Wolfbone Appraisal and Development in Southeast New Mexico: An Evolution to Profitability

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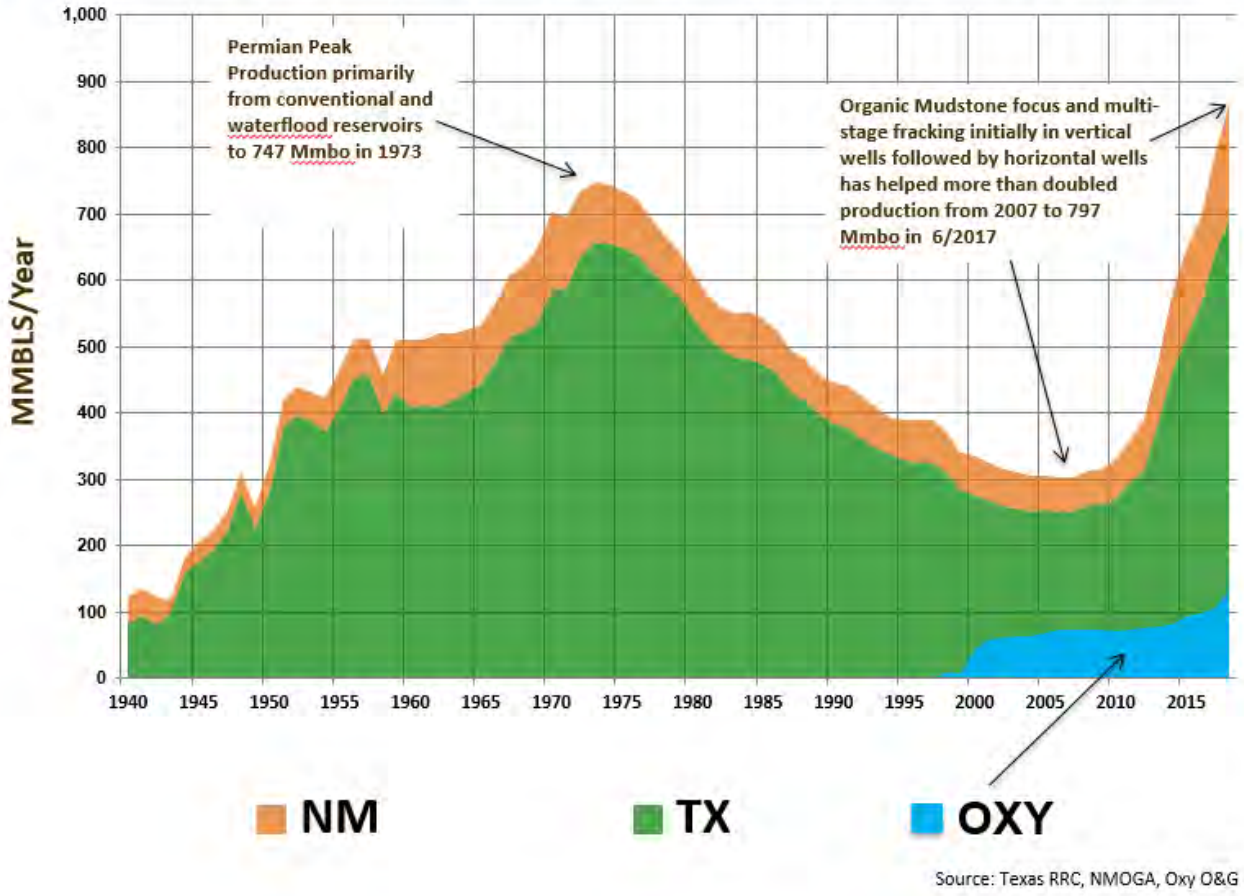
Houston, Texas

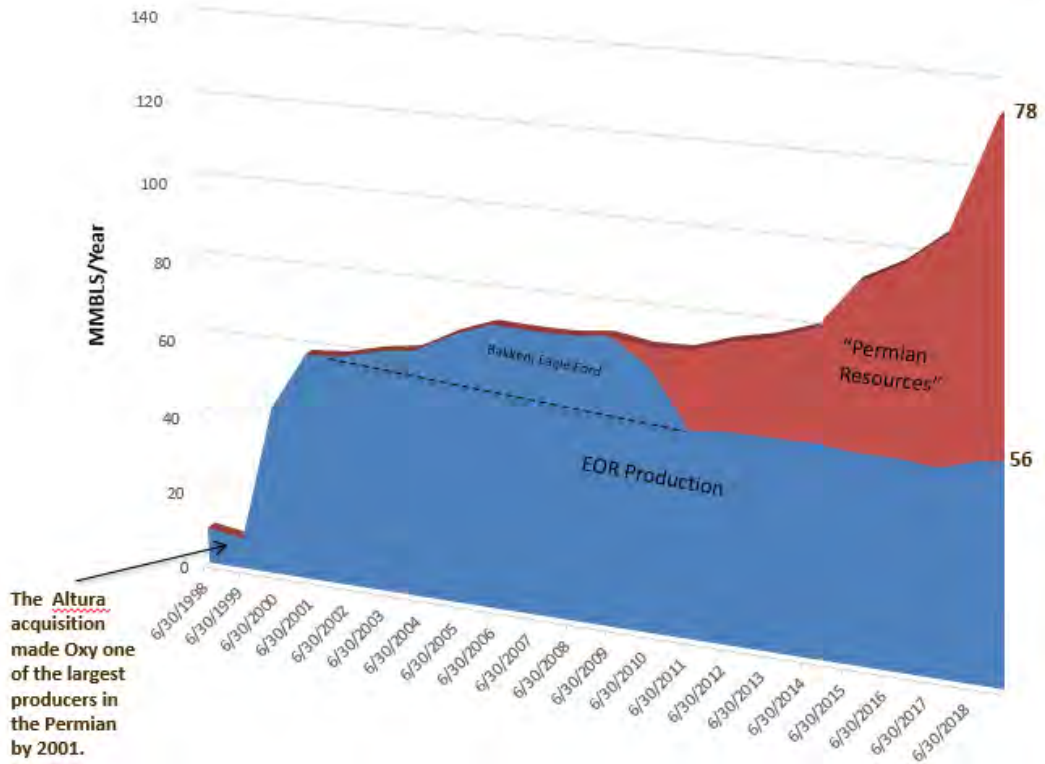
Permian Basin and Oxy's Historical Production Growth

Permian Basin Annual Oil Production 1940-2018



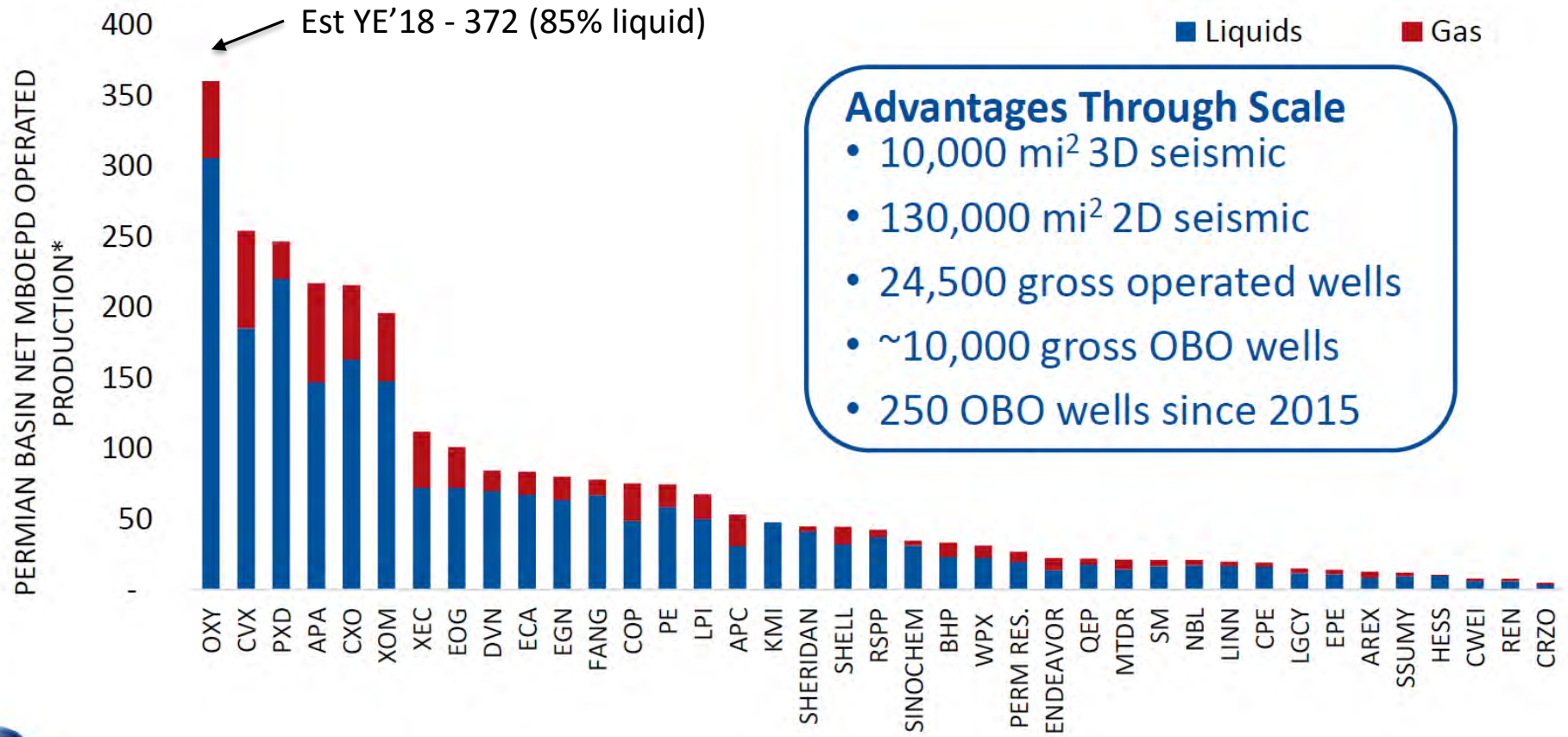
Source: Texas RRC, NMOGA, Oxy O&G

Oxy Permian Basin Annual Production 1999 to 2018



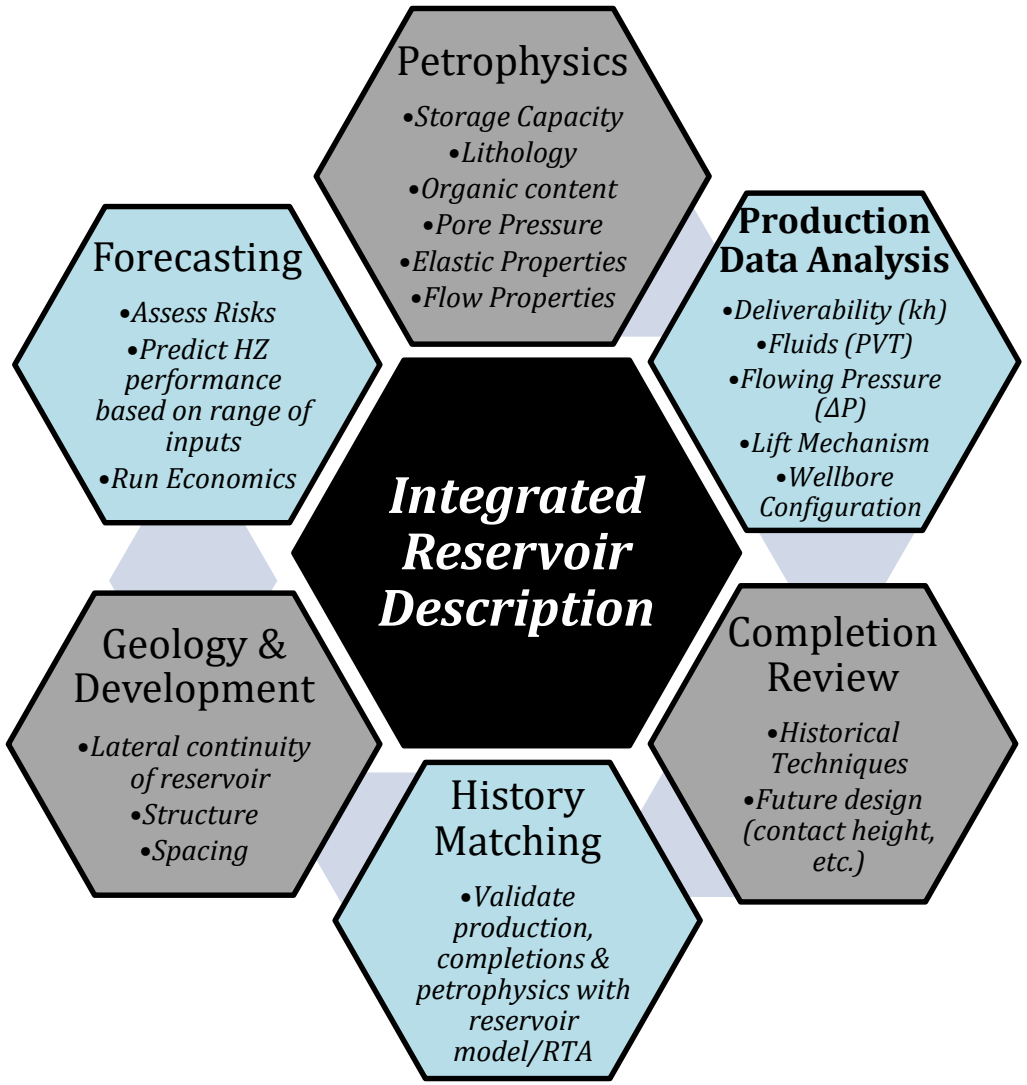
Oxy early Appraisal on unconventional targets began in 2011. Focus on high graded assets and capex efficiency began in 2016

Oxy is Largest Producer in Permian Basin



*Source: Wood Mackenzie 2016 production, 3/2/17, company NWI% production rates, operators shown represent ~85% of Permian Basin daily production
Gross Oxy operated wells including producers and injectors, and idle wells

