CREWES

VSP processing for coal reflections

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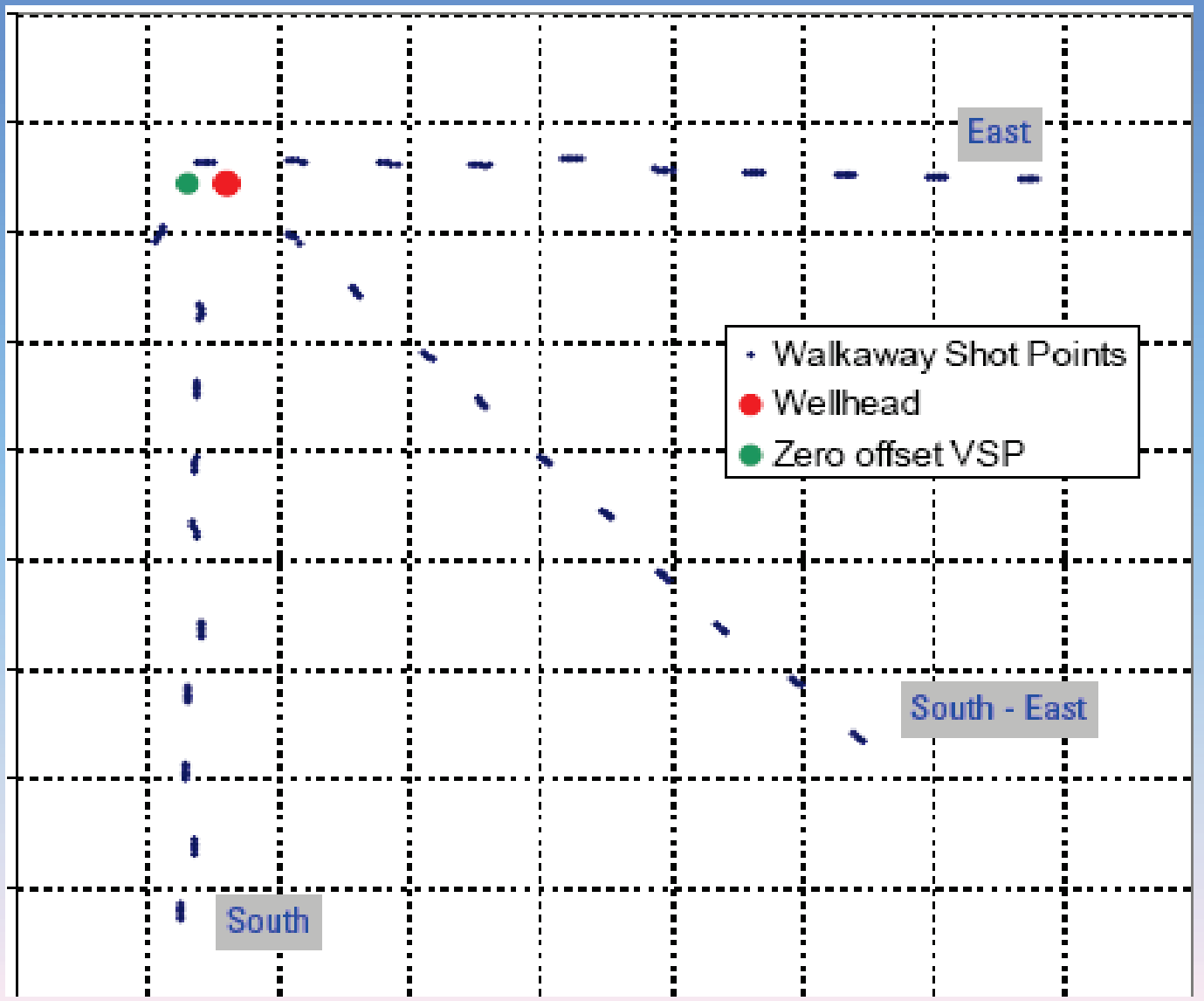
Objective and outline

- Objective:

The primary goal of the VSP surveys is to study the azimuthal variations in the AVO response of the Mannville Fm coals.

- Outline:
  - Zero Offset VSP
  - Walkaway Offset VSP
  - Conclusions

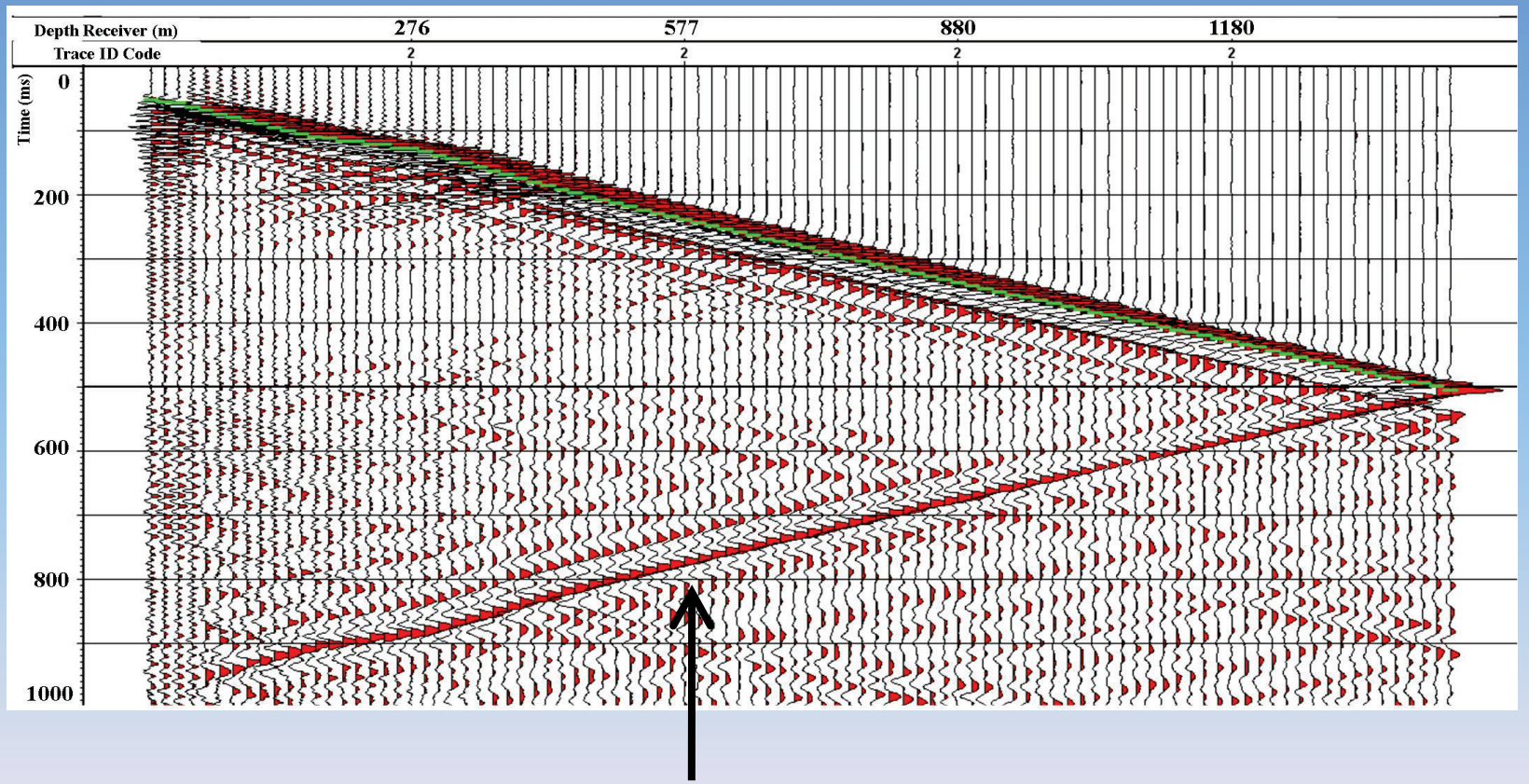
Map of zero offset and walkaway VSPs



Zero offset acquisition parameters

- Acquired by two Litton truck-mounted vibroseis 62 m away from the well with 269 degree azimuth.
- Vibroseis sweep of 12 s consisting of 8-120 Hz and sample rate of 1 ms.
- A sixteen shuttle receiver tool was utilized with 15.1 m separation.

