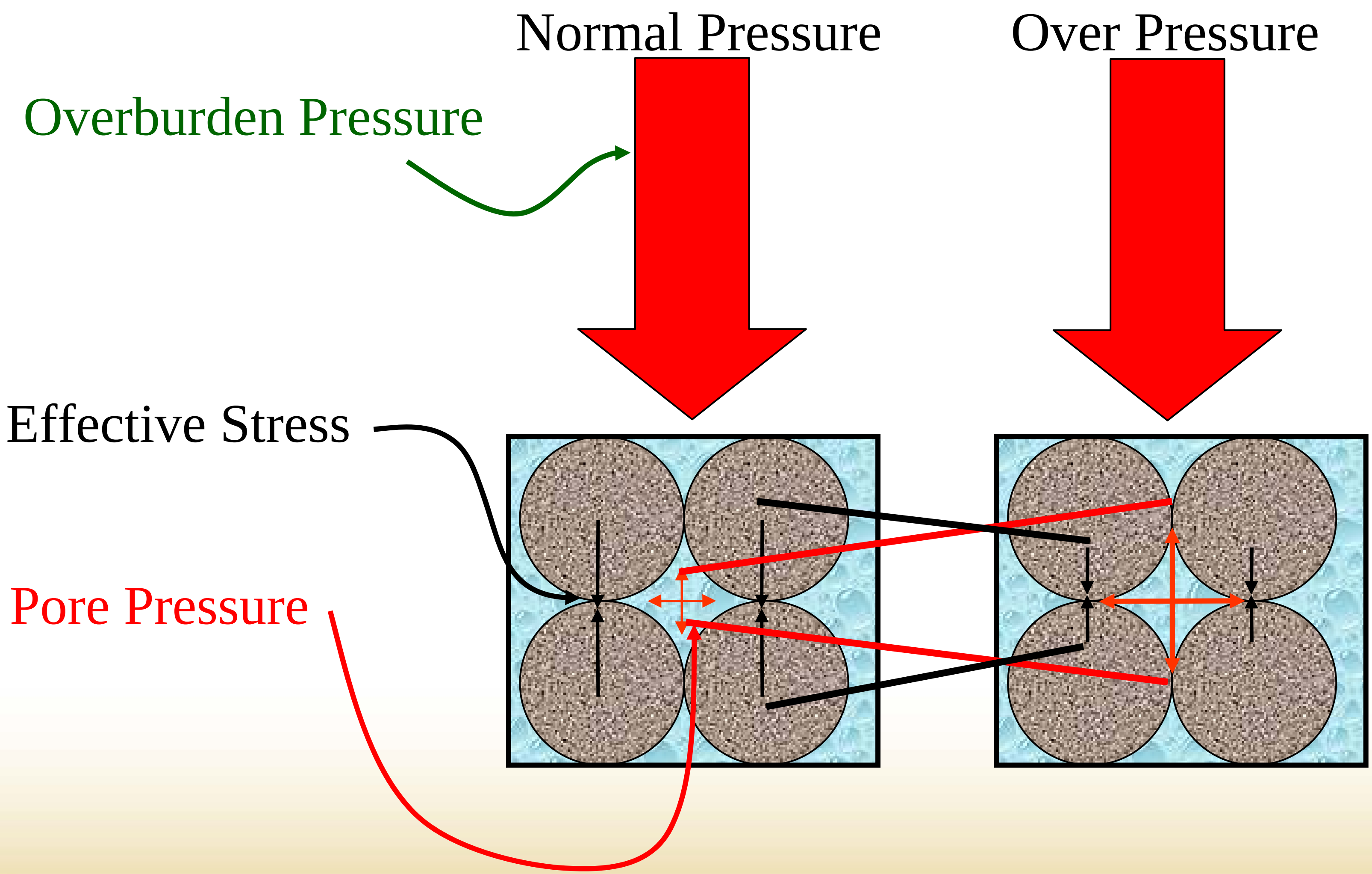
In 1938 Birch and Bancroft noted that acoustic attenuation is more sensitive to effective stress than to lithology.

