



Jiamin Wan, Hydrogeochemist, Staff Scientist

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Researcher ID: H-6656-2014

Biography

Jiamin Wan's graduate education is in hydrology and geochemistry. Since graduation, she has been employed in the Energy Geosciences Division of Lawrence Berkeley National Laboratory, and is currently a Staff Scientist. Her research is focused on interfacial, wetting, and capillary phenomena in geologic materials, and on biogeochemical reactions and subsurface transport of contaminants, colloids and nano-particulates. Her studies under high-pressure and high-temperature reservoir conditions combine pore-scale microscopy of fluid interfacial dynamics with surface spectroscopy and macroscopic interfacial measurements to understand mechanisms controlling CO₂, water, and oil interactions. She currently has over 70 publications in peer-reviewed journals. She has been the lead principal investigator for many projects over the past two decades, obtaining funding through competitive peer-reviewed processes.

Research Interests

- **Interfacial phenomenon in hydrogeological media:** dynamic wetting and fluid-fluid interfacial tensions under atmosphere and elevated (deep subsurface) pressures and temperatures; colloid stability, partitioning, and transport.
- **CO₂ enhanced oil recovery (CO₂-EOR):** altering CO₂ apparent viscosity (using foams) and varying wettability to control fluids mobility; to test these in high-pressure micromodels and cores.
- **Hydraulic fracturing:** developing new fracturing fluids as the alternative to water-based fracturing fluids; understanding the fluids-rock interactions and manipulating the interfacial properties.
- **Geological CO₂ sequestration:** studies of mechanisms controlling CO₂ mobility and trapping, and caprock integrity through pore-scale microscopy, surface spectroscopy, and macroscopic interfacial measurements under elevated P-T conditions.
- **Contaminant biogeochemistry and plume remediation:** studies of reactions, transport, and remediation of contaminants including U and Cr.
- **Soil C and N transport and transformations and their impacts on C cycling:** from the unsaturated zone to groundwater.

Education

- Ph.D. Hydrology, 1989-1993, New Mexico Institute of Mining and Technology, NM, USA
- Ph.D. Candidate in Geochemistry, 1986-1989, New Mexico Institute of Mining and Technology, NM, USA (past the candidacy exams and then switched to Hydrology)
- M.S. Geochemistry, 1981-1984, Institute of Geochemistry, Chinese Academy of Science, China
- B.S., Chemistry, 1977-1981, Beijing University of Iron and Steel Technology, China

Professional Experience

- 1997- Present: Staff Geological Scientist, Energy Geosciences Division (formerly ESD), LBNL
- 1995 -1997: Scientist, Earth Sciences Division (ESD), LBNL
- 1993 -1995: Postdoctoral Research Fellow, Earth Sciences Division, LBNL
- 1989 -1993: Graduate Research Associate in Hydrology, New Mexico Tech, NM
- 1984 -1986: Research Associate, Institute of Geochemistry, Chinese Academy of Sciences

