

Interpreting VSP, streamer, and ocean-bottom seismometer data from the White Rose oilfield, offshore Newfoundland

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Outline

- Introduction and motivations
- Stratigraphy of the White Rose oilfield, offshore Newfoundland
- VSP interpretation
- Converted-wave OBS interpretation
- Conclusions
- Acknowledgements

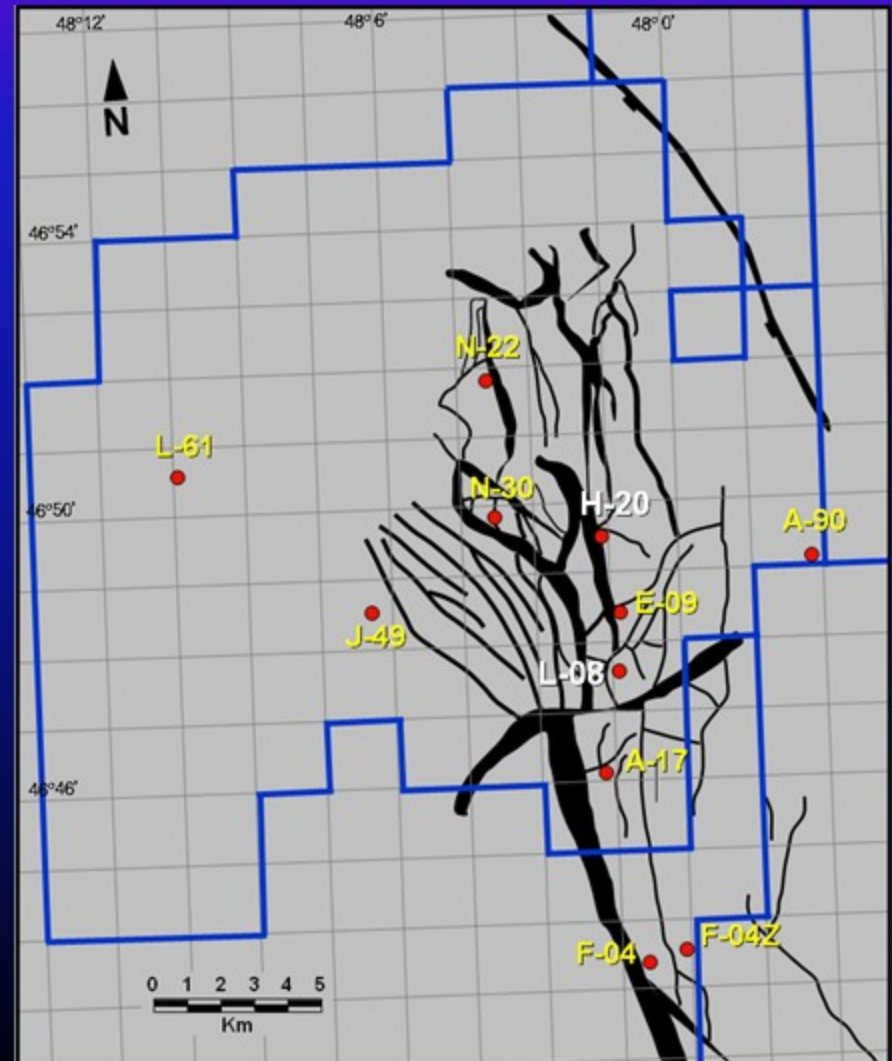
Motivations for this work

- Create a better image of the White Rose reservoirs (& prospects) using PS waves
- Tie together the VSP, streamer, & OBS information to identify targets

