

Analysis of multicomponent walkaway vertical seismic profile data

CREWES Project
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Outline



- Introduction
- VSP processing
- Interpretation
- Summary and future work
- Acknowledgements

Objectives



- Image PP and PS data from VSP
- Study the AVO response with 3C walkaway VSP
- Obtain rock properties by PP-PS joint inversion and better characterize formations

Why 3C walkaway VSP data?



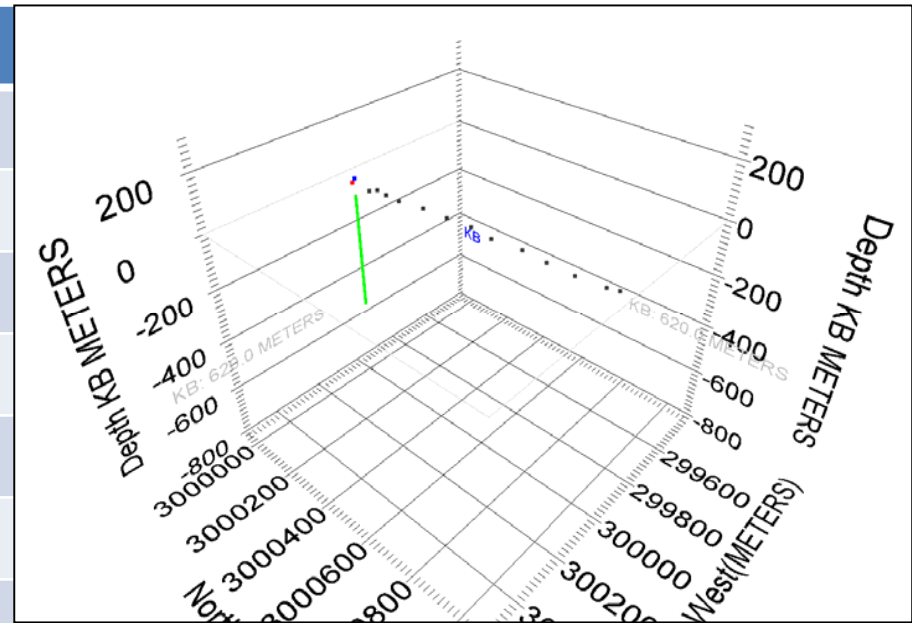
- High S/N, broad-band data
- Deterministic deconvolution
- Can obtain reflection coefficients
- Walkaway VSP(offset VSP) geometry ideal for AVO analysis
- Converted-wave data enhances traditional compressional wave exploration

3C walkaway VSP acquisition



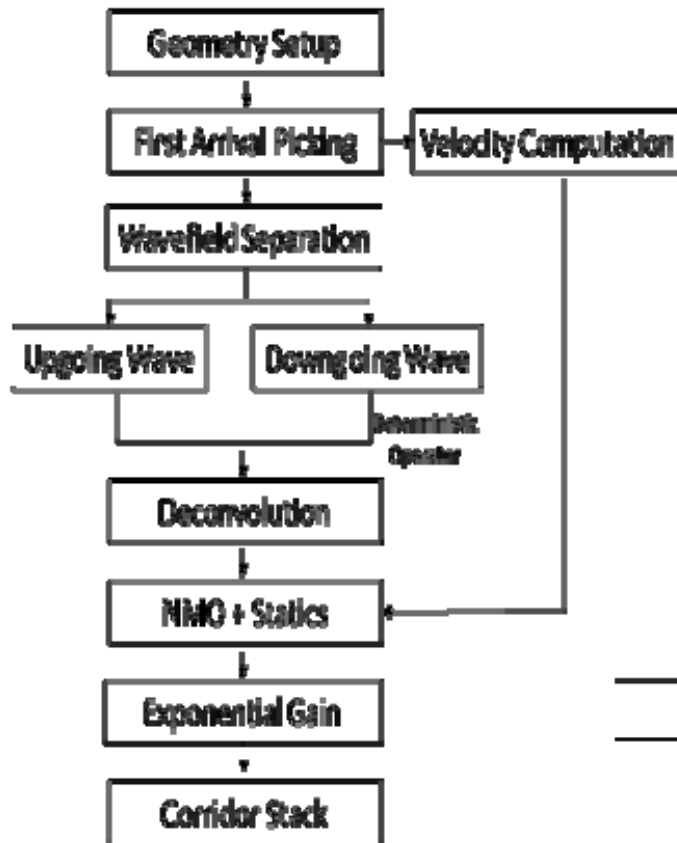
Acquisition parameters & geometry

	Dynamite	Vibroseis
Receiver type	VectorSeis	VectorSeis
Number of receivers/spacing	220/2m	220/2m
Receiver depth (m)	55-507	55-507
Sample rate(ms)	1	1
Record length (s)	3	3
Offset(m)	11.5-1031	11.5-1031
Source depth/elevation(m)	9/612-622	612-622
Charge (kg)/ Sweep	0.125	EnviroVibe, 10-300Hz, over 20s, linear, one sweep per vibe point, 100/1000ms taper
Borehole	562m TD, vertical, no fluids in borehole	

