Initial 3C-2D surface seismic and walkaway VSP results from the 2015 Brooks SuperCable experiment

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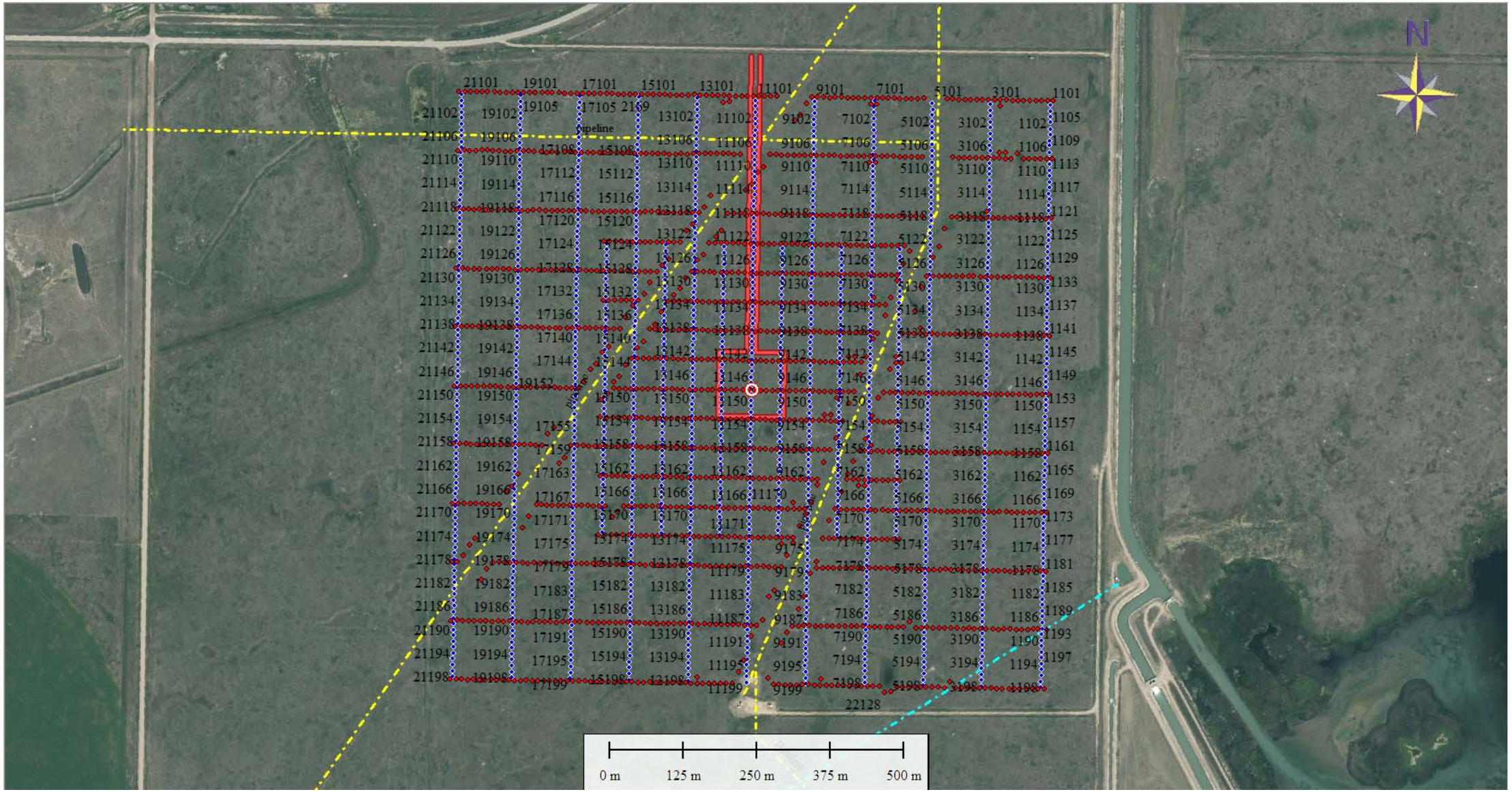
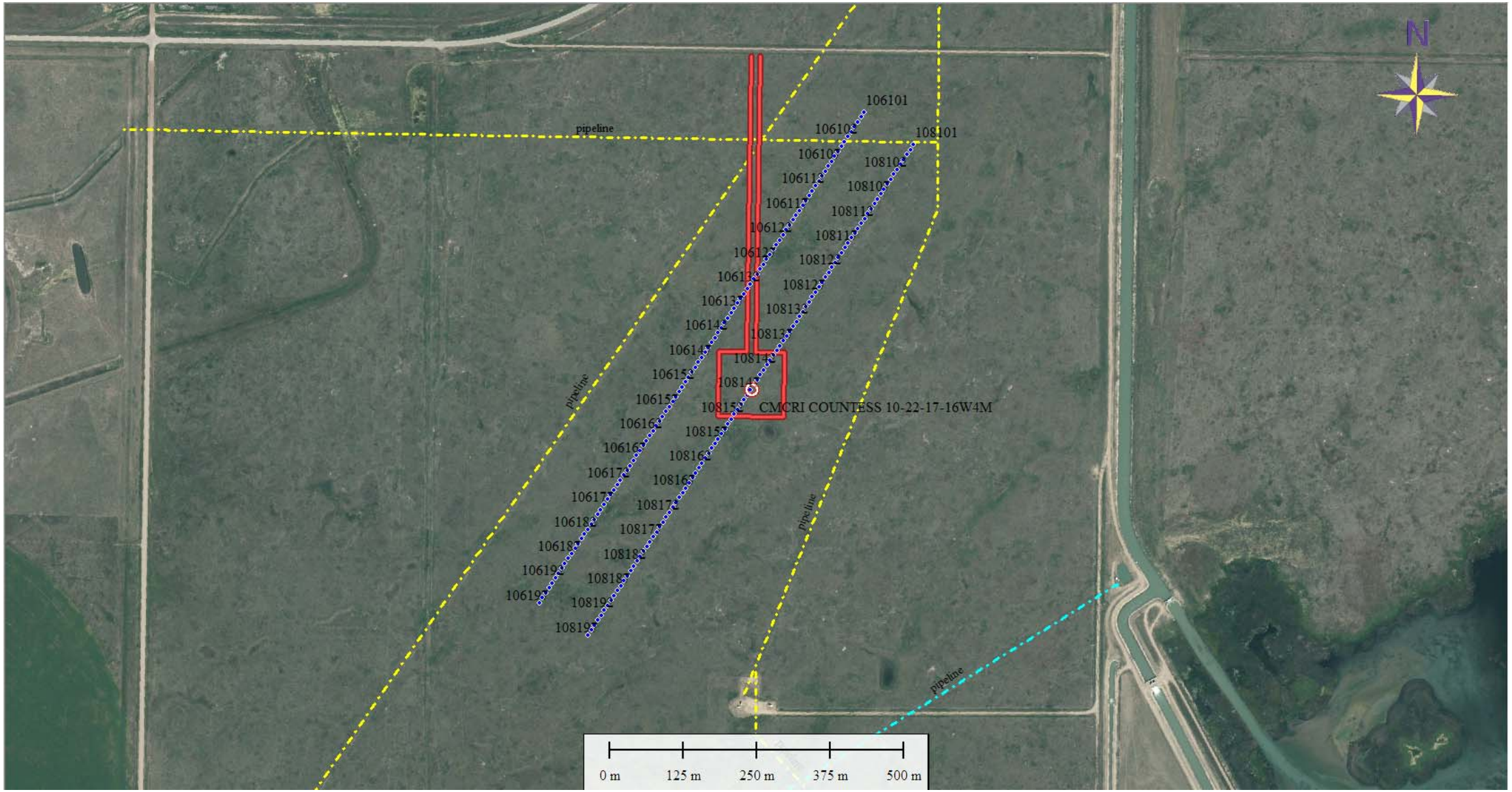
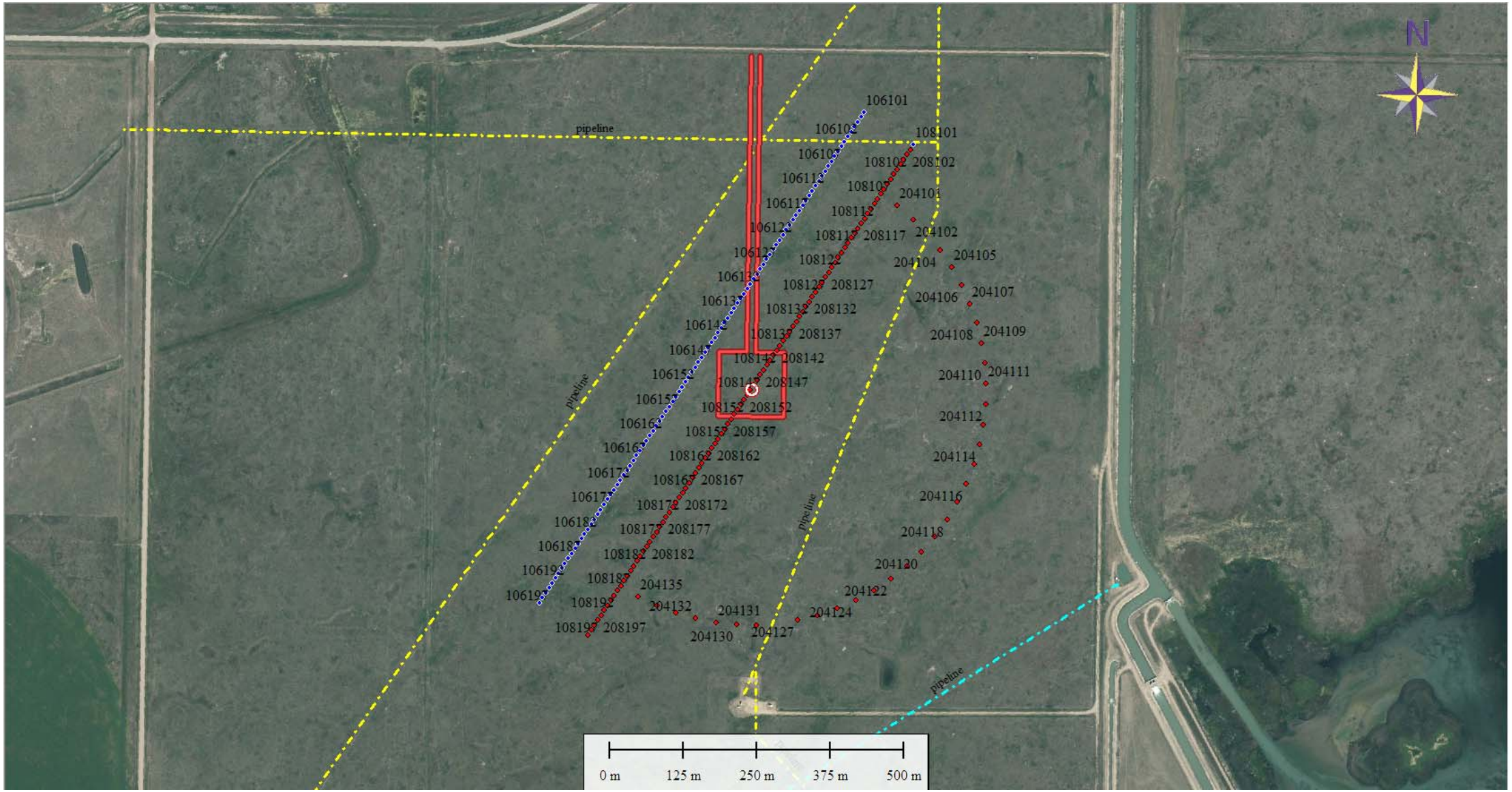
Survey map: 2014 3C-3D, conducted before the well was drilled



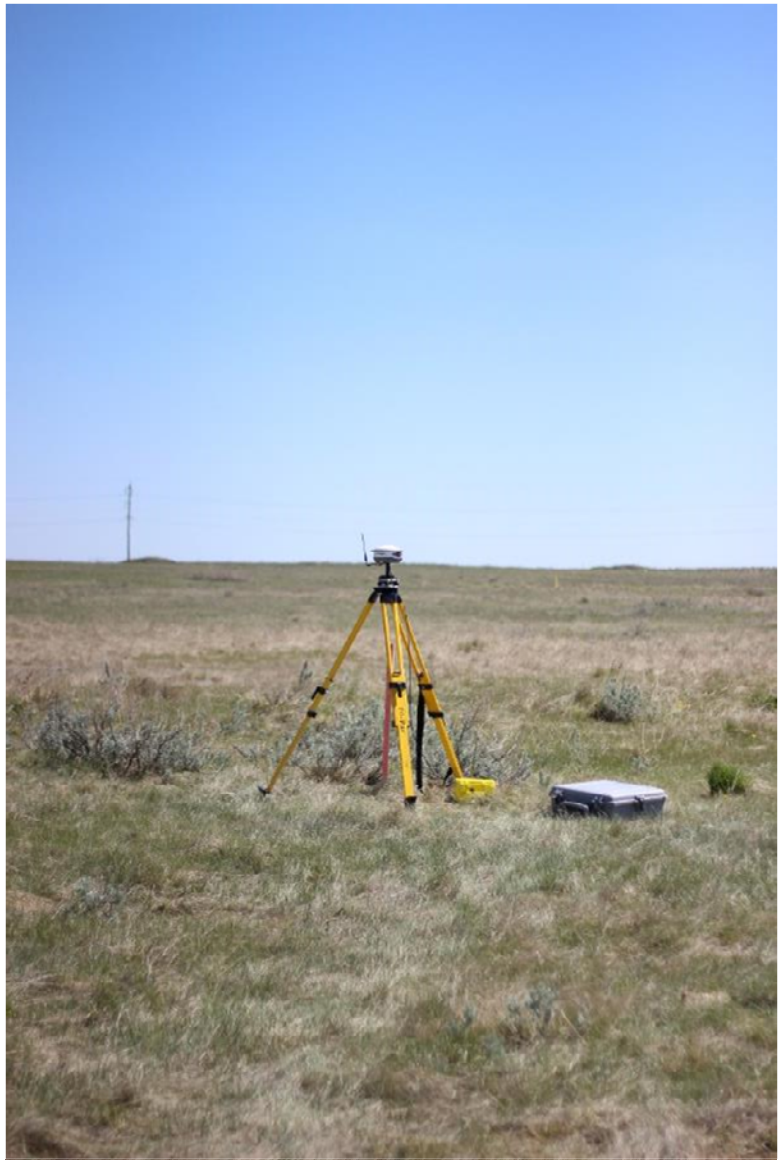
Survey map: 2015 VSP, surface receiver lines 106, 108



