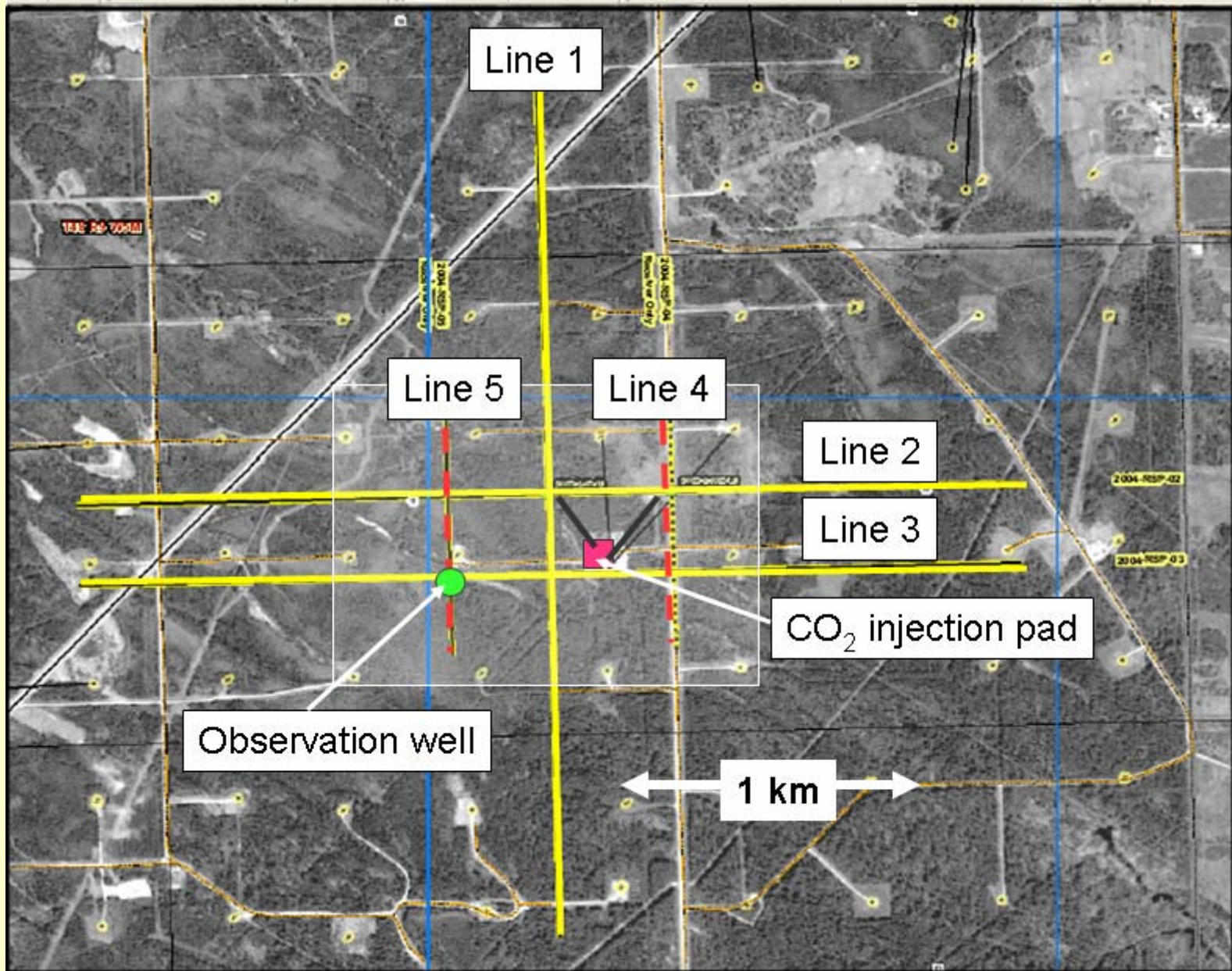


Comparisons between data recorded by several 3-component coil geophones and a MEMS sensor at the Violet Grove monitor seismic survey

Don Lawton, Malcolm Bertram,
Gary Margrave and Eric Gallant

Penn West CO₂ EOR pilot, Pembina Field, Alberta





Geophones and sensor used in experiment

Source: 2 kg @ 18 m

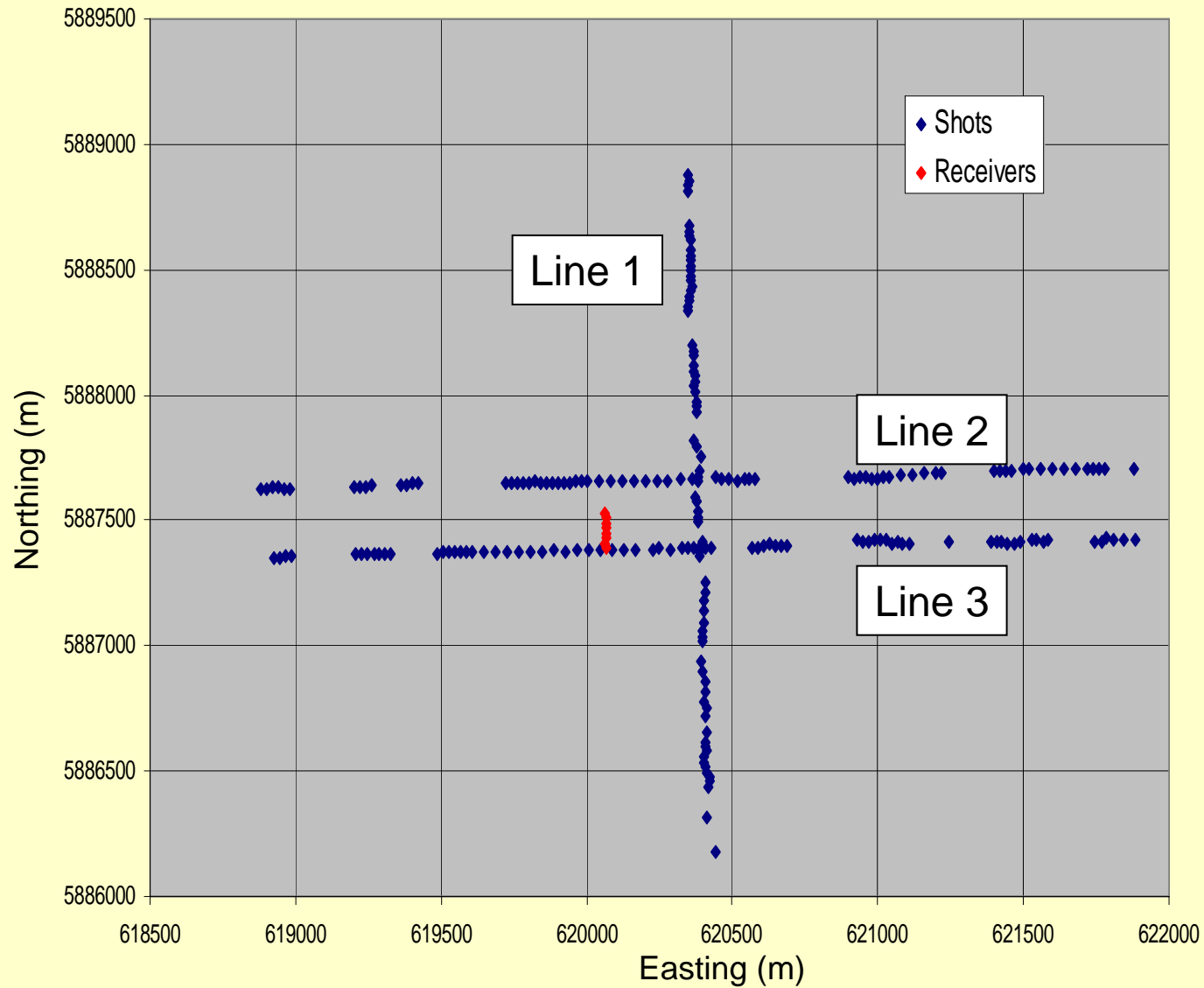
Manufacturer	Model	Element	Stations
Input/Output	IO-Spike	SM24 (10 Hz coil)	5183-5190
OyoGeospace	GS-3C	GS-20DM (10 Hz coil)	5183-5190
Sercel	DSU3	MEMS	5183-5190
OyoGeospace	OG-Nail	GS-32CT (10 Hz coil)	5183-5184



