

# Curriculum Vitae

## Dorthe Wildenschild

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### EDUCATION

- **Ph.D., Technical University of Denmark**, Civil and Environmental Engineering (1996)
  - **M.Sc., Technical University of Denmark**, Civil and Environmental Engineering, (1991)
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### EMPLOYMENT

- Feb 2017 -: Oregon State University, College of Engineering, *Associate Dean of Graduate Programs*
  - Aug. 2014 – Feb 2017: Oregon State University, Graduate School, *Associate Dean*
  - Aug. 2014 – Feb 2017: Oregon State University, Office of Postdoctoral Programs, *Director*
  - Sept 2014 - : Oregon State University, School of Chemical, Biological & Environmental Engineering, *Professor*.
  - Sept. 2009 - June 2014: Oregon State University, School of Chemical, Biological & Environmental Engineering, *Associate Professor*.
  - July 2006 - June 2009: Oregon State University, School of Chemical, Biological & Environmental Engineering, *Assistant Professor*.
  - Sept 2002 - 2006: Oregon State University, Department of Geosciences/Department of Civil, Construction & Environmental Engineering. *Assistant Professor*.
  - July 2000 - 2004: Technical University of Denmark, Environment & Resources Department. *Associate Research Professor*.
  - June 1997-June 2000: Lawrence Livermore National Laboratory, Earth and Environmental Sciences, Experimental Geophysics Group. *Postdoctoral Research Staff Member*.
  - July 1996 - May 1997: University of California, Davis, Department of Land, Air and Water Resources. *Postdoctoral Researcher*
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### PUBLICATIONS

#### *Papers in international journals*

- Iltis, G., Y Davit, and D. Wildenschild. 2016. Quantitative analysis of three-dimensional biofilm architecture in porous media using a barium sulfate contrast agent and polychromatic x-ray computed microtomography, *Advances in Water Resources*, submitted.
- Herring, A.L., L Andersson, and **D. Wildenschild**, 2016. Enhancing residual trapping of supercritical CO<sub>2</sub> via cyclic injections, *Geophysical Research Letters*, DOI: 10.1002/2016GL070304.
- Schlueter, S., S. Berg, M. Ruecker, R. T. Armstrong, H.-J. Vogel, R. Hilfer, and **D. Wildenschild**, 2016. Pore-scale displacement mechanisms as a source of hysteresis for two-phase flow in porous media, *Water Resour. Res.*, 52, 2194–2205, doi:10.1002/2015WR018254.
- Herring, A.L., A.P. Sheppard, L. Andersson, and **D. Wildenschild**, 2016. Impact of Wettability Alteration on 3D Nonwetting Phase Trapping and Transport, *Intl. J. of Greenhouse Gas Control*, 10.1016/j.ijggc.2015.12.026.
- Peszynska, M., A. Trykozko, G. Iltis, , S. Schlueter, and **D. Wildenschild**. 2015. Biofilm growth in porous media: Experiments, computational modeling at the porescale, and upscaling, *Advances in Water Resources*, doi:10.1016/j.advwatres.2015.07.008.
- Kimbrel, E.J., A.L. Herring, R.T. Armstrong, I. Lunati, B.K. Bay, and **D. Wildenschild**, 2015. On the Optimization of Capillary Trapping during Geologic CO<sub>2</sub> Sequestration. *Intl. J. of Greenhouse Gas Control*, 07/2015; 42:1-15. doi:10.1016/j.ijggc.2015.07.011
- Armstrong, R., **D. Wildenschild** and B.K. Bay, 2015. The effect of pore morphology on microbial enhanced oil recovery, *Journal of Petroleum Science and Engineering*, Vol 130, June 2015, 16–25. doi:10.1016/j.petrol.2015.03.010
- Herring, A.L., L. Andersson, S. Schlüter, A.P. Sheppard, and **D. Wildenschild**, 2015. Efficiently Engineering Pore-Scale Processes: The Role of Force Dominance and Topology during Nonwetting Phase Trapping in Porous Media, *Advances in Water Resources*, 79, 91–102 (2015), doi: <http://dx.doi.org/10.1016/j.advwatres.2015.02.005>

