Static Geologic Model of the Upper Texas and westernmost Louisiana coasts (TexLa Merge 3D)

Reinaldo Sabbagh

May 18th, 2022

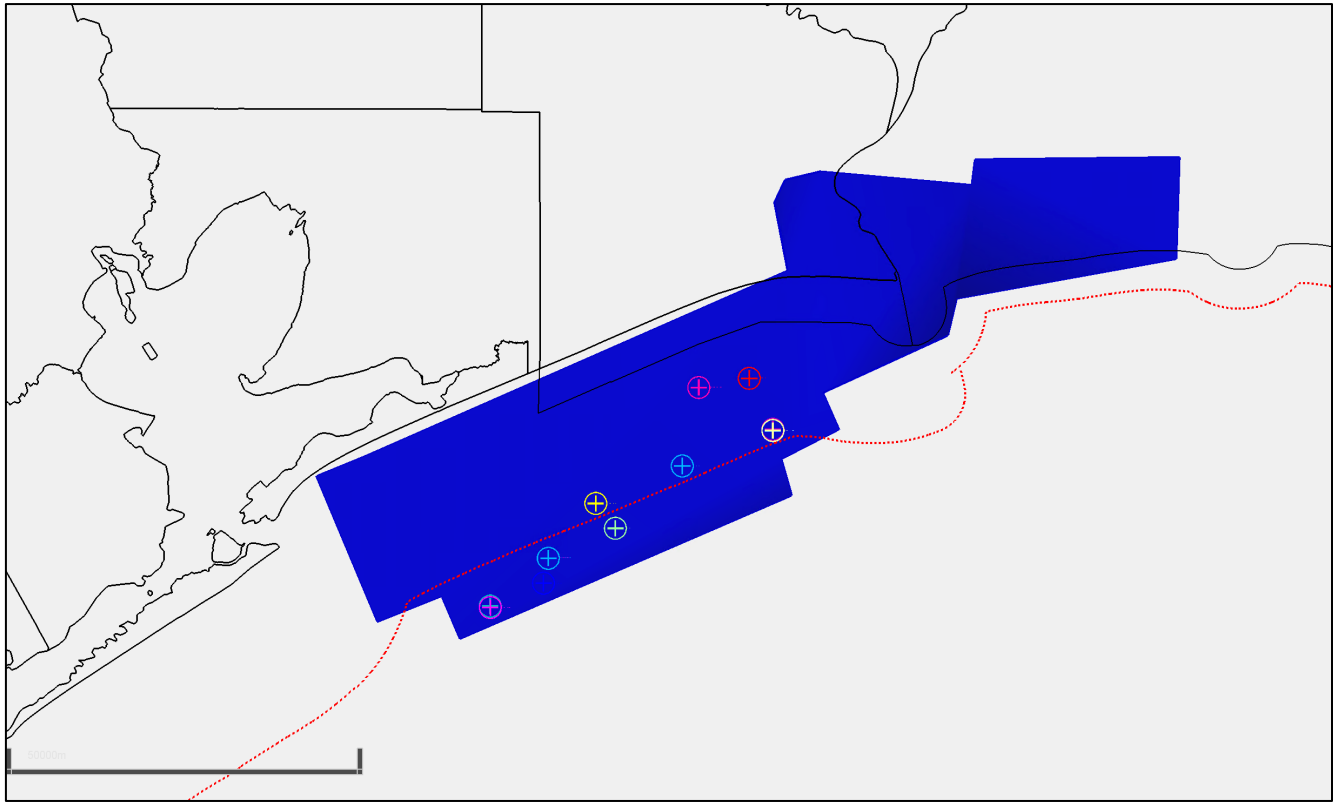
Outline

- Introduction
- How we built the model
- Results
- Summary and future work

Introduction

- The goal of seismic reservoir characterization studies is to predict three-dimensional models of rock and fluid properties in the subsurface

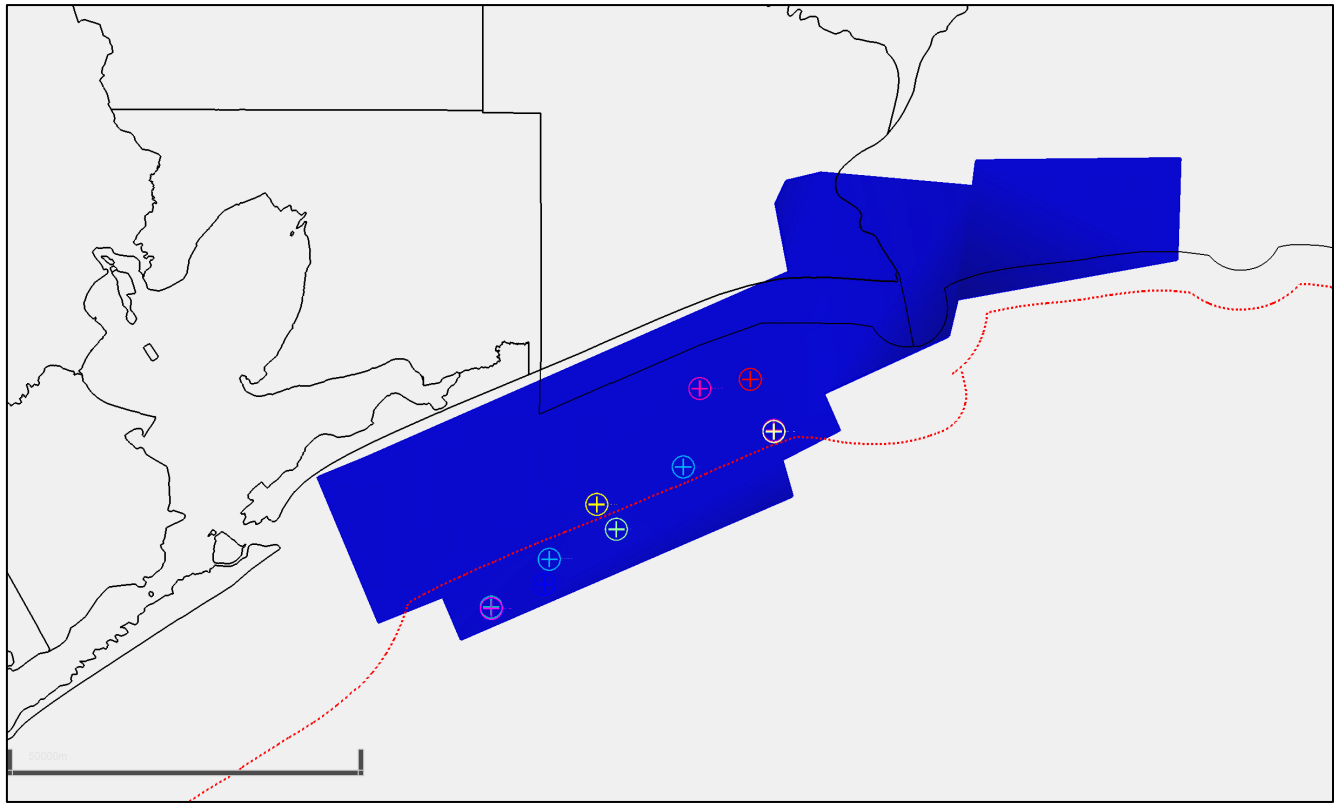
- This models are built using the available geophysical data, such as borehole measurements and surface geophysical surveys.



