

Introduction to FWI-res

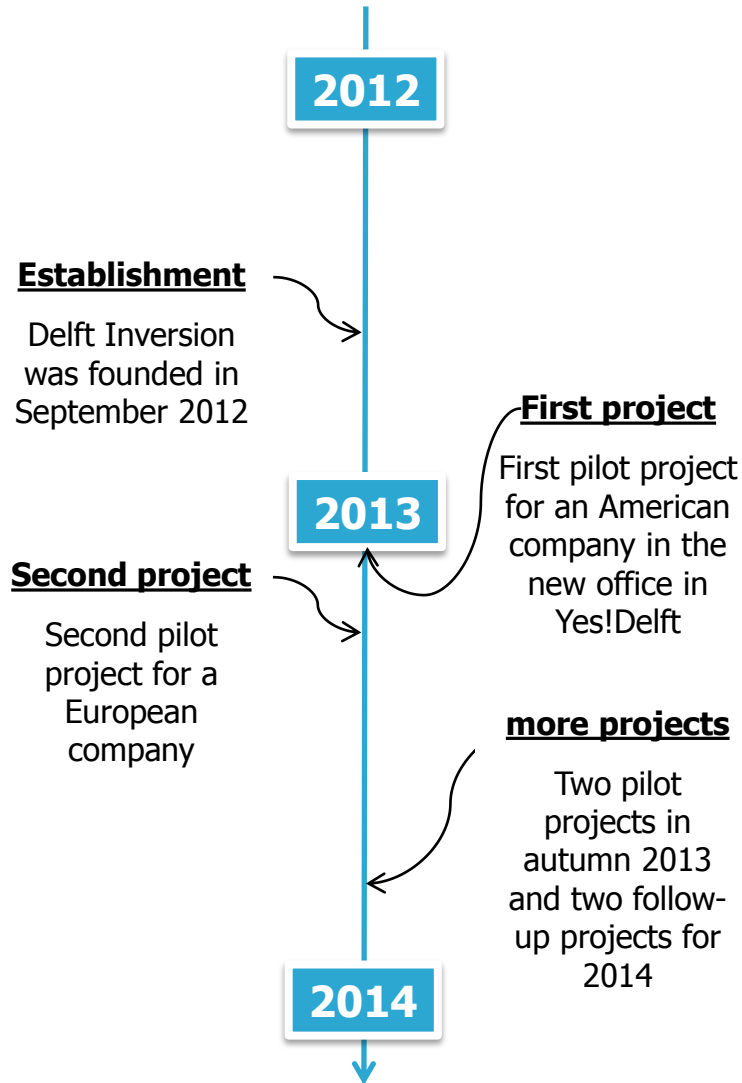
Full waveform inversion right to the target

Dries Gisolf* and Panos Doulgeris

Thursday, 20th of February, 2014



**DELFT
INVERSION**



Dries Gisolf

- Physicist, Professor at TU Delft
- 25 years experience in industry
- Worked for Shell in Africa, Middle East, Far East, Europe and Australia

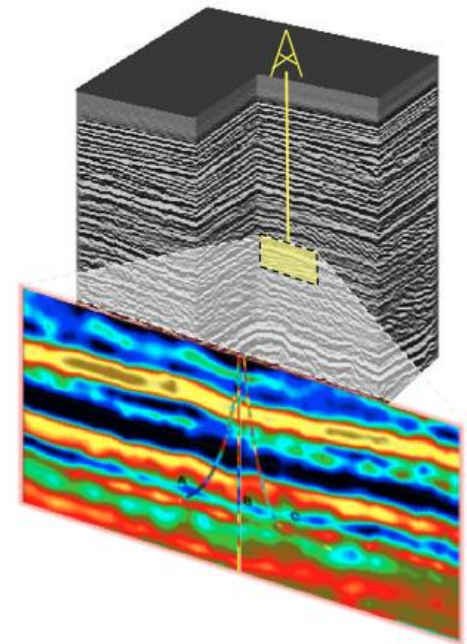
Peter Haffinger

- Geophysicist, PhD
- 8 years of industry-related research
- Oil industry internships in England and Saudi-Arabia
- Delphi Consortium Alumnus