Survey map: 2015 VSP, surface source lines 204, 208



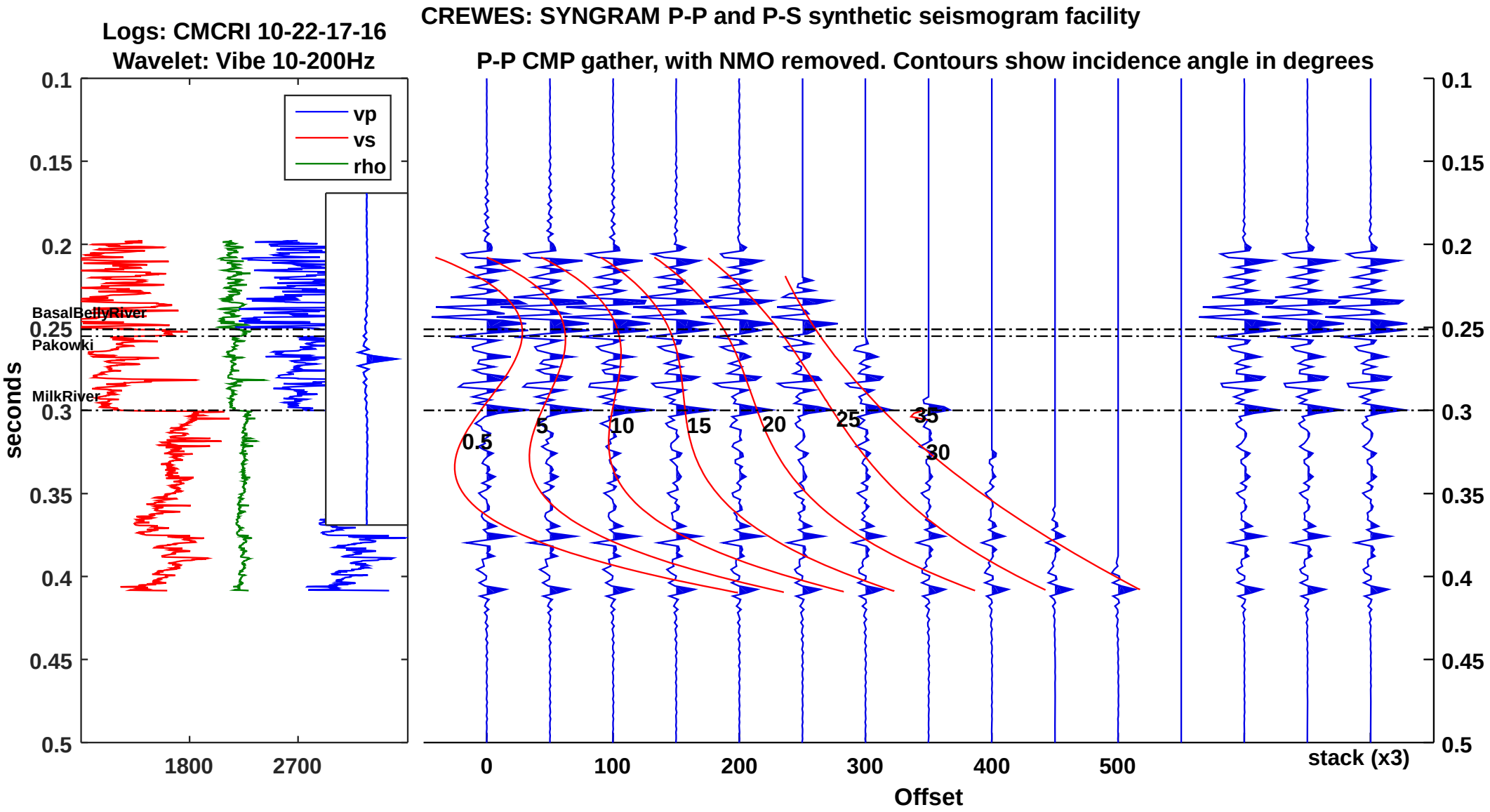
GPS Survey



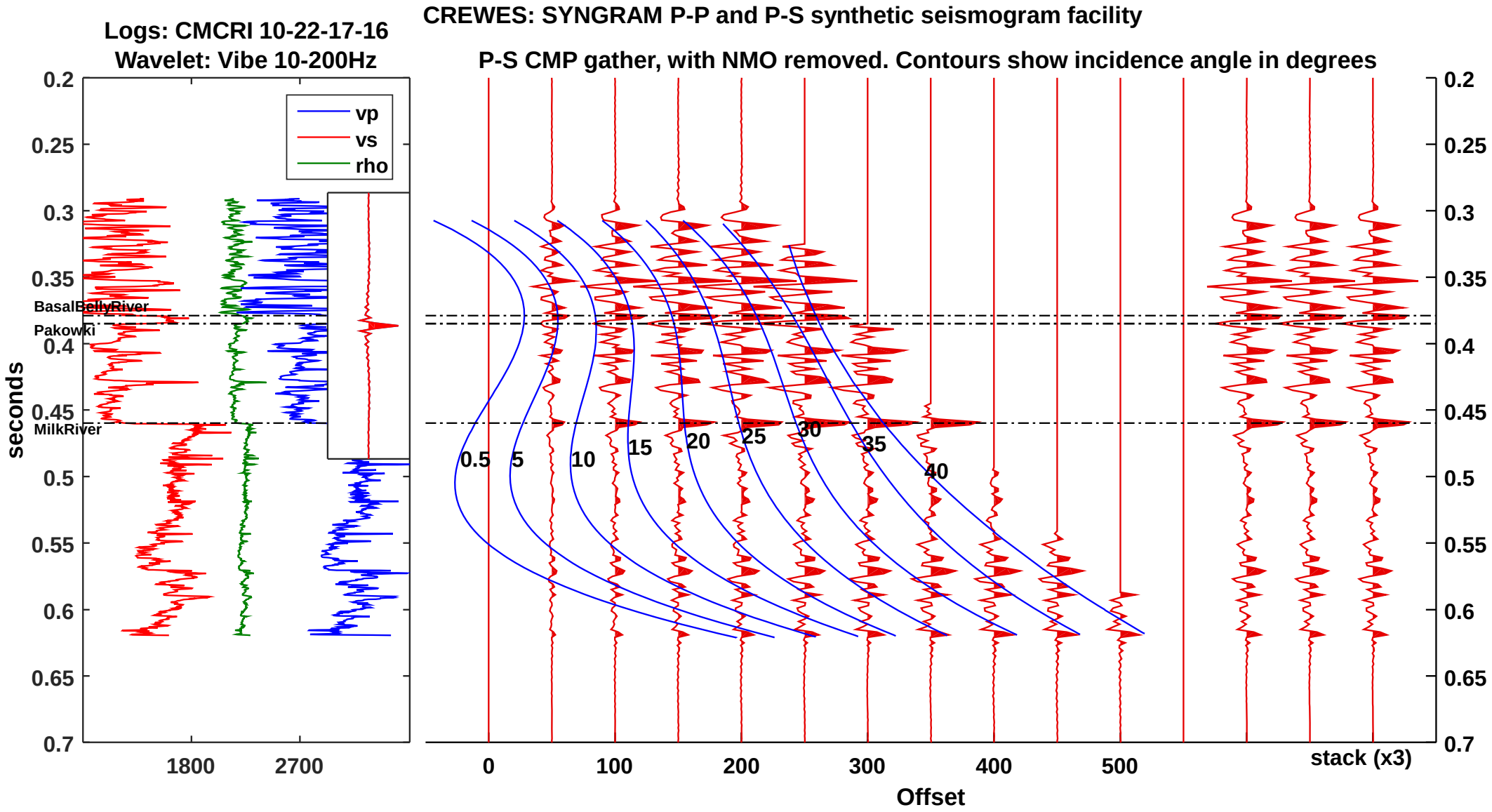
IVI EnviroVibe at north end of source line 208

