Shallow Gas in The Netherlands Derisked by Seismic Characterisation

Mijke van den Boogaard (EBN), Rutger Gras (ONE) & Guido Hoetz (EBN)

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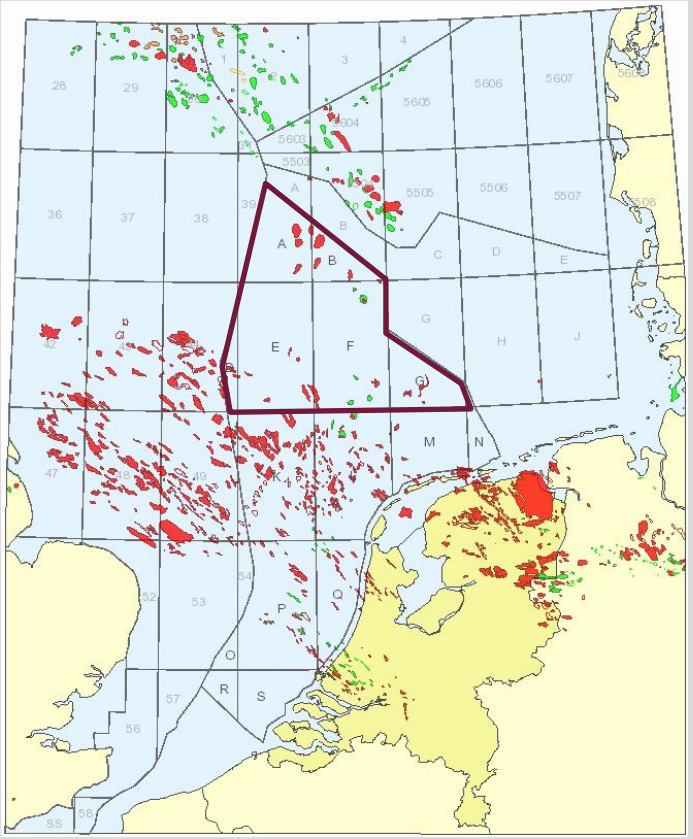
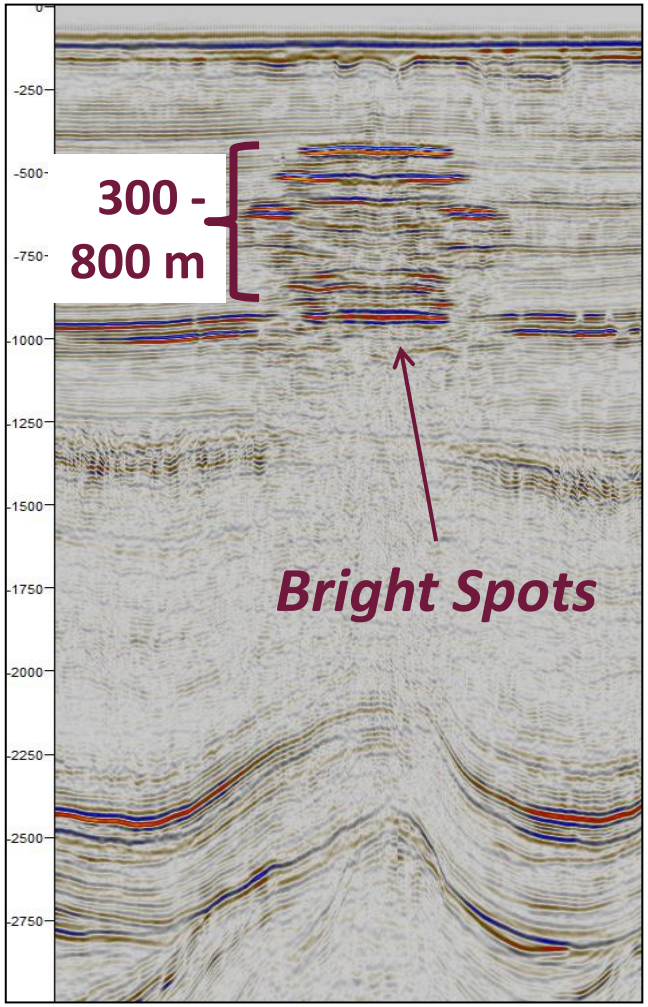
Outline

1. Introduction
2. Workflow for screening play
3. Seismic characterization
4. Case study F12-Pliocene
5. Summary

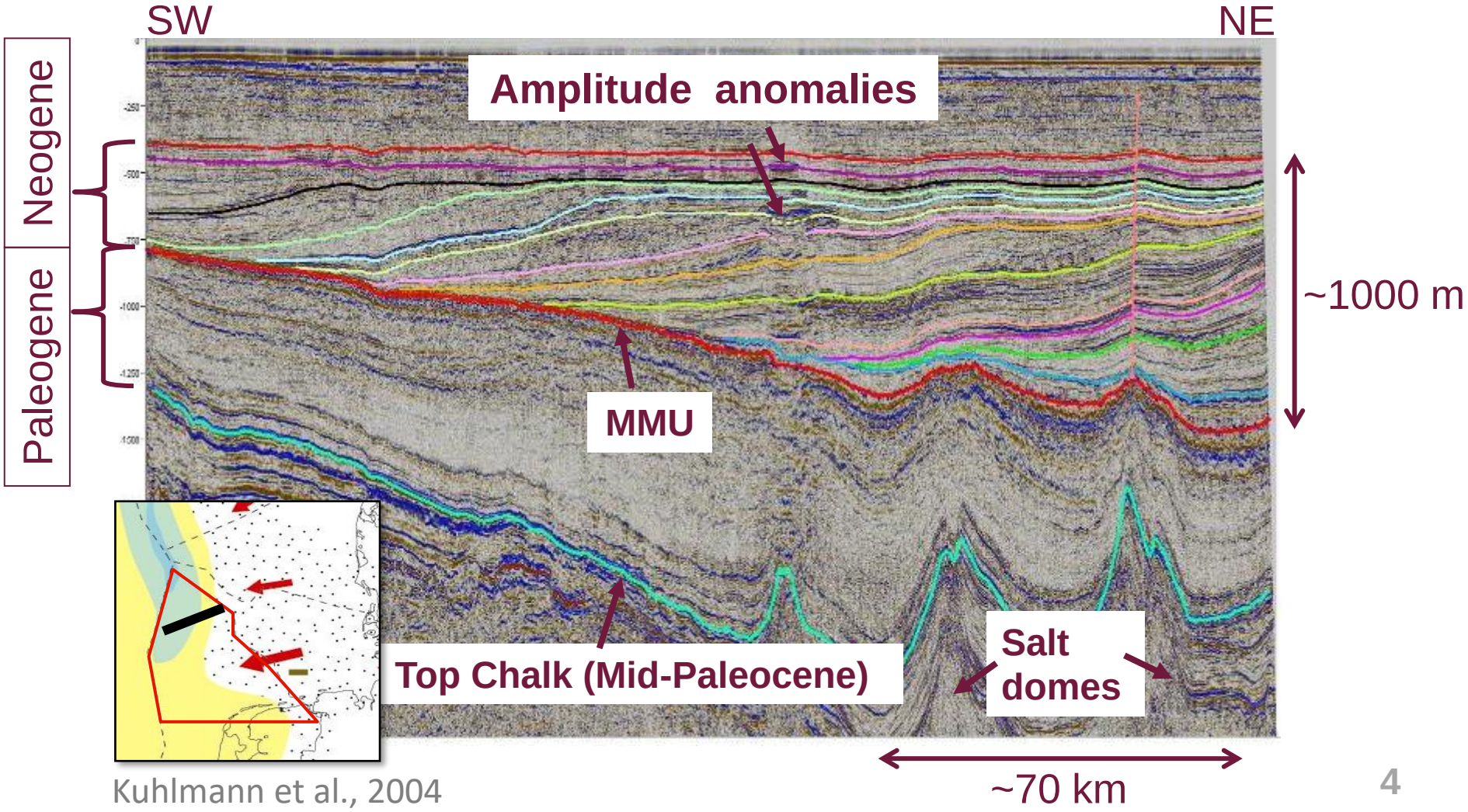


Introduction - Geological Setting

Shallow Gas (**SG**) = gas in unconsolidated, Miocene-Pleistocene sands



Introduction - Geological Setting



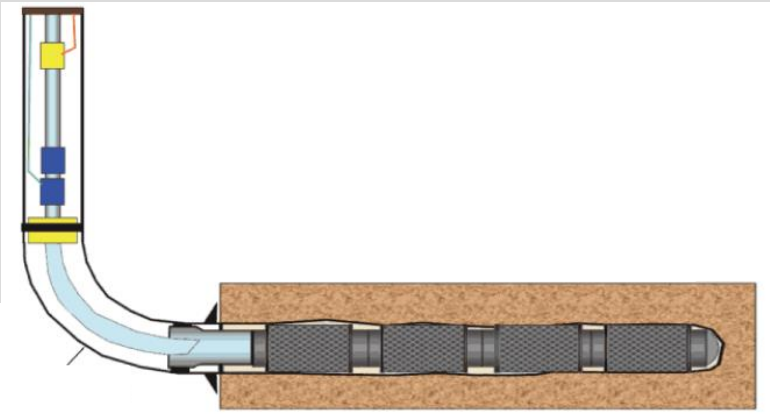
Kuhlmann et al., 2004

Introduction
Why Exploring for Shallow Gas now?

