Seismic Imaging of vertical thin pipes

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ROSE meeting
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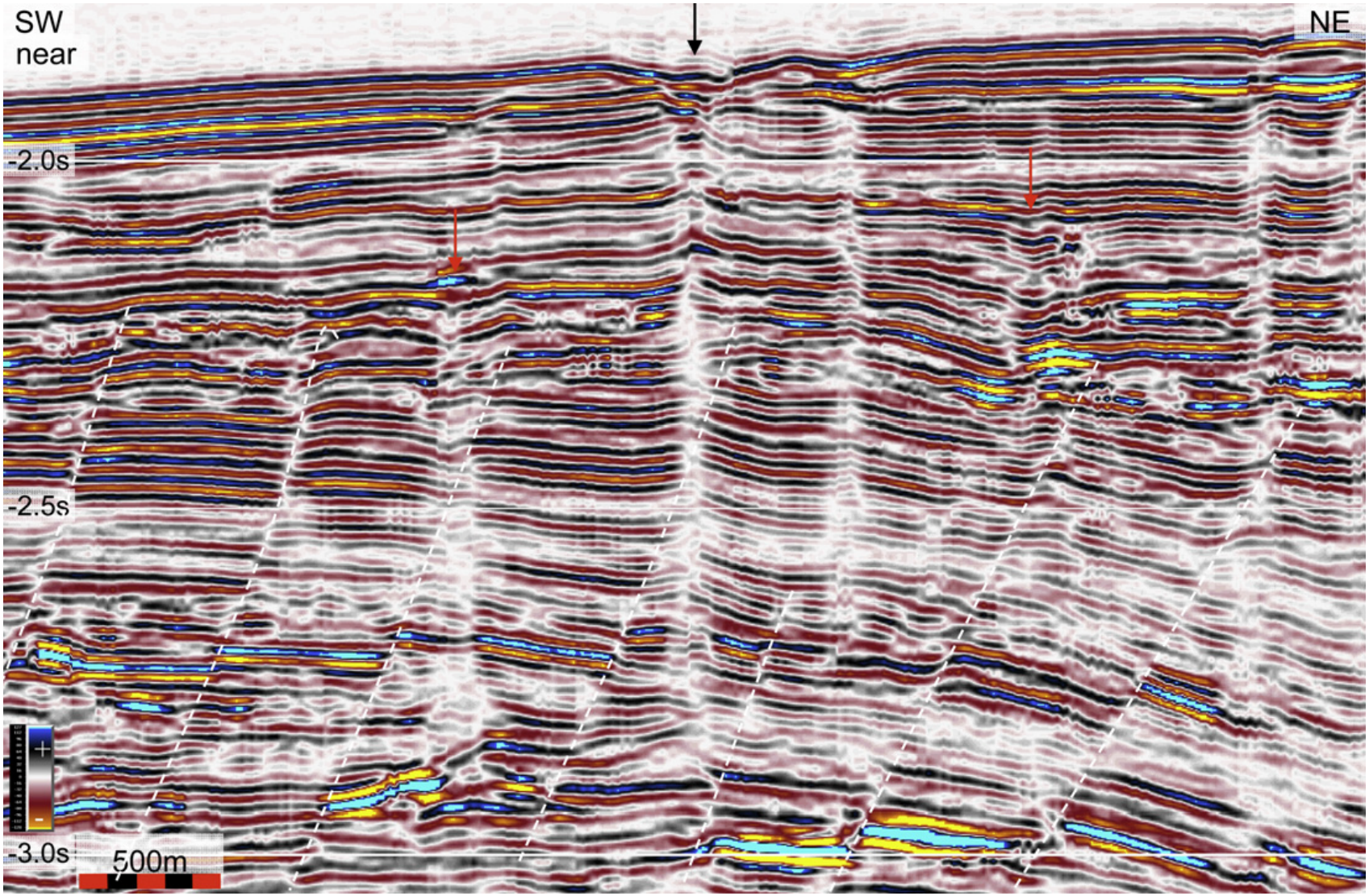
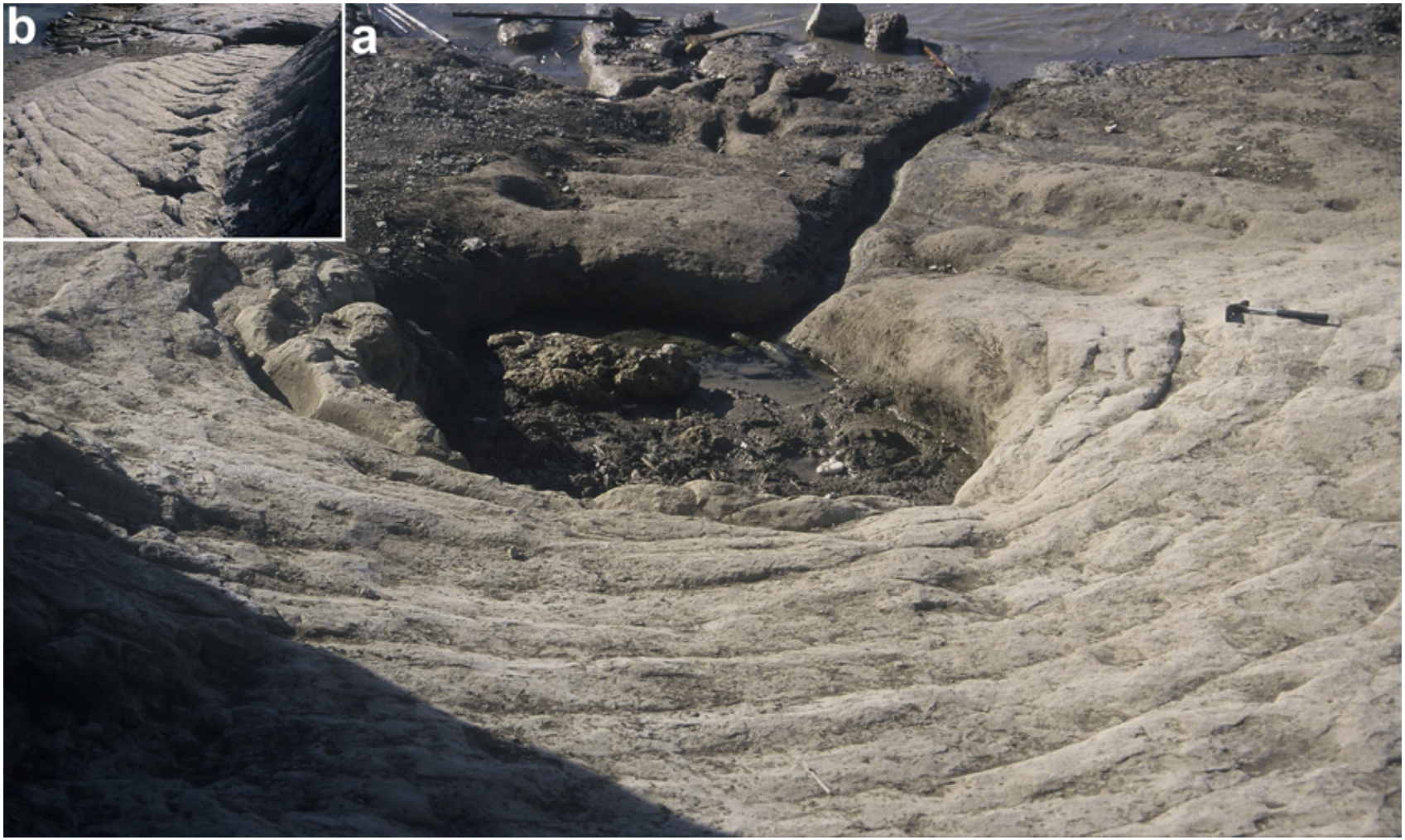
Vertical pipes West Africa



Overview

1. Introduction
2. Seismic response of vertical thin pipes
3. Imaging of a vertical thin pipe
4. Real data example
5. Conclusions

Ancient pipe Rhodos

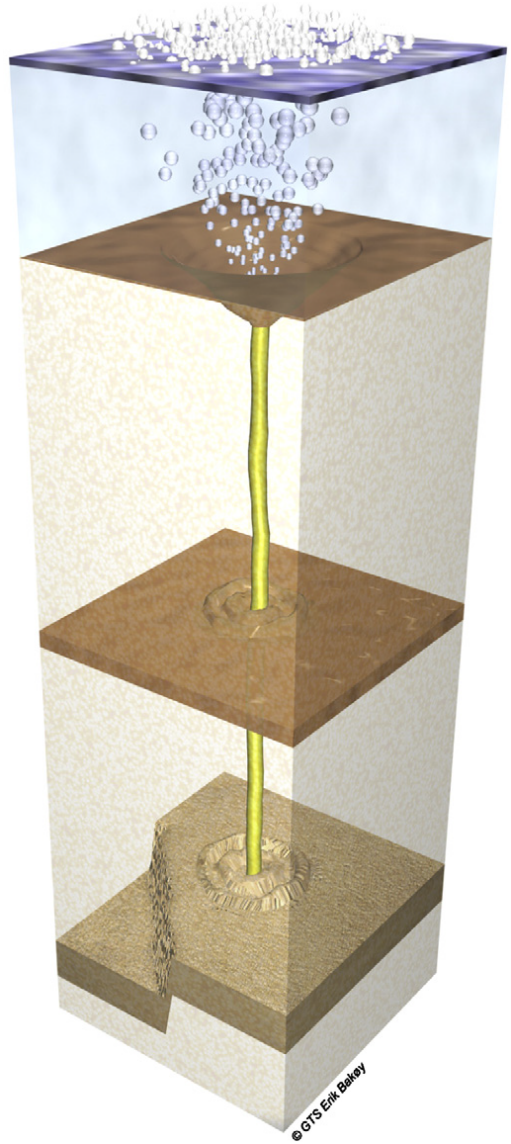


(From Løseth et. al. 2011)