Well site

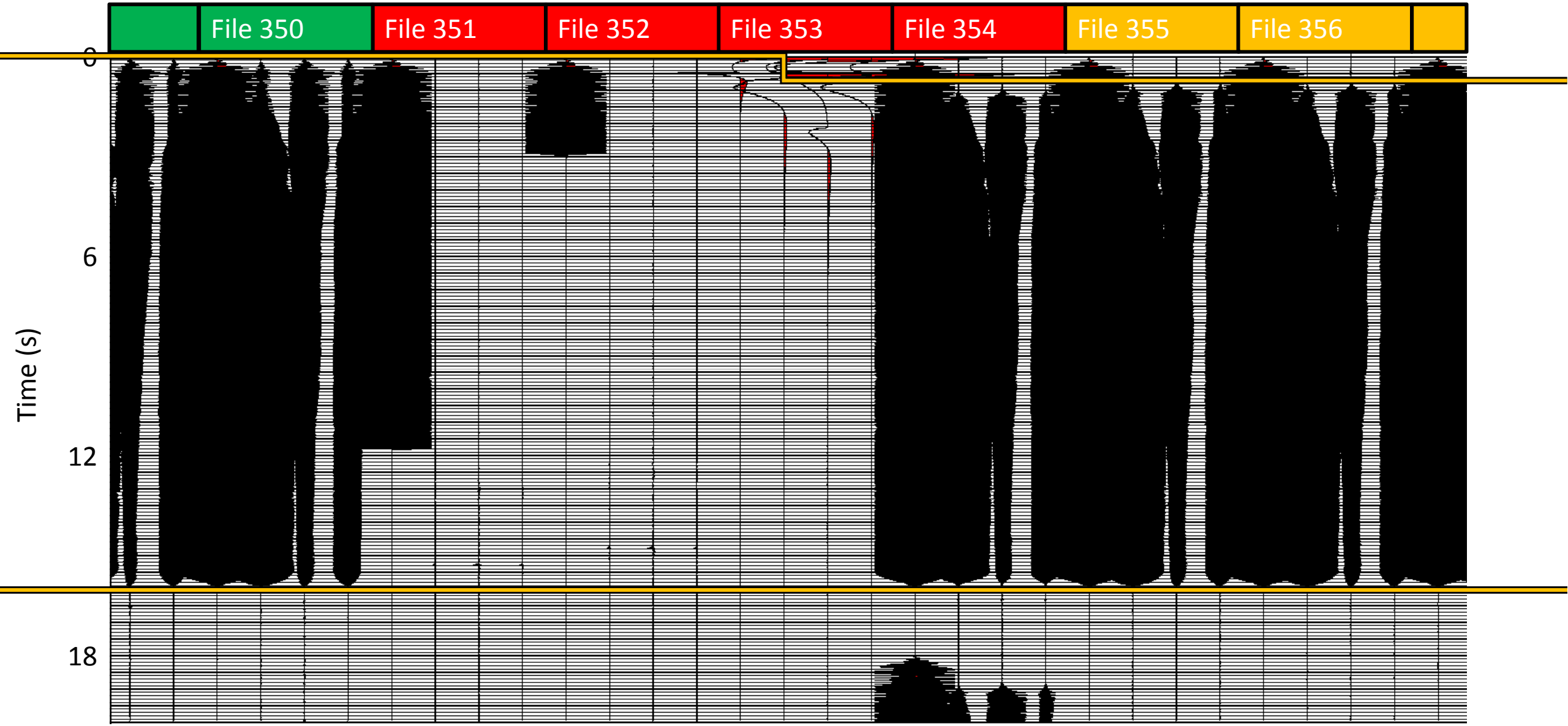
P-P Synthetic seismogram from well logs



P-S Synthetic seismogram from well logs

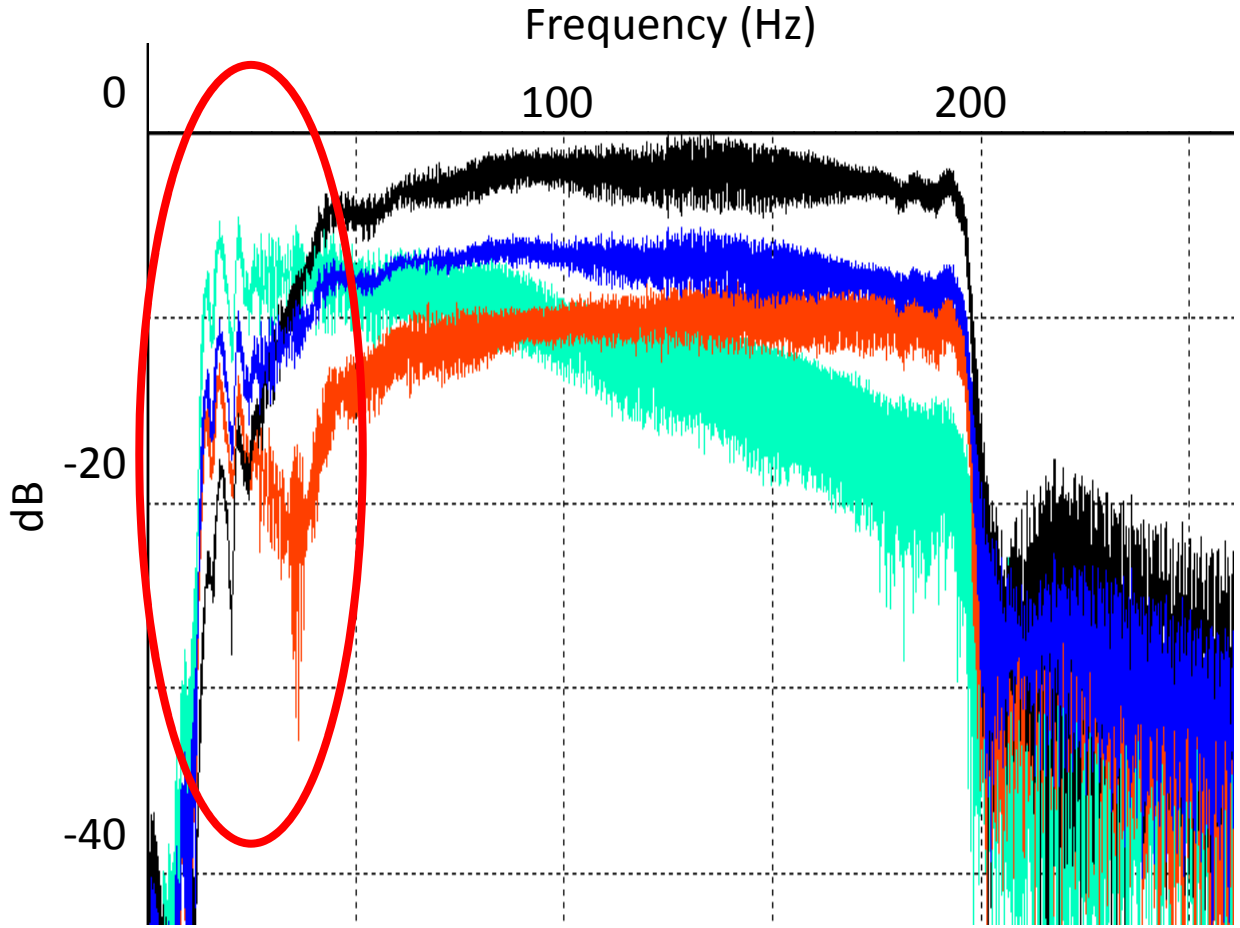


Geode Aux traces before and after Vibe decoder reset

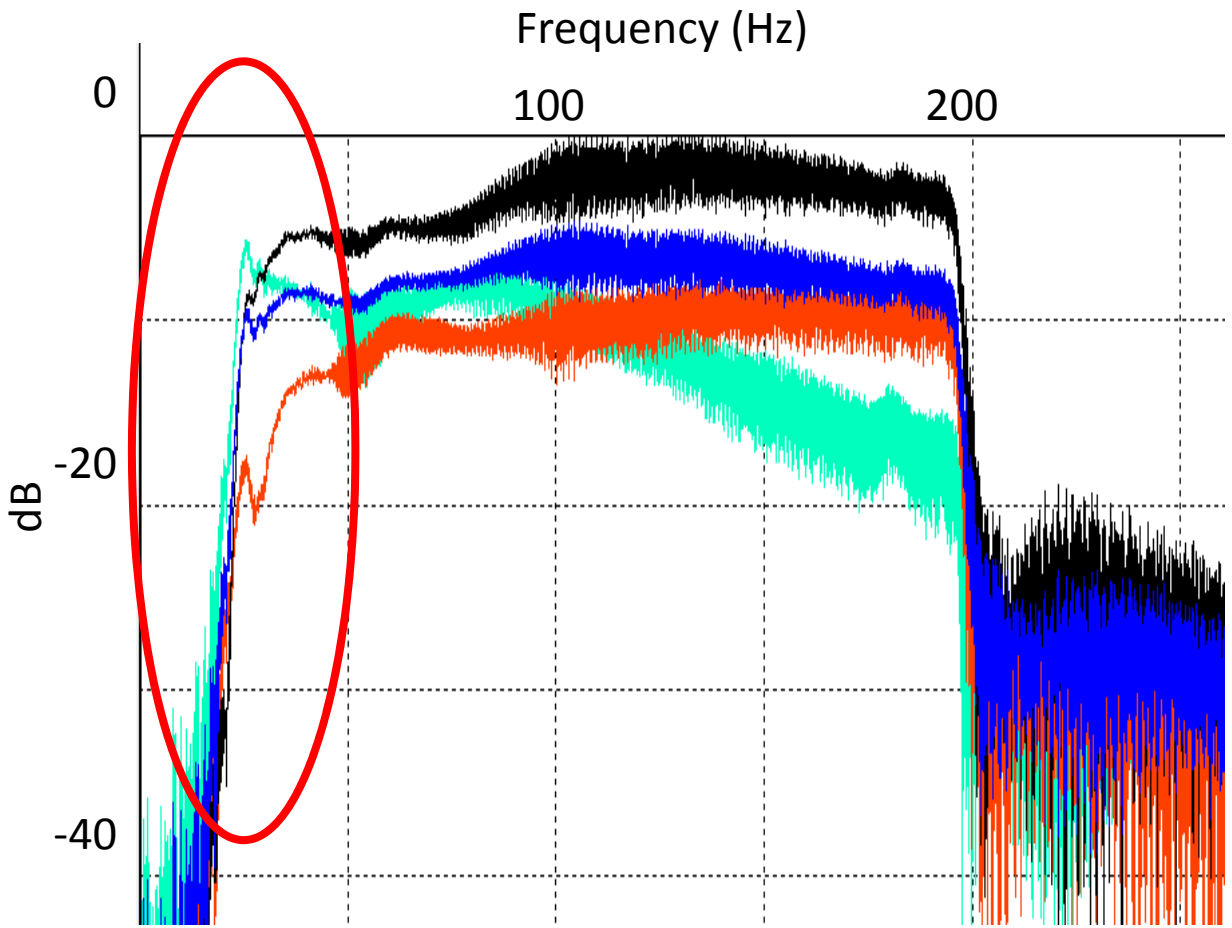


Aux trace (excluding TREF) amplitude spectra

Geode File 350,
Amplitude spectra for Aux 2,3,4 (No TREF). Dark blue = average for all 3 aux

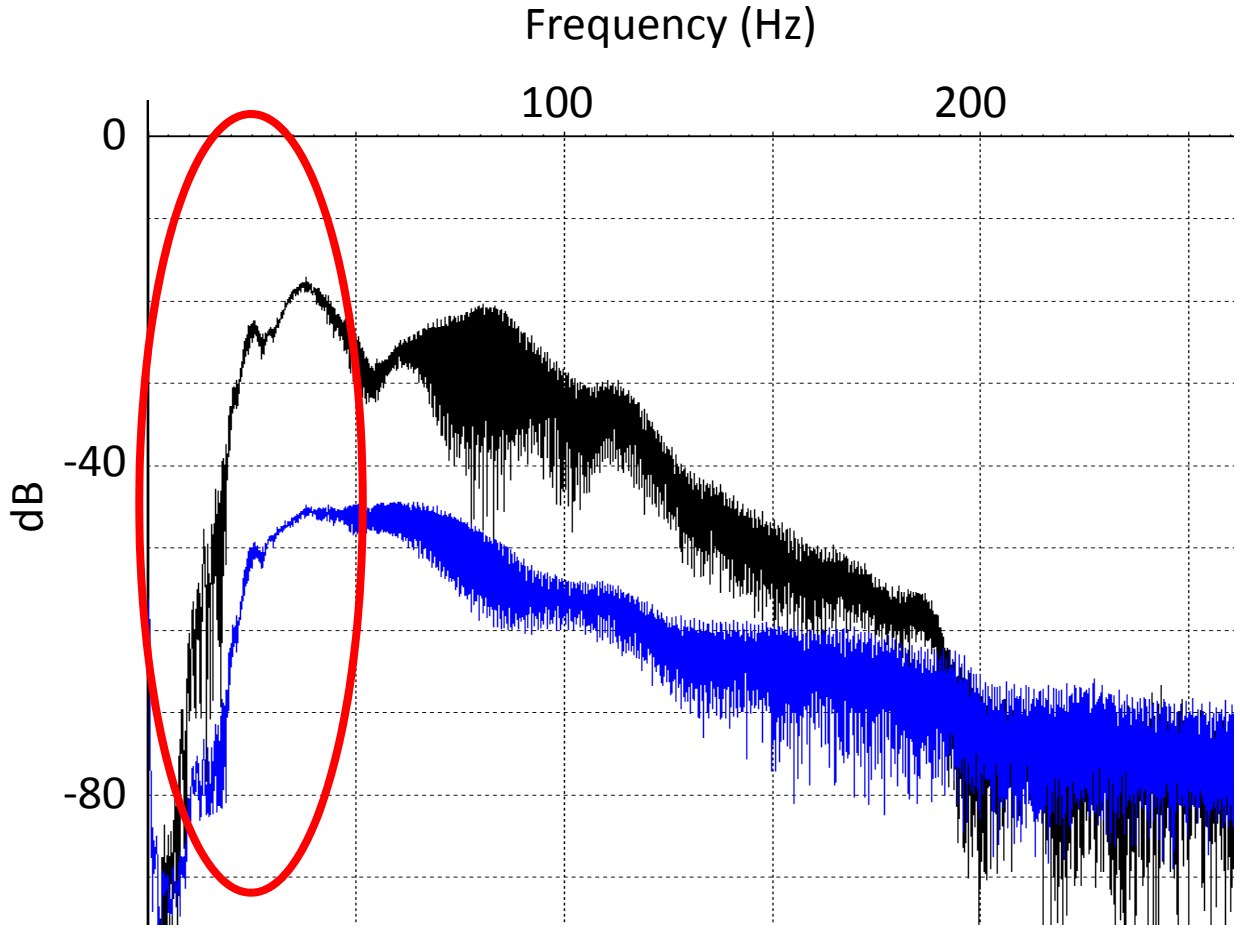


Geode File 358,
Amplitude spectra for Aux 2,3,4 (No TREF). Dark blue = average for all 3 aux

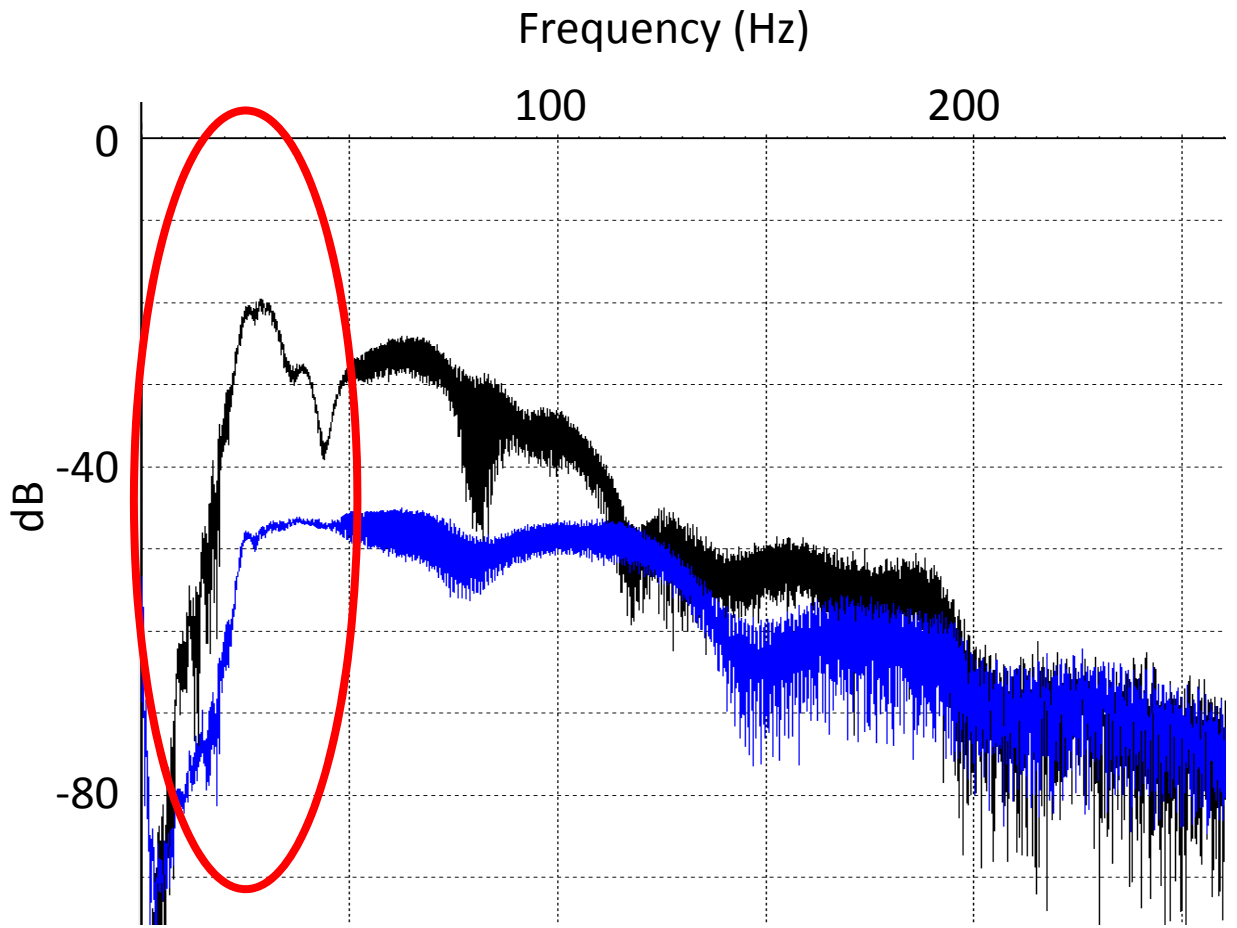


SM-24 uncorrelated amplitude spectra

Aries File 194 == Geode File 350, Uncorrelated;
Black = trace 10 m from Vibe
Blue = average, all data traces



Aries File 209 == Geode file 358, Uncorrelated;
Black = trace 10 m from Vibe
Blue = average, all data traces