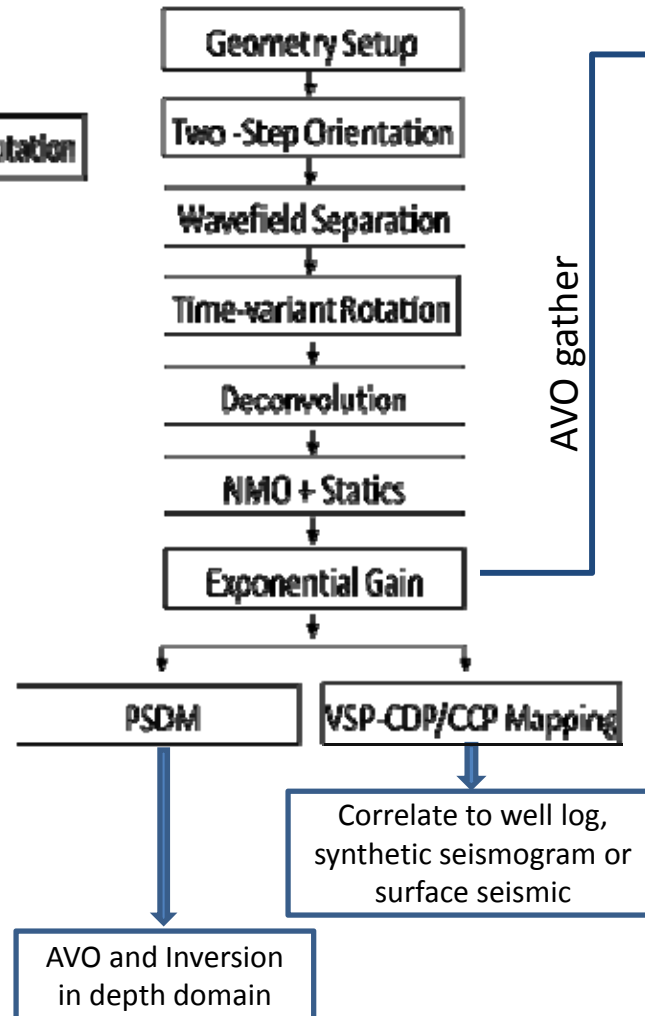


Processing flows

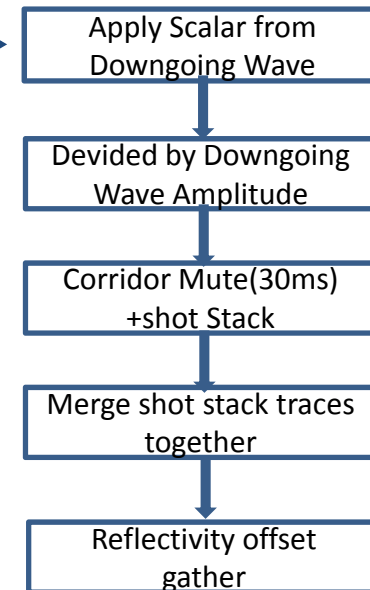
Zero-offset VSP



Walkaway VSP

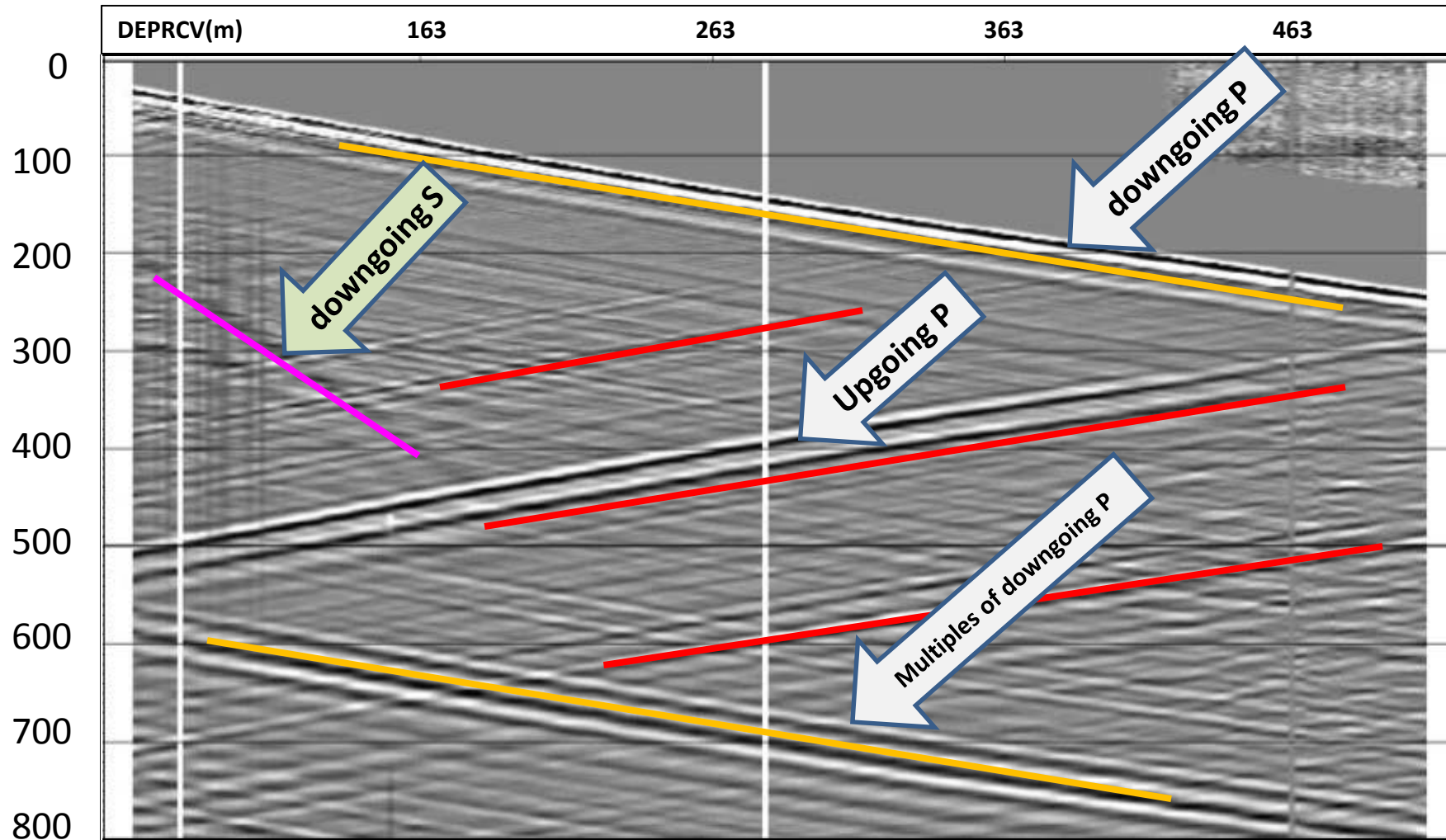


AVO gather



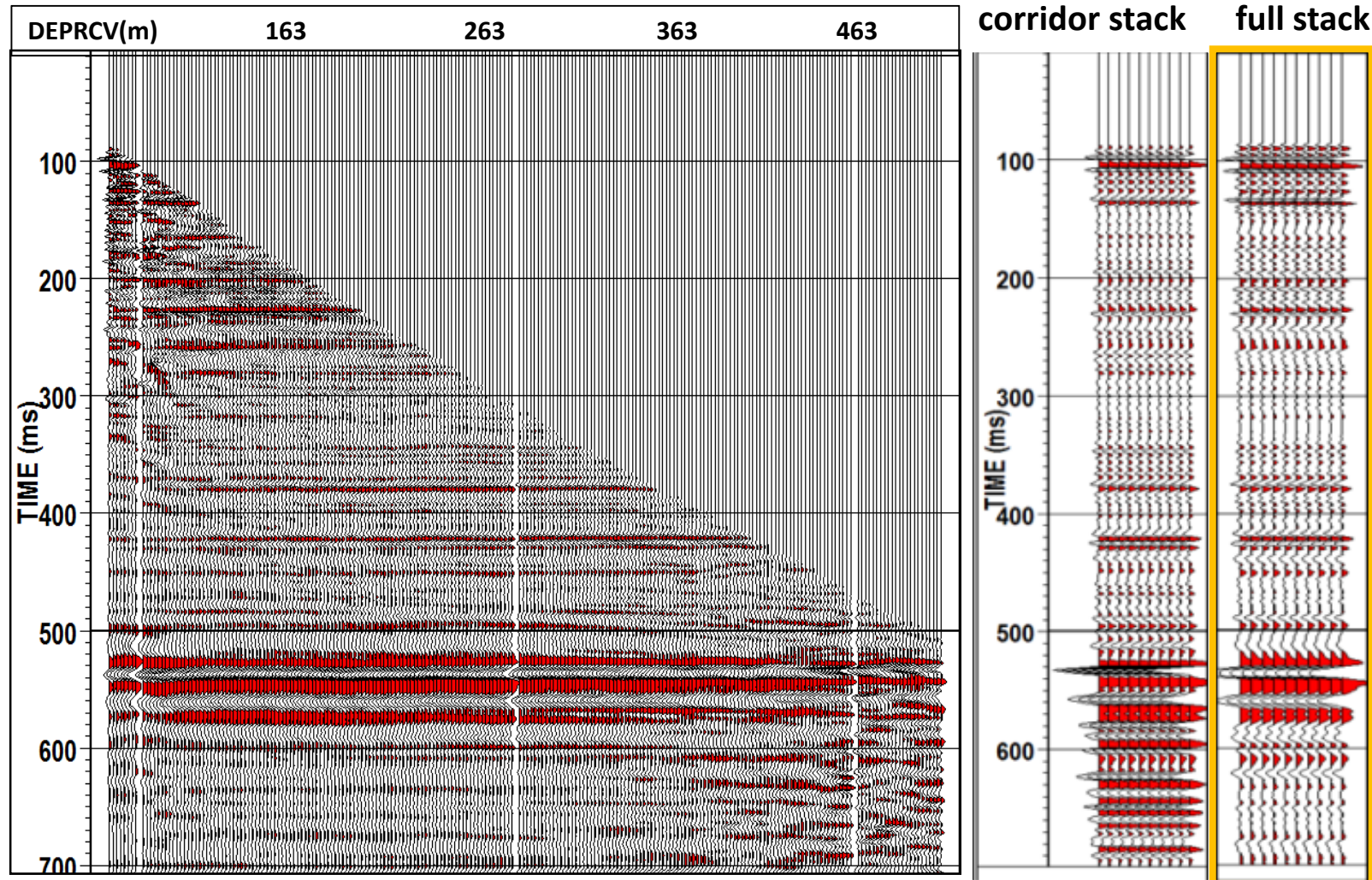
AVO gather

