Acquisition and analysis of 3C land streamer data

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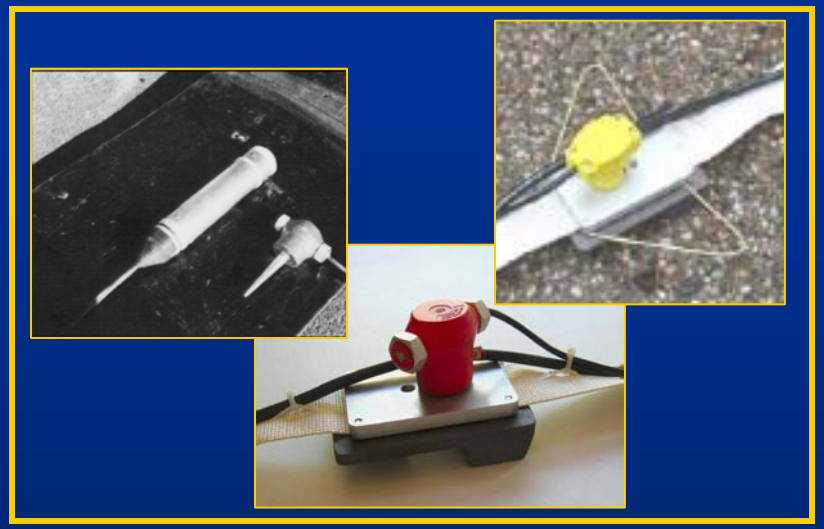
Outline

- The land streamer idea
- Geophysics Field school data 2007
- CREWES land streamer
- Future work and conclusions

The land streamer idea:
Is this the last geophone you will ever plant?

"A land streamer is an array of geophones designed to be towed along the ground"

Land Streamer equipment



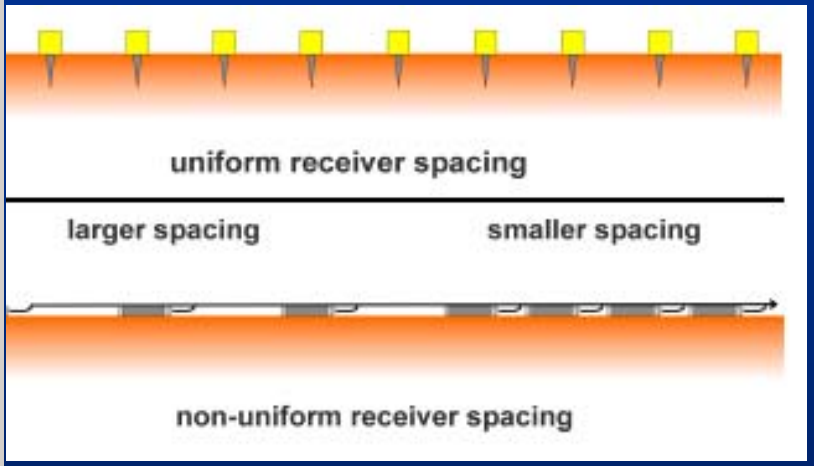
Receivers

Sources

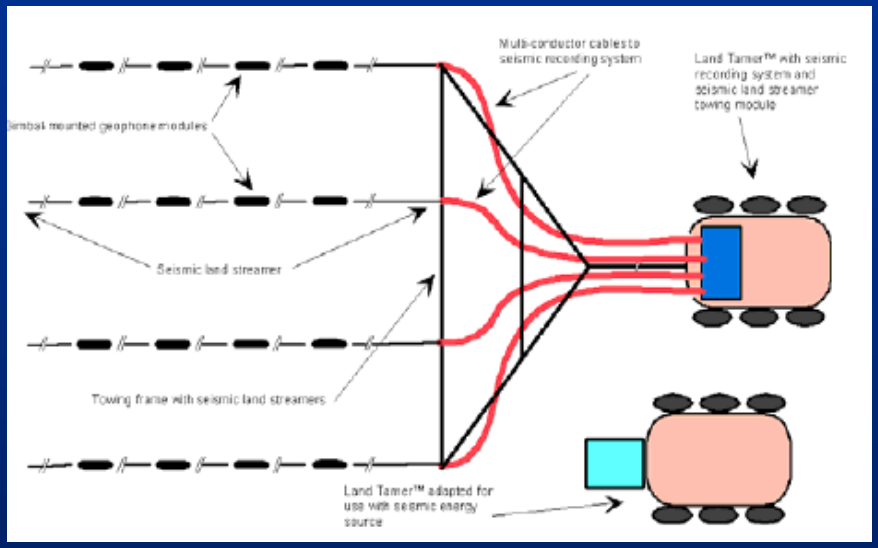
Streamer

Advantages

- Acquisition geometries



Variable receiver spacing for reflection and refraction survey acquisition (Modified from Nitsche, F. O., Delouis, B. and Green, A.G.(Institute of Geophysics, ETH Zürich))



Montana Tech and PFM Manufacturing
3D land streamer design

Advantages

- Field effort and recording time

	Traditional approach		Towed land streamer	
Seismic source	**Crew size**	**Recording time (hours)**	**Crew size**	**Recording time (hours)**
Sledgehammer	5	23	3	10.5
Pipegun	6	43	4	30.5

Example taken from Van der Veen et al (2001)