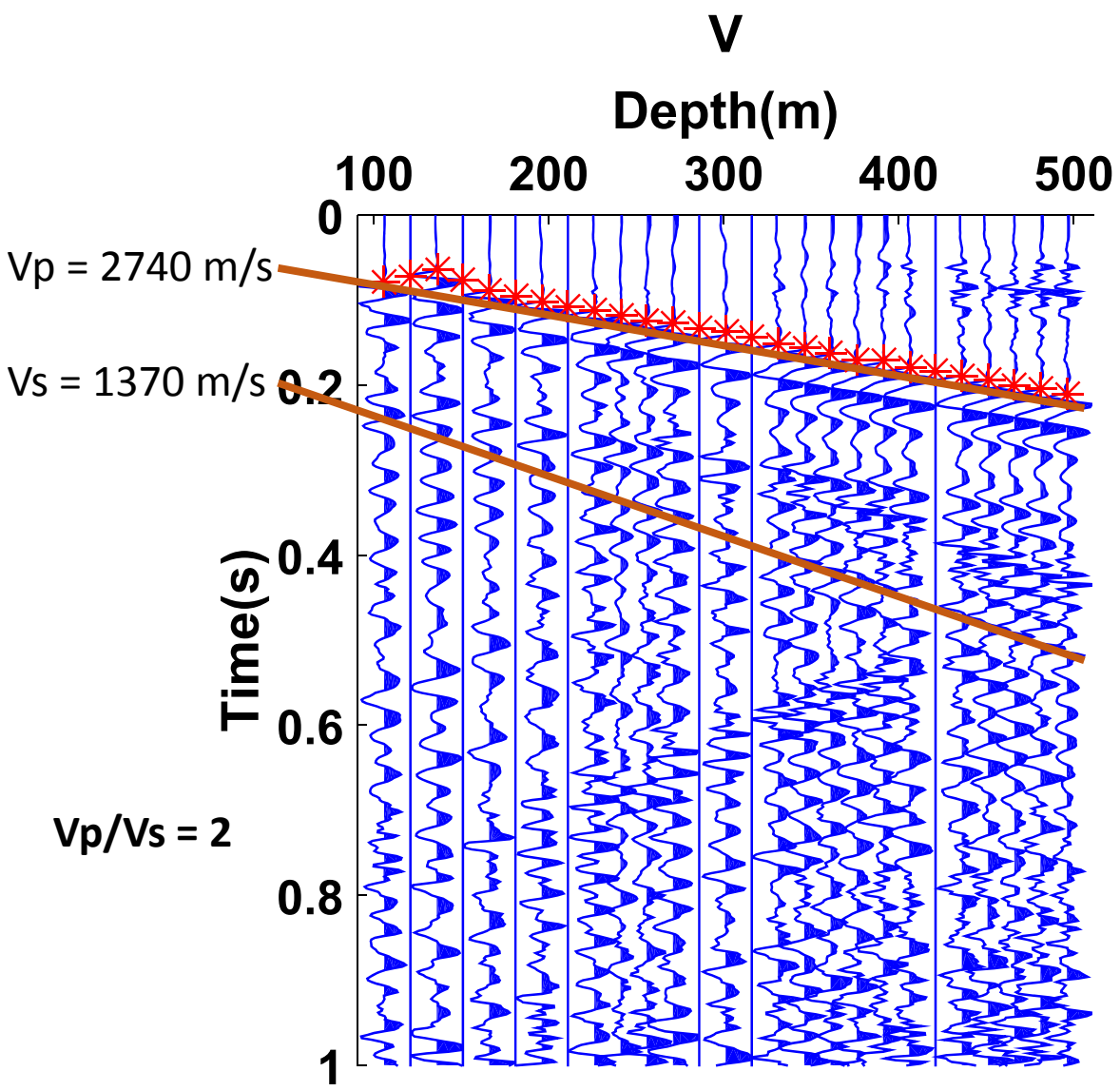


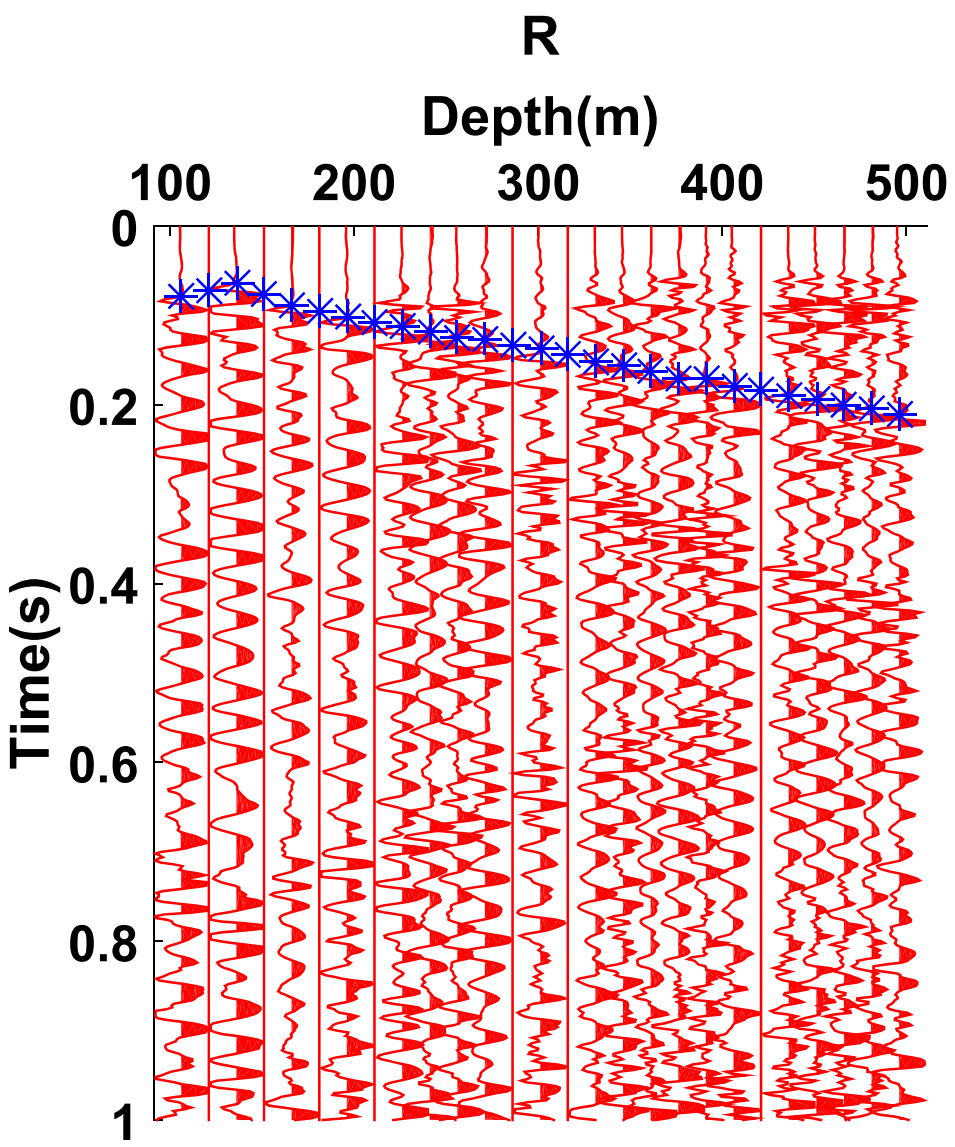
Processing flow for borehole seismic

Pre-stack processing

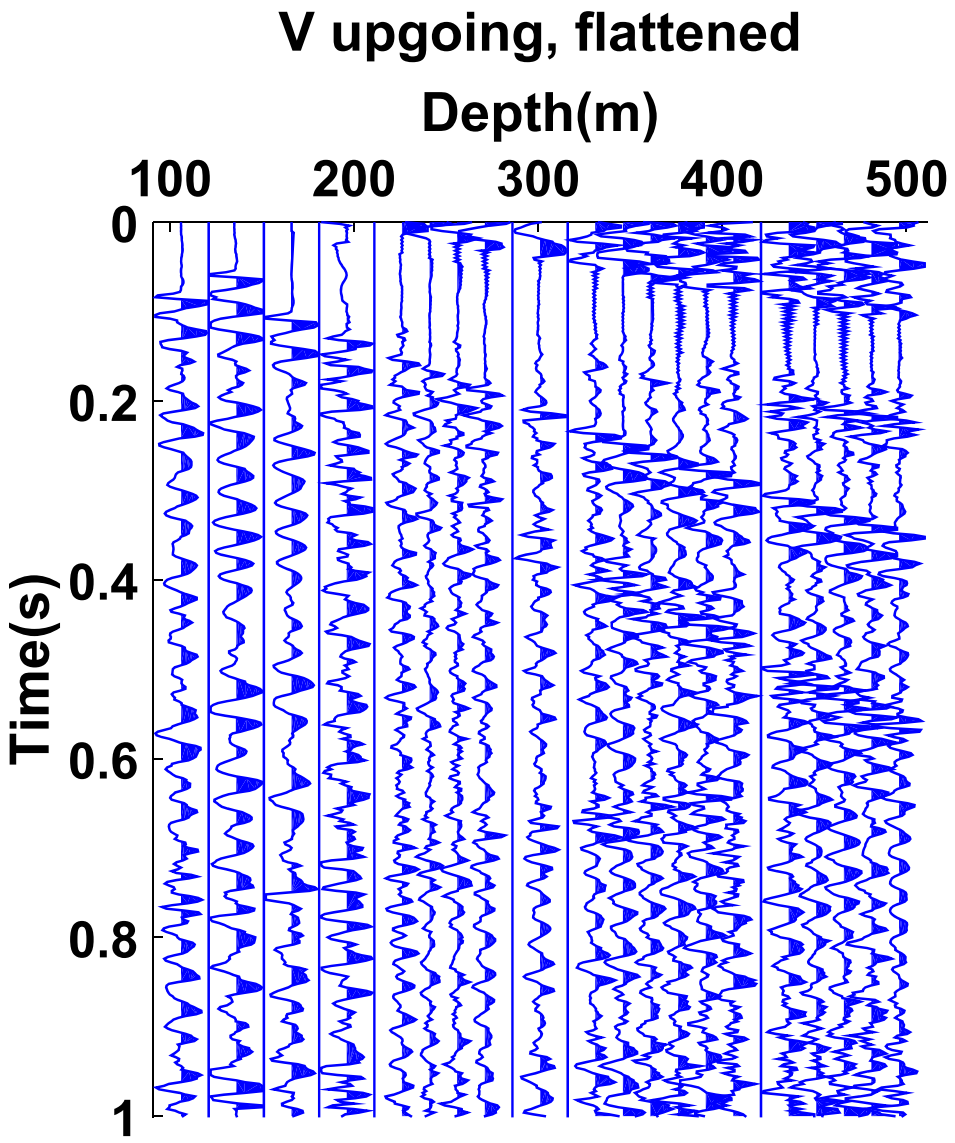
- Create 20 s uncorrelated shot gathers from 5 s SEG-Y files
- Merge deep, middle and shallow tool level data for each VP
- Vertical stack (2 sweeps per VP)
- Correlate with Aries TREF
- Max power two-component rotation (H1,H2 -> R,T)
- Trace kills and polarity reversals
- Automatic envelope correction (AEC) for display

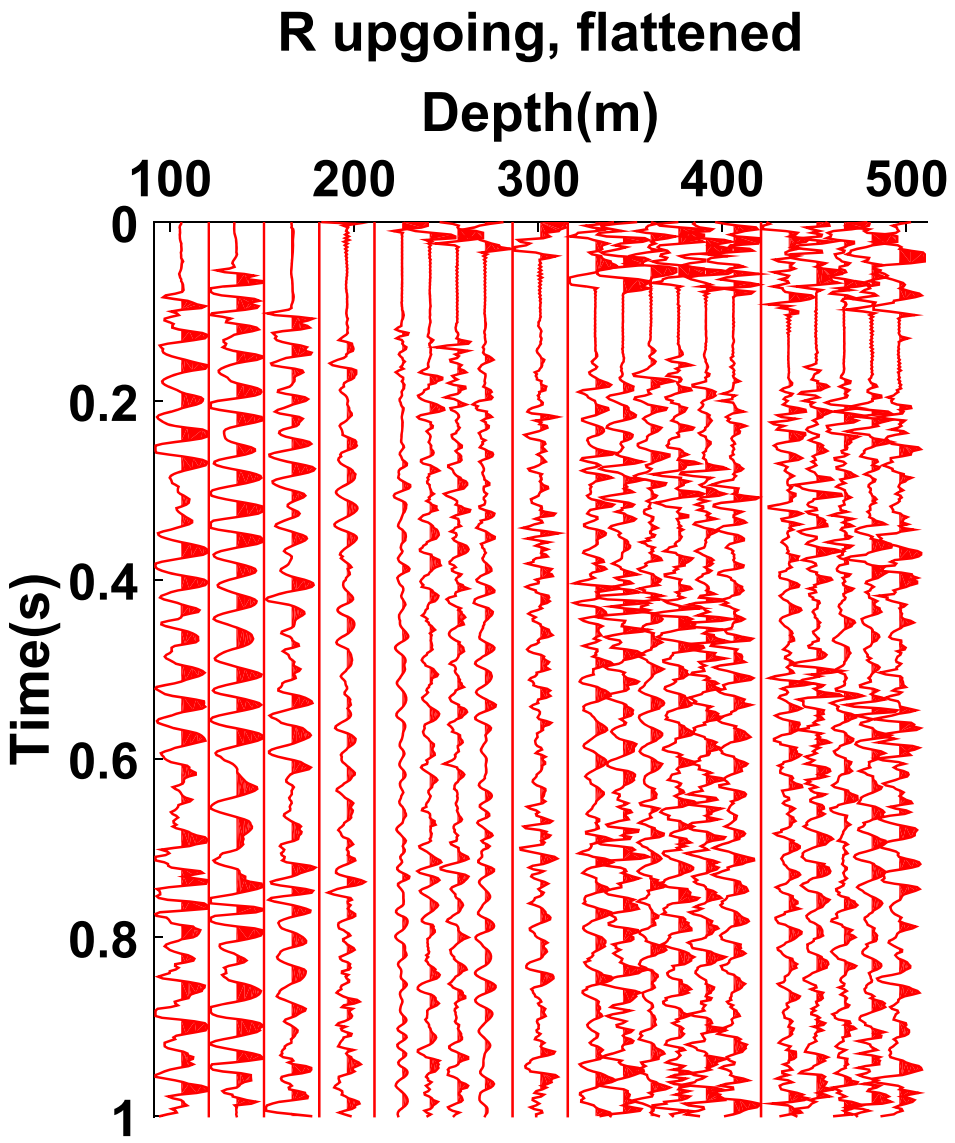
VSP data, Line 208, Station 149 (20 m NE of well)



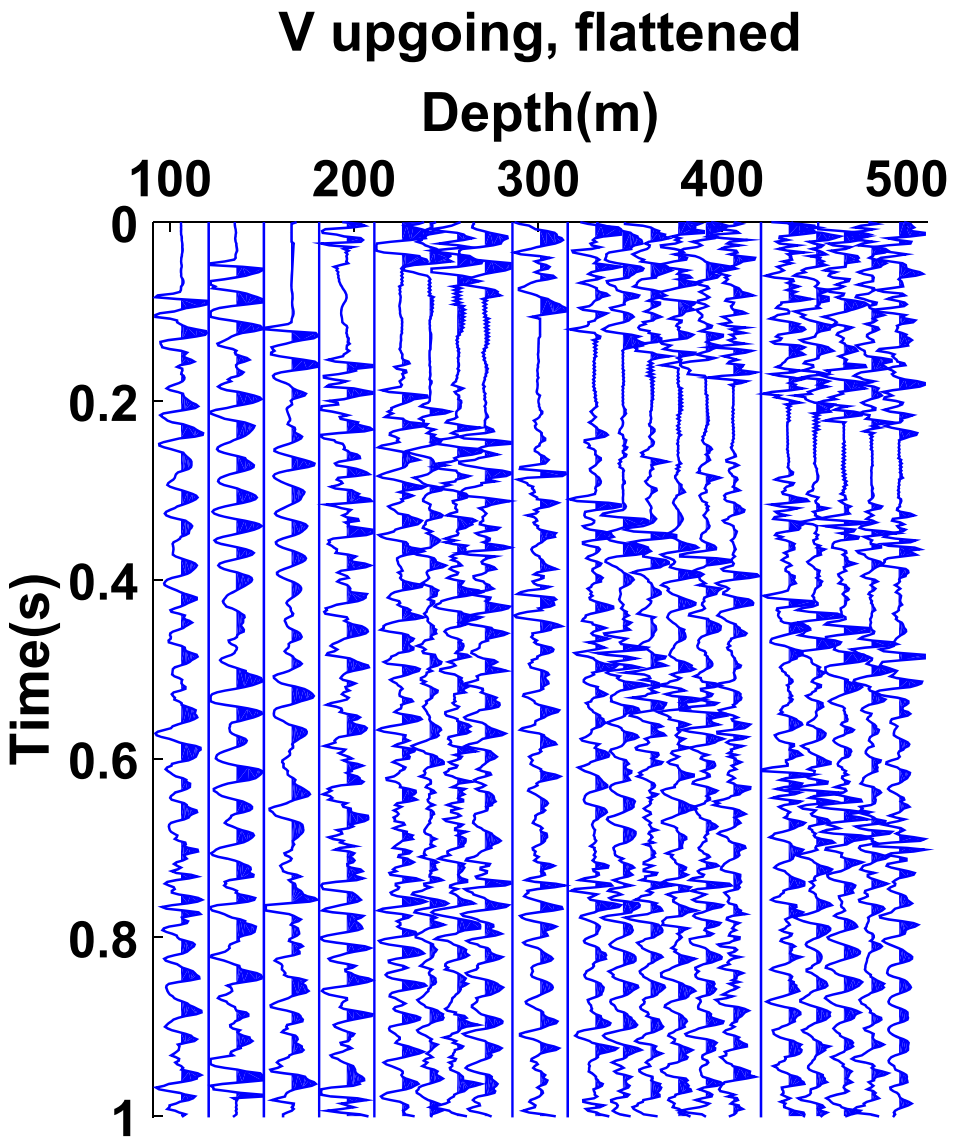


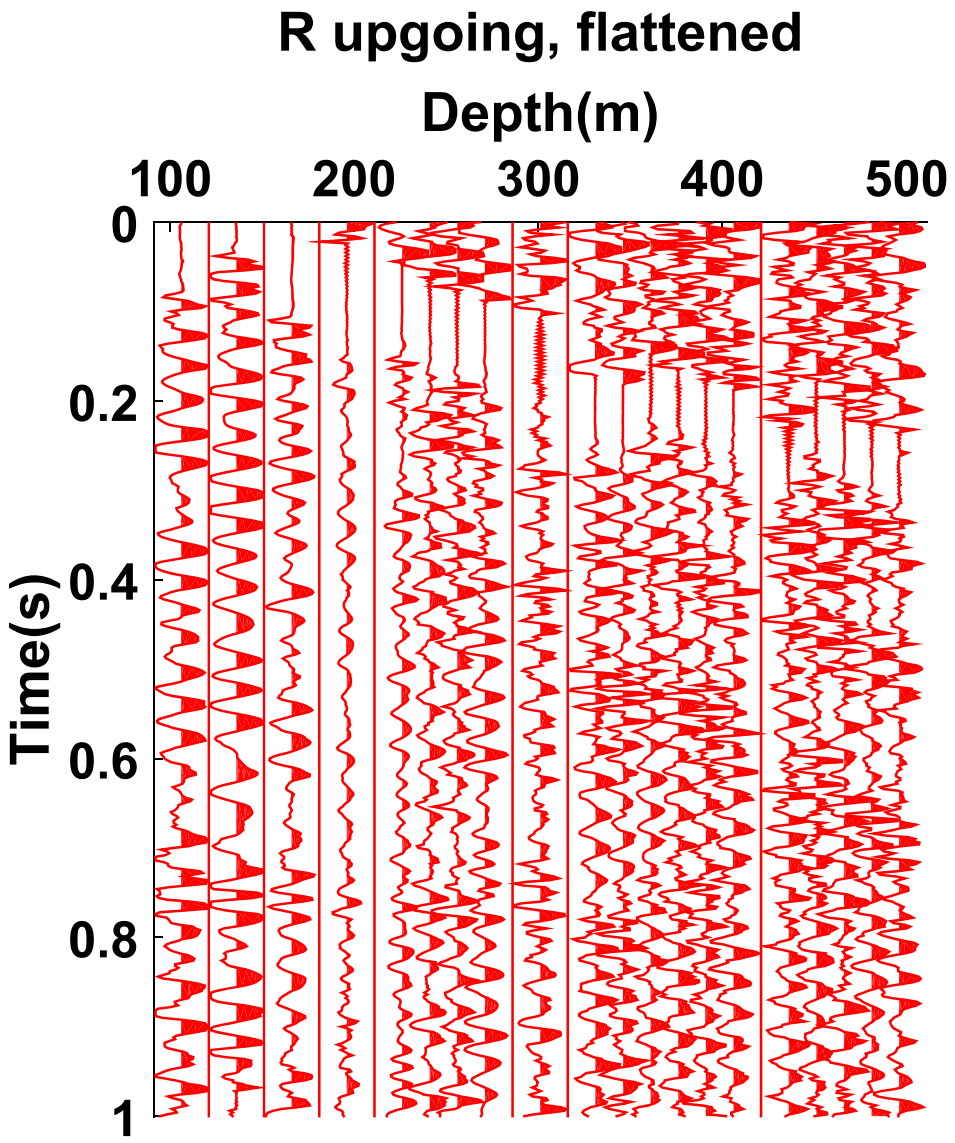
V and R components, flattened on up-going P



