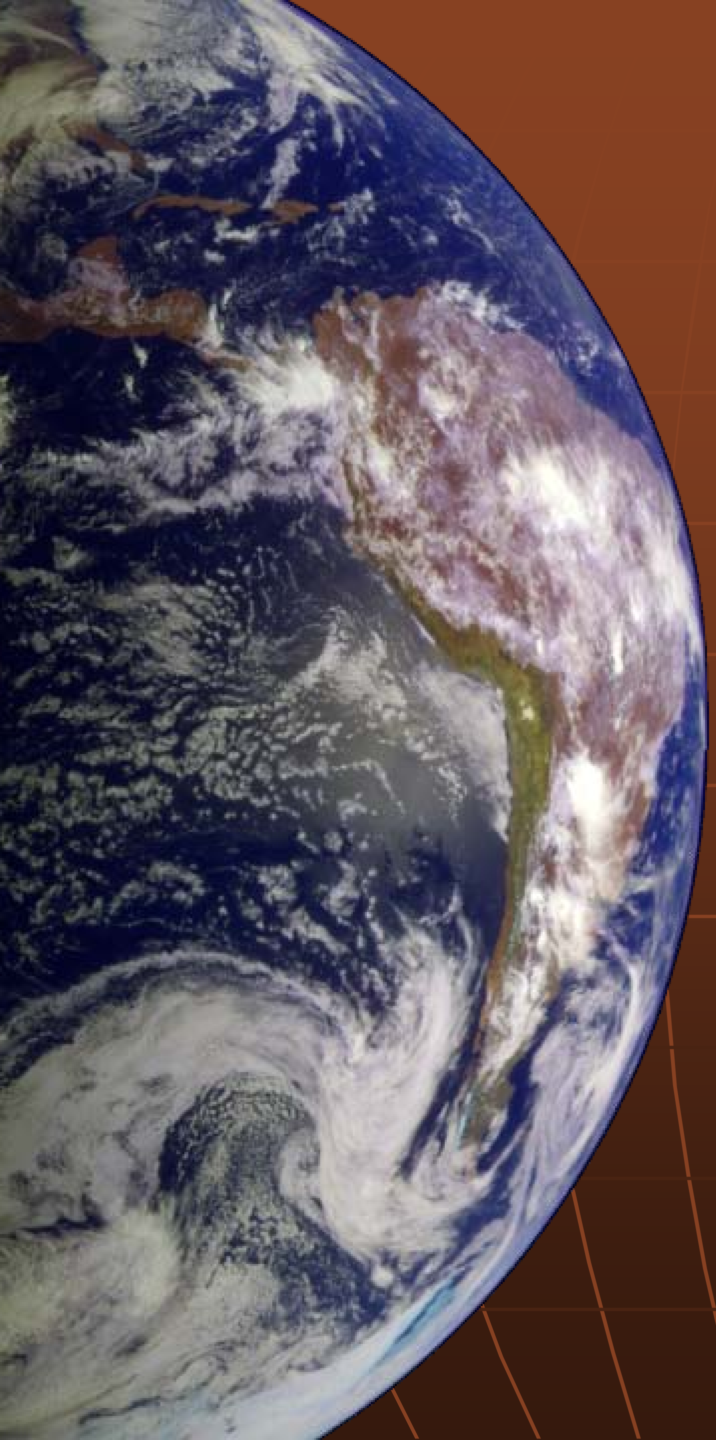

Vp/Vs Estimation from 3C-3D seismic data, to identify a tight gas sand reservoir in Bossier Formation, Tennessee Colony Field, East Texas Basin.

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THE UNIVERSITY OF TEXAS AT AUSTIN
JACKSON
SCHOOL OF GEOSCIENCES

Overview

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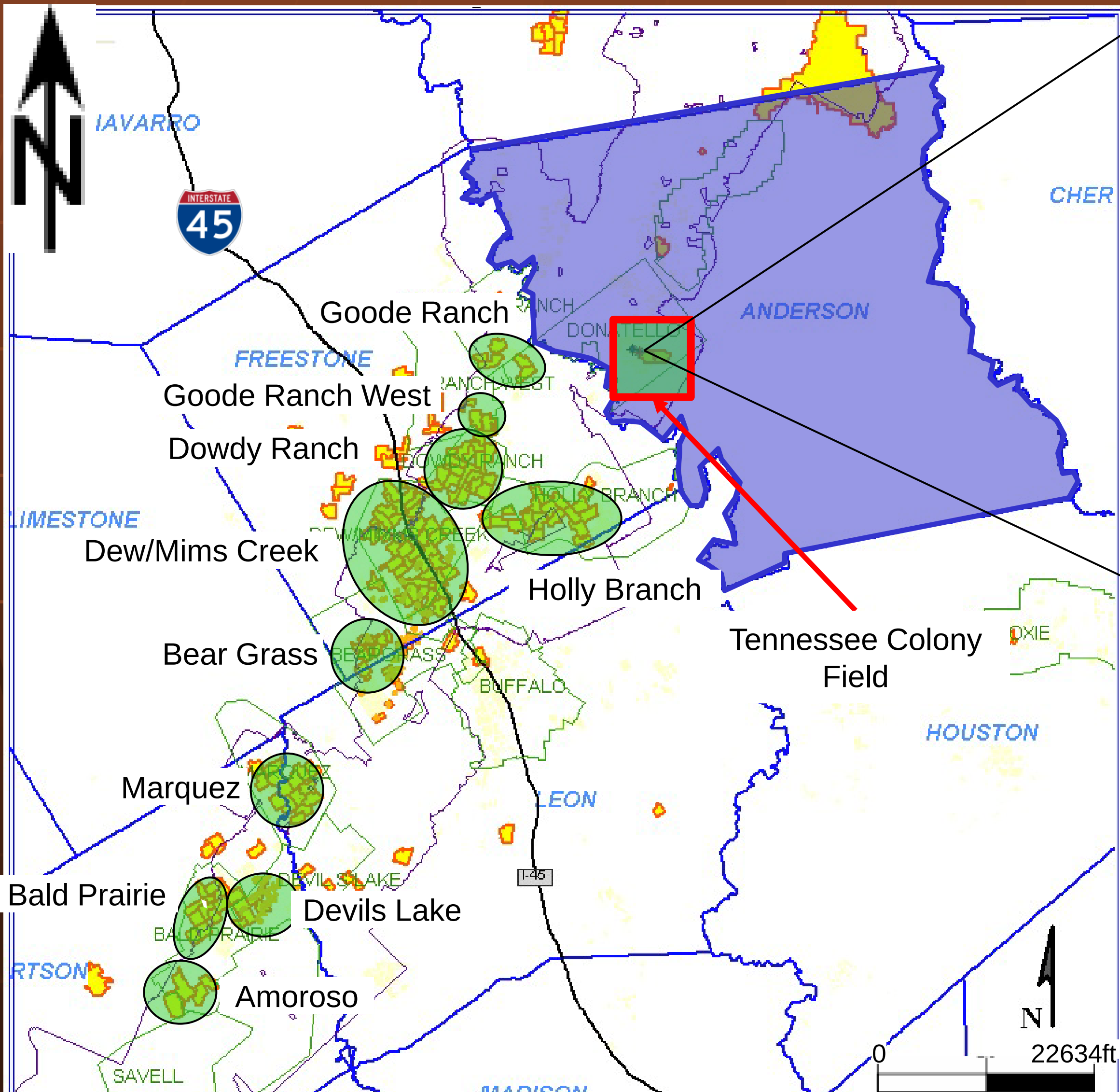
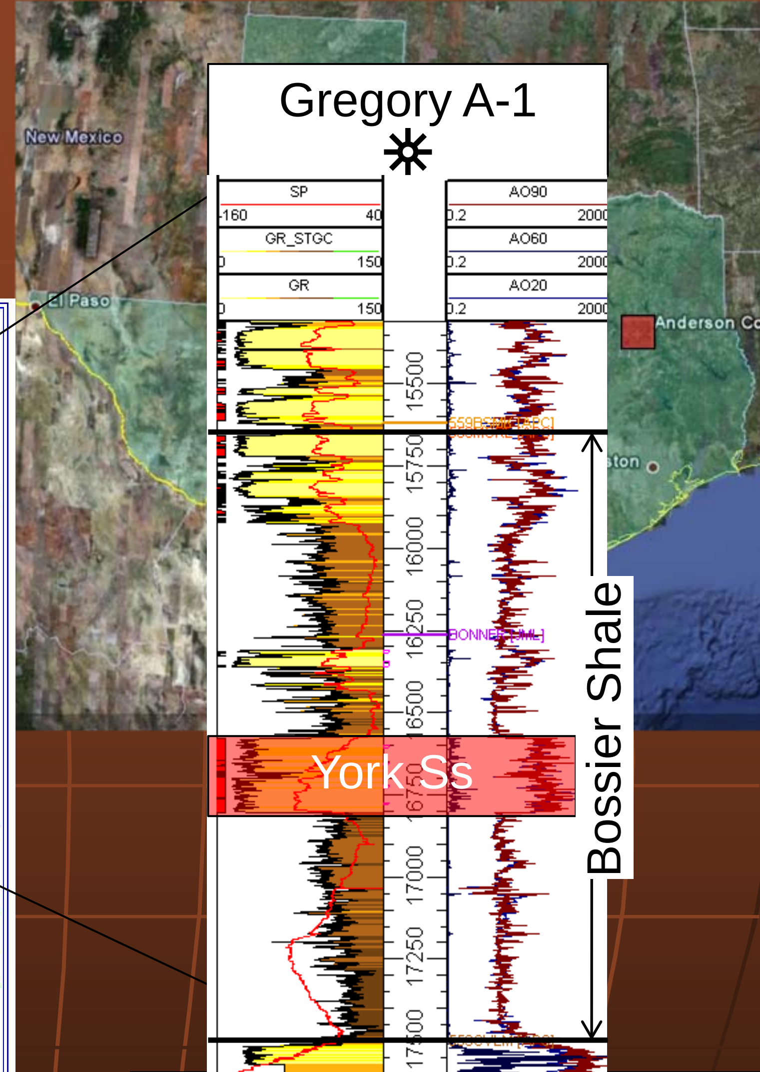
1. Introduction

1.1 Location and Generalities





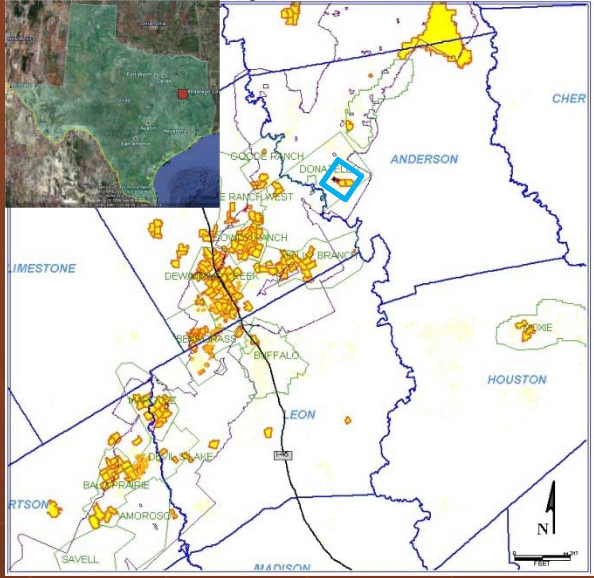
APC Bossier gas trend
Discovery Date: 1975 Montgomery, 2001.