Unconventional Resources Technical Workflow



Primary Data - In

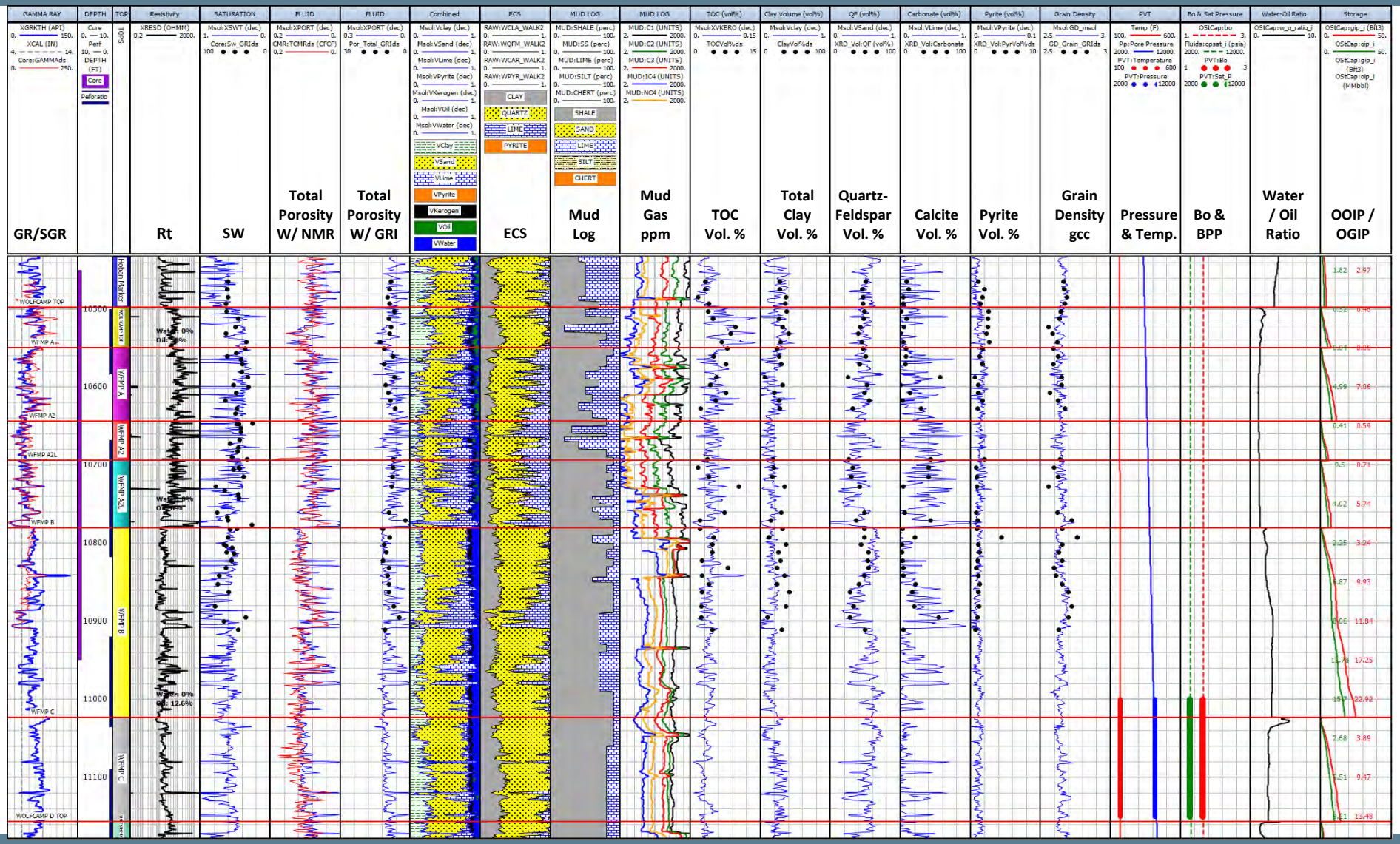
- **Rock Properties - Composition**
- **Organic content, type and maturity**
- **Storage properties**
- **Fluid Distributions & Properties**
- **Pore Pressure Profiles**
- **Elastic properties / Geomechanics**
- **Pore body (and pore throat) connection**
- **Flow properties**

Primary Impact - Out

- **Improved bench appraisal and ranking**
- **Improved HIP (more consistent RE)**
- **Hydrocarbon fractionation (mobile vs. residual oil)**
- **Water source determination (intra vs. inter – formational)**

There is a strong inter-discipline linkage as there are numerous reservoir parameters that are gathered, calculated & shared for decisions on on capital commitment.

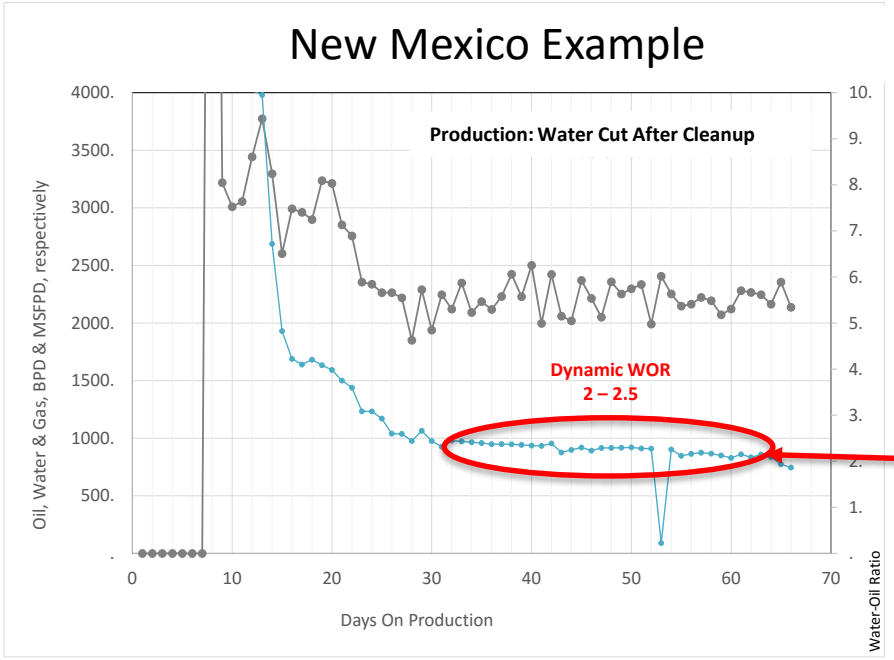
Accurate OOIP/OGIP Estimates from Quad-Combo, NMR, ECS to Match Rock and Fluid Properties to predict OOIP/OGIP/OWIP



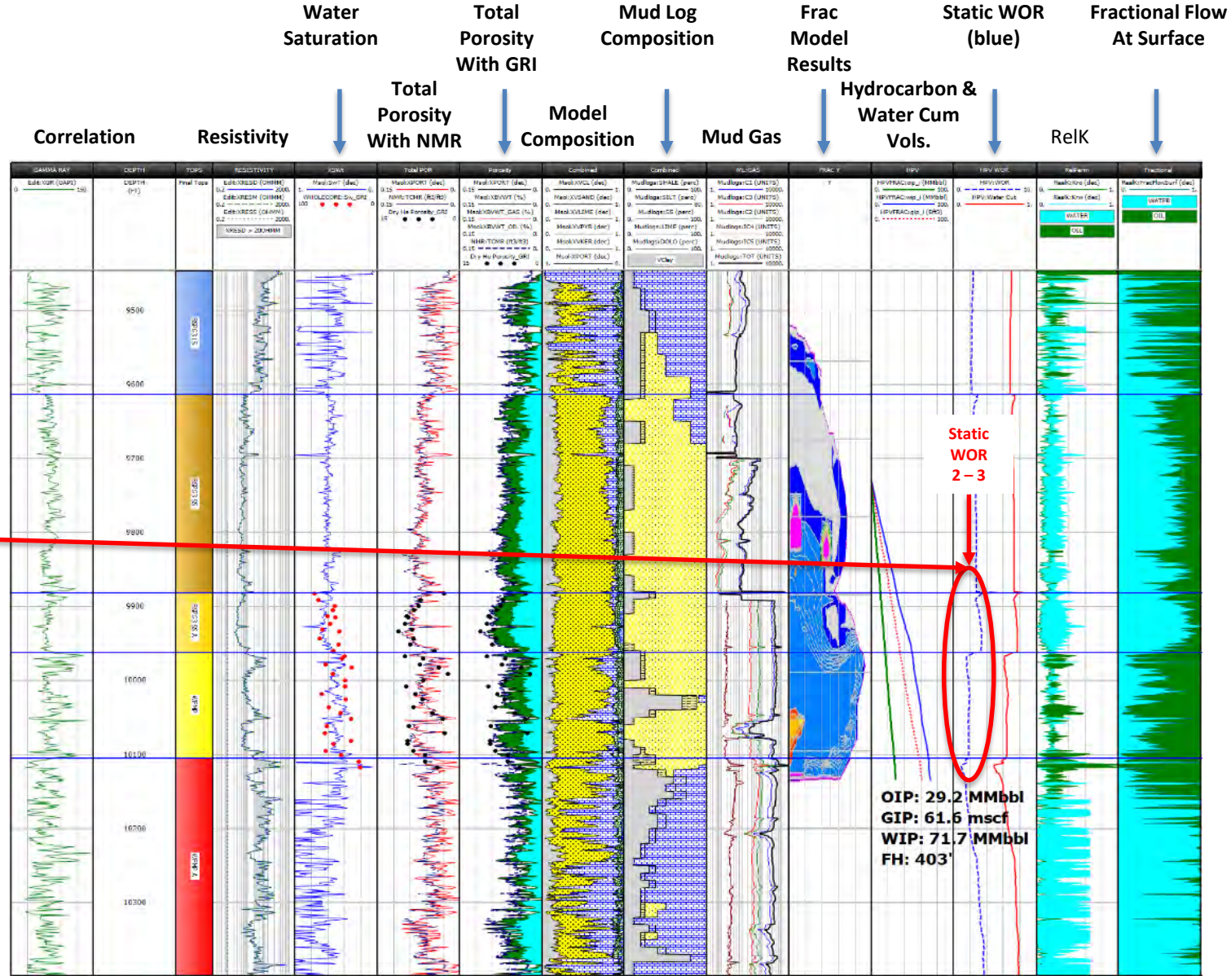
Black dots are cuttings or core measurements that are the calibration reference for the petrophysical analysis.
Fluid calibration shown by the Pressure & Temperature, Bo & Bubble Pt. (PVT) provides accurate estimates of OOIP / OGIP per bench

Petrophysical Calibration to Production: Cross Discipline Integration with Reservoir, Completions and Production Engineering

Comparison of Production Water-Oil Ratio (WOR) to Petrophysics WOR



- Production calibration of water source using fractional flow at surface estimates using relative permeability
- Cross checking performance of Petrophysical calibration is critical to development decision

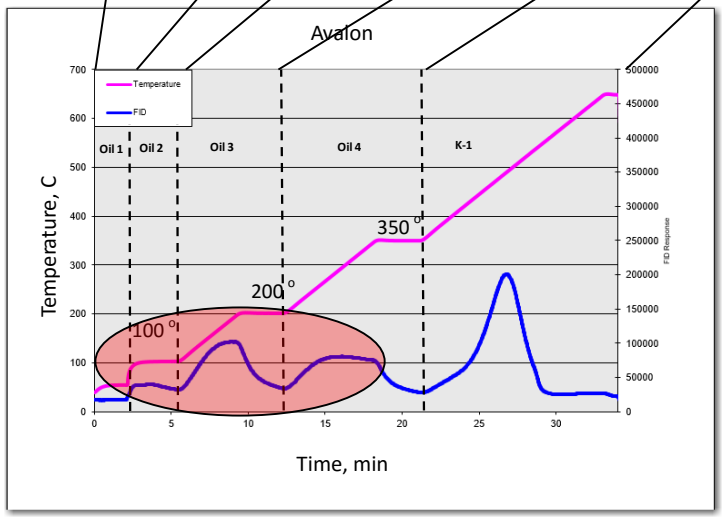


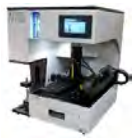
Geochemical Hydrocarbon Fractionation: Mobile vs. Immobile Oil

*To access Matirity & TOC Content

Programmed Pyrolysis
Multi-Plateau Temperature Series

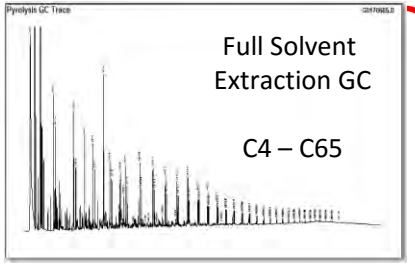
Peak (zone) Name	Oil-1	Oil-2	Oil-3	Oil-4	K-1
Temperature Range (°C) within which Tmax is designated	~50 °C to ~100 °C, hold for 5 minutes	100 °C, hold for 5 minutes	Ramp 100 °C to 180 °C at 25 °C per minute. Hold for 5 minutes	Ramp 180°C to 350 °C at 25 °C per minute. Hold for 5 minutes	Ramp 350°C to 650 °C at 25 °C per minute. Hold for 5 minutes
Petroleum Fraction	C4-C5	C6-C10	C11-C19	C20-C36	Kerogen (plus any C37+)
SARA disposition	Saturates and Aromatics			Polars	n/a



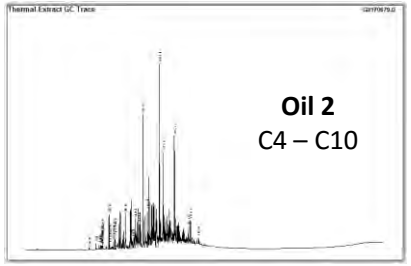


*To measure Fractional HC components

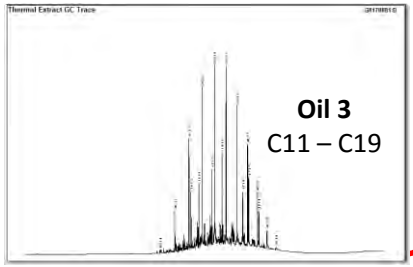
Gas Chromatography Mass Spectroscopy



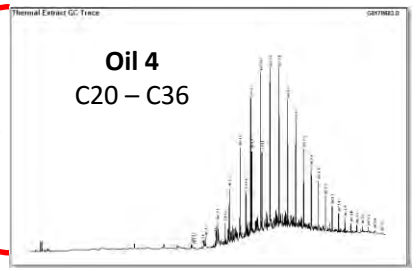
100 °C



200 °C



350 °C



Polar molecules become less mobile with increasing size

*To est. OIP from S1 fraction

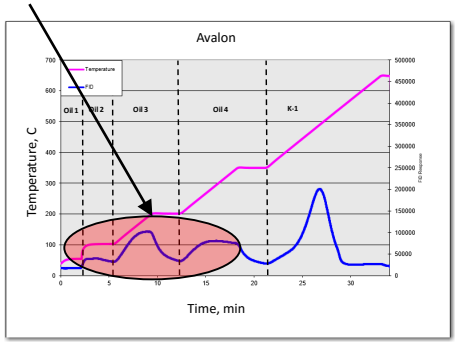
Downey Method

OOIP = *4965.36 x (ρ_{Av}) ($S1_{Av}$) / (ρ_{oil})*

ρ_{Av}= Average bulk density (g/cc)

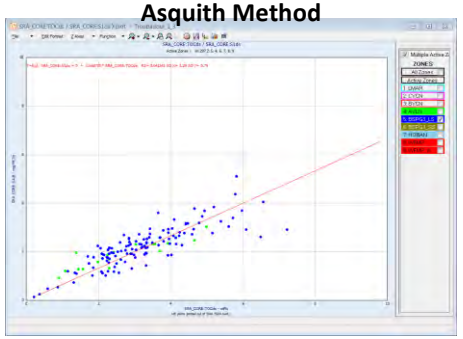
ρ_{oil}= Density of oil (g/cc)

S1= Oil 1 through Oil 4 (mg/g)