- All terrain tool
- No special instrumentation is needed
- 2D and 3D

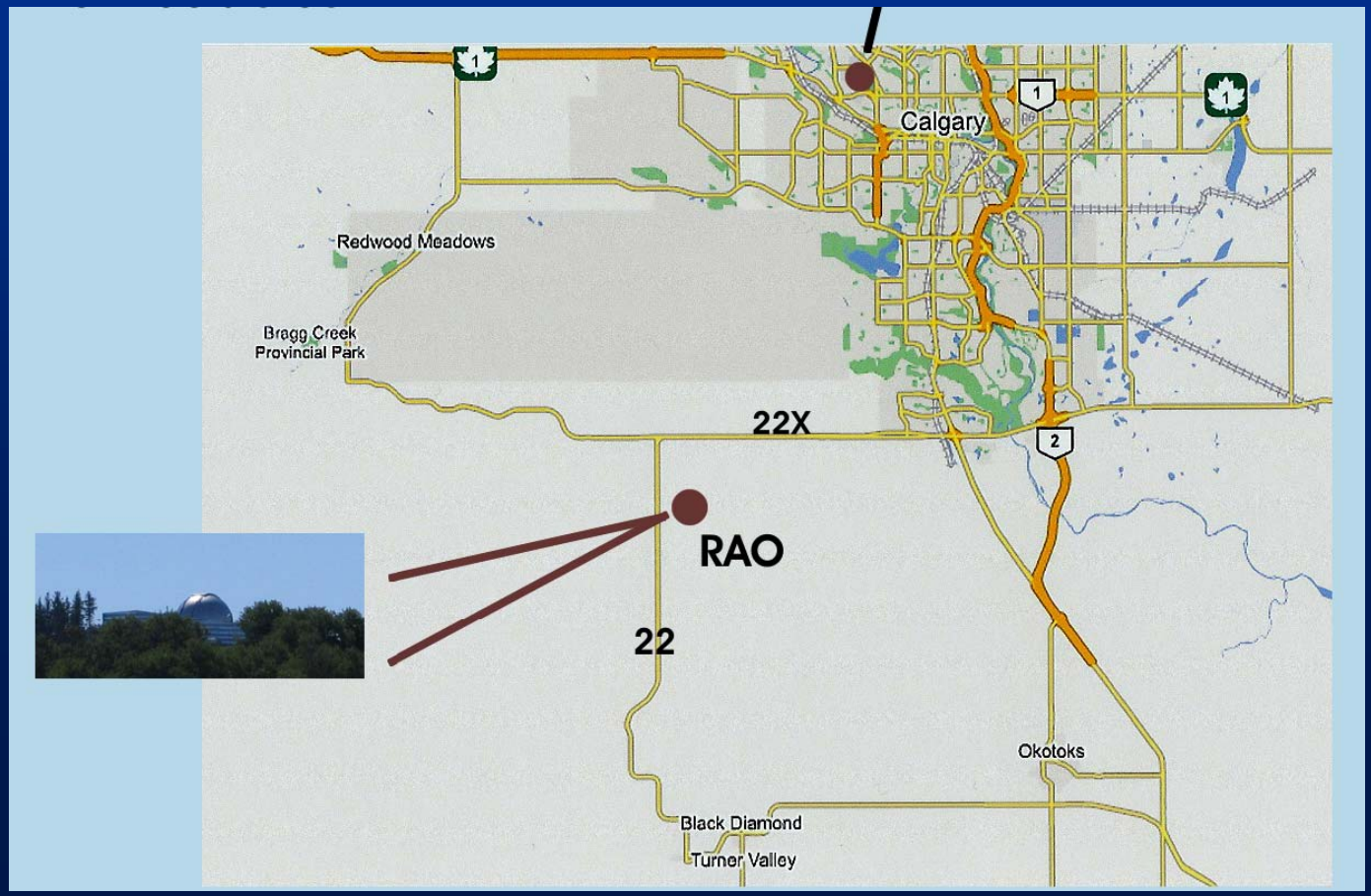
Land Streamer pioneers

Several innovators have been exploring the use of land streamers:

- Alan Green, ETH Switzerland
- Carsten Ploug, COWI, Denmark
- Andre Pugin, Illinois Geological Survey
- Rick Miller, Kansas Geological Survey
- Jorgen Ringgaard, Ramboll, Denmark
- John Clark, Bay Geophysical, Traverse City Michigan
- Mats Svensson, Tyréns Infrakonsult AB, Sweden
- Marvin Speece, Curtis Link, Pat Miller and Jack Kruppenbach, Montana Tech and PFM Manufacturing

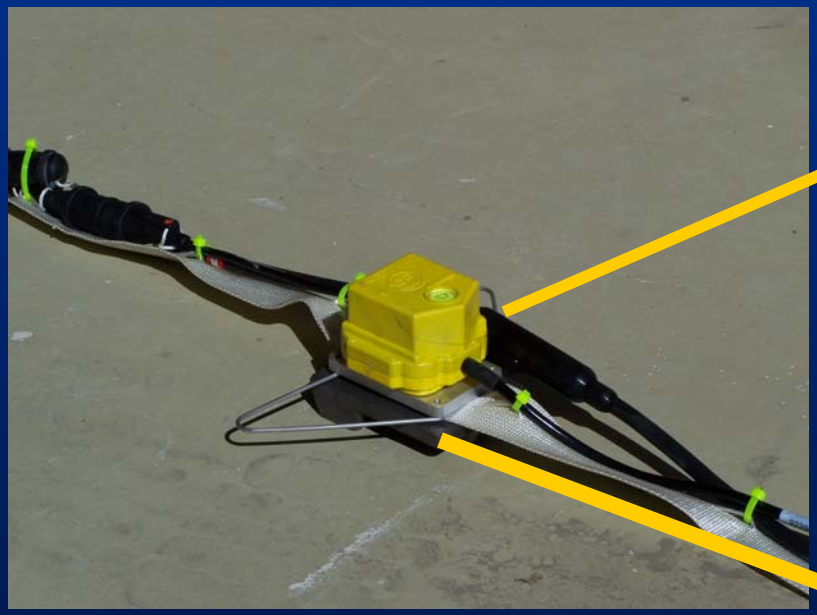
Location of the area of study

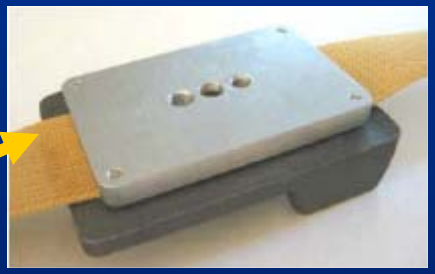
Acquired at the Rothney Astrophysical Observatory (RAO), located near Priddis (Alberta), about 30km southwest of the Calgary city center.