Ancient pipe Rhodos

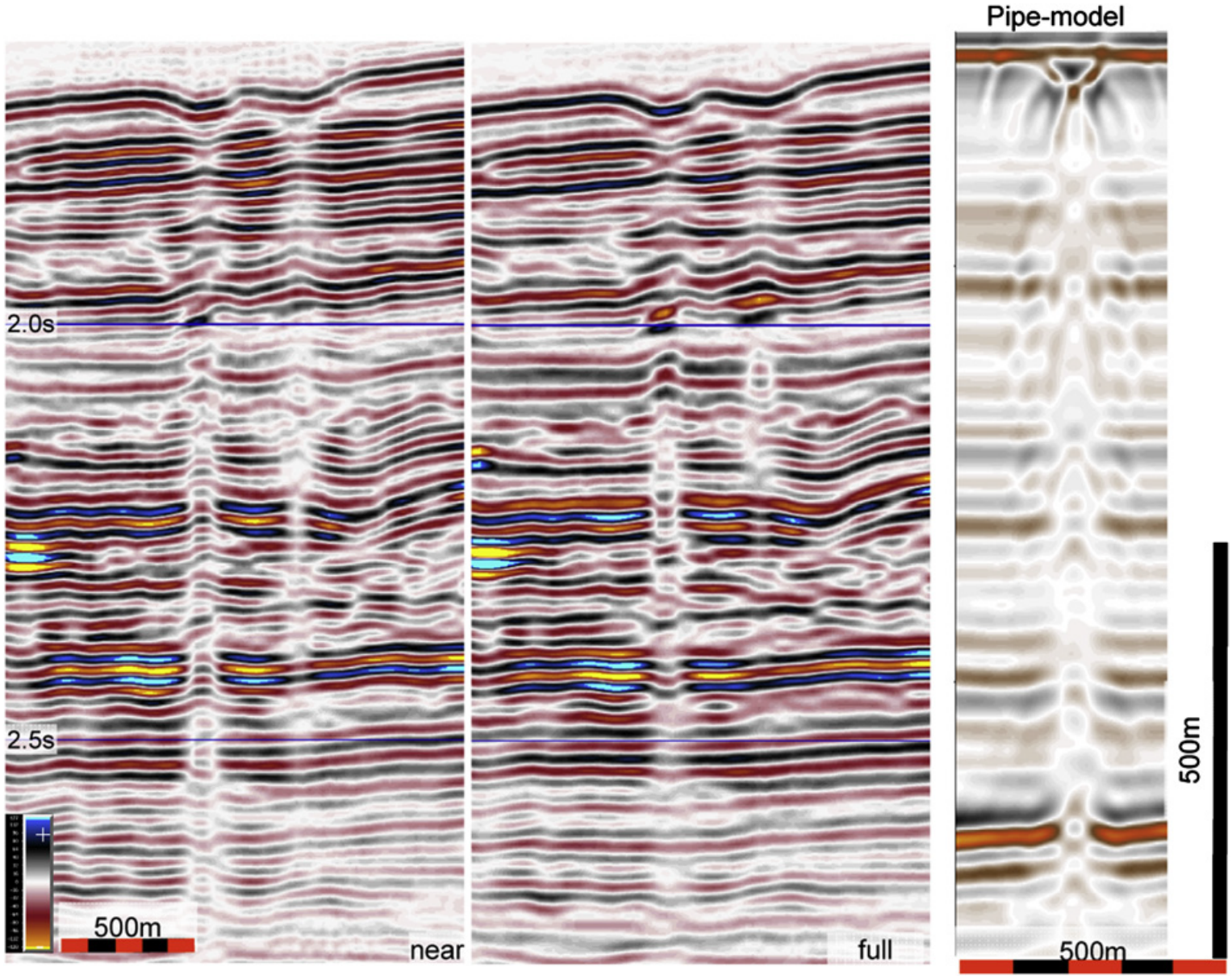
(From Løseth et. al. 2011)

Vertical pipe schematic view



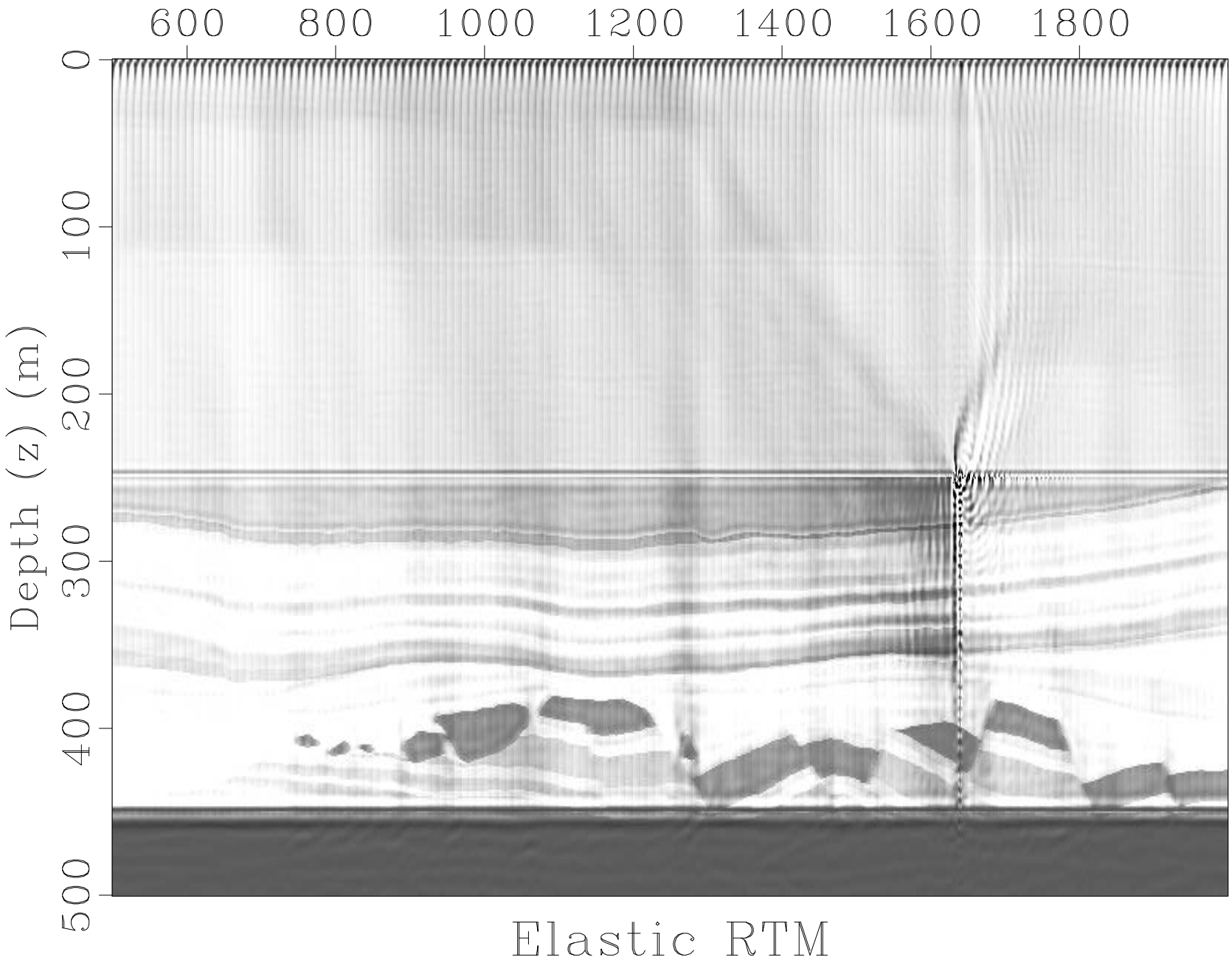
(From Løseth et. al. 2011)

Modeling of seismic response from a vertical pipe

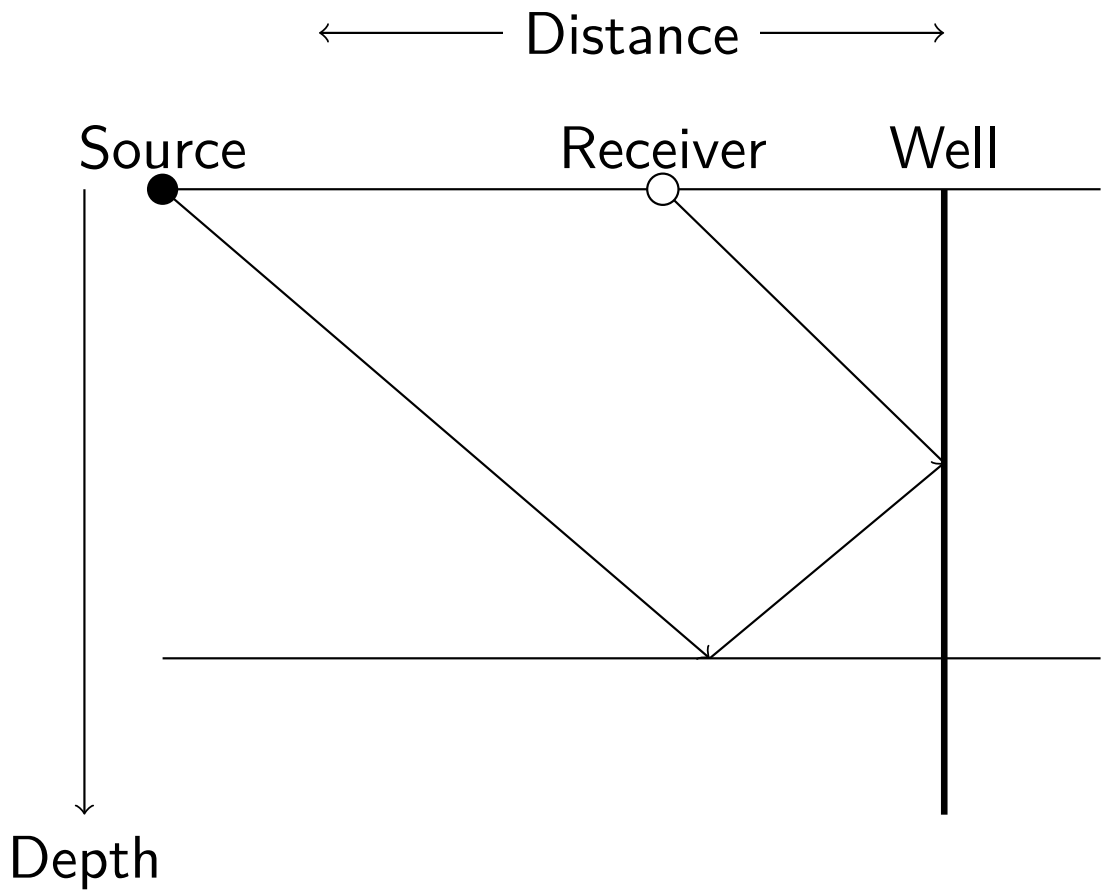


(From Løseth et. al. 2011)

