

E&P Advisors

Managing Risk. So you don't have to.



ion

→ Charged to innovate. Driven to solve.™

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Extracting the maximum information from your seismic data

ION / GX Technology & Ryder Scott

ION Geophysical Corporation in the Industry



HEADQUARTERS 
HOUSTON,
TEXAS



ABOUT

Delivering the power of data-driven decision-making
Technology leader with a history of innovation
Aligning offerings to select growing E&P and adjacent markets
Asset light with creative business models and high returns

50 years in business

23 years on the NYSE (ticker: IO)

\$400B E&P market

\$198M 2017 revenue

\$64M 2017 Adjusted EBITDA

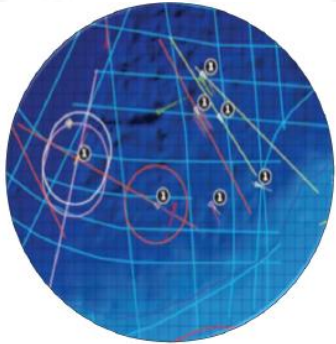
500 employees

8% revenues invested in R&D

500 patents and pending applications

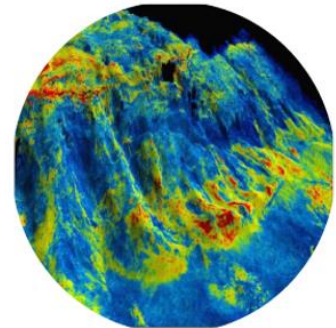
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E&P Operations Optimization

FRONTIER EXPLORATION	EXPLORATION	APPRAISAL & DEVELOPMENT	PRODUCTION
OPTIMIZATION SOFTWARE AND SERVICES ION software and services for design, execution and optimization of complex operations across a wide range of maritime activities			
SEISMIC DATA ACQUISITION DEVICES Streamer positioning and control systems for offshore seismic data acquisition			



E&P Technology & Services

MULTI-CLIENT PROGRAMS / DATA LIBRARY 2D and 3D multi-client and proprietary programs. Global BasinSPAN™ library of ~500,000 km of basin-wide, deep, geologically-driven 2D multi-client seismic data			
IMAGING SERVICES One of the most technologically advanced seismic data processing & imaging teams in the industry			
E&P ADVISORS Extensive global experience to deliver full-value-chain commercial and technical solutions to the oil & gas industry worldwide			

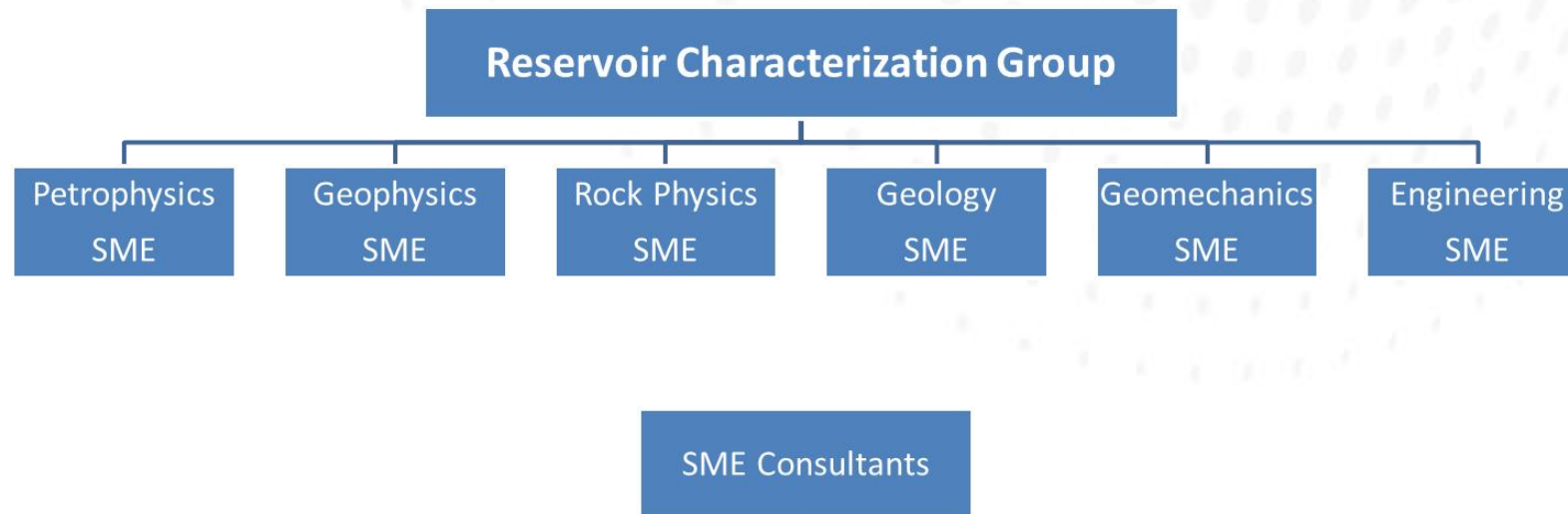


Ocean Bottom Services

		FULL-SCOPE OBS SERVICES Survey planning & design, data acquisition through OceanGeo, and imaging and interpretation deliver superior OBS data to help oil & gas companies gain insights for reservoir development decisions	
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Reservoir Services

E&P Advisors



Discover new Fields
 Increase Reserves
 Increase Production

ResSCAN™

Resource Assessment BASIN

- Basin Delineation
- Play Evaluation
- Resource Estimation

Field Characterization FIELD

- Reservoir Structure
- Rock Properties, Fractures, Geomechanics
- Initial Field Development Plans

Well Optimization Support WELL

- Well Design
- Well Landing/Placement
- Well Completion

**Pilot
Drilling**

**Development
Drilling**

SOLUTION / SERVICES

PROSPECT RANKING

FACIES / ROCK PROPERTIES CHARACTERIZATION

SWEET-SPOT DELINEATION

FRACTURE CHARACTERIZATION

PORE PRESSURE CHARACTERIZATION

MULTI-COMPONENT SEISMIC PROCESSING AND INTERPRETATION

UNCONVENTIONAL RESOURCE ASSESMENT

UNCONVENTIONAL SWEET-SPOT DELINEATION

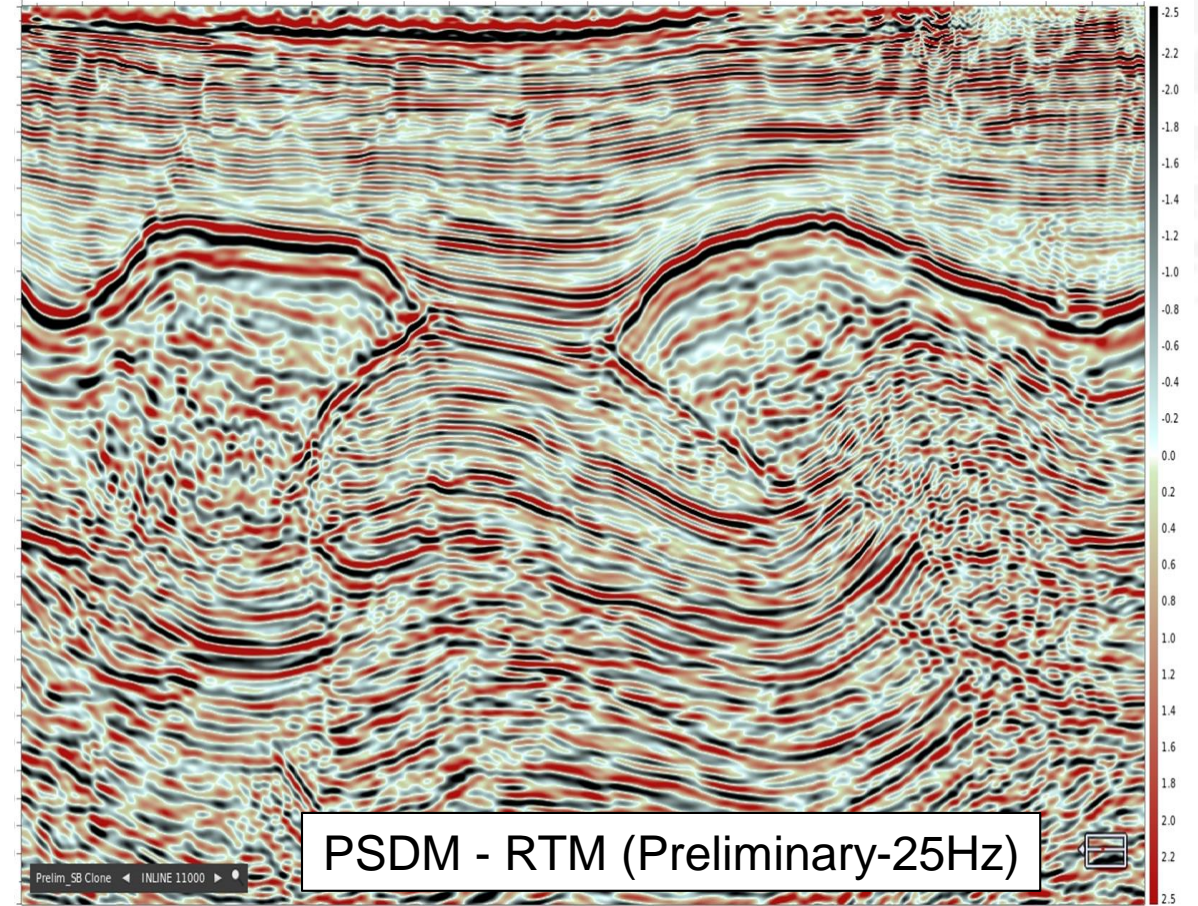
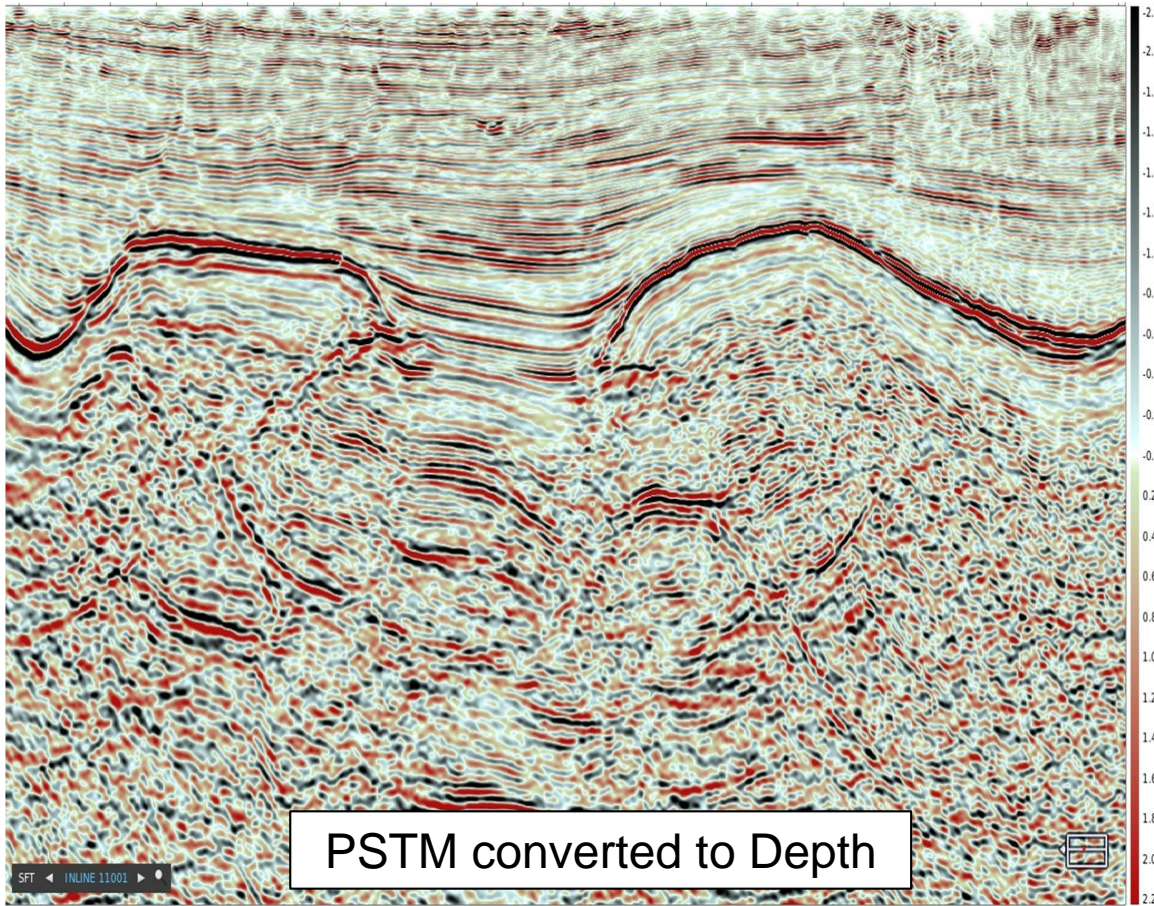
SEISMIC GEOMECHANICS FOR WELL PLACEMENT AND COMPLETION

