

## **Tetsu K. Tokunaga**

Energy Geosciences Division (MS 74-316C)

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### **Education:**

Ph.D., 1986, Soil Science, University of California, Berkeley.

The temperature dependence of gas diffusivities in porous media.

B.A., 1979, Soil Resources, University of California, Berkeley.

### **Biographical Summary:**

Tetsu Tokunaga is a Senior Scientist in the Energy Geosciences Division of Lawrence Berkeley National Laboratory, studying the physicochemical basis of environmental transport processes. While conducting his graduate studies on gas diffusion in porous media at the University of California, Berkeley, he began working at LBNL on problems of unsaturated flow and transport from uranium mill tailings, and on reactive transport of selenium in contaminated wetland (Kesterson Reservoir). Upon graduation, he continued at LBNL conducting laboratory and field based studies on soil/geologic transport problems. In addition to his research at LBNL, he taught soil physics courses at the University of California, Berkeley. He currently has over 80 publications in peer-reviewed journals.

### **Research Interests:**

Tetsu Tokunaga's research combines soil physics with related fields of hydrogeology and biogeochemistry. His research accomplishments include identifying the general free-path basis for gas diffusion in porous media, the importance of water film hydraulics in multiphase fluid flow, Boltzmann flux distributions in unsaturated rocks, limits for capillary hysteresis, the permeability-sorptivity scaling relation, the unsustainability of reduction-based remediation of uranium contamination, the role of uranyl vanadates in controlling uranium concentrations in oxidizing environments, modeling and measurements of brine film thicknesses under confinement by supercritical CO<sub>2</sub>, experimentally identifying limitations of scaling predictions of capillary pressure-saturation relations for supercritical CO<sub>2</sub>-brine in porous media, the potential acceleration of soil carbon sequestration through gypsum dissolution, measuring multiphase fluid equilibrium and flow in low permeability shales, and measuring solute diffusion through adsorbed water films.

### **Professional Experience:**

1988 -1993: Scientist, Earth Sciences Division, Lawrence Berkeley National Laboratory

1990, 1992: Lecturer, Department of Soil Science, University of California, Berkeley.

1993 - 2001: Staff Scientist, Earth Sciences Division, LBNL.

2001 - Present: Senior Scientist, Earth Sciences Division, Energy Geosciences Division, LBNL

### **Service:**

Energy Geosciences Division (formerly Earth Sciences Division), Professional Staff Committee (2001-Present).

LBNL Staff Committee (2008-2011) {note this needs correction, not addition }

Vadose Zone Journal, associate editor (2008-Present).  
Water Resources Research, associate editor (2009-Present).

#### **Patents and Invention Disclosures:**

1. Tokunaga, T.K., Y. Kim, and J.M. Wan. Aug. 20, 2013. Method of precipitating uranium from an aqueous solution and/or sediment. Unites States Patent # US 8,512,572 B1.
2. Tokunaga, T.K., and D. Shuman. Aug. 23, 2010. A method to control low capillary pressure differences over arbitrarily high total pressures. Lawrence Berkeley National Laboratory, Invention Disclosure IB-2931.
3. Tokunaga, T.K., J. Wan, Y. Kim, W. Dong, G. Shi. April 5, 2012. Supercritical CO<sub>2</sub> and water microemulsions stabilized with refractory natural organic macromolecules. Lawrence Berkeley National Laboratory, Invention Disclosure IB-3242.