A new method to calculate pore pressure from stacked seismic data

Q

Protected by US Patent No. 6,681,185

Geopressure



Pore Pressure + Effective Stress = Overburden Pressure

Q-Based Shale Pore Pressure

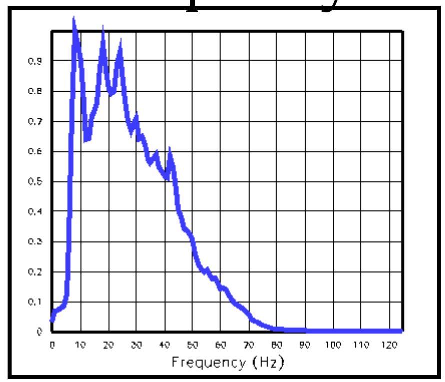
What is Q?

Q stands for Quality Factor

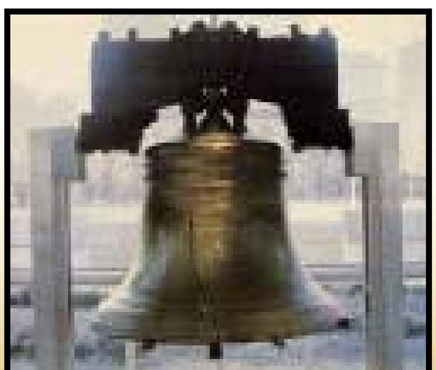
Q is the inverse of attenuation

Q-Based Shale Pore Pressure

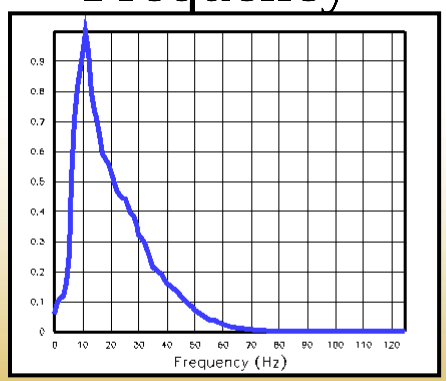
Frequency



Hi Q

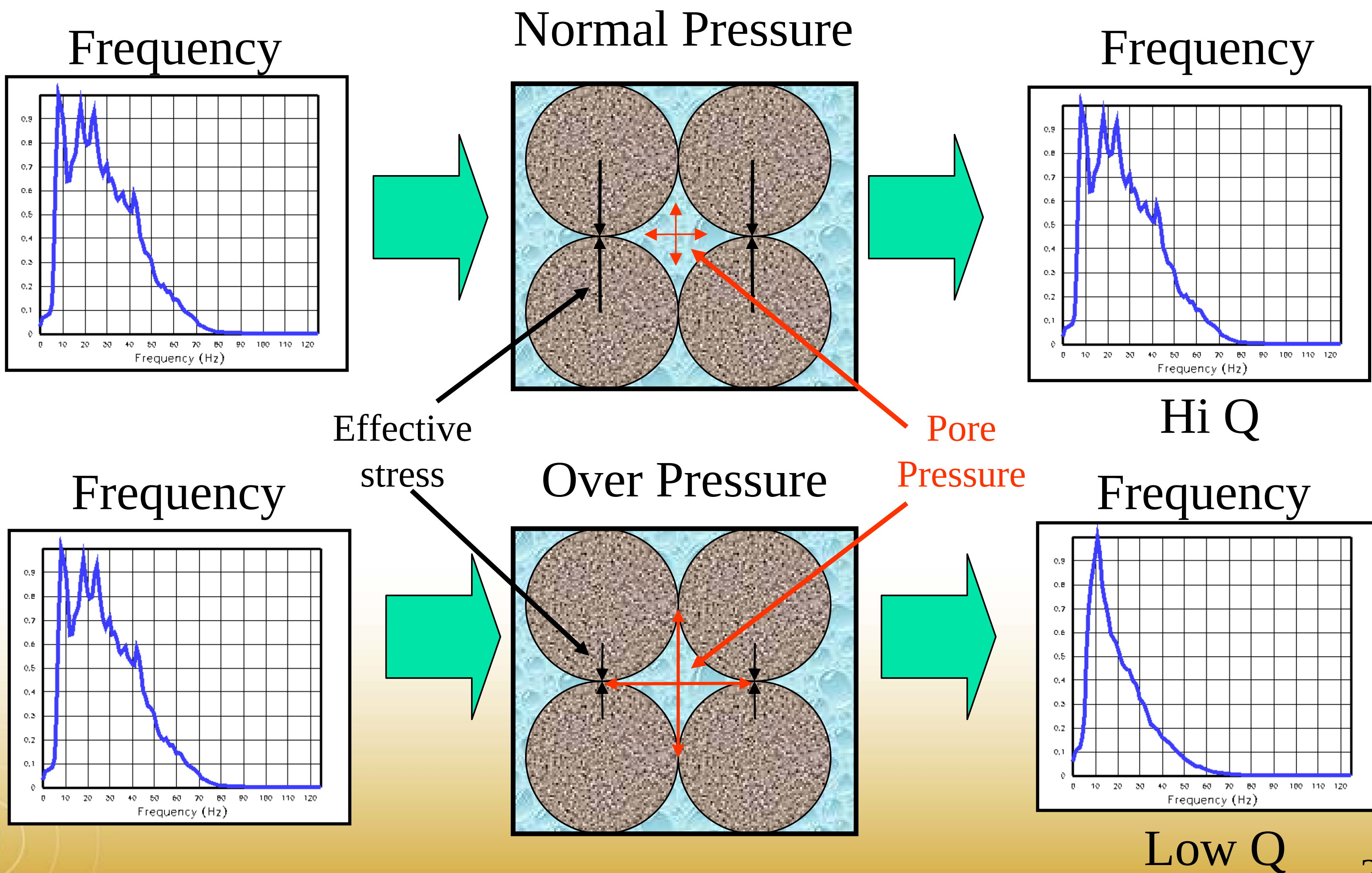


Frequency



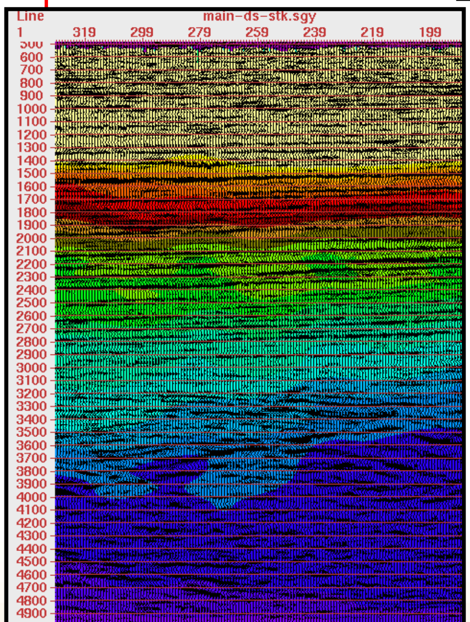
Low Q

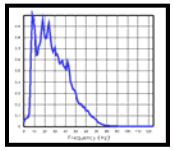