Saturates & Aromatics are the highly mobile phase

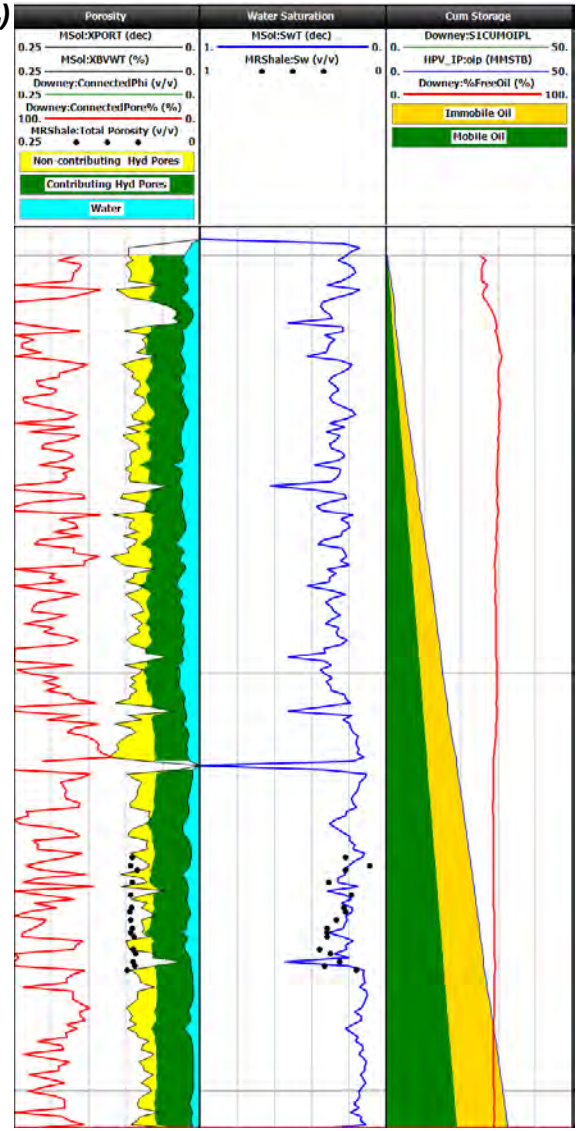
Asquith Method



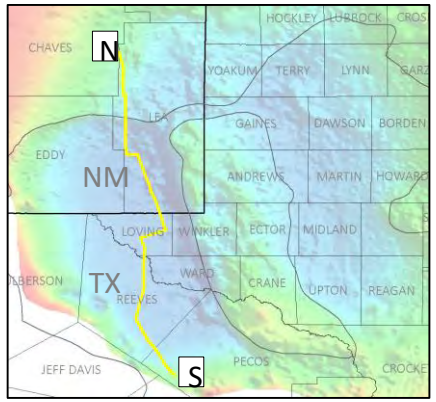
S1 correlation to upscale from point to profile

*To est. mobile HC fraction

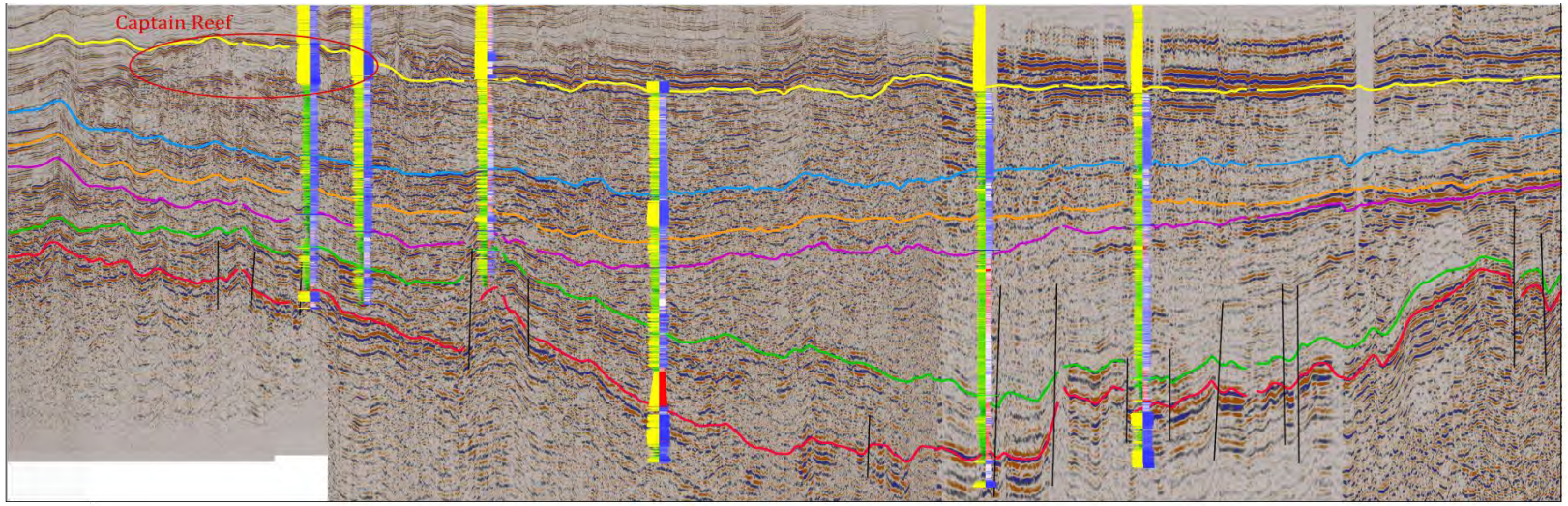
Downey-Asquith Profiles



Mega Scale: Delaware Basin Structural and Stratigraphic Complexities

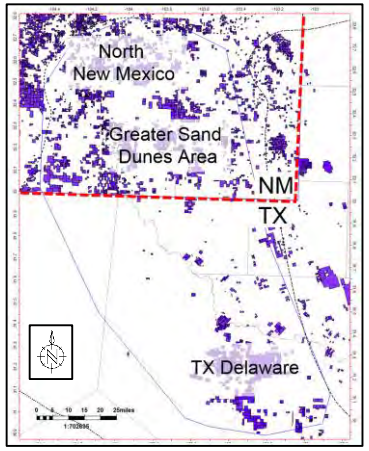


North South

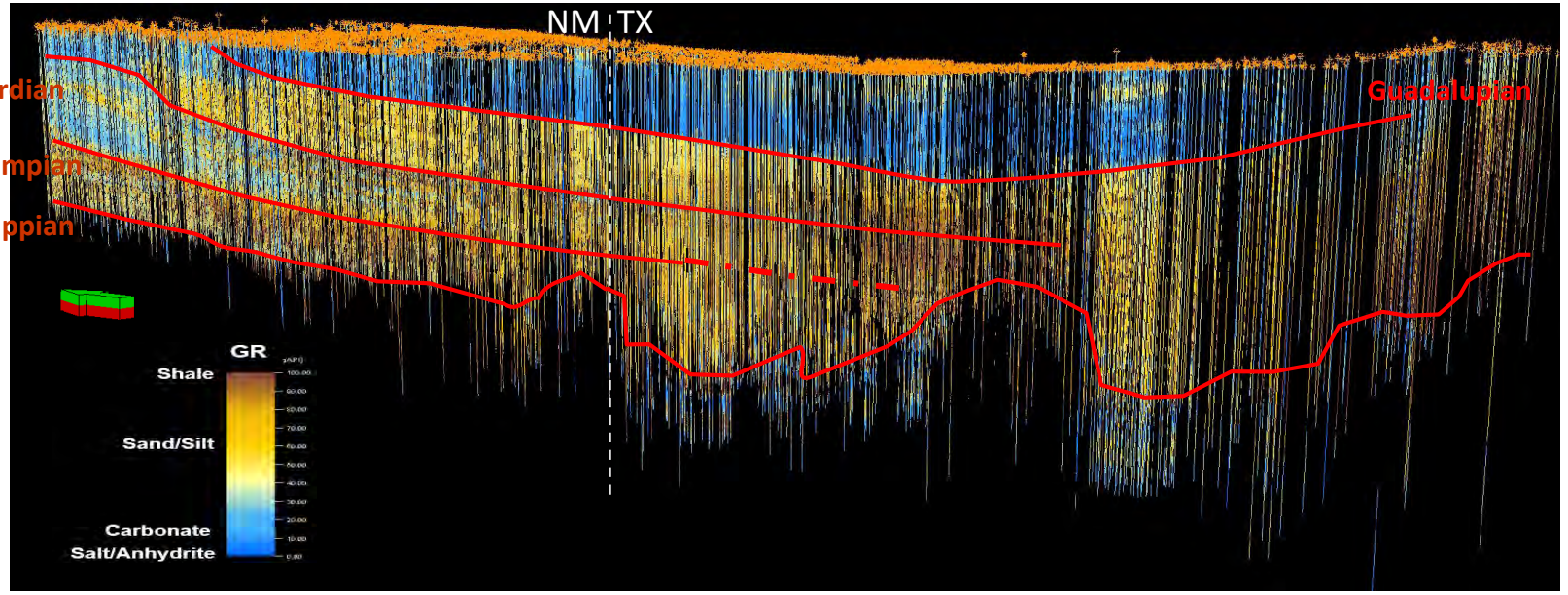


Leonardian
Wolfcampian

Mississippian

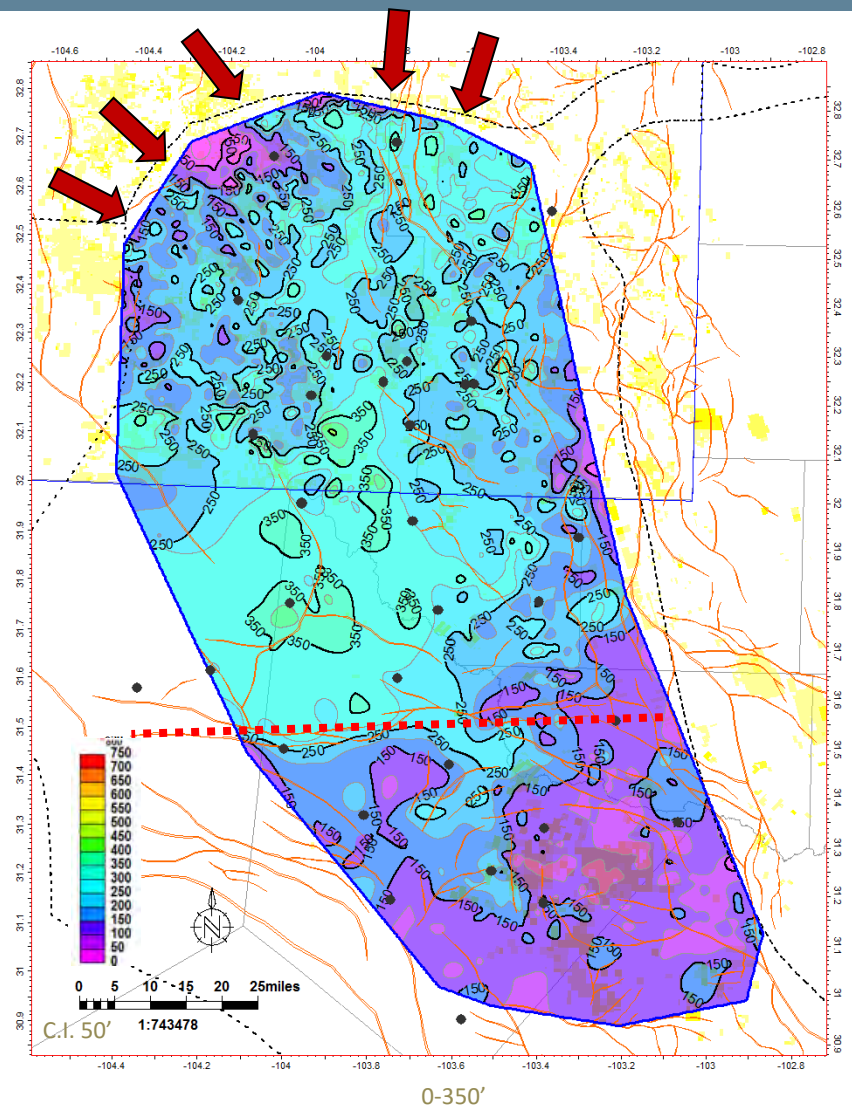


North South

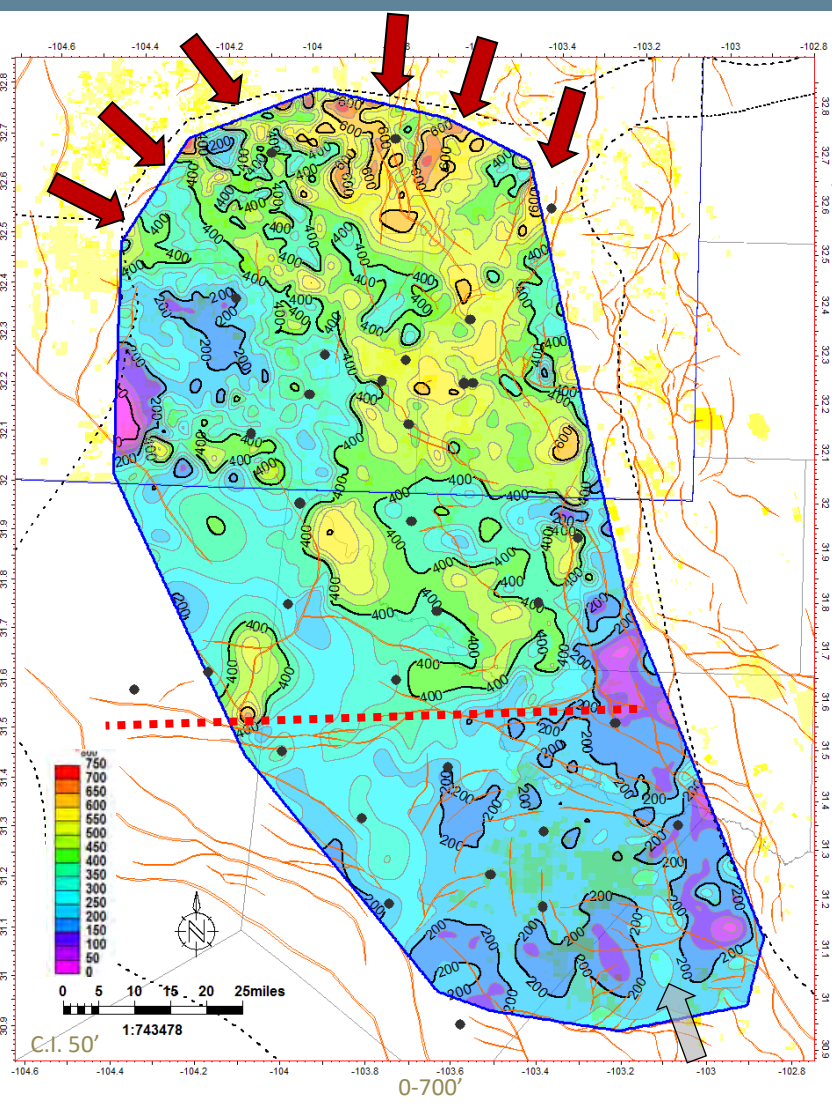


~6000 wells

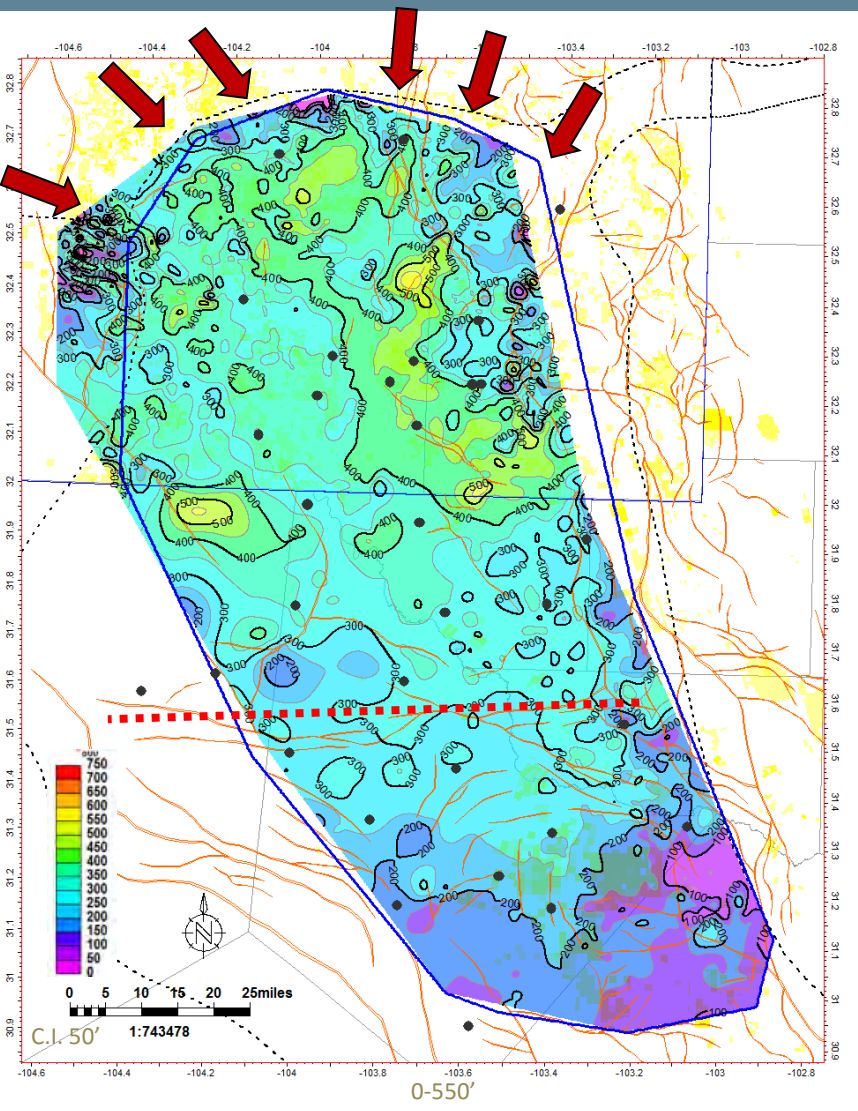
Delaware Basin: Bone Spring Sands Gross Isochore



