Edward W. Bolton: PUBLICATIONS:

Articles Submitted:

- Li, Li, Maher, K., Navarre-Sitchler, A., Bao, C., Biesman, J., Bolton, E.W., Brantley, S., Dietrich, B., Druhan, J., Jin, L., Kocar, B., Kumar, M., Lawrence, C., Mayer, U., McIntosh, J., Meile, C., Moore, J., Perdrial, J., Sonnethal, E., Steefel, C.S., Sullivan, P., Thompson, A., Tutulo, B., Valocchi, A., Zachara, J., Barrera, E., Torgerson, T., Lesmes, D., Woodward, N., King, B., a manuscript in preparation summarizing a National Science Foundation sponsored workshop: "Expanding the role of Reactive Transport Modeling (RTM) within the Biogeochemical Sciences", Alexandria, VA, 13-15 April 2014. Submitted to Earth Science Reviews on 13 Dec. 2015.

Published Refereed Articles:

- Van Hise, J.R., D.E. Martz, R.A. Jackson, D.Y. Kunihira and E.W. Bolton (1982) Polonium-218 half-life, Physical Review C, 25. 2802-2804.
- Busse, F.H. and E.W. Bolton (1984) Instabilities of convection rolls with stress-free boundaries near threshold, J. Fluid Mech., 146, 115-125.
- Bolton, E.W. and F.H. Busse (1985) Stability of convection rolls in a layer with stress-free boundaries, J. Fluid Mech., 150, 487-498.
- Azouni, M.A., E.W. Bolton and F.H. Busse (1986) Convection driven by centrifugal buoyancy in a rotating annulus, Geophys. Astroph. Fluid Dyn., 34 301-317.
- Bolton, E.W., F.H. Busse and R.M. Clever (1986) Oscillatory instabilities of convection rolls at intermediate Prandtl numbers, J. Fluid Mech., 164, 469-485.
- Fauve, S., E.W. Bolton and M.E. Brachet (1987) Nonlinear oscillatory convection: A quantitative phase dynamics approach, Physica, 29D, 202-214.
- Bolton, E.W. (1993) A simple notation for differential vector operations in orthogonal curvilinear coordinates, Geophysical Journal International, 115, 654-666.
- Bolton, E.W. and J. Maurer (1994) A new roll-type instability in an oscillating fluid plane, J. Fluid Mech, 268, 293-313.
- Bolton, E.W., K.A. Maasch and J. M. Lilly (1995), A wavelet analysis of Plio-Pleistocene climate indicators: A new view of periodicity evolution, Geophysical Research Letters, 22, 2753-2756.
- Bolton, E.W., A.C. Lasaga and D.M. Rye, (1996) A model for the kinetic control of quartz dissolution and precipitation in porous media flow with spatially variable permeability: Formulation and examples of thermal convection, Journal of Geophysical Research, 101, 22157-22187.
- Bolton, E.W., A.C. Lasaga and D.M. Rye, (1997) Dissolution and precipitation via forced-flux injection in a porous medium with spatially variable permeability: Kinetic control in two dimensions, Journal of Geophysical Research, 102, 12159-12171.
- Bolton, E.W., A.C. Lasaga and D.M. Rye, (1999) Long-term flow/chemistry feedback in a porous medium with heterogeneous permeability: Kinetic control of dissolution and precipitation, American Journal of Science, v. 299, pp. 1-68.
- Luttge, A., E.W. Bolton, and A.C. Lasaga, (1999) An interferometric study of the dissolution kinetics of anorthite: The role of reactive surface area, Invited paper in: Biogeochemical cycles and their evolution over geologic time. D. Canfield (ed) A special triple issue of the American Journal of Science, A tribute to the career of Robert A. Berner, v. 299, pp. 652-678.
- Seilacher, A., M. Meschede, E.W. Bolton, and H. Luginsland, (2000) The Precambrian "fossil" Vermiforma is a tectograph, Geology, v. 28, pp. 235-238.

