CASE STUDY OF A TERTIARY ONSHORE FIELD FROM CUENCA SURESTE: A JOINT PROJECT WITH GX TECHNOLOGY

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RYDER SCOTT CO.

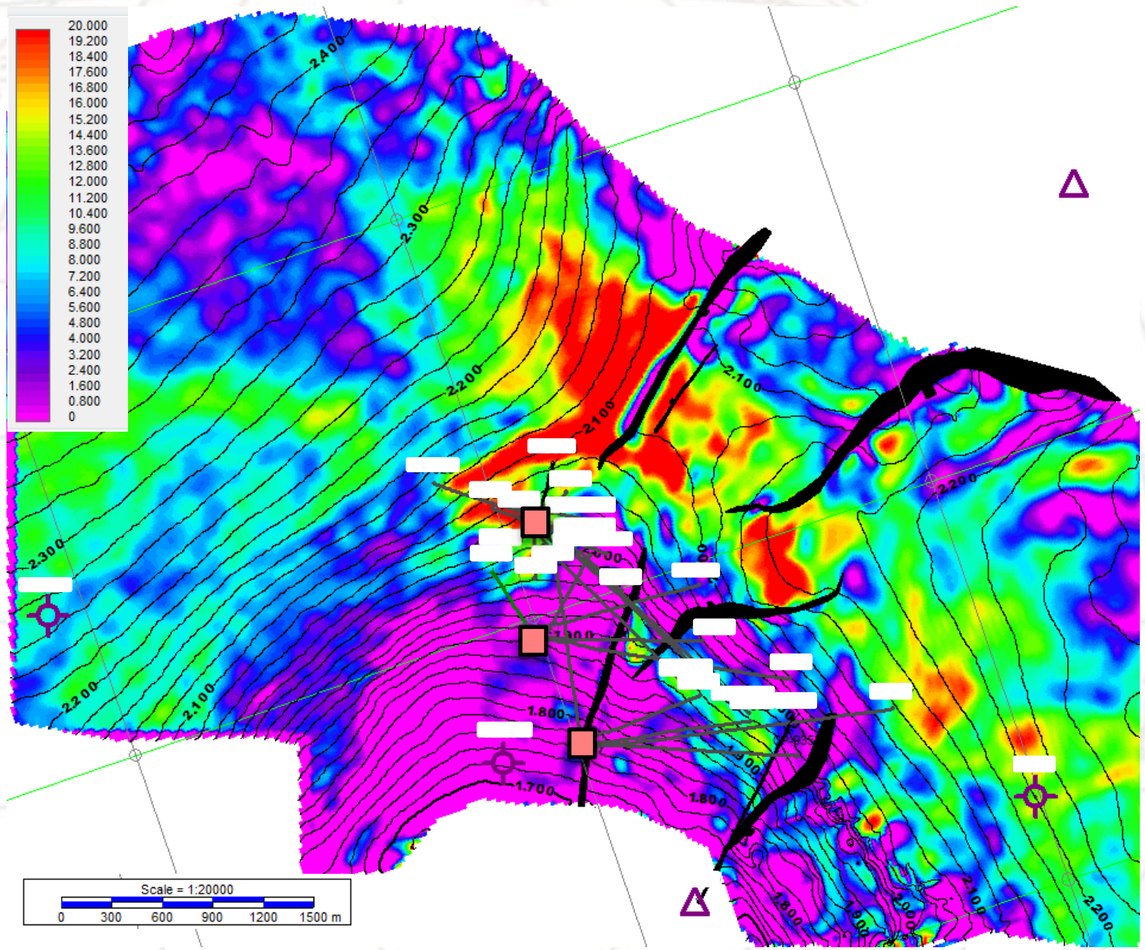
OUTLINE

- **New title: Rock physics – An overlooked component of Reservoir Modeling.**
- **Geological settings and challenges description**
- **Rock Physics Analysis**
  - What are we trying to do?
  - How it strengthens your Static Model….
  - ….and ultimately allows you to have a reliable Dynamic Model
  - ….and unlock new opportunities
- **Conclusions**

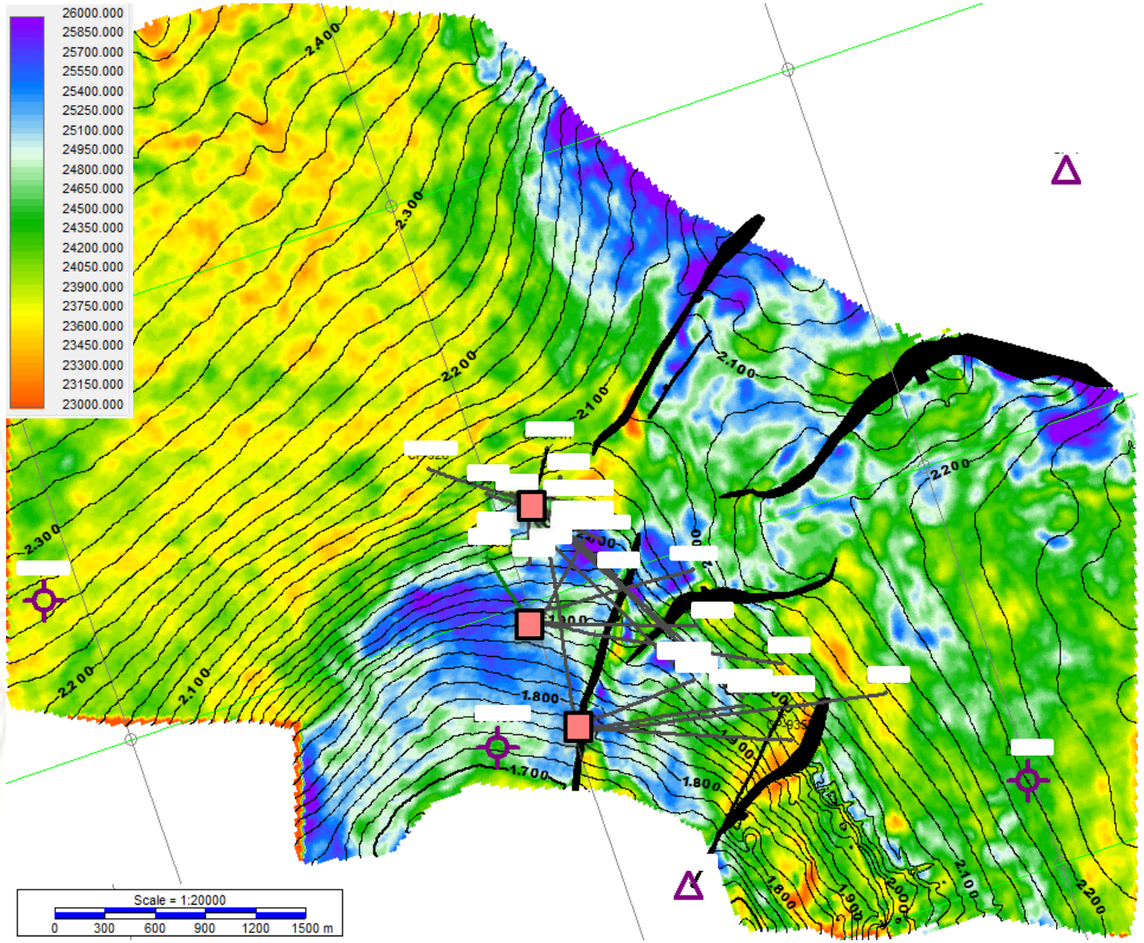
Rock physics

- **Is used to relate elastic parameters derived from seismic data to specific rock properties**
  - Impedance is the product of rock Velocity and Density
  - Acoustic Impedance involves the compressional wave: **AI = Vp * rhob**
  - Shear Impedance involves the shear wave: **SI = Vs * rhob**
- **Petrophysics mostly concerns the reservoir interval while Rock physics concerns reservoir and overburden.**

Can rock physics analyses optimize development?