Wavefield analysis – zero-offset VSP



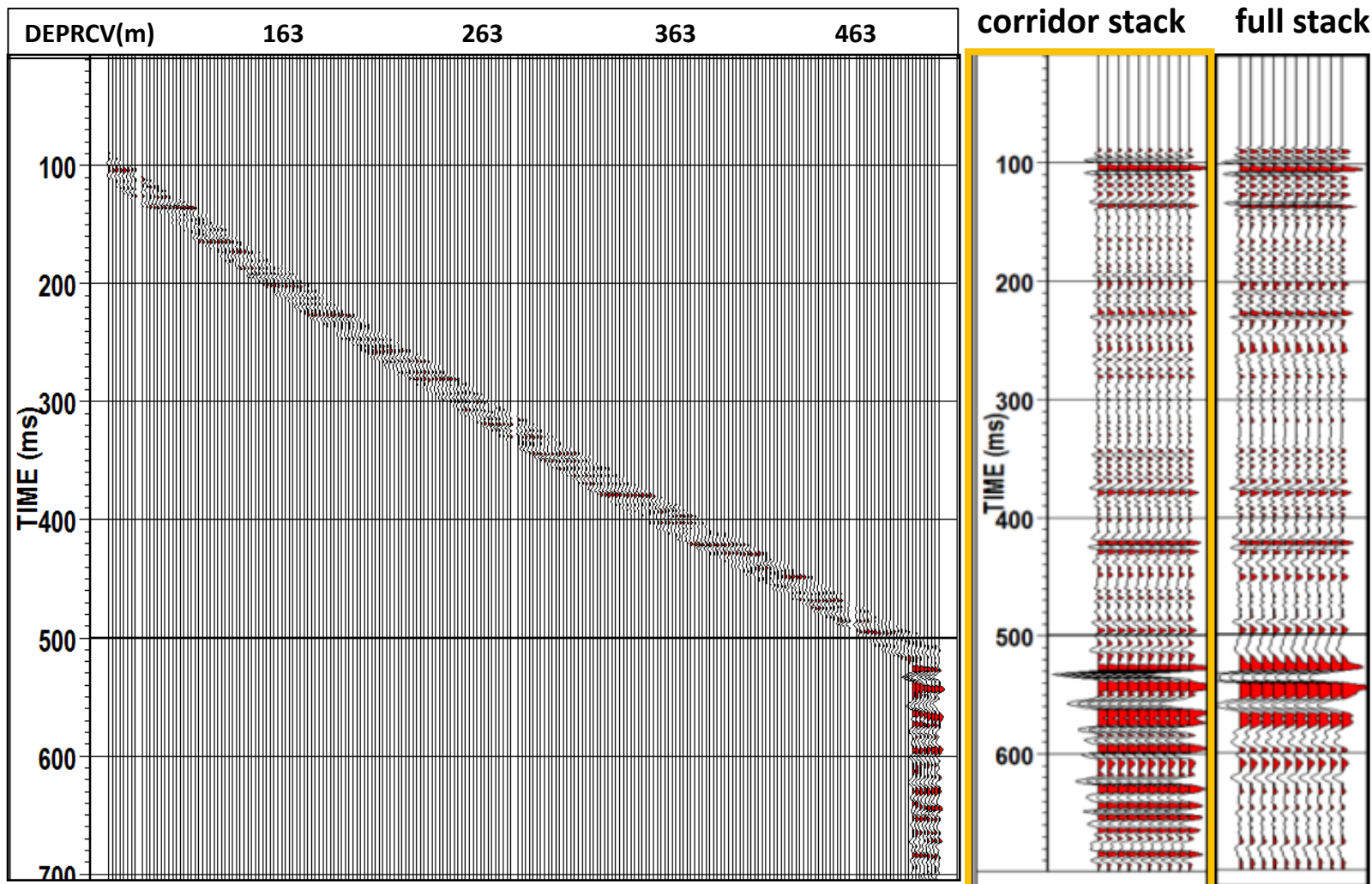
Dynamite zero-offset vertical component

Zero-offset VSP



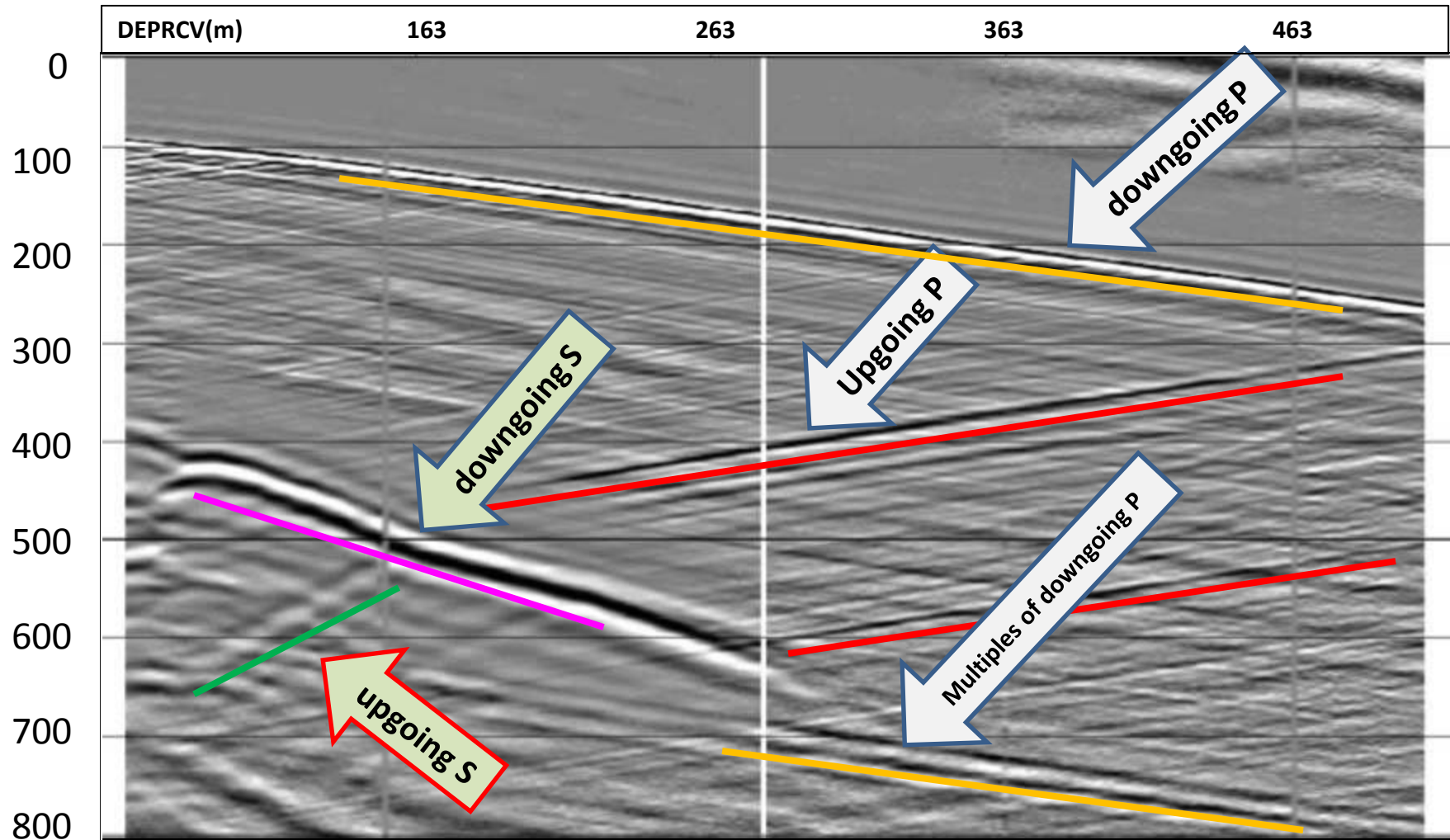
Shot1 - Processed shot gather, corridor stack and full stack