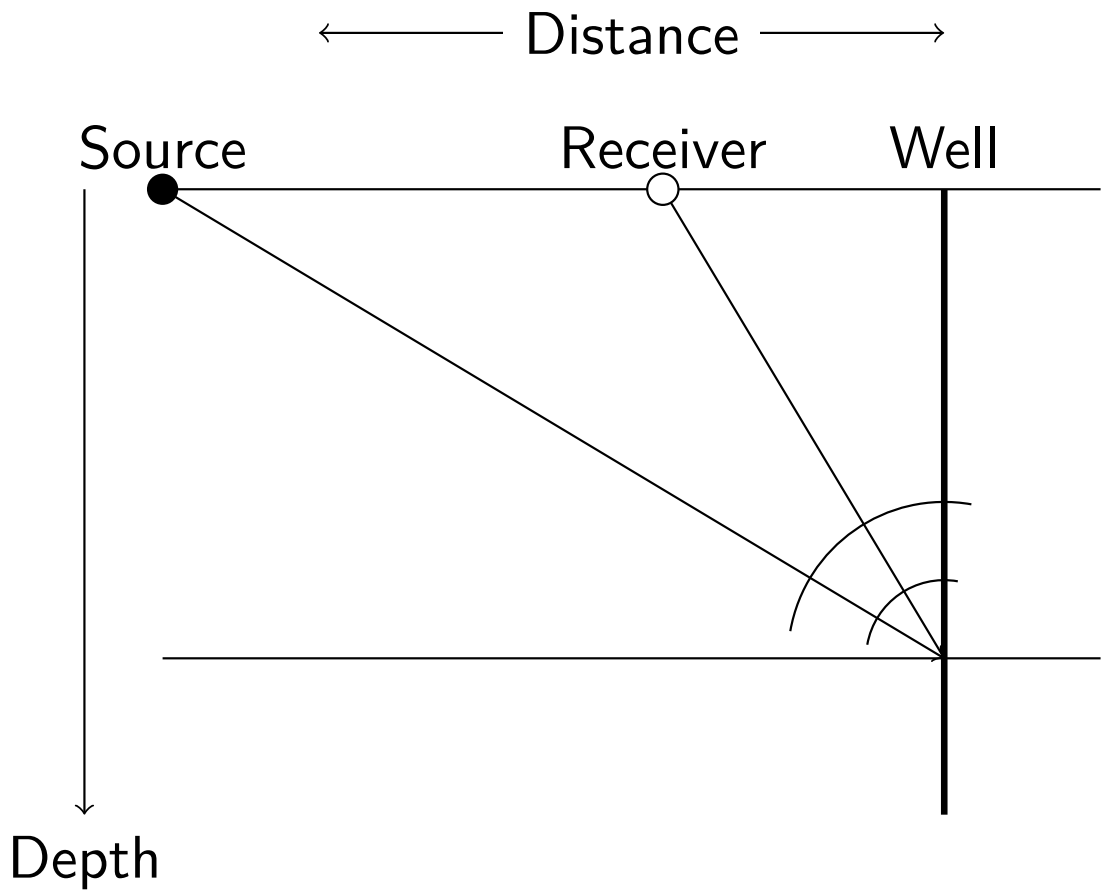
Seismic response of a vertical pipe



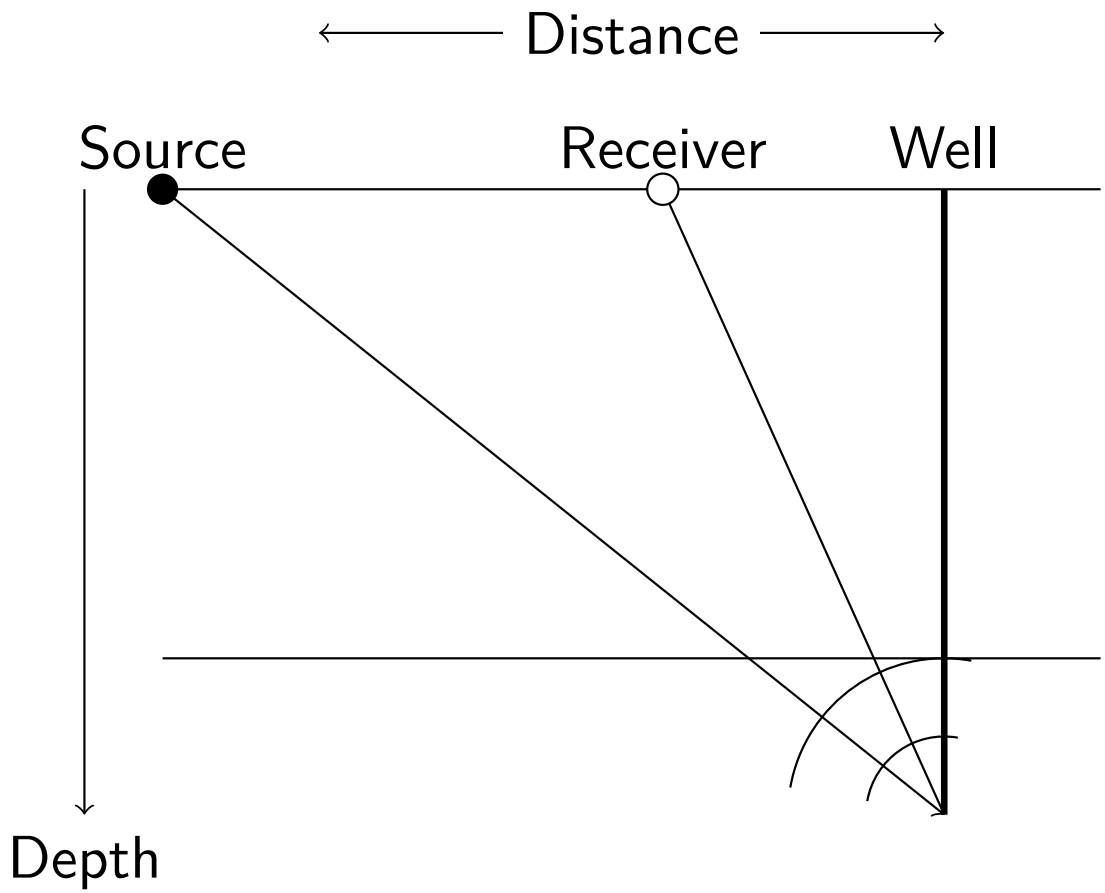
Reflections from from vertical pipe



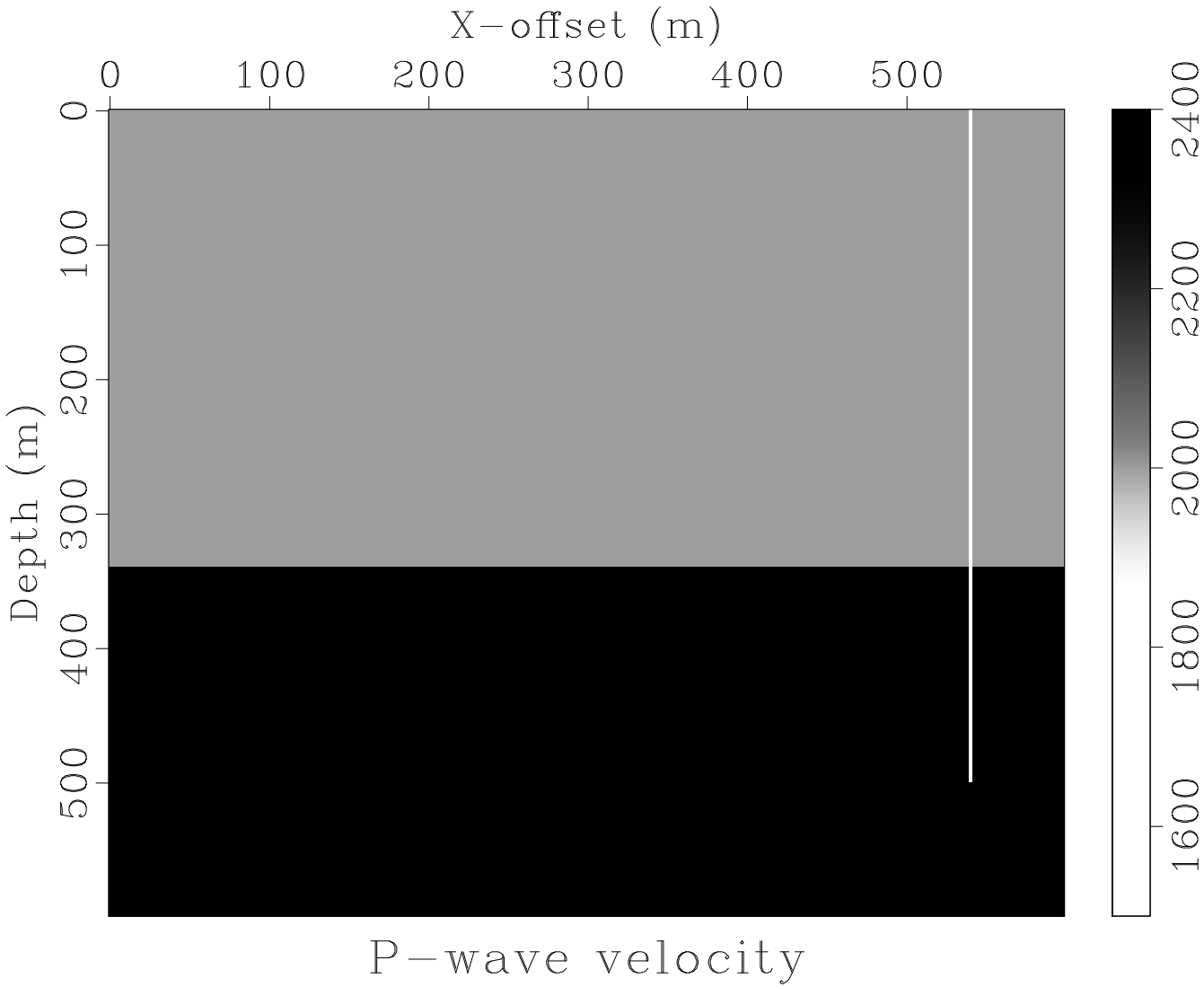
Diffractions from layer/pipe intersection



