Survey of recent advances in digital rock physics – benefits of DRP and their application to reservoir characterization

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Geopetrol - Zakopane-Kościelisko 15th -18th September, 2014

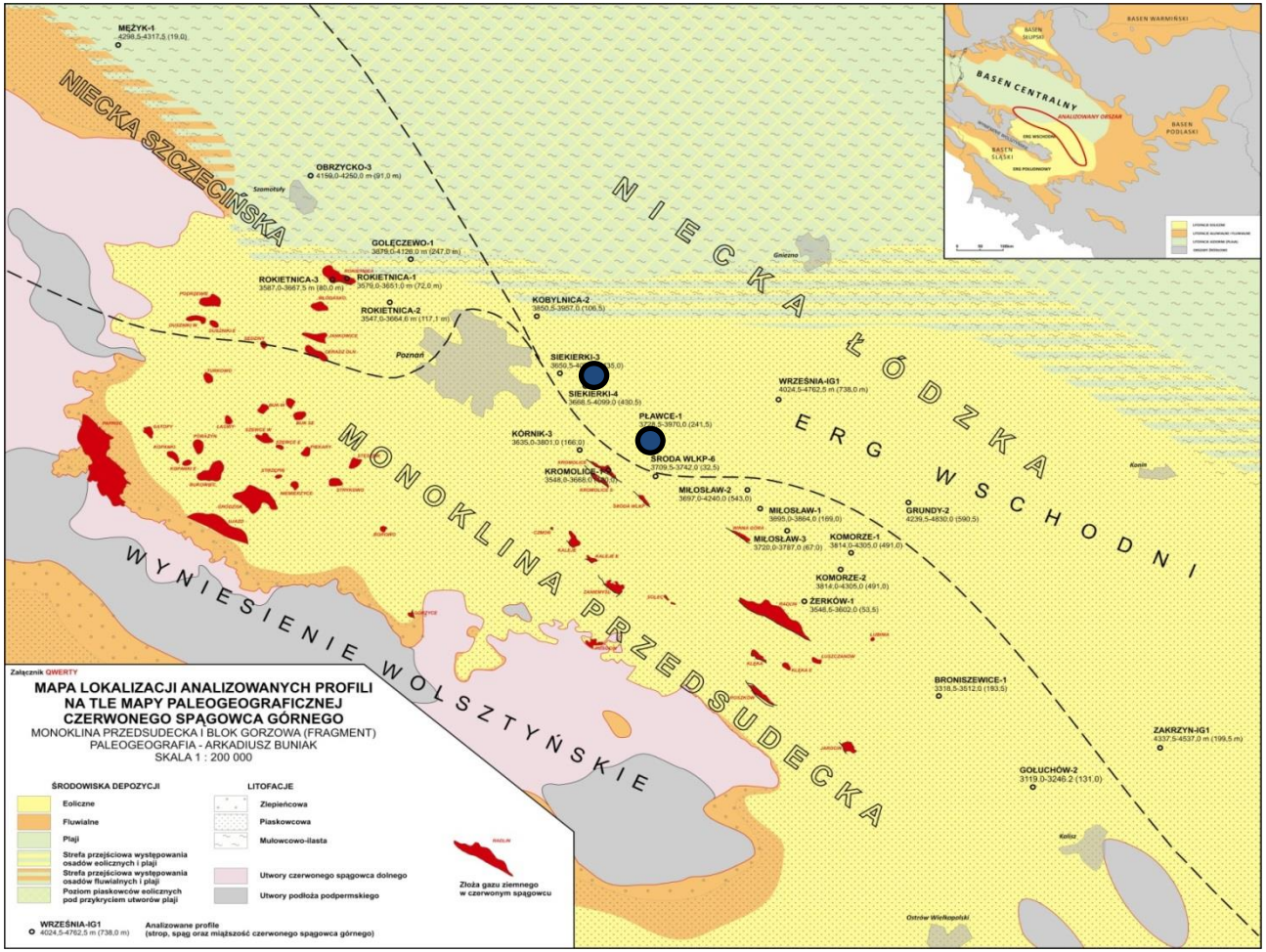
Outline

1. Region of interest
2. Rock characterization:
    - Petrophysical analysis
    - Petrographical analysis
3. Digital Rock Physics
    - Application to rock characterization
    - Correlation to standard measurments
4. Estimation of Capillary Pressure
5. Conclusions

Region of Interest

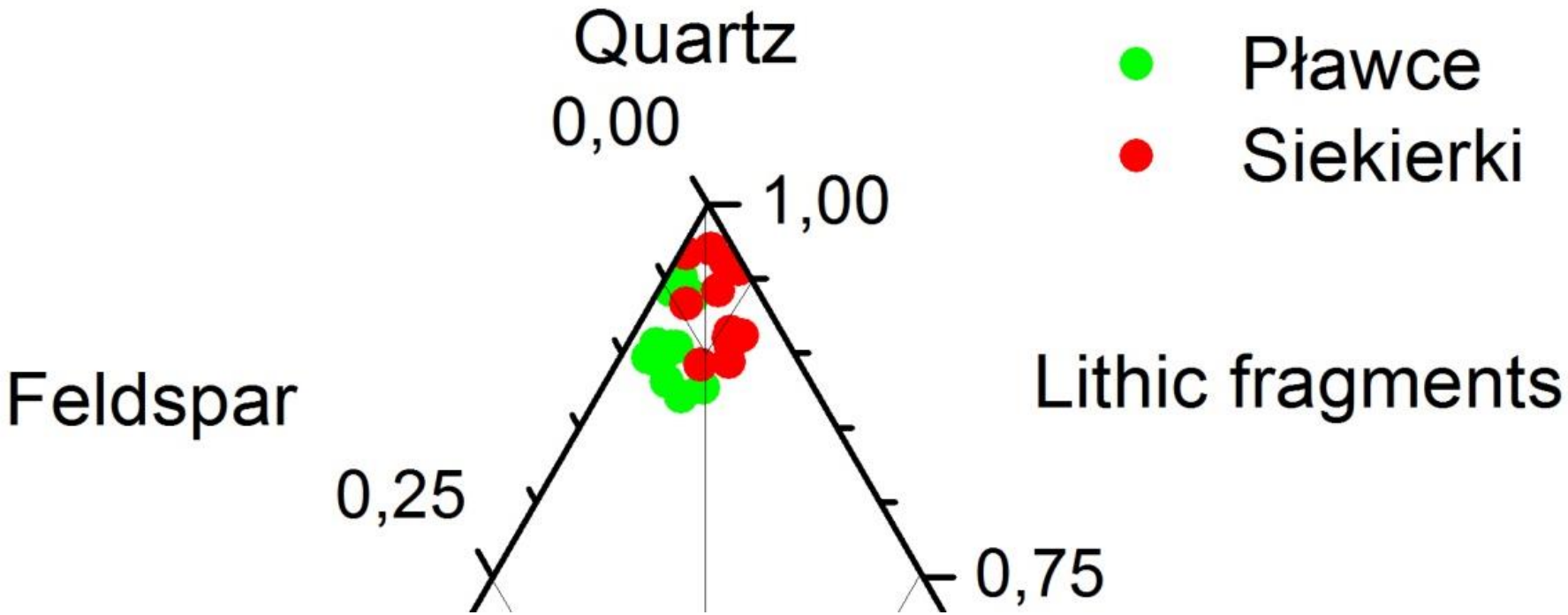
Rocks selected :

- **Rotliegende sandstones**
- **Carpathian sandstones**
- **Main dolomite**
- **Silurian shales**