#### **Publications in refereed journals:**

##### **ResearcherID: H-2790-2014**

1. Tokunaga, T.K., 1985. Porous media gas diffusivities from a free path distribution model. *J. Chem. Phys.* 82:5298-5299.
2. Narasimhan, T.N., White, A.F., and T. Tokunaga, 1986. Groundwater contamination from an inactive uranium mill tailings pile. 2. Application of a dynamic mixing model. *Water Resources Res.* 22:1820-1834.
3. Tokunaga, T.K., 1988. Laboratory permeability errors from annular wall flow. *Soil Sci. Soc. Am. J.* 52:24-27.
4. Tokunaga, T.K., L.J. Waldron, and J. Nemson, 1988. A closed-tube method for measuring gas diffusion coefficients. *Soil Sci. Soc. Am. J.* 52:17-23.
5. Long, R.H.B., S.M. Benson, T.K. Tokunaga, and A. Yee. 1990. Selenium immobilization in a pond sediment at Kesterson Reservoir. *J. Environ. Qual.* 19:302-311.
6. Tokunaga, T.K., Lipton, D.S., Benson, S.M., Yee A.W., Oldfather, J.M., Duckart, E.C., Johannis, P.W., and K.E. Halvorsen, 1991. Depth distributions and time trends in profiles of selenium and soluble salts in vegetated upland soils of Kesterson Reservoir. *Water, Air, and Soil Pollution* 57/58:31-41.
7. Tokunaga, T.K., and S.M. Benson, 1992. Selenium in Kesterson Reservoir ephemeral pools: 1. A field study of ponding resulting from shallow water table rise. *J. Environ. Qual.* 21:246-251.
8. Poister, D., and T.K. Tokunaga, 1992. Selenium in Kesterson Reservoir ephemeral pools: 2. Laboratory experiments. *J. Environ. Qual.* 21:252-258.
9. Zawislanski, P.T., T.K. Tokunaga, S.M. Benson, J.O. Oldfather, and T.N. Narasimhan. 1992. Bare soil evaporation and solute movement in selenium-contaminated soils at Kesterson Reservoir, CA. *J. Environ. Qual.* 21:447-457.
10. Tokunaga, T., 1992. The pressure response of the soil water sampler, and possibilities for simultaneous soil solution sampling and tensiometry. *Soil Sci.* 154:171-183.
11. Tokunaga, T., and R. Salve. 1994. Gauge sensitivity optimization in air pocket tensiometry: Implications for deep vadose zone monitoring. *Soil Sci.* 158:389-397.
12. Tokunaga, T.K., S.R. Sutton, and S. Bajt. 1994. Mapping of selenium concentrations in soil aggregates with synchrotron x-ray fluorescence microprobe. *Soil Sci.* 158:421-433.

13. Pickering, I.J., G.E. Brown, Jr., and T.K. Tokunaga. 1995. Quantitative speciation of selenium in soils using x-ray absorption spectroscopy. *Environ. Sci. Technol.*, 29, 2456-2459.
14. Wan, J., T.K. Tokunaga, and C.F. Tsang. 1995. Bacterial sedimentation through porous media. *Water Resour. Res.* 31:1627-1636.
15. Sutton, S.R., S. Bajt, J. Delaney, D. Schulze, and T. Tokunaga. 1995. Synchrotron x-ray fluorescence microprobe: Quantification and mapping of mixed valence state samples using micro-XANES, *Rev. Sci. Instrum.*, 66, 1464-1467.
16. Tokunaga, T.K., I.J. Pickering, and G.E. Brown, Jr. 1996. Selenium transformations in ponded sediments. *Soil Sci. Soc. Am. J.* 60:781-790.
17. Wan, J., T.K. Tokunaga, C.-F. Tsang, and G.S. Bodvarsson. 1996. Improved glass micromodel methods for studies of flow and transport in fractured porous media. *Water Resour. Res.* 32, 1955-1964.
18. Tokunaga, T.K. 1997. A tensiometer for measuring hydraulic potentials on surfaces of rock. *Water Resour. Res.*, 33, 1509-1513.
19. Tokunaga, T.K., G.E. Brown, Jr., I.J. Pickering, S.R. Sutton, and S. Bajt. 1997. Selenium redox reactions and transport between ponded waters and sediments, *Environ. Sci. Technol.* 31, 1419-1425.
20. Tokunaga, T.K., and J. Wan. 1997. Water film flow along fracture surfaces of porous rock. *Water Resour. Res.*, 33, 1287-1295.
21. Wan, J., and T.K. Tokunaga. 1997. Film-straining of colloids in unsaturated porous media: Conceptual model and experimental testing. *Environ. Sci. Technol.*, 31, 2413-2420.
22. Myneni, S.C.B., T.K. Tokunaga, and G.E. Brown, Jr. 1997. Abiotic selenium redox transformations in the presence of Fe(II,III) oxides. *Science*, 278, 1106-1109.
23. Tokunaga, T.K., S.R. Sutton, S. Bajt, P. Nuessle, and G. Shea-McCarthy. 1998. Selenium diffusion and reduction at the water-sediment boundary: Micro-XANES spectroscopy of reactive transport. *Environ. Sci. Technol.*, 32, 1092-1098.
24. Wan, J., and T.K. Tokunaga. 1998. Measuring partition coefficients of colloids at air-water interfaces. *Environ. Sci. Technol.* 32, 3293-3298.
25. Wan, J., T.K. Tokunaga, T. R. Orr, J. O'Neill, and R. W. Conners. 2000. Glass casts of rock fracture surfaces: A new tool for studying flow and transport. *Water Resour. Res.*, 36, 355-360.
26. Tokunaga, T.K., J. Wan, and S.R. Sutton. 2000. Transient film flow on rough fracture surfaces. *Water Resour. Res.*, 36, 1737-1746.
27. Salve, R., J.S.Y. Wang, and T.K. Tokunaga. 2000. A probe for measuring wetting front migration in rocks, *Water Resour. Res.*, 36, 1359-1367.
28. Veerapaneni, S., J. Wan, and T.K. Tokunaga. 2000. Particle motion in film flow, *Environ. Sci. Technol.*, 34, 2465-2471.
29. Salve, R., and T.K. Tokunaga. 2000. Flow processes in a rangeland catchment in California, *J. Range Manage.* 53, 489-498.
30. Tokunaga, T.K., and J. Wan. 2001. Surface zone flow along unsaturated rock fractures. *Water Resour. Res.*, 37, 287-296.
31. Wan, J., S. Veerapaneni, F. Gabelle, and T.K. Tokunaga, 2001. Generation of stable microbubbles and their transport through porous media, *Water Resour. Res.*, 37, 1173-1182.
32. Gabelle, F., J. Wan, and T.K. Tokunaga, 2001. Removal of U(VI) from contaminated sediments by surfactants, *J. Environ. Qual.*, 30, 470-478.