STRUCTURAL / STRATIGRAPHIC ANALYSIS

BASIN MODELING / PETROLEUM SYSTEM ANALYSIS

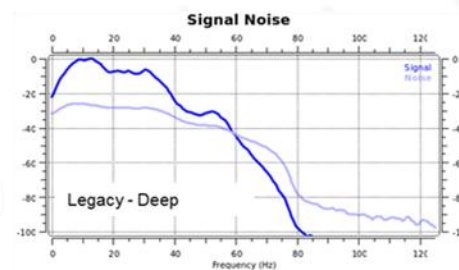
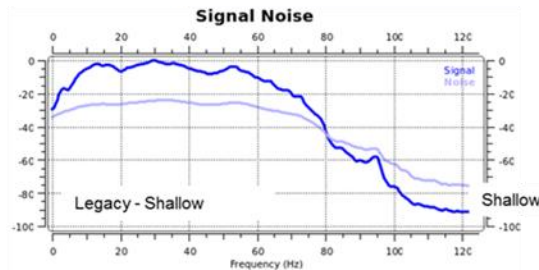
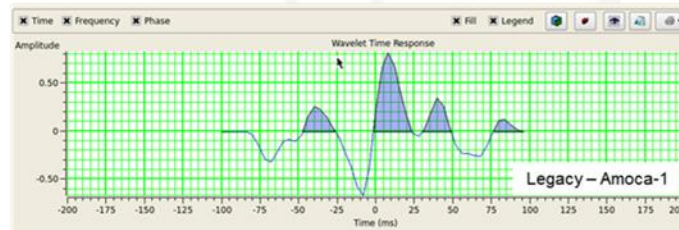
TIME LAPSE (4D) STUDIES

New Seismic Technology for Reservoir Characterization



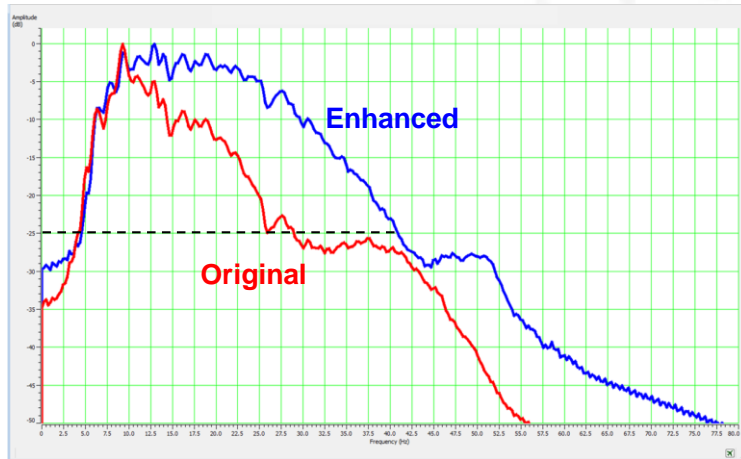
Same input seismic

Seismic Conditioning for Reservoir Characterization



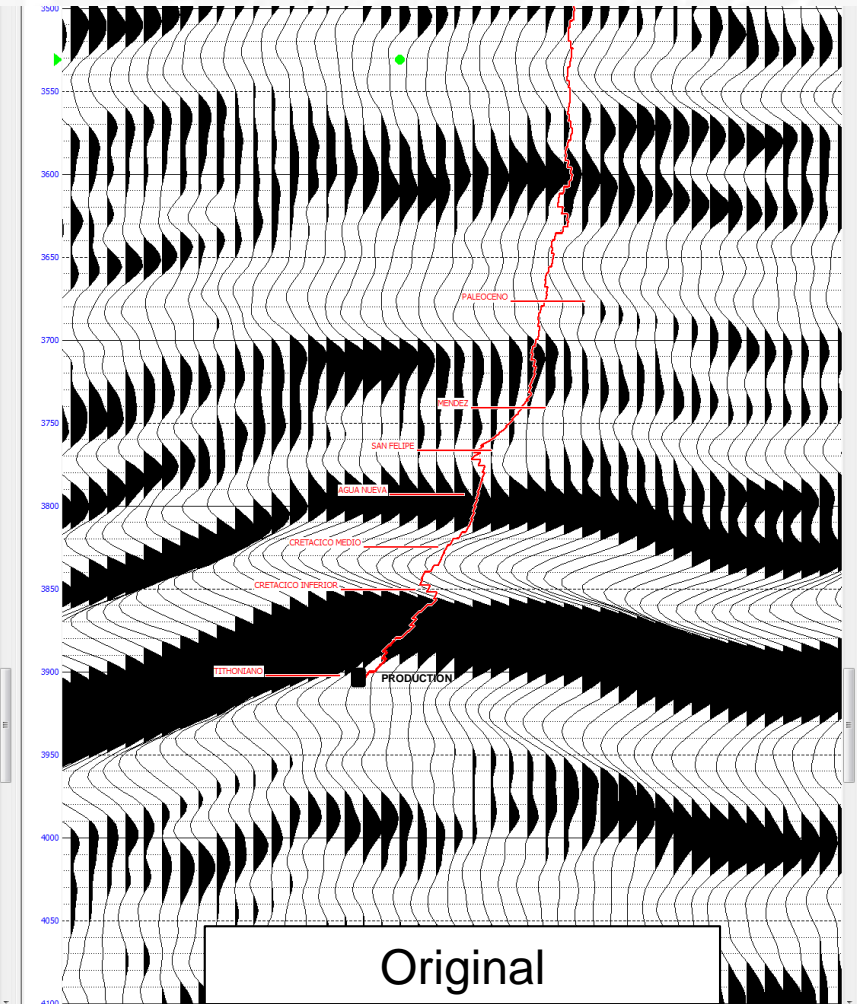
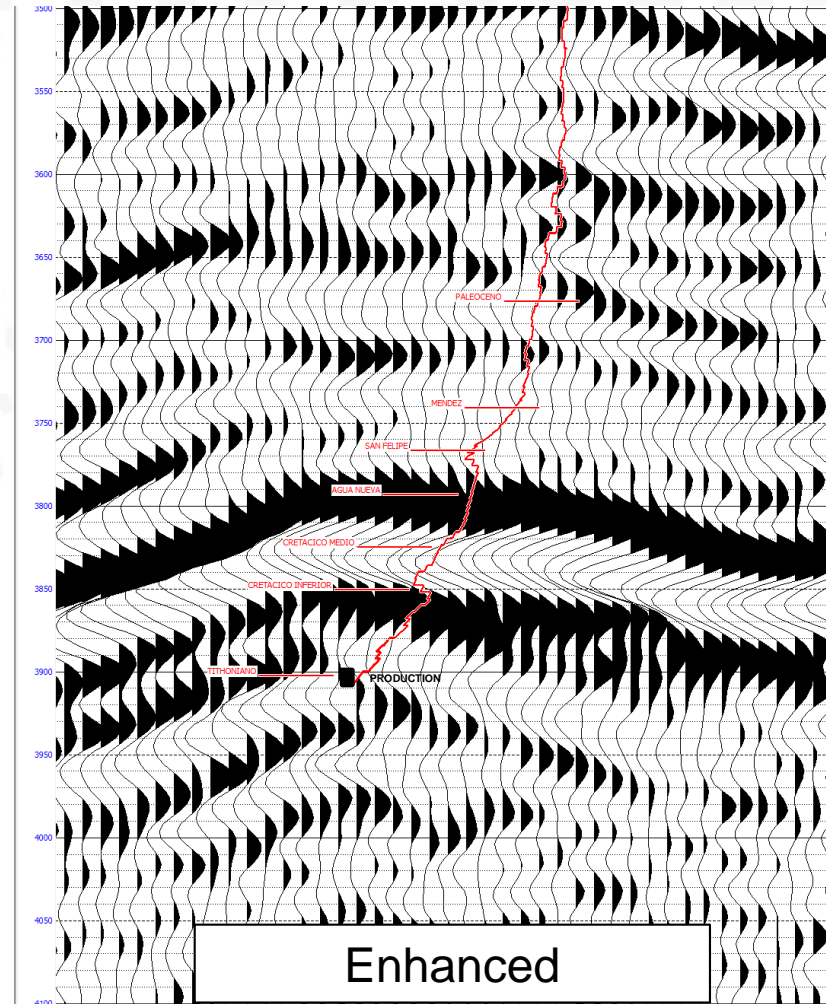
- Signal & Noise Analysis
- Inversion (post-stack)
- Inversion (pre-stack)
- Inversion (pre-stack, ani)

