

Ian C. Bourg

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PROFESSIONAL PREPARATION

- 2004 **Ph.D., Environmental Engineering**, U.C. Berkeley
Dissertation: “*Tracer Diffusion of Water and Inorganic Ions in Compacted Saturated Sodium Bentonite*”
Advisor: Prof. G. Sposito
- 1999 **M.Sc., Chemical Engineering**, Natl. Inst. of Appl. Sci. (INSA), Toulouse, France
Thesis: “*CFD Modeling of a Bubble Column Reactor*”
Advisor: Prof. H.A. Jakobsen
- 1999 **B.Eng., Chemical Engineering**, Natl. Inst. of Appl. Sci., Toulouse, France

APPOINTMENTS

- 2008-present **Postdoctoral Fellow**, Geochemistry Dept., Lawrence Berkeley National Lab
- 2008-present **Visiting Scholar**, Dept. of Earth and Planetary Sciences, Harvard University
- 2008 **Postdoctoral Researcher**, Dept. of Geophysical Sciences, University of Chicago
- 2005-2008 **Postdoctoral Fellow**, Geochemistry Dept., Lawrence Berkeley National Lab
- 2003-2004 **Graduate Student Researcher**, Environmental Geochemistry Group (Prof. G. Sposito), U.C. Berkeley (three semesters)
- 2003 **Graduate Student Instructor**, Environmental Water Chemistry (Prof. S.W. Hermanowicz), U.C. Berkeley (one semester)
- 2002, 2003 **Graduate Student Instructor**, Environmental Engineering (Prof. W.W. Nazaroff and Dr. W.J. Riley), U.C. Berkeley (two semesters)

RESEARCH INTERESTS

My research is focused on the study of interfacial phenomena at the molecular, pore, and continuum scales. In particular, I have investigated the surface chemistry of clay minerals, the diffusion of water and solutes in argillaceous media, the fractionation of solute isotopes by diffusion in water, the uses of noble gases as hydrologic tracers and paleoclimate proxies, and the molecular-scale mechanisms of solute diffusion in liquid water and water-filled nanopores.

TEACHING & MENTORING

I have taught courses in Environmental Engineering (two semesters) and Environmental Water Chemistry (one semester). Average student ratings of my teaching effectiveness reached 4.8 out of 5.0 during my last semester of teaching and were consistently higher than the average rating of graduate student instructors in Civil and Environmental Engineering at U.C. Berkeley.

PUBLICATIONS

14. **Bourg I.C.** and Sposito G. (2009) Diffusion of water and solutes (Na^+ , Cs^+ , Sr^{2+}) in water-saturated smectite clay barriers: From Molecular Dynamics simulations of individual nanopores to continuum-scale diffusion coefficients. In preparation for submission to *Geochim. Cosmochim. Acta*.
13. **Bourg I.C.** and Sposito G. (2009) Ion exchange phenomena. In: *Handbook of Soil Science*, 2nd ed. (P.M. Huang, ed.). Submitted Apr. 2009; in review.
12. **Bourg I.C.**, Richter F.M., Christensen J.N. and Sposito G. (2009) Isotopic mass-dependence of metal cation diffusion coefficients in liquid water. Submitted Dec. 2008 to *Phys. Rev. Lett.*; under revision for submission to *Geochim. Cosmochim. Acta*.
11. **Bourg I.C.**, Sposito G. and Bourg A.C.M. (2008) Modeling the diffusion of Na^+ in compacted water-saturated Na-bentonite as a function of pore water ionic strength. *Appl. Geochem.* 23, 3635-3641.
10. **Bourg I.C.** (2008) Comment on “Modeling sulfur isotope fractionation and differential diffusion during sulfate reduction in sediments of the Cariaco Basin” by M.A. Donahue, J.P. Werne, C. Meile and T.W. Lyons. *Geochim. Cosmochim. Acta* 72, 5852-5854.
9. **Bourg I.C.** and Sposito G. (2008) Isotopic fractionation of noble gases by diffusion in liquid water: Molecular dynamics simulations and hydrologic applications. *Geochim. Cosmochim. Acta* 72, 2237-2247. **#4 “hottest article” (most downloaded) in *Geochim. Cosmochim. Acta* during Apr.-Jun. 2008.**
8. **Bourg I.C.** and Sposito G. (2007) Molecular dynamics simulations of kinetic isotope fractionation during the diffusion of ionic species in liquid water. *Geochim. Cosmochim. Acta* 71, 5583-5589. **#16 “hottest article” in *Geochim. Cosmochim. Acta* during Oct.-Dec. 2007.**
7. **Bourg I.C.**, Sposito G. and Bourg A.C.M. (2007) Modeling cation diffusion in compacted water-saturated sodium bentonite at low ionic strength. *Environ. Sci. Technol.* 41, 8118-8122.
6. **Bourg I.C.**, Sposito G. and Bourg A.C.M. (2007) Modeling the acid-base surface chemistry of montmorillonite. *J. Colloid Interface Sci.* 312, 297-310. **#15 “hottest article” in *J. Colloid Interface Sci.* during Jul.-Sept. 2007.**
5. **Bourg I.C.**, Sposito G. and Bourg A.C.M. (2006) Tracer diffusion in compacted, water-saturated bentonite. *Clays Clay Miner.* 54, 363-374. **Most cited article published since 2006 in *Clays Clay Miner.***
4. **Bourg I.C.** (2004) *Caractérisation du comportement d’une bentonite sodique pour l’isolement des déchets*. Ph.D. Thesis, Université de Pau et des Pays de l’Adour, Pau, France, 114 pp.
3. **Bourg I.C.** (2004) *Tracer diffusion of water and inorganic ions in compacted saturated sodium bentonite*. Ph.D. Thesis, University of California, Berkeley, 368 pp.
2. **Bourg I.C.**, Bourg A.C.M. and Sposito G. (2003) Modeling diffusion and adsorption in compacted bentonite: a critical review. *J. Contam. Hydrol.* 61, 293-302.

