

The logo for EBN, consisting of the lowercase letters 'ebn' in a white, sans-serif font on a dark blue rectangular background.

ebn

# The Cygnus play

Opportunity for a Dutch equivalent of the Cygnus Field (UK)  
Marloes Jongerius, EBN



# Outline

- 1) Introduction
- 2) Cygnus field concept
- 3) An equivalent of the Cygnus Field in the Dutch offshore and its potential
- 4) Conclusions



# Introduction

# The Rotliegend Fm

The Rotliegend formation:

- Prolific reservoirs
- Significant fraction of Dutch gas production
- Well known

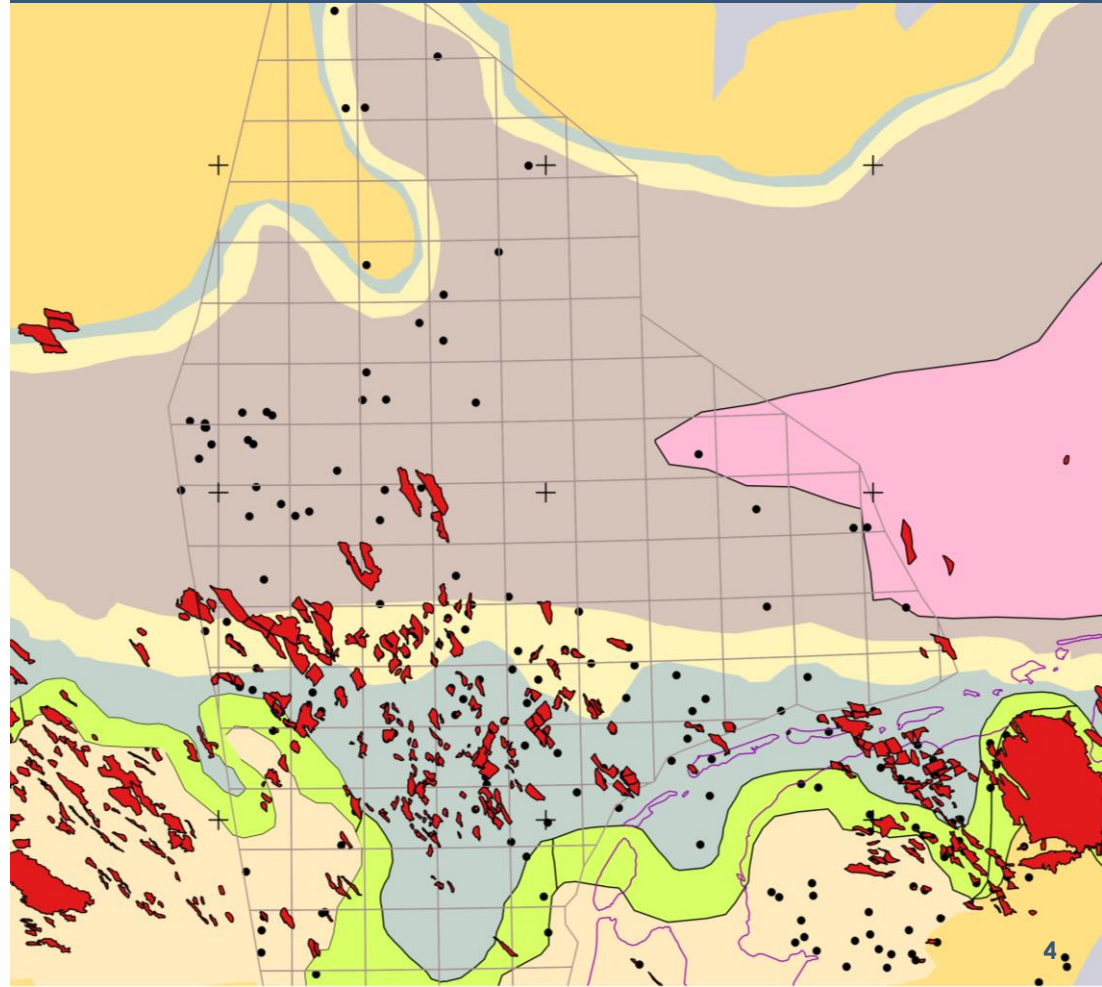
## Legend

- Rotliegend Fields
- Wellhead location of Rotliegend penetration
- Rotliegend eroded at younger unconformity

## Upper Slochteren Reservoir Facies:

- Dunes
- Fluvial Plain
- Upper Playa
- Lower Playa
- Playa lake
- Sabkha
- Massif/High
- Playa margin
- Salina

## Rotliegend fields & wells



# Rotliegend Fm.

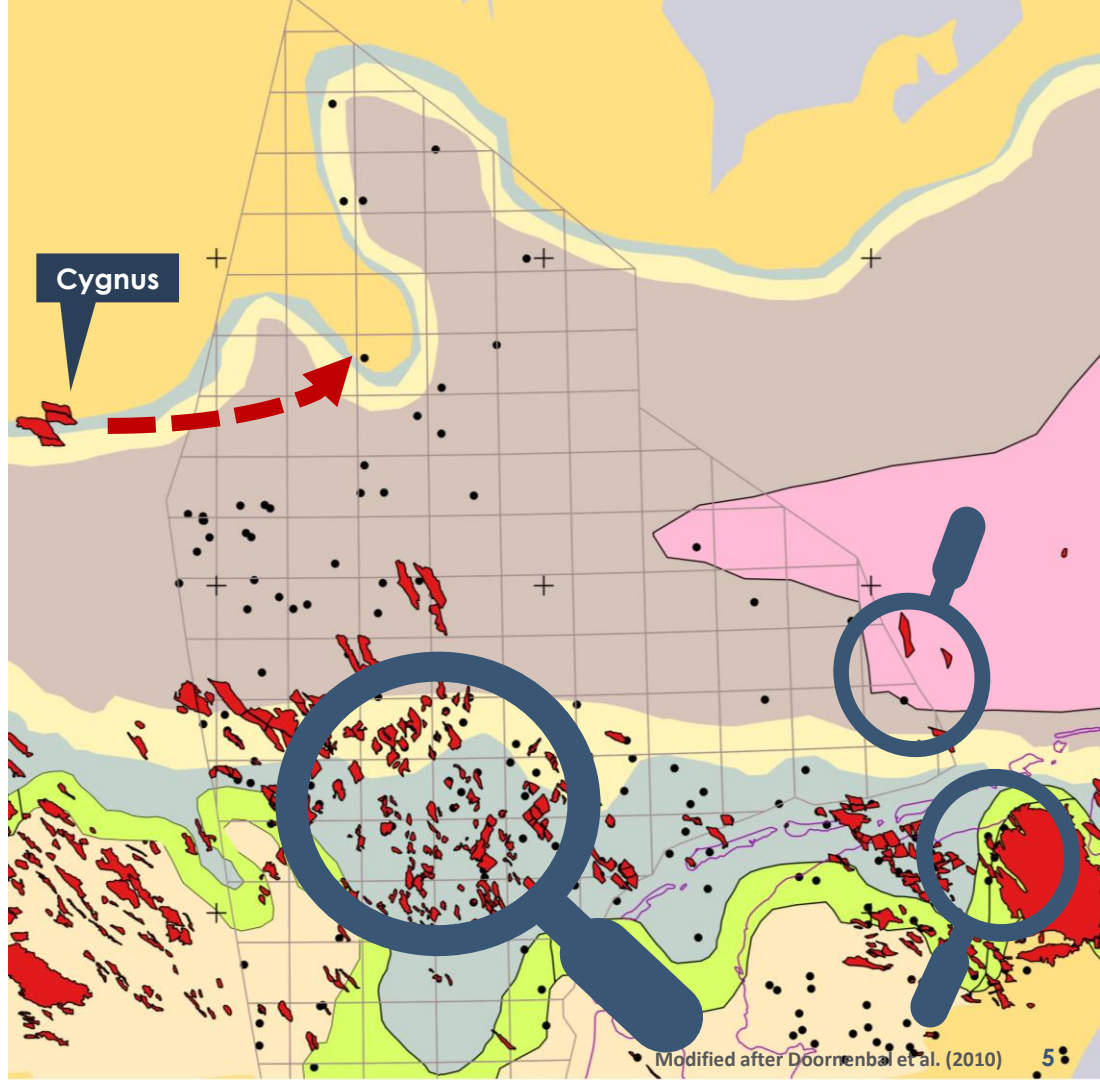
## New Rotliegend play concepts:

- 🔍 1959 – Groningen
- 🔍 1976 - Feather edge
- 🔍 1993 - Golden Fairway
- 🔍 2013 – ‘Ruby’ play

🔍 All producing fields are located at the southern edge of the Southern Permian Basin

🔍 How about the Northern fringe?