Zero-offset VSP



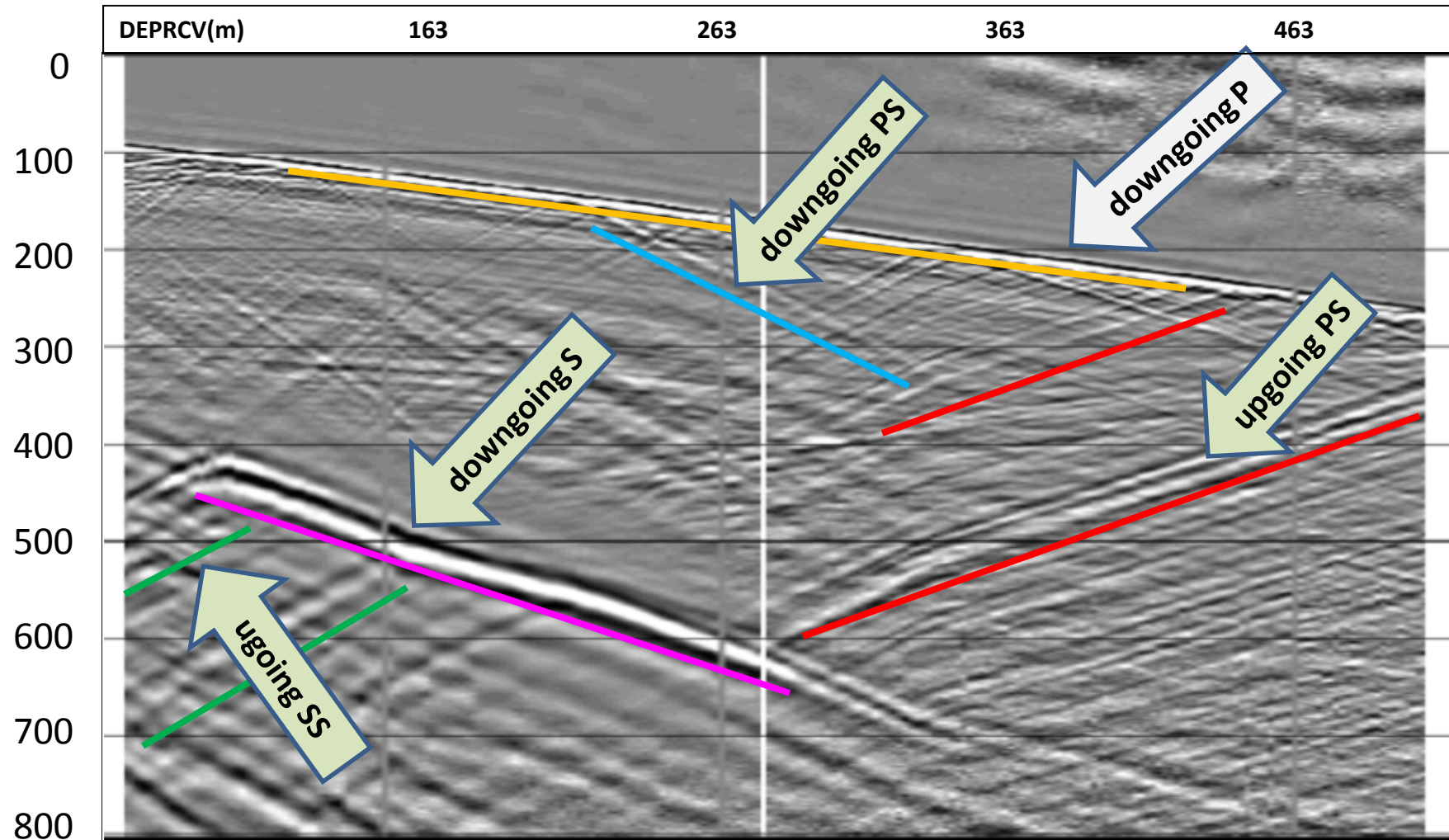
Shot1 - Processed shot gather(after corridor mute), corridor stack and full stack

Wavefield analysis – offset VSP



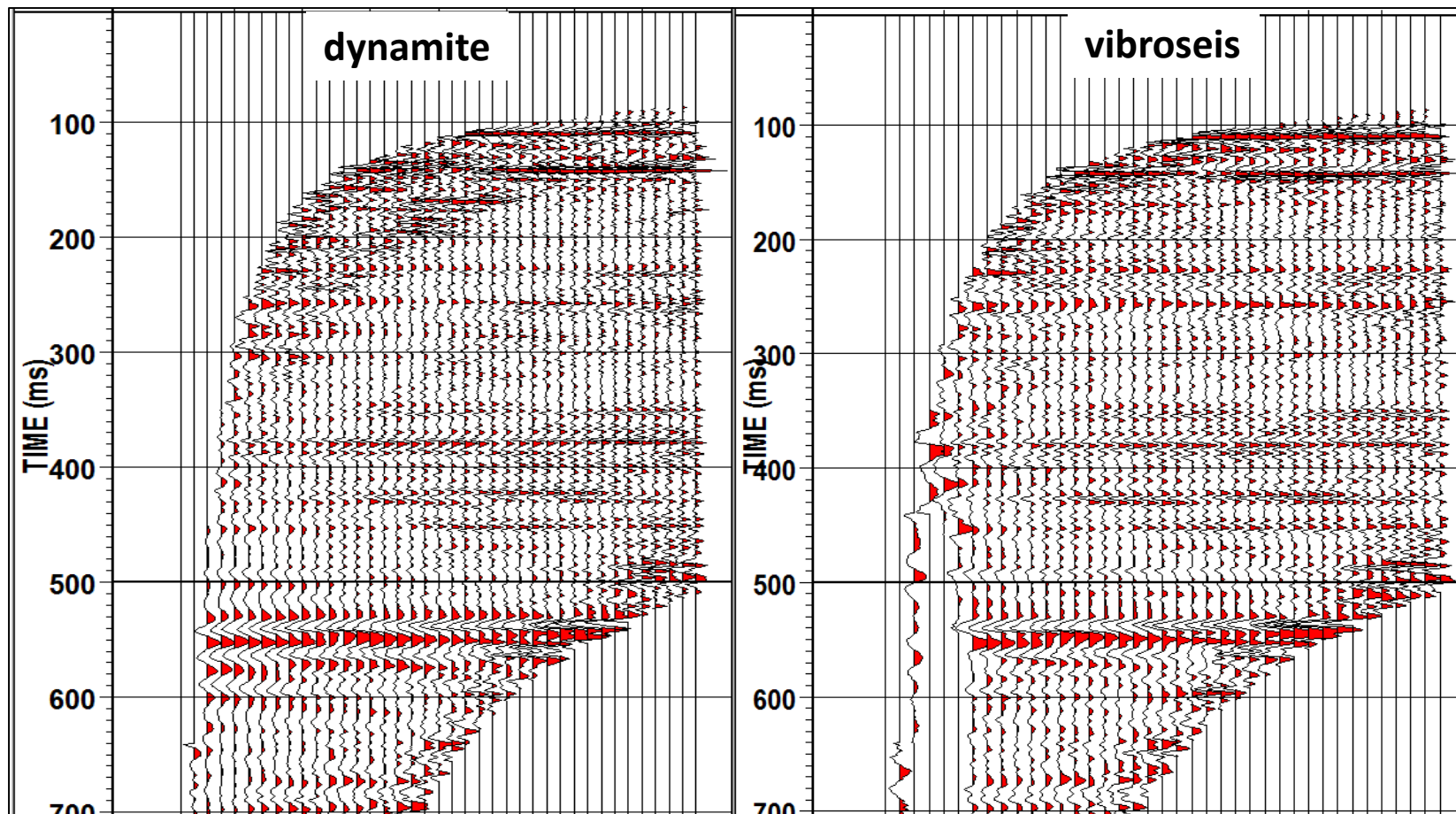
Vibroseis, Offset=153m, vertical component