33. Tokunaga, T.K., and J. Wan. 2001. Approximate boundaries between different flow regimes in fractured rocks. *Water Resour. Res.*, 37, 2103-2111.
34. Tokunaga, T.K., J. Wan, M.K. Firestone, T.C. Hazen, E. Schwartz, S.R. Sutton, M. Newville. 2001. Chromium diffusion and reduction in soil aggregates, *Environ. Sci. Technol.*, 35, 3169-3174.
35. Wan, J., and T.K. Tokunaga. 2002. Partitioning of clay colloids to gas-water interfaces, *J. Colloid Interface Sci.*, 247, 54-67.
36. Tokunaga, T.K., J. Wan, and K.R. Olson. 2002. Saturation-matric potential relations in gravel. *Water Resour. Res.*, 38(10), 1214.
37. 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. 2003. Distribution of chromium contamination and microbial activity in soil aggregates. *J. Environ. Qual.* 32, 541-549.
38. Tokunaga, T.K., J. Wan, M.K. Firestone, T.C. Hazen, K.R. Olson, D.J. Herman, S.R. Sutton, and A. Lanzirotti. 2003. In-situ reduction of Cr(VI) in heavily contaminated soils through organic carbon amendment. *J. Environ. Qual.* 32, 1641-1649.
39. Tokunaga, T.K., K.R. Olson, and J. Wan. 2003. Moisture characteristics of Hanford gravels: Bulk, grain-surface, and intragranular components. *Vadose Zone J.* 2, 322-329.
40. Zheng, Z., T.K. Tokunaga, and J. Wan. 2003. Influence of calcium carbonate on U(VI) sorption to soils. *Environ. Sci. Technol.* 37, 5603-5608.
41. Wan, J., T.K. Tokunaga, J.T. Larsen, and R.J. Serne, 2004. Geochemical evolution of highly alkaline and saline tank waste plumes during seepage through vadose zone sediments. *Geochim. Cosmochim. Acta.* 68, 491-502.
42. Wan, J., J.T. Larsen, T.K. Tokunaga, Z. Zheng, 2004. pH neutralization and zonation in alkaline-saline tank waste plumes. *Environ. Sci. Technol.* 38, 1321-1329.
43. Tokunaga, T.K., J. Wan, J. Pena, S.R. Sutton, and M. Newville. 2004. Hexavalent uranium diffusion in soils from concentrated acidic and alkaline solutions. *Environ. Sci. Technol.* 38, 3056-3062.
44. Tokunaga, T.K., K.R. Olson, and J. Wan. 2004. Conditions necessary for capillary hysteresis in porous media: Tests of grain-size and surface tension influences. *Water Resour. Res.* 40, W05111.
45. Wan, J., T.K. Tokunaga, E. Saiz, J.T. Larsen, Z. Zheng, R.A. Couture. 2004. Colloid formation at waste plume fronts. *Environ. Sci. Technol.* 38, 5603-5608.
46. Tokunaga, T.K., K.R. Olson, and J. Wan. 2005. Infiltration flux distributions in unsaturated rock deposits and their potential implications for fractured rock formations. *Geophys. Res. Lett.* 32, L05405, doi:10.1029/2004GL022203.
47. Wan, J., T.K. Tokunaga, E. Brodie, Z. Wang, Z. Zheng, D. Herman, T.C. Hazen, M.K. Firestone, and S.R. Sutton. 2005. Reoxidation of bioreduced uranium under reducing conditions. *Environ. Sci. Technol.* 39, 6162-6169.
48. Tokunaga, T.K., J. Wan, J. Pena, E. Brodie, M. Firestone, T.C. Hazen, S.R. Sutton, A. Lanzirotti, and M. Newville. 2005. Uranium reduction in sediments under diffusion-limited transport of organic carbon. *Environ. Sci. Technol.* 39, 7077-7083.
49. Wan, J., and T.K. Tokunaga. 2005. Comment on "Pore-scale visualization of colloid transport and retention in partly saturated porous media". *Vadose Zone J.* 4, 954-956.
50. Zheng, Z., J. Wan, X. Song, and T.K. Tokunaga. 2006. Sodium meta-autunite colloids: Synthesis, characterization, and stability. *Colloids Surfaces A. Physicochemical Eng. Aspects*, 274, 48-55.