CREWES Land Streamer

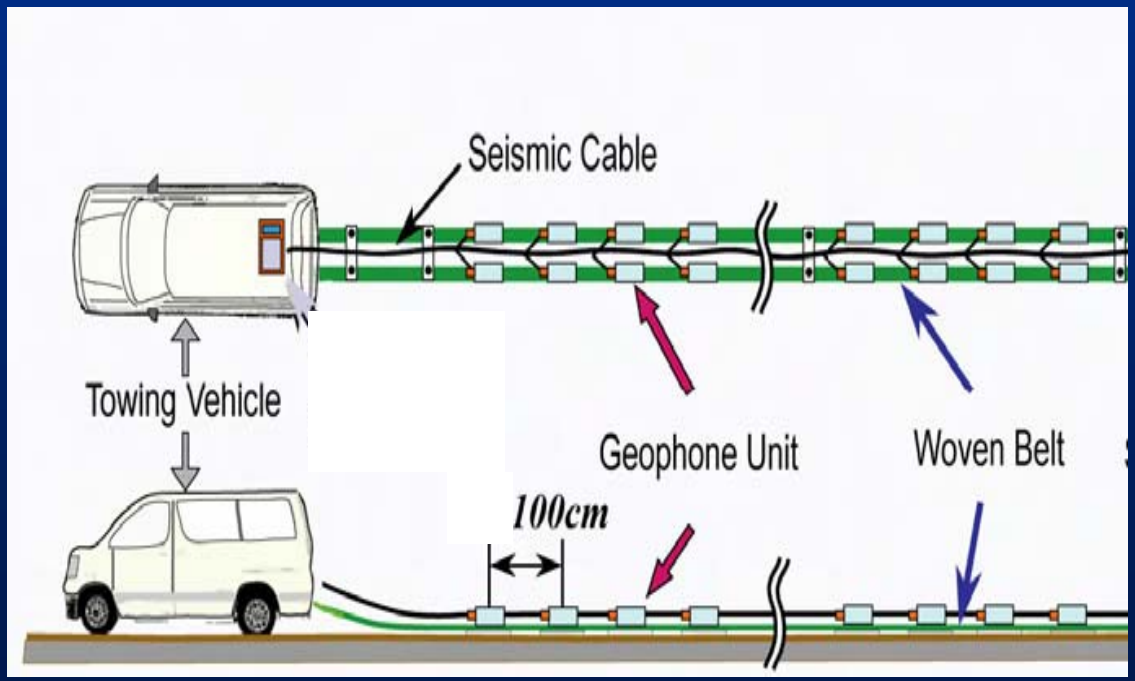
- 3C geophones
- Top and base metallic plates
- Anti-rotation wing
- Tow webbing





CREWES land streamer

- Single streamer: 20 3C geophones every 1m, sources every 5 m
- 38 shots, 211 stations -Total streamer length= 210 m



