New Stratus Energy Inc

Colombia - VMM 18 Block

Corporate Technical Presentation

2D & 3D Reprocessing & Reinterpretation

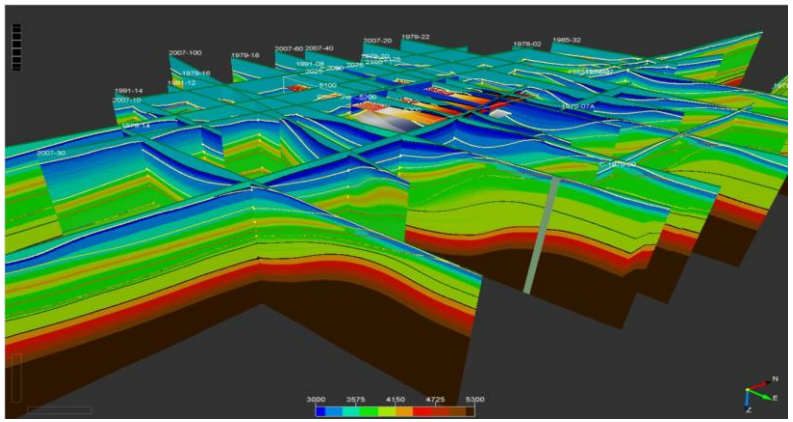
Sept 2021



Seismic Reprocessing VMM 18, 2021

INFO GEOSCIENCES TECHNOLOGY AND SERVICES, HOUSTON TX

- **Objectives**:
  - ✓ Time to depth conversion and derived properties
  - ✓ Estimation of elastic properties through inversion of seismic amplitudes and characterization of reservoir properties
  - ✓ Seismic reprocessing of the 3D volume
  - ✓ Seismic inversion and reservoir estimators in 3D cube
- **Technical Team**:
  - ✓ Info Geosciences technicians.: *Miguel Bosch / Raul Colmenares / Adriana Moreno*
  - ✓ NSE: *Arturo Lara / Juan F. Arminio*



Regional Geology and Location of VMM 18 Seismic and Well Data

Location, Seismic & Well data

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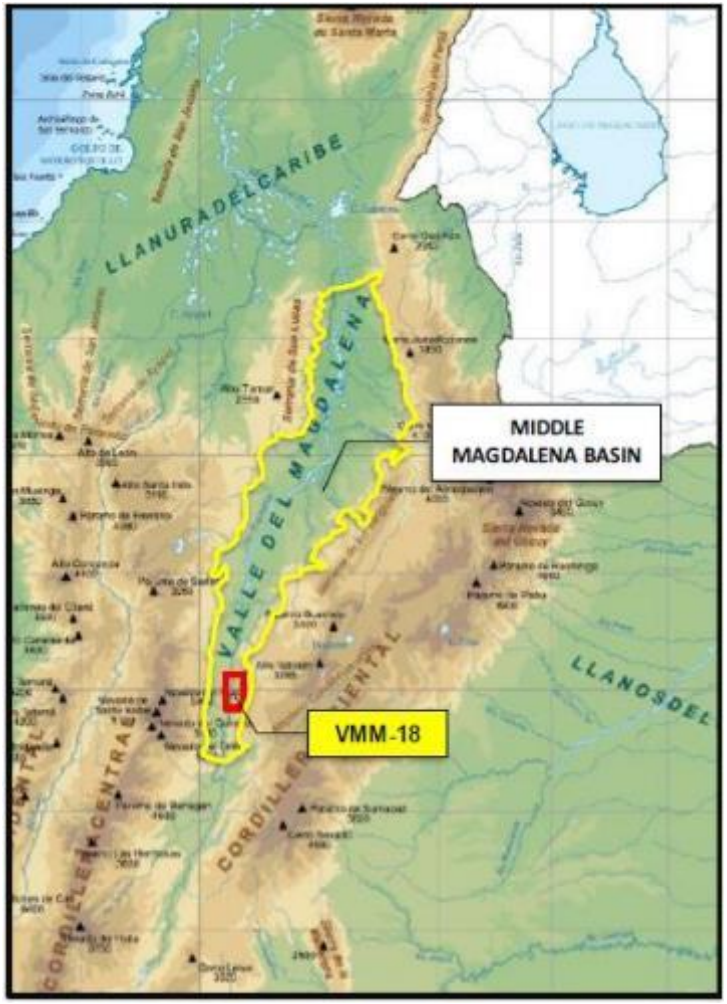
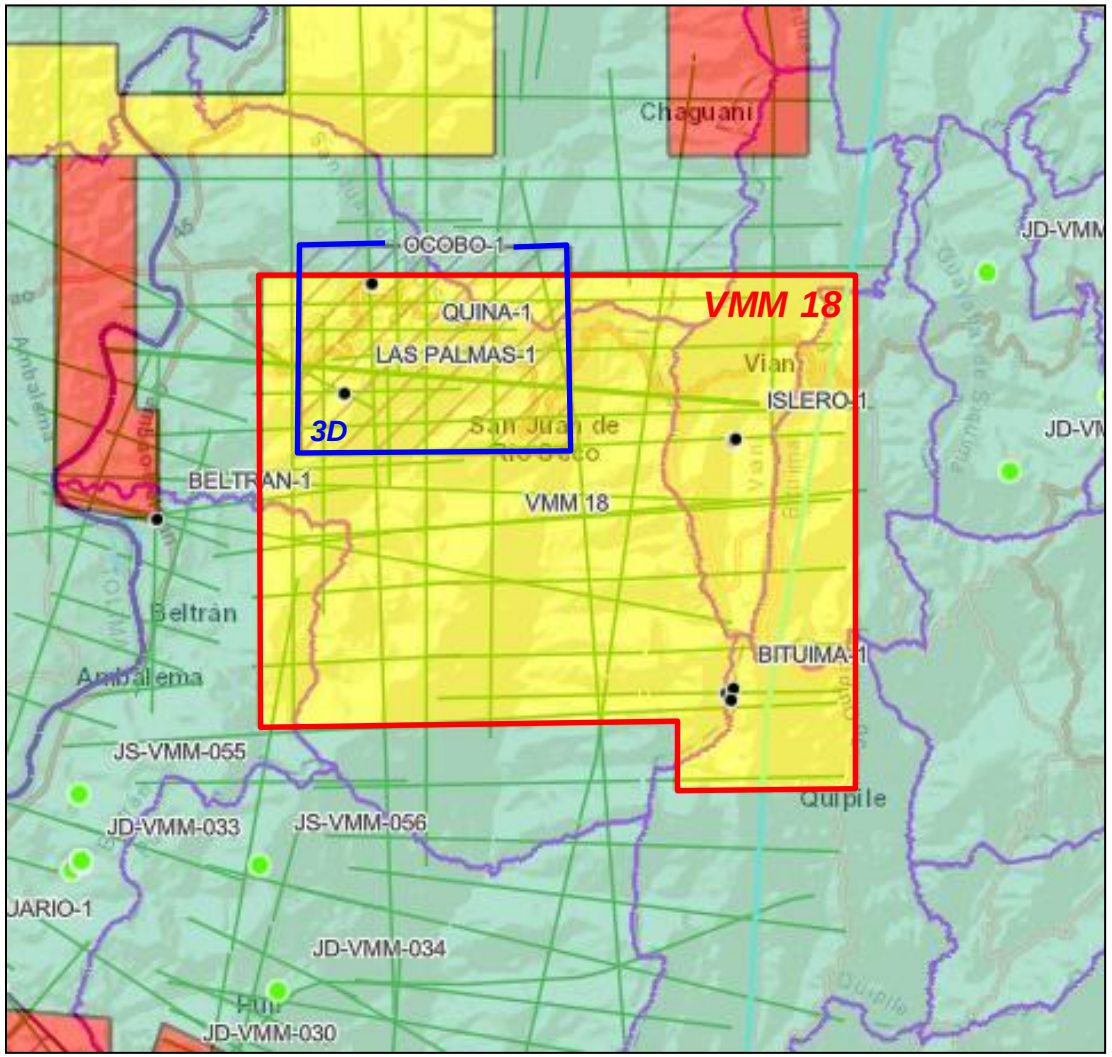
Seismic reprocessing 2021 database available:

- 25 2D-Seismic lines (~400 km)
- 60 km^2 3D-cube 2013
- Wells: Quina, Ocobo, Las Palmas, Islero, Beltran, Bituima





Oilfields, Play Trends and Infrastructure

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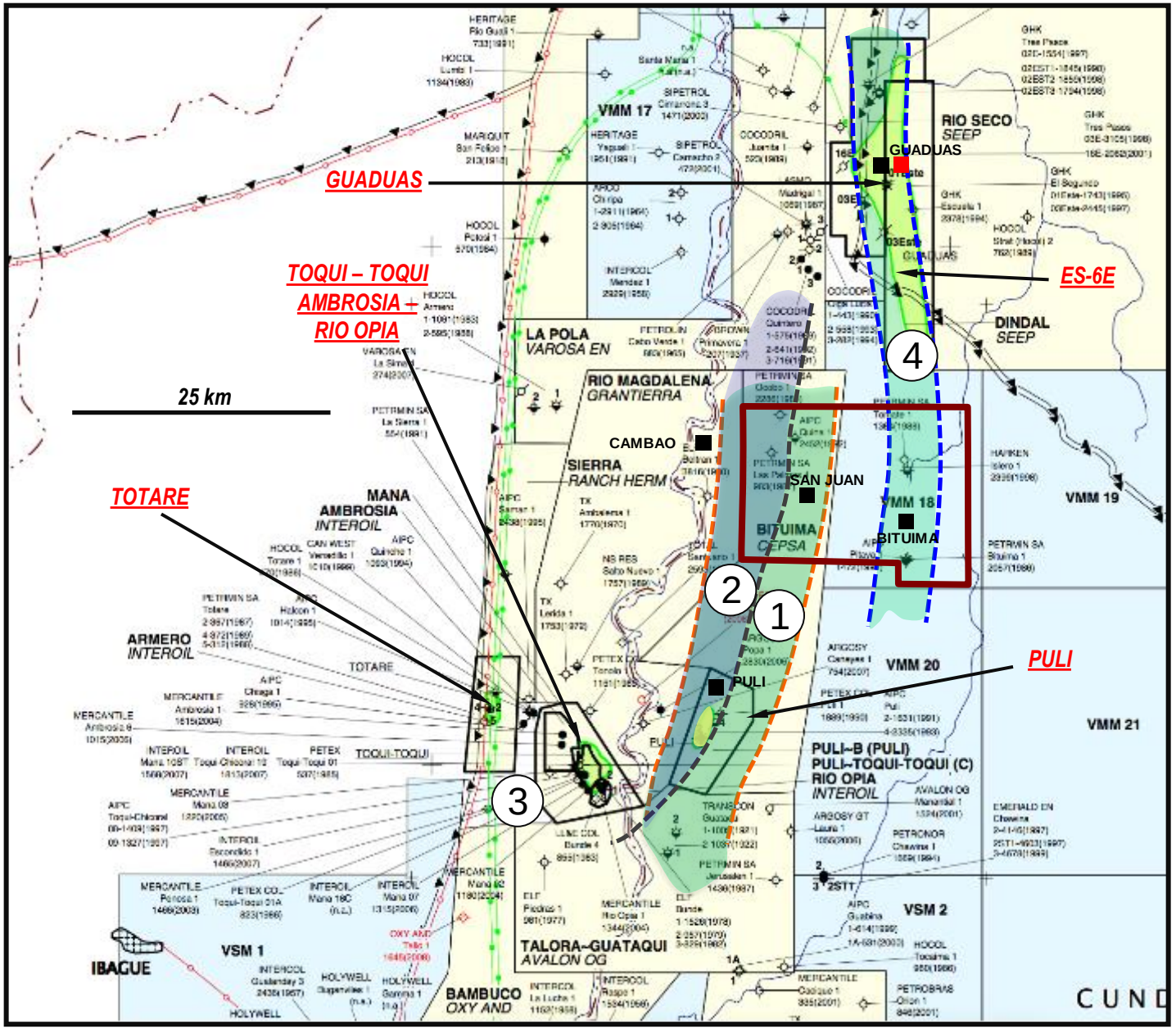

Oilfield

ALTO MAGDALENA PIPELINE (OAM)

GUADUAS DELIVERY POINT

TOWN

Play trends

1. *Puli – type thrust play: light oil in Guadalupe sands*
2. *Sub thrust play: light / medium oil in Paleogene sands*
3. *Toqui Toqui- type shallow thrusts play medium oil in Tertiary clastics*
4. *Guaduas - type heavy and light oil in fractured Cimarrona carbonates*

Surface Geological Map

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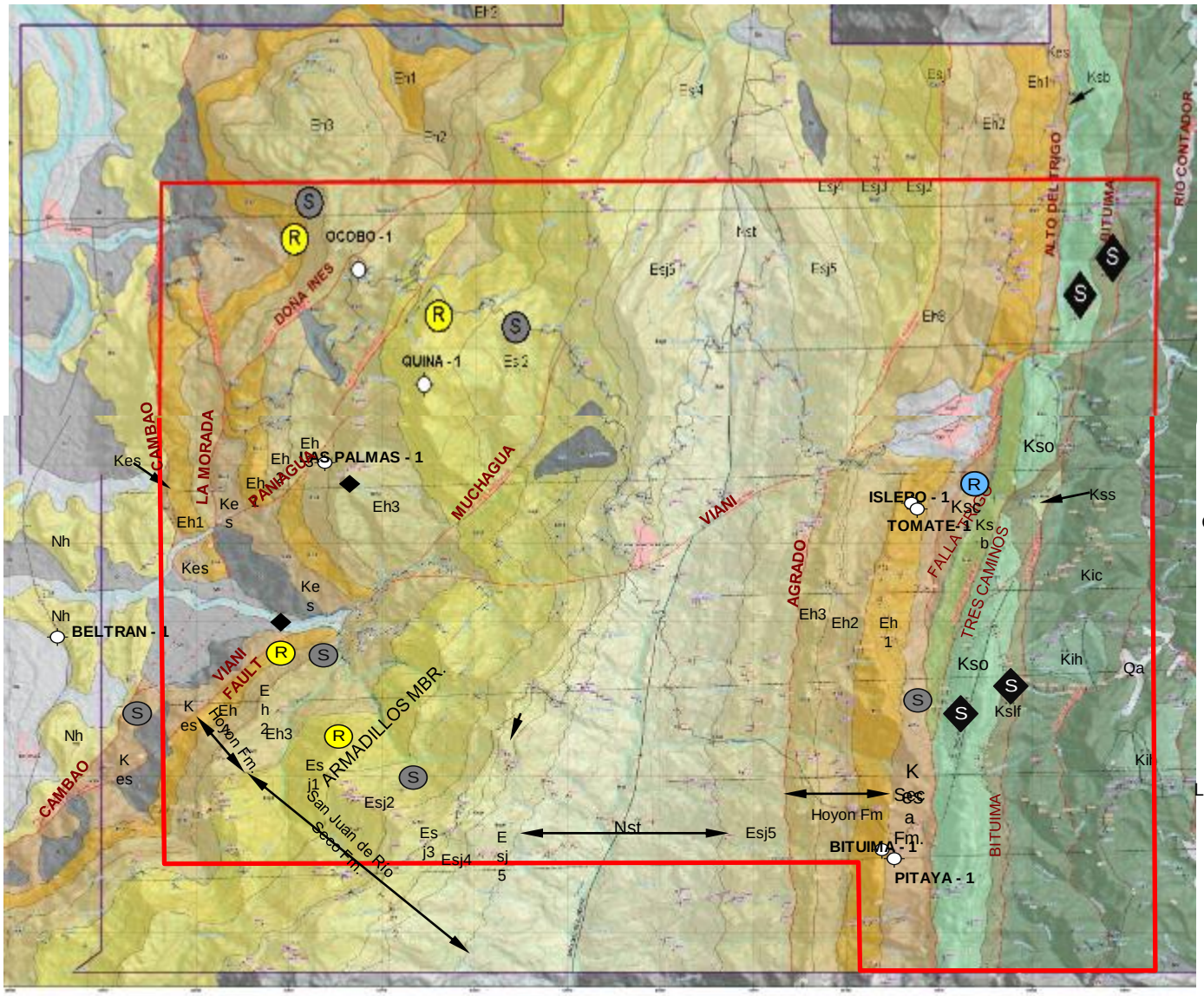

	Qa	*Alluvial deposits*
QUATERNARY	Qc	*Collluvium*
	Qt	*Alluvial terrace*
MIOCENE	Nh	*Honda Group*
L. OLIGO - E.	Nst	*Santa Teresa*

OLIGOCENE	Esj5	*San Juan de Río Seco*	*La Cruz*
	Esj4		
	Esj3		*Almacigo*
	Esj2		
	Esj1		*Armadillos*
EOCENE E. OLIGO	Eh3	*Hoyon*	*Capira*
	Eh2		*Agua Clara*
	Eh1		*Cambao*

L. MAAS - PALE	KEs	*Guadalupe*	*Seca*
MAASTRICHTI	Ksc		*Cimarrona / Monserrate*
CAMPAN	Ksb		*Buscavidas*
	Kso	*Olini Gr.*	*N/D*
TURON - CC	Kslf	*Villeta*	*La Frontera*
CENOMA	Kss		*Simijaca*
ALBIAN	Kih		*Hiló*
	Kic		*Capotes*

La Luna eq.