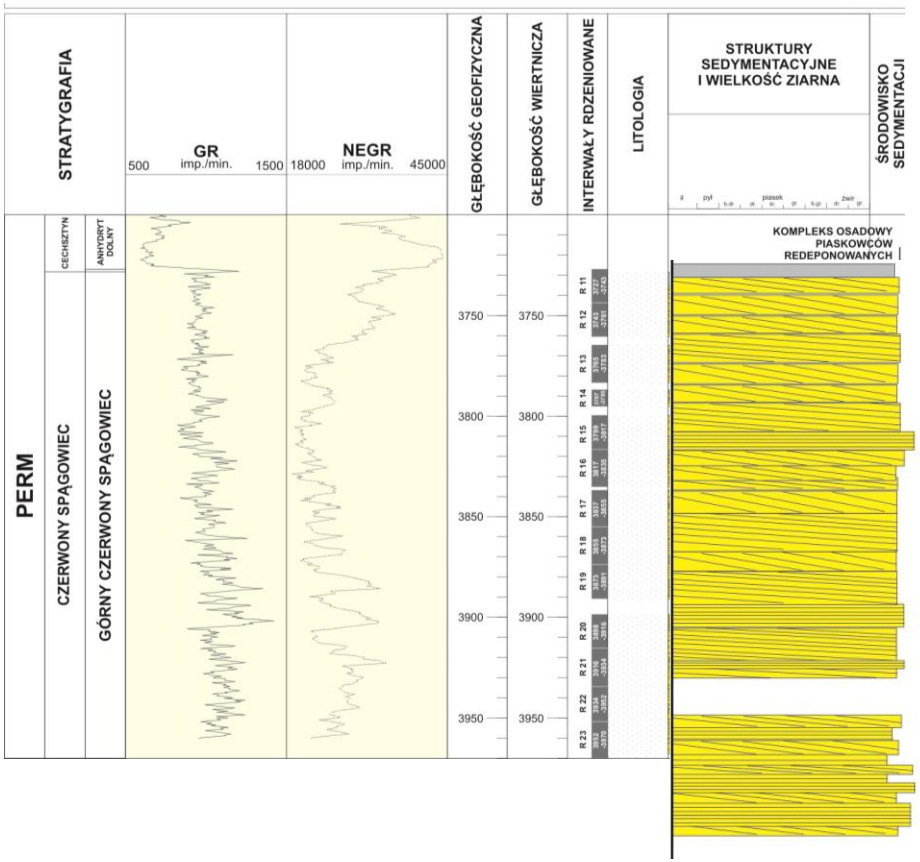
Petrophysical analysis

Classification of sandstone – Pettijohn's triangle

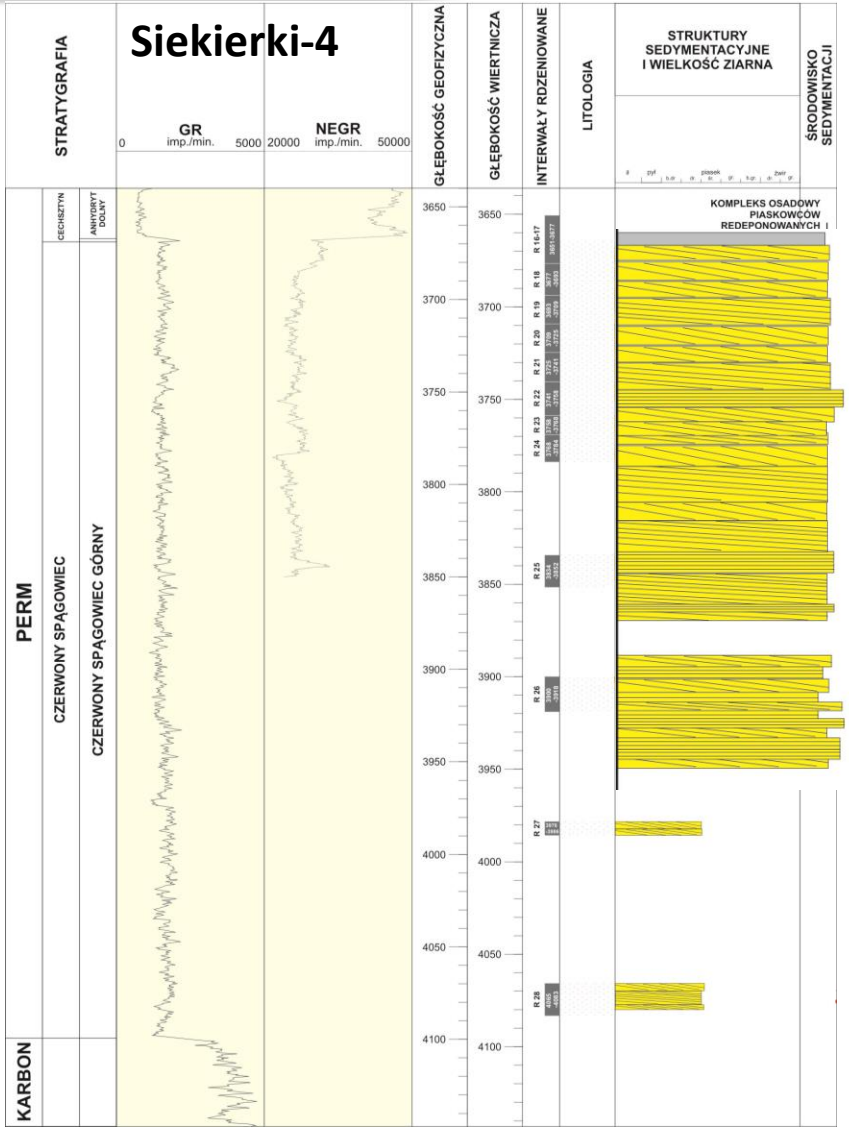


Sedimentology

Pławce-1



Siekierki-4

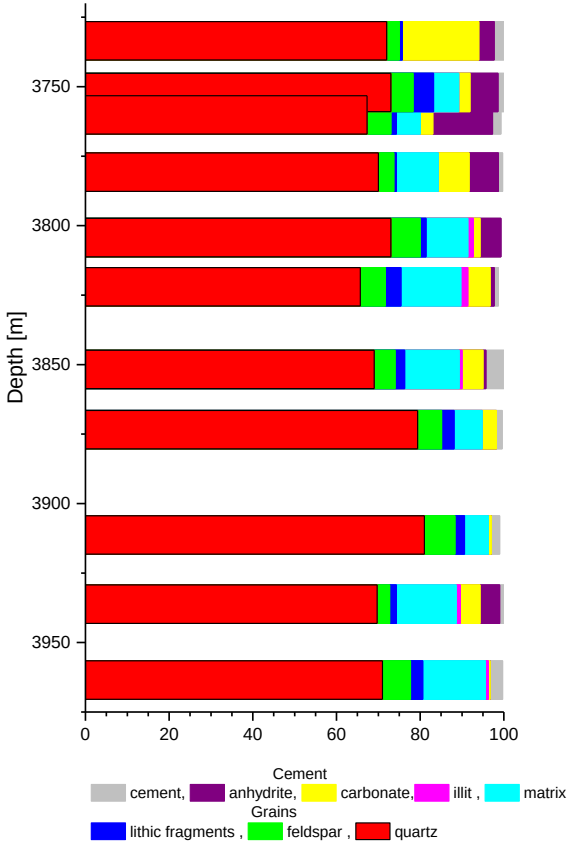


Sedymentological profile A. Buniak 2009

Sedimentology

Mineral composition

Pławce-1



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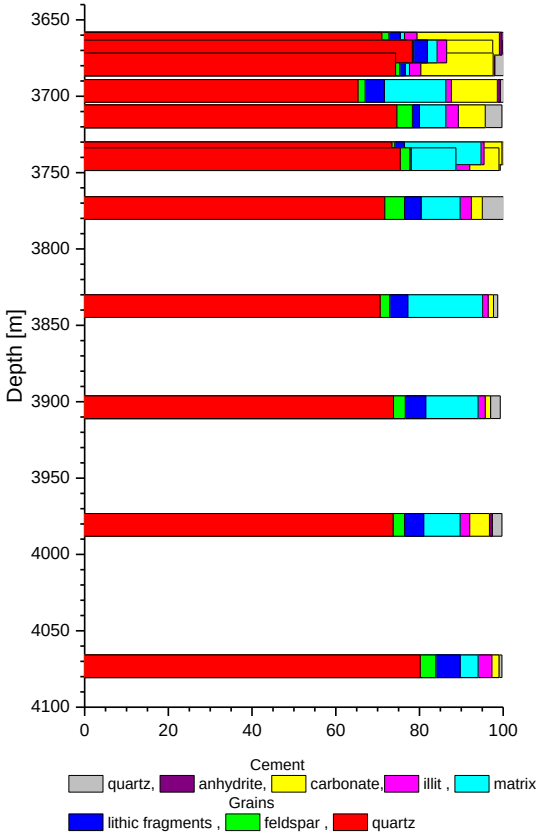
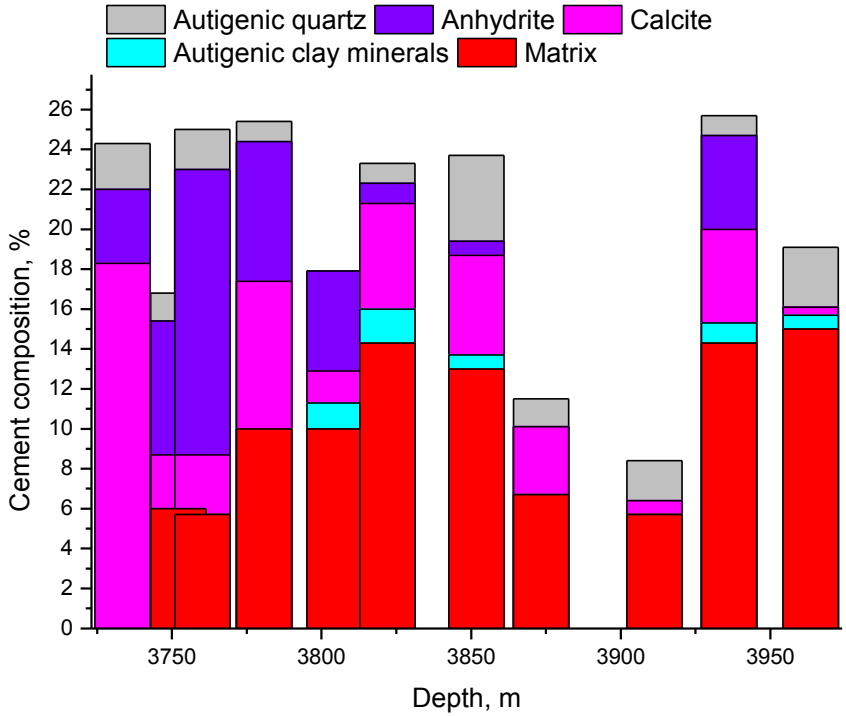


Cement composition

Pławce-1



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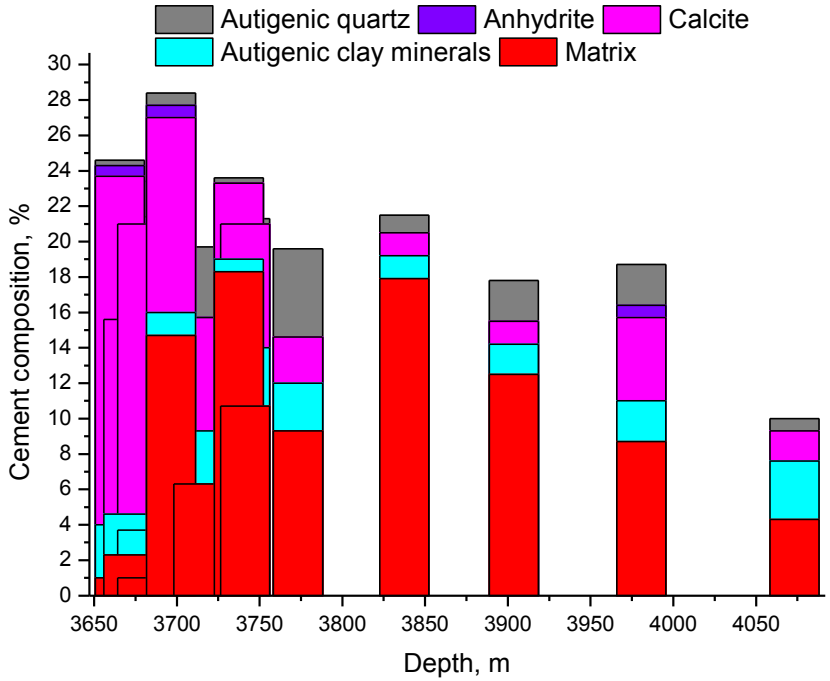