- Katuwal, S., T. Nørgaard, P. Moldrup, M. Lamandé, **D. Wildenschild**, and L.W. de Jonge, 2014. Linking air and water transport in intact soils to macro-porosity by combining laboratory measurements and X-ray Computed Tomography, accepted, *Geoderma*.
- Schlueter, S., A. Sheppard, K. Brown, and **D. Wildenschild**, 2014. Image processing of multiphase images obtained via X-ray microtomography: A review, *Water Resour. Res.*, 50, doi:10.1002/2014WR015256
- Herring, A.L., L. Andersson, D. Newell, J.W. Carey, and **D. Wildenschild**, 2014. Pore-scale observations of supercritical CO<sub>2</sub> drainage in Bentheimer sandstone by synchrotron x-ray imaging. *Intl. J. of Greenhouse Gas Control*, 25 (2014) 93–101.
- Brown, K.I., A.P. Sheppard, and **D. Wildenschild**, 2014. On the challenges of measuring interfacial characteristics of three-phase fluid flow with x-ray microtomography. *J. of Microscopy*. doi: 10.1111/jmi.12106
- Naveed, M., P. Moldrup, H.J. Vogel, M. Lamandé, **D. Wildenschild**, M. Tuller, and L.W. de Jonge. 2013. Application of Physical Characterization and X-Ray Computed Tomography to Evaluate the Impact of Long-Term Fertilization Practice on Soil Structure Evolution. *Geoderma*, 01/2014; vol 217–218, p. 181–189.
- Lamandé, M., **D. Wildenschild**, F. E. Berriso, A. Garbout, M. Marsh, P. Moldrup, T. Keller, S. B. Hansen, L.W. de Jonge, and P. Schjønning, 2013. X-ray CT and laboratory measurements on glacial till subsoil cores – assessment of inherent and compaction-affected soil structure characteristics. *Soil Science*, July 2013 - Volume 178(7), p. 359–368, doi: 10.1097/SS.0b013e3182a79e1a,
- Herring, A.L., E.J. Harper, L. Andersson, A.P. Sheppard, B.K. Bay, and **D. Wildenschild**, 2013. Effect of Fluid Topology on Residual Nonwetting Phase Trapping: Implications for CO<sub>2</sub> Sequestration. *Advances in Water Resources*, <http://dx.doi.org/10.1016/j.advwatres.2013.09.015>.
- Joekar-Niasar, V., F. Doster, R.T. Armstrong, **D. Wildenschild**, and M.A. Celia, 2013, Trapping and hysteresis in two-phase flow in porous media, *Water Resources Research*, 49, 1–13, doi:10.1002/wrcr.2031.
- Naveed, M., S. Hamamoto, K. Kawamoto, T. Sakaki, M. Takahashi, T. Komatsu, P. Moldrup, M. Lamandé, **D. Wildenschild**, M. Prodanović and L.W. de Jonge, 2013, Correlating Gas Transport Parameters and X-ray Computed Tomography Measurements in Porous Media, *Soil Science*. February 2013, 178(2), 60–68, doi: 10.1097/SS.0b013e318288784c.
- Naveed, M., P. Moldrup, E. Arthur, **D. Wildenschild**, M. Eden, M. Lamandé, H.-J. Vogel, and L.W. de Jonge, 2013. Revealing Soil Structure and Functional Macroporosity along a Clay Gradient Using X-ray Computed Tomography, *Soil Science Society of America Journal*. 77, p. 403–411, doi:10.2136/sssaj2012.0134.
- Wildenschild, D** and A.P. Sheppard, 2013. X-ray imaging and analysis techniques for quantifying pore-scale structure and processes in subsurface porous medium systems. Invited review paper for 35<sup>th</sup> issue of *Advances in Water Resources*, 51, 217–246. <http://dx.doi.org/10.1016/j.advwatres.2012.07.018>.
- Armstrong, R.T. and **D. Wildenschild**, 2012. Investigating the mechanisms of microbial enhanced oil recovery, *Journal of Petroleum Science and Engineering*, Volumes 94–95, Sept. 2012, p. 155–163, <http://dx.doi.org/10.1016/j.petrol.2012.06.031>.
- Armstrong, R.T., M.L. Porter and **D. Wildenschild**, 2012. Linking Pore-Scale Interfacial Curvature to Column-Scale Capillary Pressure, *Advances in Water Resources*, 46, 55-62, <http://dx.doi.org/10.1016/j.advwatres.2012.05.009>.
- Kulkarni, R., M. Tuller, W. Fink, and **D. Wildenschild**. 2012. Three-dimensional multiphase segmentation of x-ray CT data of porous materials using a Bayesian Markov random field framework. *Vadose Zone Journal*, 11. doi:10.2136/vzj2011.0082.
- de Jonge, L.W., P. Moldrup, A.L. Vendelboe, M. Tuller, and **D. Wildenschild**, 2012. Soil Architecture and Physicochemical Functions: An Introduction. doi: 10.2136/vzj2011.0185 *Vadose Zone Journal*, February 2012 v. 11 no. 1 vzj2011.0185.
- Armstrong, R.T. and **D. Wildenschild**, 2012. Microbial Enhanced Oil Recovery in Fractional-Wet Systems: A Pore-Scale Investigation, *Transport in Porous Media*, 92(3), 819-835. DOI 10.1007/s11242-011-9934-3.
- Armstrong, R.T. and **D. Wildenschild**, 2011. Decoupling the Mechanisms of Microbial Enhanced Oil Recovery, SPE146714, paper prepared for the SPE Annual Technical Conference and Exhibition held in Denver, CO, Oct30, Nov 2., 2011.
- Jansik, D.P., **D. Wildenschild** and N.D. Rosenberg, 2011. Flow Processes in the Dry Regime: The Effect on Capillary Barrier Performance. *Vadose Zone Journal*, 10, 1162-1172.
- Wildenschild, D.**, R.T. Armstrong, A.L. Herring, I.M. Young, and J.W. Carey, 2011. Exploring capillary trapping efficiency as a function of interfacial tension, viscosity, and flow rate, *Energy Procedia* 4, 4945-4952.
- Iltis, G., Armstrong, R.T., D.P. Jansik, B.D. Wood, and **D. Wildenschild**, 2011. Imaging Biofilm Architecture within Porous Media using Synchrotron based X-Ray Computed Microtomography. *Water Resour. Res.*, 47, W02601, doi:10.1029/2010WR009410.
- Porter, M. L., **D. Wildenschild**, G. Grant, and J. I. Gerhard (2010), Measurement and prediction of the relationship between capillary pressure, saturation, and interfacial area in a NAPL-water-glass bead system, *Water Resour. Res.*, 46, W08512, doi:10.1029/2009WR007786.

