



eSeis

A new method to calculate
pore pressure
from stacked seismic data

Q

Protected by US Patent No. 6,681,185



Q-Based Pore Pressure

What is Q?

Q stands for Quality Factor

Q is the inverse of attenuation

$$\frac{2\pi}{Q} = \frac{\Delta E}{E}$$



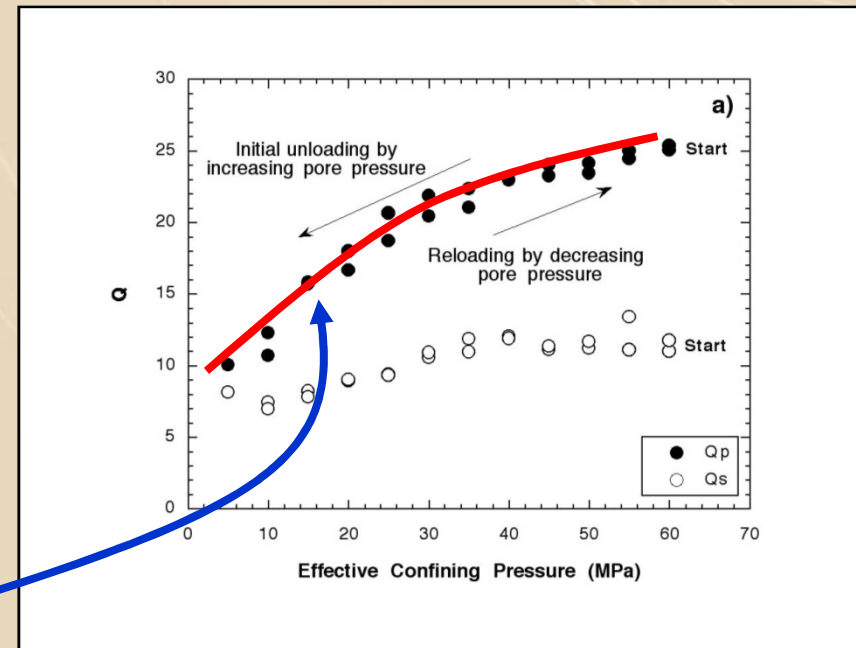
Experimental Results

Numerous authors have reported on the experimental relationship between Q_p and Pressure ($P_{\text{eff stress}}, P_p$).

Such as:

| | |
|----------------------|------|
| Birch and Bancroft | 1938 |
| Johnston et al | 1979 |
| Lucet and Zinszner | 1992 |
| Best and Sams | 1997 |
| Carcione | 2000 |
| Siggins and Dewhurst | 2001 |

With results like this

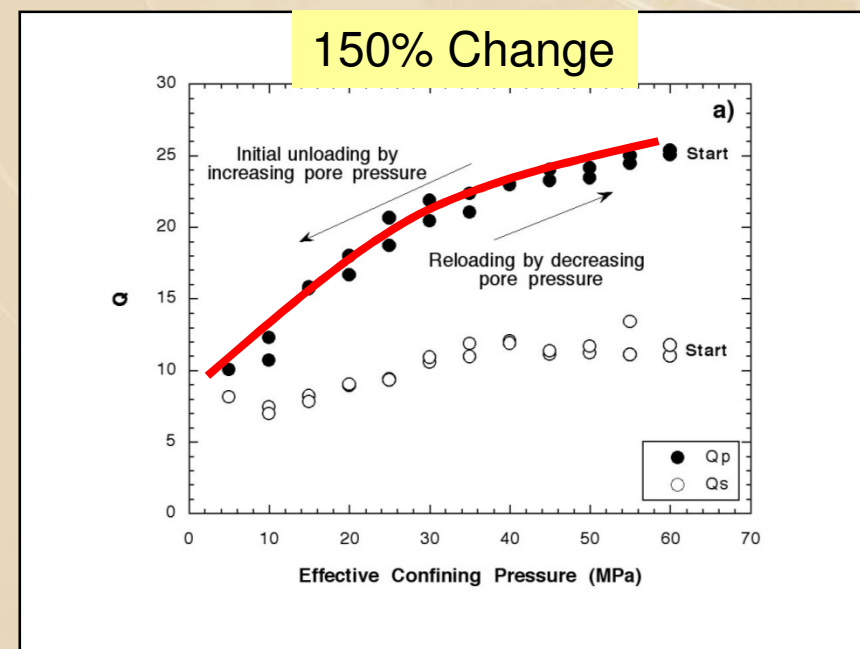
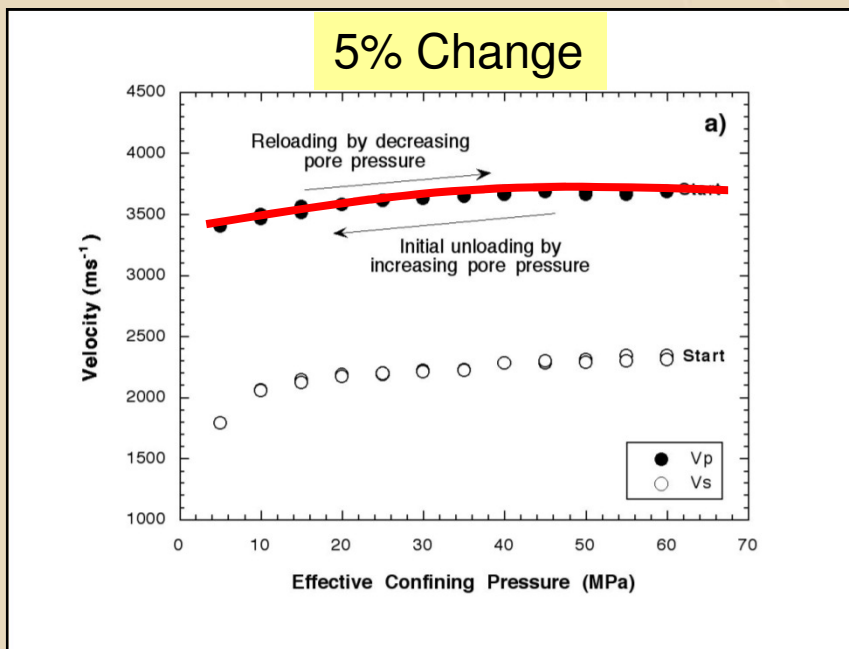


Lab Results

OTC 13043

Stress Path, Pore Pressure and Microstructural Influences on Q in Carnarvon Basin Sandstones

A.F. Siggins and D.N. Dewhurst (CSIRO Petroleum, Australia) and P.R. Tingate (National Centre for Petroleum Geology and Geophysics, University of Adelaide, Australia).



