

RUTH M. TINNACHER

Assistant Professor

Department of Chemistry and Biochemistry
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EDUCATION

Ph.D.	Colorado School of Mines (CSM), USA Environmental Science and Engineering	Completion: June 2008; Graduation: Dec. 2008
M.S.	Colorado School of Mines (CSM), USA Environmental Science and Engineering As part of the Dual-Degree Program with the University of Leoben, Austria	May 2001
Dipl.-Ing. (Equiv. M. Eng.)	University of Leoben, Austria Chemical Process Engineering in Industrial Environmental Protection Mit Auszeichnung bestanden (Passed with distinction)	Dec. 2000
Cand.-Ing. (Equiv. B.S.)	University of Leoben, Austria Industrial Environmental Protection, Waste Disposal and Recycling	Feb. 1997

TEACHING AND MENTORING EXPERIENCE

Full-time Instructor	<u>Quantitative Analysis</u> (lecture and lab section) <u>Environmental Chemistry I</u> (lecture) <u>General Chemistry I, II and III</u> (lab sections) <u>Graduate Chemistry Seminar</u> Dept. of Chemistry & Biochemistry, California State University East Bay	Fall 2016, Spring 2017 Winter 2017 Winter, Spring, Fall 2017 Fall 2017
Full-time Lecturer	<u>Principles of Environmental Chemistry</u> (lecture and lab section) Environmental Science & Engineering Division, Colorado School of Mines	Fall 2006
Guest Lecturer	<u>Chemistry of the Soil-Water Interface</u> Environmental Science & Engineering Division, Colorado School of Mines	Spring 2005
Lab Instructor	<u>Principles of Environmental Chemistry</u> (lab section) Environmental Science & Engineering Division, Colorado School of Mines	2004
Instructor	<u>Summer Outreach Program</u> Laboratory for Applied and Environ. Radiochemistry, Colorado School of Mines	2003 – 2008
Guest Lecturer	<u>Principles of Environmental Chemistry</u> Environmental Science & Engineering Division, Colorado School of Mines	2002 – 2005
Master Thesis Advisor	<u>Jonathan Pistorino</u> (Master student) Dept. of Chemistry & Biochemistry, California State University East Bay	Spring 2017 – present
Student Research Advisor	<u>Nicolas Hall and David Robles</u> (undergraduate students) CSUEB Center for Student Research Scholarship	Winter 2017 – present
Mentor	<u>Courtney Irwin</u> (summer intern) Earth Sciences Division, Lawrence Berkeley National Laboratory	Summer 2012
Committee Member	<u>Laura Cooper</u> (Plan B Master's candidate) Dept. of Chemistry & Biochemistry, California State University East Bay <u>Emily Leshner</u> (Ph.D. student) Environmental Science & Engineering Division, Colorado School of Mines	Fall 2016 2009 – 2011

RESEARCH AND PROFESSIONAL EXPERIENCE

Assistant Professor **Sept. 2016 – present**
California State University East Bay, Department of Chemistry and Biochemistry

- Teaching Quantitative Analysis, Environ. Chemistry I, General Chemistry Labs and Graduate Seminar.
- Advisor of three undergraduate and graduate research students.
- Establishing the infrastructure for an environmental radiochemistry/geochemistry research laboratory.
- Development of an independent research program with internal and external research grants.
- Contributing to university and community service.

Project Scientist **July 2011 – Aug. 2016**
Lawrence Berkeley National Laboratory, Earth Sciences Division

- Uranium Diffusion in Engineered Barrier Material (DOE Used Fuel Disposition Program)
- Organic Matter Dynamics at Mineral Interfaces (DOE Scientific Focus Area Program)
- Independent Review of Scientific Information on Advanced Well Stimulation Technologies in California (California Bureau of Land Management)
- Impacts of CO₂ Sequestration on Metal Mobility in Saline Aquifers (U.S. Environ. Protection Agency)

Postdoctoral Fellow **Aug. 2008 – June 2011**
Lawrence Livermore National Laboratory, Physical & Life Sciences Directorate

- Kinetics of Neptunium(V) Sorption and Desorption on Goethite
- Groundwater Analysis for the UnderGround Test Area (UGTA) Project (DOE Environ. Management)
- Environmental Transport of Plutonium (DOE Scientific Focus Area Program)
- Kinetic Effects on the Relative Comparison of Contaminant Sorption and Transport Parameters (Special Employee Strategic Mission Support Project)

Doctoral Research **May 2001 – June 2008**
Colorado School of Mines, Environmental Science and Engineering Division

- Effects of Fulvic Acid and Extracellular Polymeric Substances on the Mobility of Uranium and Plutonium in Saturated Groundwater Systems (Austrian Academy of Sciences; U.S. NSF; U.S. Department of Energy)

Master Thesis Research **July 1999 – May 2001**
Colorado School of Mines, Coors Brewing Company, University of Leoben

- Polymer Additives in Wastewater Treatment Processes: Characterization and Optimization (University of Leoben, Austrian Chamber of Commerce, Julius-Raab-Scholarship, Austria)

Research Internship: Bauhaus University, Weimar, Germany **Aug. / Sept. 1998**

- Comparison of Different Composting Test Methods for Municipal Solid Waste and Sewage Sludge (German Academic Exchange Service)

RESEARCH INTERESTS

- Environmental geochemistry problems driven by energy- and climate-related questions.
- Impacts of nuclear waste storage, hydraulic fracturing and CO₂ sequestration on groundwater quality.
- Effects of natural organic matter on metal/radionuclide sorption, release and transport behavior.
- Experimental investigation and modeling of metal sorption/desorption kinetics on mineral surfaces.
- Influence of organic matter-mineral interactions on carbon degradability.