Introduction

A Geologic Model has:

- A structural component
- Properties filling the cells of the model
- Data constraining the model
- Predictions



Introduction

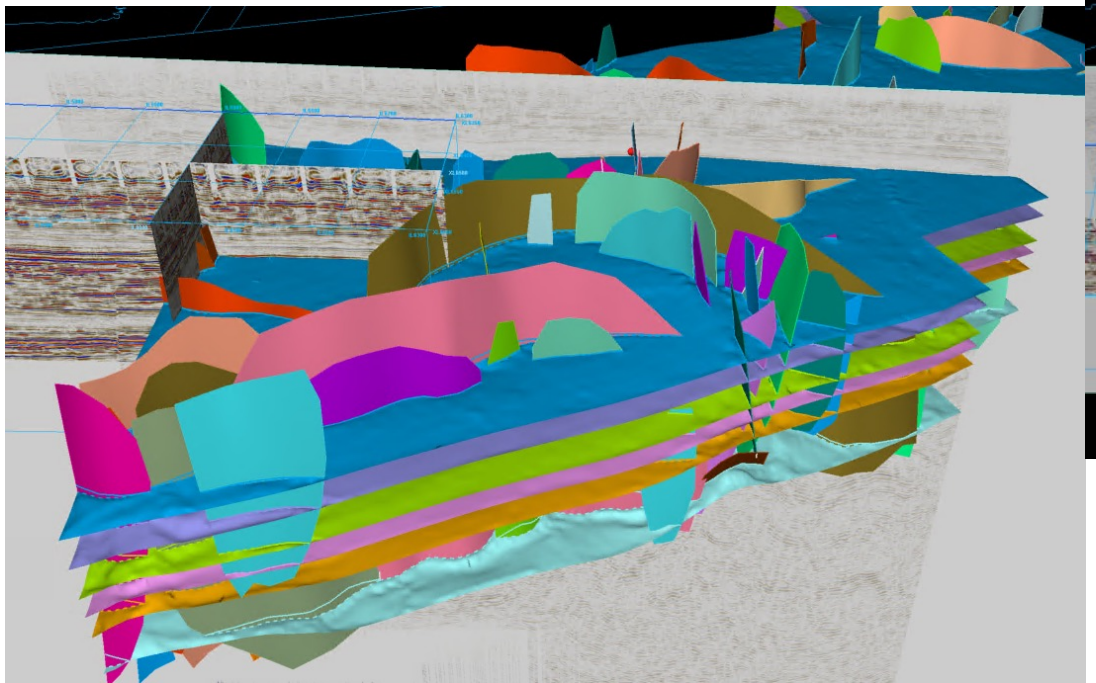
TXLA Geologic Model

Area: 1000 miles^2
Number of cells: 45793000
Number of Faults: 147
Horizons:

- MFS04
- MFS05
- MFS07
- MFS08
- MFS09
- MFS010

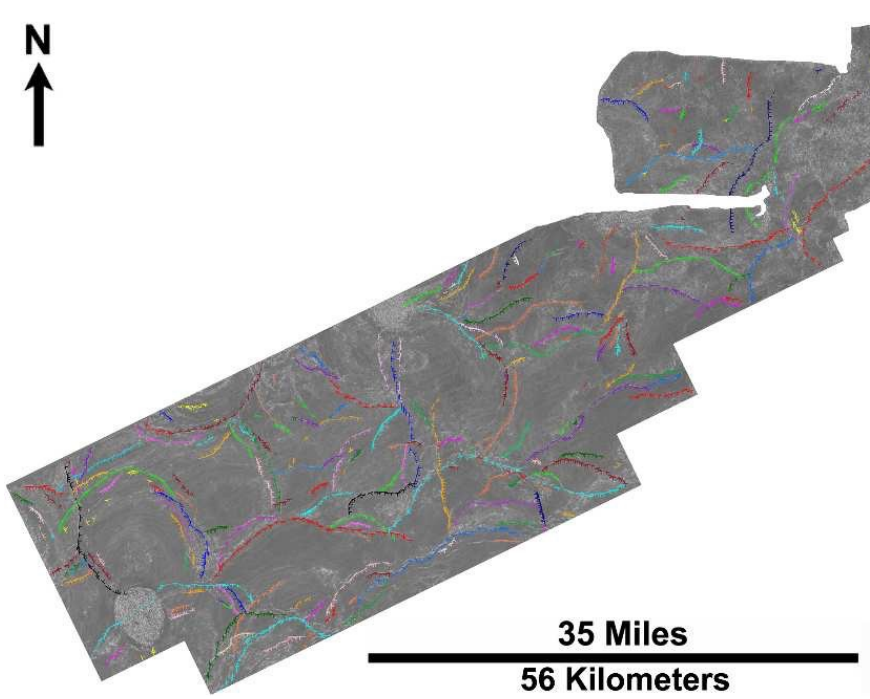
Properties:

- Lithology
- Porosity

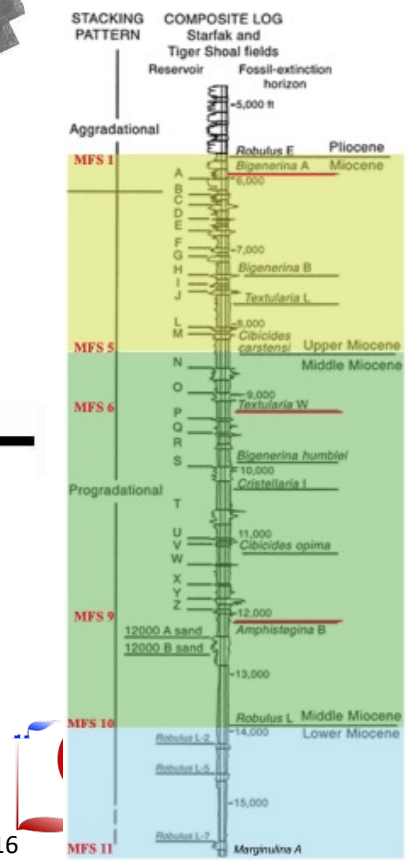


Previous Work

- Regional CO**2** sequestration capacity assessment for the coastal and offshore Texas Miocene interval (Wallace et al., 2014)
- Regional Assessment of CO**2**-Solubility Trapping Potential: A Case Study of the Coastal and Offshore Texas Miocene Interval: Environmental Science & Technology (Yang et al., 2014)
- Preliminary stratigraphy and depositional framework of Miocene in offshore Texas and Louisiana for CO2-EOR resource assessment (Olariu et al., 2016)
- Evaluation of lower Miocene confining units for CO**2** storage, Offshore Texas State Waters, northern Gulf of Mexico, USA (Lu et al,. 2017)
- Implications of Miocene Petroleum Systems for Geologic CO**2** Sequestration beneath Texas Offshore Lands (Meckel, T. A., Rhatigan, J. L., 2017)
- A seismic-based CO2-sequestration regional assessment of the Miocene section, northern Gulf of Mexico, Texas and Louisiana (De Angelo et al., 2019)