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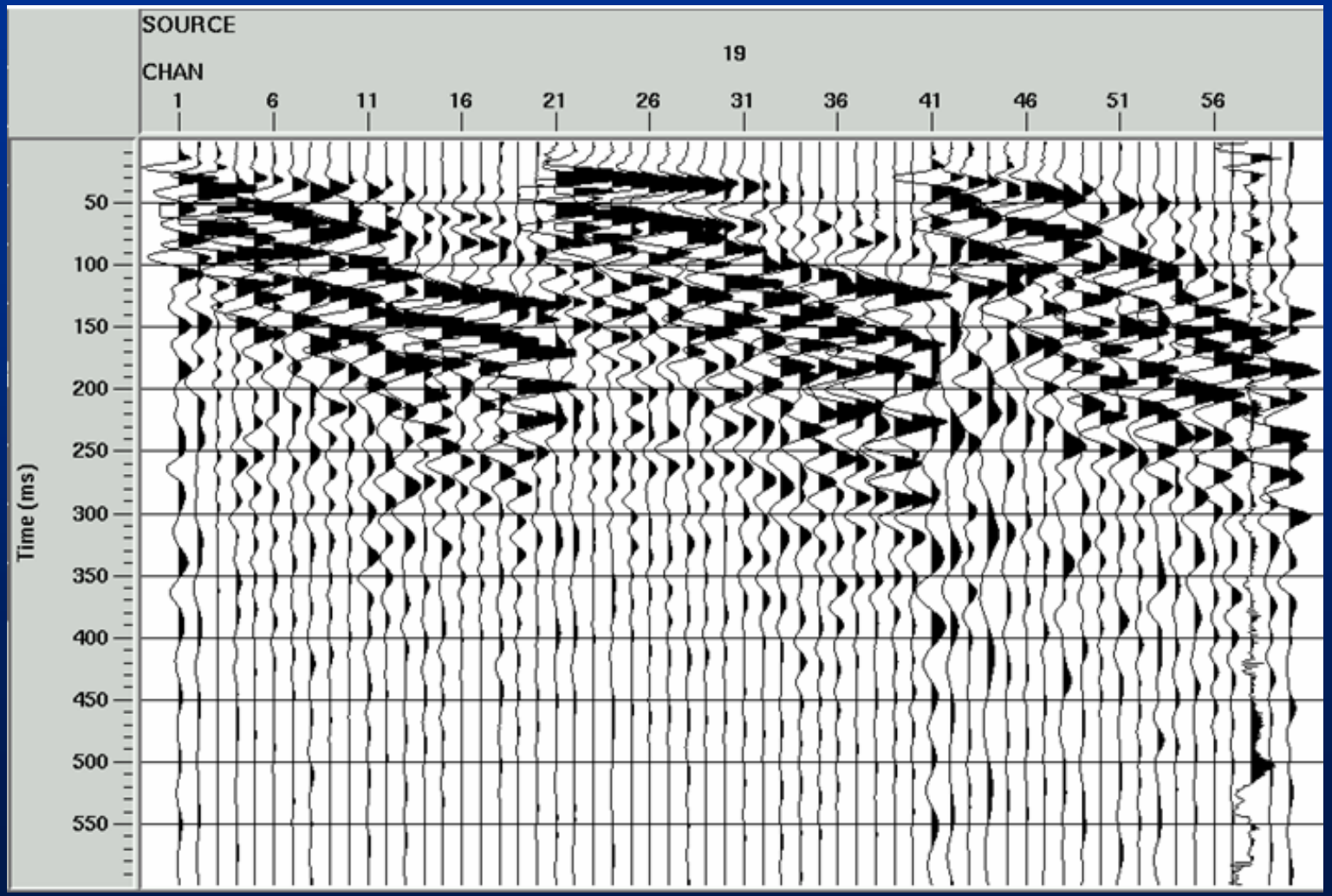
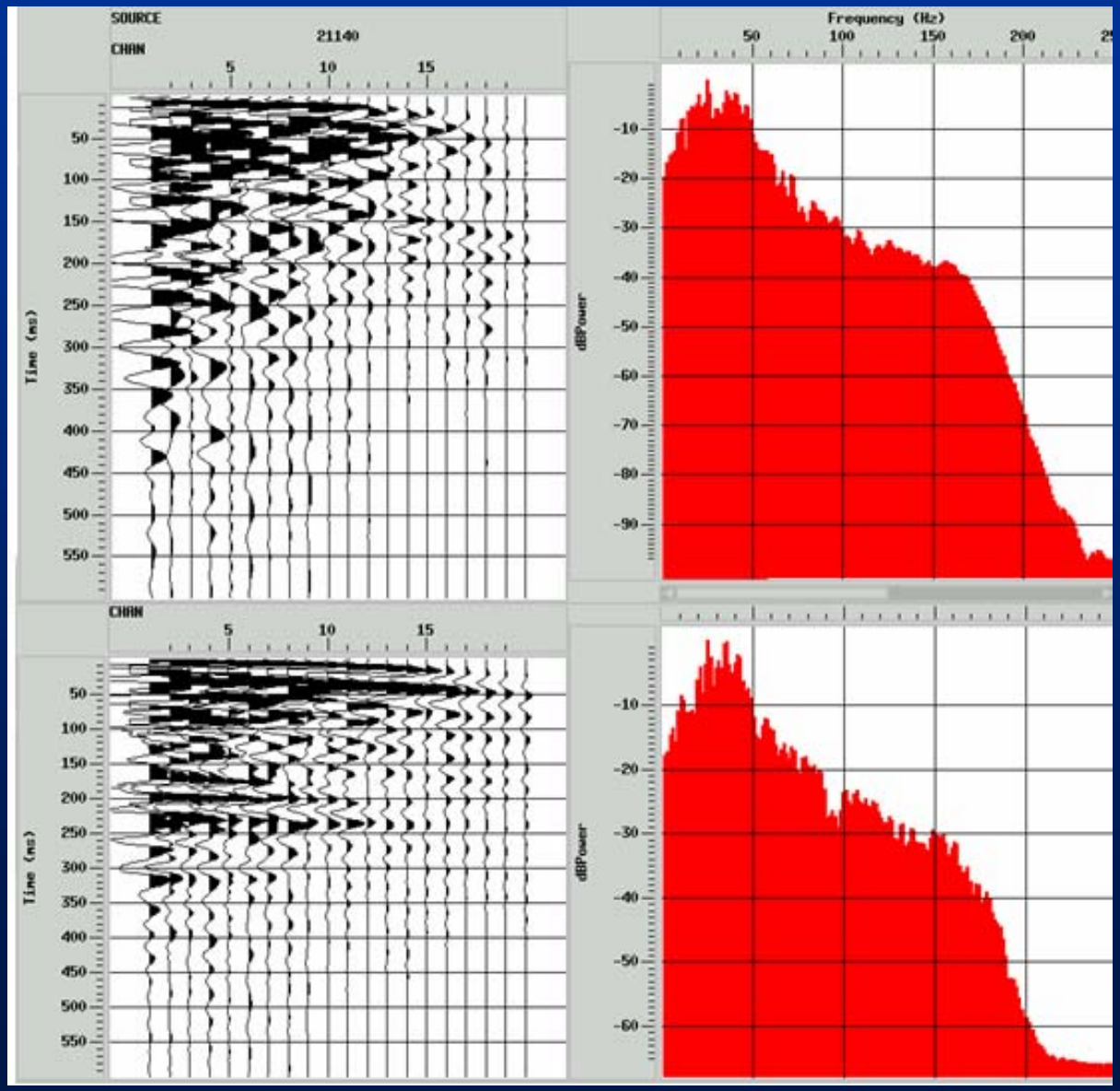
Land Streamer data examples