Panos Doulgeris

- Electrical and computer engineer, PhD
- 6 years of industry-related research
- Oil industry internships in the United States
- Delphi Consortium Alumnus

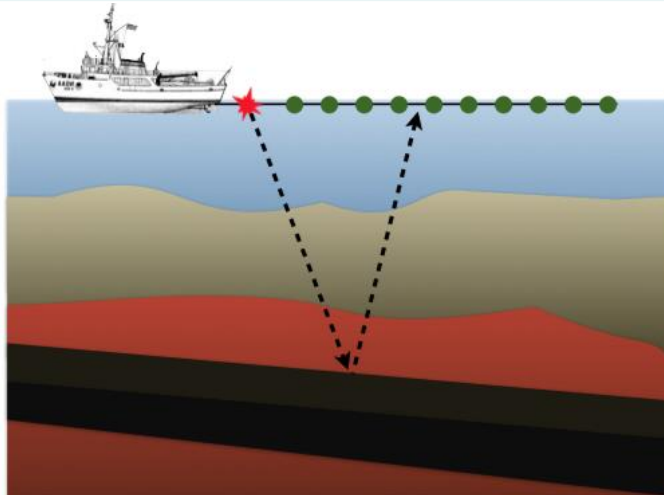
- Target-oriented full waveform inversion (e.g. reservoir, near-surface etc.)
- Characterisation of target area in terms of absolute quantitative properties (on a 3m-10m grid).
- High-resolution output ideal for reservoir delineation, reservoir model building, near-surface characterisation, time-lapse interpretation, etc.



Conventional inversion vs. FWI-*res*

Conventional inversion

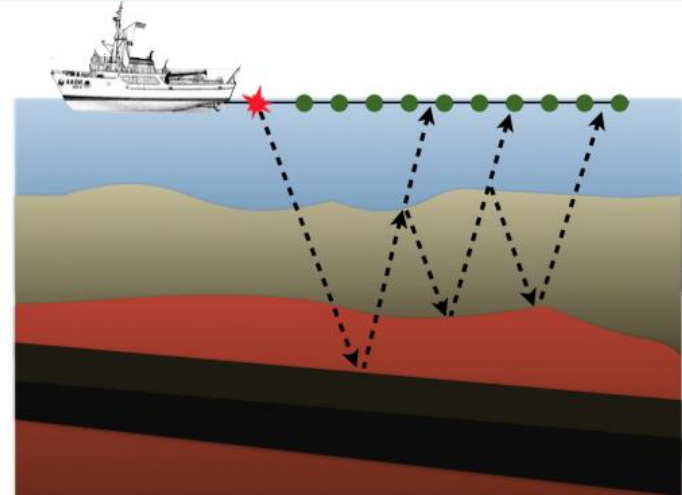
- Propagation in the (smooth) background medium
- Uses primary reflections only



Primary reflections

Inversion using multiple scattering

- Propagation in the true medium
- Includes transmission effects
- Uses primary and multiple internal scattering and mode conversions
- True amplitudes