Location of White Rose oilfield, Offshore Newfoundland

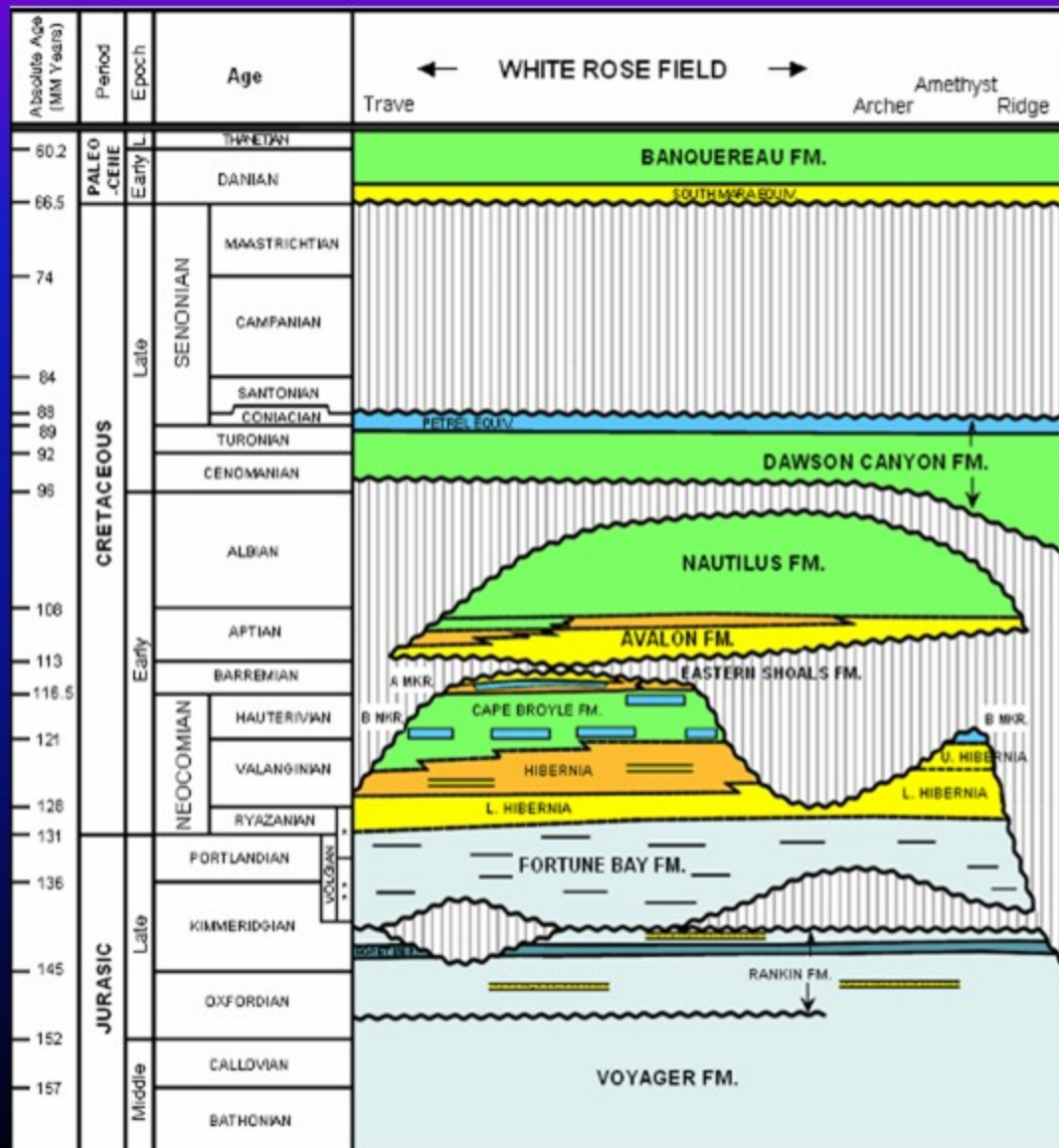


Modified from Geography Network, 2002



Modified from Husky Oil Operations Ltd, 2001

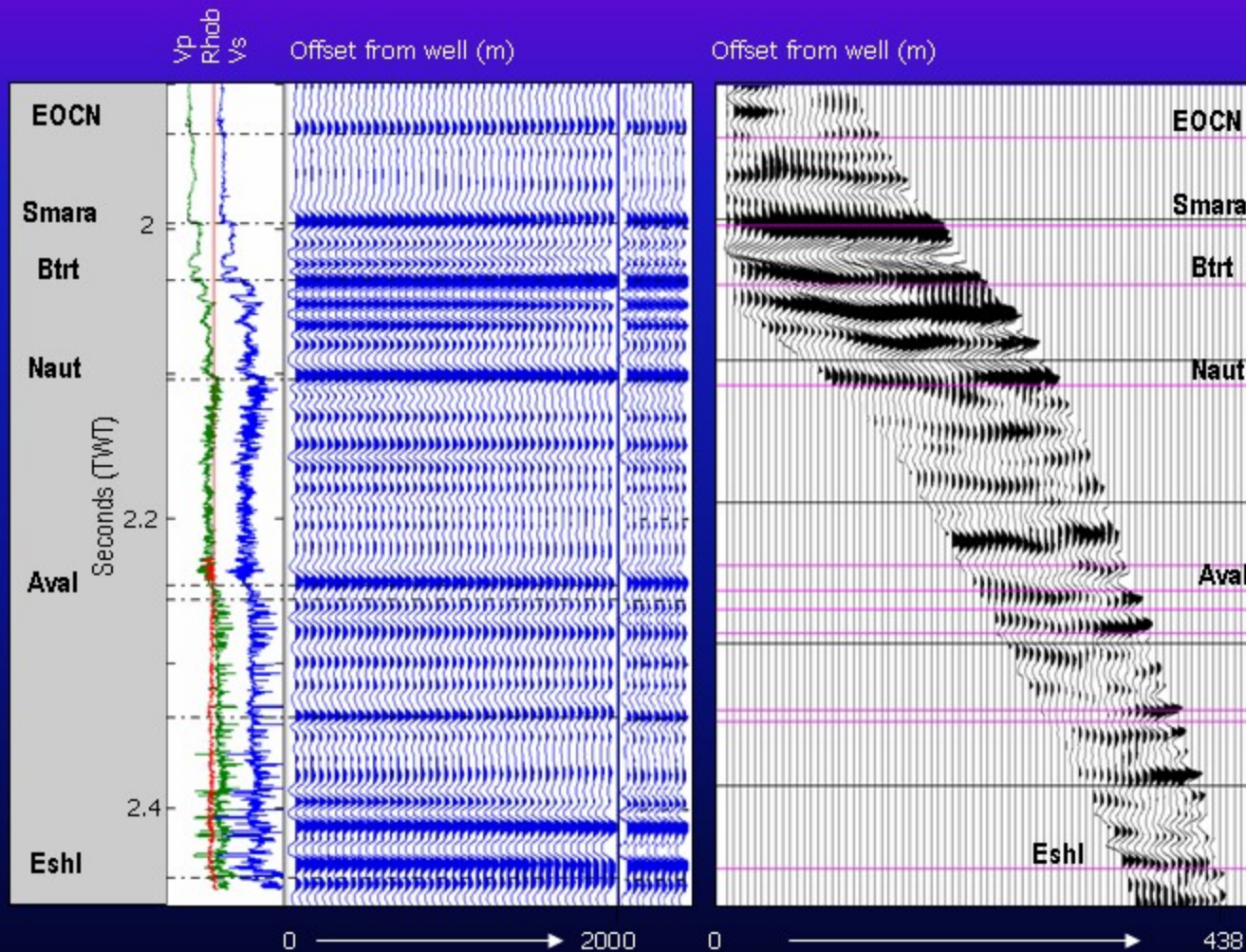
Stratigraphy of White Rose field



- Shale
- Sandstone
- Siltstone
- Carbonates
- Shale-Sandstone
- Source rock

H-20 well Multi-VSP analysis

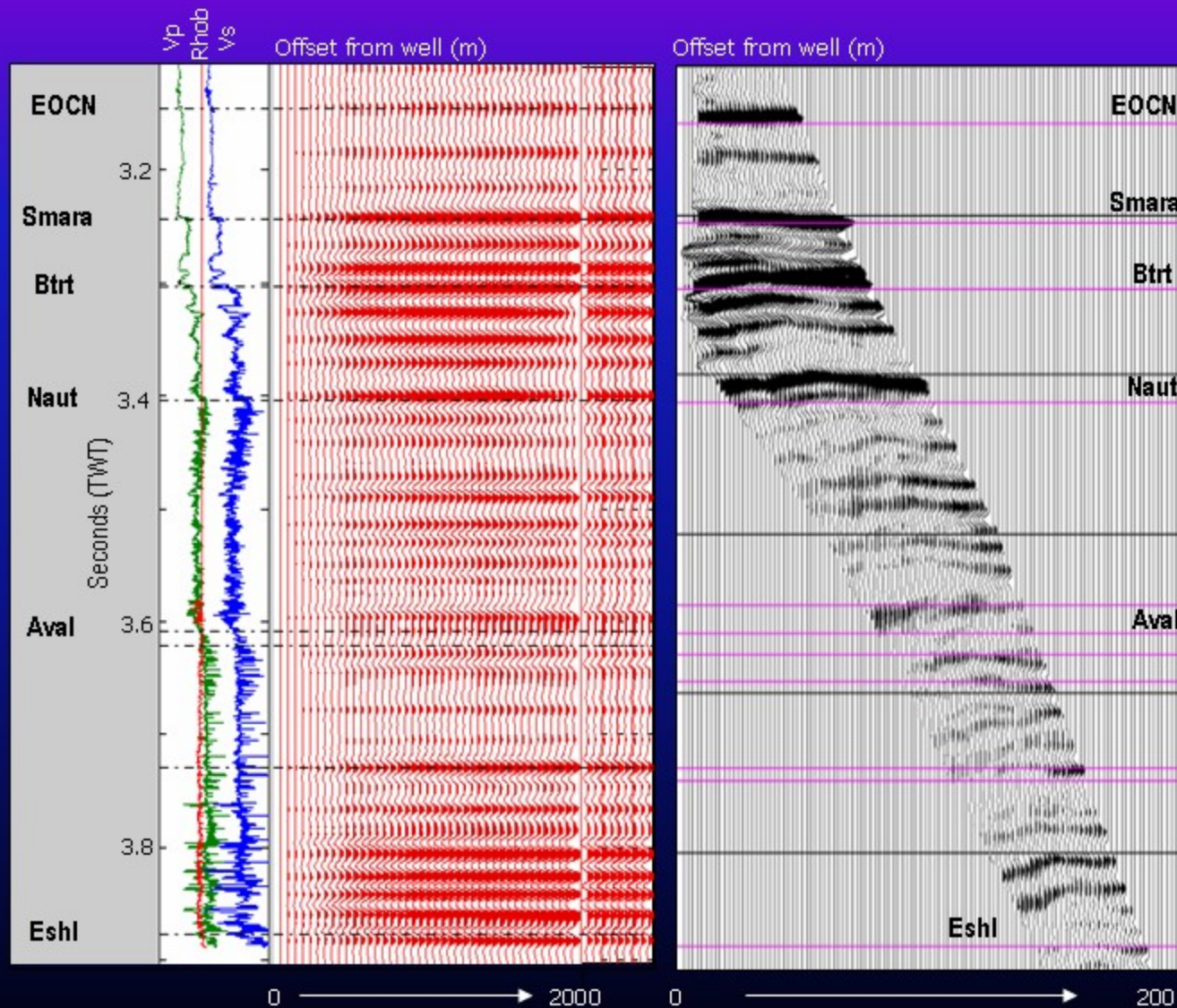
PP synth & Offset VSP



Synthetic gather (45Hz Ricker wavelet) - stack

VSP-CDP actual data. Increase in acoustic impedance is a peak

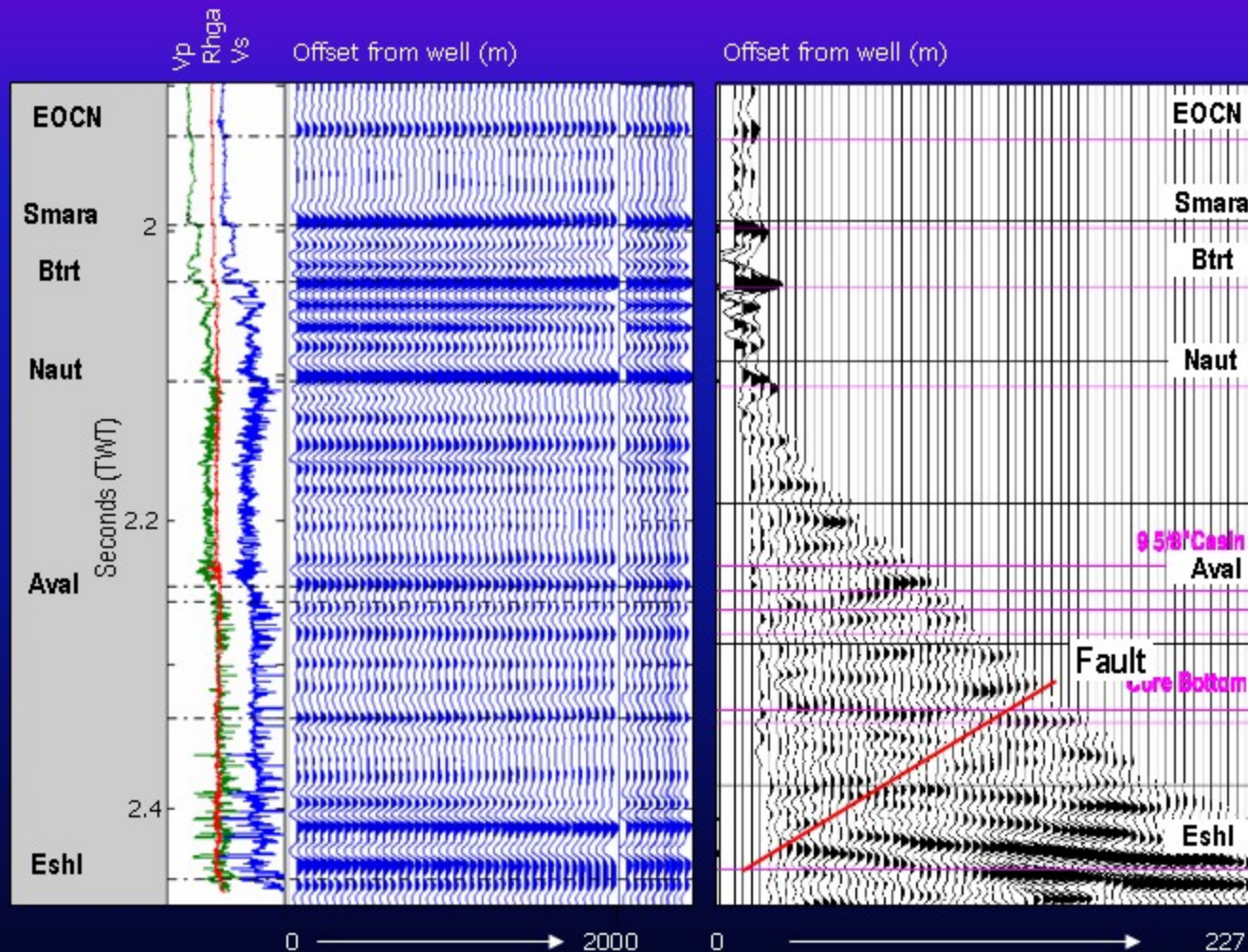
PS synth & Offset VSP



Synthetic gather (45Hz Ricker wavelet) - stack

VSP-CCP actual data. Increase in acoustic impedance is a peak