- Lasaga, A.C., A. Luttge, D.M. Rye, and E.W. Bolton, (2000) Dynamic treatment of invariant and univariant reactions in metamorphic systems, American Journal of Science, v. 300, pp. 173-221.
- Lasaga, A.C., D.M. Rye, A. Luttge, and E.W. Bolton, (2001) Calculation of fluid fluxes in Earth's crust, Geochimica et Cosmochimica Acta, Vol. 65, No. 7, pp. 1161-1185.
- Breeding, C.M., J.J. Ague, M. Brocker, and E.W. Bolton, (2003) Blueschist preservation in a retrograded, high-pressure, low-temperature metamorphic terrane, Tinos, Greece: Implications for fluid flow paths in subduction zones, G-cubed, Vol. 4, No. 1, 22 Jan. 2003.
- Rye, D., E.W. Bolton, A. Luttge (2003) Erratum to Antonio C. Lasaga, Danny M. Rye, Andreas Luttge, and Edward W. Bolton (2001) "Calculation of fluid fluxes in the Earth's crust," Geochimica et Cosmochimica Acta, Vol. 67, No. 9, p. 1755.
- Luttge, A., E.W. Bolton, and D.M. Rye (2004) A kinetic model of metamorphism: An application to siliceous dolomites, Contributions to Mineralogy and Petrology, DOI: 10.1007/s00410-003-0520-8, Vol. 146, No. 5, January 2004, pp. 546 - 565.
- Wildman, R. A., Berner, R. A., Petsch, S. T., Bolton, E. W., Eckert, J.O., Mok, U., and, Evans, J.B., (2004) The weathering of sedimentary organic matter as a control on atmospheric O_2: I. Analysis of a black shale, American Journal of Science, Vol. 304, p. 234-249.
- Bolton, E.W., D.M. Rye, J.J. Ague, and A. Luttge, (2004) Modeling contact metamorphism of siliceous dolomite via kinetic control of overall reactions, Water-Rock Interaction, Vol. 1, R.B. Wanty and R.R. Seal II, eds., Proceedings of the 11th International Symposium on Water-Rock Interaction, 27 June -2 July 2004, Saratoga Springs, NY, USA, pp. 269-272.
- Berner, R.A., E.W. Bolton, R.A. Wildman, and S.T. Petsch, (2004) Organic matter weathering and atmospheric oxygen: A field and modeling study of black shale oxidation, Water-Rock Interaction, Vol. 1, R.B. Wanty and R.R. Seal II, eds., Proceedings of the 11th International Symposium on Water-Rock Interaction, 27 June -2 July 2004, Saratoga Springs, NY, USA, pp. 805-808.
- Bolton, E. W., Berner, R. A., and Petsch, S. T., (2006) The weathering of sedimentary organic matter as a control on atmospheric O_2: II. Theoretical Modeling, American Journal of Science, October, Vol. 306, pp. 575-615.
- Buss L.W., Anderson C., Bolton E.W. (2013) Muscular Anatomy of the *Podocoryna carnea* Hydrorhiza. PLoS ONE 8(8): e72221. doi:10.1371/journal.pone.0072221.
- Bolton, E.W., and A. Firoozabadi, (2014) Numerical modeling of temperature and species distributions in hydrocarbon reservoirs, Journal of Geophysical Research-Solid Earth, Vol. 119, p. 18-31, doi:10.1002/2013JB010043.
- Neogi, S., Bolton, E.W., and Chakraborty, S., (2014) Timescales of disequilibrium melting in the crust: constraints from modeling the distribution of multiple trace elements and a case study from the Lesser Himalayan rocks of Sikkim, Contributions to Mineralogy and Petrology, 168:1020, DOI 10.1007/s00410-014-1020-8.
- Buss, L. W., C. P. Anderson, E. K. Perry, E. D. Buss, and E. W. Bolton (2015) Nutrient distribution and absorption in the colonial hydroid *Podocoryna carnea* is sequentially diffusive and directional. Public Library of Science ONE, PONE-D-15-21037R1.
- Connally, N., Anderson, C.P., Bolton, J.E., Bolton, E.W., Buss, L.W. (2015) The Selective Myosin II Inhibitor Blebbistatin Reversibly Eliminates Gastrovascular Flow and Stolon Tip Pulsations in the Colonial Hydroid *Podocoryna carnea*, Public Library of Science ONE,
-

<u>Articles in Preparation:</u>

- Bolton, E.W., J. Rimas Vaisnys, and L.W. Buss, A dynamic circulation model for the colonial hydroid *Podocoryne carnea* network.

- Bolton, E.W., Zhengrong Wang, Jay J. Ague, Lin Qiu, Shuang Zhang, David Bercovici, Shun-ichiro Karato, and Michael Oristaglio, Geochemical and kinetic modeling of fluid chemistry during coupled forsterite dissolution and magnesite precipitation.
- Lin Qiu, Zhengrong Wang, Shuang Zhang, Shun-ichiro Karato, Jay J. Ague, Michael L. Oristaglio, Edward W. Bolton, and David Bercovici, Experimental study of the reaction kinetics between CO2-bearing fluid and olivine.
- Bolton, E.W., Druhan, J.L., and Steefel, C.I., "The influence of heterogeneous permeability on bulk kinetic rates".
- Bolton, E.W., A. Luttge, D.M. Rye, and J.J. Ague, Modeling kinetically controlled reactive flows during contact metamorphism, in preparation.