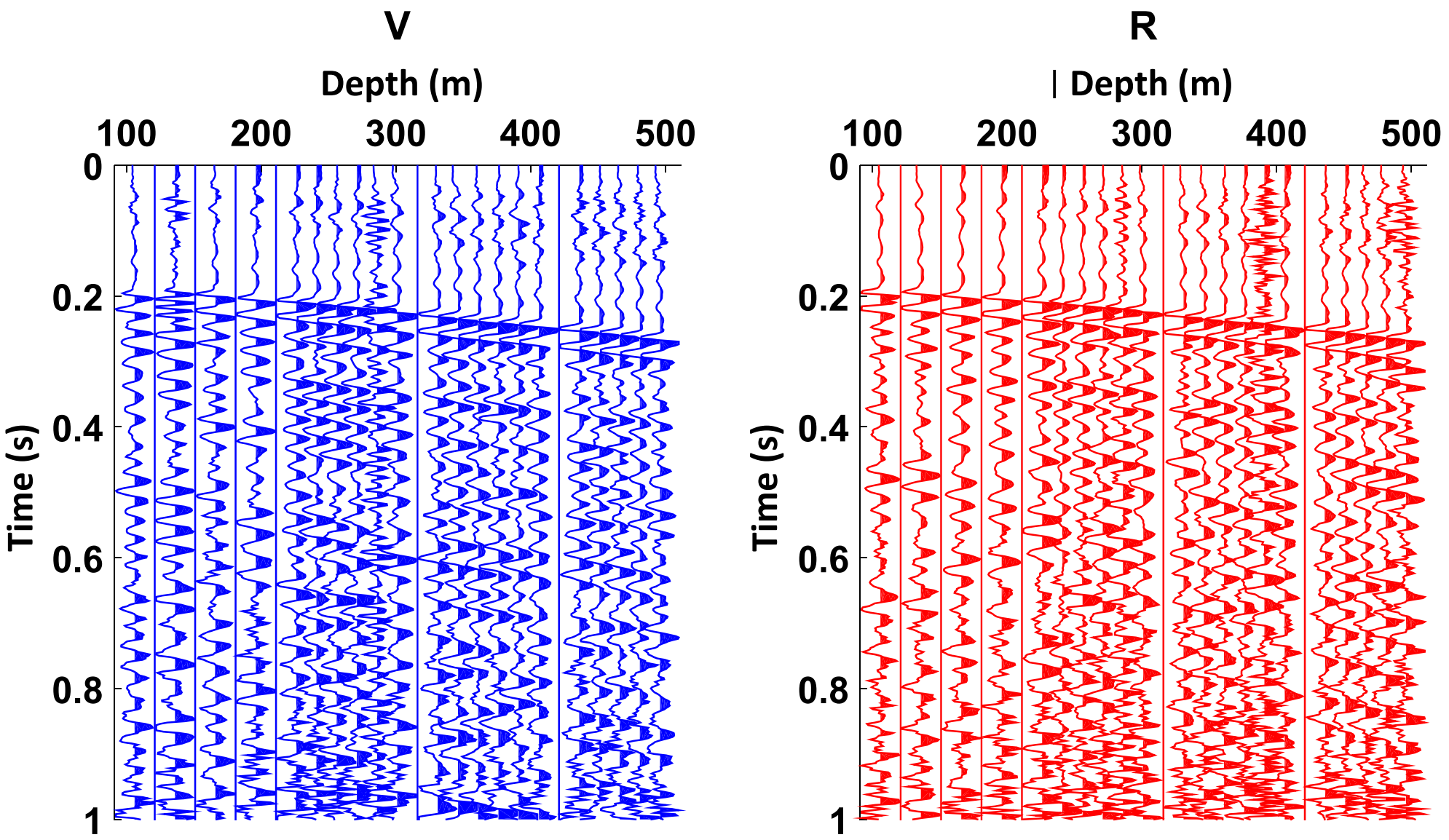


V and R components, flattened on up-going S

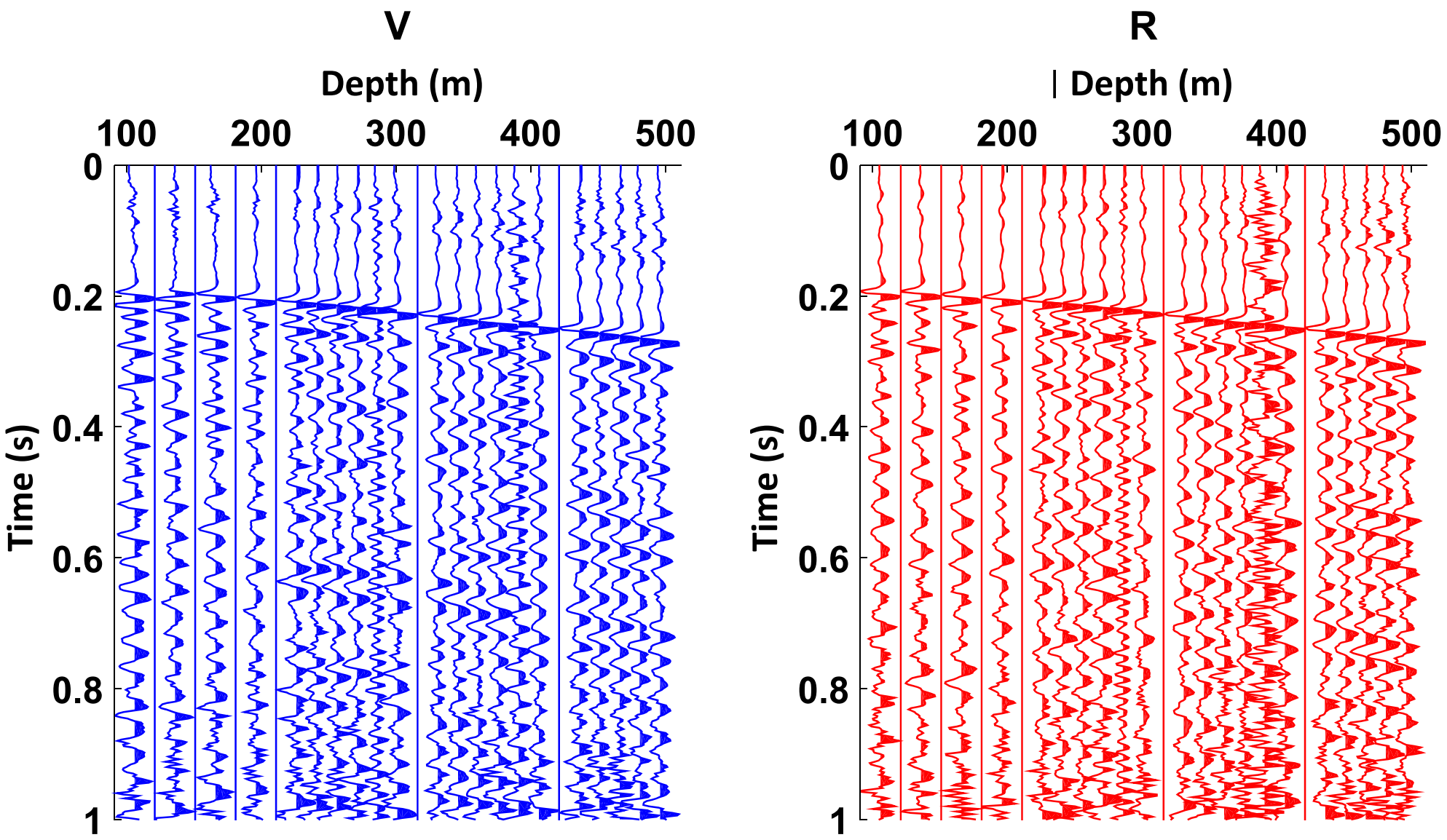




VSP data, Line 204, Station 136 (400 m SW of well)

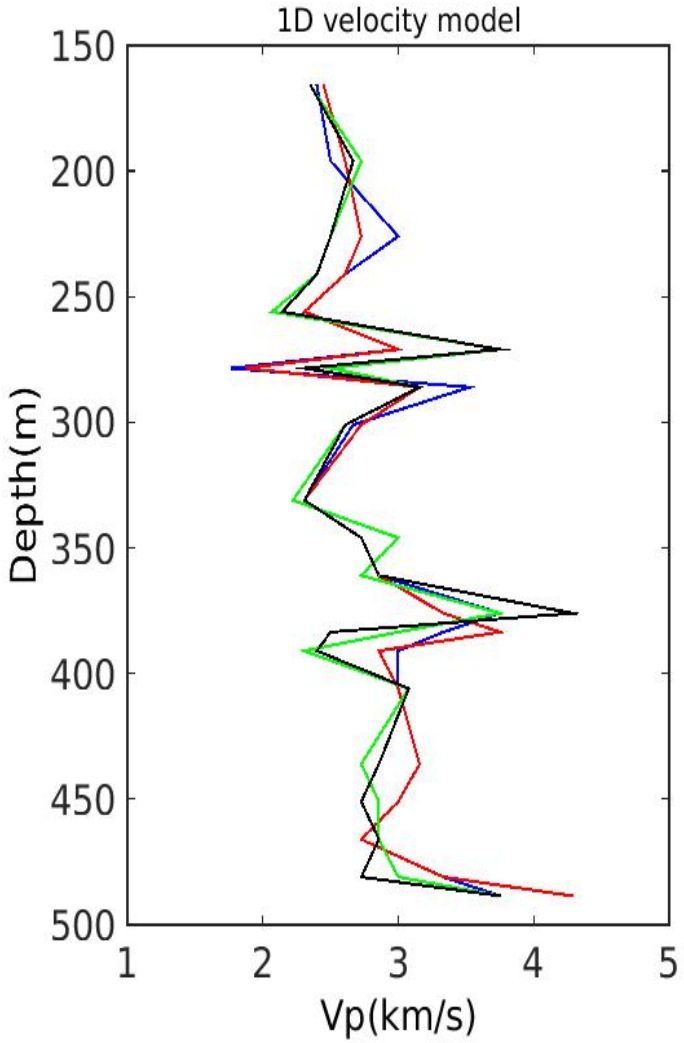


VSP data, Line 204, Station 118 (400 m SE of well)