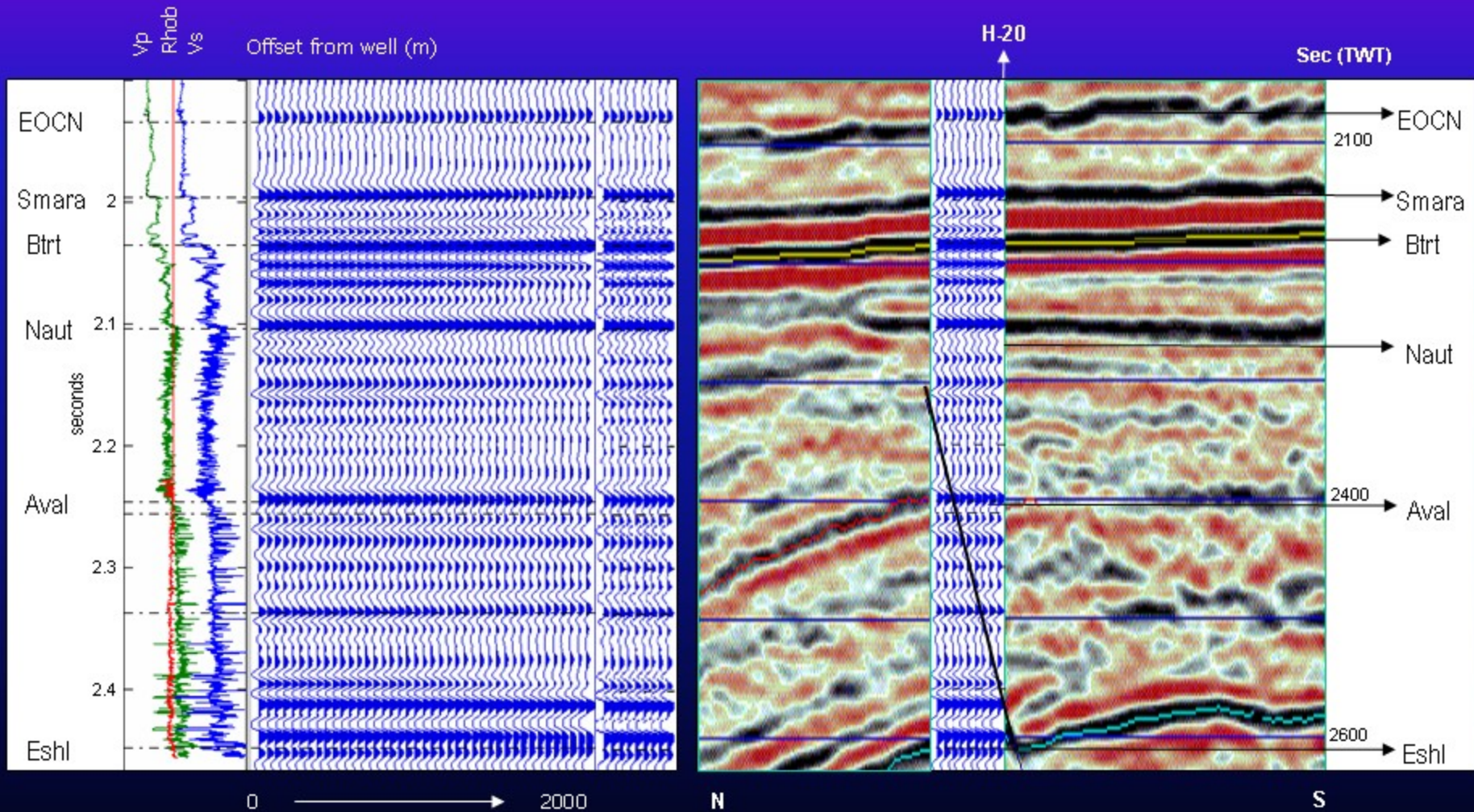
PP synth & Walk-Above VSP



Synthetic gather (45Hz Ricker wavelet) - stack

VSP-CDP actual data. Increase in acoustic impedance is a peak

PP synth & PP seismic PGS 97



Synthetic (45Hz Ricker wavelet) - stack

North South PP Seismic section and Synthetic seismogram

(Black is a peak and red is a trough)

OBS data analysis

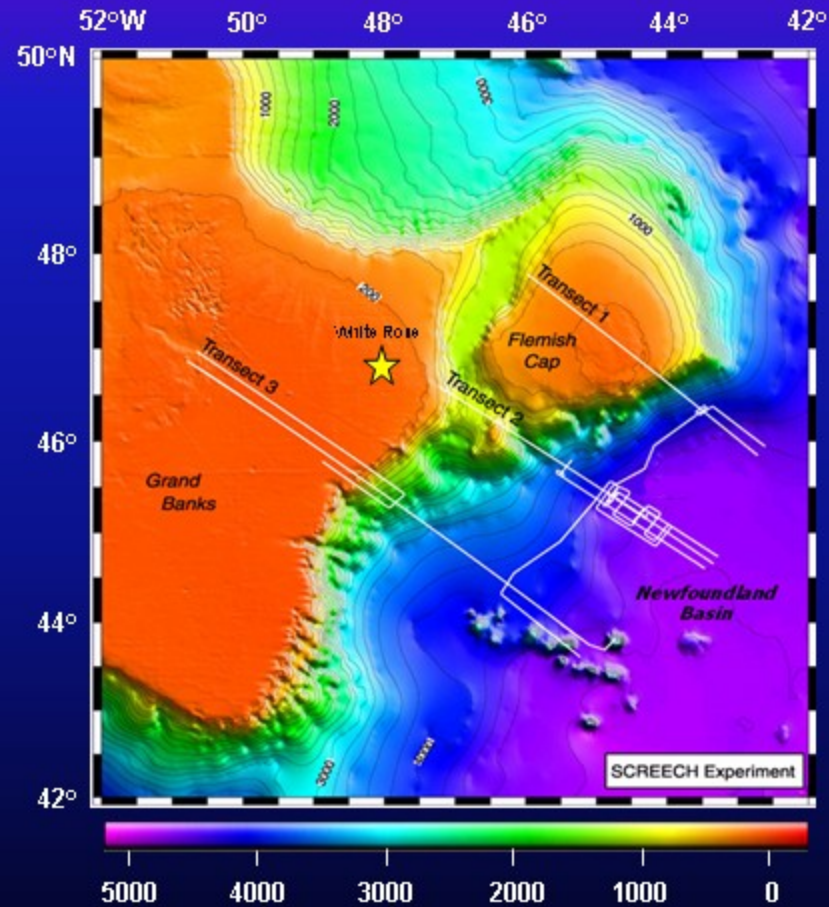
White Rose imaging challenges

- Hard Water Bottom
- Strong P-wave impedance contrast at the T-K unconformity
- Poor P-wave impedance contrast between the Avalon and Nautilus Formations
- Distortion of the reservoir image by the presence of gas clouds in the overlying T sediments



Terra Nova boulders
(www.huskywhiterose.com/, 2002)