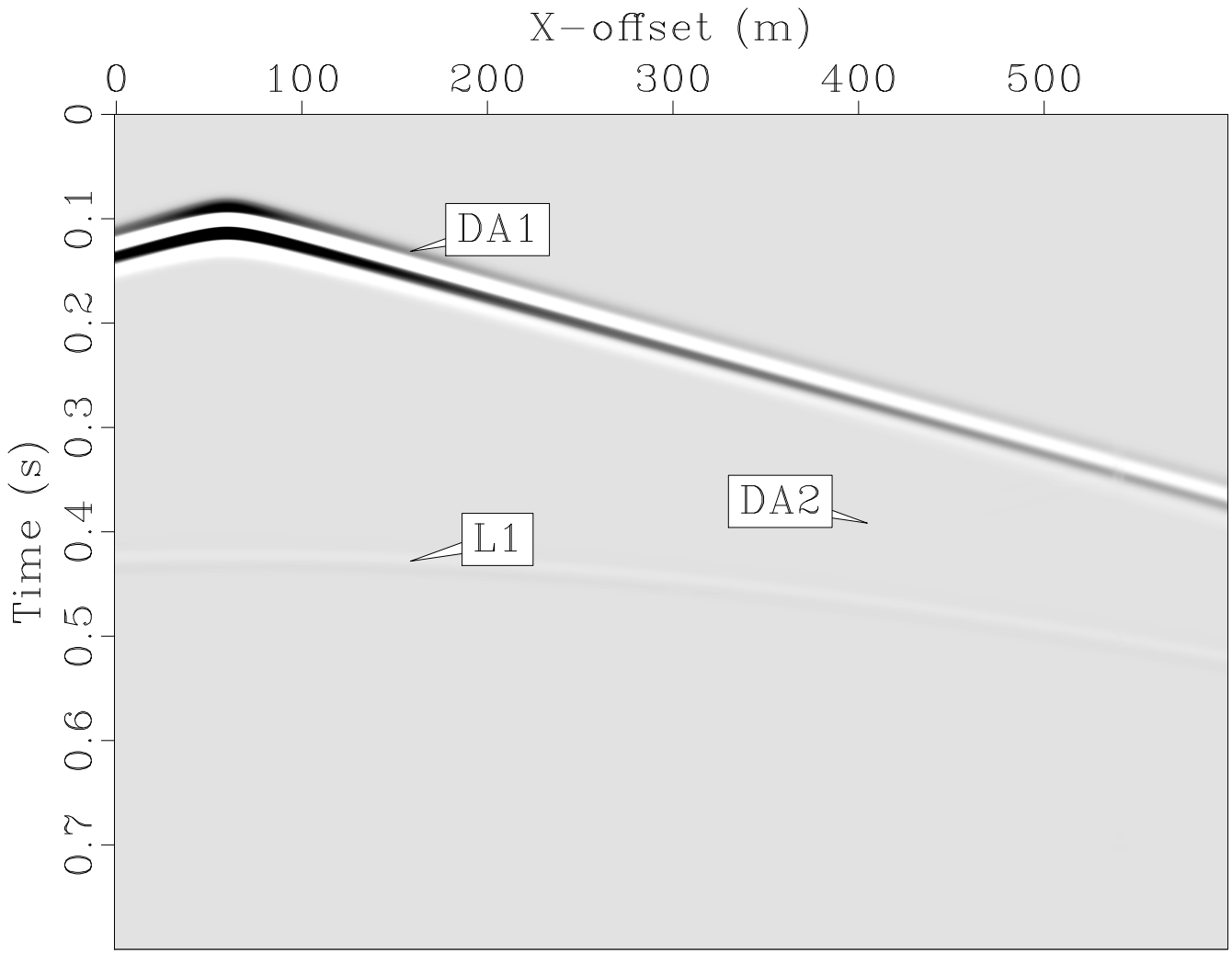
Diffractions from bottom of pipe



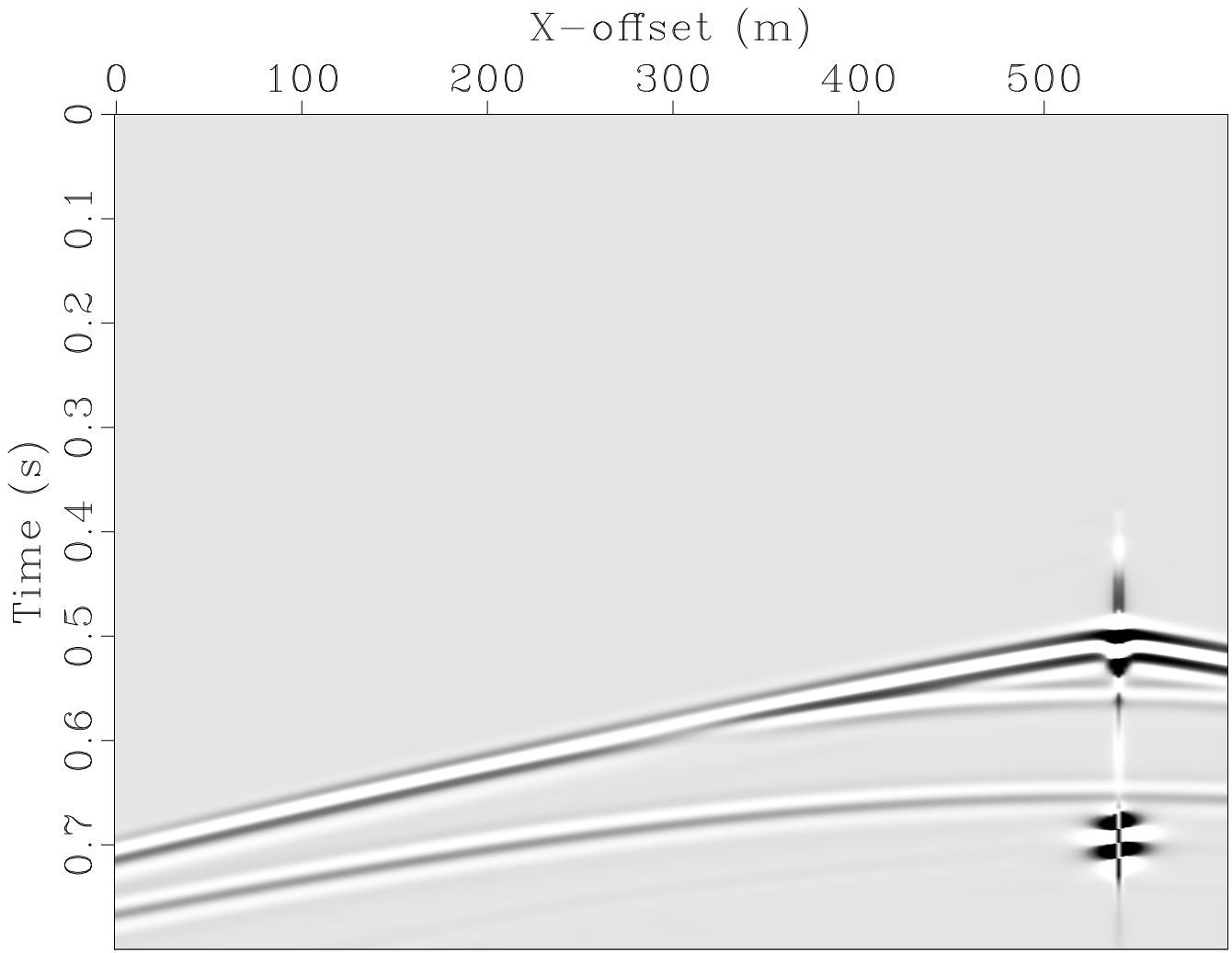
Seismic response from pipe



Seismic response from pipe



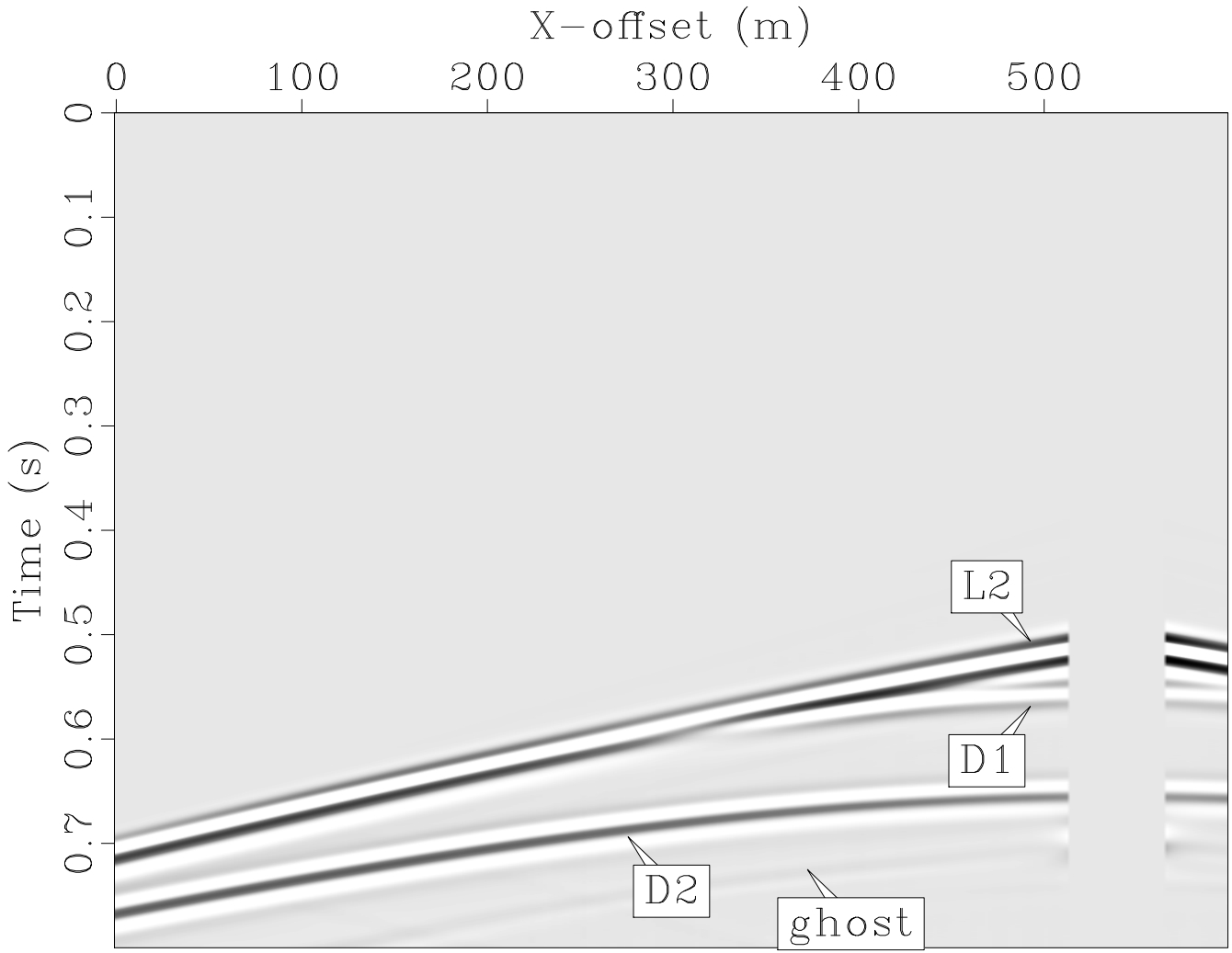
Time lapse Seismic response from pipe



Peak source frequency: 30Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

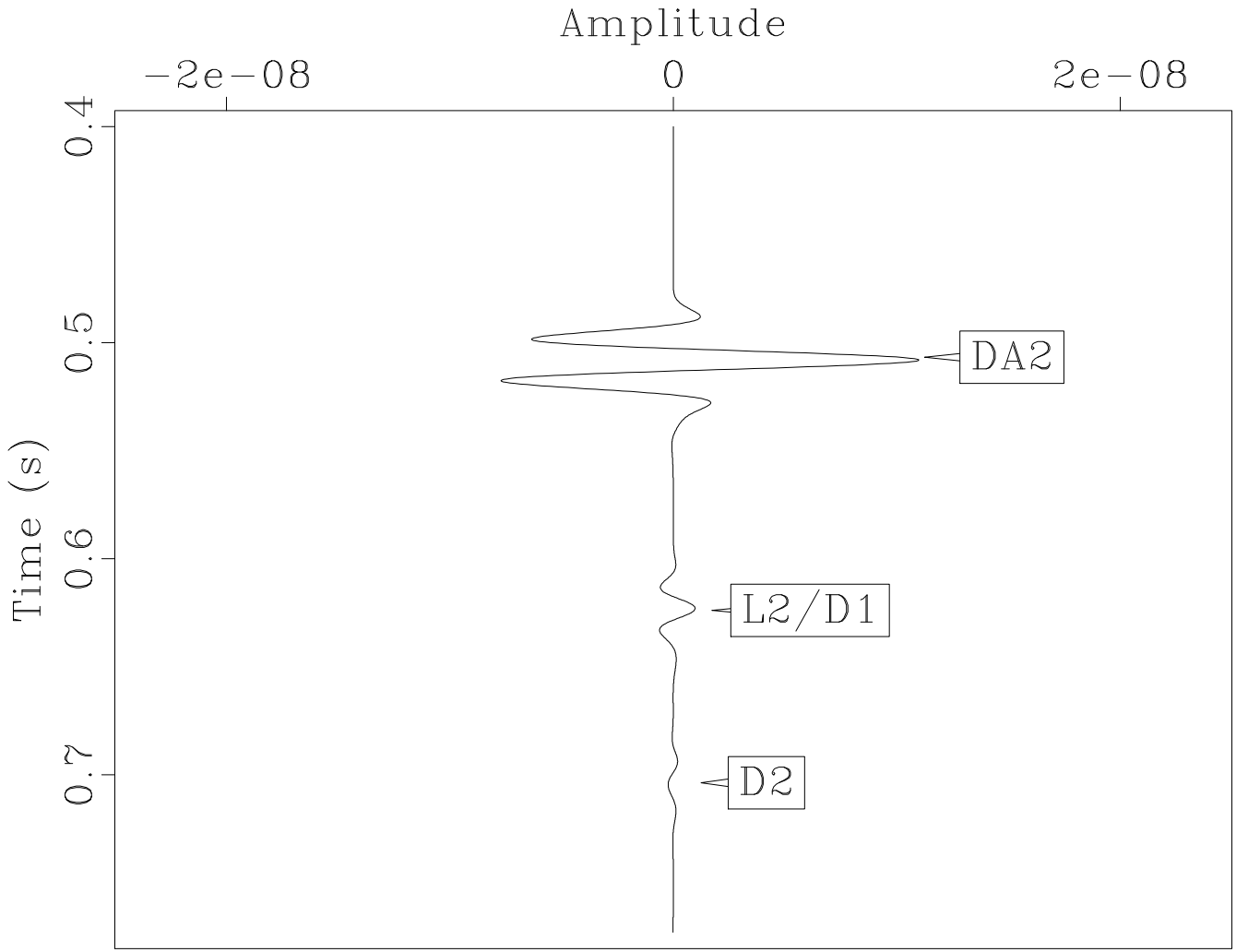
DA2: Direct Reflection from pipe. Water filled pipe



