# Reservoir properties revisited

## Results of data mining in www.nlog.nl

- Data mining exercise for publically available core plug data of the **Lower Volpriehausen Sandstone Member** (RBMVL) in the Netherlands from www.nlog.nl
- Analysis of large data sets support generally known trends and provides **excellent reference framework** for more detailed reservoir property analyses.
- The results of this study show the strength and benefit of large publicly available data sets.

## Porosity – Permeability trend

- Large poro-perm data set has **curved nature** (Fig. 1 & 2).
- Straight line poro-perm relations often defined on limited data set and result in:
  - Perm overestimation in high & low poro range
  - Perm underestimation in intermediate poro range
- Therefore curved or bilinear function preferred above straight lines to describe poro-perm relations.

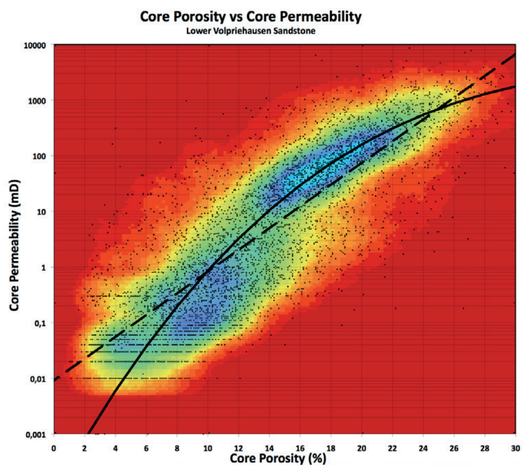


*Fig. 1: Poro-perm plot, >5000 RBMVL core plug measurements. Colours display data point density.*

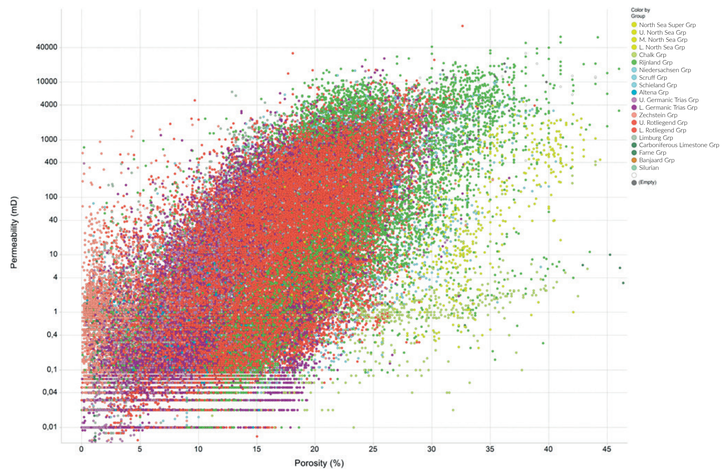


*Fig. 2: Poro-perm plot of all core plug measurements from Dutch wells (EBN, 2016).*

## Porosity – Depth trend

- Correction for **maximum burial** depth required.
- Correction based on **basin modelling study** of Nelskamp & Verwey (2012). The effect is shown in Fig. 3 & 4.
- Scattered data in Fig. 4 due to **facies differences and diagenesis**. Complicates definition of poro-depth relation.
- **High porosity envelope** present **>>>** effect of sediment burial.