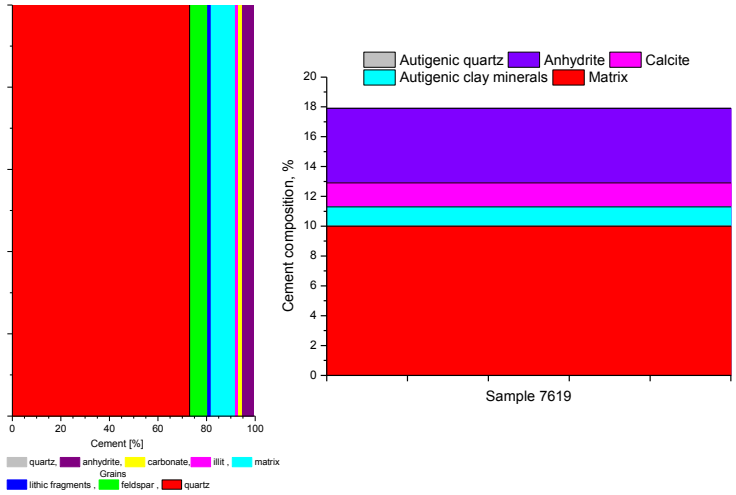
Selected samples

7619
3804.30
PŁAWCE-1

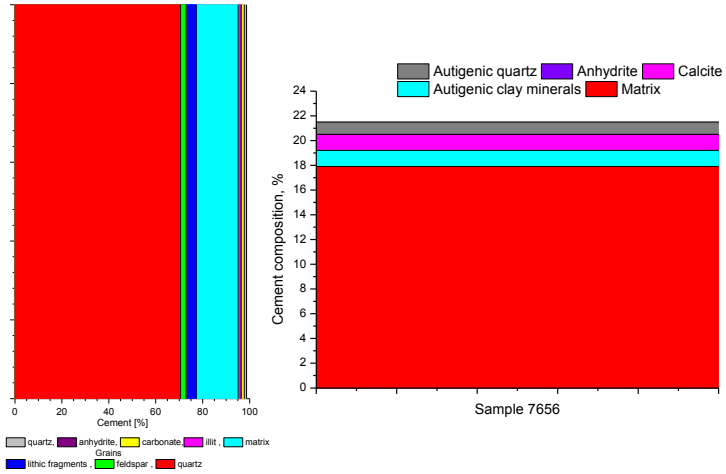
Similar porosity
Different permeability

7656
3837.40
SIEKIERKI-4

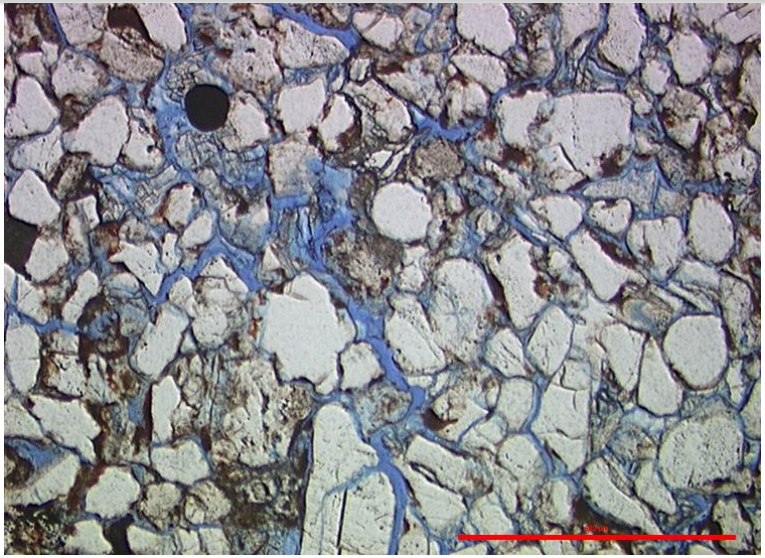
Porosity 8.36 %
Permeability 15.98 mD



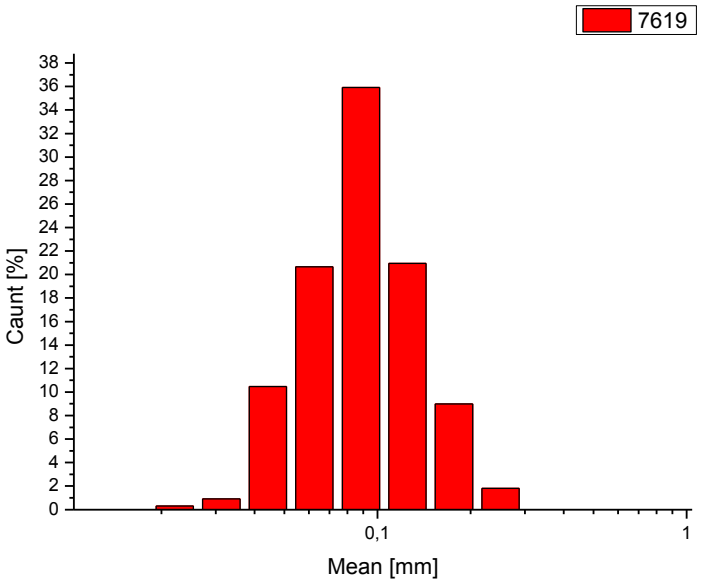
Porosity 8.32 %
Permeability 4.61 mD