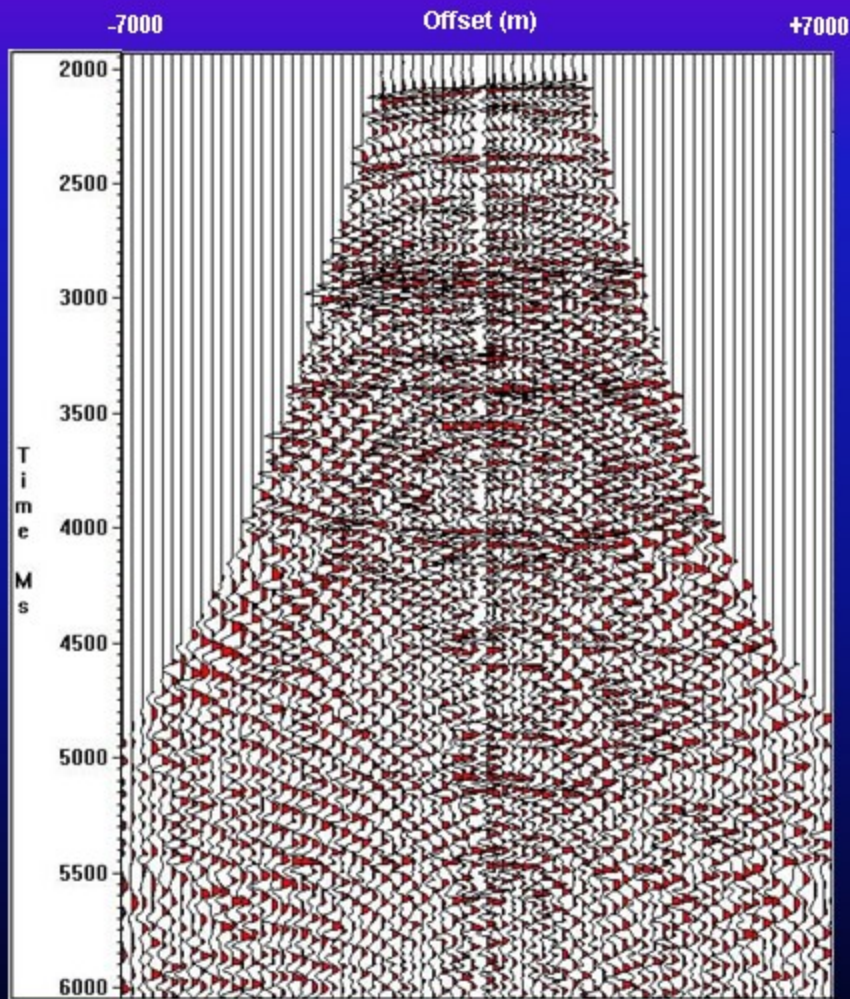
2000 OBS Survey



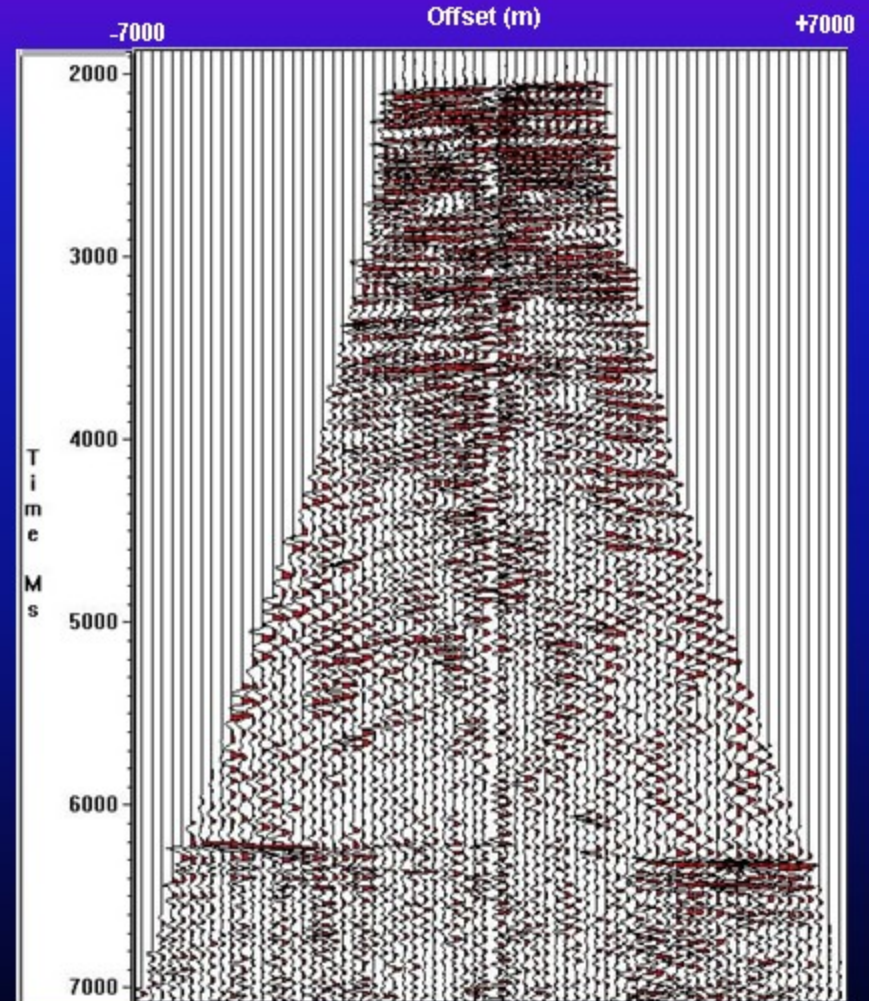
Modified from odp.tamu.edu

2000 OBS Survey

PP and PS (vertical & radial components) seismic sections

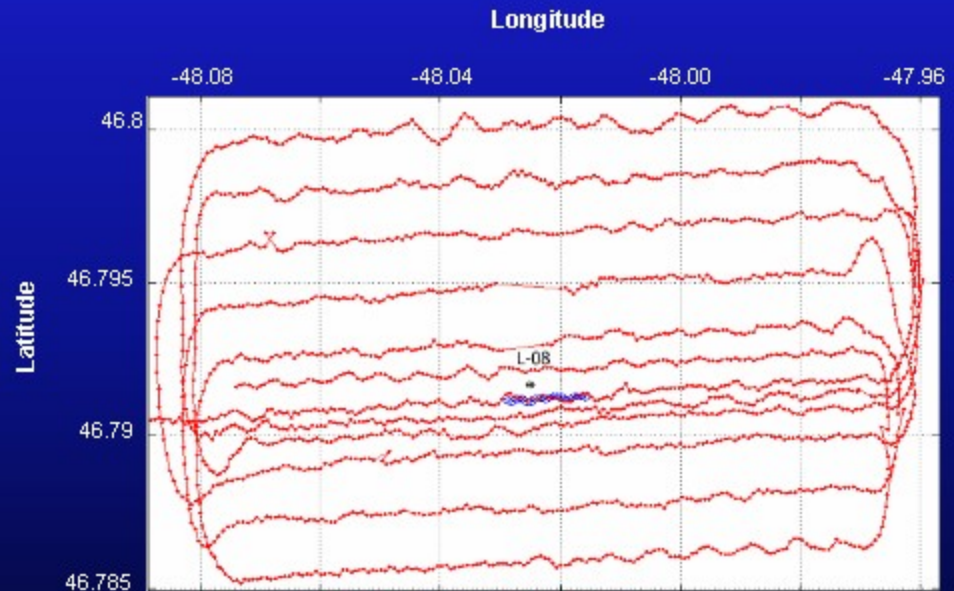
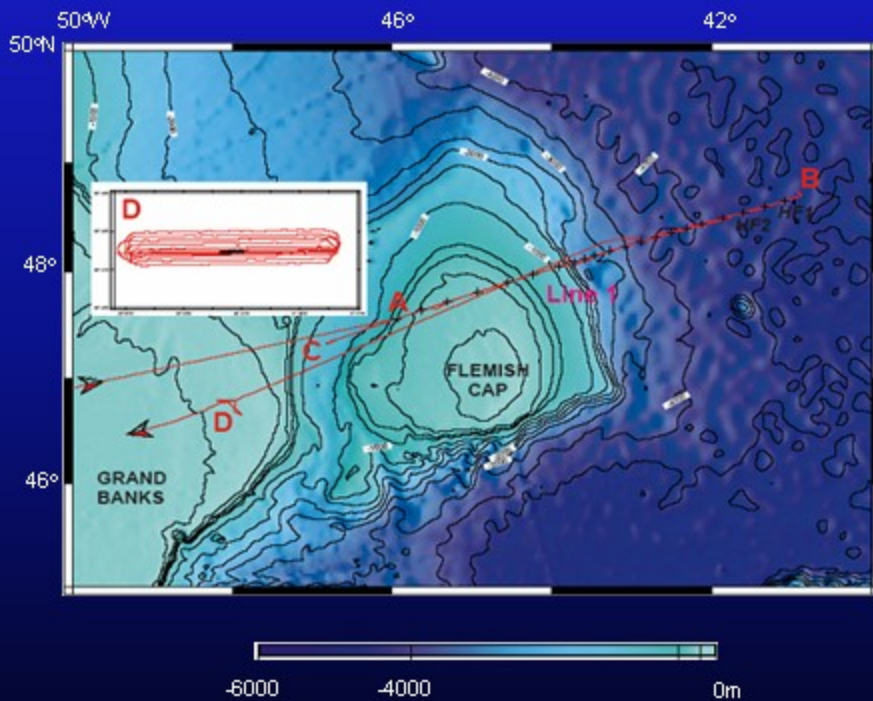


Vertical component (PP time)