Porosity: 7%
Permeability: < .1 md

Depth: 13,000 – 18,000 ft

1.2 Summary of the Field

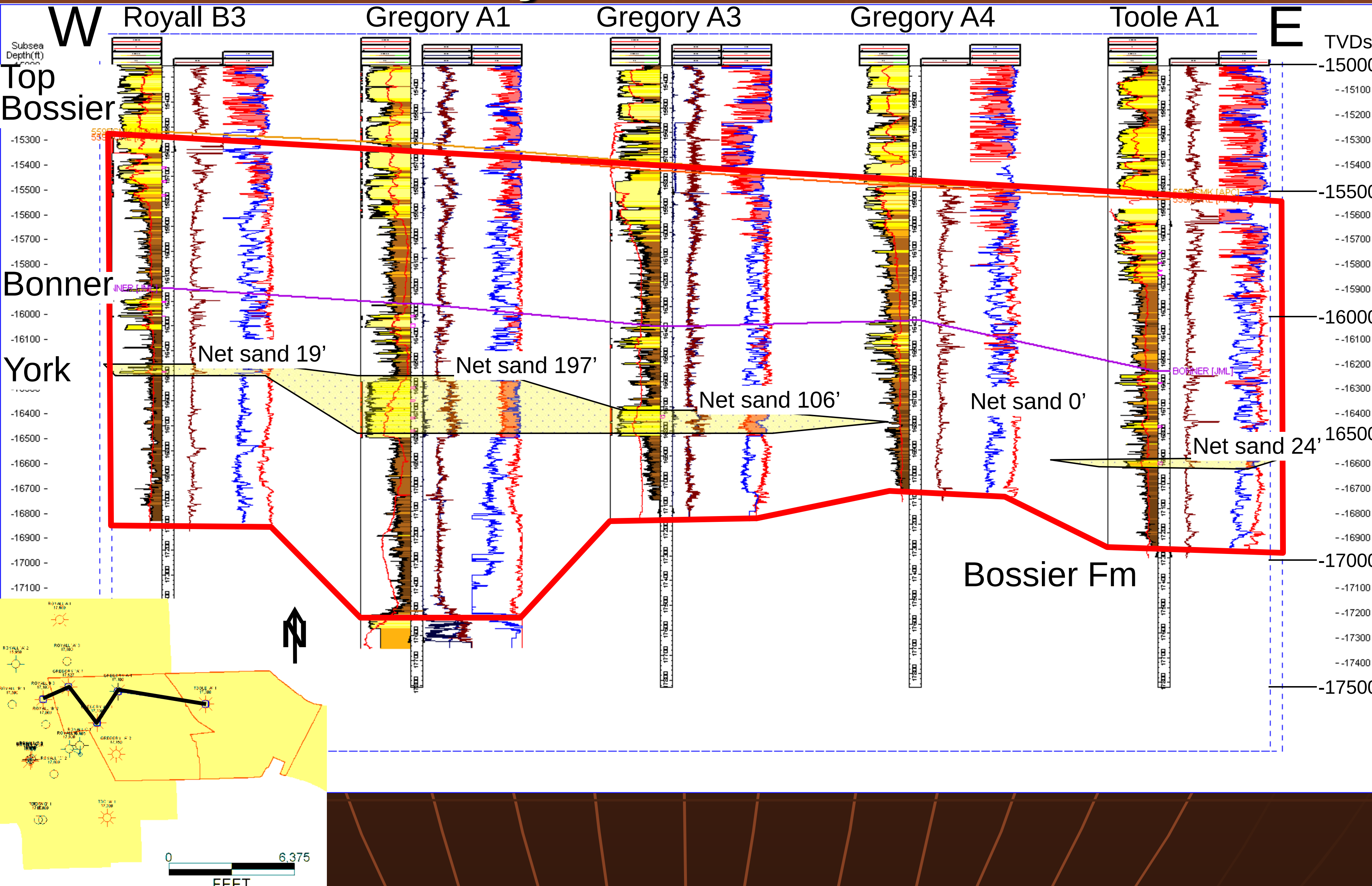
Well map distribution and net sand thickness of the York Ss Tennessee Colony field



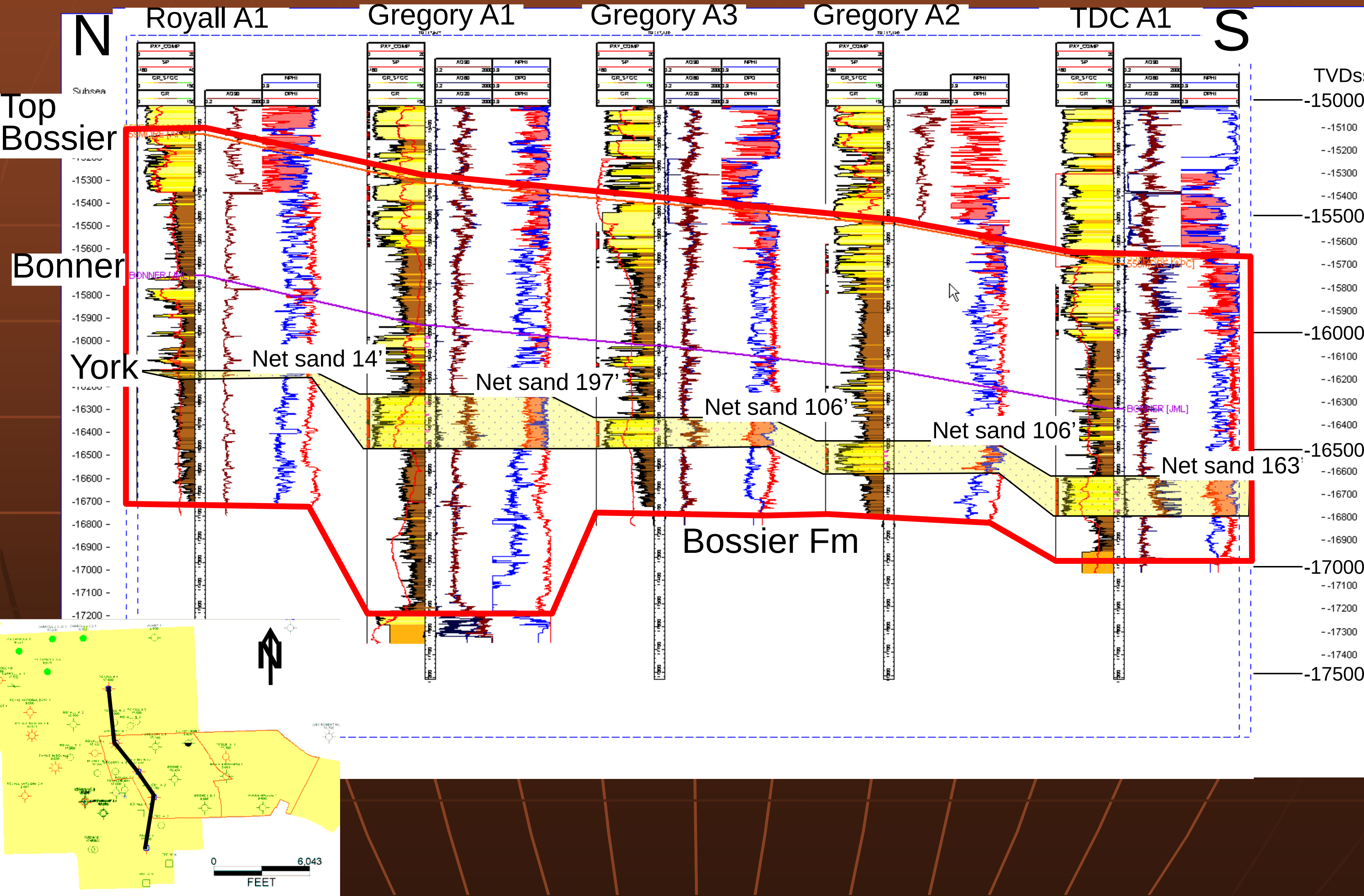
• From 11 wells drilled based on only the interpretation of conventional 2D and 3D seismic only 5 wells present thicknesses larger than 50' at the York level.

•Can other type of geophysical data help us to diminish the uncertainty when planning new development wells?

1.2.1 W-E Structural dip cross section Tennessee Colony field



1.2.2 N-S Structural strike cross section Tennessee Colony field



1.3 Problem

- The analysis of the conventional 3D seismic and attribute extraction (amplitude extraction and AVO), have proved to be not reliable in showing the actual distribution of the York sand at the Bossier Fm., because:

1. Sand/shale contrast is subtle
   - **Small P impedance contrast**
   - **Class IIP/II AVO response**

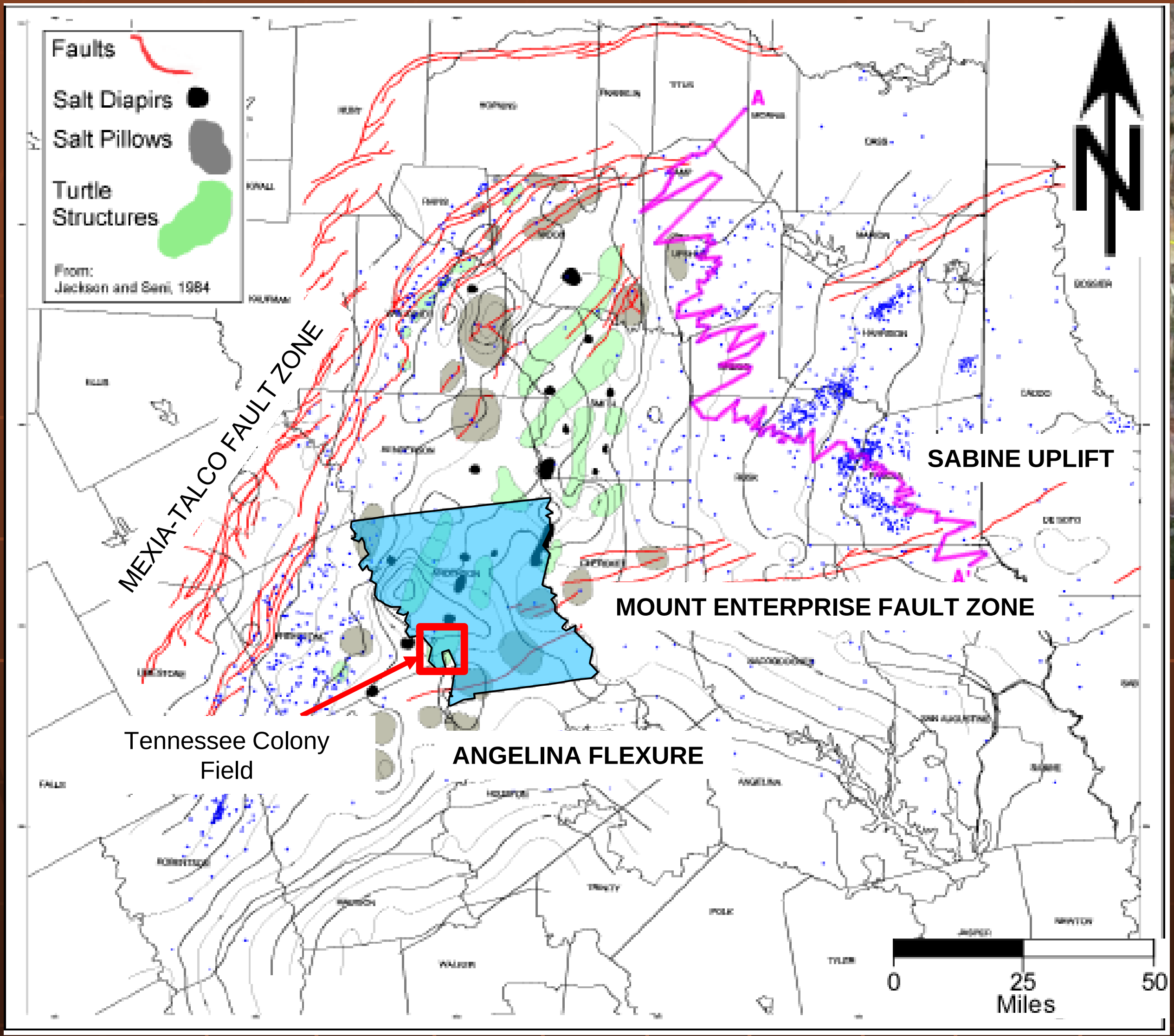
2. Seismic data unsuitable for AVO attribute extraction
   - **Poor far offset SNR**
   - **Low frequency content**
   - **Noise (multiples)**
   - **Tuning effects**

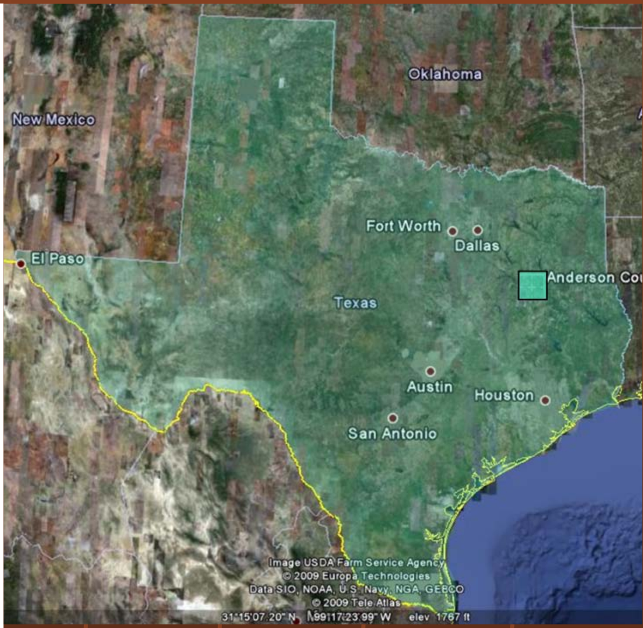
1.4 Objective

- The objective of this research is to test the capabilities and the reliability of interval Vp/Vs extraction from the conventional 3D and 3C-3D seismic interpretations as an effective lithology indicator.