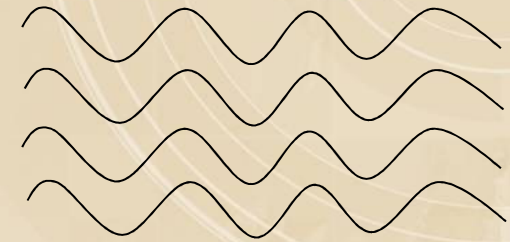
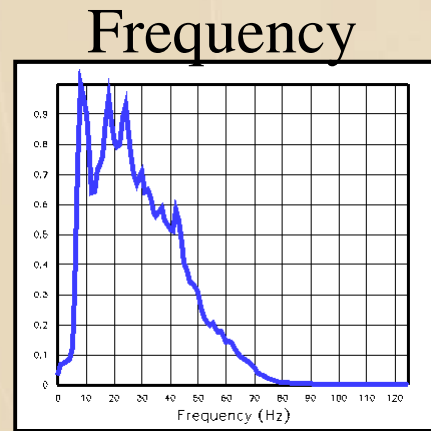
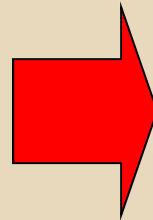


Q-Based Pore Pressure

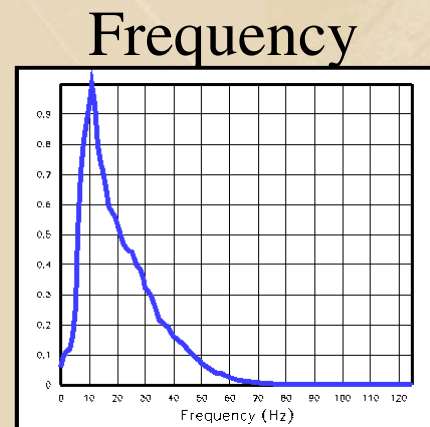
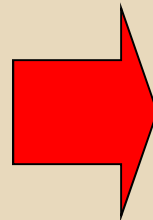
An Intuitive Explanation



Q-Based Shale Pore Pressure



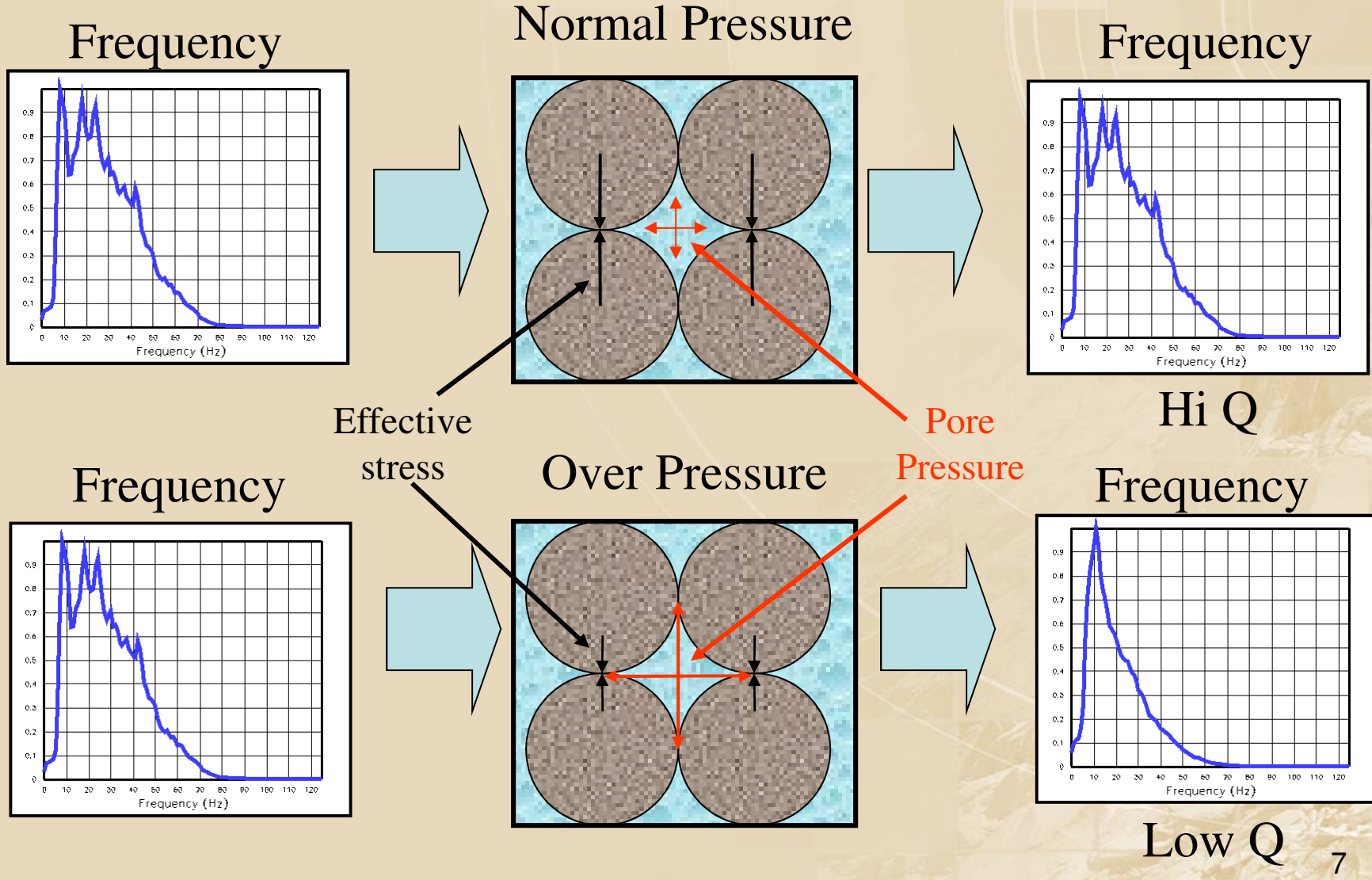
Hi Q



Low Q



Q Responds to Effective Stress





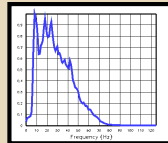
Q-Based Pore Pressure

Procedure

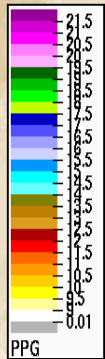
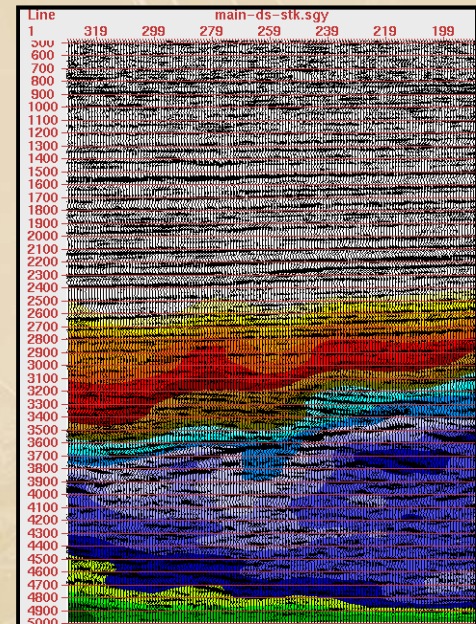
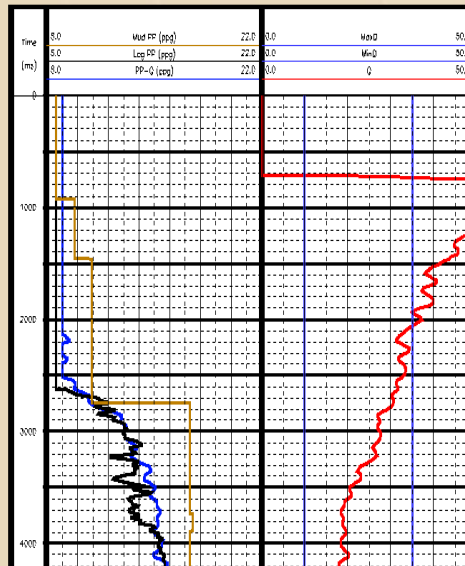
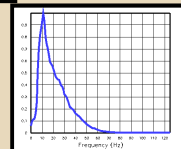
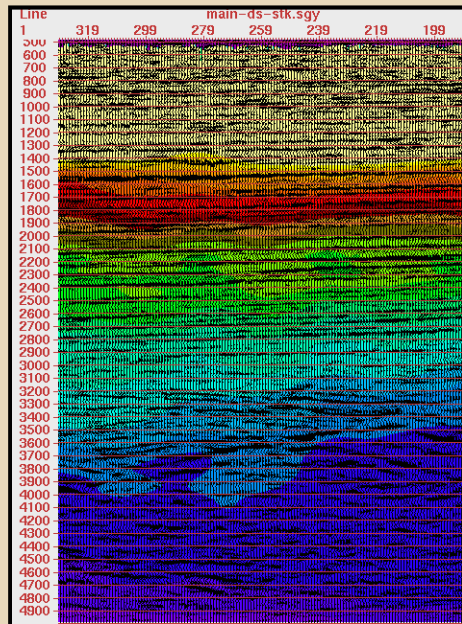