Experimental layout

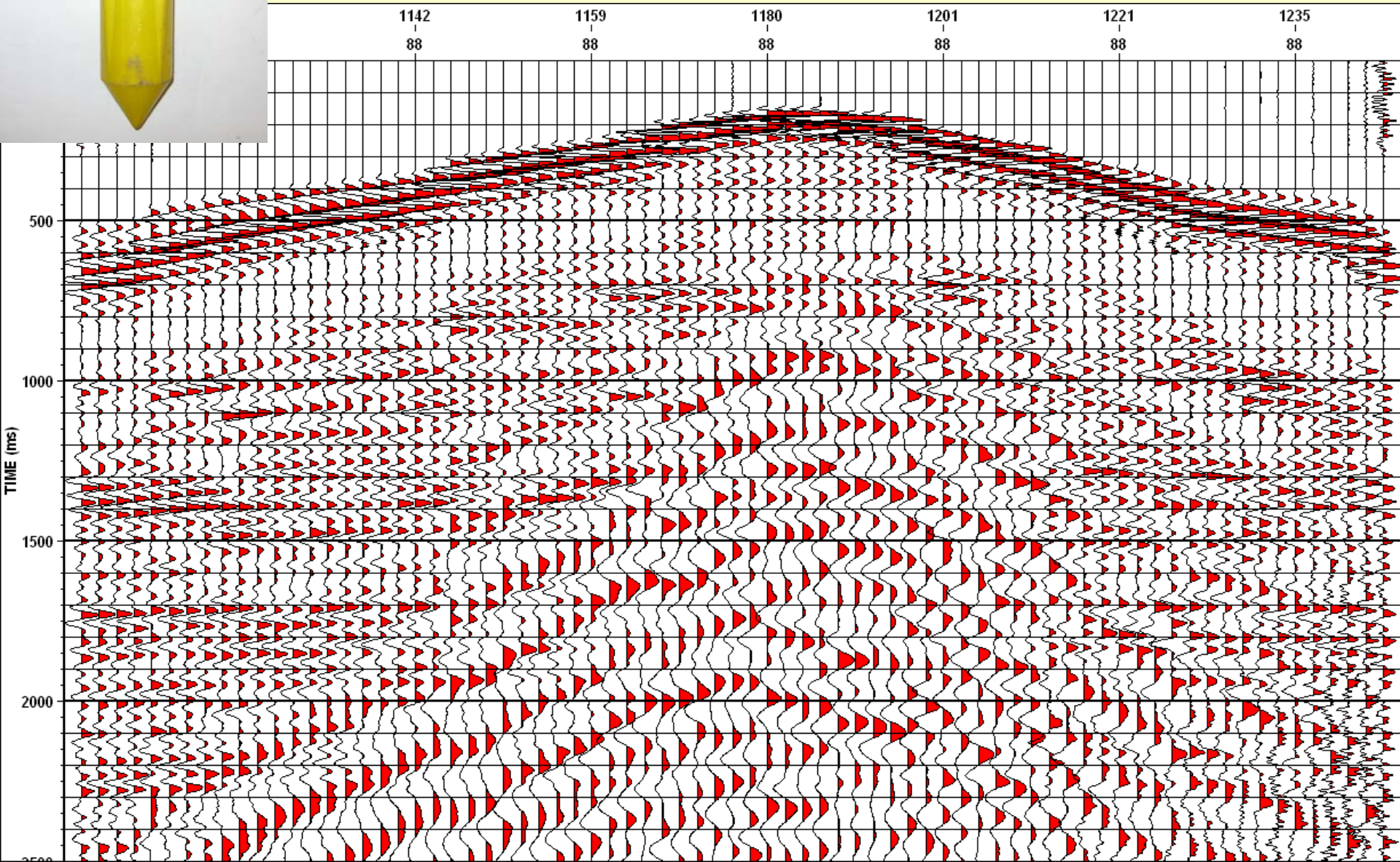


Shots & receiver locations

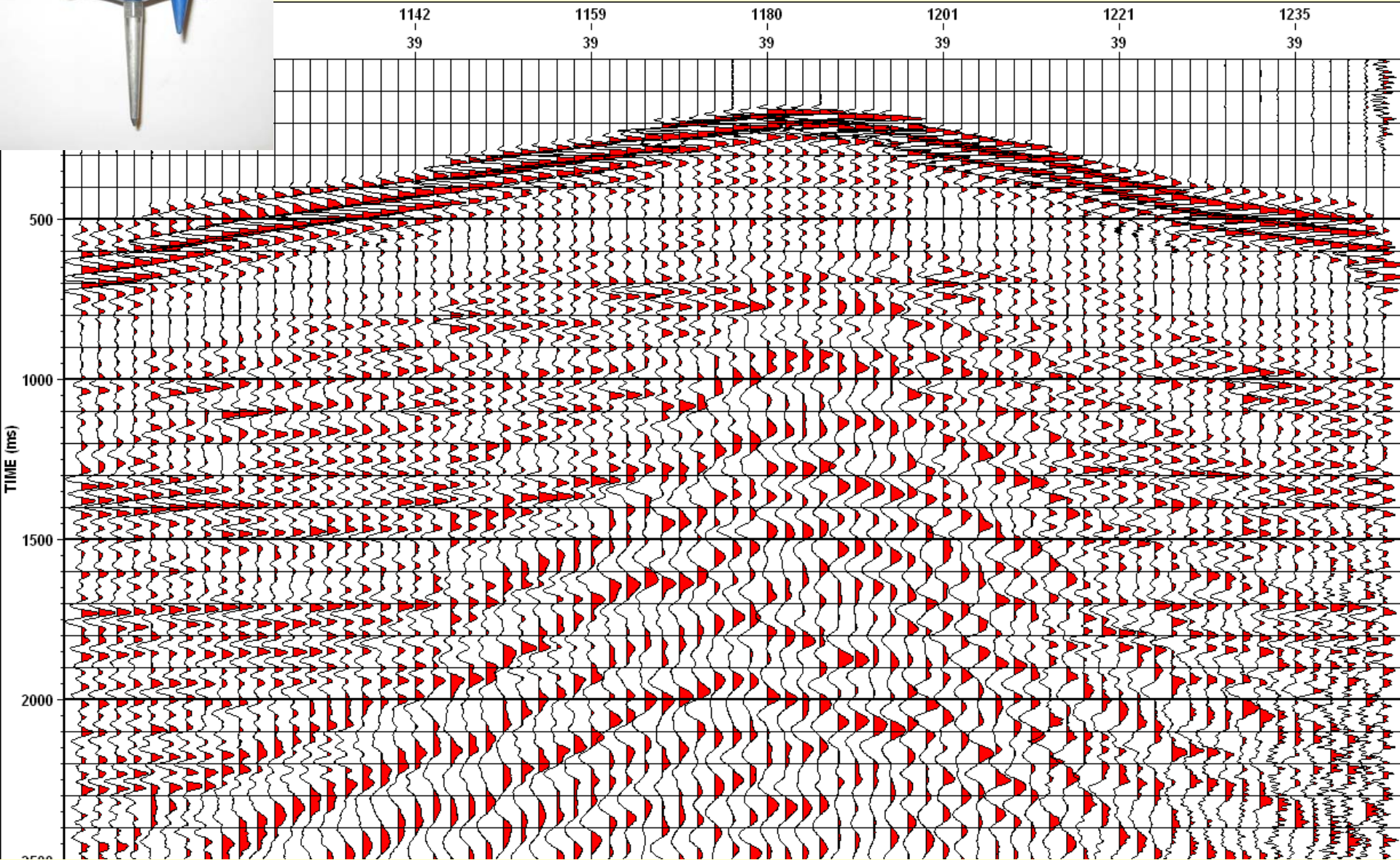




OG-nail vertical component

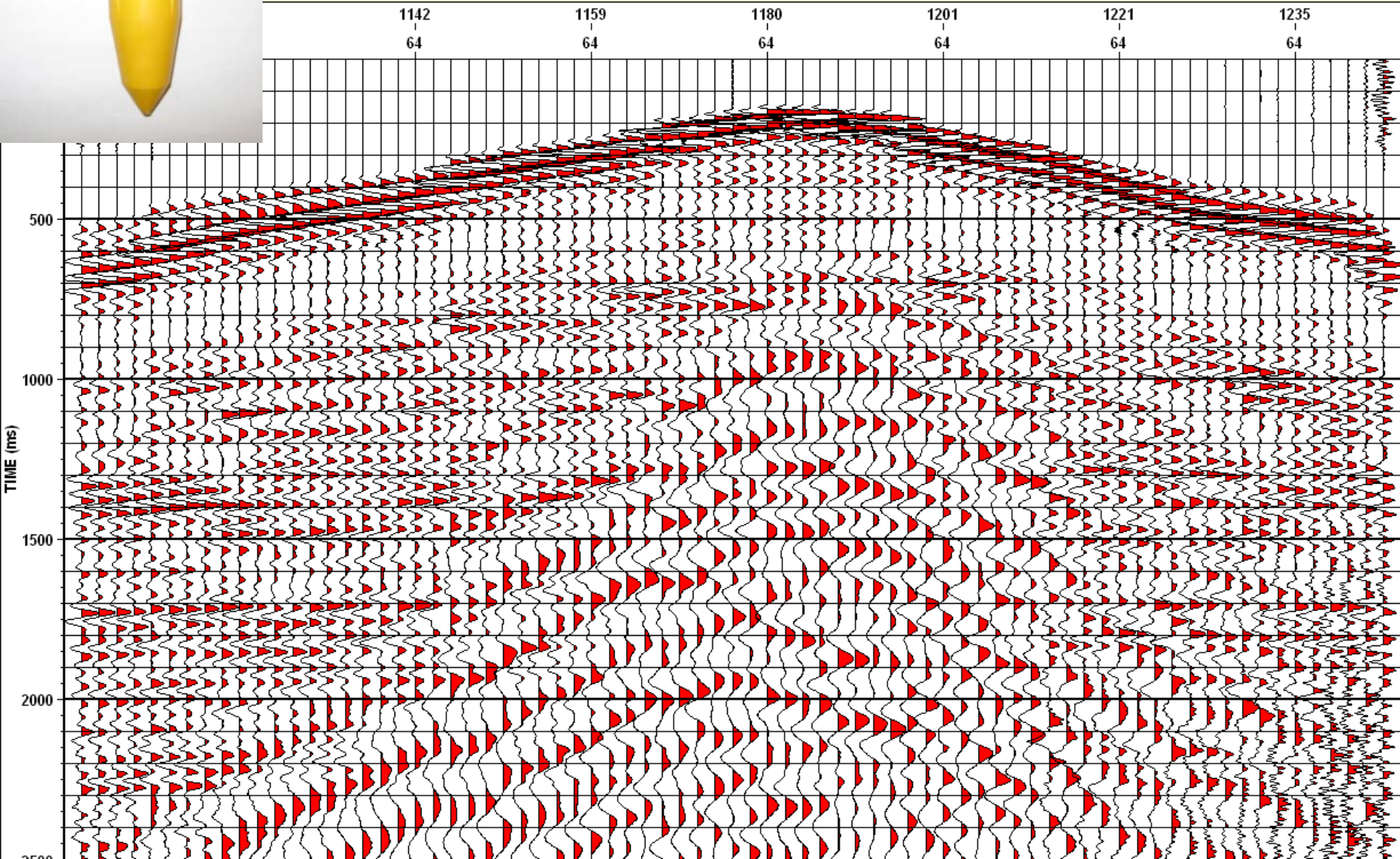


GS-3C vertical component