- Raw 3-C shots



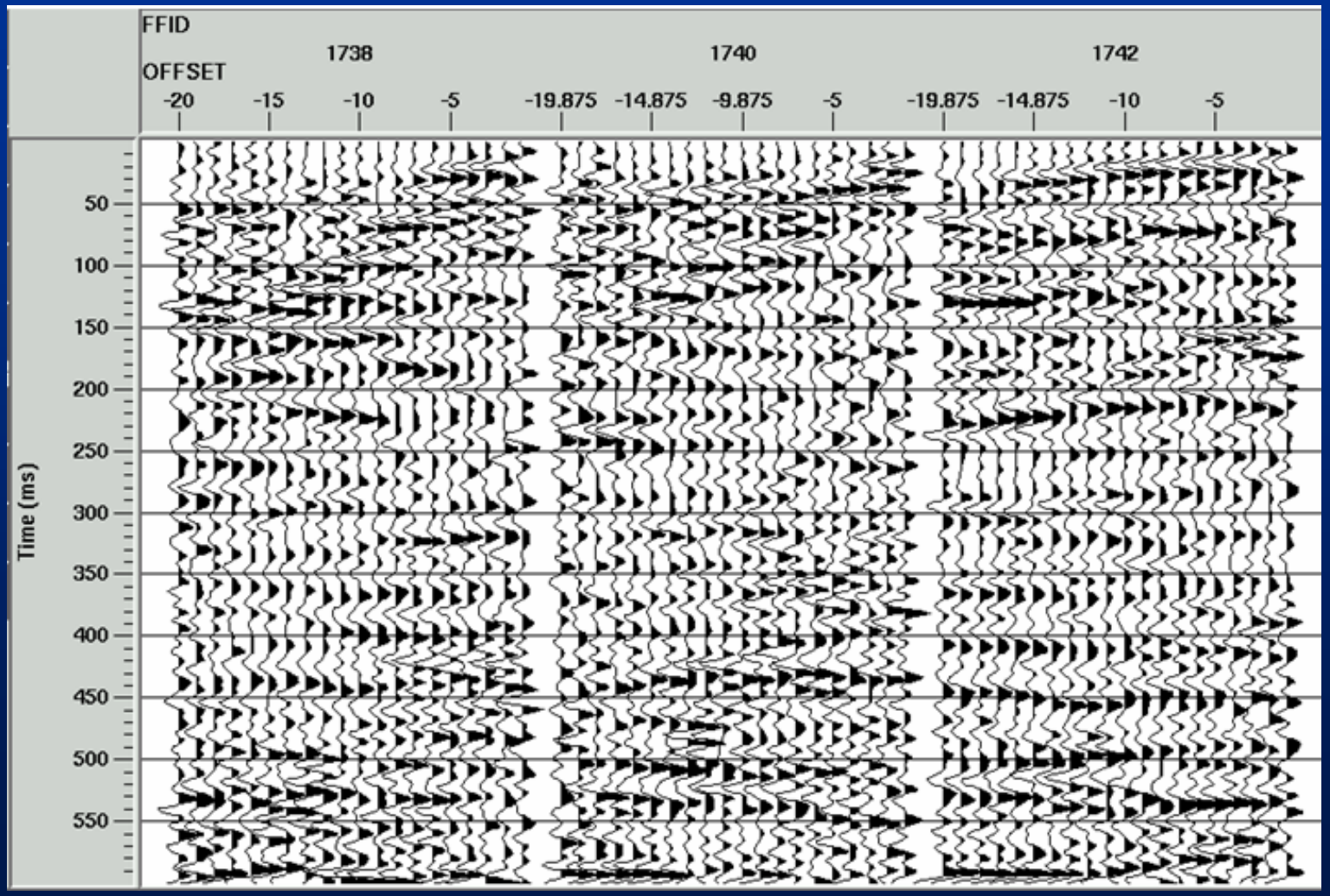
Amplitude spectrum for FFID 1798



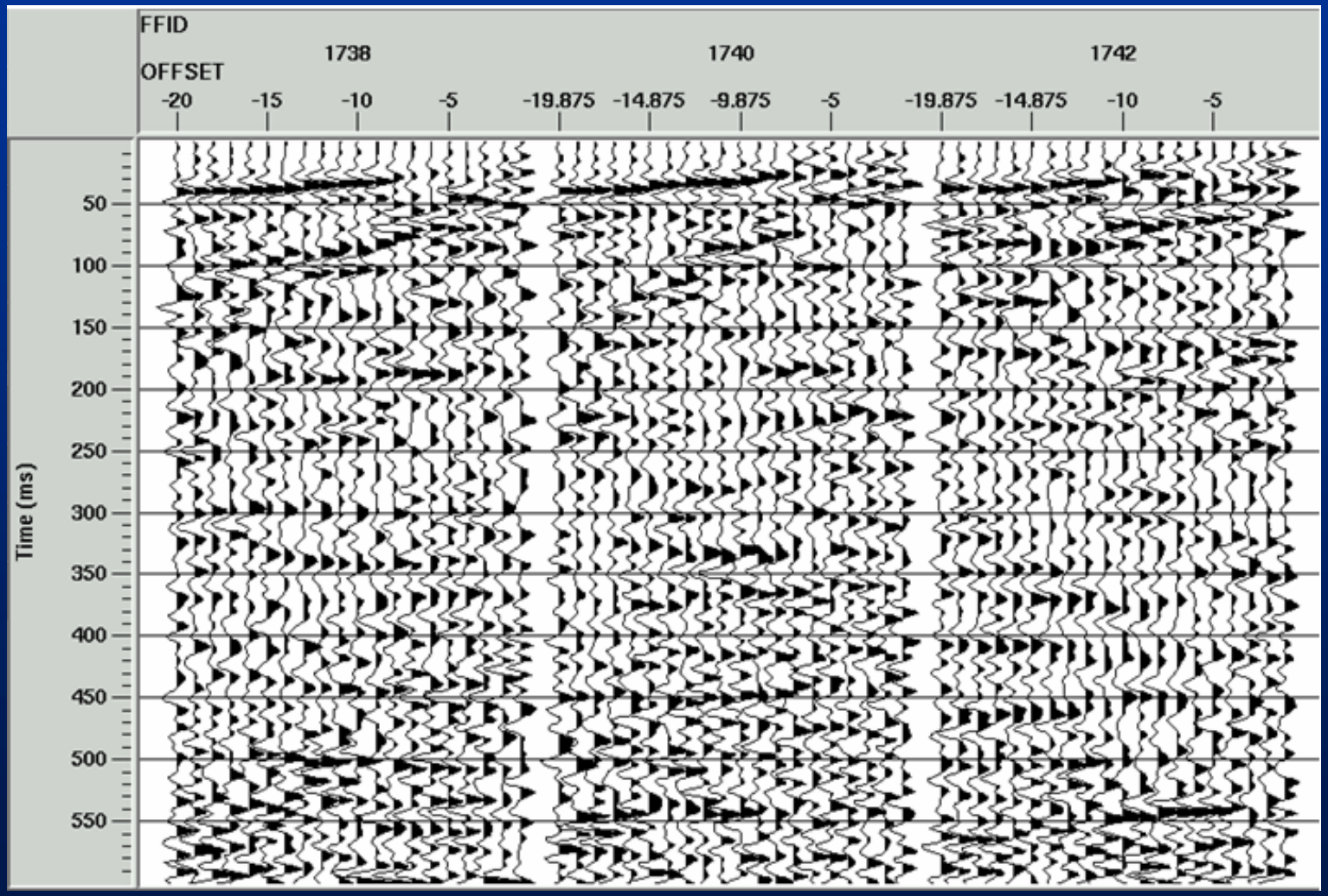
Vertical

Inline