Seismic Conditioning for Reservoir Characterization

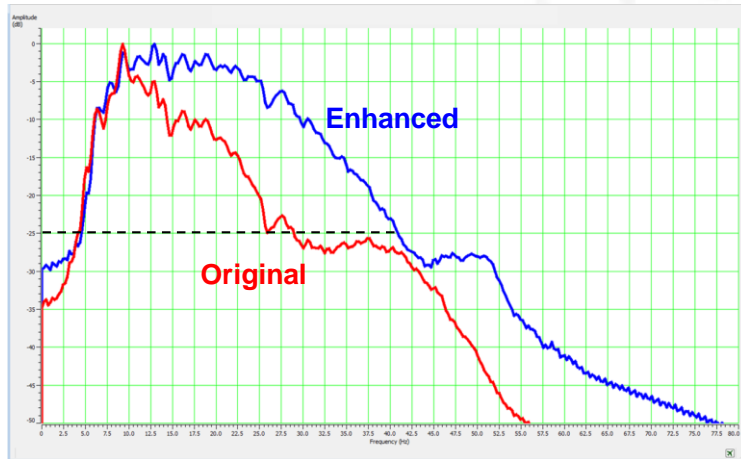


25 Hz (6,000 m/s) > 40 m

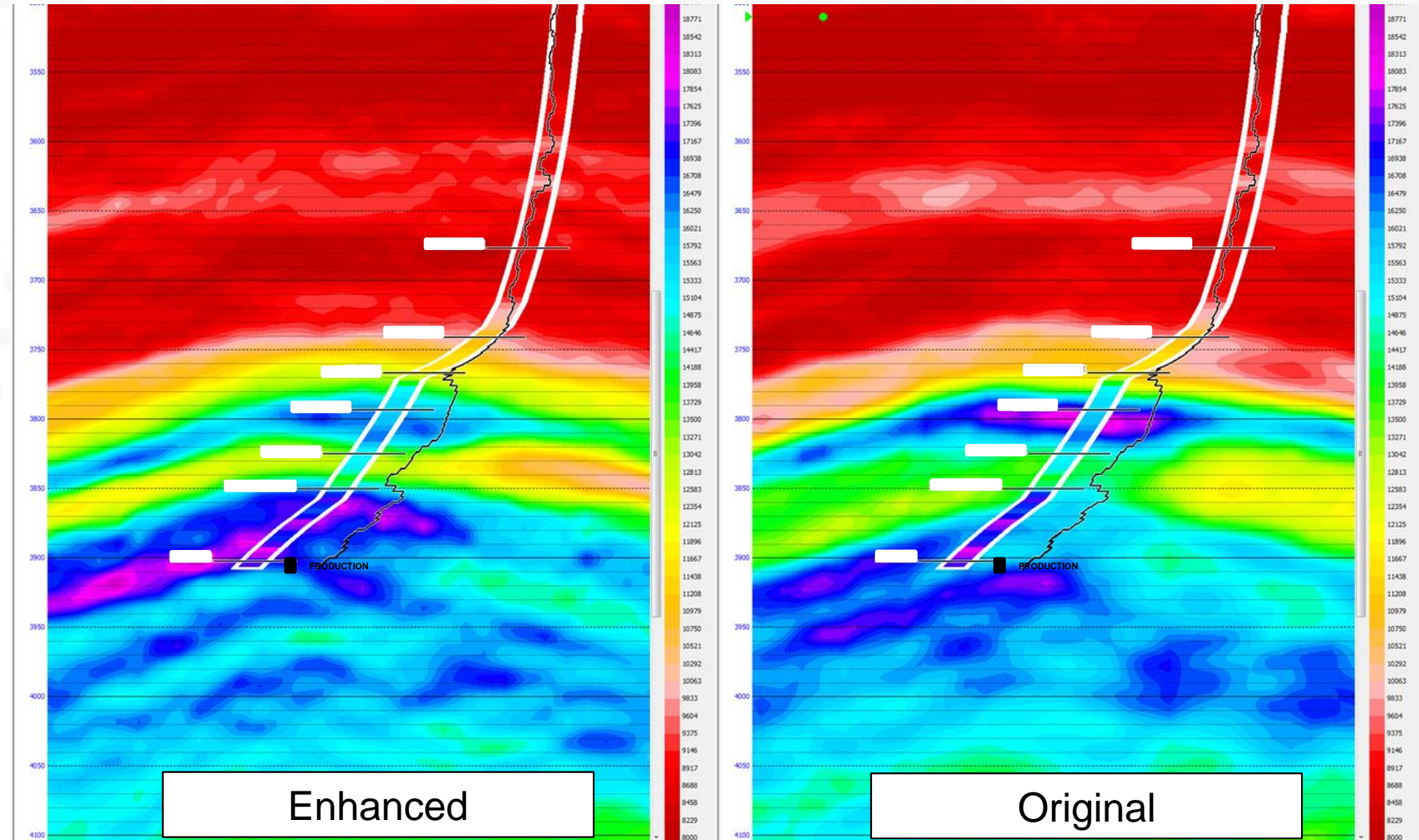
40 Hz (6,000 m/s) > 25 m



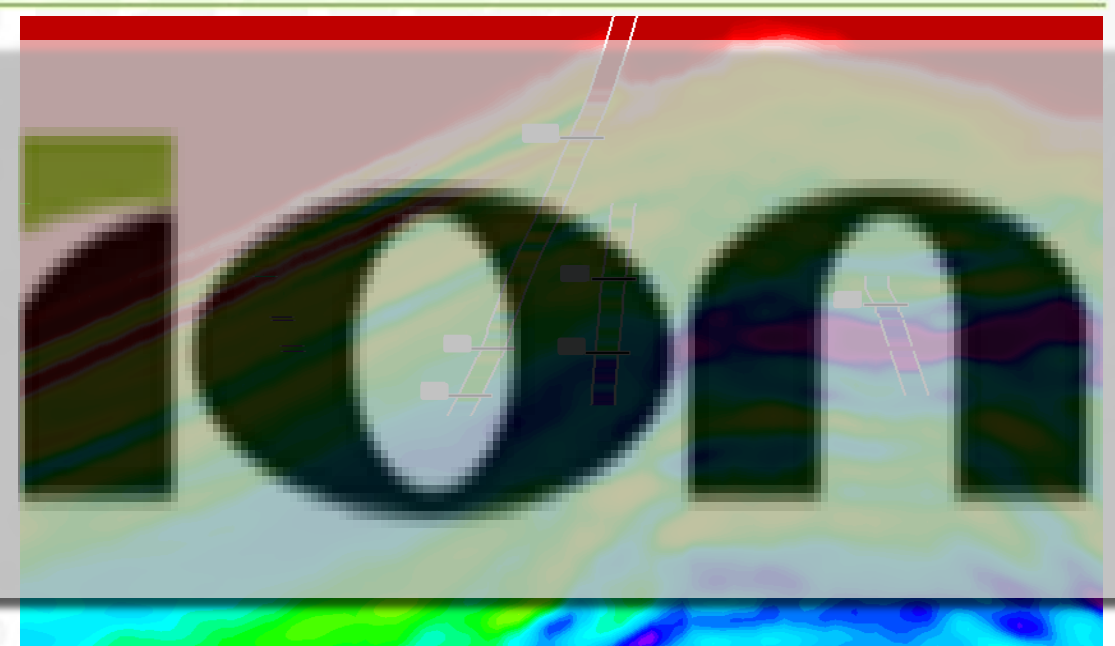
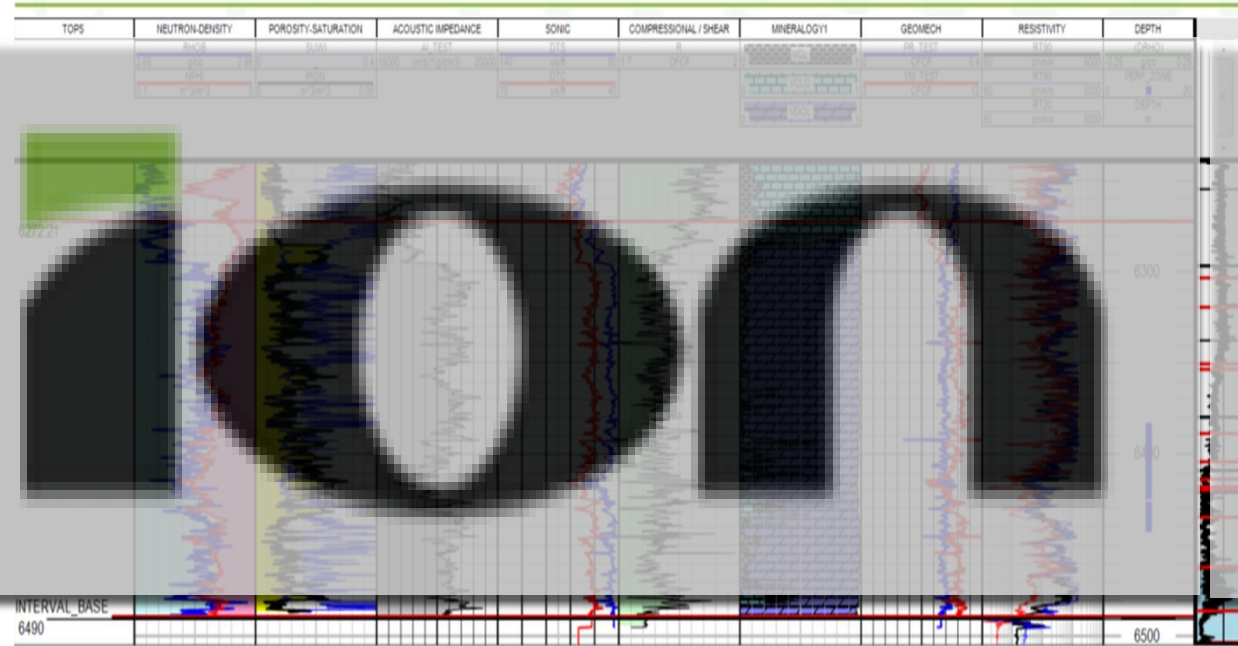
Seismic Conditioning for Reservoir Characterization



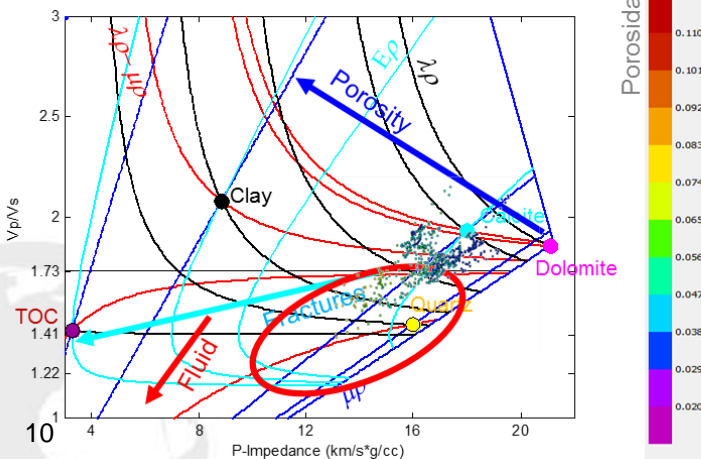
25 Hz (6,000 m/s) > 40 m
40 Hz (6,000 m/s) > 25 m



