OPTIMISE SUCCESS THROUGH SCIENCE

The Value of Regional Studies in the West of Shetland

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**GeoTrack International

12.25pm

Agenda

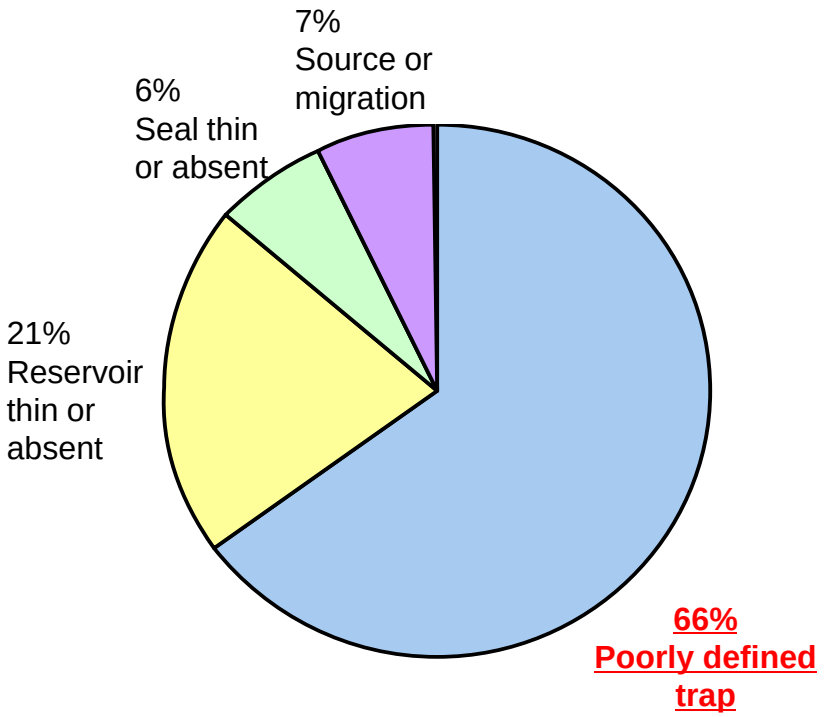
1.Exploration Risks
2. Database
3. Reservoir Compartmentalization
4. Shale Pressures
5, Overpressure Mechanisms
6. Implications for Well Planning
7. Conclusions

ikon GeoPressure

WEST OF SHETLAND RISKS
Analysis of 109 failed exploration wells

Each of the failed wells has been assessed in terms of : -

- **Trap definition**
- **Reservoir presence and quality**
- **Seal presence and effectiveness**
- **Source rocks and charge**



From Loizou et al. (2006)

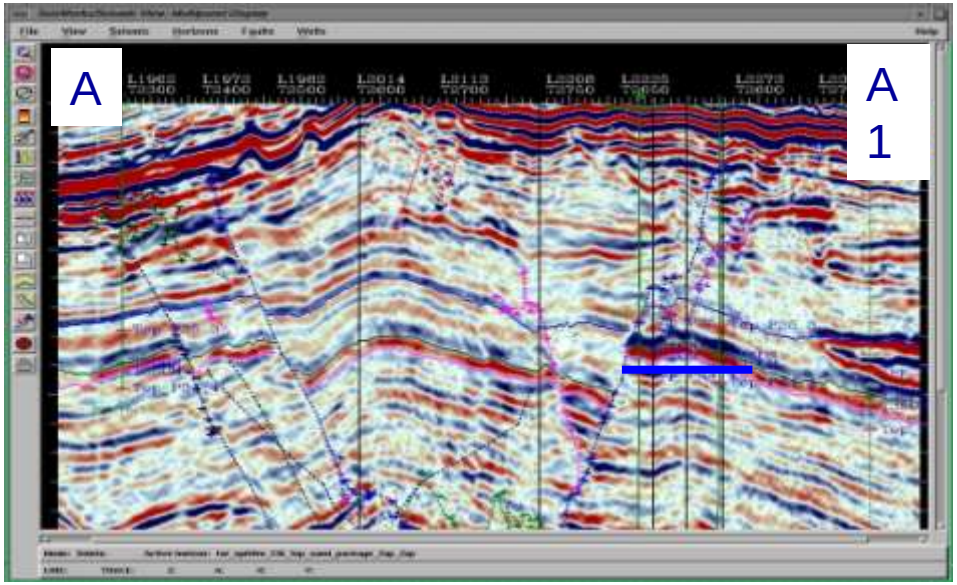
The key reason for most failures has been poor trap definition

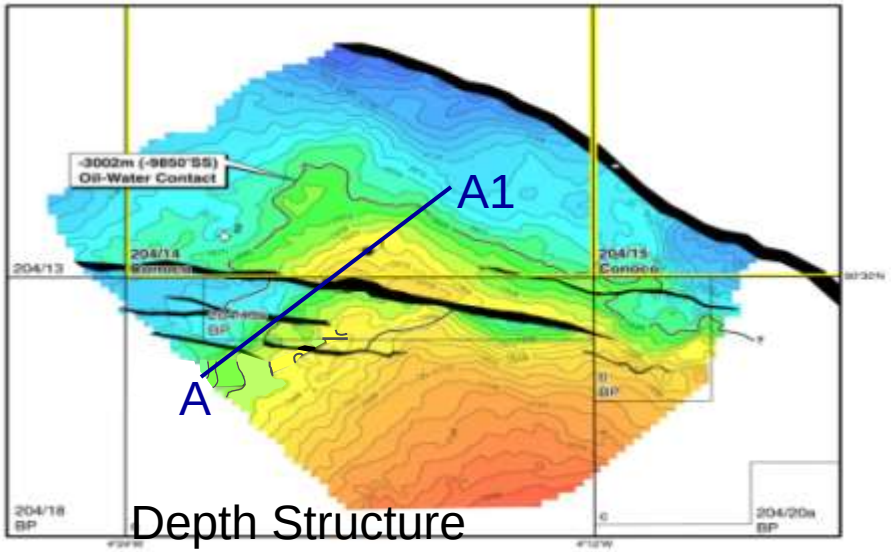
However

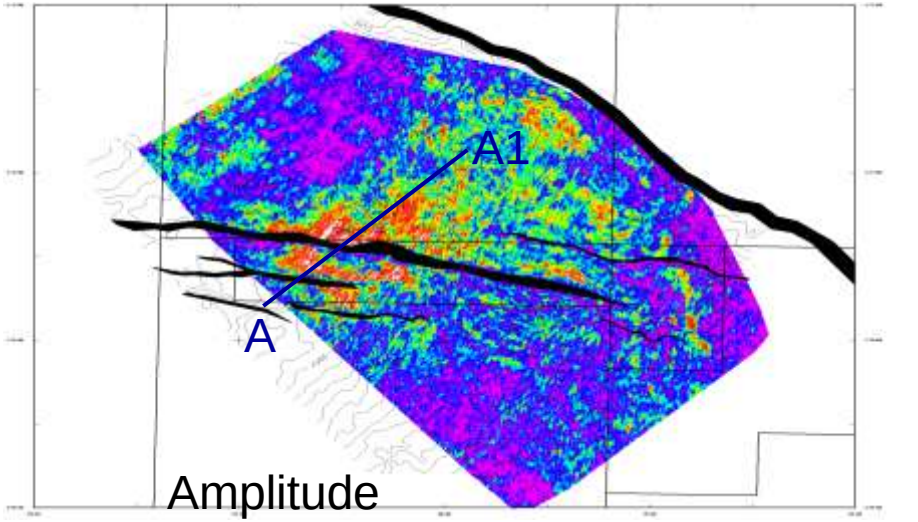
Many wells failed on a combination of geologic components

Suilven Oil & Gas accumulation, Blocks 204/14a & 19b

- Provides a good Palaeocene analogue of a structural trap







Courtesy of ConocoPhillips

Data Available

(1) Pressure Data – IHS-supplied (244 wells; 100% capture of publically-released wells)

Formation and fracture pressures from WFT logs, DSTs, Kicks, FIT/LOT and Lost circulation events