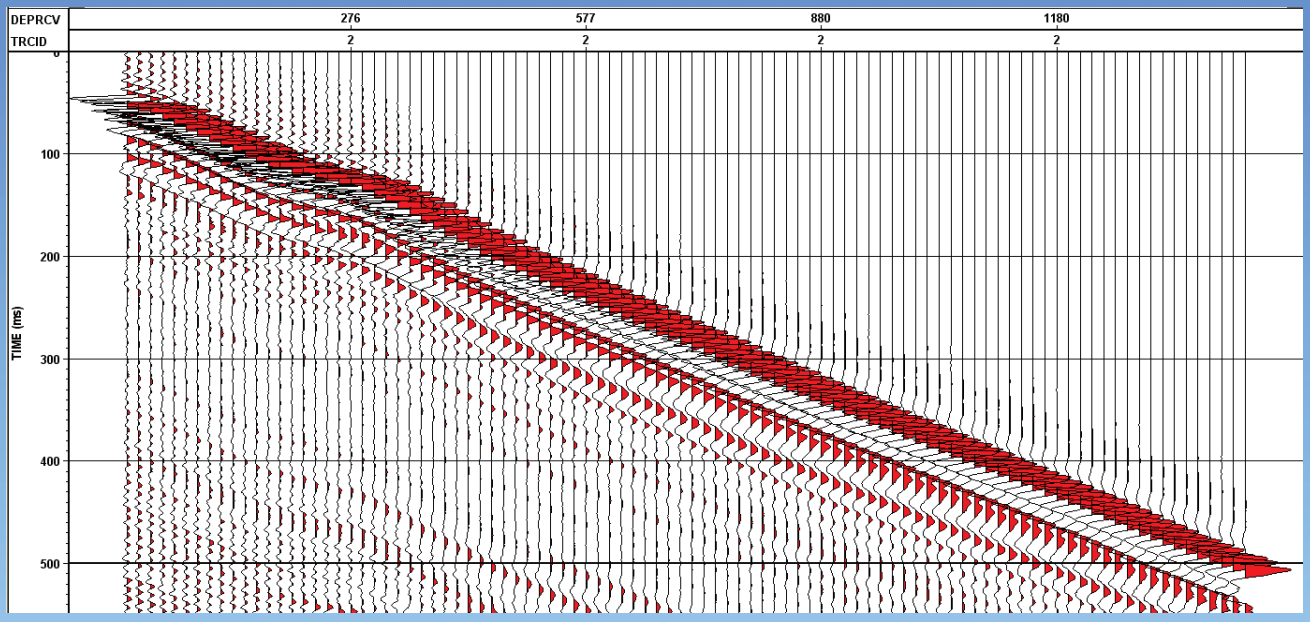
Raw Z components with first break



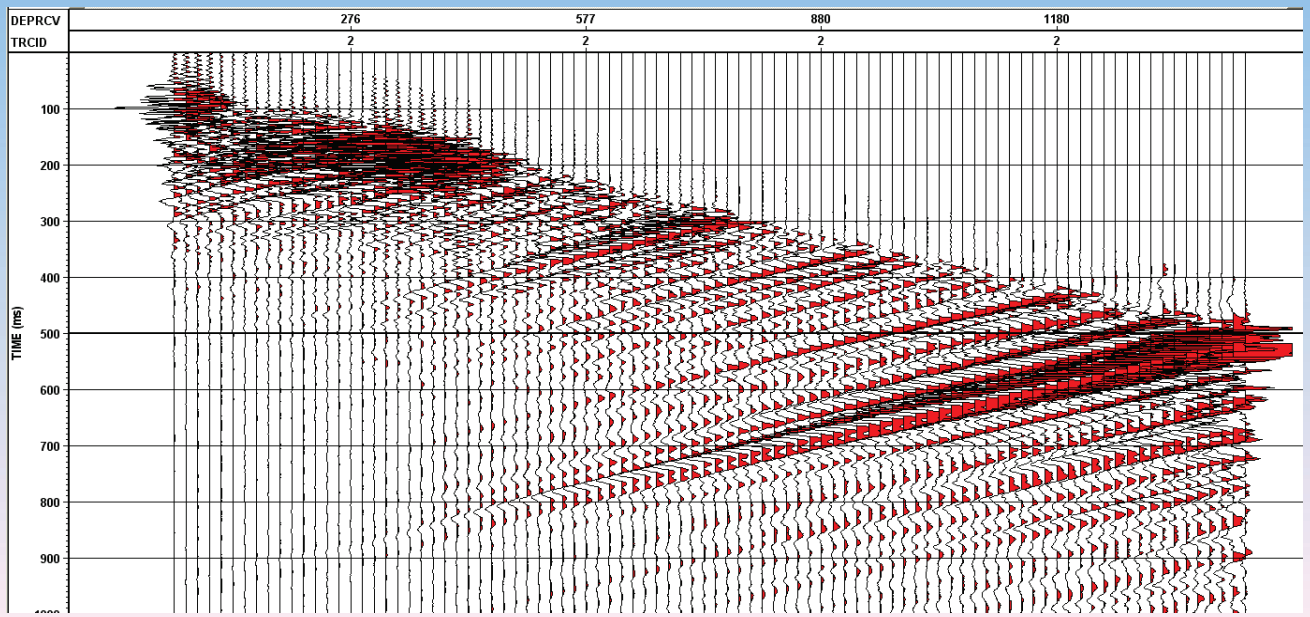
Mannville coal reflection

Wavefield separation

Downgoing waves after 21 point median filtering

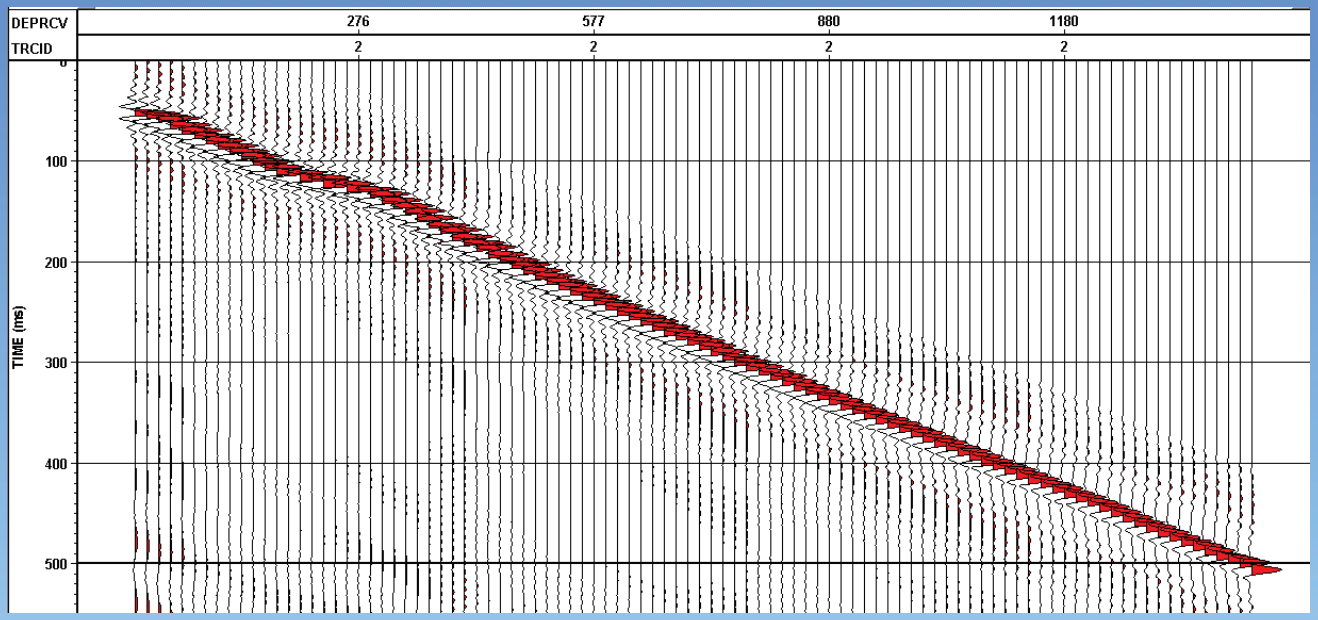


Upgoing waves after 21 point median filtering

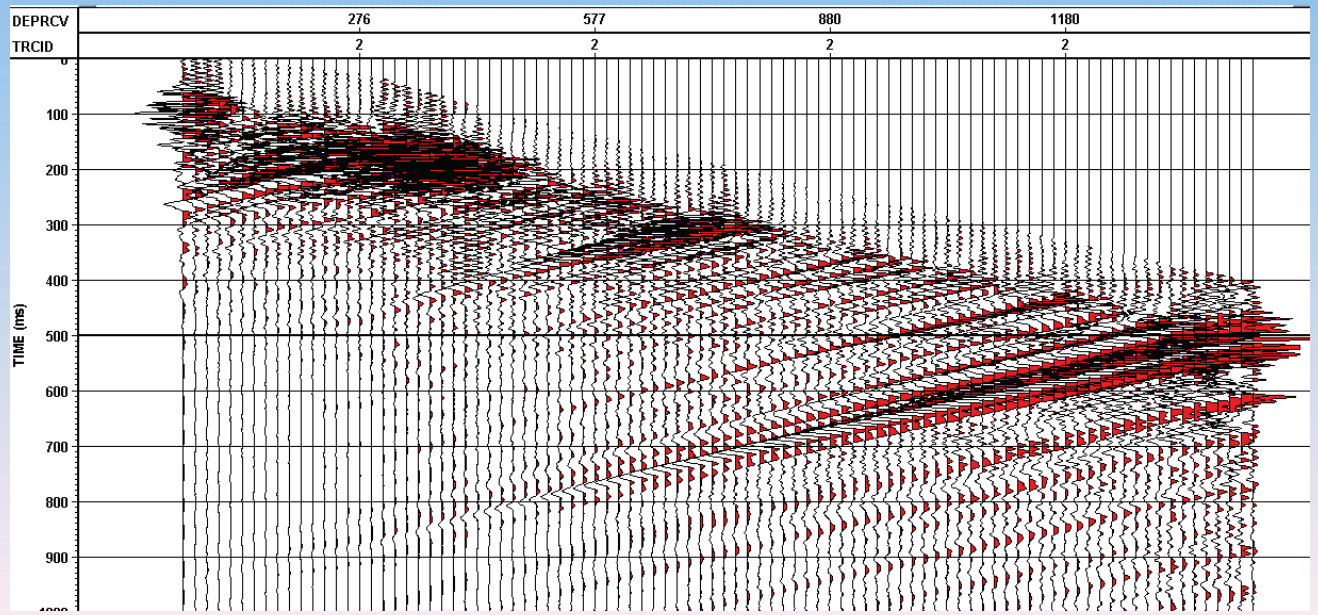


Deconvolution of wavefield

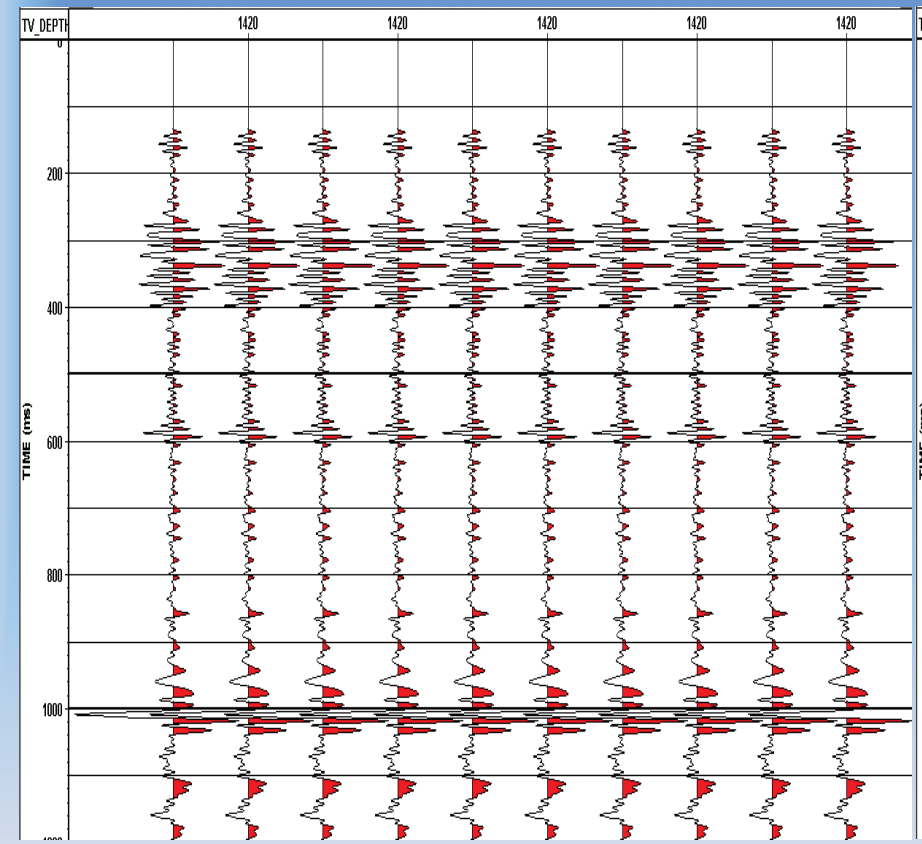
Downgoing waves after deconvolution



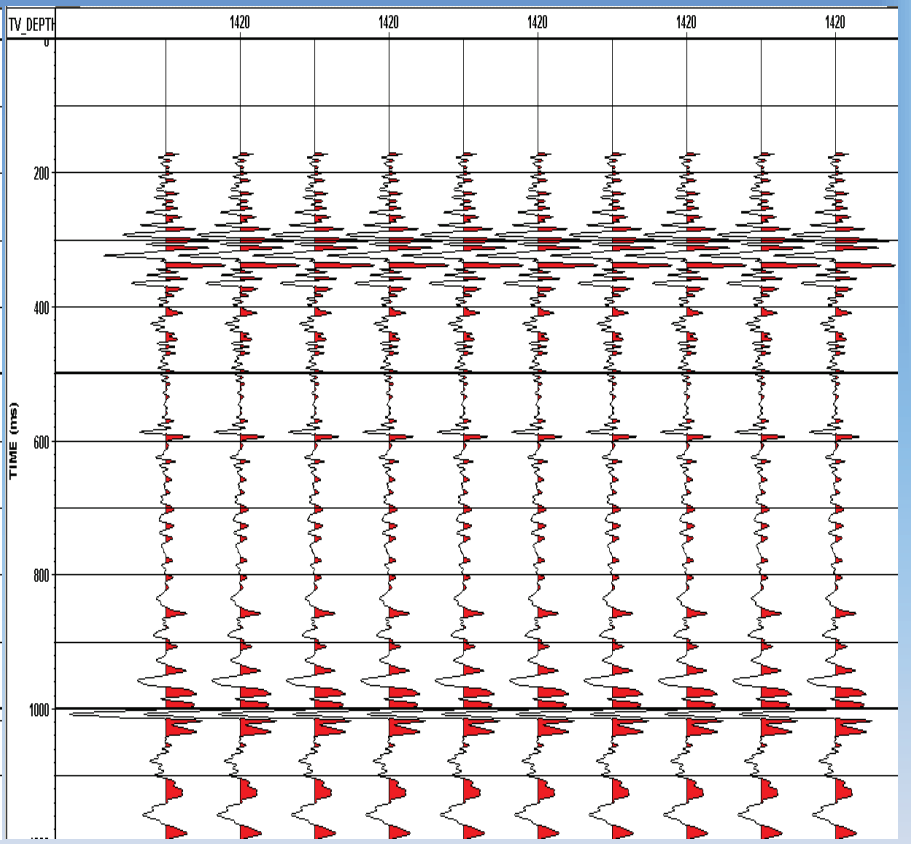