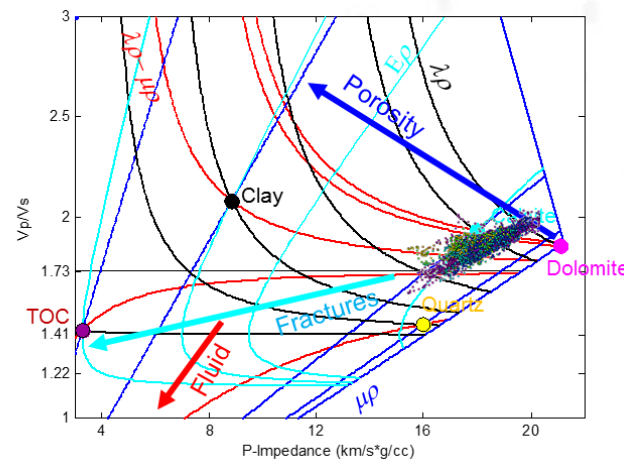
Petrophysics, Rock Physics and Seismic Integrated Analysis



Producer



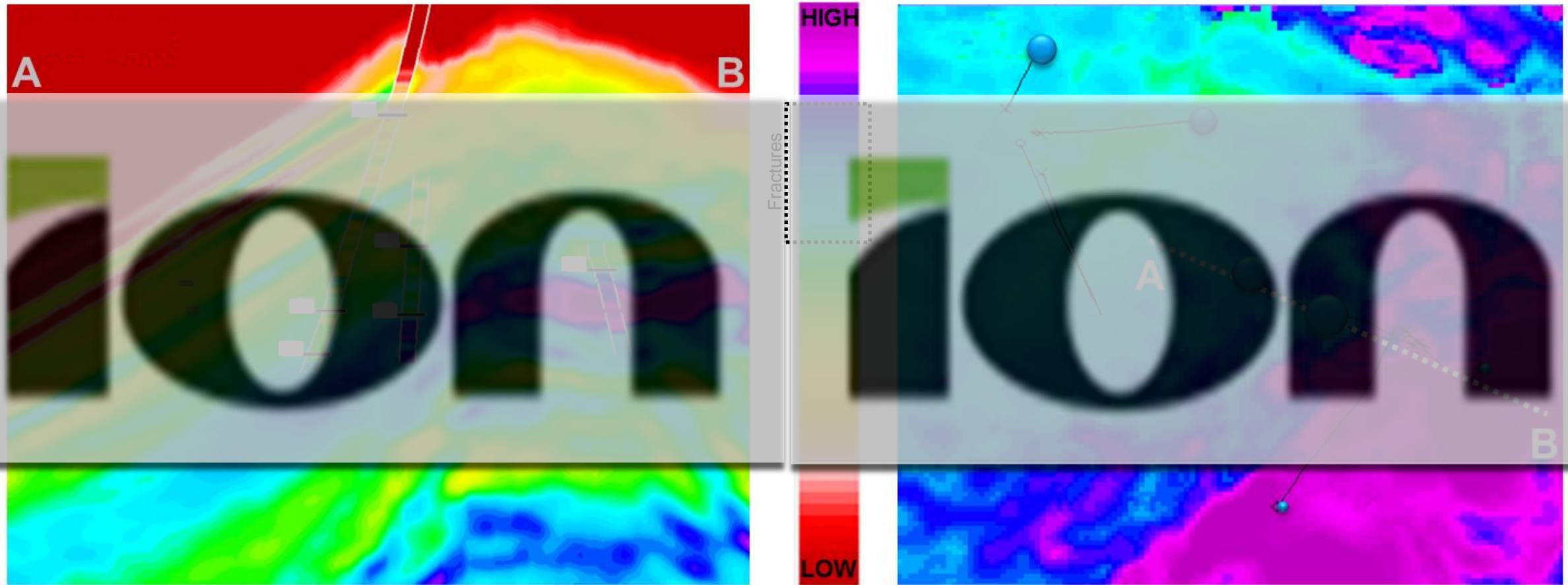
Non-Producer



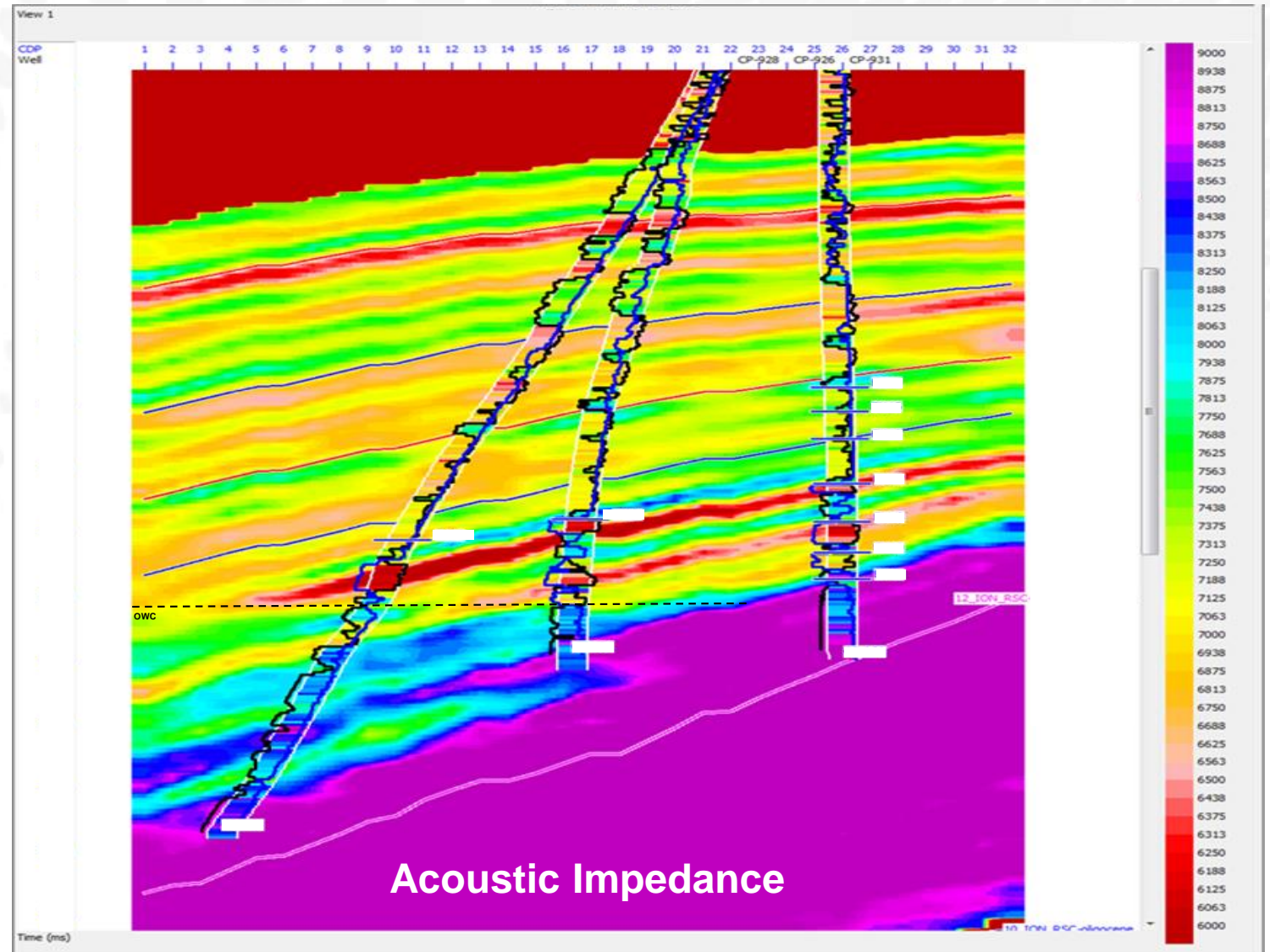
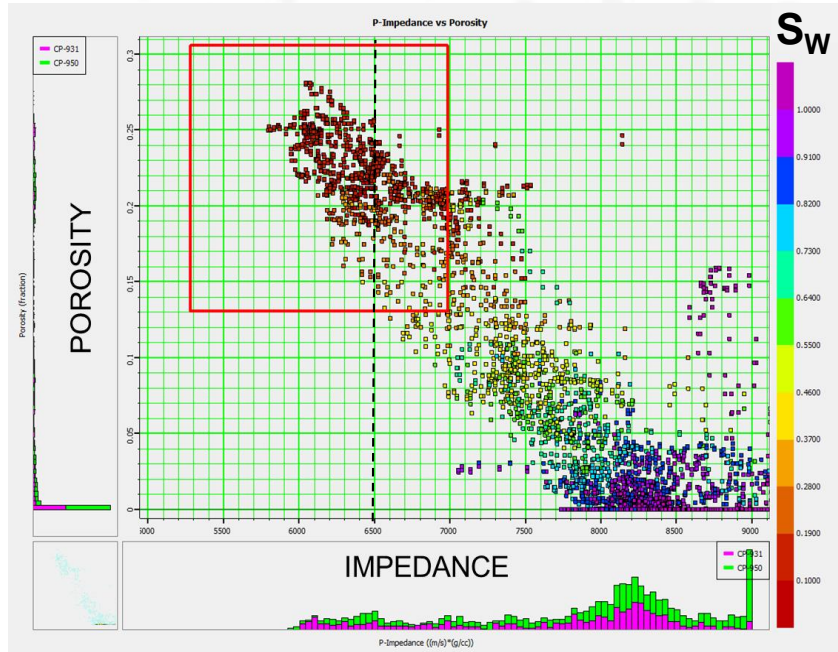
	Production	No Production
Petrophysics	Higher Porosity Higher Dolomite volume	Lower Porosity Lower Dolomite volume
Rock Physics	Lower Impedance Lower Vp/Vs Lower Poisson's Ratio	Higher Impedance Higher Vp/Vs Higher Poisson's Ratio
Rock Mechanics	Lower Young's modulus Higher Fracture Density	Higher Young's modulus Lower Fracture Density
Seismic Attributes	P-Impedance for discriminating porosity P-Impedance and Vp/Vs for discriminating porosity, lithology and mechanical properties (fractures) Anisotropy (fracture orientation)	