Stratigraphy and Petroleum Systems of the Southern MMB

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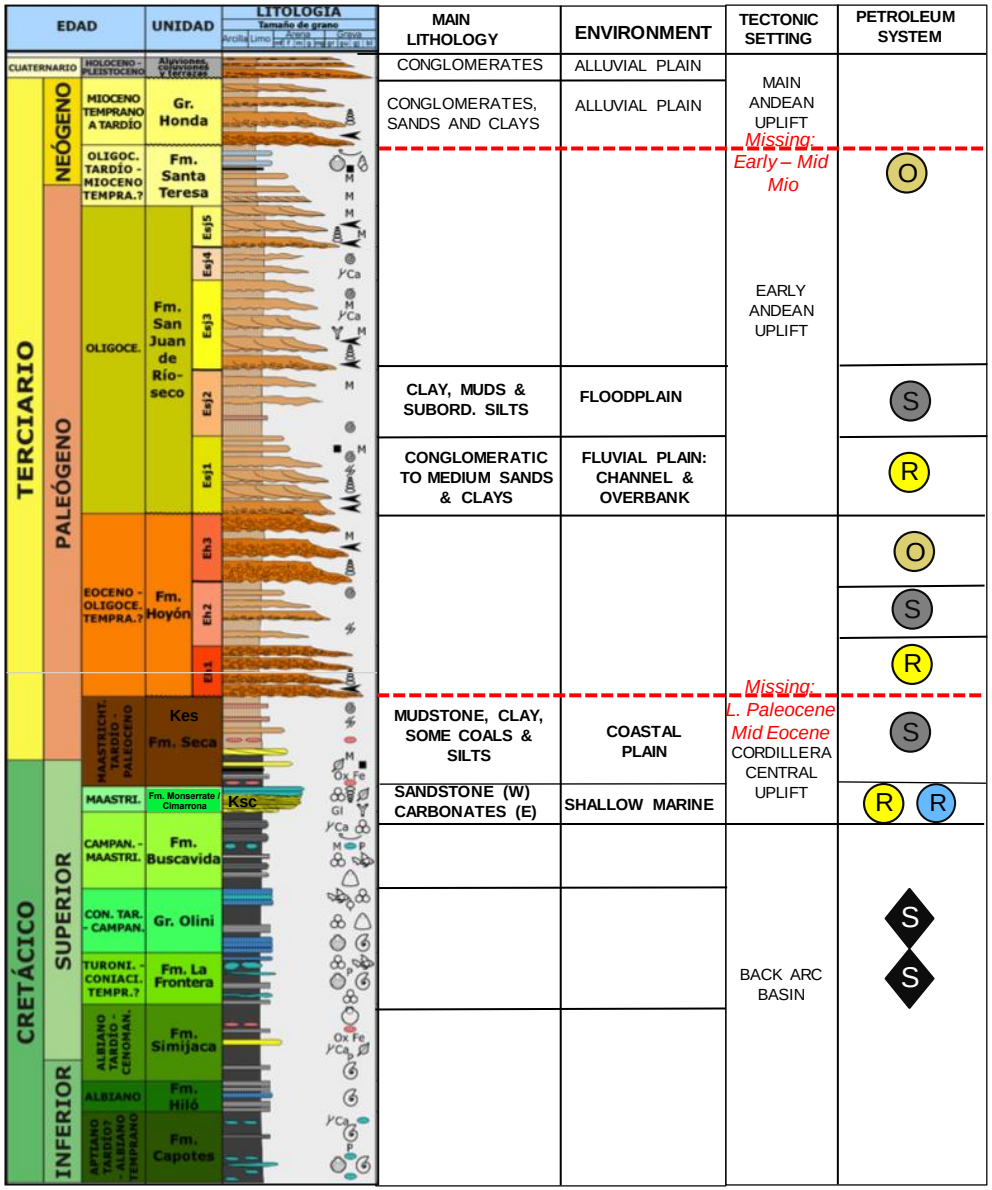

Modified from: Manrique, J., Amézquita, C. et al. (2014)

Almacigo Esj2 clay prone local member

Oligocene fluvial Doima sands equivalent to San Juan´s Armadillos basal unit are effective reservoir in Toqui - Toqui

Hoyon´s local Agua Clara mudstone member

Eocene fluvial Chicoral sands equivalent to basal Hoyon (Cambao) are effective reservoir in Toqui - Toqui

Seca fm. regional shale unit

Monserrate sand reservoir in Puli and Quintero fields
Cimarrona carbonate reservoir in Guaduas

PETROLEUM SYSTEM

- O — OVERBURDEN
- S — SEAL
- R — RESERVOIR (Limestone)
- R — RESERVOIR (Sandstone)
- S — SOURCE

MMB Southern: Structure & Play Concepts

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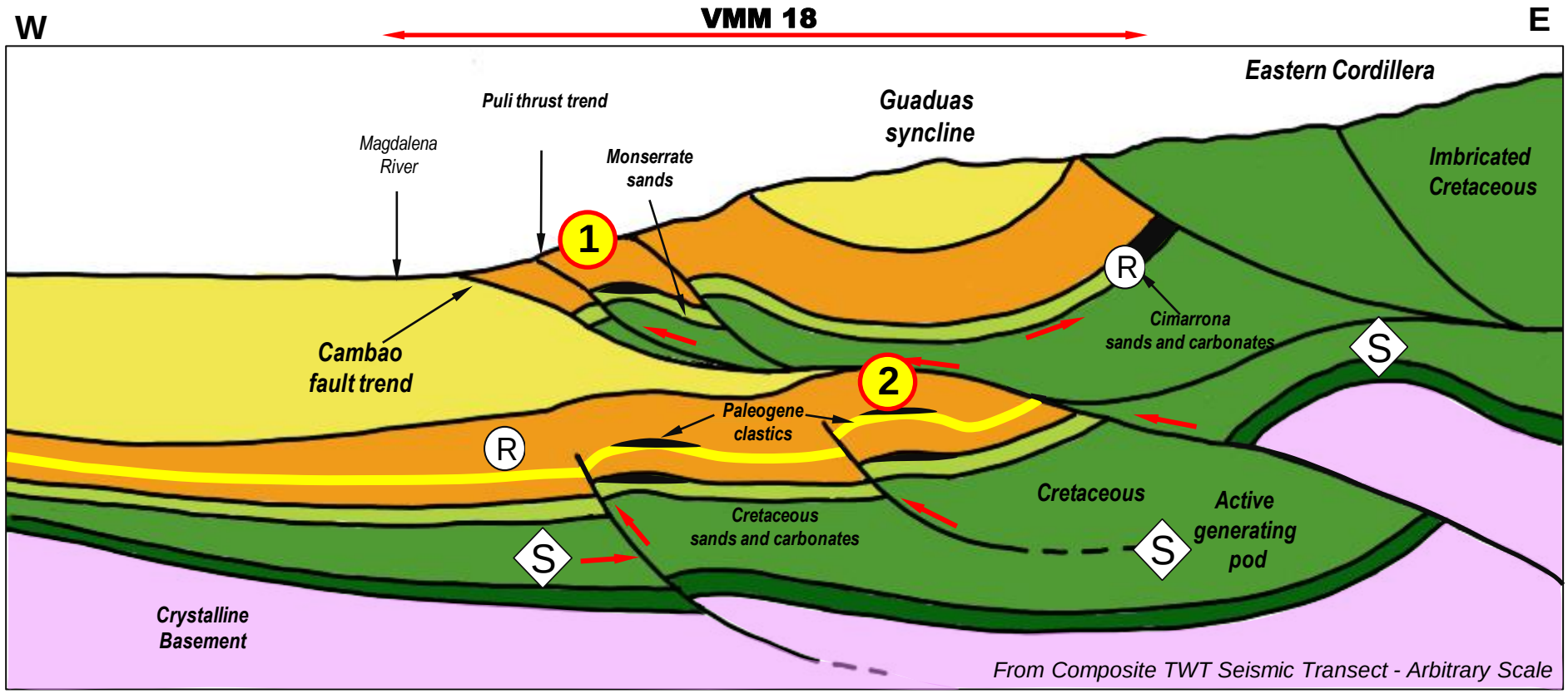
Western Mountain Front of the Eastern Cordillera of Colombia



Source: NSE, 2019

1 Puli-type thrust play (light oil in Guadalupe sands) - Hercules & Hercules Norte Prospects

2 Sub thrust play (light/medium oil in Paleogene sands) - Cigarra Prospect

S Regional Cretaceous source: Villeta - equivalent, mature in surface

R Regional Reservoirs: Cretaceous Cimarrona lmst & Monserrate ss / Eocene Hoyon & Chicoral ss

VMM18 Block is an attractive asset with three main prospects and leads located in the Puli and Dindal-Rio Seco (Guaduas Field) proven hydrocarbon trend of the MMB

Seismic Reprocessing Activities

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- ✓ Review and upload of seismic data.
- ✓ Review and treatment of well data.
- ✓ Review of vertical adjustments
- ✓ Interpretation of relevant horizons for the elaboration of the seismic velocity model.
- ✓ Elaboration of the prior model of compressional wave velocities (Vp).
- ✓ Characterization of elastic, density and reservoir properties based on available well information.
- ✓ Elaboration of the prior model of shear wave velocity (Vs) and mass density.
- ✓ Transformation of the vertical dimension from time to depth of the seismic.
- ✓ Seismic reprocessing of the 3D volume, starting from field data until PSTM migration.
- ✓ Inversion of data from 2D seismic lines and 3D seismic volume for the estimation of elastic properties and mass density.
- ✓ Estimation of lithology and porosity.
- ✓ Analysis of seismic sensitivity to fluids.
- ✓ Time-to-depth transformation of elastic and reservoir properties.

Reprocessing: Seismic 2D: Vertical Adjustment

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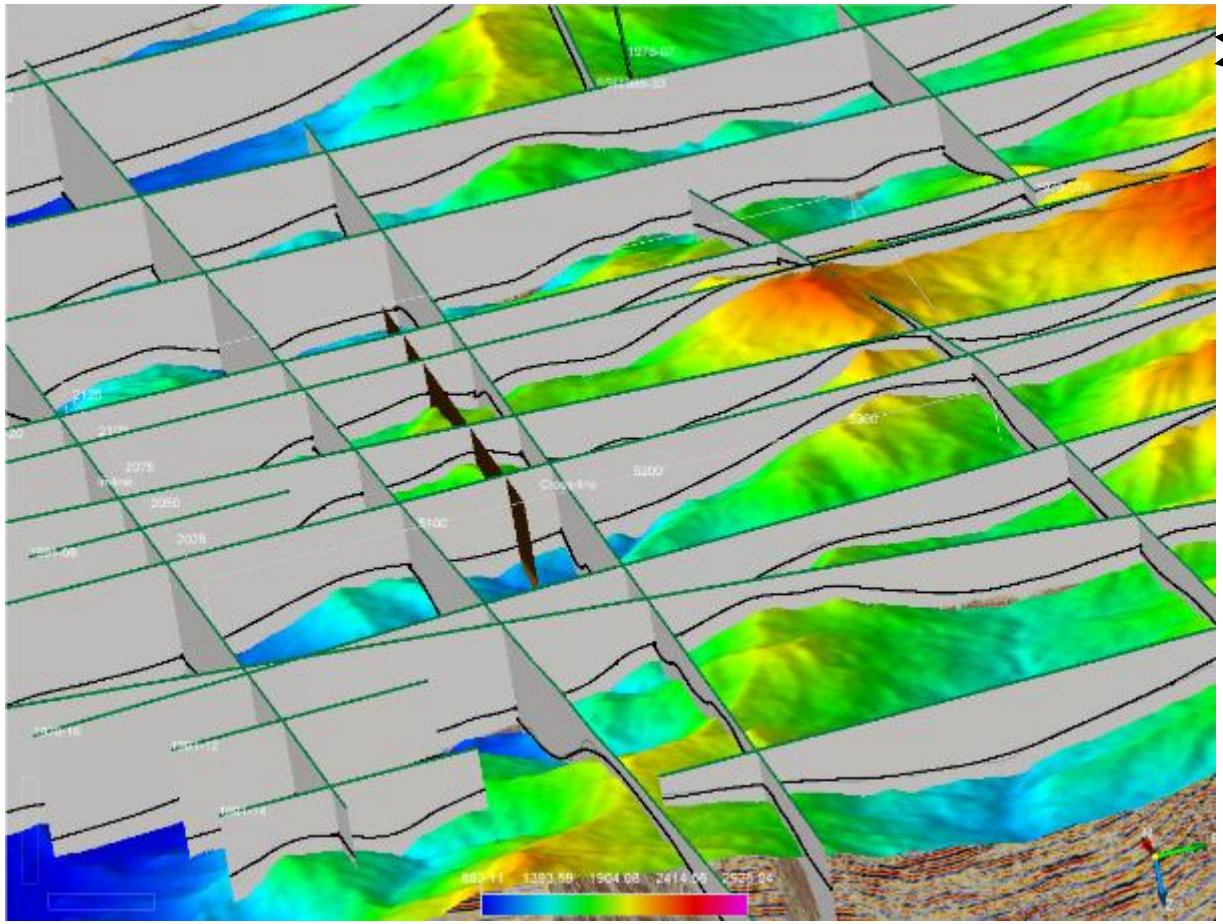

Landmark in seismic is not consistent with elevation map

- The nominal datum of 1800m-msl, the nominal replacement velocity of 3400 m/s are inconsistent with the actual elevations of the wells, seismic surface and digital elevation map of the area.

The seismic sections in time and depth have a vertical position difference with the elevation map, which required a detailed study, analysis and correction.

Reprocessing: 3D Cube Vertical Adjustment

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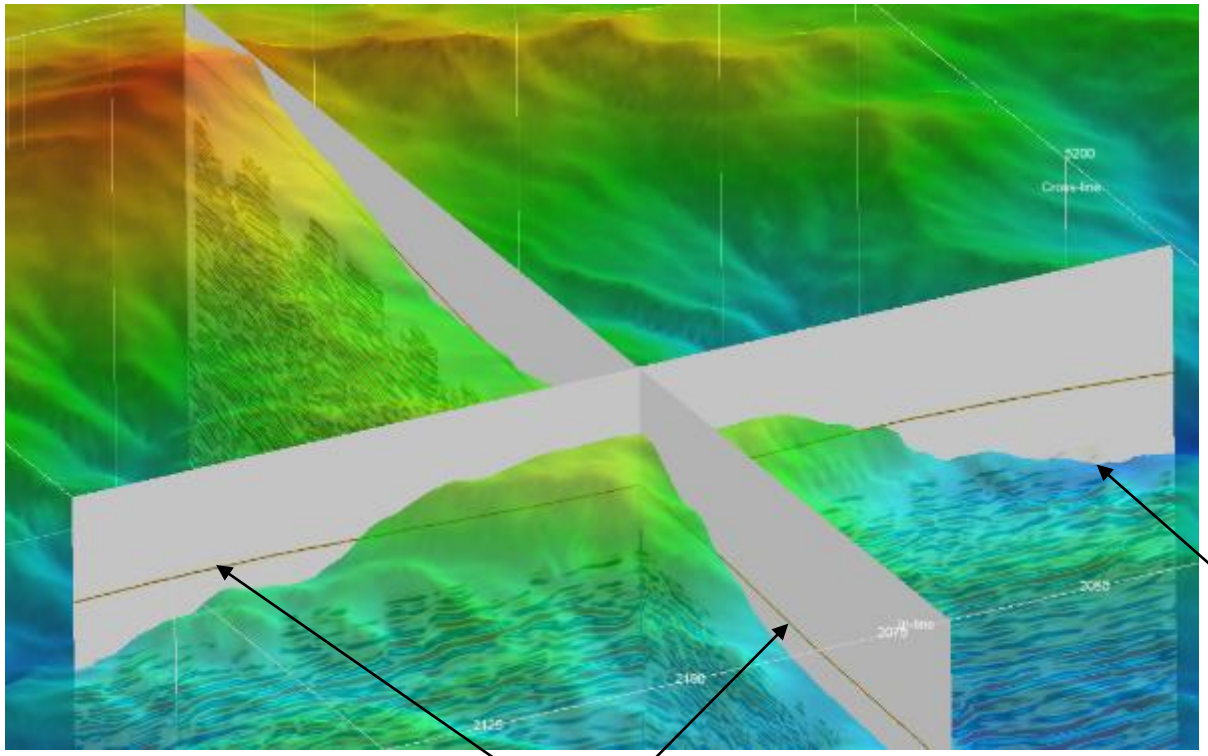

Surface elevation is very smoothed compared to the real one

Terrain elevations in the 3D cube show two problems:

- The surface elevation profile was exaggeratedly smoothed for seismic processing
- There is an average downward shift of the actual elevation map

On average the true elevations are displaced down from respect to the used in the processing