Upgoing waves after deconvolution



Outside and inside corridor stacks



Outside corridor stack

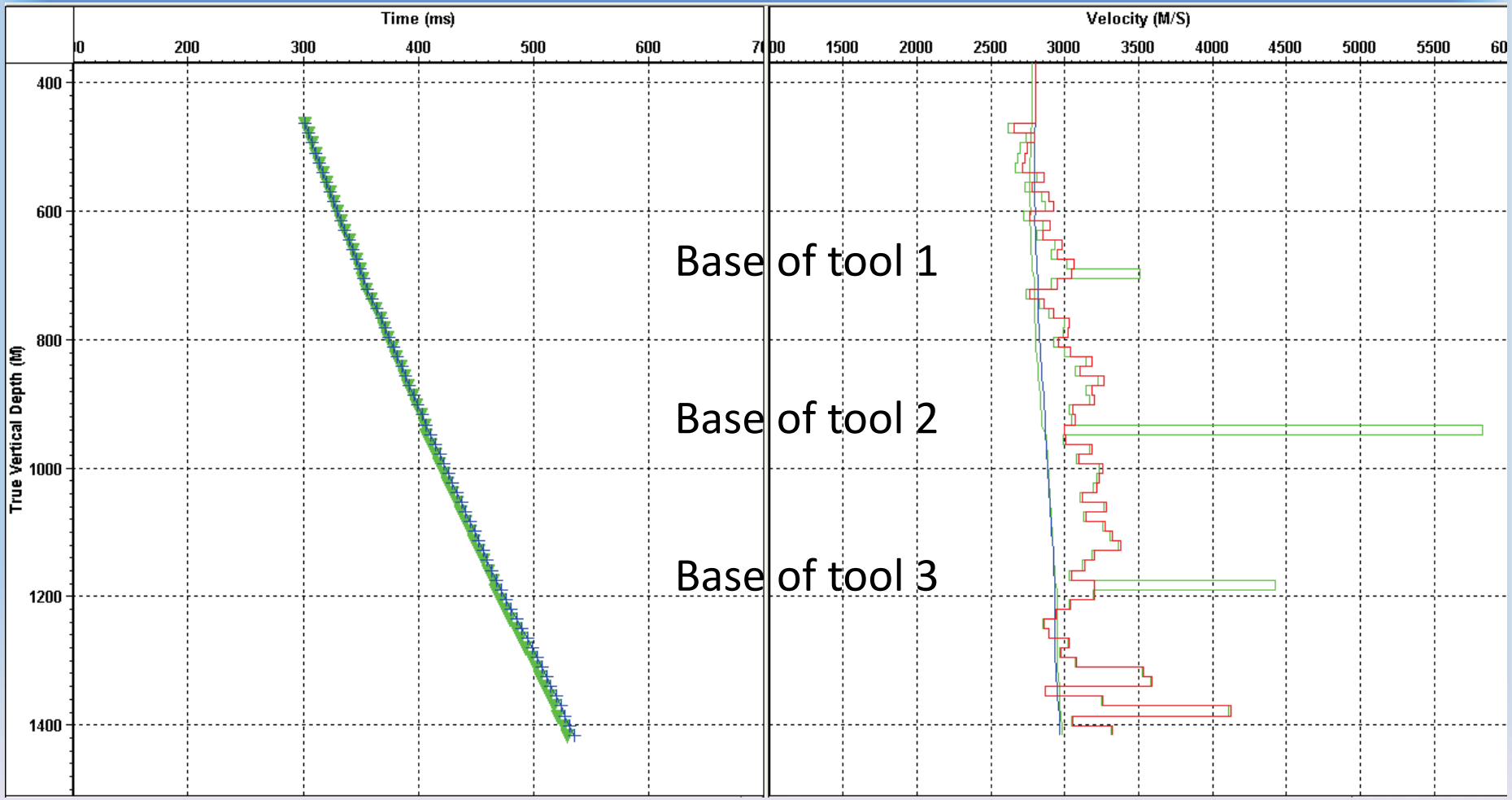


Inside corridor stack

Walkaway VSP acquisition

- Three Walkaway VSPs were acquired with a maximum shot offset of 1346 m and total of 10 offsets.
- Coverage was acquired from 468 m – 1420 m in depth.
- There were 4 receiver shuttle tools with 16 levels were lowered in the borehole.
- Since the sources are dynamite, a shot static problem was encountered.