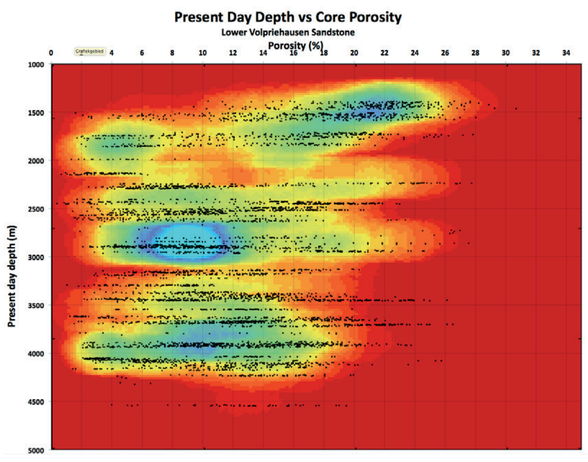


*Fig. 3: Core plug porosity vs Present day depth.*

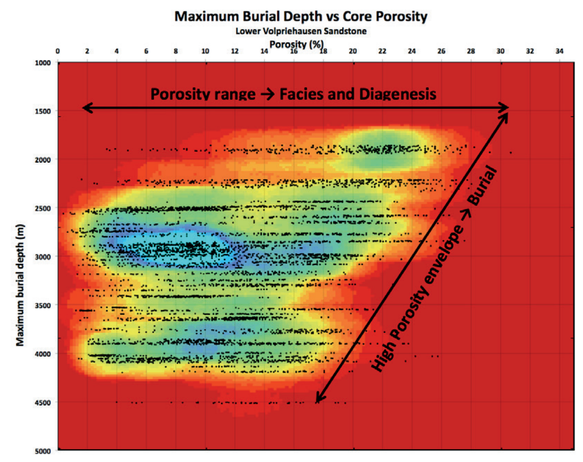


*Fig. 4: Core plug porosity vs Maximum burial depth.*

## Facies and diagenesis

- Two methods for definition of poro-depth trend:
  1. Assign **attributes for clay volume/cementation**, based on public information: petrography reports, core descriptions etc. (Fig. 5).
  2. Assign **attributes for grain density**, which is a good porosity indicator (Fig. 6).
- Clear poro-depth trend for **reservoir quality samples** (Fig. 5: blue points, Fig. 6: orange & green points).

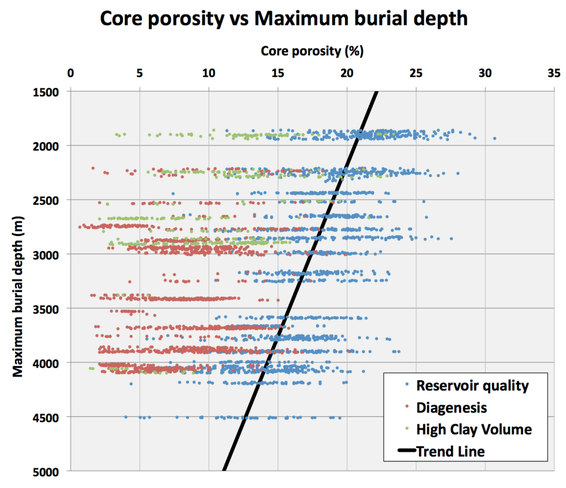


*Fig. 5: Poro-depth plot with (colour) attributes for clay volume/diagenesis based on public information.*

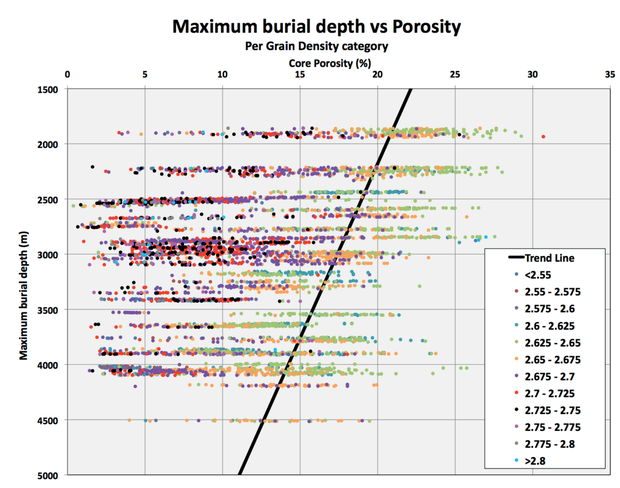


*Fig. 6: Poro-depth plot, (colour) attributes for grain density.*

## Grain density (GD) analysis

- Interesting: development of poro-depth relation with **increasing clay volume/diagenesis**.
  - GD classes defined (range 2.60 – 2.75 g/cm³, steps of 0.025 g/cm³)
  - Calculate average poro per 50m depth interval, plot vs depth.
- Trend lines through each GD class (Fig. 7a) show **decreasing slope with increasing GD class** (Fig. 7b).
- This shows that a different porosity-depth relation should be applied for rocks with different sedimentary facies or varying amounts of early diagenesis.