Q-Based PP Procedure

Frequency
Decay

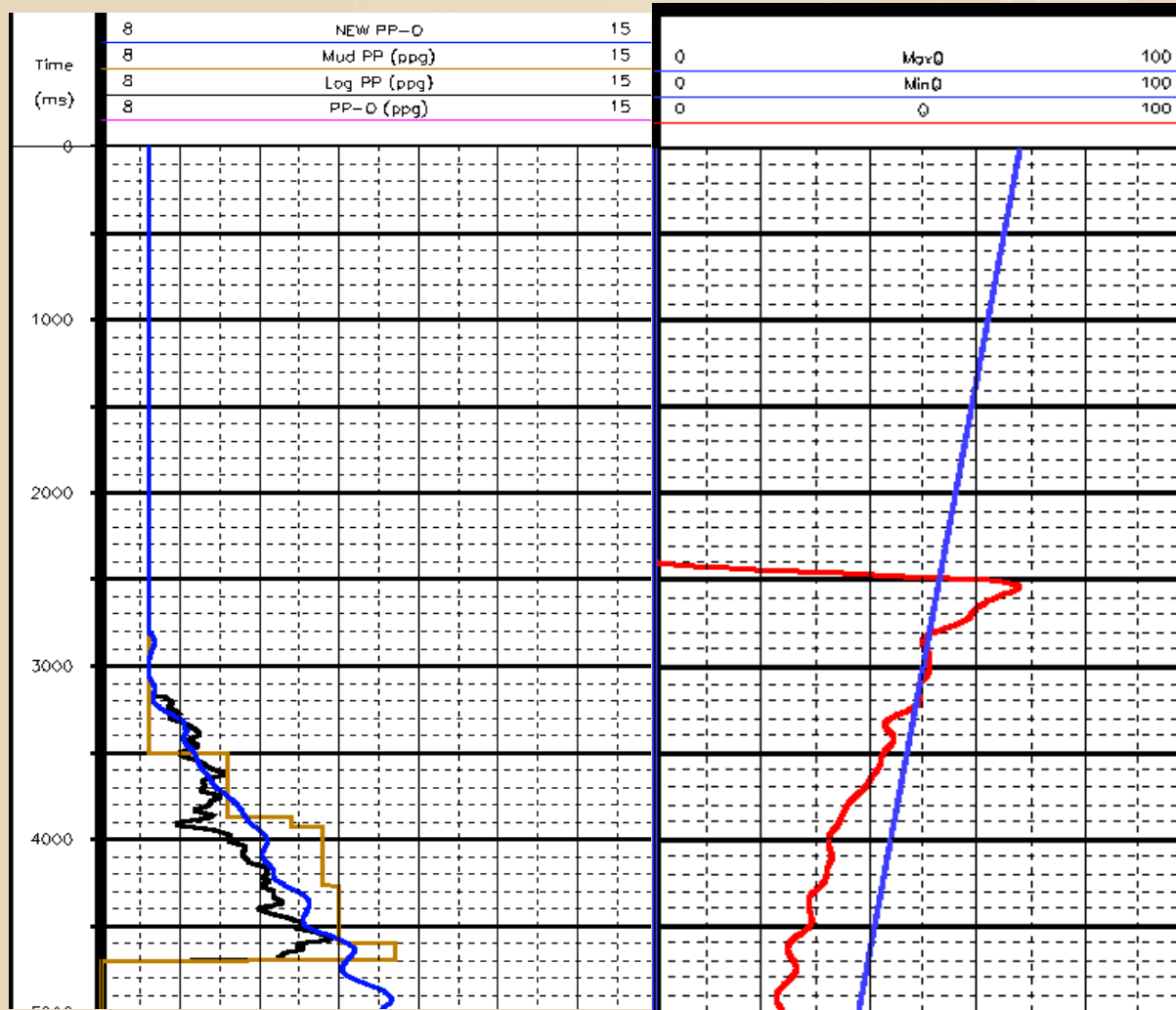


Pore Pressure



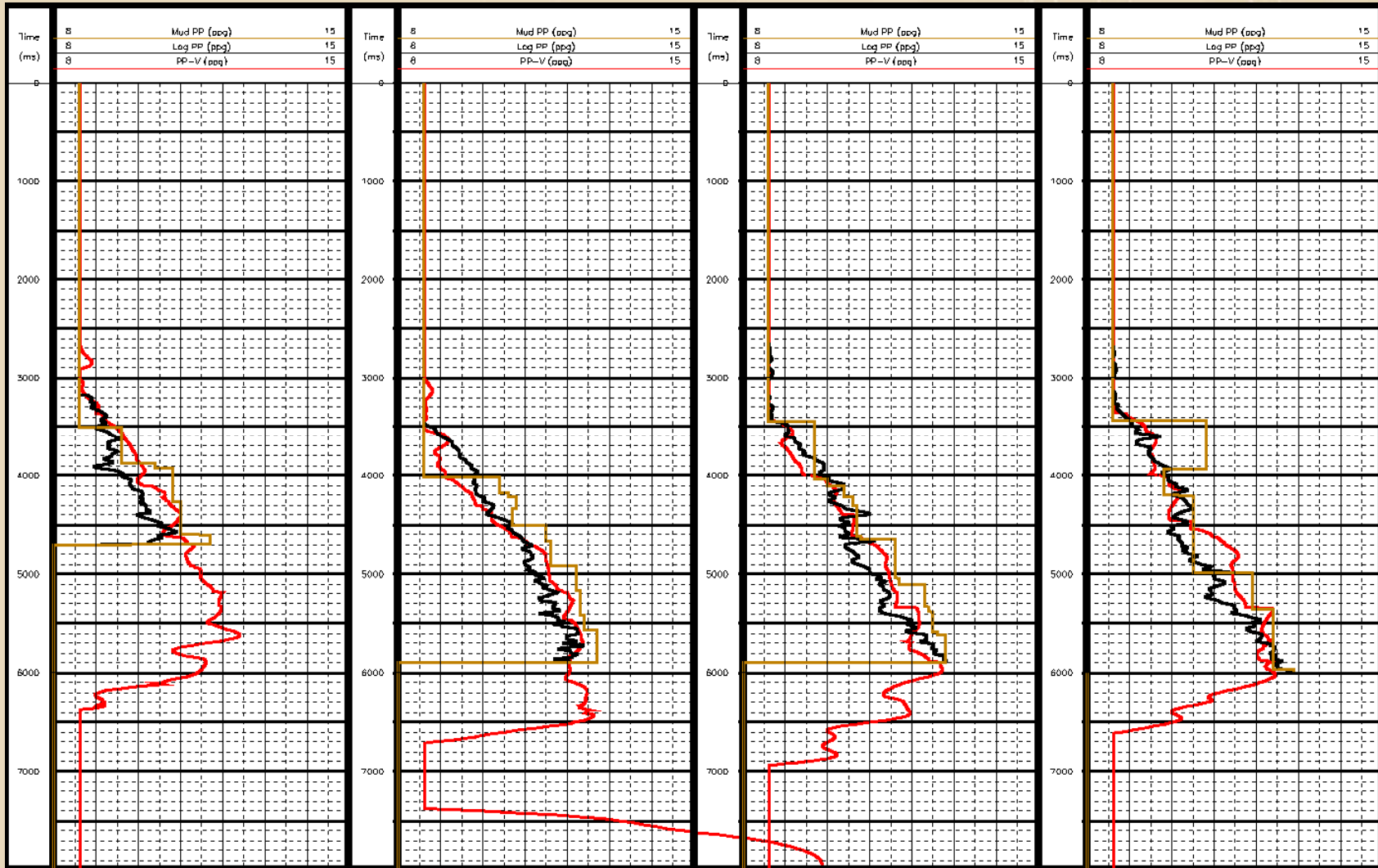


Deep Water Frequency Trend



