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EDUCATION

Ph.D. Environmental Engineering Science, California Institute of Technology, Pasadena, CA
Advisor: Professor James J. Morgan
M.S. Environmental Engineering Science, California Institute of Technology, Pasadena, CA
B.S. Civil Engineering, Northeastern University, Boston, MA

RESEARCH EXPERTISE AND FOCUS

Investigations of chemical element cycling in aquatic and sediment environments, including

- Biological and chemical transformation of mercury at the sediment-water interface, resolving the genetic basis of mercury methylation, a key question ever since Minamata disease was identified in the 1950s. Current research explores the fundamentals of mercury interaction in microbial cells and in water. Biogeochemical research into carbon cycling in the Arctic permafrost environments.
- Using neutrons to understand protein-mineral surface interaction. Geochemical and interfacial processes that affect metal oxide colloidal particles in aquatic and subsurface environments. Novel synthesis of monodispersed nanoparticles (SiO_2, TiO_2, Fe_2O_3, core-shell composites) and colloidal arrays (as sensing materials) and study of electrical double layers that influence the stability of colloidal particles and transport in porous media.
- Research and development of remediation technologies for soil and groundwater; particularly, characterization technologies to identify mercury in soil at contaminated sites, development of thiol-resin beads for mercury removal from water, and novel composite materials for TCE degradation in water.
- Sequestration studies of clathrate CO_2 gas hydrates using seafloor simulator and development of a new method to produce dispersible seawater-hydrate composite.
- Technology development of Permeable Reactive Barriers (PRB) for groundwater remediation, focusing on degradation mechanisms of chlorinated organic compounds (TCE, CT, PCB) using zero valence iron (ZVI). Developed palladized ZVI for increased (20x) reaction rate and more complete degradation. Geochemical research into mineral precipitation influencing permeability of reactive media.
- Aqueous chemical speciation and surface chemical reactions that control the fate of metals, radionuclides and organic pollutants in engineering systems and natural environments. Laboratory and field investigation of dissolved oxygen effects on iron oxide particle formation, dissolution kinetics, and transport in groundwater.
- Fate of nanoparticles in natural water/sediment environments: colloid stability, deposition, and transport, and the chemical processes governing mineral oxide particle precipitation and dissolution in water.

PUBLICATIONS

Journal articles

1. Herndon, EM, BF Mann, TR Chowdhury, Z Yang, SD Wullschleger, D Graham, L Liang, and B Gu, 2015. Pathways of anaerobic organic matter decomposition in tundra soils from Barrow, Alaska, *J. Geophys. Res. Biogeosci., 120, 2345–2359*. DOI:10.1002/2015JG003147.

2. Herndon, EM, Z Yang, J Bargar, N Janot, TZ Regier, DE Graham, SD Wullschleger, B Gu, L Liang, 2015. Geochemical drivers of organic matter decomposition in Arctic tundra soils, Biogeochemistry, 126:397–414. DOI 10.1007/s10533-015-0165-5

3. Miller, Carrie; Watson, David; Lester, Brian; Howe, Jane; Phillips, Debra; He, Feng; Liang, Liyuan; Pierce, Eric. 2015. "Formation of soluble mercury oxide coatings: transformation of elemental mercury in soils" Environ. Sci. Technol., 2015, 49 (20), pp 12105–12111. DOI: 10.1021/acs.est.5b00263

4. Lin, H; Lu, X; Liang, L; Gu, B. 2015. Thiol-Facilitated Cell Export and Desorption of Methylmercury by Anaerobic Bacteria, Environ. Sci. Technol. Lett., 2 (10), pp 292–296. DOI: 10.1021/acs.estlett.5b00209

5. Watson, D; Miller, C; Lester, B; Lowe, K; Southworth, G; Bogle, MA; Liang, L; Pierce, E. 2015. Mercury source zone identification using soil vapor sampling and analysis, FRONTIERS OF ENVIRONMENTAL SCIENCE & ENGINEERING, 9(4), 596- 604. DOI: 10.1007/s11783-014-0709-2

6. Mann, BF; Chen, HM; Herndon, EM; Chu, RK; Tolic, N; Portier, EF; Chowdhury, TR; Robinson, EW; Callister, SJ; Wullschleger, SD; Graham, DE; Liang, L; Gu, B. 2015. Indexing Permafrost Soil Organic Matter Degradation Using High-Resolution Mass Spectrometry, PLOS ONE. 10(6). DOI: 10.1371/journal.pone.0130557

7. He, F; Gao, J; Pierce, E; Strong, PJ; Wang, HL; Liang, L. 2015. In situ remediation technologies for mercury-contaminated soil, ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 22(11), 8124-8147. DOI: 10.1007/s11356-015-4316-y

8. Lin, H; Lu, X; Liang, L; Gu, B. 2015. Cysteine Inhibits Mercury Methylation by Geobacter sulfurreducens PCA Mutant Delta omcBESTZ; ENVIRONMENTAL SCIENCE & TECHNOLOGY LETTERS, 2(5): 144-148. DOI: 10.1021/acs.estlett.5b00068

9. Newman, BD; Throckmorton, HM; Graham, DE; Gu, B; Hubbard, SS; Liang, L; Wu, Y; Heikoop, JM; Herndon, EM; Phelps, TJ; Wilson, CJ; Wullschleger, SD. 2015. Microtopographic and depth controls on active layer chemistry in Arctic polygonal ground, GEOPHYSICAL RESEARCH LETTERS. 42(6): 1808-1817. DOI: 10.1002/2014GL062804

10. He, F., W. Zhao, L. Liang, and B. Gu., 2015. Photochemical oxidation of dissolved elemental mercury by carbonate radicals in water, Environ. Sci. Technol. Lett., 2014, 1 (12), pp 499–503, DOI: 10.1021/ez500322f

11. Chowdhury T.R., E.M. Herndon , T.J. Phelps, D.A. Elias, B. Gu, L. Liang, S.D. Wullschleger and D.E. Graham, 2015. Stoichiometry and temperature sensitivity of methanogenesis and CO2 production from saturated polygonal tundra in Barrow, Alaska. Global Change Biology 21:722-737. doi: 10.1111/gcb.12762.

12. He, F., W. Zhao, L. Liang, and B. Gu., 2014. Photochemical oxidation of dissolved elemental mercury by carbonate radicals in water, *Environ. Sci. Technol. Lett.*, 2014, 1 (12), pp 499–503, DOI: 10.1021/ez500322f

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14. Riding R., L. Liang and JC Braga, 2014. Millennial-scale ocean acidification and late Quaternary decline of cryptic bacterial crusts in tropical reefs, Geobiology, 12 (5):387-405. DOI: 10.1111/gbi.12097

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22. Zheng, Wang; Lin, Hui; Mann, Benjamin F, Liang L., Gu, B. 2013. Oxidation of Dissolved Elemental Mercury by Thiol Compounds under Anoxic Conditions, Environ Sci & Technol. 47 (22): 12827-12834, DOI: 10.1021/es402697u

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24. Hu, H., H. Lin, W. Zheng, S. J. Tomanicek, A. Johs, X. Feng, D. A. Elias, L. Liang, B. Gu. Oxidation and methylation of dissolved elemental mercury by anaerobic bacteria. Nature Geosci. 2013. DOI: 10.1038/NGEO1894.

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