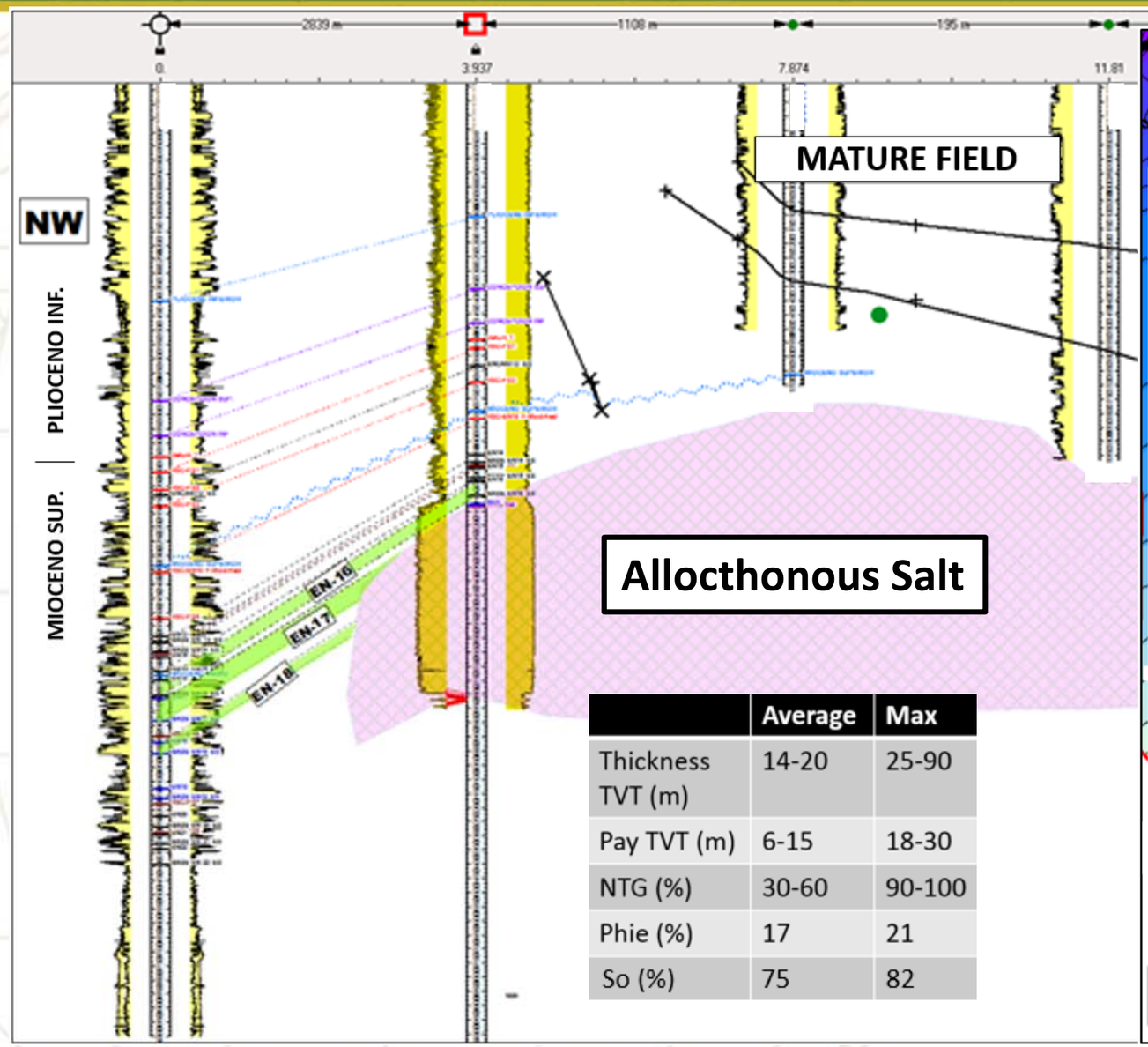


2009 RMS amplitude on shallower reservoirs

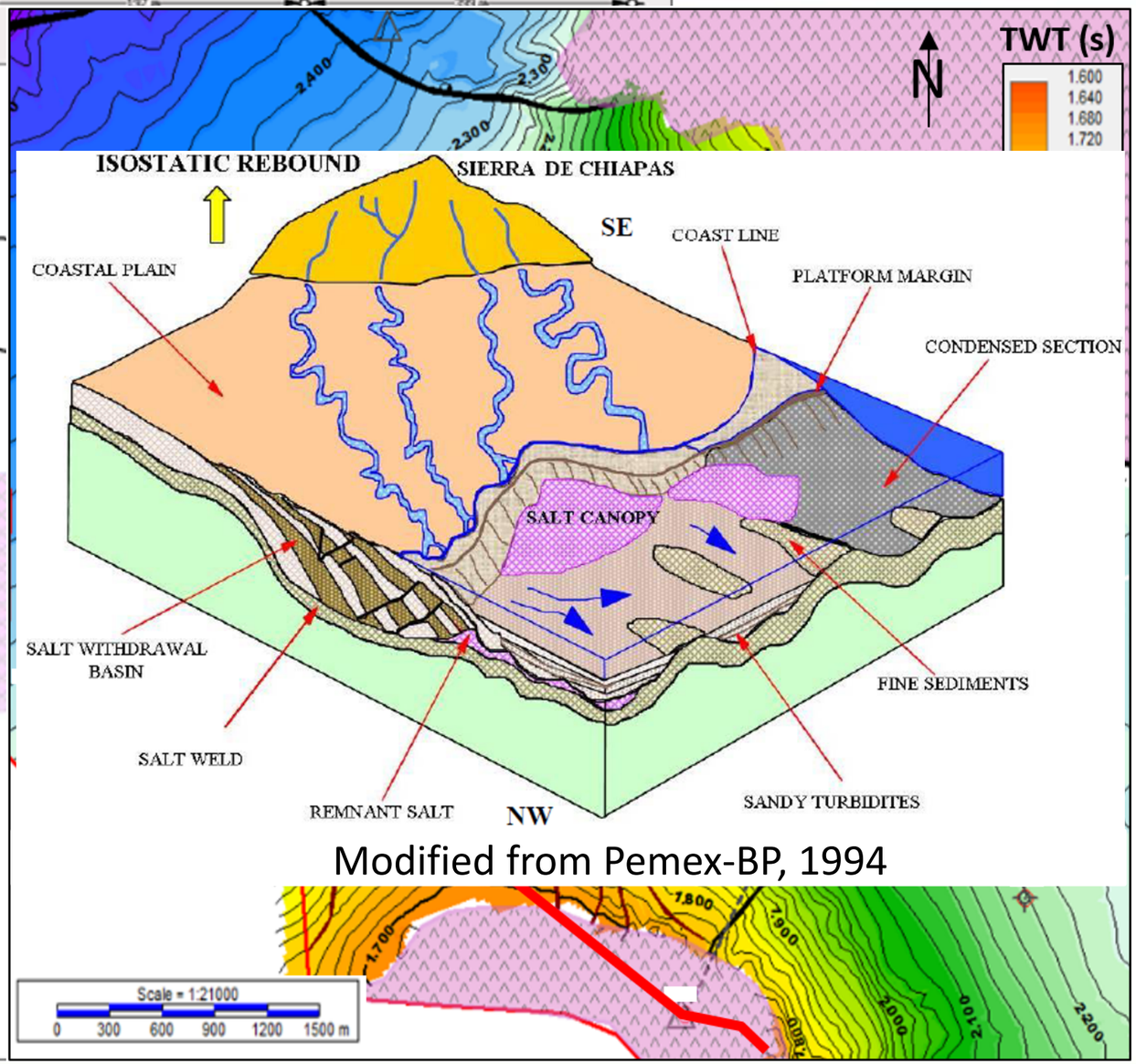


2018 Well-calibrated (1st pass) Acoustic Impedance on shallower reservoirs

Description of the settings

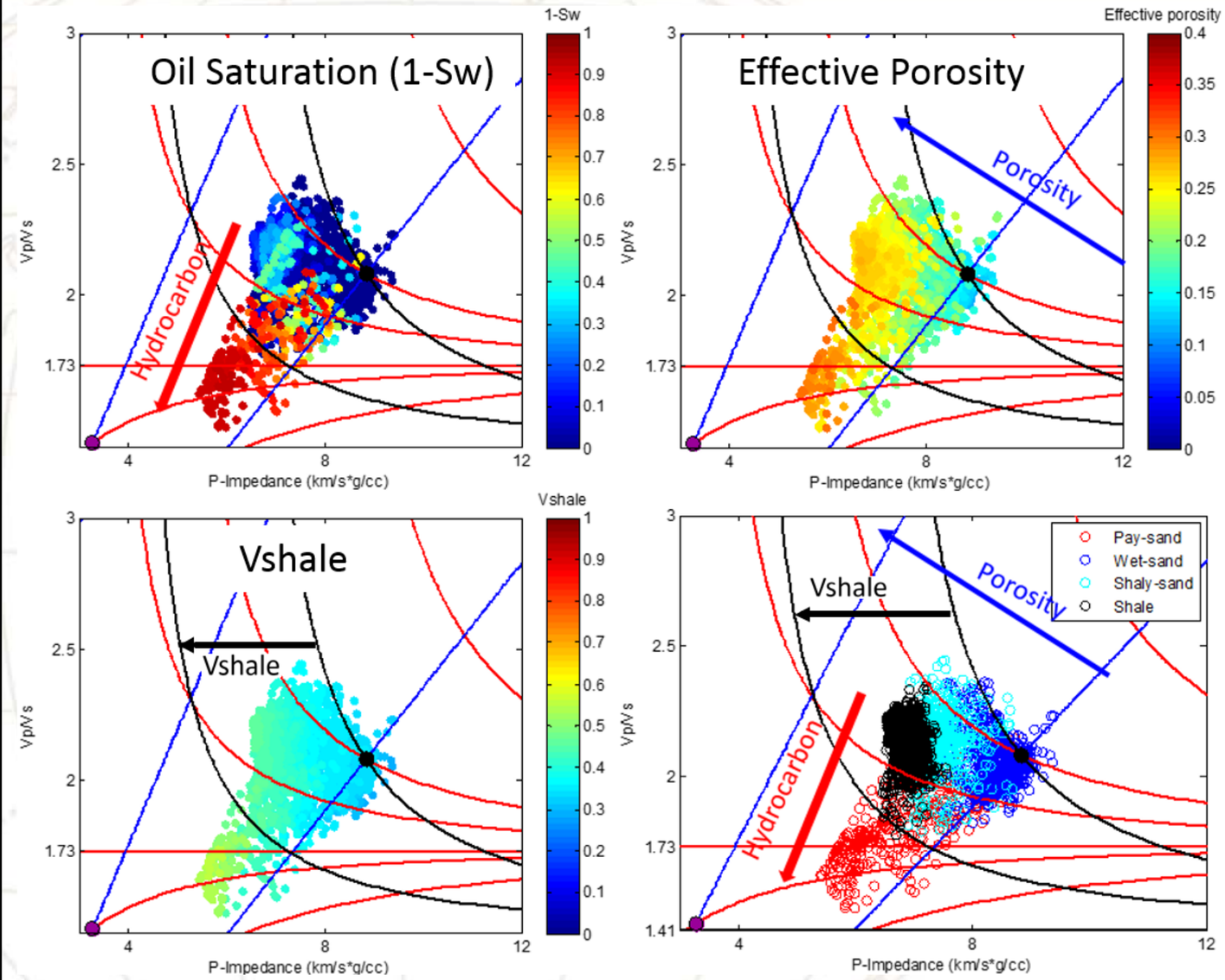


	Average	Max
Thickness TVT (m)	14-20	25-90
Pay TVT (m)	6-15	18-30
NTG (%)	30-60	90-100
Phie (%)	17	21
So (%)	75	82



Modified from Pemex-BP, 1994

Rock Physics is the bridge



- Derive from your well data the acoustic relationships that could be inferred from seismic.
  * Velocities and Density
- Do you see any possible discrimination?

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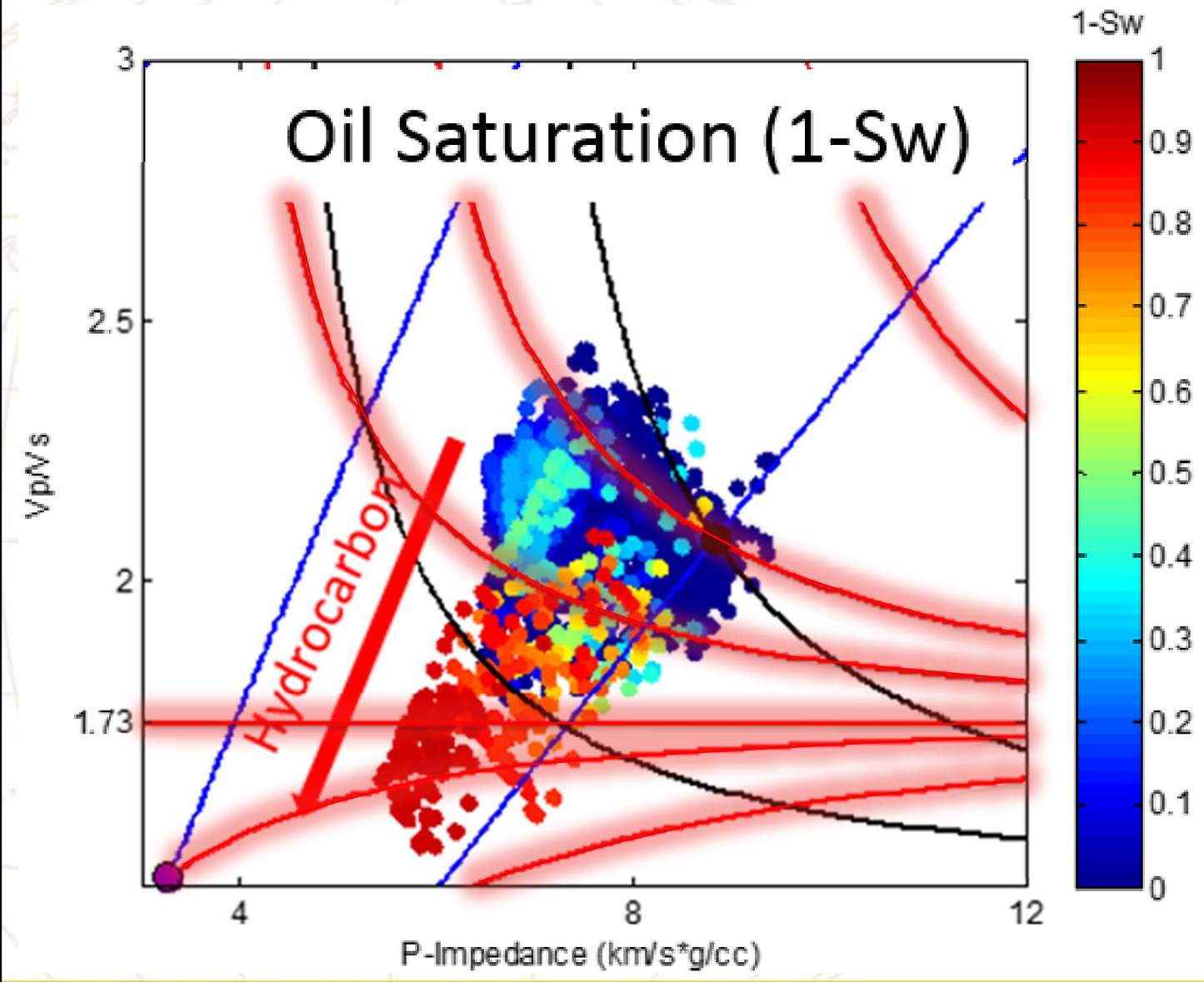

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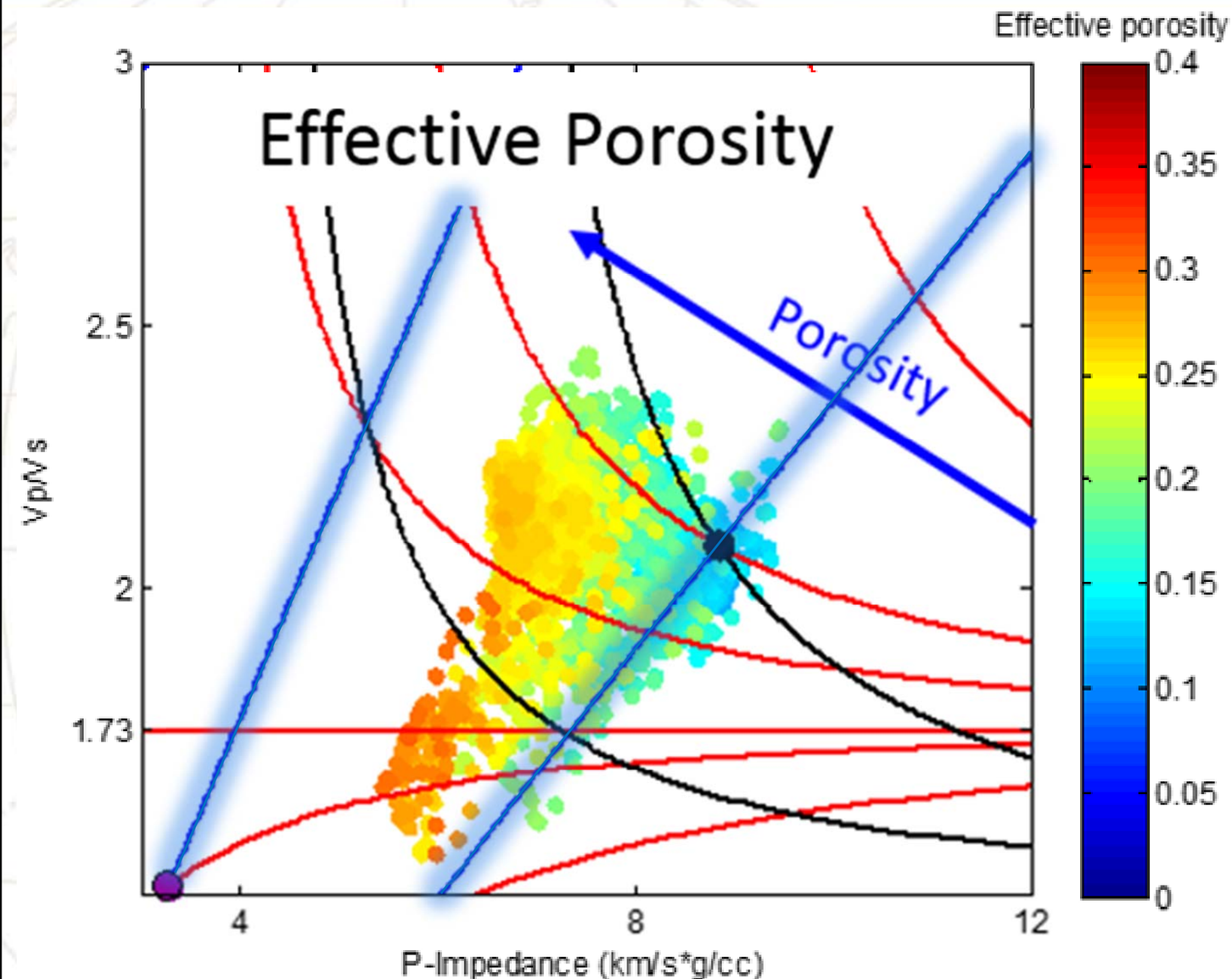