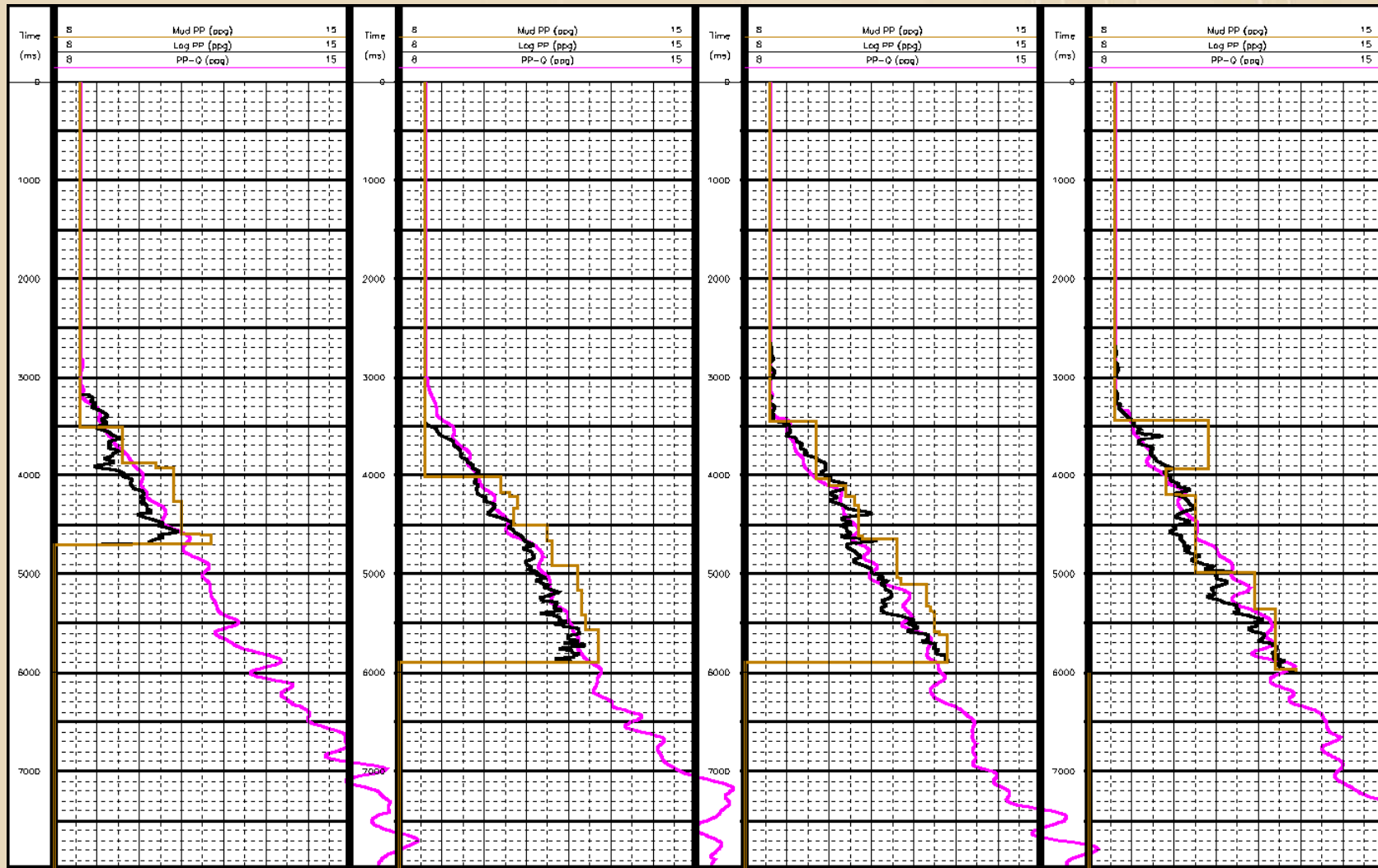


PP-V Calibration





PP-Q Calibration

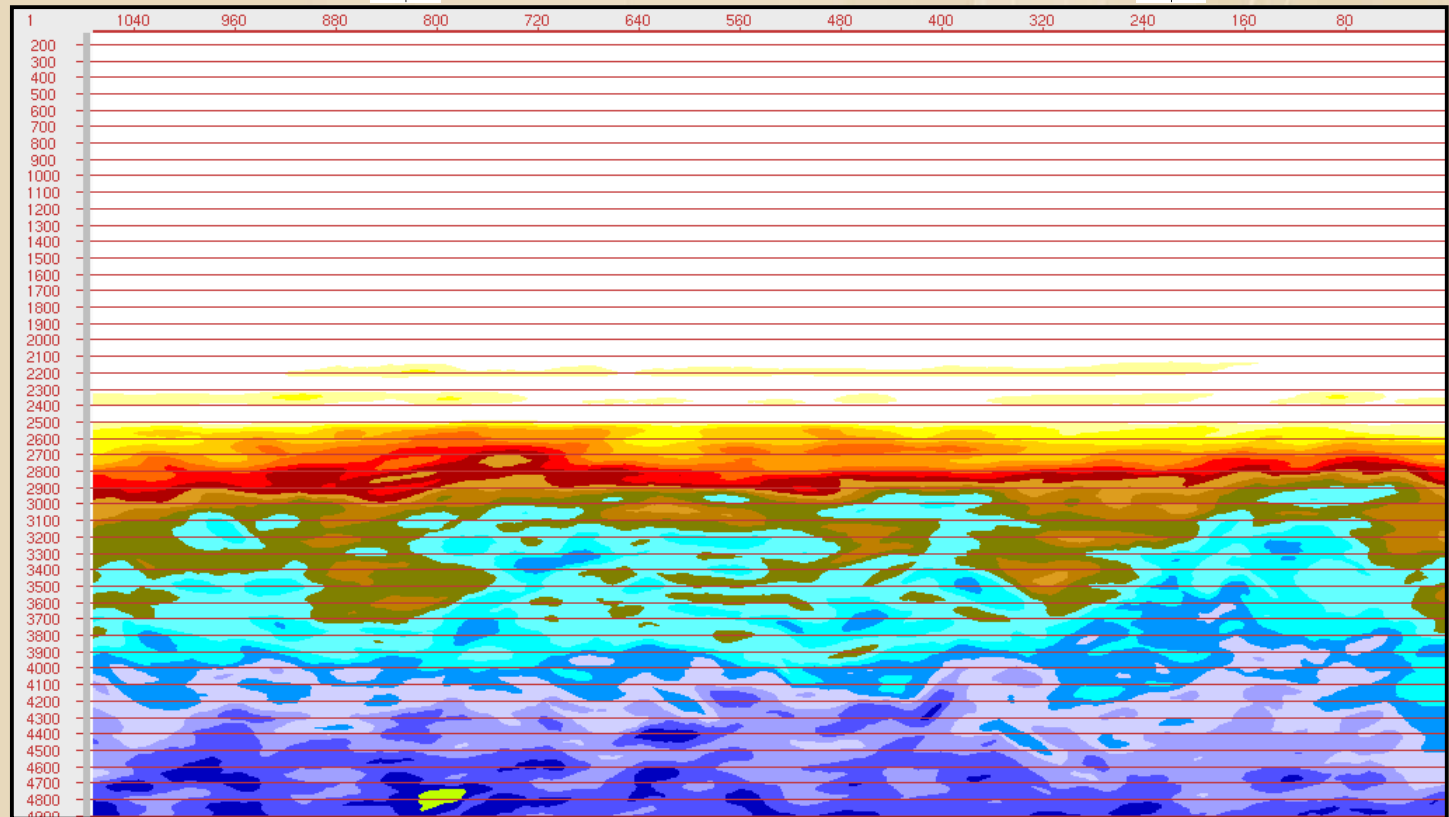
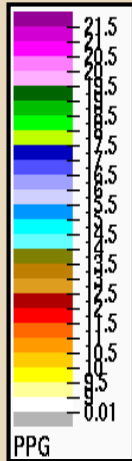




Q-Based Shale PP

Well B