51. Brodie, E.L., T.Z. DeSantis, D.C. Joyner, S.M. Baek, J.T. Larsen, G.L. Andersen, T.C. Hazen, P.M. Richardson, D.J. Herman, T.K. Tokunaga, J.M. Wan, and M.K. Firestone. 2006. Application of a high-density oligonucleotide microarray approach to study bacterial population dynamics during uranium reduction and reoxidation. *Appl. Environ. Microbiol.* 72, 6288-6298.
52. Tokunaga, T.K., J. Wan, A. Lanzirotti, S.R. Sutton, M. Newville, and W. Rao. 2007. Long-term stability of organic carbon-stimulated chromate reduction in contaminated soils, and its relation to manganese redox status. *Environ. Sci. Technol.* 41, 4326-4331.
53. Wan, J, T. Tyliszczak, and T.K. Tokunaga. 2007. Organic carbon distribution, speciation, and elemental correlations within soil microaggregates: Applications of STX and NEXAFS spectroscopy. *Geochim. Cosmochim. Acta* 71, 5439-5449.
54. He, Y.T., J. Wan, and T. Tokunaga. 2008. Kinetic stability of hematite nanoparticles: the effect of particle size. *J. Nanoparticle Res.*, 10, 321-332.
55. Wan, J., T.K. Tokunaga, Y. Kim, Z. Wang, A. Lanzirotti, E. Saiz, R.J. Serne. 2008. Effect of saline waste solution infiltration rates on uranium retention and spatial distribution in Hanford sediments. *Environ. Sci. Technol.* 42, 1973-1978.
56. Tokunaga, T.K., J. Wan, Y. Kim, S.R. Sutton, M. Newville, A. Lanzirotti, W. Rao. 2008. Real-time X-ray absorption spectroscopy of uranium, iron, and manganese in contaminated sediments during bioreduction. *Environ. Sci. Technol.* 42, 2839-2844.
57. Tokunaga, T.K., Wan, J., Kim, Y., R.A. Daly, E.L. Brodie, T.C. Hazen, D. Herman, and M.K. Firestone. 2008. Influences of organic carbon supply rate on uranium reduction in initially oxidizing, contaminated sediment. *Environ. Sci. Technol.* 42, 8901-8907.
58. Wan, J., T.K. Tokunaga, Y. Kim, Z. Wang, A. Lanzirotti, E. Saiz, and R.J. Serne. 2008. Effect of saline waste solution infiltration rates on uranium retention and spatial distribution in Hanford sediments. *Environ. Sci. Technol.* 42, 1973-1978.
59. Wan, J., T.K. Tokunaga, Y. Kim, E. Brodie, R. Daly, T.C. Hazen, and M.K. Firestone. 2008. Effects of organic carbon supply rates on uranium mobility in a previously bioreduced contaminated sediment. *Environ. Sci. Technol.* 42, 7573-7579.
60. Faybishenko, B. et al. (21 co-authors). 2008. In situ long-term reductive bioimmobilization of Cr(VI) in groundwater using hydrogen release compound. *Environ. Sci. Technol.* 42, 8478-8485.
61. Wan, J., Y. Kim, T.K. Tokunaga, Z. Wang, S. Dixit, C.I. Steefel, E. Saiz, M. Kunz, and N. Tamura. 2009. 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.
62. Tokunaga, T.K. 2009. Hydraulic properties of adsorbed water films in unsaturated porous media. *Water Resour. Res.* 45, W06415, doi:10.1029/2009WR007734.
63. Tokunaga, T.K., Y. Kim, and J. Wan. 2009. Potential remediation approach for uranium-contaminated groundwaters through potassium uranyl vanadate precipitation. *Environ. Sci. Technol.* 43, 5467-5471.
64. Torkzaban, S., Y. Kim, M. Mulvihill, J. Wan, T.K. Tokunaga. 2010. Transport and deposition of functionalized CdTe nanoparticles in saturated porous media. *J. Contaminant Hydrology* 118, 208-217.
65. Wan, J., W. Dong, and T.K. Tokunaga. 2011. Method to attenuate U(VI) mobility in acidic waste plumes using humic acids. *Environ. Sci. Technol.* 45, 2331-2337.