Radial component (PS time)

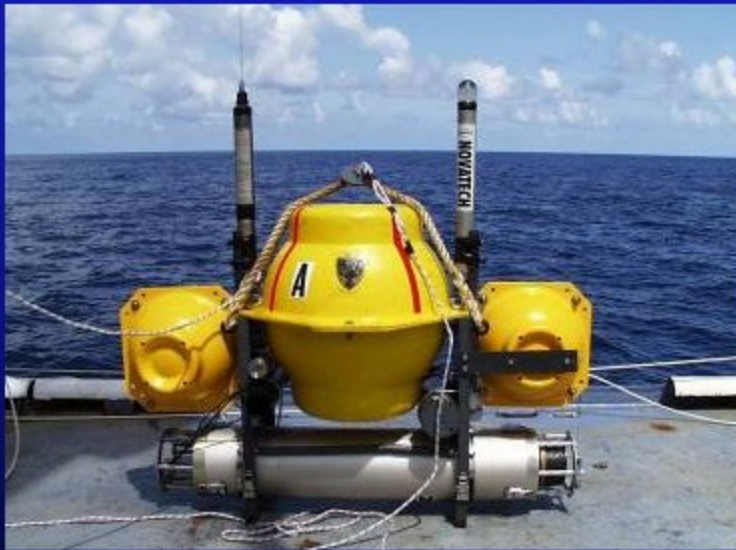
2002 OBS Survey



Modified from Hall and Stewart, 2002

Modified from Jackson et al., 2002

2002 OBS Survey Equipment

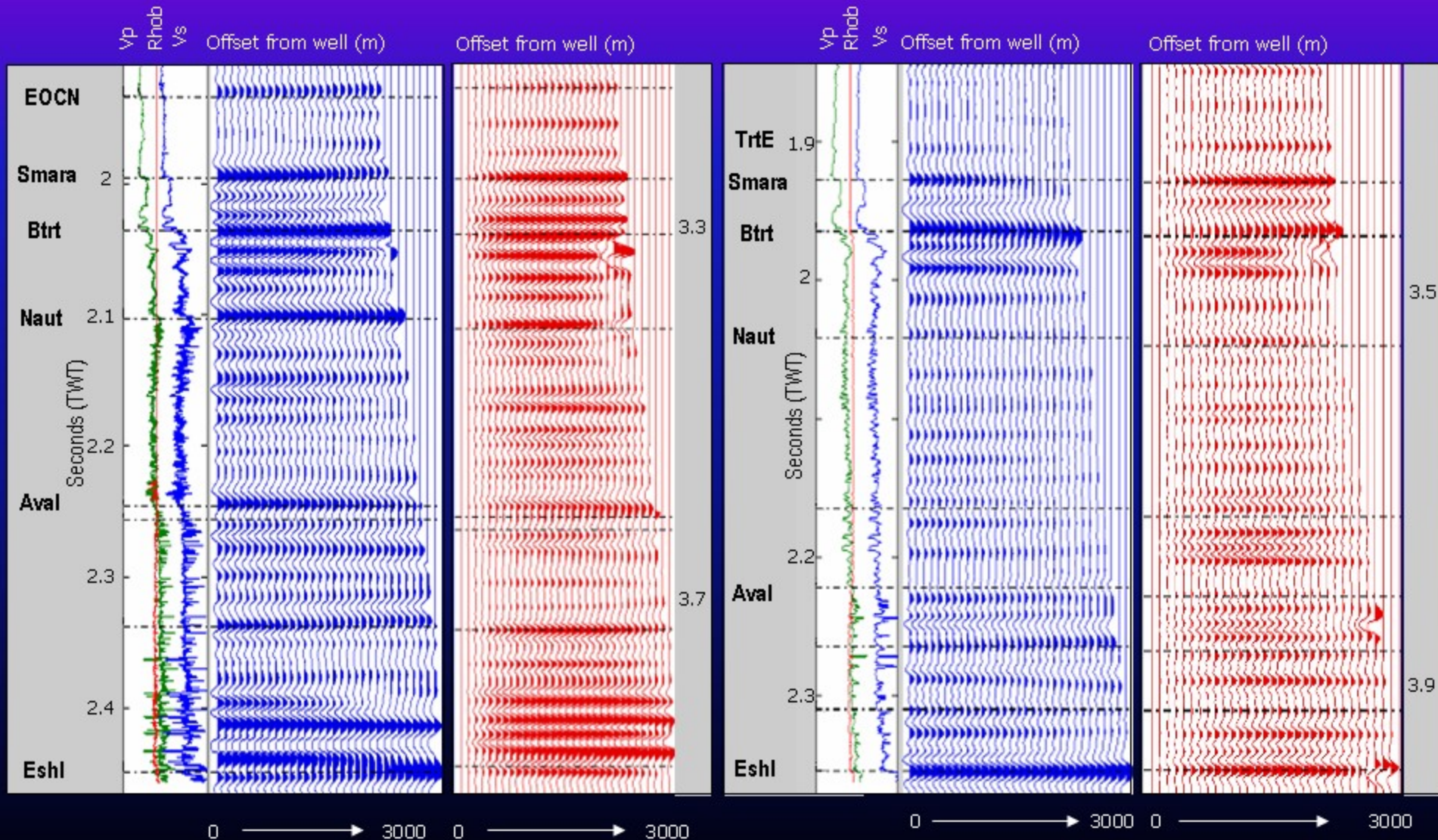


Modified from phys.ocean.dal.ca, 2002



Modified from Jackson et al., 2002

Well-log Interpretation (H-20 & L-08)



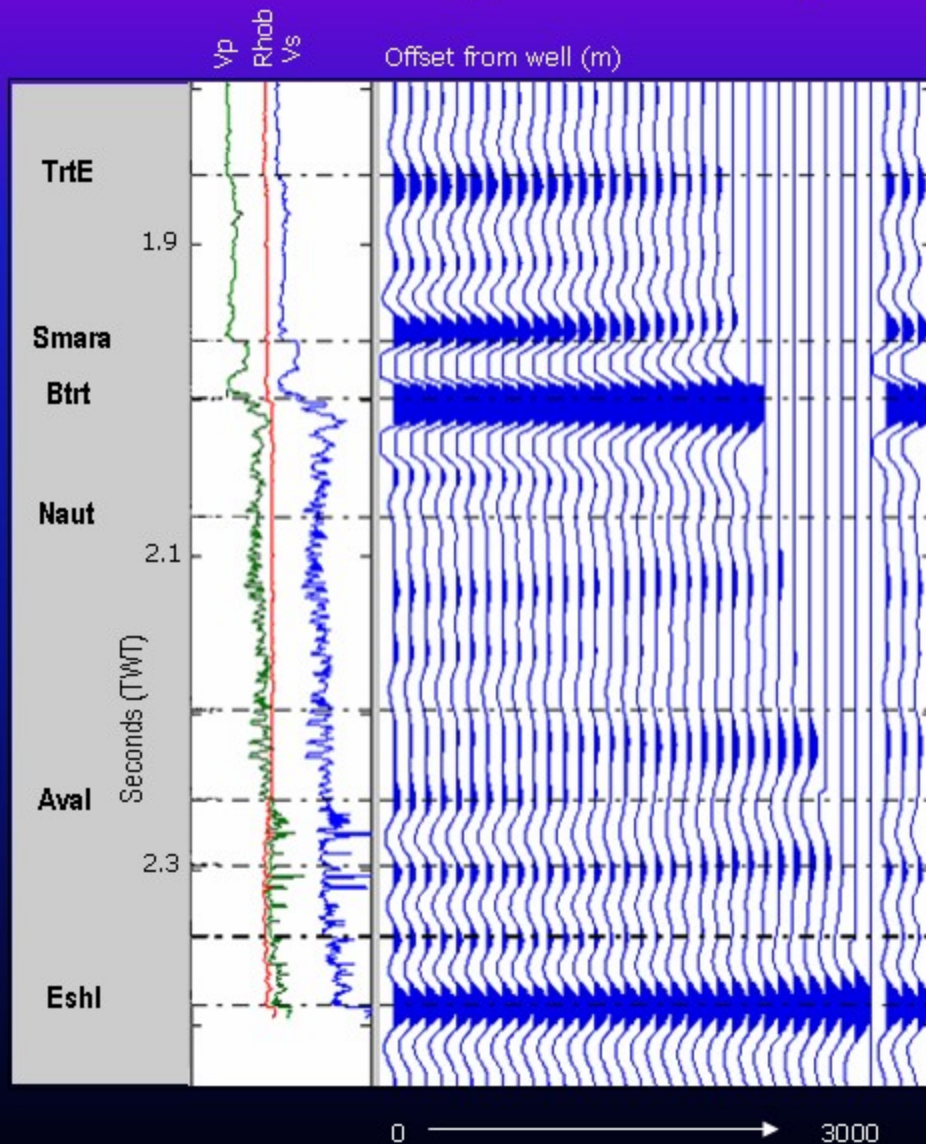
Well H-20
PP Synth (45Hz Ricker wavelet)