Well A



Calibrated PP from seismic frequencies



eSeis

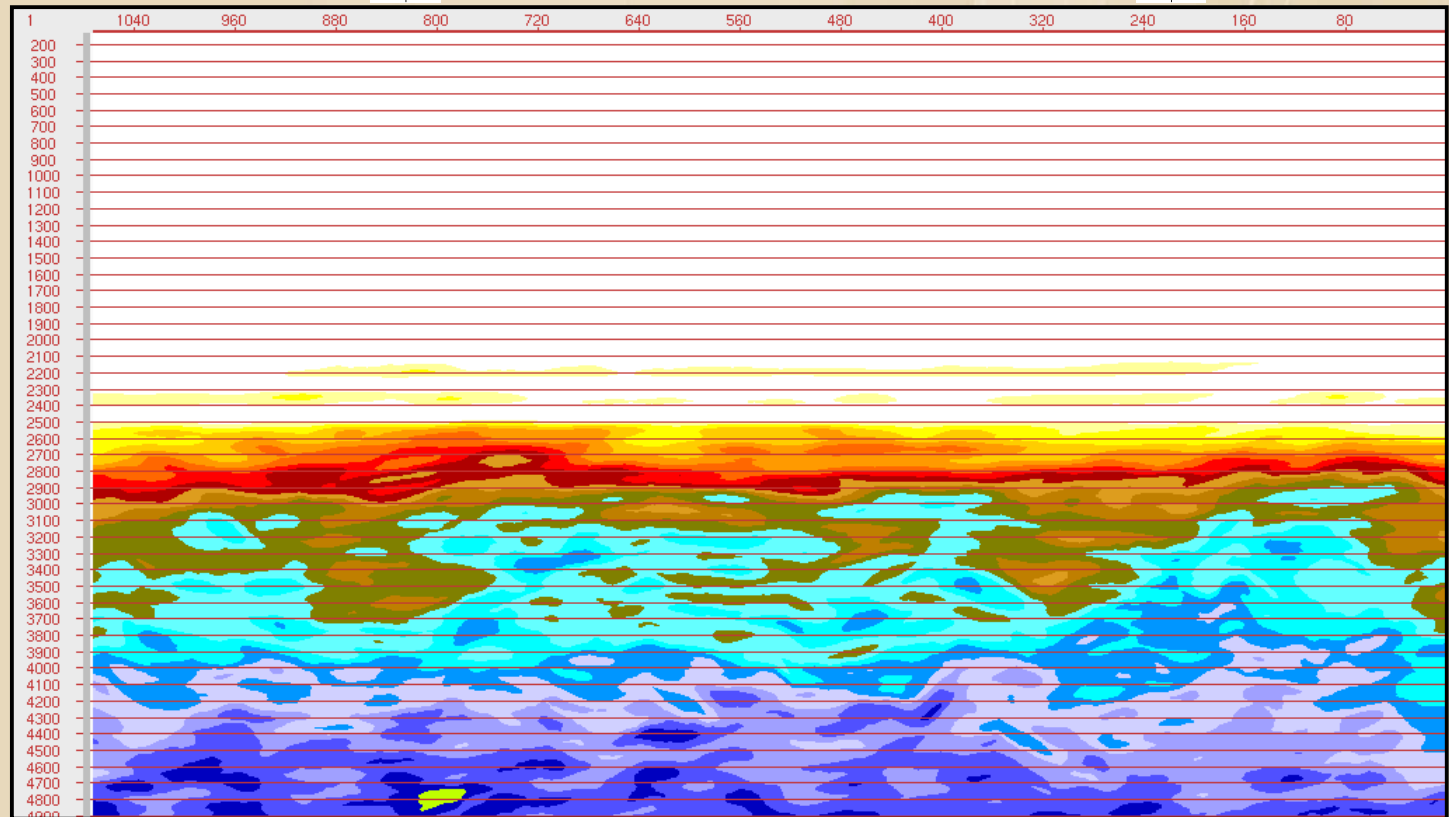
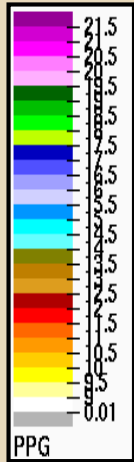
Why Use Two Methods to Calculate PP?