(2) Other data sources utilized – IHS,BERR and other public domain

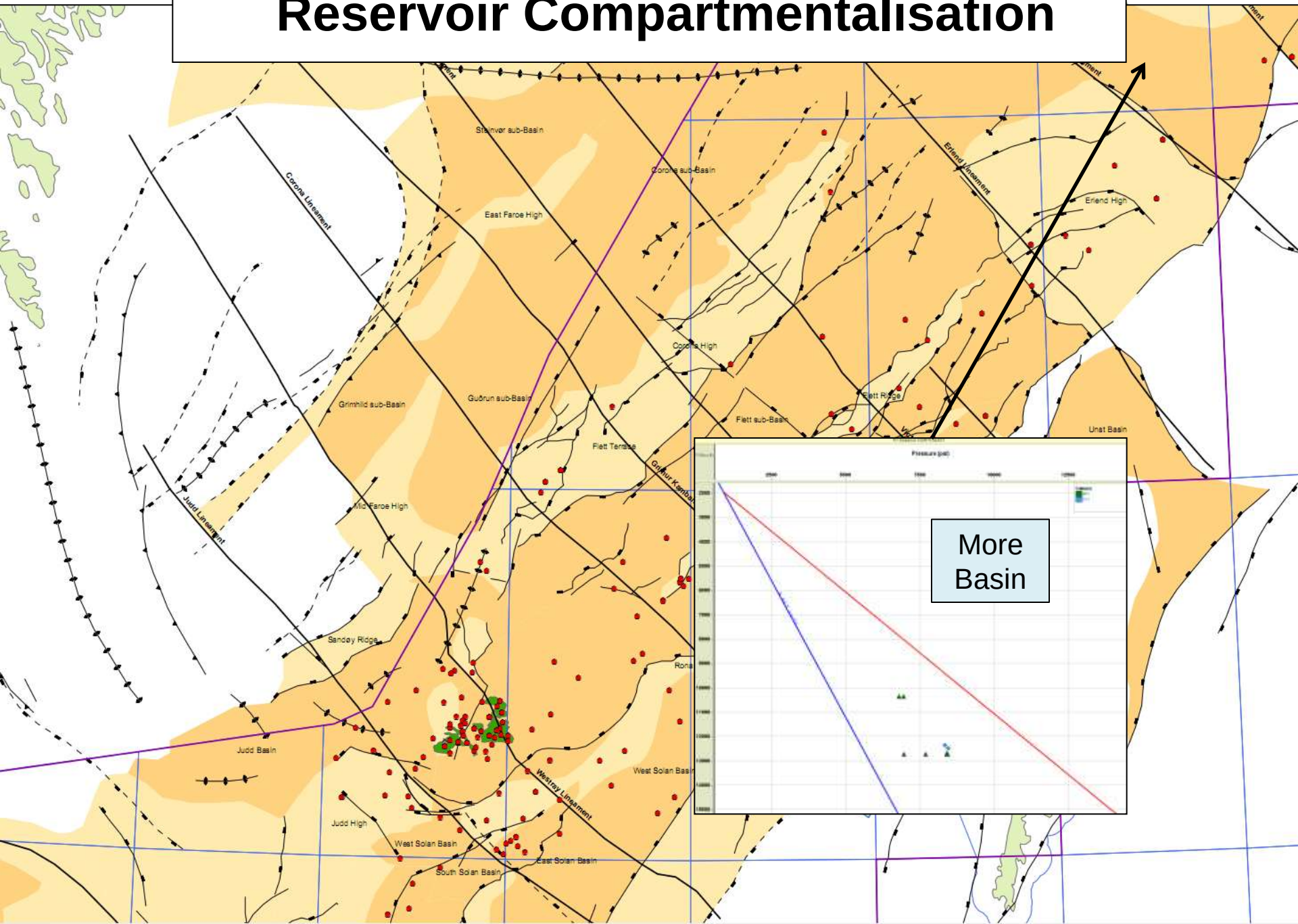
Composite Logs
Mud Logs/Formation Evaluation Logs
End of Well Reports/Final Well Reports
DST Reports
Fluid sample reports
Directional Survey Reports
Wireline Formation Test Logs (i.e. RFT, MDT, FMT, RCI, etc.)

(3) Apatite Fission Track (AFTA), Vitrinite Relectance (VR) and Geothermal data - supplied by GeoTrack International, Australia – 38 wells

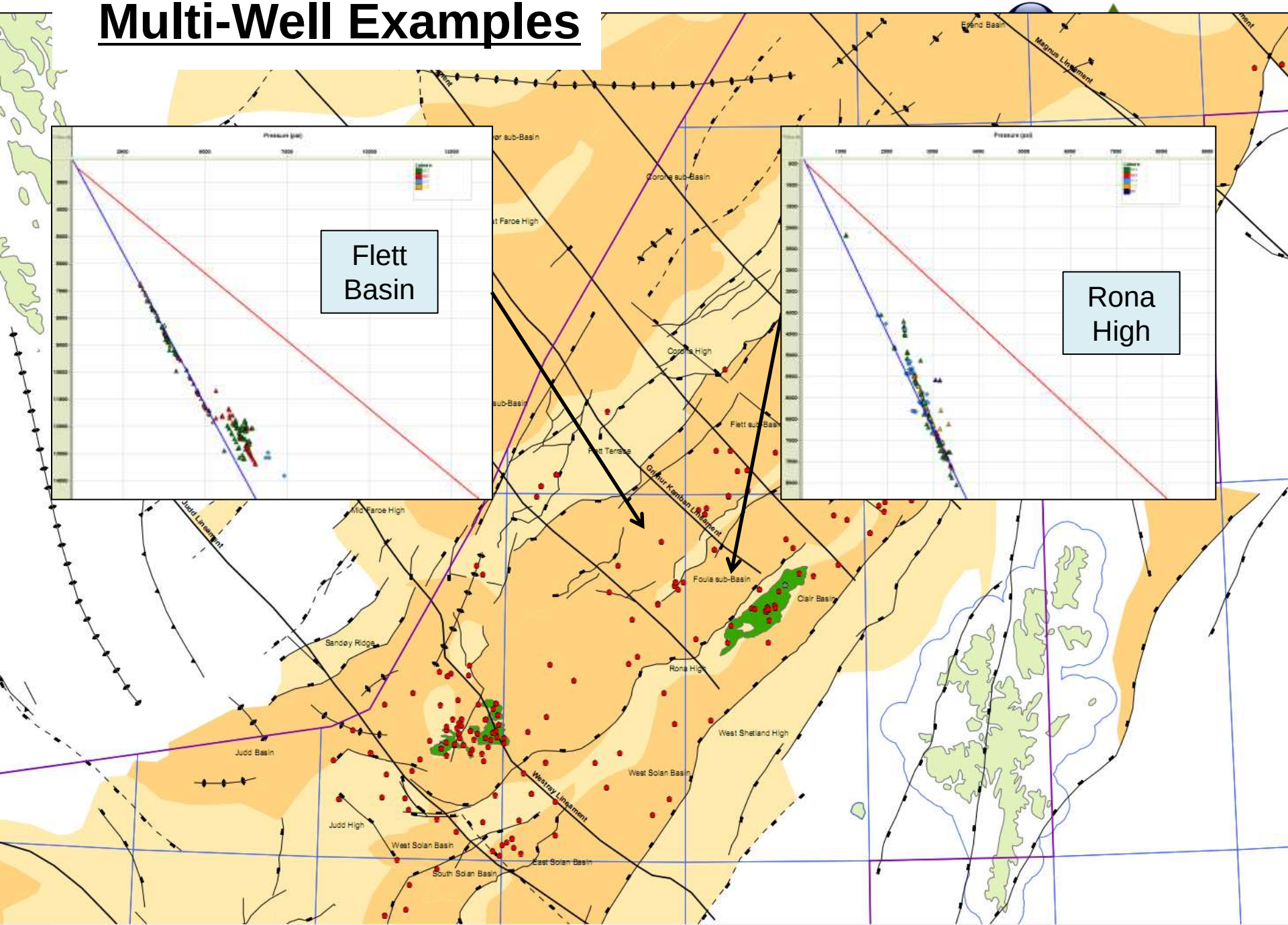
(4) Sonic-log assessment of uplift (23 wells) – University of Adelaide/BGS

(5) Ichron Stratigraphic Classification

Reservoir Compartmentalisation



Multi-Well Examples



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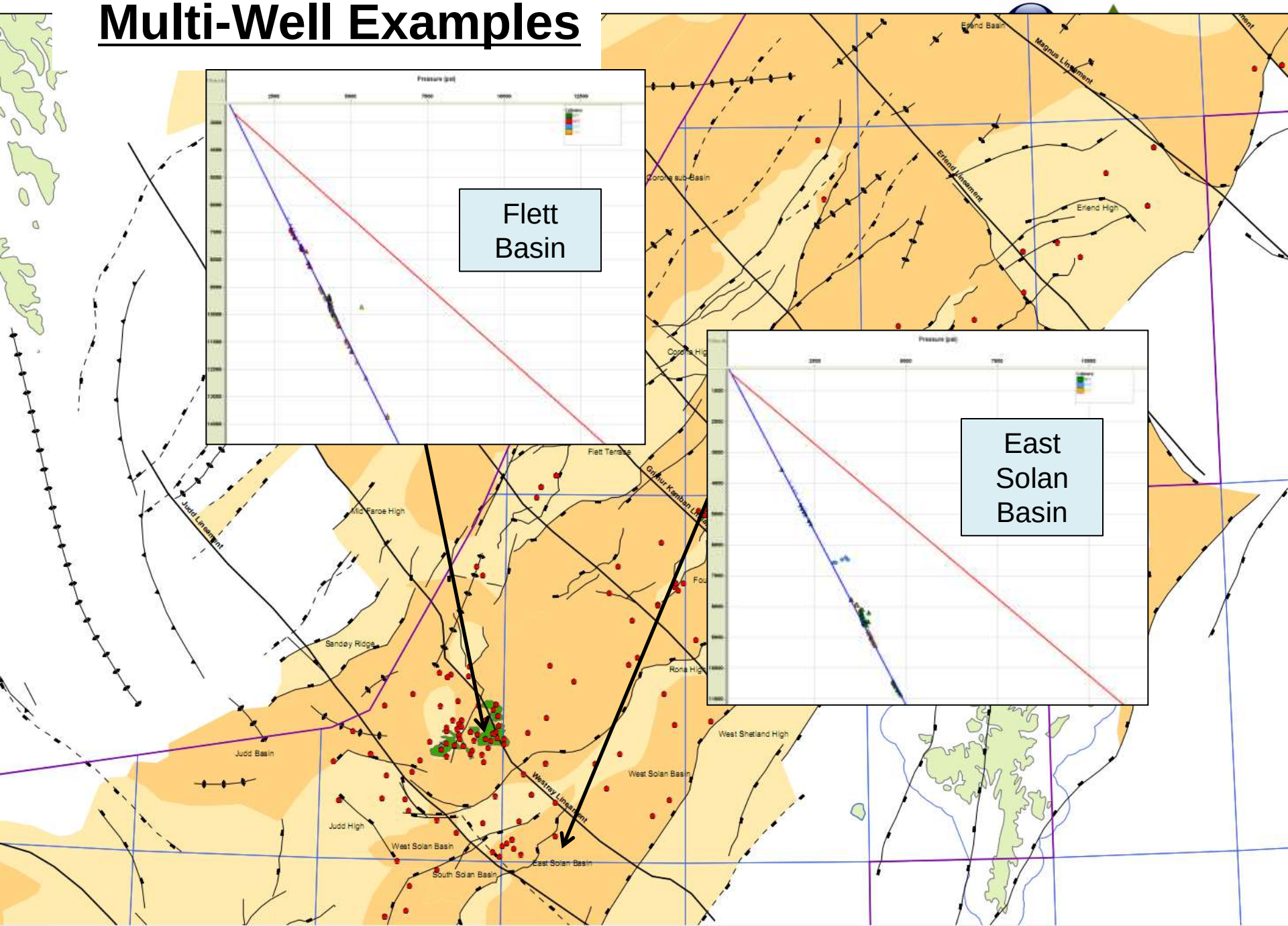