Peer-reviewed Publications

1. Wang, S., T. K. Tokunaga, **J. Wan**, W. Dong, and Y. Kim, Capillary pressure-saturation relations in quartz and carbonate sands: Limitations for correlating capillary and wettability influences on air, oil, and supercritical CO₂ trapping, *Water Resour. Res.*, 52, doi:10.1002/2016WR018816, 2016.
2. Zhang, L., Y. Kim, H. Jung, **J. Wan**, Y. S. Jun, Effects of Salinity-Induced Chemical Reactions on Biotite Wettability Changes under Geologic CO₂ Sequestration Conditions, *Environ Sci Tech Lett* 3(3): 92-97. doi: 10.1021/acs.estlett.5b00359, 2016.
3. Arora, B., N.F. Spycher, C.I. Steefel, S. Molins, M. Bill, M.E. Conrad, W.M. Dong, B. Faybishenko, T.K. Tokunaga, **J.M. Wan**, K.H. Williams, S.B. Yabusaki, Influence of hydrological, biogeochemical and temperature transients on subsurface carbon fluxes in a flood plain environment. *Biogeochemistry* 127, 2-3, 367-396, doi: 10.1007/s10533-016-0186-8, 2016.
4. Tokunaga, T.K., Y. Kim, M.S. Conrad, M. Bill, C. Hobson, K.H. Williams, W. Dong, **J. Wan**, M. Robbins, P. Long, B. Faybishenko, J. Christensen, S.S. Hubbard, Deep vadose zone respiration contributions to CO₂ fluxes from a semi-arid floodplain. *Vadose Zone J.* 15, doi: 10.2136/vzj2015.10.0136, 2016.
5. Bikkina, P, **J. Wan**, Y. Kim, T. J. Kneafsey, and T. K. Tokunaga, Influence of wettability and permeability heterogeneity on miscible CO₂ flooding efficiency, *Fuel*, in press, 2015.
6. Chen, C., **J. Wan**, and Y. Song, Water contact angles on Quartz surfaces under supercritical CO₂ sequestration conditions: Experimental and molecular dynamic simulation studies. *IJGGC* 42 655–665, 2015.
7. Shen, W., **J. Wan**, T.K. Tokunaga, Y. Kim, X. Li, Porosity calculation, pore size distribution and mineral identification within shale rocks: Application of scanning electron microscopy and energy dispersive spectroscopy, *EJGE, Bund.* 19, 1477-1490, 2015.
8. **Wan, J. M.**, Kim, Y., Tokunaga, T. K., Contact angle measurement ambiguity in supercritical CO₂-water-mineral systems: Mica as an example, *International Journal of Greenhouse Gas Control*, 31, 128-137, Doi 10.1016/J.ijggc.2014.09.029, 2014.
9. Dong, W. M., **Wan, J. M.**, Additive Surface Complexation Modeling of Uranium(VI) Adsorption onto Quartz-Sand Dominated Sediments, *Environmental Science & Technology*, 48, (12), 6569-6577, Doi 10.1021/Es501782g, 2014.
10. Tokunaga, T. K., **J. Wan**, J.-W. Jung, T. W. Kim, Y. Kim, and W. Dong, Capillary pressure and saturation relations for supercritical CO₂ and brine in sand: High-pressure P_c(S_w) controller/meter measurements and capillary scaling predictions, *Water Resour. Res.*, 49, 4566–4579, 2013.
11. Tokunaga, T.K., and **J. Wan**, Capillary pressure and mineral wettability influences on reservoir CO₂ capacity. *in Reviews in Mineralogy and Geochemistry*, D.J. DePaolo, D.R. Cole, A. Navrotsky, and I.C. Bourg, eds., Vol. 77, Chapter 14, pp. 481-503, 2013.
12. Torkzaban, S., S. A. Bradford, **J. Wan**, T. K. Tokunaga, and A. Masoudih, Release of quantum dot nanoparticles in porous media: role of cation exchange and aging time, *Environ. Sci. Technol.*, 47, 11528-11536, 2013.
13. **Wan, J.**, T. K. Tokunaga, W. Dong, M. E. Denham, and S. S. Hubbard, Persistent source influences on the trailing edge of a groundwater plume, and natural attenuation timeframes: The F-Area Savannah River Site, *Environ. Sci. Technol.* 46, 4490–4497, 2012.
14. Tokunaga, T.K., **J. Wan**, and M.E. Denham, Estimates of vadose zone drainage from a capped

seepage basin, Vadose Zone J., web-released 2012.