- Davit, Y., G. Iltis, G. Debenesta, S. Veran-Tissoiresa, **D. Wildenschild**, M. Gerinoc, M. Quintard, 2010. Imaging biofilms in porous media using X-ray computed microtomography, *Journal of Microscopy*, DOI: 10.1111/j.1365-2818.2010.03432.x.
- Joekar-Niasar, V., M. Prodanovic, **D. Wildenschild**, and S. M. Hassanizadeh, 2010. Network Model Investigation of Interfacial Area, Capillary Pressure and Saturation Relationships in Granular Porous Media, *Water Resources Research*, 46, W06526, doi:10.1029/2009WR008585.
- Porter, M.L., M.G. Schaap, and **D. Wildenschild**, 2009. Comparison of Interfacial Area Estimates for Multiphase Flow Through Porous Media Using Computed Microtomography and Lattice-Boltzmann Simulations. doi:10.1016/j.advwatres.2009.08.009, *Advances in Water Resources*.
- Porter, M.L. and **D. Wildenschild**, 2009. Validation of an image analysis method for computed microtomography image data of multiphase flow in porous systems. *Journal of Computational Geosciences*. doi:10.1007/s10596-009-9130-5
- Schaap, M.G., M.L. Porter, B.S.B. Christensen, **D. Wildenschild**. 2007. Comparison of pressure-saturation characteristics derived from computed tomography and Lattice Boltzmann simulations, *Water Resour. Res.*, 43, W12S06, doi:10.1029/2006WR005730.
- Culligan, K.A., **D. Wildenschild**, B.S.B. Christensen, W.G. Gray, and M.L. Rivers, 2006. Pore-scale Characteristics of Multiphase Flow in Porous Media: a Synchrotron-based CMT Comparison of Air-Water and Oil-Water Experiments. *Advances in Water Resources*, 29(2), 227-238.
- Wildenschild, D.**, J.W. Hopmans, A.J.R. Kent, M.L. Rivers, 2005. A Quantitative Study of Flow-Rate Dependent Processes Using X-ray Microtomography. *Vadose Zone Journal*, 4, 112-126.
- Wildenschild, D.**, K.A. Culligan, B.S.B. Christensen, 2004. Application of x-ray microtomography to environmental fluid flow problems. in *Developments in X-Ray Tomography IV*, ed. U. Bonse, Proc. of SPIE Vol. 5535 (SPIE, Bellingham, WA, 2004), 432-441.
- Culligan, K.A., **D. Wildenschild**, B.S.B. Christensen, W.G. Gray, M.L. Rivers, and A.F.B. Tompson, 2004. Interfacial Area Measurements for Unsaturated Flow Through a Porous Medium. *Water Resources Research*, 40(12), Art. No. W12413 (p.1-12).
- Roberts, J.J. and **D. Wildenschild**, 2004. Electrical Properties of Sand-Clay Mixtures Containing Trichloroethylene and Ethanol. *Journal of Environmental & Engineering Geophysics*, 9(1), March 2004, 1-10.
- Cherepy, N. and **D. Wildenschild**, 2003. Electrolyte management for effective long-term electro-osmotic transport of volatile organics through low-permeability soils. *Environmental Science and Technology*, 37, 3024-3030.
- Wildenschild, D.**, J.W. Hopmans, C.M.P. Vaz, M.L. Rivers, and D. Rikard, 2002. Using x-ray computed tomography in hydrology: Systems, resolutions, and limitations. *Journal of Hydrology*, 267(3-4), 285-297.
- Vaz, C.M.P., J.W. Hopmans, A. Macedo, L.H. Basso, and **D. Wildenschild**, 2002. Soil Water Retention Measurements Using a Combined Tensiometer-Coiled TDR Probe, *Soil Sci. Soc. of Am. J.*, 66(6), 1752-1760.
- Wildenschild, D.**, J.W. Hopmans, and J. Simunek, 2001. Flow rate dependence of soil hydraulic characteristics. *Soil Sci. Soc. Am. J.*, 65(1), 35-48.
- Wildenschild, D.** and J.J. Roberts, 2001. Experimental Tests of Enhancement of Vapor Diffusion in Topopah Spring Tuff. *Journal of Porous Media*, 4(1), 1-13.
- Wildenschild, D.**, J.J. Roberts, and E.D. Carlberg, 2000. On the Relationship Between Microstructure and Electrical and Hydraulic Properties of Sand-Clay Mixtures. *Geophysical Research Letters*, 27(19), 3085-3088.
- Wildenschild, D.** and K.H. Jensen, 1999. Laboratory investigations of effective flow behavior in unsaturated heterogeneous sands. *Water Resources Research*, 35(1), 17-29.
- Wildenschild, D.** and K.H. Jensen, 1999. Numerical modeling of observed effective flow behavior in unsaturated heterogeneous sands. *Water Resources Research*, 35(1), 29-42.
- Wildenschild, D.**, K. H. Jensen, K.J. Hollenbeck, T.H. Illangasekare, D. Znidarcic, T. Sonnenborg and M.B. Butts, 1997. A two-stage procedure for determining unsaturated hydraulic characteristics using a syringe pump and outflow observations. *Soil Sci. Soc. Am. J.*, 61(2), 347-359.
- Wildenschild, D.**, K.H. Jensen and T. H. Illangasekare, 1994. A laboratory analysis of the effect of macropores on solute transport. *Ground Water*, May-June 1994, 32(3), 381-389.

#### *In preparation*

- Iltis, G.C., S. Schlueter, B.D. Wood, and **D. Wildenschild**, 2015. Resolving the influence of flow rate on biofilm growth in three dimensions using microimaging. To be submitted to PNAS.
- Brown, K.I., **D. Wildenschild**, W.G. Gray, C.T. Miller, 2015. On the capillary pressure-saturation-interfacial area relationship for three-phase fluid flow in porous media. To be submitted to *Advances in Water Resources*.
- Harper E.J. and **D. Wildenschild**, 2015. Nonwetting phase Trapping: Relationship between original saturation and residual saturation. To be submitted to *Vadose Zone Hydrology*.

**Wildenschild, D.,** A.P. Sheppard, and M. Prodanovic. 2015. The effect of pore network geometry on fluid-fluid interfacial areas in two-phase flow. To be submitted to *Water Resources Research*.

*Books/ Book Chapters*

**Wildenschild, D.,** M.L. Rivers, M.L. Porter, G.C. Iltis, R.T. Armstrong, and Y. Davit, 2013. Using Synchrotron-based X-ray Microtomography and Functional Contrast Agents in Environmental Applications, Invited book chapter for 2<sup>nd</sup> edition of *Tomography and Imaging of Soil-Water-Root Processes* edited by S.H. Anderson and J.W. Hopmans. CSA Books.

*Recent other publications (Proceedings, Abstracts, Reports, etc. for the last 5 years)*

Andersson, L., T. Li, J-O Helland, and **D. Wildenschild**, 2016, On the Effect of Wettability, Hysteresis, and Spreading Films on Three-Phase Fluid Flow in Porous Media, 8th International Conference on Porous Media, Abstract.