Seismic Reprocessing Process

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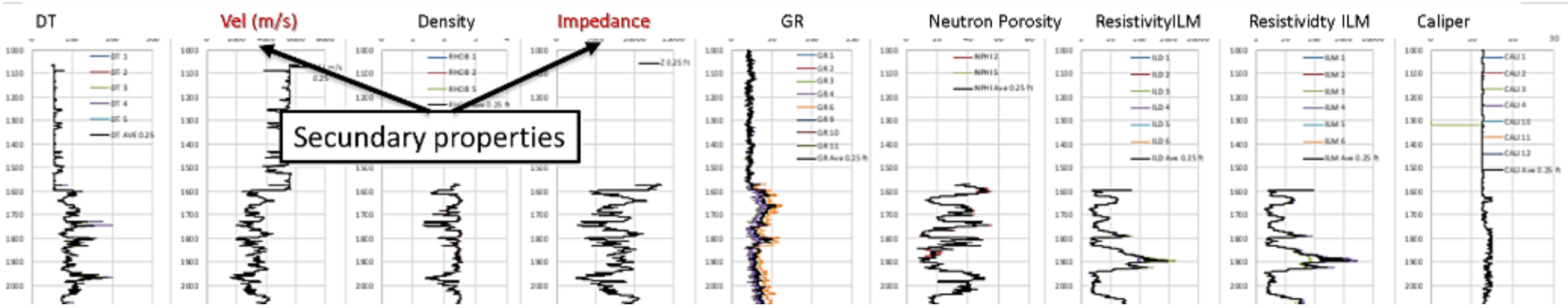
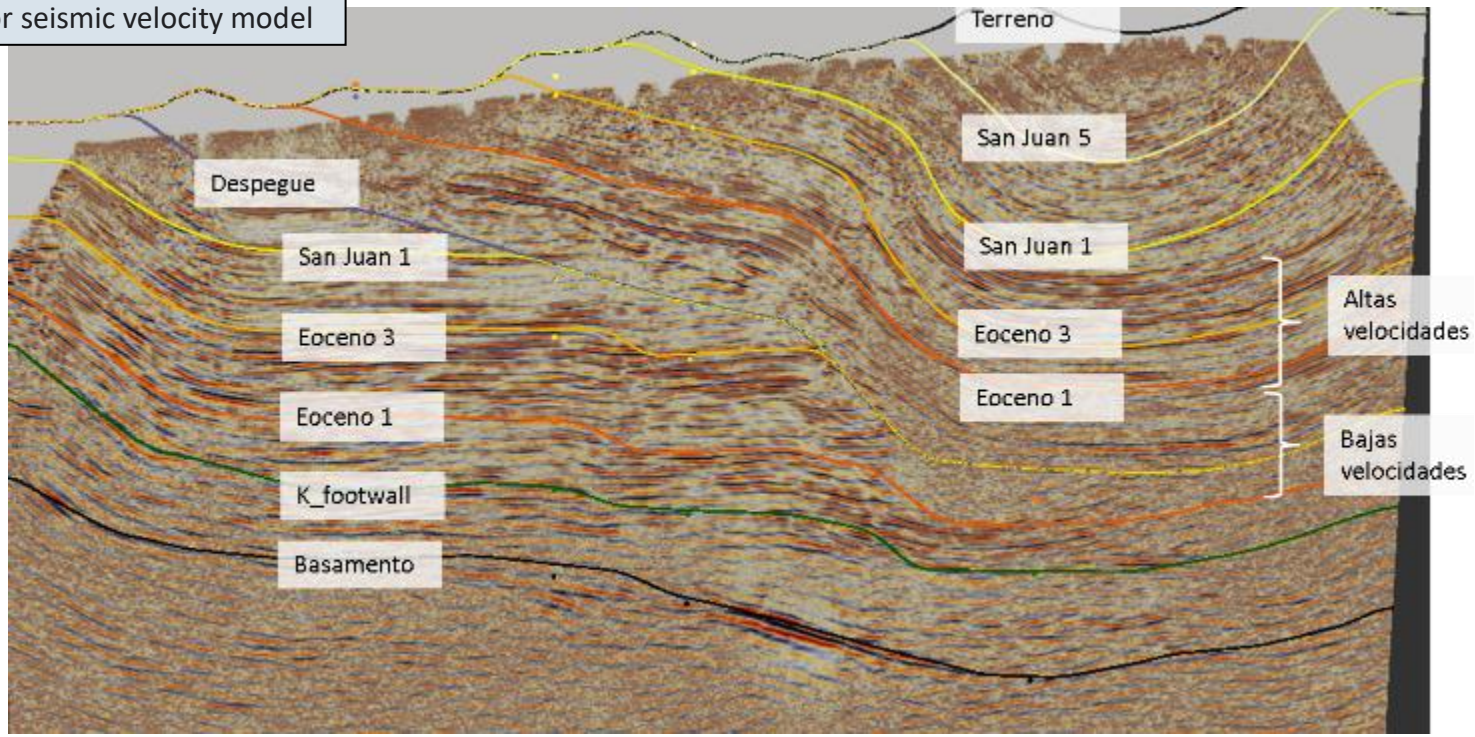
Well data compilation & treatment



Horizon picking for seismic velocity model



cessing process:

Seismic Velocity Model 2D-3D

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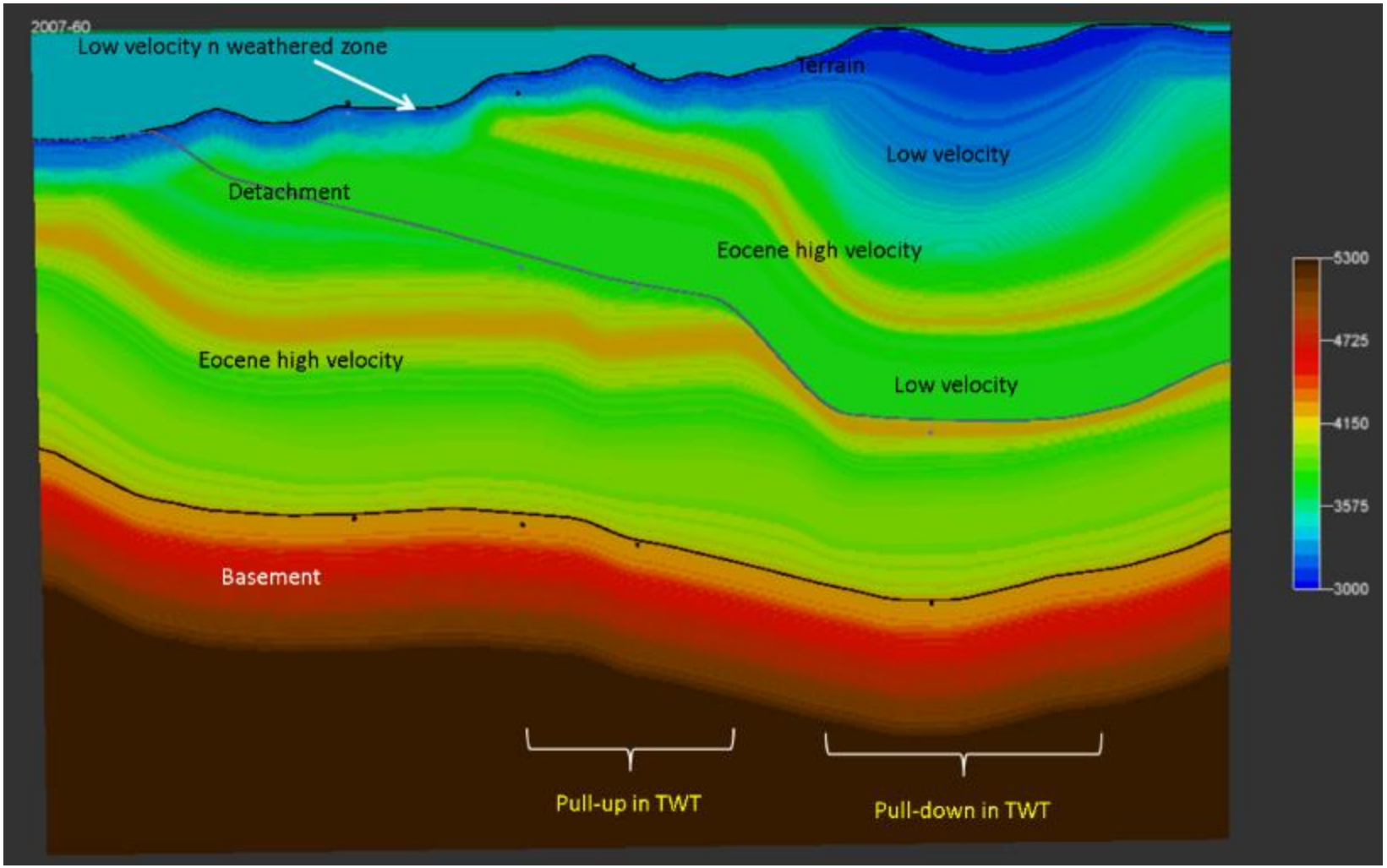

Seismic Velocity Model Extrapolation

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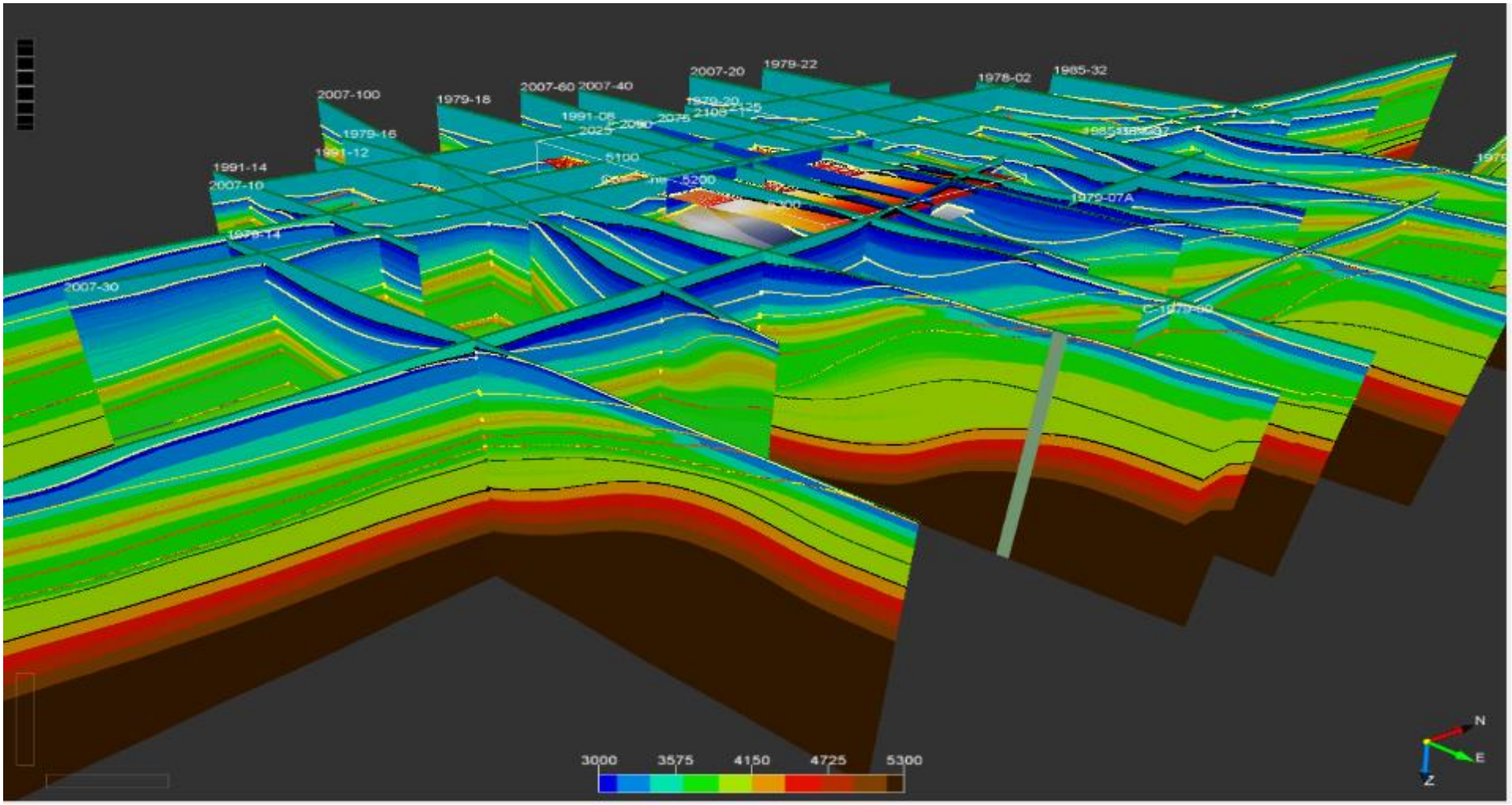

2D &3D seismic integrated velocity model

Time To Depth Conversion PSTM 2D & 3D Cube

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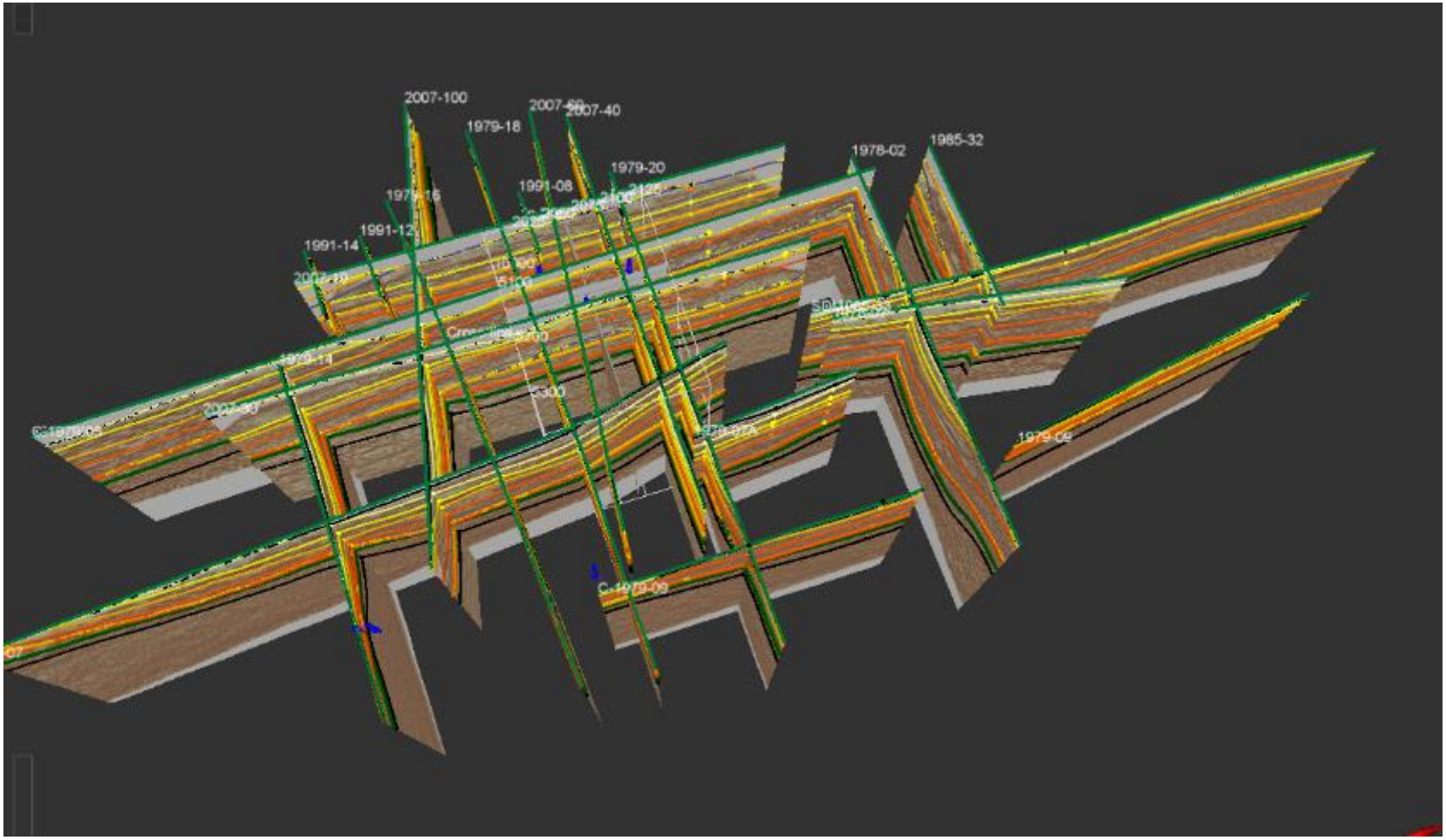