SELECTED PUBLICATIONS

Peer-Reviewed Journal Articles (13 published):

- Tournassat, C.; **Tinnacher, R. M.**; Grangeon, S.; Davis, J. A. Modeling Uranium(VI) Adsorption onto Montmorillonite under Varying Carbonate Concentrations: A Surface Complexation Model Accounting for the Spillover Effect on Surface Potential, *Geochimica et Cosmochimica Acta*, 2018, 220, 291-308.
- Zheng, L.; Spycher, N.; Bianchi, M.; Pugh, J. D.; Varadharajan, C.; **Tinnacher, R. M.**; Birkholzer, J.; Nico, P. S.; Trautz, R. C. Impacts of Elevated Dissolved CO₂ on a Shallow Groundwater System: Reactive Transport Modeling of a Controlled-Release Field Test, *Chemical Geology*, 2016, 447, 117-132.

- Tinnacher, R. M.**; Holmboe, M.; Tournassat, C.; Bourg, I. C.; Davis, J. A. Ion Adsorption and Diffusion in Smectite Clay Barriers: Molecular, Pore, and Continuum Scale Views, *Geochimica et Cosmochimica Acta*, 2016, 177, 130-149.
- Gilbert, B.; Comolli, L. R.; **Tinnacher, R. M.**; Kunz, M.; Banfield, J. F. Formation and Restacking of Disordered Osmotic Hydrates of Smectite, *Clays and Clay Minerals*, 2016, 63, 432-442.
- Zheng, L.; Spycher, N.; Varadharajan, C.; **Tinnacher, R. M.**; Pugh, J. D.; Bianchi, M.; Birkholzer, J.; Nico, P. S.; Trautz, R. C. On the Mobilization of Metals by CO₂ Leakage into Shallow Aquifers: Exploring Release Mechanisms by Modeling Field and Laboratory Experiments, *Greenhouse Gases: Science and Technology*, 2015, 5, 1-16.
- Tinnacher, R. M.**; Begg, J.; Mason, H.; Ranville, J.; Powell, B. A.; Wong, J. C.; Kersting, A. B.; Zavarin, M. Effects of Fulvic Acid Surface Coatings on Plutonium Sorption and Desorption Kinetics, *Environmental Science and Technology*, 2015, 49, 2776-2785.
- Zhao, P.; **Tinnacher, R. M.**; Zavarin, M.; Kersting, A. B. Analysis of Trace Neptunium in the Vicinity of Underground Nuclear Tests at the Nevada National Security Site. *Journal of Environmental Radioactivity*, 2014, 137, 163-172.
- Varadharajan C.; **Tinnacher, R. M.**; Pugh J. D.; Trautz R. C.; Zheng L.; Spycher, N. F.; Birkholzer J. T.; Castillo-Michel H.; Esposito, R. A.; Nico, P. S. A Laboratory Study of the Initial Effects of Dissolved Carbon Dioxide (CO₂) on Metal Release from Shallow Sediments, *International Journal of Greenhouse Gas Control*, 2013, 19, 183-211.
- Tinnacher, R. M.**; Nico, P. S.; Davis, J. A.; Honeyman, B. D. Effects of Fulvic Acid on Uranium(VI) Sorption Kinetics, *Environmental Science and Technology*, 2013, 47, 6214-6222.
- Tinnacher, R. M.**; Zavarin, M.; Powell, B. A.; Kersting, A. B. Kinetics of Neptunium(V) Sorption and Desorption on Goethite: An Experimental and Modeling Study, *Geochimica et Cosmochimica Acta*, 2011, 75, 6584-6599.
- Tinnacher, R. M.**; Honeyman, B. D. Theoretical Analysis of Kinetic Effects on the Quantitative Comparison of K_d Values and Contaminant Retardation Factors, *Journal of Contaminant Hydrology*, 2010, 118, 1-12.
- Tinnacher, R. M.**; Honeyman, B. D. Modeling the Chemical Conversion of Organic Compounds in Sodium Borohydride Reduction Reactions, *Organic Process Research and Development*, 2008, 12, 456-463.
- Tinnacher, R. M.**; Honeyman, B. D. A New Method to Radiolabel Natural Organic Matter by Chemical Reduction with Tritiated Sodium Borohydride, *Environmental Science and Technology*, 2007, 41, 6776-6782.