- Presence shallow gas known since 70's
- Early water breakthrough & sand production expected
  → fields not developed

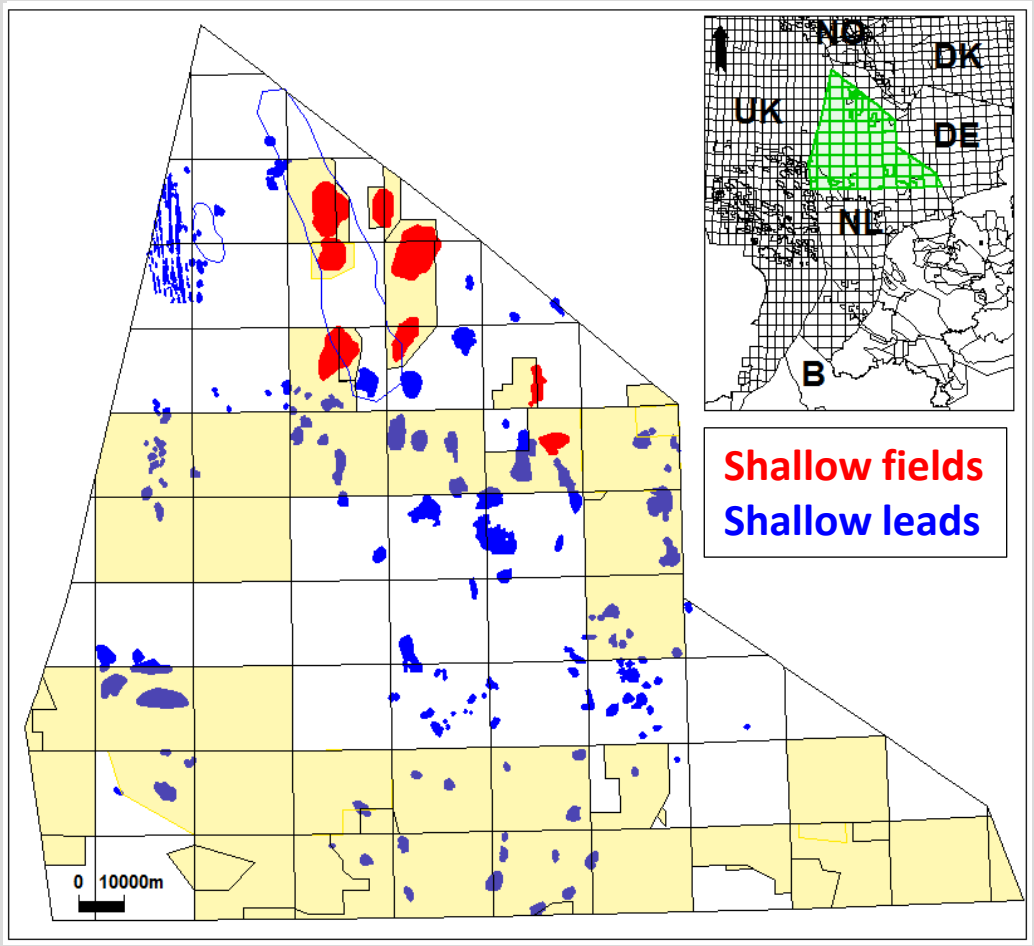
- Currently 3 successfully producing fields:
  - A12-FA (2007)
  - F02a-B-Pliocene (2009)
  - B13-FA (2011)

- Technical breakthrough
  (e.g. sand control in horizontal wells)



Chevron, Oil&Gas Journal, 2009

Introduction
Why Exploring for Shallow Gas now?



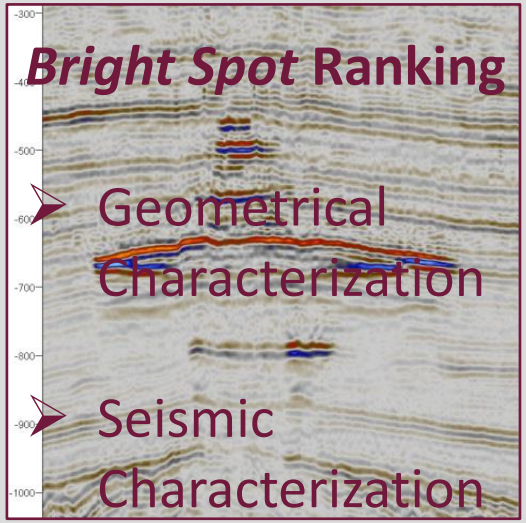
1. New technology proven successful for SG developments
2. 3D seismic points to more opportunities
3. Marginal field tax incentive applicable (2010)
4. Guaranteed gas off take

Workflow for Screening Shallow Gas Play

SG Portfolio

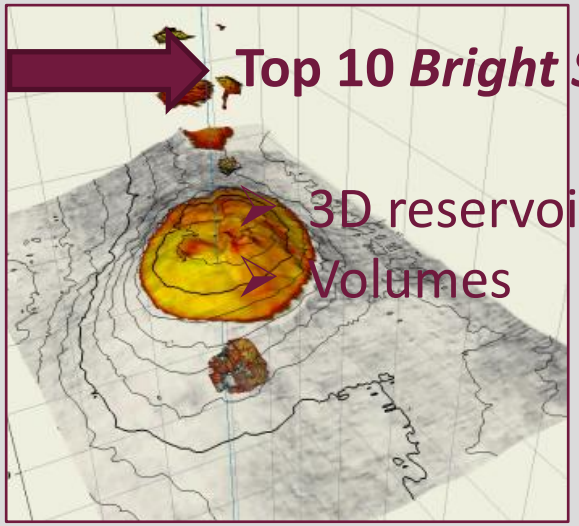
- *Bright Spots* identified (RMS ampl. scanning)
- 150 leads & prospects