2. Geology of the area

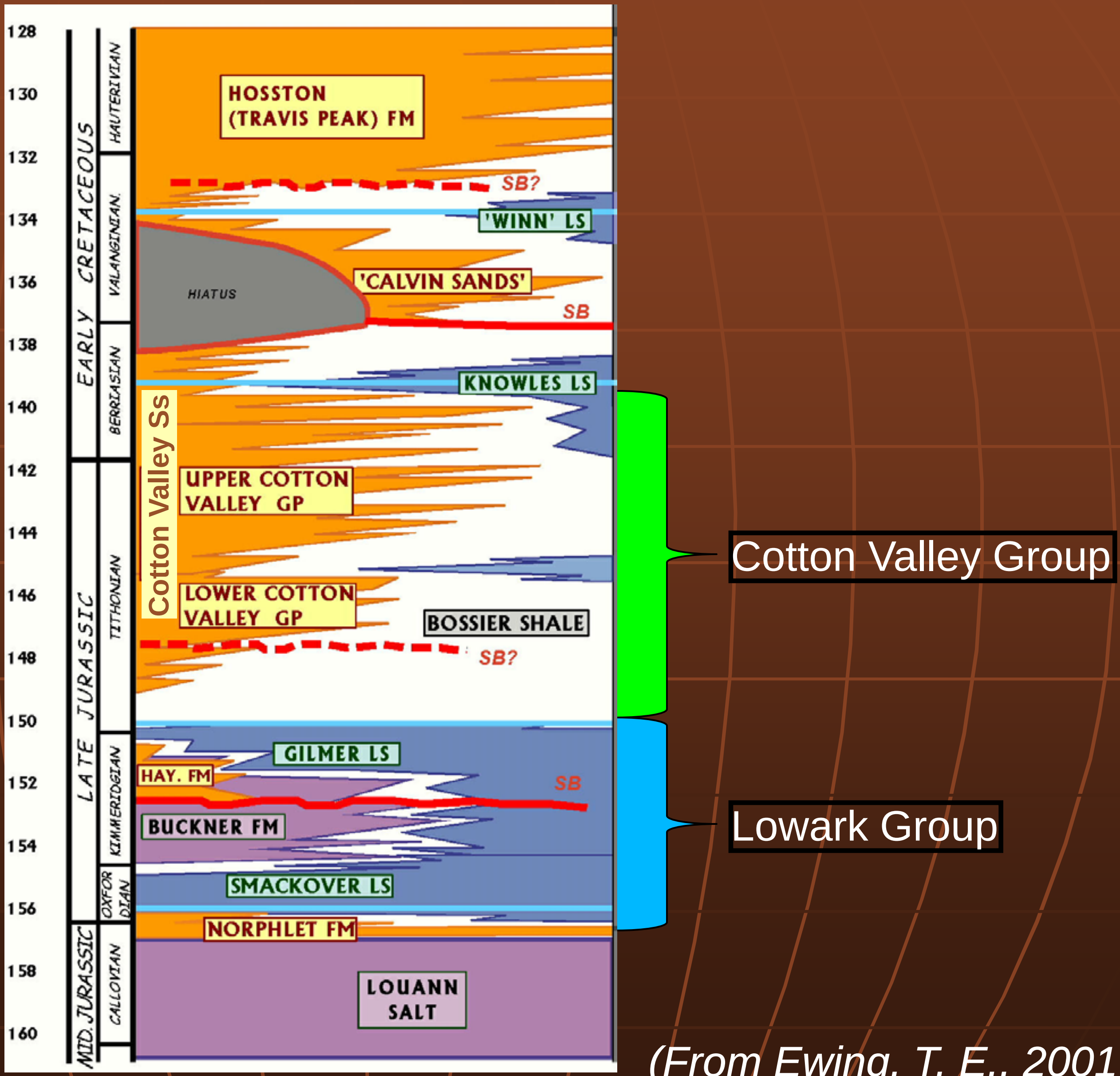
2.1 Structural and tectonic elements from the East Texas Basin





(From Ewing, T. E., 2001)

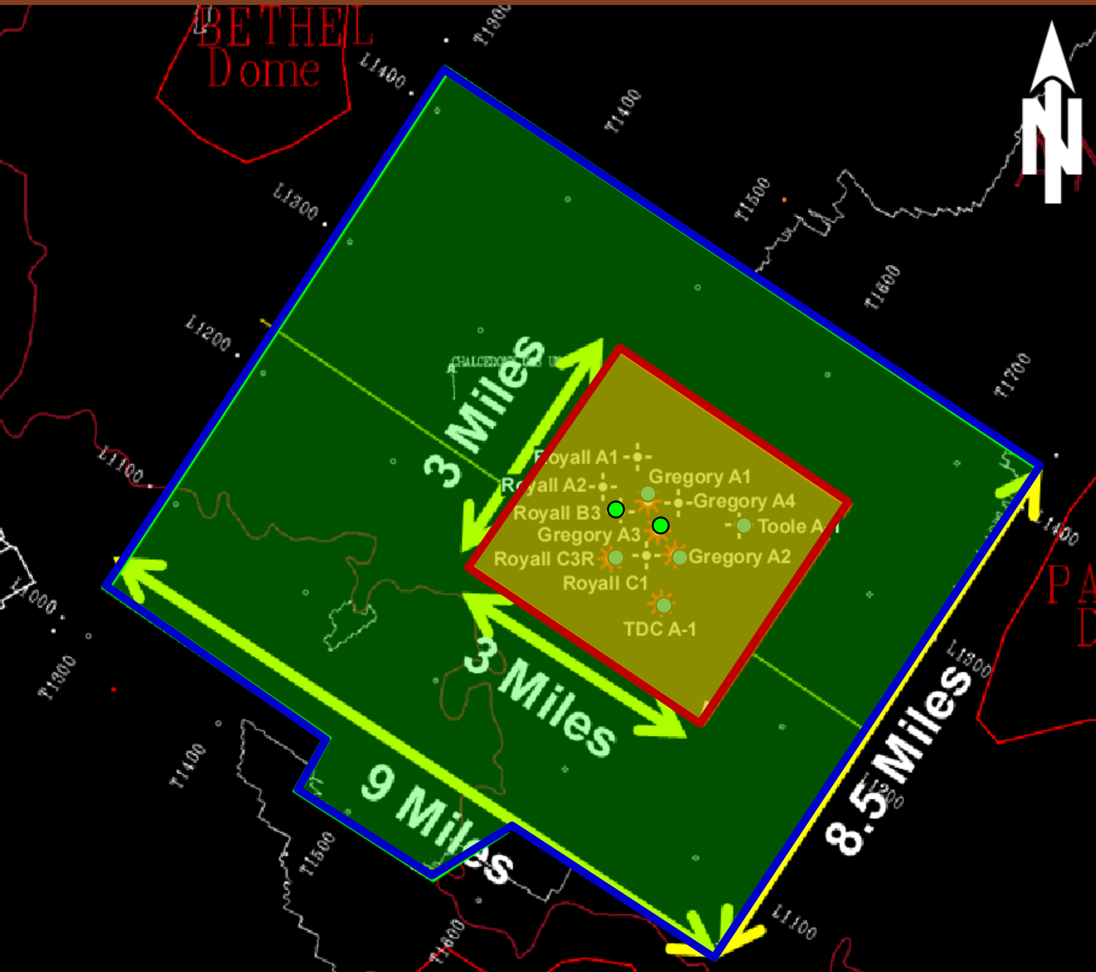
2.2 Stratigraphy of the East Texas Basin



(From Ewing, T. E., 2001)

3. Data set

3.1 Availabe data



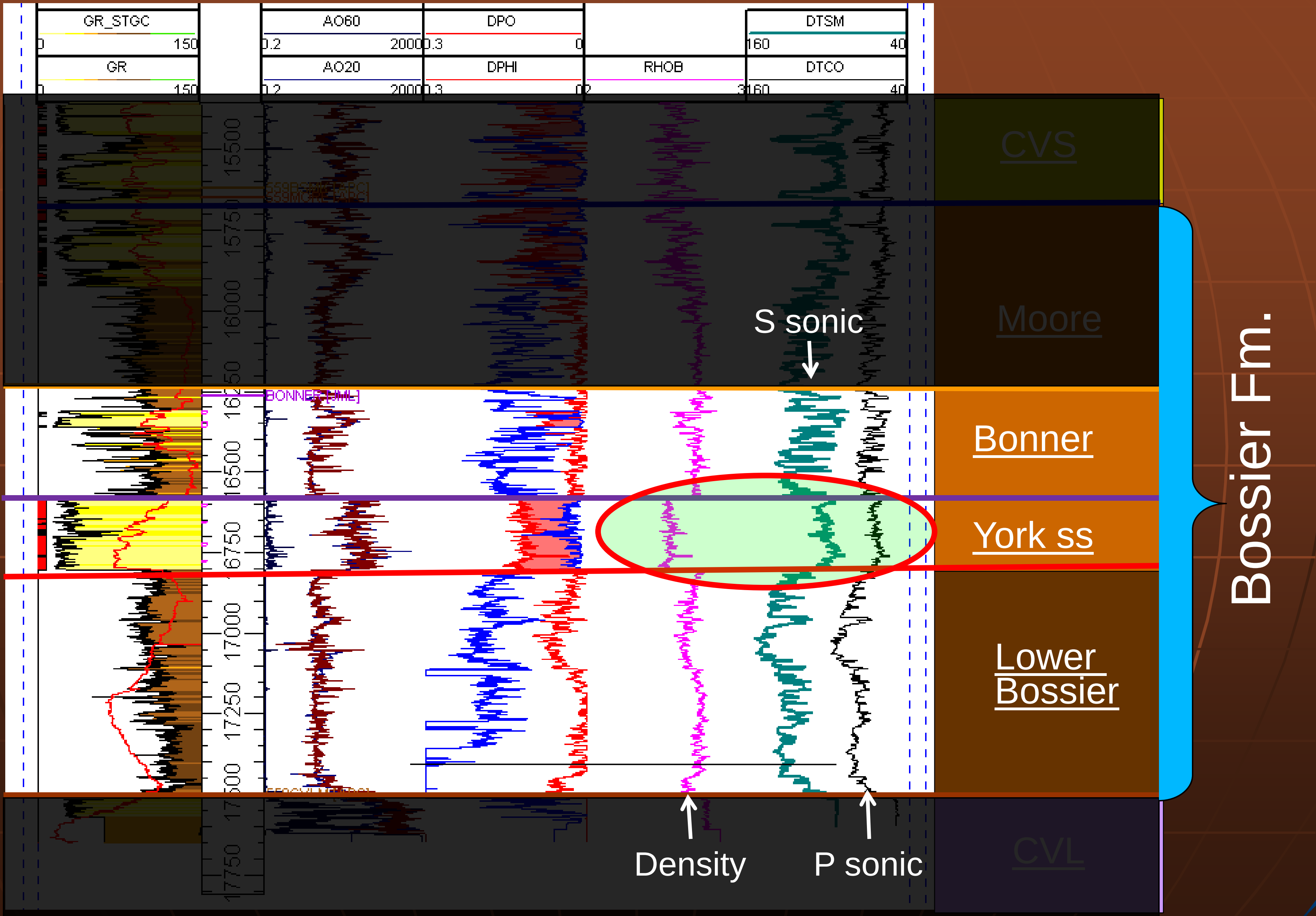
1. One 3D conventional seismic cube (76.5Miles^2).
2. One 3C-3D seismic cube (9Miles^2).
3. Dipole logs at the Bossier shale for the wells: Gregory A1, Gregory A2, TDCA1, Royall C3R, Toole A1.
4. Two multicomponent VSP validate the horizon picking wells: Gregory A3 (deep section), Royall B3 (Shallow section).