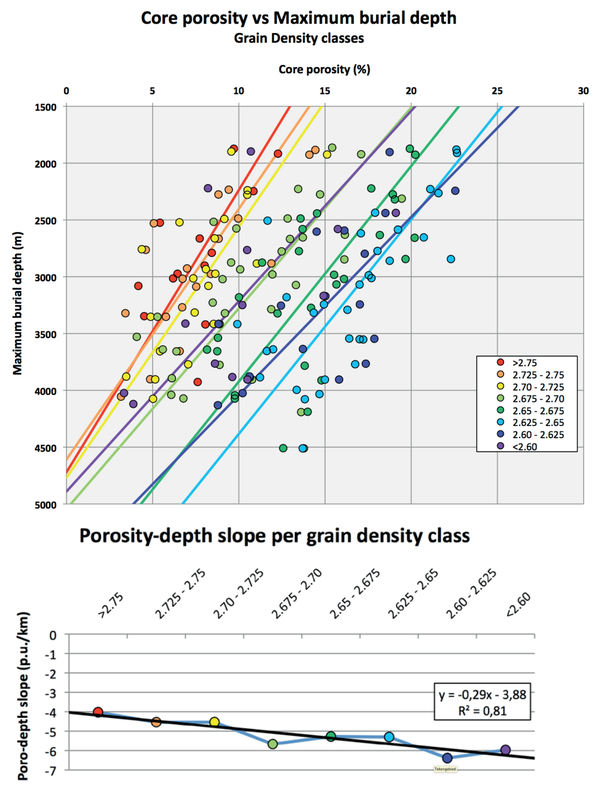


*Fig. 7a: For each GD class: average porosity per 50m depth interval plotted vs depth.*

*Fig. 7b: Slope of poro-depth relation per GD class, as defined in Fig. 7a.*

## Example of applicability

Poro-depth relations can be used for interpolation of well based porosity data, e.g. to create **regional porosity maps**.

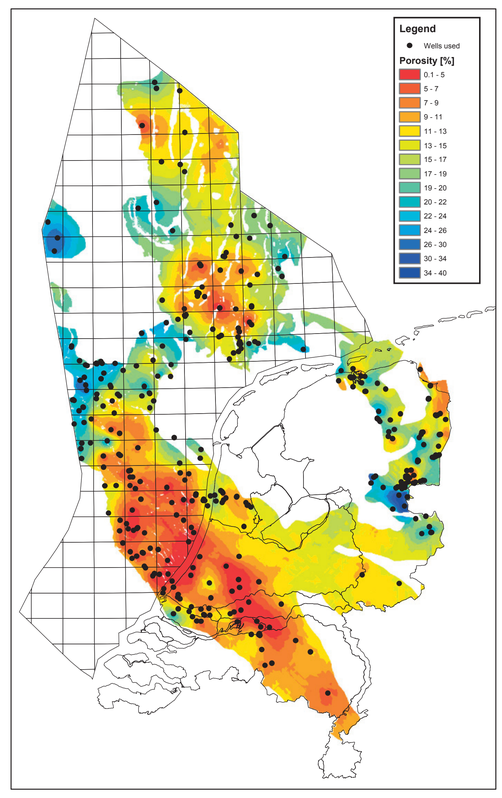


*Fig. 8: Porosity map of the Lower Volpriehausen Sandstone Member. Example of the applicability of poro-depth relations. Regional porosity maps can be constructed per reservoir zone.*

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