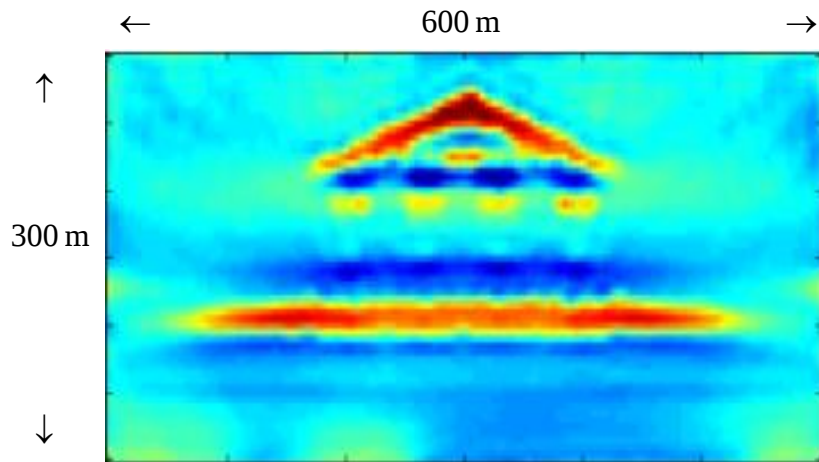


Primary and multiple internal scattering

Conventional inversion vs. FWI-*res*

Conventional inversion

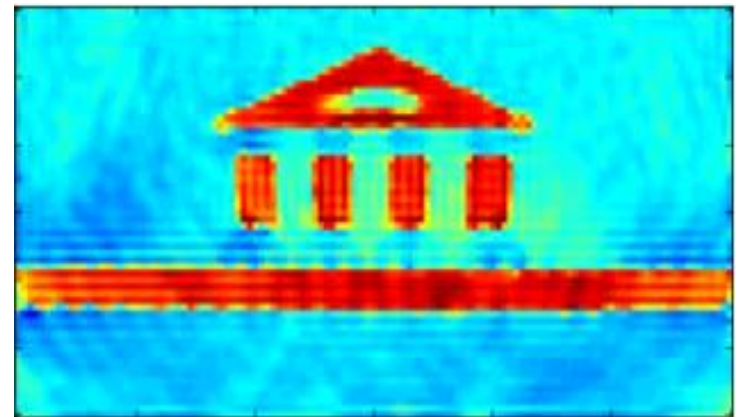
- Propagation in the (smooth) background medium
- Uses primary reflections only



Inversion technology based on primaries.