Peak source frequency: 30Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

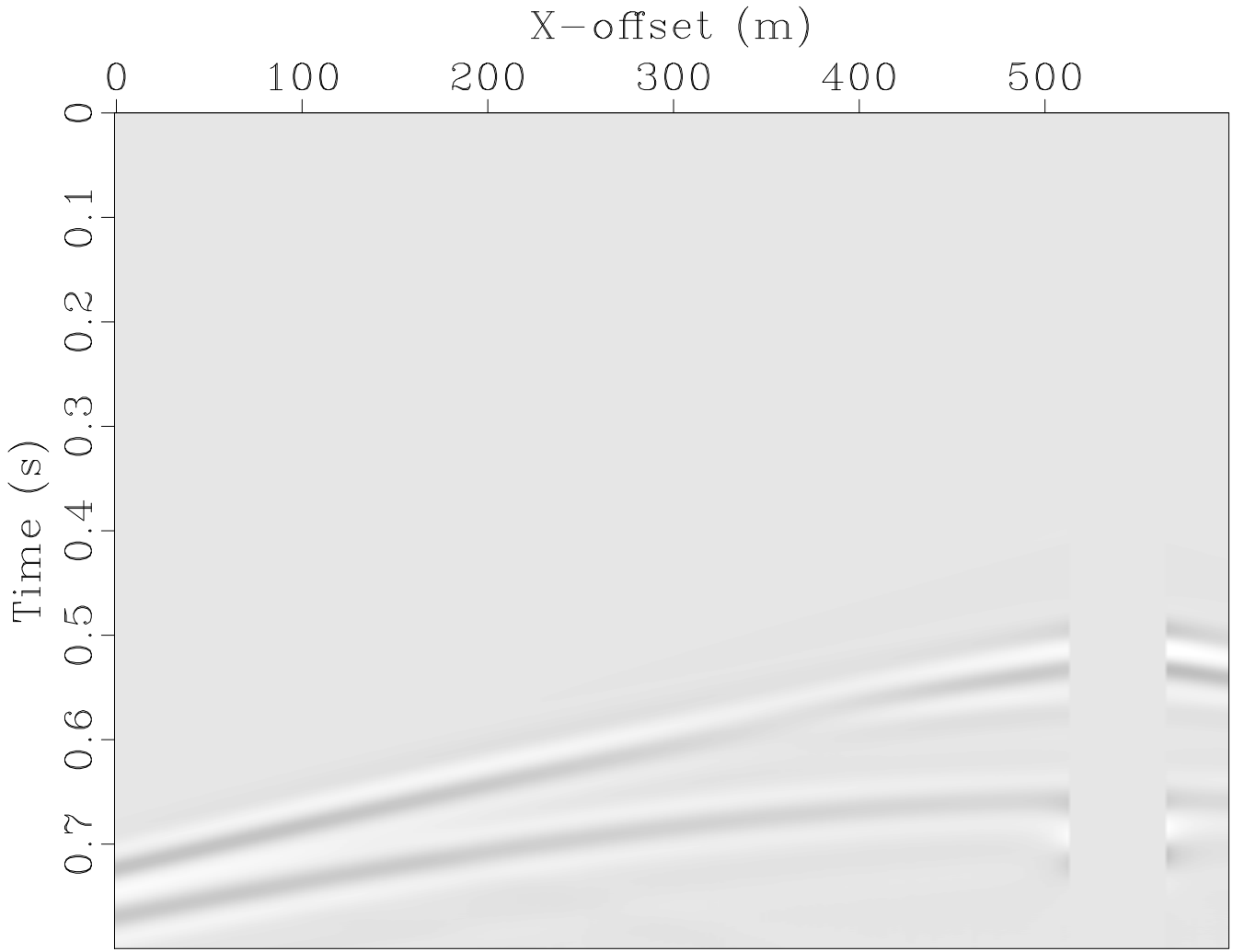
Water filled pipe



Peak source frequency: 15Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

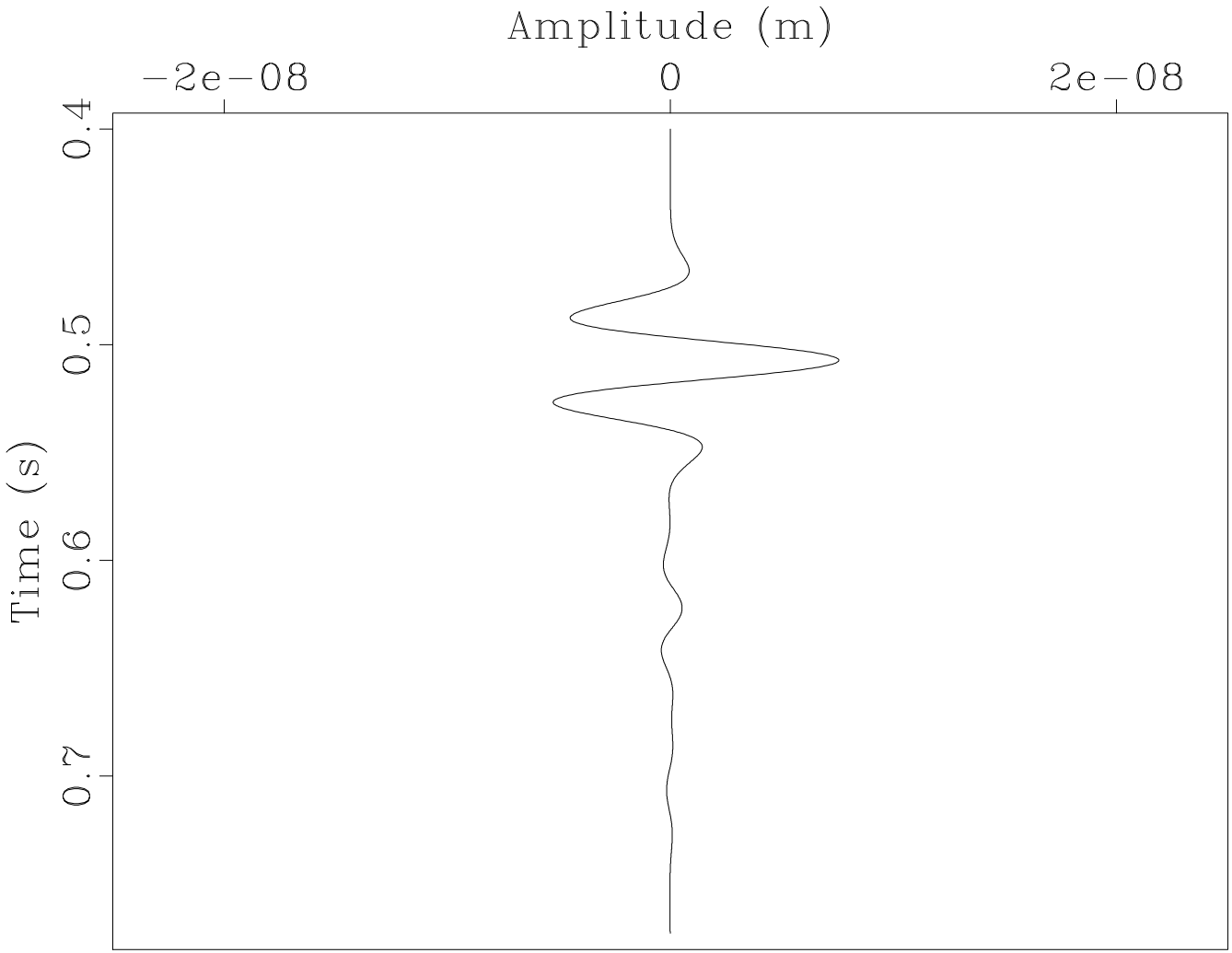
Water filled pipe



Peak source frequency: 15Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

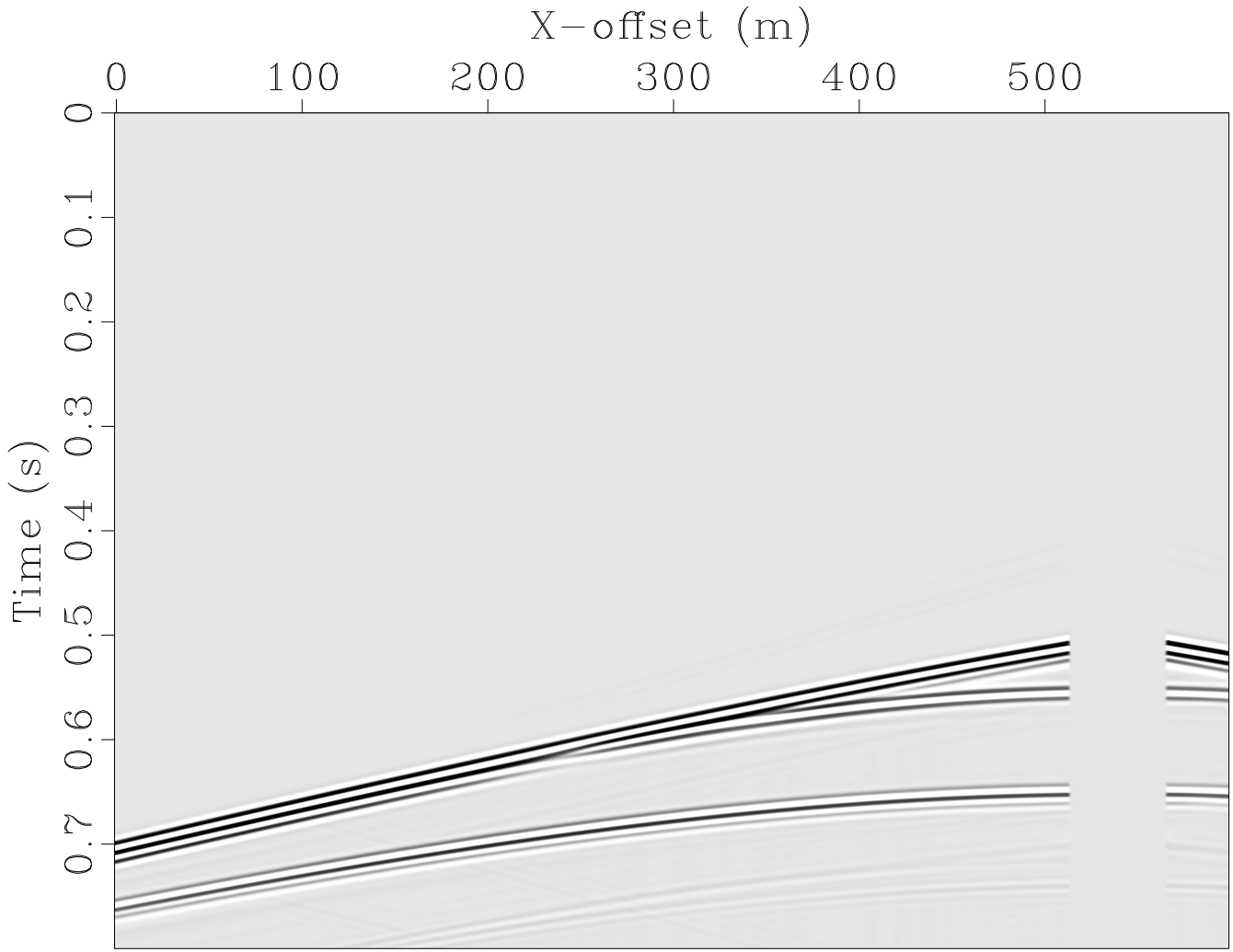
Water filled pipe



Peak source frequency: 60Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