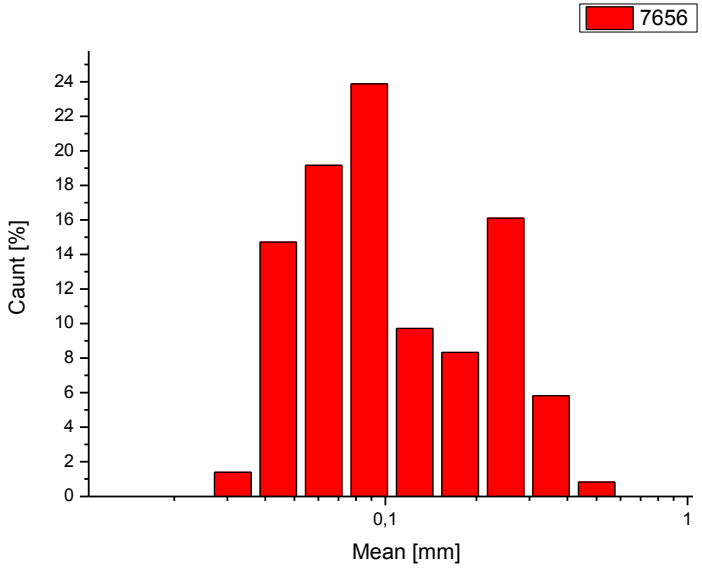


Thin section and grain size distribution

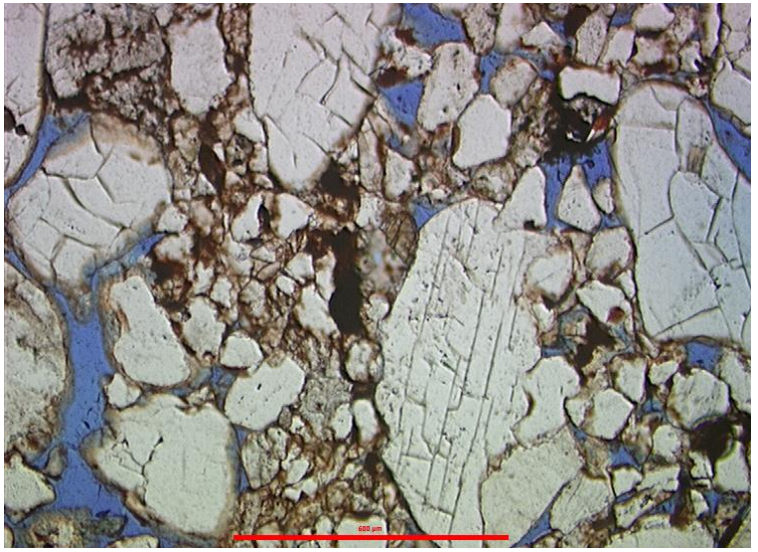


7619
Pławce-1



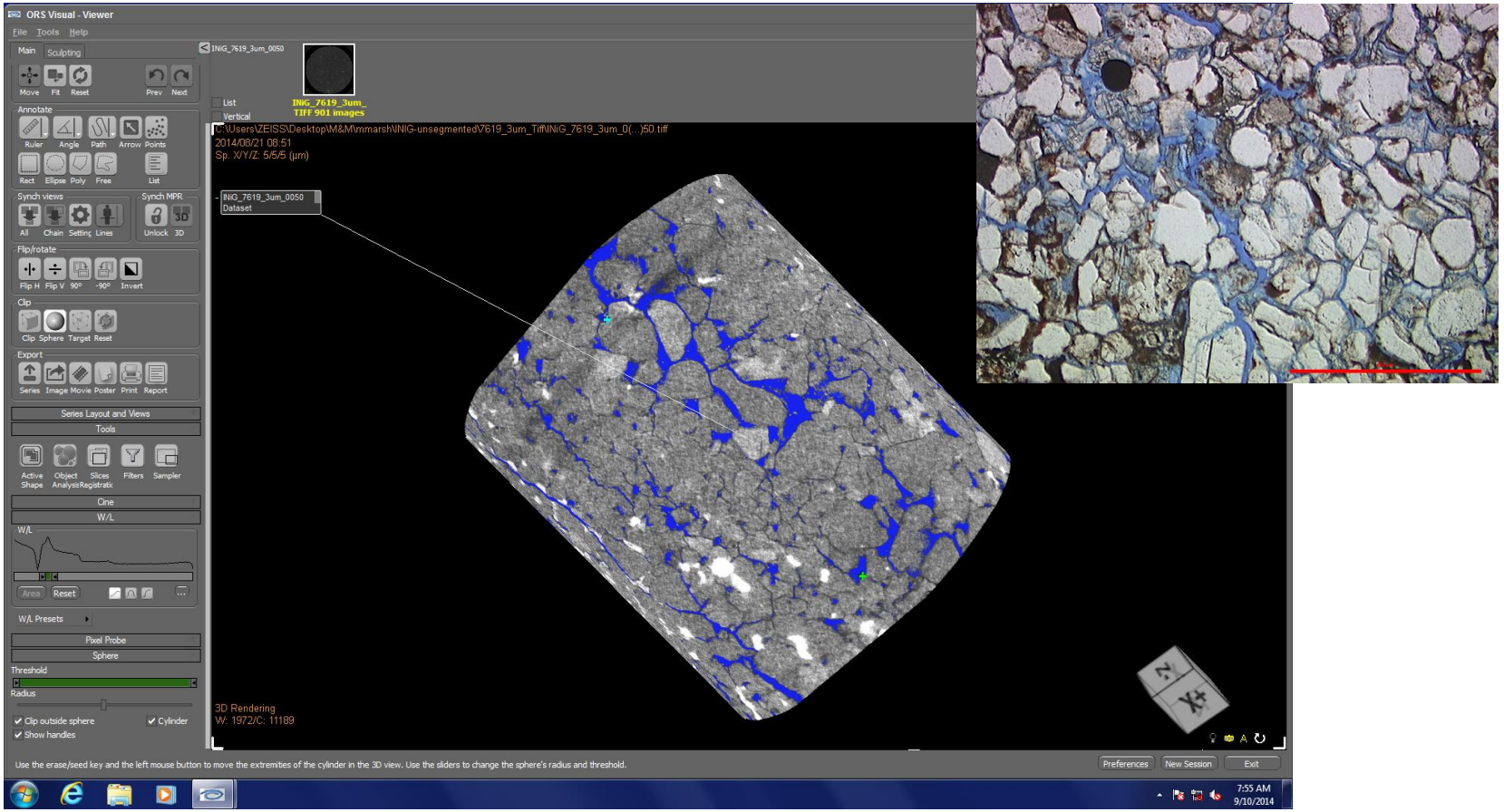


7656
Siekierki-4



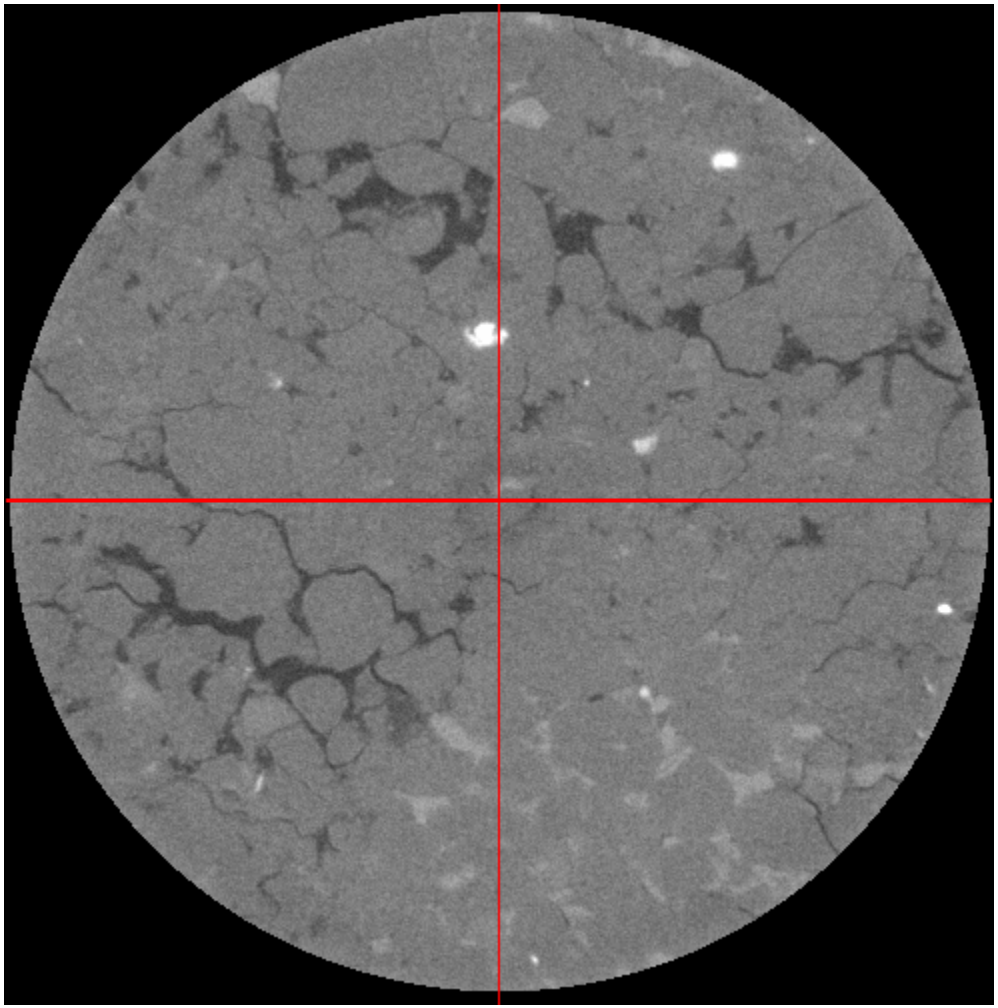
X-ray microscopy

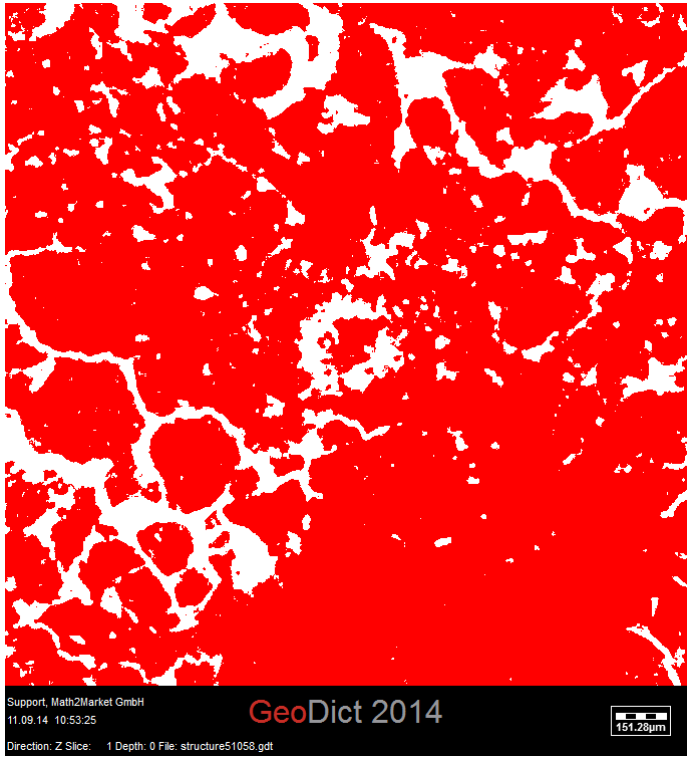
7619 - Pławce-1



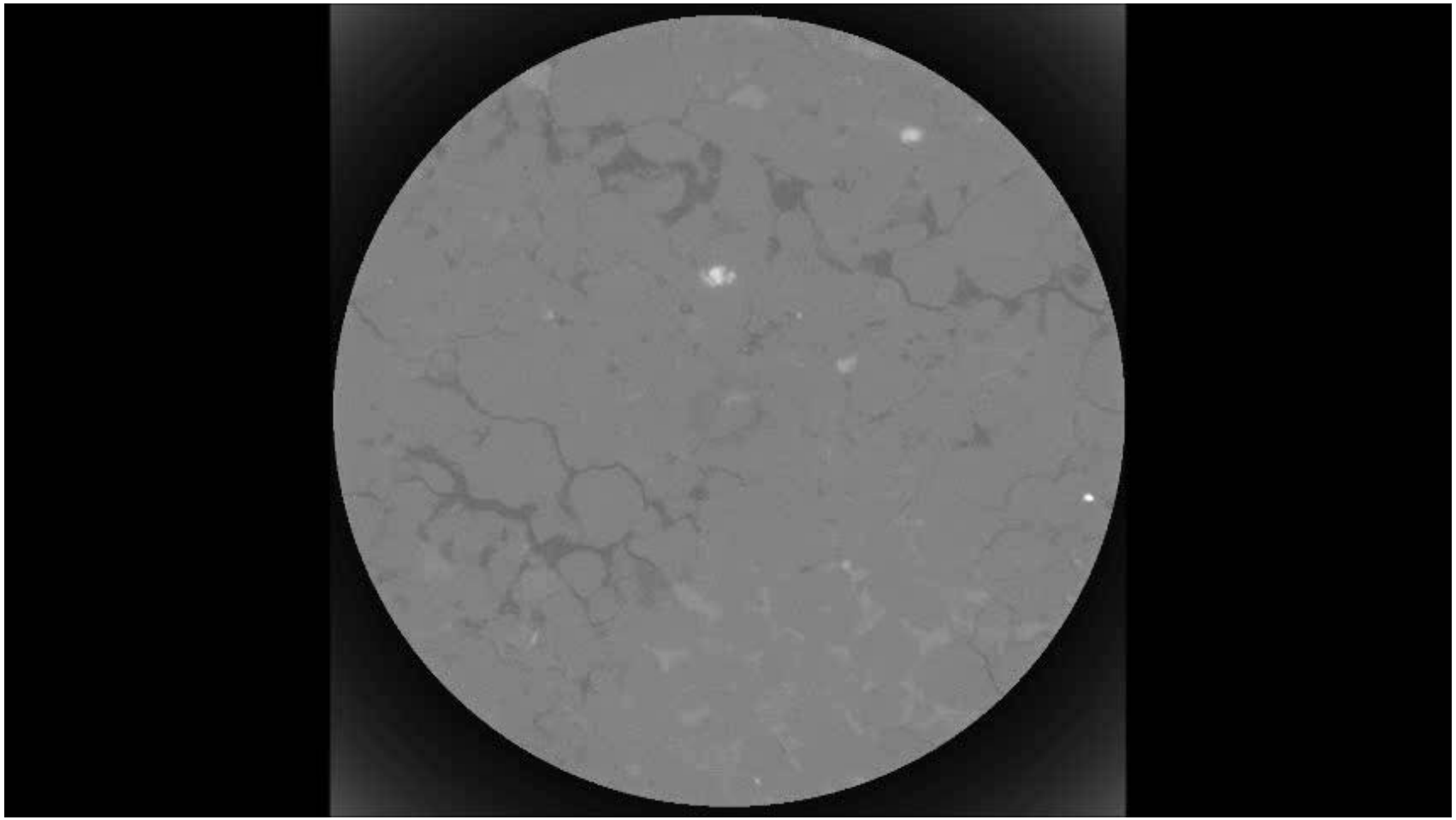
X-ray microscopy