Well H-20
PS Synthetic

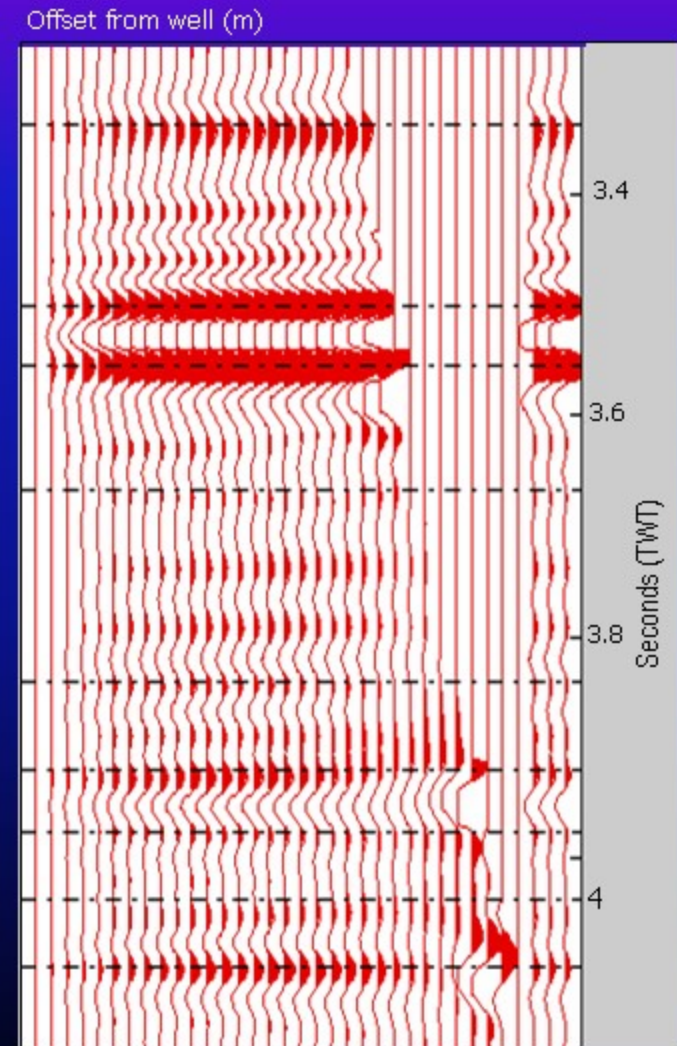
Well L-08
PP Synth (45Hz Ricker wavelet)

Well L-08
PS Synthetic

Well-log Interpretation (L-08)



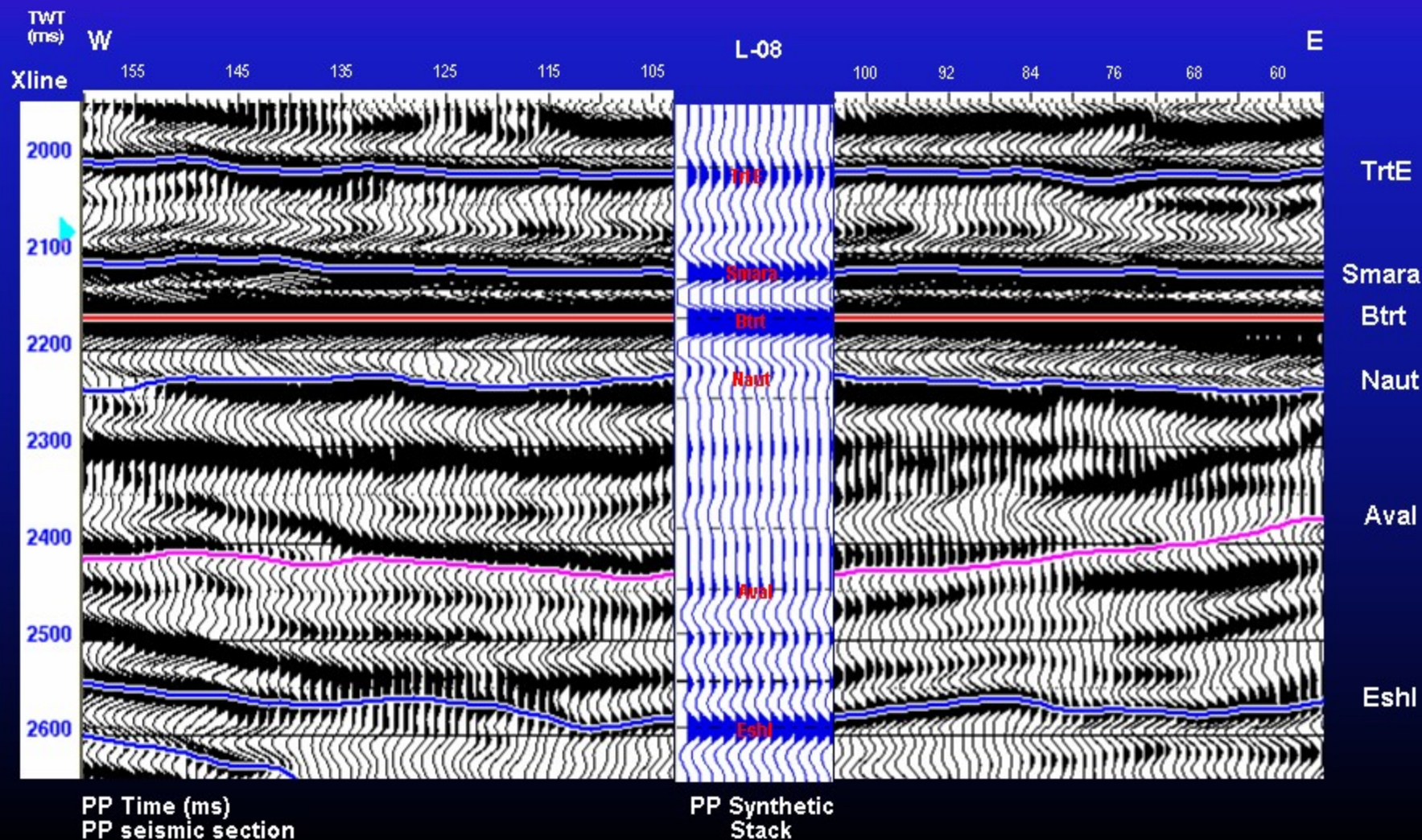
PP Synthetic (4/8 25/30 bandpass wavelet) - stack