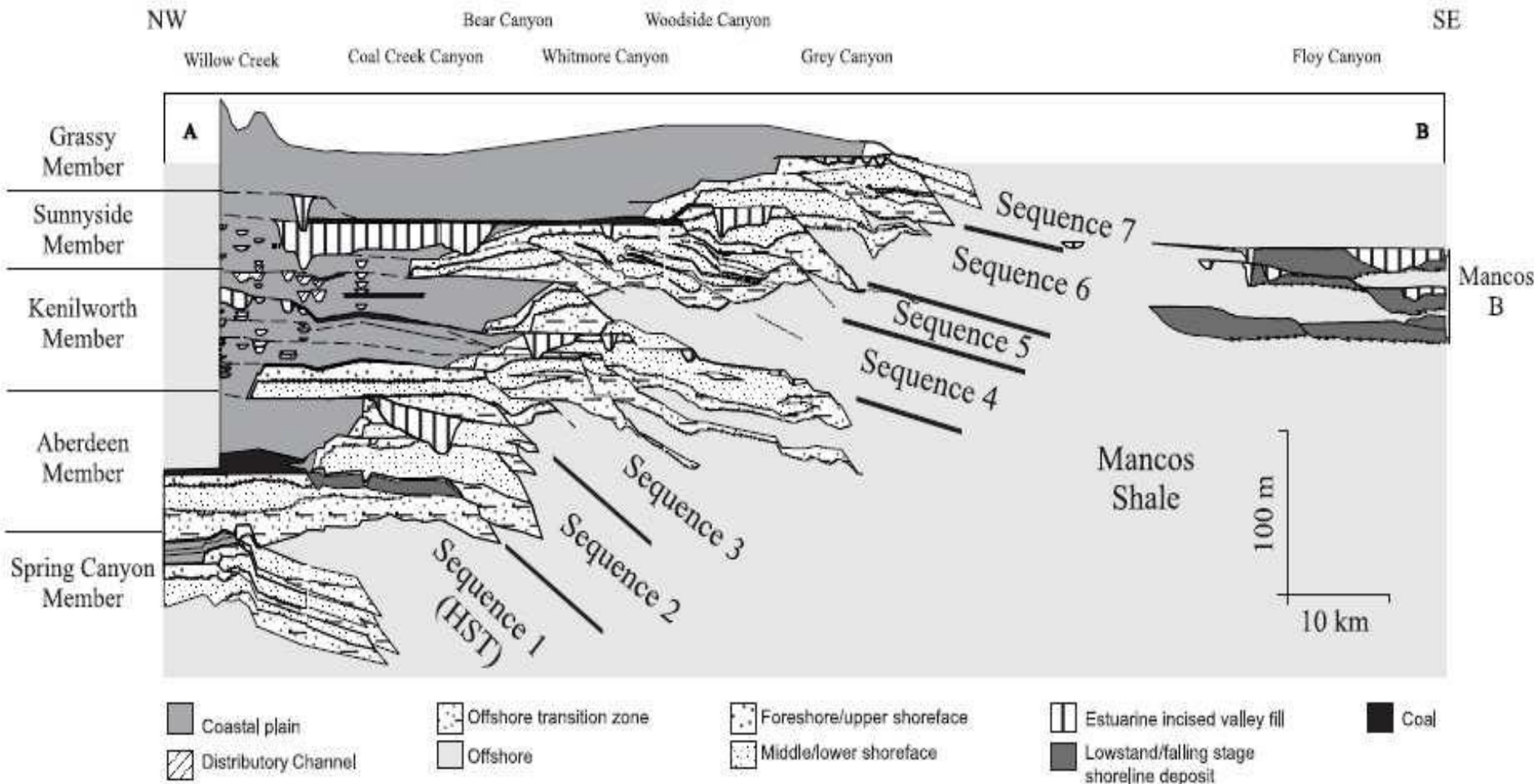
Inversion using multiple scattering

- Propagation in the true medium
- Includes transmission effects
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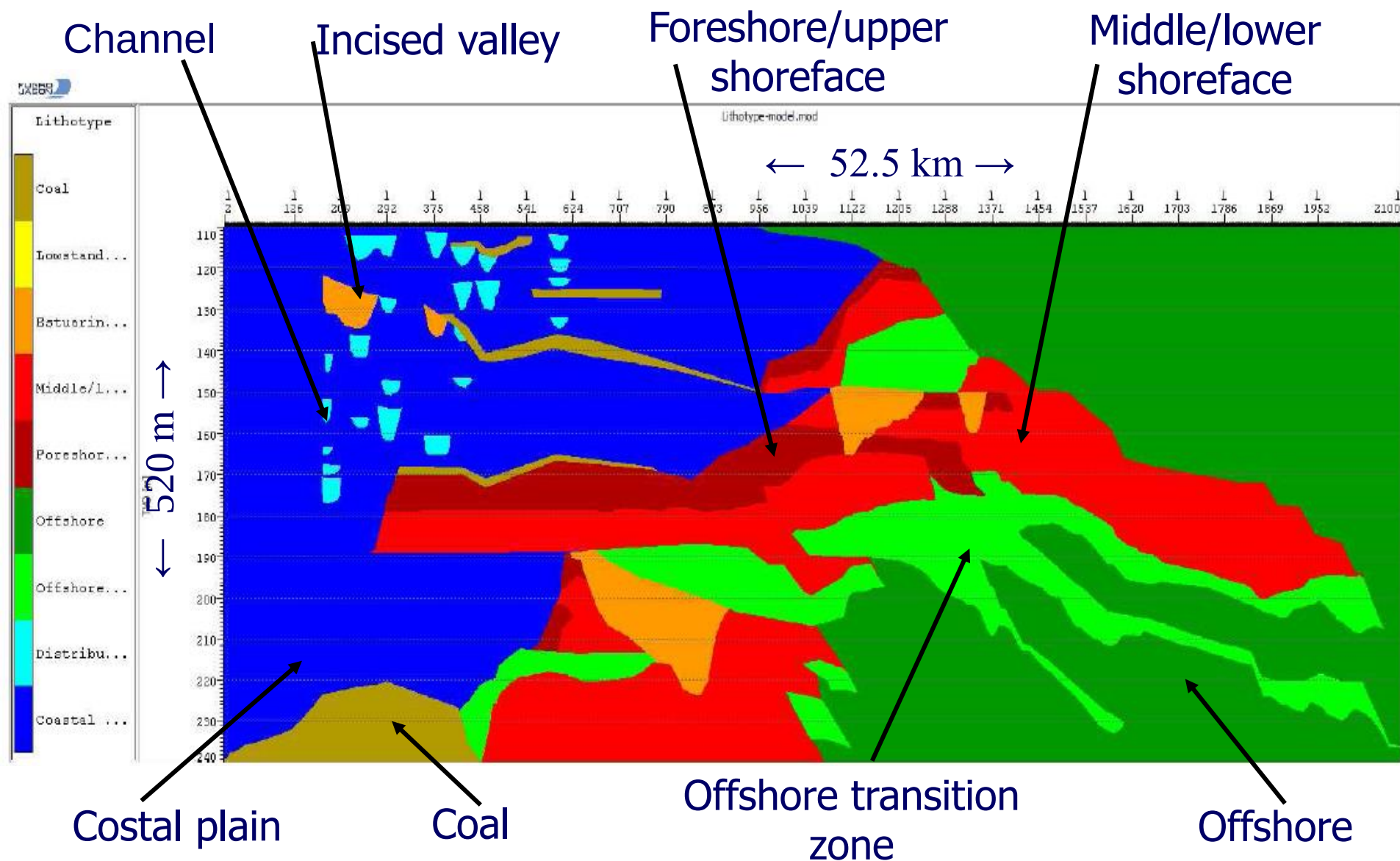
Inversion technology including multiples.