66. Tokunaga, T.K. 2011. Physicochemical controls on adsorbed water film thickness in unsaturated geological media. *Water Resour. Res.* 47, W08514, doi:10.1029/2011WR010676.
67. Dong, W., T.K. Tokunaga, J.A. Davis, and J. Wan. 2012. Uranium(VI) adsorption and surface complexation modeling onto background sediments from the F-Area Savannah River Site. *Environ. Sci. Technol.* 46, 1565-1571.
68. Tokunaga, T.K., J. Wan, and M.E. Denham. 2012. Estimates of vadose zone drainage from a capped seepage basin, F-Area, Savannah River Site. *Vadose Zone Journal*, 11(3), DOI:10.2136/vzj2011.0131.
69. Tokunaga, T.K. 2012. DLVO-based estimates of adsorbed water film thicknesses in geologic CO<sub>2</sub> reservoirs. *Langmuir* 28, 8001-8009.
70. Kim, Y., J. Wan, T.J. Kneafsey, and T.K. Tokunaga. 2012. Dewetting of silica surfaces upon reactions with supercritical CO<sub>2</sub> and brine: Pore-scale studies in micromodels. *Environ. Sci. Technol.* 46, 4228-4235.
71. Wan, J., T.K. Tokunaga, W. Dong, M.E. Denham, and S.S. Hubbard. 2012. 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.
72. Torkzaban, S., J. Wan, T.K. Tokunaga, and S.A. Bradford. 2012. Impacts of bridging complexation on the transport of surface-modified nanoparticles in saturated sand. *J. Contaminant Hydrology* 136-137, 86-95.
73. Tokunaga, T. K., Y. Kim, J. Wan, L. Yang. 2012. Aqueous uranium(VI) concentrations controlled by calcium uranyl vanadate precipitates. *Environ. Sci. Technol.* 46, 7471-7477.
74. Kim, T.W., T.K. Tokunaga, D.B. Shuman, S.R. Sutton, M. Newville, A. Lanzirotti. 2012. Thickness of nanoscale brine films on silica surfaces equilibrated with supercritical carbon dioxide under geologic CO<sub>2</sub> sequestration conditions. *Water Resour. Res.* 48, W09558, DOI:10.1029/2012WR012200.
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76. Tokunaga, T.K., J. Wan, J. Jung, T.W. Kim, and W. Dong. 2013. Capillary pressure and saturation relations for supercritical CO<sub>2</sub> and brine in sand: High-pressure P<sub>c</sub>(S<sub>w</sub>) controller/meter measurements and capillary scaling predictions. *Water Resour. Res.* 49, 4566-4579, doi:10.1002/wrcr.20316, 2013. LBNL-6401E.
77. Kim, T.W., T.K. Tokunaga, J.R. Bargar, M.J. Latimer, and S.M. Webb. 2013. Brine film thicknesses on mica surfaces under geologic CO<sub>2</sub> sequestration conditions and controlled capillary pressures. *Water Resour. Res.* 49, 5071-5076, doi:10.1002/wrcr.20404.
78. Torkzaban, S., S.A. Bradford, J. Wan, T. Tokunaga, and A. Masoudith. 2013. Release of quantum dot nanoparticles in porous media: Role of cation exchange and aging time. *Environ. Sci. Technol.* 47, 11528-11536.
79. Tokunaga, T.K., and J. Wan. 2013. Capillary pressure and mineral wettability influences on reservoir CO<sub>2</sub> 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.
80. Han, Y.-S., and T.K. Tokunaga. 2014. Calculating carbon mass balance from unsaturated soil columns treated with CaSO<sub>4</sub>-minerals: Test of soil carbon sequestration. *Chemosphere*, 117, 87-93.