Exploring and Characterizing Conventional & Unconventional Reservoirs

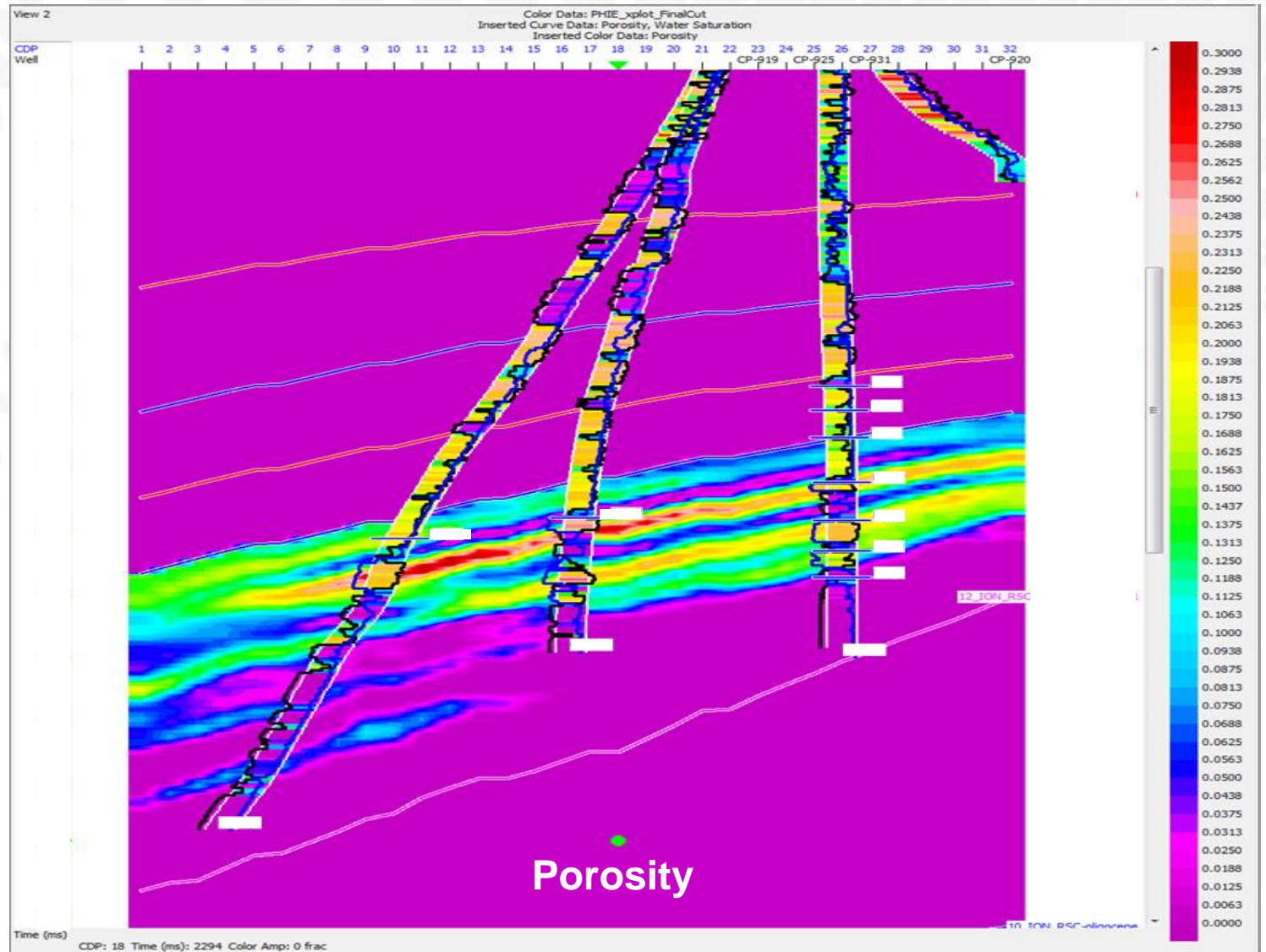
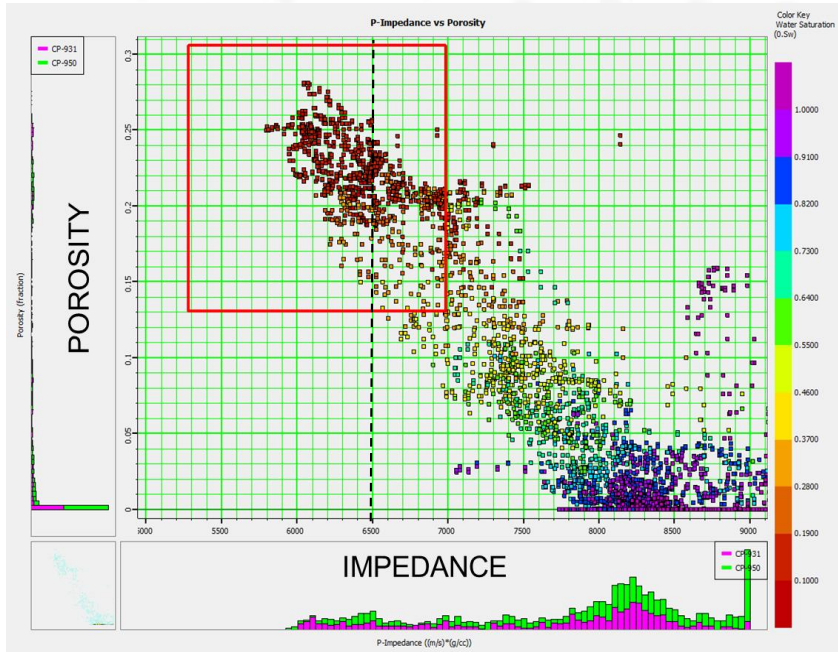
Reservoir Rock Properties (Fractures) Characterization