0-350'



0-700'

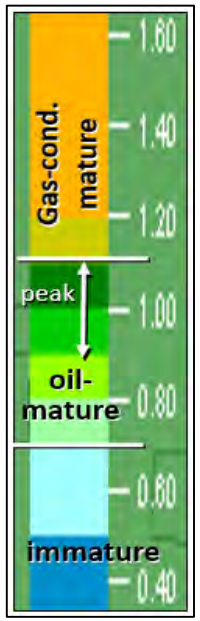


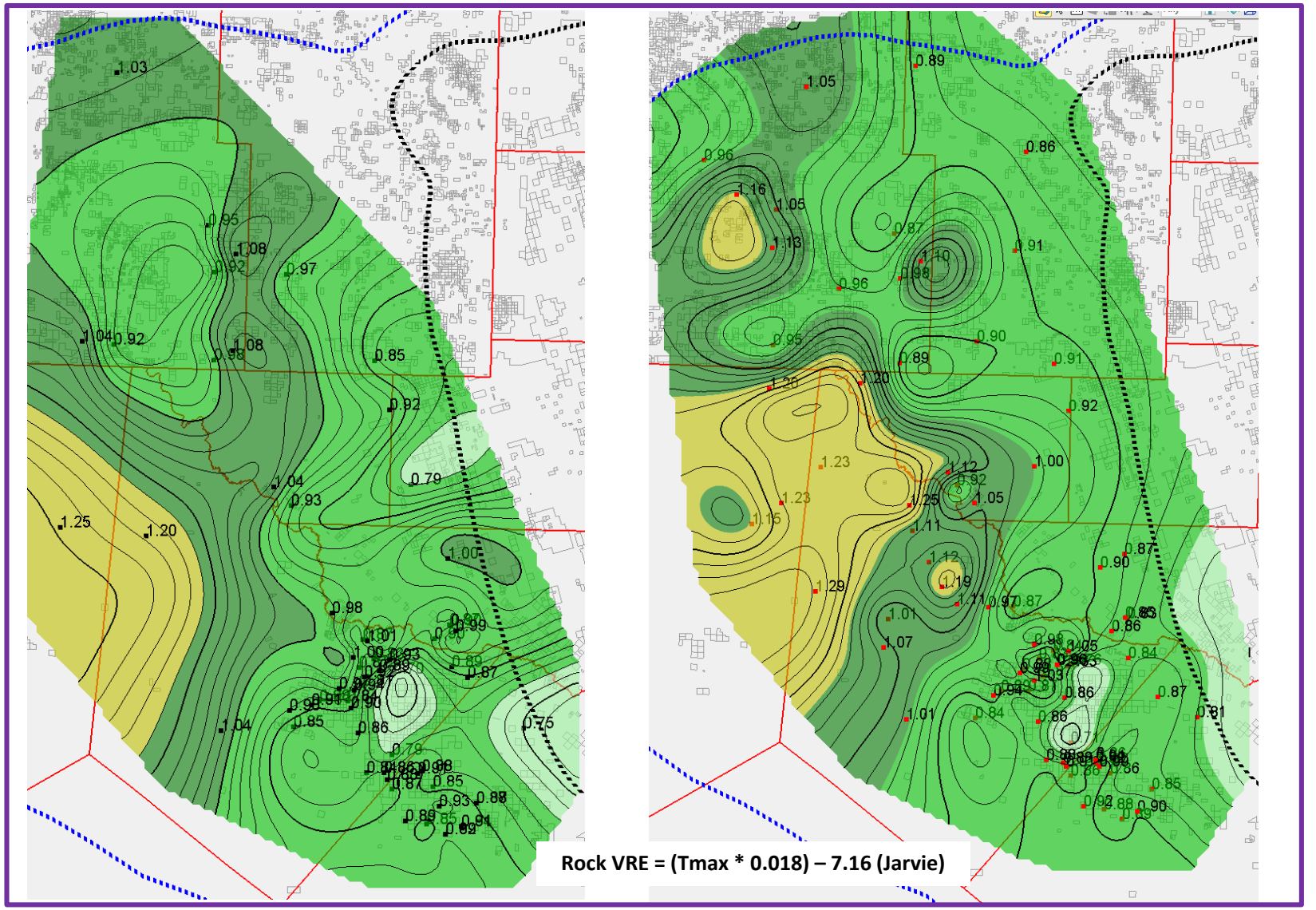
0-550'

Sediment Source Direction

Grisham Arch/
Fault Location

Geochem and Basin Modeling - Maturity of Potential Source Rocks

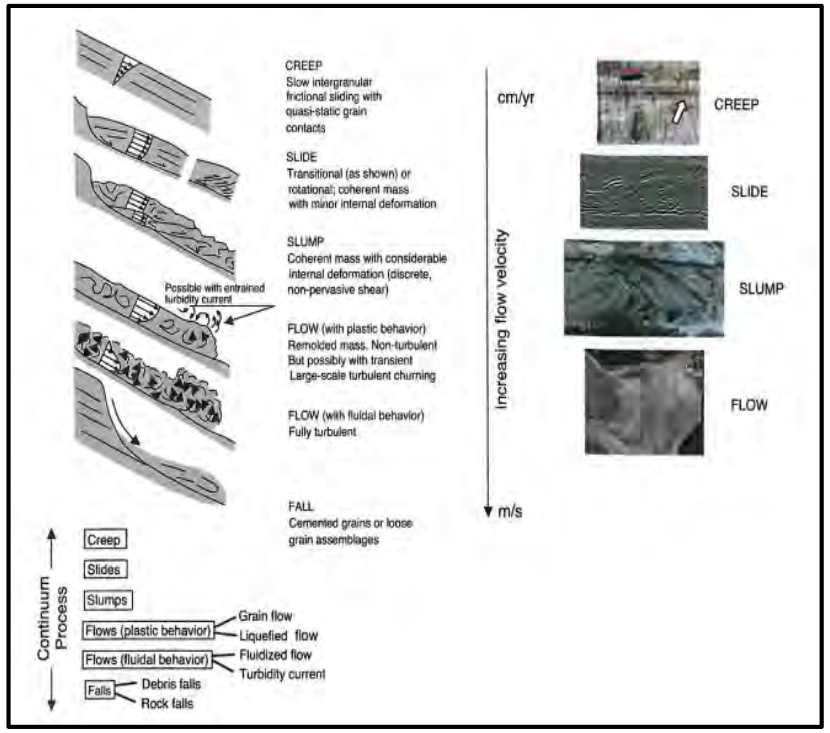




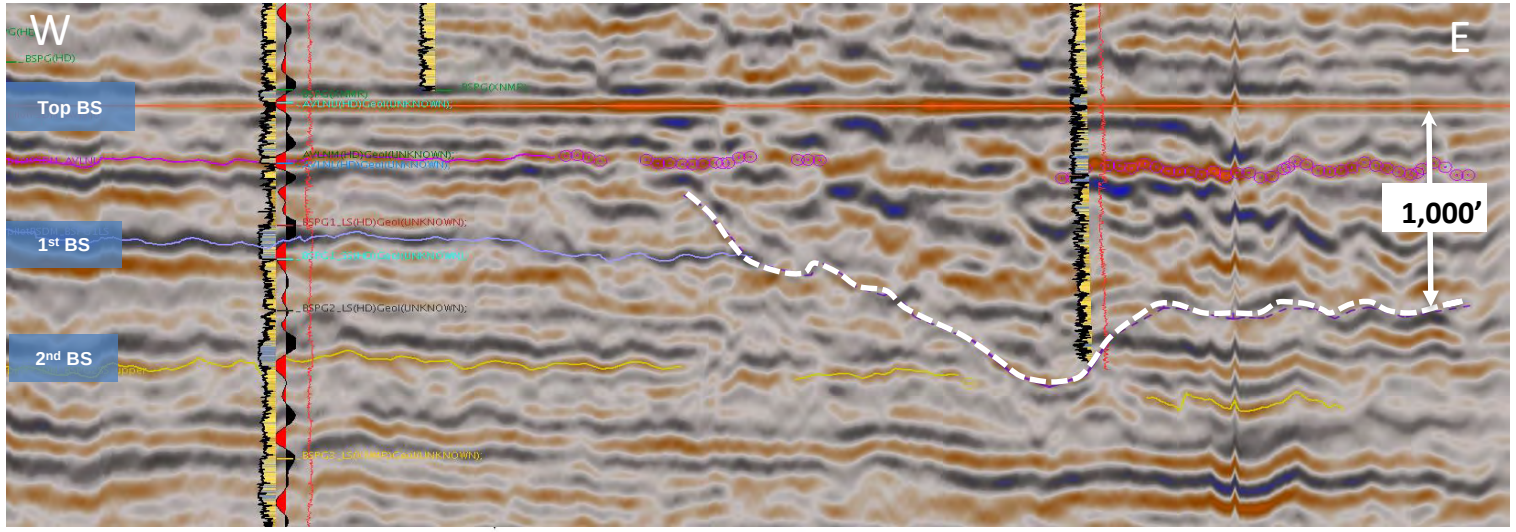
Rock VRE = (Tmax * 0.018) – 7.16 (Jarvie)

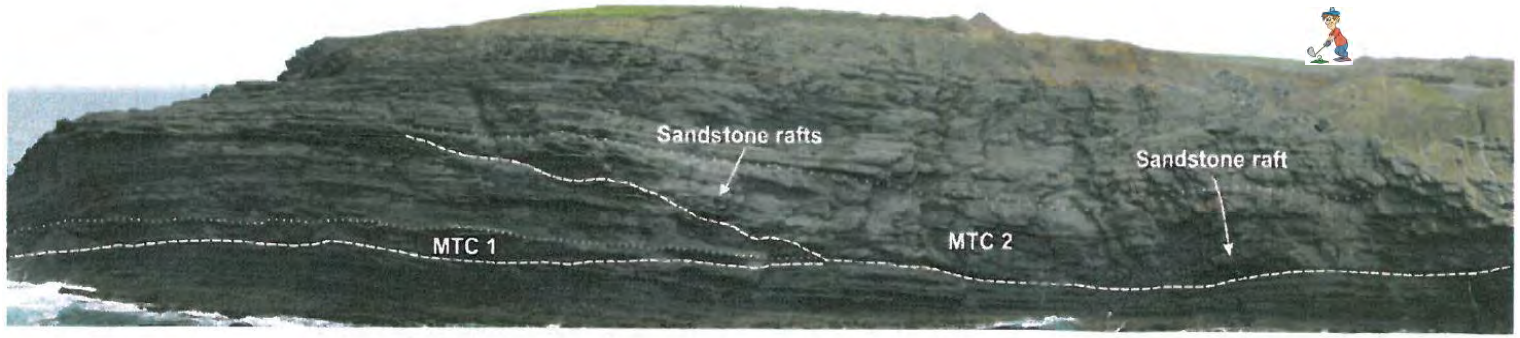
Structural and Stratigraphic Complexities on a Local Scale