Book Reviews:

- Bolton, E.W., Review of Buoyancy-induced Flows and Transport, by B. Gebhart, et.al., (Hemisphere, New York, 1988), which appeared in American Scientist, 77, pp. 298-299, 1989.
- Bolton, E.W., Review of Annual Review of Fluid Mechanics, 22, John L. Lumley, et al., editors, published by Annual Reviews, Palo Alto, California 1990, for the Bulletin of the American Meteorological Society, 72, 1399-1400, 1991.
- PONE-D-15-28617R1.

Software Systems Developed:

- KINFLOW: Reactive transport in a 2D, non-isothermal, heterogeneous, dynamic permeability, porous media with mineral reactions under kinetic control and numerous aqueous speciation reactions (see also KINFLOW1D below). The five mineral code was extended to include the 46 minerals, with accompanying thermodynamic and kinetic rate databases.

- META-KINFLOW: Similar to the above model, but with supercritical fluids (H_2O, CO_2) EOS at metamorphic conditions. 8 minerals used for computation of reactions of siliceous dolomites.

- DIG: Diffusion of isotopes and trace elements in grains during recrystallization (a moving boundary problem), exchanging with moving fluids in porous media.

- OMPYR: Weathering of organic matter and pyrite in eroding soils. The formulation and results are described in Bolton, E. W., Berner, R. A., and S. T. Petsch, (2006).

- DIGmajorelem: Diffusion of major elements based on nonequilibrium thermodynamics in a 4 mineral set during rapid uplift of kimberlites with applications to thermobarometry (a collaboration with Alex Andrews and Zhengrong Wang)**.**

- KINFLOW1D: Similar to KINFLOW, but for 1D, with 46 minerals under kinetic control, 27 aqueous phase equilibrium reactions, 64 aqueous species, and 2 gases (O_2, CO_2). A 0D version of this model has been implemented for comparison to the geochemical experiments. This models has recently been linked with a 1D geomechanical compaction model, in collaboration with Zhengyu Cai and David Bercovici. In addition to the viscous solid end-member geomechanical compaction model, a poroelastic solid model has been coded.

- KINFLOWCO2SEQ: Reactive transport in a 2D, non-isothermal, heterogeneous, dynamic permeability, porous media with mineral reactions under kinetic control and numerous aqueous speciation reactions. The code above was extended to 2D and to include liquid and vapor phases, separate EOS for CO_2-brine phases, with applications to subsurface carbon sequestration.

- CVS 5.0, 6.0: Compositional Variation Software for hydrocarbon reservoir evolution in a two-phase fluid based on non-equilibrium thermodynamics. Prepared in collaboration with A. Firoozabadi. Available to members of the Reservoir Engineering Research Institute. Software package included Bolton's modification of the nearly 17,000 lines of code, manuals (1 CVS5 release, 3 CVS6 releases), example input files and case studies with accompanying figures and descriptions, hydrocarbon property databases, instructions for plotting via R and Splus. Bolton implemented dynamic thermal evolution and convection, tilt of the reservoir layers, heterogeneities in tortuosity, separate barycentric reference frames for liquid and vapor phases, multiple injection and extraction wells.

- Diffusion Coefficient Calculations for Hydrocarbon Reservoir Fluids: Created FORTRAN code to implement the diffusion coefficient calculations of Leahy-Dios, Alana and Abbas Firoozabadi, (2007) Unified Model for Nonideal Multicomponent Molecular Diffusion Coefficients, AIChE Journal, November 2007 Vol. 53, No. 11, p. 2932-2939.

- COLONYCODE: Fluid flow and nutrient circulation driven by an arbitrary number of polyps (as pumps) in an arbitrary network of elastic tubes as a model for the circulation system of the hydrozoan *Podocoryne carnea*.

- Double diffusive convection (heat and salt) for the investigation of salt fingering and cabbeling and their contribution to vertical heat and mass transport in the ocean with thermobaric effects. This project is a collaboration with Prof. George Veronis.

Reports of Significance:

- Bolton, E.W. and A. Firoozabadi, (2008) The Addition of Tilt and Charging for Compositional Variation Software, Report for: Reservoir Engineering Research Institute (RERI), Palo Alto, CA, April 21, 2008, available upon request, 130 pages (30 text, 100 figures and captions)
- Li, Li, Maher, K., Navarre-Sitchler, A., Bao, C., Biesman, J., Bolton, E.W., Brantley, S., Dietrich, B., Druhan, J., Jin, L., Kocar, B., Kumar, M., Lawrence, C., Mayer, U., McIntosh, J., Meile, C., Moore, J., Perdrial, J., Sonnethal, E., Steefel, C.S., Sullivan, P., Thompson, A., Tutulo, B., Valocchi, A., Zachara, J., Barrera, E., Torgerson, T., Lesmes, D., Woodward, N., King, B., a report summarizing a National Science Foundation sponsored workshop: "Expanding the role of Reactive Transport Modeling (RTM) within the Biogeochemical Sciences", Alexandria, VA, 13-15 April 2014, has been the National Science Foundation.