ION / GX Technology & Ryder Scott Petrophysics / Rock Physics Analysis



ION / GX Technology & Ryder Scott Petrophysics / Rock Physics Analysis

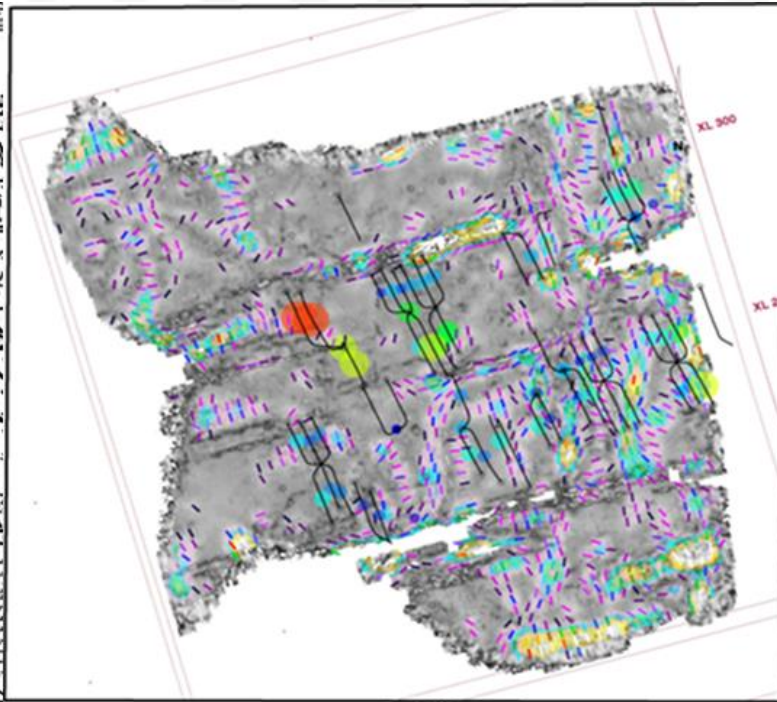


ION / GX Technology & Ryder Scott

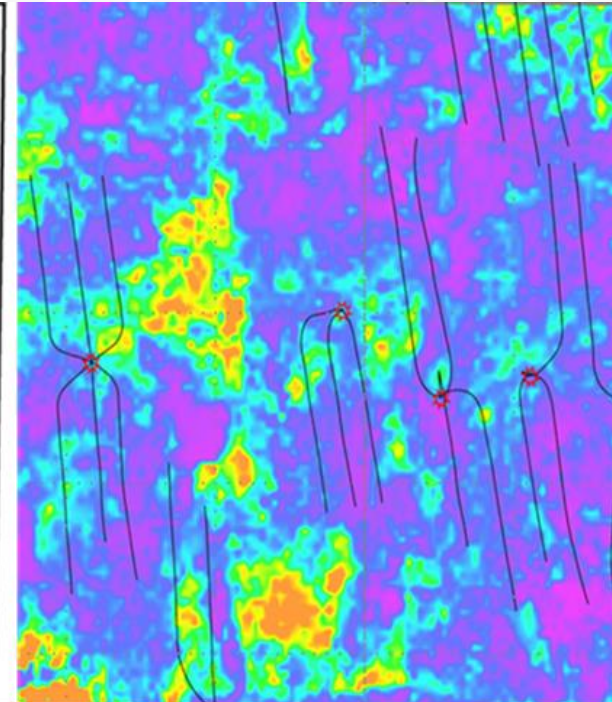
Seismic and Fracture Characterization



Fault Probability



VVAz

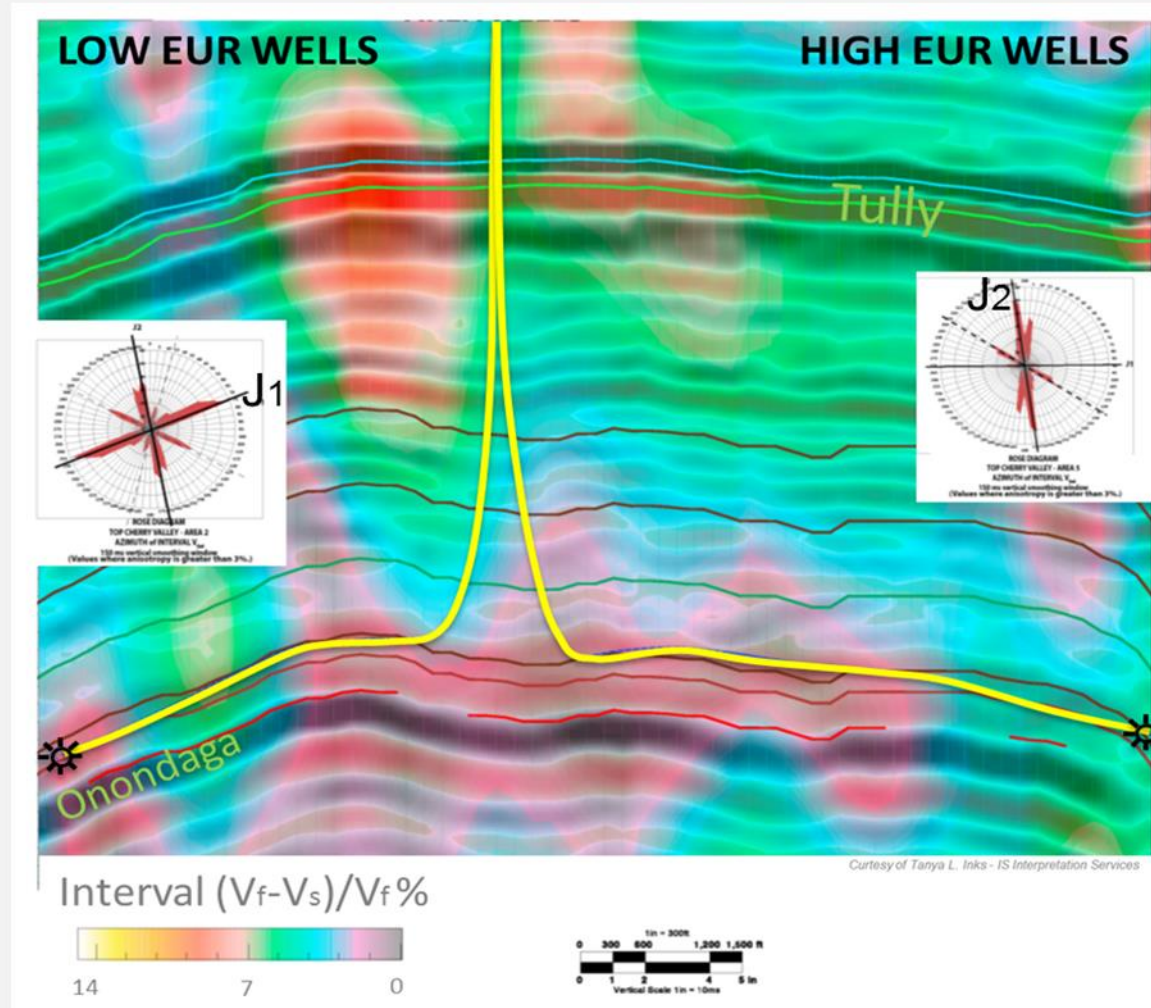


AVAz

ION / GX Technology & Ryder Scott Seismic and Fracture Characterization



Anisotropy (fracture/stress) Analysis



Fracture Characterization with Multi-Component Data

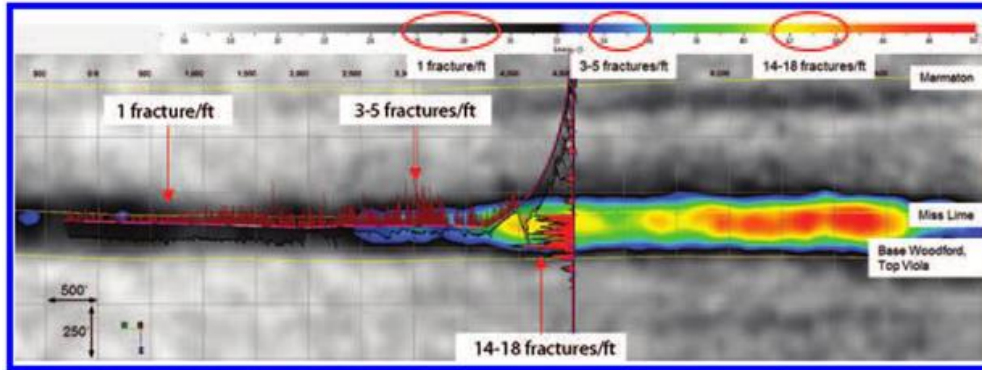
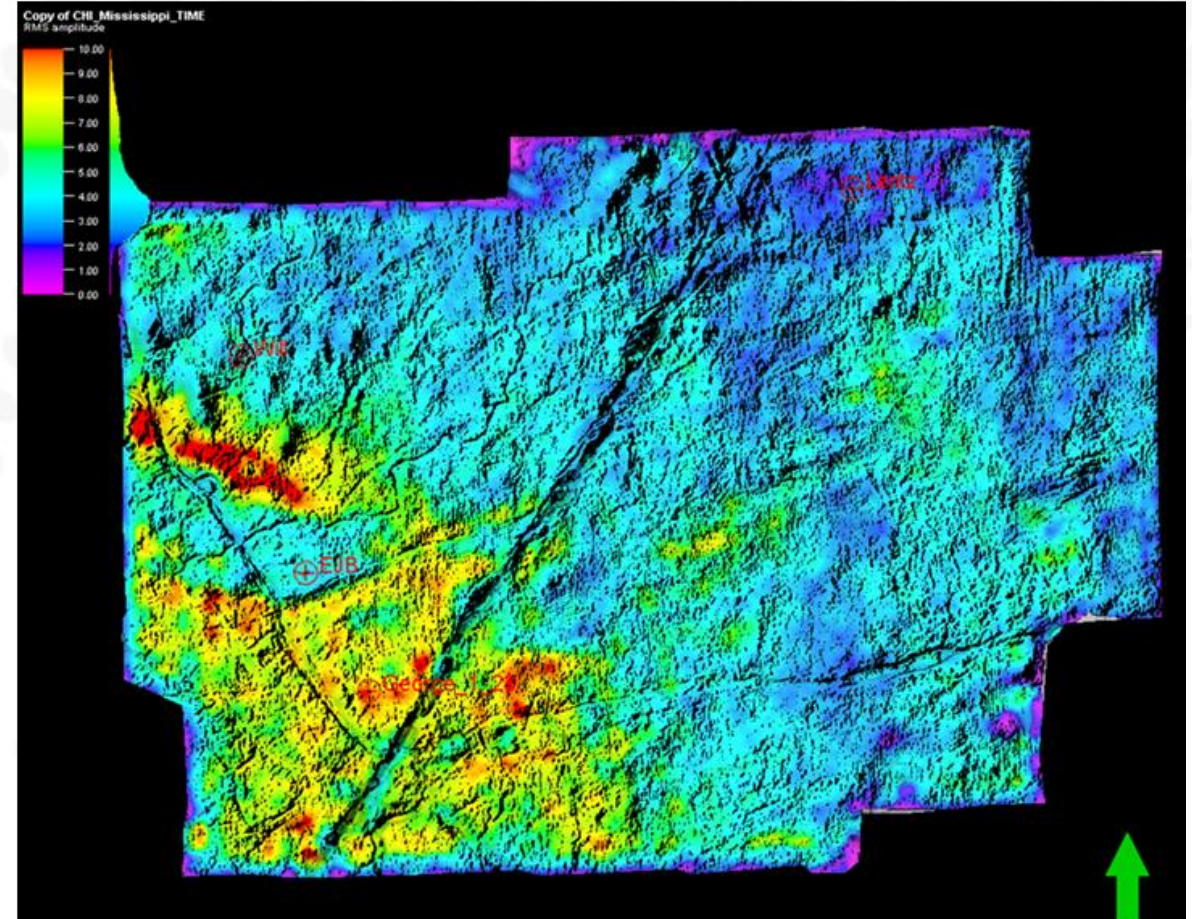
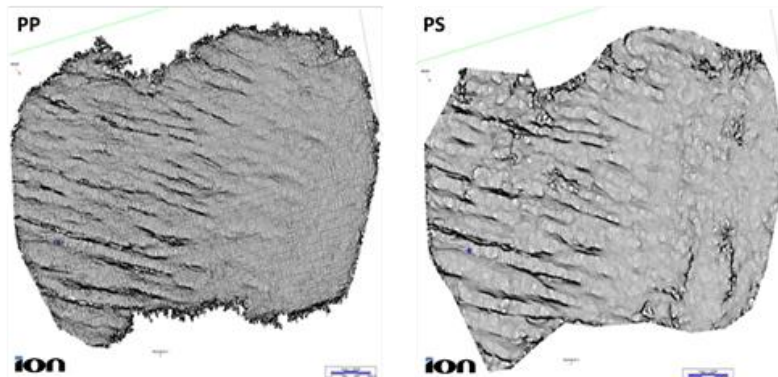


Figure 4. PS transverse-energy volume along the 23-2H lateral with relevant horizons. Vertical and lateral FMI logs are shown, along with lateral LWD gamma ray. Fracture counts are given in several locations. Vertical and lateral FMI fracture densities calibrate to the PS transverse-energy signature, as shown on the color bar. After Singleton et al. (2015), Figure 6.