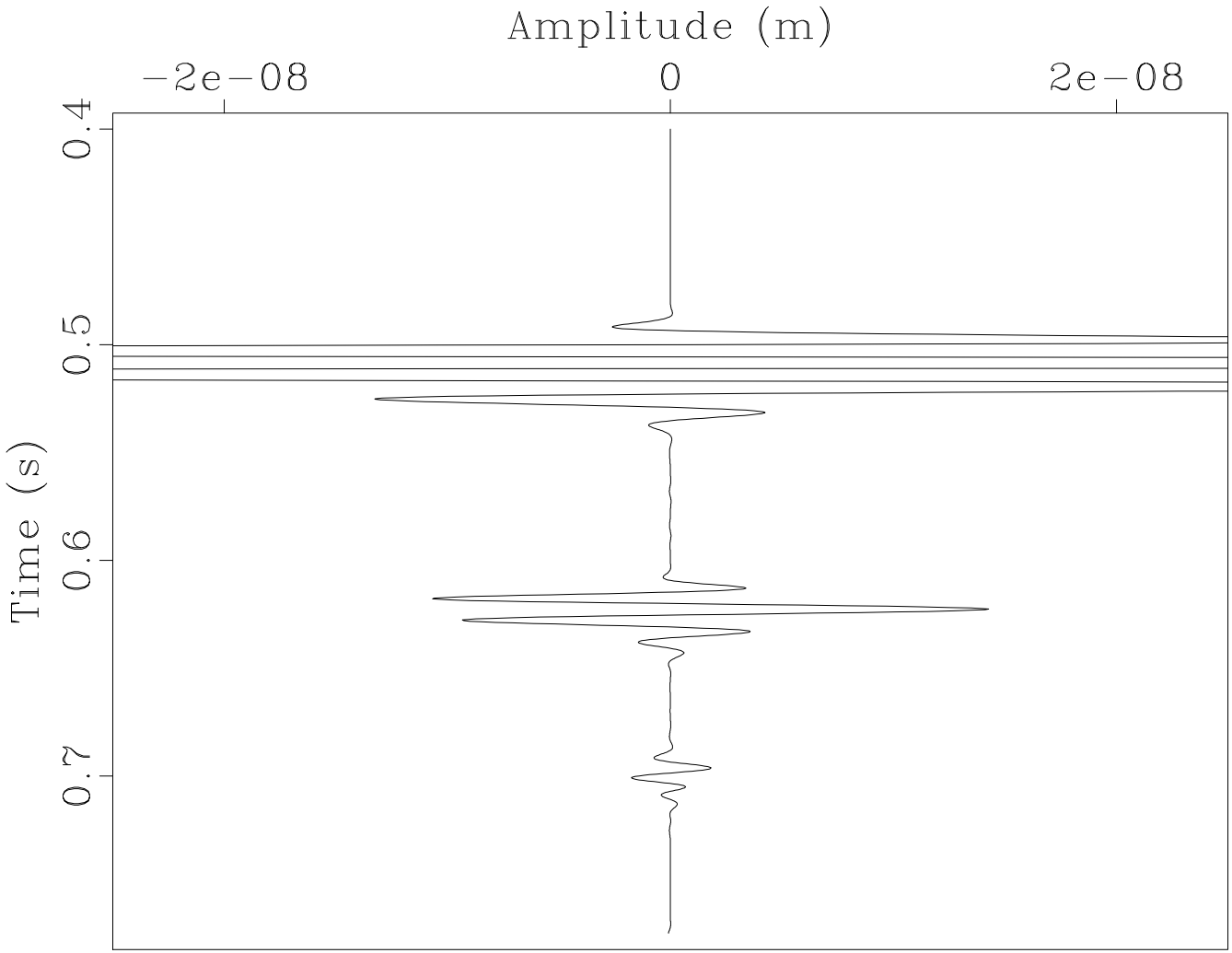
Water filled pipe



Peak source frequency: 60Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

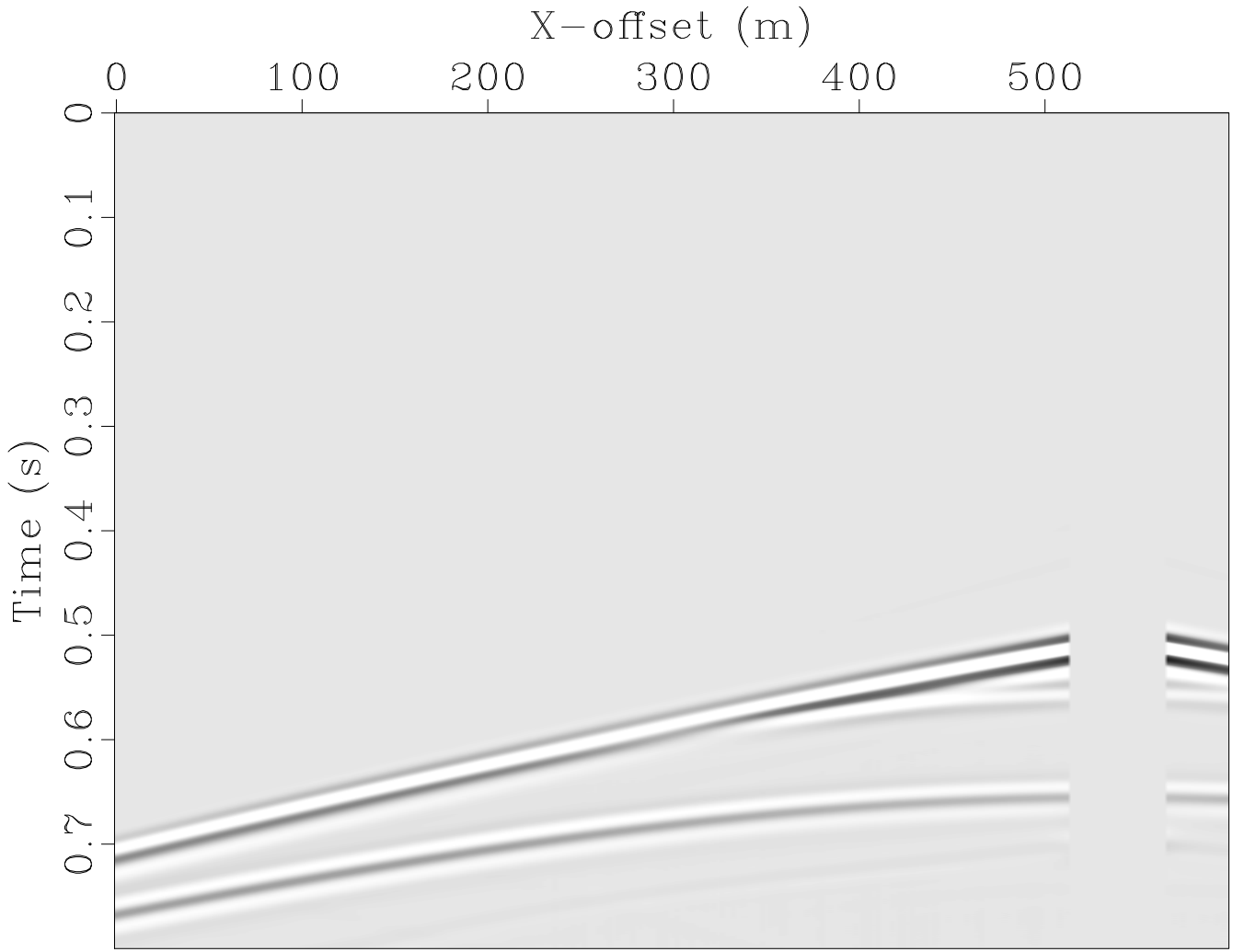
Water filled pipe



Peak source frequency: 30Hz

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

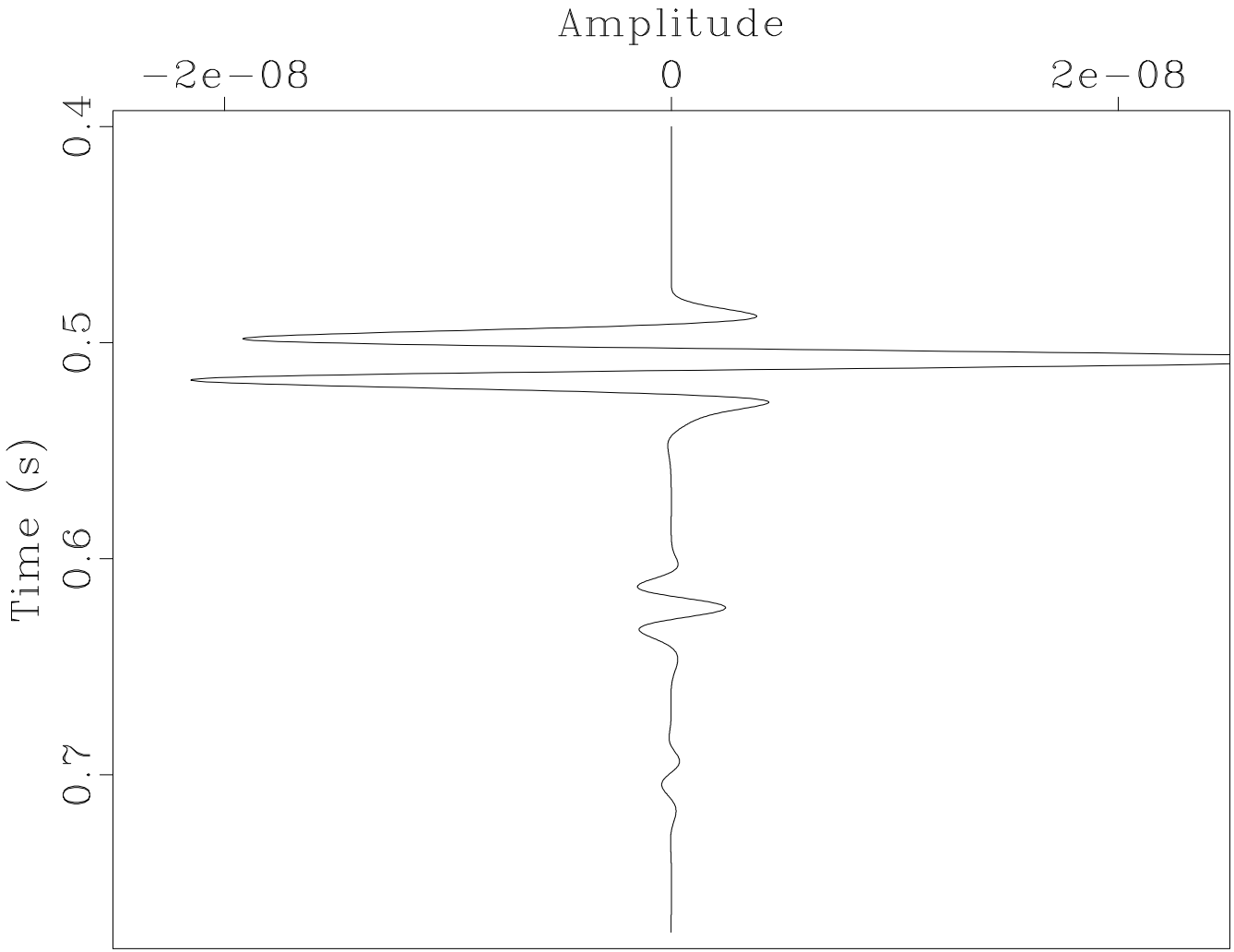
Mud filled pipe



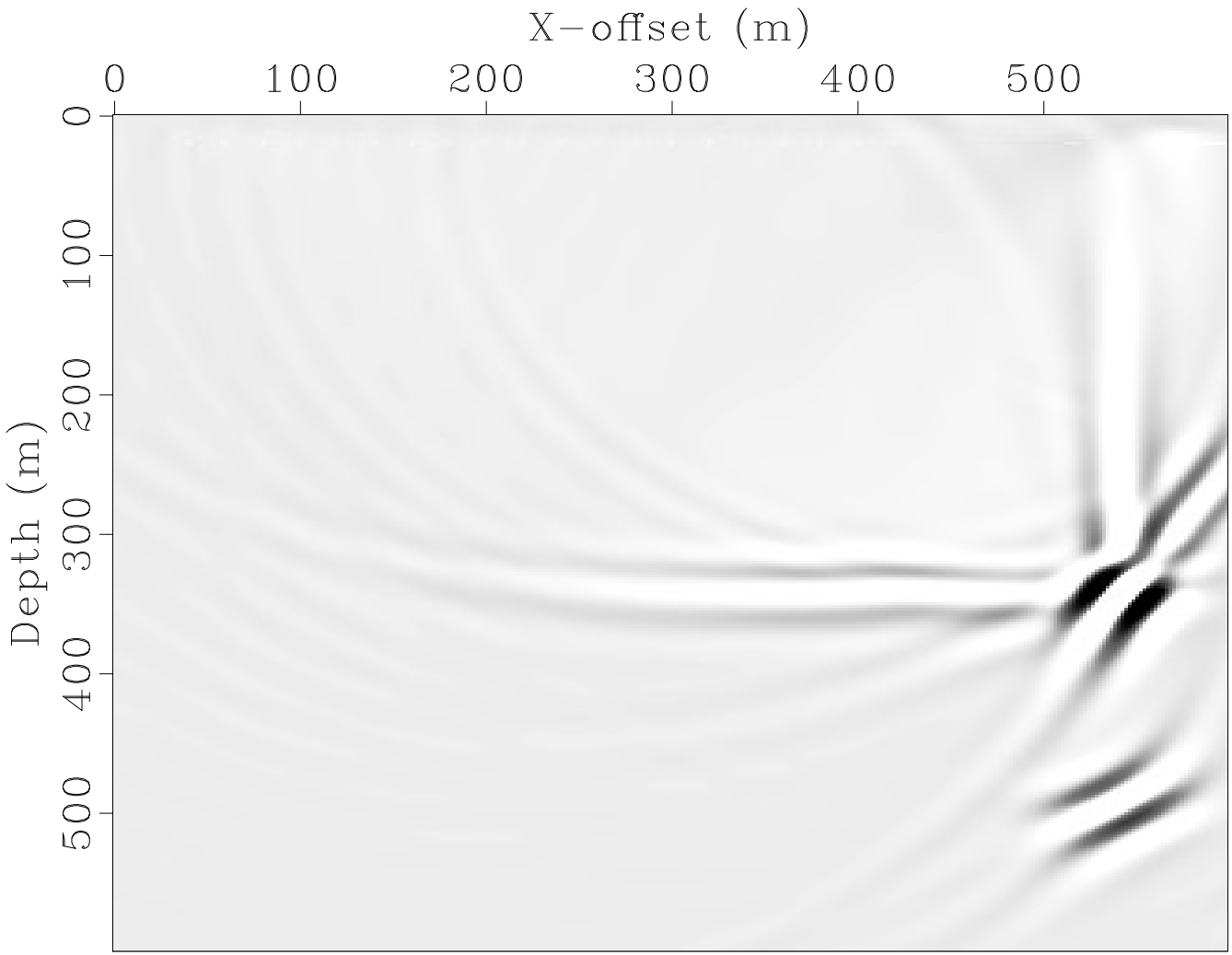
Peak source frequency: 30H