Elastic Inversion Of Seismic Data

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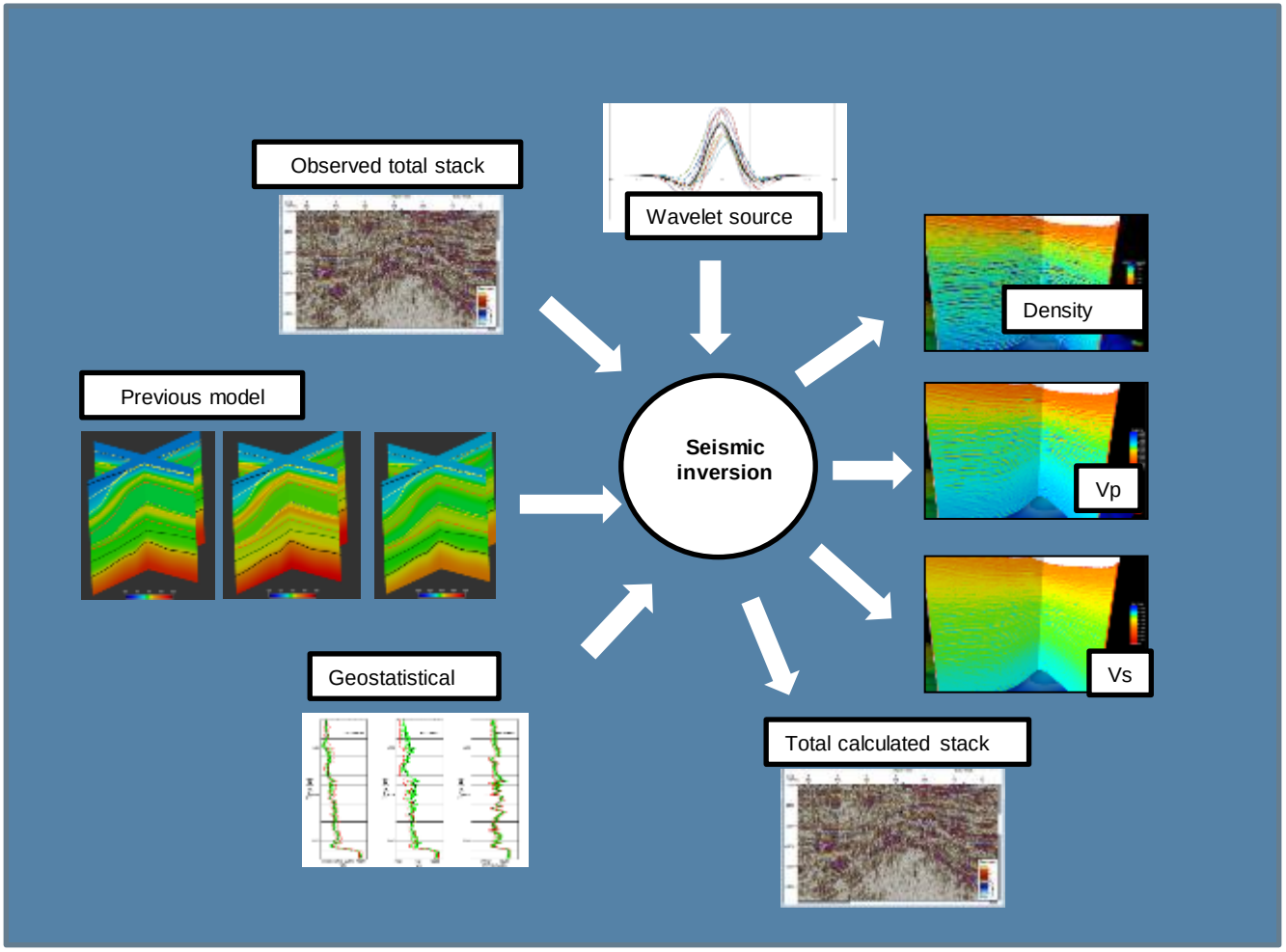

The seismic inversion estimates the elastic parameter models that explain the reflectivity in total stacking, or various stacks by incidence angle ranges. The seismic calculated from the estimated model reproduces the observed seismic, except for residuals due to noise or anomalous amplitudes of the processing. The inversion was calibrated by validating the source wavelet in pilot tests, and the spatial covariance of the properties in the well was characterized

Seismic Inversion Vp, Vs & Density (3D)

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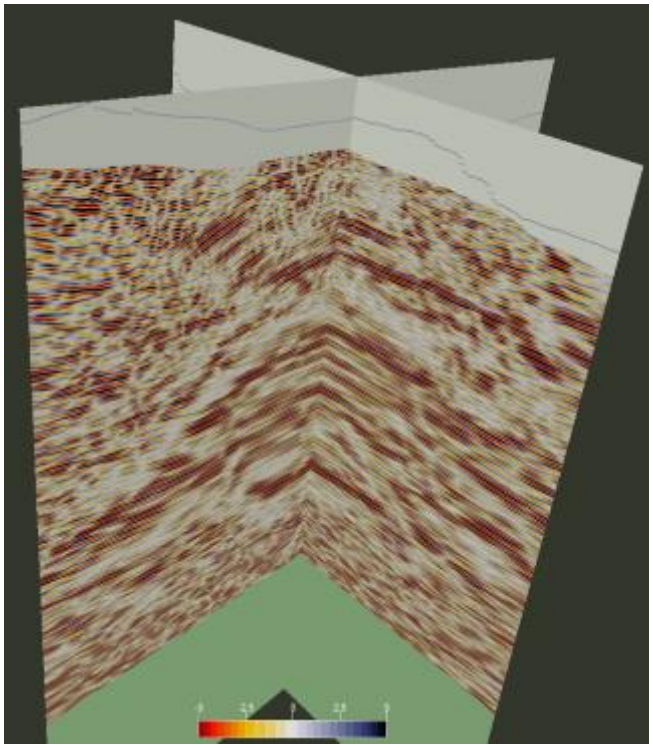
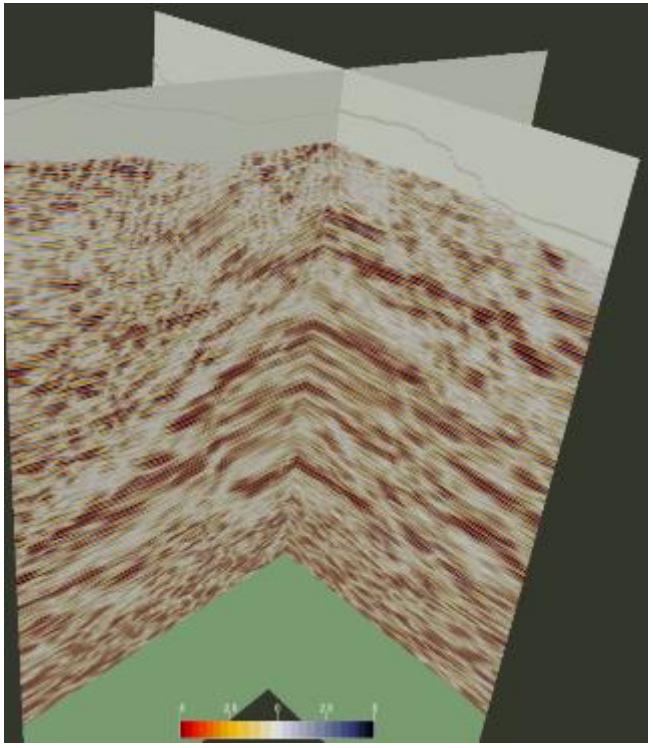
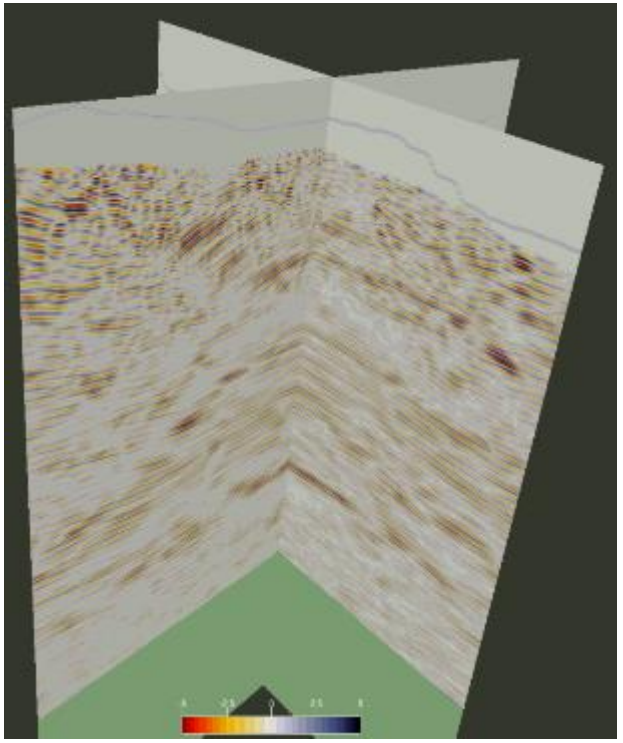
Observed seismic



Calculated seismic



Residual seismic



The seismic calculated from the estimated properties reproduces the observed seismic, leaving noise and anomalous amplitudes in the residue.
A source wavelet with a dominant frequency of 35Hz and zero phase in SEG standard polarity was used - positive impedance contrasts produce negative reflections

Seismic Inversion - Estimated Properties

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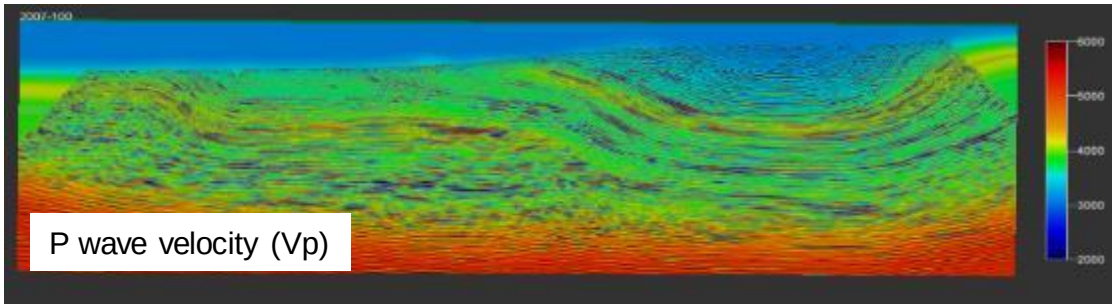

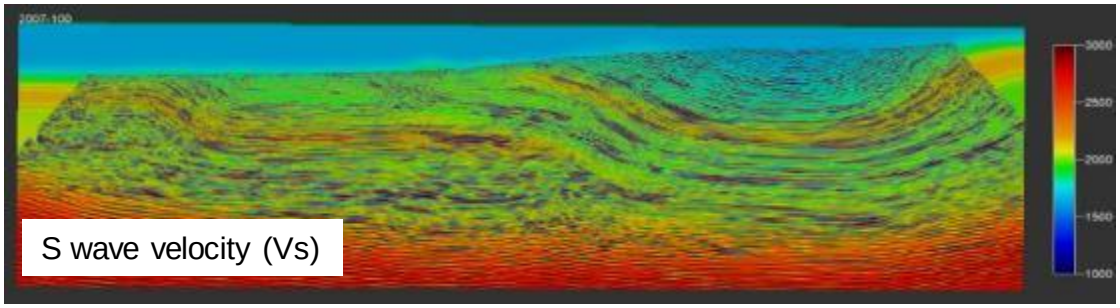

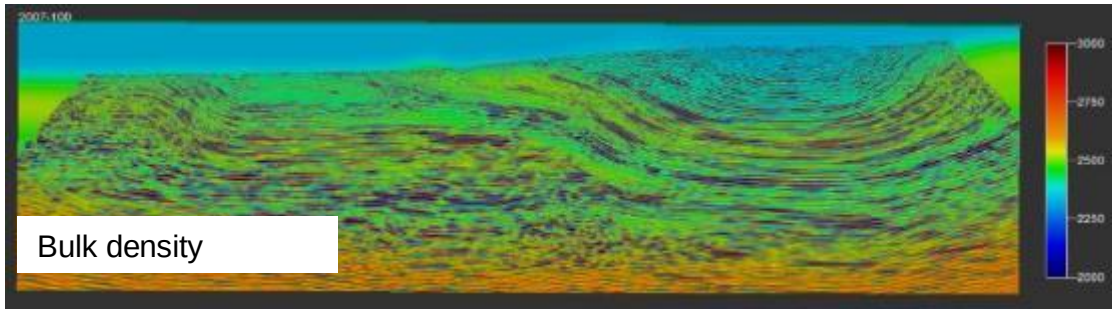

The seismic inversion technique allows estimating the elastic properties of the medium that explain the observed seismic reflections. The reflectivity is calculated by the well-known Zoeppritz formula; an advanced estimation algorithm is used taking into account the previous information on the elastic properties and the source seismic wavelet.

Pre-stack Signal Enhancement Process (1)

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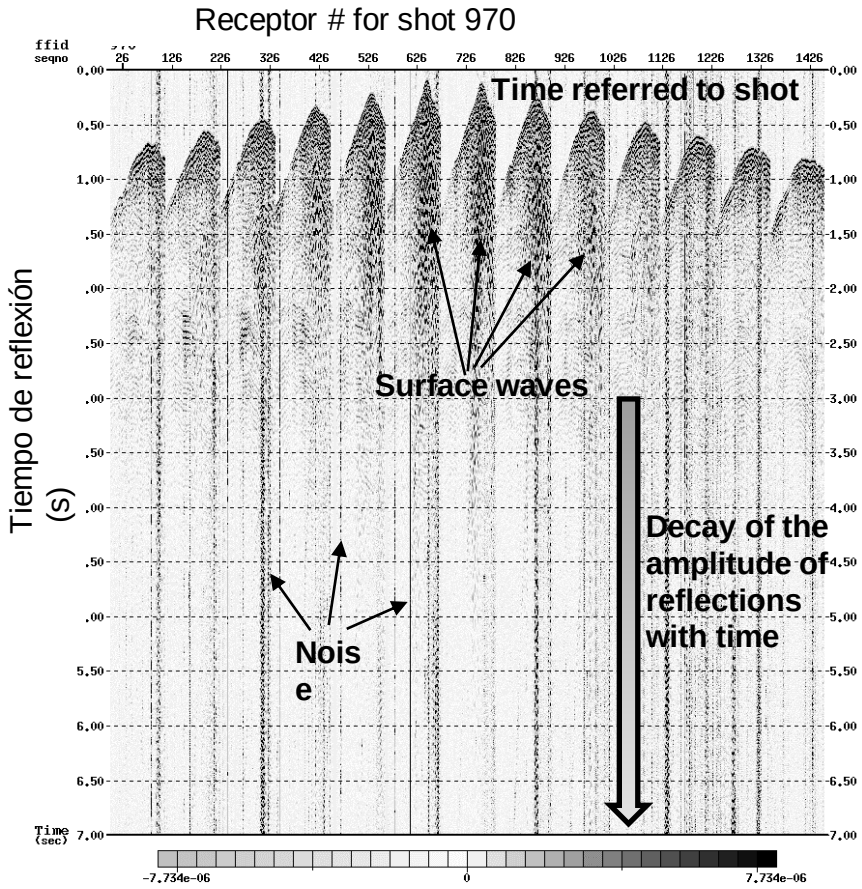
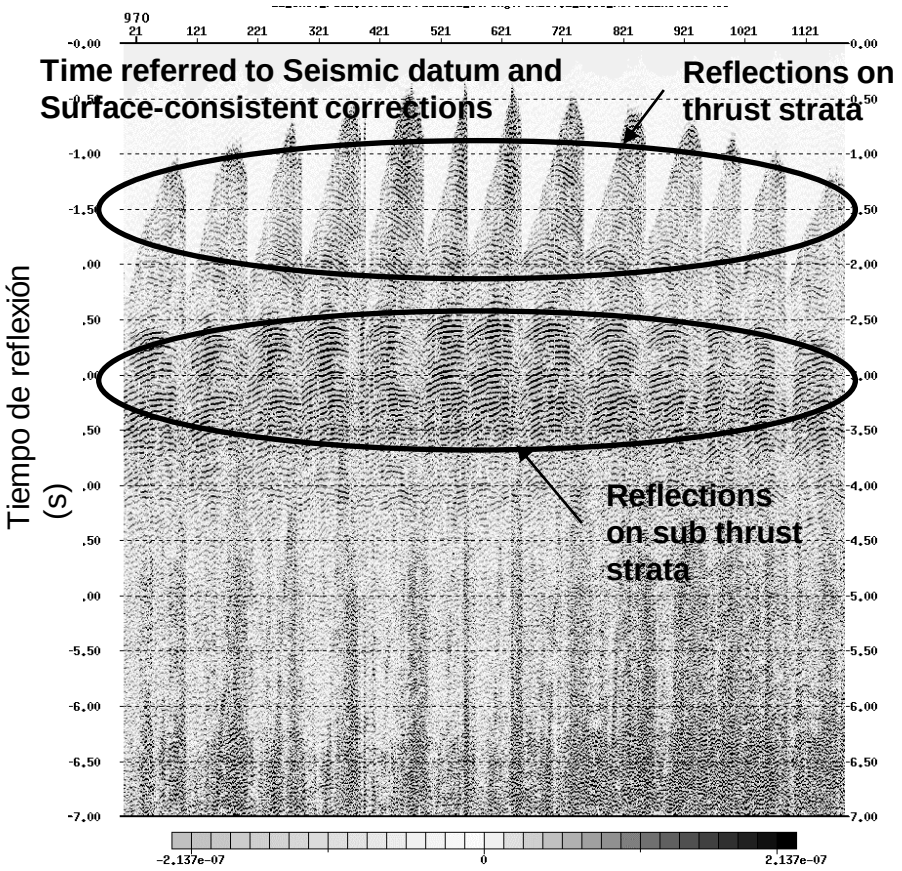
a) Raw shot example



b) After pre-stacking process



Pre-stacking data preparation in common shot domain corrects for time shifts due to surface and retains the signal from primary reflections while attenuating other recorded components: such as surface waves and ambient noise.