81. Wan, J., Y. Kim, and T.K. Tokunaga. 2014. Contact angle measurement ambiguity in supercritical CO<sub>2</sub>-water-mineral systems: Mica as an example. *Int. J. Greenhouse Gas Control*. 31, 128-137.
82. Wang, S., and T.K. Tokunaga. 2015. Capillary pressure-saturation relations for supercritical CO<sub>2</sub> and brine in limestone/dolomite sands: Implications for geologic carbon sequestration in carbonate reservoirs. *Environ. Sci. Technol.* 49, 7208-7217.
83. 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. 2016. 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.
84. Bikkina, P., J. Wan, Y. Kim, T.J. Kneafsey, and T.K. Tokunaga. 2016. Influence of wettability and permeability heterogeneity on miscible CO<sub>2</sub> flood efficiency. *Fuel* 166, 219-226, doi: 10.1016/j.fuel.2015.10.090.
85. Tran, A.P., B. Dafflon, M.B. Kowalsky, P. Long, T.K. Tokunaga, K.H. Williams, and S.S. Hubbard. 2016. Quantifying shallow subsurface water and heat dynamics using coupled hydrological-thermal-geophysical inversion. *Hydrology and Earth Systems Sciences Discussion*, 175, doi: 10.5194/hess-2016-175, 2016.
86. 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. 2016. Deep vadose zone respiration contributions to CO<sub>2</sub> fluxes from a semi-arid floodplain. *Vadose Zone J.* 15, doi: 10.2136/vzj2015.10.0136.
87. Wang, S., T.K. Tokunaga, J. Wan, W. Dong, and Y. Kim. 2016. Capillary pressure – saturation relations in quartz and carbonate sands: Limitations for correlating capillary and wettability influences on air, oil, and supercritical CO<sub>2</sub> trapping. *Water Resour. Res.*, doi: 10.1002/2016WR018816.
88. Han, Y.S., T.K. Tokunaga, R. Salve, and C.M. Chon. 2016. Environmental feasibility of soil amendment with flue gas desulfurization gypsum (FGDG) for terrestrial carbon sequestration. *Environ. Earth Sci.* 75, 1148.
89. Dong, W., J. Wan, T.K. Tokunaga, B. Gilbert, and K.H. Williams. 2017. Transport and humification of dissolved organic matter within a semi-arid floodplain. *J. Environ. Sci.*, in press.