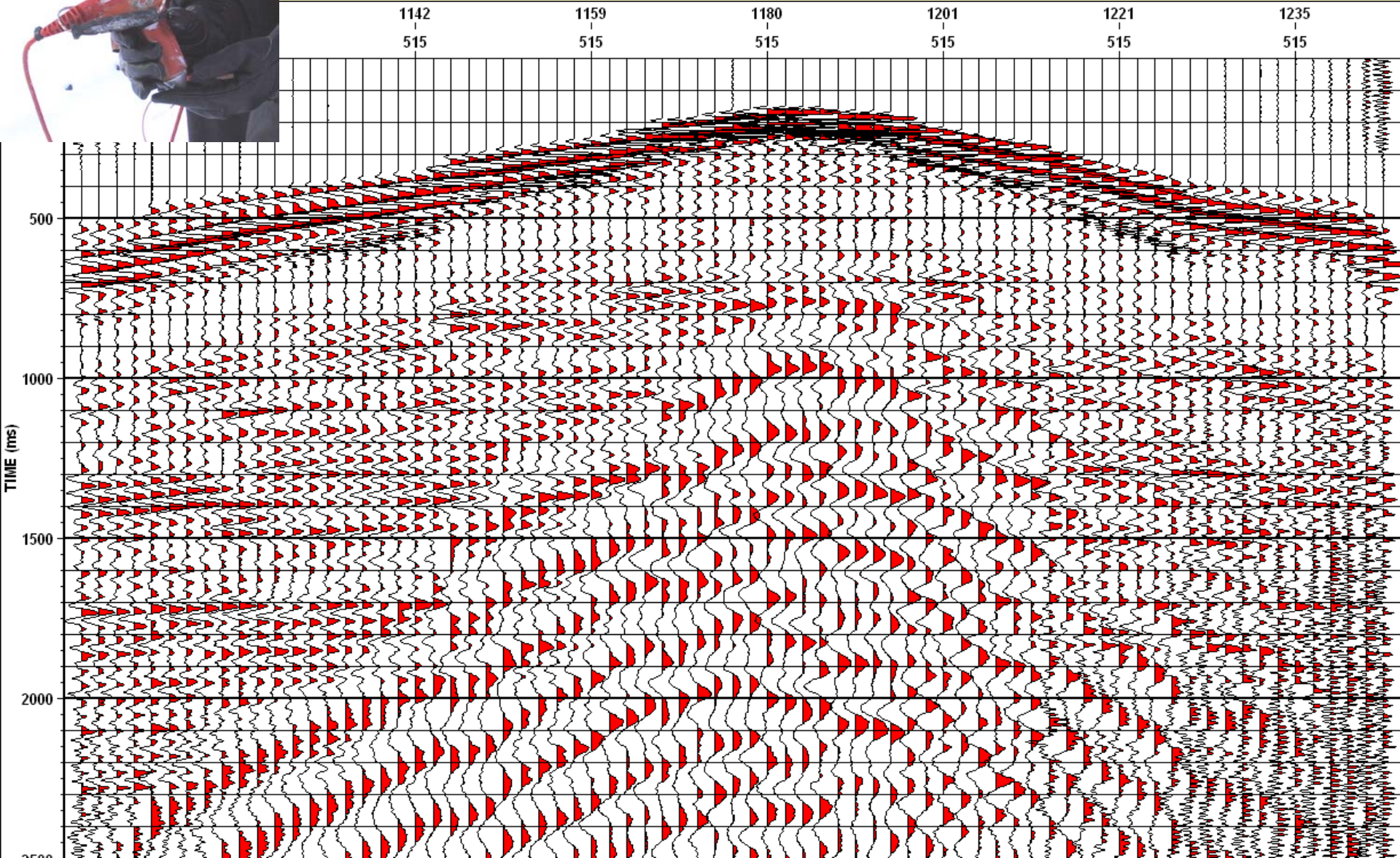




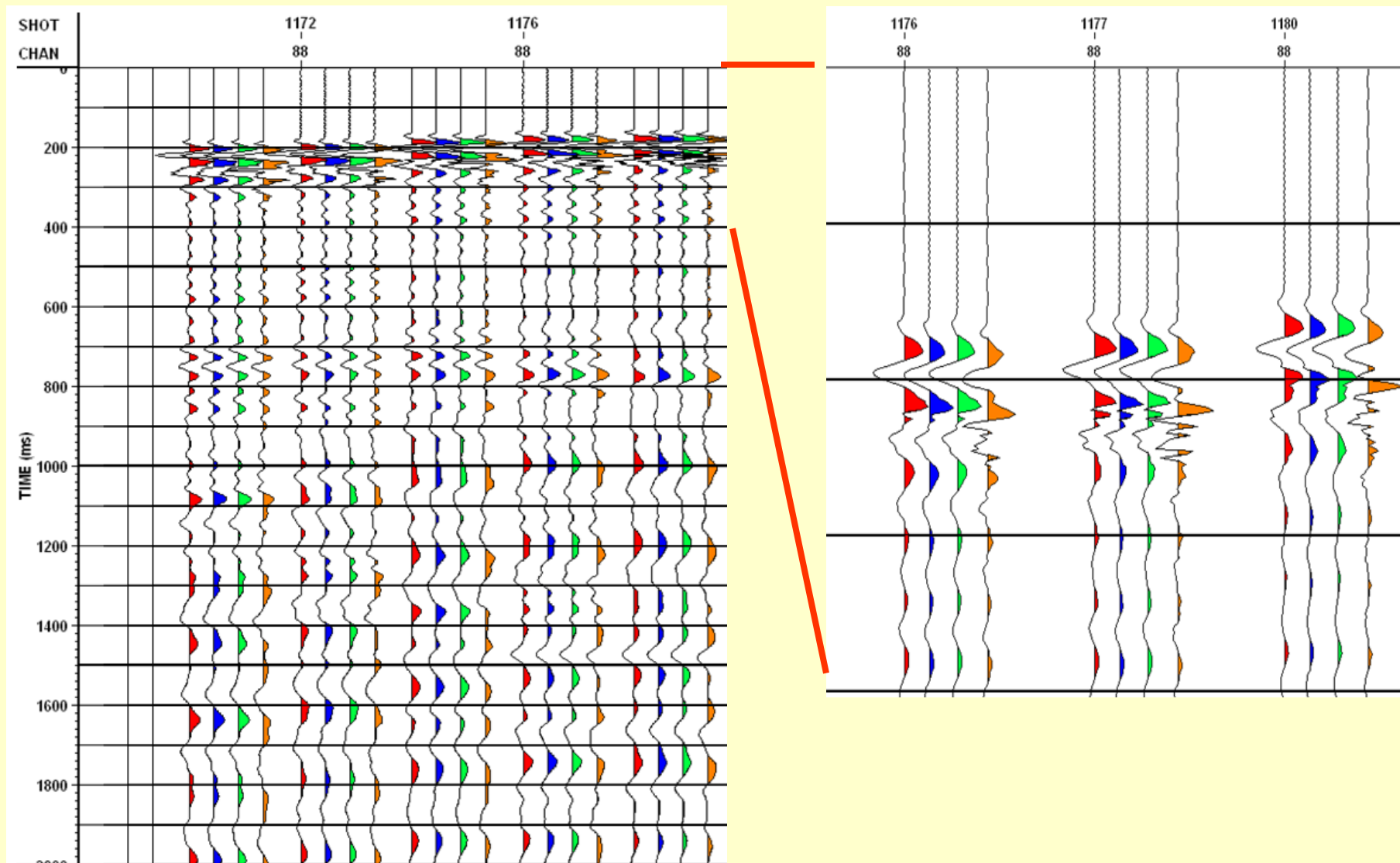
IO-spike vertical component



Sercel-DSU3 vertical component

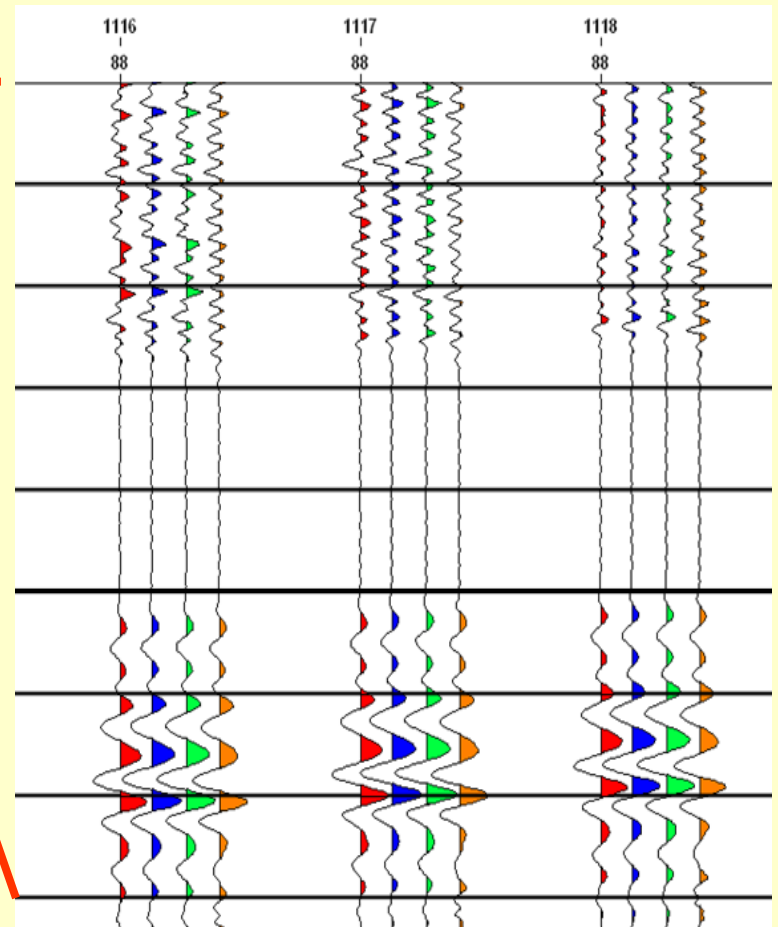
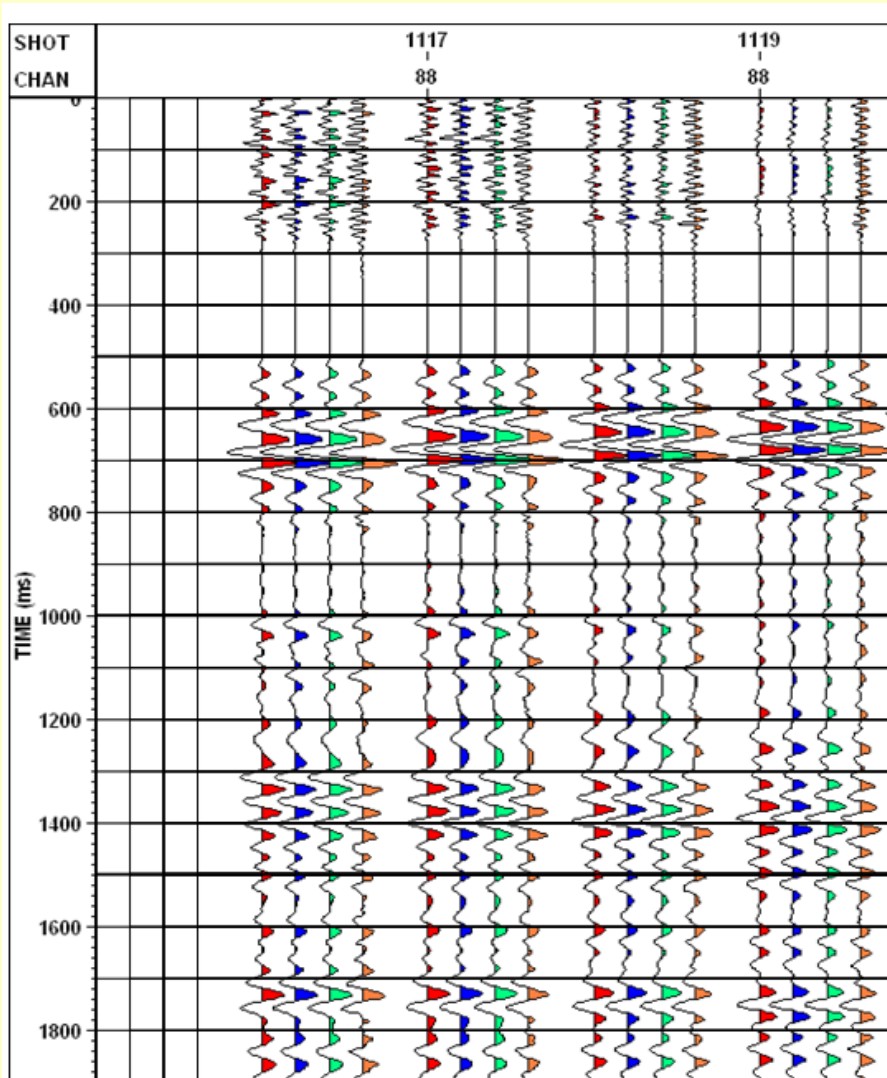