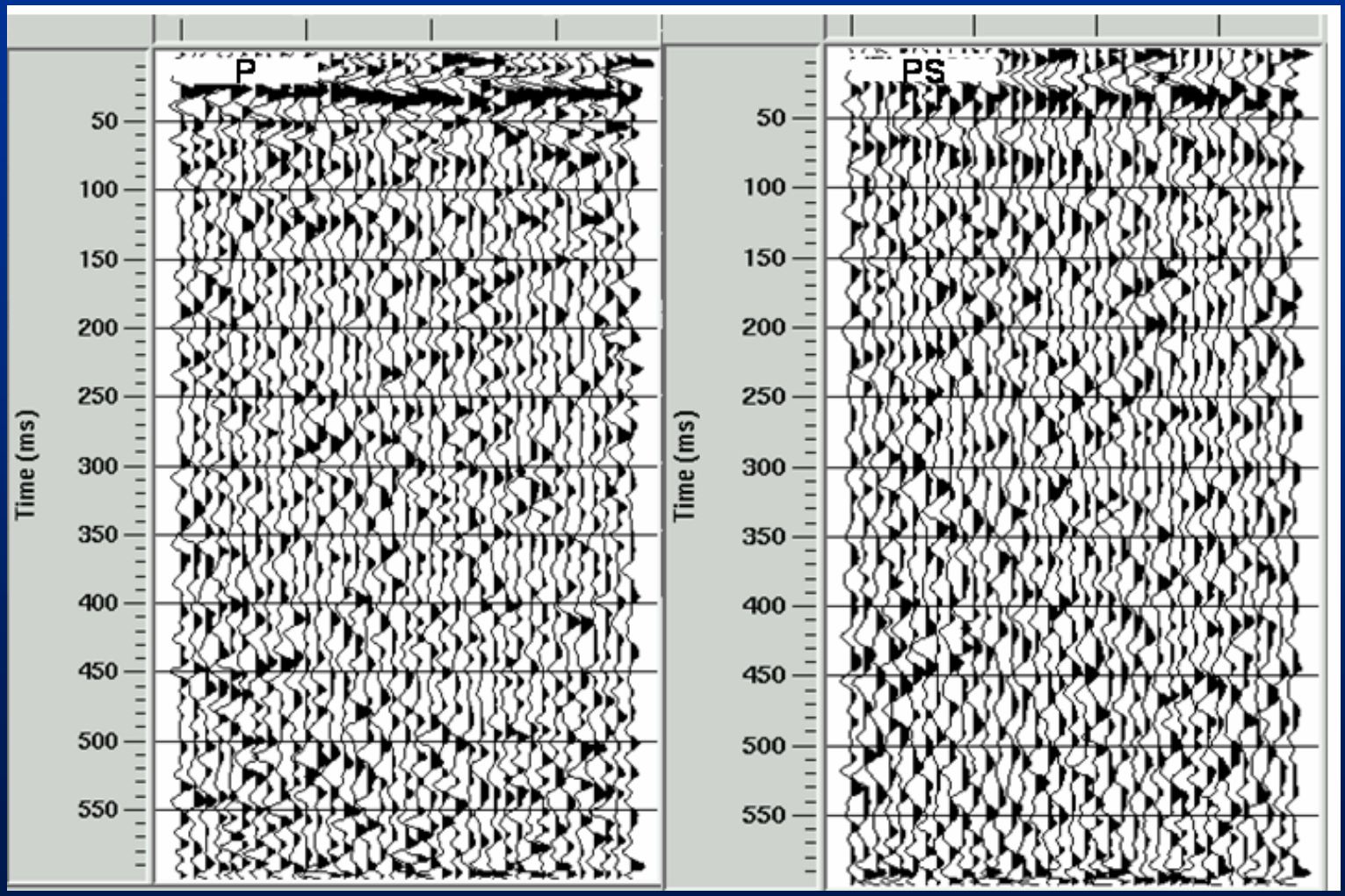
Vertical component filtered shots



Inline component filtered shots



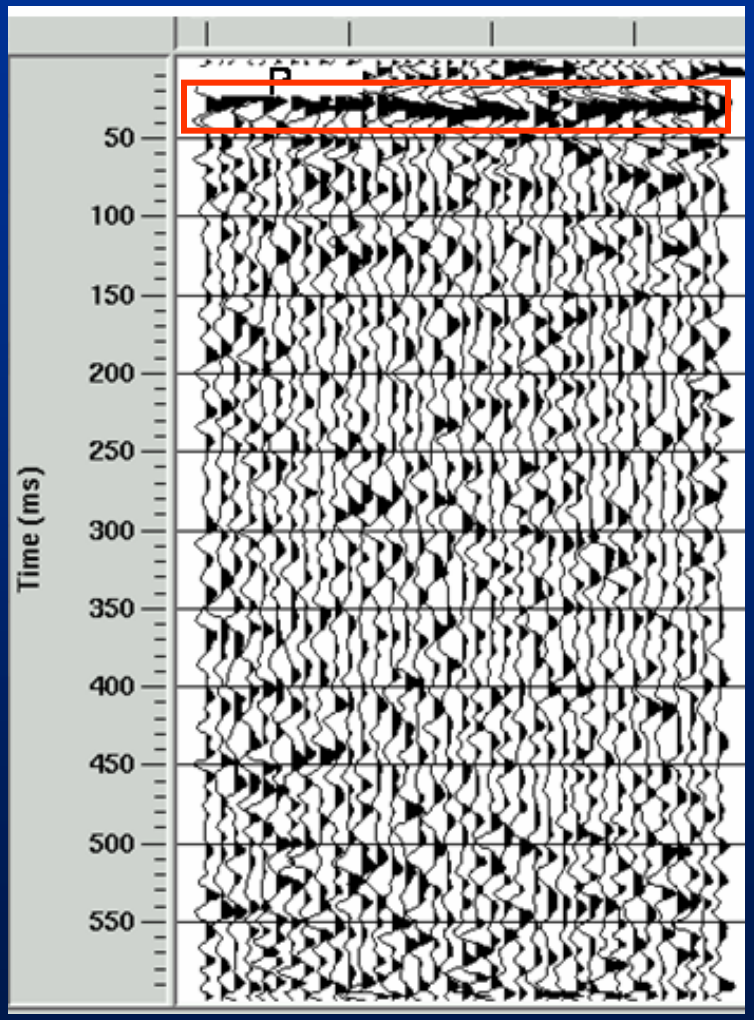
Filtered stack sections