4. Petrophysics

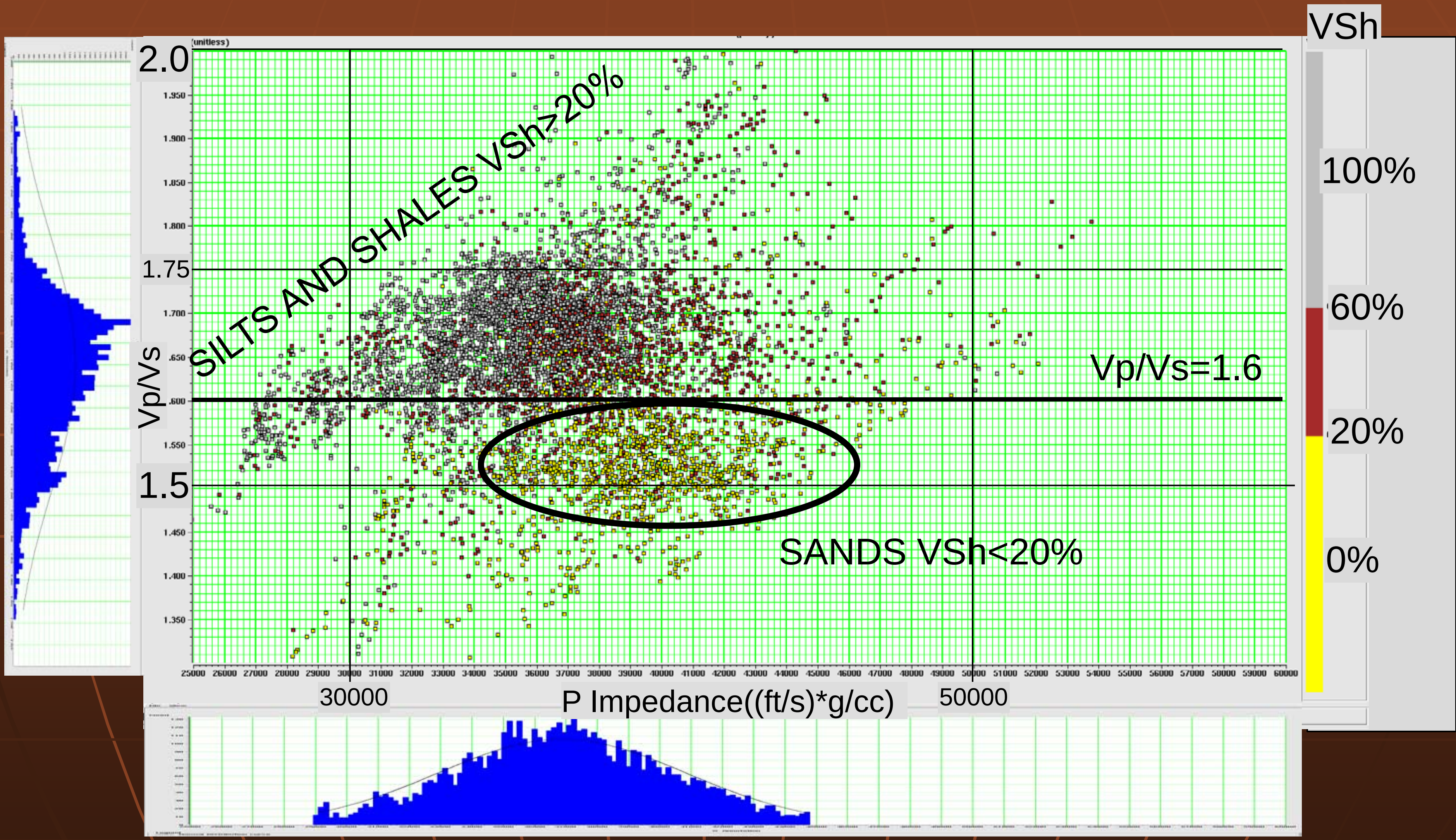
Question

- From the well logs analysis, is there any physical attribute (acoustic impedance, Vp/Vs, density), that can be extracted from the seismic and be considered as a good lithology indicator?