Pre-stack Signal Enhancement Process (2)

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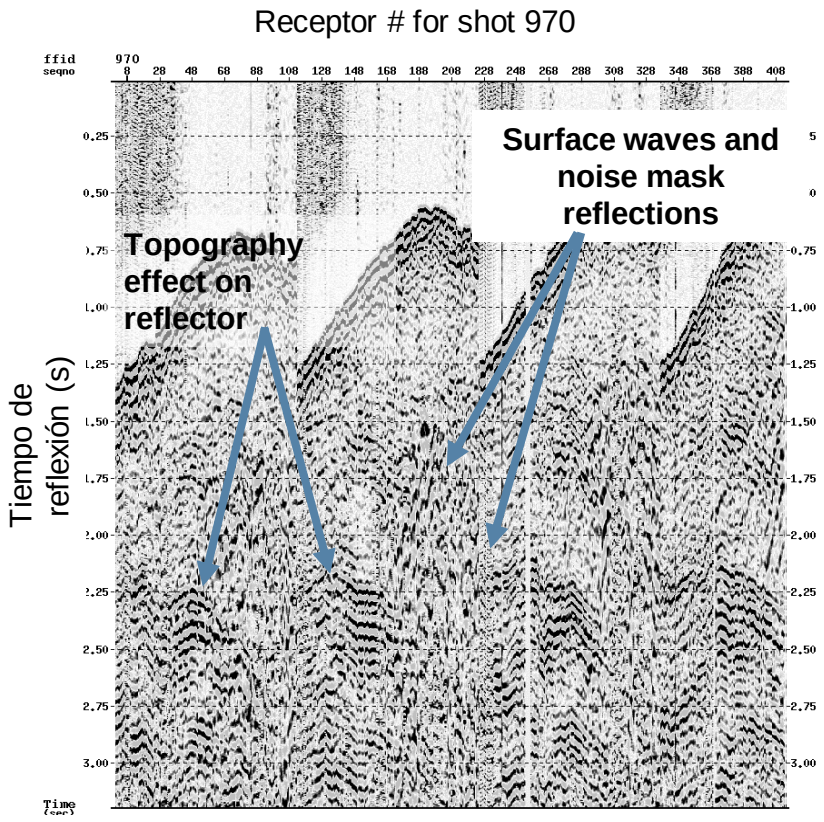
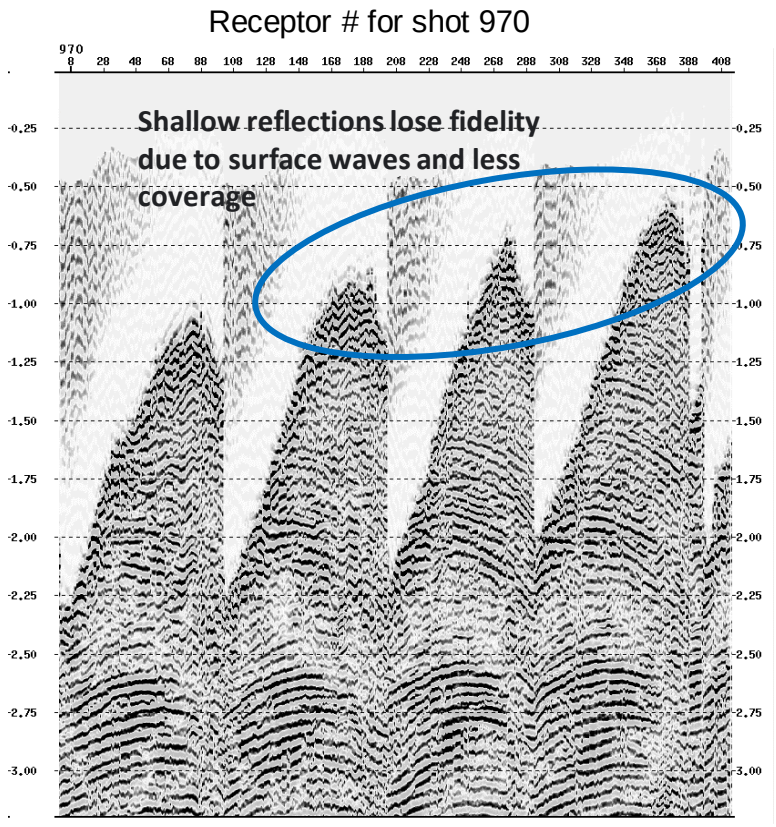
a) Raw shot example



b) After pre-stacking process



Pre-stacking data preparation in common shot domain corrects for time shifts due to surface and retains the signal from primary reflections while attenuating other recorded components: such as surface waves and ambient noise.

Time Correction For Terrain Elevation & Shallow Layer Velocities (1)

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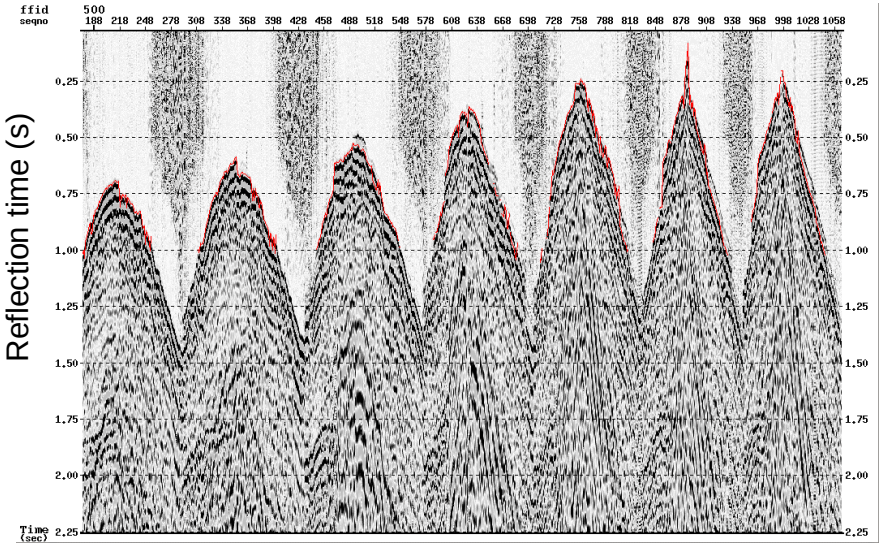
Receptor # for shot 970



First arrival selection

An algorithm based on the energy arrival time is used for the automatic selection of the first arrivals for all shots.

This selection is the basis for a refraction analysis that allows estimating the velocities of the first two layers of the soil and removing effects close to the source and receiver.

These first arrivals, together with the data of elevations and positions of receivers and shots are used for the joint estimation of the following time corrections:

- By receiver elevation
- By elevation shot
- By receptor soil layer
- Per ground layer shot

Time Correction For Terrain Elevation & Shallow Layer Velocities (2)

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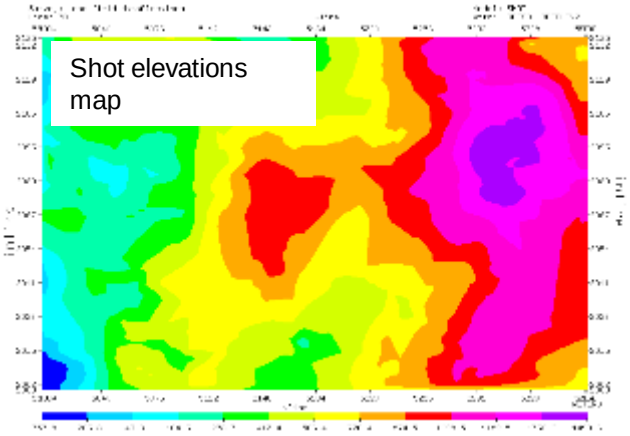

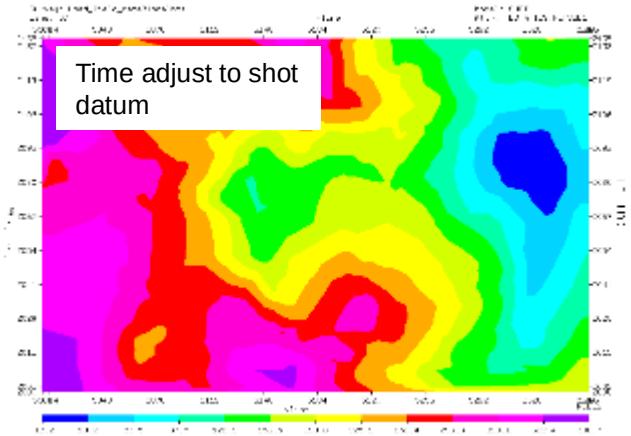

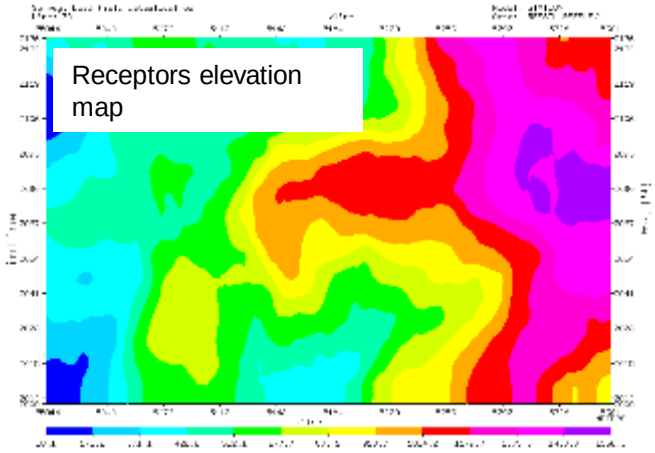

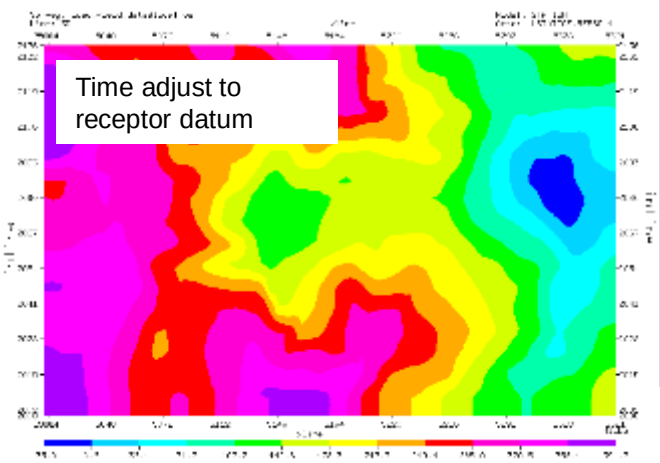

The elevations of receivers and shots to the seismic datum are calculated according to their elevation, using:

- The seismic DATUM is set at 1800 m above sea level The replacement seismic wave velocity is taken at 3400 m/s
- The elevations and the corresponding time corrections in receiver and shot are presented in the graphs of this sheet.

3D Cube: Migration Pre & Post Stack

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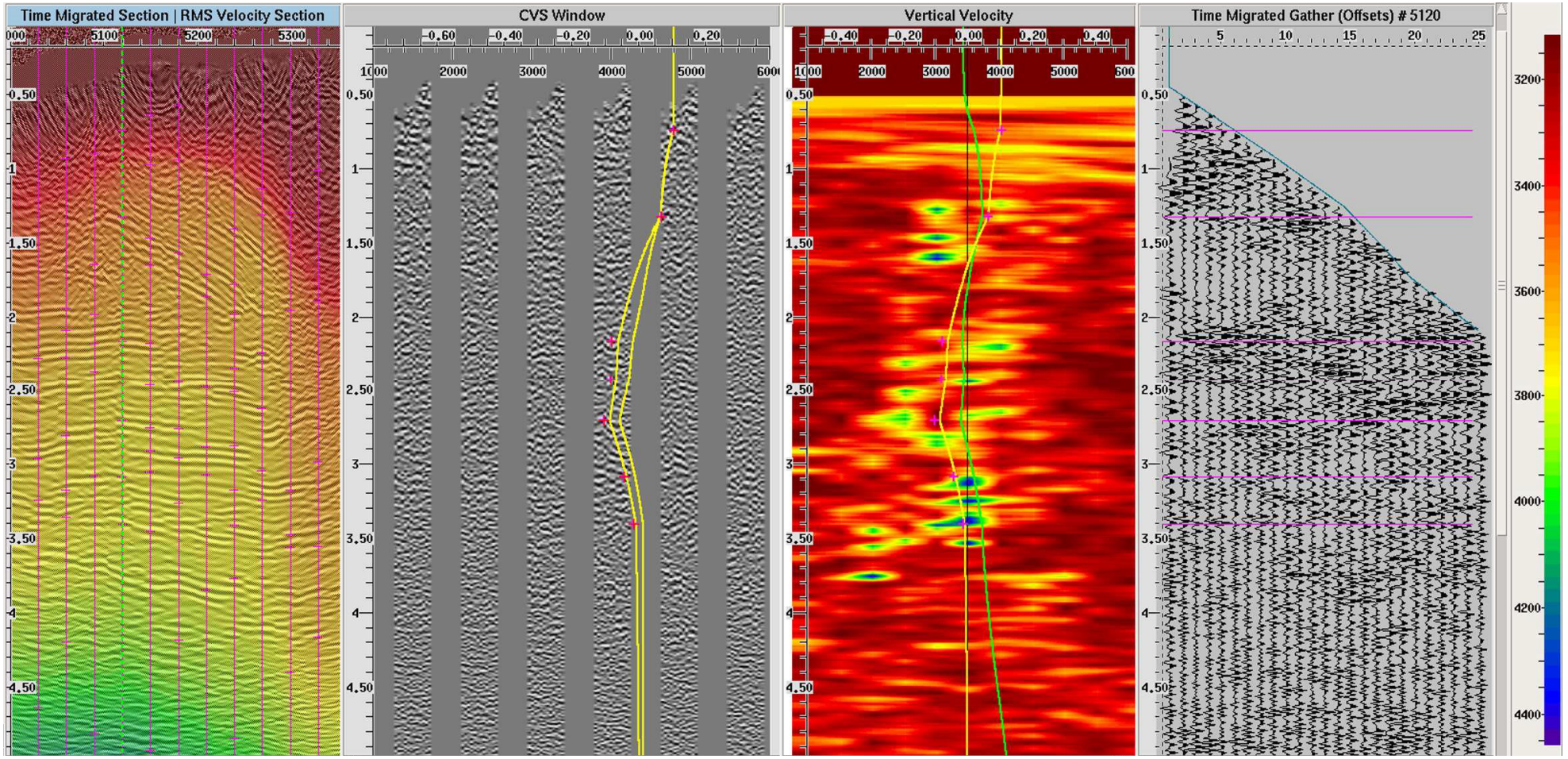
Velocity Analysis



Residual velocity analysis module for Geodepth migration (ECHOSParadigm)

Comparison between 2021 & 2014 Reprocessing (Post-stack migrated sections)