Meisenheimer, D. and **D. Wildenschild**, 2016. Utilizing fast microtomography to quantify the production and evolution of interfacial areas and curvatures of dynamic, two-phase flow experiments in a 3D porous media, 8th International Conference on Porous Media, Abstract.

**D. Wildenschild**, Li, T. S. Schlueter, and M. Dragila. 2016. Curvature Measurement, Nonwetting Phase Trapping and Film Flow in Porous Media, 8th International Conference on Porous Media, Abstract.

Meisenheimer, D., C. Brueck, and **D. Wildenschild**. 2015. 3D quantification of dynamic fluid-fluid interfaces in porous media with fast x-ray microtomography: A comparison with quasi-equilibrium methods. Eos Trans. AGU, Fall Meet. Suppl., Abstract H41D-1342.

Li, T. S. Schlueter, M. Dragila and **D. Wildenschild**. 2015. Curvature Measurement and Tracking of Nonwetting Phase Trapping and Pressure State in Porous Media, Eos Trans. AGU, Fall Meet. Suppl., Abstract H41D-1341.

Andersson, L., S. Schlueter, T. Li, K.I. Brown, J-O. Helland, and **D. Wildenschild**, 2015. Three-Phase Capillary Pressure, Hysteresis and Trapping in a Porous Glass-Bead Column. Eos Trans. AGU, Fall Meet. Suppl., Abstract H41D-1343.

Herring, A.L., L. Andersson, Kimbrel, E.L, A.P Sheppard, and **D. Wildenschild**, 2015. Pore-scale Evaluation of Immiscible Fluid Characteristics and Displacements: Comparison Between Ambient- and Supercritical-Condition Experimental Studies. Eos Trans. AGU, Fall Meet. Suppl., Abstract H41D-1344.

Brueck, C., D. Meisenheimer, and **D. Wildenschild**. 2015. Colloid Transport in Unsaturated Porous Media: 3D Visualization Using Synchrotron X-Ray Microtomography. Eos Trans. AGU, Fall Meet. Suppl., Abstract H21G-1465.

Herring, A.L., L. Andersson, and **D. Wildenschild**, 2014. Pore-scale Evolution of Supercritical CO<sub>2</sub> within Bentheimer Sandstone during Multiple Drainage-Imbibition Cycles. Eos Trans. AGU, Fall Meet. Suppl., Abstract H14C-08.

Iltis, G., Y. Davit, J.M. Connolly, R. Gerlach, B.D. Wood, and **D. Wildenschild**, 2013. The effect of hydraulic loading on bioclogging in porous media: Quantitative results from tomographic imaging, Eos Trans. AGU, Fall Meet. Suppl., Abstract B13A-0454.

**Wildenschild, D.** and G. Iltis, 2013. Imaging Microbial Biofilms in Opaque Three-dimensional Porous Media: Opportunities and Limitations, Eos Trans. AGU, Fall Meet. Suppl., Abstract NS24A-01

Herring, A.L., L. Andersson, D.L. Newell, J.W. Carey, and **D. Wildenschild**, 2013. High Resolution X-ray CMT Imaging of Supercritical CO<sub>2</sub> in Porous Media: Experimental Challenges, Solutions, and Results, Eos Trans. AGU, Fall Meet. Suppl., Abstract H31E-1226

Andersson, L., A.L. Herring, D.L. Newell, J.W. Carey, and **D. Wildenschild**, 2013. High-resolution x-ray tomography imaging of supercritical CO<sub>2</sub>: Investigating capillary trapping under reservoir conditions and addressing wettability alteration, Eos Trans. AGU, Fall Meet. Suppl., Abstract H41P-03.

Verma, R., M. Prodanovic, and **D. Wildenschild**, 2013. Estimating three phase relative permeability based on realistic pore scale configurations, Eos Trans. AGU, Fall Meet. Suppl., Abstract H42D-03.

Schlueter, S., A.P. Sheppard and **D. Wildenschild**, 2013. Recent advances in quantitative analysis of fluid interfaces in multiphase fluid flow measured by synchrotron-based x-ray microtomography, Eos Trans. AGU, Fall Meet. Suppl., Abstract H51L-1362.

Sheppard, A.P., **D. Wildenschild**, L. Andersson, and A.L. Herring, 2013. Pore-scale mechanisms for hysteresis in capillary-dominated drainage and imbibition, Eos Trans. AGU, Fall Meet. Suppl., Abstract H53M-01.

**Wildenschild, D.,** 2013. Understanding the Foundations of Flow and Transport in Porous Media: Insights From Pore-Scale Imaging. Interpore 2013, 5th International Conference on Porous Media & Annual Meeting of the International Society for Porous Media, Prague, Czech Republic, May 21-24, 2013.

Andersson, L., A.L. Herring, G C. Iltis, and **D. Wildenschild**, 2013. Porous medium topology and wettability and related effects on non-wetting phase trapping. Interpore 2013, 5th International Conference on Porous Media & Annual Meeting of the International Society for Porous Media, Prague, Czech Republic, May 21-24, 2013.