Q-Based Shale PP

Well B

Well A



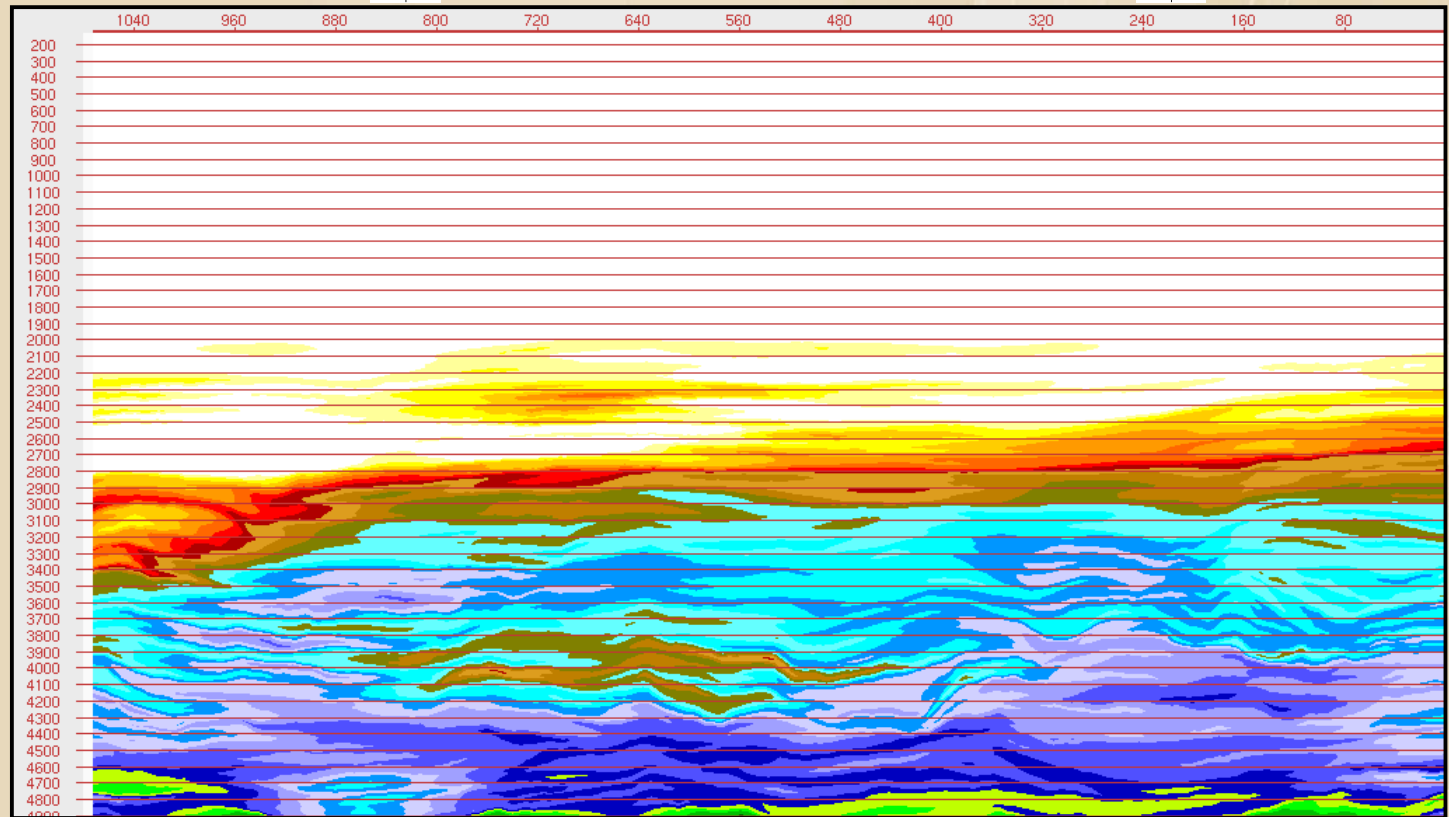
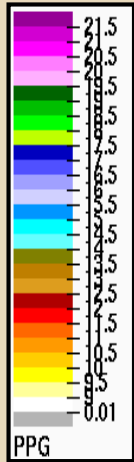
Calibrated PP from seismic frequencies