↑  
**Opportunity**



# Cygnus field concept

# Facts

## Location:

- UK southern North sea
- Blocks 44/11 & 44/12

**Current operator:** Neptune

**Estimated UR:** 21.25 BCM (760 BCF)



Catto et al. (2017)



Discovery of Cygnus Field

1988

2016

First gas



# Missed-pay

## Initial target reservoir:

- **Upper Carboniferous** Westphalian C Ketch formation

**Tight**

**But... with shows in the Leman Sst Fm.**

## Producing reservoirs:

1. **Permian Rotliegend** Leman Sandstone formation
2. **Upper Carboniferous** Westphalian C Ketch formation

**Largest field discovered in the UK SNS in the last 30 yrs**



= Lower Leman sst. (~Lower Slochteren sst.)



Discovery of Cygnus Field

1988

2016

First gas



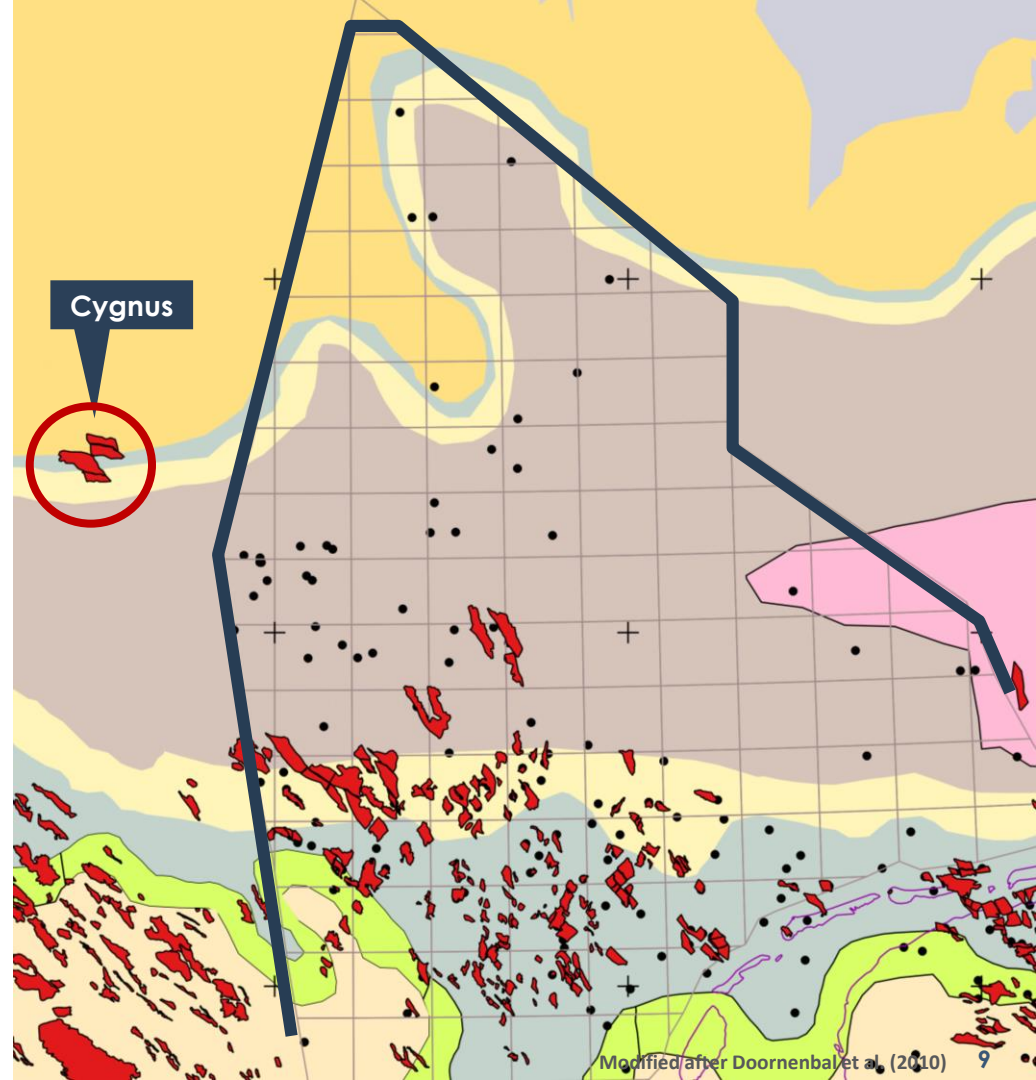


# Missed-pay

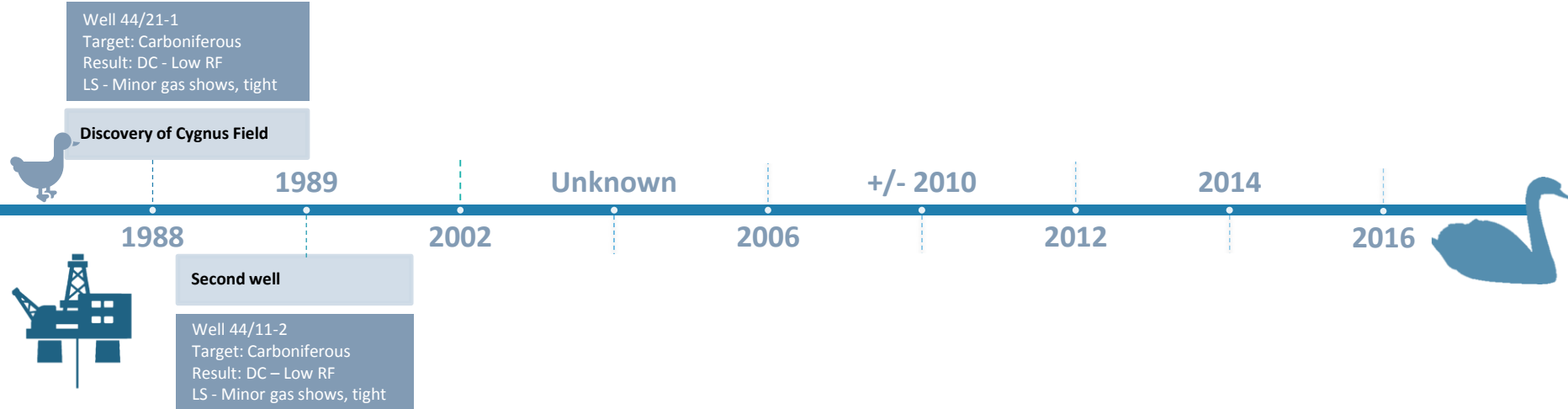
The Lower Lemman sst. (Rotliegend) was in this area not recognised as potential reservoir.

Was conceived non-productive:

- Tight
- Thin



# The importance of data acquisition

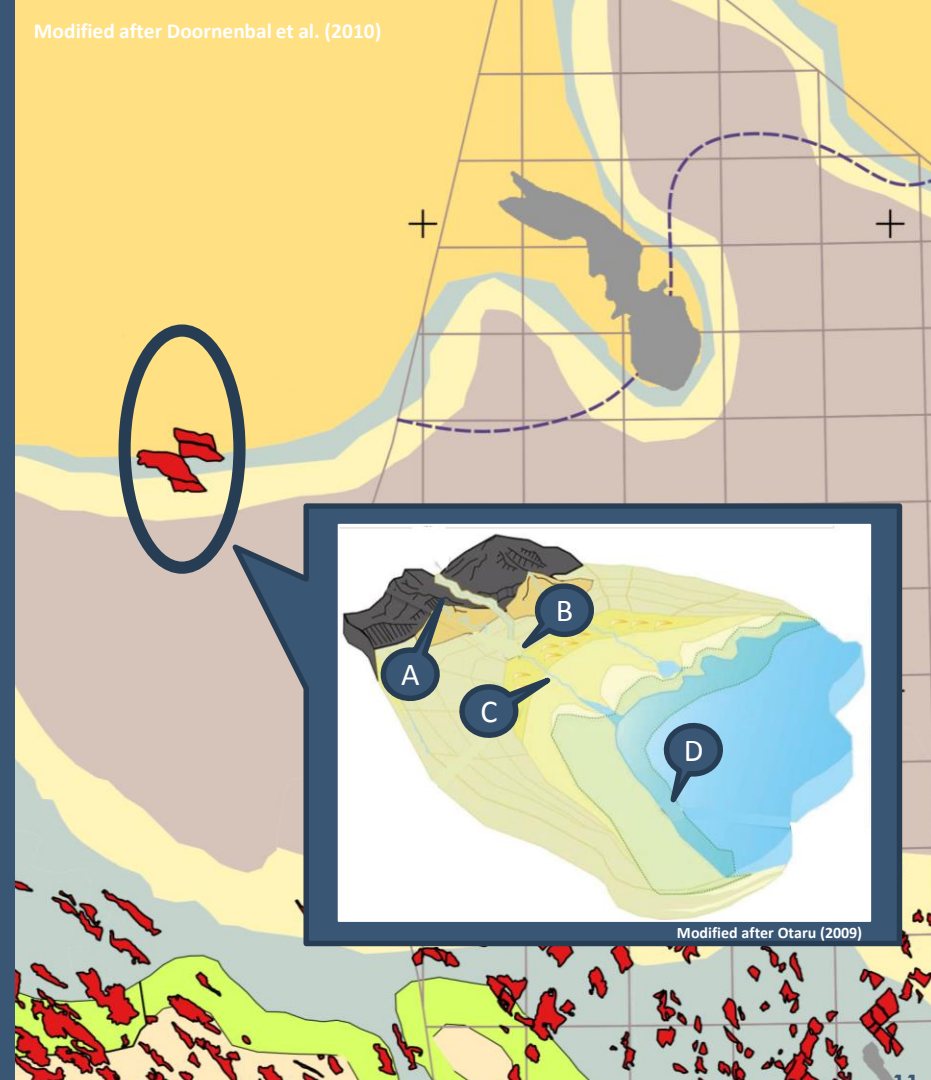


# Initial depositional model



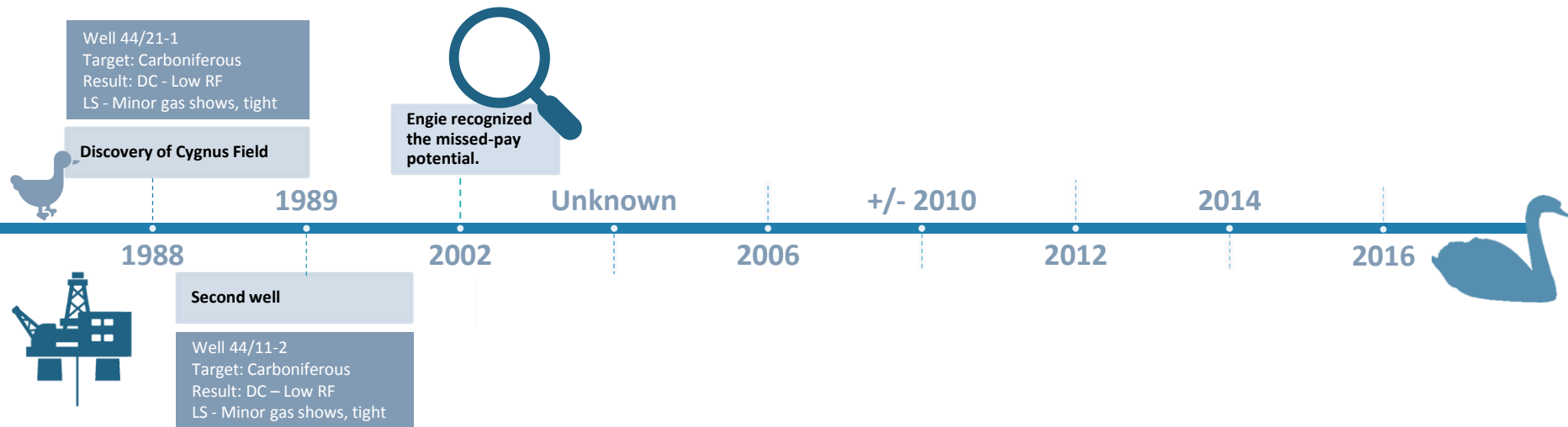
Modified after Otaru (2009)

Modified after Doornenbal et al. (2010)

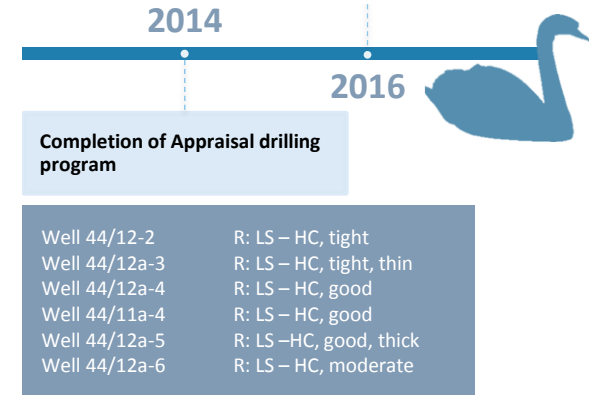
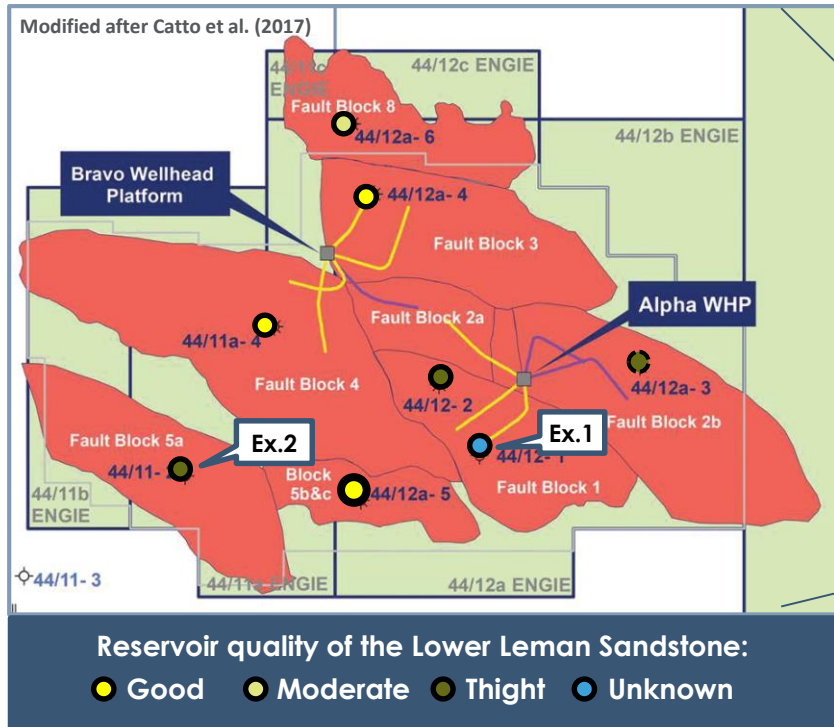


Modified after Otaru (2009)