Borehole: Velocity analysis and anisotropy characterization

1D internal velocity model



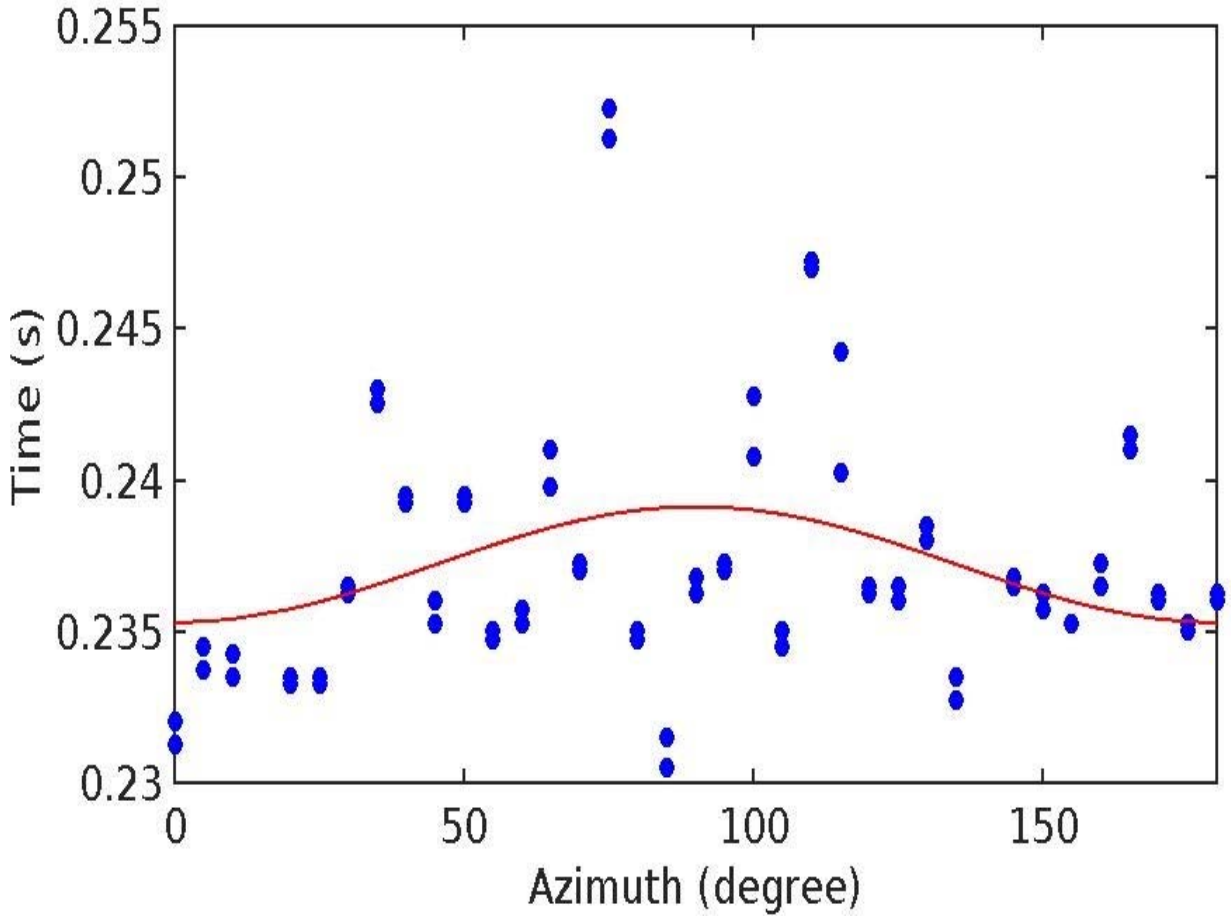
Blue = 208153, sweep 1

Red = 208153, sweep 2

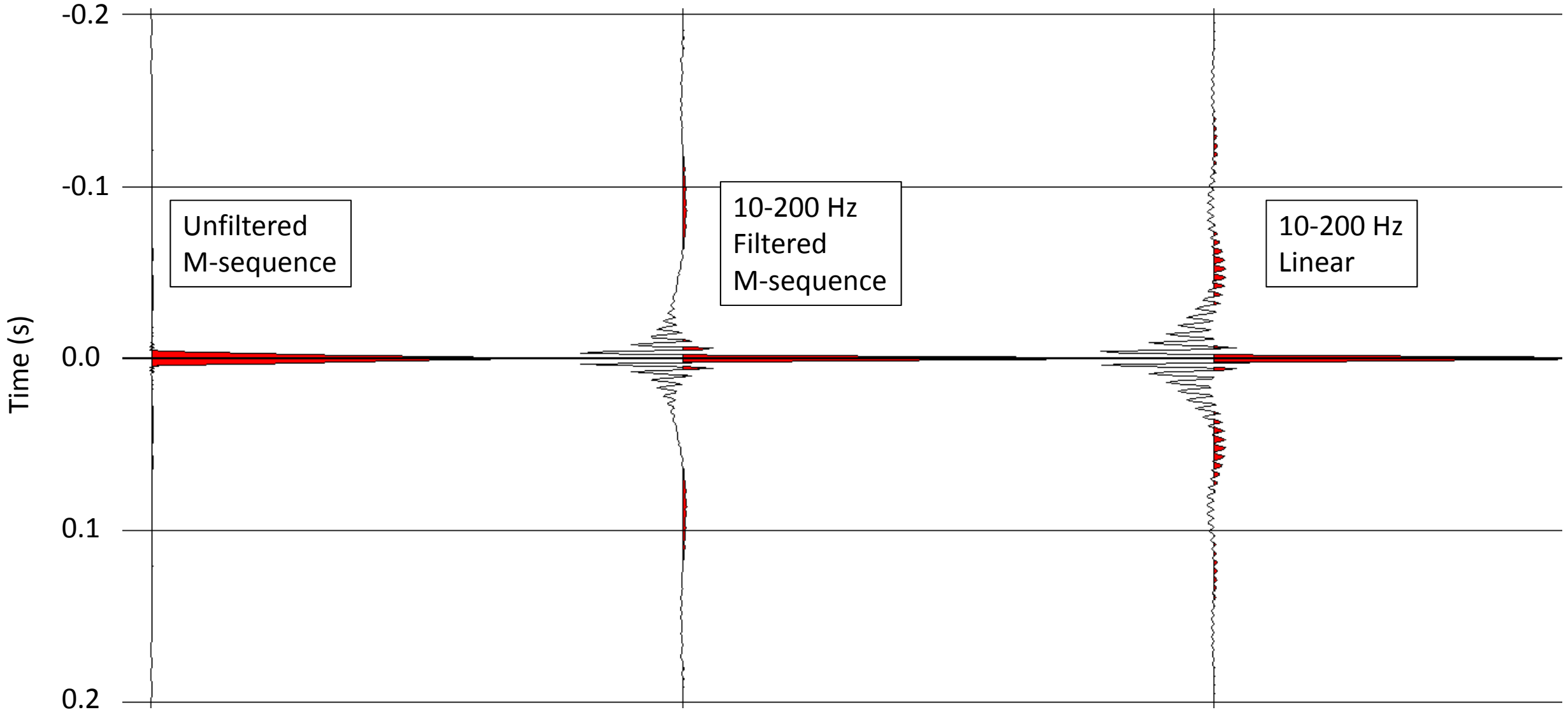
Green = 208149, sweep 1

Black = 208149, sweep2

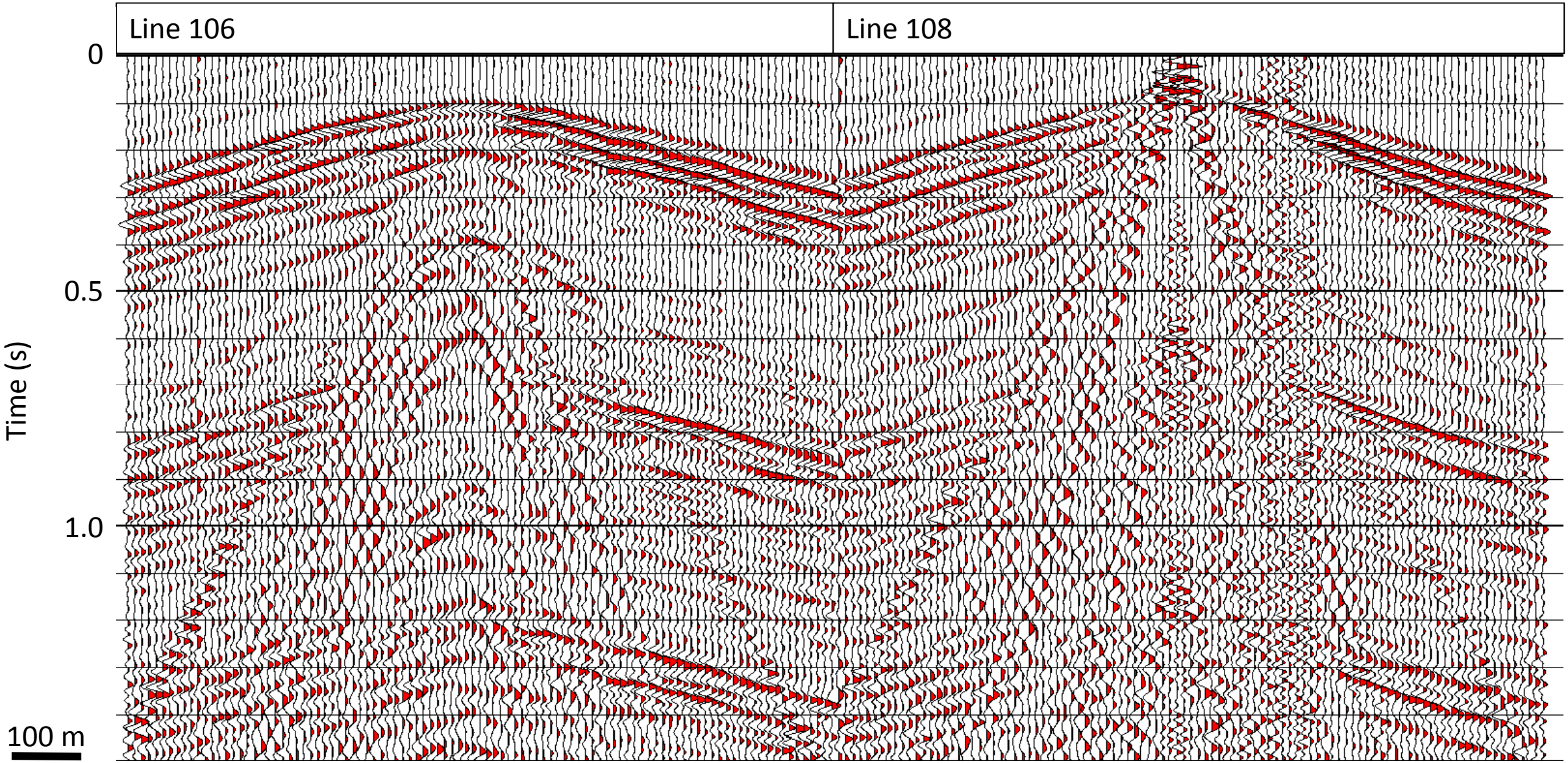
Line 204 travel time variations for receiver at 383.5 m depth



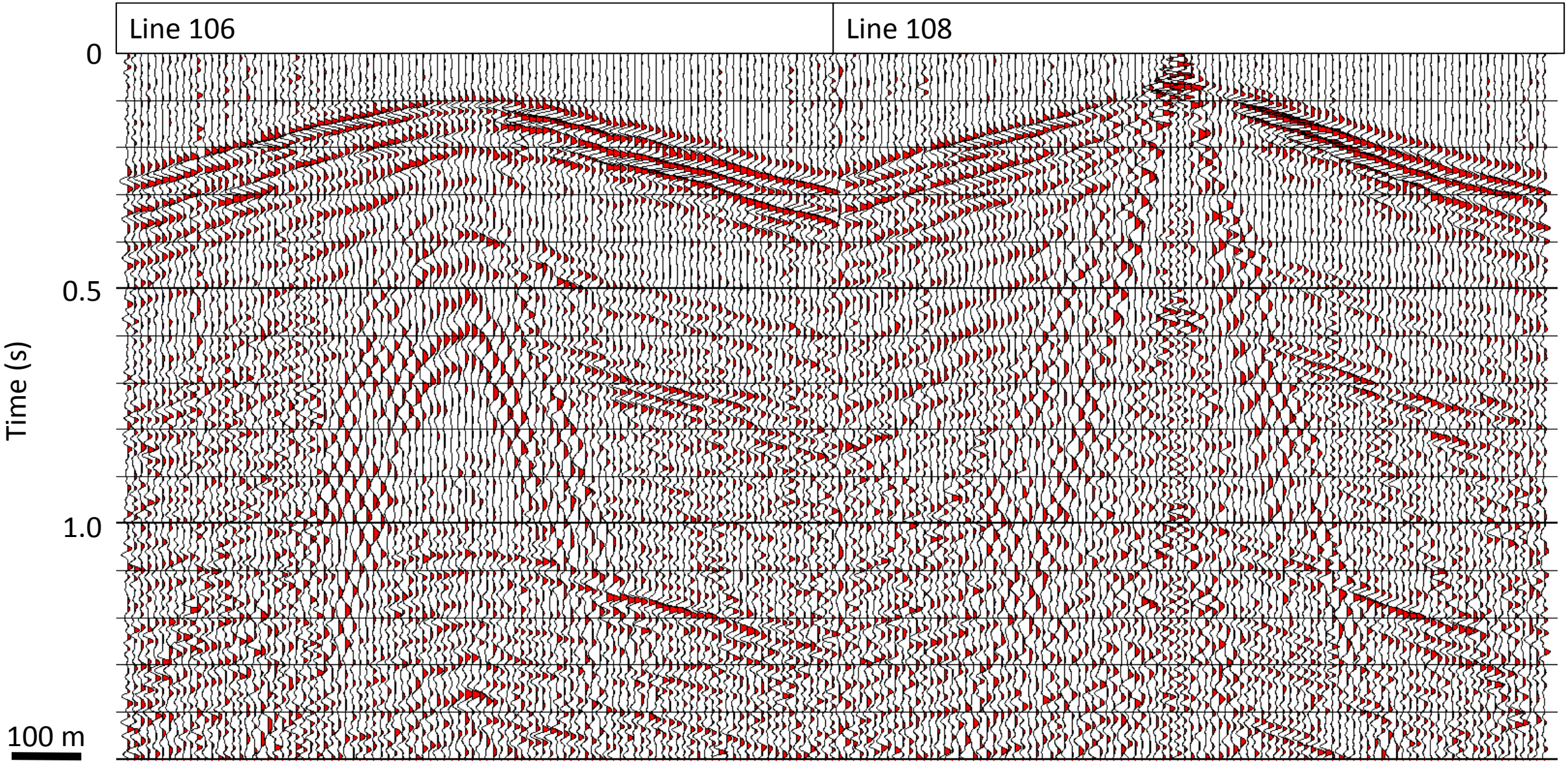
Auto-correlated sweeps



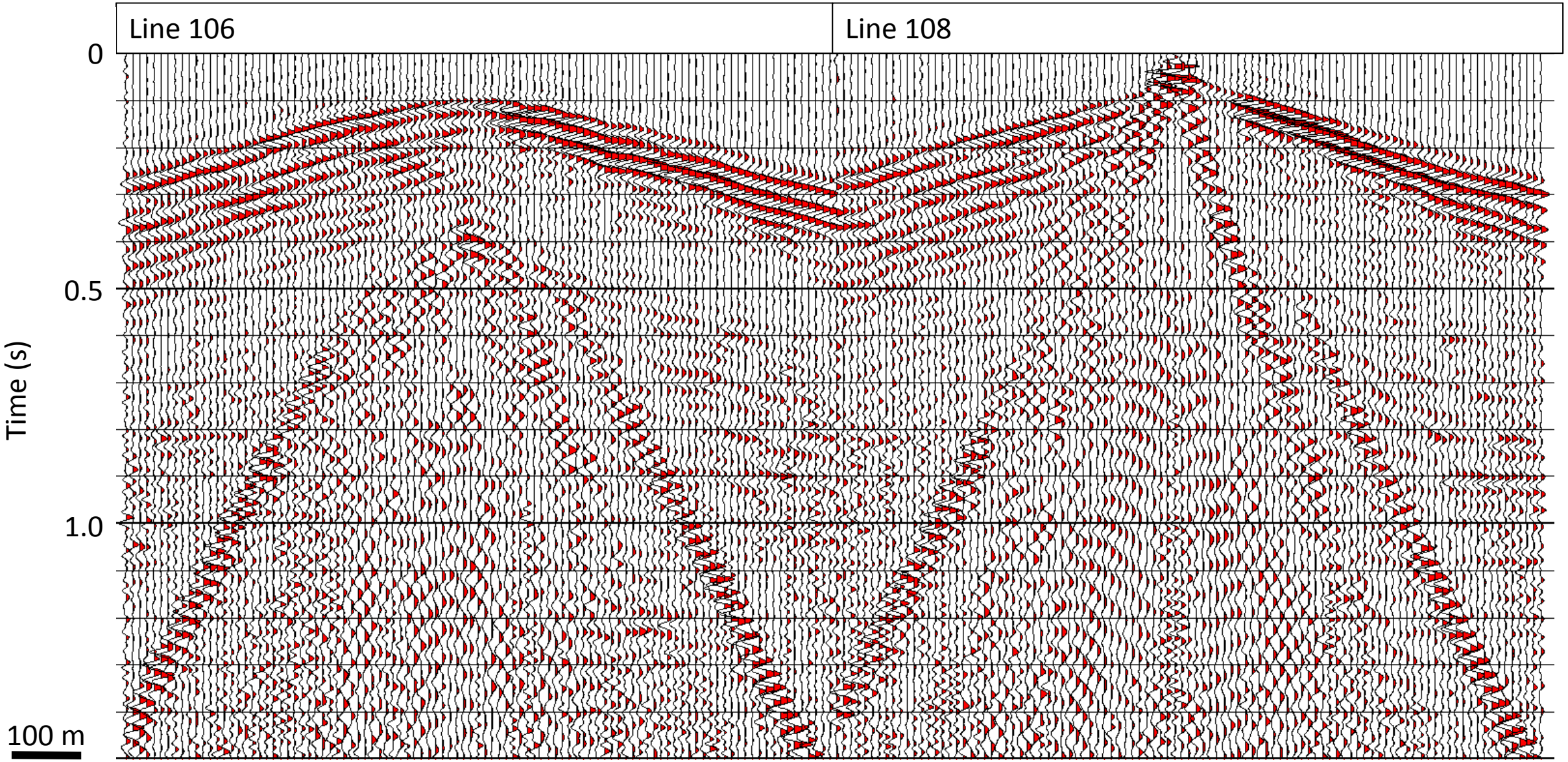
208149, unfiltered M-sequence (Aries File 887), Bandpass+AGC