Q Responds to Effective Stress

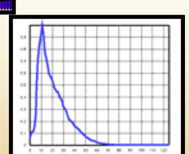


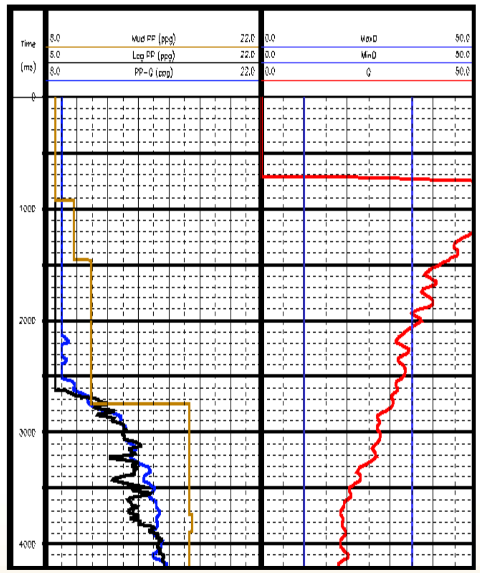
Q-Based PP Procedure

Frequency Decay

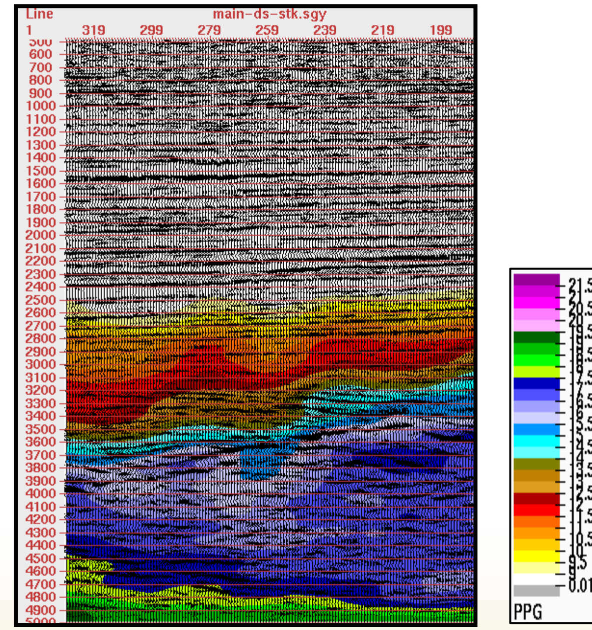




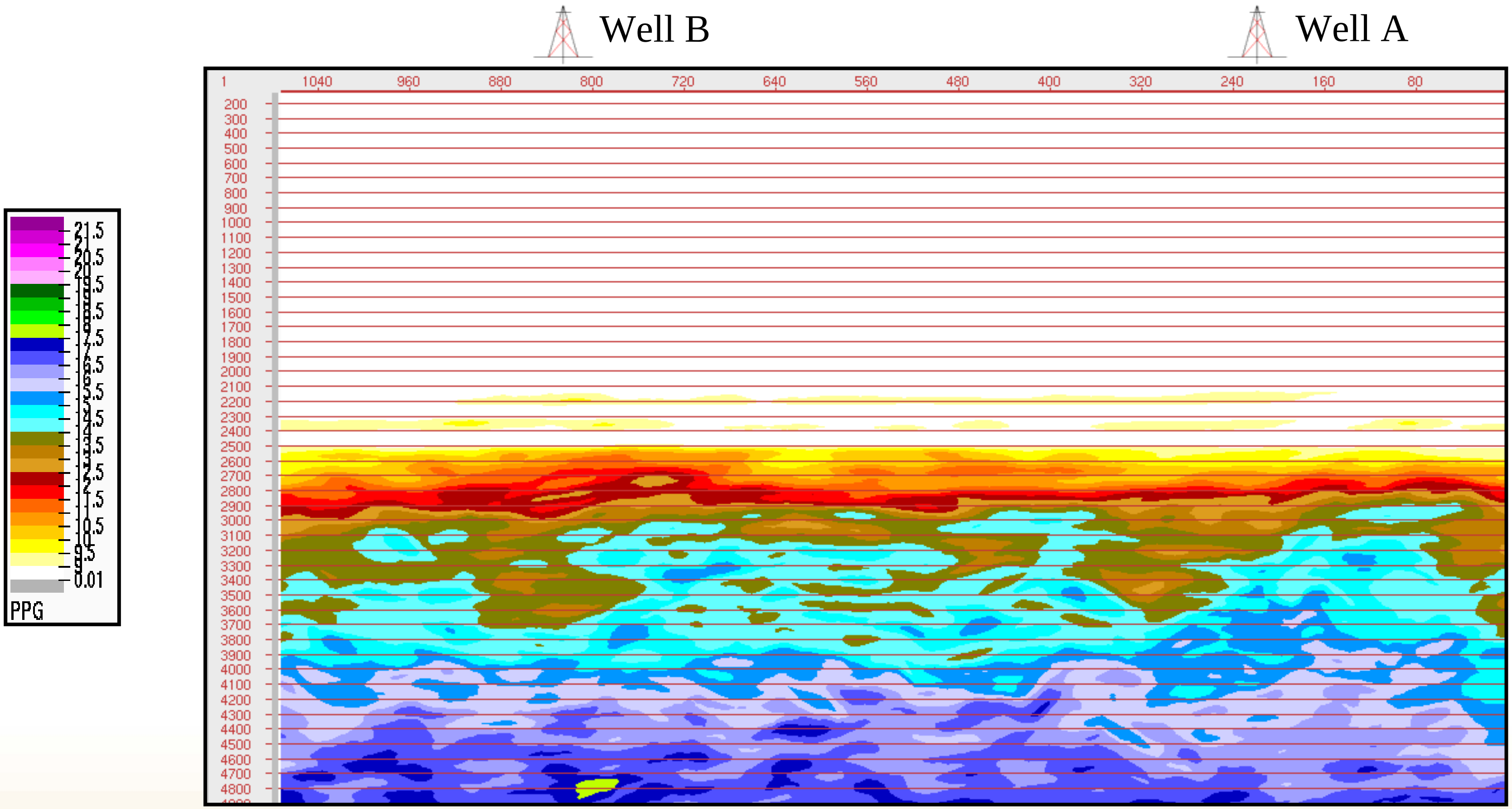




Pore Pressure