Bright Spot Ranking



- Geometrical Characterization
- Seismic Characterization

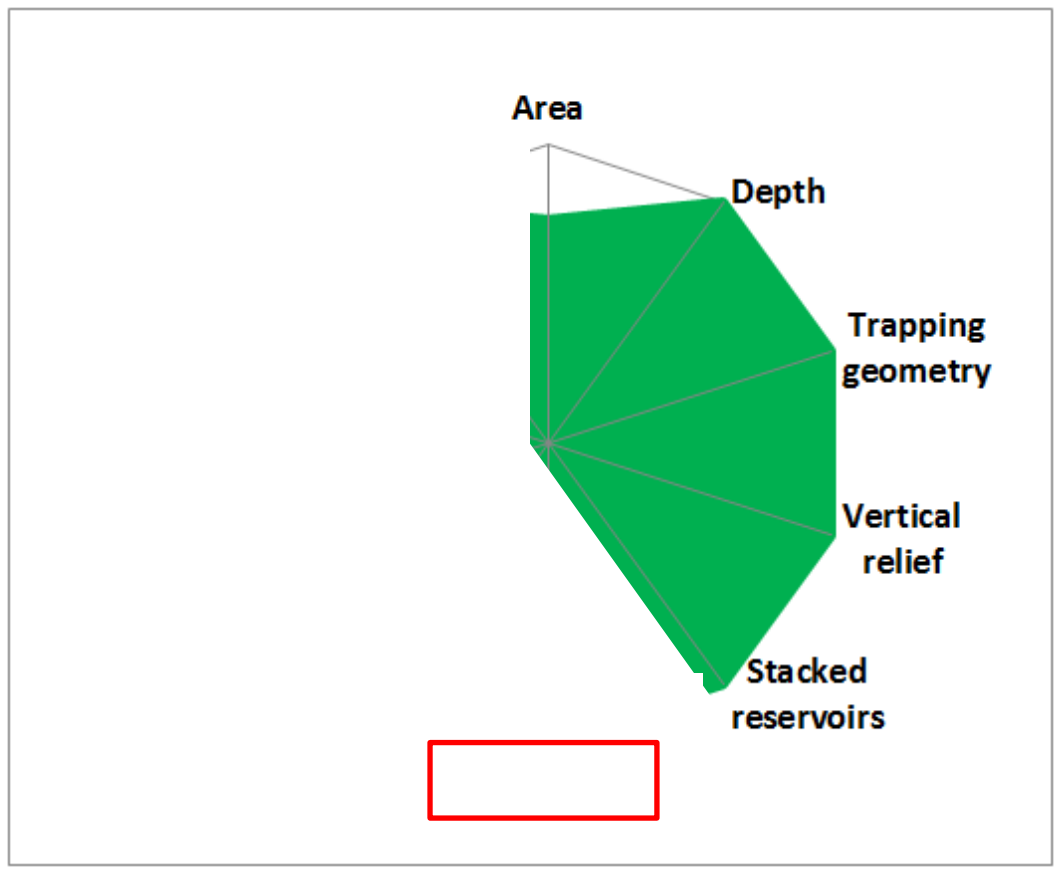
Top 10 _Bright Spots:_



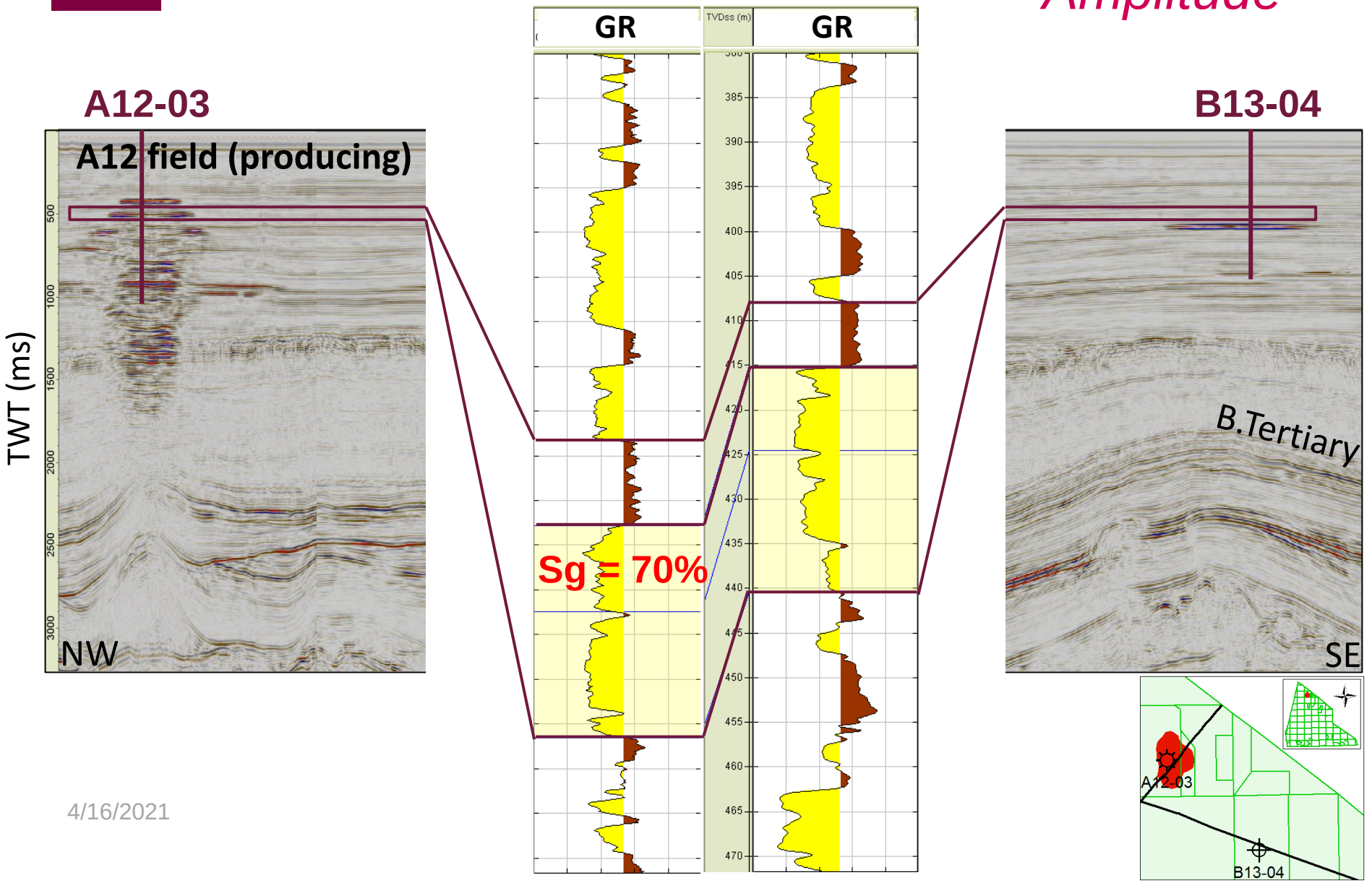
- 3D reservoir model Volumes

Workflow for Screening Shallow Gas Play

Seismic Characterization



Seismic Characterization Shallow Gas
- Amplitude -



Seismic Characterization Shallow Gas
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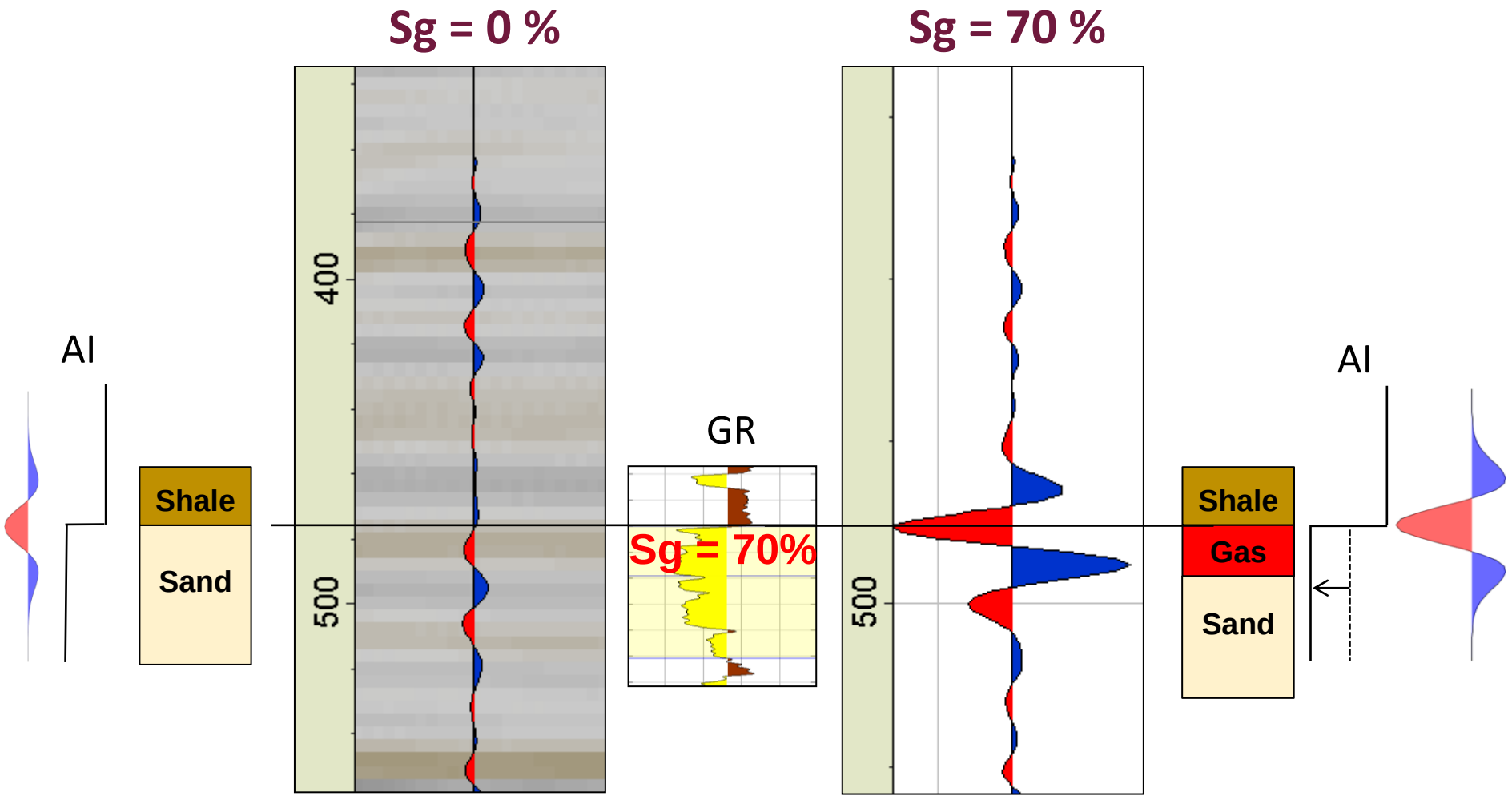
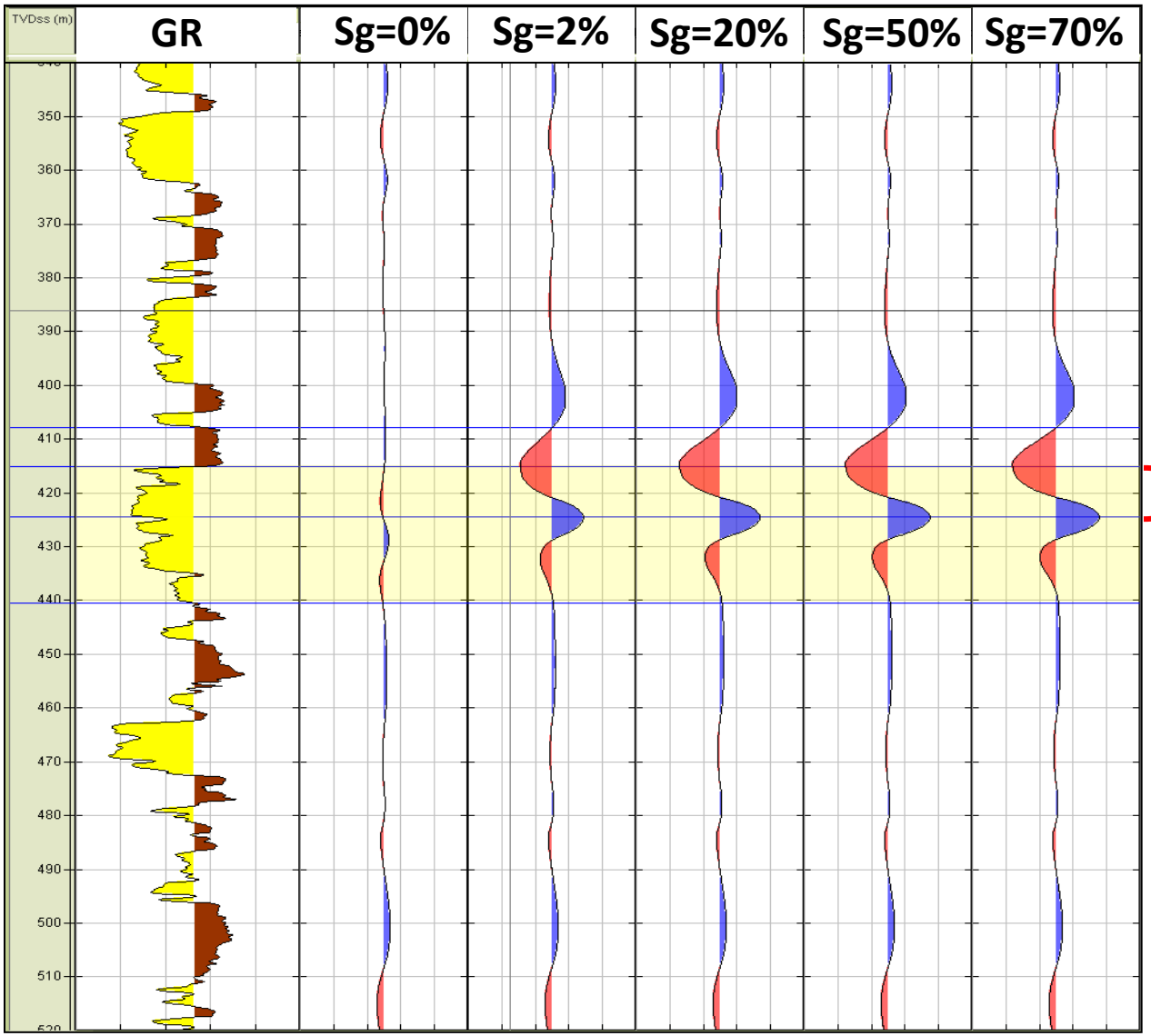
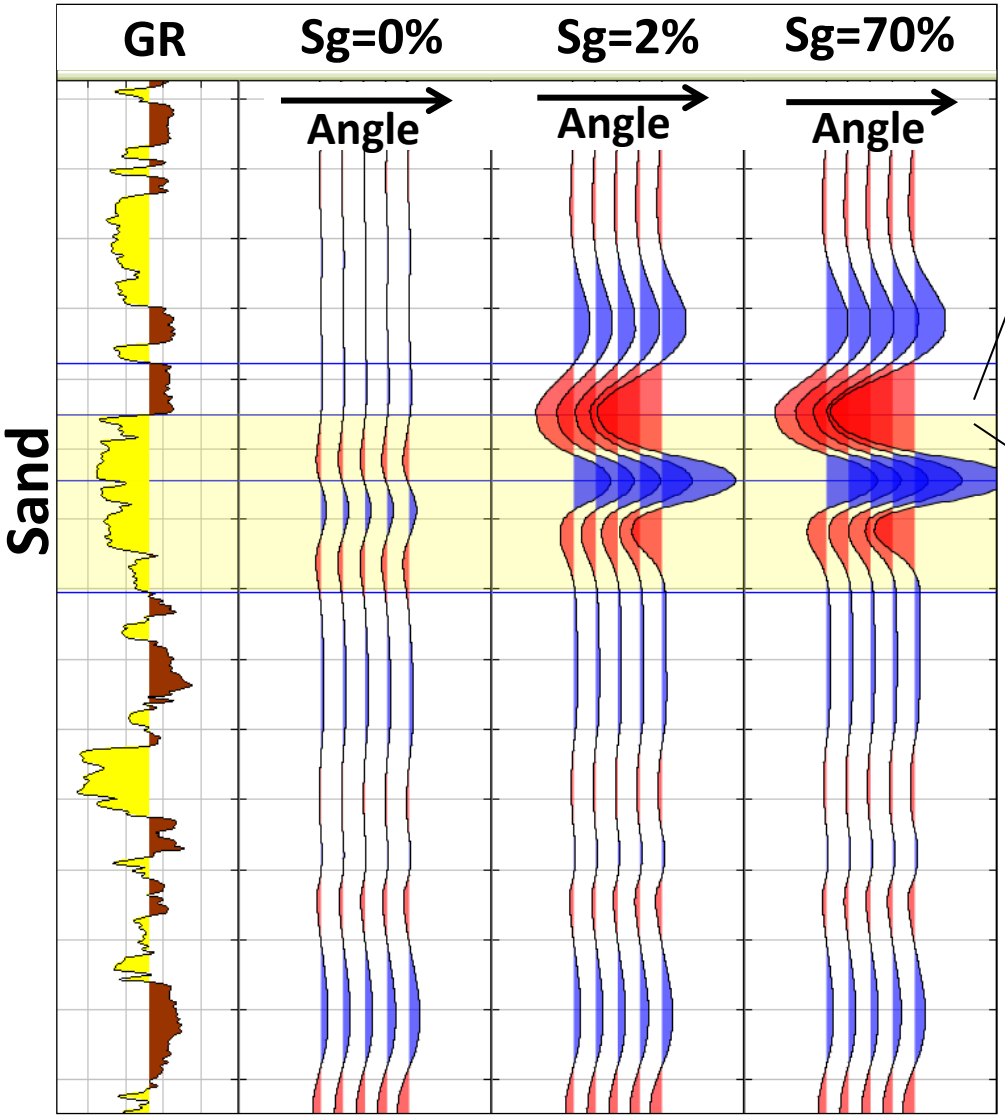