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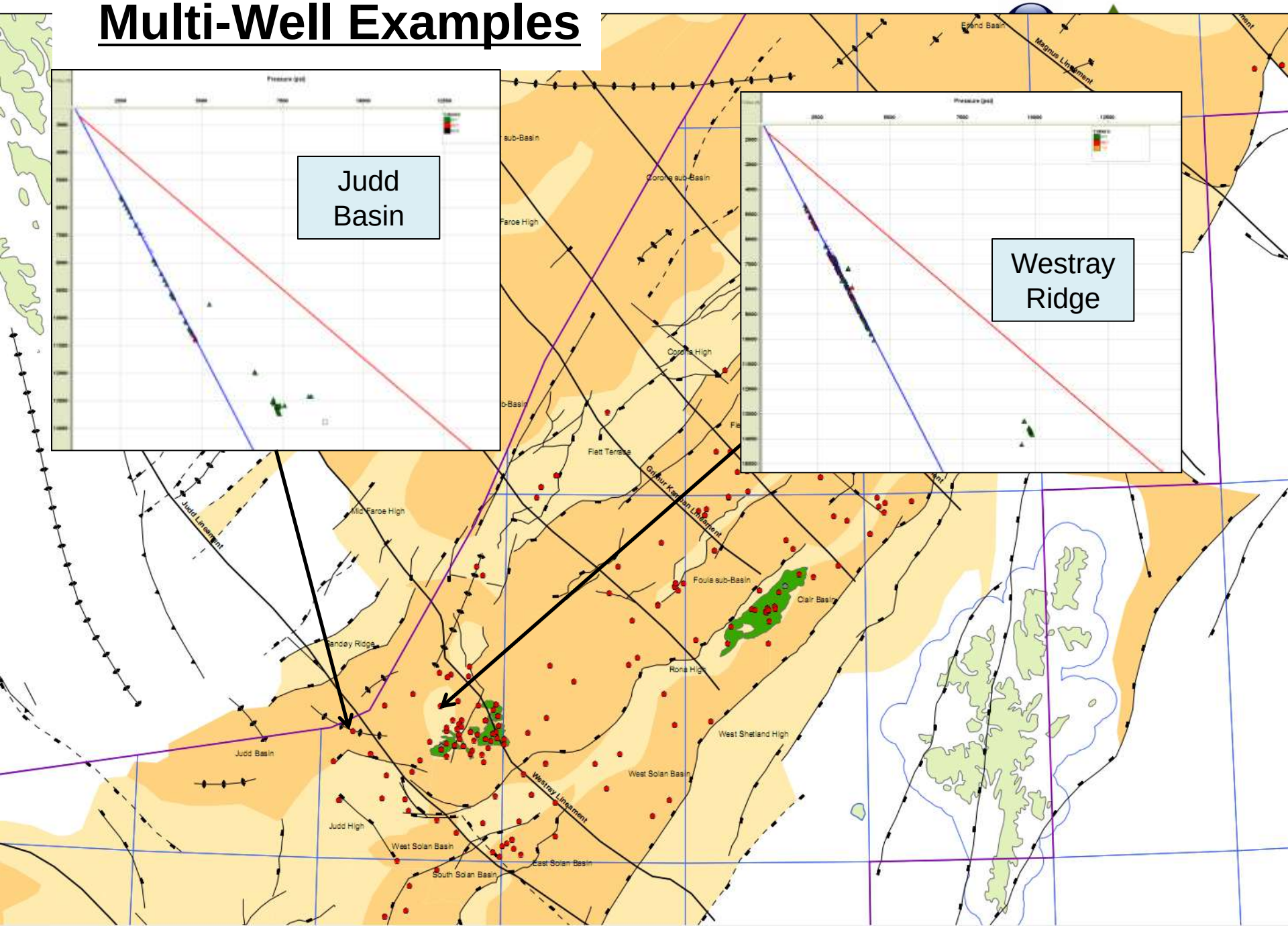
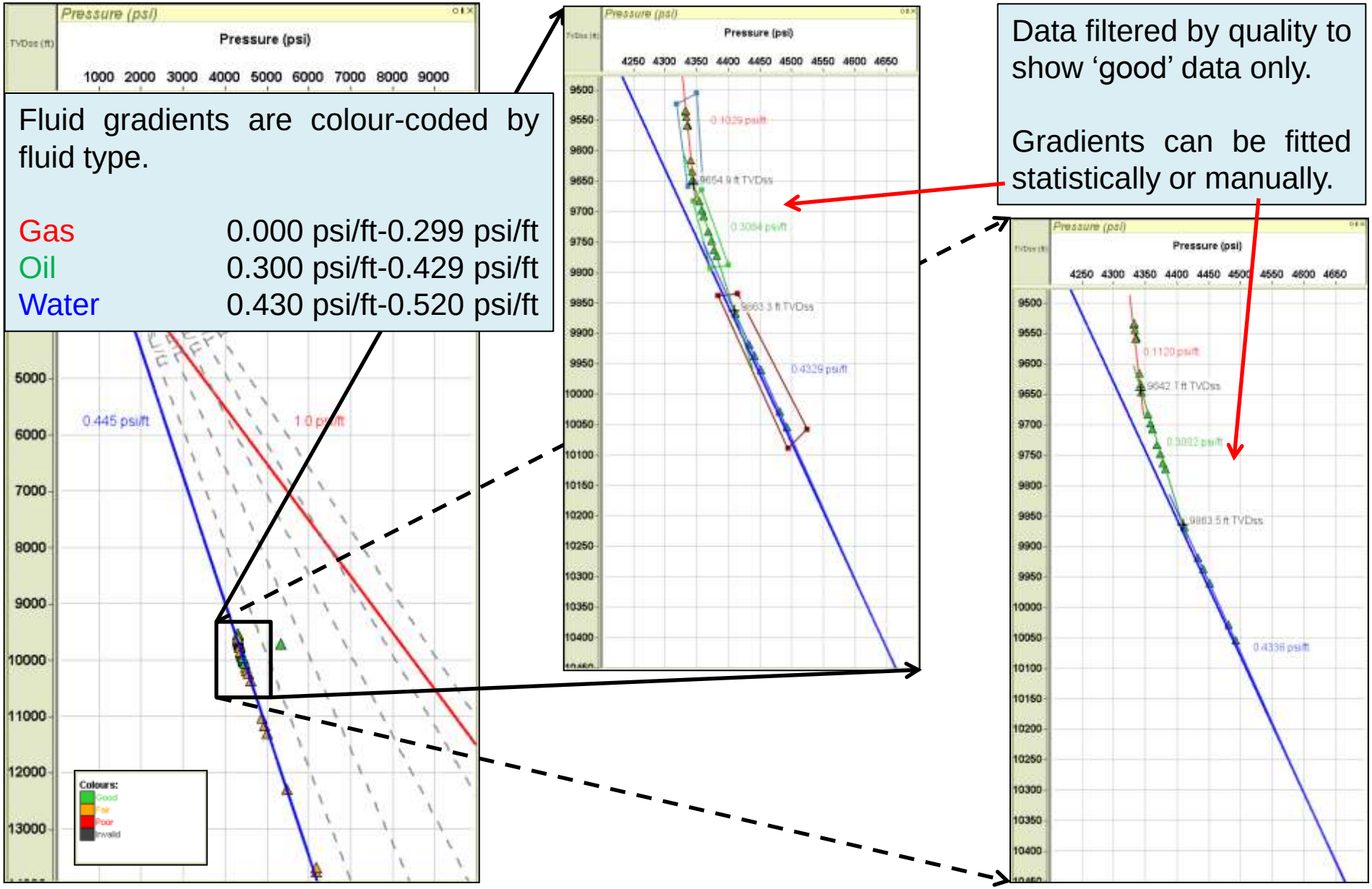
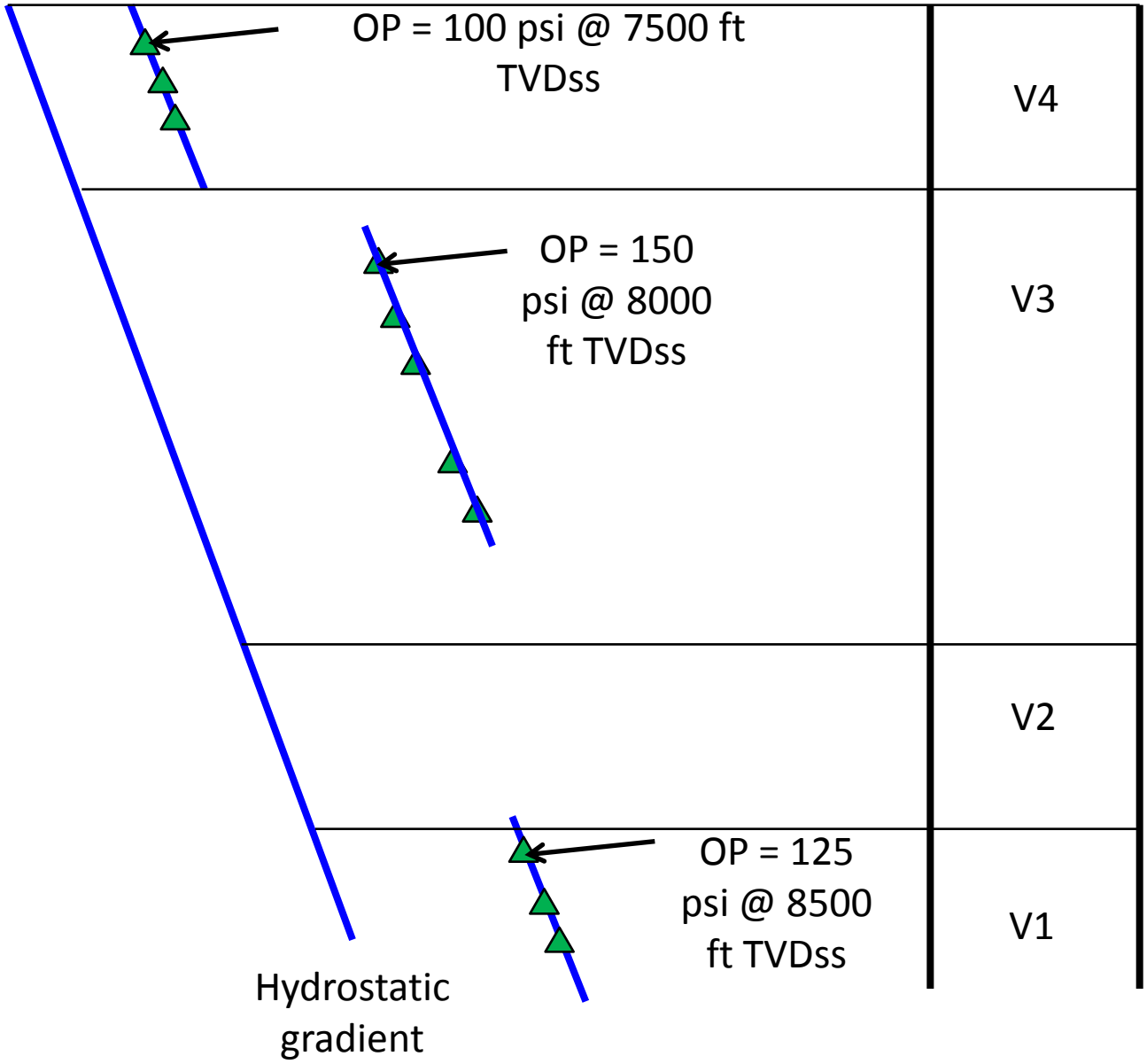