First breaks and shot static correction

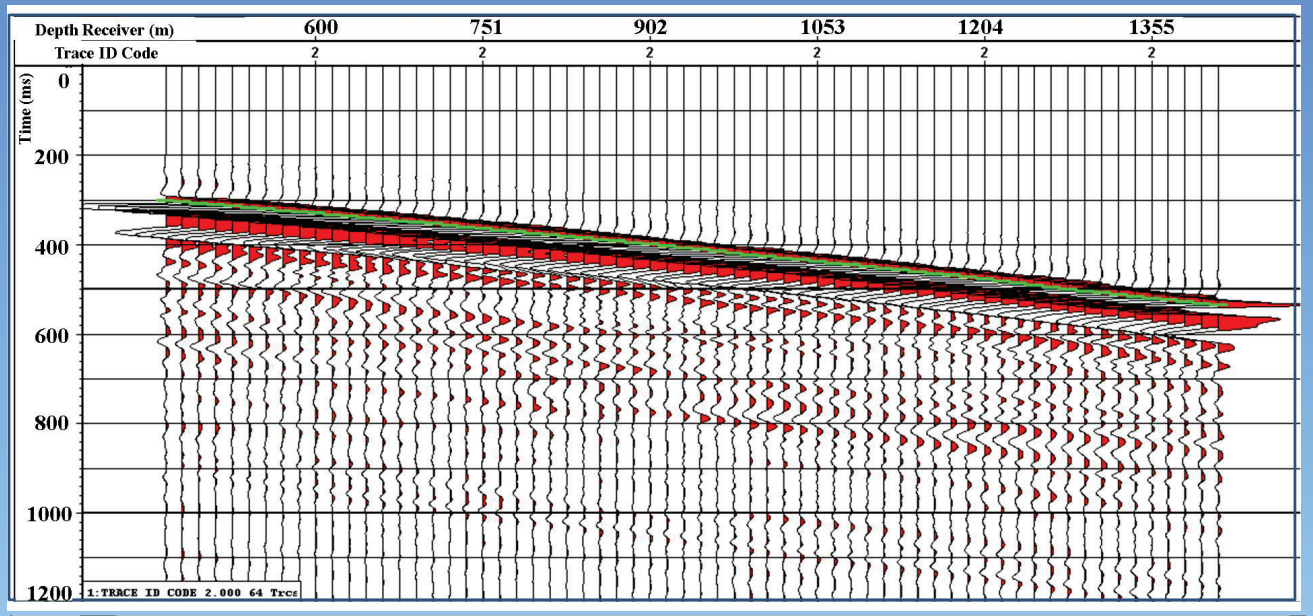


Separation of wavefields

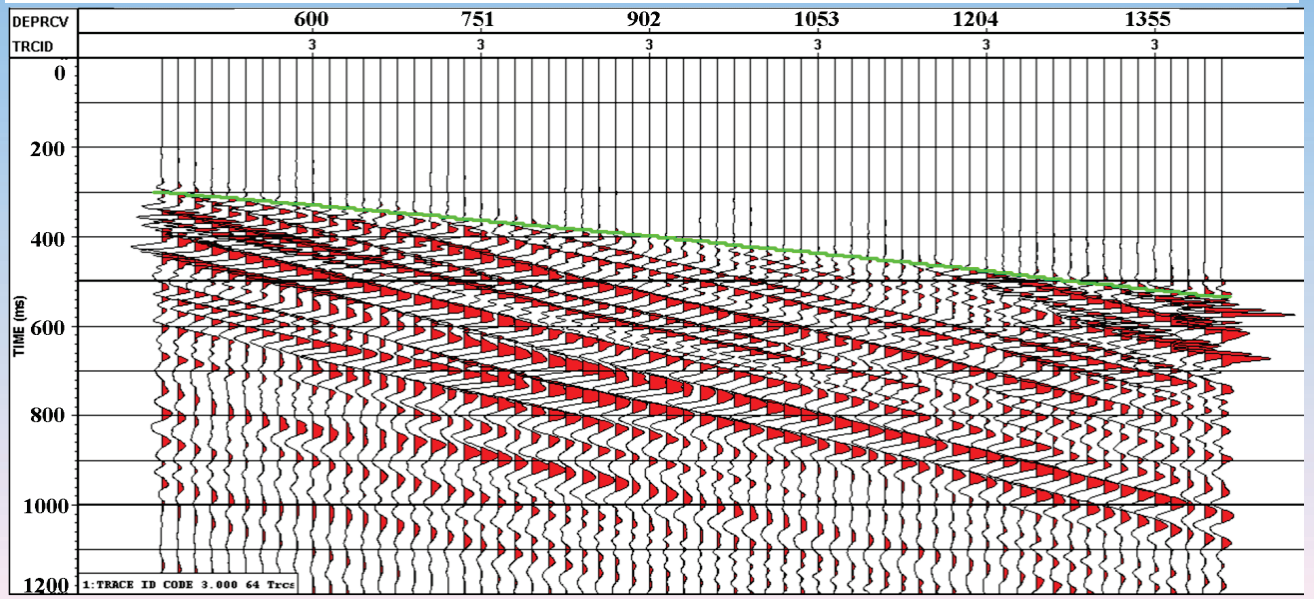
- Two hodogram rotations are performed to isolate the P and SV downgoing wavefields.
- FK filtering is applied to obtain downgoing P, downgoing SV, upgoing P and upgoing SV.
- Time variant rotation is applied to the upgoing P and upgoing SV wavefields to further isolate the upgoing waves.
- Examples of the different wavefields for offsets 647 and 1346 are shown of the south walkaway line.