15. Dong, W., T.K. Tokunaga, J.A. Davis, **J. Wan**, Uranium(VI) adsorption and surface complexation modeling on background sediments from the F-Area, Savannah River Site, *Environ. Sci. Technol.* 46, 1565-71, 2012.
16. Jung, J. and **J. Wan**, Supercritical CO₂ and ionic strength effects on wettability of silica surfaces: Equilibrium contact angle measurements, *Energy & Fuels*, 26, 6053-6059, 2012.
17. Kim, Y., **J. Wan**, T. J. Kneafsey, and T. K. Tokunaga, Dewetting of silica surfaces upon reactions with supercritical CO₂ and brine: Pore-scale studies in micromodels, *Environ. Sci. Technol.*, 46 (7), pp 4228–4235, 2012.
18. Torkzaban, S., **J. Wan**, T.K. Tokunaga, S. A. Bradford, Impacts of bridging complexation on the transport of surface-modified nanoparticles in saturated sand, *Journal of Contaminant Hydrology* 136–137, 86–95, 2012.
19. Tokunaga, T. K., Y. Kim, **J. Wan**, L. Yang, Aqueous uranium(VI) concentrations controlled by calcium uranyl vanadate precipitates. *Environ. Sci. Technol.* 46, 7471-7477, 2012.
20. **Wan, J.**, W. Dong, T. K. Tokunaga. Method to attenuate U(VI) mobility in acidic waste plumes using humic acids, *Environ. Sci. Technol.* 45, 2331-2337, 2011.
21. Torkzaban, S., **Wan, J.**, Kim, Y., Mulvihill, M., and Tokunaga, T. K., Transport and deposition of functionalized CdTe nanoparticles in saturated porous media. *J. Contaminant Hydrology*, 118, 208-217, 2010.
22. Mulvihill, M.J., S.E. Habas, I.J. La Plante, **J. Wan**, and T. Mokari, The influence of size, shape, and surface coating on the stability of aqueous nanoparticle suspensions, *J. Phys. Chem*, 22 (18), 5251–5257, 2010.
23. **Wan, J.**, Y. Kim, T.K. Tokunaga, Z. Wang, S. Dixit, C.I. Steefel, E. Saiz, M. Kunz, and N. Tamura. Spatially resolved U(VI) partitioning and speciation: Implications for plume scale behavior of contaminant U in the Hanford vadose zone. *Environ. Sci. Technol.* 43, 2247-2253, 2009.
24. Tokunaga, T.K., Y. Kim, and **J. Wan**. Potential remediation approach for uranium-contaminated groundwaters through potassium uranyl vanadate precipitation. *Environ. Sci. Technol.*, 43, 5467-5471, 2009.
25. **Wan, J.**, T.K. Tokunaga, Y. Kim, E. Brodie, R. Daly, T.C. Hazen, and M.K. Firestone. Effects of organic carbon supply rates on uranium mobility in a previously bioreduced contaminated sediment. *Environ. Sci. Technol.* 42, 7573-7579, 2008.
26. Tokunaga, T.K., **Wan, J.**, Kim, Y., R.A. Daly, E.L. Brodie, T.C. Hazen, D. Herman, and M.K. Firestone. Influences of organic carbon supply rate on uranium reduction in initially oxidizing, contaminated sediment. *Environ. Sci. Technol.* 42, 8901-8907, 2008.
27. **Wan, J.**, T.K. Tokunaga, Y. Kim, Z. Wang, A. Lanzirrotti, E. Saiz, and R.J. Serne, Effect of saline waste solution infiltration rates on uranium retention and spatial distribution in Hanford sediments, *Environ. Sci. Technol.*, 42, 1973-1979, 2008.
28. Tokunaga, T.K., **J. Wan**, Y. Kim, S.R. Sutton, M. Newville, A. Lanzirrotti, and W. Rao. Real-time X-ray absorption spectroscopy of uranium, iron, and manganese in contaminated sediments during bioreduction. *Environ. Sci. Technol.*, 42, 2839-2844, 2008.
29. Zheng, Z., G. Zhang, **J. Wan**, Reactive transport modeling of column experiments on the evolution of saline-alkaline waste solutions, *Journal of Contaminant Hydrology*, 97, 42-54, 2008.
30. He, Y.T., **J. Wan**, and T.K. Tokunaga, Kinetic stability of hematite nanoparticles: the effect of