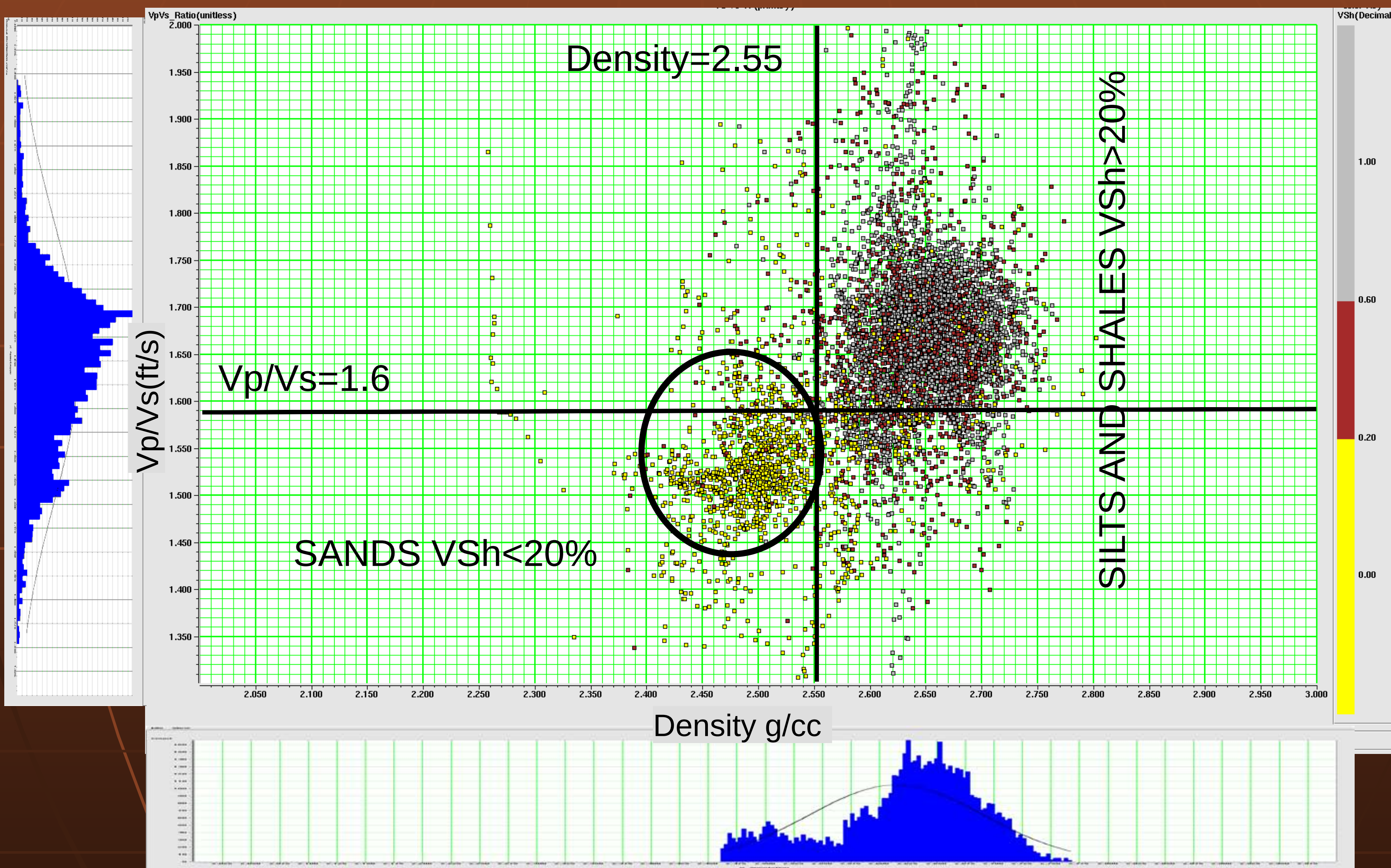
4.1 Type log Well Gregory A1



4.2 Vp/Vs vs. P impedance plot

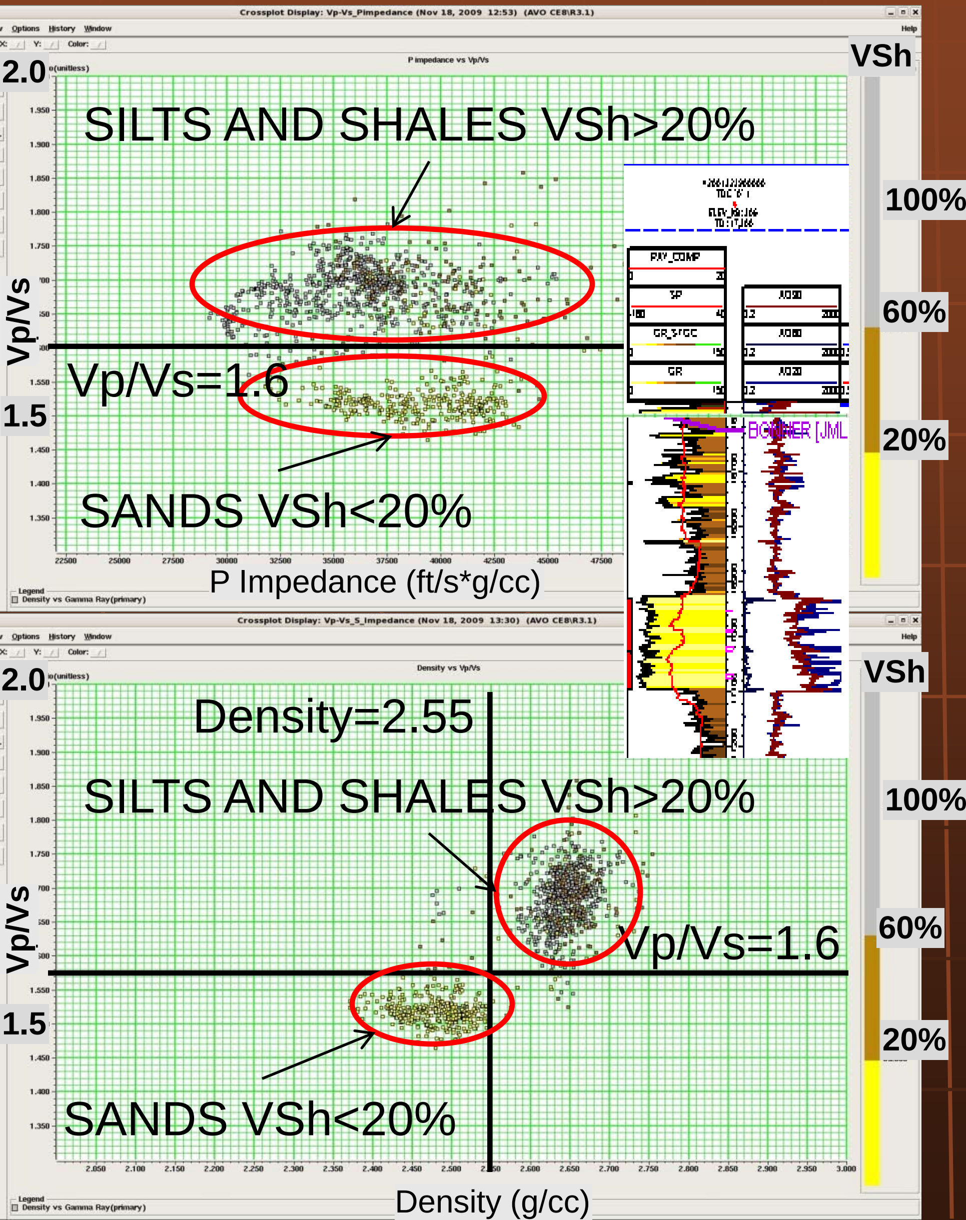


4.3 Vp/Vs vs. Density plot

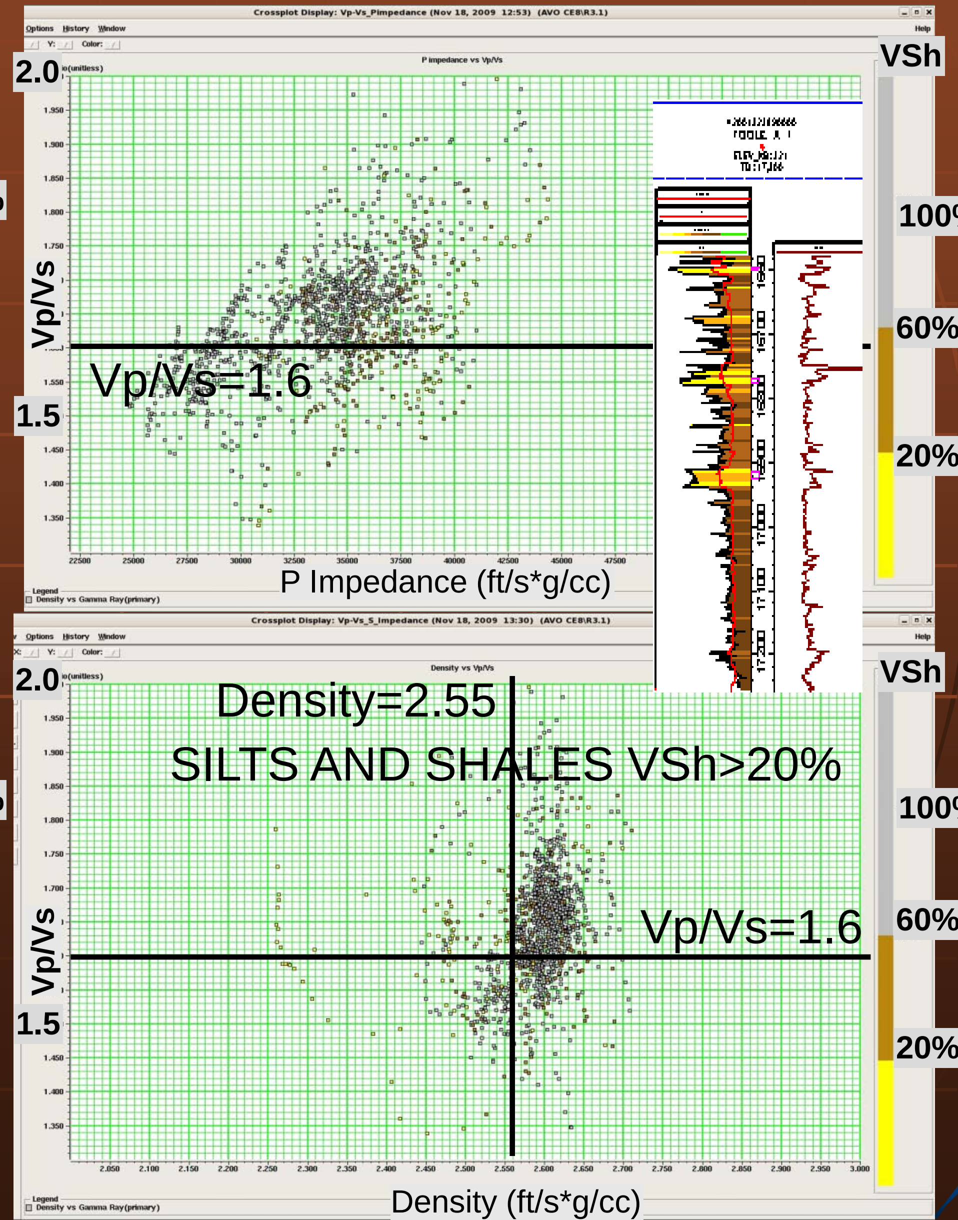


4.4 Comparison of crossplots between wells TDCA1 and TOOLEA1

TDC A-1



TOOLE A-1



Answer

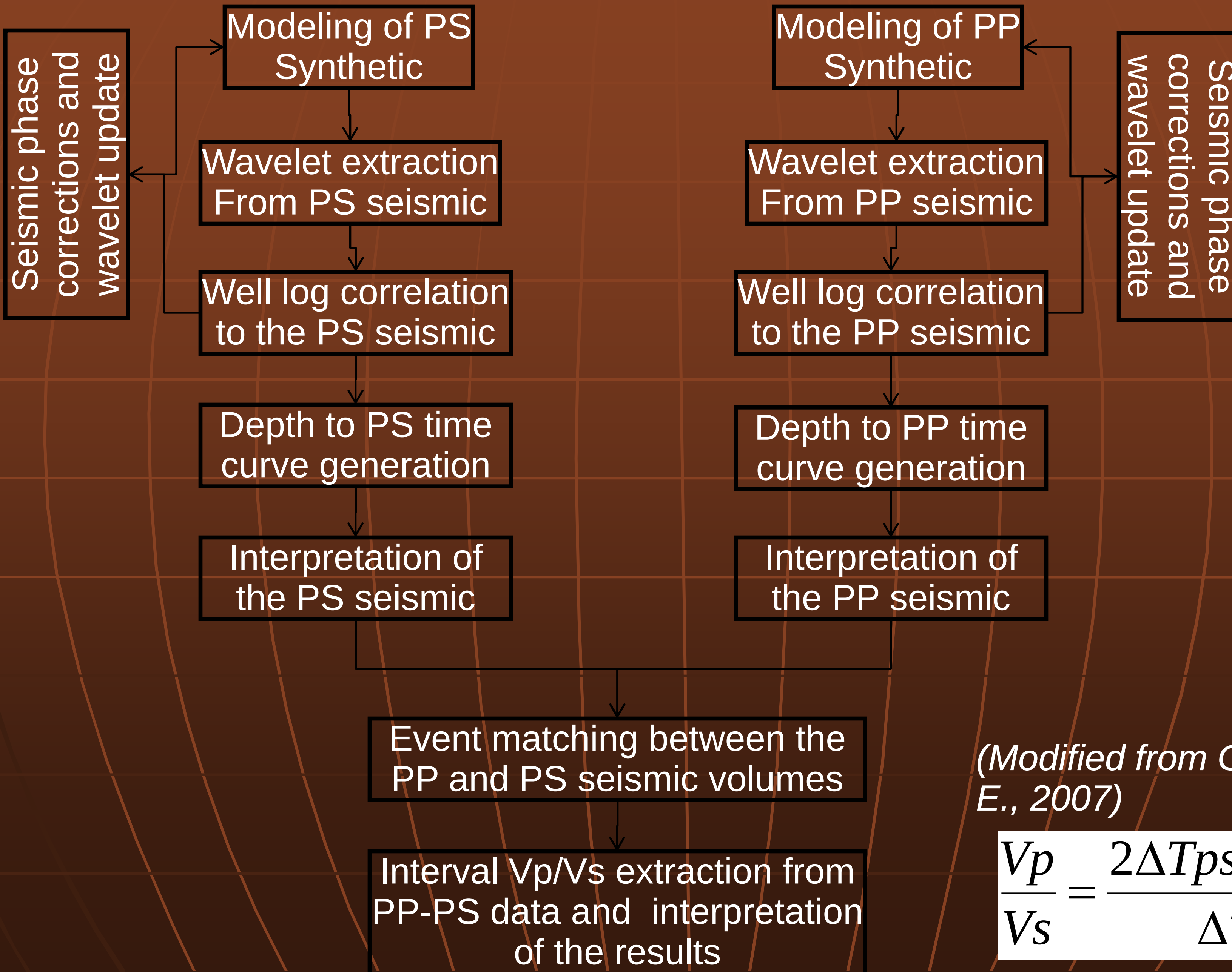
- From the well logs analysis is there any physical attribute (acoustic impedance, Vp/Vs, density), that can be extracted from the seismic and be considered as a good lithology indicator?
- A/. From the crossplots I conclude that density and Vp/Vs ratio could be used as lithology indicators.
- Taking into the low reliability of attribute extraction from the conventional 3D seismic and that density is a difficult attribute to extract from the seismic, I propose that a good alternative to identify lithology is a Vp/Vs extraction from a join interpretation of the conventional 3D and the 3C-3D seismic data.

5. Preliminary conventional 3D and 3C-3D Registration

Question

- Is it possible that interval Vp/Vs ratio, attribute extracted from the registration and interpretation of conventional 3D and 3C-3D be a reliable lithology indicator and diminish the uncertainty when looking for the York sands in the Tennessee colony area?

5.1 Work flow chart for interval Vp/Vs estimation

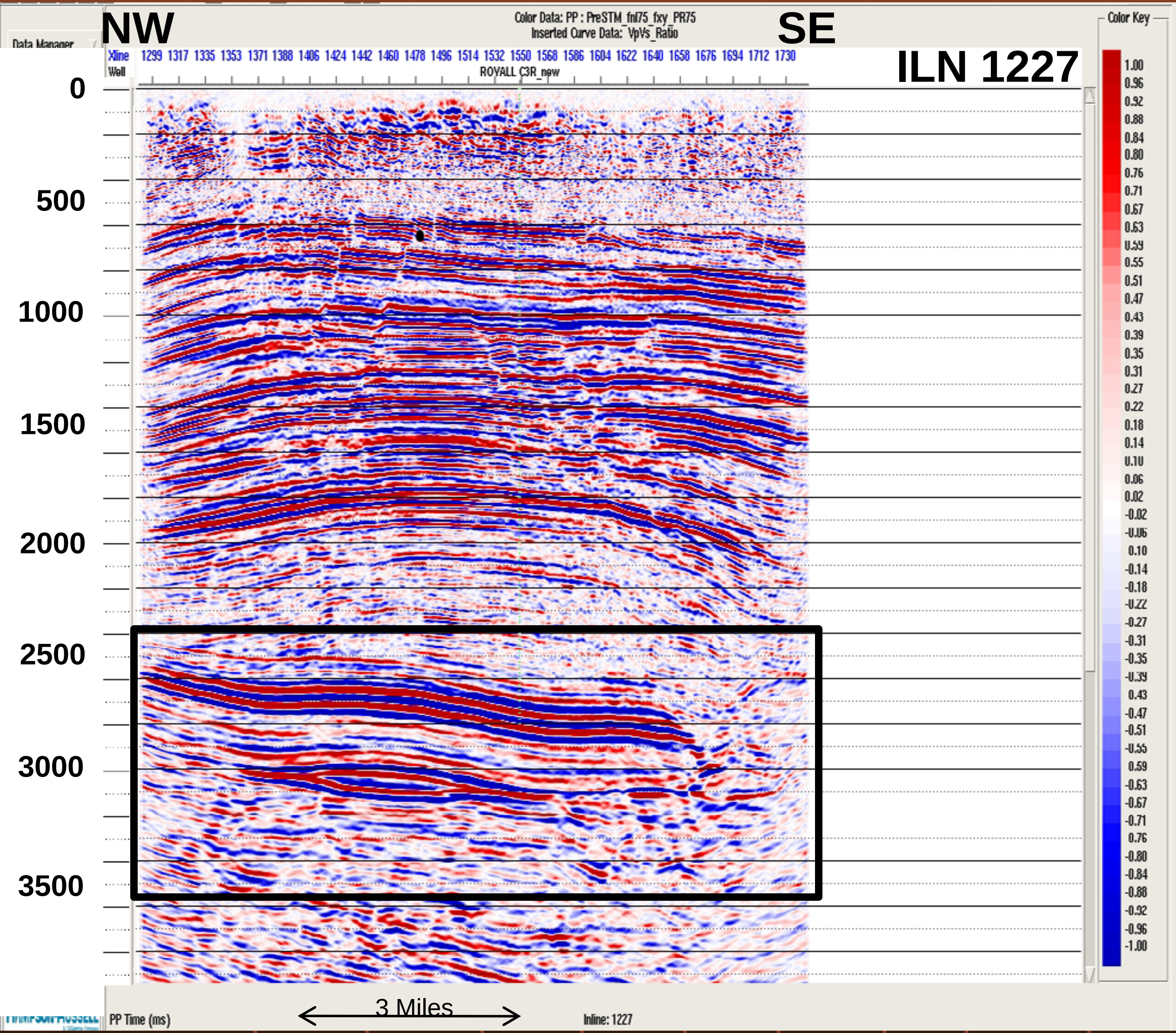


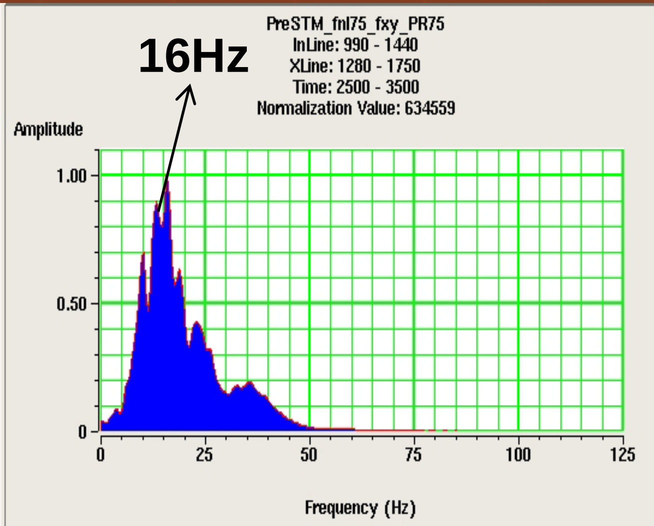
(Modified from Guliyev, E. E., 2007)

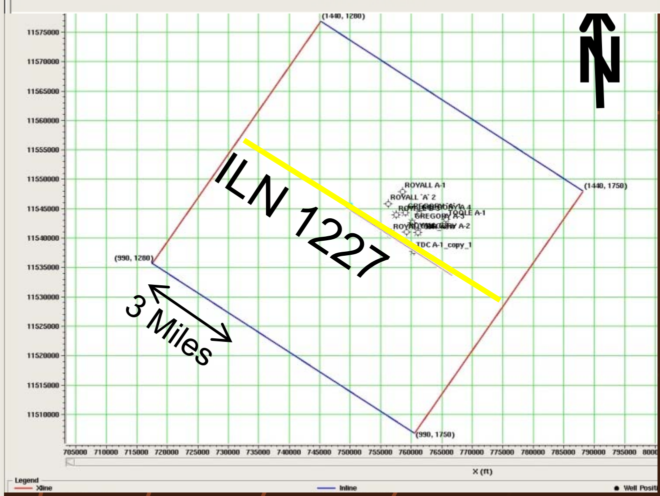
$$\frac{Vp}{Vs} = \frac{2\Delta Tps - \Delta Tpp}{\Delta Tpp}$$