- Herring, A.L., A. Sheppard, E.J. Harper, B.K. Bay, and **D. Wildenschild**, 2013. Effect of Fluid Topology on Residual Nonwetting Phase Trapping. *Interpore 2013, 5th International Conference on Porous Media & Annual Meeting of the International Society for Porous Media*, Prague, Czech Republic, May 21-24, 2013.
- Iltis, G., J. Connolly, Y. Davit, R. Gerlach, B.D. Wood, and **D. Wildenschild**, 2012. Pore-scale imaging of biofilm grown under varying flow rates. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract H13E-1395.
- Herring, A.L., **D. Wildenschild**, L. Andersson, A. Sheppard, and W.P. Carey, 2012. Impact of IFT and Viscosity on Morphology of Nonwetting Phase, and Application to Geologic CO<sub>2</sub> Sequestration. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract H21K-03.
- Wildenschild, D.**, E.J. Harper, A.L. Herring, and R.T. Armstrong, 2012. Optimization geological sequestration of CO<sub>2</sub> by capillary trapping mechanisms. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract H21K-05.
- Wildenschild, D.**, K.I. Brown, 2012. Imaging and quantifying three-phase flow in porous media. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract H52C-05.
- Schaap, M.G. and **D. Wildenschild**, 2012.. Evaluation of a Lattice Boltzmann Model with Realistic Equations of State for Capillary Trapping of CO<sub>2</sub> at the Pore-Scale. *Eos Trans. AGU, Fall Meet. Suppl.*, Abstract H53M-02
- Brown, K.I., **D. Wildenschild**, W.G. Gray, C.T. Miller, 2012. Three-phase flow in porous media: on the relationship between capillary pressure, saturation and interfacial area. Abstract submitted to the *2012 Gordon Research Conference on Flow and Transport in Porous Media*, Les Diablerets, Switzerland, June 23-28, 2012.
- Harper, E., **D. Wildenschild**, R.T. Armstrong; A.L. Herring, 2012. Capillary trapping of CO<sub>2</sub>: A detailed investigation using proxy fluids. Abstract submitted to the *2012 Gordon Research Conference on Flow and Transport in Porous Media*, Les Diablerets, Switzerland, June 23-28, 2012.
- Sheppard, A., S. Latham, G. Myers, A. Kingston, T. Varslot, M. Knackstedt, **D. Wildenschild**, and L. Andersson, 2012. Imaging of in-situ and ex-situ drainage and imbibition experiments. *Interpore 2012, 4<sup>th</sup> International Conference on Porous Media & Annual Meeting of the International Society for Porous Media*, Purdue, IN, USA, May 14-16, 2012.
- Armstrong, R.T., M.L. Porter and **D. Wildenschild**, 2012. Measuring fluid-fluid interfacial curvatures using x-ray microtomography. *Interpore 2012, 4<sup>th</sup> International Conference on Porous Media & Annual Meeting of the International Society for Porous Media*, Purdue, IN, USA, May 14-16, 2012.
- Wildenschild, D.** and R.T. Armstrong, 2011. The effects of fractional wettability on microbial enhanced oil recovery. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H51E-1244
- Harper, E., **D. Wildenschild**, R.T. Armstrong; A.L. Herring, 2011. Optimization of capillary trapping for application in geological carbon dioxide sequestration. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H51G-1281.
- Herring, A.L., **D. Wildenschild**, E. Harper, R.T. Armstrong, J.W. Carey. 2011. Quantifying the effects of fluid properties and flow rates on the effectiveness of capillary trapping of CO<sub>2</sub> in a Bentheimer sandstone. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H51G-1282
- Armstrong, R.T., M.L. Porter, **D. Wildenschild**. 2011. Analysis of interfacial curvature during drainage and imbibitions. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H54C-02.
- Brown, K.I., **D. Wildenschild**, W.G. Gray, C.T. Miller. 2011. Measuring interfacial areas and curvatures for three immiscible fluid phases in a porous medium. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H54C-03.
- Brown, K.I., **D. Wildenschild**, W.G. Gray, and C.T. Miller, 2011, Interfacial area measurements for robust models of multiphase flow in porous media, 2011 Goldschmidt Conference, August 14-19, 2011, Prague, Czech Republic, abstract.
- Armstrong, R.T. and **D. Wildenschild**, 2011, Decoupling the Mechanisms of Microbial Enhanced Oil Recovery, SPE-146714-PP, *2011 SPE Annual Technical Conference and Exhibition (ATCE)*, 30 October-2 November 2011, Denver, Colorado
- Iltis, G., Y. Davit, R.T. Armstrong, B.D. Wood, and **D. Wildenschild**, 2011. Imaging Microbial Biofilm in Three-dimensional Opaque Porous Media with X-ray Tomography. *Interpore 2011, 3rd International Conference on Porous Media & Annual Meeting of the International Society for Porous Media*, Bordeaux, France, March 28-31, 2011.
- Wildenschild, D.**, M. Marsh, P. Schjoenning, M. Lamande, L.W. de Jonge, P. Moldrup, A. Garbout, and F.E. Berisso. 2011. Pore morphology-based visualization and quantification of compaction effects in subsoils using x-ray CT, *Interpore 2011, 3rd International Conference on Porous Media & Annual Meeting of the International Society for Porous Media*
- Wildenschild, D.**, A.L. Herring, J.W. Carey, I.M. Young, 2010. Exploring the effect of interfacial tension, viscosity, and flow rate on the effectiveness of capillary trapping of CO<sub>2</sub>. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H13C-0986
- Jansik, D.P., D.M. Wellman, E. Cordova, **D. Wildenschild**, 2010, Impact of Mobile-Immobile Water on the Transport of Technetium (Tc-99) in Unsaturated Sediments. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H51H-04.
- Armstrong, R.T. and **D. Wildenschild**, 2010 Designer-Wet Micromodels for Studying Potential Changes in Wettability during Microbial Enhanced Oil Recovery. *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract H53D-1061.
- Iltis, G., Y. Davit, B. D. Wood, **D. Wildenschild**, 2010, In situ imaging of biofilm within opaque porous media (Invited). *Eos Trans. AGU, 89(53)*, Fall Meet. Suppl., Abstract NS33A-03.