Spectrum of slope depositional processes



New Mexico example of slump and fill of mass transport deposit

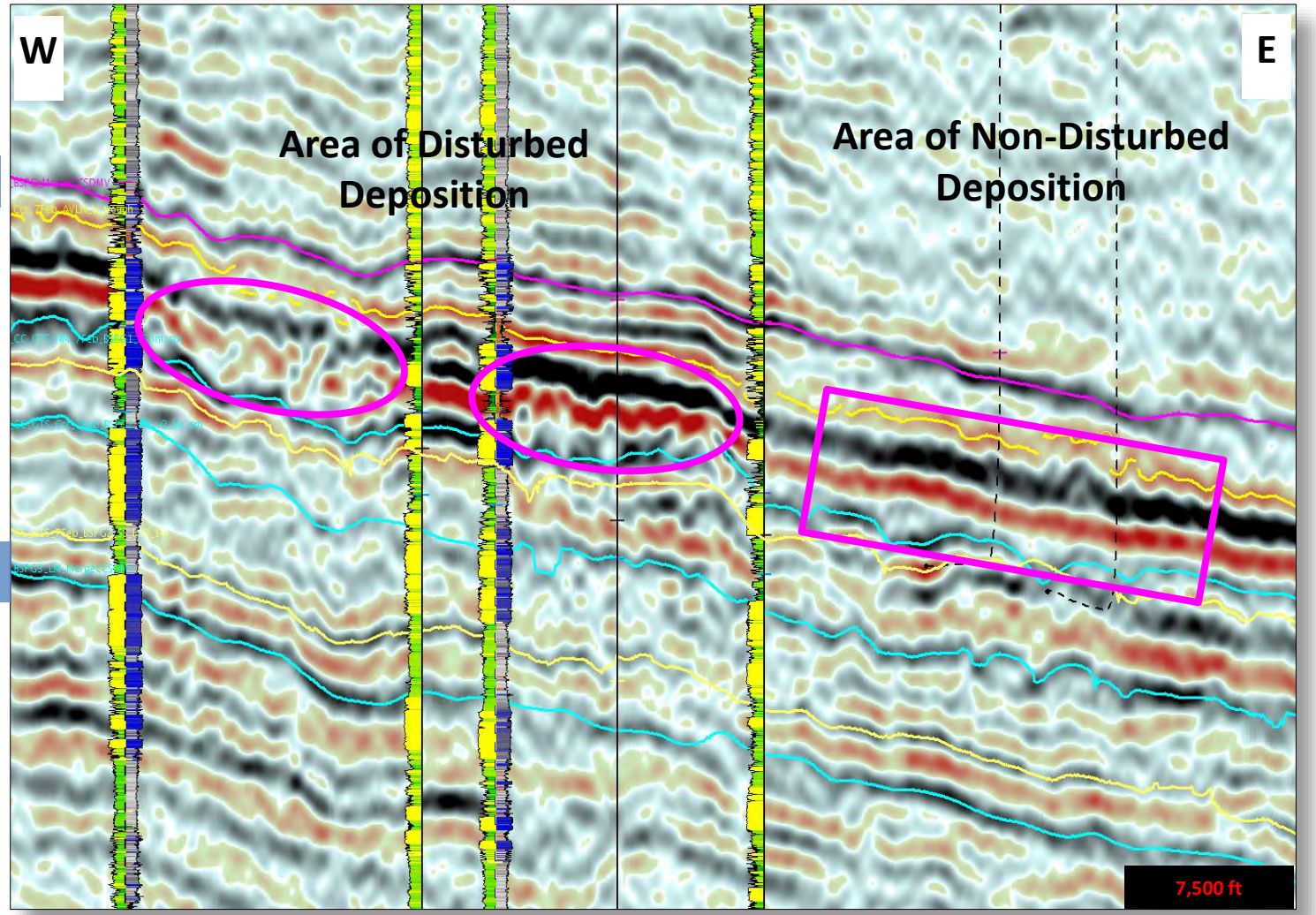


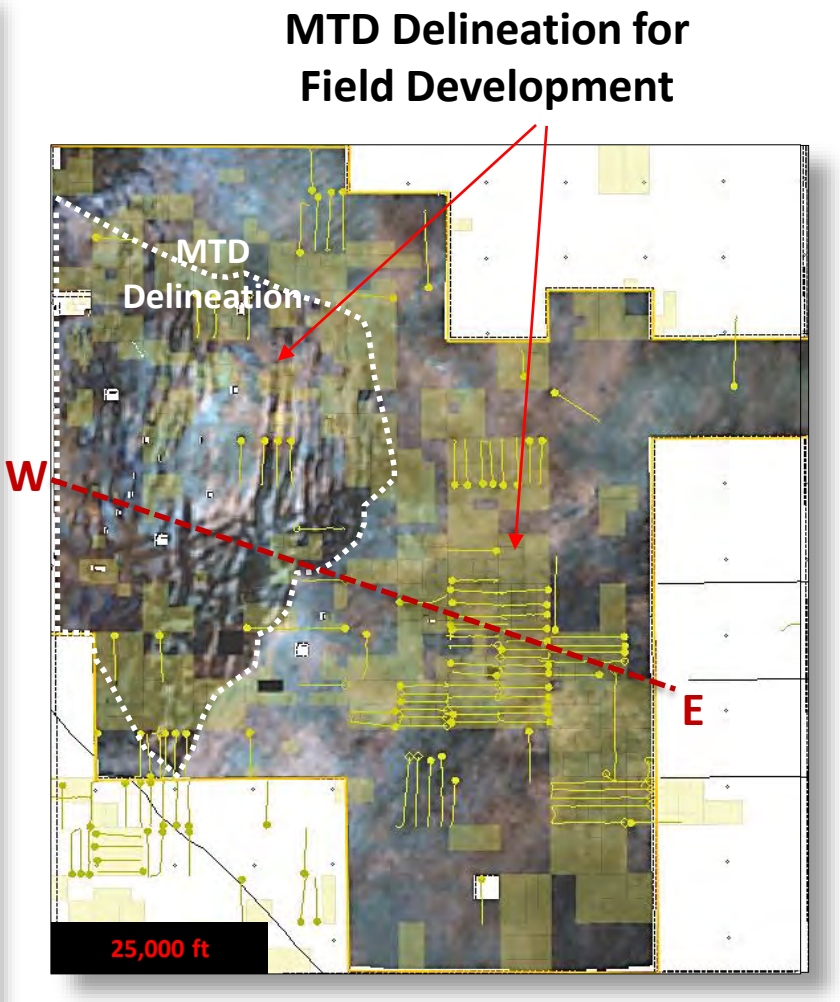


Example of slope-slump scars and fill of mass transport deposit (MTD) from U Carboniferous Gull Island Fm, Clare County, Ireland.

From: Posamentier & Martinsen, 2011, SEPM Special Publication No 96

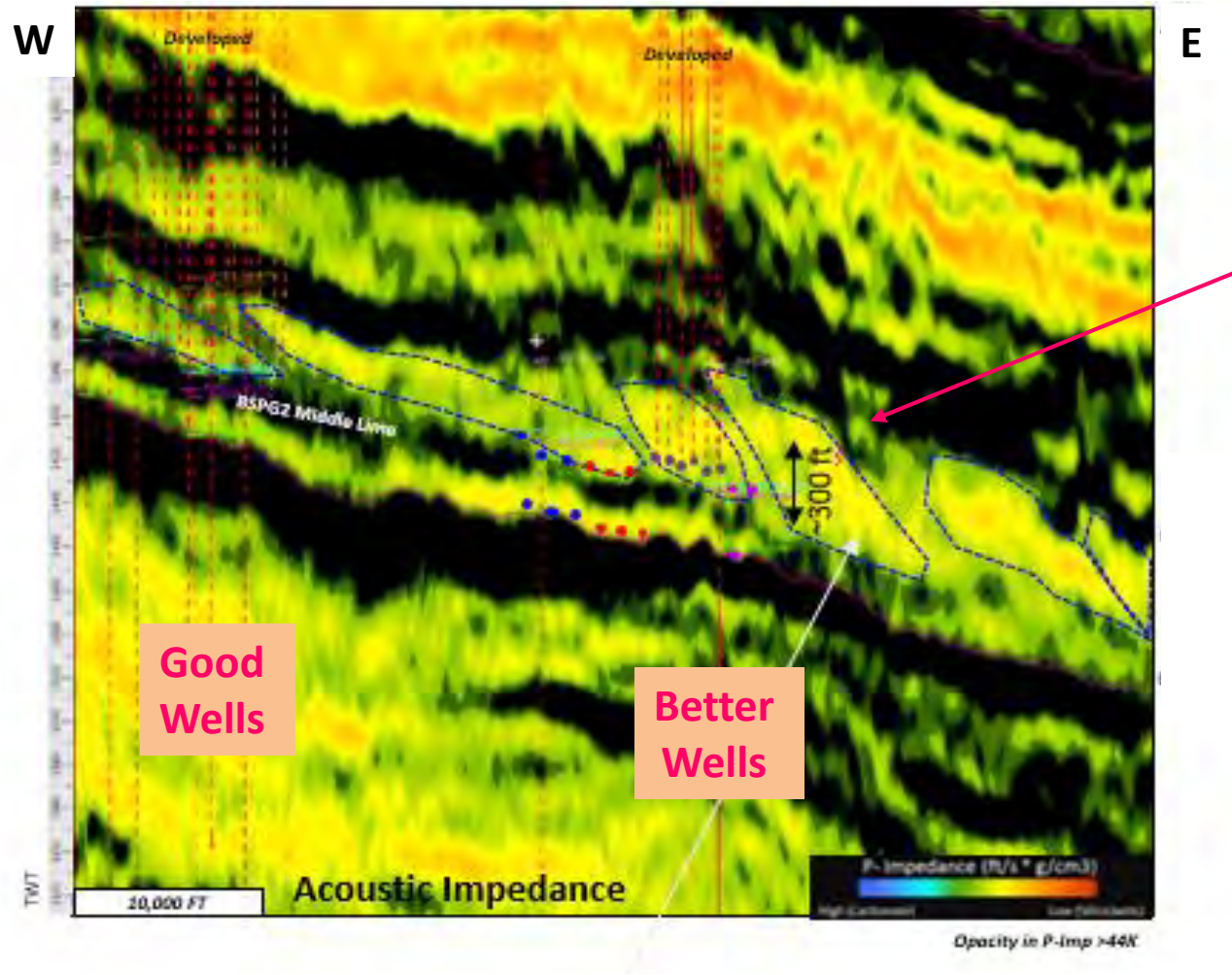
Stratigraphic & Structural Complexities for Field Development Scale



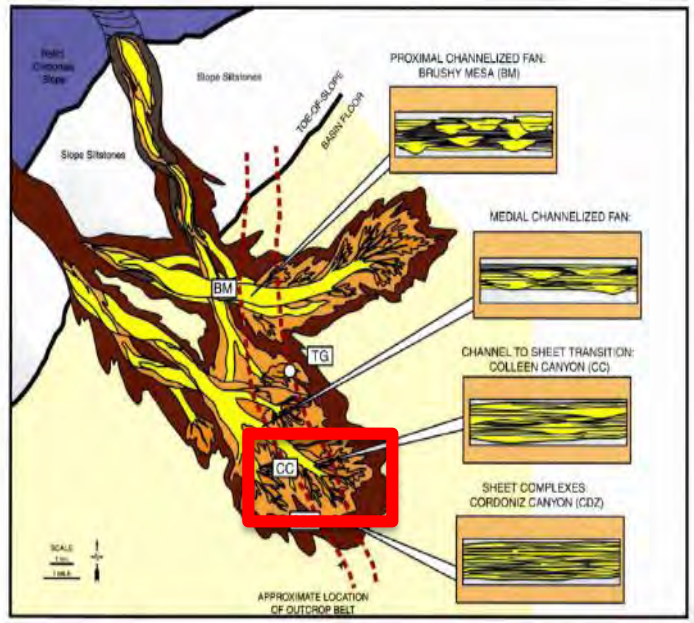


Understanding the geological and reservoir complexities of the disturbed vs non-disturbed rocks is critical prior to field development

Depositional Facies and Reservoir Thickness to High Grade Development



Acoustic Impedance helps to better define reservoir quality, thickness and geometry = better well performance

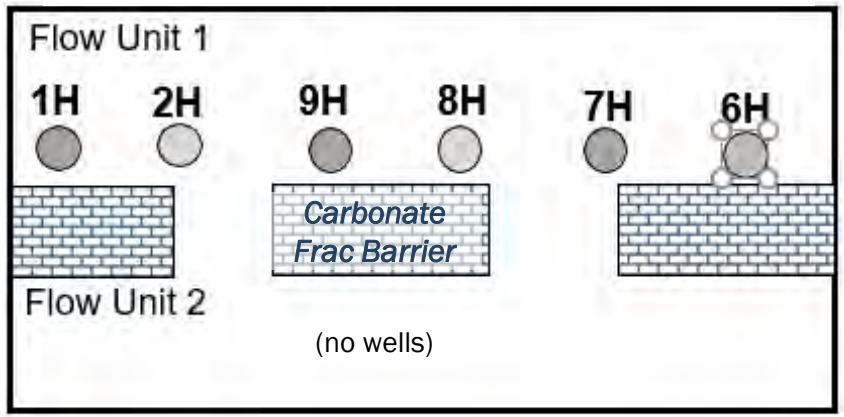


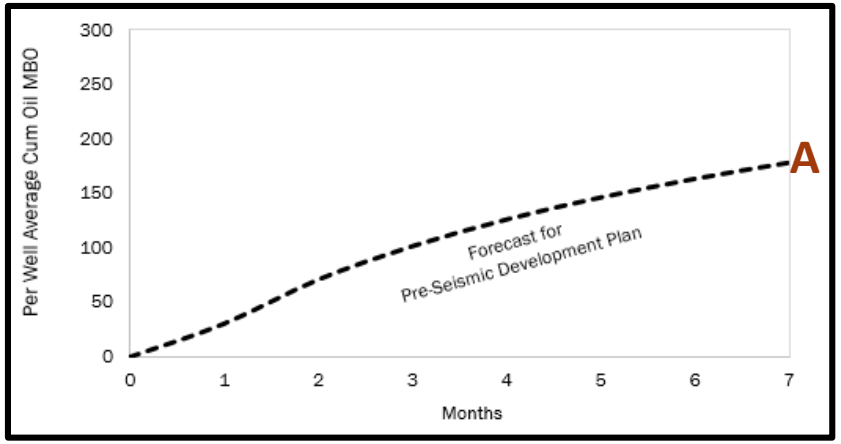
Vertically stacked BS reservoirs, carbonate frac barriers and variations of mapping geometries all affect well performance and development spacing

Geological & Business Risks Associated with Lack of Critical Data & Timing

Original (Pre-AI) 640 ac Development Plan

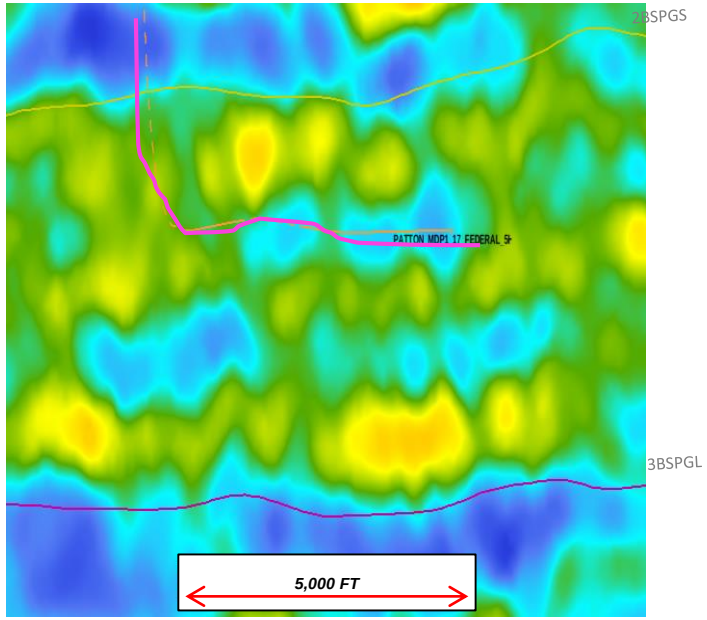
Gun Barrel View, 10K Laterals



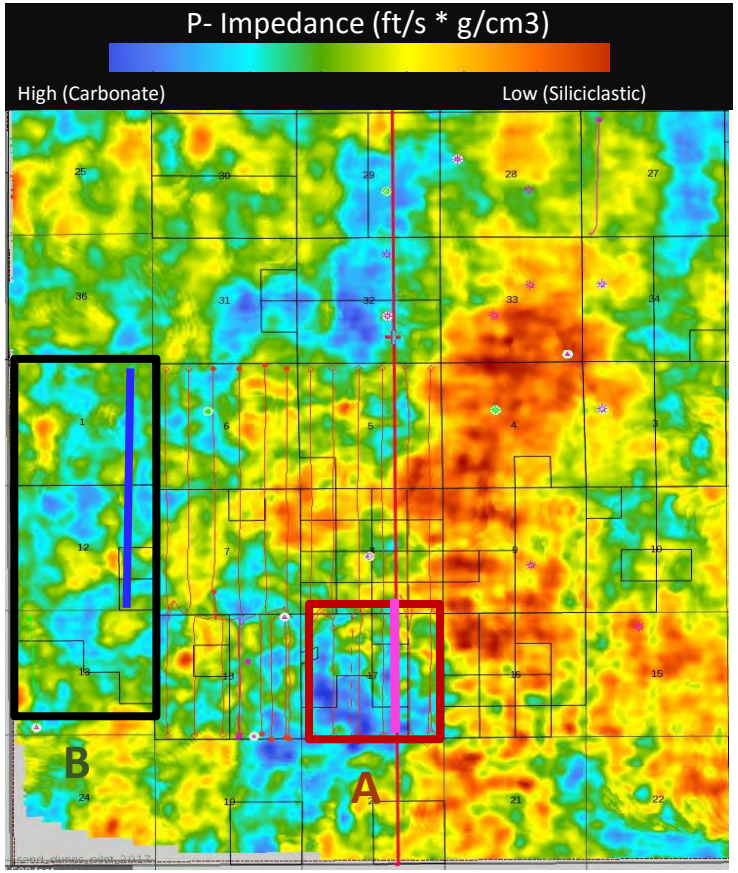


Pre AI - 10K Development Type Curve

Upper Flow Unit Landings
6 Wells per section



Development well drilled, prior to Seismic Impedance Volume, that encountered lower organic carbonate facies along much of lateral