Wavefield analysis – offset VSP



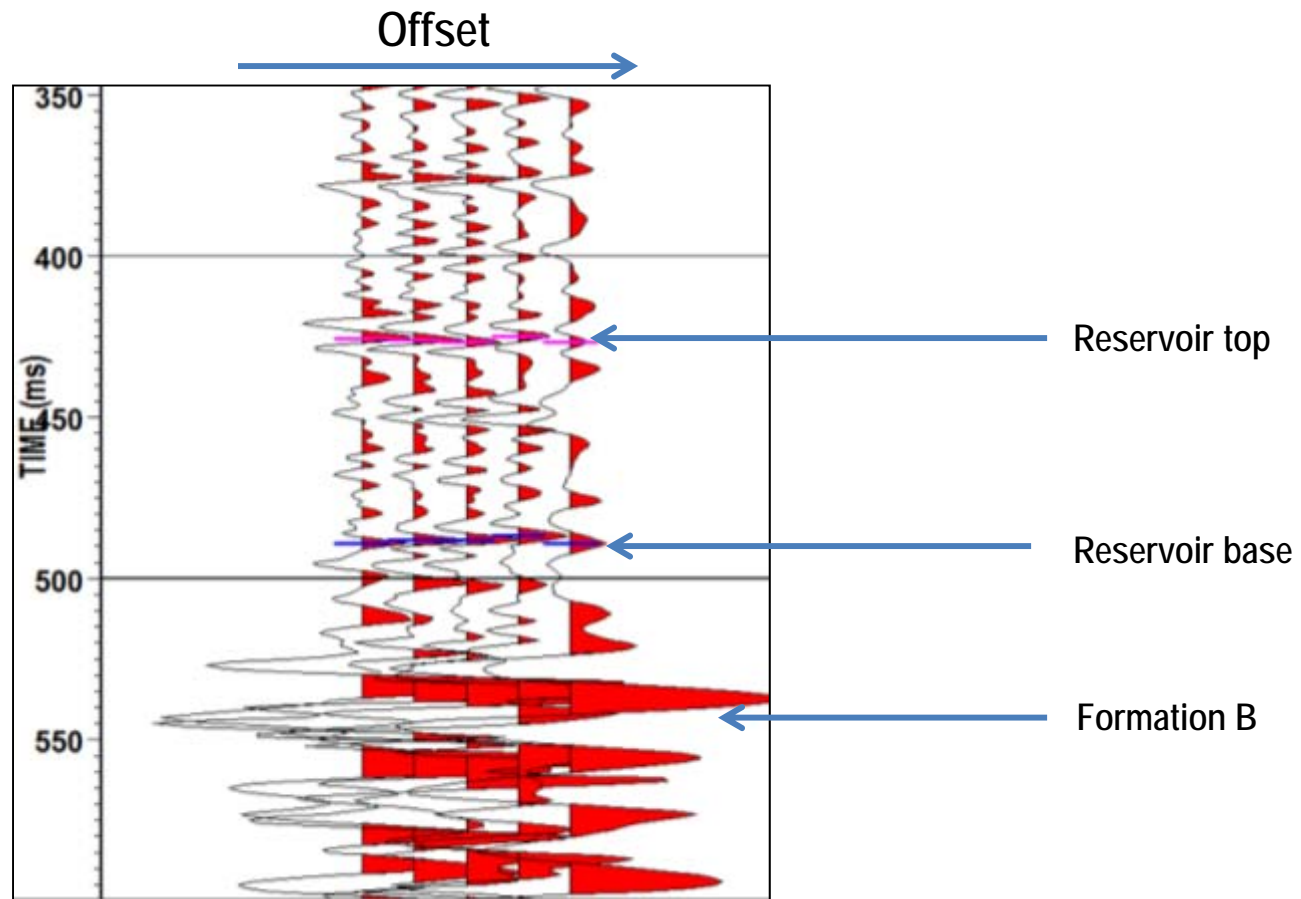
Hmax component(after horizontal rotation)

VSP-CDP mapping



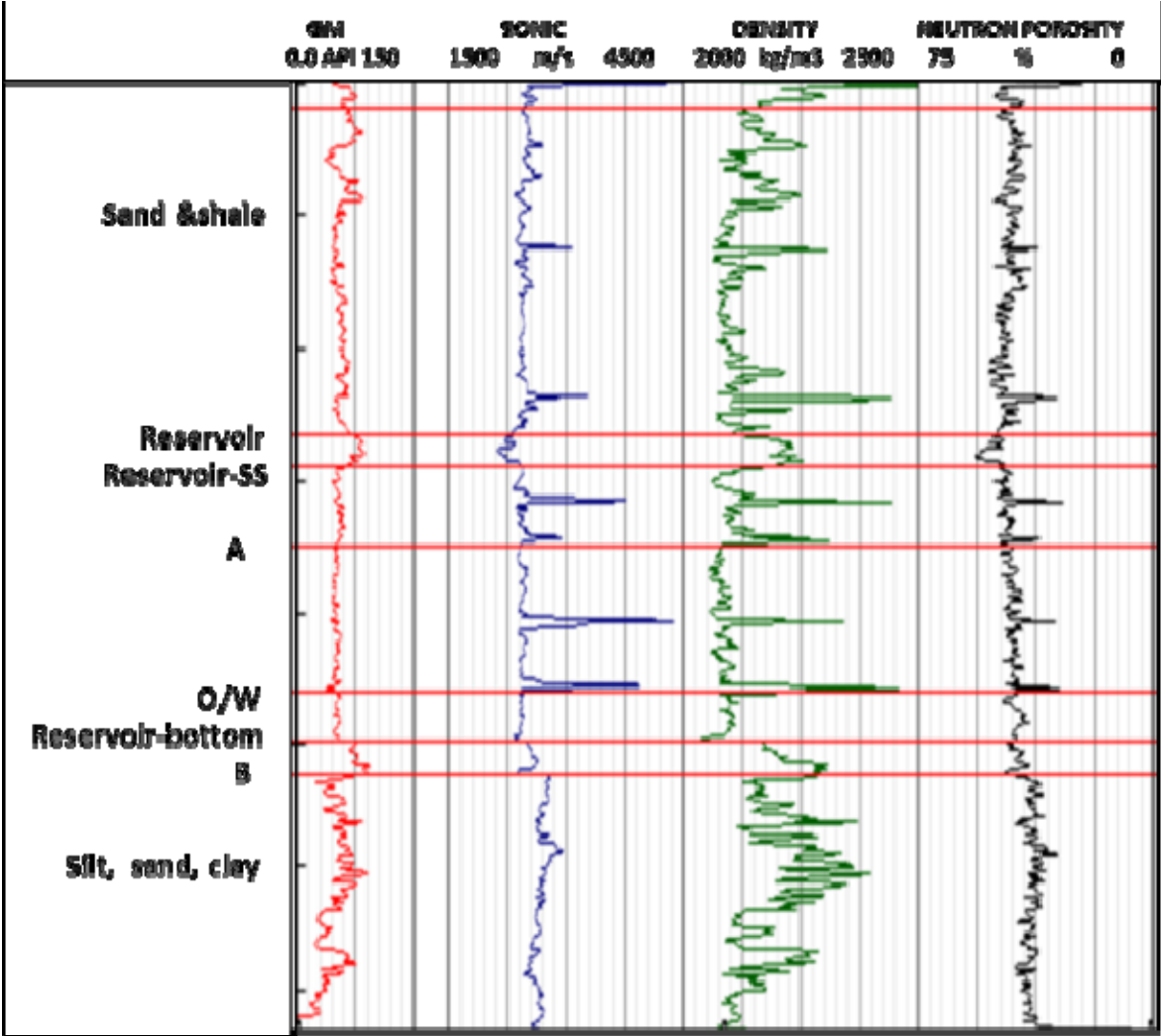
grid size=2m, AGC window=200ms

Reflectivity gather



Common shot reflectivity gather (offset=11.5-308m)