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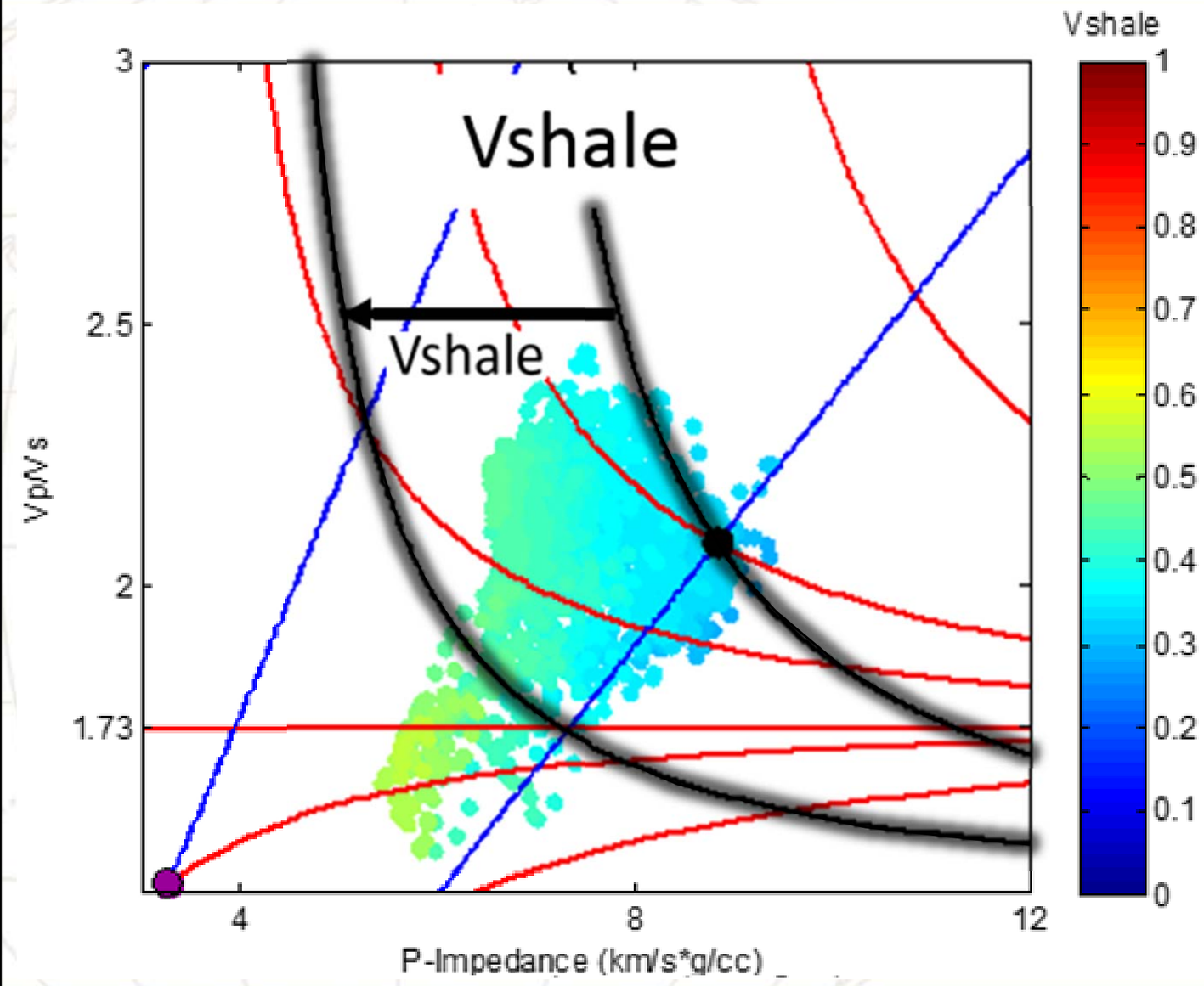

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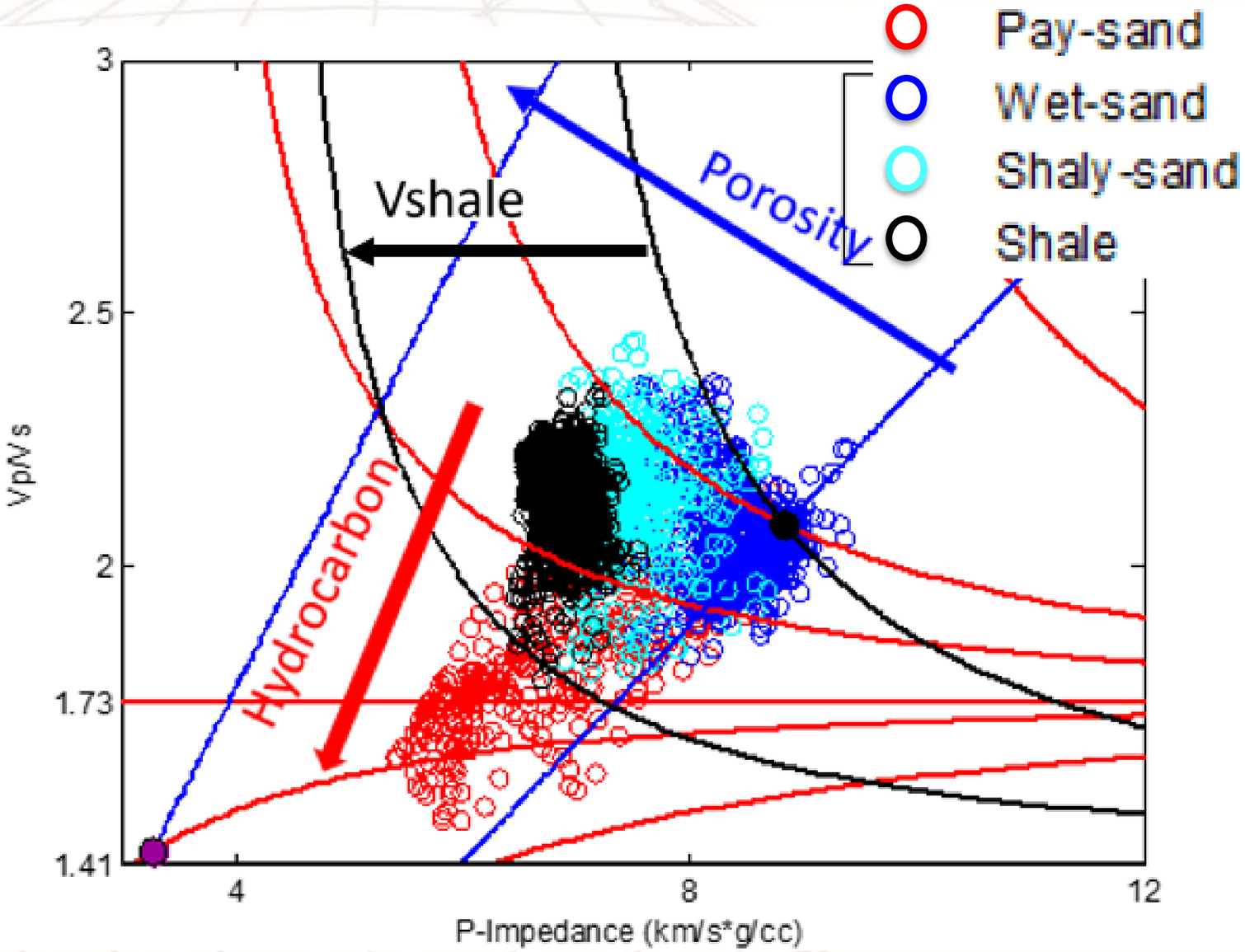

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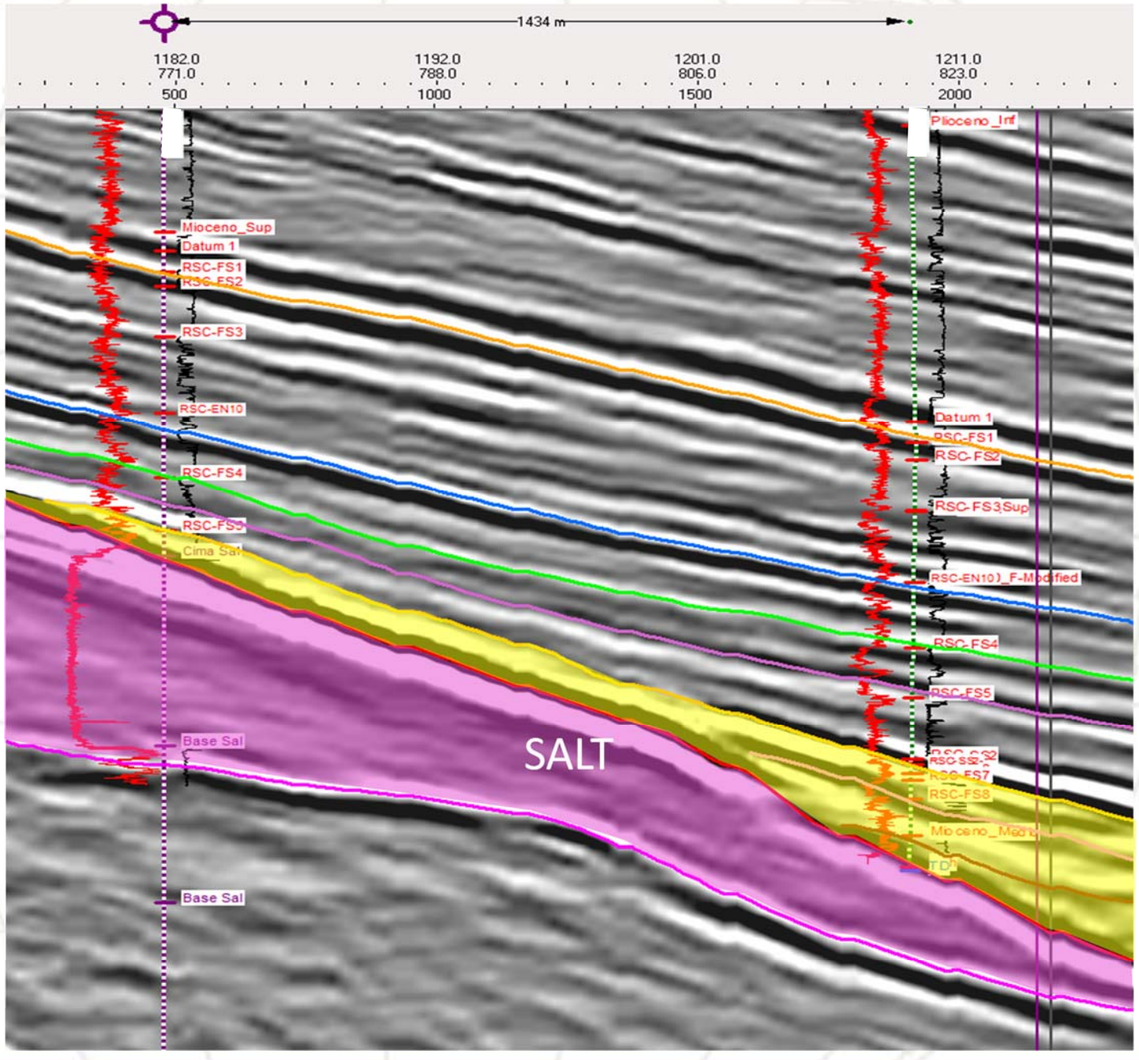
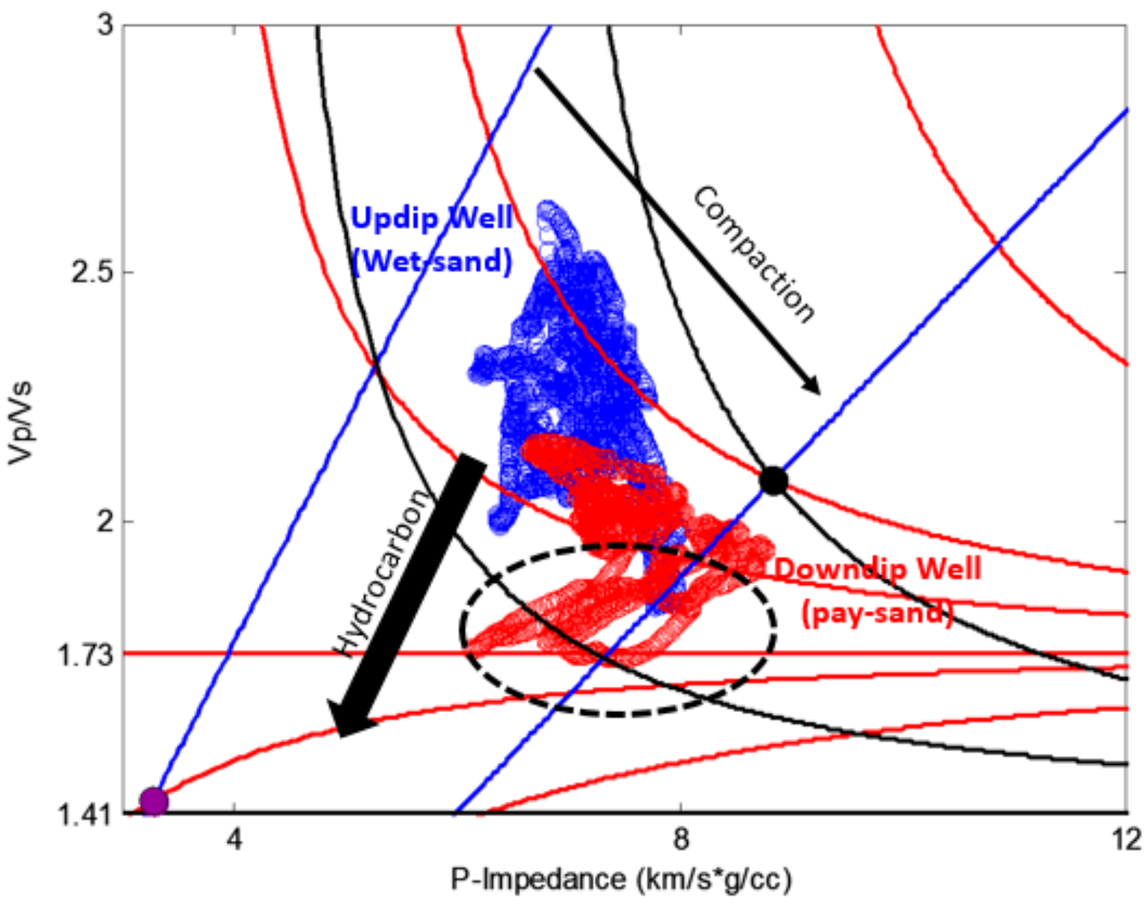
Rock Physics is the bridge