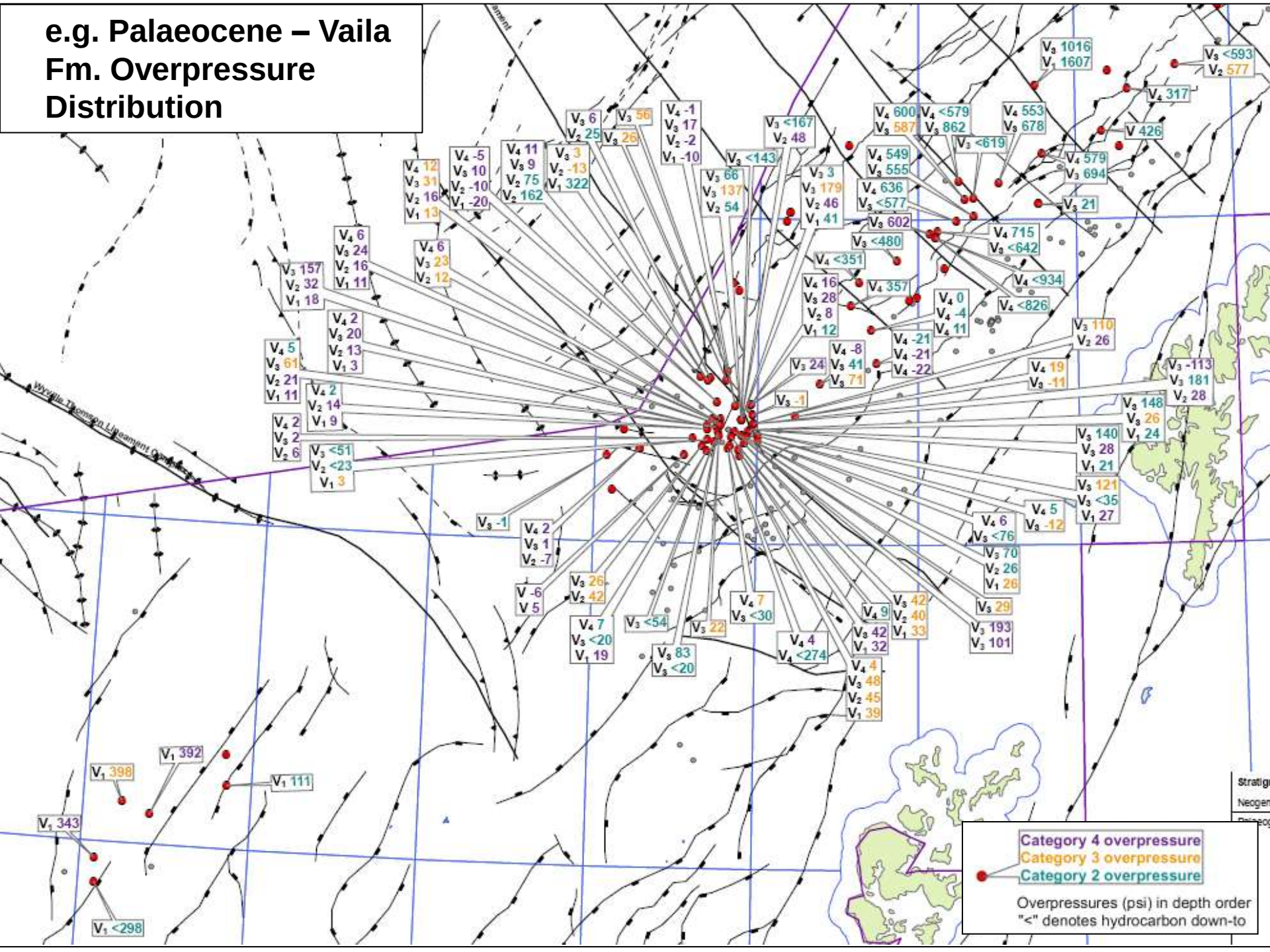
Pressure vs. Depth Plots



Vertical Seals e.g. Vaila Fm.