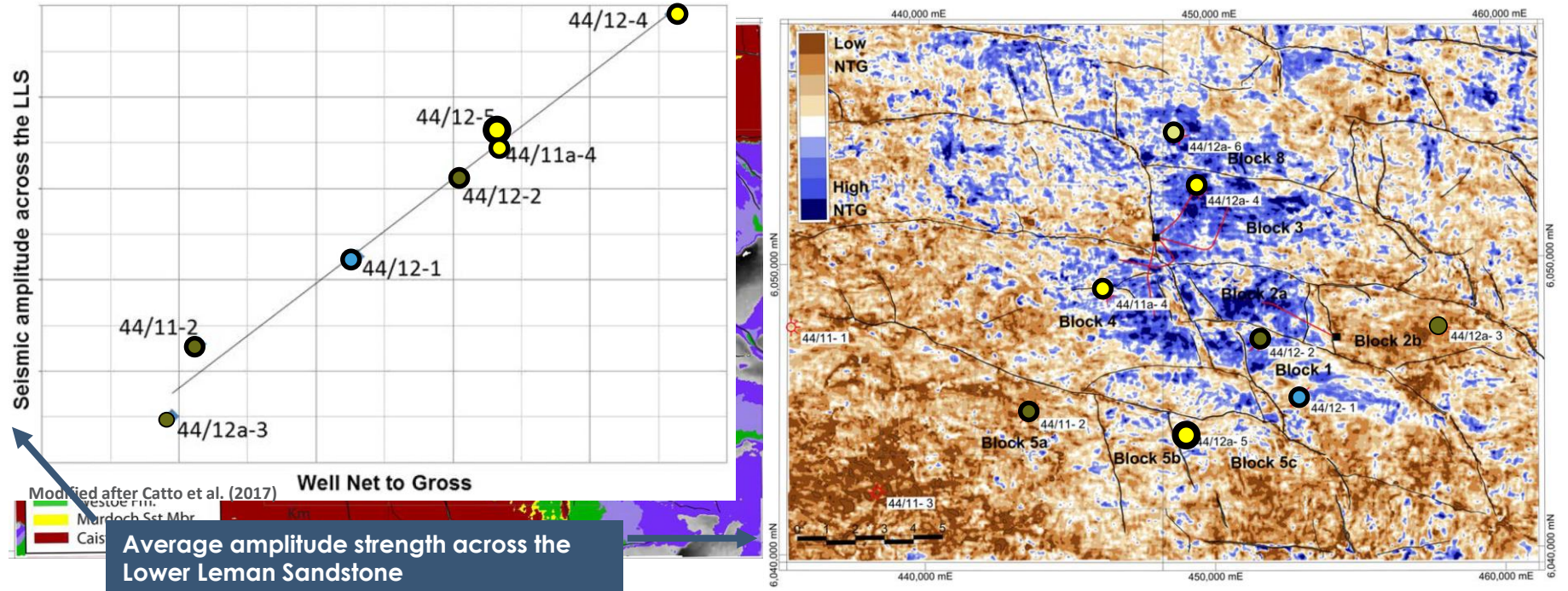
# The importance of data acquisition



# The importance of data acquisition

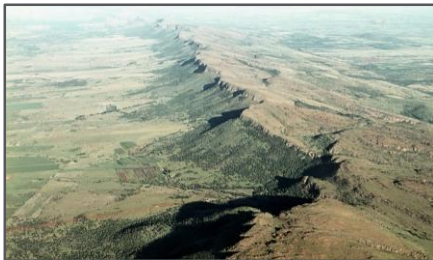
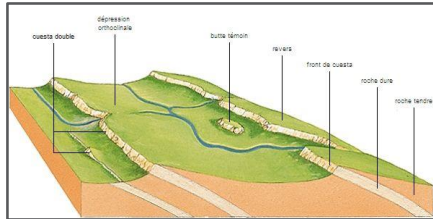


# The impact of 3D seismic data



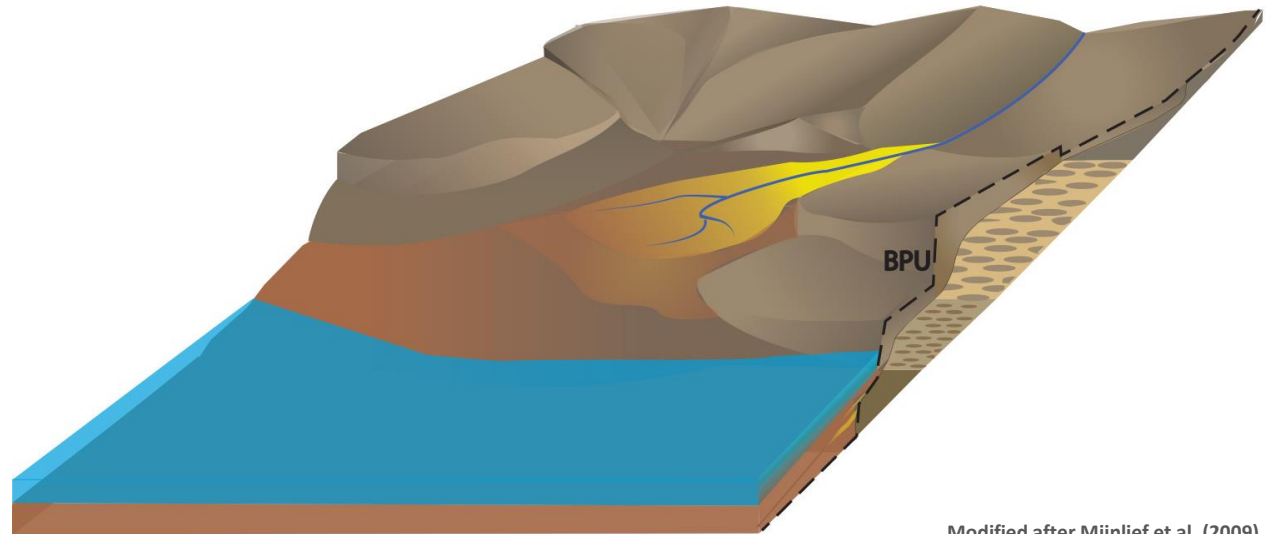
Modified after Catto et al. (2017)

# Cuesta model



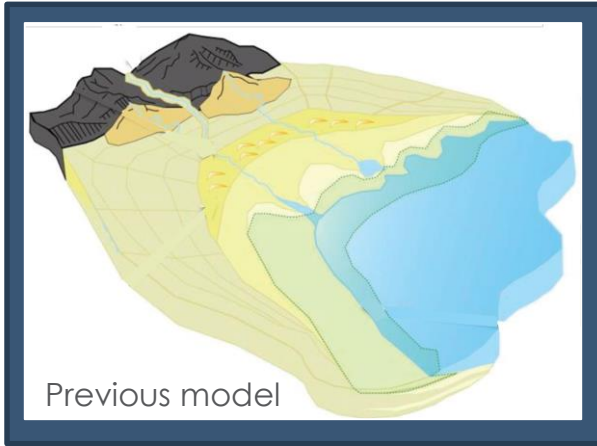
+/- 1995 - Featheredge  
2013 - 'Ruby' play

Cuesta model



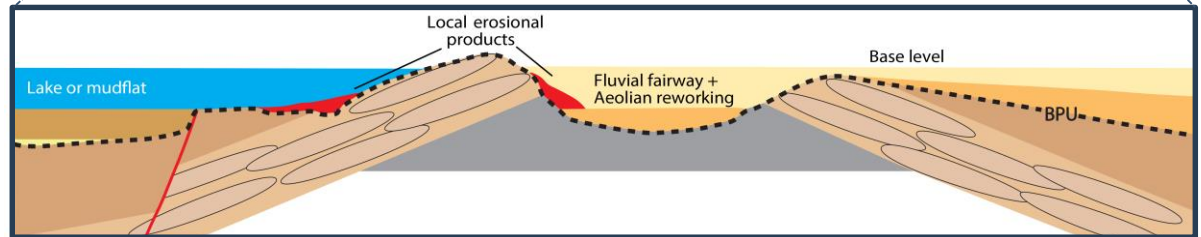
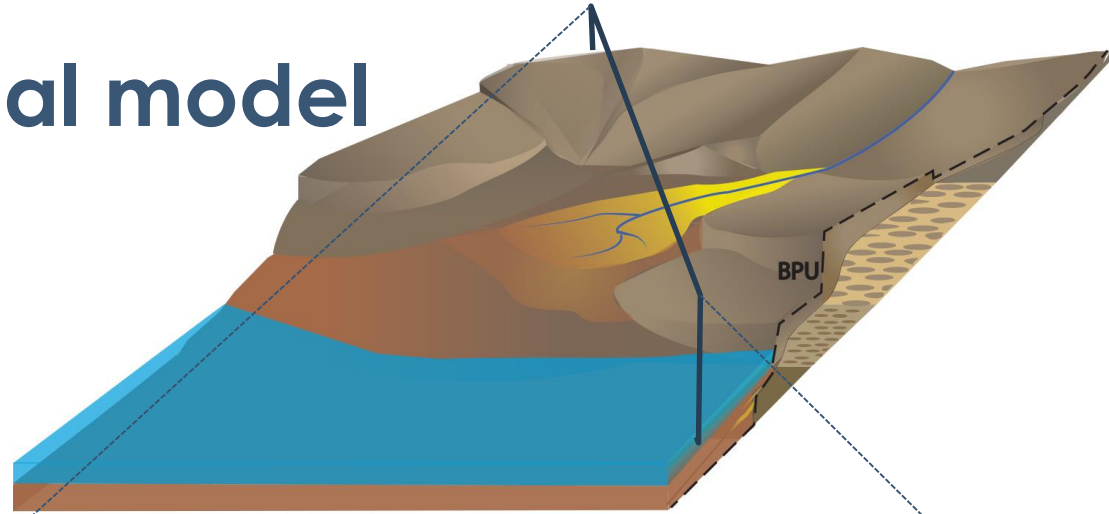
Modified after Mijnlief et al. (2009)

# Cuesta depositional model



Previous model

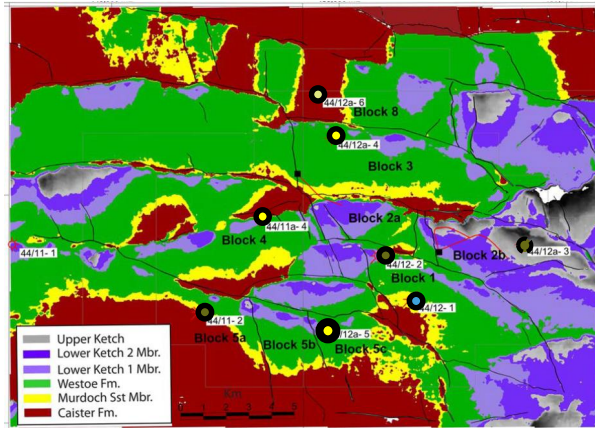
Modified after Otaru (2009)