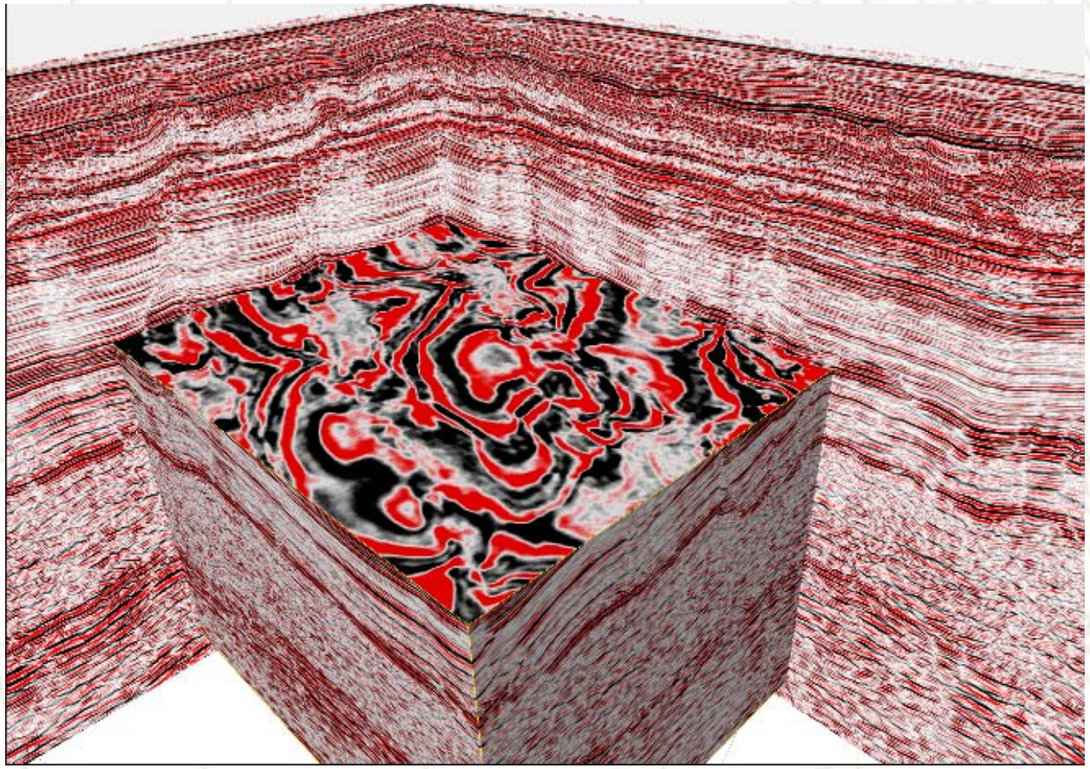
Analysis is robust when all cases (bad or good) are included

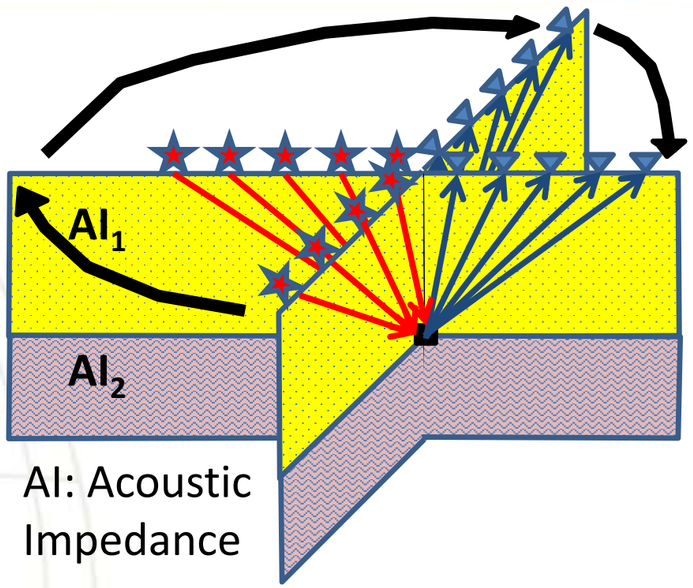


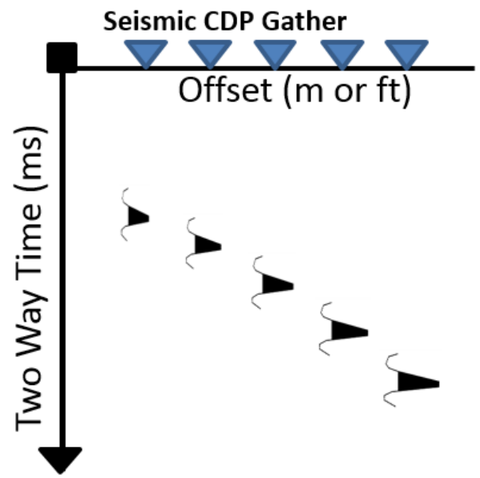


Rock Physics is the bridge

Is all seismic the same?







Post-Stack

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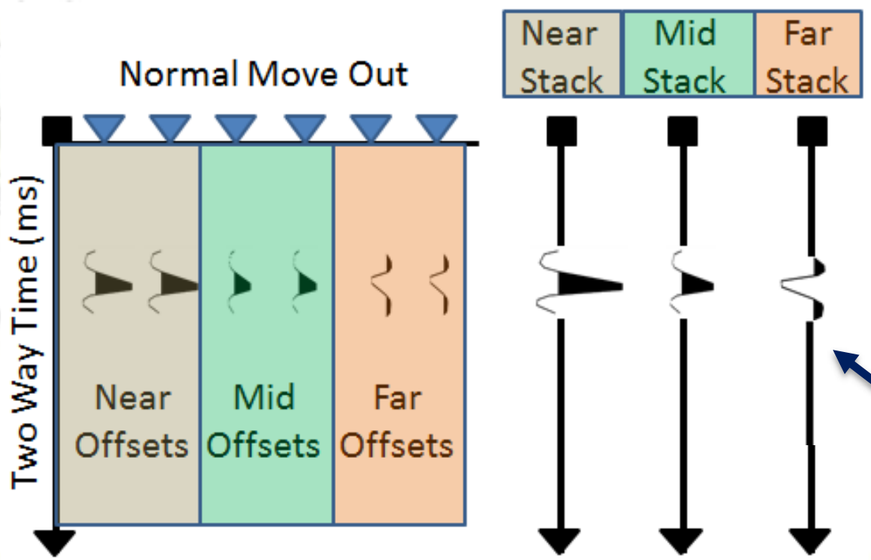
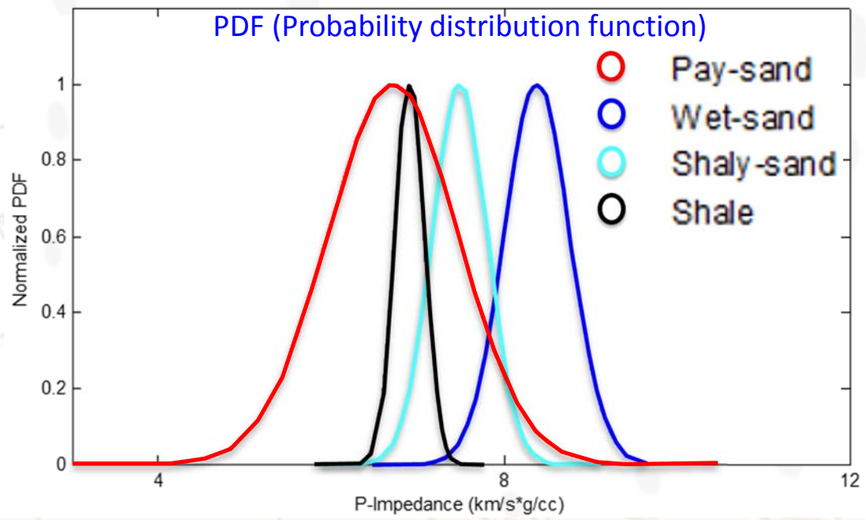
Pre-Stack