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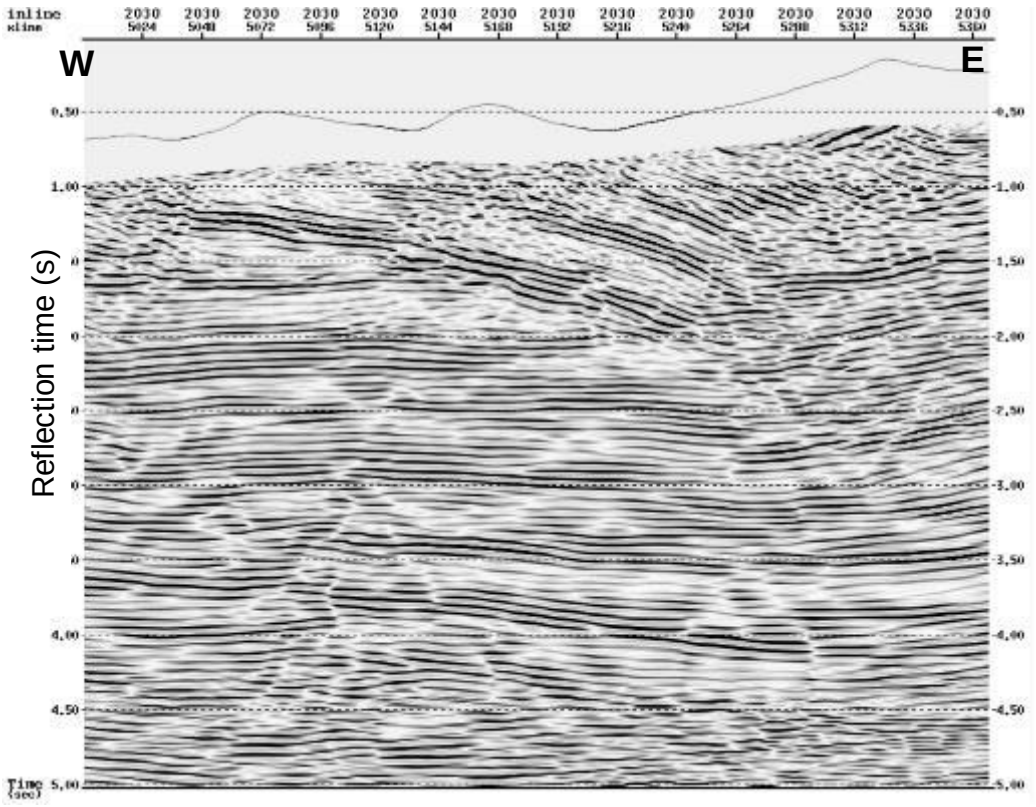
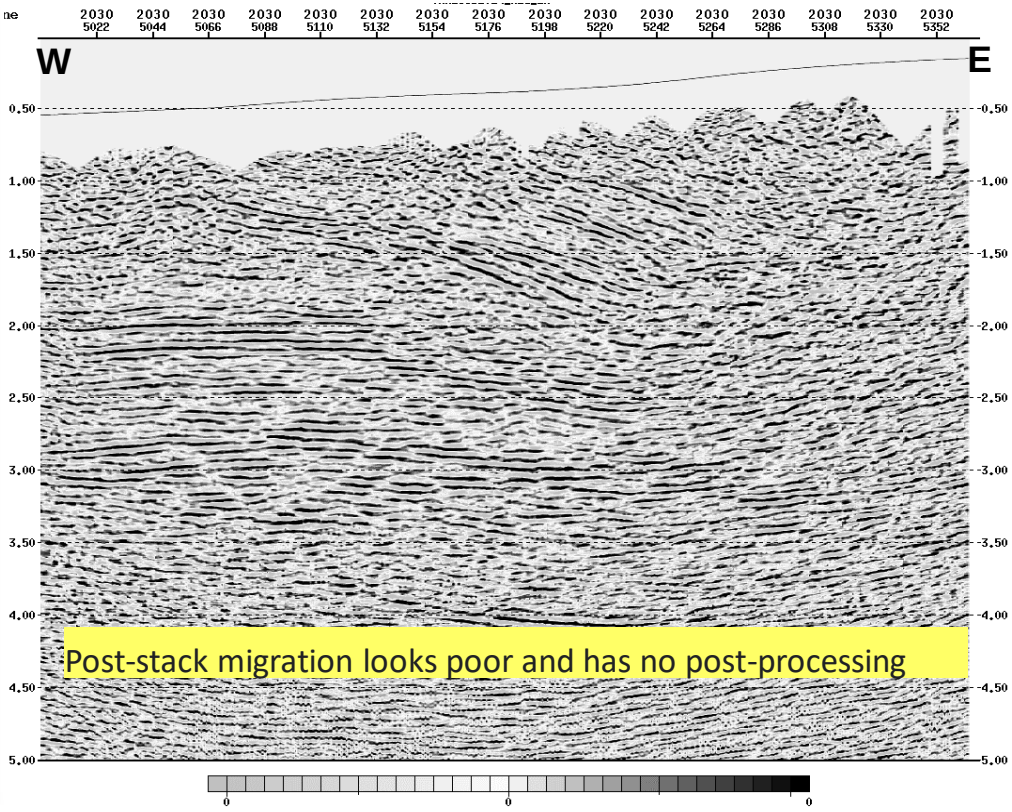
Inline 2030 Migration post-stack **2021**



Inline 2030 Migration post-stack **2014**



Seismic Inversion Results for Vp, Vs & Density (3D)

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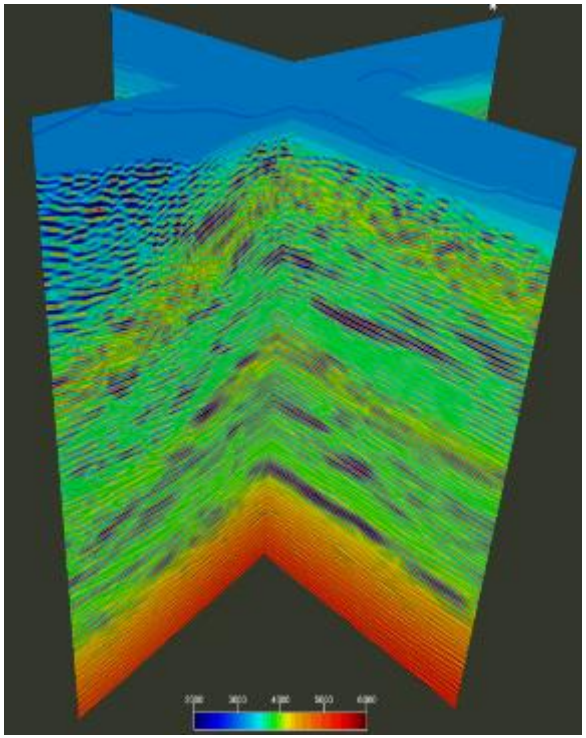
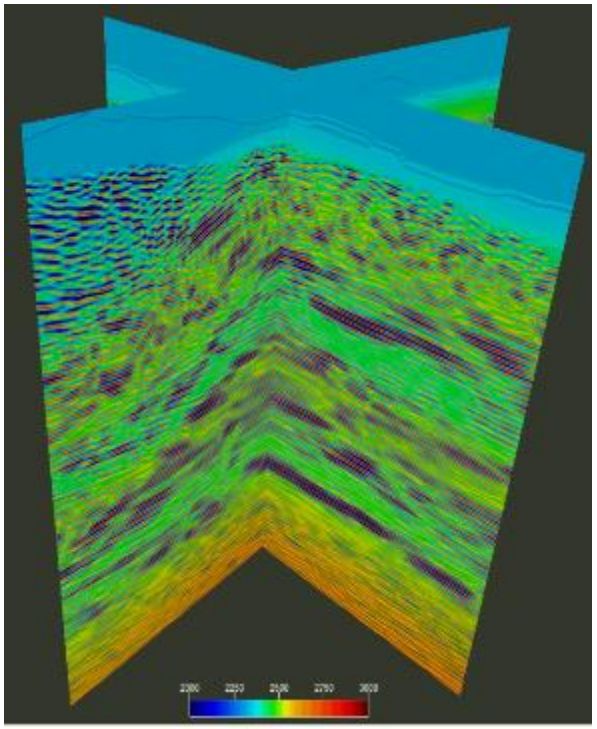
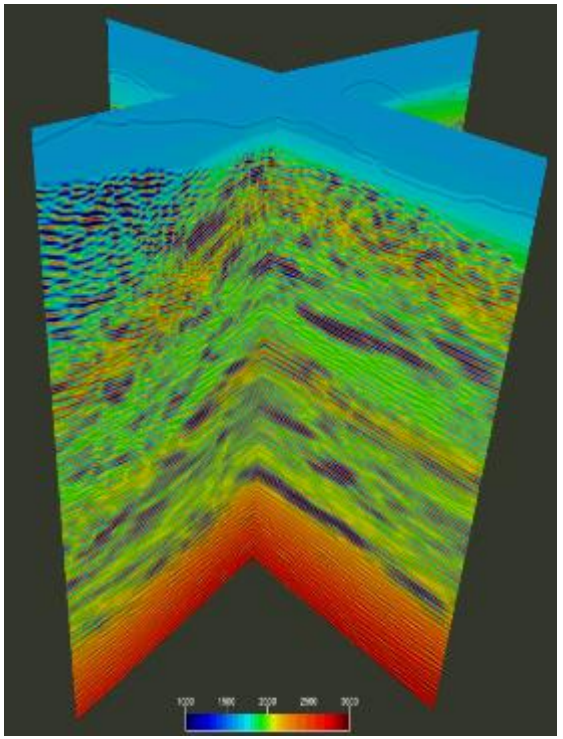
P-Wave velocity (Vp)



S-Wave velocity (Vs)

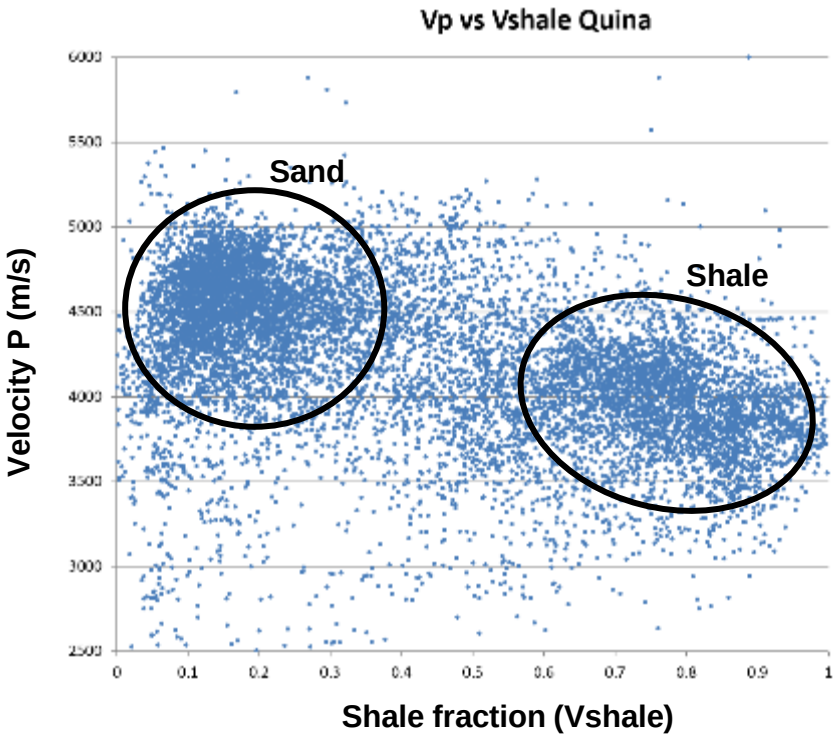


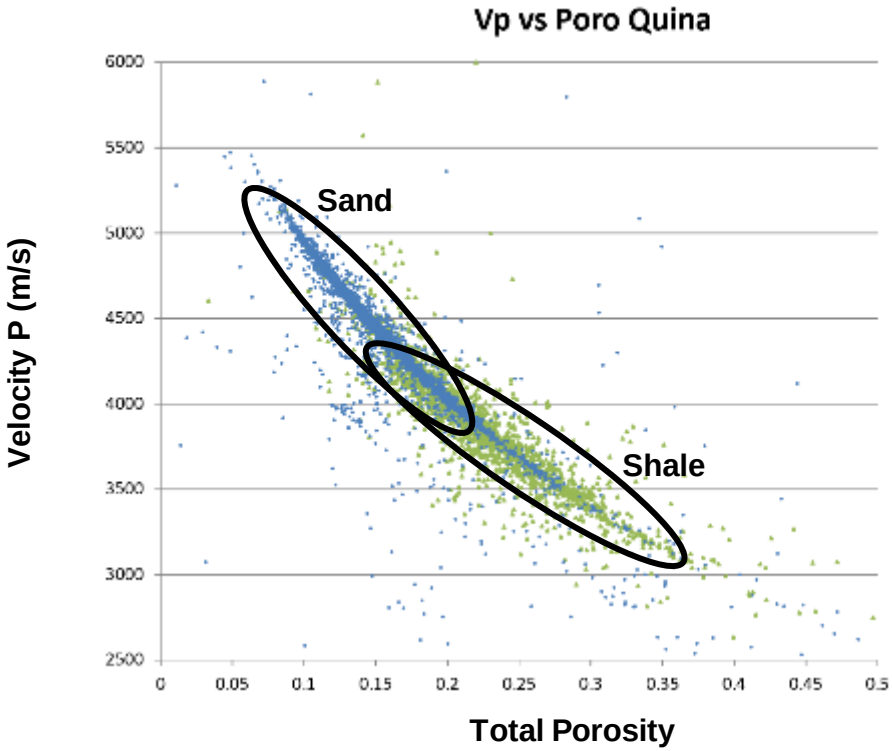
Bulk Density



Lithology & Porosity plots

The sands in this area are characterized by a higher seismic velocity than shale, as well as lower porosity, higher acoustic impedance and density than clays. This allows to discriminate sands and clays from the properties estimated with the investment





Reservoir Properties Characterization - Quina Well

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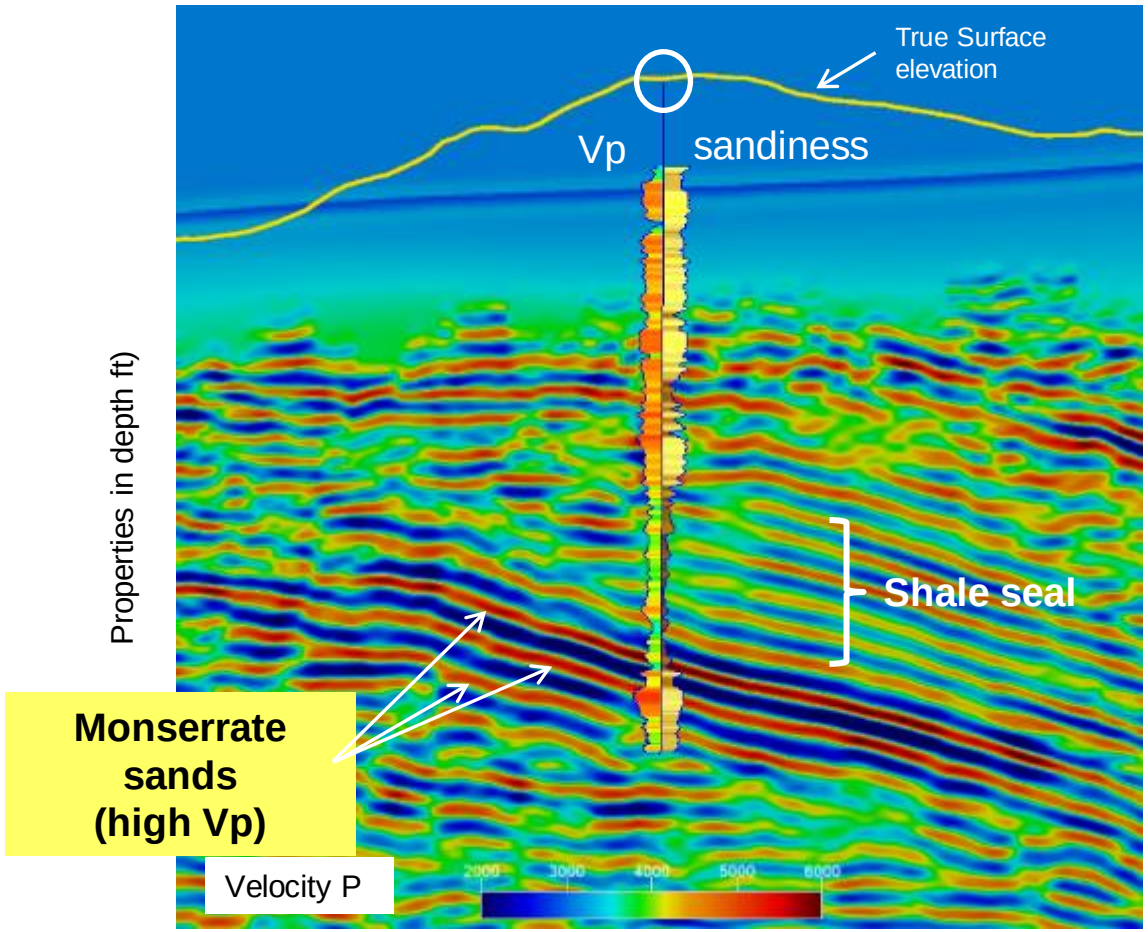
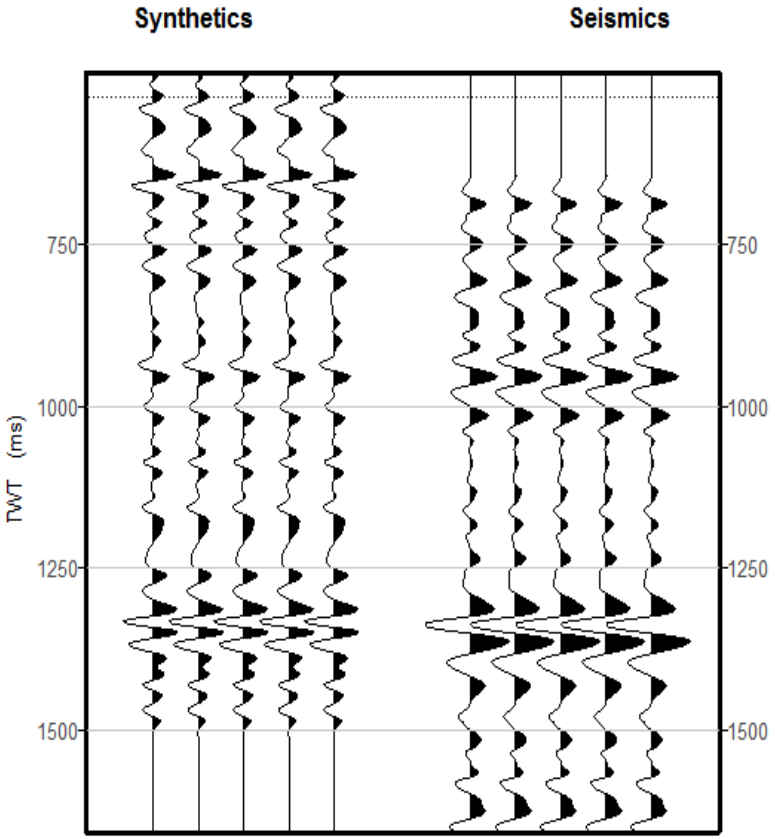
Quina Well - Inline 2067