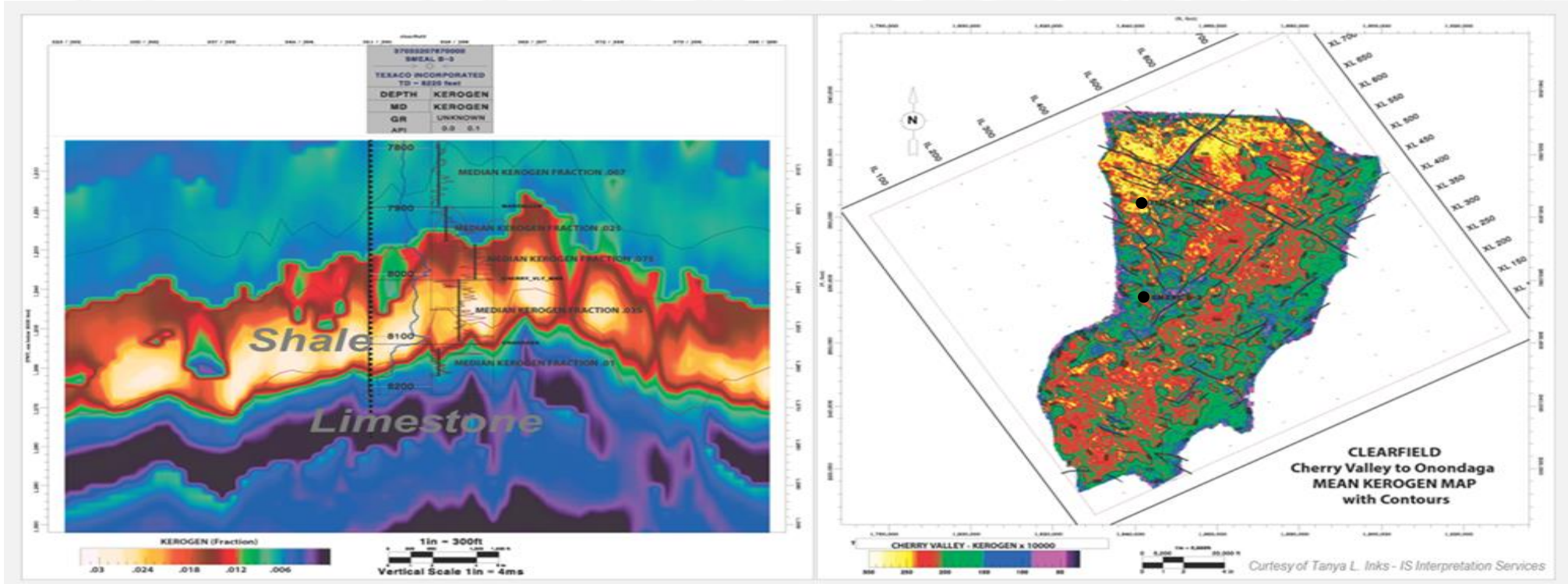


FRACTURE CHARACTERIZATION

Coherency Attribute on PP and PS data



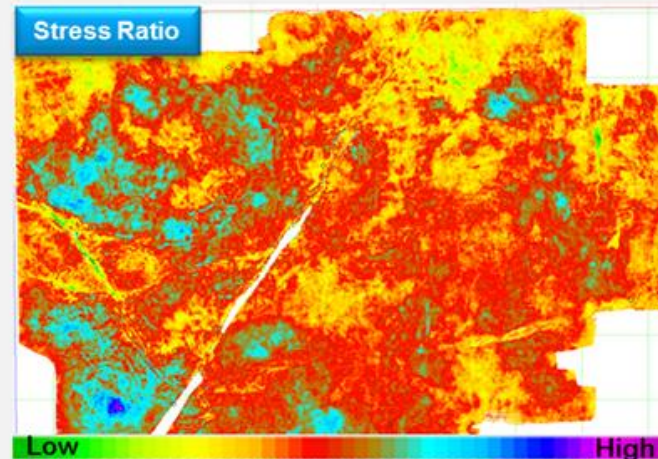
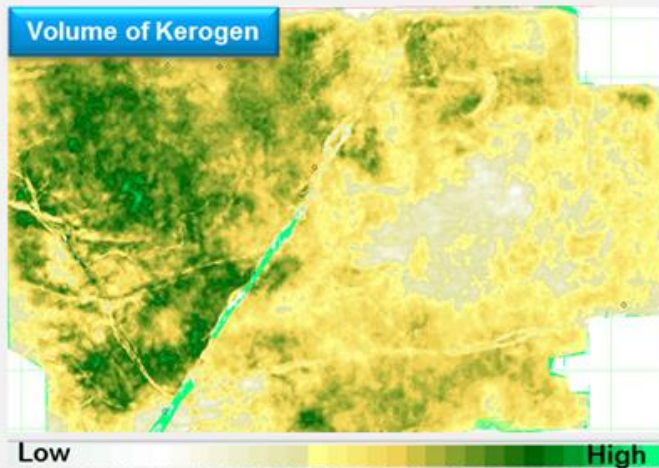
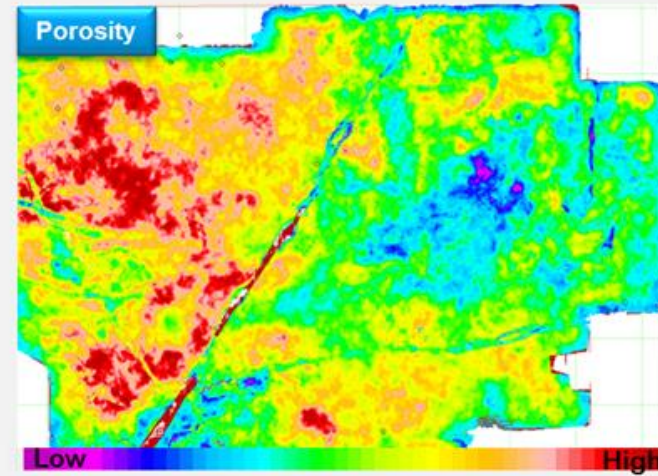
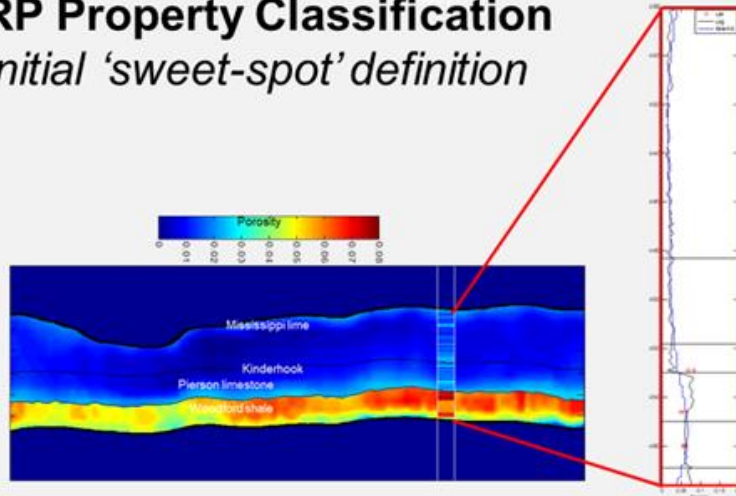
The Value of Seismic Data in Unconventional



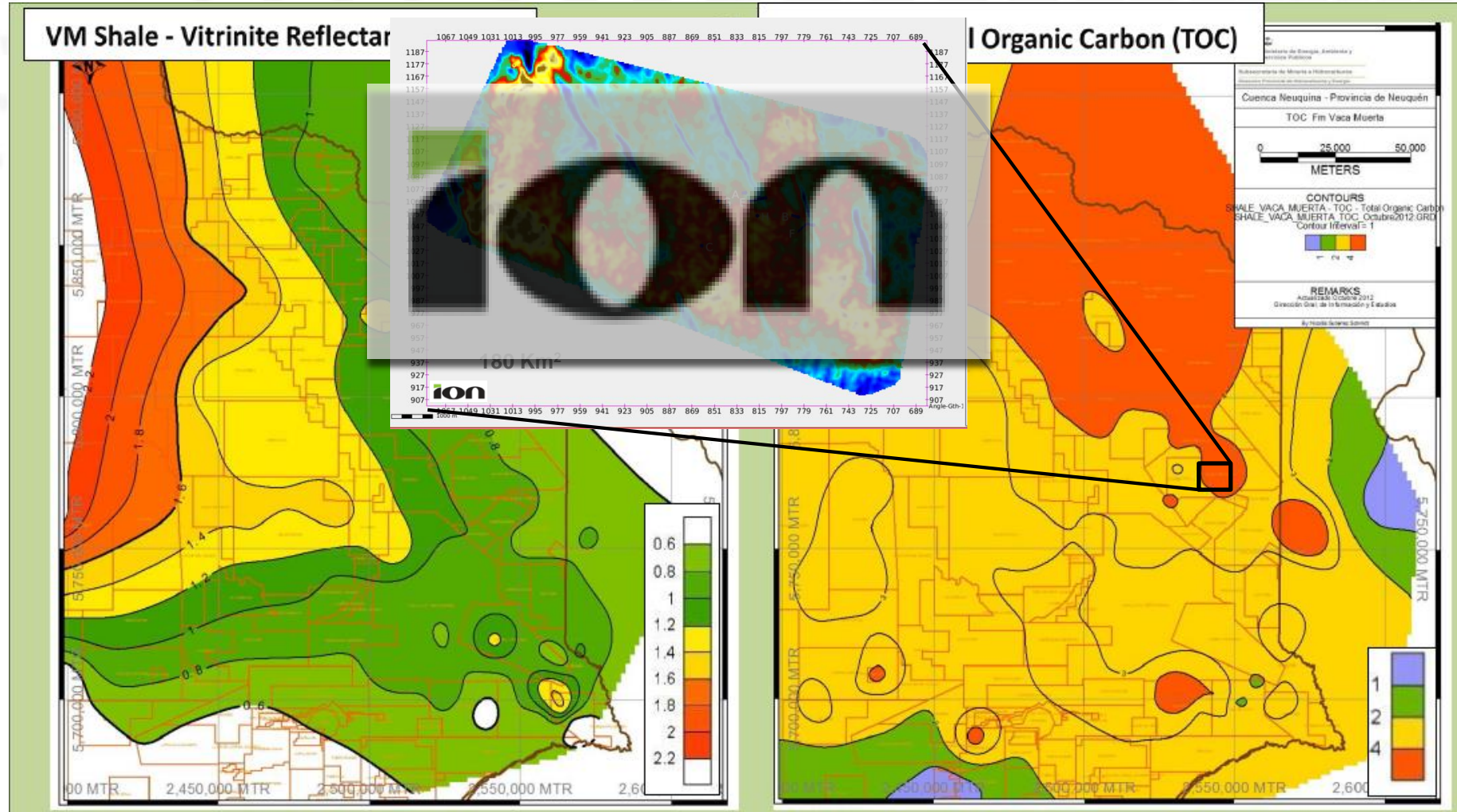
Exploration	Appraisal	Drilling	Completion
Basin Delineation	Characterization	Geosteering	HF Modeling
Petroleum System	Well Placement	Hazard Prediction	Well Design
Prospect Ranking	Production Drivers	Geomechanics	HF Monitoring

The Value of Seismic Data in Unconventional

RP Property Classification Initial 'sweet-spot' definition



The Value of Seismic Data in Unconventional



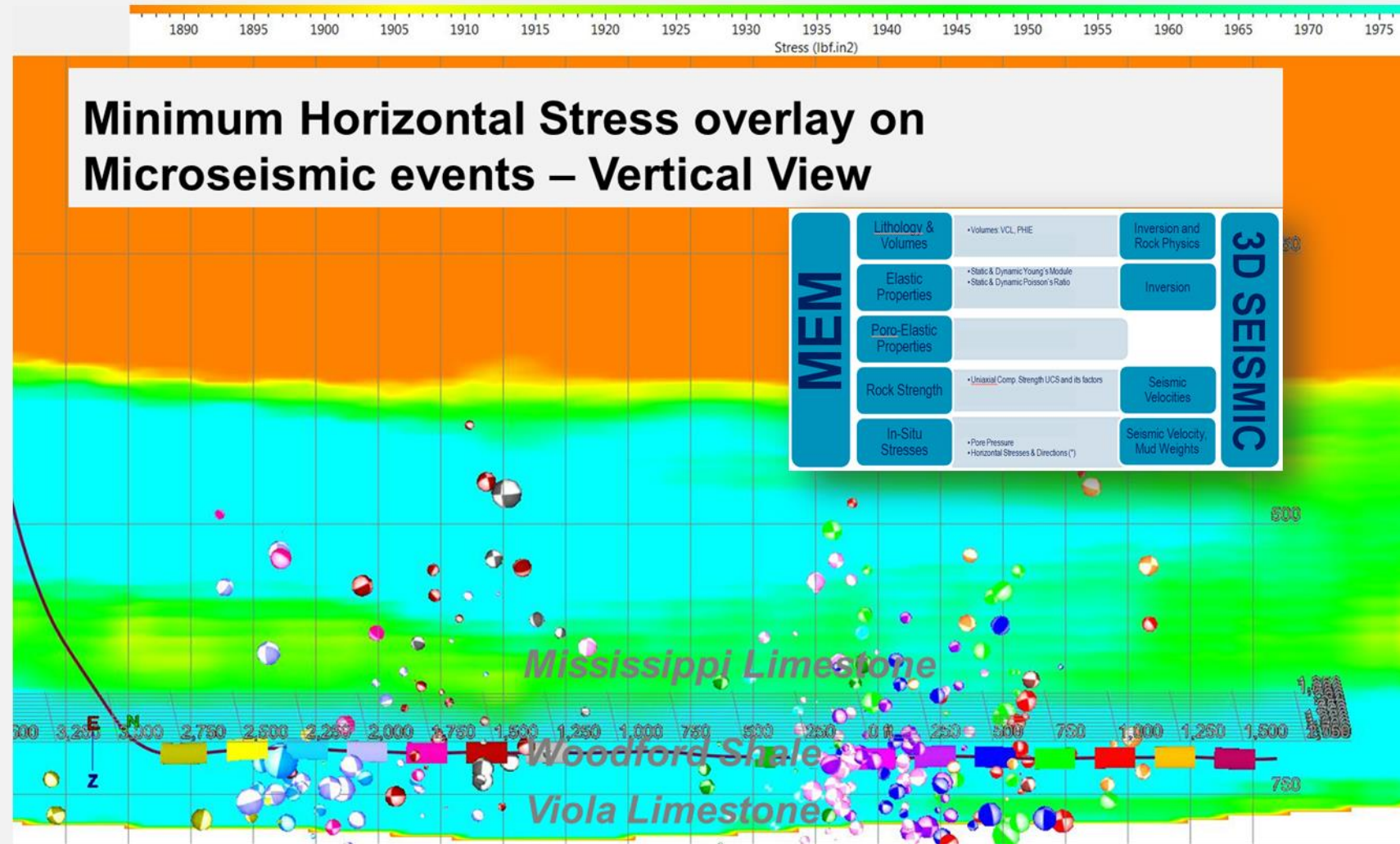
Nicolás Gutierrez Schmidt, Julio C. Alonso y Adolfo Giusiano