e.g. Palaeocene – Vaila Fm. Overpressure Distribution

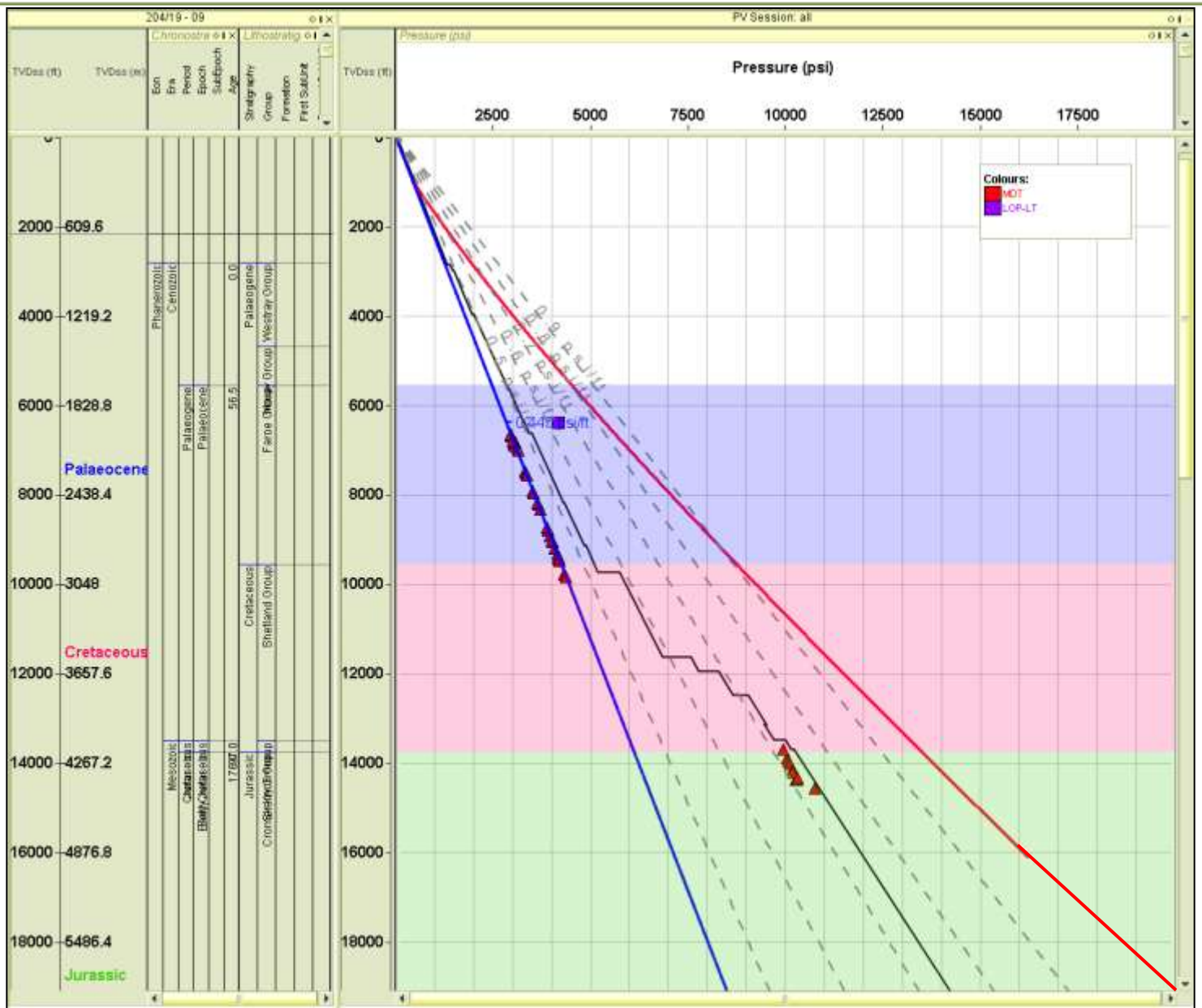


1. Reservoir Compartmentalisation

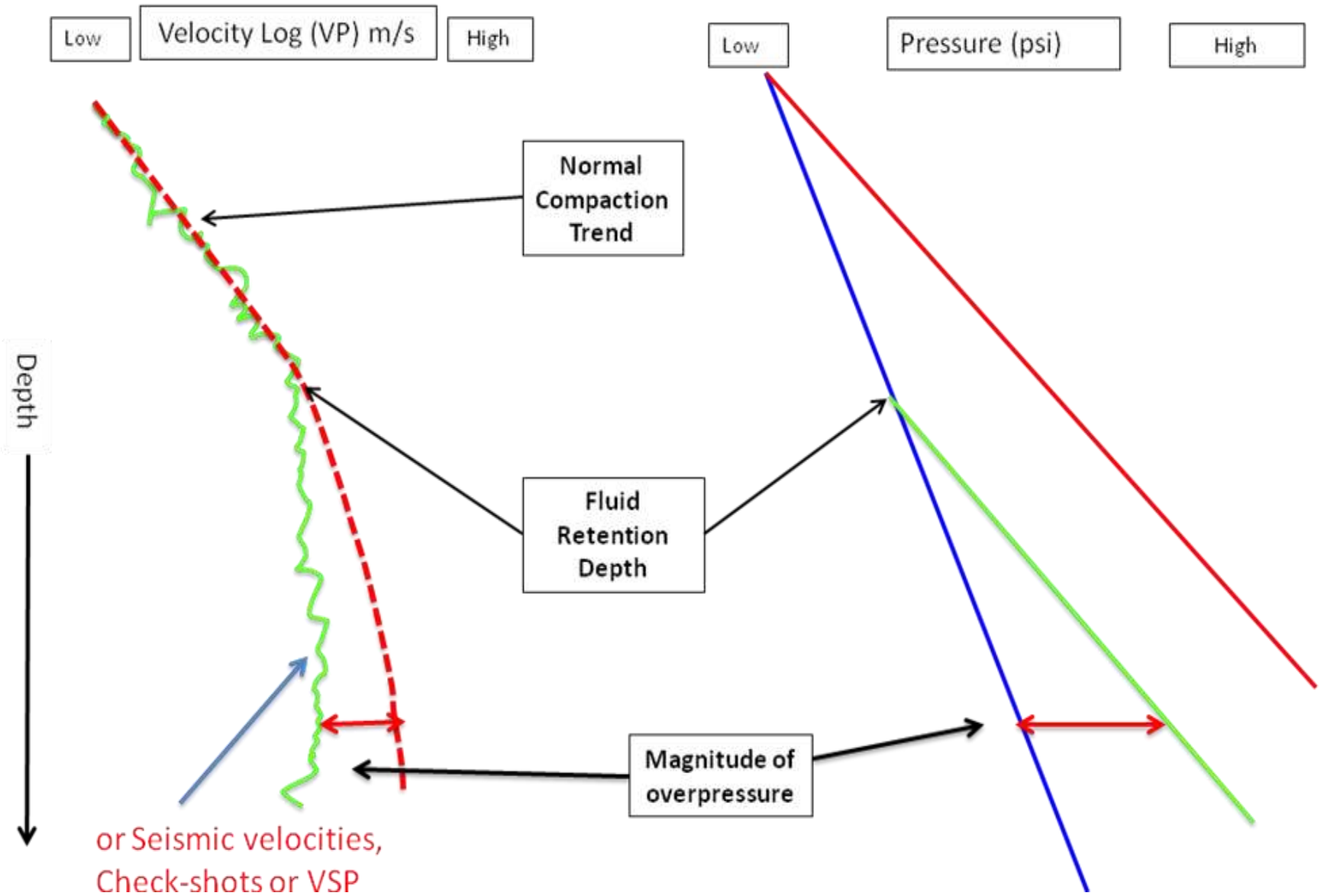
- Compartmentalization between Vaila units
- Kettla Tuff; in wells that have overpressure data in Lamda and Vaila sands (approximately 30 wells), in the majority of cases, there is minimal overpressure differences between the horizons
- In the same Formation between the Corona and Victory Lineaments, at the same depth, a series of overpressure compartments are identified.

>> more effective understanding of lateral (and vertical) seals

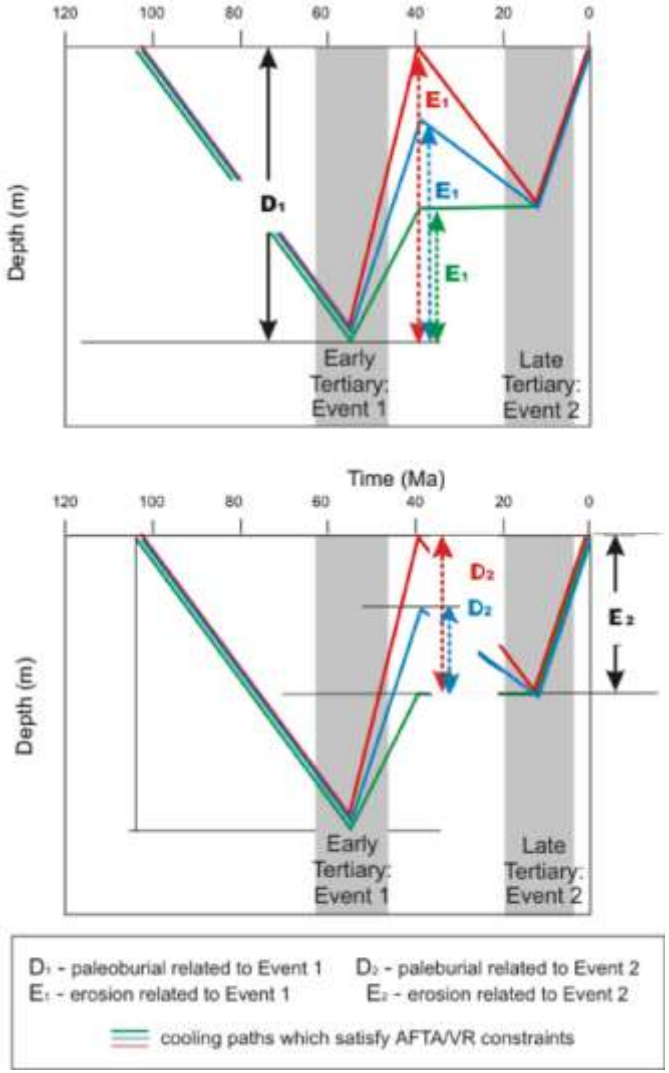
Shale Pressures based on Mud-weight?