7619 - Pławce-1

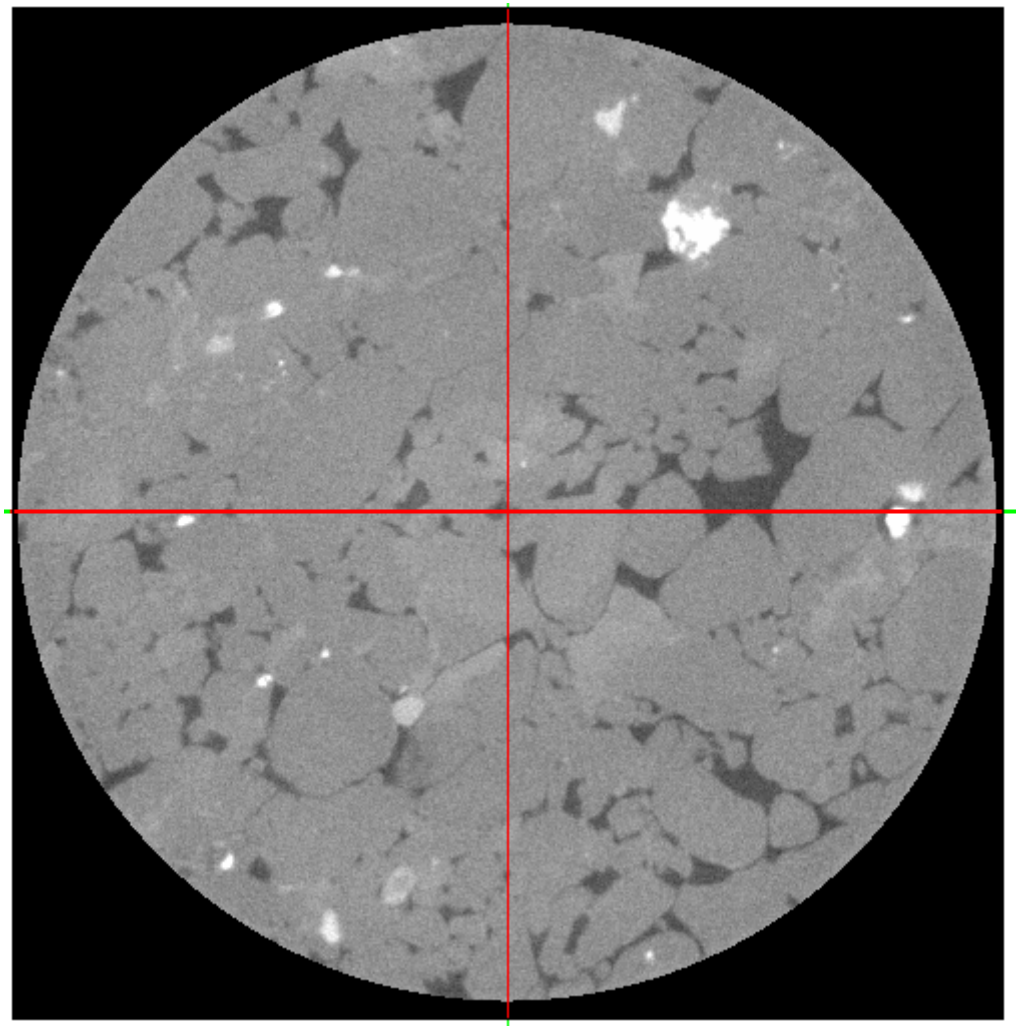


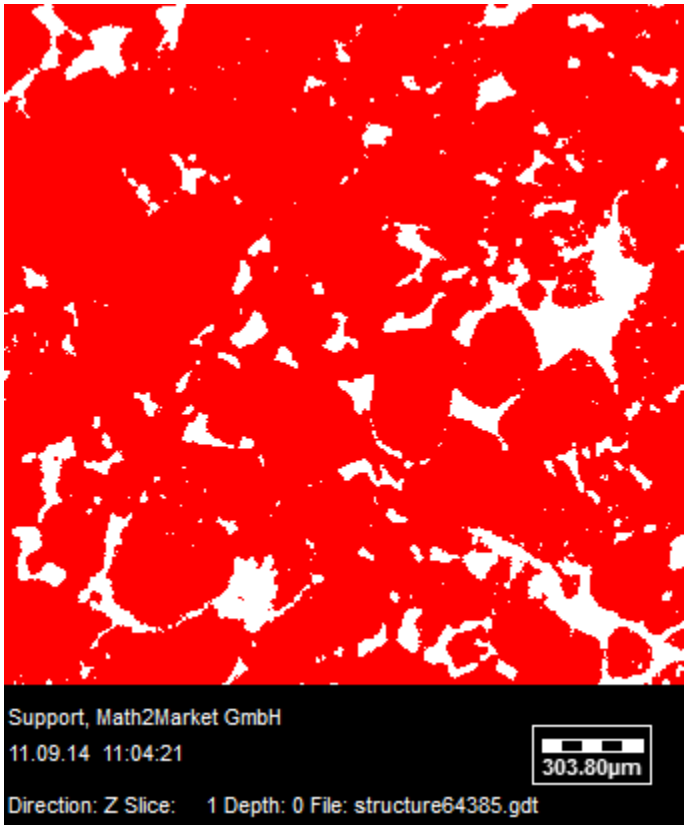


X-ray microscopy

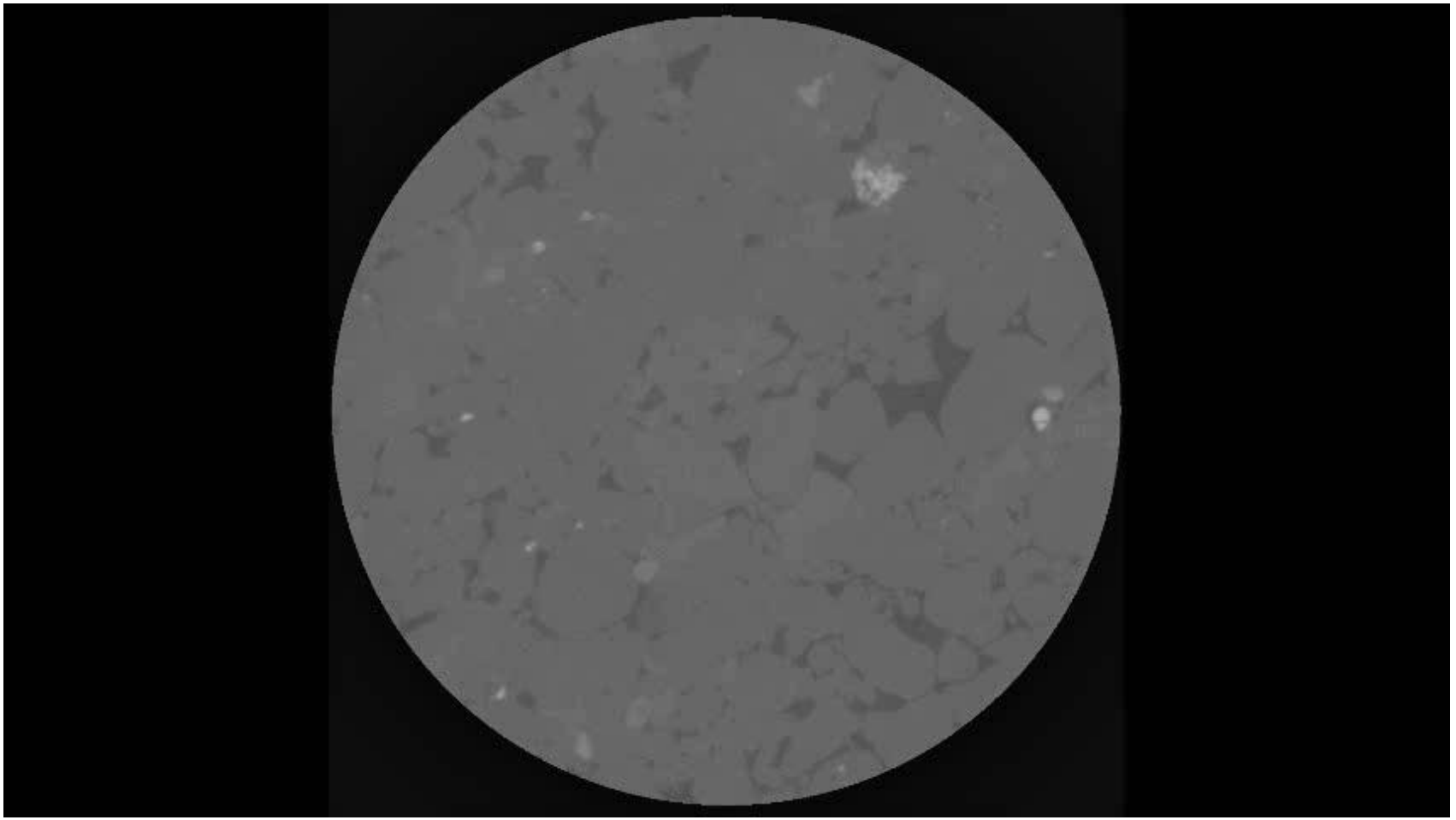


7656 – Siekierki-4

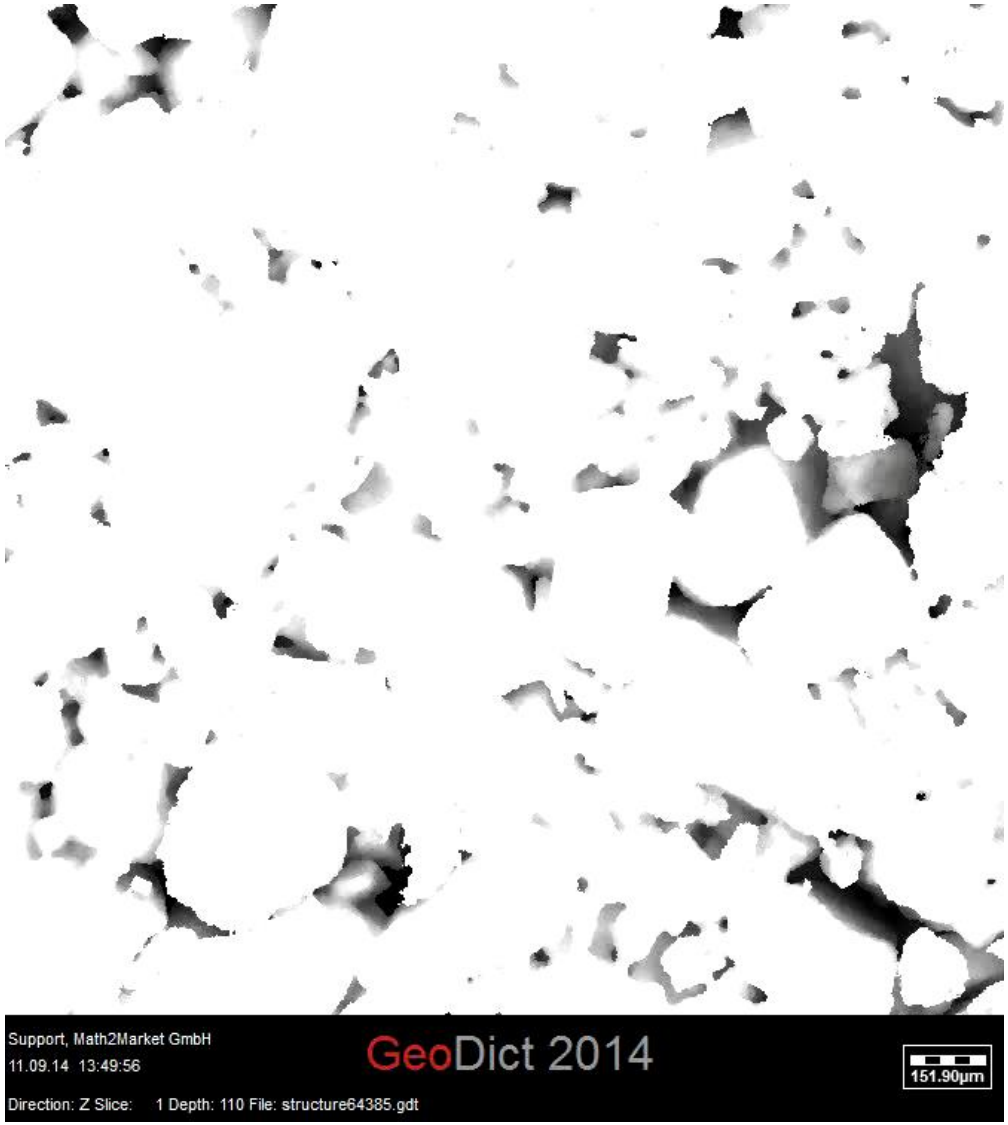




X-ray microscopy

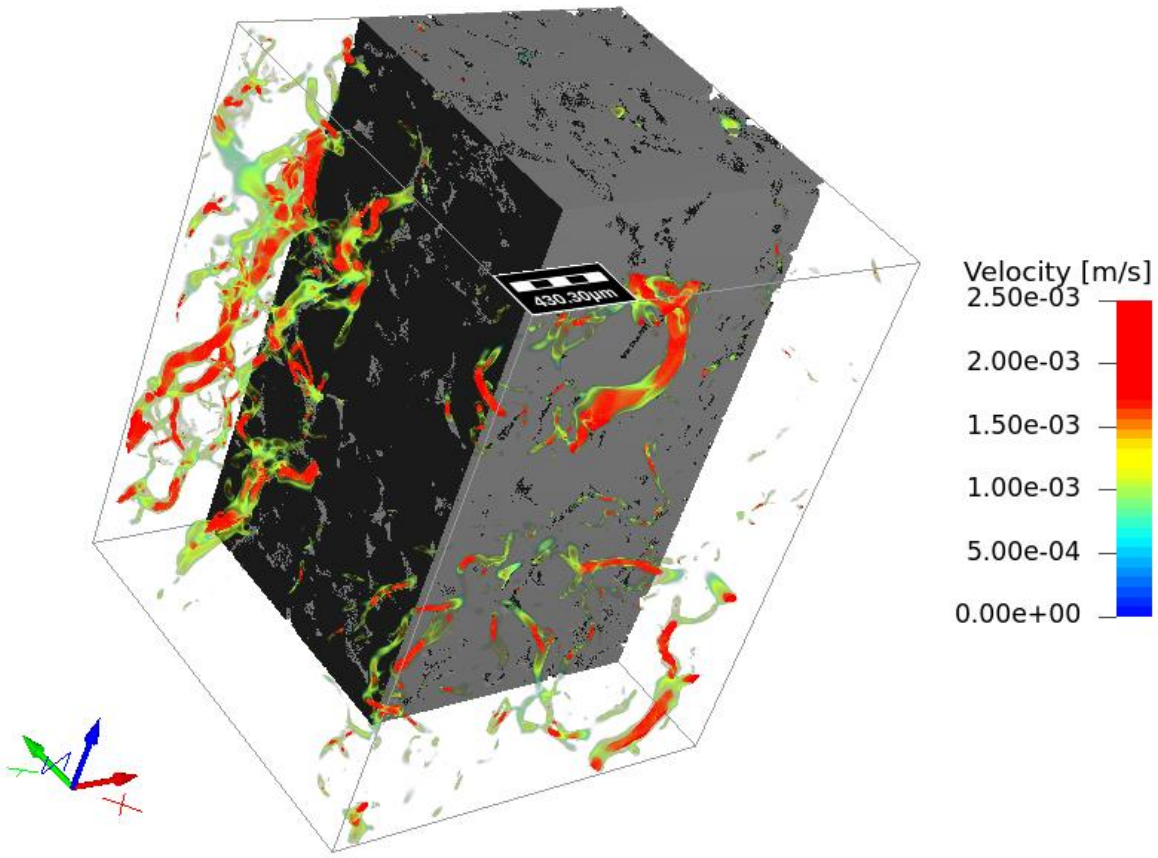


Simulation in GeoDict

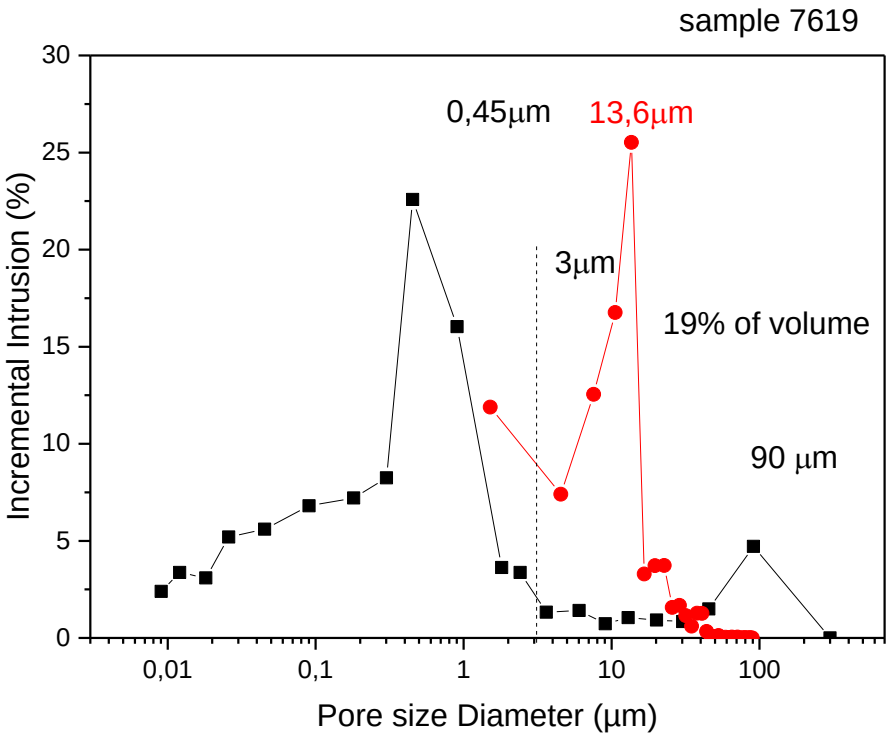