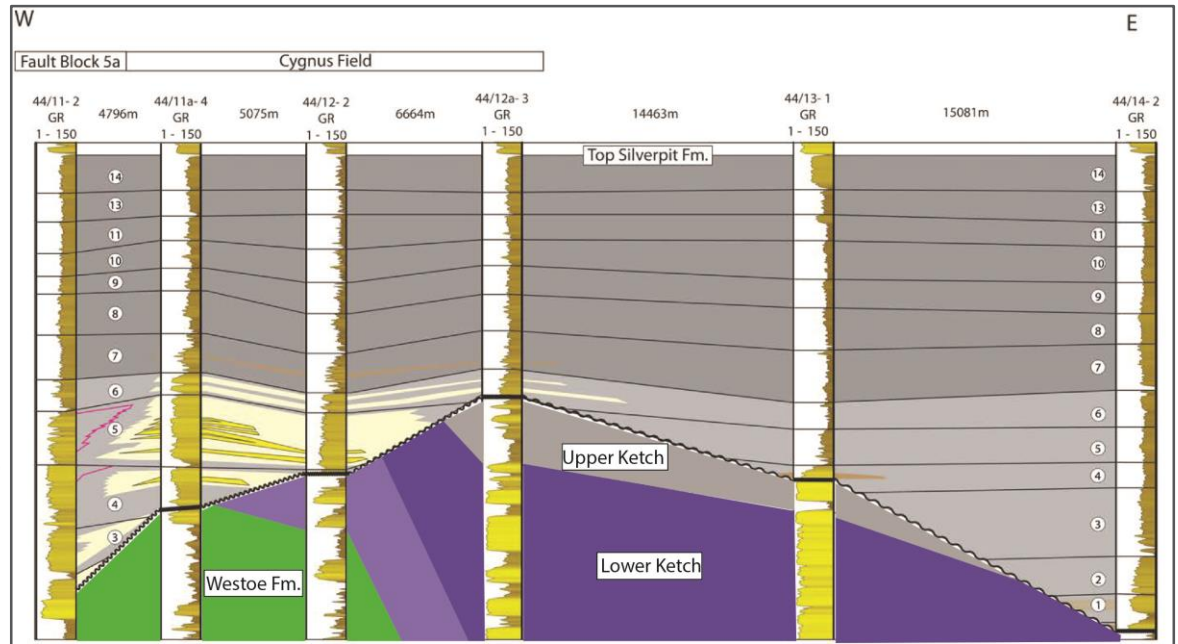
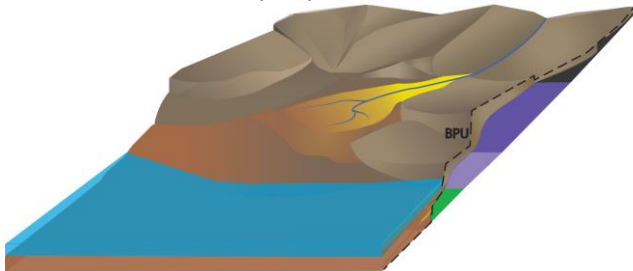
Modified after Mijnlief et al. (2009)



# Cuesta depositional model

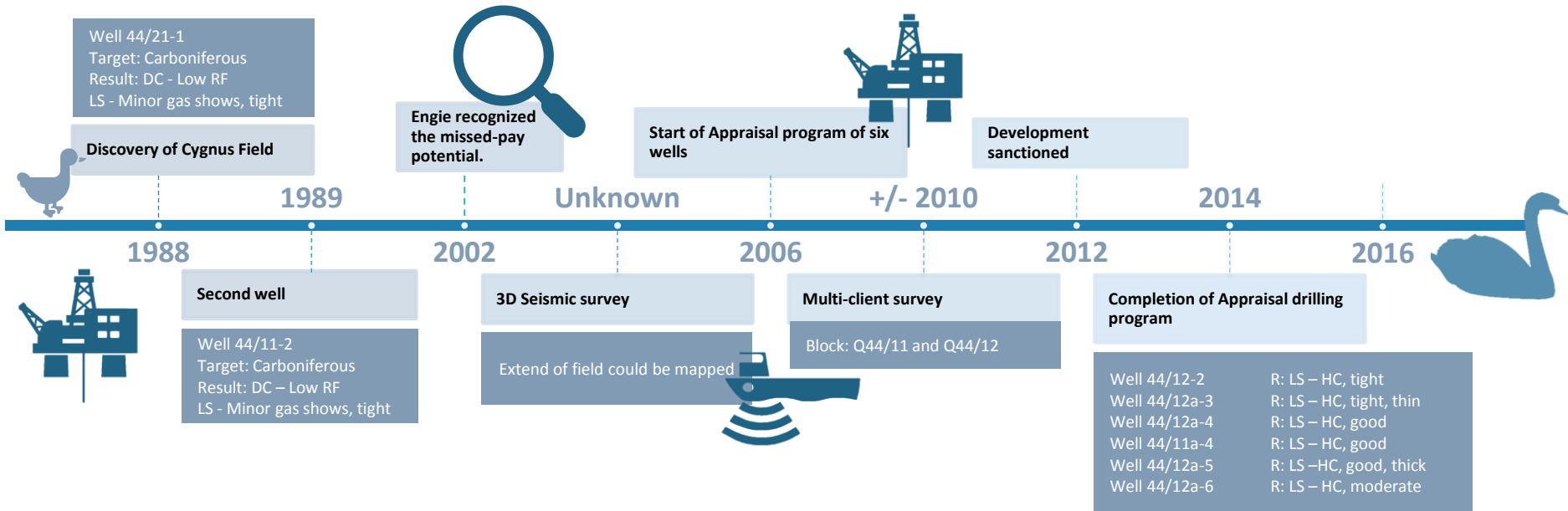


Modified after Catto et al. (2017)



Modified after Catto et al. (2017)

# The importance of data acquisition



# A new play concept



Trap

## Trap:

Broad, anticlinal low-relief, faulted structure comprising a series of terraced, tilted fault blocks



Seal

## Seal:

Shales of the Silverpit Fm.



Reservoir

## Reservoir:

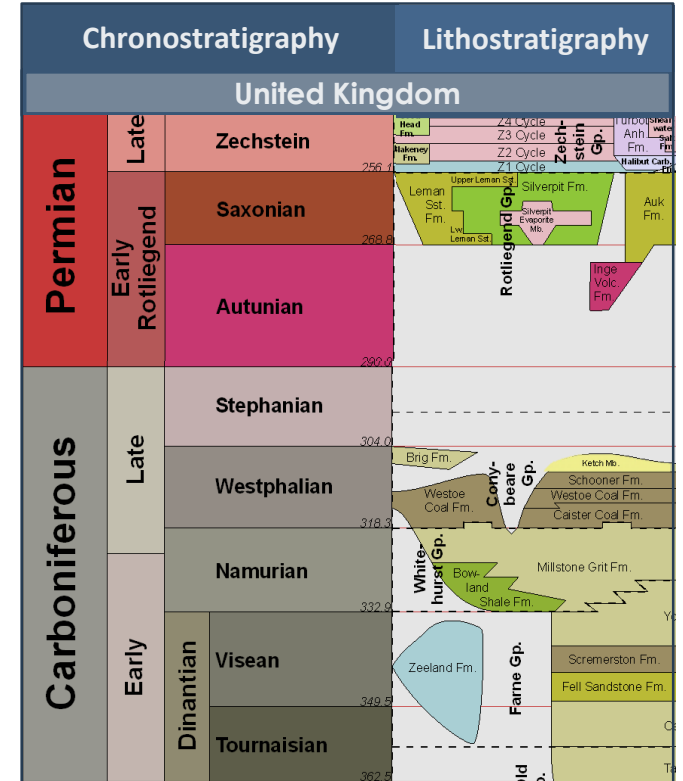
- 1) Permian Rotliegend Leman Sandstone formation
- 2) Upper Carboniferous Westphalian C Ketch formation



Source

## Source rock & Charge:

- Carboniferous Westphalian A/B
- Namurian

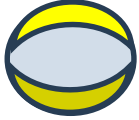


# The potential of the Cygnus play in the Dutch Northern offshore

# Dutch potential



Main production is from the South side of the SPBA.