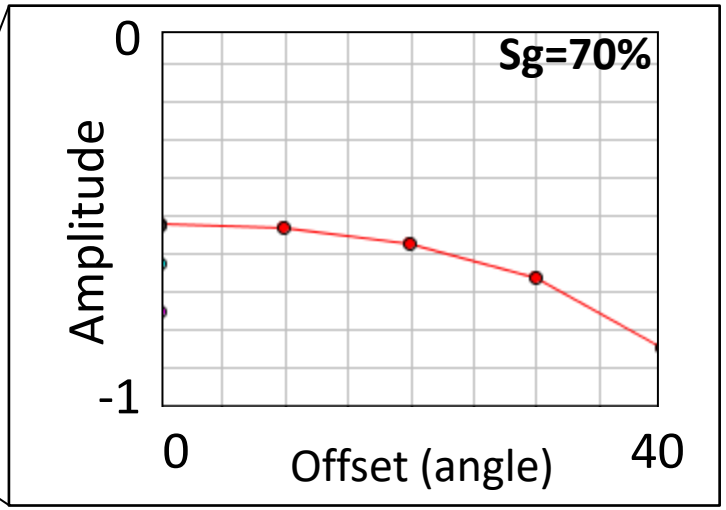
Gassmann fluid substitution approximately valid

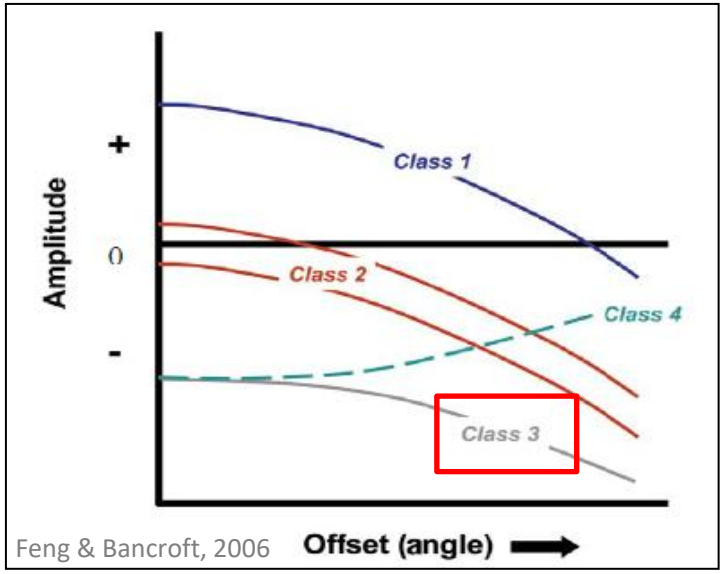
Seismic Characterization Shallow Gas
- Amplitude -