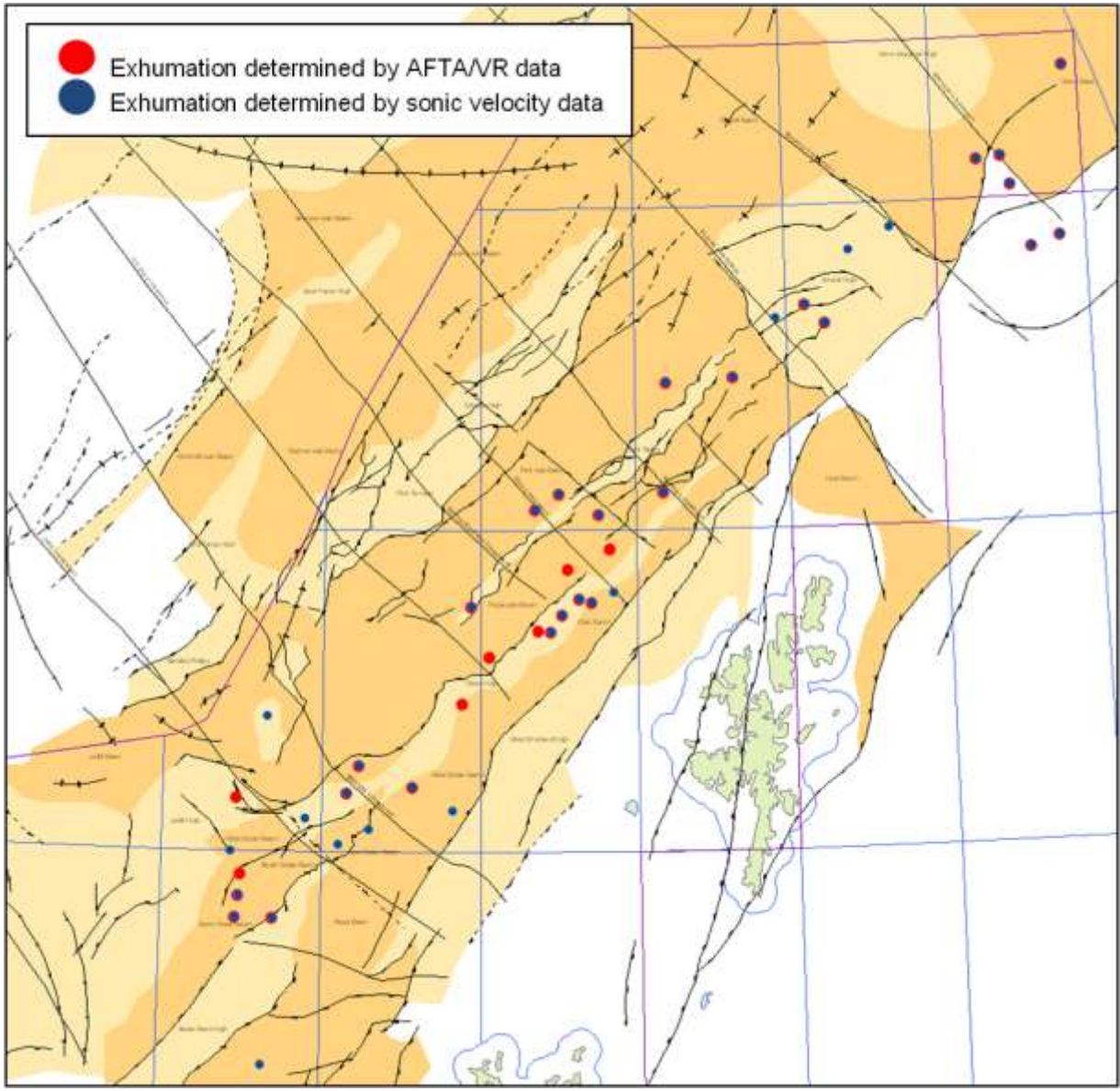


Pressure Prediction in Shales

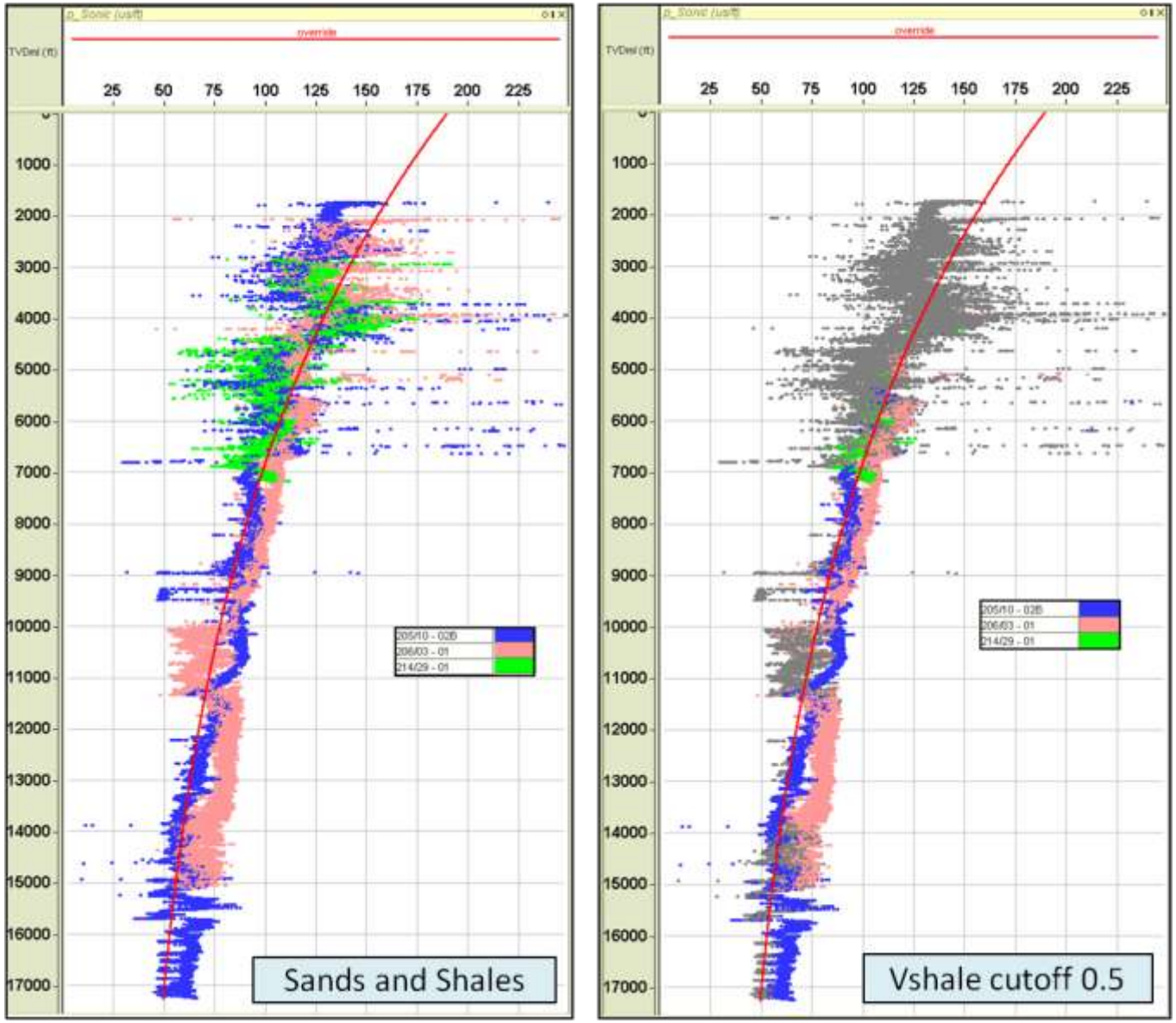


AFTA and VR data – Assessment of uplift



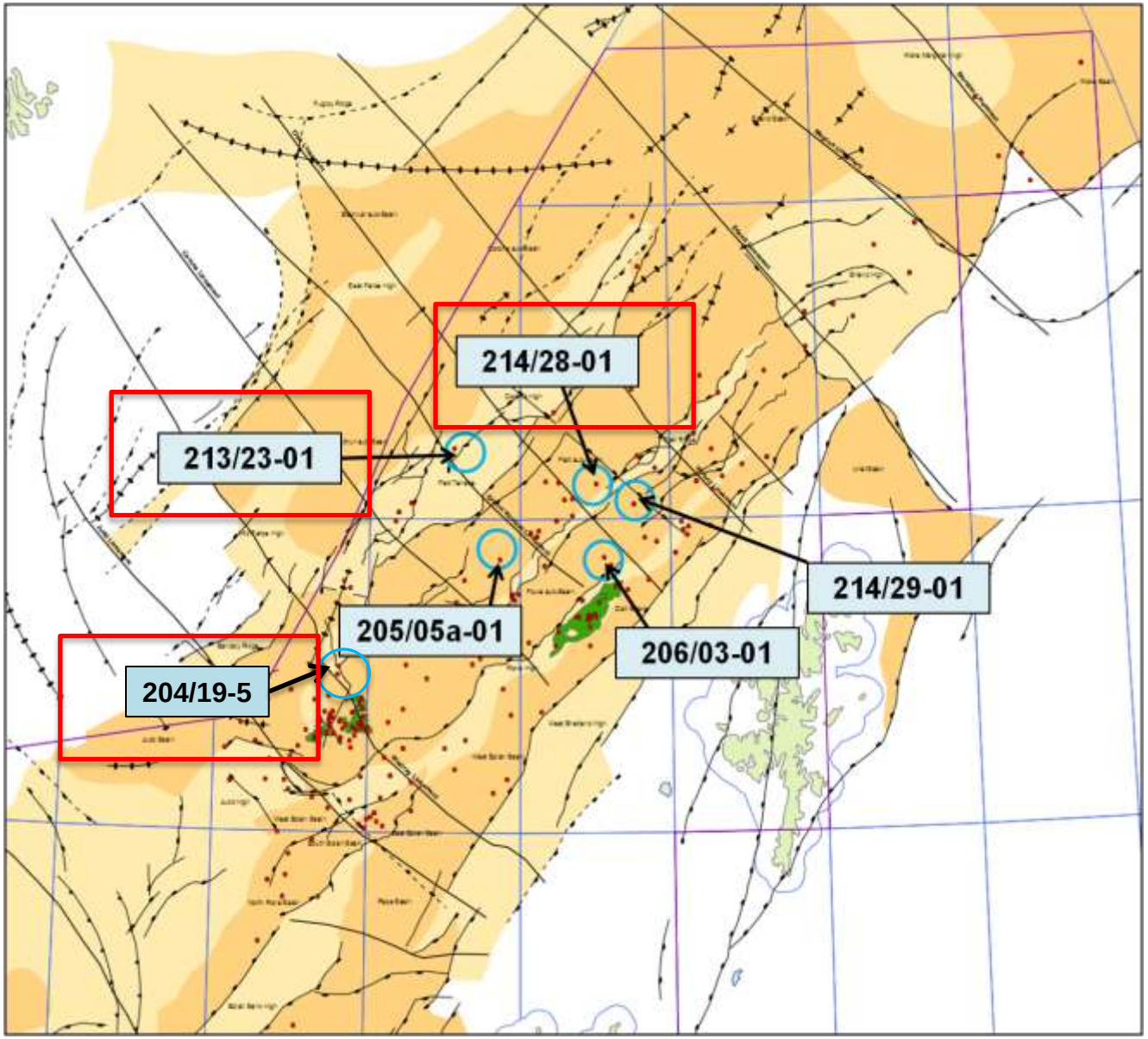


Defining compaction behaviour