P velocity in log and seismic



Seismic – log tie in time domain



Reservoir Properties Characterization - Hercules Prospect

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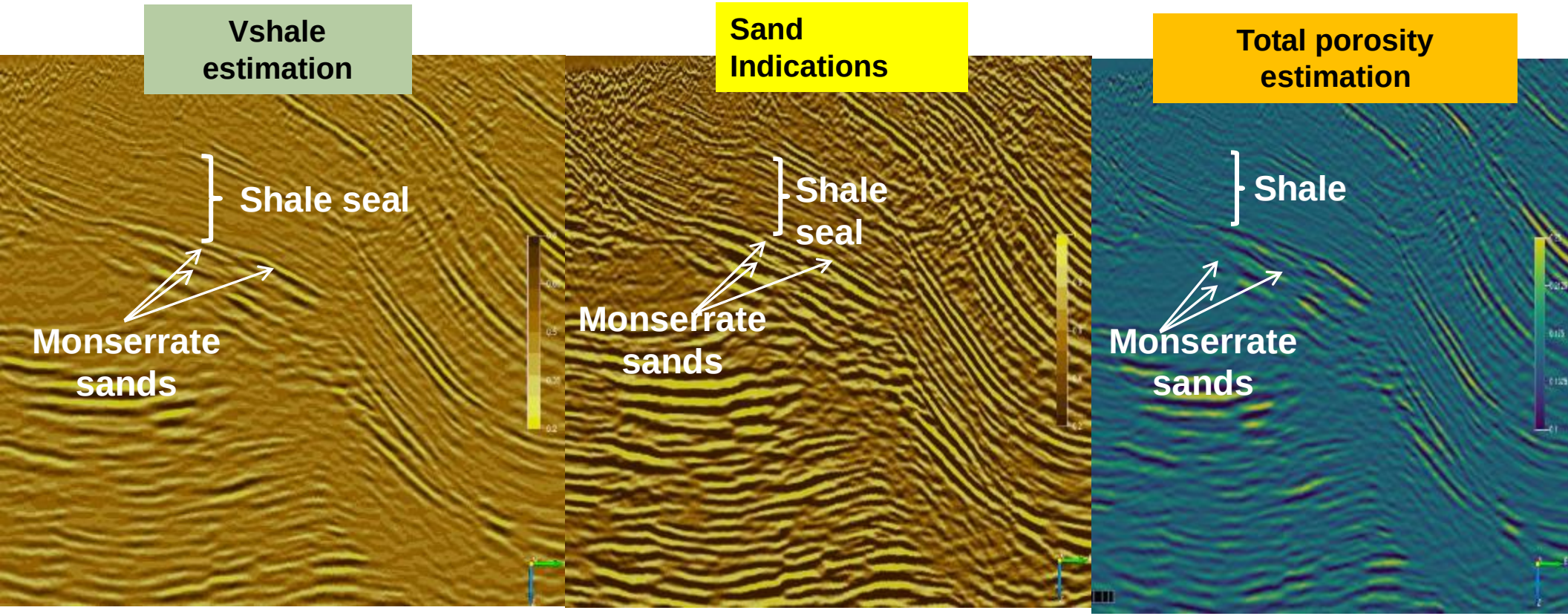

Hercules Prospect - 2D Line 2007-100

Reservoir Properties Characterization - Hercules Prospect

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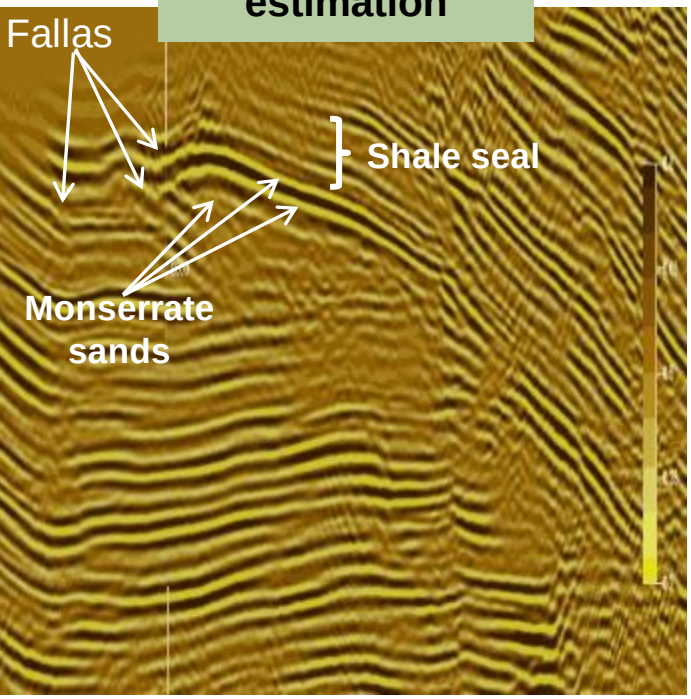
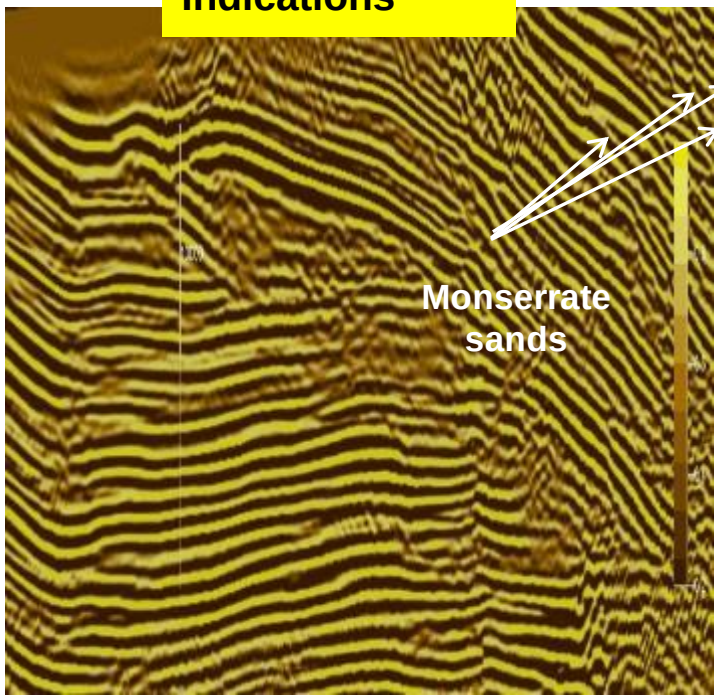
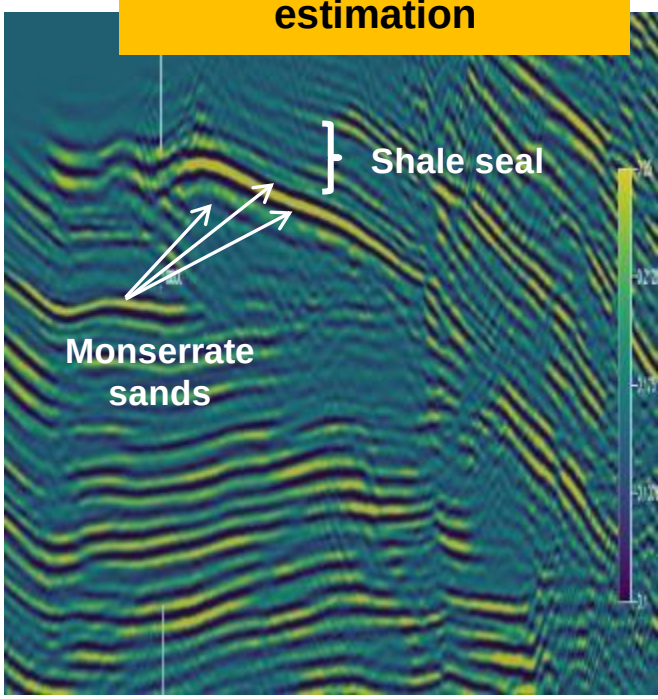
Vshale estimation



Sand Indications



Total porosity estimation



Hércules Norte - 2D Line 1979-18

Hercules Prospect - Preliminary Interpretation

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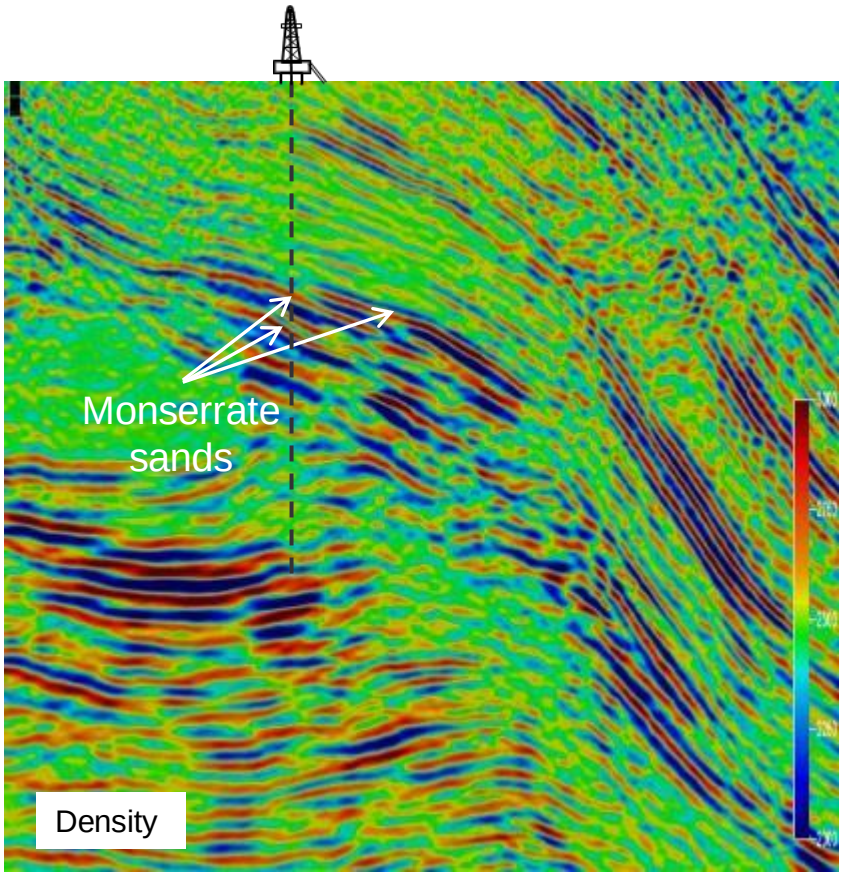
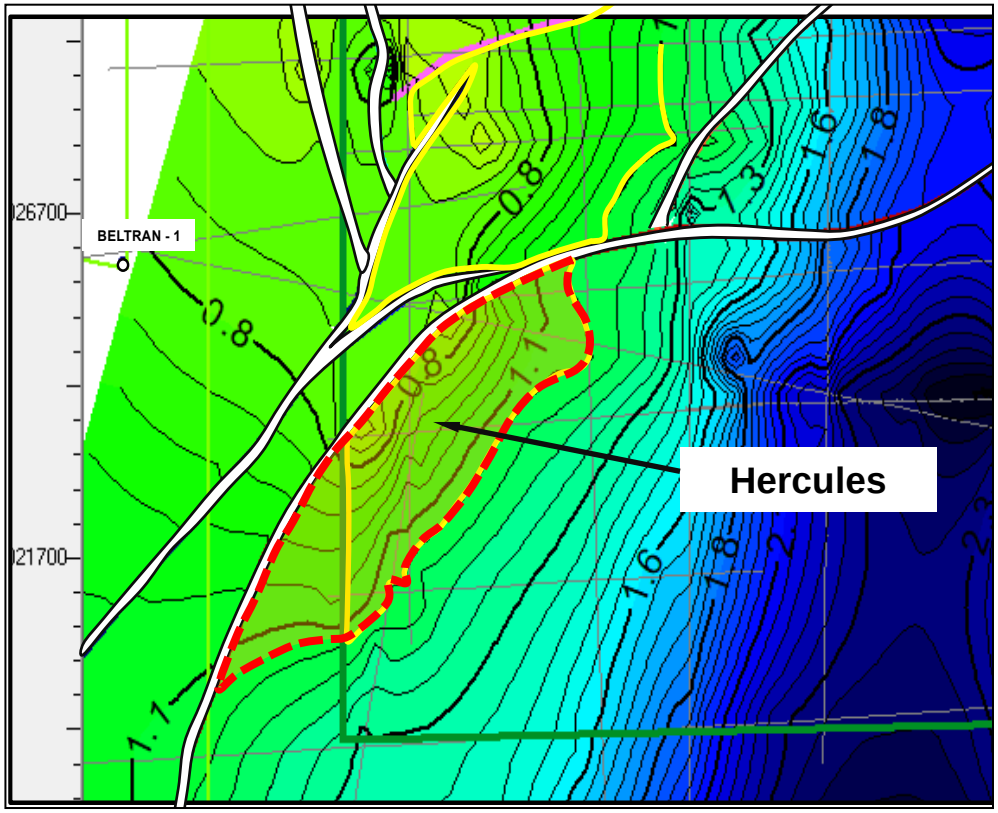
Hercules 1

(proposed vertical trajectory)