1. Jakobsen H.A., **Bourg I.**, Hjarbo K.W. and Svendsen H.F. (2001) Interaction between reaction kinetics and flow structure in bubble column reactors. In: *Parallel Computational Fluid Dynamics – Trends and Applications*, Elsevier, Amsterdam, 543-550.

SCIENTIFIC PRESENTATIONS

Migration Conference (on actinides and fission products in the geosphere) (2001, 2005, 2009)

Goldschmidt Conference (2009**)

University of Notre Dame faculty job talk (2009)

American Chemical Society annual meeting (2006, 2009)

DOE Geosciences Symposium (2007, 2009)

American Geophysical Union Fall meeting (2002, 2003, 2005, 2007, 2008*)

Massachusetts Institute of Technology faculty job talk (2008)

ETH Zurich faculty job talk (2008)

Paul Scherrer Institute seminar presentation (2008)

Surface Reactions & Electrical Interfacial Layer European Union workshop (2007)

Clay Minerals Society annual meeting (2007)

Environment, Neutrons and Molecular Dynamics U. of Grenoble/ILL workshop (2007)

International Workshop on Waste Management at Hokkaido University (2005)

International Clay Conference (2005)

(invited presentation and * sessions convened)

FORTHCOMING SCIENTIFIC PRESENTATION

2009 International Conference on the Chemistry and Migration of Actinides and Fission Products in the Geosphere (Migration '09), Kennewick, WA, September 20-25, 2009:

“Diffusion of water and solutes near clay surfaces: Bridging the nanopore and continuum scales” (oral presentation)

GRANTS

- 2008 **DOE:** Contributor to a successful proposal for the creation of an Energy Frontiers Research Center on the “*Molecular Control of Geologic CO₂*” that will include multiple researchers from LBNL and other institutions under the direction of Prof. D.J. DePaolo (\$20M).
- 2006 **DOE:** Contributor to a successful proposal on “*Clay Mineral Surface Chemistry*” with Prof. G. Sposito (\$600k).
- 2005-2008 **DOE:** Contributor to four successful proposals for CPU time from the DOE-funded National Energy Research Scientific Computing Center (NERSC) with Prof. G. Sposito.
- 2005-2007 **NSF:** Author of three successful proposals for CPU time from the NSF Teragrid program through the San Diego Supercomputer Center (SDSC), twice as sole PI and once as co-PI with Prof. G. Sposito.

FELLOWSHIPS

- 2005-2009 **Postdoctoral Fellowship**, Lawrence Berkeley National Lab (four years, \$68,000/y)
- 2000, 2002 **Doctoral Fellowships**, Environmental Engineering Group, U.C. Berkeley (two years, tuition and fees waiver)
- 1999-2002 **Doctoral Fellowship**, French Radioactive Waste Management Agency (three years, \$17,000/y)
- 1999 **Leonardo Scholarship**, European Union (one semester, \$1,000)

MISCELLANEOUS

Member of the American Chemical Society (ACS), American Geophysical Union (AGU), Clay Minerals Society (CMS), and Mineralogical Society of America (MSA).

Reviewer of over 30 manuscripts for *Geochimica et Cosmochimica Acta*, *Journal of Colloid and Interface Science*, *Clays and Clay Minerals*, *Environmental Science and Technology*, *Journal of Geophysical Research*, *Journal of Physical Chemistry*, *Water Resources Research*, *Advances in Water Resources*, *Journal of Hydrology*, *Applied Geochemistry*, *Vadose Zone Journal*, *Acta Geotechnica*, *Nuclear Technology*, and *Croatica Chimica Acta*.