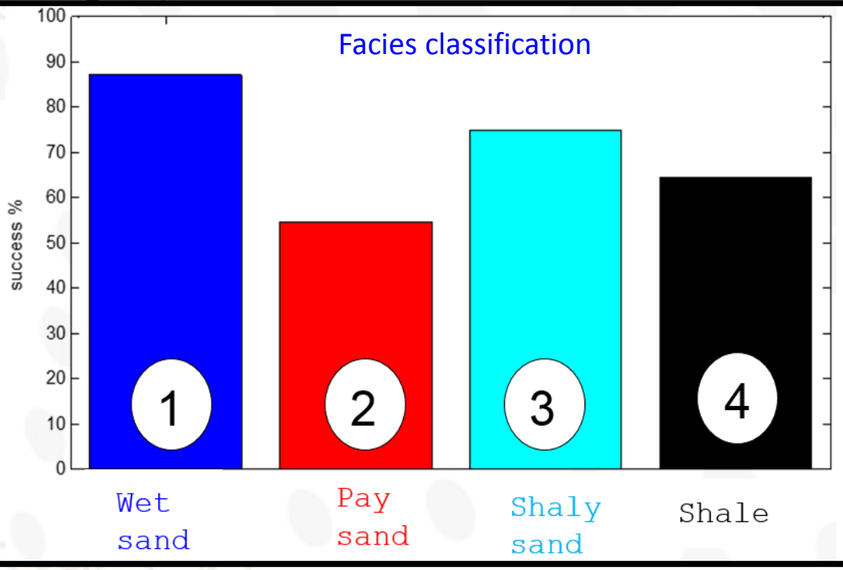


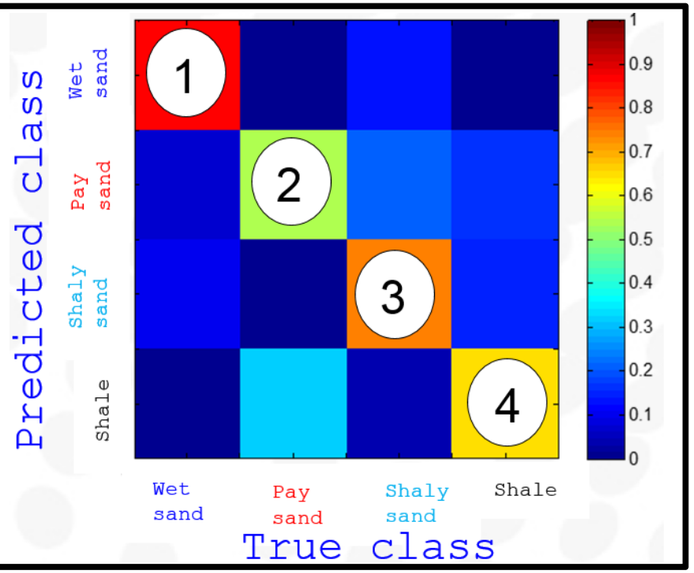
Rock Physics is the bridge

Understanding (measuring?) uncertainties

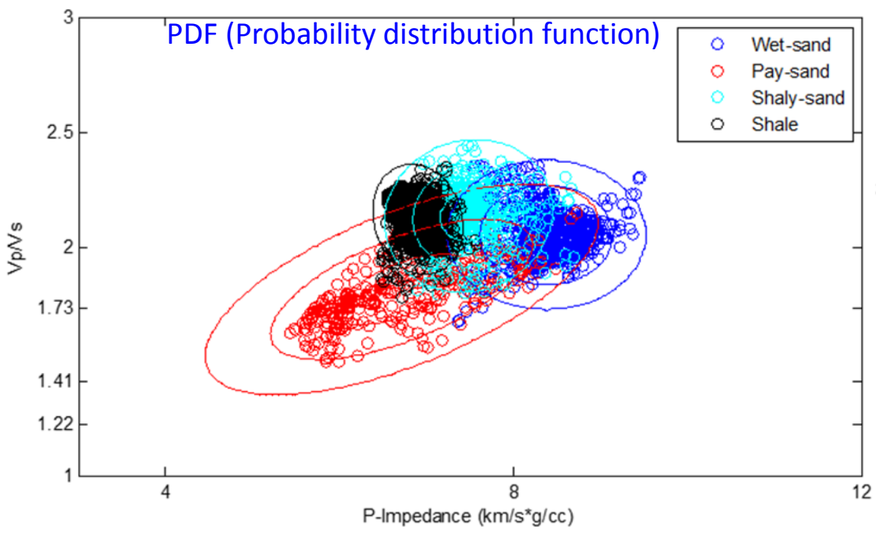
POST-STACK

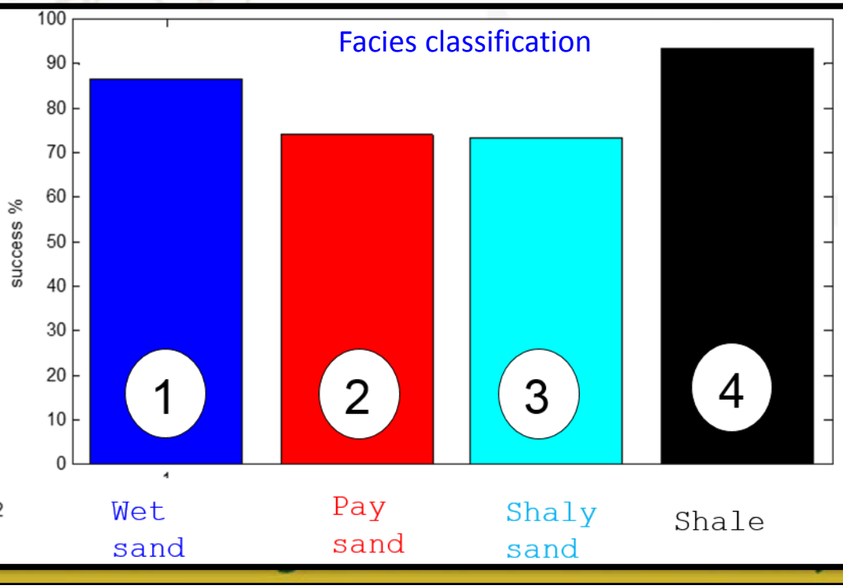


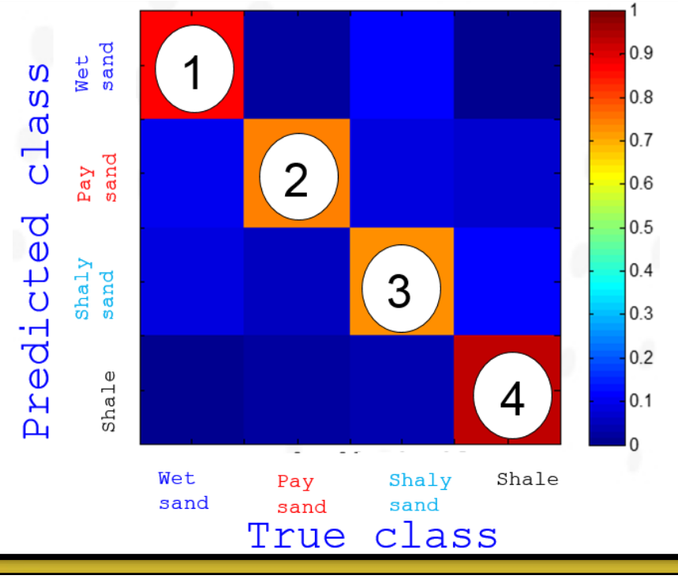




PRE-STACK

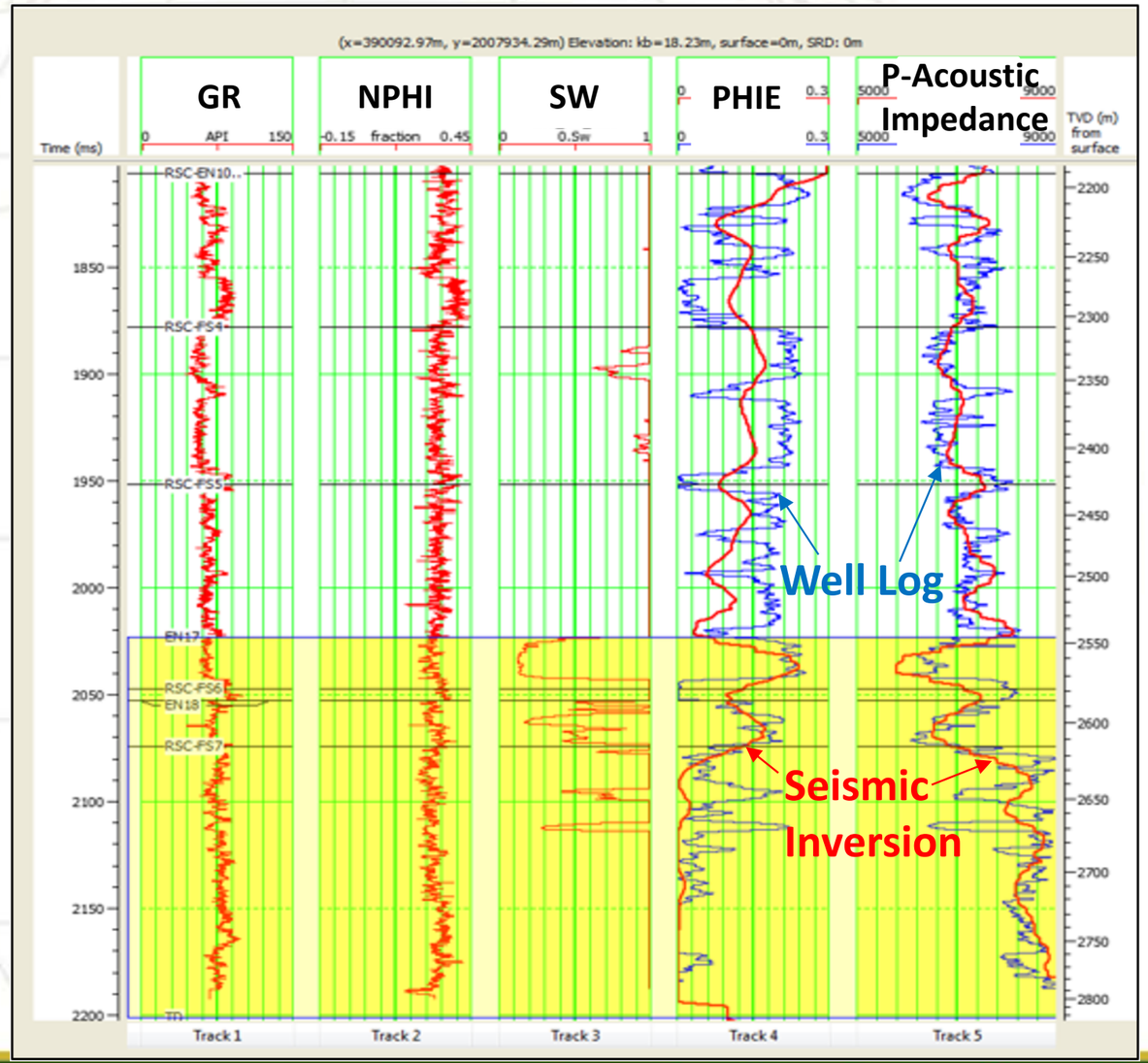


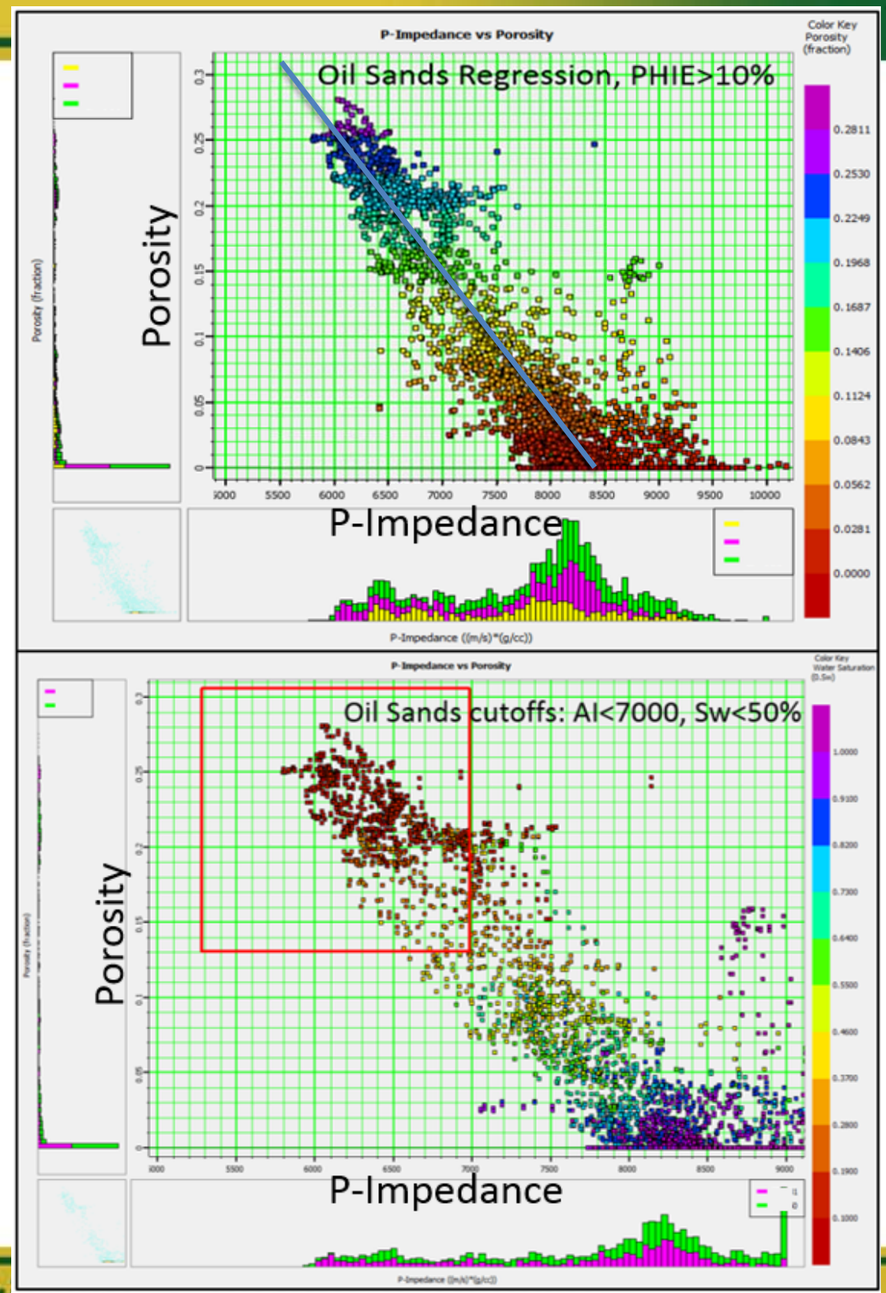