PP seismic data fair field process 2005

ILN 1227 3D conventional seismic

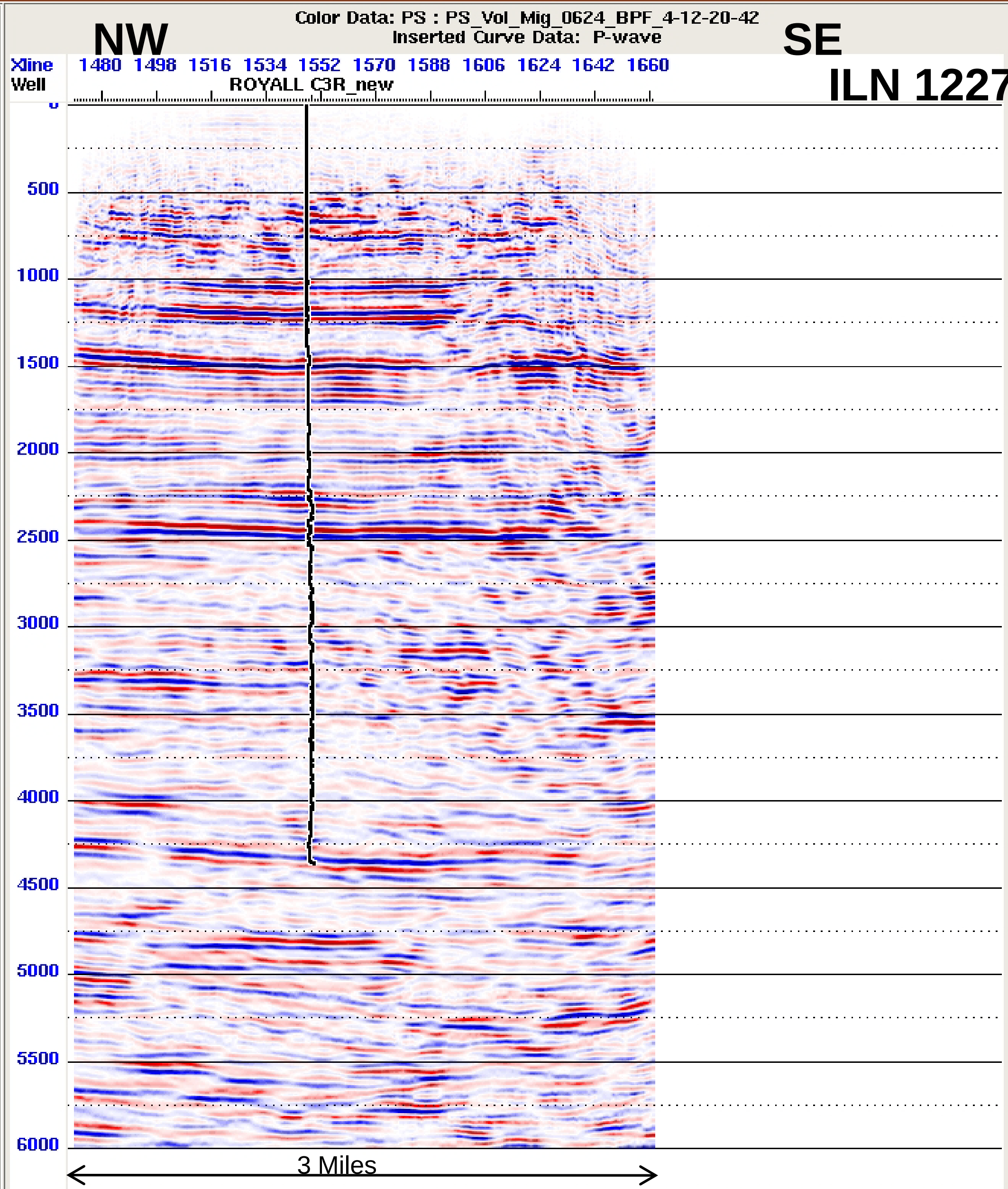


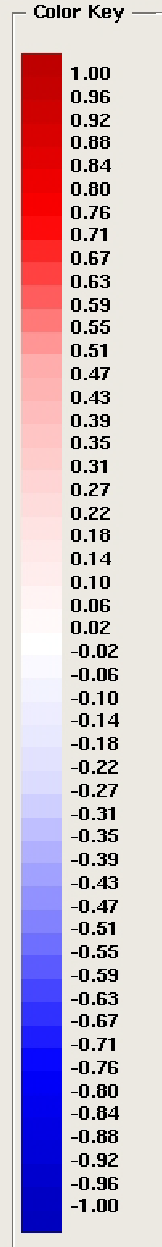


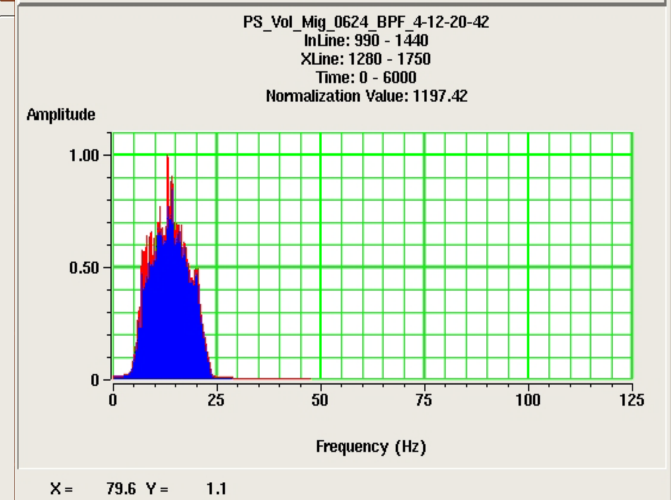


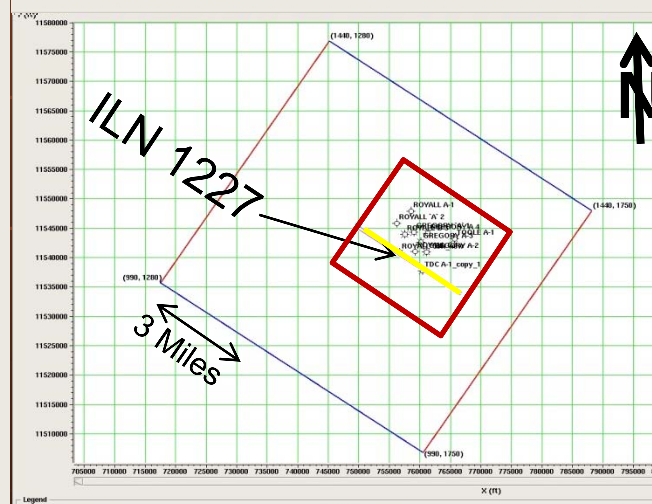
PS seismic data Donatello 3C-3D survey

ILN 1227 Band pass Filter 4-12-20-24Hz

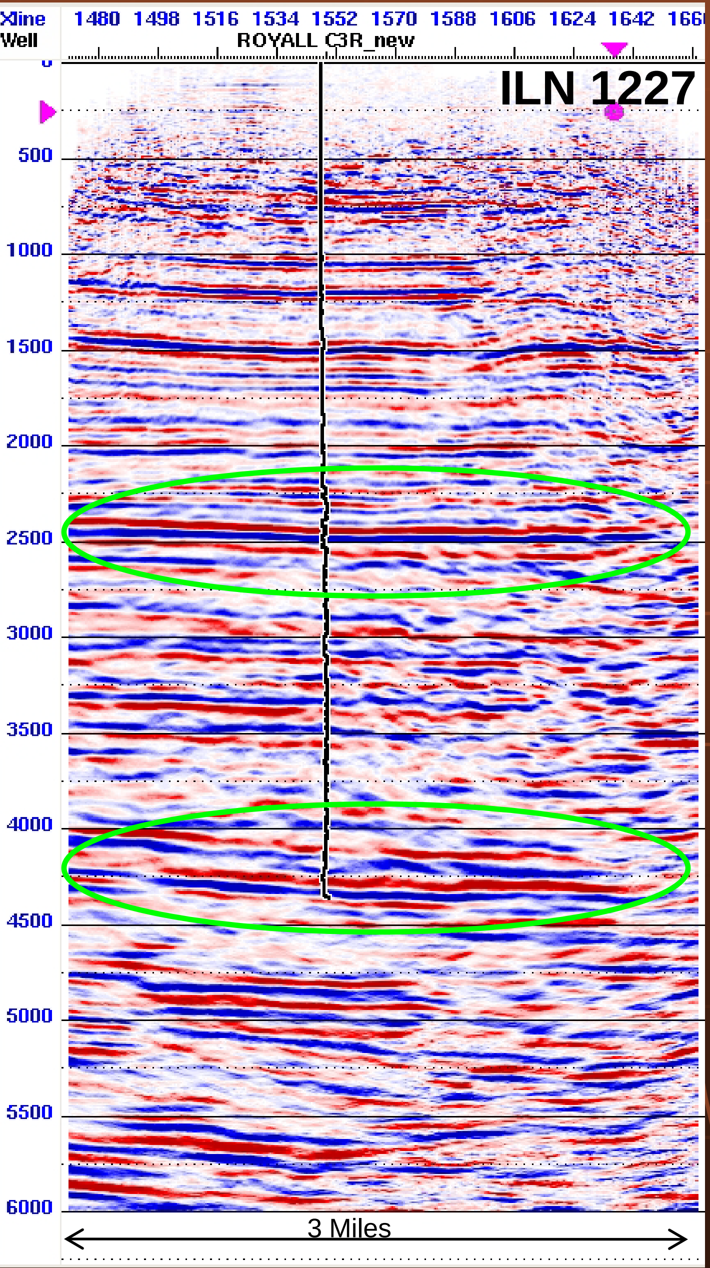