208149, filtered M-sequence (Aries File 962), Bandpass+AGC



208149, Linear sweep (Aries file 229), Bandpass+AGC



Processing flow for surface seismic

Pre-stack processing

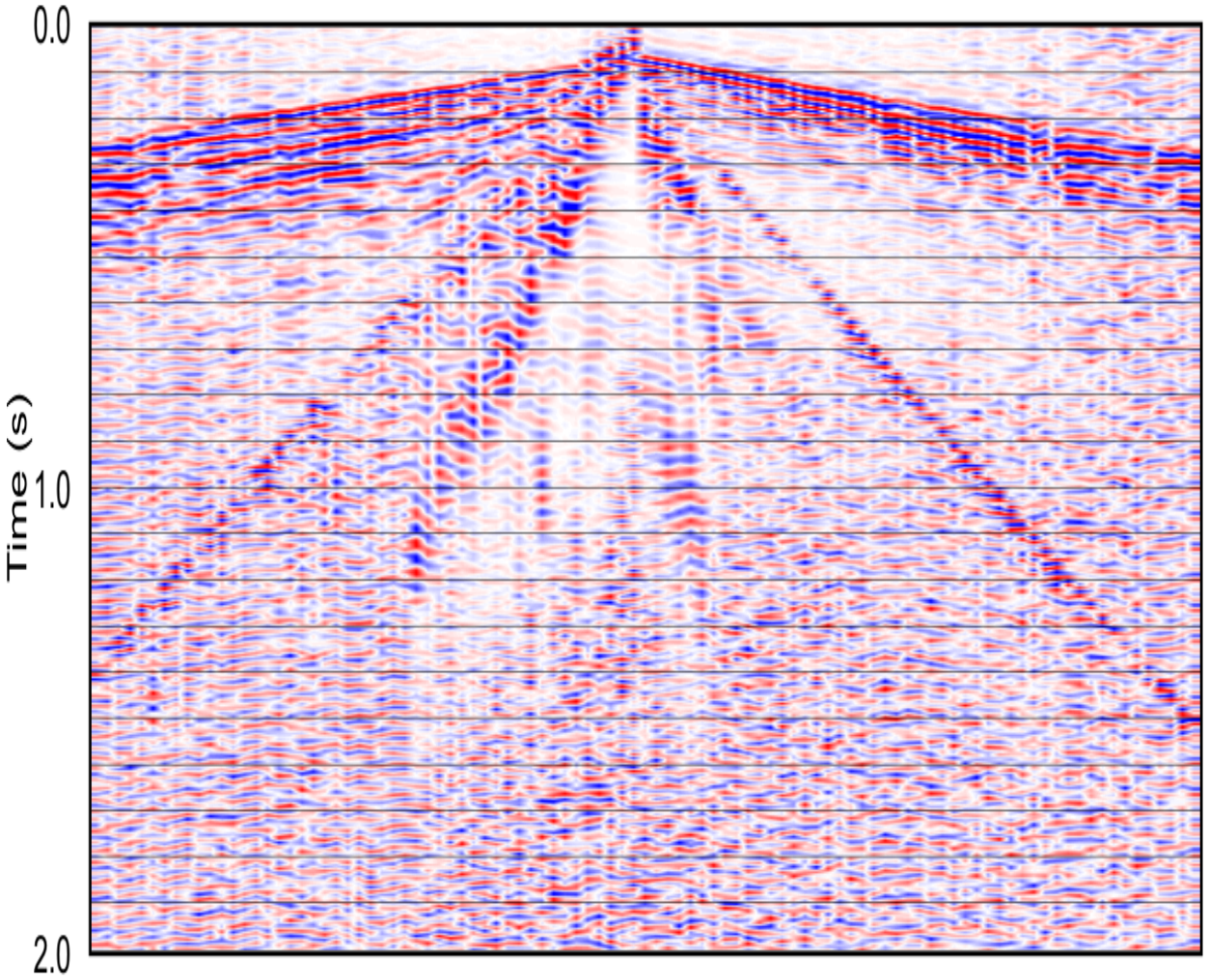
- Refraction statics
- Air blast attenuation
- Spike and noise burst edit
- Surface wave noise attenuation
- Gabor deconvolution

Post-stack processing

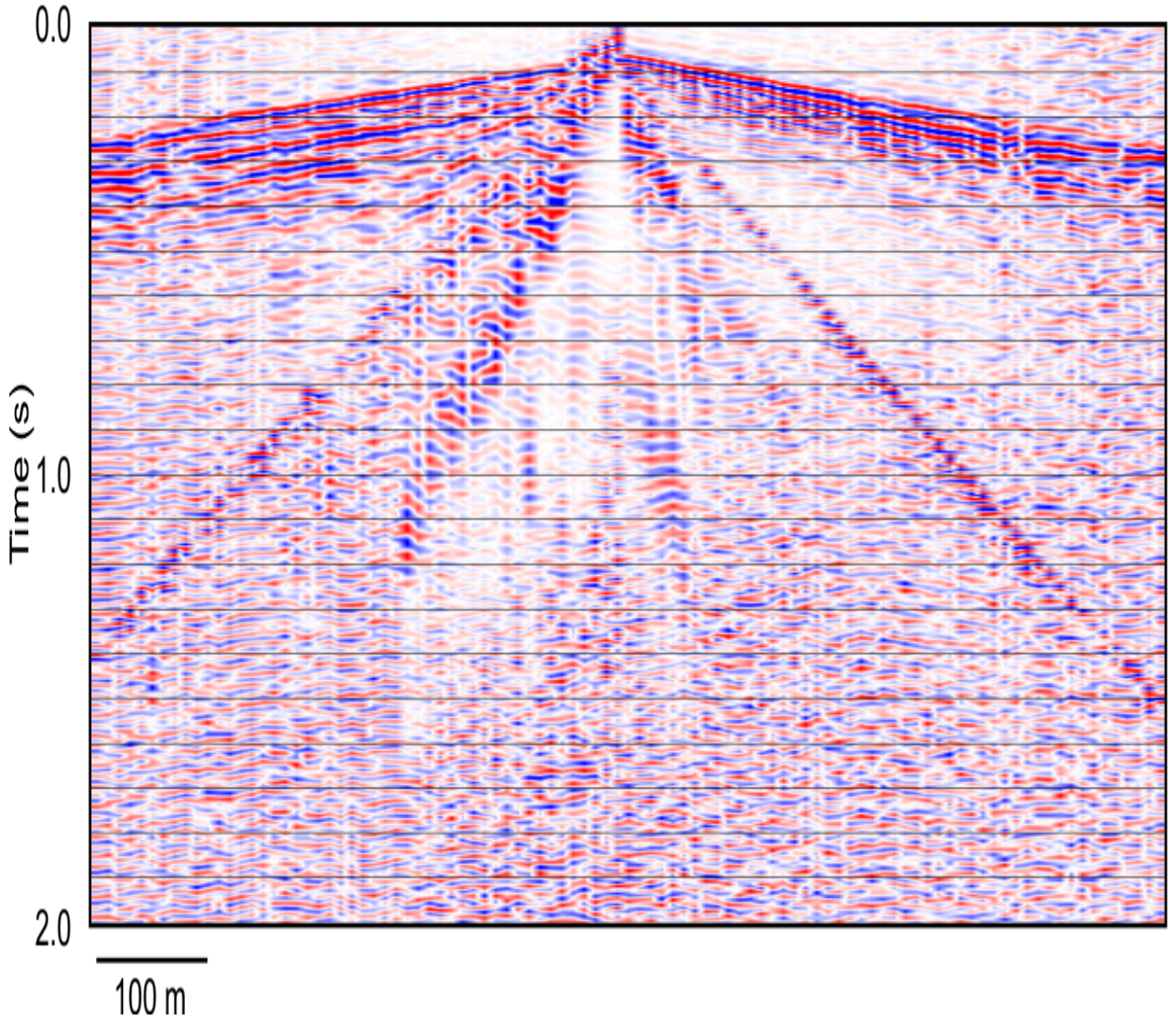
- Finite difference migration
- 10-15-80-90 Hz bandpass filter