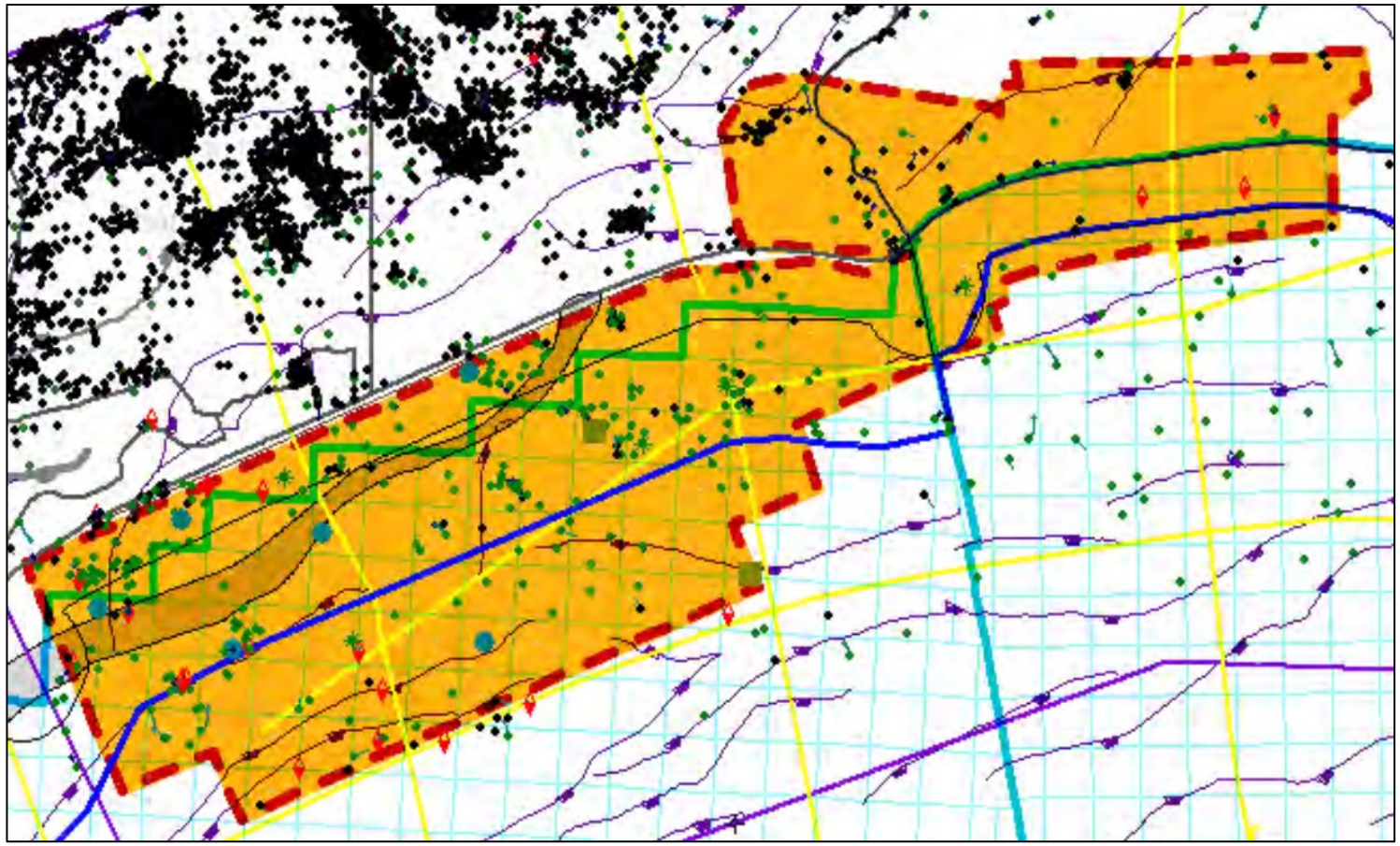


(De Angelo et al., 2019)



Olariu 2016

Introduction



Trevino et al., 2016

- Orange box: Seismic Data

Well Data:

- Green Dots Digital SP logs
- Red Dots Digital Gamma Ray logs
- Black dots: not digital data

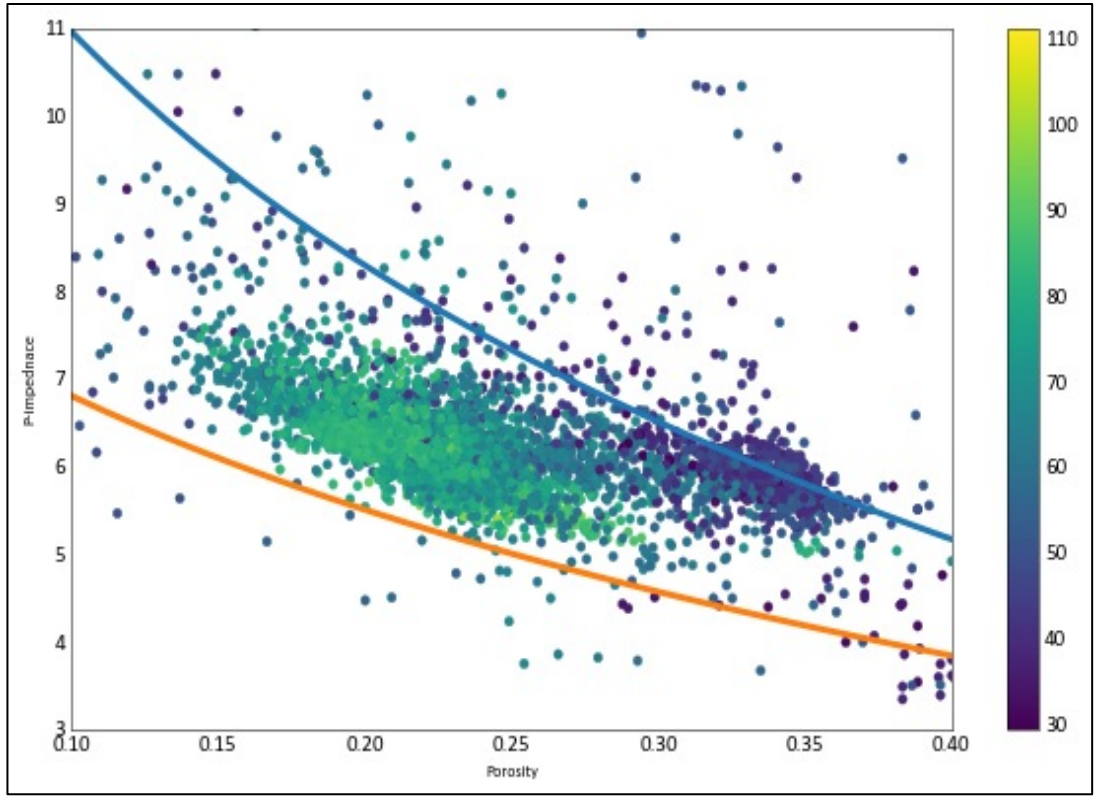
- Far away from the wells we don't measure these reservoir properties.
- How can we estimate these properties away from the well ?

How we built the geologic model:

- First, well-log data were analyzed to define facies. In this case, we described three facies: high porosity sand, shaly sand, and a low porosity shale

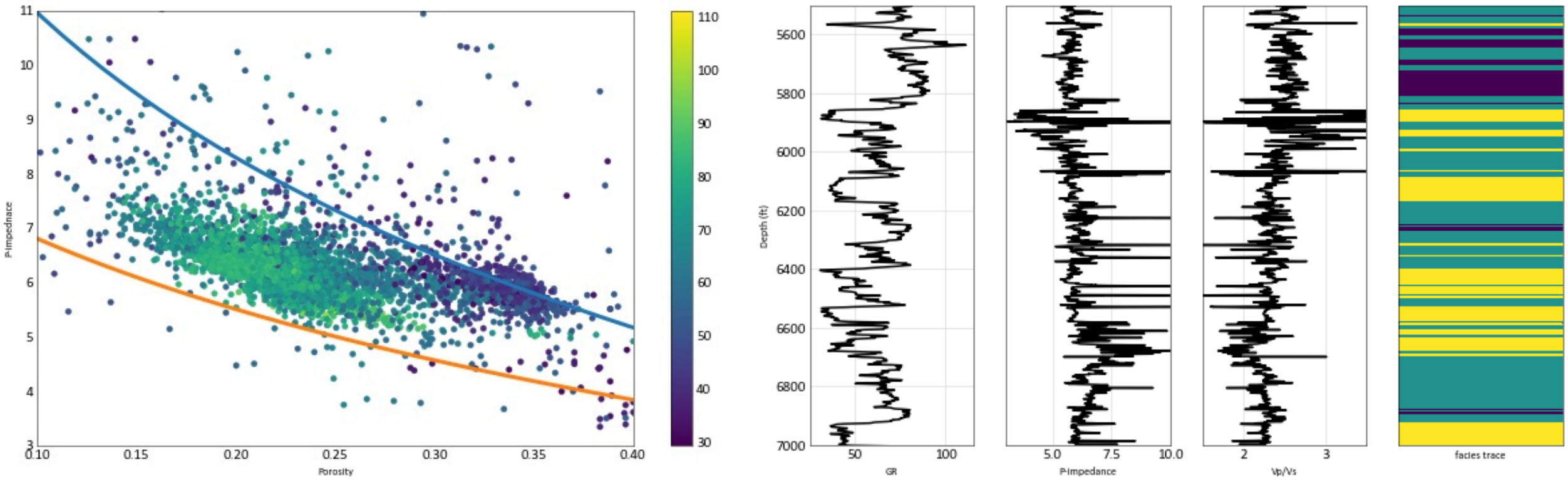
- Then, we calibrated the rock physics models using well-log data and computed facies-dependent statistical pdf's from the elastic properties of interest