Wavefield separation of offset 647

Downgoing P waves

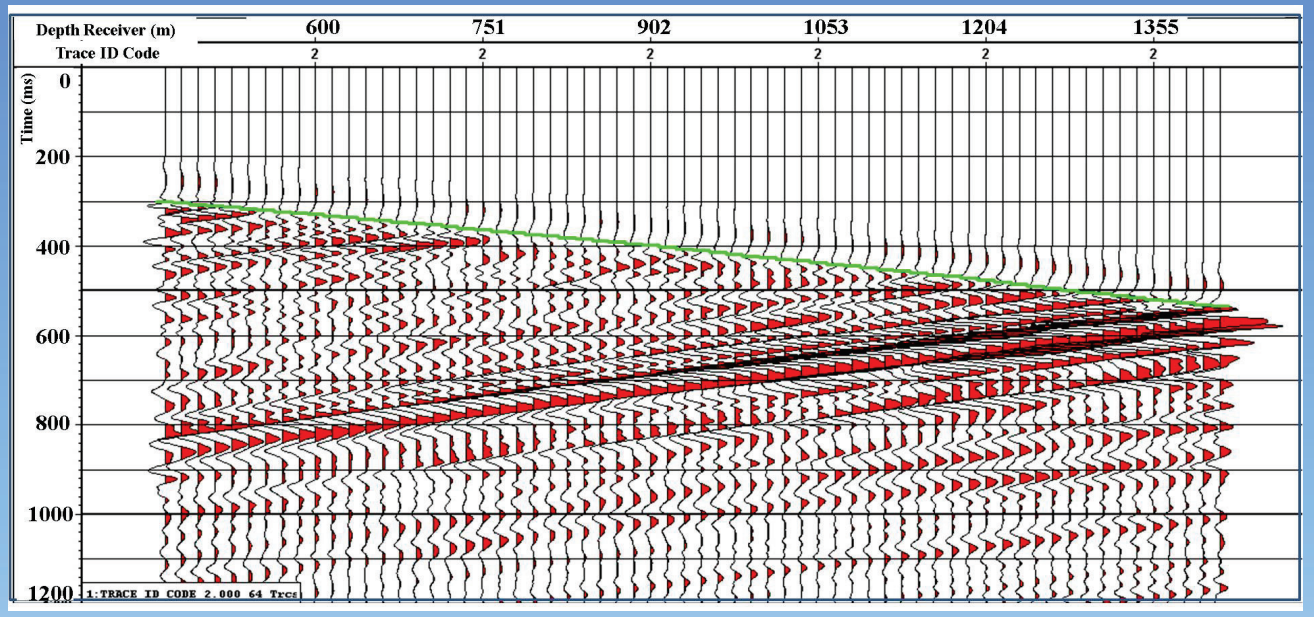


Downgoing S waves

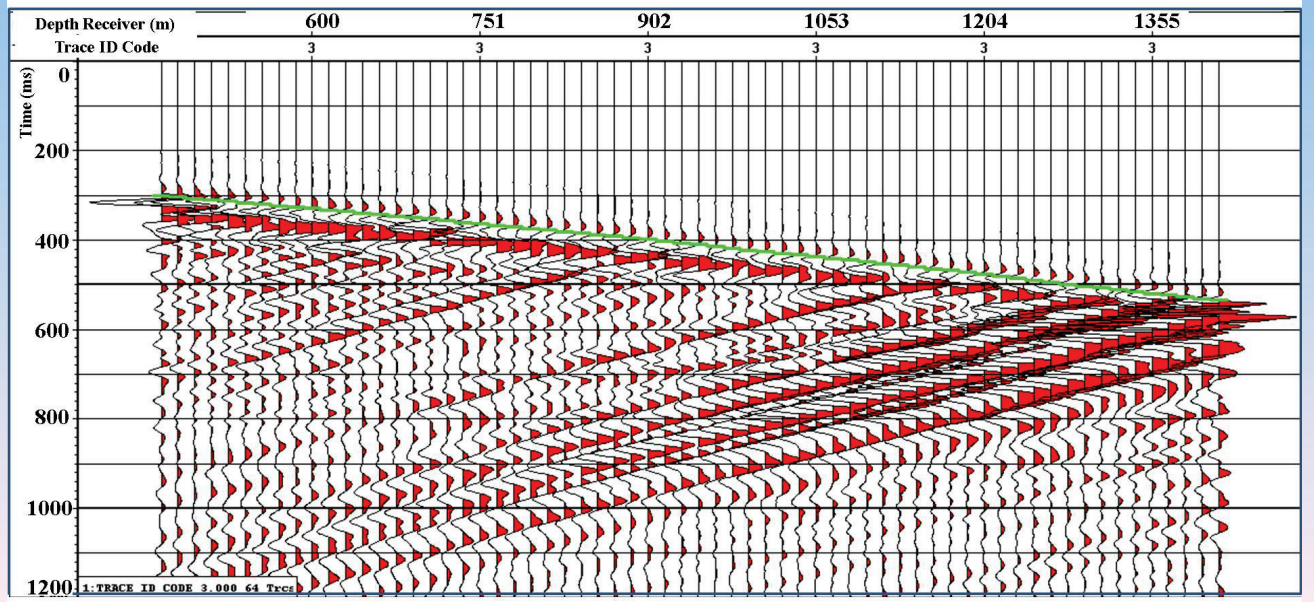


Wavefield separation of offset 647

Upgoing
P waves

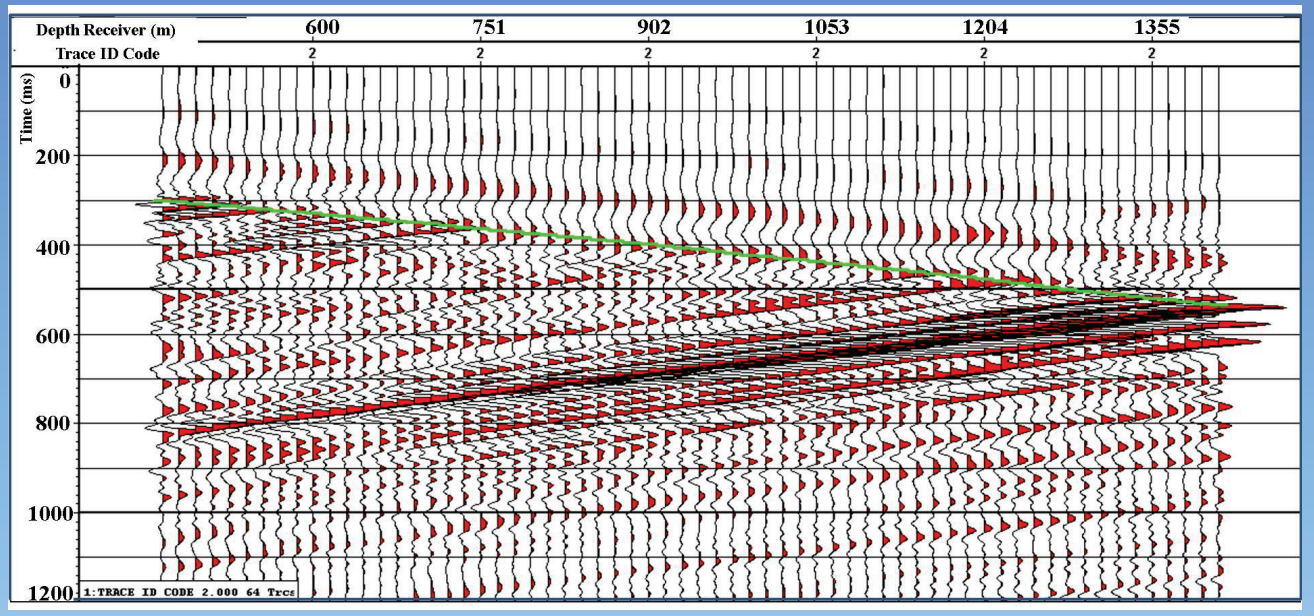


Upgoing
S waves

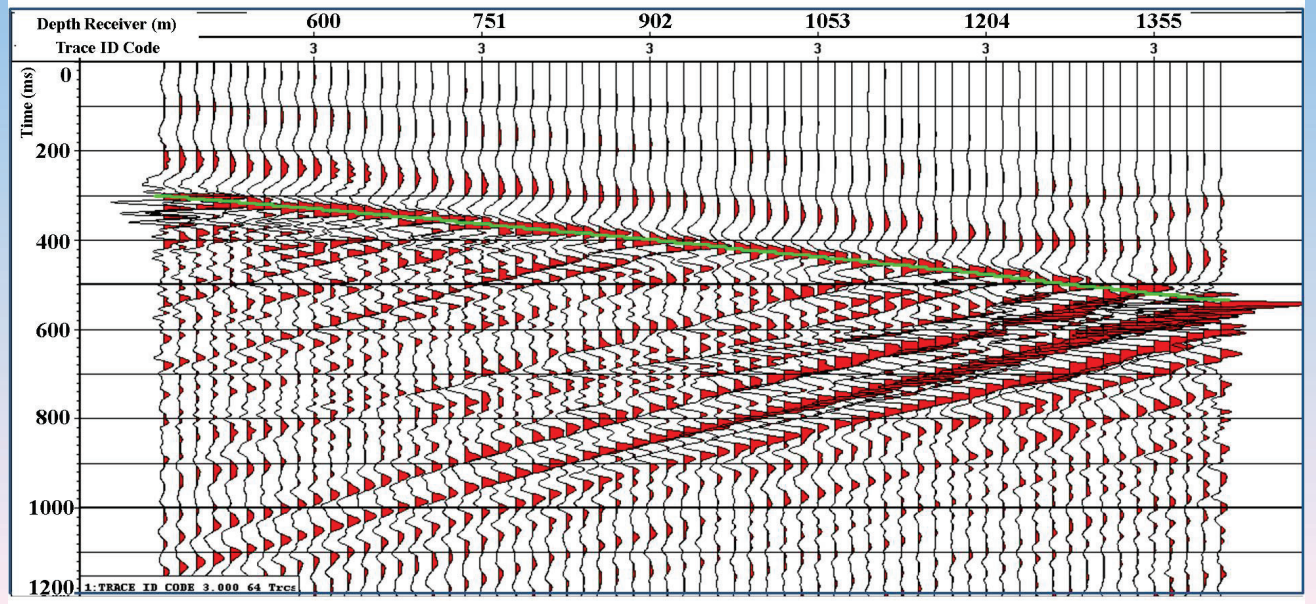


Deconvolution of offset 647

Deconvolved upgoing P waves

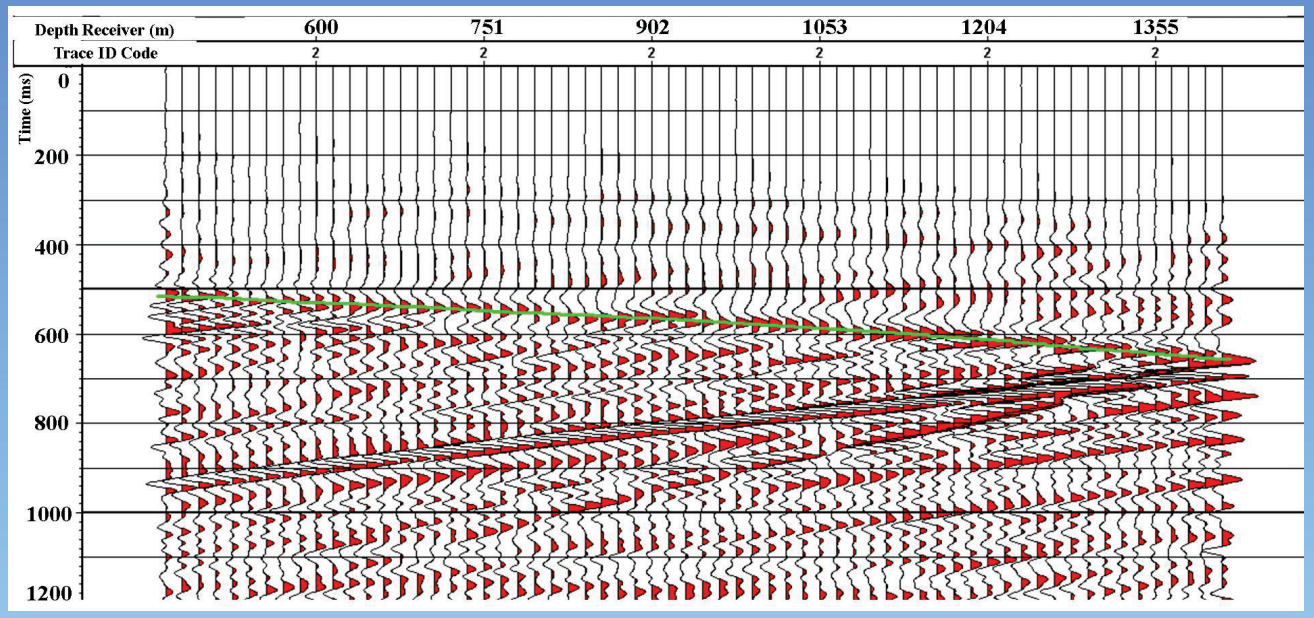