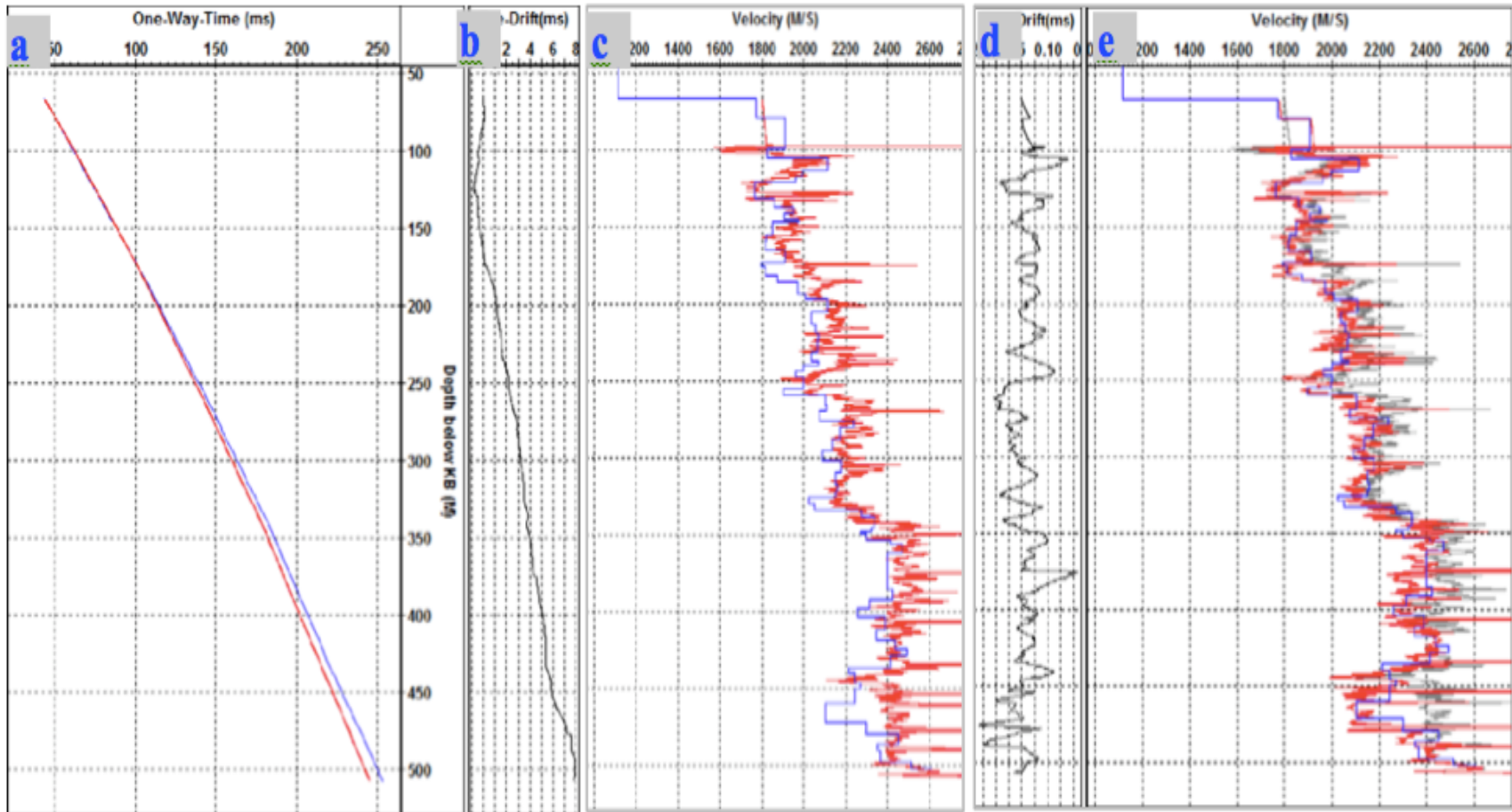
Well log analysis



Logs from well A



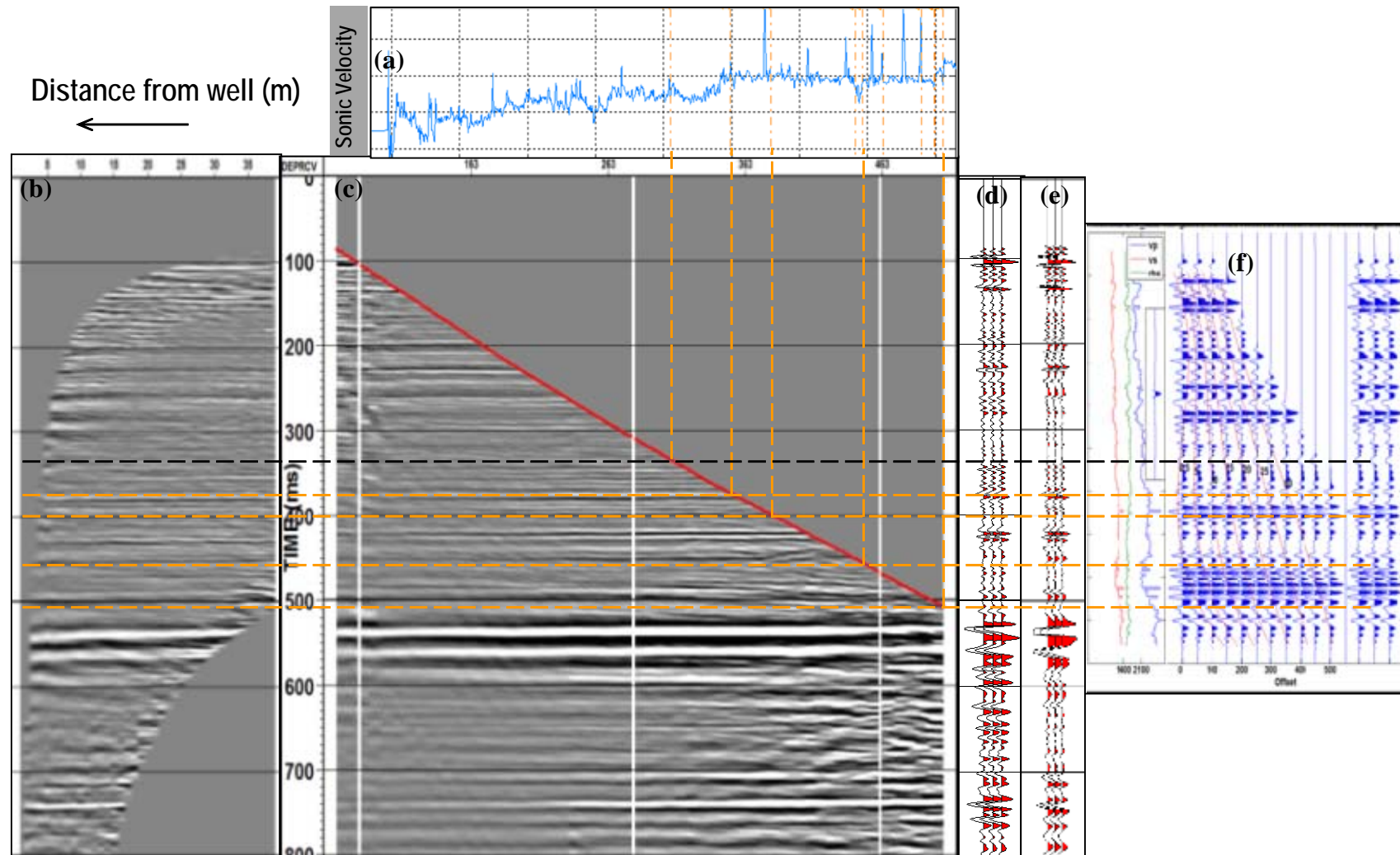
Well log calibration



Sonic log calibration



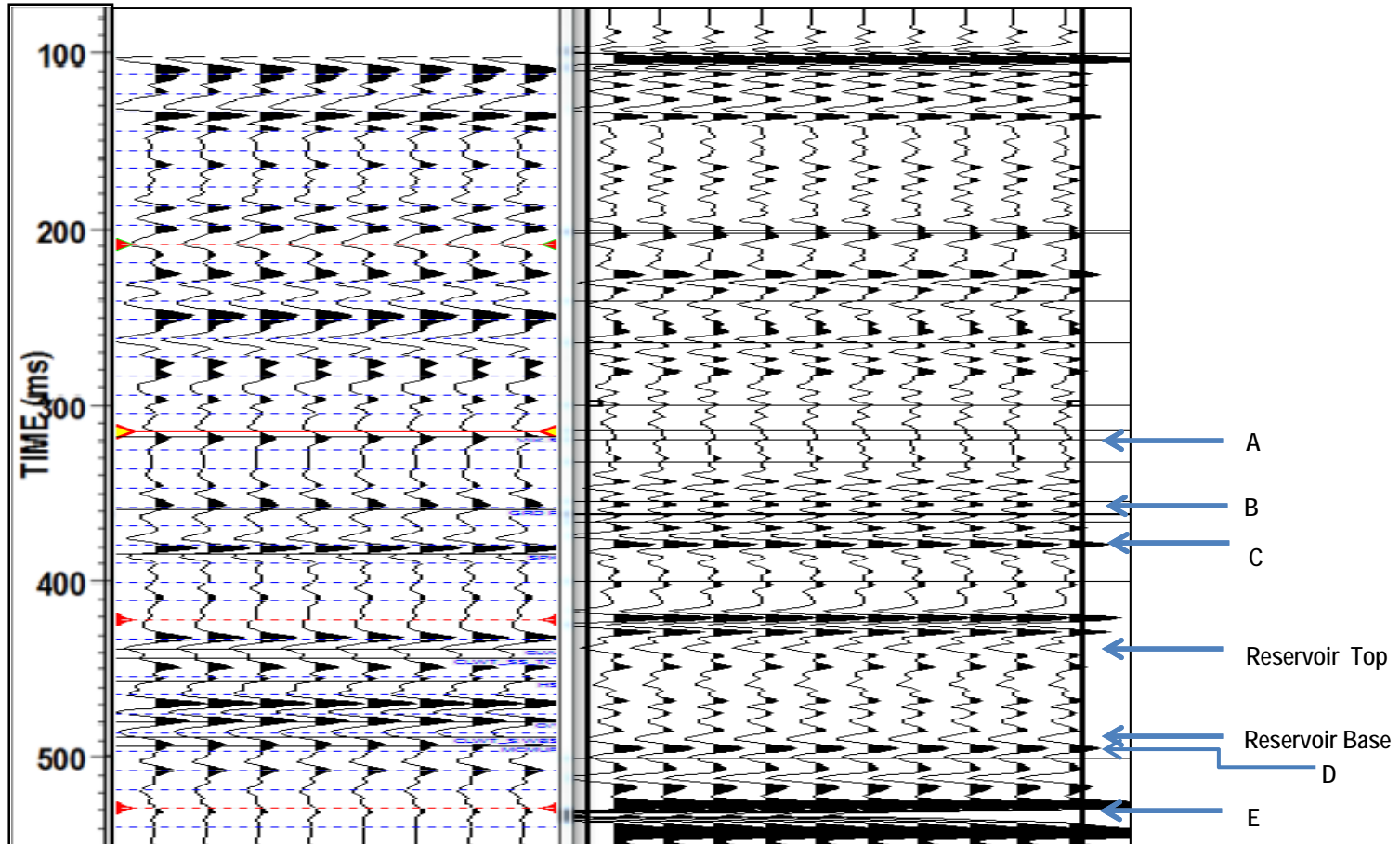
Correlation -1



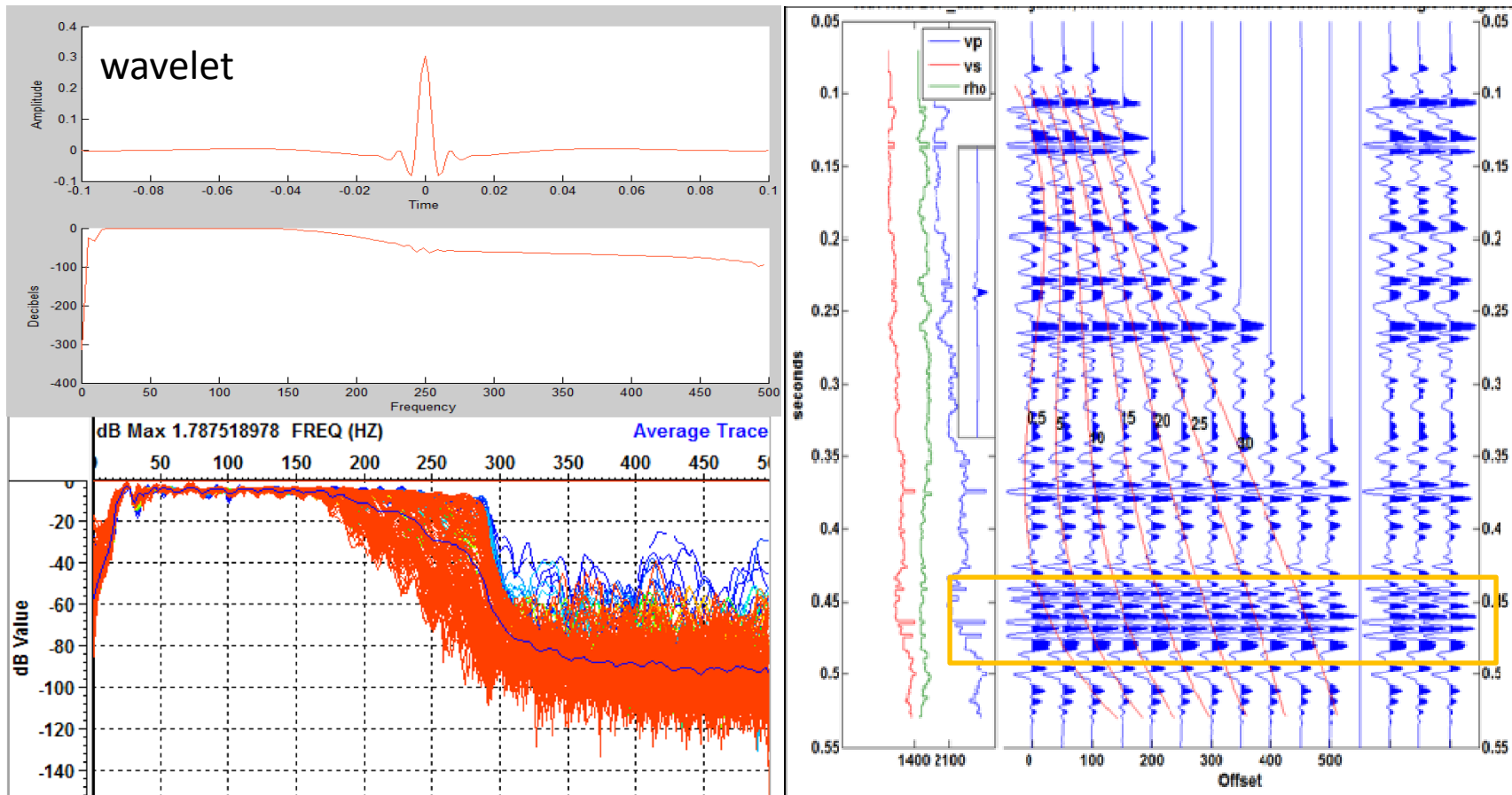
Correlation -2

zero-offset synthetic
seismogram

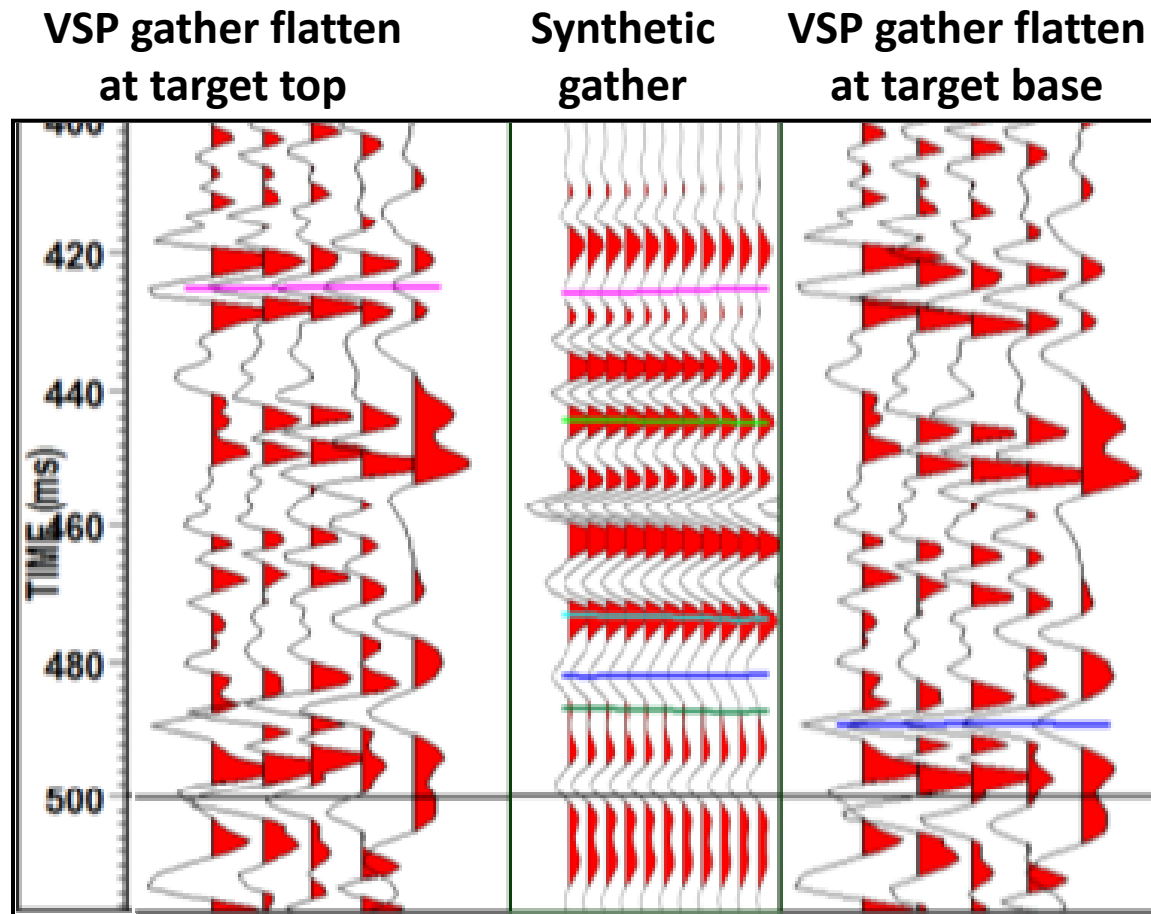
VSP corridor stack



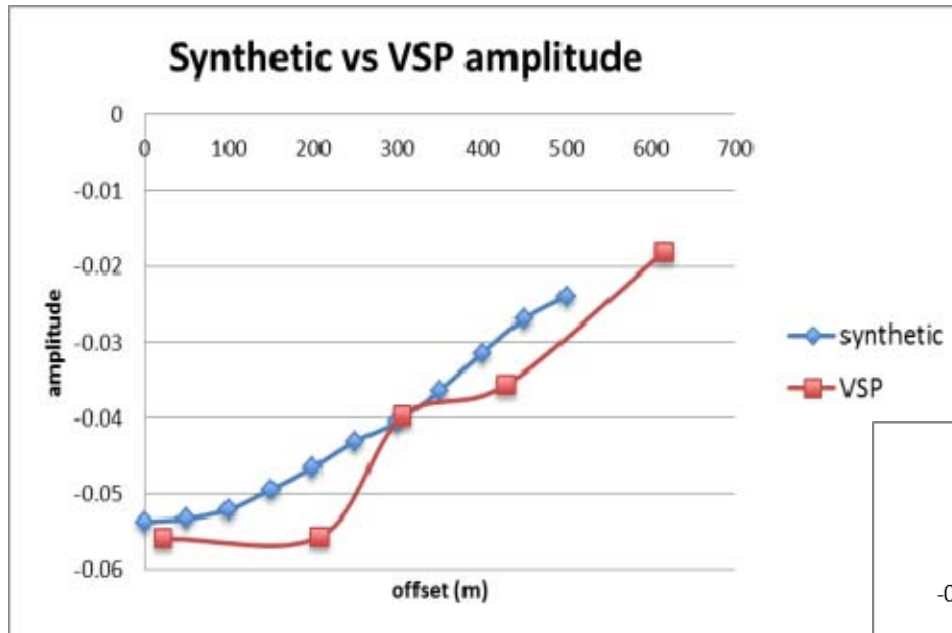