### **Book chapters**

- Tokunaga, T.K., P.T. Zawislanski, P.W. Johannis, D. Lipton, and S.M. Benson. 1994. Field investigations of selenium speciation, transformation, and transport in some Kesterson Reservoir and Lahontan Valley soils. *in* Selenium in the Environment, W.T. Frankenberger, Jr., and S.M. Benson, eds. Marcel Dekker, Inc.
- H.M. Ohlendorf, E.R. Byron, G.M. Santolo, S.M. Benson, P.T. Zawislanski, T.K. Tokunaga, and M. Delamore. 2002. Ecological Risk Assessment Example: Waterfowl and Shorebirds Feeding in Ephemeral Pools at Kesterson Reservoir, California. *Handbook of Ecotoxicology*, Second Edition, David J. Hoffman, Barnett A. Rattner, G. Allen Burton, Jr., John Cairns, Jr. Editors. CRC, Lewis Publishers.
- Tokunaga, T.K. 2004. Tensiometry. *in* Encyclopedia of Soils in the Environment, D. Hillel, Ed., Elsevier.

Tokunaga, T.K., and J. Wan. 2013. Capillary pressure and mineral wettability influences on reservoir CO<sub>2</sub> 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.

### **Selected conferences, proceedings, and invited talks (past 15 years)**

Wan, J., T. K. Tokunaga, D. Joyner, T. C. Hazen, M. Firestone, E. Schwartz, S. Sutton, and M. Newville, Mesoscale Biotransformation Dynamics Controlling Reactive Transport of Chromium, NABIR PI Workshop, Warrenton, Virginia, March 12, 2001.

Tokunaga, T. K., J. Wan, T. C. Hazen, E. Schwartz, M. Firestone, S. Sutton, M. Newville, K. Olson, A. Lanzirotti, and W. Rao. Diffusion-limited chromium reduction in soil aggregates. 222<sup>nd</sup> Am. Chem. Soc. National Meeting, Chicago, Aug. 26-30, 2001.

Tokunaga, T. K., Chromium-contaminated soils: Cr redox zonation in soil aggregates. Invited seminar, Dept. of Chemistry and Biochemistry, San Francisco State University, Oct. 19, 2001.

Tokunaga, T. K., J. Wan, T. C. Hazen, M. K. Firestone, E. Schwartz, S. R. Sutton, M. Newville, K. R. Olson, A. Lanzirotti, W. Rao, Intra-aggregate biogeochemical dynamics of chromium contamination and in-situ remediation. Am. Geophys. Union, Fall Meeting, San Francisco, CA Dec. 14, 2001.

Tokunaga, T. K. Chromium biogeochemistry in contaminated sediments: Linking laboratory batch scale and field-scale understanding. Invited seminar, Geological and Environmental Sciences, Stanford University, Jan. 29, 2002.

Tokunaga, T. K., J. Wan, T. C. Hazen, E. Schwartz, M. Firestone, D. Herman, S. Sutton, M. Newville, K. Olson, A. Lanzirotti, and W. Rao. Chromium biogeochemistry in contaminated sediments: Linking laboratory batch scale and field-scale understanding. U.S. Dept. of Energy, Natural and Accelerated Bioremediation Research Program Meeting, Warrenton, VA, March 18, 2002.

Tokunaga, T. K., J. Wan, K. R. Olson. Unsaturated hydraulic properties of gravels. Environmental Remediation Technology Department, Lawrence Berkeley National Laboratory, Sept. 23, 2002.

Tokunaga, T. K. Chromium biogeochemistry in contaminated sediments: Linking laboratory batch scale and field-scale understanding. Soil Microbiology seminar, Ecosystem Sciences, Department of Environmental Science, Policy and Management, University of California, Berkeley, Oct. 31, 2002.

Tokunaga, T. K., J. Wan, T. C. Hazen, E. Schwartz, M. Firestone, D. Herman, S. Sutton, M. Newville, K. Olson, A. Lanzirotti, and W. Rao. Chromium redox transformations in diffusion-limited domains: Linking micro- and macroscale processes. Soil Science Society America Annual Meeting, Indianapolis, IN, Nov. 11, 2002.



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Tokunaga, T. K. Some experimental approaches for investigating coupled soil processes at multiple scales. Invited talk. U.S. National Committee for Soil Science. Washington, DC. June 15-16, 2011.

Tokunaga, T.K., Brine Films in Reservoir Pores During Geologic CO<sub>2</sub> Sequestration. Invited talk. Am. Geophys. Union, Fall Meeting, San Francisco, Dec. 5, 2011.