Synthetic example: Book Cliffs

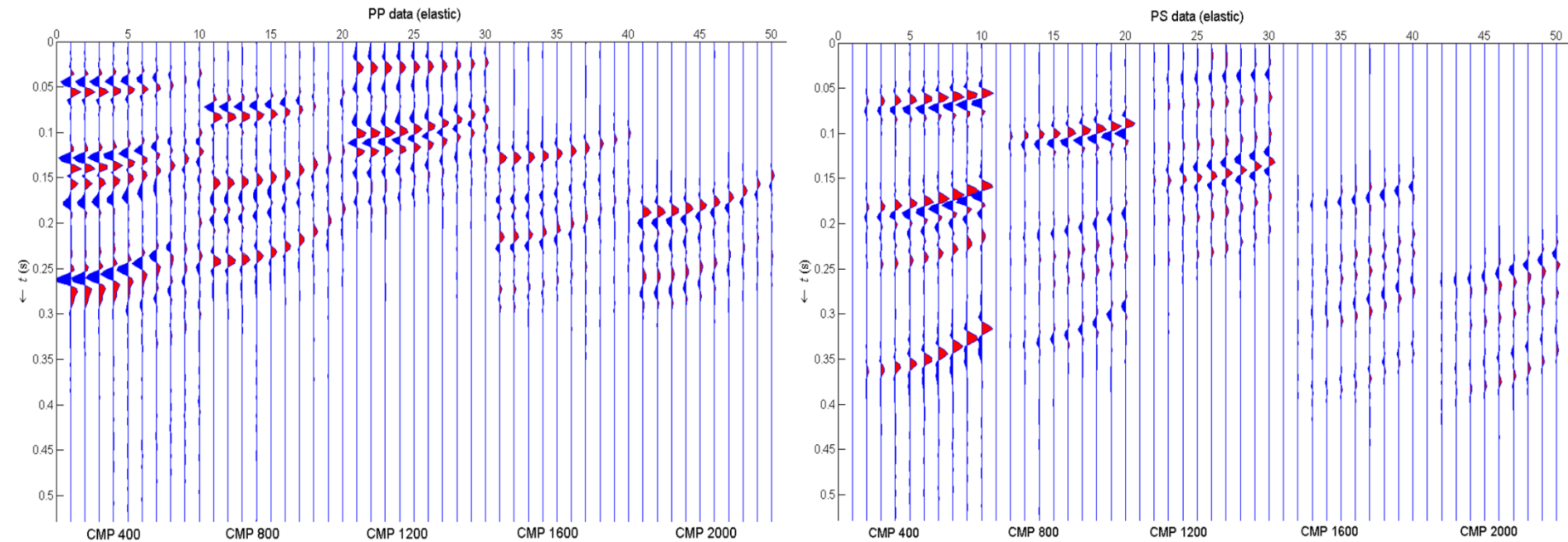


- Sequence stratigraphy of the Blackhawk Formation, by Hodgetts and Howell (2000).
- Dimensions: 500 m thick, 125 km long; approximately 3 Ma of geological time.