Seismic Characterization Shallow Gas
- Amplitude: Can AVO help? -

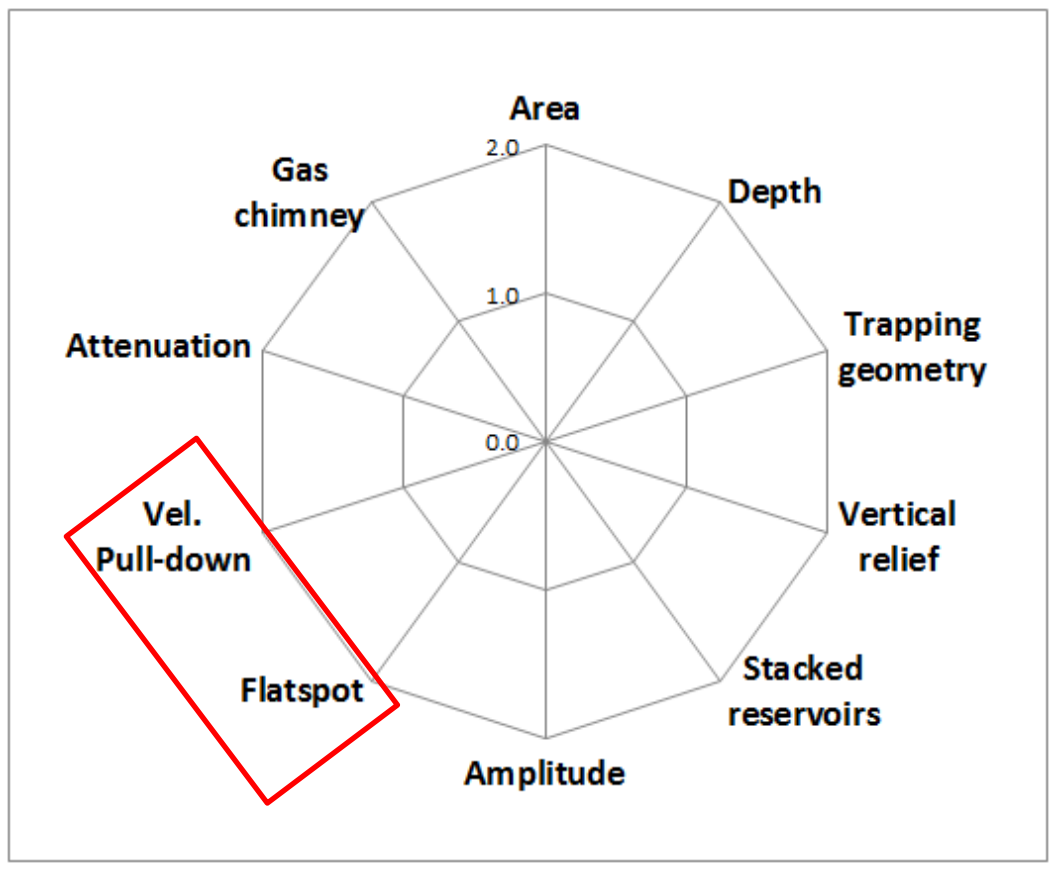




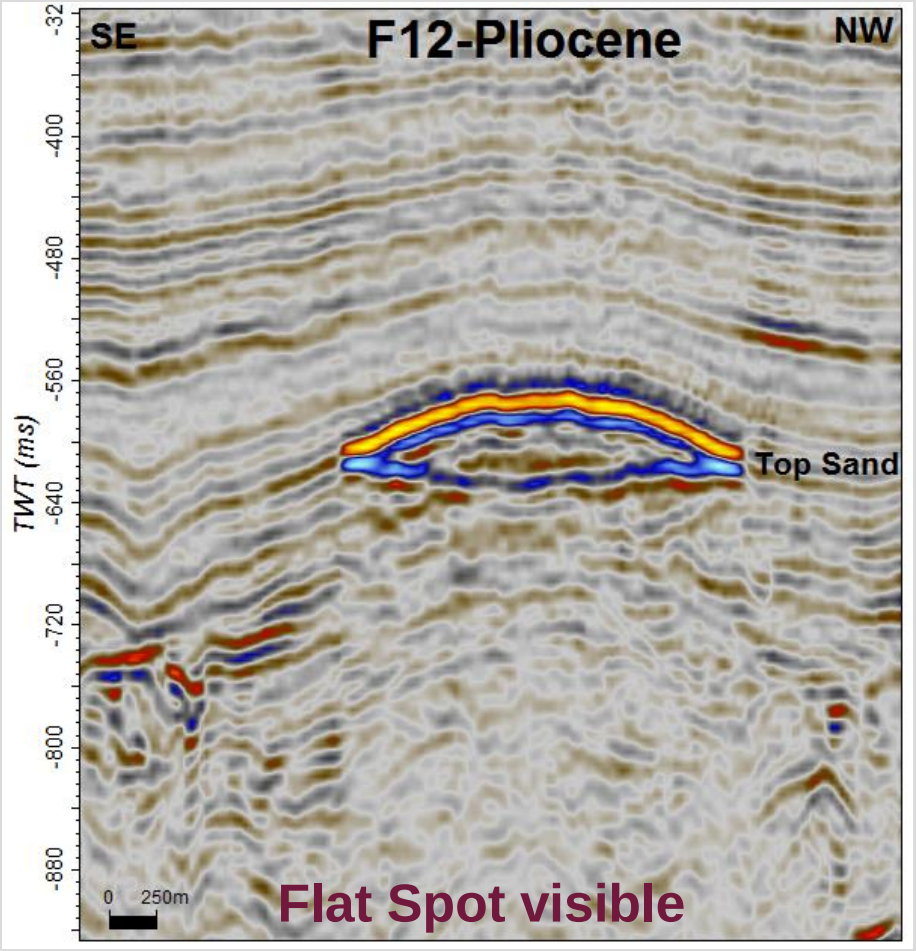


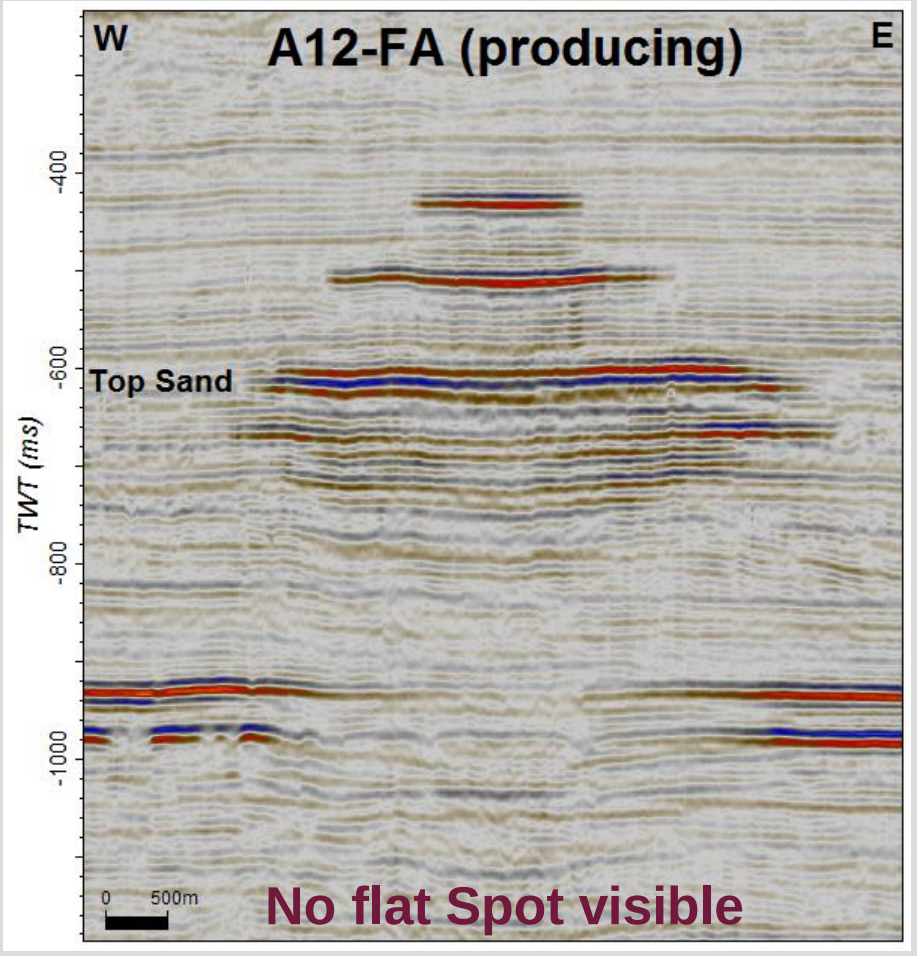
Feng & Bancroft, 2006

Seismic Characterization Shallow Gas



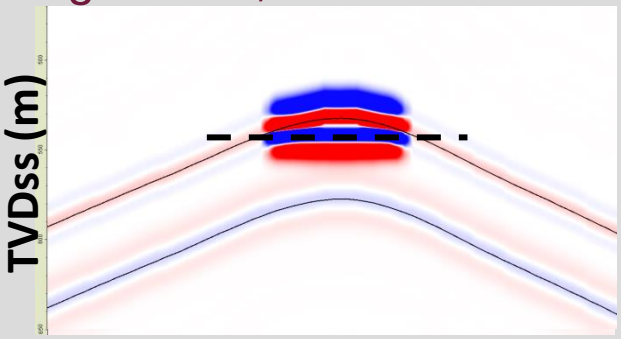
Seismic Characterization Shallow Gas
- Flat Spot -





Seismic Characterization Shallow Gas
- Flat Spot -

Reservoir = 50m
Sg = 60%, Column = 10m



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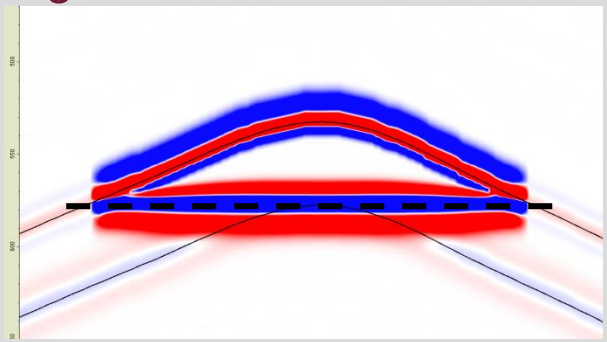