- The elastic properties from the seismic inversion are used in a statistical classification technique to classify the seismic data to predict the most likely facies. In addition, calibrating the attributes with the probability distributions defined at well locations allows measuring the probability of occurrence of each facies.



How we built the geologic model:

- Well-log data are analyzed to obtain facies and calibrate with rock physics model

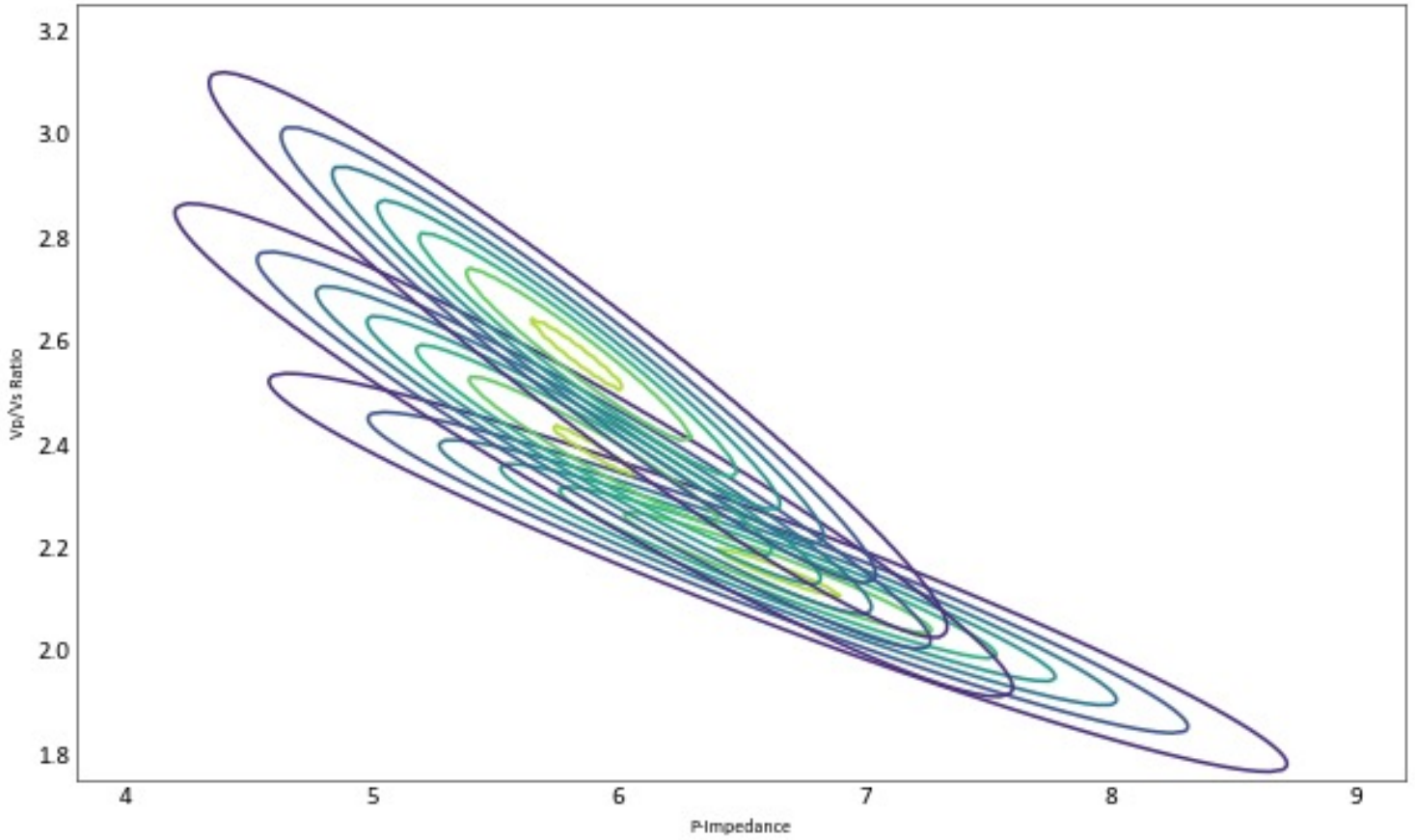


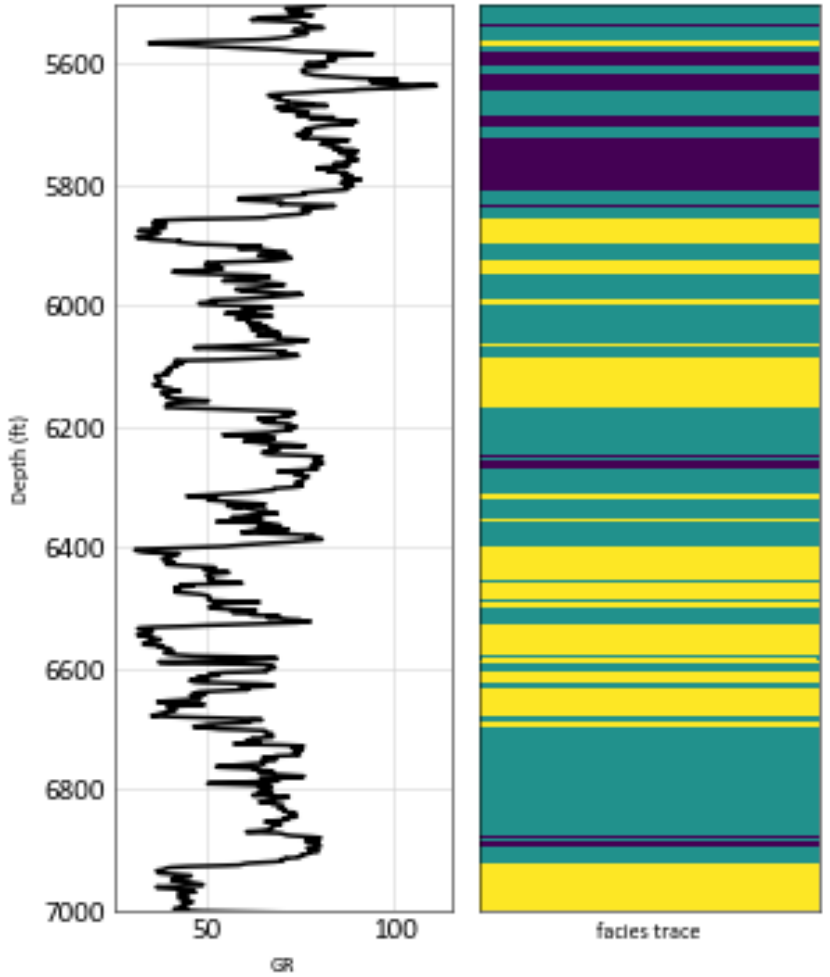
Bureau of Economic Geology

GCCC Gulf Coast Carbon Center

How we built the geologic model:

- Facies dependent statistical analysis



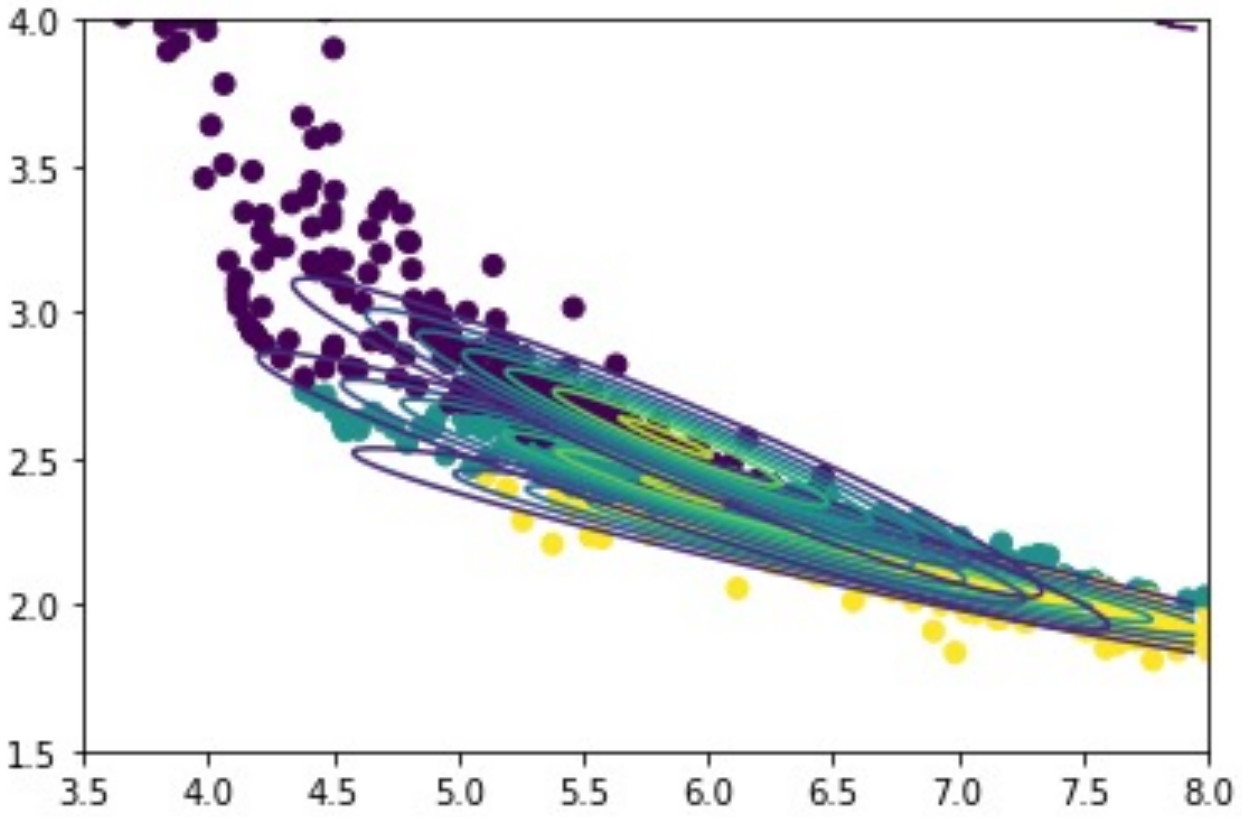


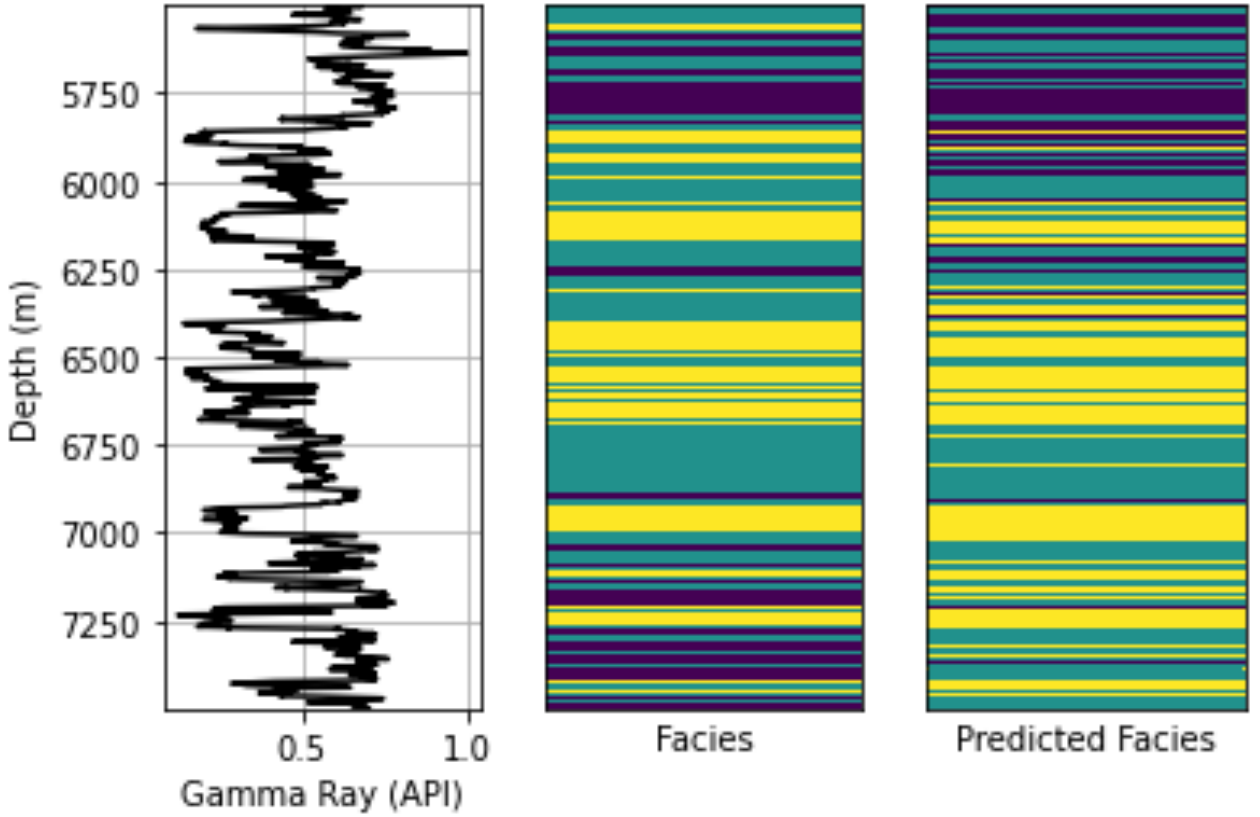
Bureau of Economic Geology

GULF COAST CARBON CENTER

How we built the geologic model:

- Facies dependent statistical



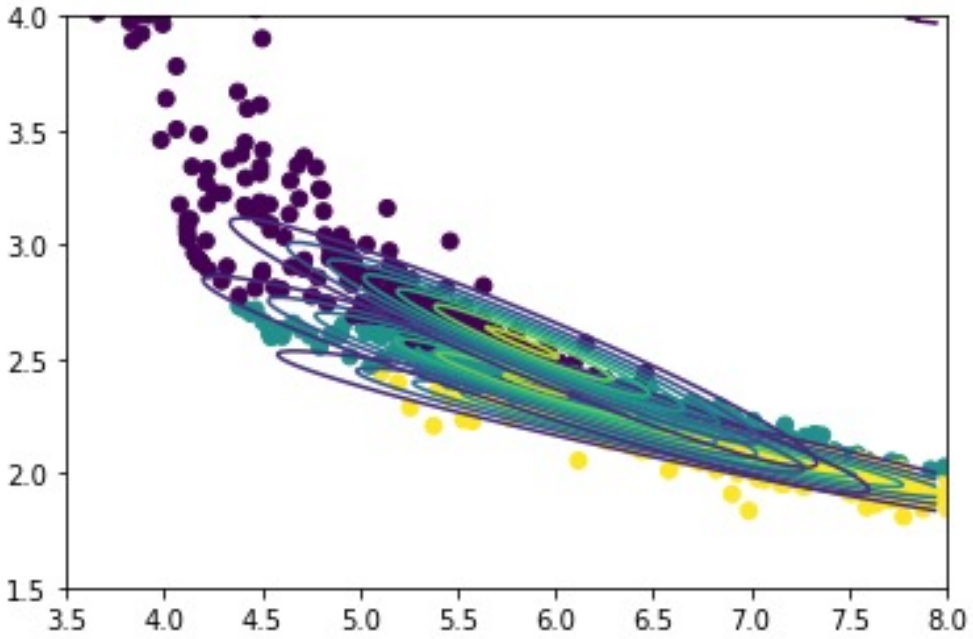


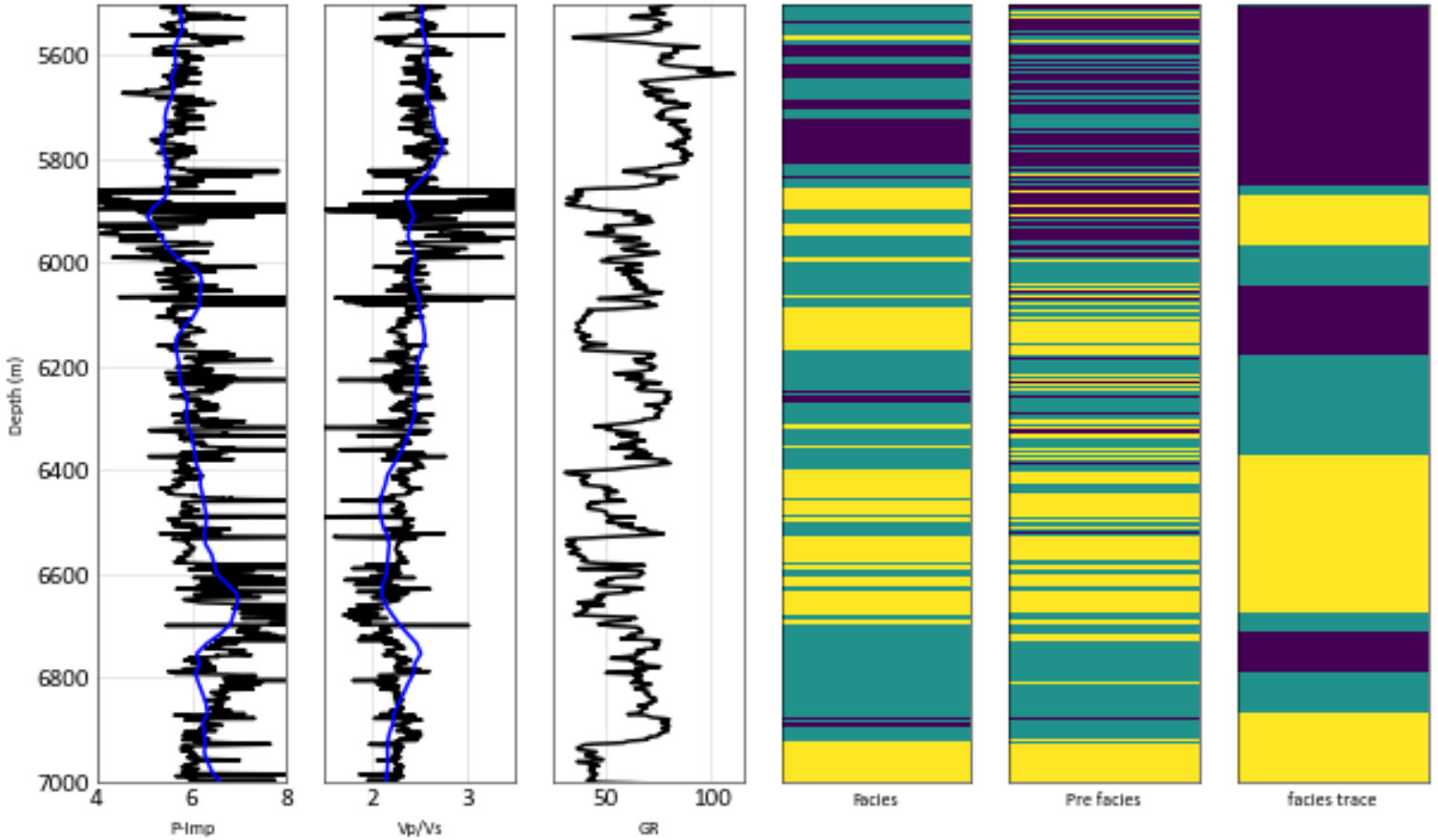
Bureau of Economic Geology

GCCC Gulf Coast Carbon Center

How we built the geologic model:

- Facies classification with seismic attributes



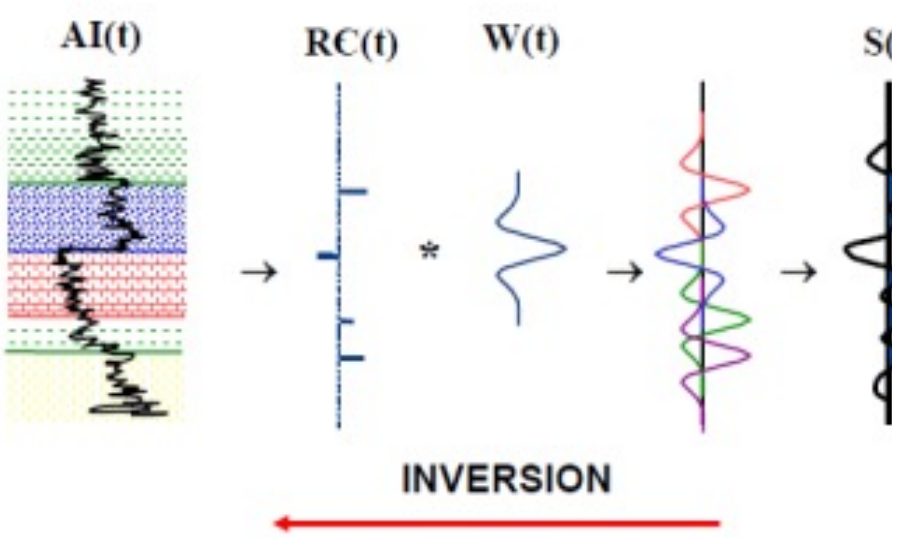


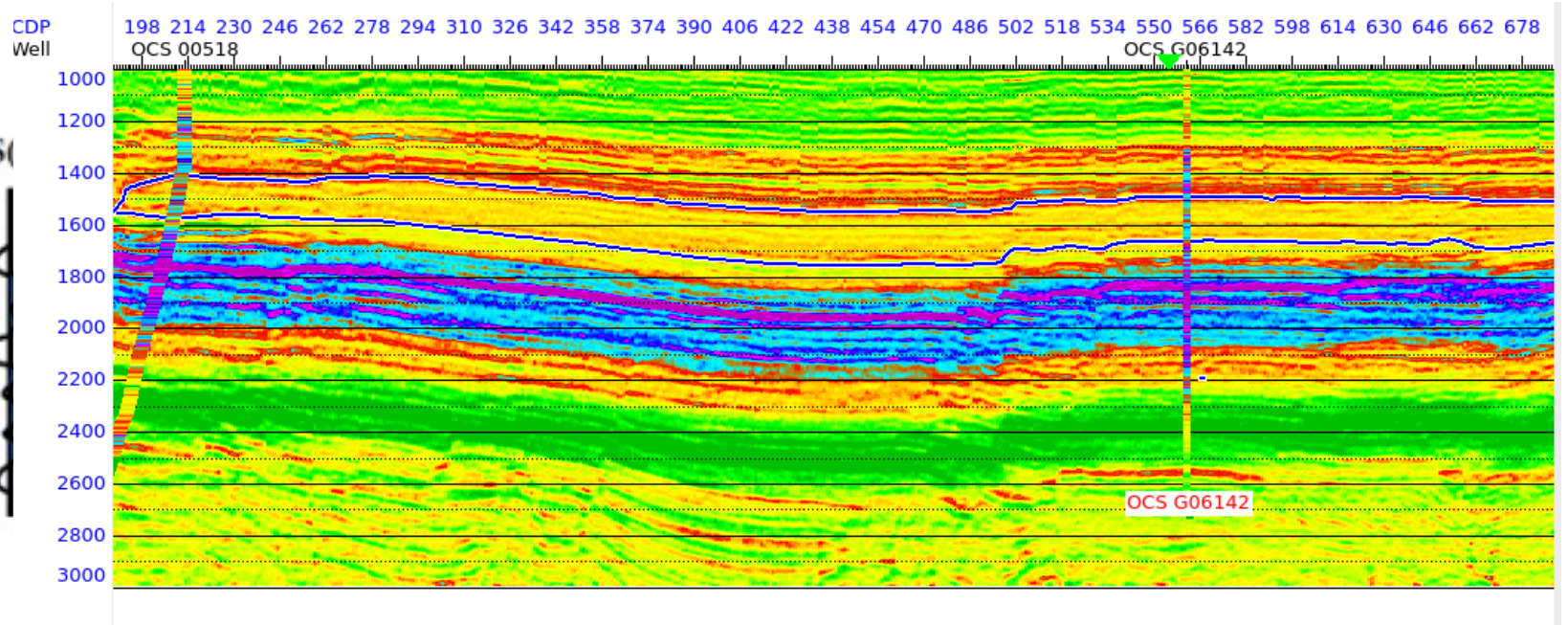
Bureau of Economic Geology

GCCC Gulf Coast Carbon Center

How we built the geologic model:

- Pre-Stack Seismic Inversion to obtained the elastic properties to perform the facies classification and estimate porosity from seismic data