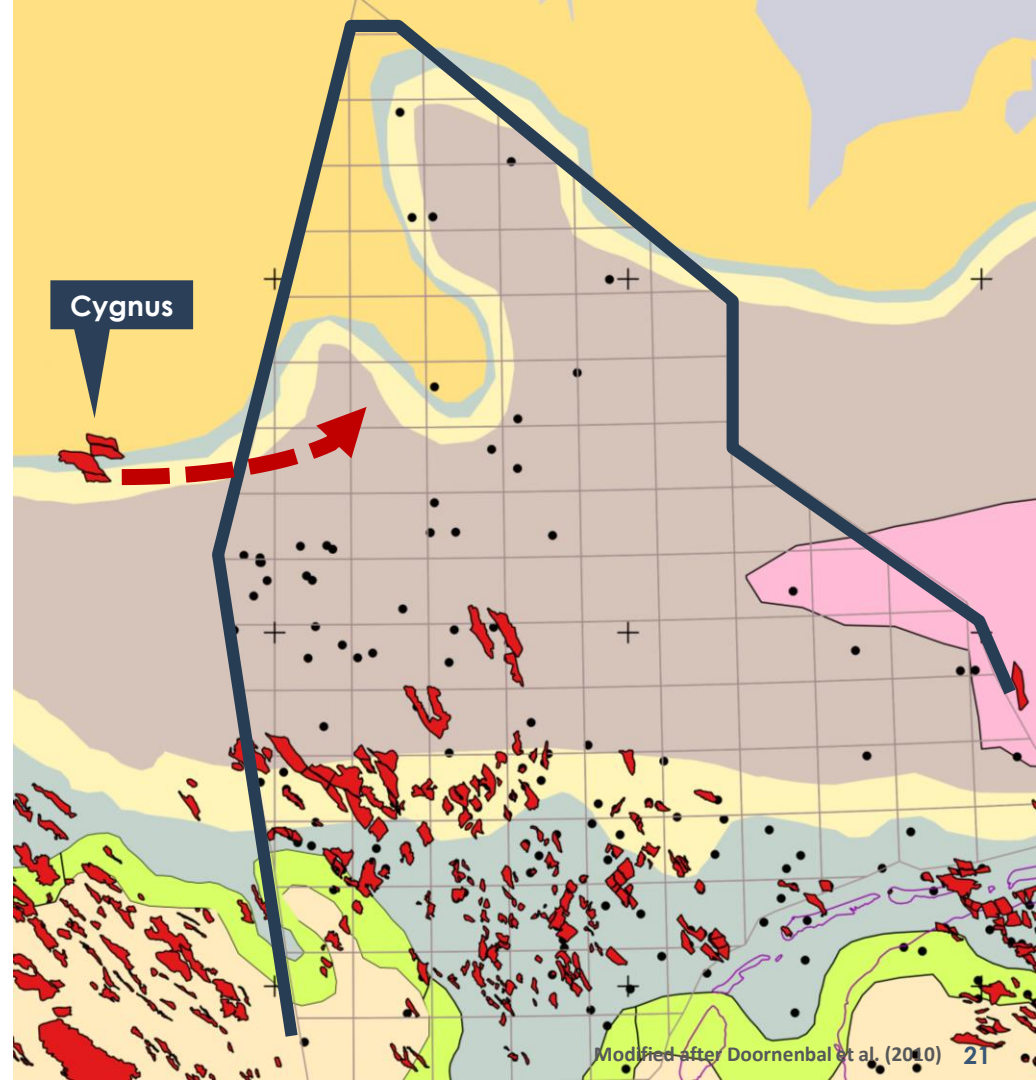
The Cygnus field proves the presence of a Northern sediment source.

## Study

- **TNO:** New Petroleum Plays in the Dutch Northern Offshore (TKI project – to be released)

## Data:

- **Wells:** Limited
- **Seismic:** Varying quality



# The play elements of the Cygnus play



## Trap:

Broad, anticlinal low-relief, faulted structure comprising a series of terraced, tilted fault blocks



## Seal:

Shales of the Silverpit Fm.



## Reservoir:

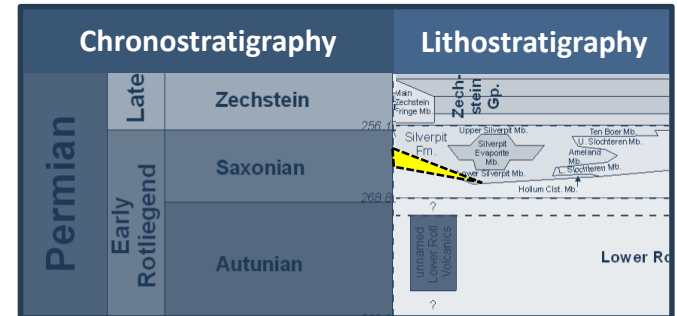
- 1) Permian Rotliegend Lemna Sandstone formation
- 2) Upper Carboniferous Westphalian C Ketch formation



## Source rock & Charge:

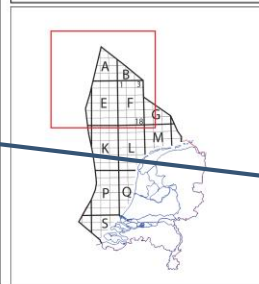
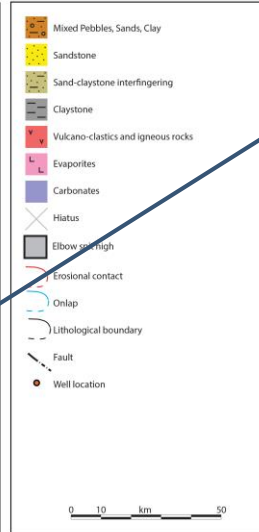
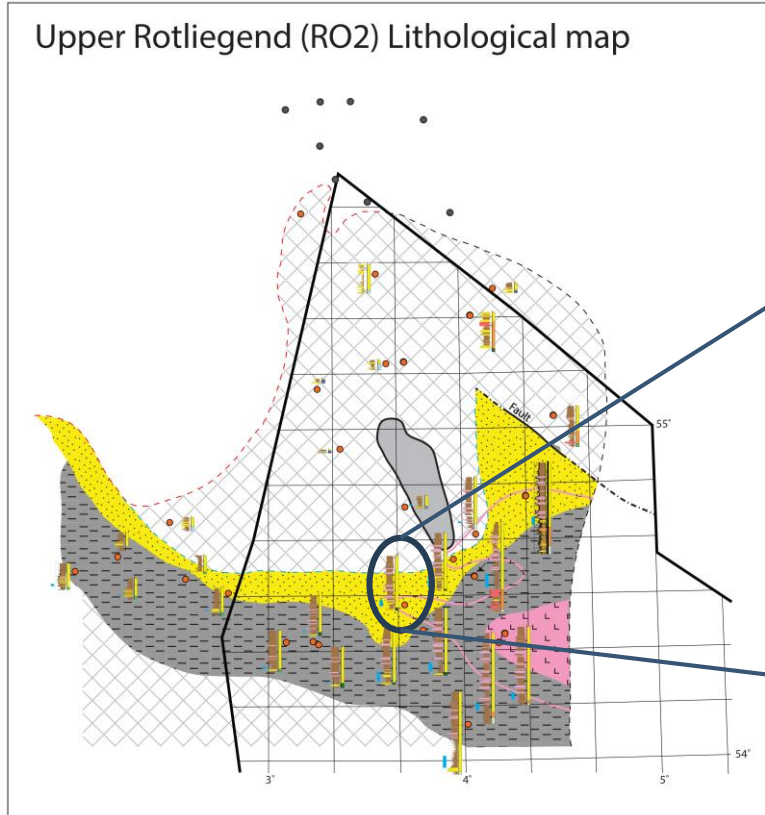
- Carboniferous Westphalian A/B
- Namurian

Permian Rotliegend  
Lower Slochteren sst. Fm.