Deconvolved upgoing SV waves

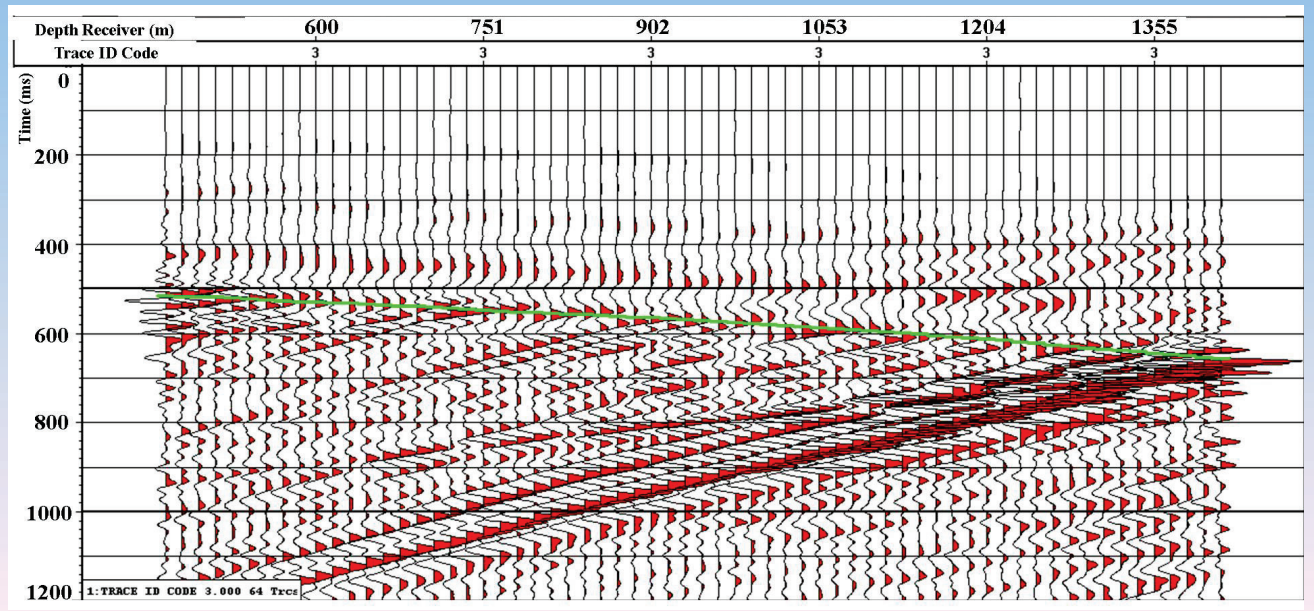


Deconvolution of offset 1346

Deconvolved upgoing P waves

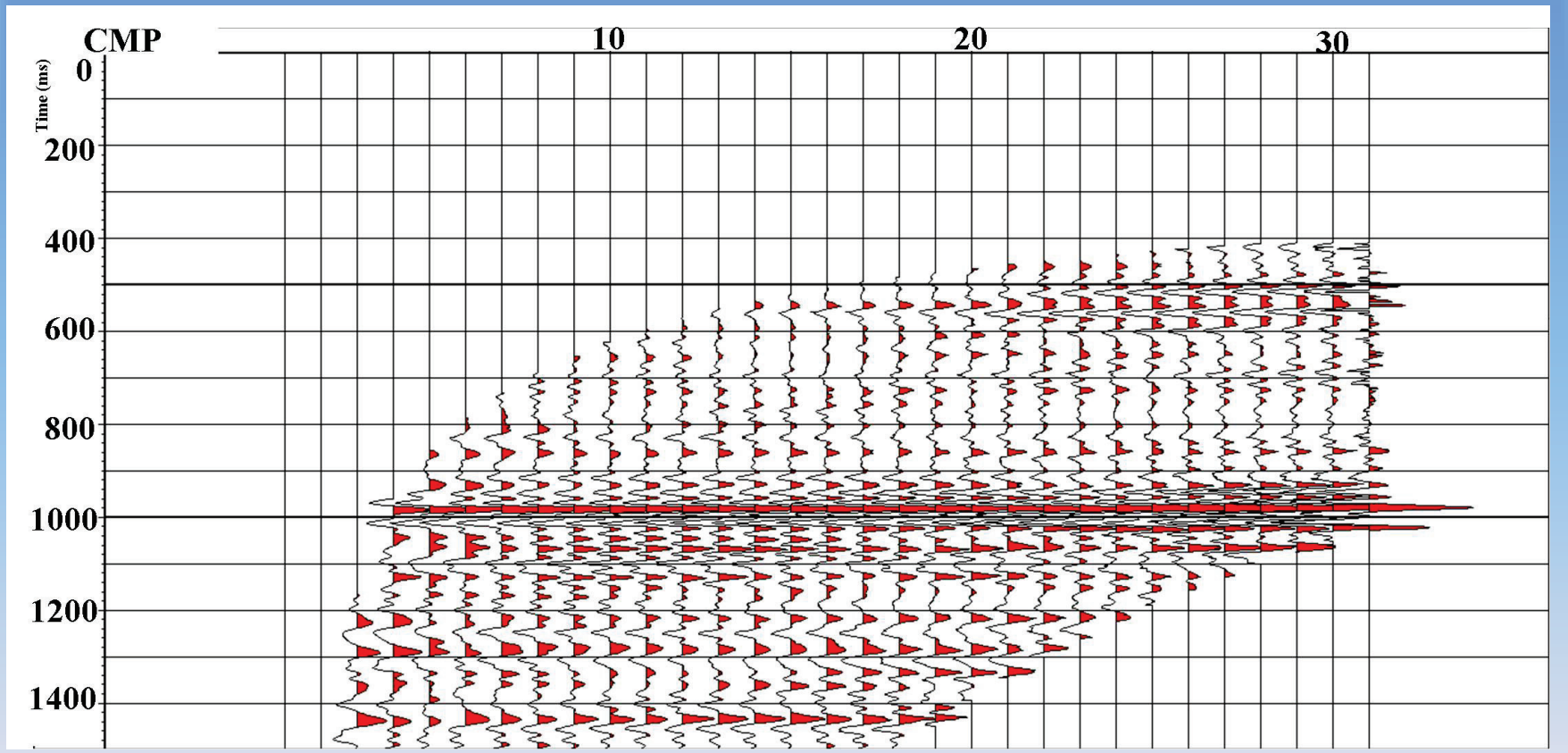


Deconvolved upgoing SV waves



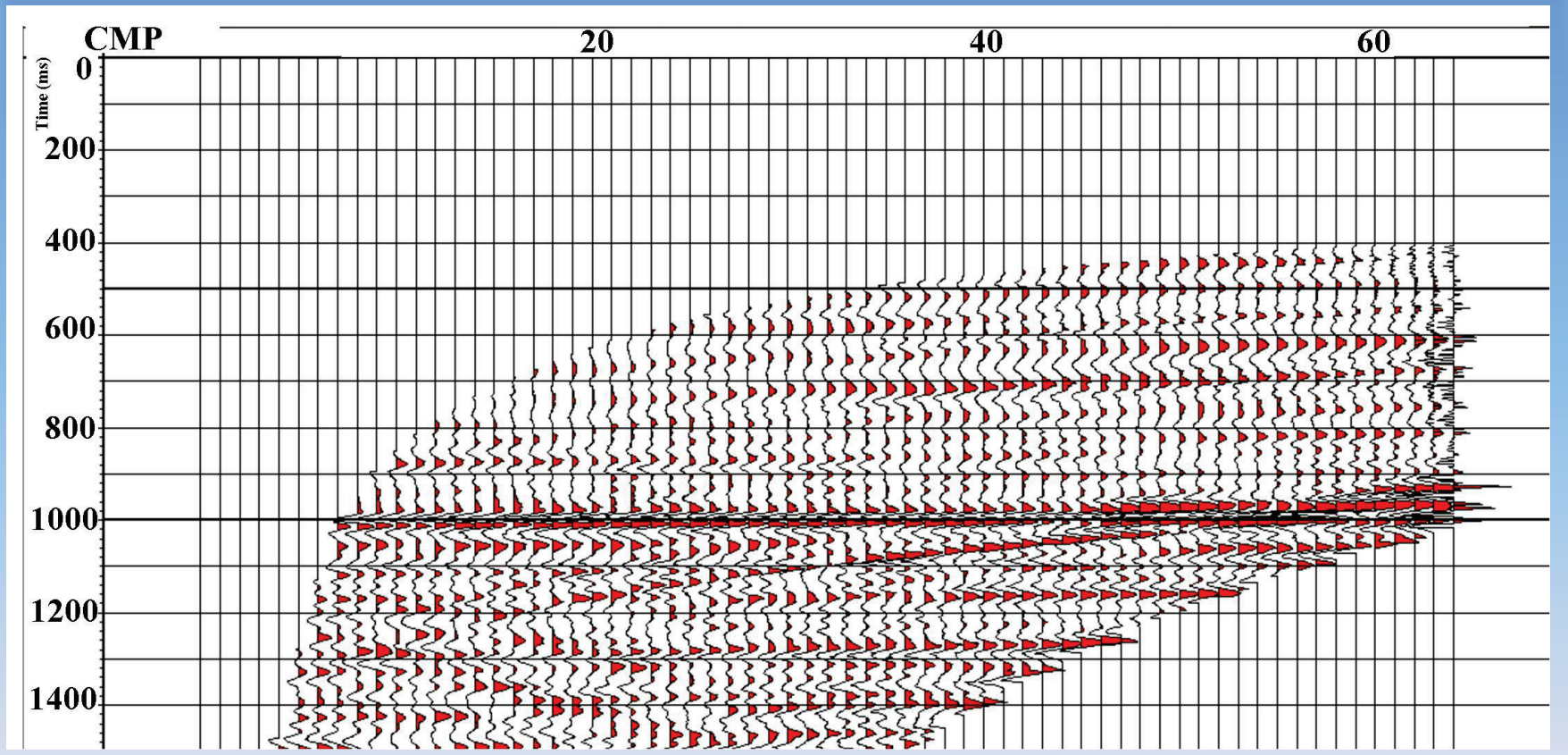
VSPCDP gather for offset 647

Maximum offset 299 m



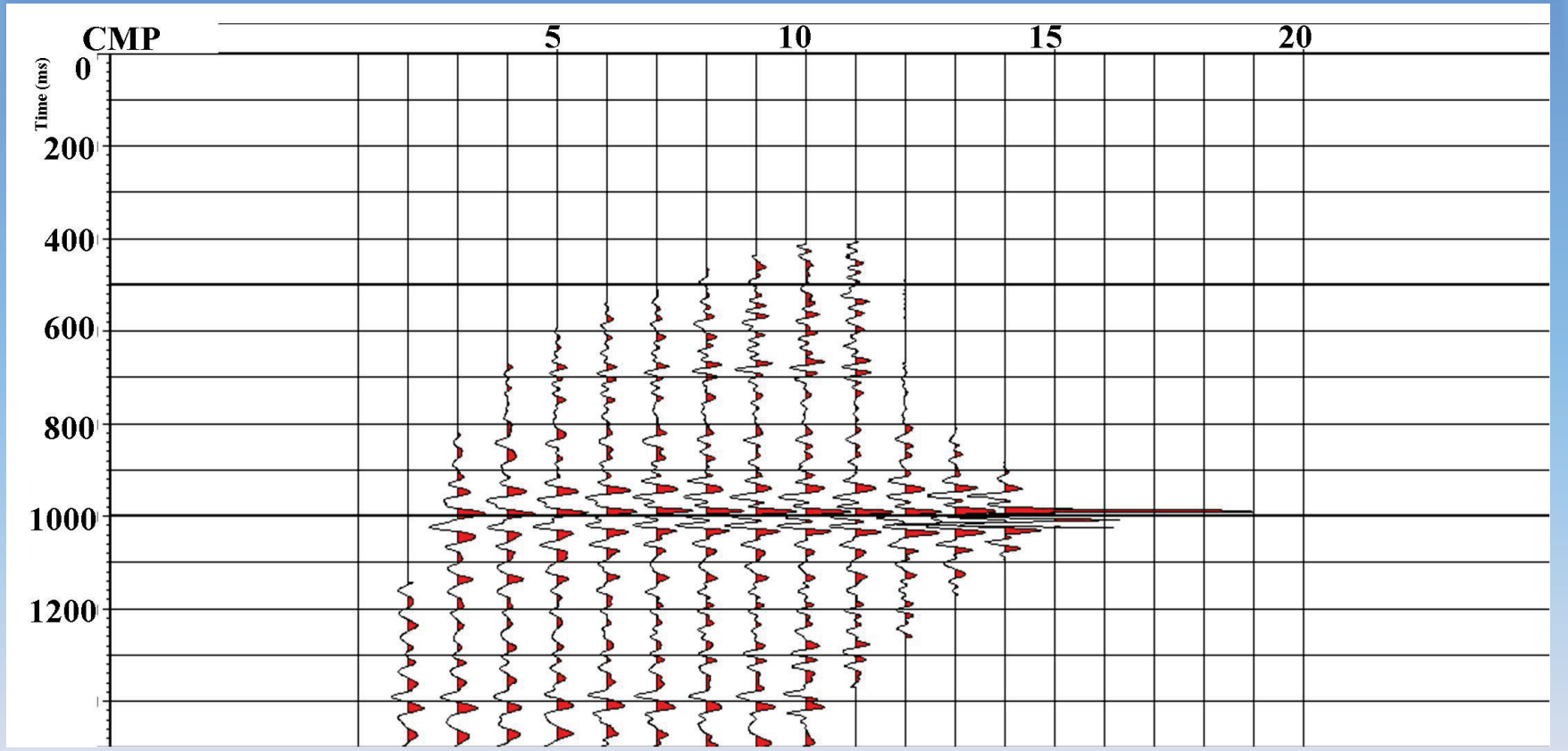
VSPCDP gather for offset 1346

Maximum offset 639 m



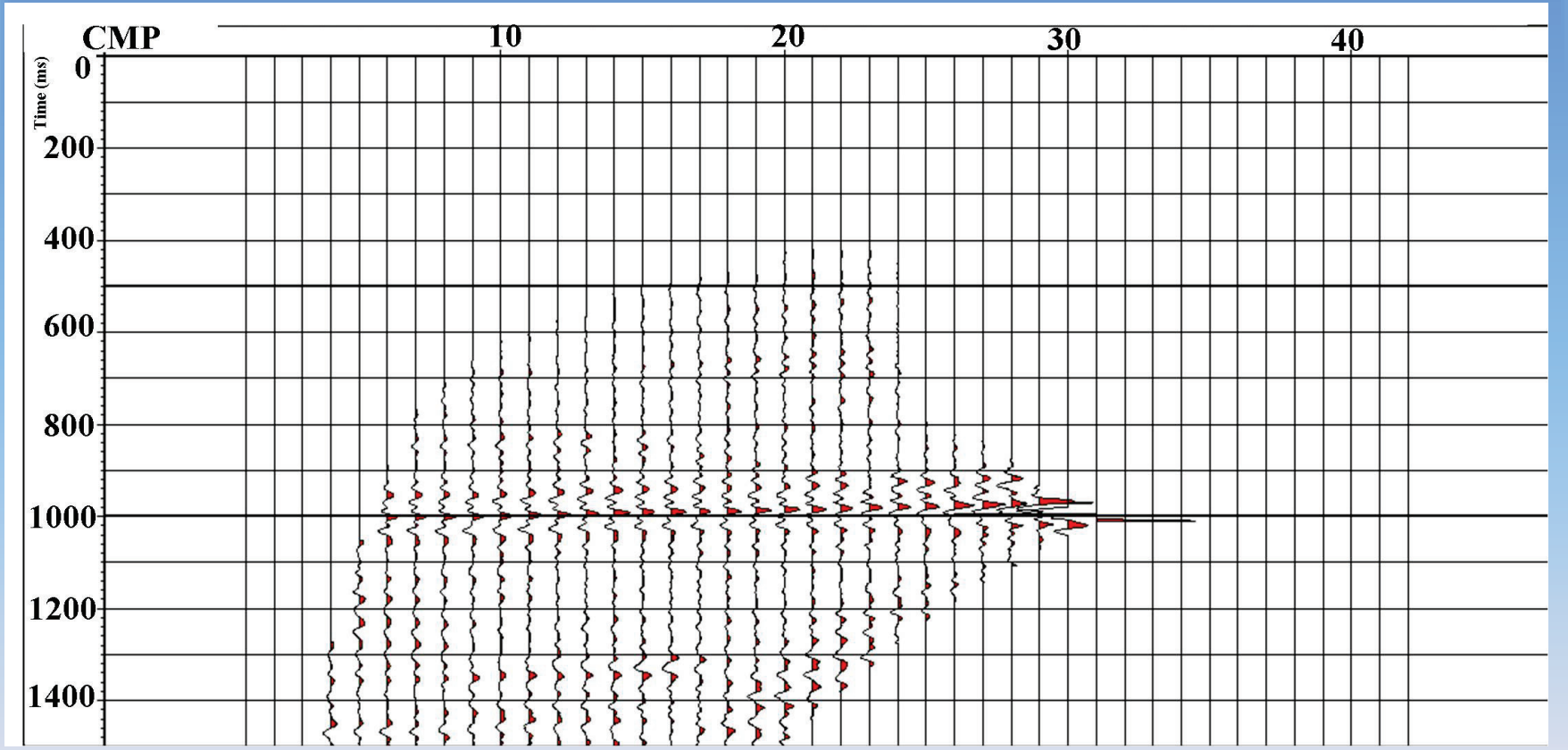