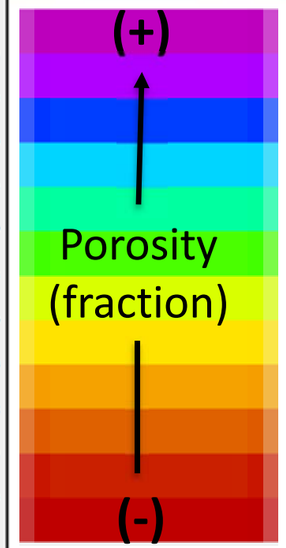


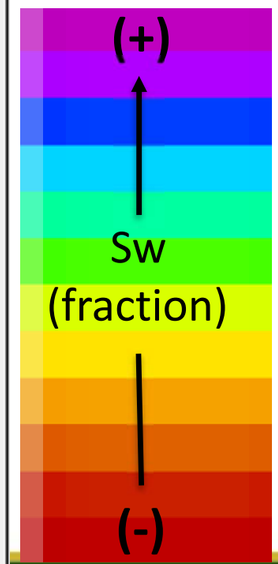
Rock Physics is the bridge

Infer reservoir properties

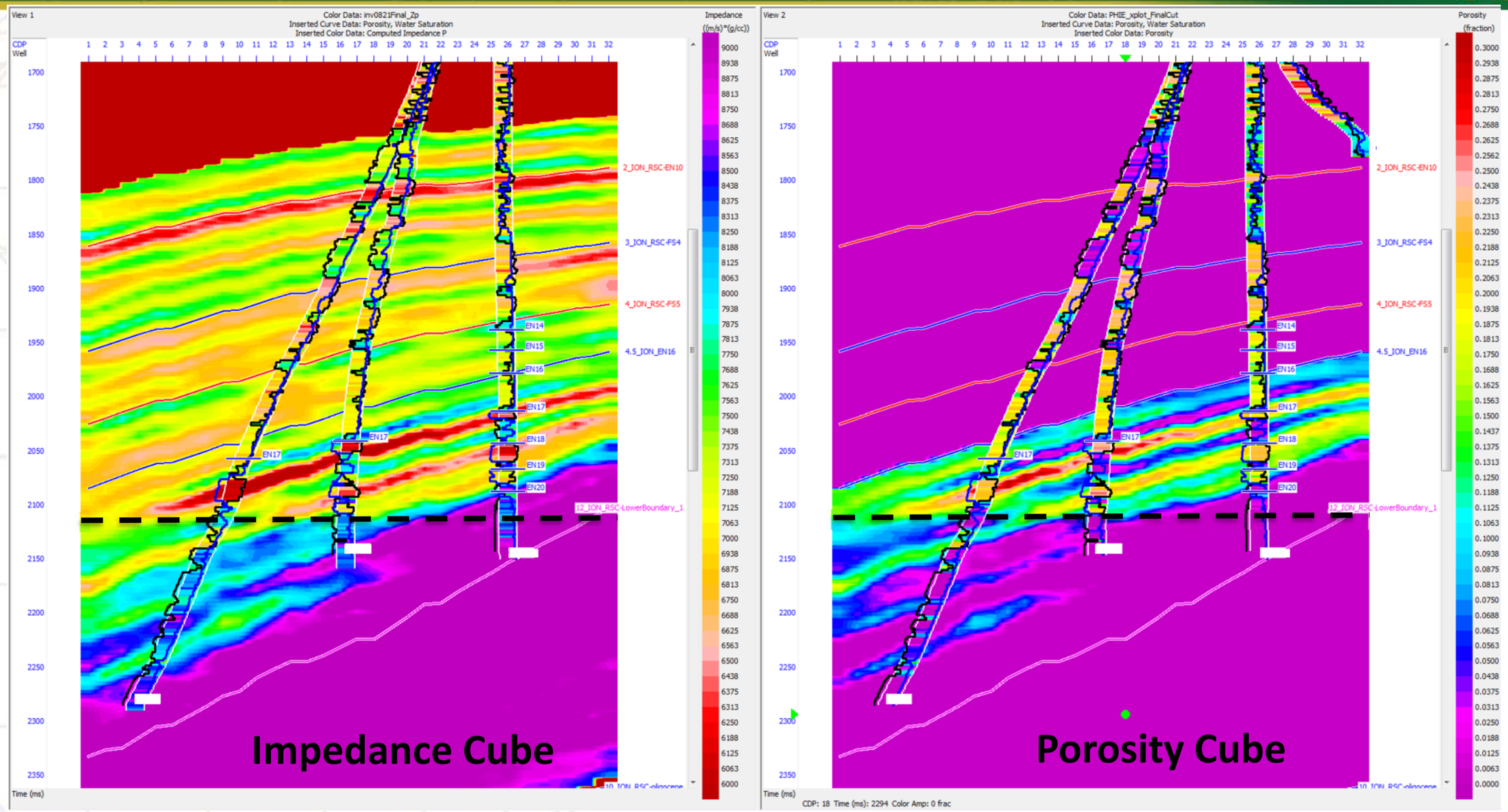








Solving your puzzle: where is my sand, OWC?



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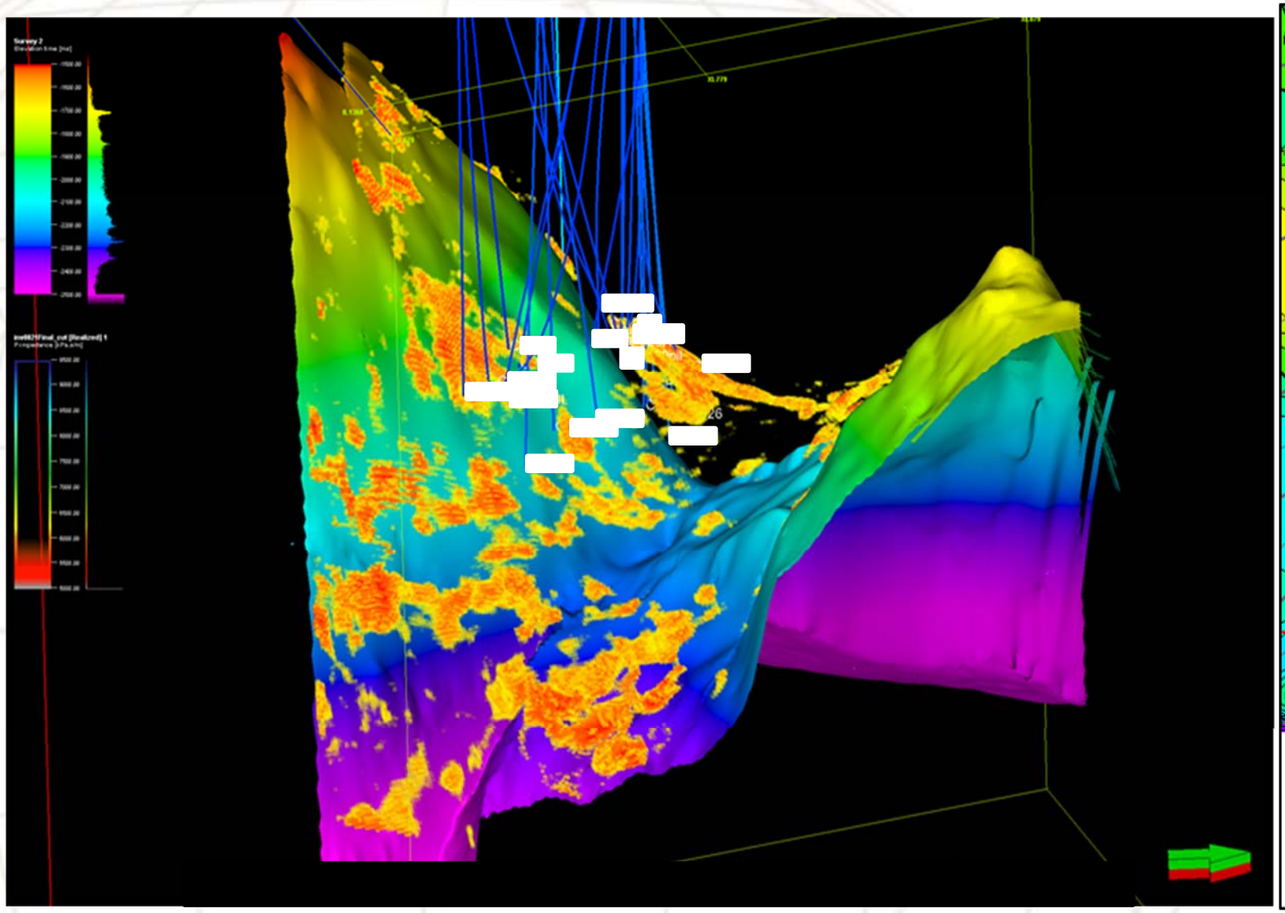
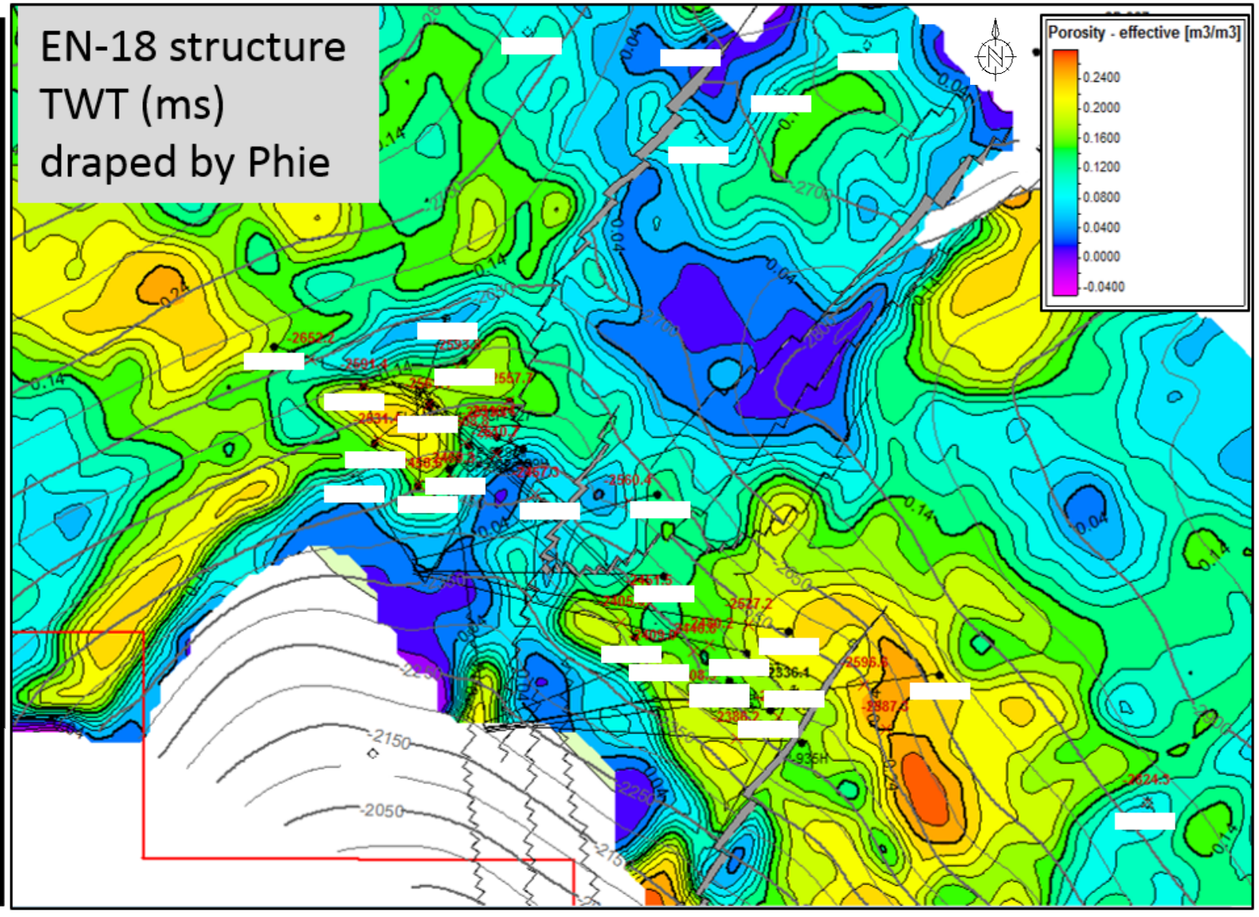
Strengthening your static model and……