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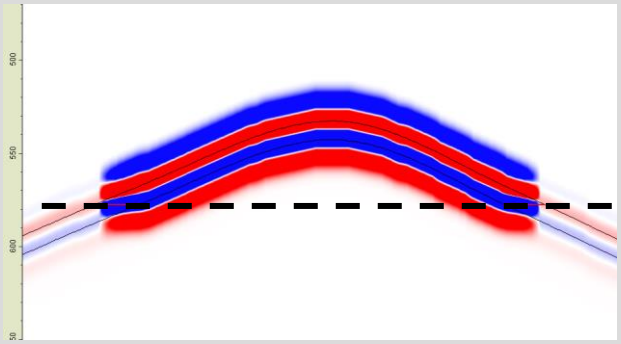
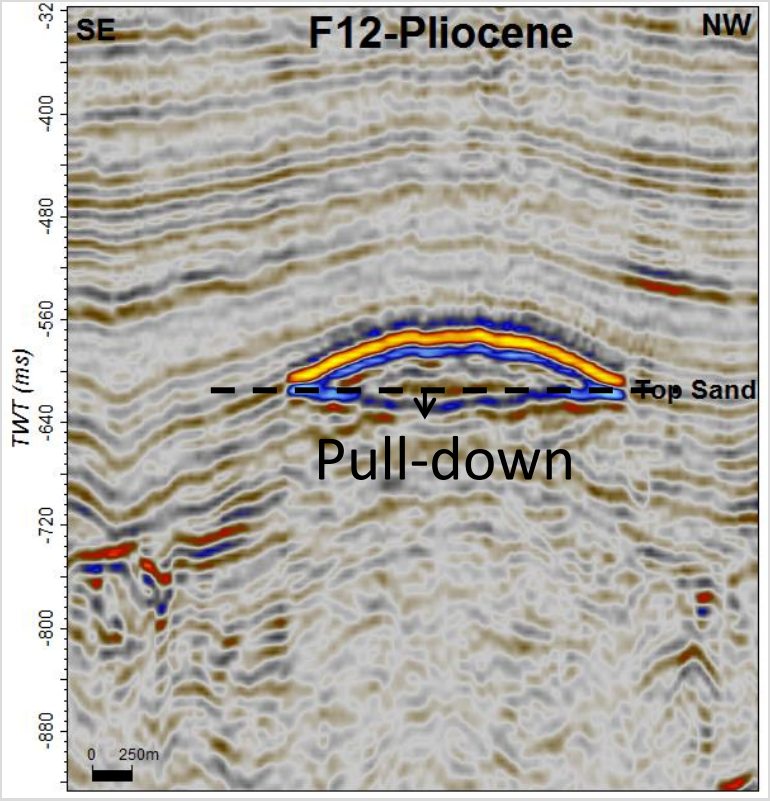


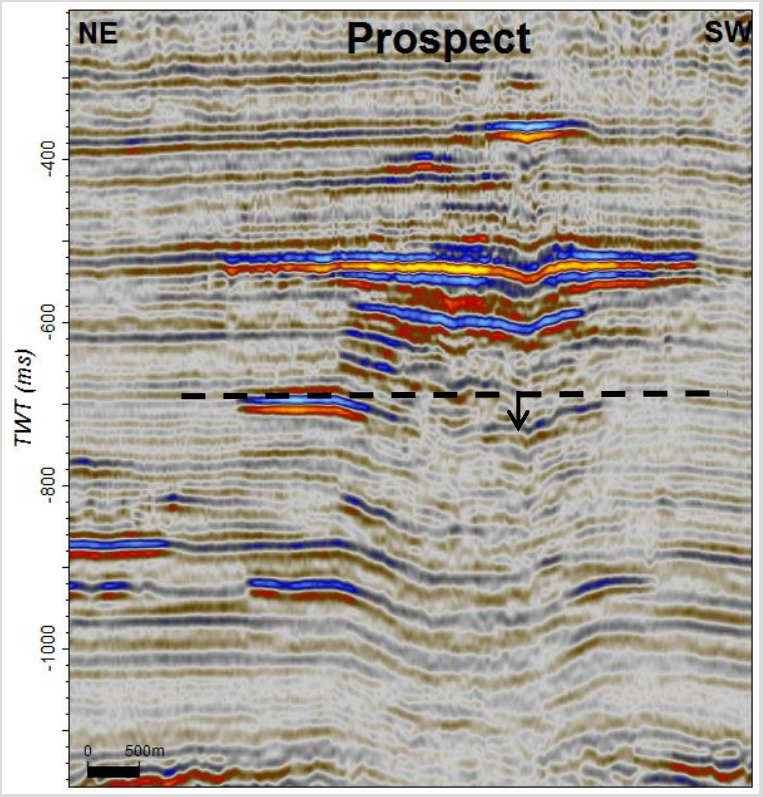
Visibility of flat spot dependent on:

- Vertical relief
- Reservoir thickness
- Column height

Flat spot indicates reservoir thickness & HC column, not saturation

Seismic Characterization Shallow Gas
- *Velocity Pull Down* -

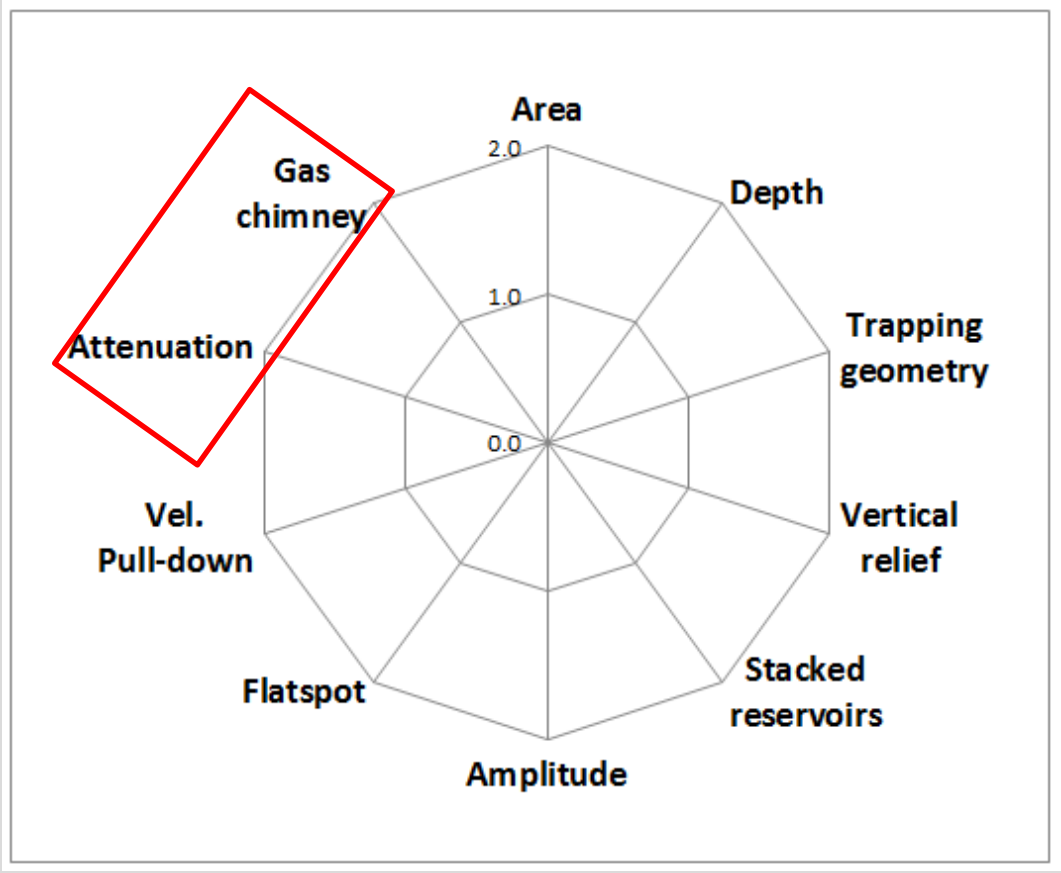




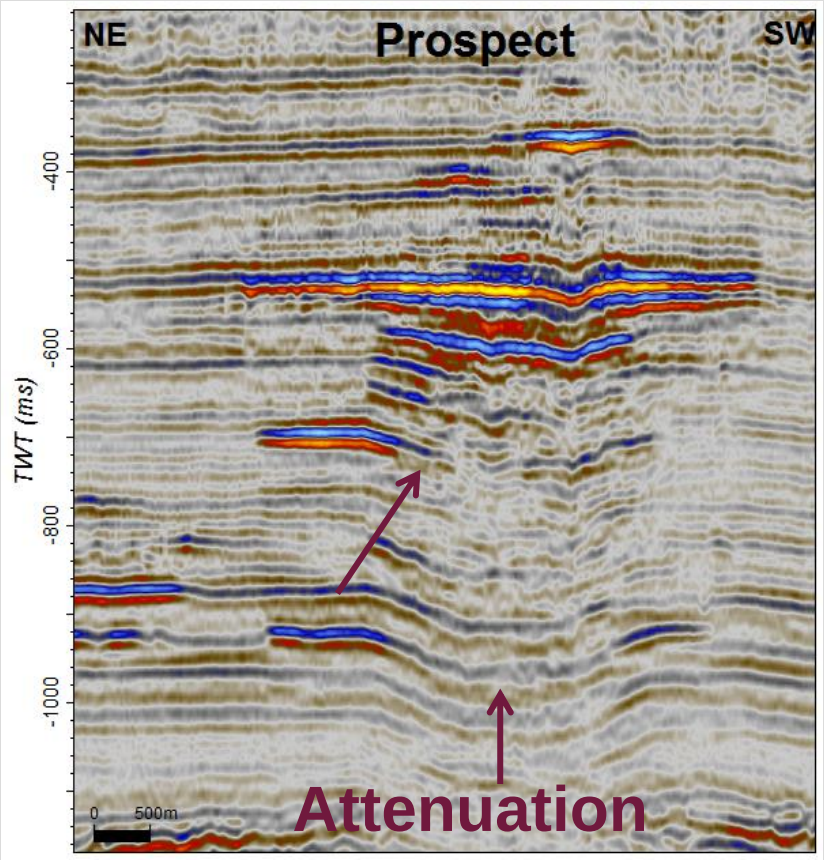
→ **Pull-down indicates (total) HC column, not saturation**