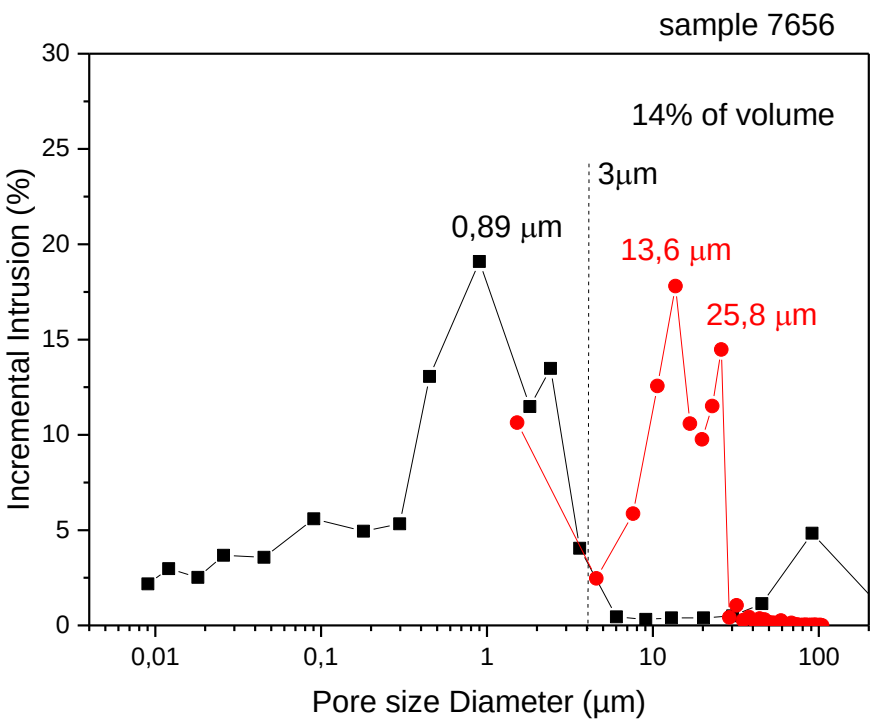
7656
Siekierki-4

Simulation in GeoDict



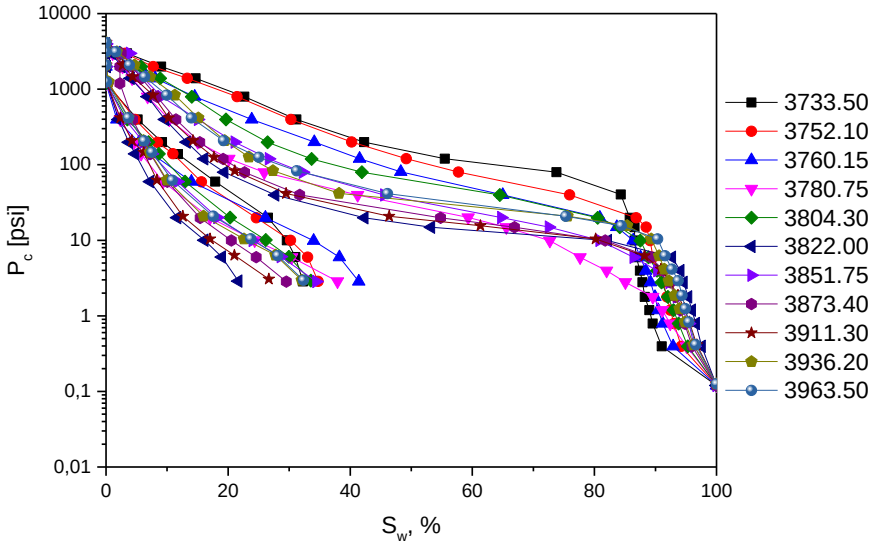
Pore size distribution

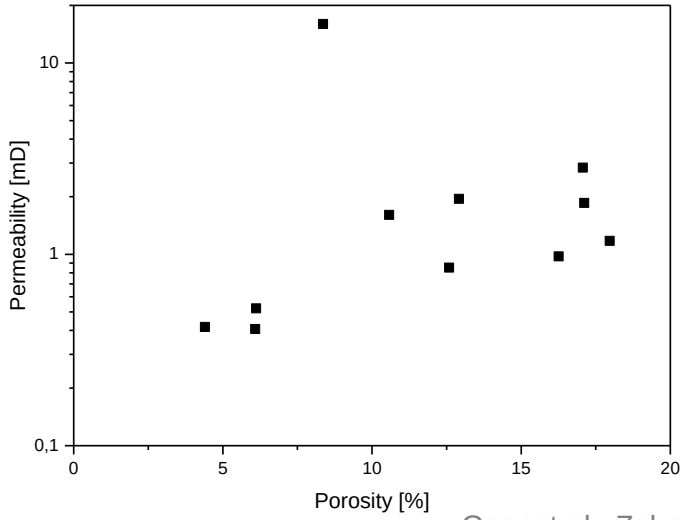




Capillary pressure

Pławce-1





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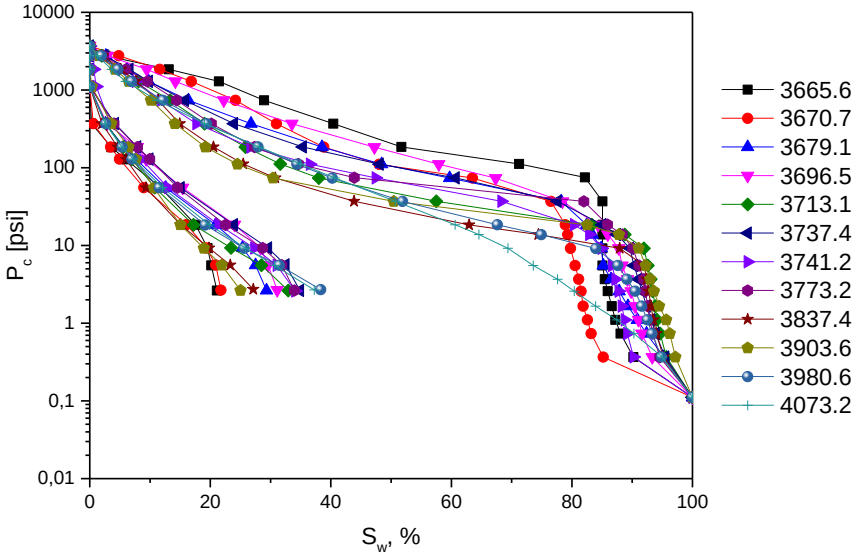
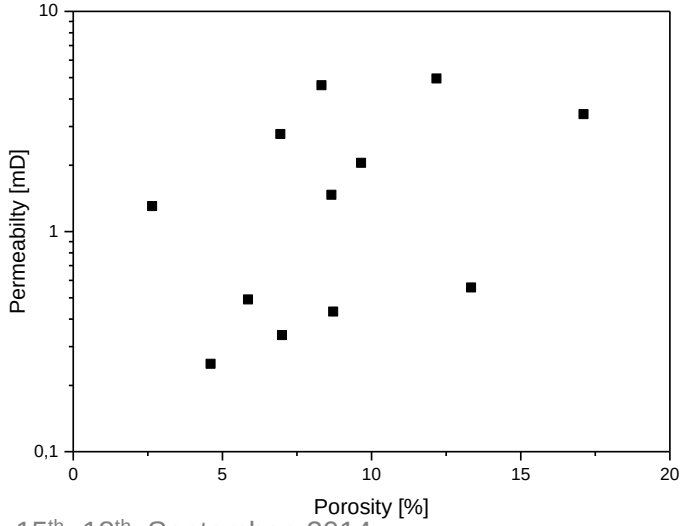