The Value of Seismic Data in Unconventional

WELL

Well Optimization Support

- Well Design
- Well Landing/Placement
- Well Completion



What Seismic Reservoir Characterization Delivers

CONVENTIONAL & UNCONVENTIONAL

Thickness

N/G

Facies

Mineral Volumes & Probability

Porosity

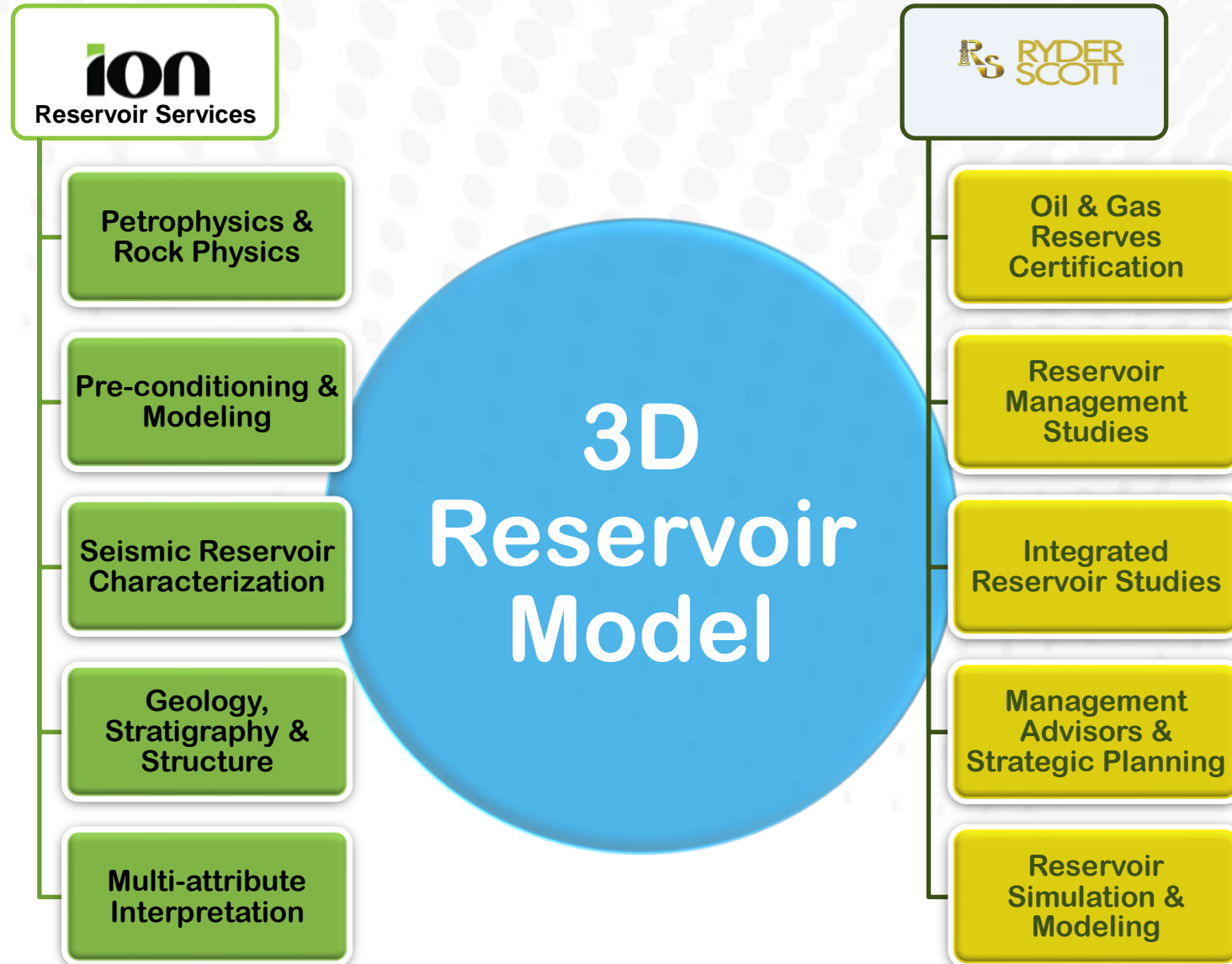
Fluids & Saturation

Pore Pressure

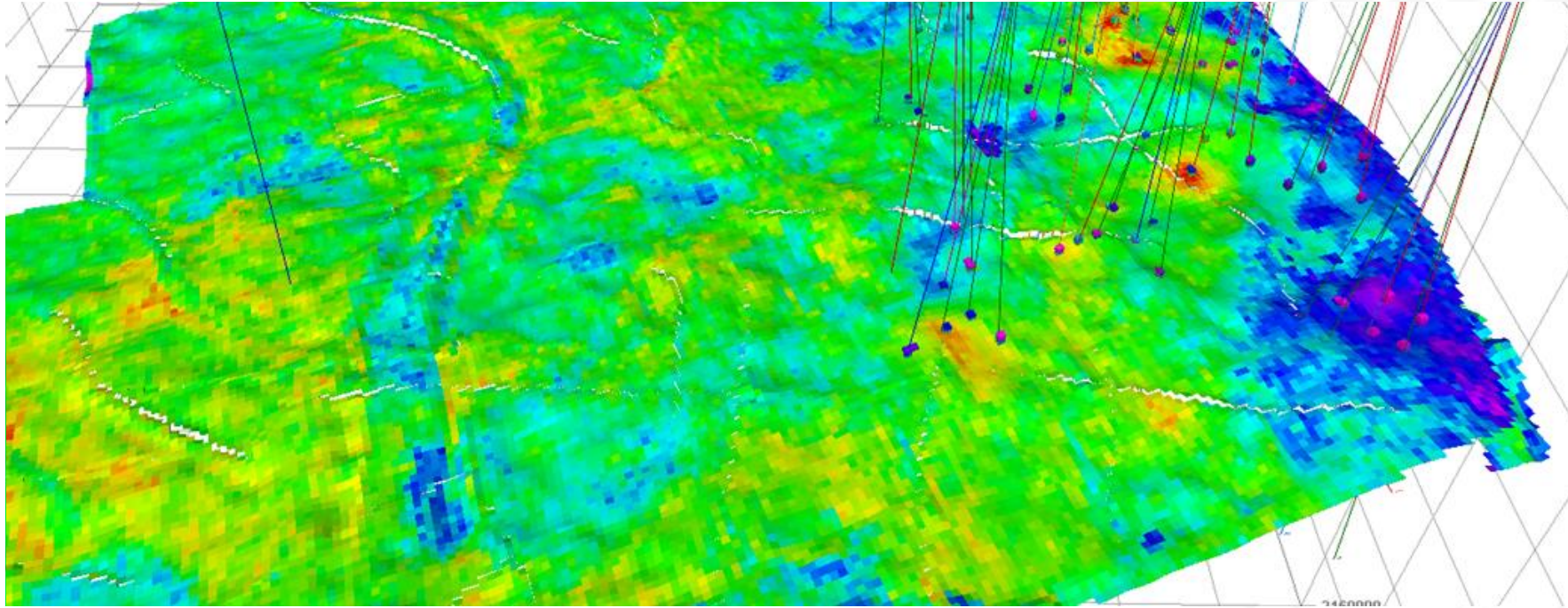
Fracture Density & Orientation

Stress

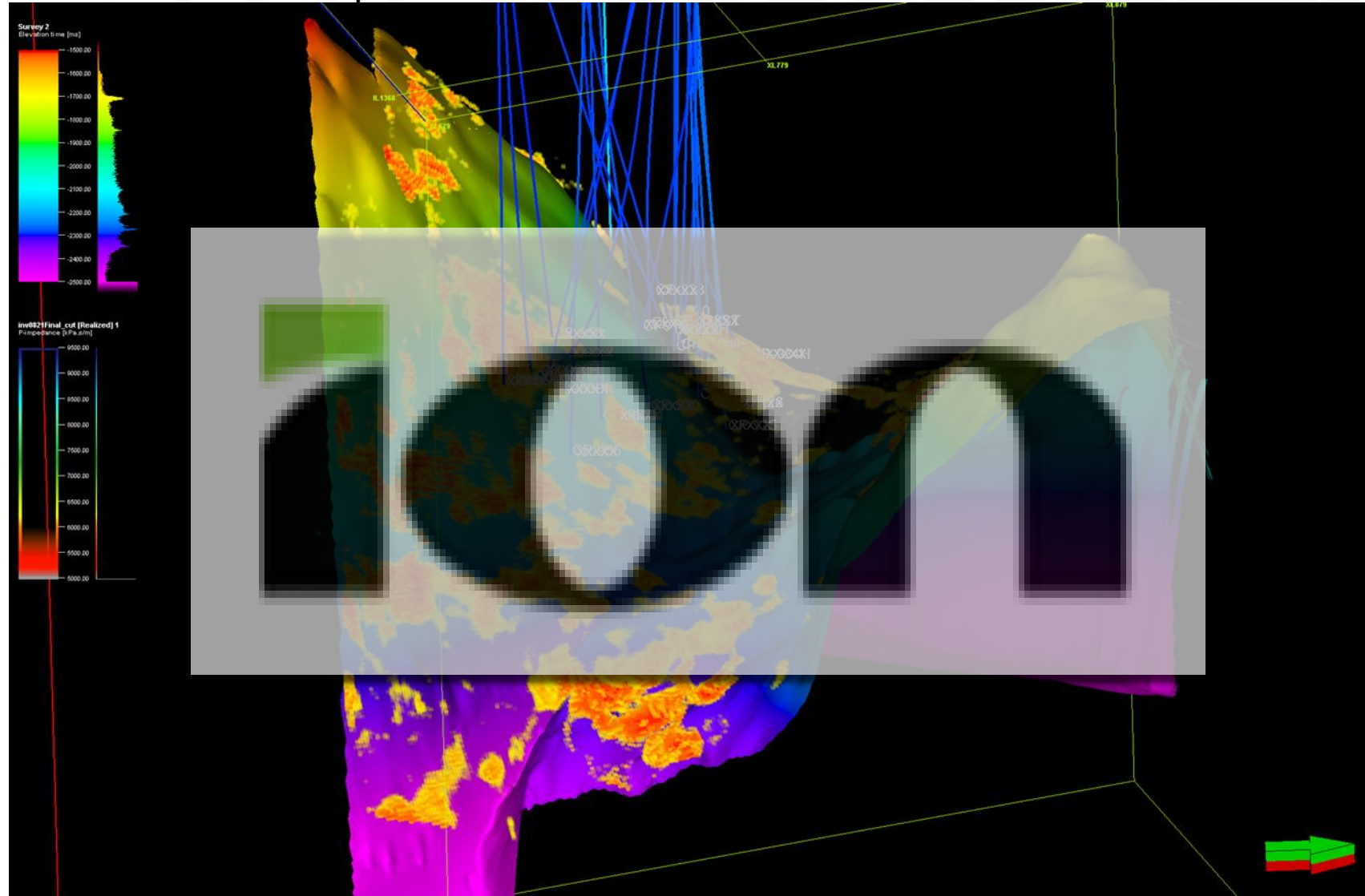
ION / GX Technology & Ryder Scott ...working together on Integrated Solutions



ION / GX Technology & Ryder Scott ... working together on integrated solutions



Atributo sismico de predicción de Probabilidad de Aceite



E&P Advisors



Thank You