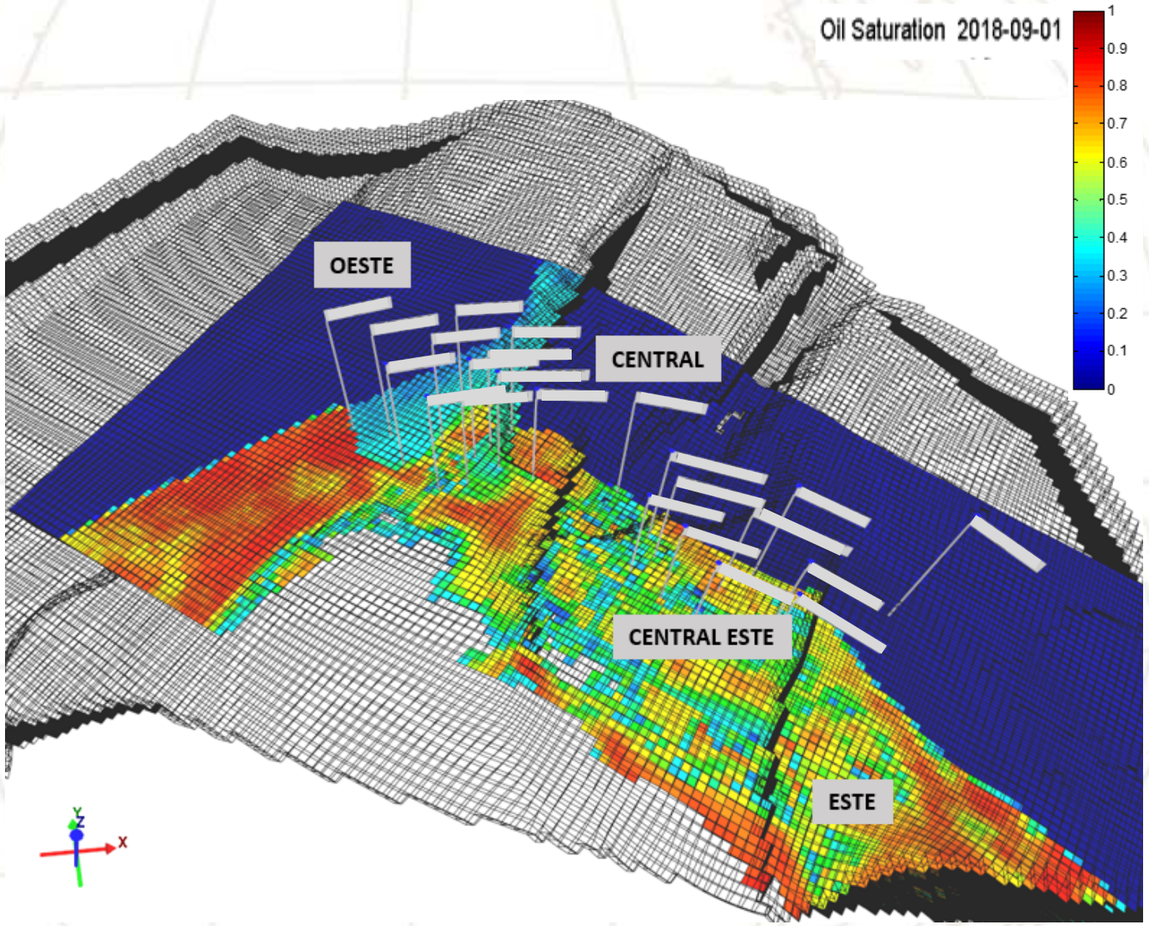


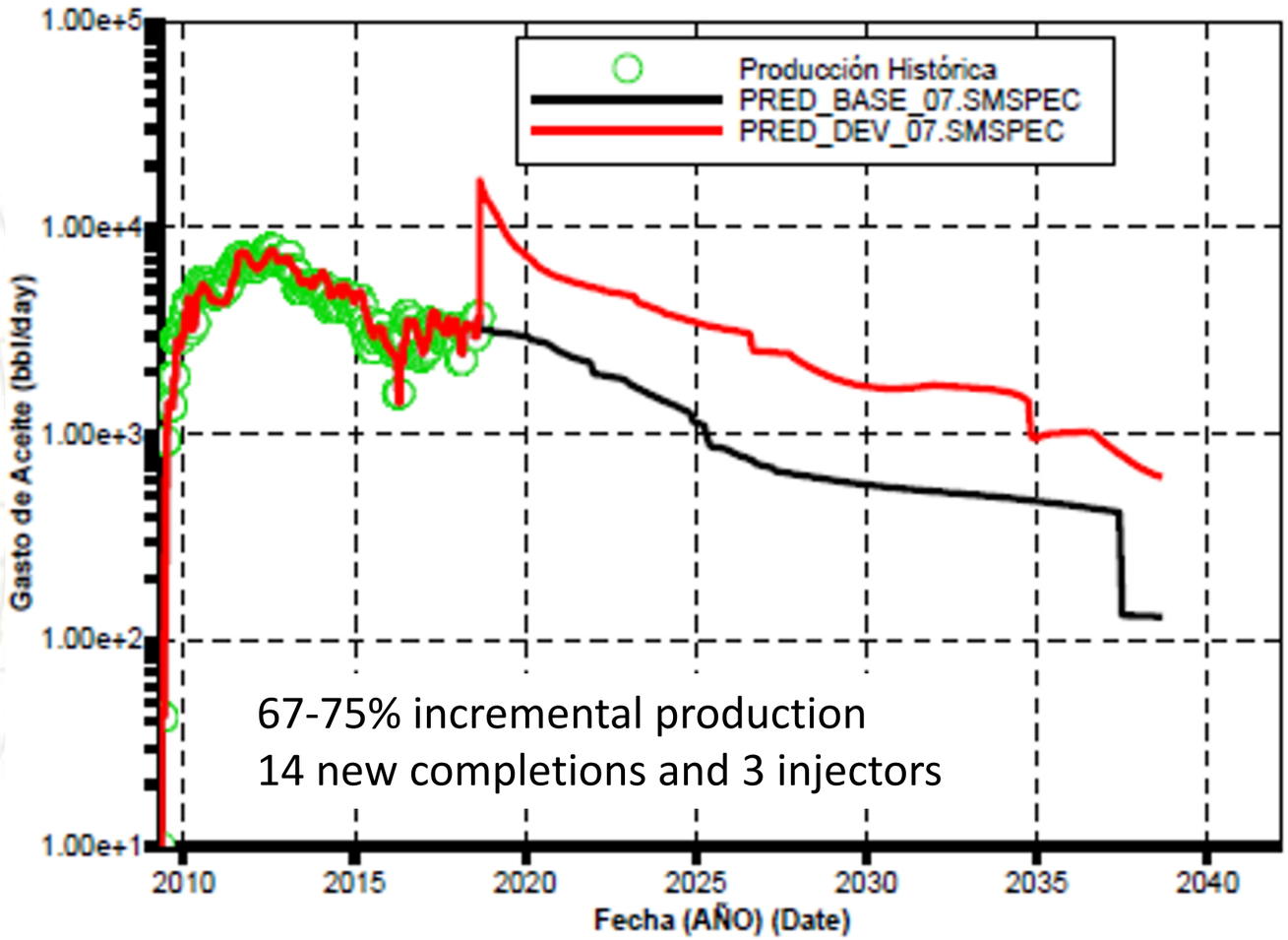
3D view of the low acoustic impedance sands over the base surface of static model



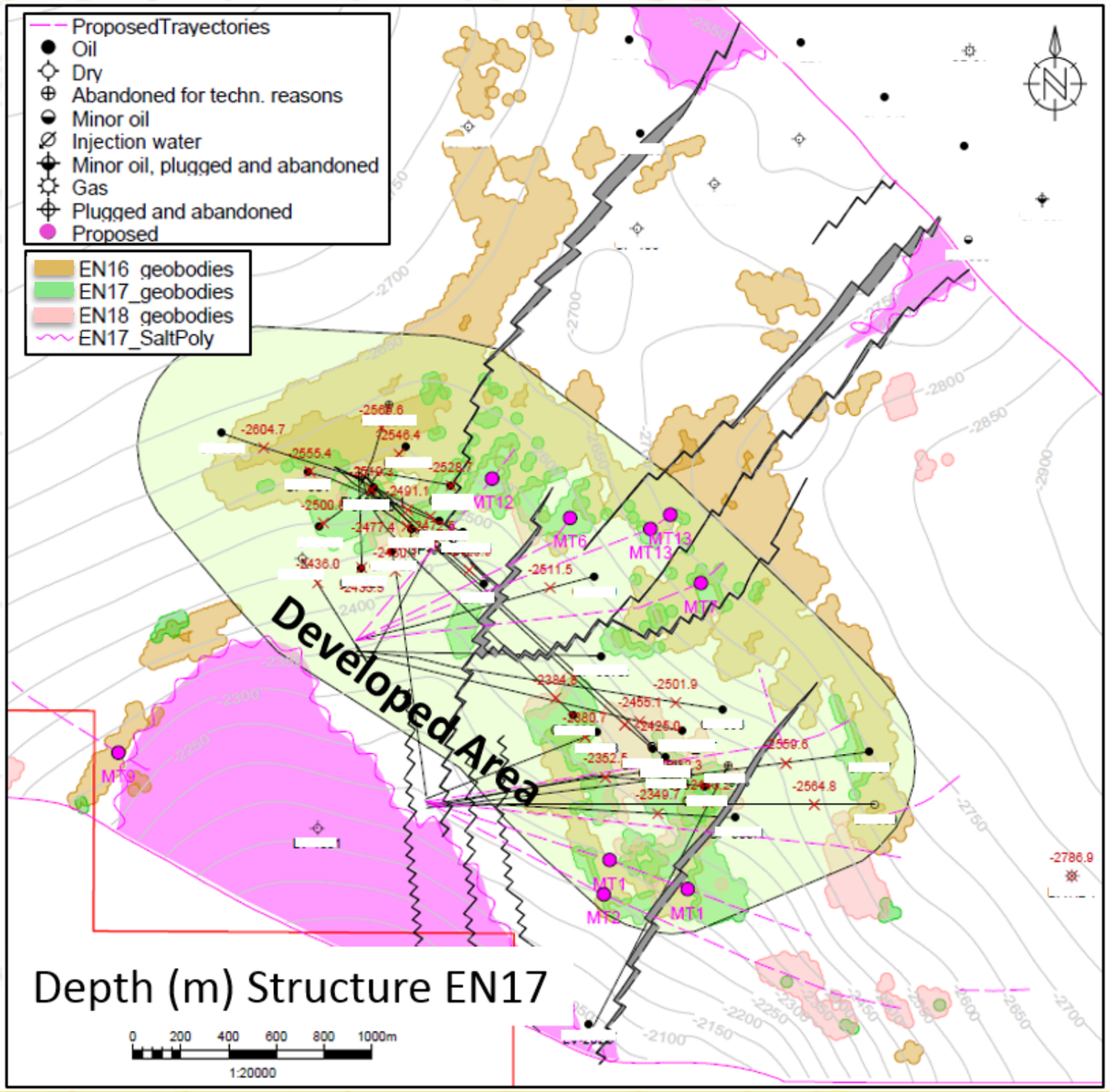
Inversion based Porosity trend map extracted for one of the shallower reservoirs

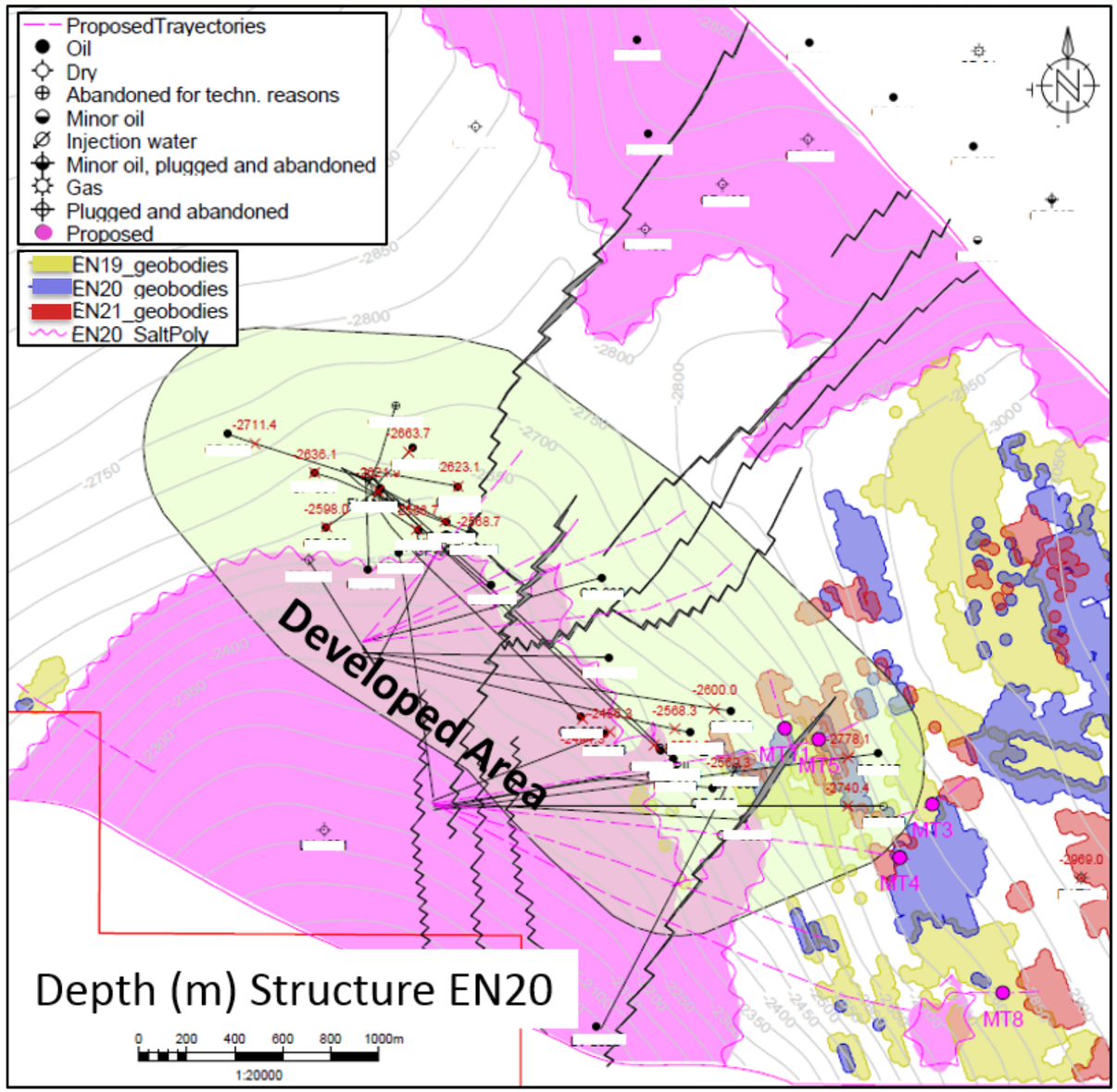
.....eventually your dynamic simulations and .....