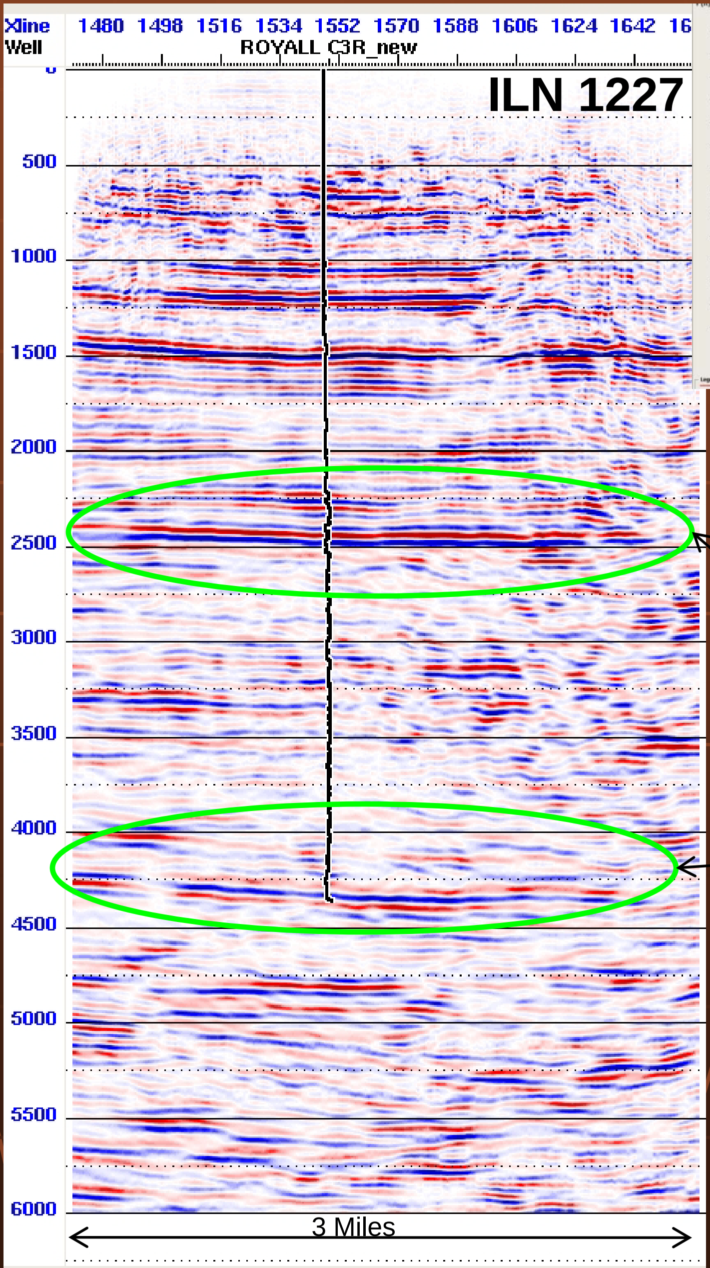


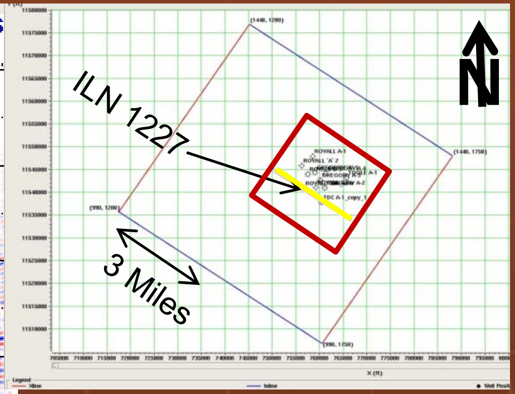




Comparison between original and filtered PS sections

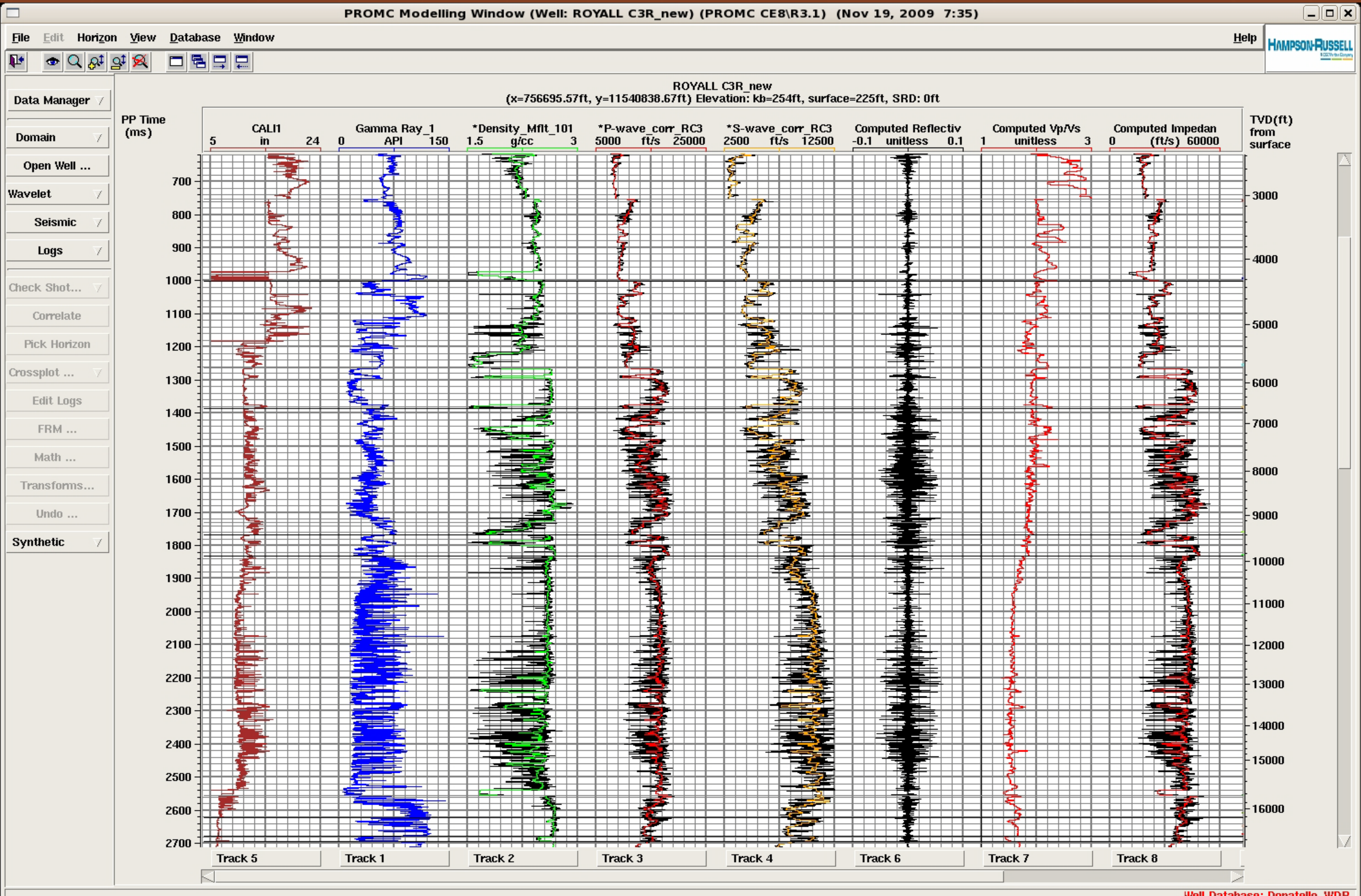




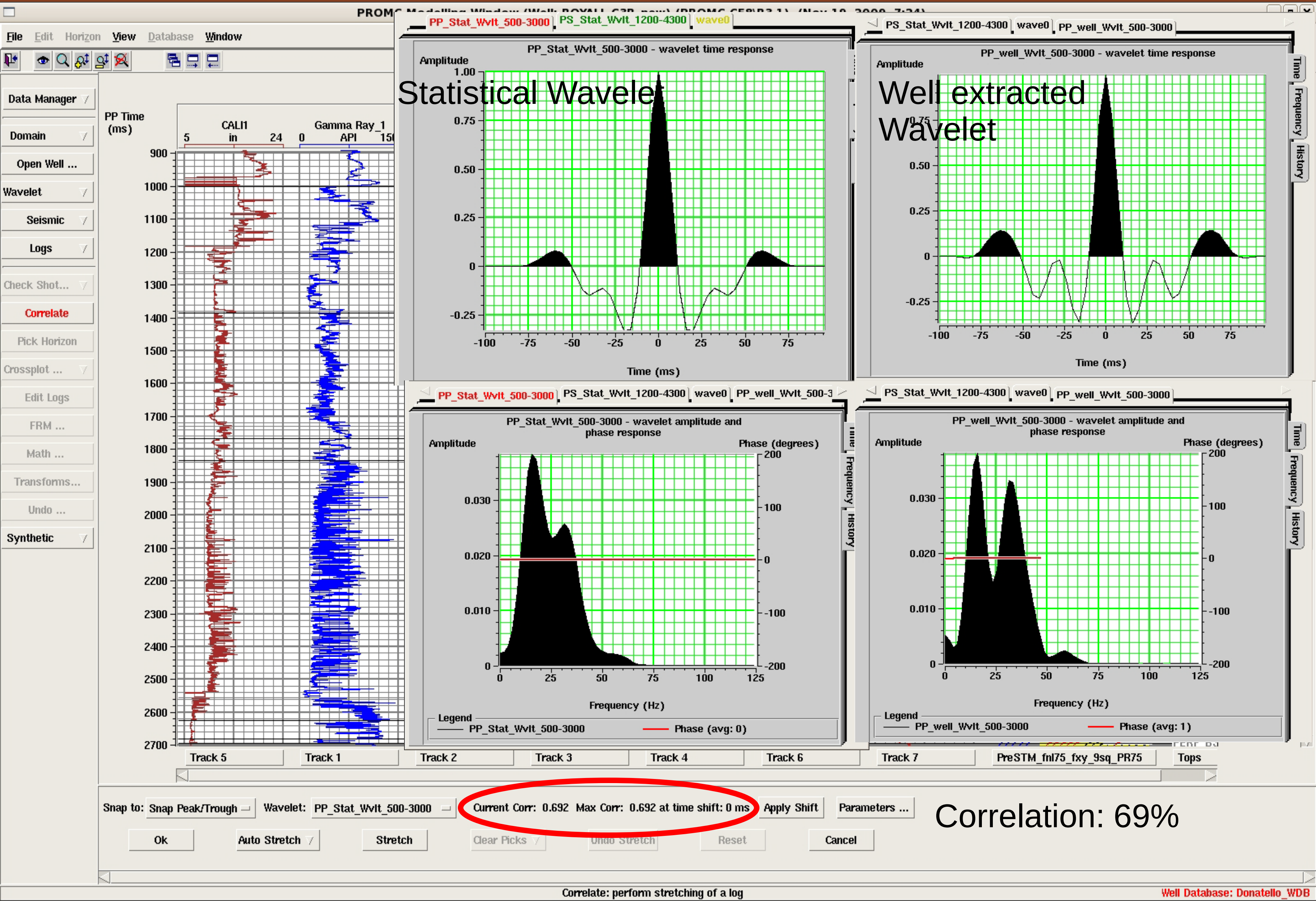


More continuous reflections

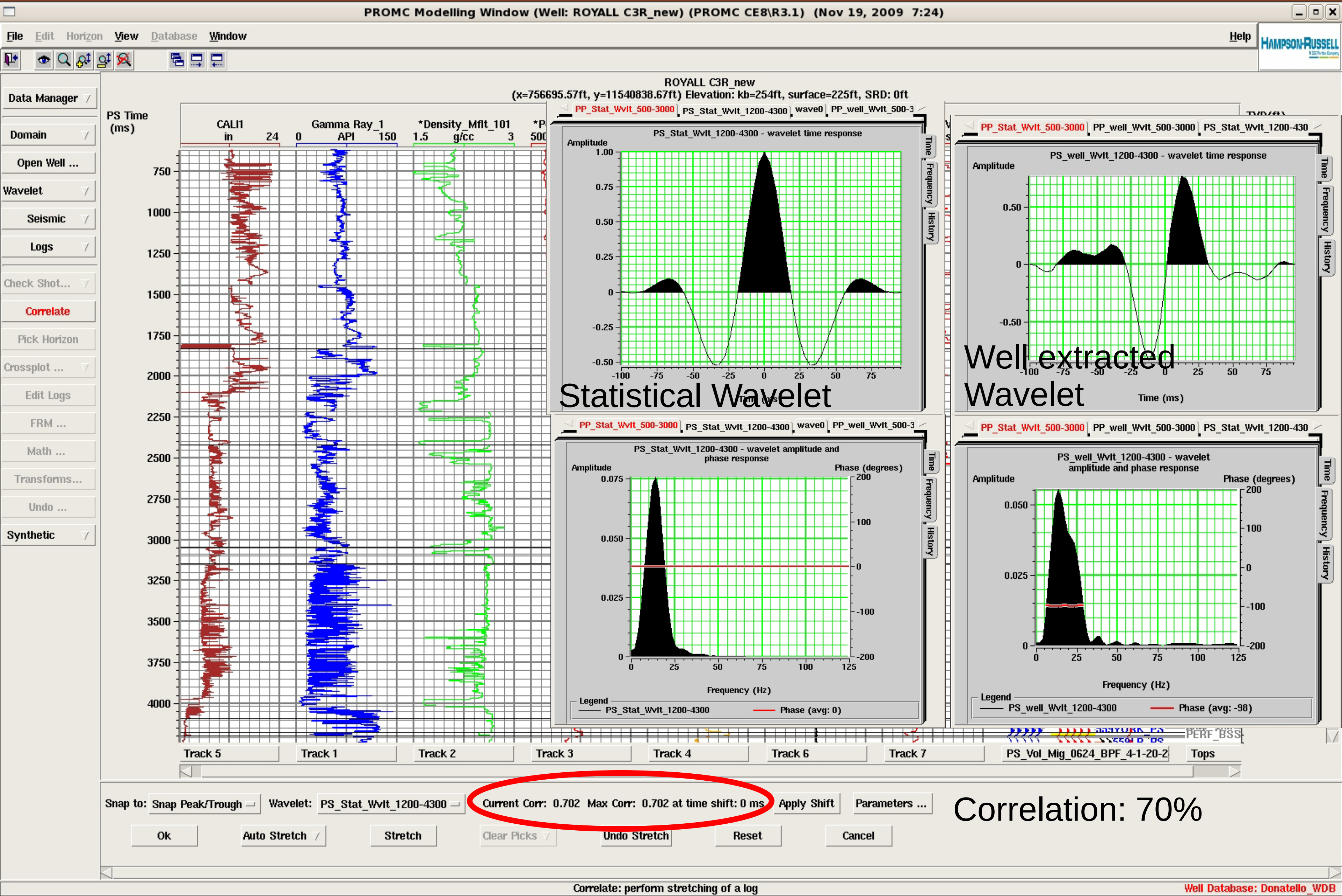
Royall C3R original and despiked logs (density and sonic logs)