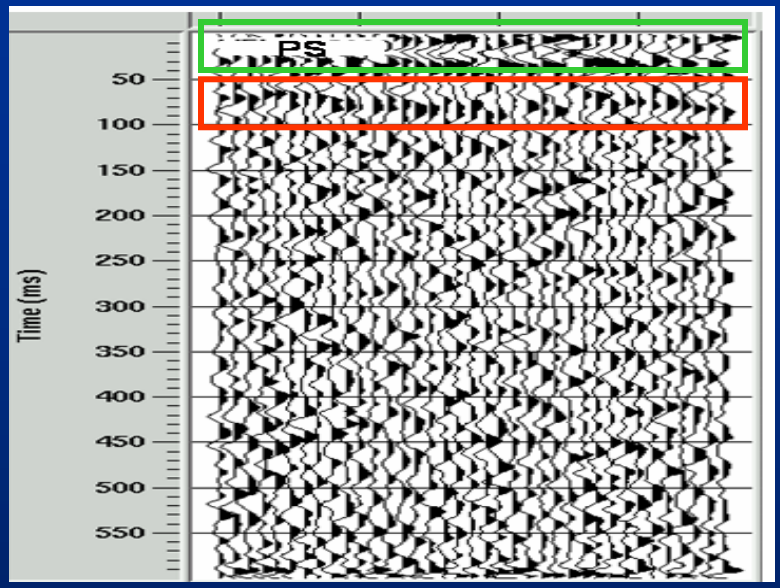
Vertical

Inline

Comparison P-PS stack sections



Vertical

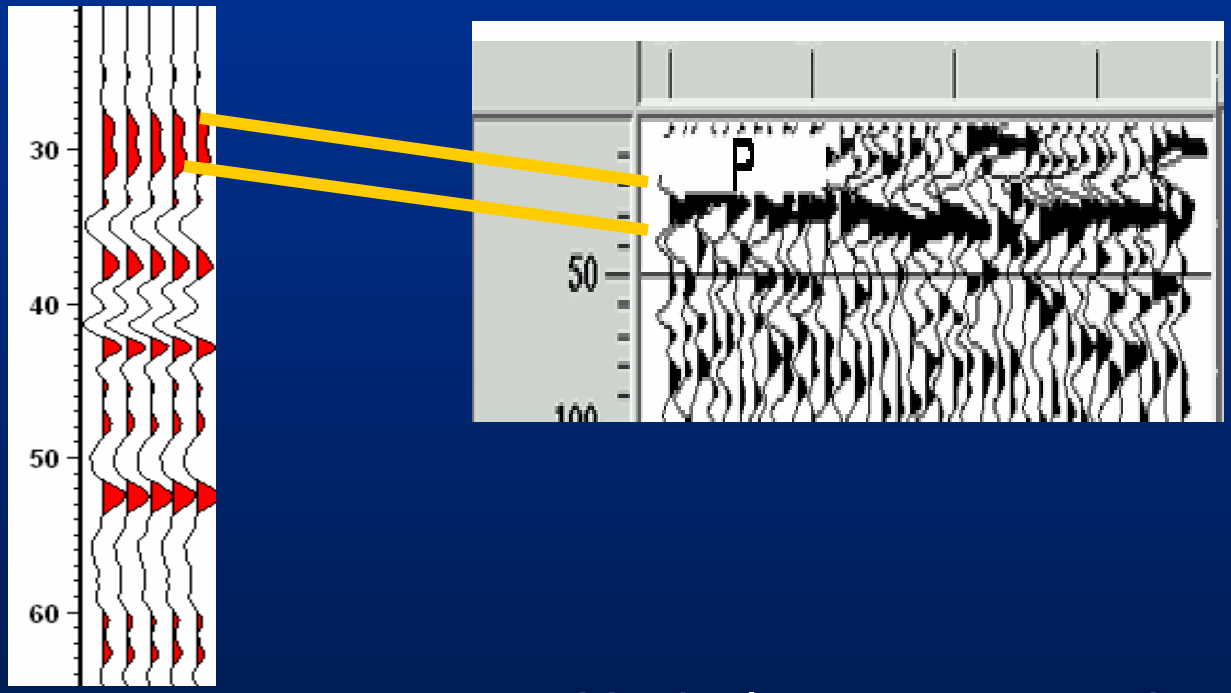


?