VSPCCP gather for offset 647

Maximum offset 189 m



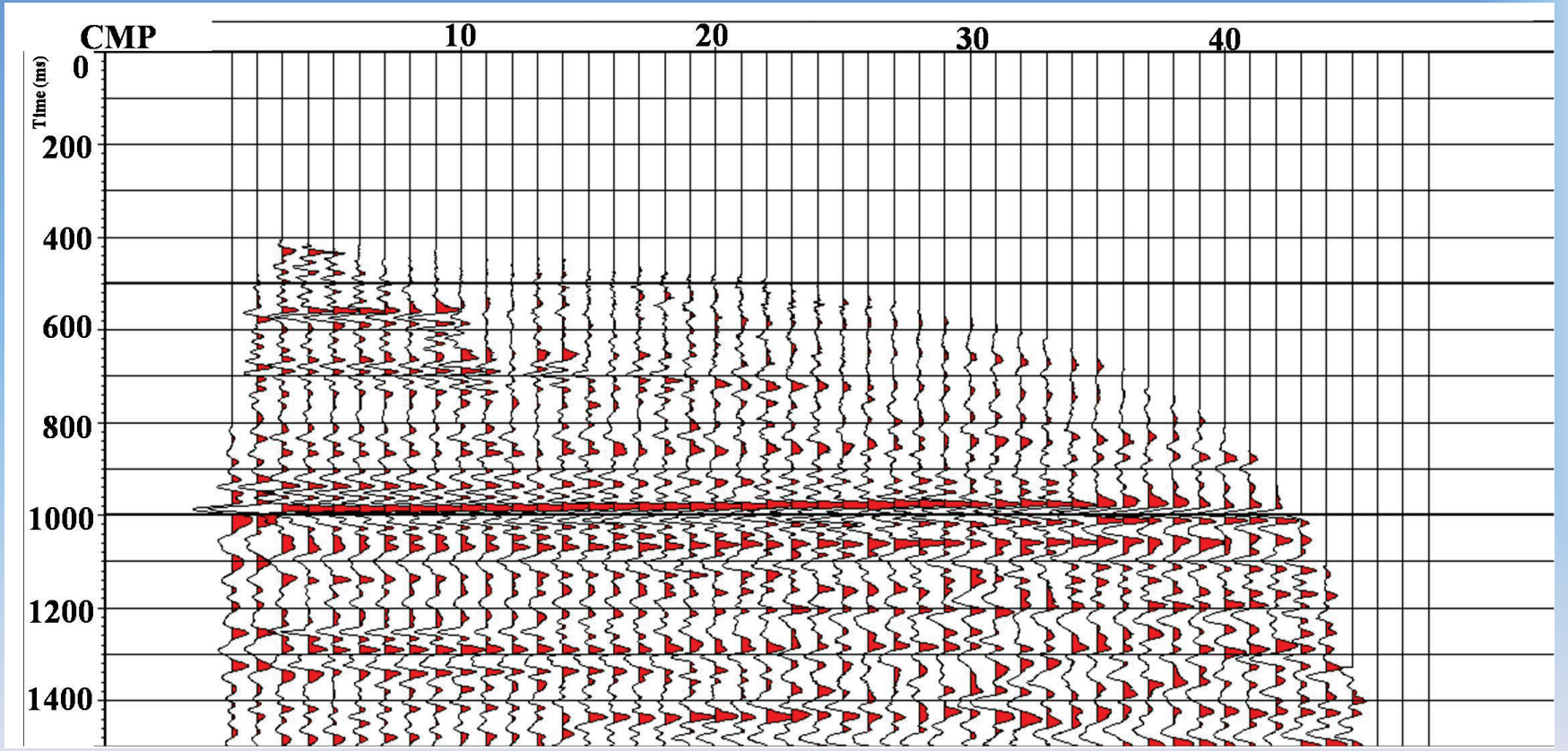
VSPCCP gather for offset 1346

Maximum offset 409 m



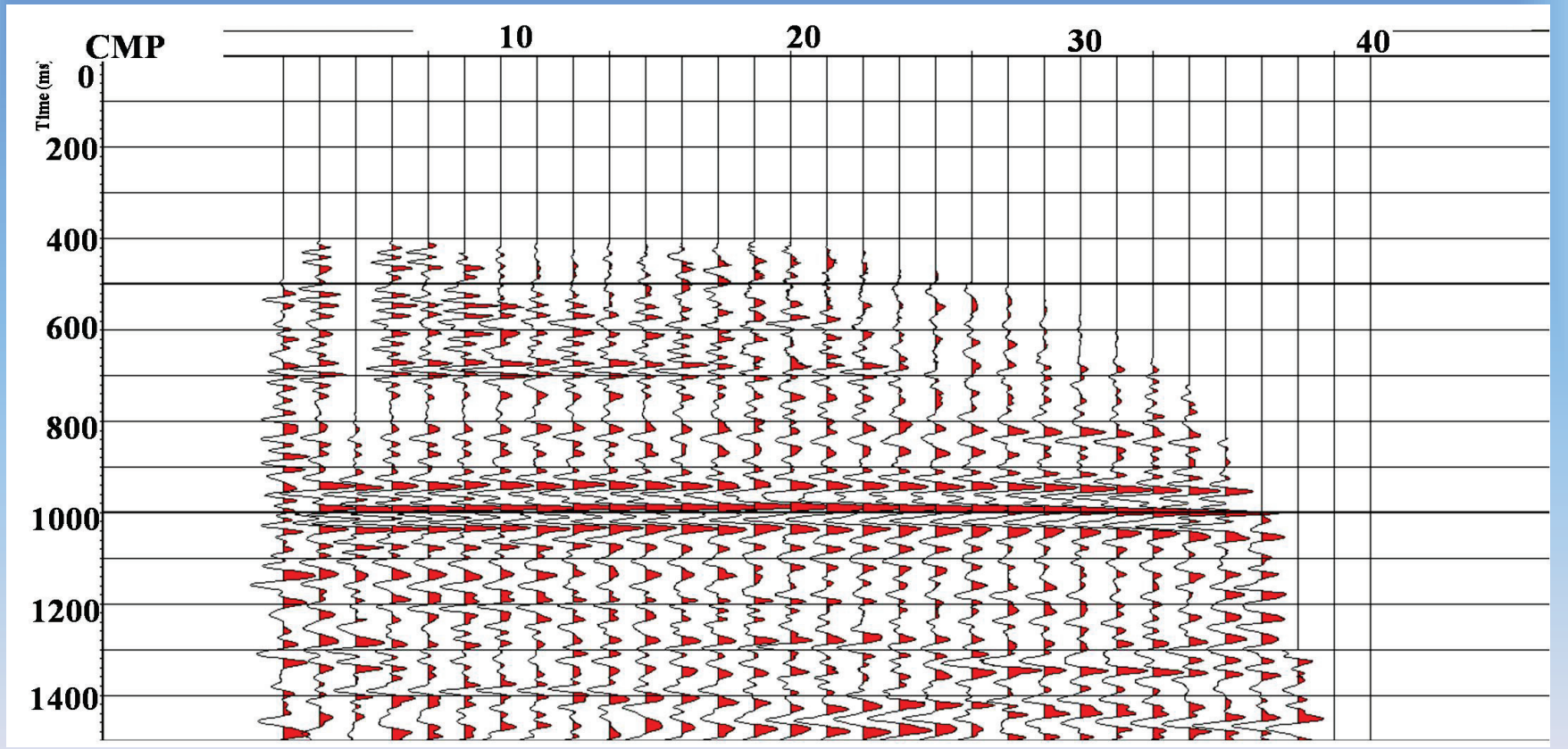
Multi-offset VSPCDP stack of the south walkaway VSP

Maximum offset 335 m



Multi-Offset VSPCCP stack of the south walkaway VSP

Maximum offset 216 m



Future work: Multicomponent AVO analysis

Conclusions

- The zero offset VSP proved to have no significant multiples.
- A suggestion to have a receiver overlap in VSP acquisition to avoid shot static problems.
- As offset increases in VSP walkaway, the upgoing S waves improve the image of the coals increasingly better than P waves.
- The VSPCDP and VSPCCP stack showed that the Mannville coals has the most dominant reflection of the whole dataset.

Acknowledgments

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