L2: Prismatic reflection D1: Layer/pipe diffraction D2: Bottom diffraction

Mud filled pipe

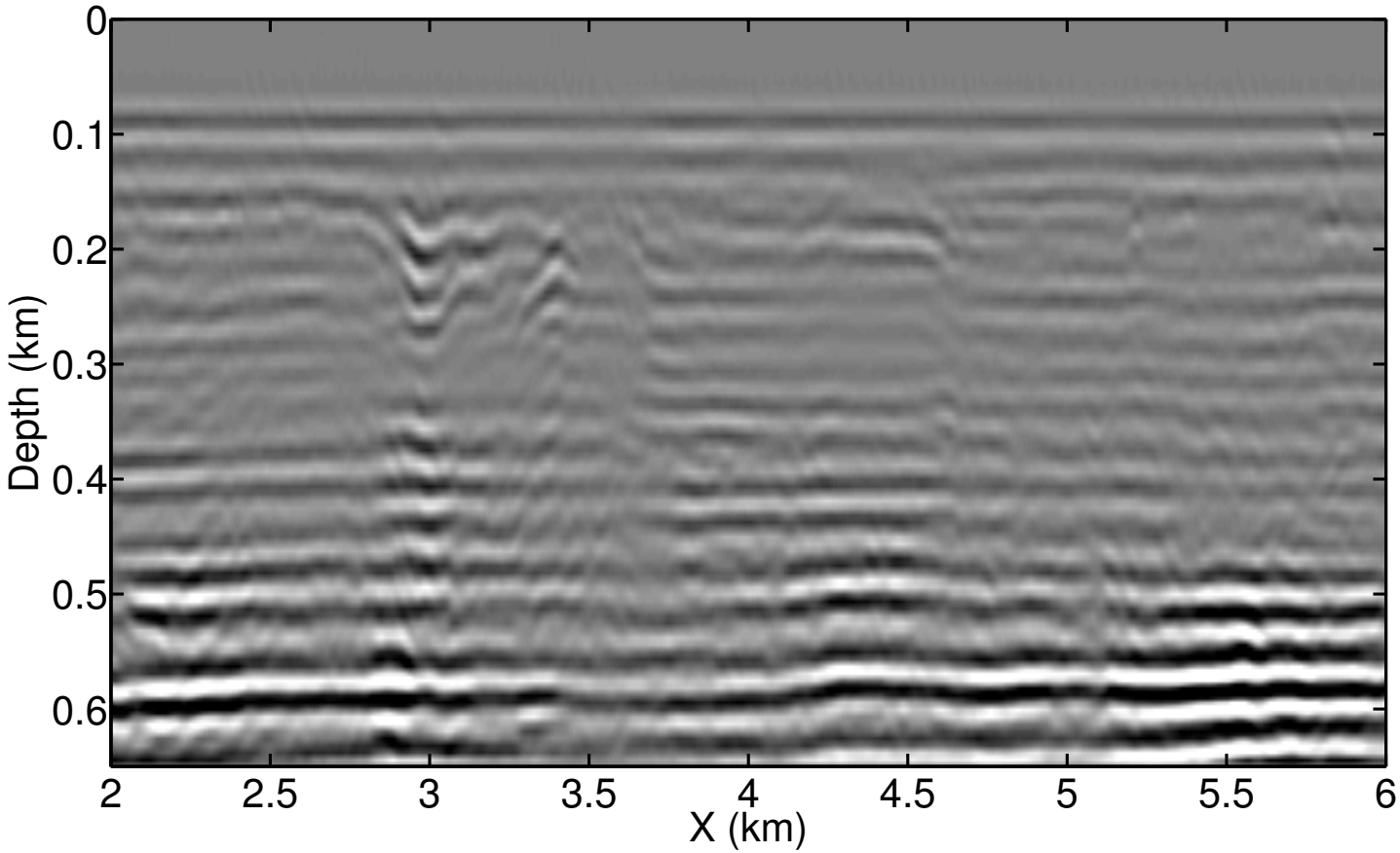


2D RTM of 20 3D shotgathers



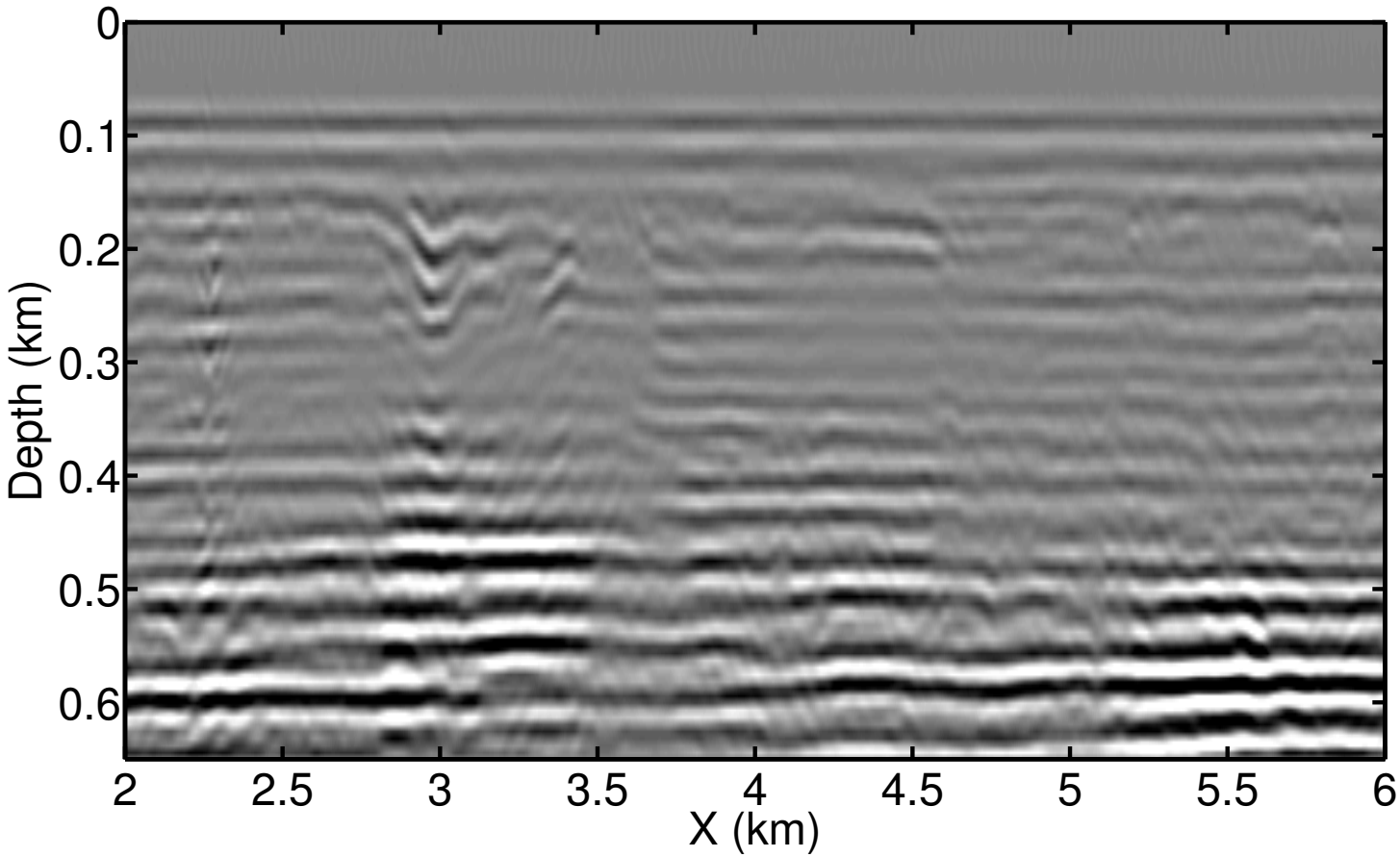
Site survey relief well 2-4/25

Pre drill 1988



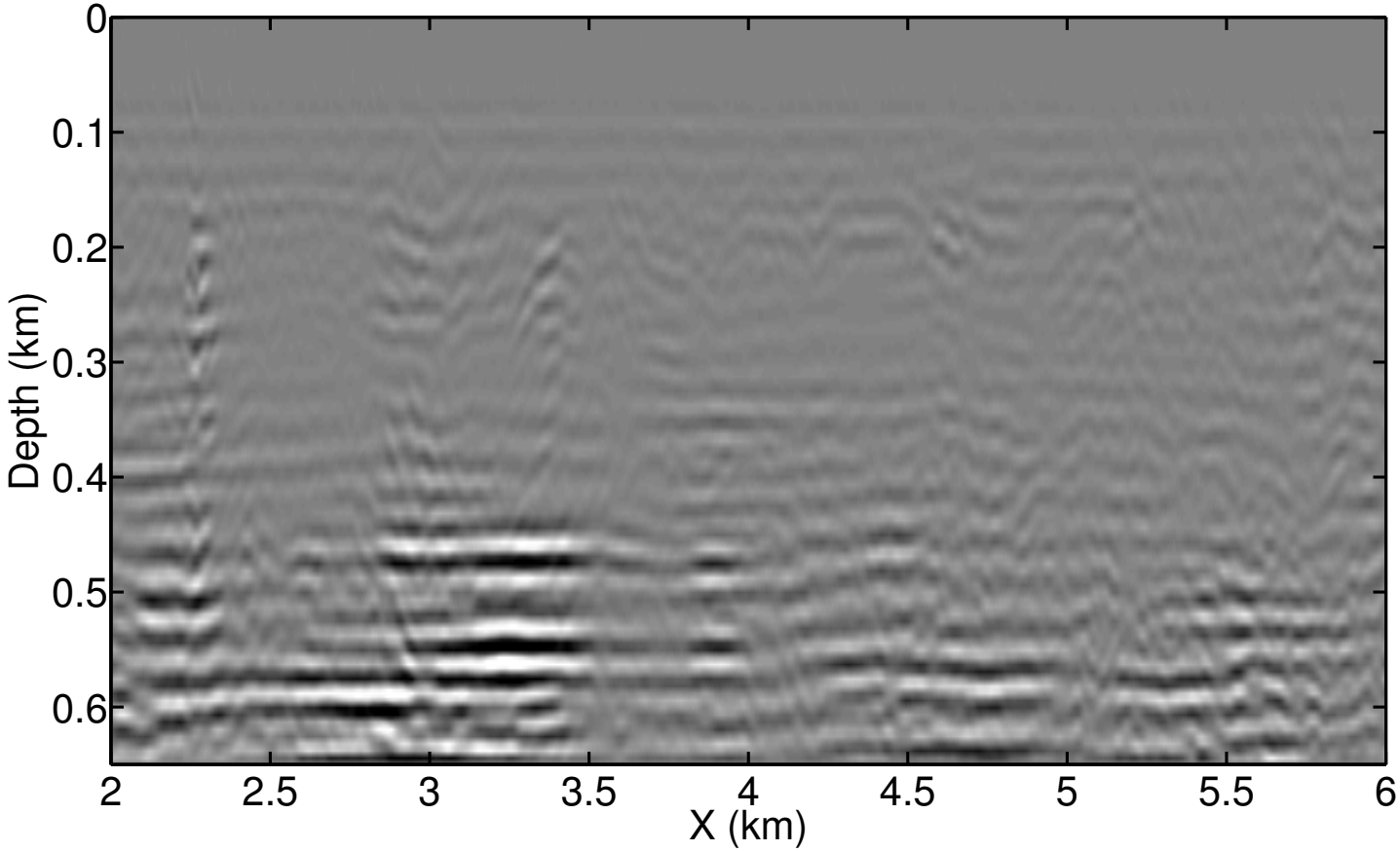
Site survey relief well 2-4/25

Post drill 1990



Site survey relief well 2-4/25

Difference between Pre drill 1988 and Post drill 1990



Conclusions

- Natural vertical pipes with diameters of 10-50 meters are visible on conventional 3D seismic data
- Crude finite-difference modeling seem to indicate vertical boreholes with diameters of a few meters are visible at seismic wavelengths
- Images made from site survey data above 2-4/15 relief well show similar features as the synthetic fd-data at the well position and indicates that vertical wells might be visible on seismic data
- The 2-4/15 well might have gas migrating along the outside of the borehole enhancing the visibility