Raw trace comparison at near offset



Red:OG-Nail Blue: IO-Spike Green: GS-3C Orange: Sercel-DSU3

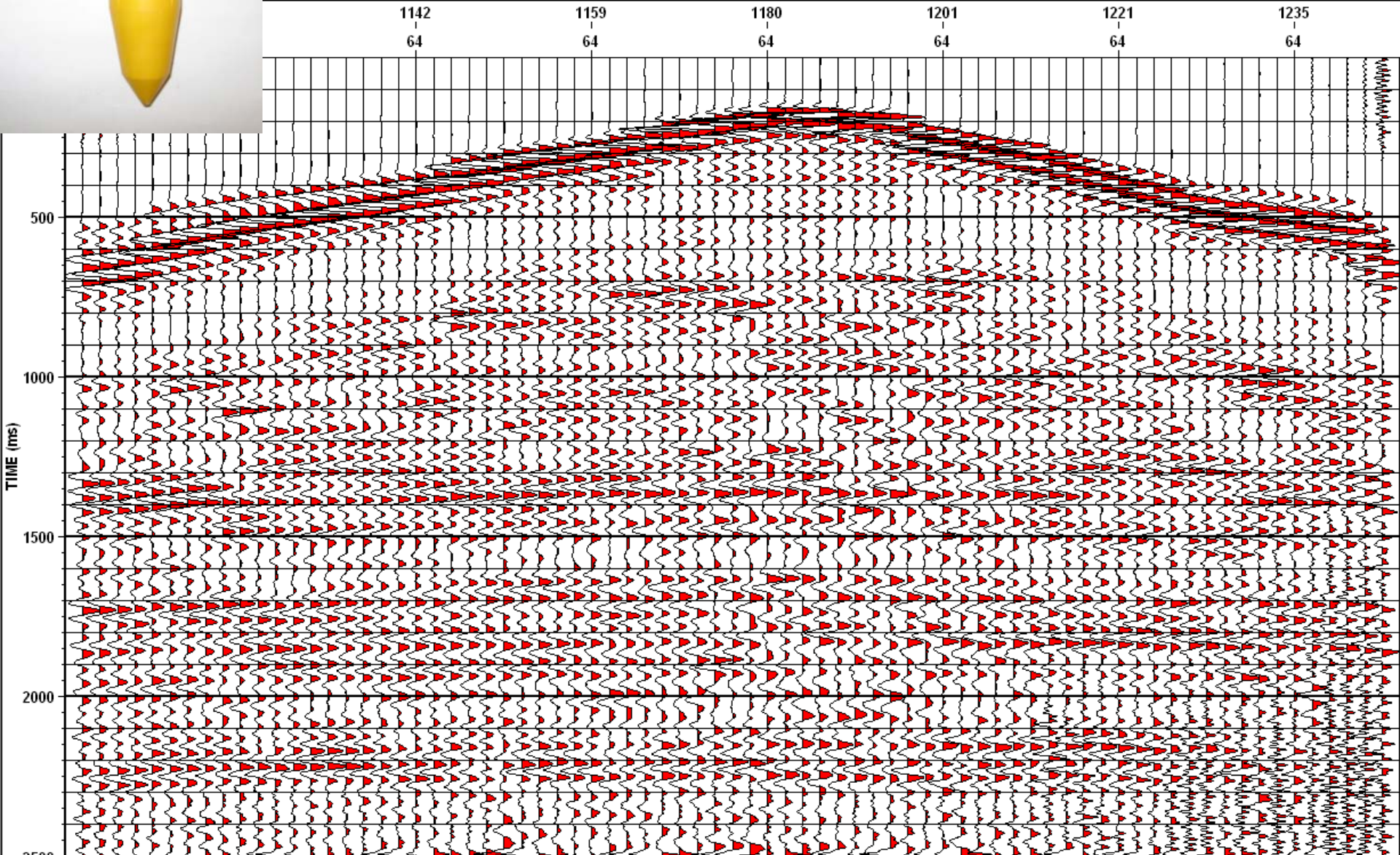
Raw trace comparison at far offset



Red:OG-Nail Blue: IO-Spike Green: GS-3C Orange: Sercel-DSU3

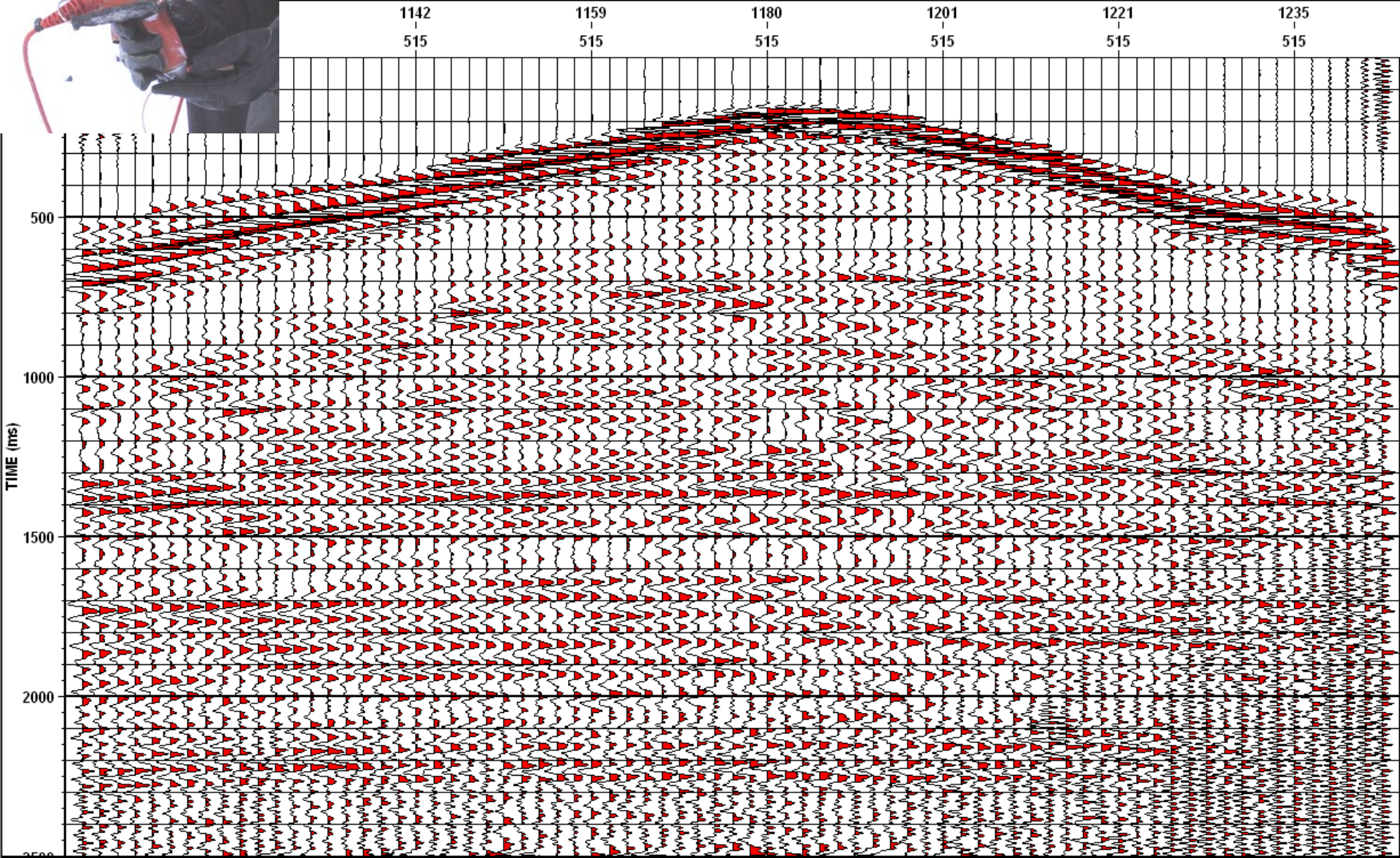


IO-spike vertical component



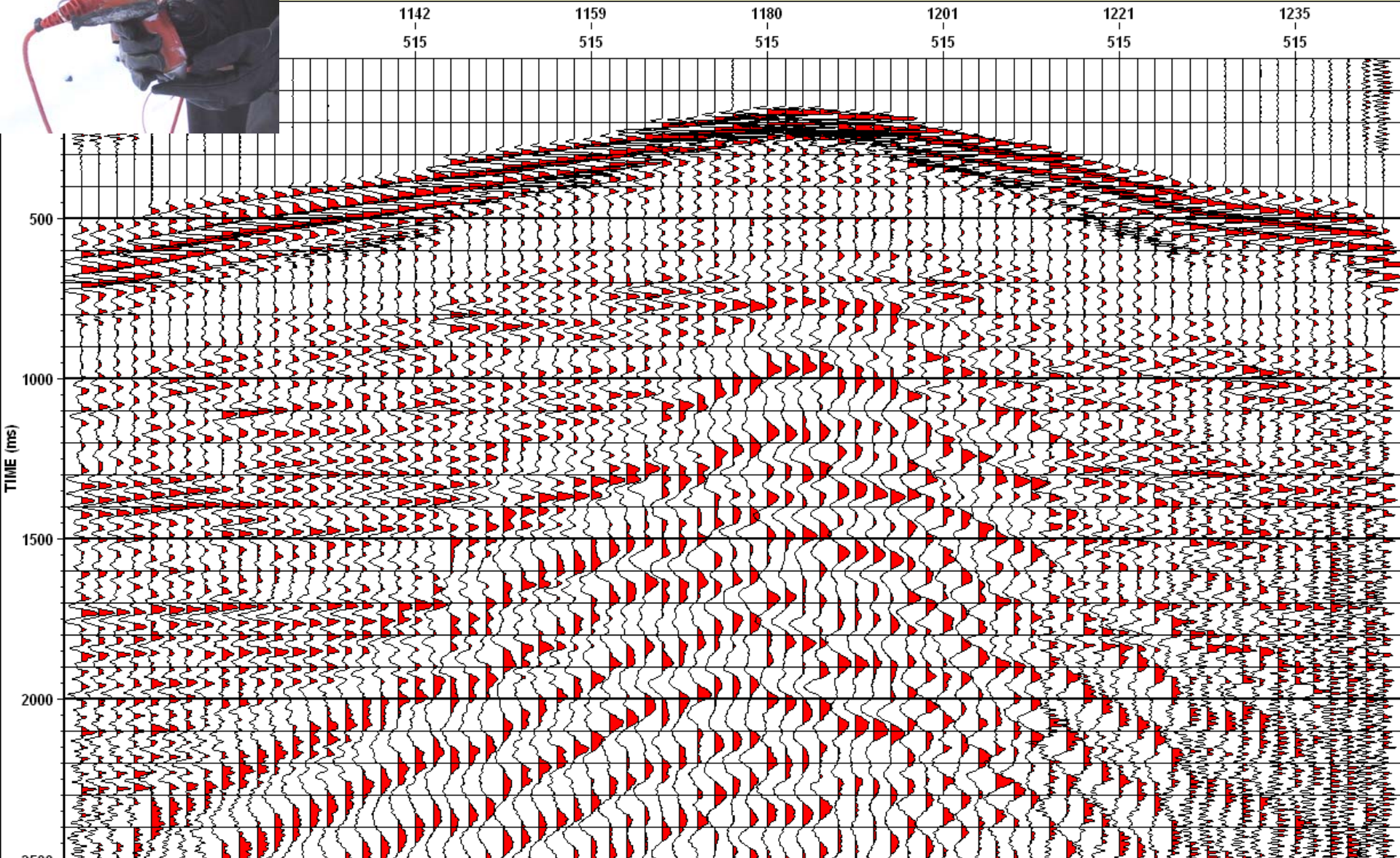
10-15-60-80Hz bandpass filter

Sercel-DSU3 vertical component



10-15-60-80Hz bandpass filter

Sercel-DSU3 vertical component

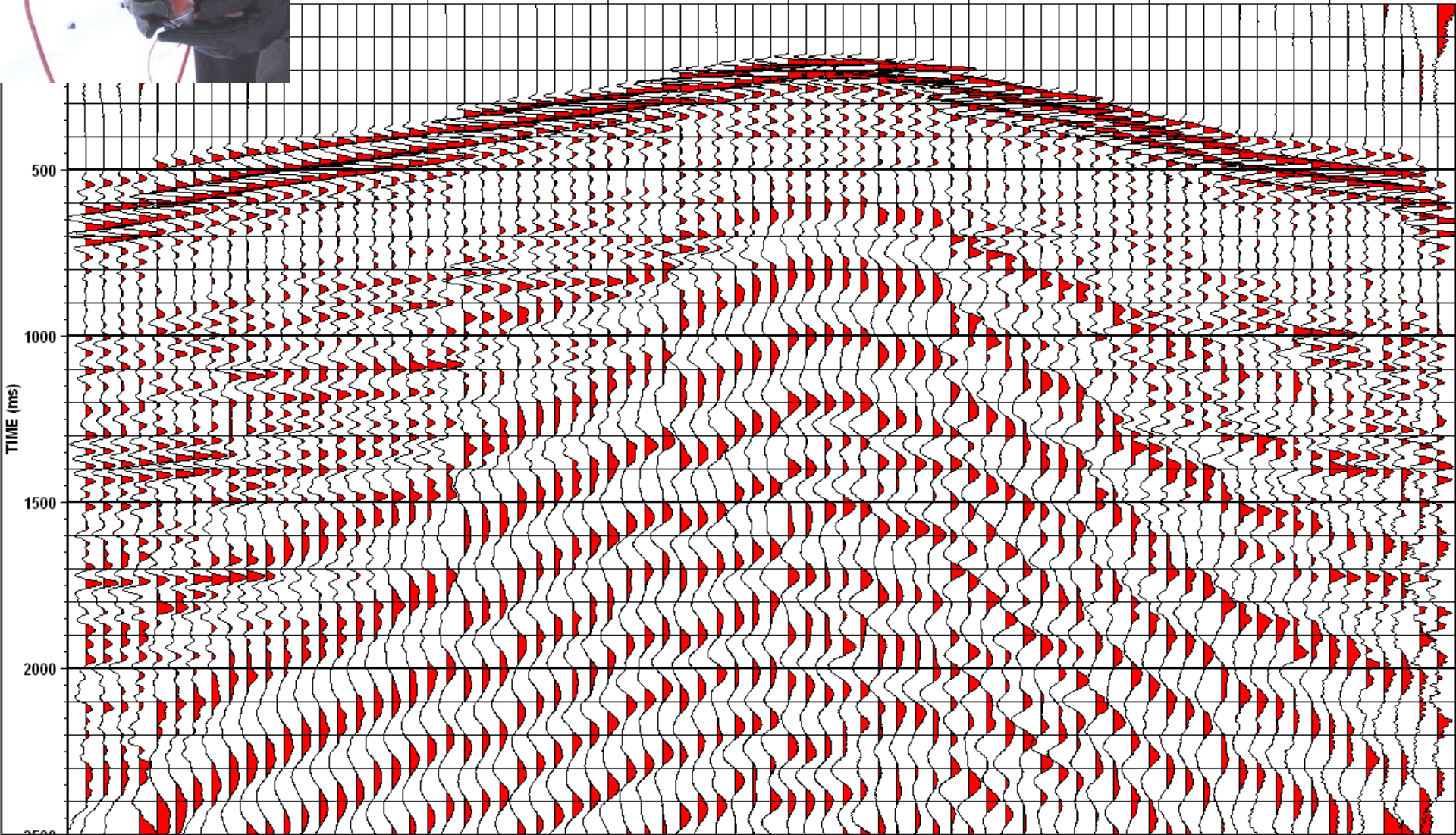


10-15-60-80Hz bandpass filter