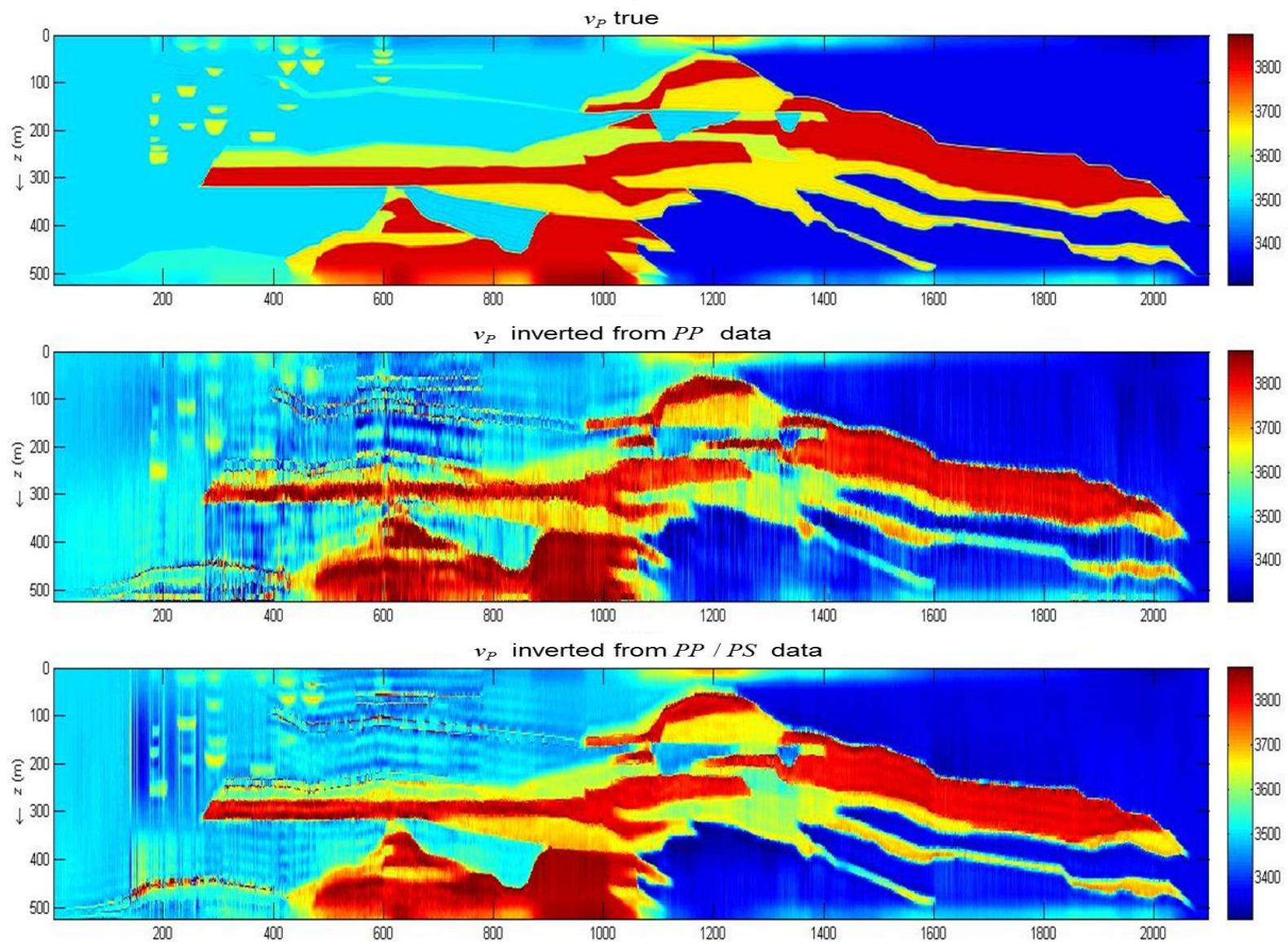
Litho-type model



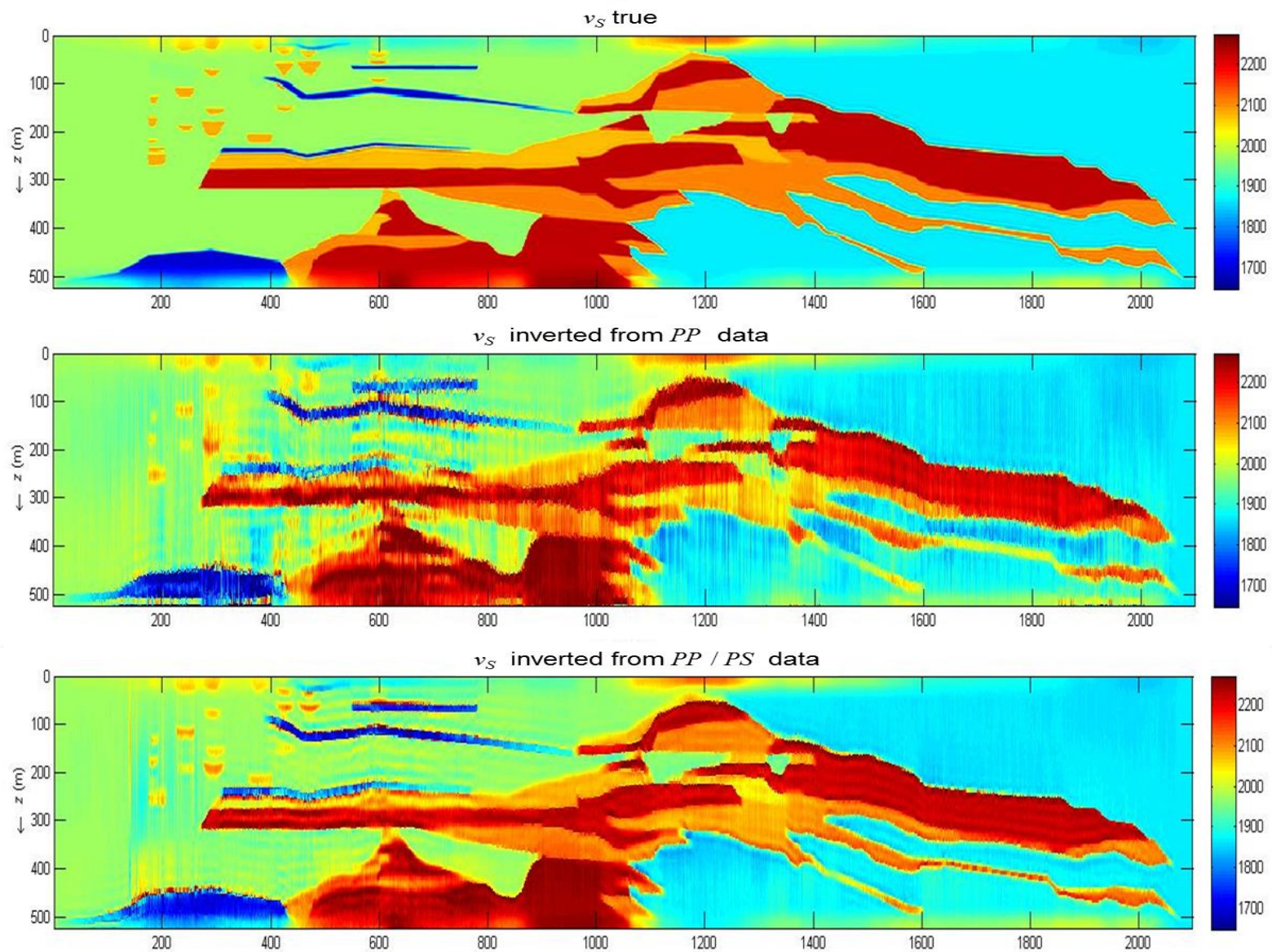
PP and PS data for selected CMPs



Inversion results: v_p , on a 3 m grid



Inversion results: v_s , on a 3 m grid



Inversion results: ρ , on a 3 m grid