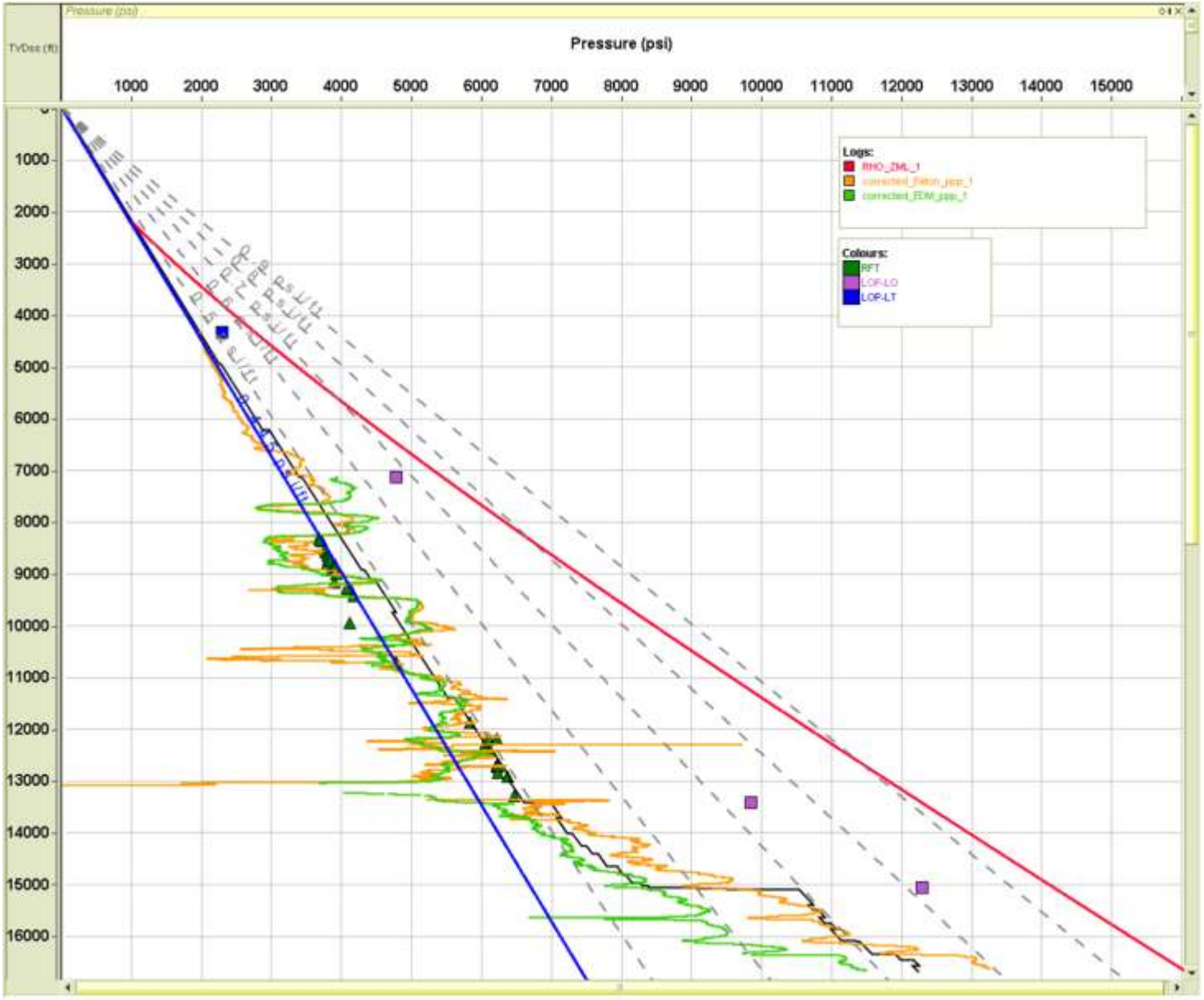


To establish the normal compaction behaviour for shales in the West of Shetlands region shale sonic velocity values were selected from wells thought to be presently at their maximum burial depth on the basis of AFTA and VR data