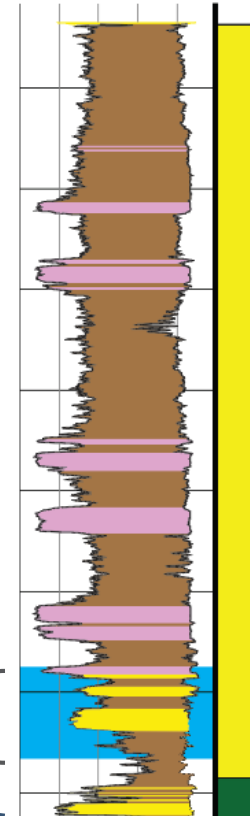


# Sand distribution

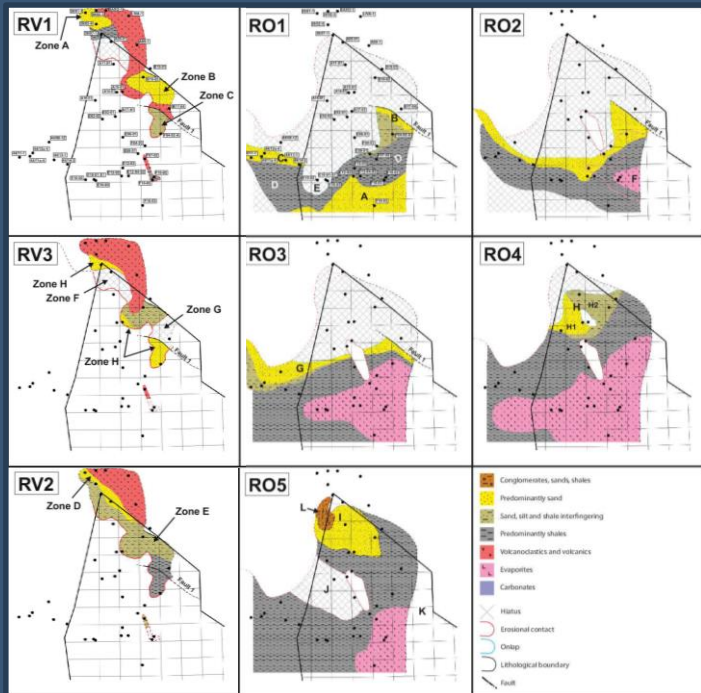
Well E12-03



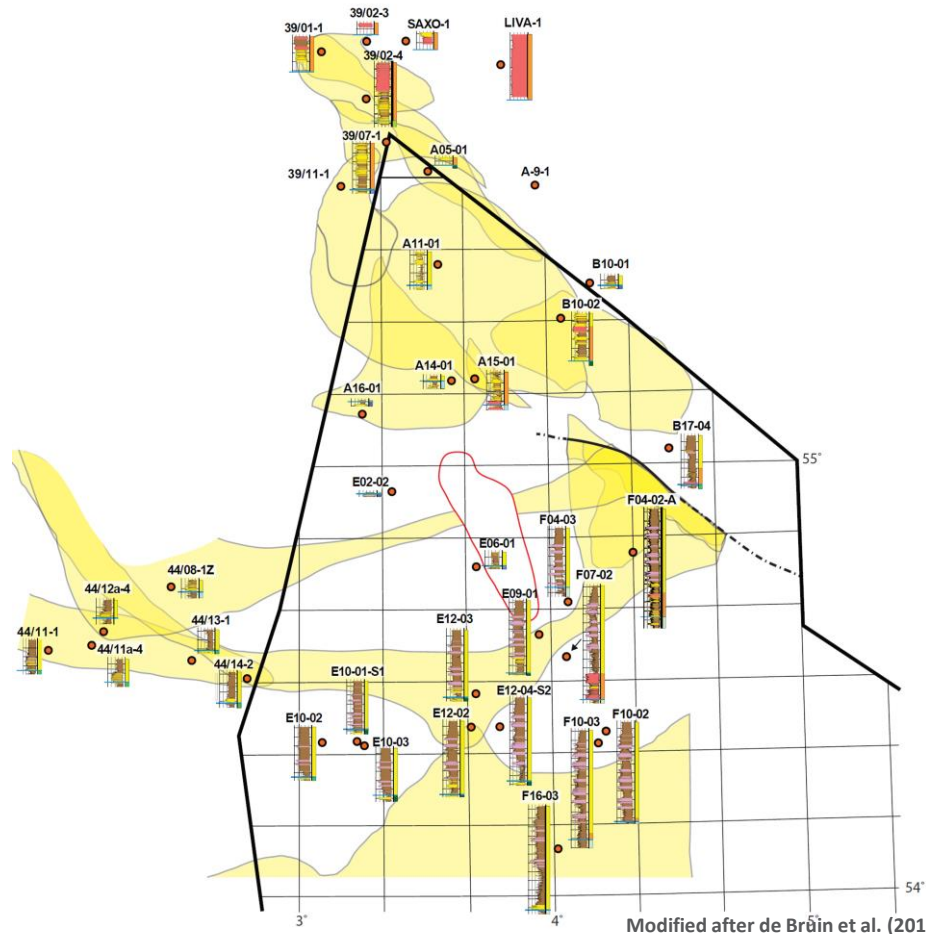
RO2 {



# Reservoir potential



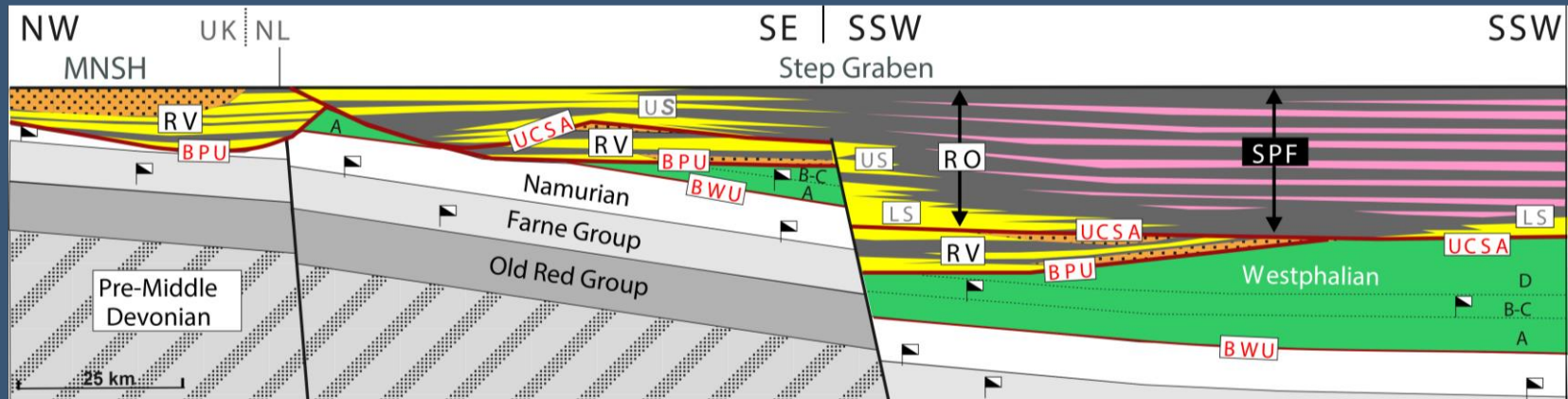
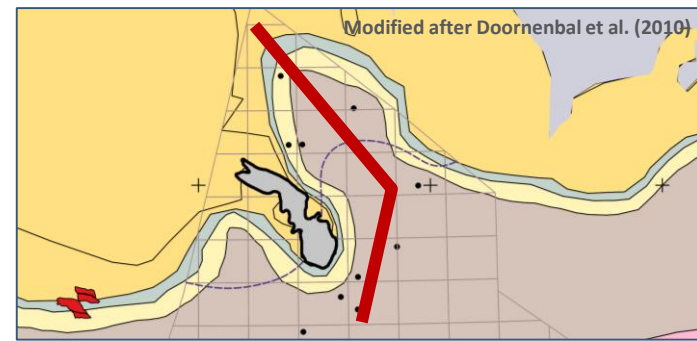
Modified after de Bruin et al. (2015)



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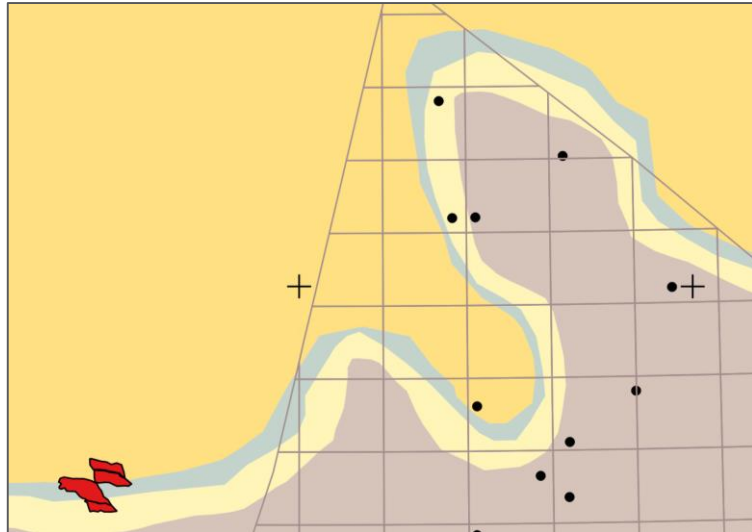
# Setting in the Dutch Northern offshore