- particle sizes, *J. Nanopart. Res.*, 10:321-332, 2008.
31. Faybishenko, B., T. C. Hazen, P. E. Long, E. L. Brodie, M. E. Conrad, S. S. Hubbard, J. N. Christensen, D. Joyner, S. E. Borglin, R. Chakraborty, K. H. Williams, J. E. Peterson, J. Chen, S. T. Brown, T. K. Tokunaga, **J. Wan**, M. Firestone, D. R. Newcomer, C. T. Resch, K. Cantrell, A. Willett, and S. Koenigsberg, In situ long-term reductive immobilization of Cr(VI) in groundwater using Hydrogen Release Compound, *Environ. Sci. Technol.*, 42 (22), 8478-8485, 2008.
 32. Tokunaga, T.K., **J. Wan**, A. Lanzirrotti, S.R. Sutton, and M. Newville, Long-term stability of organic carbon-stimulated chromate reduction in contaminated soils, and its relation to manganese redox status, *Environ. Sci. Technol.*, 41 (12) 4326-31, 2007.
 33. **Wan, J.**, T. Tylliszczak, T.K. Tokunaga, Organic carbon distribution and elemental correlations: Applications of STXM and NEXAFS spectroscopy, *Geochim. Cosmochim. Acta*, 71, 5439-49, 2007.
 34. McKinley, J. P., J. M. Zachara, **J. Wan**, D. E. McCready, and S. M. Heald, Geochemical controls on contaminant uranium in vadose Hanford formation sediments at the 200 Area and 300 Area, Hanford Site, Washington, *Vadose Zone J.* 6(4) 1004–1017, 2007.
 35. Brodie, E.L., T.Z. DeSantis, D.C. Joyner, S. Baek, J.T. Larsen, G.L. Andersen, T.C. Hazen, D.J. Herman, T.K. Tokunaga, **J. Wan**, and M.K. Firestone, Application of a high-density oligonucleotide microarray approach to study bacterial population dynamics during uranium reduction and reoxidation. *Appl. Environ. Microbiol.* 72:6288-6298, 2006.
 36. Zheng, Z., **J. Wan**, and X. Song. Sodium meta-autunite colloids: Synthesis, characterization, and stability. *Colloids Surfaces A. Physicochemical Eng. Aspects*, 274, 48-55, 2006.
 37. **Wan, J.** and T.K. Tokunaga, Comments on “Pore-scale visualization of colloid transport and retention in partly saturated porous media”, *Vadose Zone J.*, 4, 954-956, 2005.
 38. Tokunaga, T.K., K.R. Olson, and **J. Wan**, Infiltration flux distributions in unsaturated rock deposits and their potential implications for fractured rock formations. *Geophys. Res. Lett.* 32, L05405, doi:10.1029/2004GL022203, 2005.
 39. **Wan, J.**, T.K. Tokunaga, E. Brodie, Z. Wang, Z. Zheng, T.C. Hazen, M.K. Firestone, S.R. Sutton, Reoxidation of bioreduced U under reducing conditions. *Environ. Sci. Technol.*, 39, 6162-69, 2005.
 40. Tokunaga, T. K., **J. Wan**, J. Pena, E. Brodie, M.K. Firestone, and T.C. Hazen, Uranium reduction in sediments under diffusion-limited transport of organic carbon, *Environ. Sci. Technol.*, 39, 7077-83, 2005.
 41. Zhang, G., Z. Zheng, **J. Wan**, Modeling reactive geochemical transport of concentrated aqueous solutions in variably saturated media. *Water Resour. Res.*, 41, W02018, doi: 10.1029/ 2004 WR003097, 2005.
 42. Zheng, Z. and **J. Wan**, Release of contaminant U(VI) from soils, *Radiochim. Acta*, 93, 1–7, 2005.
 43. Tokunaga, T.K., **J. Wan**, J. Pena, S.R. Sutton, and M. Newville. Hexavalent uranium diffusion in soils from concentrated acidic and alkaline solutions. *Environ. Sci. Technol.* 38, 3056-3062, 2004.
 44. **Wan, J.**, T.K. Tokunaga, J.T. Larsen, and R.J. Serne, Geochemical evolution of highly alkaline and saline tank waste plumes during seepage through vadose zone sediments, *Geochim. Cosmochim. Acta.* 68, 491-502, 2004.
 45. **Wan, J.**, J.T. Larsen, T.K. Tokunaga, Z. Zheng, pH neutralization and zonation in alkaline-saline tank waste plumes. *Environ. Sci. Technol.* 38, 1321-1329, 2004.
 46. **Wan, J.**, T.K. Tokunaga, E. Saiz, J.T. Larsen, Z. Zheng, R.A. Couture, Colloid formation at waste plume fronts. *Environ. Sci. Technol.* 38, 5603-5608, 2004.

