Economic risk reduction of geothermal energy projects: Case study of the Delft Sandstone

Study objective

Reduce economic risks for geothermal projects
Reduce uncertainties of reservoir characteristics
Conclusions

- Better model to predict sand bodies, in depth and space
  - No one Delft Sandstone
  - Sand 1 deeper than Sand 2

- Use reservoir characteristics for specific targeted sand

- Placement of doublets in NW-SE direction
Geothermal energy

- Doublets
- Closed system
- Injection and production well
West Netherlands Basin

- First doublet
- Cretaceous reservoir rocks
- Late Jurassic rifting
- Late Cretaceous inversion

Modified after Herngreen and Wong, 2007
Stratigraphic scheme West Netherlands Basin

- Four important members
- Delft Sandstone main target
- In whole WNB a dominant sandstone
Stratigraphic scheme West Netherlands Basin

- Four important members
- Delft Sandstone main target
- In whole WNB a dominant sandstone
Nieuwerkerk Fm

- Fluvial deposits
- NW-SE trend
- Constrained by fault activity
- Occurs throughout the WNB
Problem statement

- Current knowledge from structural highs
- Architecture of the fluvial Delft Sandstone reservoir is difficult to predict
- Economic risk depends on well placement
Problem statement

- Current knowledge from structural highs
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Reservoir Challenges

- Presence
- Thickness
- Continuity
- Geological model
Stratigraphic correlations

• Biostratigraphical correlation:
  – Age
  – Depositional environment

• Well correlations

• Seismic correlations
Original hypothesis

One continuous Delft Sst. in the WNB

Van Adrichem Boogaert & Kouwe, 1997

30km

Lithostratigraphic Correlation
Original hypothesis

One continuous Delft Sst. in the WNB

Van Adrichem Boogaert & Kouwe, 1997

No Delft Sst.
Thick, stacked channel complexes in the WNB

DeVault & Jeremiah, 2002
Results biostratigraphy

Elegans marker

Paratolia marker
Results biostratigraphy

- Elegans marker
- Paratolia marker
- Sand 1
- Sand 2
Conclusion - hypothesis

- Not one Delft Sandstone
- Fluvial system moved from east to west

![Diagram showing geological formations and locations](image)
Conclusion - hypothesis

Fluvial depocentres:
- Ryazanian/ Early Valanginian
- Valanginian
Conclusion - hypothesis

- Sand distribution
Conclusion - hypothesis

Fluvial depocentres:
- Ryazanian/ Early Valanginian
- Valanginian
Geothermal implications

- Reduced uncertainties in reservoir characteristics important for economic risk reduction
  - Better model to predict sand bodies, in depth and space
    - No one Delft Sandstone
    - Sand 1 deeper than Sand 2
  - Use reservoir characteristics for specific targeted sand
  - Placement of doublets in NW-SE direction
Thank you