V-Based Shale PP

Well B

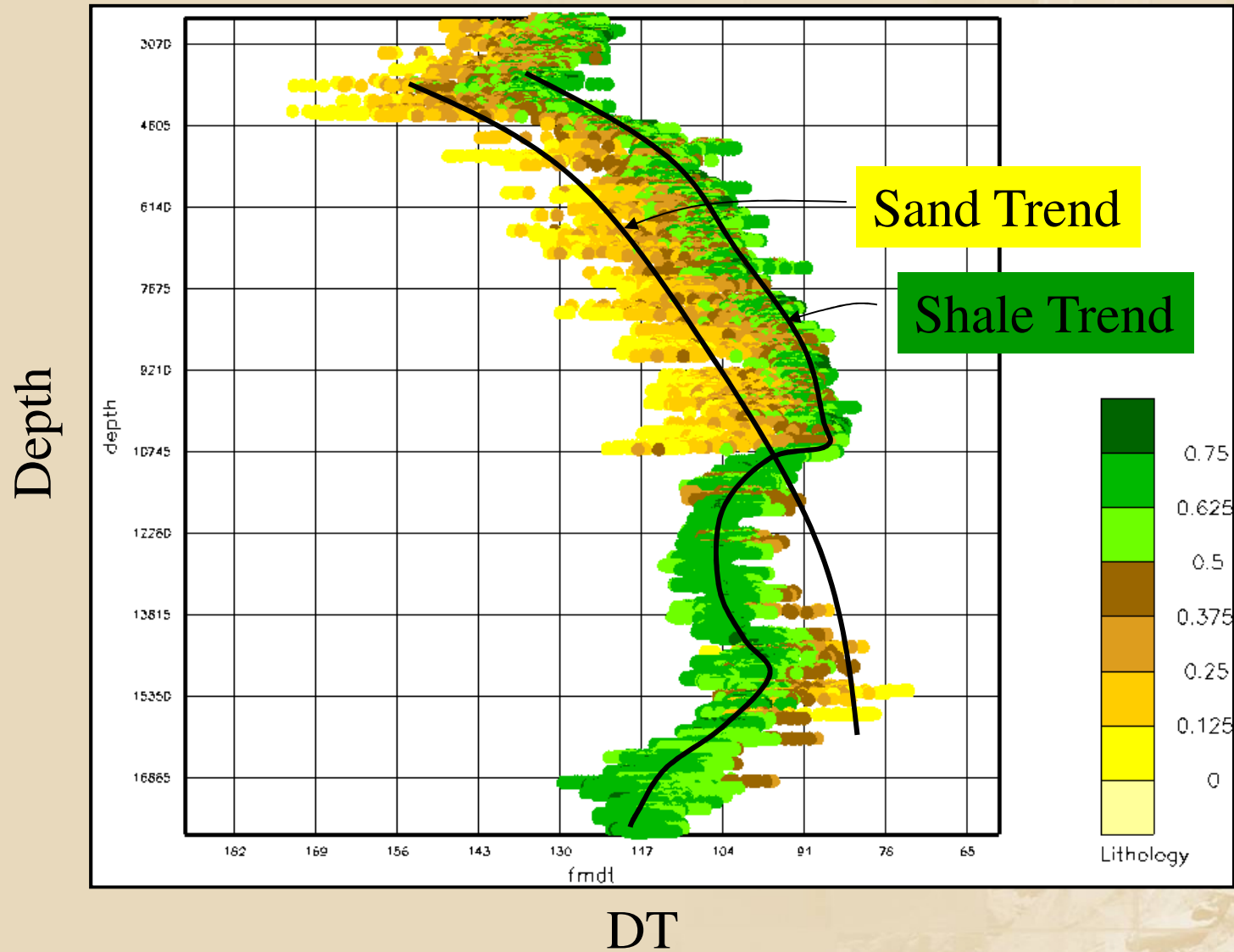
Well A



Calibrated PP from seismic velocities



Velocity Responds to Lithology





eSeis

Examples



Water Bottom →

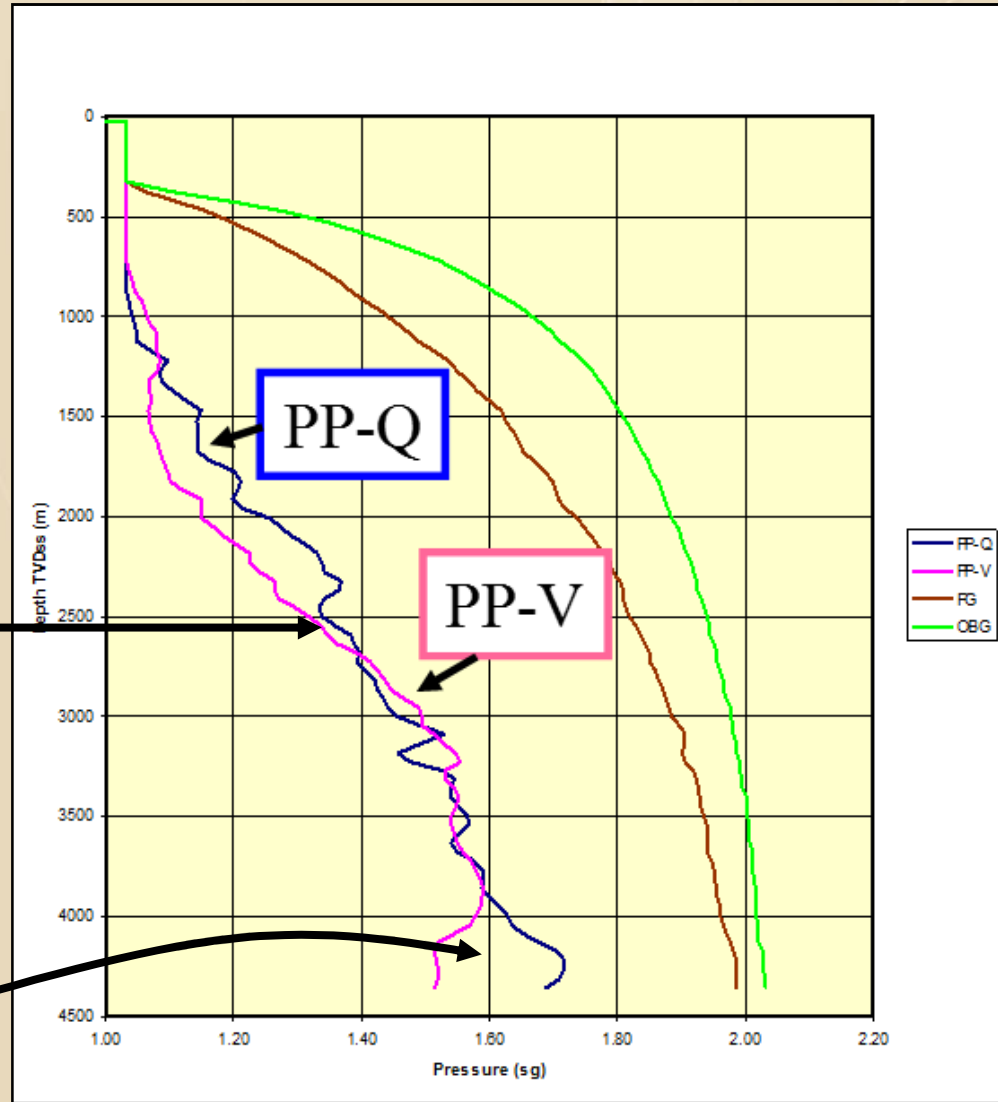
Moderate Sand/Shale Ratio



Shale



Steep Structure Causing Seismic Velocity Issues





Water Bottom



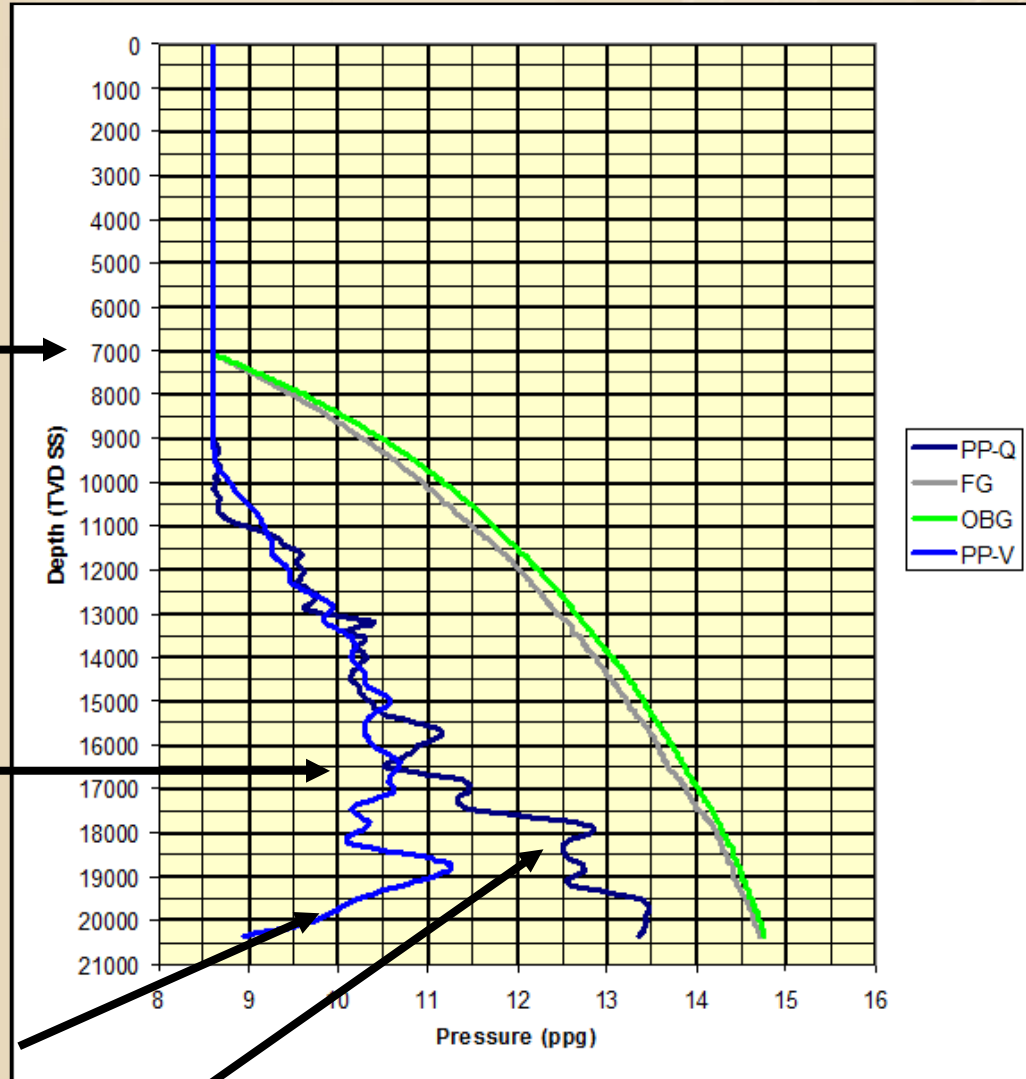