DSU3 vertical component integrated

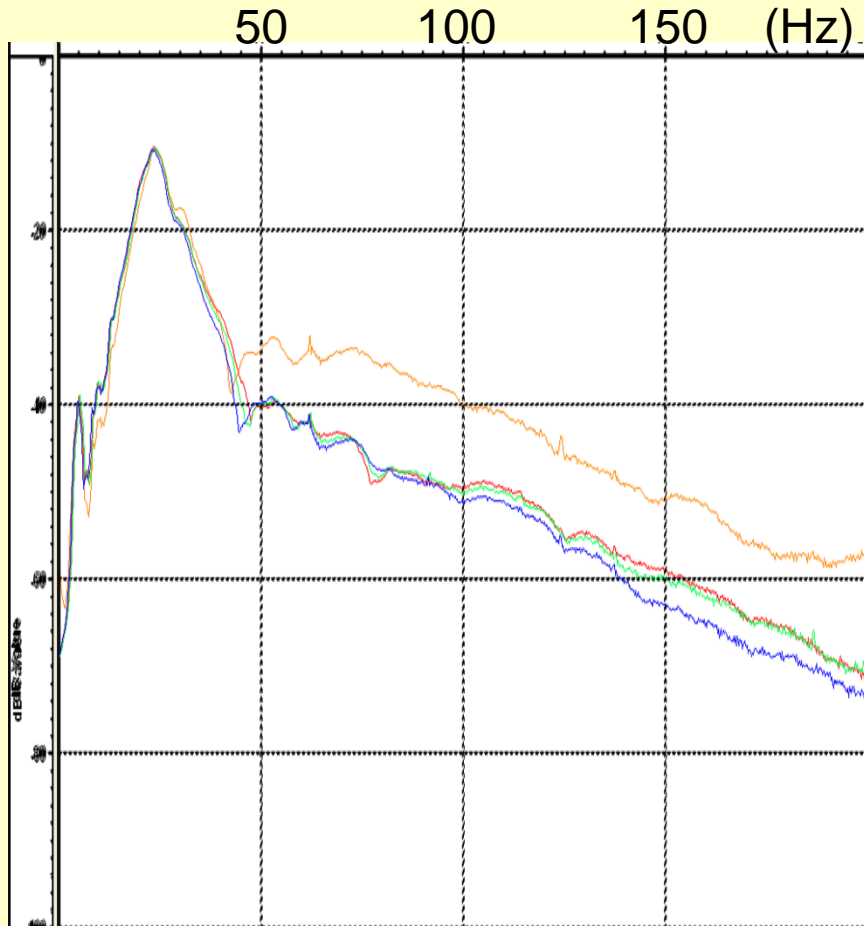


1142 1159 1180 1199 1219 1234
515 515 515 515 515 515

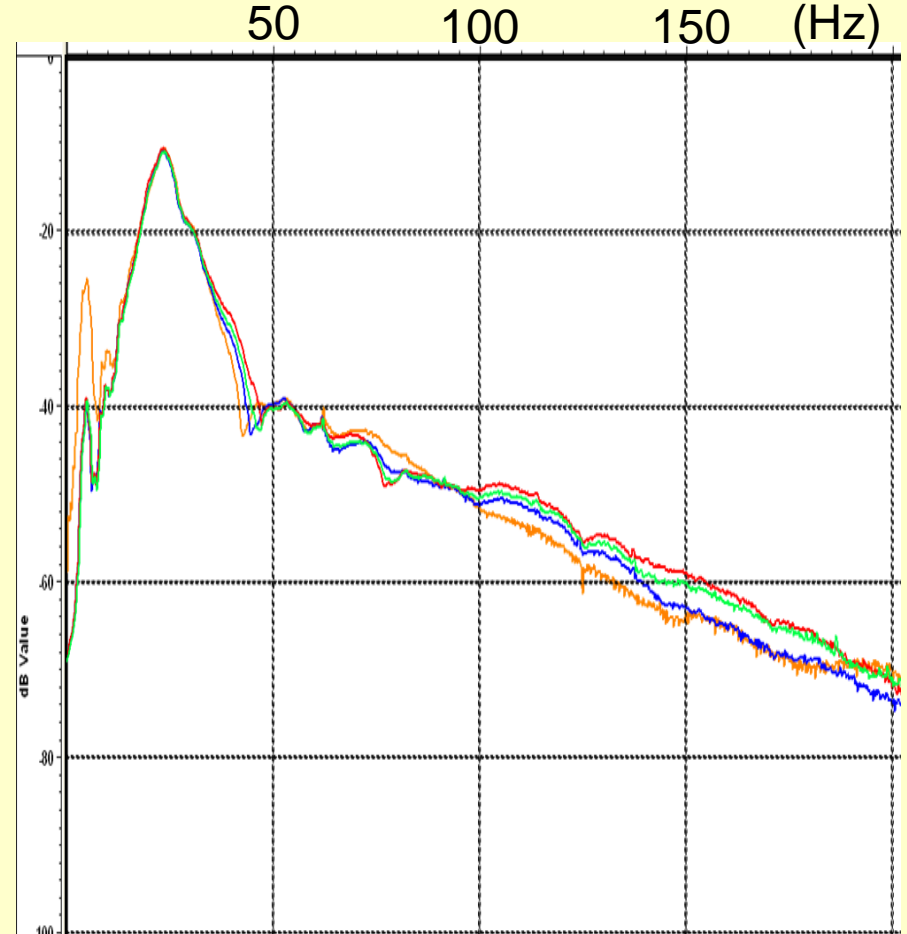


Amplitude spectra

Raw data



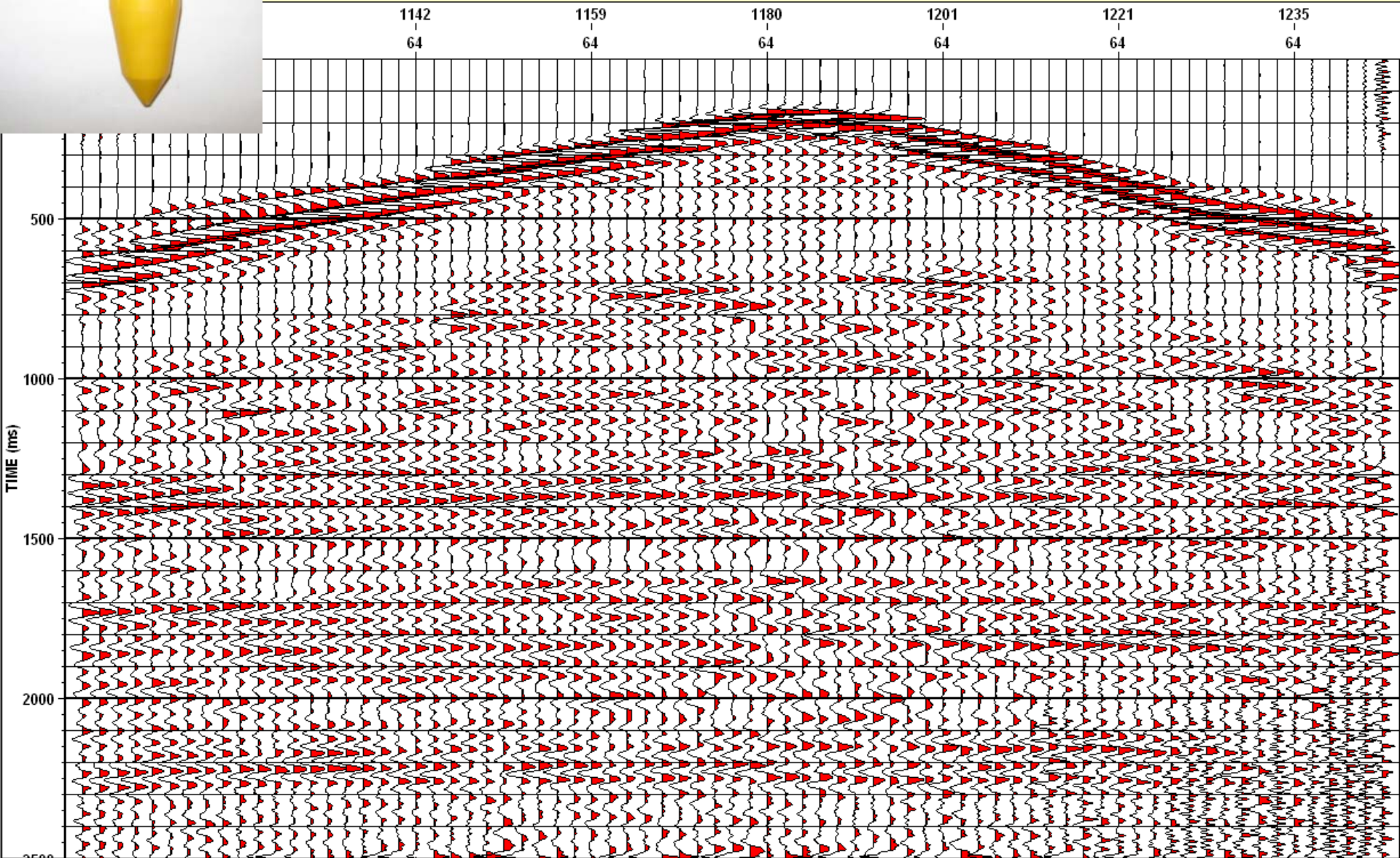
After integration of DSU3 data



Red:OG-Nail Blue: IO-Spike Green: GS-3C Orange: Sercel-DSU3

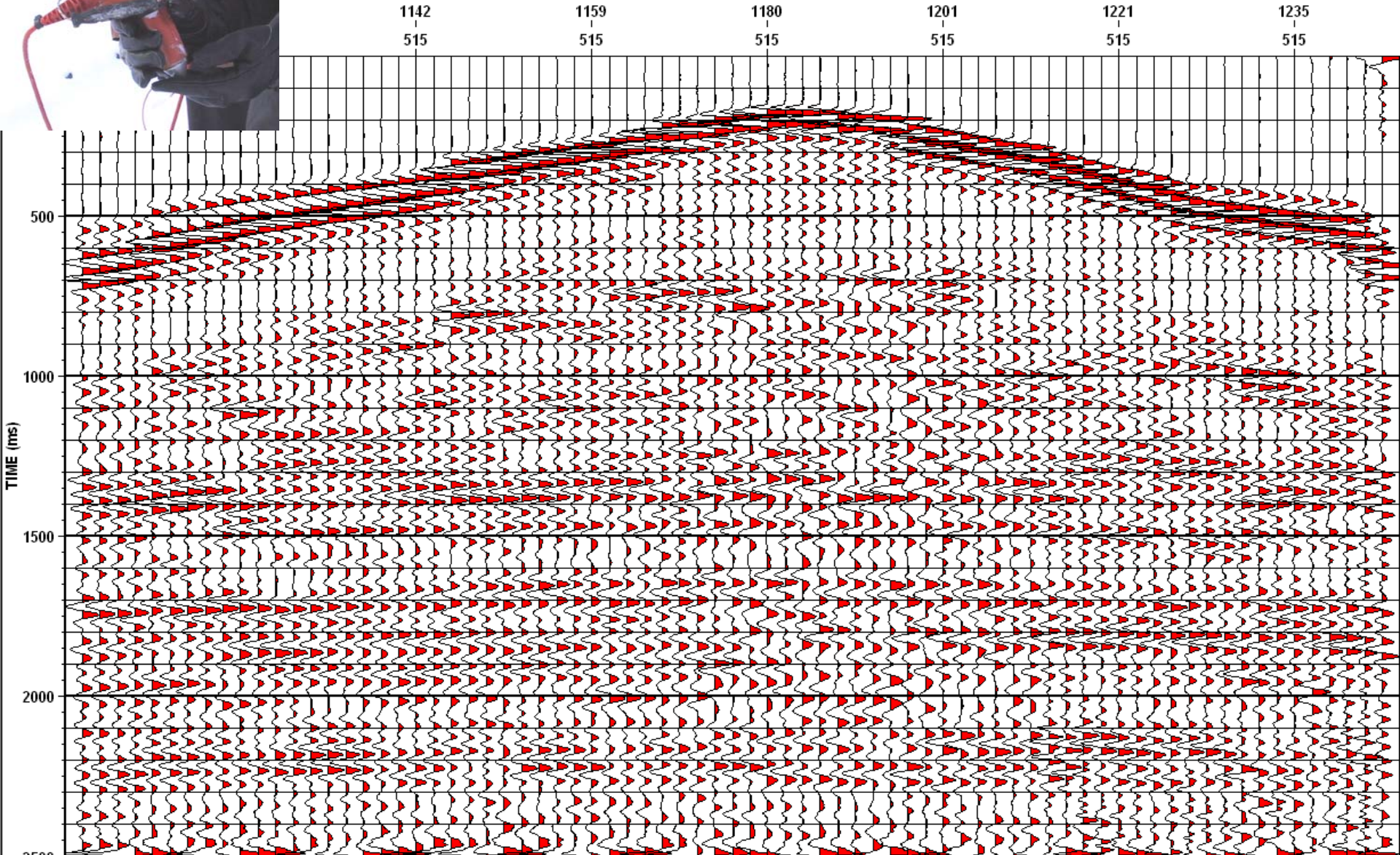


IO-spike vertical component



10-15-60-80Hz bandpass filter

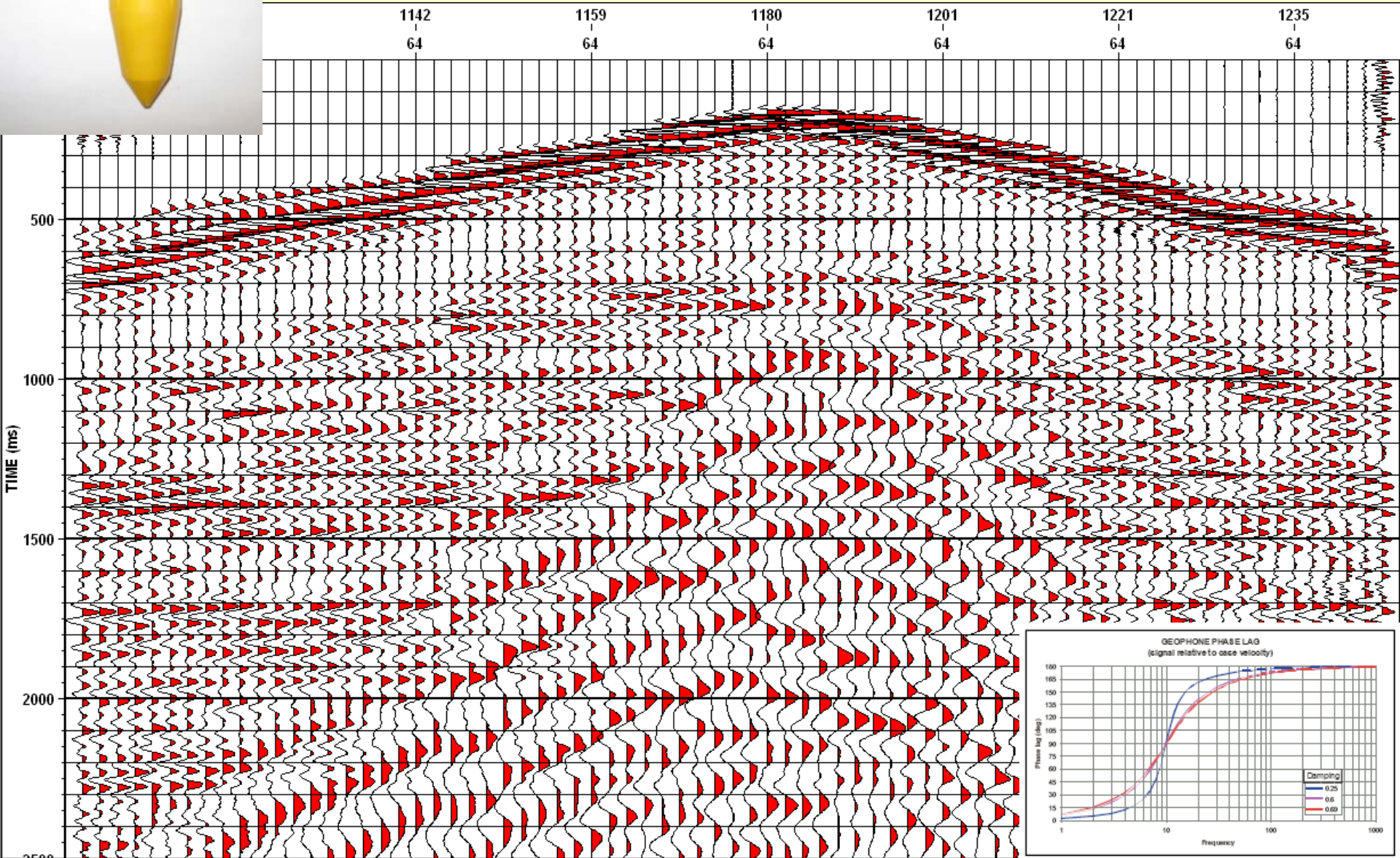
DSU3 vertical component integrated



10-15-60-80Hz bandpass filter