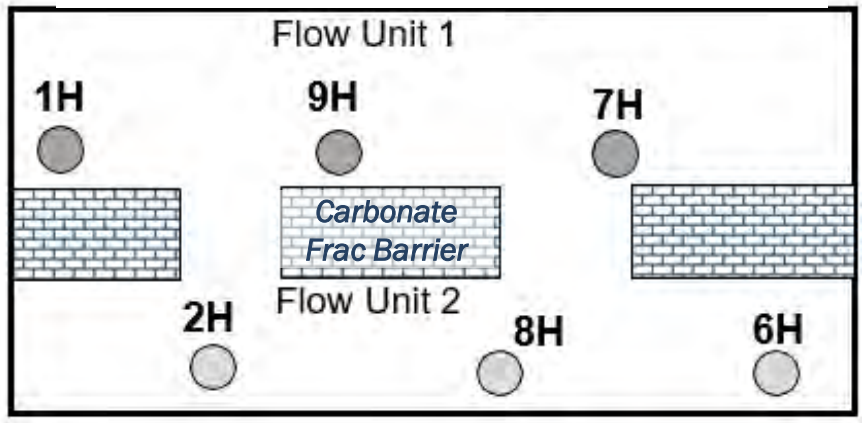
Avg P-Impedance Slice of upper landing zone

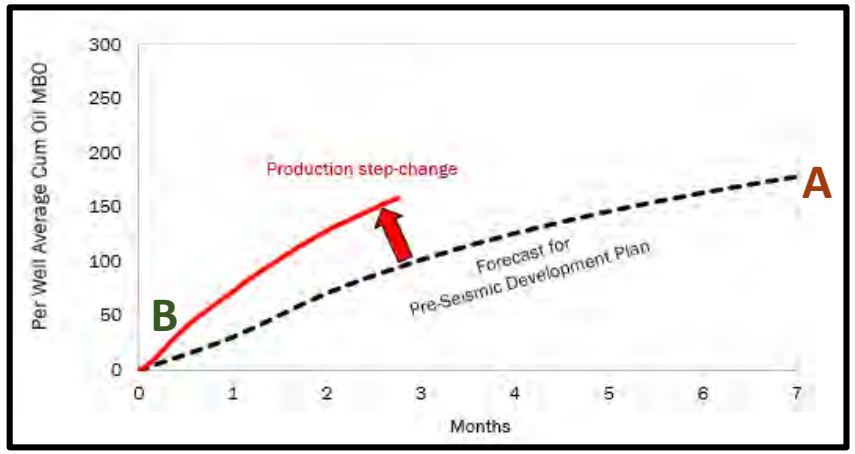
Initial Appraisal well and FDP was generated from 3D Depth Volume and accelerated due to rig obligations and permit issues

Mitigating Geological & Business Risks Through Impedance Integration

Post 3D Adjusted 640 ac Development Plan

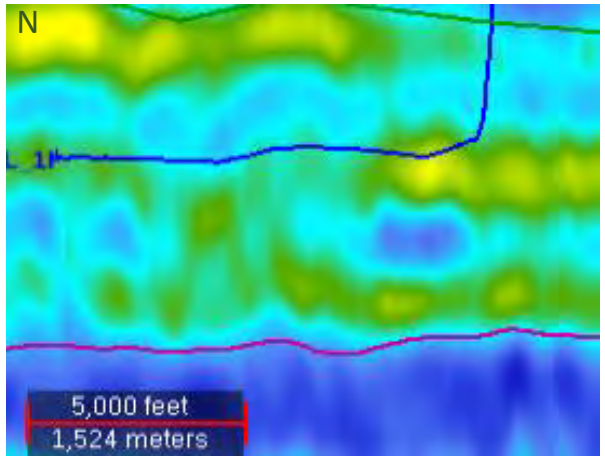
Gun Barrel View, 10K Laterals



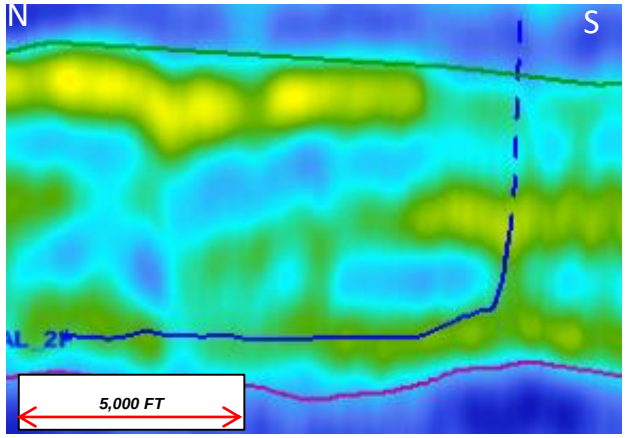


>30% Increase in productivity and increase in EUR due to landing and spacing adjustments

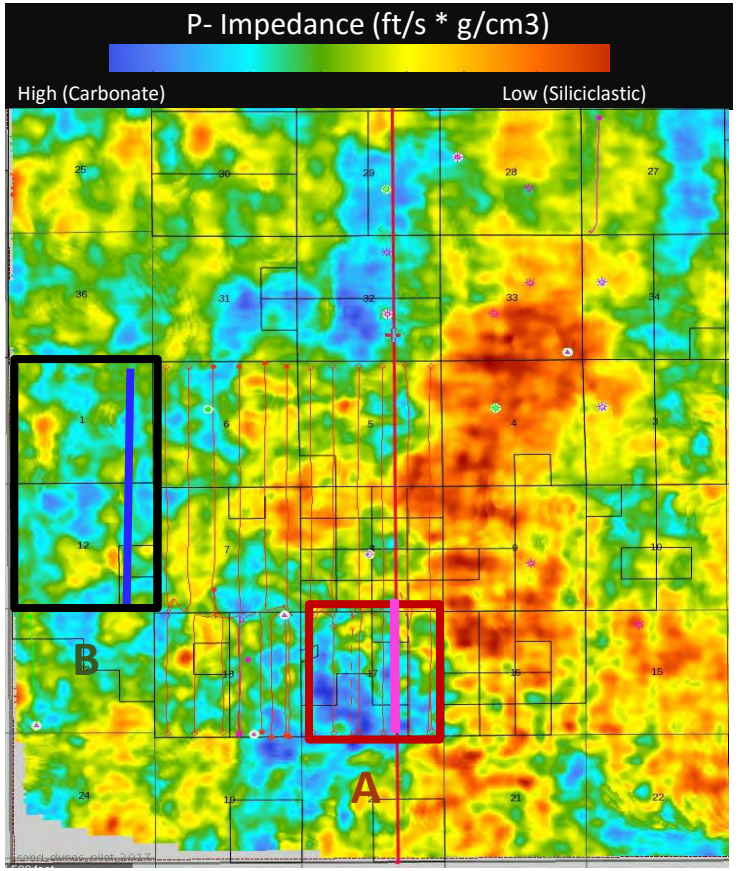
B upper well



B lower well



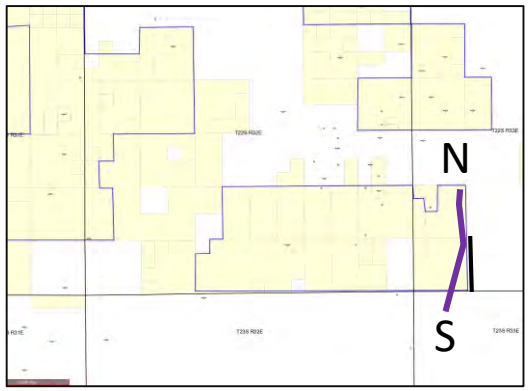
3 WPS – both upper & lower Landings

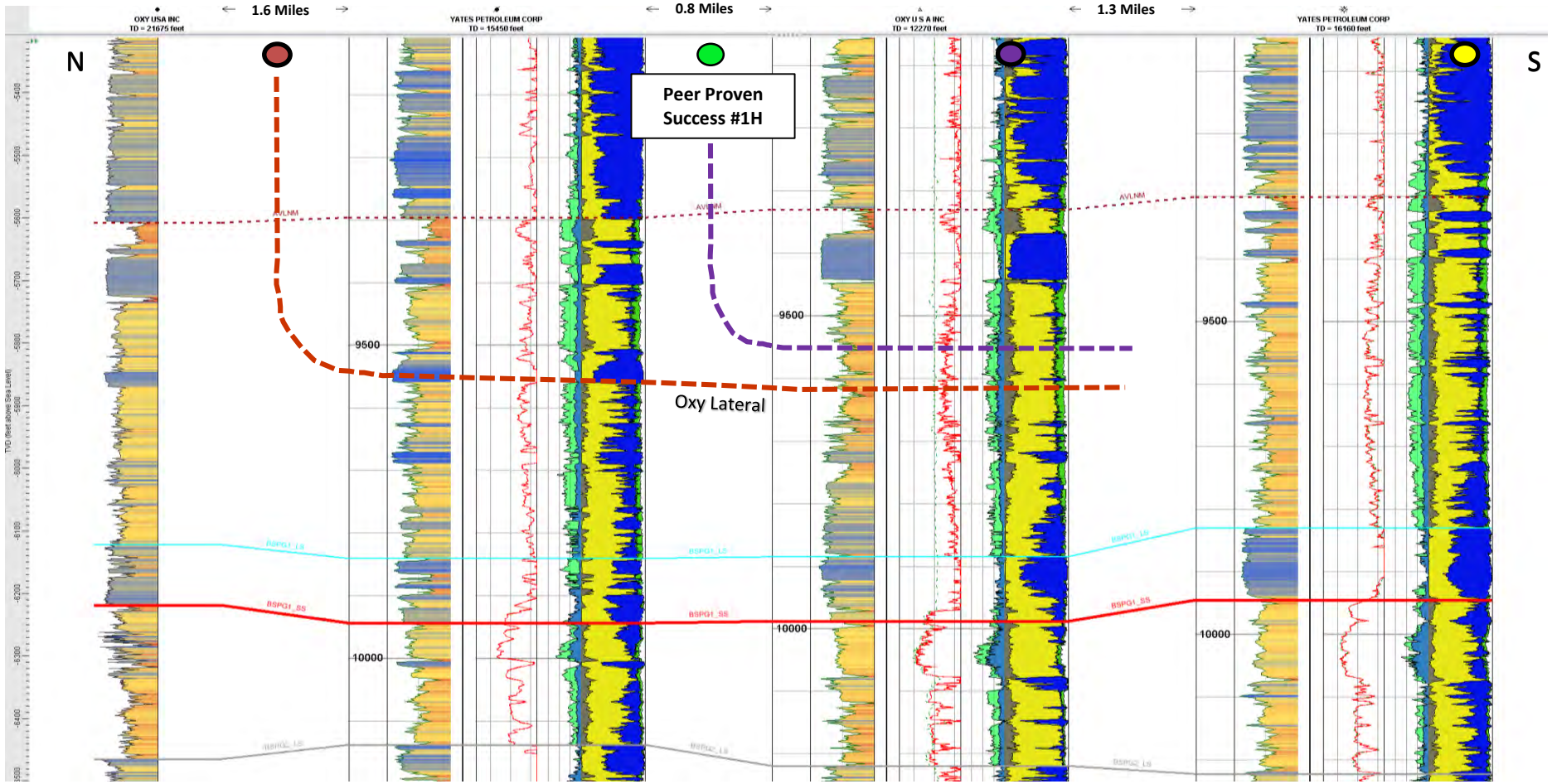


Avg P-Impedance Slice of upper landing zone

Lessons learned from early Appraisal well results and ability to adjust quickly reduces over-capitalization risks

Understanding Reservoir Changes for Geosteering and Development Purposes



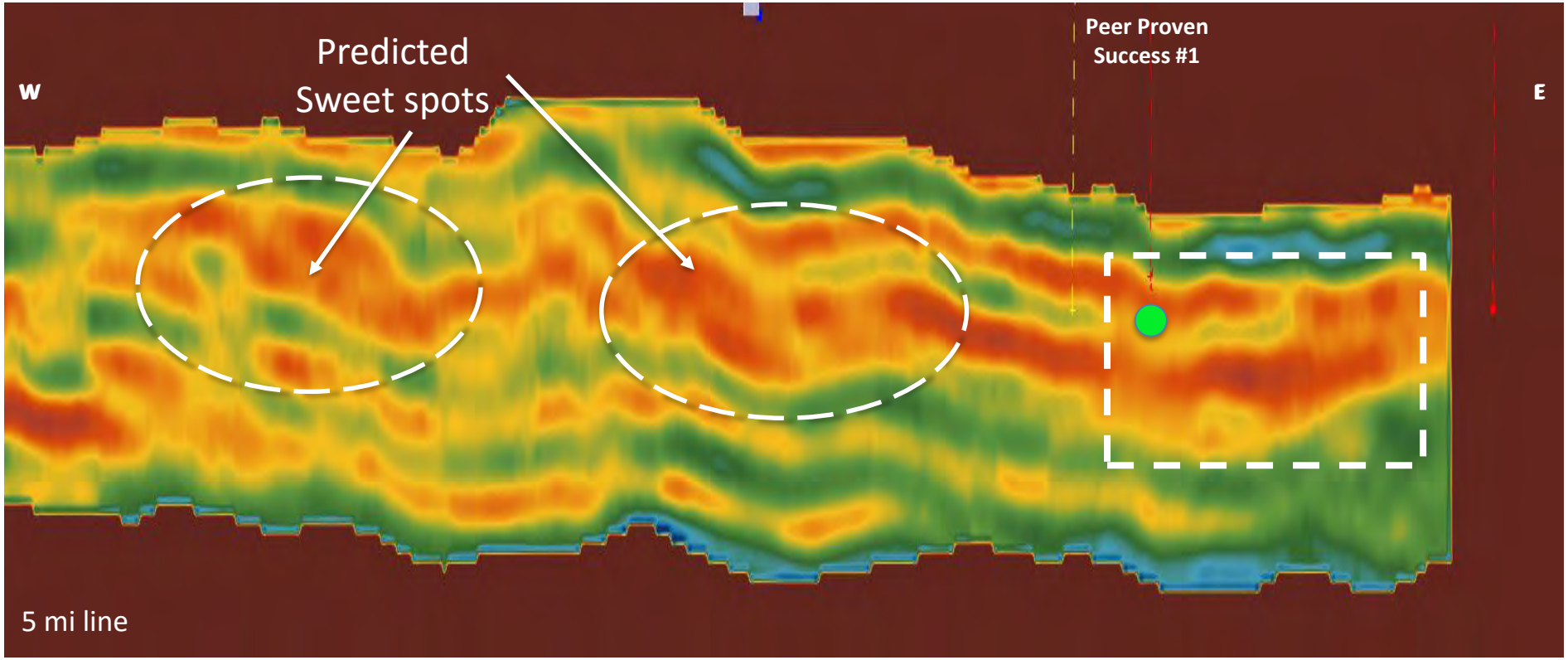


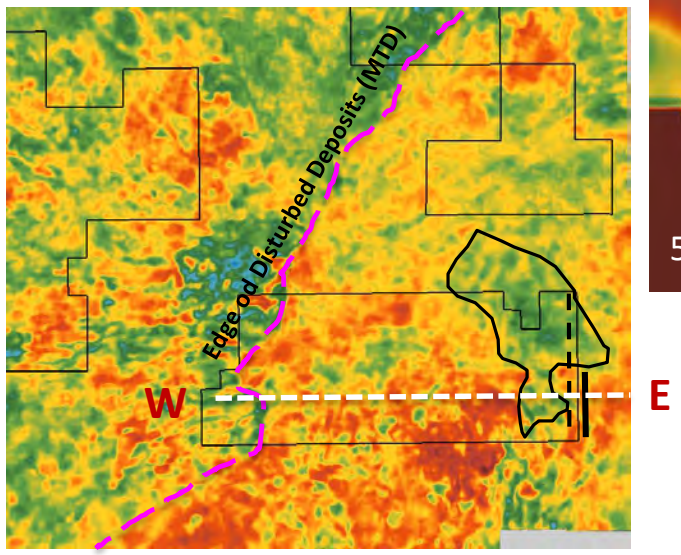
Structural cross section of top Bone Spring

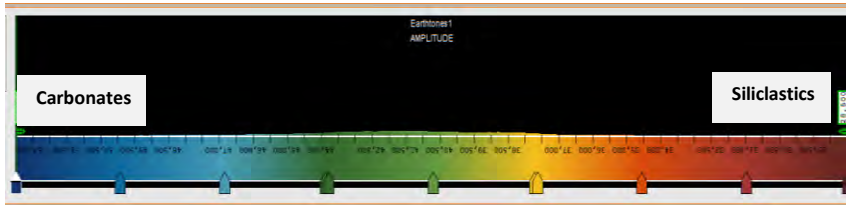
Using well control only for decisions can give a false understanding on stratigraphy, drilling, geosteering and development expectations.