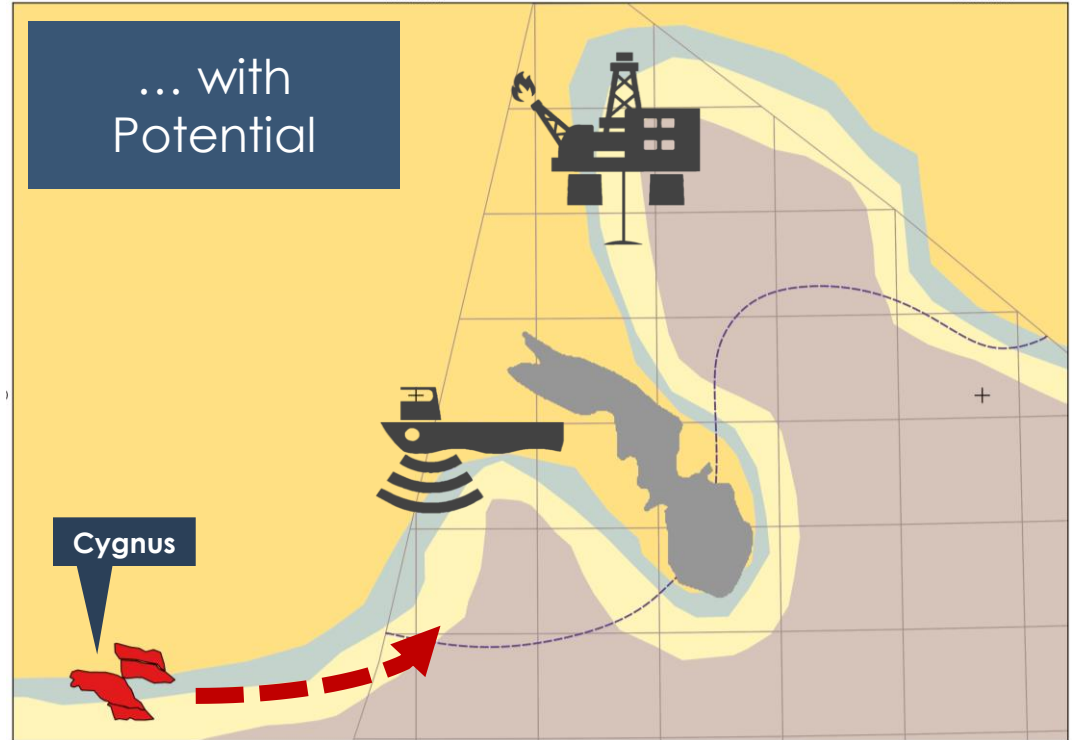
Modified after de Bruin et al. (2015)

# A Dutch equivalent of the Cygnus field

Undersampled area



... with Potential

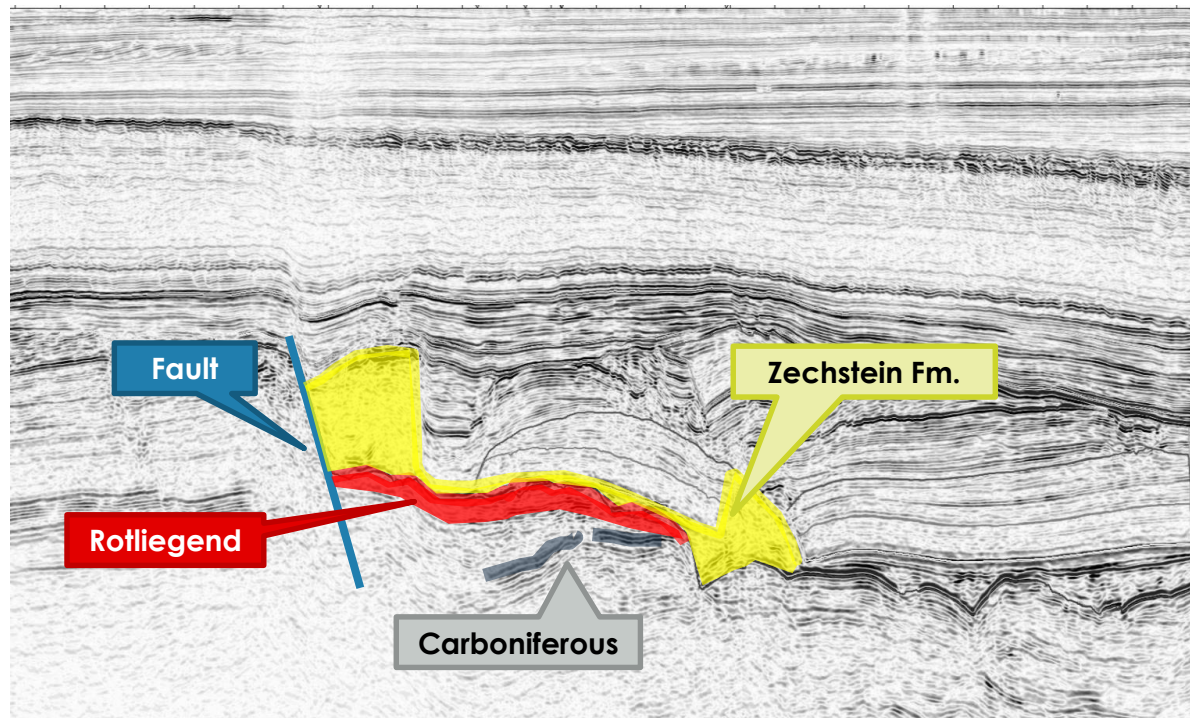


Cygnus

Modified after Doornenbal et al. (2010)

# Which elements do we need?

 Trap	Presence	✓
 Seal	Presence	✓
	Efficiency	✓
 Reservoir	Presence	🔍
	Efficiency	🕒
 Source	Presence	🔍
	Efficiency	🕒



# Conclusions

# Conclusions and way forward

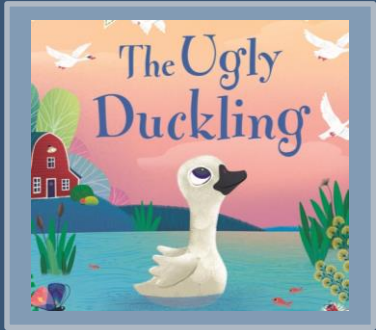
## Conclusions:

- The Cygnus field confirms the presence and efficiency of a viable Lower Leman (~Slochteren) sst. play fairway on the northern feather edge of the Southern Permian Basin.
- There is opportunity for a Dutch equivalent of the Cygnus Field.
- The Cygnus reservoir potentially present in the Northern offshore is waiting to be unlocked

## Way forward:

EBN will continue to work on this play to confirm prospectivity in the Dutch Northern offshore.

*The timeline of the Cygnus field follows the same stages as the 'Ugly duckling' fairytale.*



The Ugly Duckling is pushed away because he doesn't fit in. He struggles through the winter, but is friendship just around the corner?

Discovery of Cygnus Field

1988

Primary target: Carb. Caister Formation (minor shows).

The grey duckling grew even bigger than the other ducklings. "Big feet!" teased his brother. "Fuzzy feathers!" snapped his sisters. "Ugly Duckling!" they all squawked at him. "You don't belong with us."

1989

At the pond, Mummy Duck guided her ducklings into the water. Splish, splish, splish they went as they hopped in. SPLASH! went the big, grey duckling.

Engie recognized the missed-pay potential.

2002

Completion of Appraisal drilling program

The little, fluffy, yellow ducklings swam very nicely. But the big, grey duckling was the best swimmer of all! "Well done!" quacked Mummy Duck, proudly.

2014



**Valuable support in following publications by TNO and Neptune.**

# References

- **Bruin, G. d.**, Bouroullec, R., Geel, K., Fattah, R., Hoof, T. v., Pluymaekers, M., . . . Zijp, F. (2015). New Petroleum Plays in the Dutch Northern Offshore. TNO report TNO 2015 R10920. Retrieved from [www.nlog.nl](http://www.nlog.nl)
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- **Doornenbal, H.**, & Stevenson, A. (Red.). (2010). Petroleum Geological Atlas of the Southern Permian Basin Area. Houten: EAGE Publications.
- **Mijnlieff, H.**, & Pezatti, G. (2009). Distribution and thickness of Permian basal Upper Rotliegend sandstones. A sequel of the Rotliegend featheredge model. Poster from Coreworkshop of "Fifty years of petroleum exploration in the Netherlands after the Groningen discovery". Retrieved from [www.nlog.nl](http://www.nlog.nl).
- **Otaru, G.** (2015). *Cygnus Development Opportunities. Presentation at the SPE North Sea and Europe Area Stimulation Workshop. GDF SUEZ E&P UK.*