

Technical University of Denmark



## Model-based interpretation of tracer tests in fractured limestone and clayey till

**Mosthaf, Klaus; Jørgensen, Peter R.; Thalund-Hansen, Rasmus; Broholm, Mette Martina; Bjerg, Poul Løgstrup; Rolle, Massimo**

*Publication date:*  
2018

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Mosthaf, K., Jørgensen, P. R., Thalund-Hansen, R., Broholm, M. M., Bjerg, P. L., & Rolle, M. (2018). Model-based interpretation of tracer tests in fractured limestone and clayey till. Abstract from InterPore 10th Annual Meeting and Jubilee , New Orleans, United States.

## DTU Library

Technical Information Center of Denmark

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



Contribution ID : 506

Type : Oral 15 Minutes

## Model-based interpretation of tracer tests in fractured limestone and clayey till

*Tuesday, 15 May 2018 16:16 (15)*

The importance of fracture flow and matrix diffusion was investigated in two different fractured geologies: limestone and clayey till. Natural- and forced-gradient tracer tests were designed and conducted to analyze the transport behavior in the two fractured media and to investigate the required model complexity for the simulation of solute transport. A discrete-fracture model was employed to plan and interpret the tracer tests in the two different geologic settings. We present results from:

- 1) A pumping test combined with depth-discrete tracer tests in fractured limestone using fluorescent and ionic tracers with different diffusion properties
- 2) An infiltration tracer test in clayey till using the color tracer brilliant blue to identify the major transport pathways

The pumping and tracer tests and geologic investigations showed that the fractured limestone is highly permeable with fractures dominating the primary solute transport. The conductivity of major fractures has a strong contrast to the limestone matrix. The diffusive interaction between fractures and matrix was revealed by significant tailing in the tracer breakthrough curves at the pumping well. The observed behavior demonstrated the importance of including fracture flow and transport in the modeling of solute transport at fractured limestone sites. The simultaneous injection of multiple tracers with different diffusion properties facilitated the analysis of compound-specific fracture-matrix interactions.

The infiltration tracer test in the clayey till was performed in a large-scale excavation at an agricultural field site to identify the major transport pathways and to assess groundwater vulnerability to pesticides leaching. The tracer experiment revealed low fracture conductivities. Despite many fractures were filled with precipitate and only few of the visible fractures were hydraulically active, they were still major transport pathways for the applied tracer. The infiltration depth and the diffusion length into the matrix were used to infer hydraulic apertures of the fractures. These are compared to the apertures determined in large undisturbed column tests on the same soil material. The infiltration tracer test allowed to identify the hydraulically active fractures. These were incorporated as a 3D fracture network into a 3D model representing these main preferential flow and transport paths as well as the exchange with the clayey till matrix.

### References

### Acceptance of Terms and Conditions

[Click here to agree](#)

**Primary author(s) :** Dr. MOSTHAF, Klaus (Technical University of Denmark)

**Co-author(s)** : Dr. JØRGENSEN, Peter R. (PJ-Bluetech ApS); Mr. THALUND-HANSEN, Rasmus (Technical University of Denmark); Prof. BROHOLM, Mette M. (Technical University of Denmark); Prof. BJERG, Poul L. (Technical University of Denmark); ROLLE, Massimo (Technical University of Denmark)

**Presenter(s)** : Dr. MOSTHAF, Klaus (Technical University of Denmark)

**Session Classification** : Parallel 5-C

**Track Classification** : MS 1.06: Upscaling of mass transfer in fractured porous media