AI Volume & Well Surveillance to High-grade Development Inventory

Horizontal AI and Targeted Stratigraphic Packages





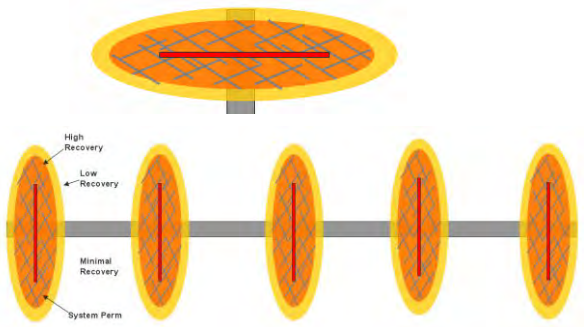


Lateral geological variability and reservoir complexities can occur even on an asset scale

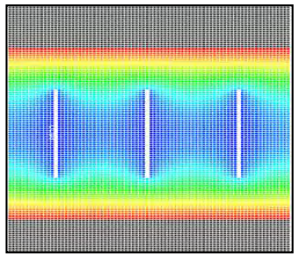
Hydraulic Fracturing Model – Run Advanced Analysis into Integrated Workflow

Creation of Permeability is Critical

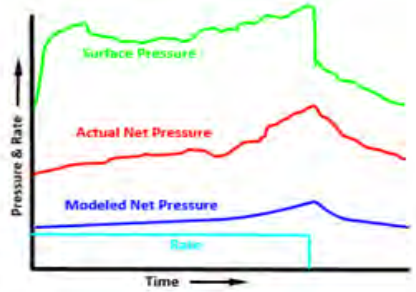
Representation of SRV around a fracture

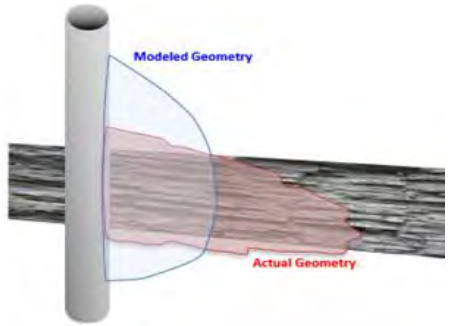


Representation of SRV in Reservoir Modeling



Calibration via Net Pressure Matching & DFIT

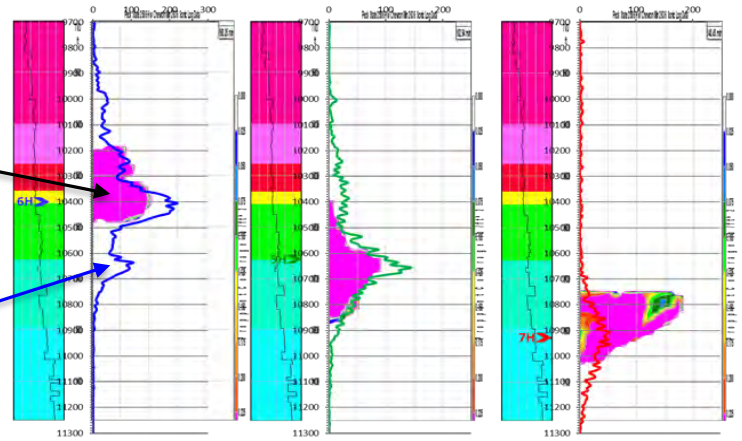


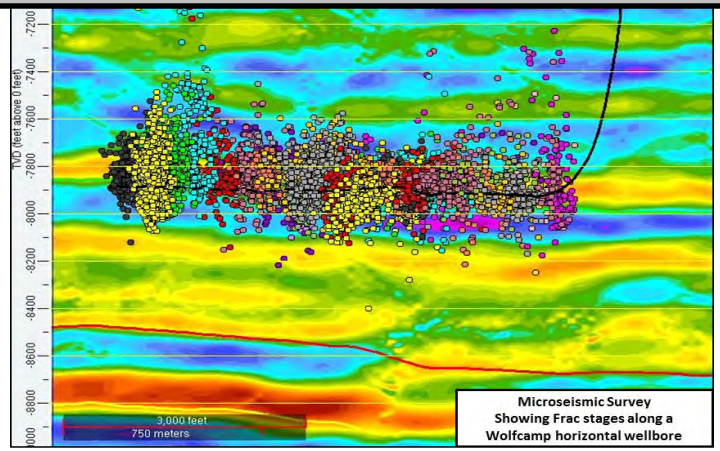


Calibration via Microseismic

Predicted frac model

Microseismic events



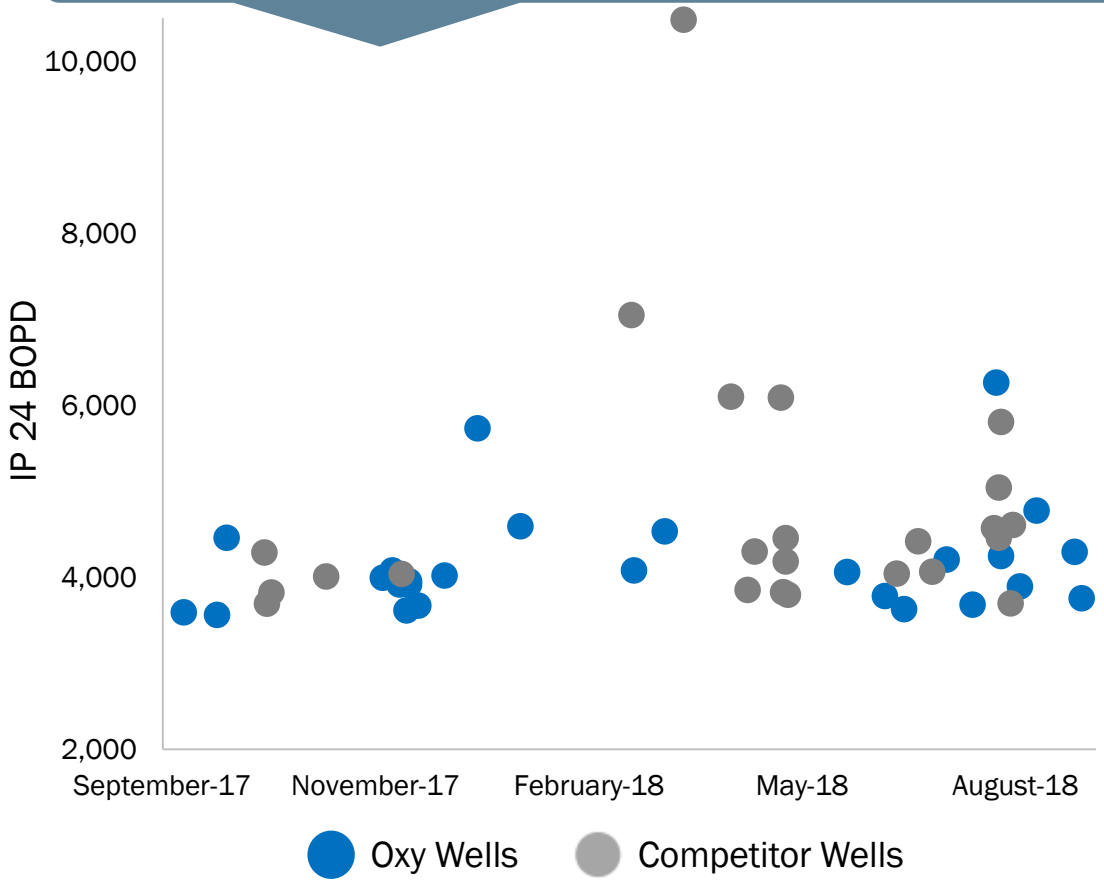


Frac modeling require integration of Petrophysics, Geomechanics, Geophysics, Geology, DFIT and pressure matching for optimum performance and repeatability

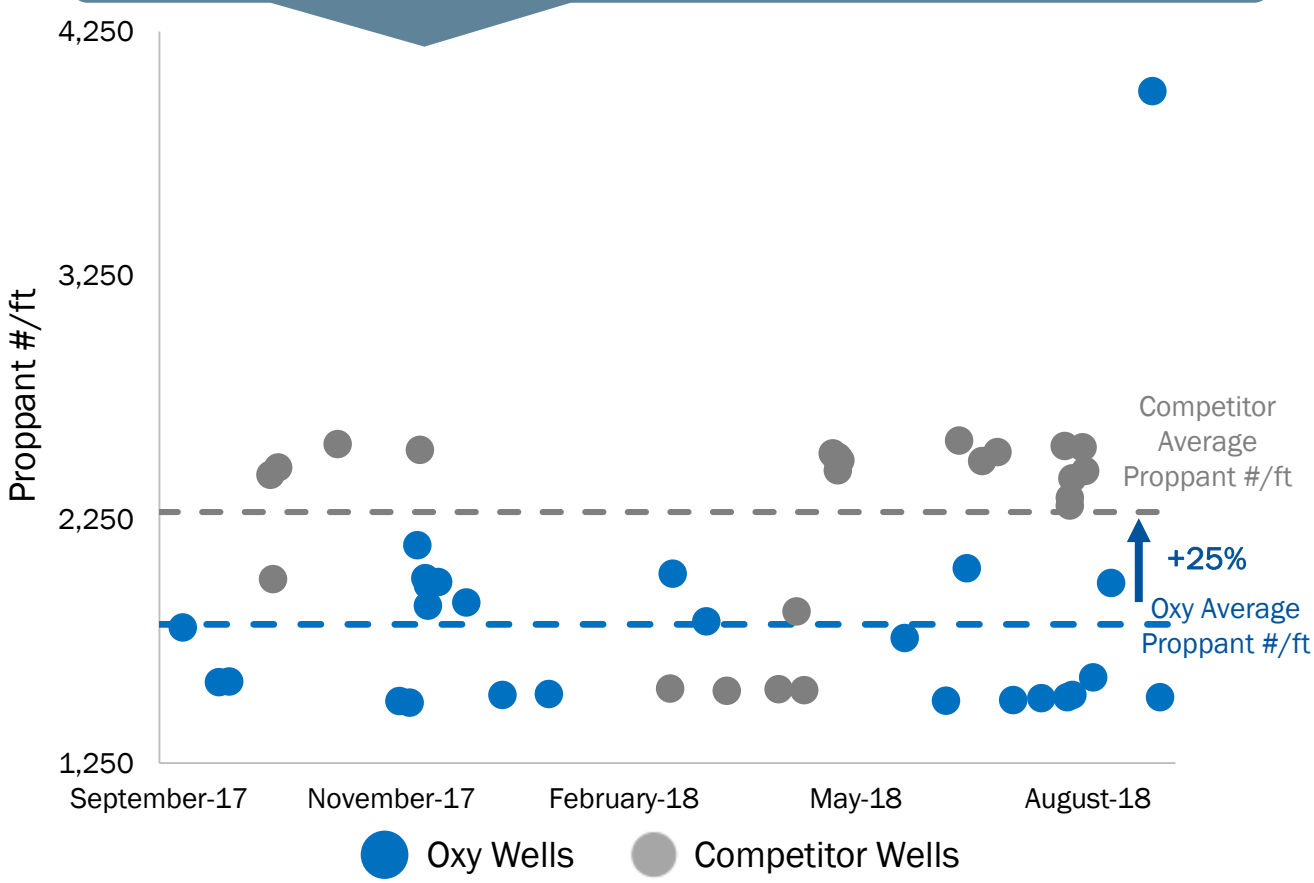
Oxy Delivers Basin Leading Wells with Less

Period 9/2017 – 9/2018: Oxy drilled 5% (208 of 4301 Permian) of total basin well count

Oxy has 26 of the top 50 Wells in the Permian

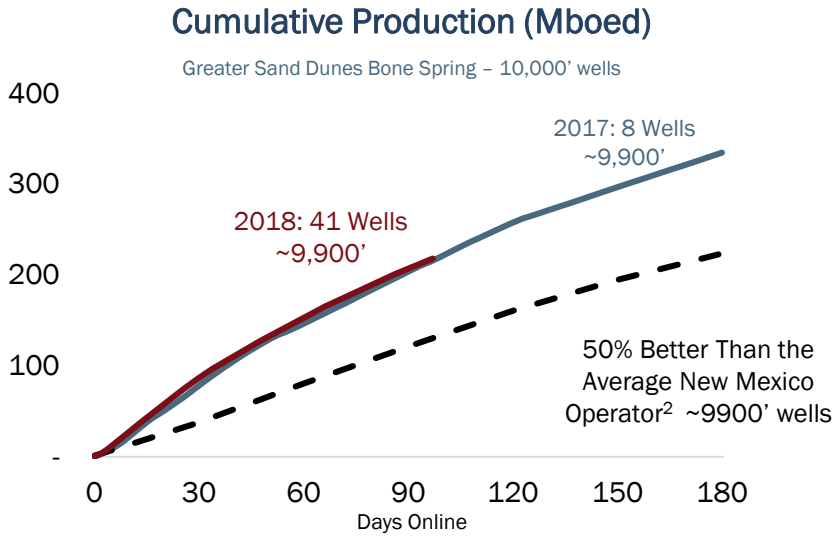


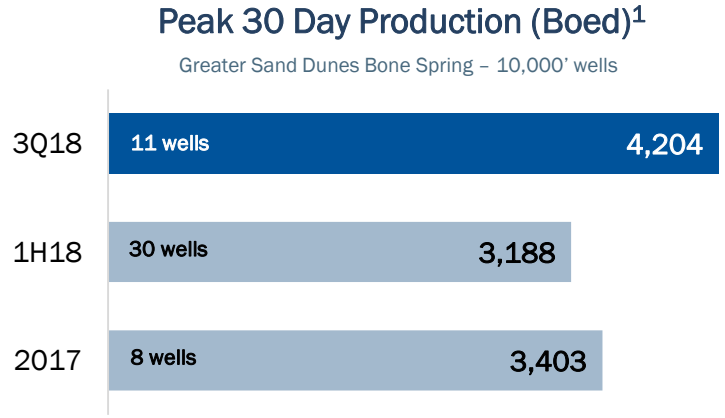
Basin Leading Wells with Less Proppant



Note: Data sourced from IHS Enerdeq as of 10/29/2018 for the period 09/2017 – 09/2018. Data for five Oxy wells were sourced from internal data as records were not yet available in IHS Enerdeq.