47. Tokunaga, T.K., K.R. Olson, and **J. Wan**. Conditions necessary for capillary hysteresis in porous media: Tests of grain-size and surface tension influences. *Water Resour. Res.* 40, W05111, 2004.
48. Zheng, Z., T.K. Tokunaga, and **J. Wan**, Influence of calcium carbonate on U(VI) sorption to soils. *Environ. Sci. Technol.* 37, 5603-5608, 2003.
49. Tokunaga, T.K., **J. Wan**, T.C. Hazen, E. Schwartz, M.K. Firestone, S.R. Sutton, M. Newville, K.R. Olson, A. Lanzirotti, and W. Rao. Distribution of chromium contamination and microbial activity in soil aggregates. *J. Environ. Qual.* 32, 541-549, 2003.
50. Tokunaga, T.K., K.R. Olson, and **J. Wan**, Moisture characteristics of Hanford gravels: Bulk, grain-surface, and intragranular components. *Vadose Zone J.* 2, 322-329, 2003.
51. Tokunaga, T.K., **J. Wan**, M.K. Firestone, T.C. Hazen, K.R. Olson, D.J. Herman, S.R. Sutton, and A. Lanzirotti, In-situ reduction of Cr(VI) in heavily contaminated soils through organic carbon amendment. *J. Environ. Qual.* 32, 1641-1649, 2003.
52. **Wan, J.**, T.K. Tokunaga, Partitioning of clay colloids at air-water interfaces, *J. Colloid Interface Sci.* 247, 54-61, 2002.
53. Tokunaga, T.K., **J. Wan**, and K.R. Olson, Saturation-matric potential relations in gravel. *Water Resour. Res.*, 38(10), 1214, 2002.
54. **Wan, J.**, S. Veerapaneni, F. Gabelle, and T.K. Tokunaga, Generation of stable micro-bubbles and their transport through porous media, *Water Resour. Res.*, 37, 1173-1182, 2001.
55. Tokunaga, T.K., and **J. Wan**, Surface-zone flow in unsaturated rock fractures, *Water Resour. Res.*, 37, 287-296, 2001.
56. Tokunaga, T.K., and **J. Wan**, Approximate boundaries between different flow regimes in fractured rocks. *Water Resour. Res.*, 37, 2103-2111, 2001.
57. Gabelle, F., **J. Wan**, and T.K. Tokunaga. Removal of U(VI) from contaminated sediments by surfactants, *J. Environ. Qual.*, 30, 470-478, 2001.
58. Tokunaga, T.K., J. Wan, M.K. Firestone, T.C. Hazen, E. Schwartz, S.R. Sutton, M. Newville, Chromium diffusion and reduction in soil aggregates, *Environ. Sci. Technol.*, 35, 3169-3174, 2001.
59. Veerapaneni, S., **J. Wan**, and T. K. Tokunaga, Particle motion in film flow, *Environ. Sci. Technol.*, 34, 2465-2471, 2000.
60. **Wan, J.**, T.K. Tokunaga, T. Orr, and J. O'Neill, Glass casts of rock fractures: A new tool for studying flow and transport, *Water Resour. Res.*, 36, 355-360, 2000.
61. Tokunaga, T.K., **J. Wan**, and S.R. Sutton. Transient film flow on rough fracture surfaces, *Water Resour. Res.*, 36, 1737-1746, 2000.
62. **Wan, J.** and T.K. Tokunaga, Measuring partition coefficients of colloids at air-water interfaces, *Environ. Sci. Technol.*, 32, 3293-3298, 1998.
63. **Wan, J.** and T.K. Tokunaga, Film-straining of colloids in unsaturated porous media: conceptual model and experimental testing, *Environ. Sci. Technol.*, 31, 2413-2420, 1997.
64. Tokunaga, T.K. and **J. Wan**, Water film flow along fracture surfaces of porous rock, *Water Resour. Res.*, 33, 1287-1295, 1997.
65. **Wan, J.**, T.K. Tokunaga, C.F. Tsang, and G.S. Bodvarsson, Improved glass micromodel methods for studies of flow and transport in fractured porous media, *Water Resour. Res.*, 32, 1955-1964, 1996.
66. **Wan, J.**, T.K. Tokunaga, and C.F. Tsang, Bacterial sedimentation through a porous medium, *Water Resour. Res.*, 31, 1627-1636, 1995.