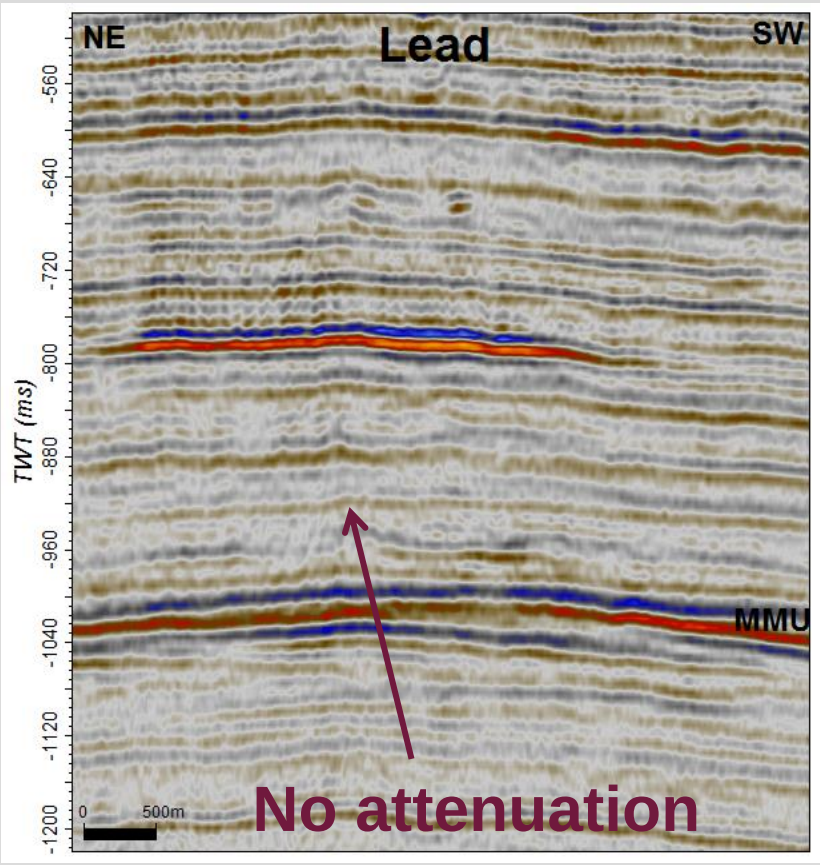
→ **Absence pull-down indicates low saturation**

Seismic Characterization Shallow Gas



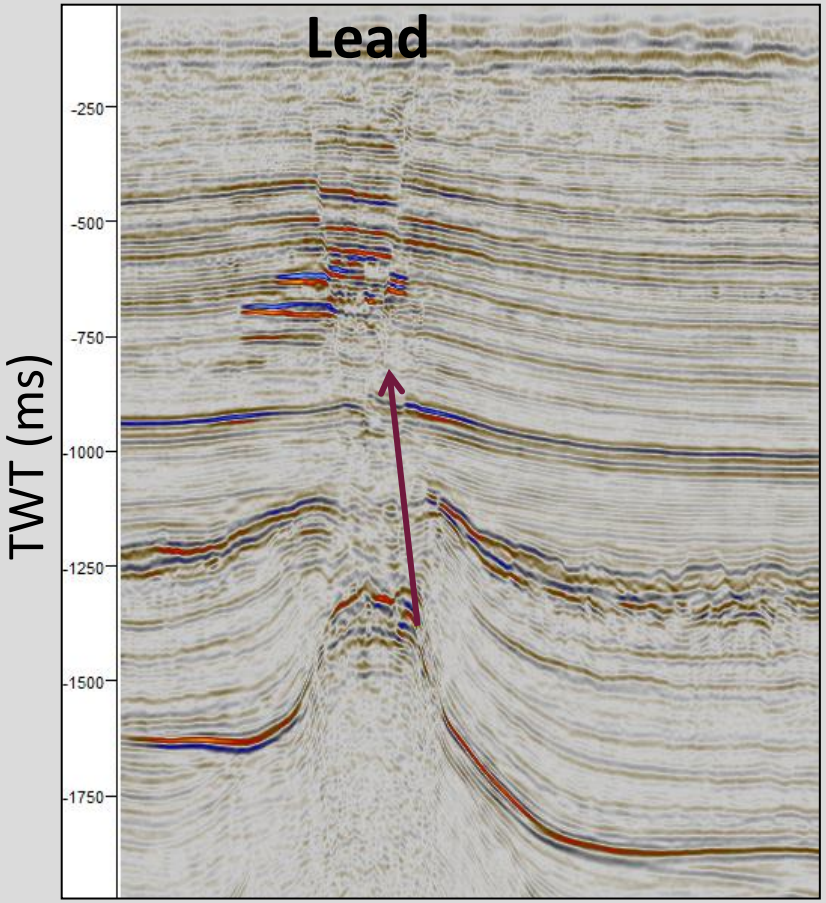
Seismic Characterization Shallow Gas
- Attenuation -





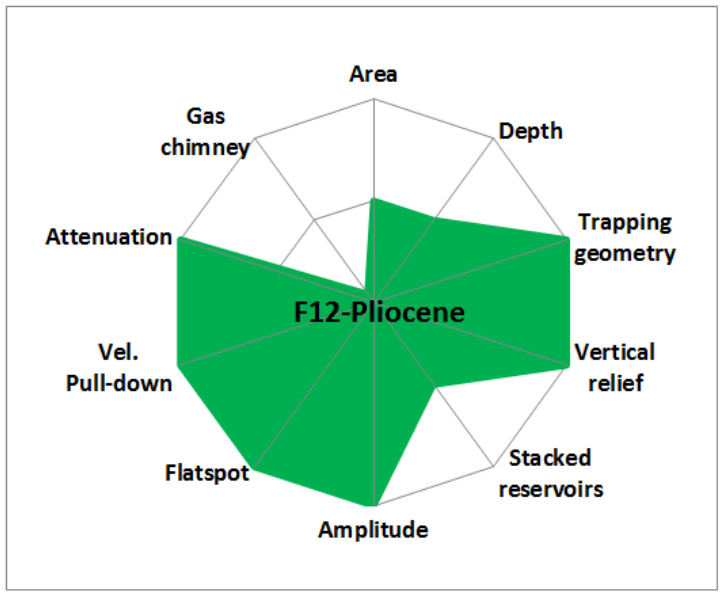
Absence attenuation indicates low saturation

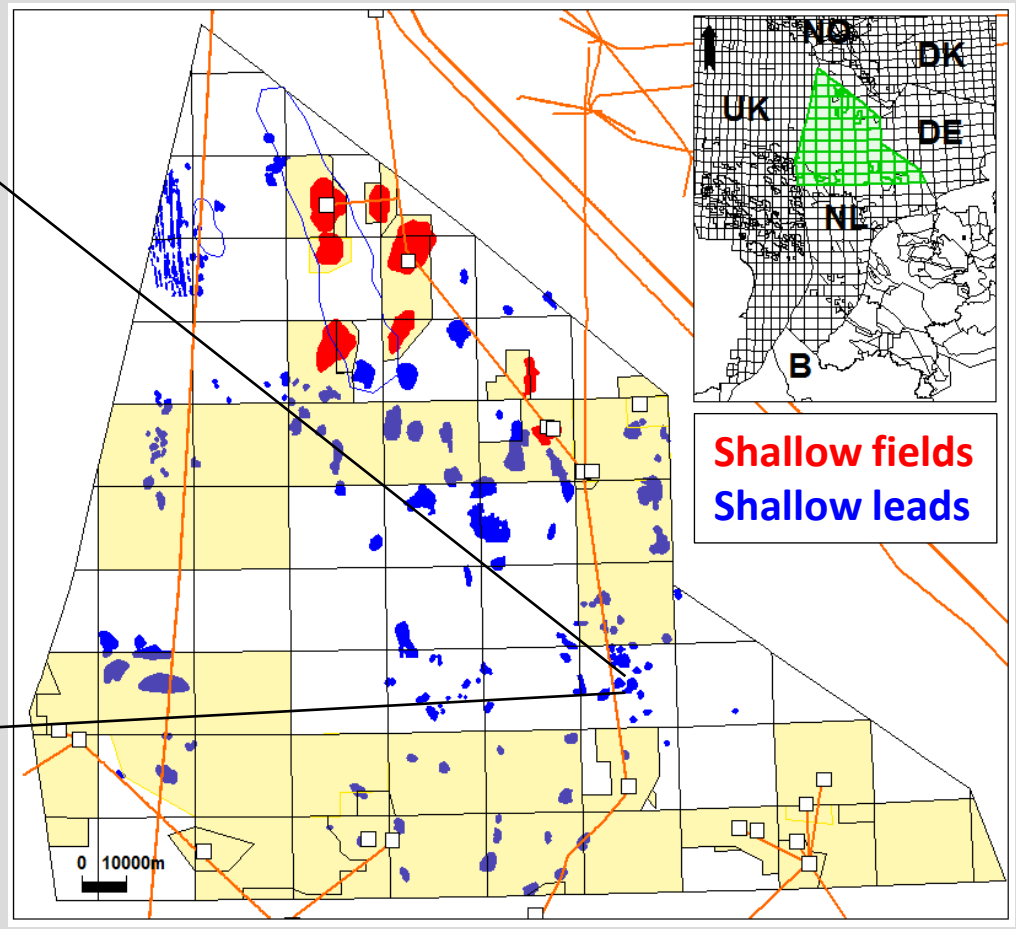
Seismic Characterization Shallow Gas
- Gas Chimney -