Synthetic tie conventional 3D seismic

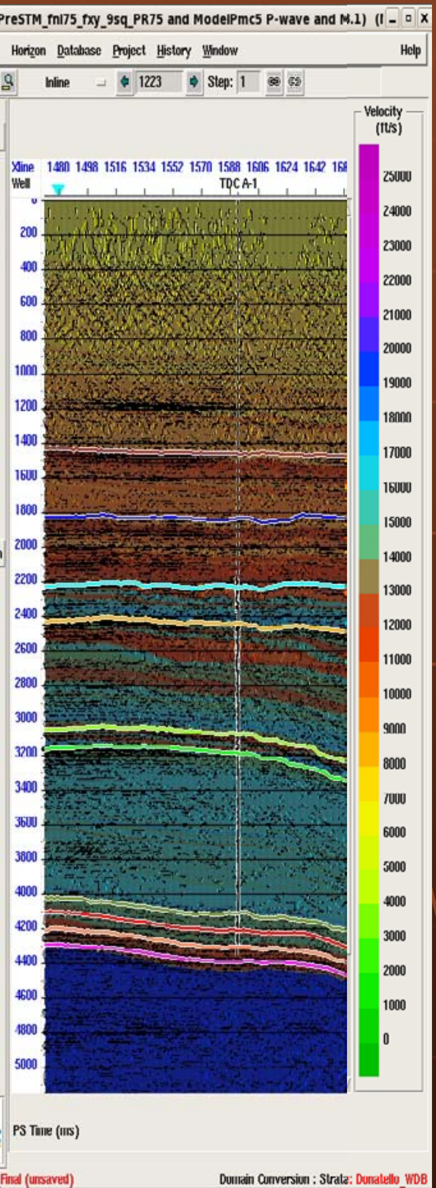


Synthetic tie 3C-3D seismic

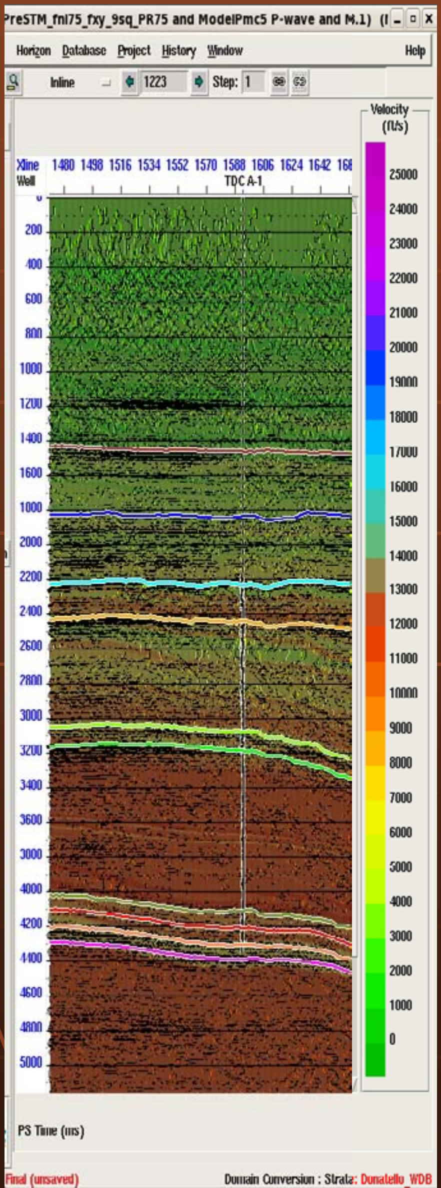


Vp, Vs Density and Vp/Vs Models generated from the well RC3R

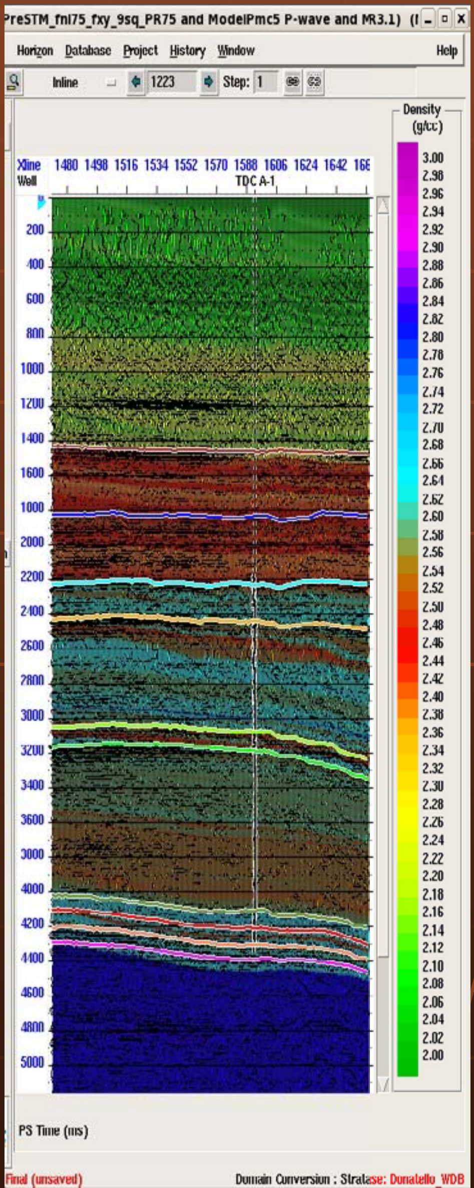
Vp Model



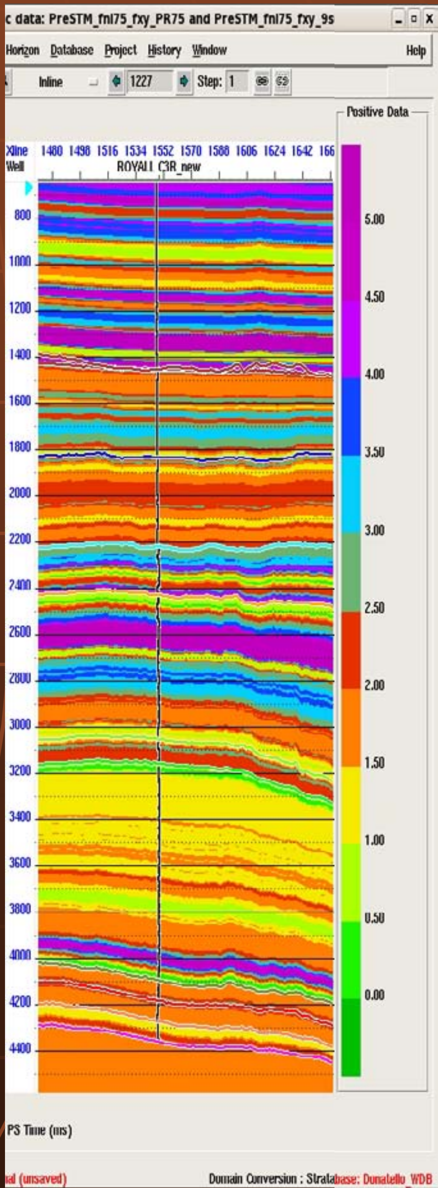
Vs Model



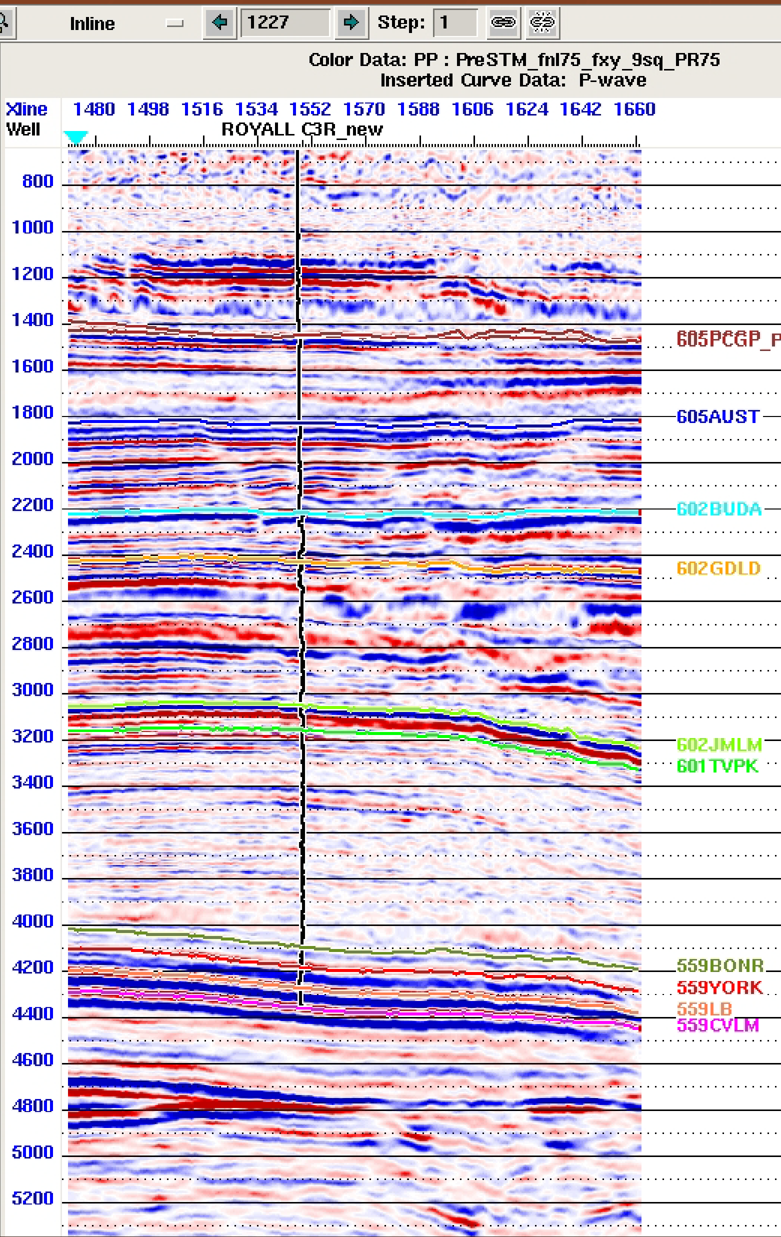
Density Model

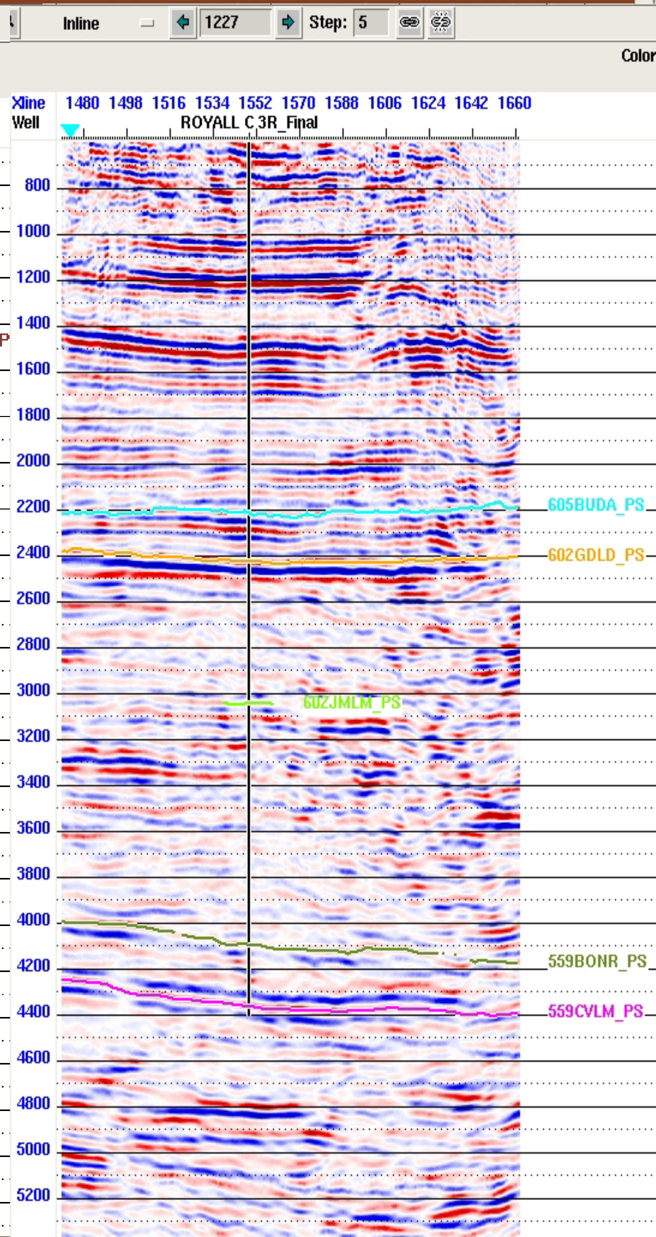


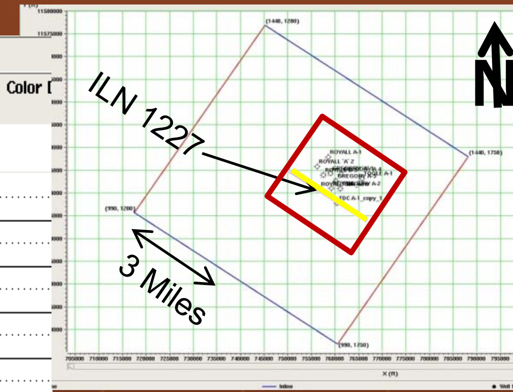
Vp/Vs



Comparison between PP and PS sections the ILN 1227 PS time domain







Future Work

1. Validate the registration with the generation of full wave form synthetics and the multicomponent VSP data.

2. Interpreting the interest horizons in the PS Volume, generate isochrons and interval Vp/Vs.

3. If possible, do an inversion.

4. Conclusions.

Thanks!

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