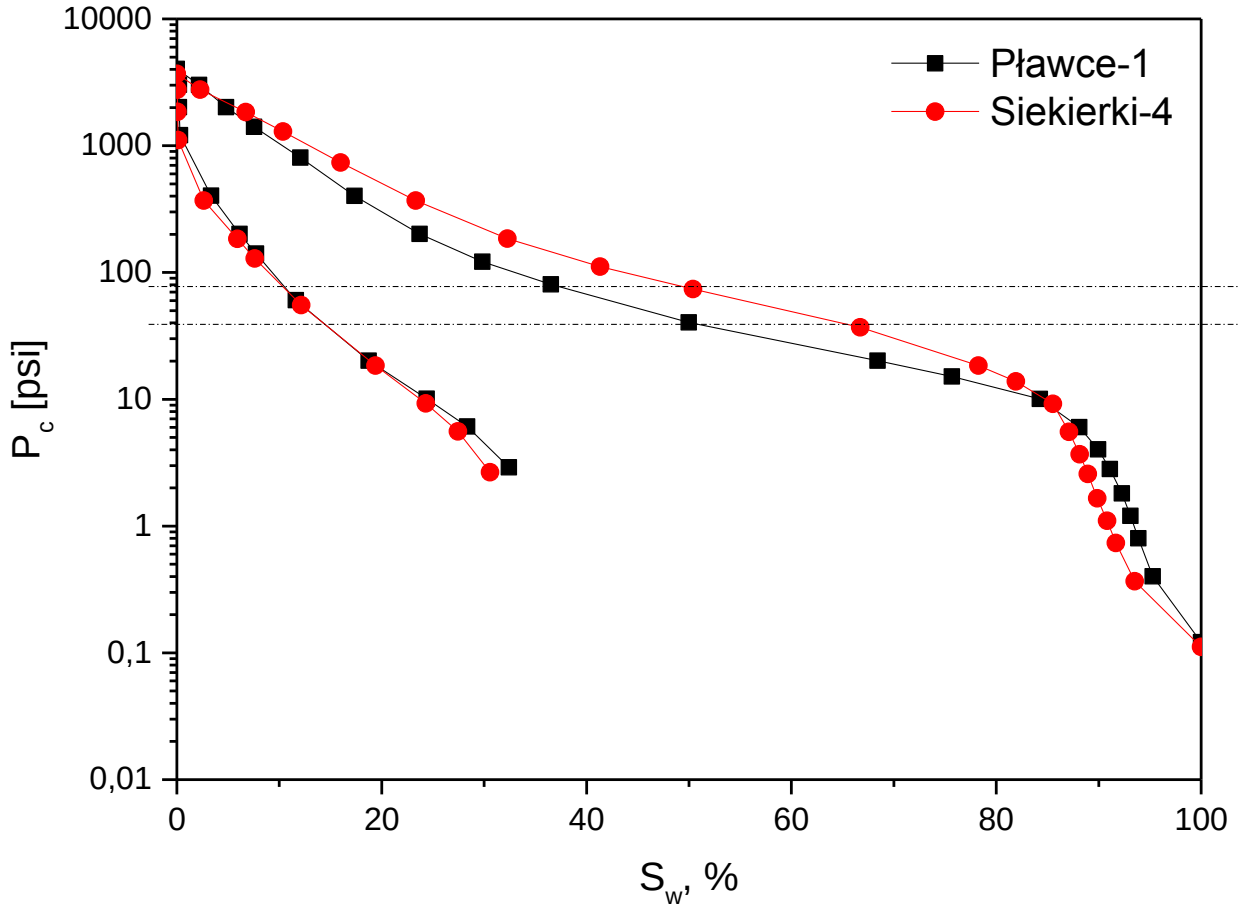
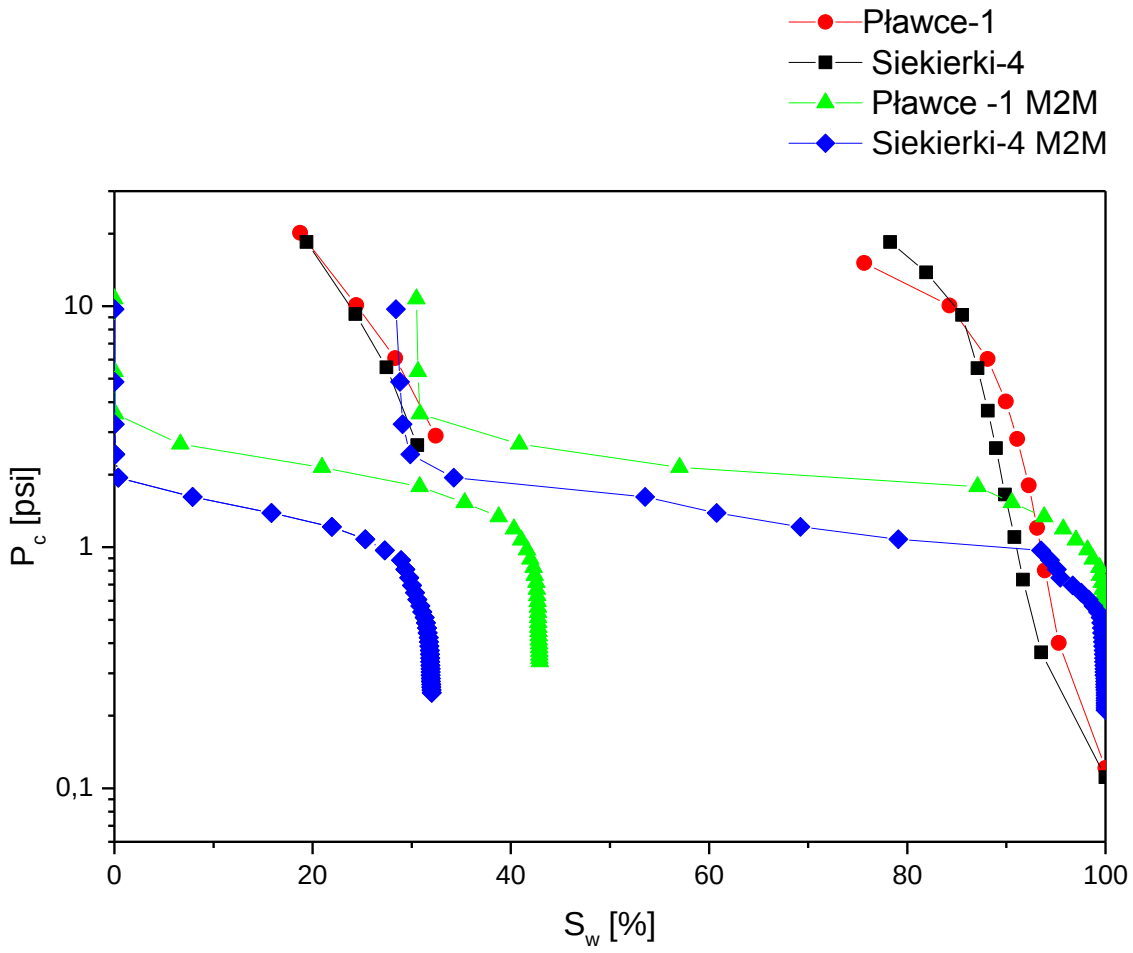




Avarage capillary pressure



Comparision of measured and simulated data



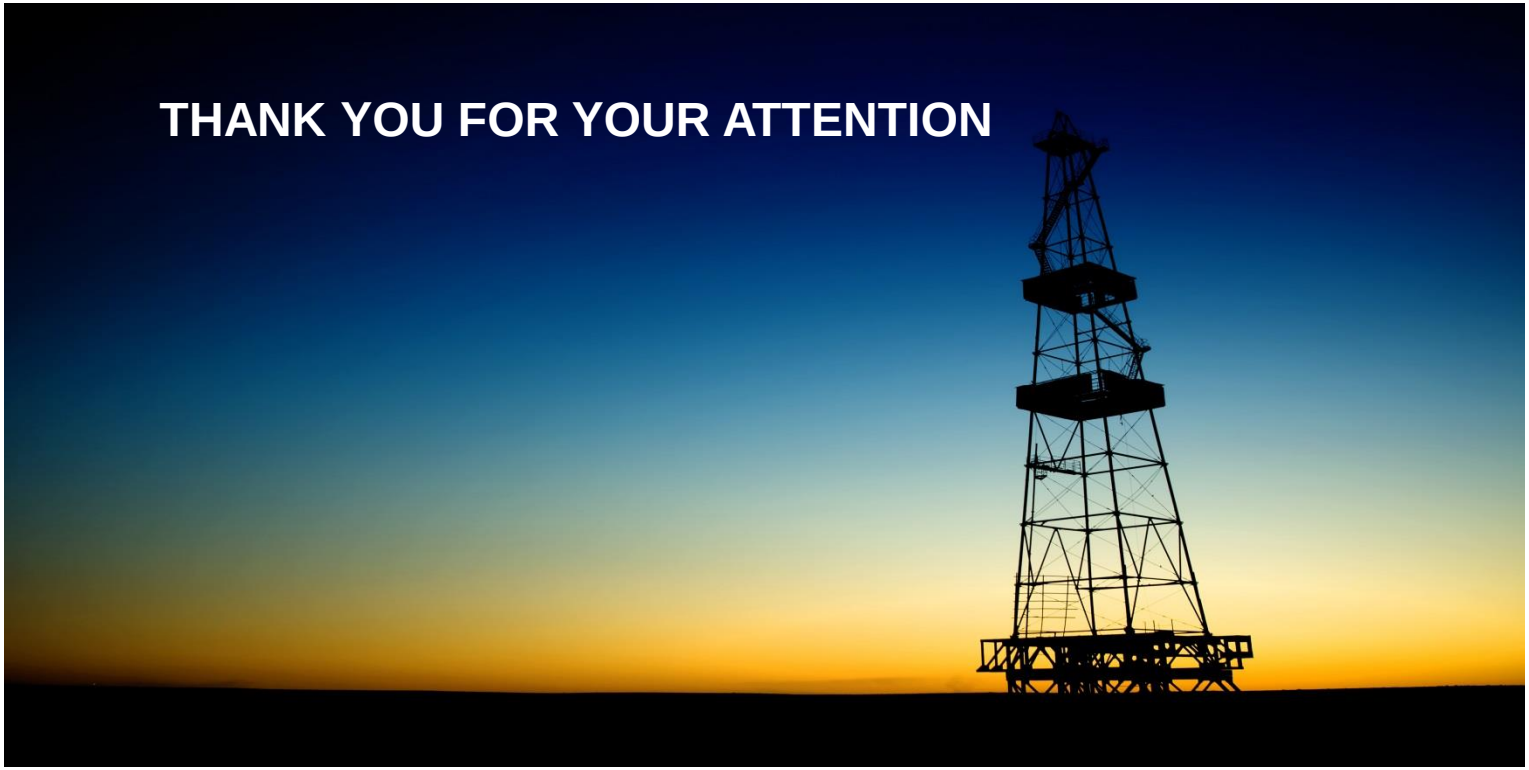
Conclusions

Performed analysis showed variation between porosity and permeability within the plugs from Rotliegend Sandstone.

Characterization of thin beds is hard using conventional methods – they are observed but not measured

X-ray Microscopy can be consider as powerfull tool to examine those regions and can give us detailed information about capillary forces

Based on the capillary pressures estimation we may assume that beds with high permeability will be preferential paths for water


THANK YOU FOR YOUR ATTENTION