- Iversen, B., F.E. Berisso, P. Schjønning, **D. Wildenschild**, L. de Jonge, A. Etana, N.J. Jarvis, M. Larsbo, T. Keller, J. Arvidsson, and C.D. Børgesen, Effect of Subsoil Compaction On Hydraulic Parameters, 2010 ASA/CSSA/SSSA Annual Meeting, Long Beach, CA, Oct 31- Nov 4., 2010.
- Jansik D., D. Wellman, E. Cordova, **D. Wildenschild**, Impact of Mobile-Immobile Water Domains on the Retention of Technetium (<sup>99</sup>Tc) in Unsaturated Soils, Goldschmidt 2010, Knoxville, TN, June 13-18, 2010.
- Iltis, G., R.T. Armstrong, and **D. Wildenschild**, 2010. Visualization and quantification of biofilm architecture within porous media using synchrotron based x-ray computed microtomography. *Geox2010: 3rd International Workshop on X-Ray CT for Geomaterials*, New Orleans, LA, March 1-3. 2010.
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## PRESENTATIONS

### *Invited presentations at international meetings (last 5 years)*

- 8th International Conference on Porous Media; *Minisymposium in honor of Geoffrey Mason*, Cincinnati, May 12<sup>th</sup>, 2016. "Curvature Measurement, Nonwetting Phase Trapping and Film Flow in Porous Media"
- University of Saskatchewan, Breakthroughs in Water Security Research: The Global Institute for Water Security Distinguished Lecture Series, Nov 5th 2015. "Demystifying the pore: Using high-resolution imaging to better understand fluid flow in porous media"
- MIMENIMA, University of Bremen, Germany, July 6, 2015. "Measuring morphological and topological characteristics of fluids in porous media: Applications to environmental science and engineering problems"
- IOR Norway Workshop, Univ. of Stavanger, April 30, 2015. "Quantifying pore-scale phenomena of relevance to large-scale EOR using x-ray tomography"
- IOR Norway, Univ. of Stavanger, April 28-29, 2015. "Quantifying microbial enhanced oil recovery processes at the pore-scale with microimaging"
- **2014 Distinguished Darcy Lecturer of Groundwater Science** (48 lectures in the US and at international sites during 2014 calendar year).
- 2014 Gordon Conference on Flow and Transport in Permeable Media, Bates College, Lewiston, ME, July 6-11, 2014, "Three-phase flow in porous media: On spreading films, wettability alteration, and the relationship between capillary pressure, saturation and interfacial area"
- Fall AGU Meeting, San Francisco, Dec. 9-12, 2013, "Imaging Microbial Biofilms in Opaque Three-dimensional Porous Media: Opportunities and Limitations".
- 2013 Workshop on 3D Imaging and Applications in Geosciences, SIMBIOS Centre (University of Abertay Dundee, UK), Oct 7-8, 2013. "Quantifying pore-scale mechanisms of microbial enhanced oil recovery using microimaging", **KEYNOTE LECTURER**
- 2nd International Conference on Non-linearities and Upscaling in Porous Media (NUPUS), Os, Norway, Sept 30- Oct 2, 2012, "Multi-phase fluid interfaces and their implications for geologic storage of CO<sub>2</sub>", **KEYNOTE LECTURER**
  - Evonik Meets Science North America 2013, Sept. 18-19, 2013, Atlantic City, NJ. "Using surfactant and interfacial technology in microbially enhanced oil recovery and geologic sequestration of CO<sub>2</sub>"
- 2013 EMSL User Meeting Workshop: X-ray computed tomography for biological systems. Richland, WA, Aug 6-7, 2013. "Opportunities and limitations for tomographic imaging of biological material in porous media"
- 5th International Conference on Porous Media & Annual Meeting of Interpore Society, 21 - 24 May, 2013, Prague, Czech Republic, Invited Speaker, Special Session in honor of Jacob Bear, "Understanding the Foundations of Flow and Transport in Porous Media: Insights From Pore-Scale Imaging"
- Fall AGU Meeting, San Francisco, Dec. 3-8, 2012: "Imaging and quantifying three-phase flow in porous media"
- 2012 DOE Basic Energy Sciences Workshop on the Forefront of Science: *Reaction and Transport within Internal Domains of Porous Media*, San Francisco, Dec 1-2. 2012, "Probing internal domains and relevant transport and transformation variables with x-ray microtomography"
- 2012 *STAIR* PhD course: Visualization of Soil Inner Space – Advanced Visualization Methods and Links to Soil Physical Functions. Nov 21-23, Univ. of Aarhus, Denmark. **KEY LECTURER**
- Soil Science Society of America Meetings, symposium on Tomography and Imaging of Soil-Water-Root Processes, Cincinnati, Ohio, Oct. 21- 24, 2012. "Using Synchrotron-Based Microtomography and Functional Contrast Agents In Environmental Applications"
  - Workshop on Biofilm-Induced Mineralization: Modeling and Experiment, Aug 8-9, 2012, Montana State University, Bozeman, MT. "Imaging Microbial Biofilms in Porous Media: Technique and Applications"
  - Joint USGS/NETL/SECARB workshop on CO<sub>2</sub> Storage: Re-evaluating Storage Efficiency Estimates, Austin, TX July 17-18, 2012. "Optimizing capillary trapping as a CO<sub>2</sub> storage mechanism: Results from tomographic imaging"

- 4th International Conference on Porous Media & Annual Meeting of International Society for Porous Media, May 14-16, 2012, Purdue University, West Lafayette, Indiana, USA, "Measuring fluid-fluid interfacial curvatures using x-ray microtomography"
- DOE-Basic Energy Sciences, Geosciences Program Annual Meeting, Washington DC, April 5-6, 2012, "Optimizing capillary trapping of CO<sub>2</sub> during geological carbon sequestration"
- SPE Forum on Digital Rocks: Realizing Step Change in Value of Laboratory Data, 14 - 19 August 2011, Ojai, California, "Generation of 3D data via Synchrotron and Lab-based X-ray Methods"
- Pore-scale Modeling Challenge/Workshop, August 9-10th 2011, EMSL at PNNL, Richland WA, "X-ray Computed Microtomography: Opportunities and Limitations for Porous Media Characterization and Process Quantification"
- University of Texas, Austin, Workshop on Image Analysis for Porous Media, July 14-15, 2011: "Interfacial Configurations and Capillary Pressure Measurements from Microtomographic Images"
- DOE-Subsurface Biogeochemical Research Programs 6<sup>th</sup> Annual Meeting, Washington DC, April 26-28, 2011, "Current status of imaging microbial biofilms in three-dimensional opaque porous media using x-ray microtomography"
- 3<sup>rd</sup> International Conference on Porous Media, Annual Meeting of the International Society for Porous Media Bordeaux, France, March 29-31, 2011, "Imaging Microbial Biofilm in Three-dimensional Opaque Porous Media with X-ray Tomography"
- Fall AGU Meeting, San Francisco, Dec. 13-18, 2010: "Beyond the Black Box: Coupling x-ray tomographic imaging of multi-phase flow processes to numerical models and traditional laboratory measurements"
- 1st International Conference and Exploratory Workshop on Soil Architecture and Physico-Chemical Functions "CESAR" Nov. 30 – Dec. 2, 2010: Faculty of Agricultural Sciences, Aarhus University, Research Centre Foulum, Denmark. *KEYNOTE LECTURER*
- 2010 STAIR PhD course: Visualization of Soil Inner Space – Advanced Visualization Methods and Links to Soil Physical Functions. January 26-28, Univ. of Aarhus, Denmark. *KEY LECTURER*