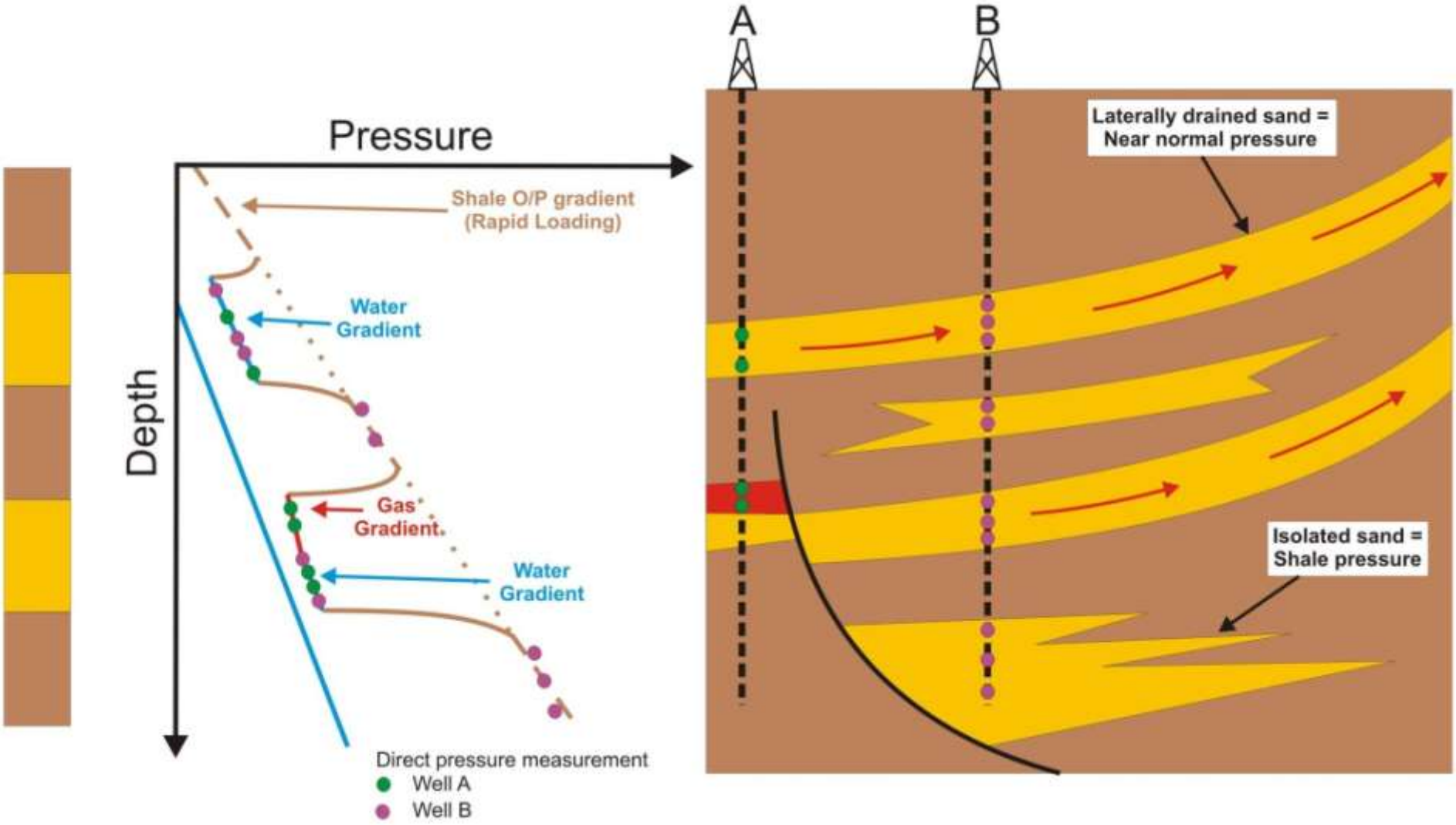
Sand vs. Shale Pressures



Well 214/28-1; shale pressures >> reservoirs



West of Shetland – Conceptual Model



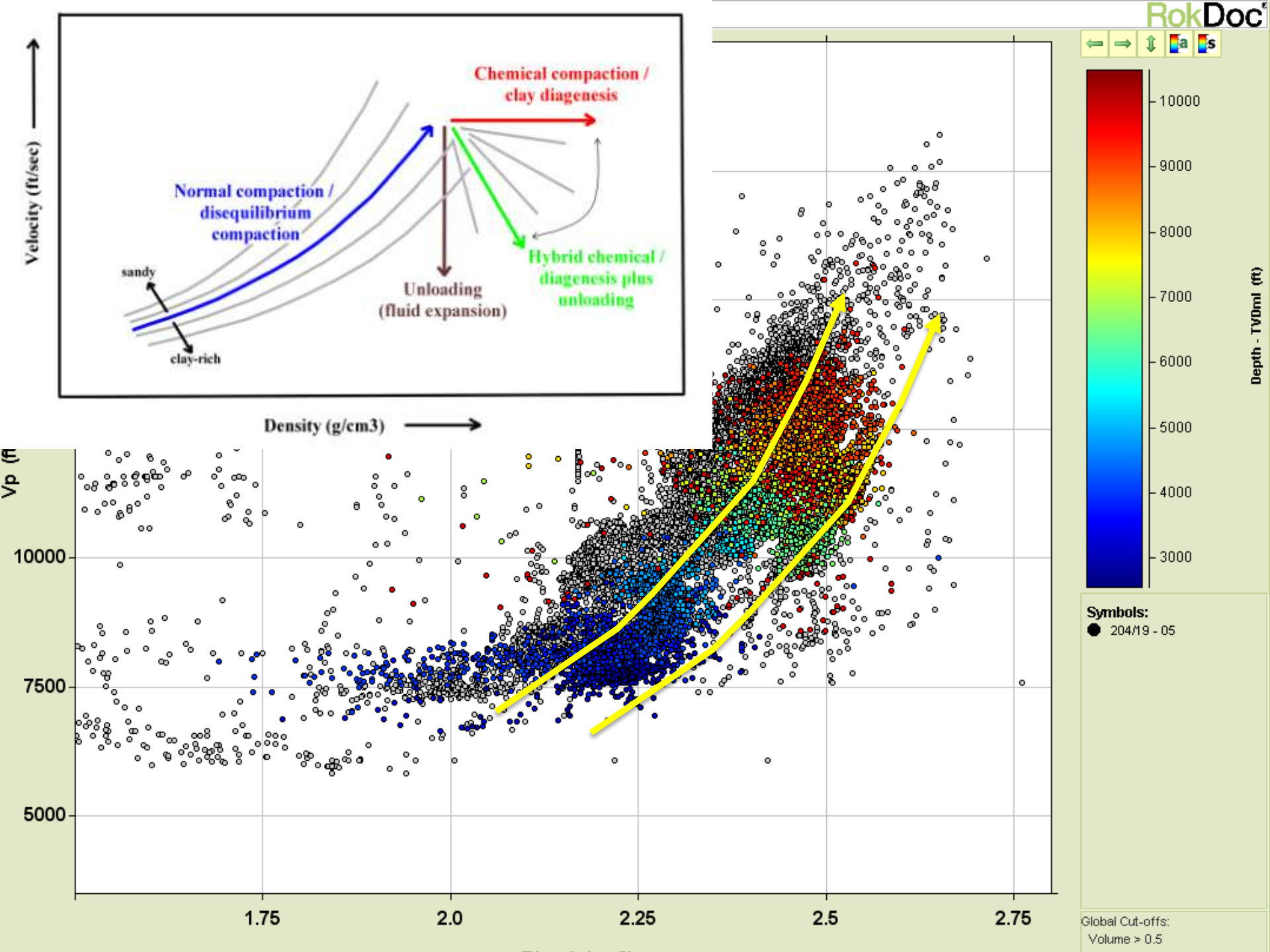
2. Reservoir vs. Shale Pressures

- Majority of reservoirs are naturally drained relative to their associated shales
- Drainage is proportional to permeability and time
- Stratigraphic isolation i.e. fault seal or low net/gross; sand = shale pressure – use seismic facies!!

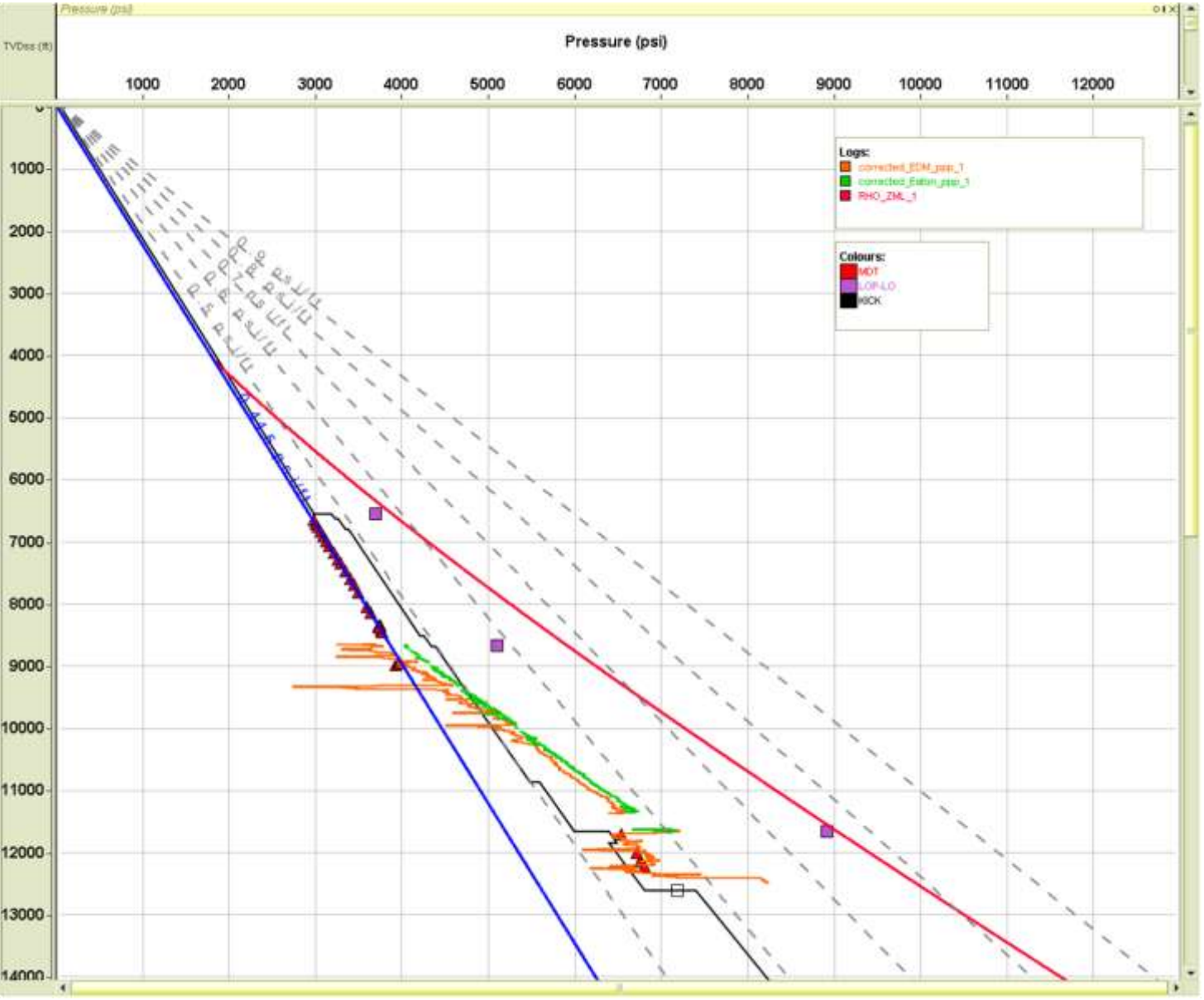
>> enhances primary migration

>> enhanced seal capacity (res vs. seal pressure)

>> calibration for basin models


RokDoc
Velocity (ft/sec)
Chemical compaction / clay diagenesis
Normal compaction / disequilibrium compaction
sandy
clay-rich
Unloading (fluid expansion)
Hybrid chemical / diagenesis plus unloading
Density (g/cm3)
Vp (ft
10000
7500
5000
1.75
2.0
2.25
2.5
2.75
10000
9000
8000
7000
6000
5000
4000
3000
Depth - TVDml (ft)
Symbols:
204/19 - 05
Global Cut-offs:
Volume > 0.5

3. Implications for well planning



Well 213/23-1

3. Drilling Wells

>> **Complex sand vs. shale pressures = complex mud-weights!!**

>> Maps of overpressure to identify prospect pressure regime (Stratigraphic traps vs. draining reservoir play)

>> Predictive algorithms for shale pressures

Benefits of the Work

- Predict aquifer overpressures in prospect reservoirs using Stratigraphic maps, defined on Ichron Stratigraphic scheme.
- Identify drained (hydrodynamic) and un-drained (strong seals) reservoirs in acreage.
- Provide understanding on uplift using AFTA, VR and sonic log data, with results suggesting differential amounts across Basin.
- Variations in fault seal mapped providing potential for understanding structural trapping..
- Forward-predict pore pressures in shales for future drilling i.e. seismic-based pore pressure prediction - cemented shales.....
- Provide algorithms for safe well-planning (overburden and fracture models).

Any Questions?

Thank you