P-P sample surface receiver gather, Lines 108,208

SM-24, single component

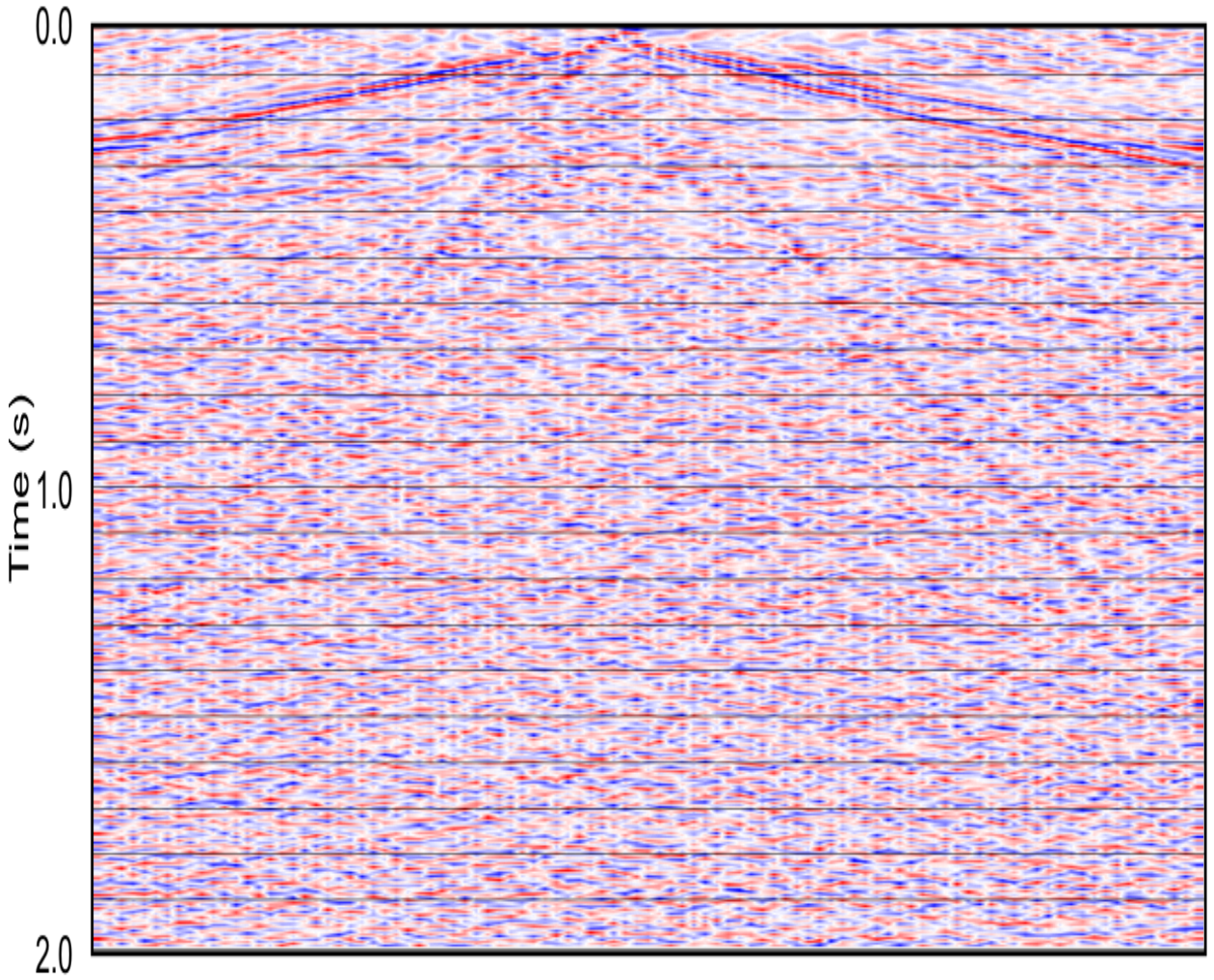


SM-7, vertical component

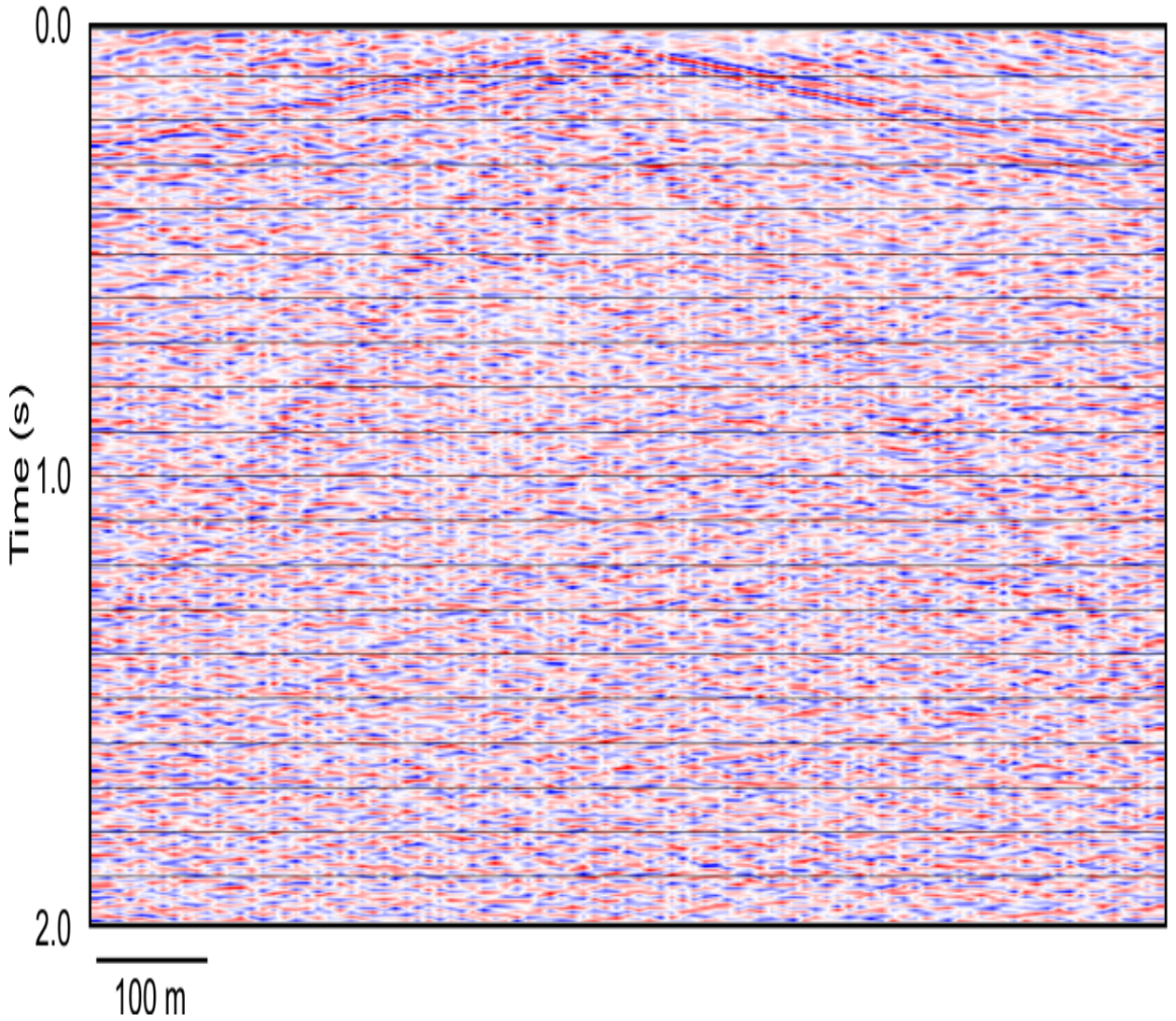


P-P sample surface receiver gather, Lines 108,208

SM-24, processed single component

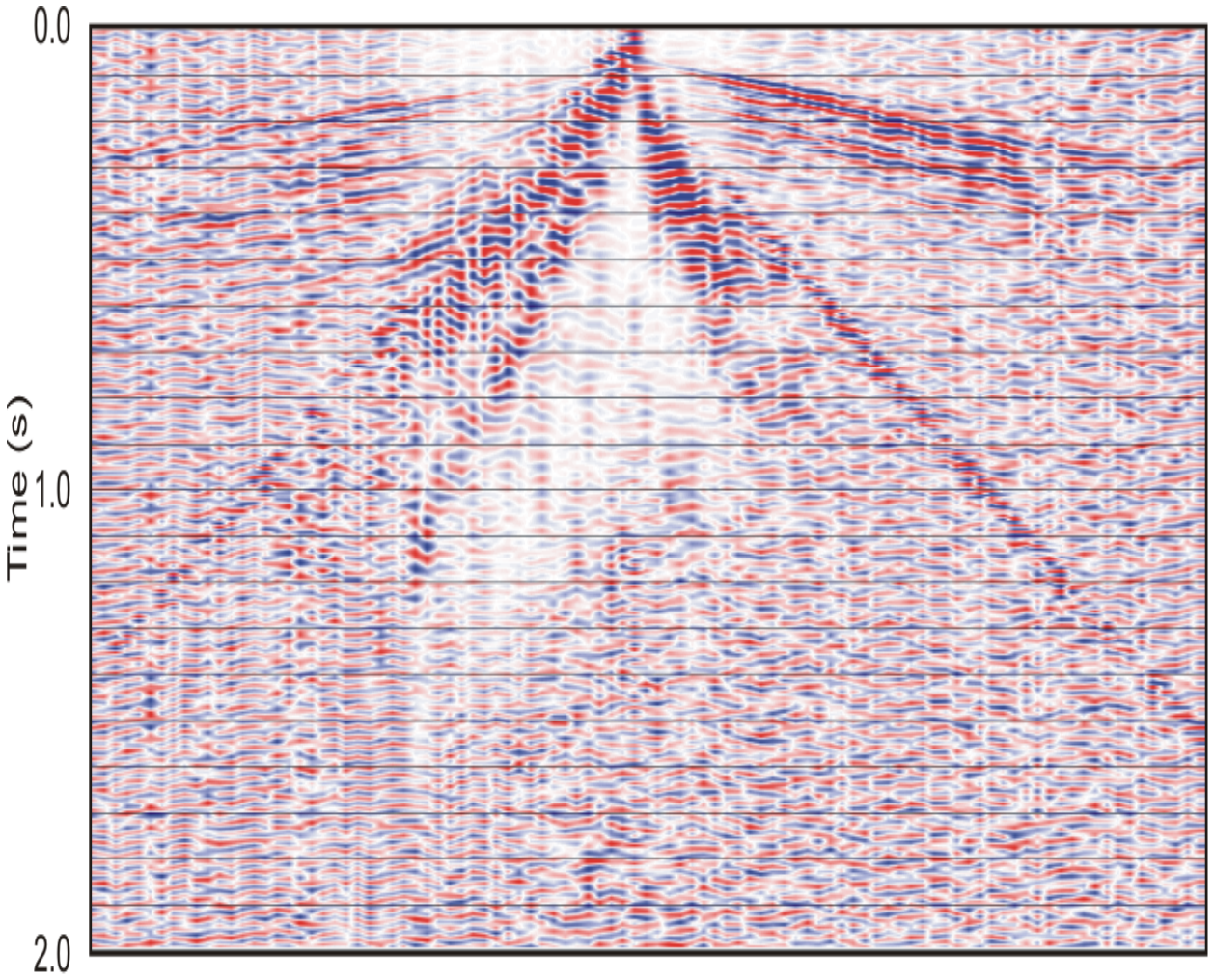


SM-7, processed vertical component

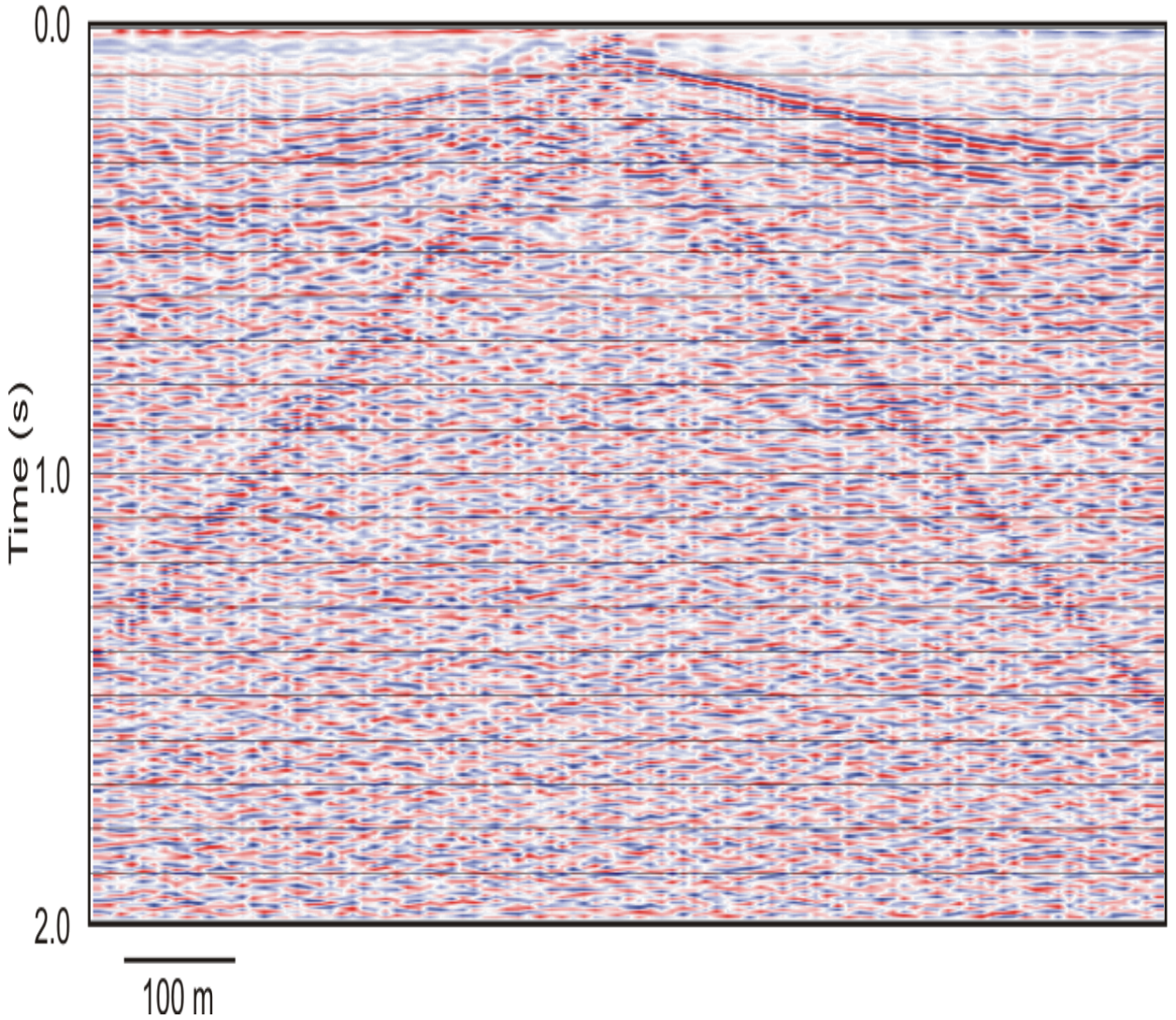


P-S sample surface receiver gather, Lines 108,208

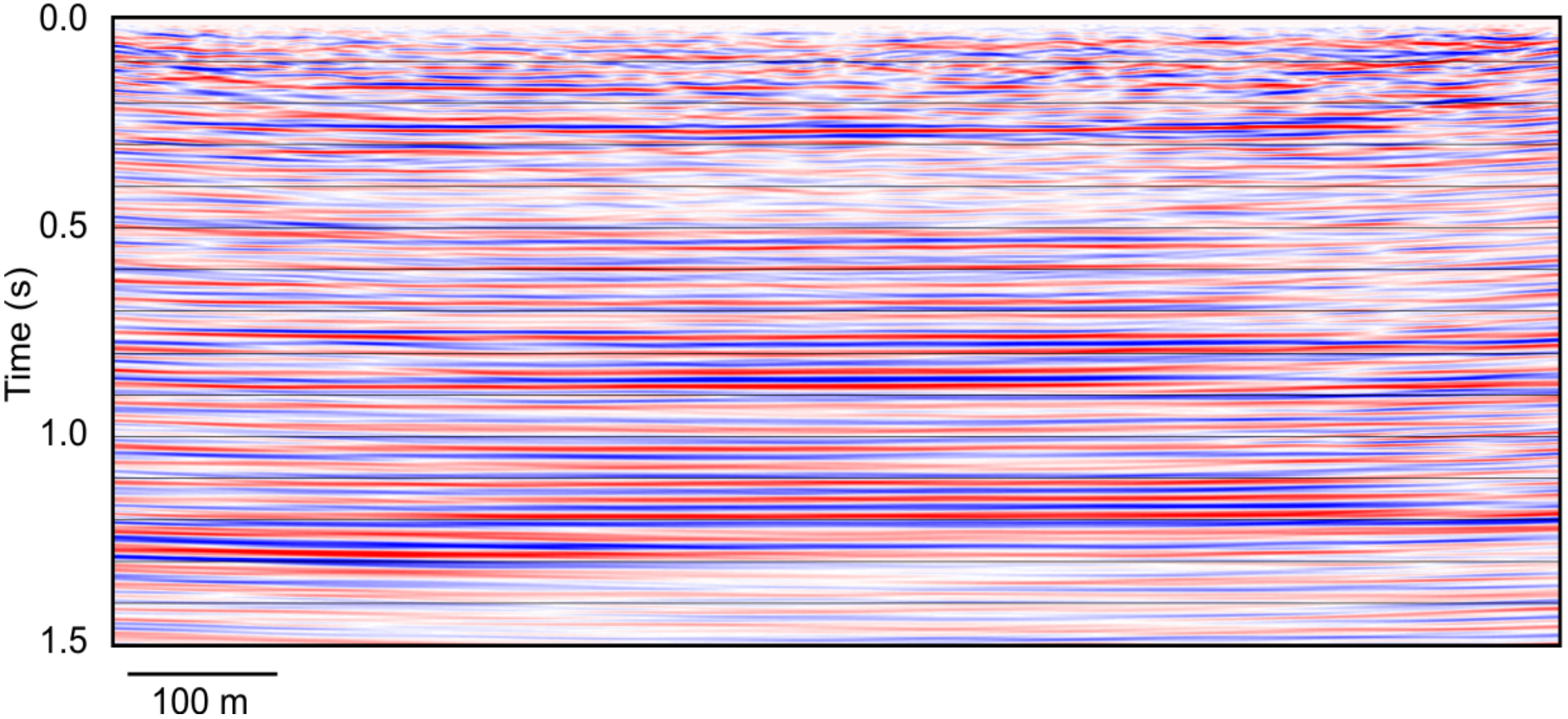
SM-7, radial component



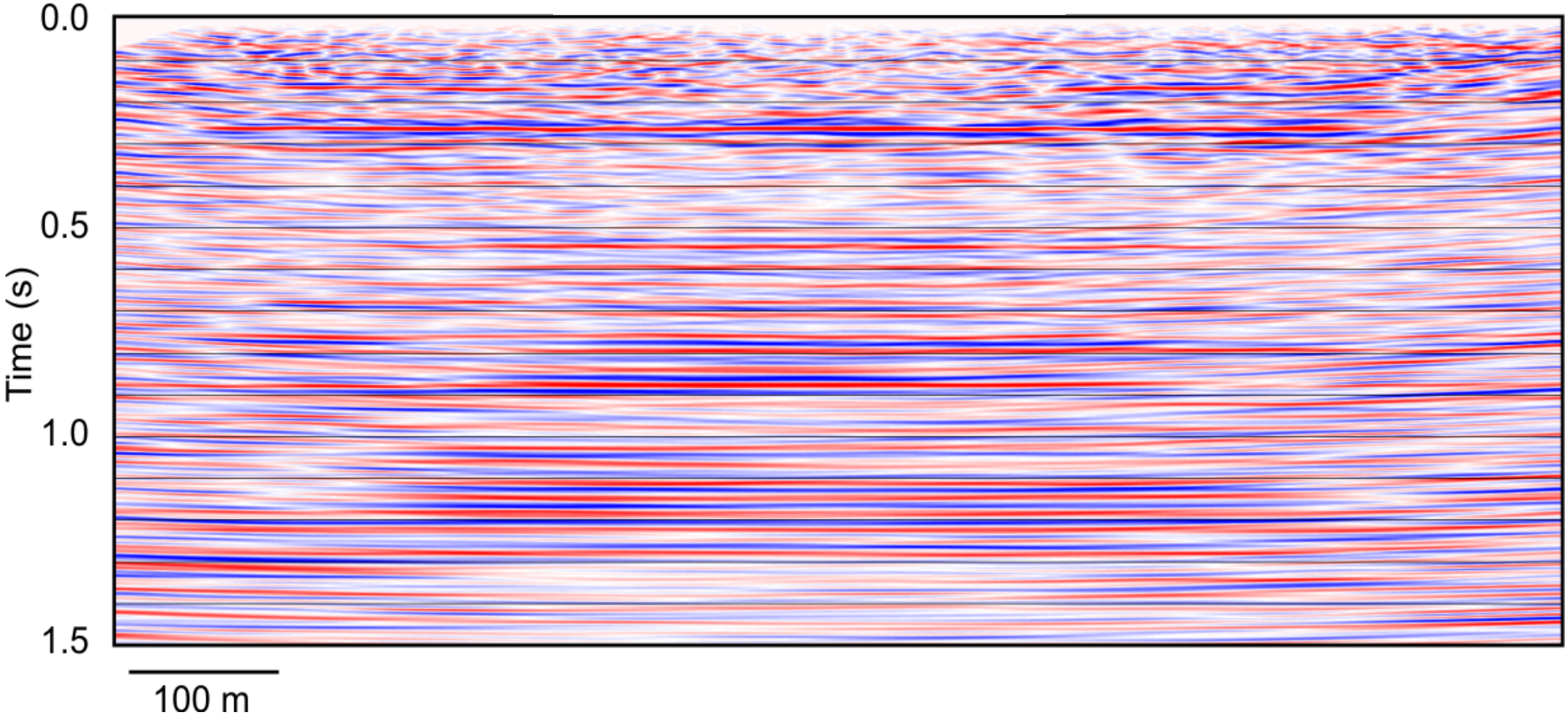
SM-7, processed radial component



P-P migrated receiver stack, SM-24, Lines 108,208



P-P migrated receiver stack, SM-7, Lines 108,208



Discussion and future work

A variety of seismic work was successfully completed at the Containment and Monitoring Institute (CaMI) Field Research Station (FRS) in May of 2015. Over the course of two days data were acquired for a variety of experiments, including a walk-away 3C VSP, data for a velocity tomography study, 1C-2D and 3C-2D surface seismic, and m-sequence sweep tests

Future work includes:

- Processing of the radial component of the 3C-2D.
- Processing the near-zero-offset vertical and radial components of the VSP to corridor stacks.
- Processing the walk-away VSP data – perhaps reflections will become more clear with stacking.
- Processing the m-sequence source gathers to a migrated stack
  - Simulate multiple Vibes simultaneously running different m-sequence sweeps, and seeing how successfully the source gathers can be separated
  - Attenuating (or using) source-generated m-sequence multiples.
- Interpretation.

Acknowledgements

- CREWES sponsors
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- CMC Research Institutes
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- Schlumberger (VISTA)