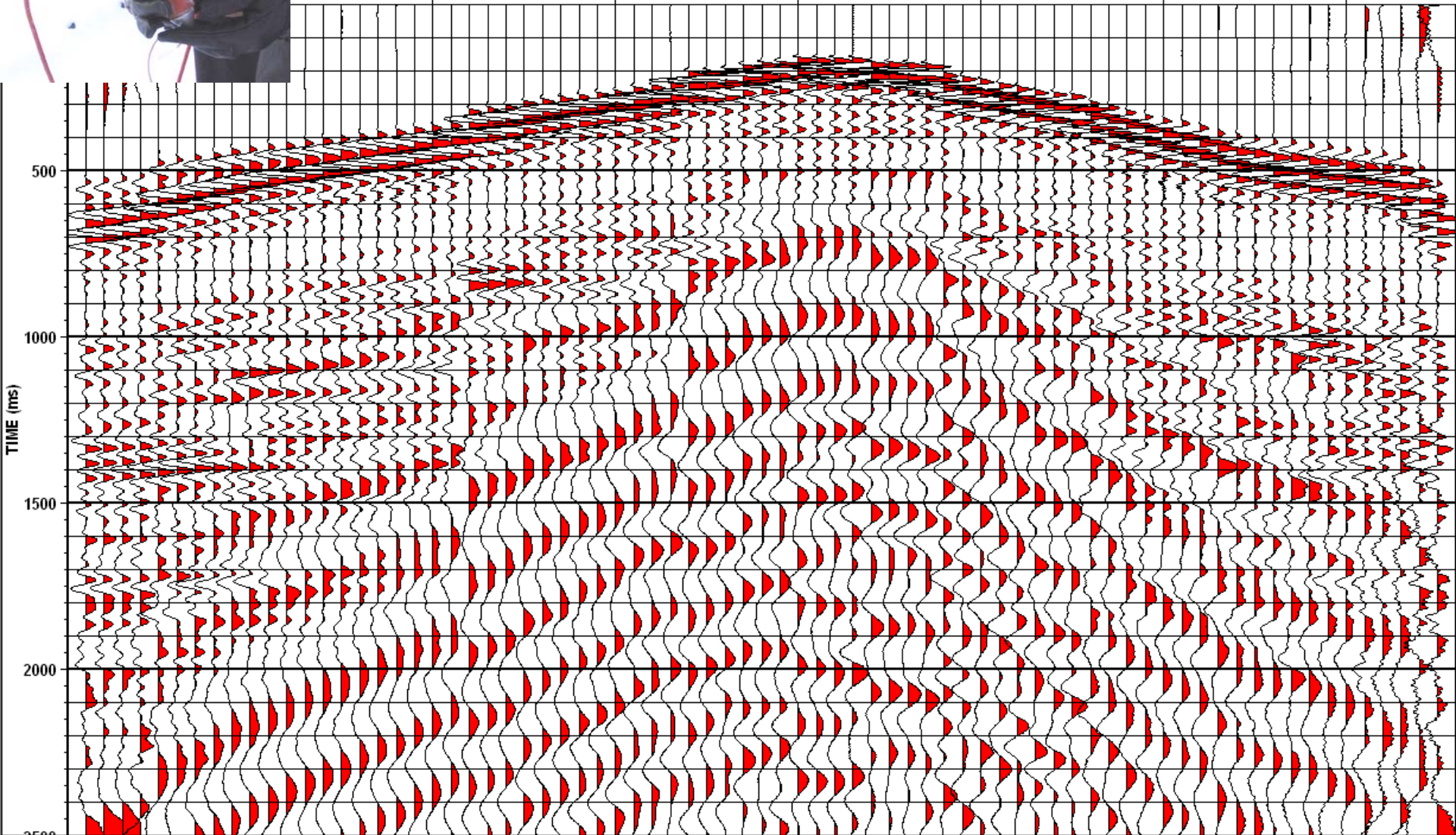
IO-Spike corrected for geophone phase



DSU3 corrected for instrument aafilter

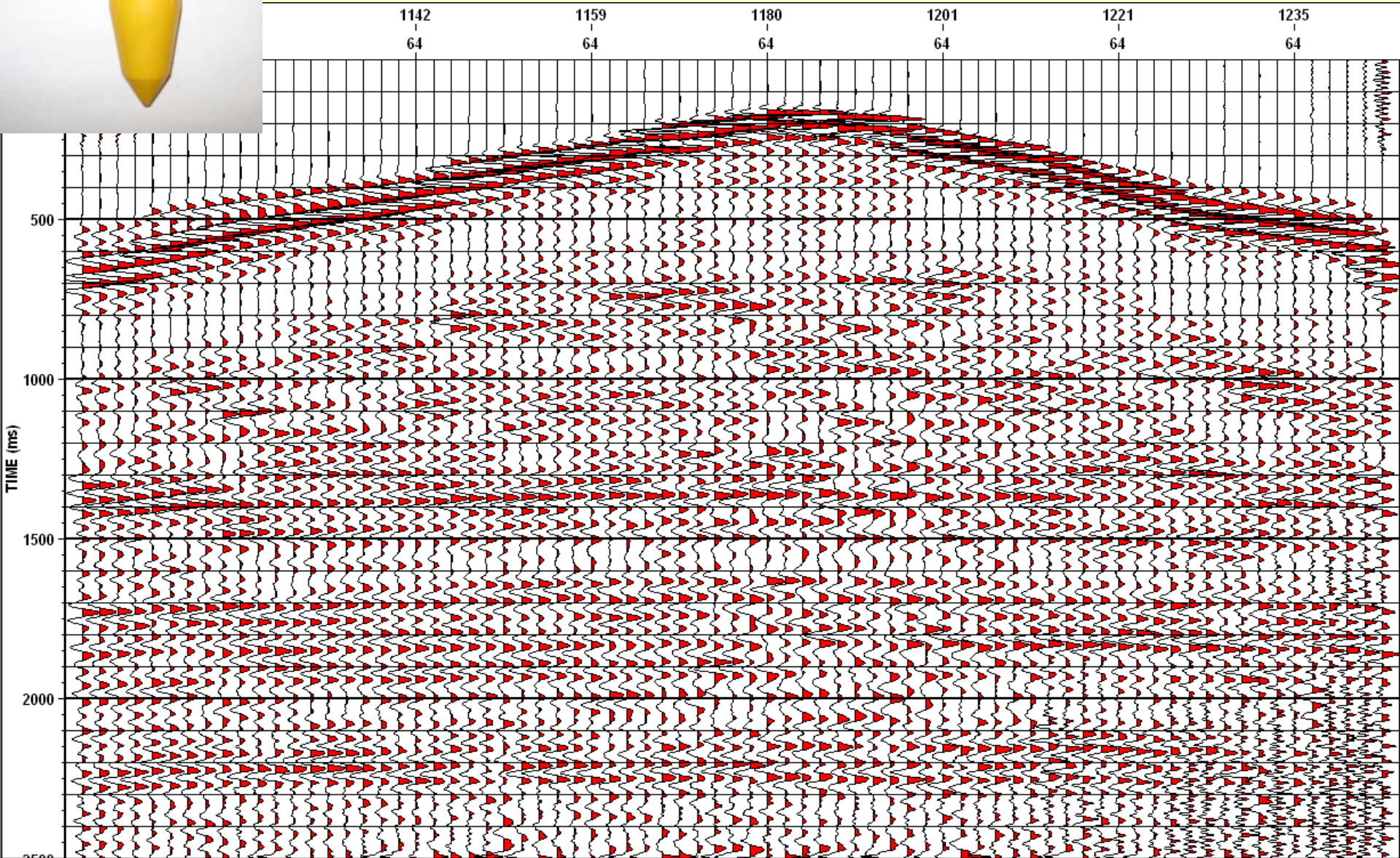


1142 1159 1180 1201 1221 1235
515 515 515 515 515 515



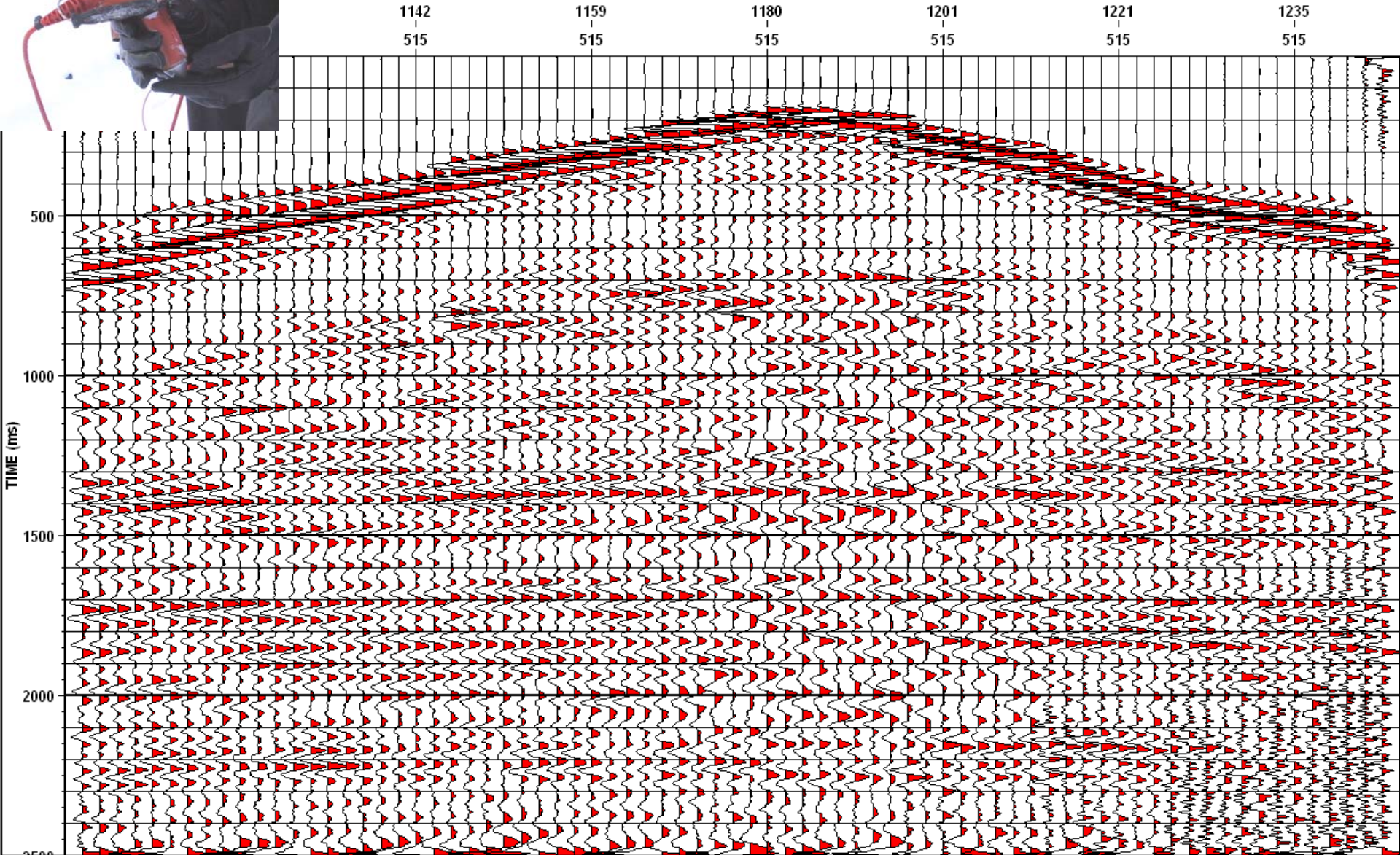


IO-Spike corrected for geophone phase



10-15-60-80Hz bandpass filter

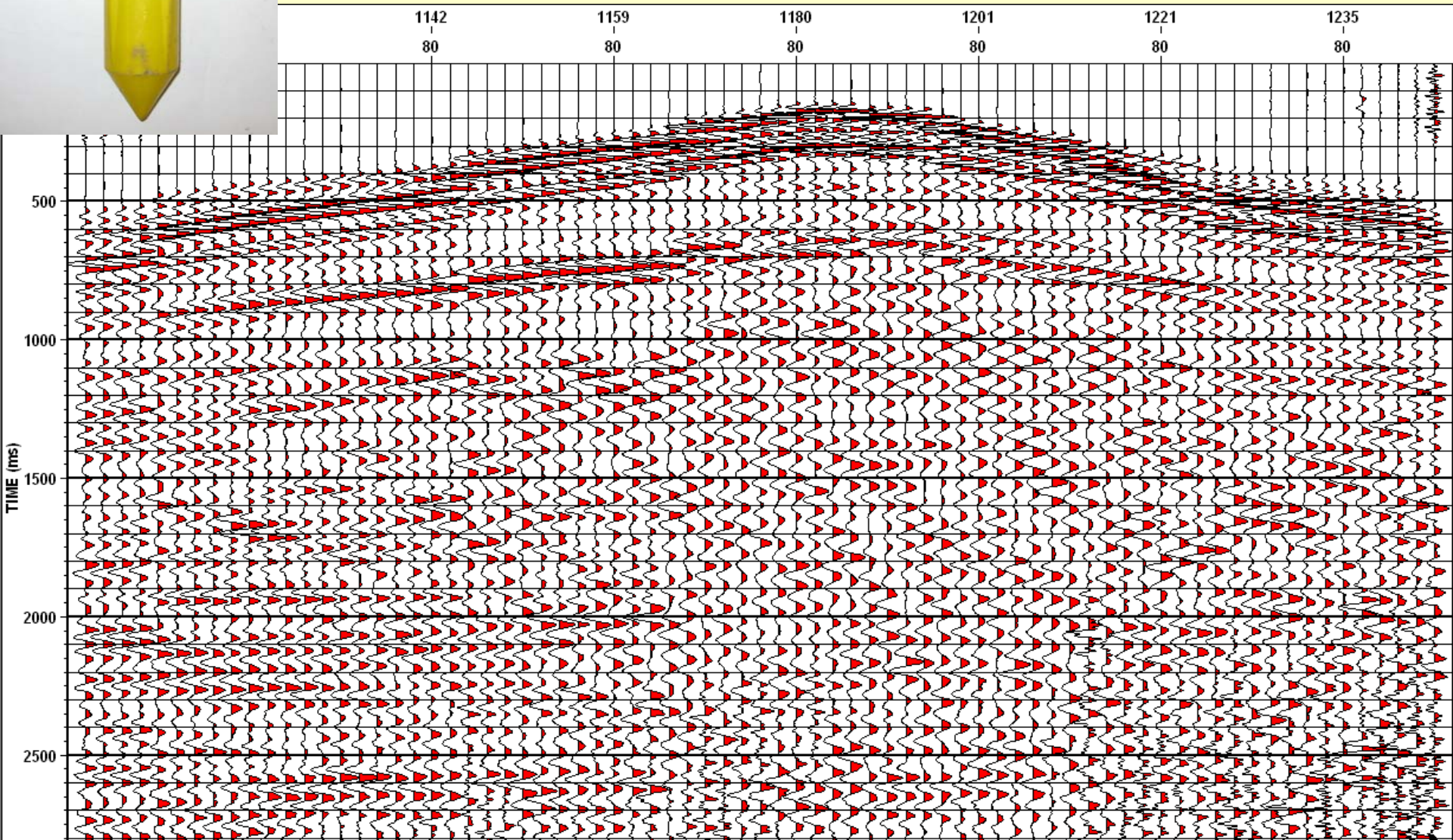
DSU3 integrated and aafilter correction



10-15-60-80Hz bandpass filter



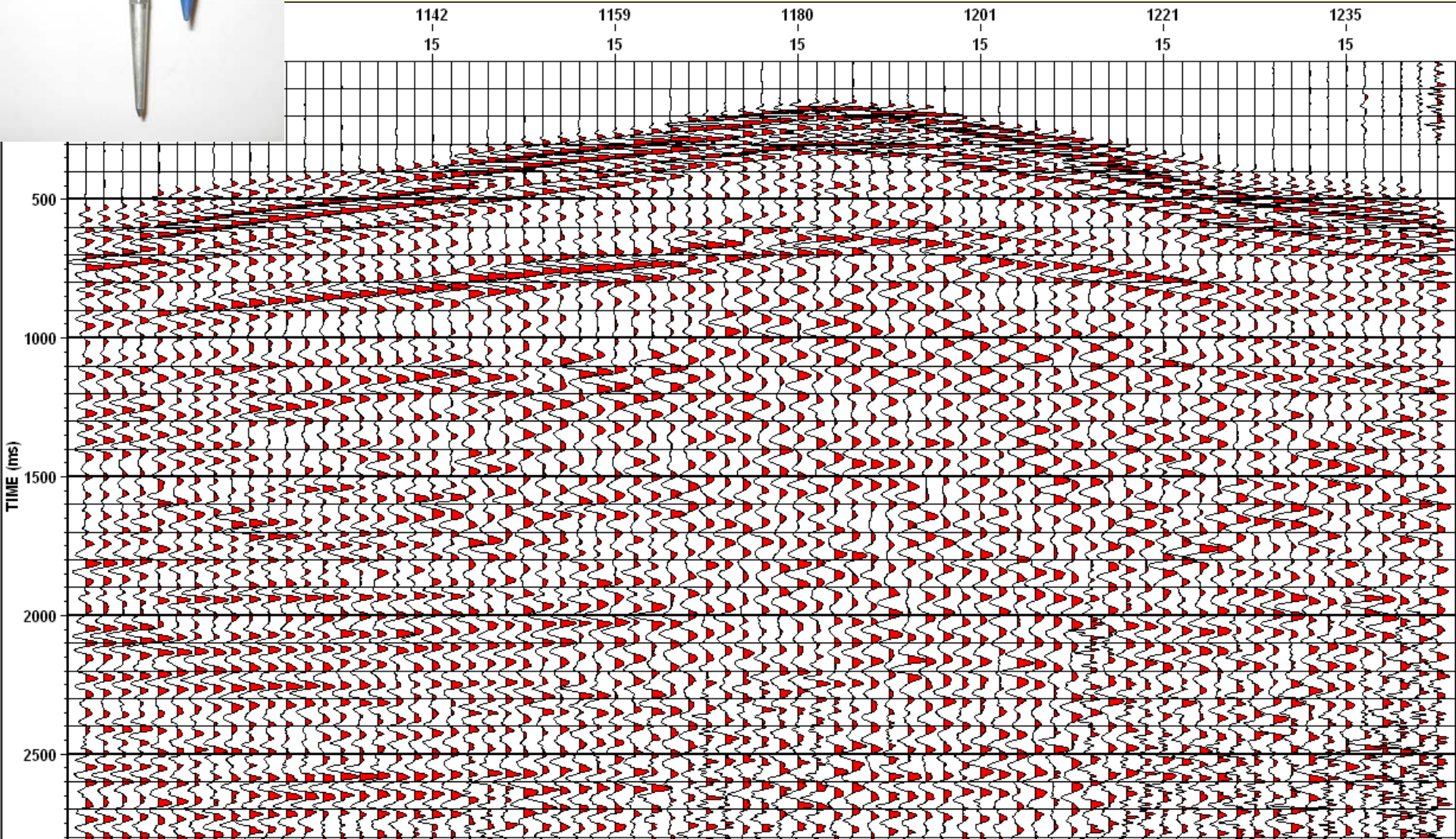
OG-nail radial component