Gas chimney indicator for gas

Case Study: F12-Pliocene





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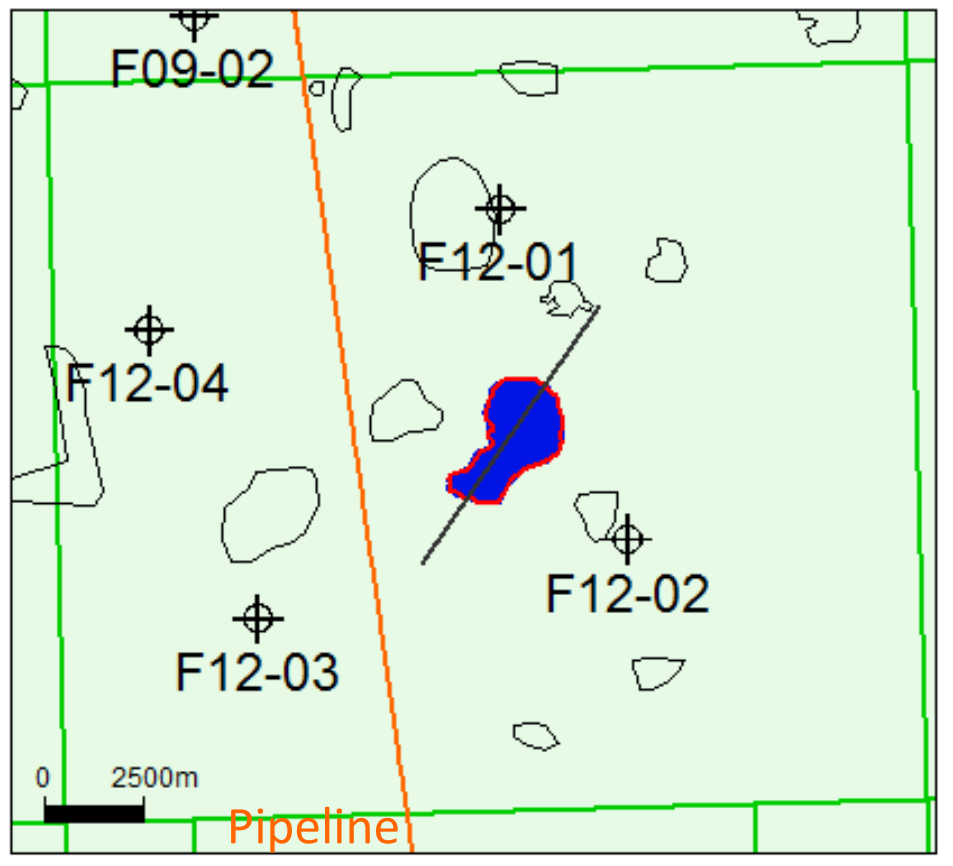

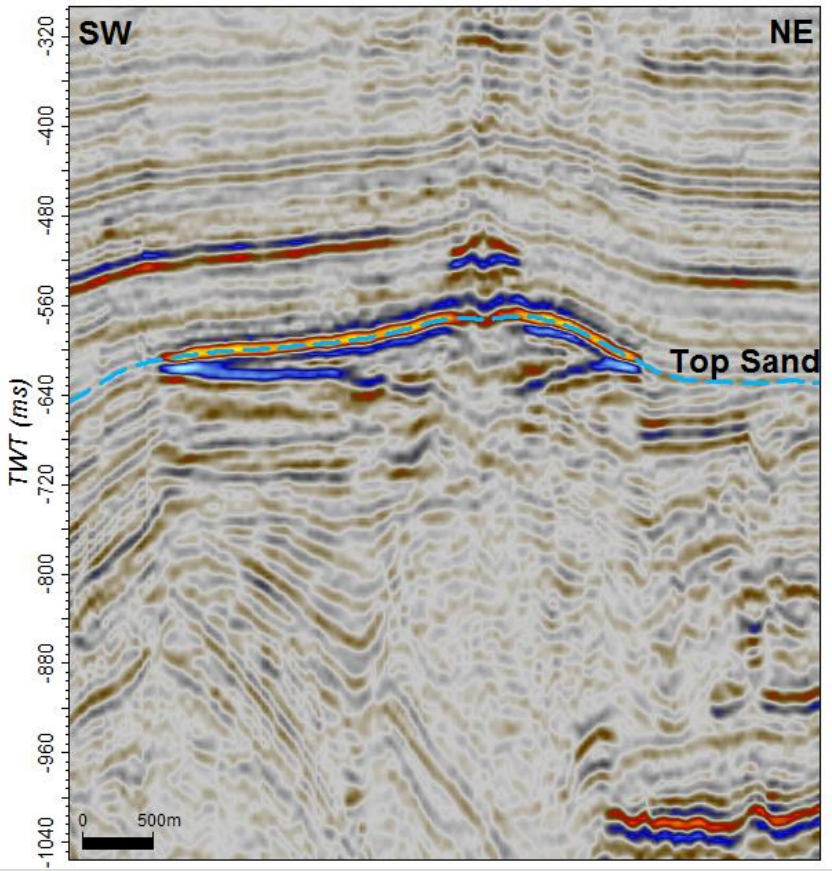

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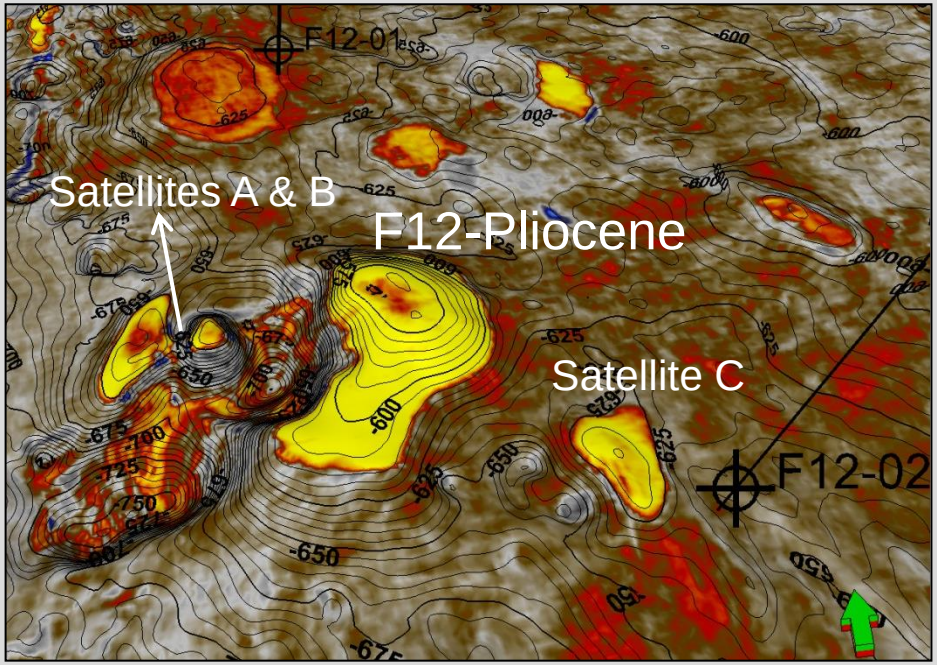

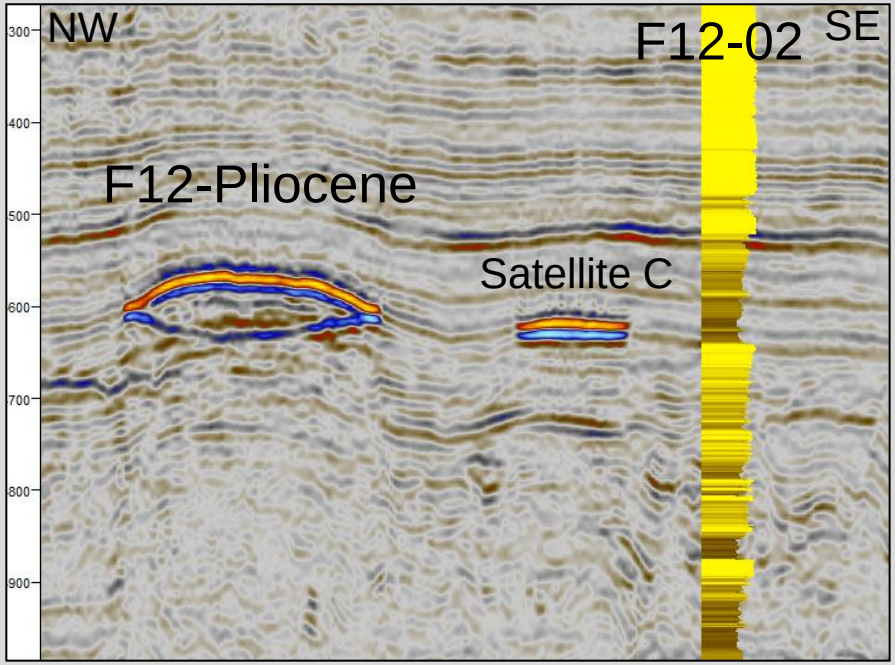

GIIP (bcm*)		
P10	P50	P90
0.6	0.8	1.1

***1 bcm (Nm) ≈ 37.3 bcf**

Summary
Shallow Gas Derisked by Seismic Characterization

- 8 fields (wells) & more than 150 leads (seismic data)
- Semi-quantitative seismic characterization useful for first order ranking
- Ultimate derisking required by the bit
- Find cost efficient solutions:
  - Relatively small leads
  - Distance to infrastructure

Acknowledgements

- ONE
- TNO
- Ikon Science
- Chevron (E. Campbell, K. Borowski)
- EBN B.V. (B. Scheffers, E. Rosendaal)

More information in booth 1826