Core Development Areas Delivering High Results – Greater Sand Dunes





Subsurface Characterization is Driving Basin Leading Results

- **Customized development to maximize value**
  - > Landing and spacing optimization with seismic data
  - > Value-based well designs
  - > Life of field development plans
- **New Oxy Record Permian Well: Corral Fly 35-26 21H**
  - > 8,931 Boed[1] Peak 24-hr
  - > 6,722 Boed[1] Peak 30-day
- **Continued basin leading Bone Spring results in 3Q:**
  - > 27 Wells Online ~7,622 ft
  - > Avg IP 24-hr = 4,045 Boed[1]
  - > Avg IP 30-day = 3,052 Boed[1]
- 71 of the 75 wells online YTD have an offset producing well

[1]Three stream production results
[2]Peer data sourced from IHS Performance Evaluator and represents an average of Peers with greater than two wells online in 2017 for New Mexico Bone Spring wells with a lateral length greater than 9,500 ft

Improving Profitability and Returns Through Opex Reduction

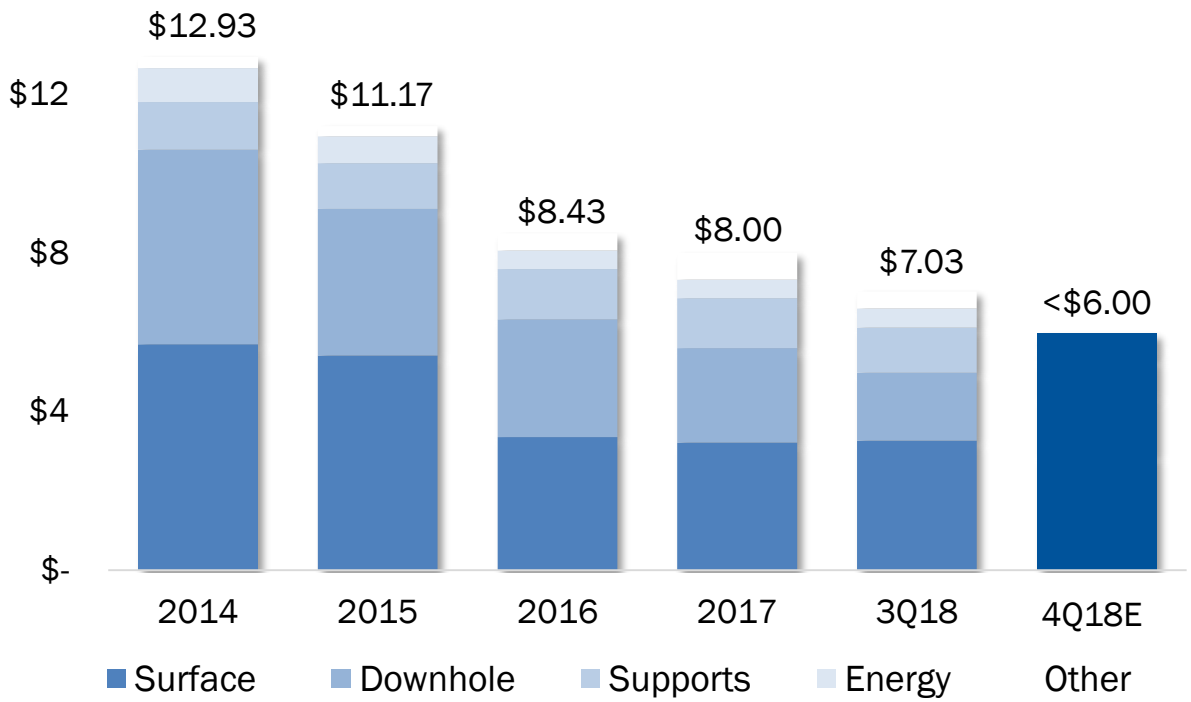
Permian Scale and Operating Capability Reduces Costs

- **Development planning focused on value maximization (life-cycle cost)**

- **Lower Cost**
  - > Water management
  - > Equipment failure reduction
  - > Automation and analytics to optimize operating parameters
  - > Early infrastructure development
  - > Improved well maintenance cost and cycle times

- **Higher Production**
  - > Increased well productivity
  - > Base production management
  - > Artificial lift optimization
  - > Well reconditioning and enhancement
  - > System reliability and lower downtime

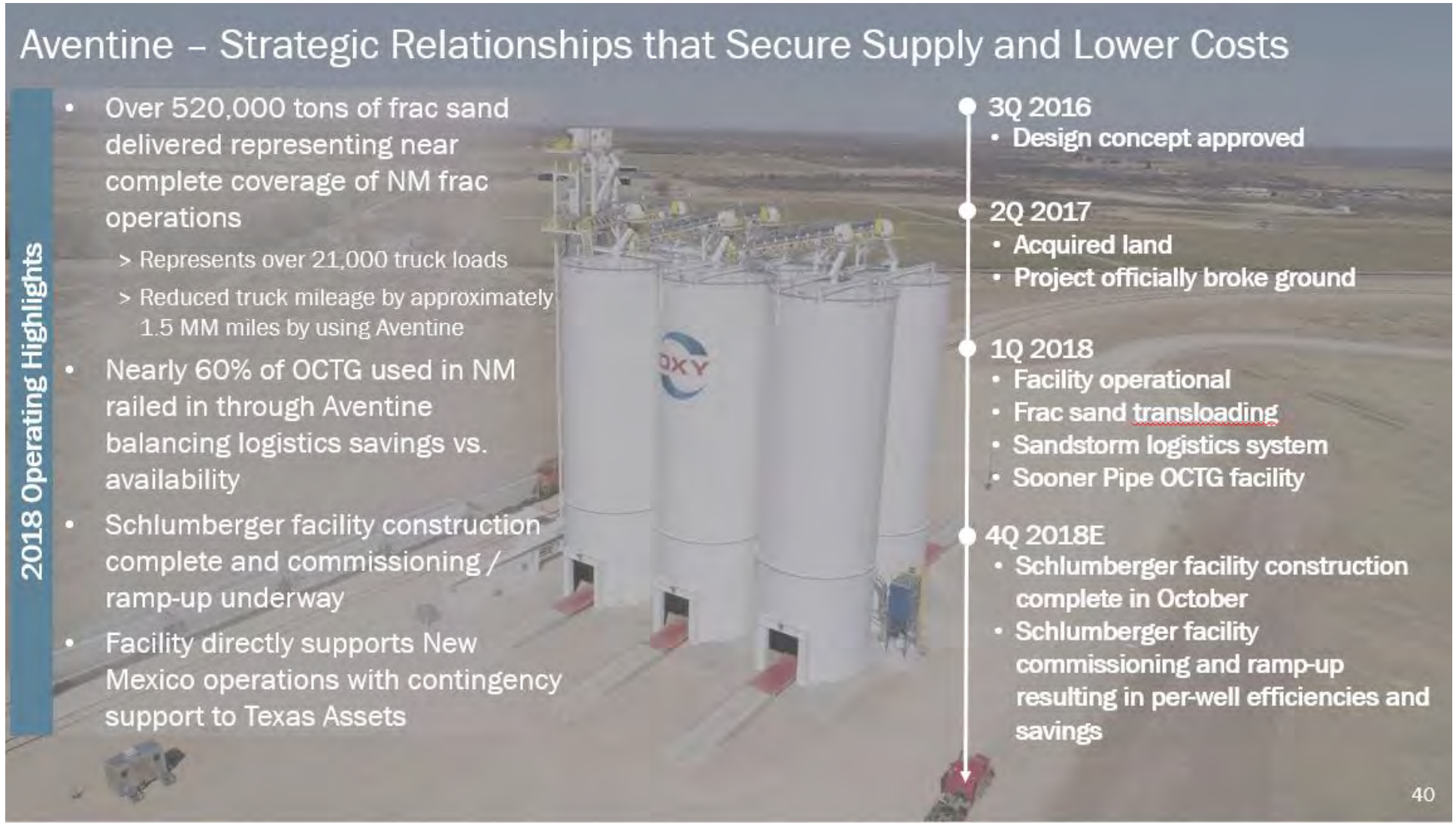
Permian Resources Opex/BOE



Increase in well productivity combined with a decrease in cycle time and opex costs improves profitability.

Improving Profitability Through Supply Chain and Logistics Efficiencies

Aventine – Strategic Relationships that Secure Supply and Lower Costs



2018 Operating Highlights

- Over 520,000 tons of frac sand delivered representing near complete coverage of NM frac operations
  - > Represents over 21,000 truck loads
  - > Reduced truck mileage by approximately 1.5 MM miles by using Aventine
- Nearly 60% of OCTG used in NM railed in through Aventine balancing logistics savings vs. availability
- Schlumberger facility construction complete and commissioning / ramp-up underway
- Facility directly supports New Mexico operations with contingency support to Texas Assets

3Q 2016
- Design concept approved

2Q 2017
- Acquired land
- Project officially broke ground

1Q 2018
- Facility operational
- Frac sand transloading
- Sandstorm logistics system
- Sooner Pipe OCTG facility

4Q 2018E
- Schlumberger facility construction complete in October
- Schlumberger facility commissioning and ramp-up resulting in per-well efficiencies and savings

40

Secures supply, shortens logistics and saves $$$ per well.

Increasing Value of Unconventional Assets with Oxy's Unique EOR Advantage

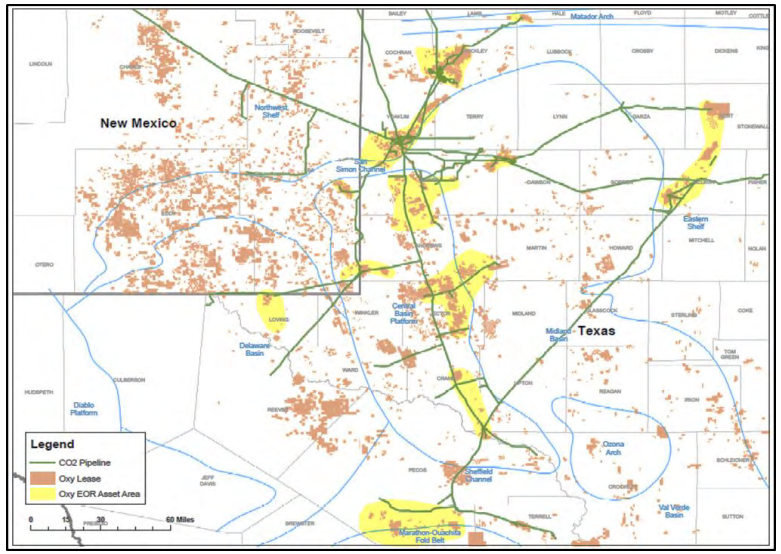
Unconventional EOR

Occidental's Efforts

- ✓ ***Uniquely Designed Processes Based on Subsurface Characterization***
- ✓ ***CO_2 Supply***
- ✓ ***Infrastructure***

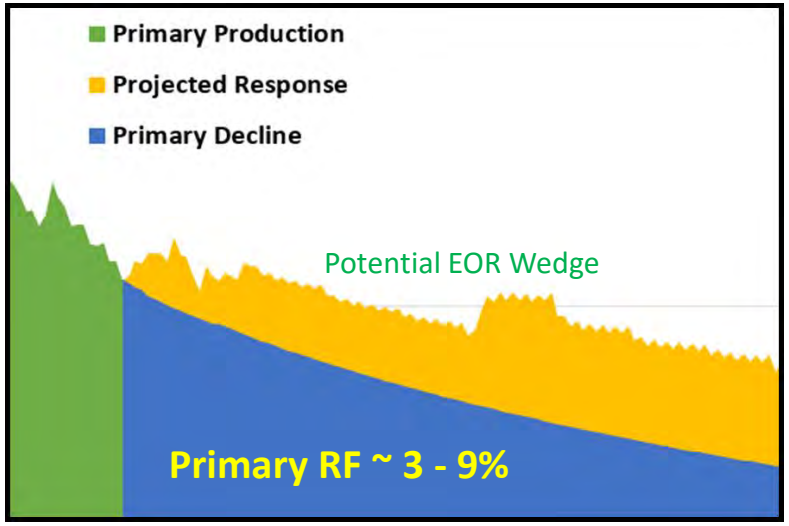
Organizational Capability

- Industry leader with over 40 years experience in EOR
- Subsurface Characterization Workflows and Technology to Maximize Recovery
- Field and plant automation for surveillance
- Innovative Facilities Designs
- Operational Expertise - 34 Permian CO2 Floods

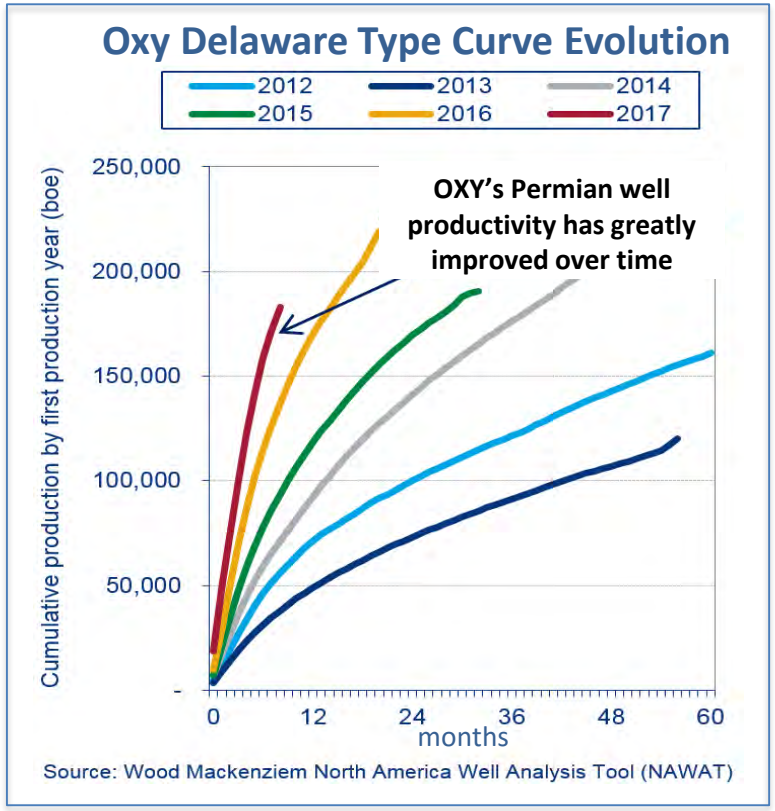


Permian Infrastructure Position

- 3 operated CO_2 source fields
- 13 CO_2 processing plants
- 30,000 miles of pipelines; 1,200 miles DOT pipelines
- Long-term CO_2 supply agreements



Wolfbone Evolution to Profitability



Wolfbone Resource plays requirements

- Require "big data" and large multi-disciplined staff
- Technology driven and constantly improving
- Accurate rock properties, bench ranking and fluid estimates calibrated into petrophysical models and production engineering.
- A regional-to-asset size understanding of geological and structural details and rock richness for business plans
- Improvements in 3D seismic integration into stratigraphic variations and production results for proper landing and development spacing.
- Optimal completions & developments for each play is always evolving and may include future EOR
- Increase in productivity coupled with opex reduction, efficiencies in asset management and logistics all help to improve profitability in the Wolfbone in southeast New Mexico

Acknowledgements: Oxy Groups

- Appraisal & Asset Exploitation Group
- North America Exploration & Subsurface Technologies
- Unconventional Petrophysics, Rock Fluid & Geomechanics
- Unconventional Reservoir & Subsurface Engineering Tech
- Permian Resources - New Mexico Development and Asset Teams
- Unconventional Stimulation Design
- Investor Relations

Thank You

Bio

John Polasek Bio 1/2019

John is currently Vice President of Geoscience for Occidental Oil & Gas Corporation in Houston Texas. Geoscience teams include: North America Exploration and CO2 Sourcing; Subsurface Reservoir Characterization and Technical Assurance; Appraisal and asset Exploitation; Unconventional and Conventional Petrophysics & Engineering and functional responsibility through discipline Chiefs, for mentorship, training and technology advances in Geology, Geophysics, Petrophysics and the data management standards associated with those disciplines.

He has held numerous management and technical leadership positions throughout his career, which has focused on Oil & Gas exploration and development in many diverse areas and diverse rocks around the world.

John holds a Bachelor's degree in geology from Syracuse University, and a Master's degree in Geoscience from the State University of New York at Binghamton.

The title of his talk is ***Wolfbone Appraisal and Development in Southeast New Mexico: An Evolution to Profitability***