10-15-60-80Hz bandpass filter + 500 ms display agc



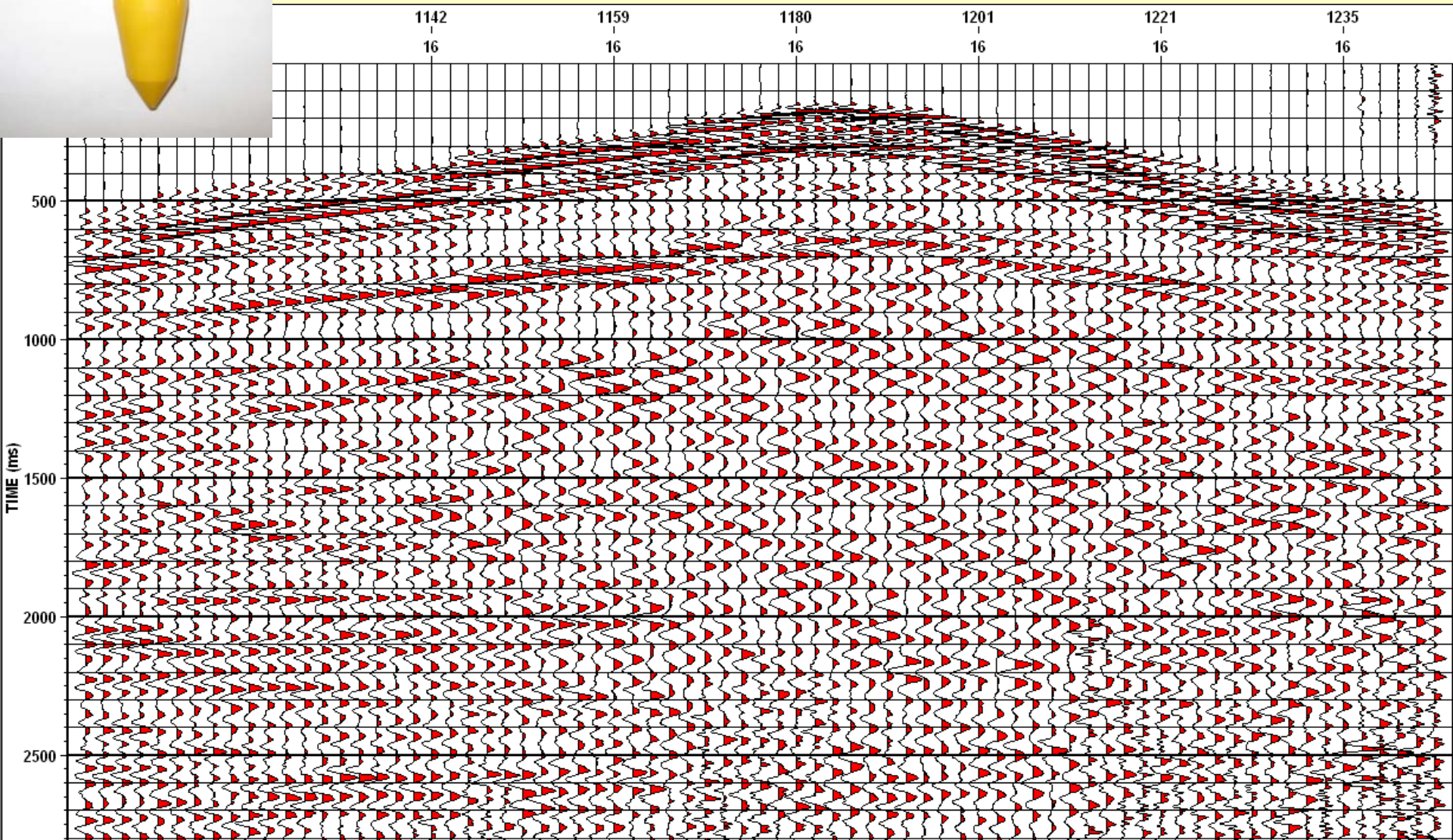
GS-3C radial component



10-15-60-80Hz bandpass filter + 500 ms display agc

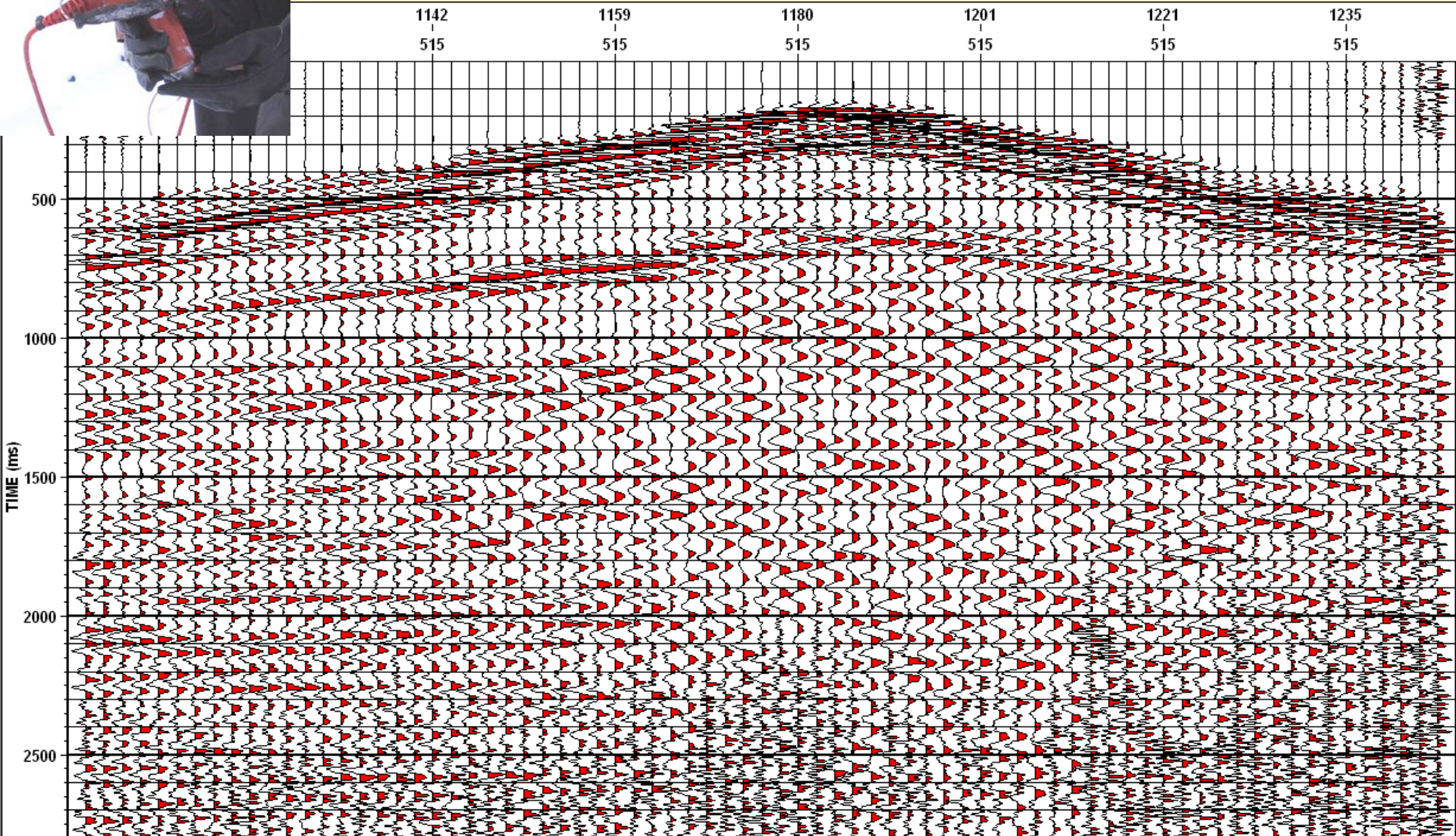


IO-spike radial component



10-15-60-80Hz bandpass filter + 500 ms display agc

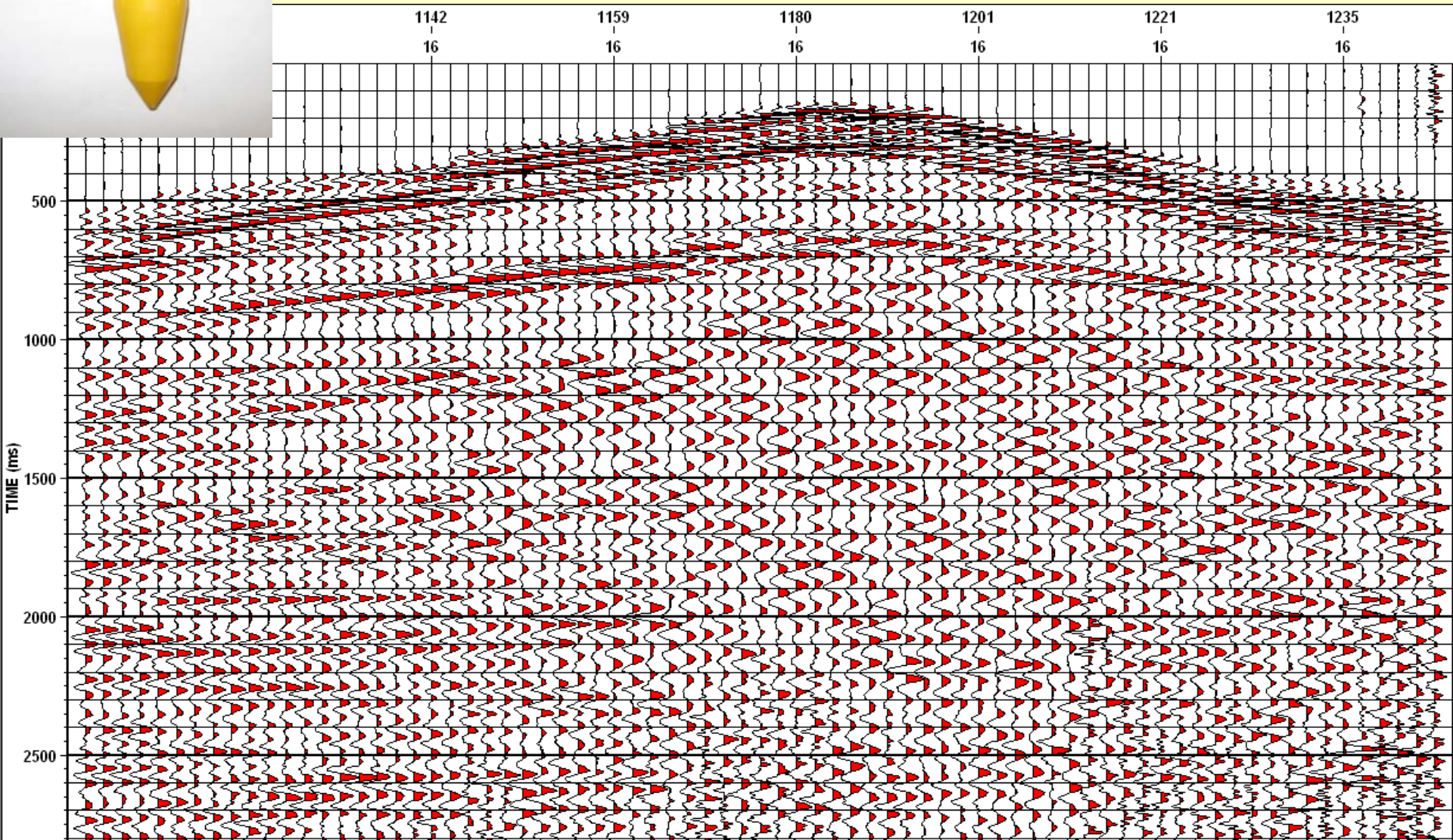
Sercel-DSU3 radial component



10-15-60-80Hz bandpass filter + 500 ms display agc

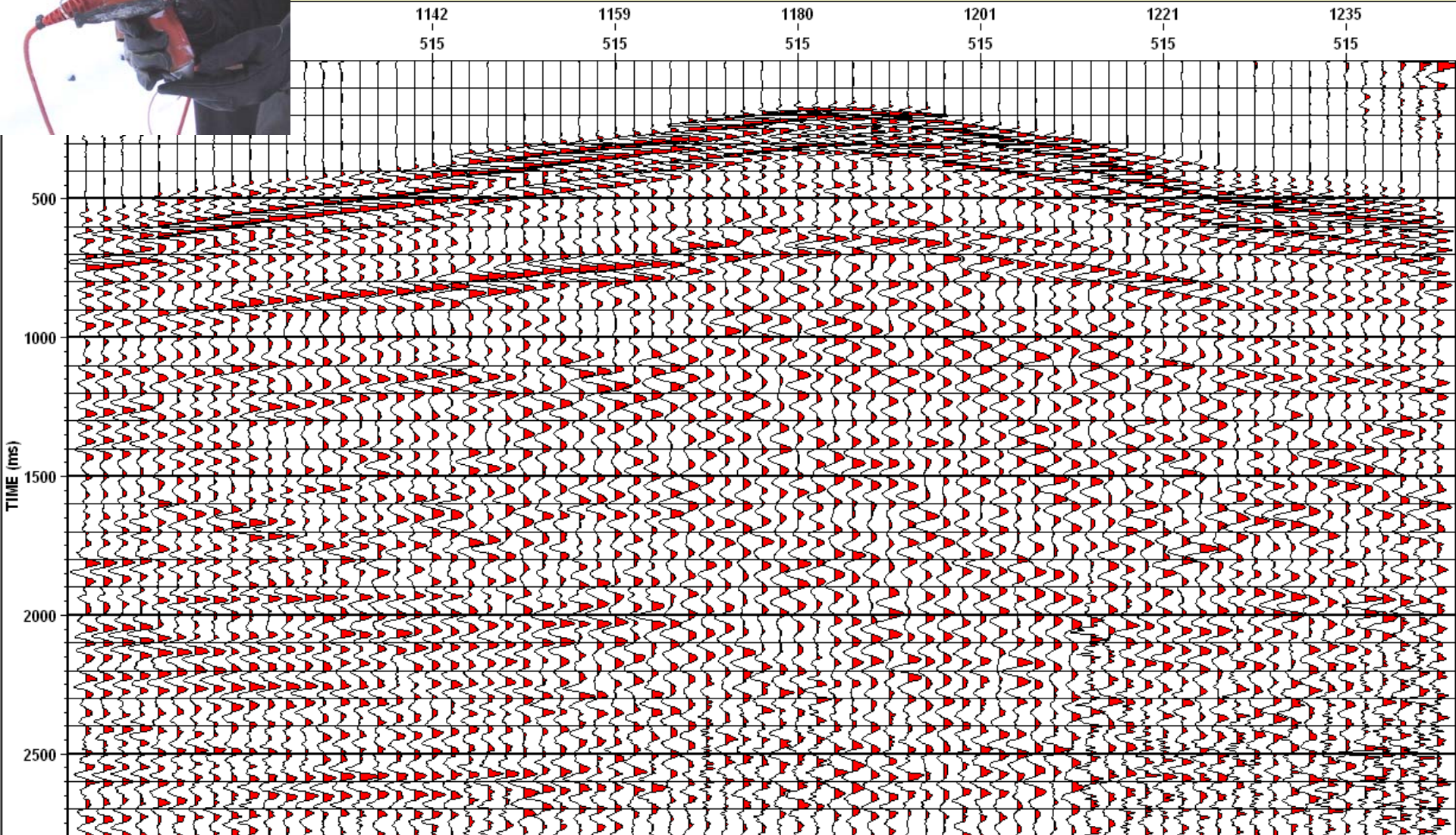


IO-Spike corrected for geophone phase



10-15-60-80Hz bandpass filter + 500 ms display agc

DSU3 integrated and aafilter phase



10-15-60-80Hz bandpass filter + 500 ms display agc

Conclusions

- All devices show high quality data
- Geophone data are essentially identical
- Geophone (velocity) and MEMS (accelerometer) raw reflection data look very similar
- Integrating accelerometer data and applying geophone and aafilter phase corrections yield higher correlation over full data bandwidth

Acknowledgements

- CREWES sponsors
- ASRIP/Nexen for funding for UofC equipment
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- GEDCO for VISTA support