Suggest V_P/V_S ratio ≈ 3

Inline

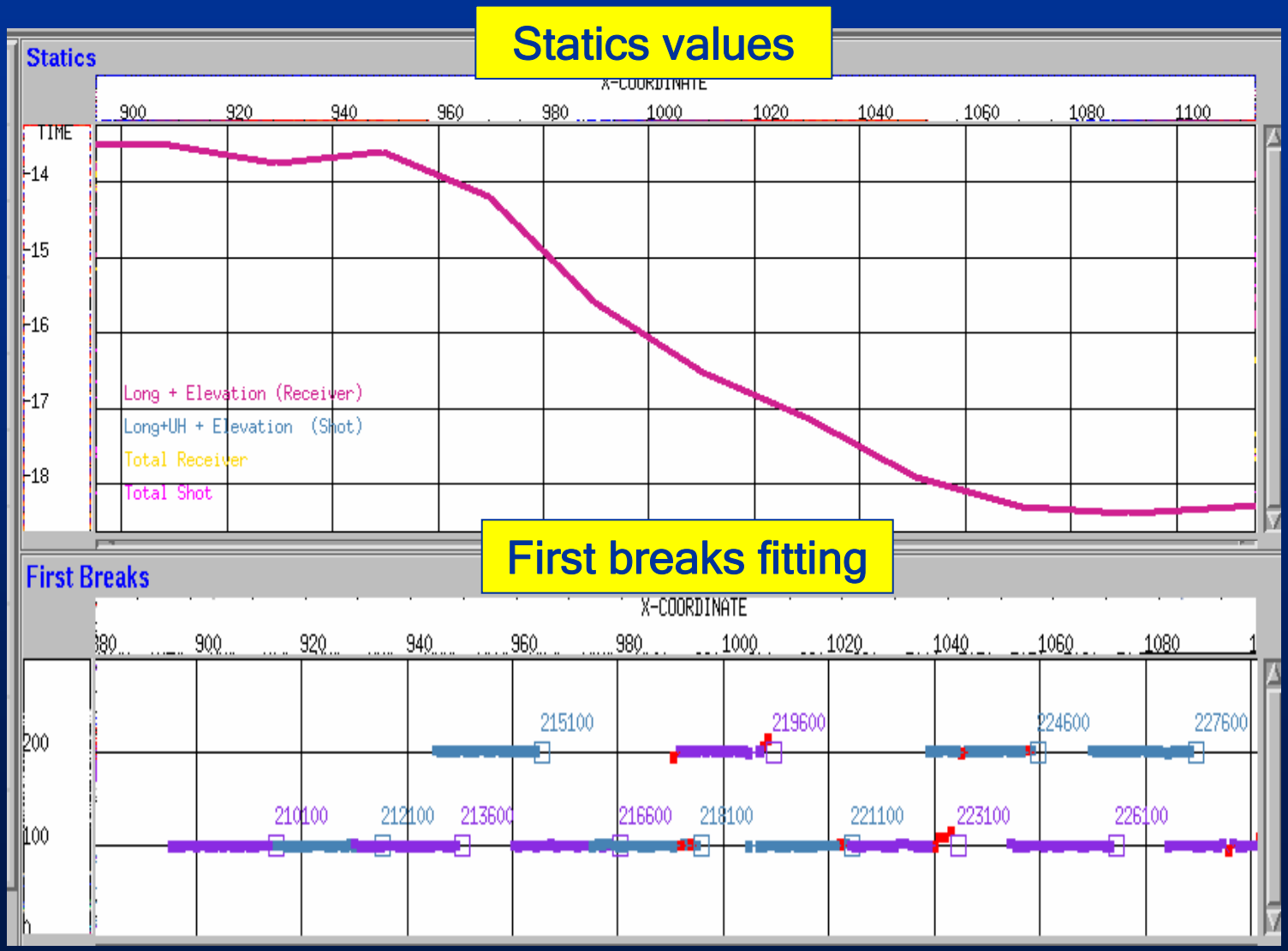
VSP vs. land streamer data



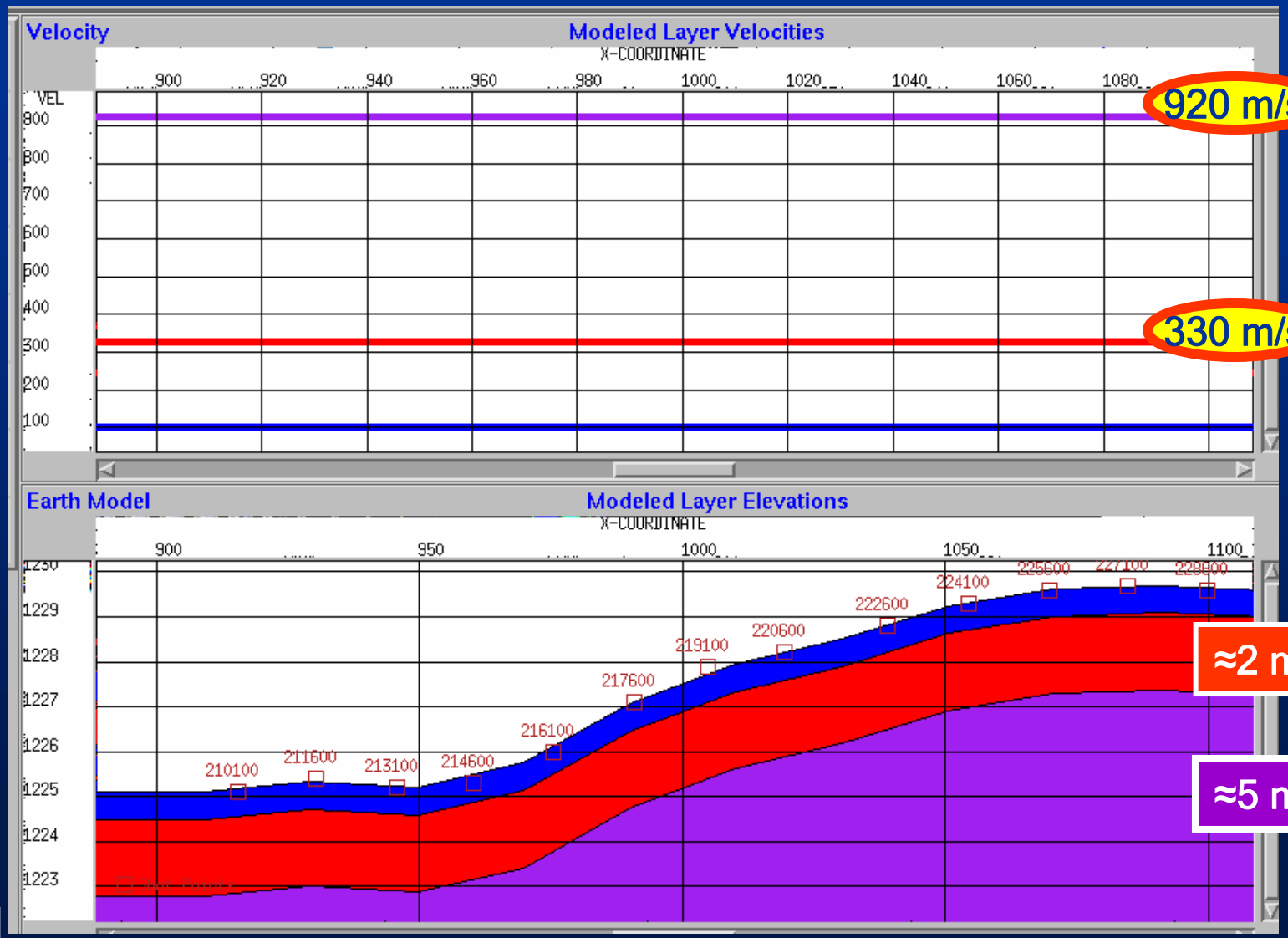
VSP corridor stack

Vertical component stack
Section (1st 100 ms)

Refraction modelling



Refraction modelling



≈2 m

≈1 m

Conclusions and future work

- Strong reflection observed around 30 ms, corroborated with VSP corridor stack
- V_P/V_S ratio of 3 for this area
- 2 layer refraction model with velocities of around 300 m/s and 900 m/s
- Used of vibroseis as seismic source
- Variable geophone spacing
- Acquire conventional 3C data to compare land streamer data
- Find an area with an specific problem to solve to test land streamer

Acknowledgments

- Robert R. Stewart
- David Henley
- Kevin Hall
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