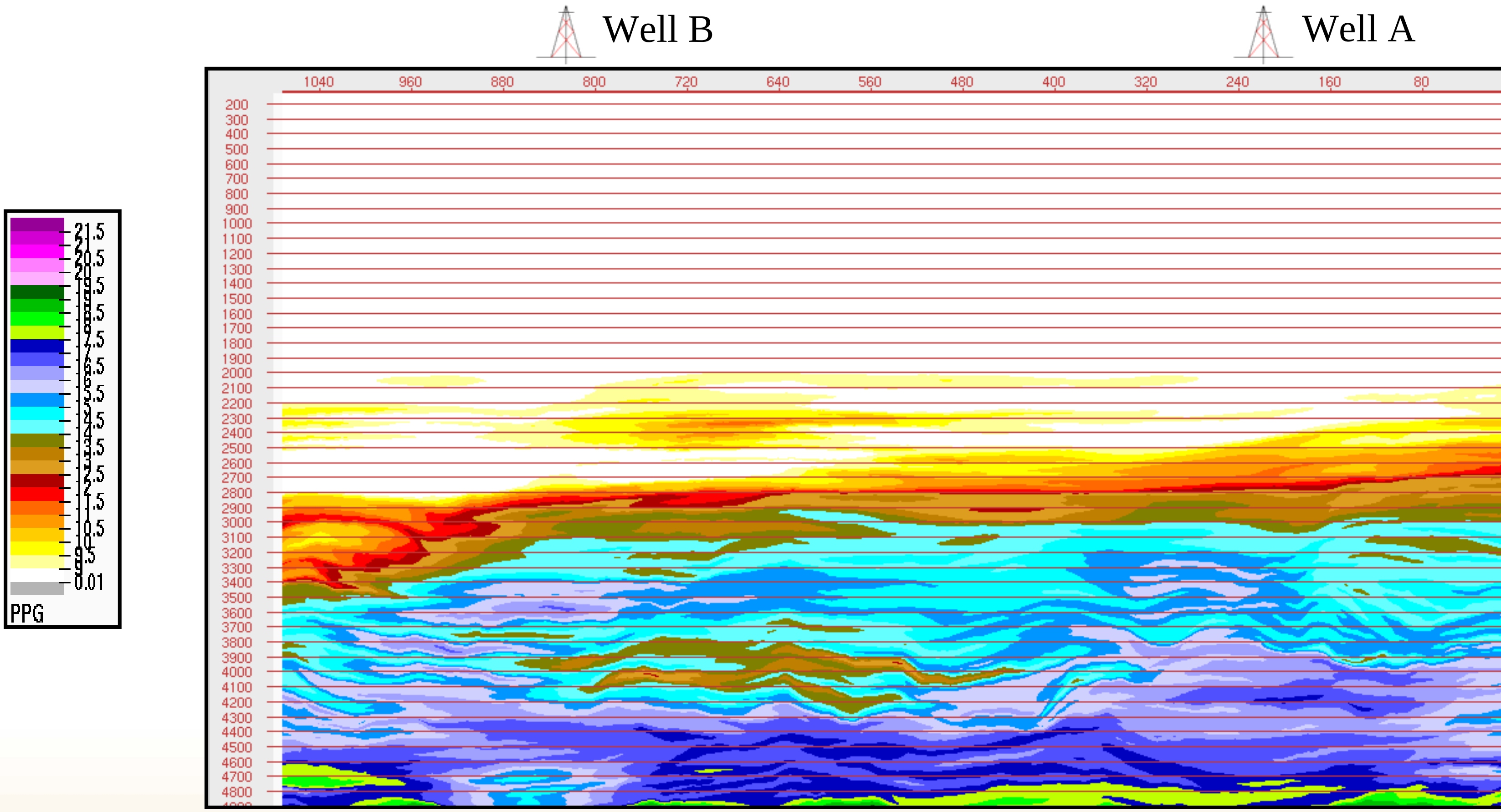


Q-Based Shale PP



Calibrated PP from seismic frequencies

V-Based Shale PP



Calibrated PP from seismic velocities

Conclusion

Using Multiple Pore Pressure Prediction Techniques provides a way to mitigate the increased risk inherent in drilling near or below salt.