Maximum closure 4,586 acres

Hercules Norte Prospect - Preliminary Interpretation

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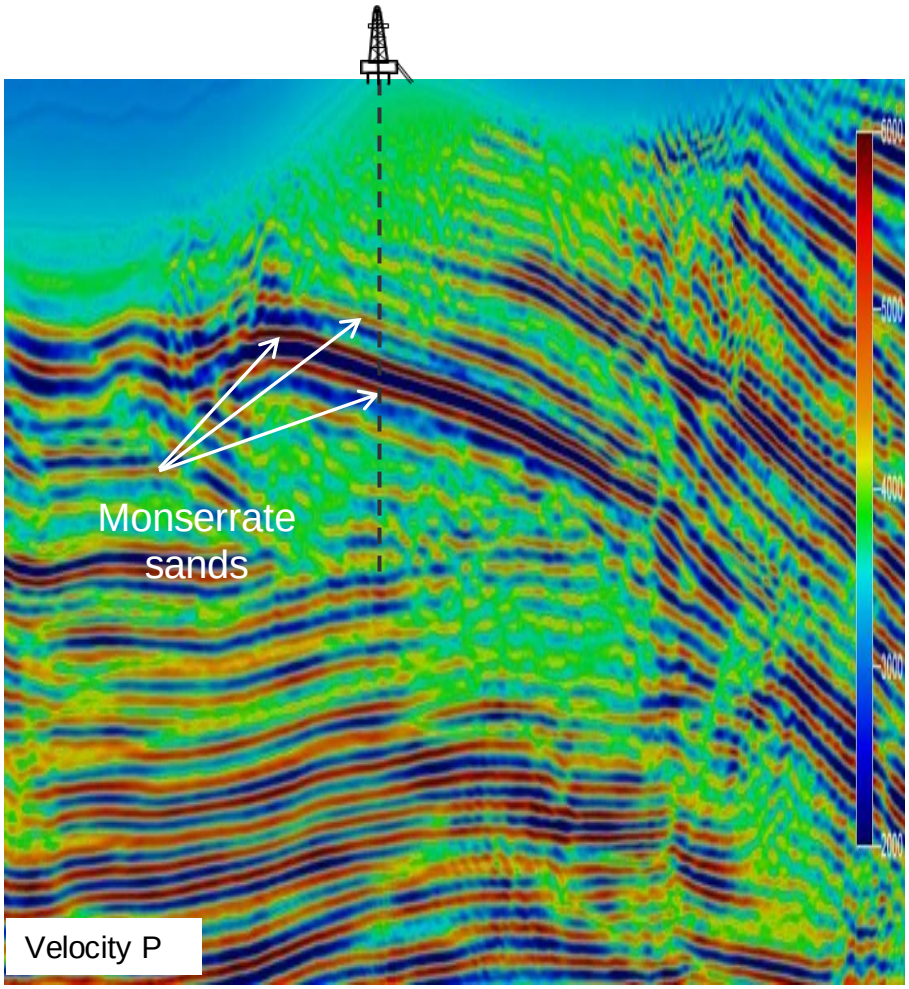
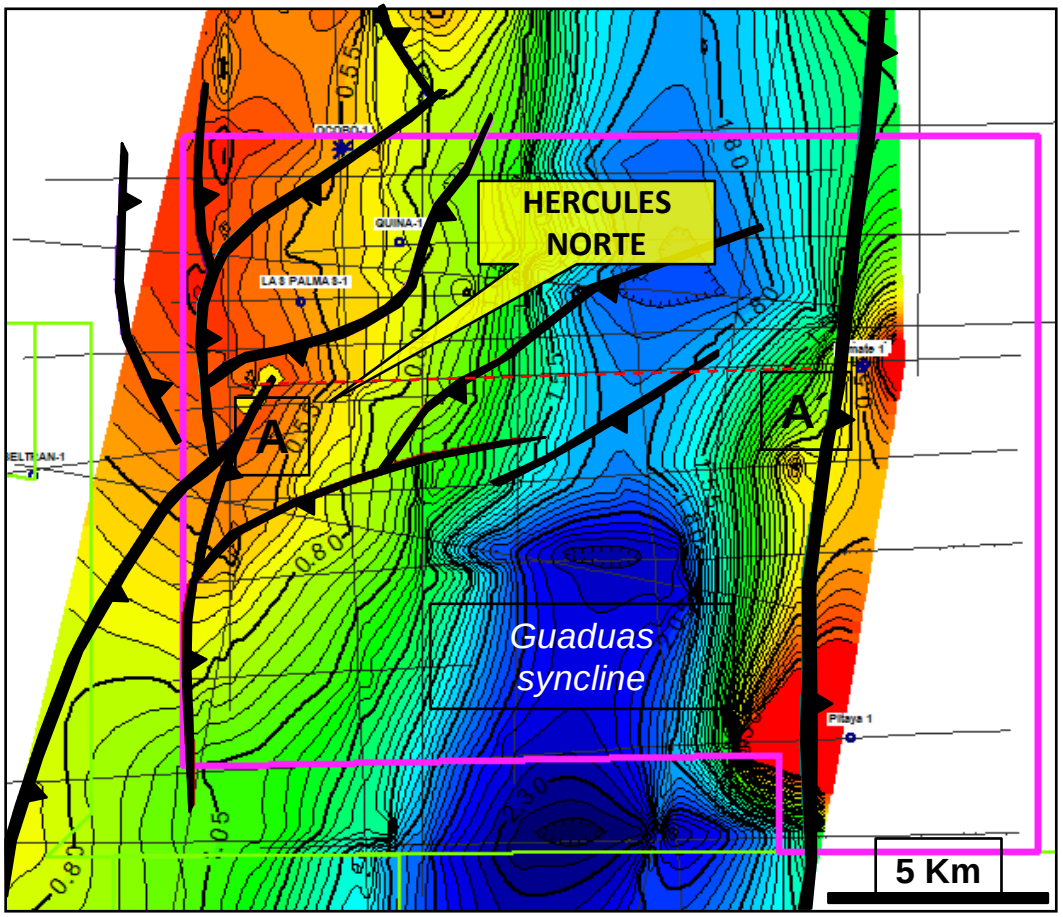
Hercules Norte 1

(proposed vertical trajectory)





Maximum closure 5,200 acres

Hercules Norte Prospect / Partial 3D View

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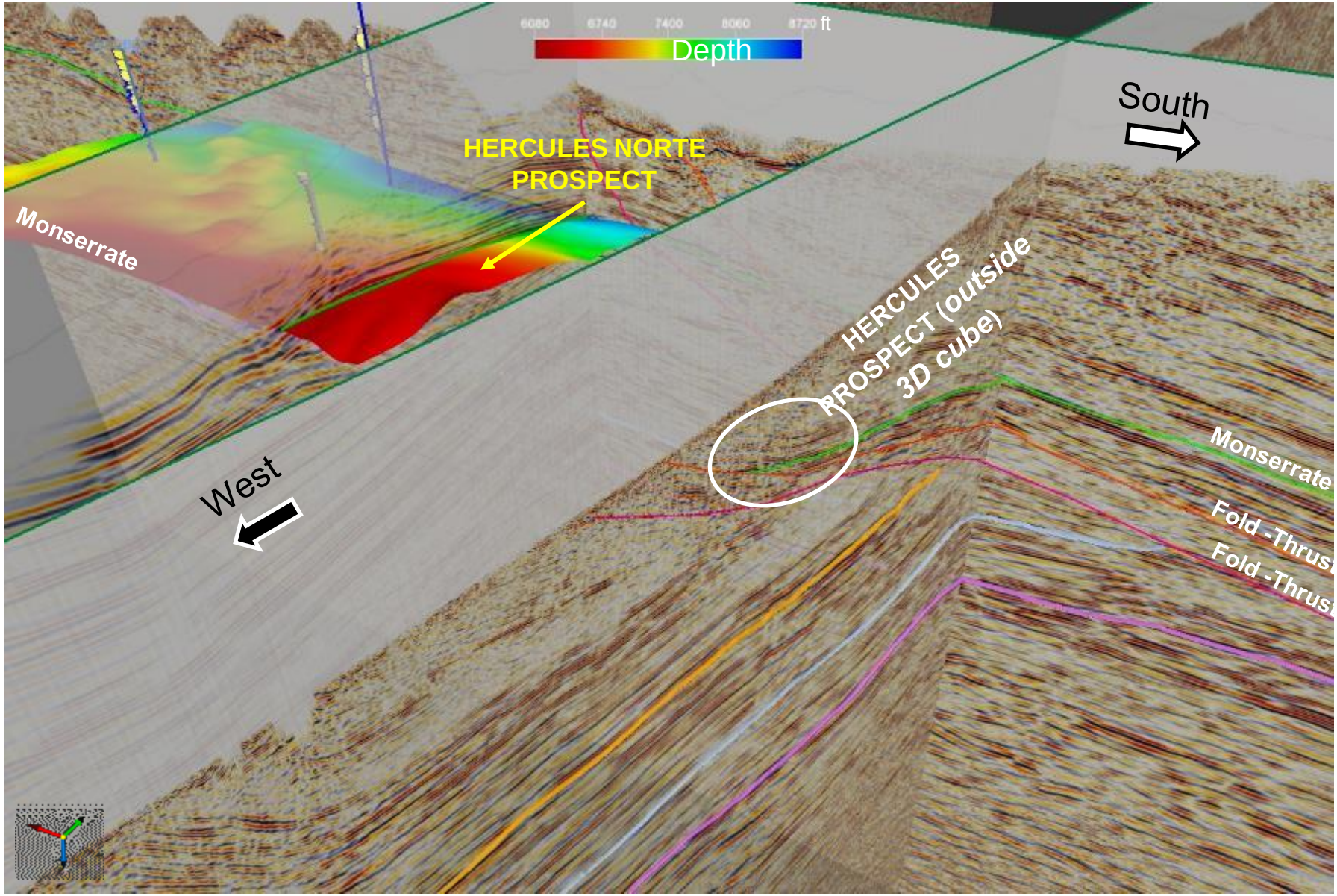

Hercules Norte Prospect – Sand/Shale Indicator

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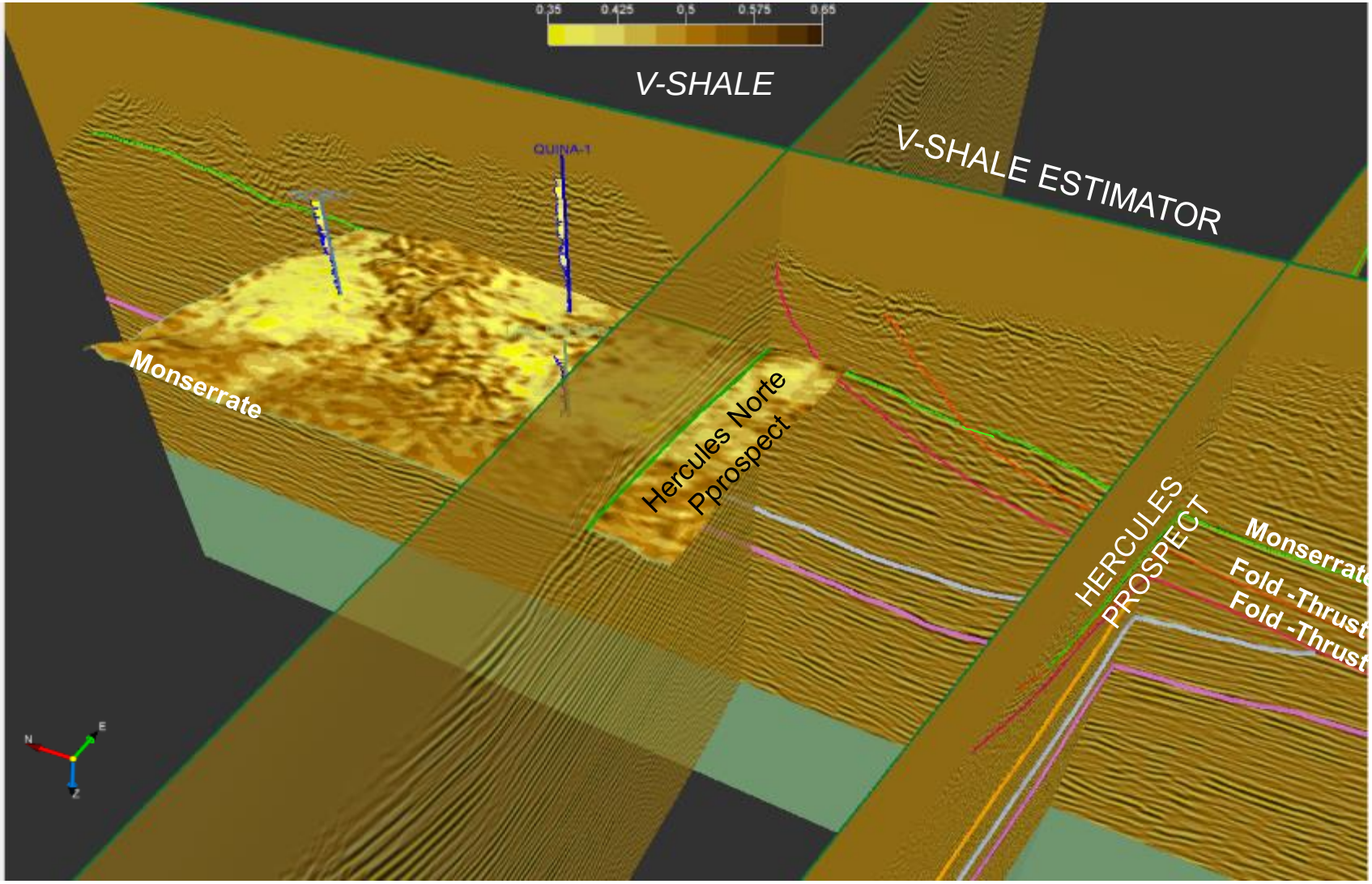

Cigarra Sub-thrust @ Monserrate Formation

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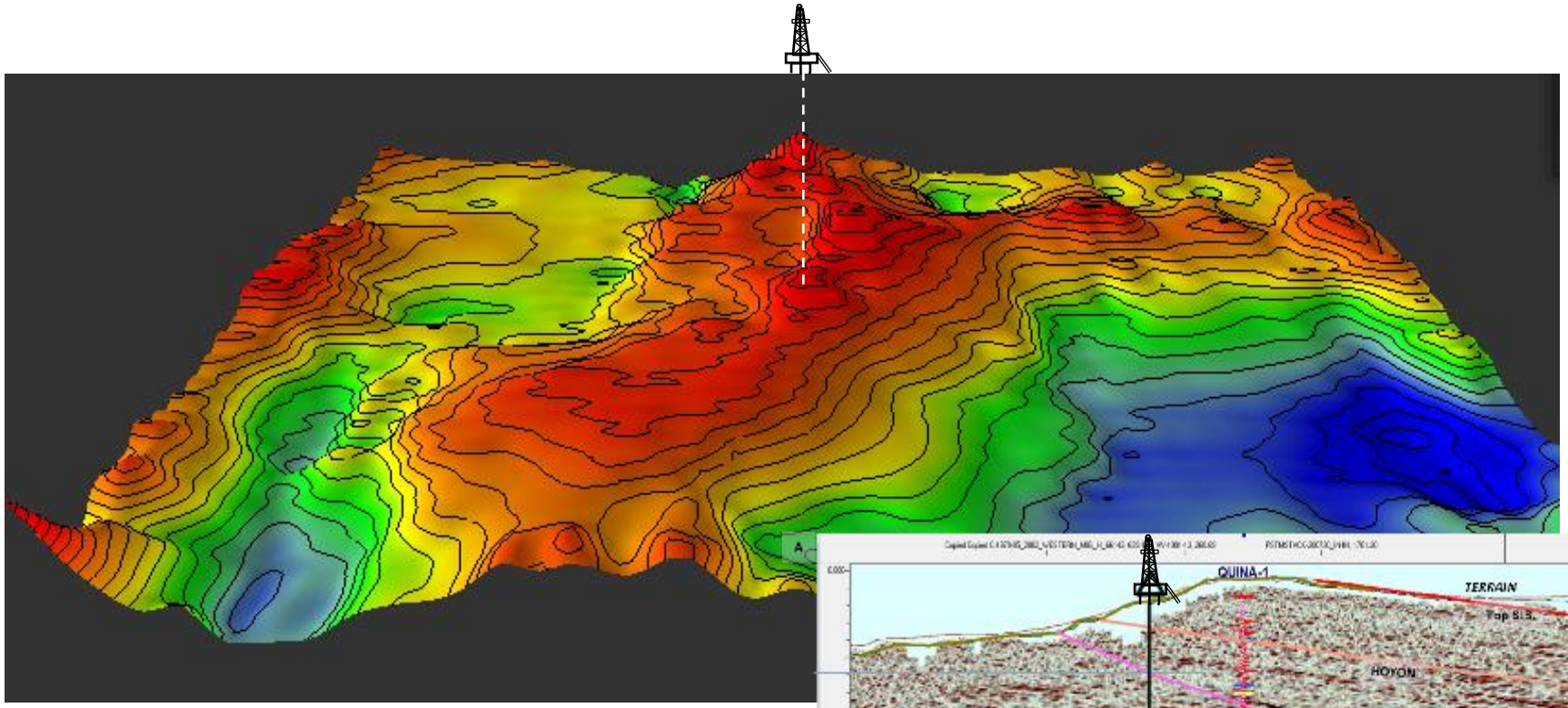
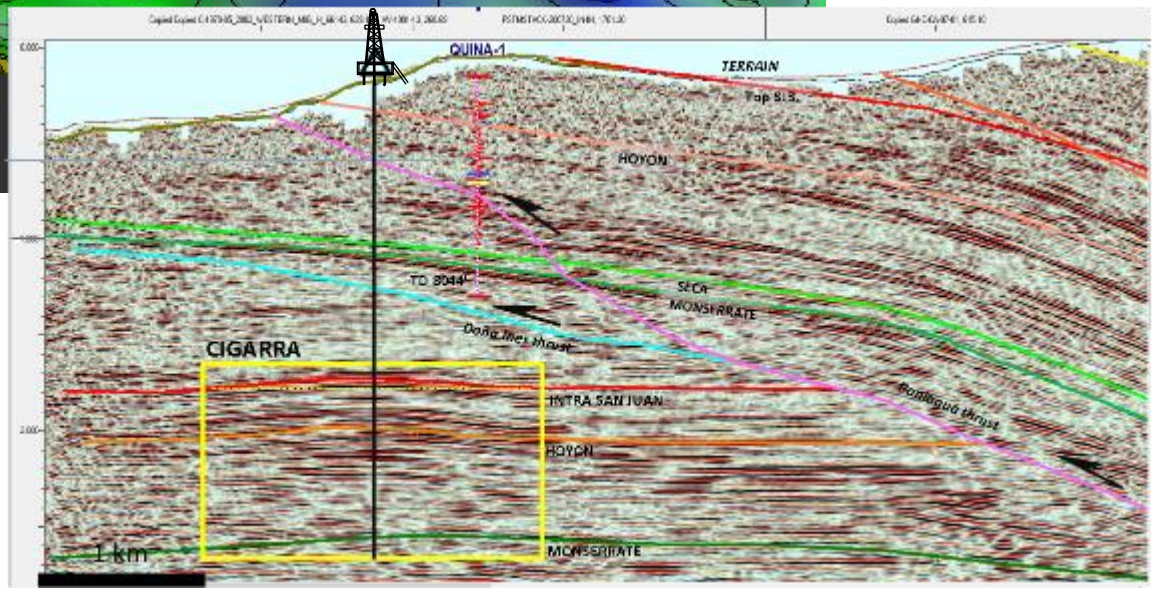
Cigarra 1

(proposed vertical trajectory)





Monserrate Fm:

- Ø: 13%
- Hc Sat: 65%
- Closure Area: 38,000 acres
- Net Pay: 47 - 73 ft

END