.....and unlocking new opportunities





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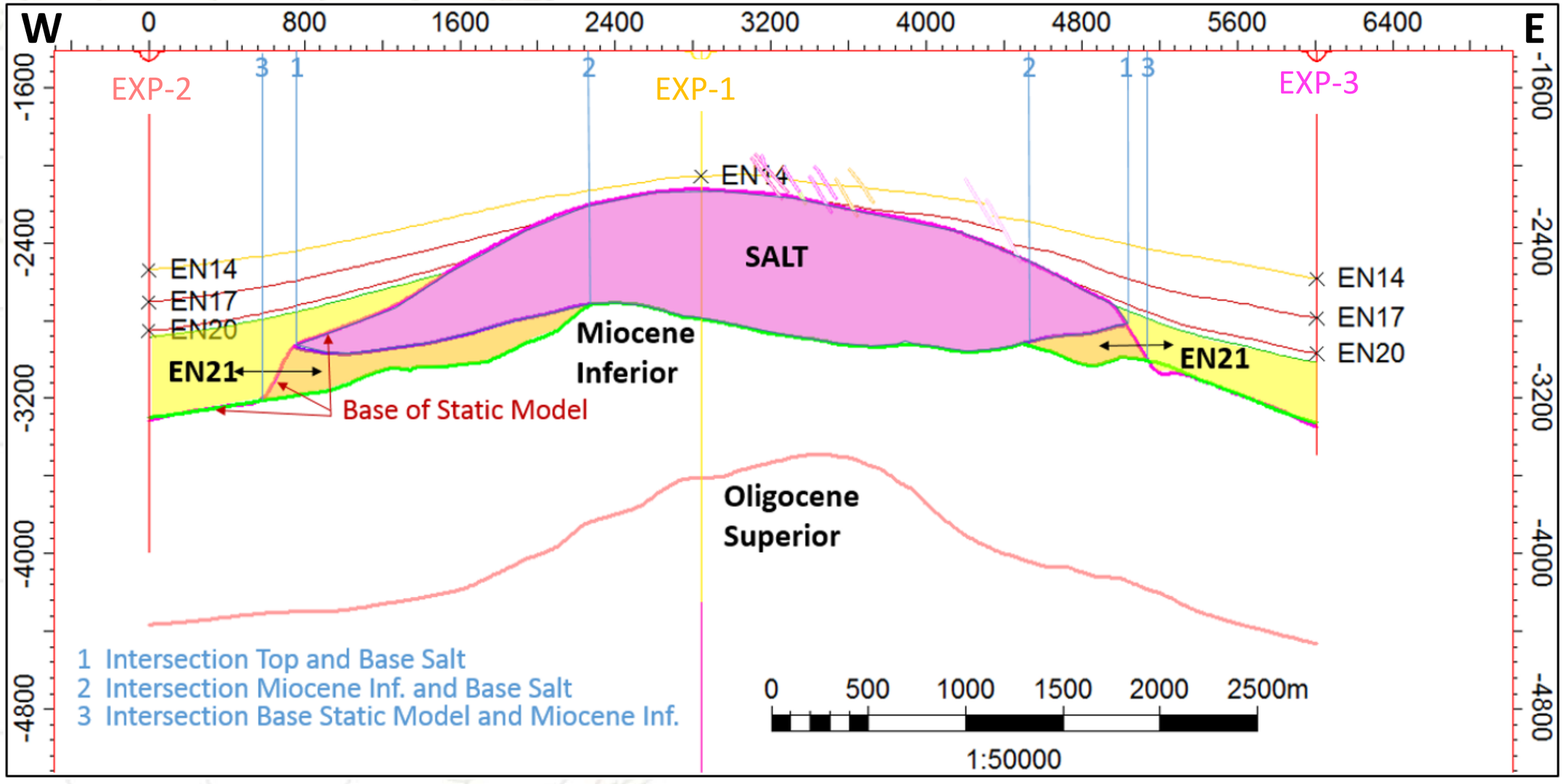

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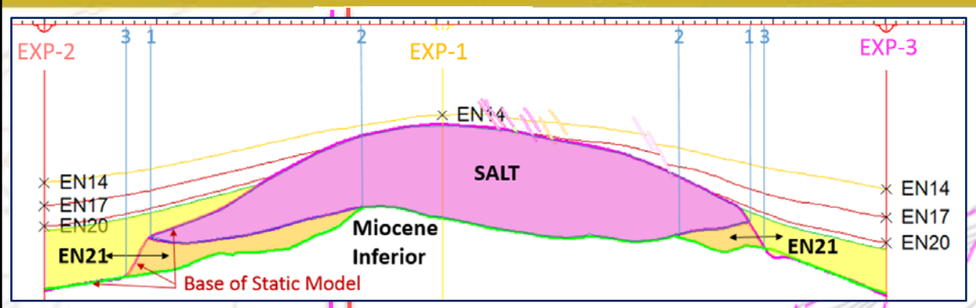

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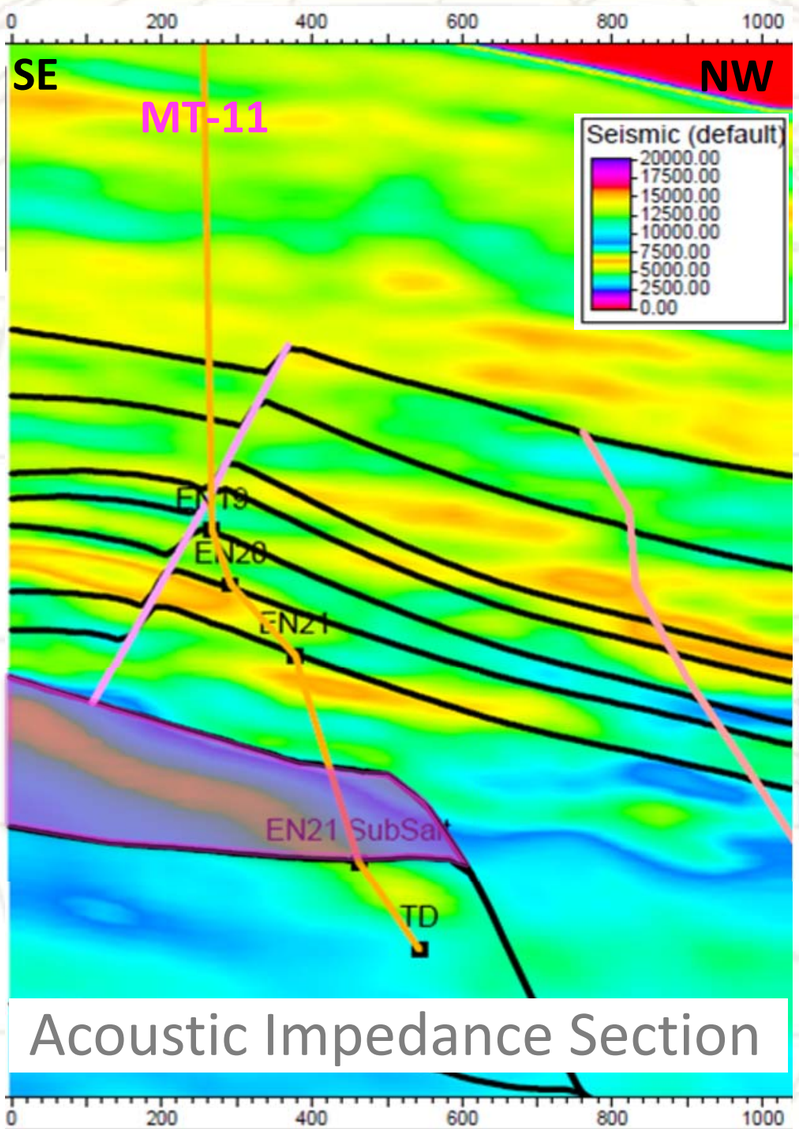
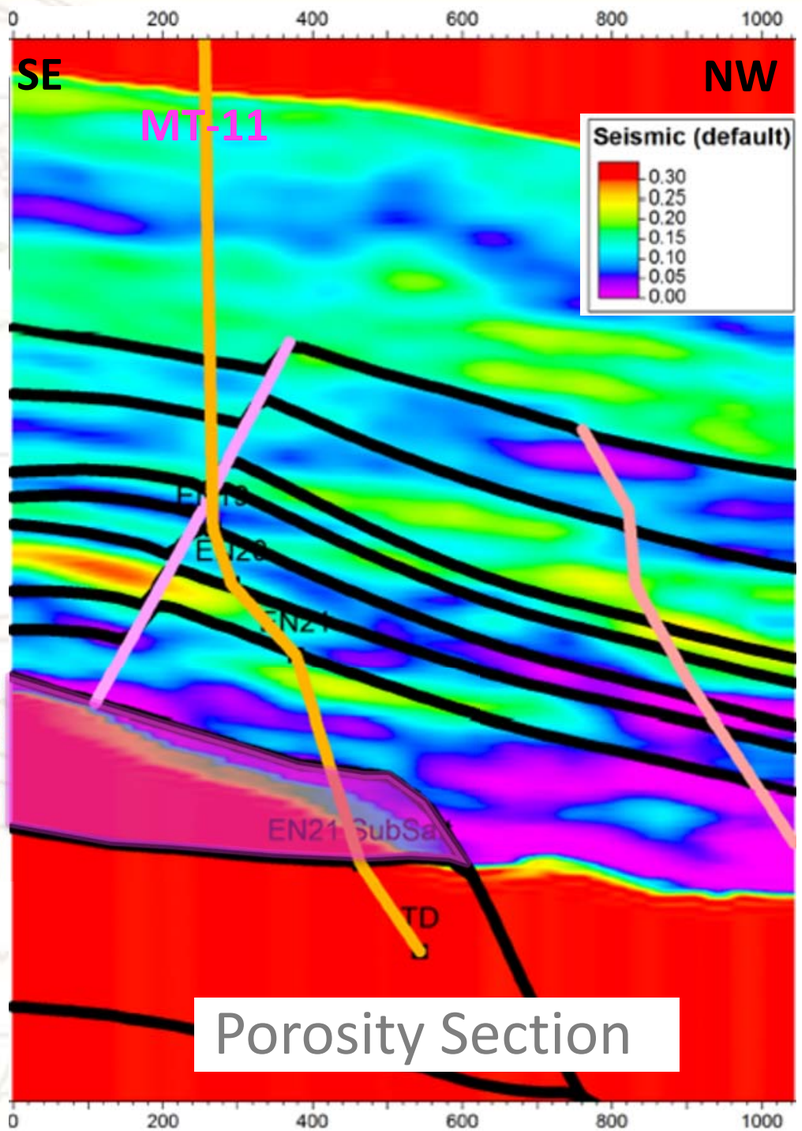


Acoustic Impedance Section



Porosity Section

Sub Salt targets are frontier knowledge for development team.

It becomes a possibility where salt body thins out and

When smart deviated drilling is proposed taking into account:

- Limited surface access
- Drilling constraints
- Multi targets

CONCLUSIONS

- **This study demonstrated Rock Physics brings value to the knowledge of the field.**
  - **Allowed extracting more information from seismic data**
  - **Improved our modeling capacities**
    - Hydrocarbon charged sands geometry
    - Potential contacts
    - Lateral distribution of reservoir properties
  - **Provided a tool for more efficient drilling (allowing geo-steering).**

CONCLUSIONS

- **Extract all possible information from seismic using Rock Physics.**
  - **Evaluate data resolution before committing to a full seismic-inversion project:**
    - Test potential for acoustic well data to discriminate lithology and fluids
    - Verify that seismic data quality (acquisition & processing) is adequate for AI inversion
- **Understand and communicate strengths and limitations of interpretations and models**
  - **Continually update models with new data**
  - **Include all cases in order to avoid bias towards positive outcomes**
  - **Optimize future development plans based on data-driven static and dynamic models.**