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Tokunaga, T.K. Capillary pressure relations for brine film thicknesses and for reservoir storage. Center for Nanoscale Control of Geologic CO<sub>2</sub> Symposium, Berkeley, October 18-19, 2012.

Tokunaga, T.K., Water films in unsaturated porous media. BES Geosciences Workshop on Reactions and Transport within Internal Domains of Porous Media, San Francisco, Dec. 1-2, 2012.

Tokunaga, T.K., J. Wan, J. Jung, T.W. Kim, Y. Kim, Saturation-capillary pressure relations in geologic CO<sub>2</sub> sequestration reservoirs. NRAP-LBNL meeting with Tom Richards, Jan. 17, 2013.

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Tokunaga, T.K., Film hydrostatics and flow under control by capillarity and adsorption. Geological Society of America Annual Meeting, Denver, Oct. 26-30, 2013.

Tokunaga, T.K., and J. Wan, Capillary pressure and mineral wettability influences on reservoir CO<sub>2</sub> capacity. Mineralogical Society of America Short Course on Geochemistry of Geological CO<sub>2</sub> sequestration, Lawrence Berkeley National Laboratory, December 7-8, 2013.

Tokunaga, T.K., Geologic carbon sequestration for mitigation of climate change, and the influence of capillary phenomena. Invited seminar, School of Environmental Science and Technology, Dalian University of Technology, Dalian, China, April 1, 2014.

Tokunaga, T.K., Geologic carbon sequestration for mitigation of climate change, and the role of pore-scale processes. Invited seminar, School of Environmental Science and Technology, Dalian University of Technology, Dalian, China, April 3, 2014.

Han, Y.-S., T.K. Tokunaga, and C. Oh. Soil carbon sequestration in semi-arid soil through the addition of flue gas desulfurization gypsum (FGDG). European Geophysical Union General Assembly, Vienna, Austria, April 27 to May 2, 2014.

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Tokunaga, T.K., SFA2.0 Tracking Component update/overview. Sustainable Systems SFA2.0 Fall 2014 Retreat, Bodega Bay, October 23, 2014.

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Tokunaga, T., S. Finsterle, Y. Kim, J. Wan, T. Lanzirotti, and M. Newville. Solute diffusion along water films in unsaturated porous media. LBNL-ESD BES Geochemistry Cluster seminar, March 3, 2015.

Tokunaga, T., S. Wang, J. Wan. Capillary controls on CO<sub>2</sub>-brine distributions in porous media. NCGC Dynamic Wetting Workshop, LBNL, April 21, 2015.

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Tokunaga, T.K., D.J. DePaolo, J. Wan, S. Wang, I. Bourg. Interfacial controls on geologic carbon sequestration. Joint Workshop of ESD and CSD BES Programs, LBNL, May 20, 2015.

Tokunaga, T., S. Wang, J. Wan, Y. Kim. Why do some scCO<sub>2</sub>-brine saturation relations deviated from capillary scaling predictions? NCGC Pore-scale multiphase Workshop, Stanford University, Aug. 25, 2015.

Tokunaga, T., S. Wang, J. Wan, Y. Kim. What causes deviations in predictions of scCO<sub>2</sub>-brine saturation relations? NCGC Fall 2015 Symposium, LBNL, Nov. 19-20, 2015.

Tokunaga, T.K., Y. Kim, J. Wan, W. Dong, M.E. Conrad, M. Bill, C. Hobson, K.H. Williams, P.E. Long. CO<sub>2</sub> production rate maxima in the deeper unsaturated zone of a semi-arid floodplain at rifle, Colorado. American Geophysical Union Fall Meeting, San Francisco, December 14-18, 2015.

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Tokunaga, T.K., A. Cihan, J. Wan, Y. Kim, and W. Shen. Understanding water controls on shale gas mobilization, U.S. Department of Energy, National Energy Technology Laboratory, Mastering the Subsurface Through Technology, Innovation, and Collaboration: Carbon storage and oil and gas technologies review meeting. Pittsburgh, PA, August 16-18, 2016.

Tokunaga, T.K., S. Finsterle, Y. Kim, J. Wan, A. Lanzirotti, and M. Newville. Ion diffusion through water films in unsaturated sands. American Geophysical Union Fall Meeting, San Francisco, December 12-16, 2016.