Shaley
Clastics



Sandy and Tight

PP-V

PP-Q



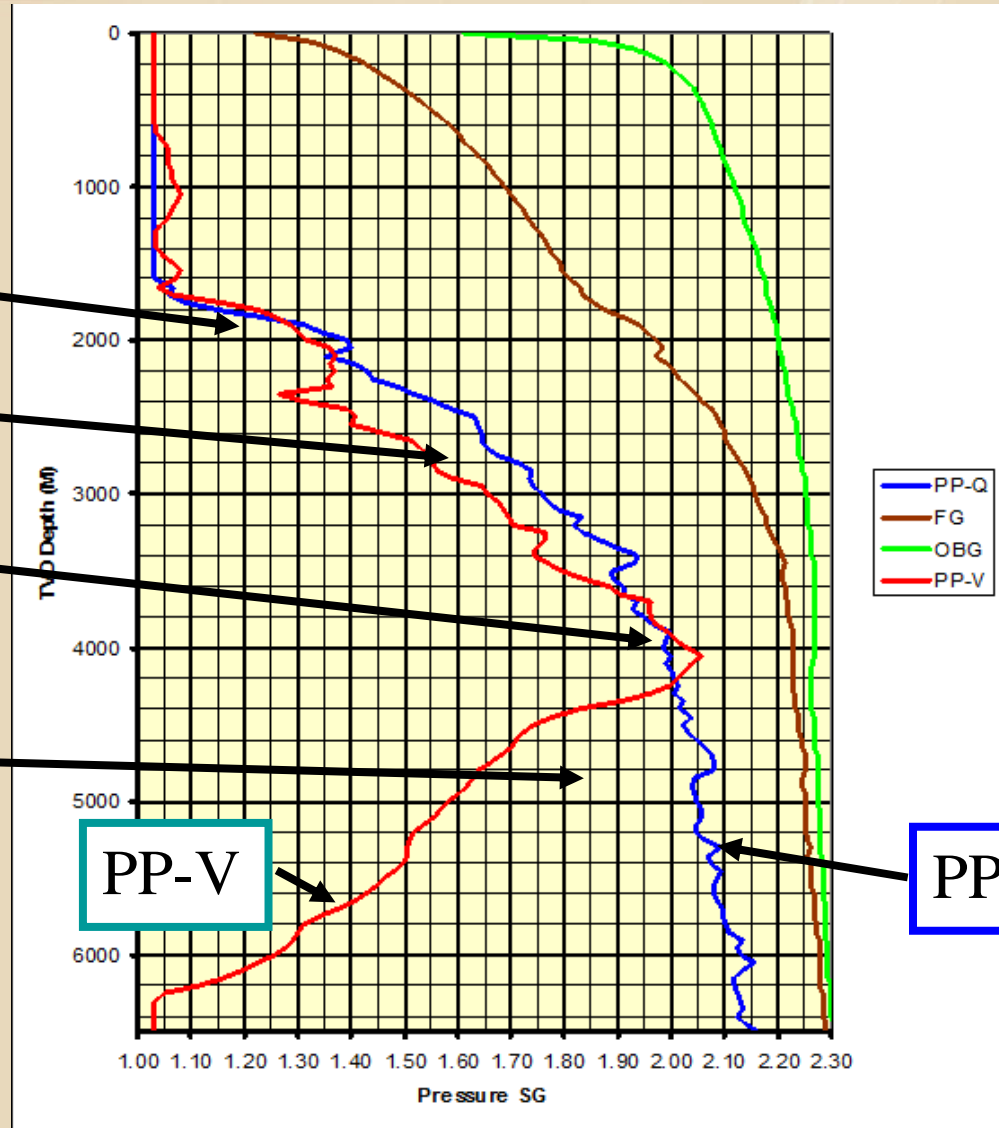


Shale

Sandy

Shale

Carbonate

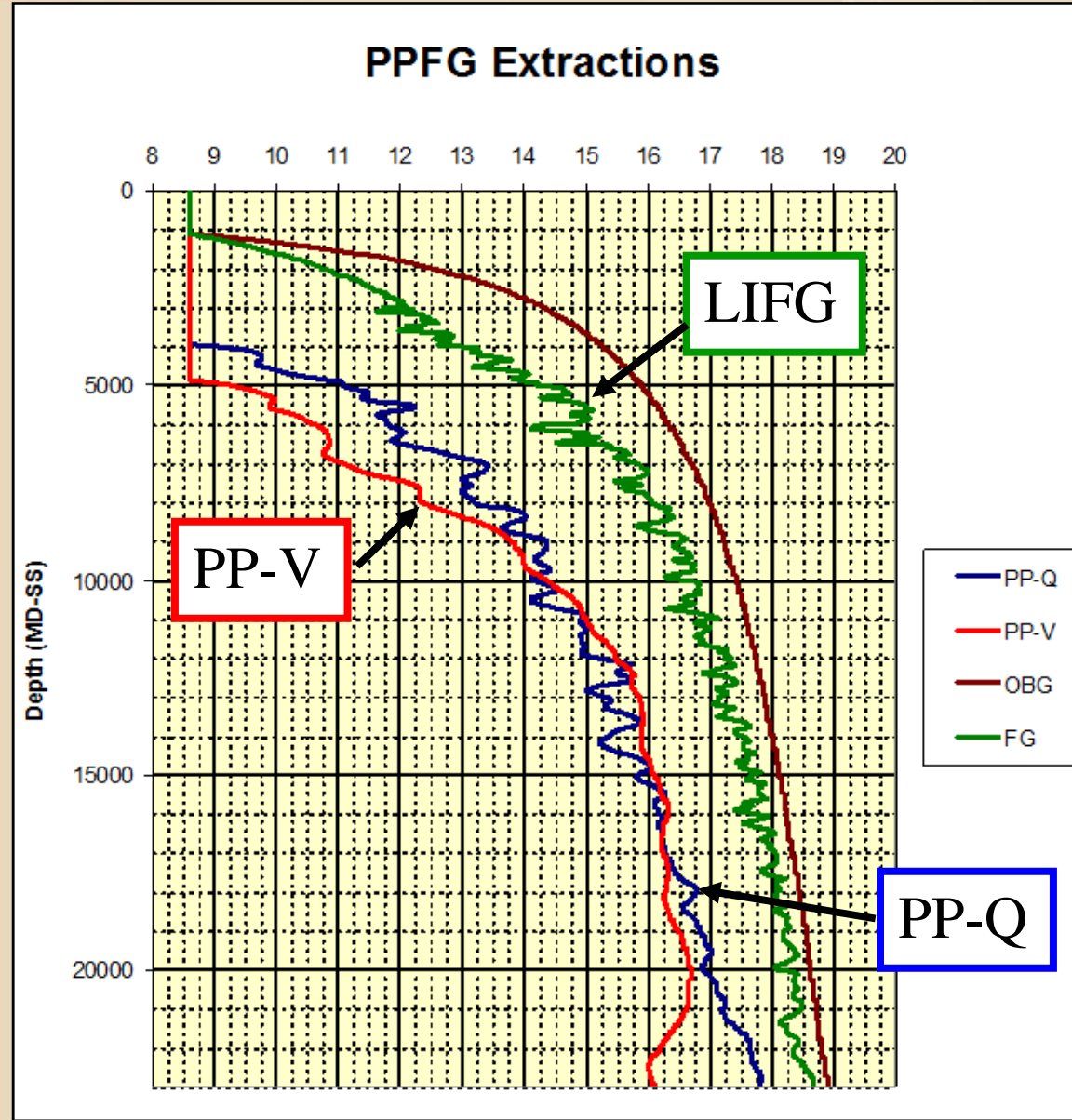


PP-V

PP-Q



Now including a lithology influenced frac-gradient, LIFG.





Conclusion

Using Multiple Pore Pressure Prediction Techniques provides a way to mitigate risk.