*Other presentations by Wildenschild (last 5 years)*

- SPLWA Pore-scale imaging and digital rocks: Expanding the Petrophysical Toolkit, Skamania Lodge, Stevenson, WA, May 3-7<sup>th</sup> 2015. "Curvature measurement and tracking of nonwetting phase trapping, and pressure state, in porous media"
- Oregon State University, Material Sciences Graduate Program Seminar Series. Feb 5<sup>th</sup>, 2015. "Probing Earth Science materials and their Relevant Transport and Transformation Variables with X-Ray Tomography"
- Oregon State University, Water Resources Graduate Program Seminar Series, Feb. 4<sup>th</sup>, 2015, "Optimizing Capillary Trapping of CO<sub>2</sub> for Safe Storage and Prevention of Groundwater Acidification"
- Carl Zeiss Microscopy/XRadia, Pleasanton, CA, Dec. 15. "Three-phase flow in porous media: On spreading films, wettability alteration, and the relationship between capillary pressure, saturation and interfacial area"
- University of Stuttgart, Stuttgart, Germany, Jan. 27<sup>th</sup>, 2014. "Imaging and characterizing microbial biofilms in opaque porous media"
- US National Science Foundation, Sept 17<sup>th</sup>, 2013. "Developing a State-of-the-art Tomography System for Imaging and Quantifying Geoscience-related Processes"
- Oregon State University, Physics, Departmental Seminar Series. Apr 10<sup>th</sup>, 2013. "Imaging Microbial Biofilms in Porous Media: Technique and Applications"
- Oregon State University, Geotechnical Seminar Series, Mar 14<sup>th</sup>, 2013. "Probing Porous Media and Relevant Transport and Transformation Variables with X-Ray Tomography"
- Oregon State University, Water Resources Graduate Program Seminar Series, Jan 23<sup>rd</sup>, 2013. "Optimizing Storage of Anthropogenic CO<sub>2</sub> in the Subsurface via Capillary Trapping"
- 2011 SPE ATCE, Denver Oct 30-Nov 2, 2011, "Decoupling the Mechanisms of Microbial Enhanced Oil Recovery"
  - SPE Forum on Digital Rocks: Realizing Step Change in Value of Laboratory Data, 14 - 19 August 2011, Ojai, California, "Estimating Curvatures from High-resolution X-ray Tomography Images"
  - University of Texas, Austin. Instructor for short course on "Image Analysis for Porous Media", co-taught and co-organized with Masa Prodanovic (Univ. of Texas, Austin) and Adrian Sheppard (Australian Natl. Univ.).
  - Oregon State University, Applied Mathematics and Computation Seminar, Jan 28<sup>th</sup>, 2011, "Exploring the effect of interfacial tension, viscosity, and flow rate on the effectiveness of capillary trapping of CO<sub>2</sub>"
  - Oregon State University, Water Resources Graduate Program Seminar Series, Feb. 9<sup>th</sup>, 2011, "Imaging and Quantifying Small-Scale Groundwater-Related Processes with Large Scale Implication"

- University of Wyoming, Dept. of Petroleum Engineering, Oct 4<sup>th</sup>, 2010, "Probing Interfaces With X-ray Microtomography and Using Etched Silicon Wafer Micromodels: Applications for Multi-phase Flow, MEOR, and CO<sub>2</sub> Sequestration"
  - Schlumberger Carbon Services, Cambridge, MA, July 16<sup>th</sup>, 2010, "Probing Multiphase Interfaces with X-ray Microtomography"
  - University of New South Wales, Australia, School of Petroleum Engineering, June 9<sup>th</sup>, 2010, "Probing Interfaces with Microtomography"
  - Australian National University, Dept. of Applied Mathematics, May 20<sup>th</sup>, 2010, "Using synchrotron-based microtomography to measure interfacial characteristics of relevance to (bio)remediation, CO<sub>2</sub> sequestration, and oil recovery"
  - Utrecht University, Department of Earth Sciences, Nov. 9. 2009, "The effect of pore network geometry on fluid-fluid interfacial area formation"
  - Geological Survey of Denmark/GEOCENTER Copenhagen, Oct 21. 2009, "Using Microimaging in Hydrologic and Environmental Engineering Research"
  - University of Copenhagen, Niels Bohr Institute, Oct 22, 2009, "Using x-ray microtomography in Microbial Enhanced Oil Recovery (MEOR) and geologic carbon sequestration research".
  - Danish Technical University, Dept. of Chemical Engineering/IVC-SEP, Oct 22. 2009, "Using x-ray microtomography in Microbial Enhanced Oil Recovery (MEOR) and geologic carbon sequestration research".
  - European Geosciences Union General Assembly 2009, Vienna, Austria, 19 - 24 April 2009. "Using synchrotron-based microtomographic imaging to characterize biofilm architecture in porous media"
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## SYNERGISTIC ACTIVITIES

- Organizing Committee, 2008 and 2012 Gordon Conference on Flow & Transport In Permeable Media
  - Discussion Leader, 2010 Gordon Research Conference on Flow & Transport In Permeable Media
  - Chair of the American Geophysical Union's Unsaturated Zone Executive Committee (2007-2009)
  - Session organizer and co-organizer for Fall Meetings of the American Geophysical Union (1999-present)
  - Associate Editor for *Advances in Water Resources*, and for *Vadose Zone Journal*
  - Invited participant, DOE Environmental Remediation Sciences Program's Strategic Planning workshop, Aug 2009
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## GRANT AND CONTRACT SUPPORT

### Current

A detailed study of the CO<sub>2</sub>-brine capillary trapping mechanism as applied to geologic carbon storage. US DOE BES, D. Wildenschild (PI), M.G. Schaap, **\$787,976/424,557 for OSU**, 09/01/11-11/30/16

Interfacial Controls on Dynamics and Equilibration in Porous Media. **D. Wildenschild (PI)**, NSF Hydrology Program, **\$431,155**, 04/01/14-03/31/16.