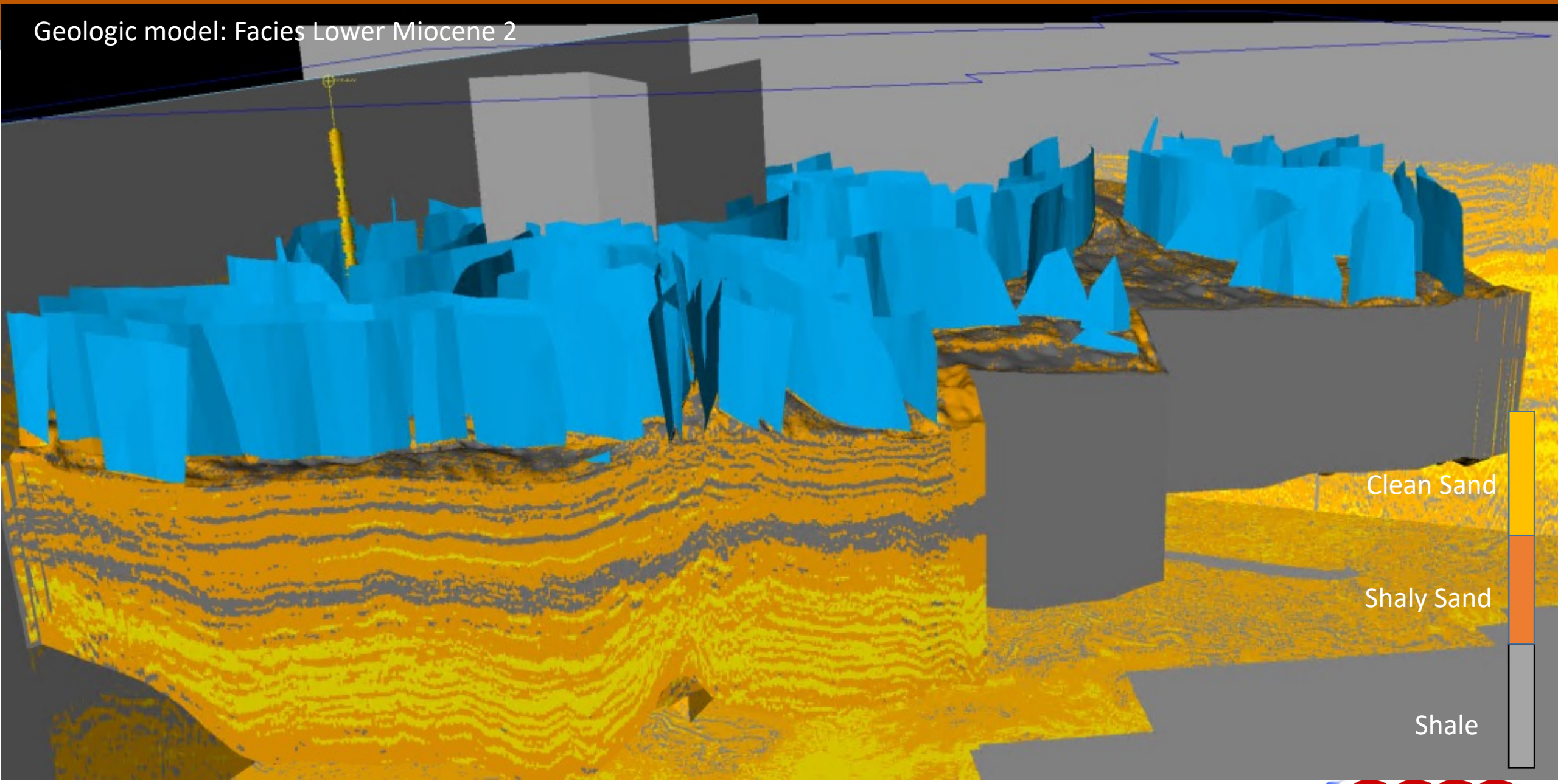




Bureau of Economic Geology

GCCC Gulf Coast Carbon Center

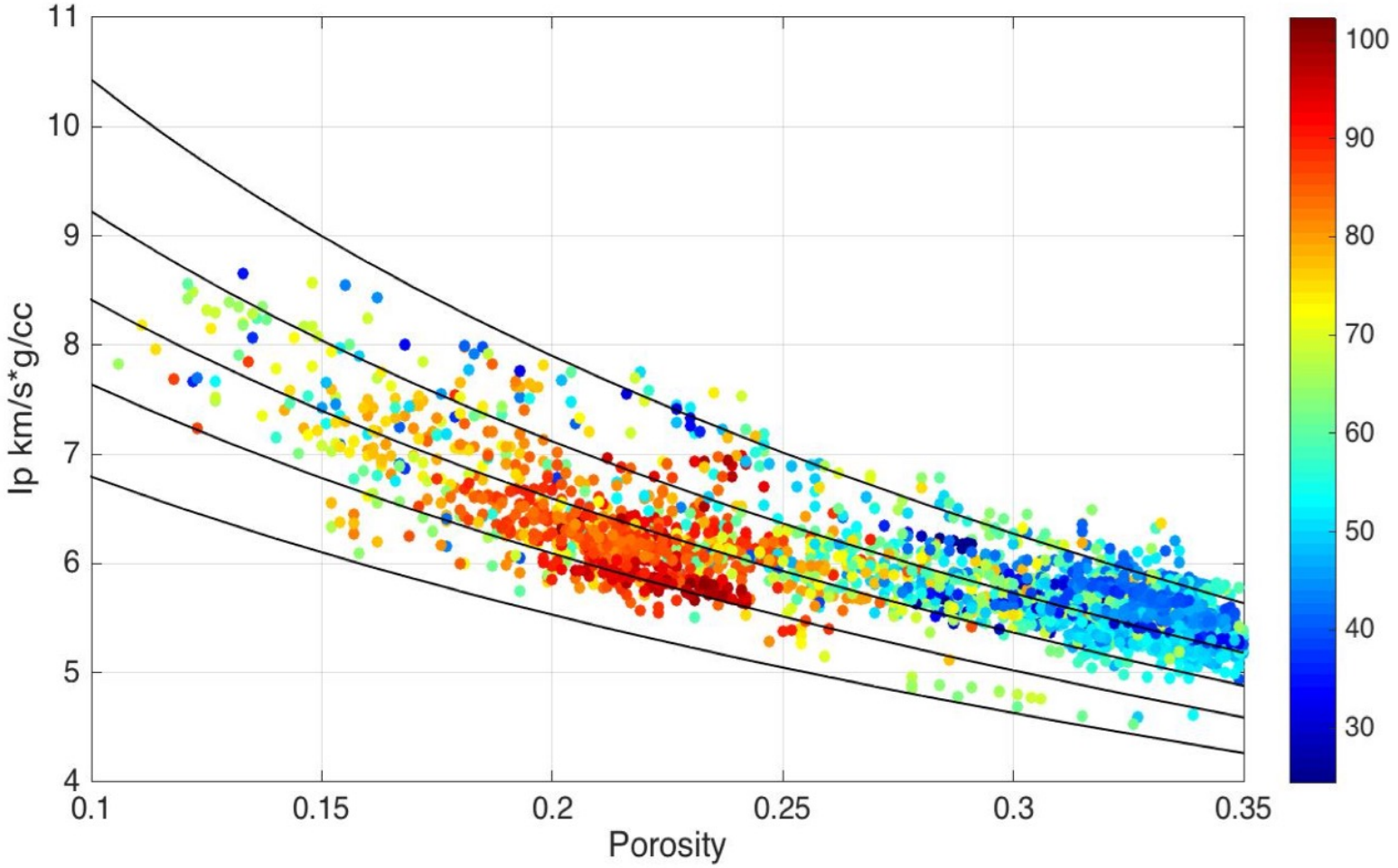
Geologic model: Facies Lower Miocene 2



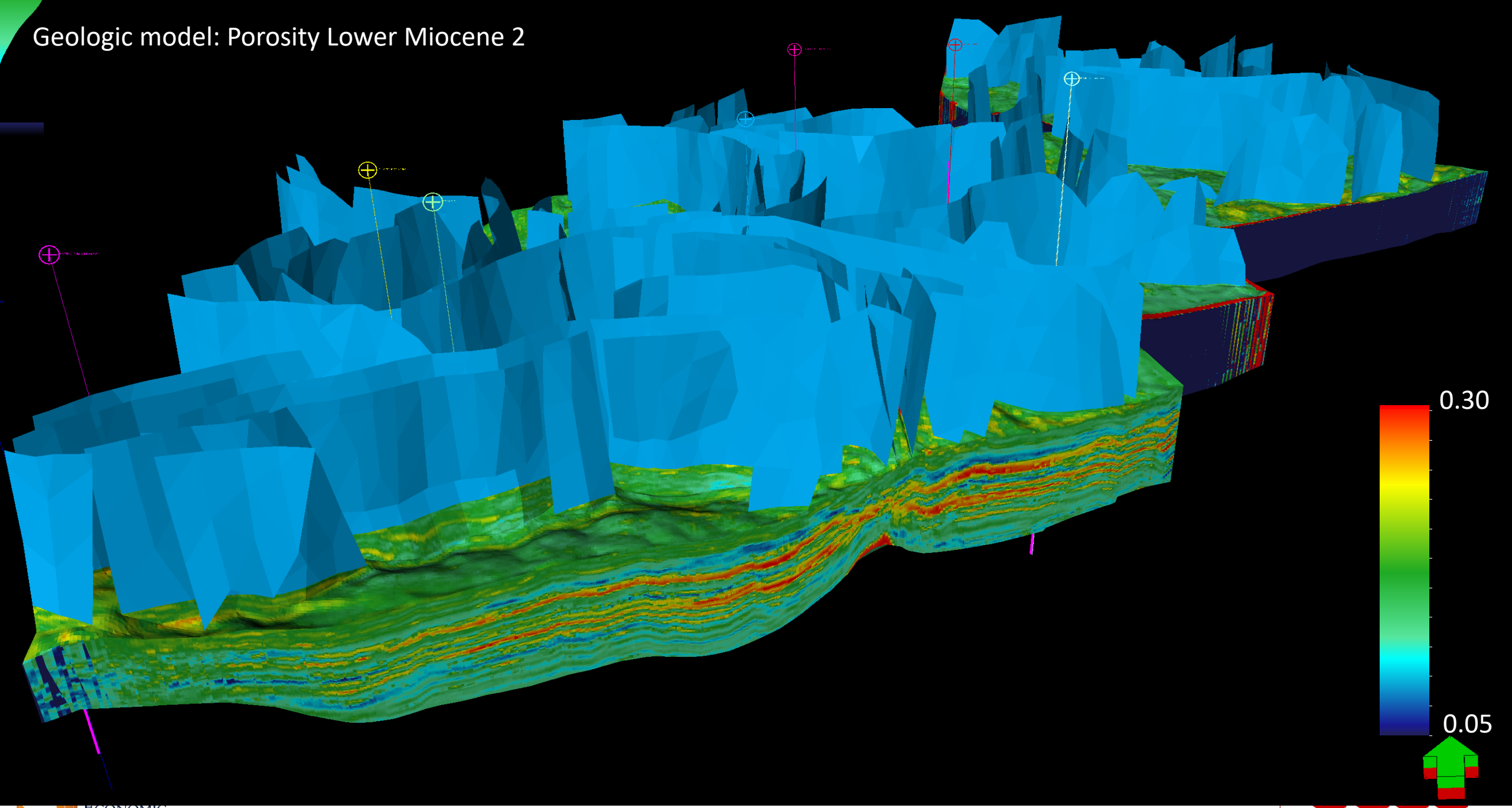
How we built the geologic model:

- Porosity Prediction

From the rock physics model, we can estimate the porosity by using the Ip-porosity transforms represented for the 3 different facies used in this model.



Geologic model: Porosity Lower Miocene 2



Summary and Future Work

- Successfully built a 3D geological model integrating seismic data and well data
- The geostatistical workflow to predict facies and porosity away from the well and shows a good correlation with previous geological interpretations
- Next Step is to perform a CO2 injection simulation to study how CO2 will flow in this area.

Thank you
Questions ?