Synthetic seismogram - PP



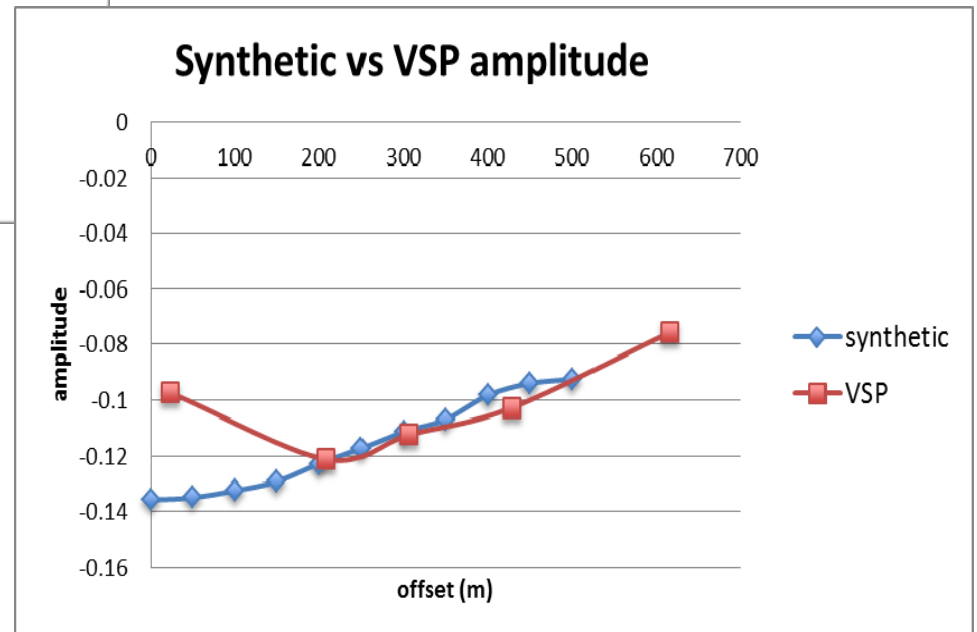
Correlation of synthetic and VSP gather



Comparison of AVO responses



AVO response of the top of target



AVO response of the bottom of target

Summary and future work



- The PP wave of walkaway VSP data has been processed and applied in AVO study successfully
- On top and bottom of the reservoir, the PP wave AVO responses of VSP and synthetic seismogram show similar trends. The results give us promise of rock properties inversion.
- Robust interpretation has been achieved

In the future:

- Build up an accurate velocity model of PS wave data, process and interpret it
- AVO cross-plot analysis
- Further study rock properties through PP – PS joint inversion



Acknowledgements



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