Colloid Mobility in Soils: Fundamental Pore-Scale Mechanisms, Simplifications and Practical Relevance for Risk Analysis. M. Schaap and **D. Wildenschild (co-PI)**, USDA AFRI Program. **\$239,662 for OSU**, 10/01/13-09/30/16.

Three-Phase Capillary Pressure, Hysteresis and Trapping in Mixed-Wet Rock, J.O. Helland (PI), **D. Wildenschild (co-PI)**, M. Prodanovic (co-PI), Norwegian Research Council and Conoco Phillips, **\$170,000 for OSU**, 09/30/14-09/01/2017.

### Past

Hybrid Modeling in Evolving Porous Media, M. Peszynska (PI), **D. Wildenschild (co-PI)**, NSF Division of Mathematical Sciences, **\$299,905**, 09/15/11-09/14/14

Collaborative Research: CDI-Type II - Revolutionary Advances in Modeling Transport Phenomena in Porous Medium Systems, NSF CDI Program. C.T. Miller, C.T. Kelley, **D. Wildenschild (co-PI)**, **\$1,7 mill. (OSU portion: \$300,000)** 12/01/09-11/30/13.

Microbial Activity and Precipitation at Solution-Solution Mixing Zones in Porous Media. DOE ERSP Program. F.S. Colwell, R. Gerlach, A. Mitchell, G. Redden, **D. Wildenschild (co-PI)**, B.D. Wood, **1,213,902**, 04/01/09-05/31/12.

Integrated Experimentation and Hybrid Modeling for Control of Multiphase Flow and Reaction in CO<sub>2</sub> Injection and Storage, LANL LDRD. J.W. Carey, P. Lichtner, Q. Kang, S. Backhaus, Y. Zhao, D. Moulton. A. Abdel-Fattah, A. Valocchi, C. Werth, **D. Wildenschild (Co-PI)**, **\$1.65 mill., (OSU portion: \$270,000)** 10/01/09-09/30/12.



Biosurfactant Enhanced Oil Recovery: A Pore-scale Investigation of Interfacial and Microbial Interactions. ACS Petroleum Research Fund, **D. Wildenschild (PI)**, **\$147,198**. 09/01/08-09/31/12.

Three-dimensional Imaging and Quantification of Biomass in Porous Media. DOE ERSP Program. **D. Wildenschild (PI)** and B.D. Wood, **\$149,985**, 04/01/09-03/31/11.

CMG Collaborative Research: Mathematical and Experimental Analysis of Transport Phenomena in Highly Heterogeneous Porous Media. B. Wood, **D. Wildenschild (co-PI)**, E. Waymire, E. Thomann, V. Bokil. NSF Collaboration in Mathematical Geosciences (CMG). **\$421,739**, 07/01/08-06/30/10.

Colloidal transport in variably saturated porous media: A detailed evaluation of colloid mobilization mechanisms. OSU IWW USGS mini-grant. **D. Wildenschild (PI)**, **\$8,728**. 04/01/09-09/31/09.

Three-Dimensional Imaging and Quantification of Biomass in Porous Media. **D. Wildenschild (PI)**. OSU General Research Fund. **\$8,850**. 06/08-05/09

Collaborative Research: Experimental and Numerical Characterization of Thin Films in Three-Dimensional Porous Media. **D. Wildenschild (PI)** – REU Supplement NSF Hydrology. **\$11,307**, 08/01/06-07/31/09.

Collaborative Research: Experimental and Numerical Characterization of Thin Films in Three-Dimensional Porous Media. **D. Wildenschild (PI)**. NSF Hydrology. **\$130,897**, 08/01/06-07/31/09.

Purchase of High Performance Computing cluster nodes for computational science research in College of Science (COS). OSU Research Equipment Reserve Fund (RERF). M. Peszynska, A. Faridani, R. Higdon, R. Landau, **D. Wildenschild (co-PI)**. **\$26,636**. 04/06.

Collaborative Research: Interfacial Dynamics in Multi-Phase Flow and Transport Processes, **D. Wildenschild (PI)** – REU Supplement, NSF Hydrology Program, **\$5,179**

Collaborative Research: Interfacial Dynamics in Multi-Phase Flow and Transport Processes, **D. Wildenschild (PI)**, NSF Hydrology Program, **\$238,348**, 06/01/04-05/31/06.

Investigating Subsurface Pore Scale Flow Processes With OSU's X-ray Microtomography Facility. **D. Wildenschild (PI)**, OSU General Research Fund. **\$7,600**. 04/03-09/05.

The use of x-ray micro-tomography and pore-scale modeling to evaluate dynamic and equilibrium pore-scale processes in porous media. **Personal grant to D. Wildenschild (PI)**. Danish Technical Research Council (Talent Project). (DKK 2.61 mill.) ~**\$435,000**. 07/00-07/04.

X-ray tomography to determine moisture distribution in a soil sample for various outflow conditions, **D. Wildenschild (PI)**. Institute of Geophysics and Planetary Physics, Lawrence Livermore National Laboratory. **\$13,000**. 11/99-11/00.

#### **Pending**

MRI: Development of a State-of-the-art High-Resolution Tomography Facility Customized for Dynamic (4D) Imaging, D. Wildenschild (PI), K. Sharp, B. Bay, F. Colwell, M. Evans, NSF MRI Program, **\$836,816 (from NSF)**, 10/01/15-9/30/17.