PS Synthetic (4/8 25/30 bandpass wavelet) - stack

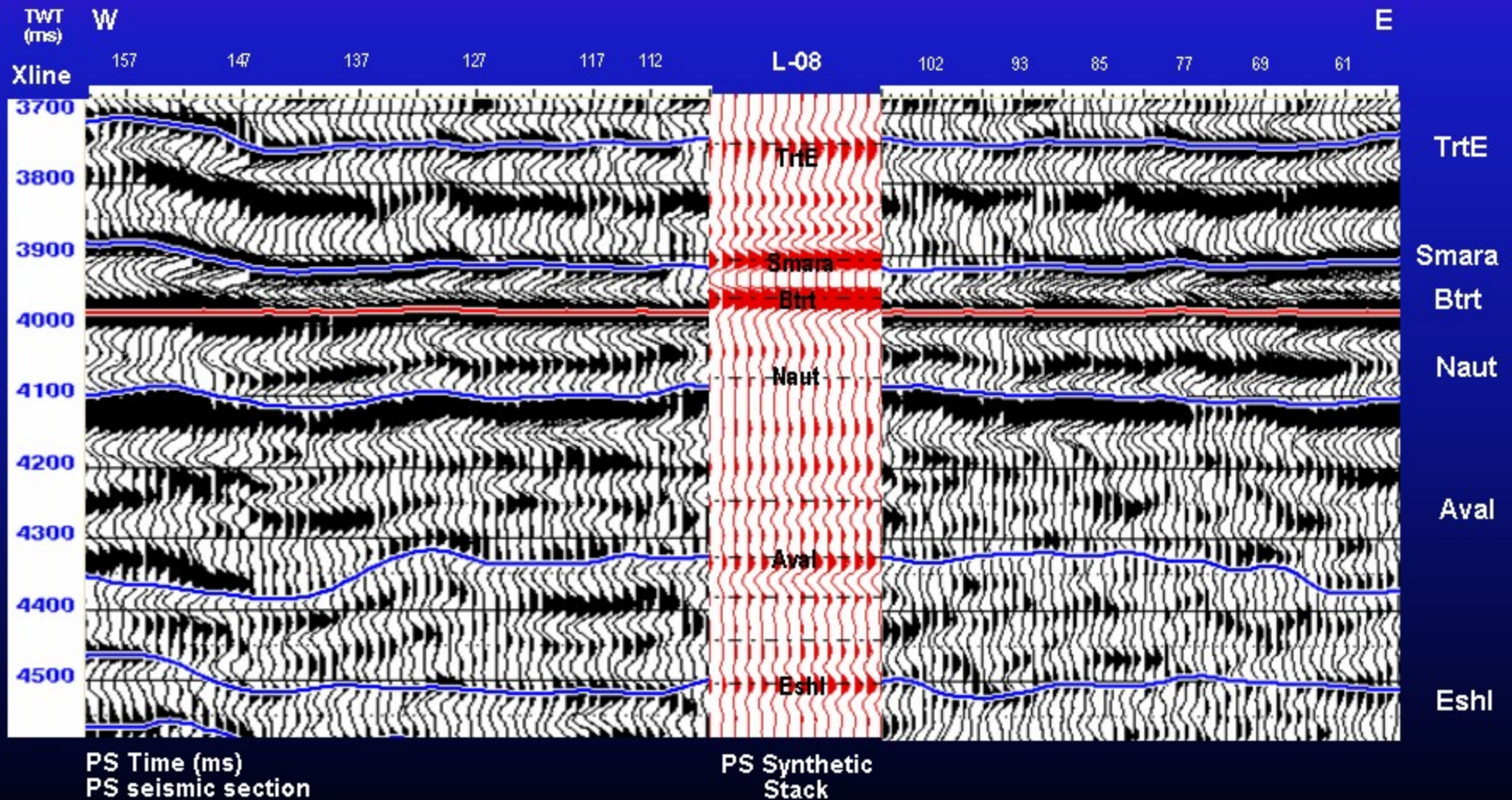
OBS Interpretation

PP synthetic-Vertical component



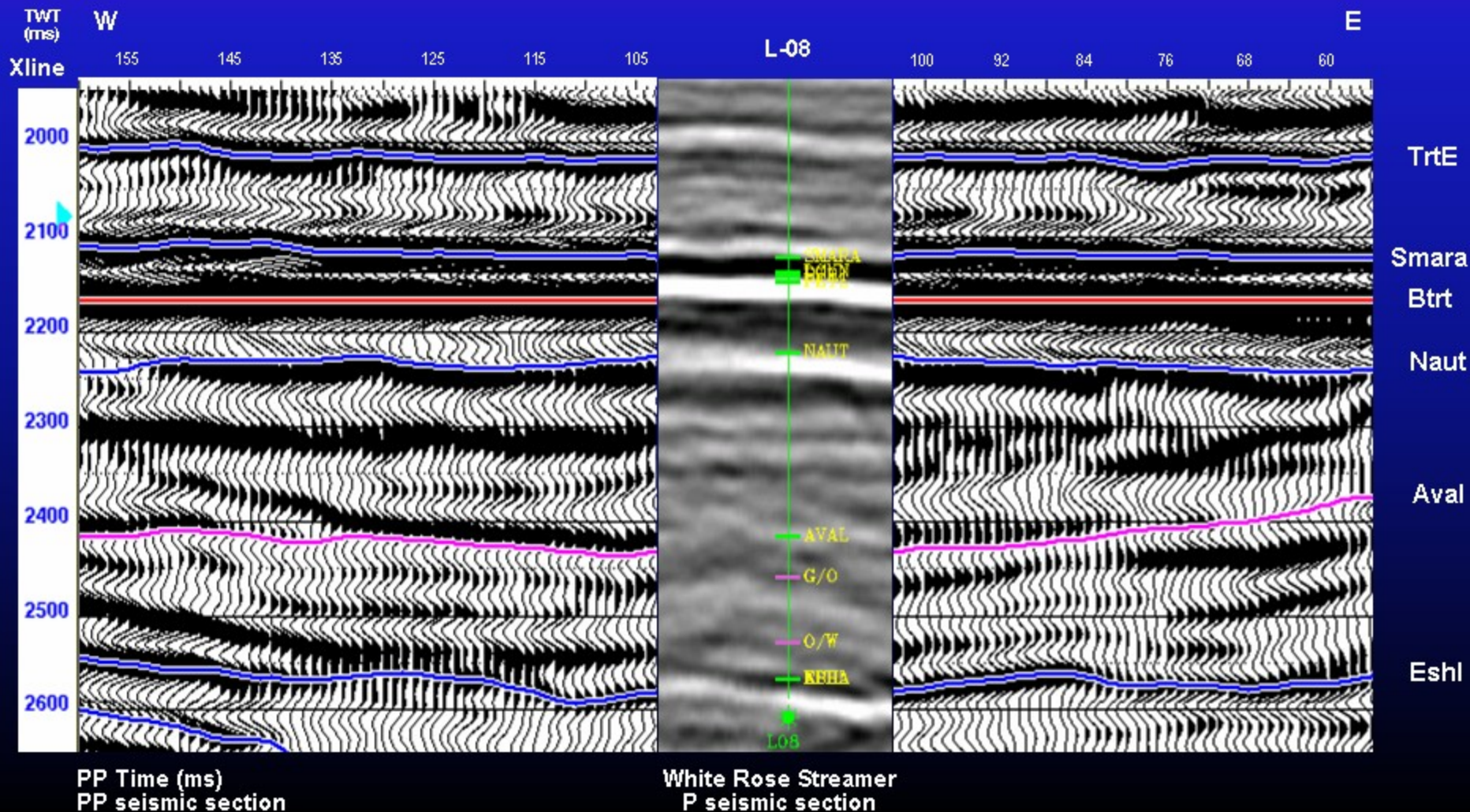
OBS Interpretation

PS synthetic-Radial component



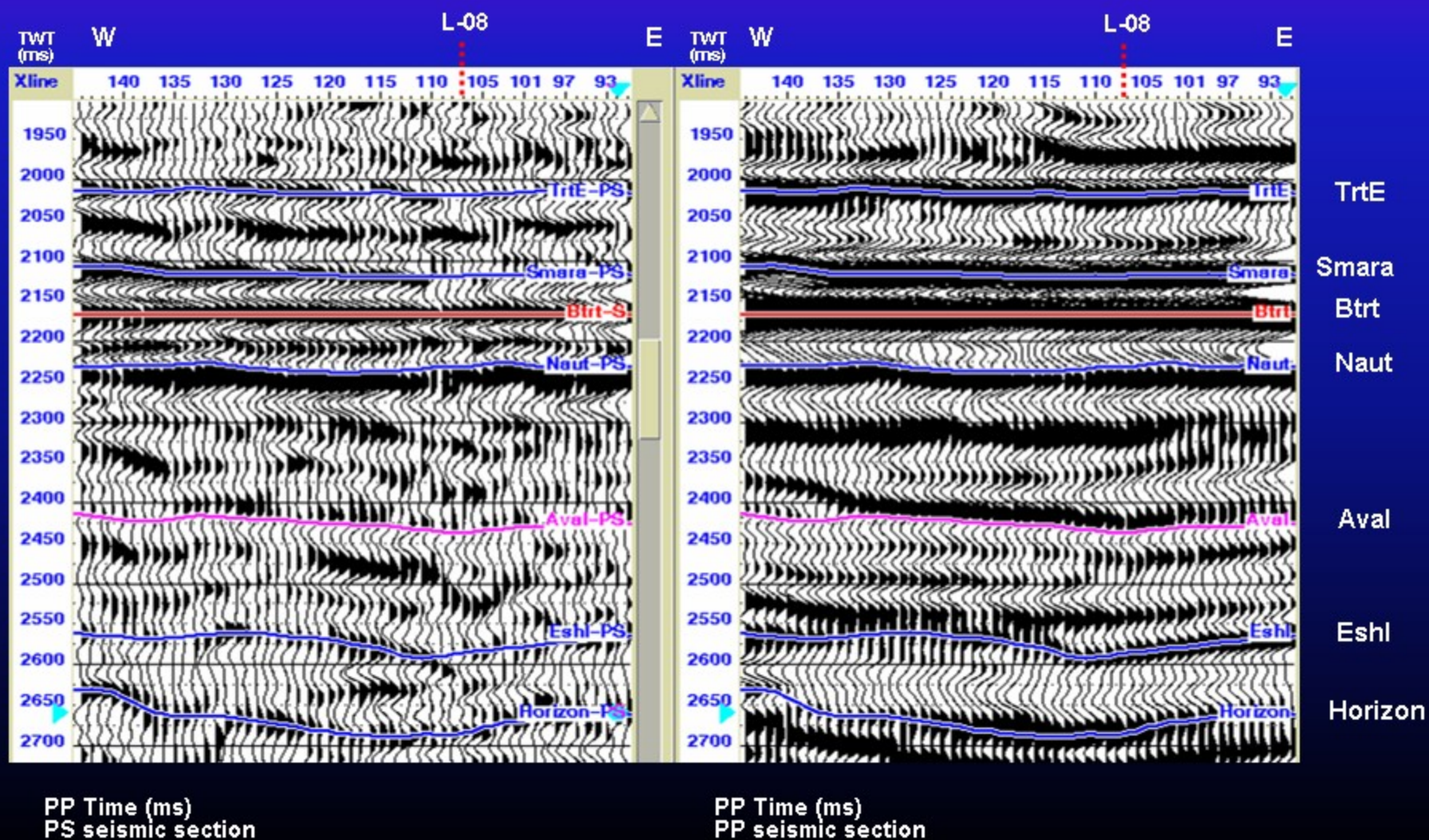
Correlation

OBS P data-Streamer P data

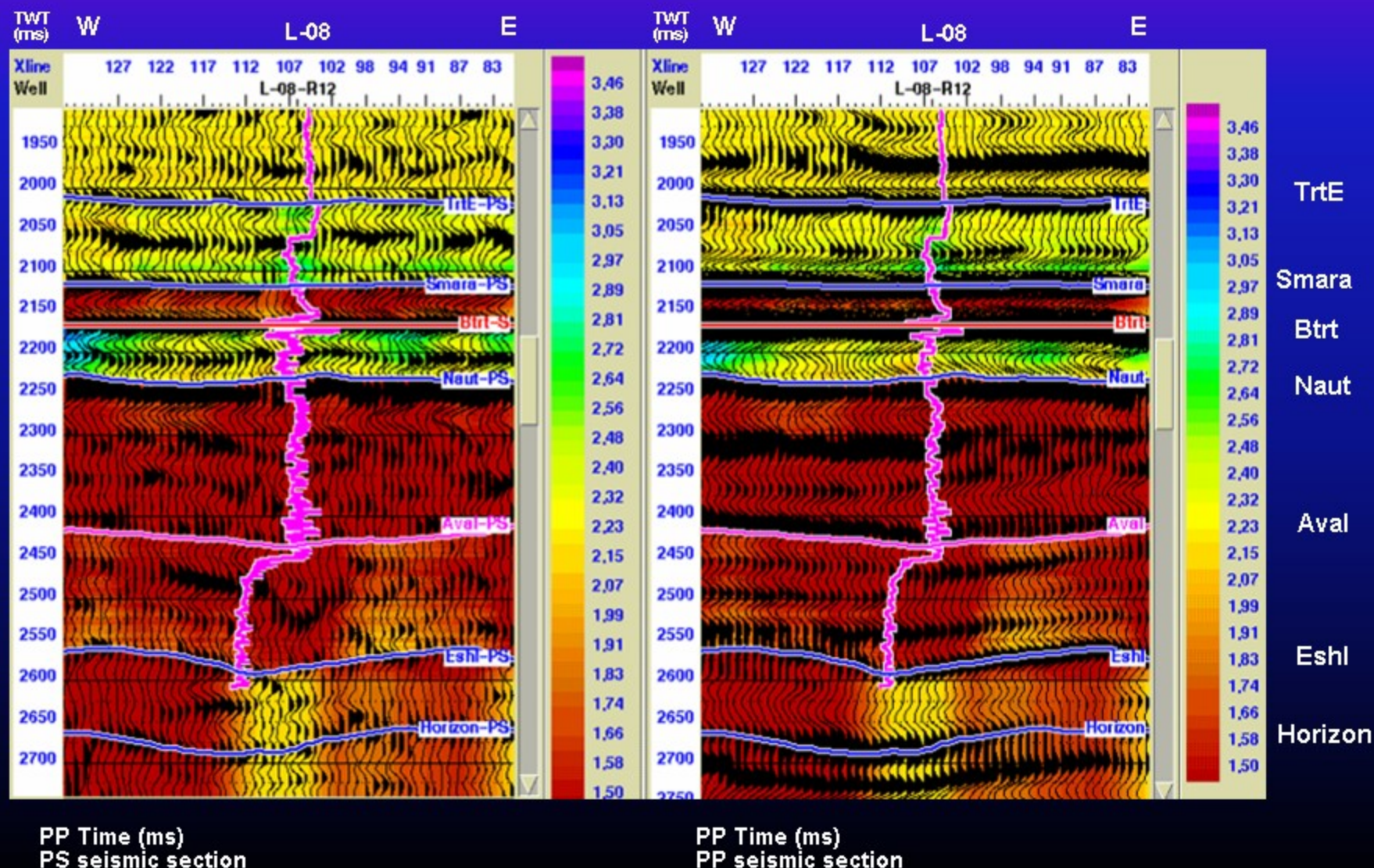


OBS Interpretation

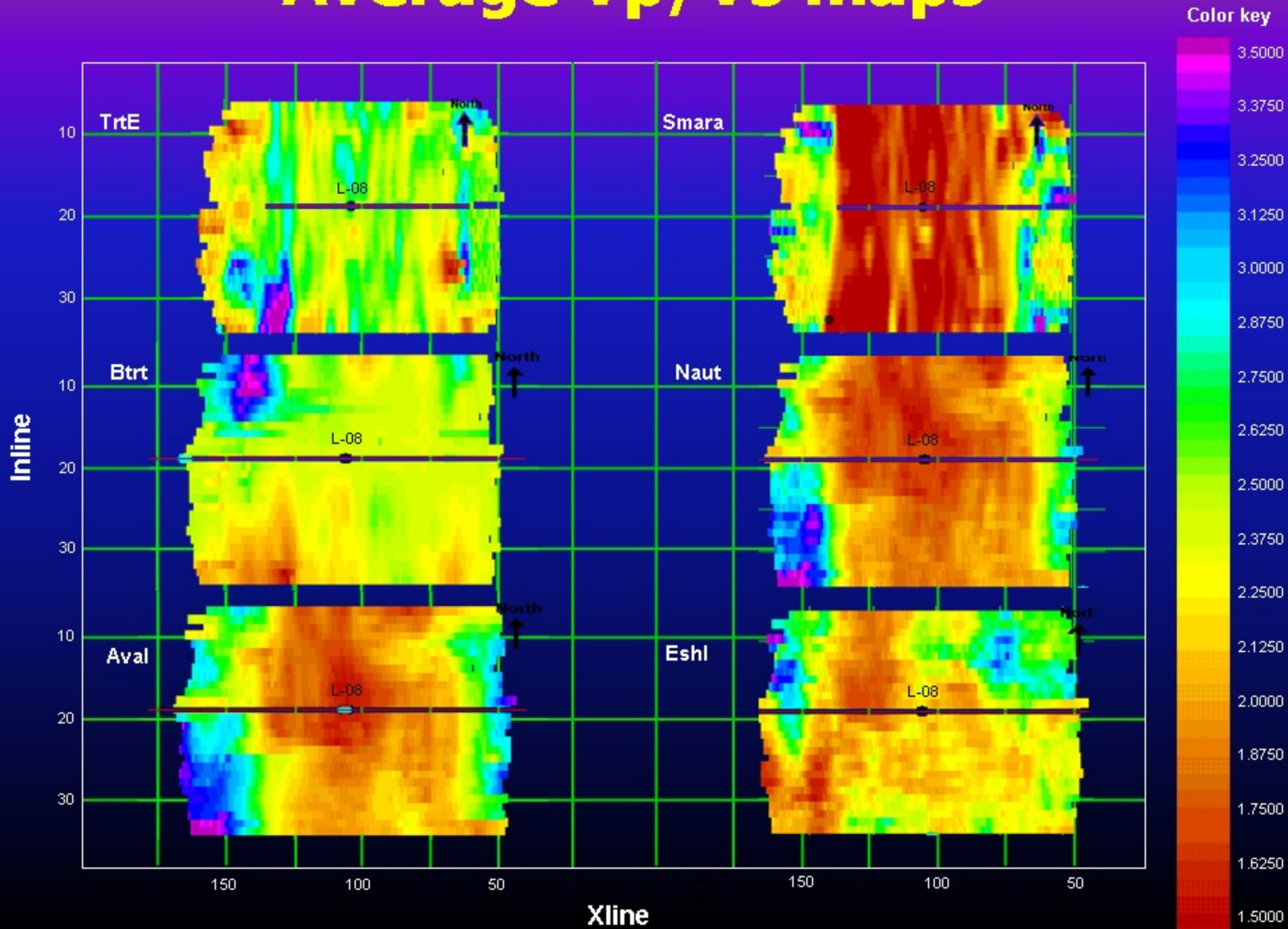
Radial component-Vertical component



Vp/Vs analysis



Average Vp/Vs maps



Conclusions

Conclusions (VSP interpretation)...

- The P-P synthetics seismograms match well with the Offset VSP (PP) field data, with the Walk-above VSP (PP) and the seismic section (PP)
- The P-S synthetic seismograms match well with the Offset VSP (PS) field data
- Comparing the PS to the PP synthetic seismograms and comparing the field results of the Offset VSP (PS) to the offset VSP (PP), the PS images improve the top of the Avalon Formation.
- PS (synthetic and offset VSP data) shows less amplitude loss at the top of the Tertiary unconformity leaving more energy to image below

Conclusions (OBS interpretation)...

- Detailed correlation information from the wells L-08 and H-20 enabled the interpretation of the low impedance contrast between the Avalon and Nautilus Fms on the synthetics
- A reasonable data match was found for:
 - PP synthetics & PP vertical component seismic section (OBS)
 - PS synthetics & PS radial component seismic section (OBS)
- V_p/V_s values from the seismic and the well L-08 are related, presence of lateral V_p/V_s anomalies is evident on the seismic
- Acquiring converted wave with the help of an OBS survey, should help address the different image challenges of White Rose field.

Acknowledgements

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