67. **Wan, J.**, and J.L. Wilson, Colloid transport in unsaturated porous media, *Water Resour. Res.*, 30, 857,1994.
68. **Wan, J.**, J.L. Wilson, and T. Kieft, Influence of the gas-water interface on transport of microorganisms through unsaturated porous media, *Appl. Environ. Microbio.*, 60, 509 1994.
69. **Wan, J.** and J.L. Wilson, Visualization of the role of the gas-water interface on the fate and transport of colloids in porous media, *Water Resour. Res.*, 30, 11-23, 1994.

Awards

- “Outstanding Contributions in Geosciences Research” from U.S. Department of Energy Office of Basic Energy Science, August 1998.
- The Langmuir Award, from New Mexico Institute of Mining and Technology, 1995.
- First place as "Outstanding Dissertation Award for the Water Resources" in Environmental and Biological Sciences, The Universities Council of Water Resources, 1993.
- Graduate Student Award, Division of Environmental Chemistry of Am. Chem. Soc. 1993.
- Graduate Student Paper Award, from the American Chemical Society, 1993.

Grant Awards (as the Lead PI)

- 2008-2010 (\$1.5 M), DOE–BER: Environmental impacts of engineered nano-materials.
- 2006-2008 (\$1.4 M), DOE–ERSP: Hydrological and geochemical studies of alkaline plumes at the 200 Area the Hanford Site.
- 2003-2005 (\$1.2 M), DOE–EMSP: Development of U waste plumes at the Hanford Site.
- 2005-2007 (\$0.6 M), DOE–BES: Nanoparticles fate and transport in the subsurface.
- 2002-2004 (\$ 1.12 M), DOE–NABIR: Coupled transport and bioreduction of U(VI) in sediments.
- 2000-2002 (\$ 1.0 M), DOE–EMSP: Evolution of alkaline-saline waste plumes in the Hanford Site
- 2002-2004 (\$ 0.6 M), DOE–BES: Interfacial properties of colloids and nanoparticles in subsurface.
- 1999-2001 (\$ 1.2 M), DOE–NABIR: Mesoscale biotransformation dynamics of Cr and U
- 1999-2001 (\$ 0.6 M), DOE–BES: Unsaturated flow and colloid transport
- 1997-1999 (\$1.2 M), DOE–EMSP: Sorption of organics and metals onto gas-water interfaces: implications on contaminant transport and remediation
- 1996-1998 (\$ 0.6 M), DOE–BES: Colloid transport in unsaturated porous media.

Scholarly Service:

- 1998-present - Environmental Science & Technology
- 1997-present - Water Resources Research
- 2002-present - Journal of Colloid & Interface Science
- 2005-present - *Geochimica et Cosmochimica Acta*
- 2007-present - *Vadose Zone Journal*
- 2008-present - *Journal of Contaminant Hydrology*
- 2012-present - *Energy and Fuel*

Research Supervision and Mentoring:

Lu Wang (Oct. 2015- Oct. 2016, PhD student)

Ran Hu (March 2015- August 2016, Postdoc)
Weijun Shen (Oct. 2014- Oct. 2015, PhD student)
Cong Chen (Oct. 2013- Oct. 2014, visiting professor, Dalian University of Technology)
Prem Bikkina (June 2013- July 2014, Postdoc)
Wenming Dong (2009-2016, Science Engineering Associate)
Jongwon Jung (2010-2012, Postdoc)
Guang Shi (2011-2012, Postdoc)
Martin Mulvihill (2010-2011, Molecular Foundry Postdoc, funded by my project)
Susan Habas (2009-2010, Molecular Foundry Postdoc, funded by my project)
Saeed Torkzaban (2009-2011, Postdoc)
Thomas He (2005-2007, Postdoc)
Guiling Han (2005-2006, Visiting Scientist)
Joern Larsen (2003-2005, RA)
Jasquelin Pena (2002-2004, RA)
Zuoping Zheng (2002-2004, Postdoc)
Frederic Gadelle (2000-2002, Postdoc)
Egbert Schwartz (1999-2001 UCB Postdoc, funded by my project)
Srinivas Veerapaneni (1999-2001, Postdoc)
Gordon Vrdoljak (1999-2000, postdoc)
Dominic Joyner (1998-2000, RA)
Mark Yahnke (1998-1999, RA)
Ann Sweet (1997-1998, RA)