Book Chapters (3 published):

- Tinnacher, R. M.**; Dwivedi D.; Houseworth J. E.; Reagan, M. T.; Stringfellow, W. T.; Varadharajan, C.; Birkholzer, J. T. Chapter 4: Hydraulic Fracturing from the Groundwater Perspective. In *Groundwater Research on Exploration, Assessment, Modelling and Management of Groundwater Resources and Pollution*, Taylor & Francis, 2016.
- Sofield R. M.; **Tinnacher R. M.**; Eckard S. M. Plutonium, In *Reference Module in Earth Systems and Environmental Sciences*, Elsevier, 2013 (second edition).
- Harper, R. M.; **Tinnacher, R. M.** Plutonium. In *Ecotoxicology. Vol. [4] of Encyclopedia of Ecology*, Jorgensen, S. E., Fath B. D., Eds.; Elsevier: Oxford, 2008; 2845-2850 (first edition).

Peer-Reviewed Conference Proceedings:

- Tinnacher, R. M.**; Davis, J. A. Effects of Chemical Solution Conditions on Uranium(VI) Diffusion in Clays. Proceedings to International High-Level Radioactive Waste Management Conference, Albuquerque, NM, April 28-May 2, 2013, 867-874.
- Tinnacher, R. M.**; Honeyman, B. D. In Search of Simplicity in Reactive Transport Models. In *Water-Rock Interaction*, Proceedings of the 11th International Symposium on Water-Rock Interactions, Saratoga Springs, NY, June 27-July 2 2004; R. B. Wanty and R. R. Seal, II, Eds.; A. A. Balkema Publishers: Leiden, The Netherlands, 2004; v. 2, 1003-1006.

AWARDED GRANTS AND FELLOWSHIPS

- Lead principal investigator: "Effects of Mineral Impurities and Heat on Uranium(VI) Sorption onto Bentonite", DOE Nuclear Engineering University Program, 2017; total funding awarded: \$ 785,700.
- Principal investigator: "Characterizing the Release of Organic Carbon from Groundwater Sediments Under Changing Geochemical Conditions", Lawrence Berkeley National Laboratory Standard Research Contract, 2017; total funding awarded: \$ 9,818.
- Principal investigator: "Effects of Calcite Impurities on Uranium(VI) Sorption to Montmorillonite Clay", CSUEB Faculty Support Grant (Release Time), 2017; total funding awarded: 4 WTU's, \$ 200 (supplies).

- Collaborative research proposal: “LBNL Sustainable Systems SFA 2.0 Science Plan”, Component: “Organic Matter Dynamics at Mineral Interfaces”, 2013; total funding awarded: \$ 20.4 million.
- Collaborative research proposal: “Assessment of Potentially Deleterious Effect of CCS Operations on Groundwater Quality”, California Energy Commission, 2012; total funding awarded: \$ 400,000.
- Collaborative research proposal: “Environmental Transport of Plutonium: Geochemical Processes at Femtomolar Concentrations and Nanometer Scales”, DOE Environ. Remediation Science Program, 2009; total funding awarded: \$ 6.0 million.
- Independent research proposal: “The Role of Organic Acids in the Transport of Trace Metals through Saturated Porous Media: the Application of Surface Chemical Models to Transport Simulations of Bench-Scale Experiments”, DOC Scholarship of the Austrian Academy of Sciences: 2002 and 2003; total funding awarded: € 43,800.
- Colorado School of Mines Graduate Student Association Travel Grant: Spring 2003, Fall 2002
- Scholarship of the University of Leoben, Austria: January 2000, April 1999, July 1997
- Scholarship of the Chamber of Commerce, Austria: May 1999, March 1997
- Julius-Raab-Scholarship, Austria: July 1999, October 1997
- German Academic Exchange Service: Practical Traineeship for Foreign Students: Summer 1998
- Scholarship of the State of Styria, Austria: December 1997

HONORS, AWARDS AND PATENTING

- Lawrence Berkeley National Laboratory Spot Award: Relevant contributions to review of impacts of advanced well stimulation technologies (hydraulic fracturing) in California, May 2014
- U.S. Patent 08039266: Tinnacher, R. M.; Honeyman, B. D. Methods to Radiolabel Natural Organic Matter by Reduction with Hydrogen Labeled Reducing Agents; October 18, 2011
- Lawrence Livermore National Laboratory Chemical Sciences Division Spot Award: Best Chemical Science Division Post Doc Symposium Poster, June 2009
- 2008–2009 CH2MHill/ESE Outstanding Graduate Student Award: Colorado School of Mines, May 2009
- Best Poster Prize: Poster Presentation at Migration Conference, Munich, Germany, August 2007
- Environmental Science and Engineering Division Student Journal Paper Award: CSM, May 2007
- 1st Prize Best Student Paper Award: Rocky Mountain SETAC Conference, Golden, Colorado, April 2007
- Top Poster Presentation Prize: Graduate Student Association Research Fair, CSM, April 2006
- High Scientific Value Recognition: Poster Presentation at Migration Conference, Avignon, France, Sept. 05
- 1st Prize Outstanding Oral Presentation: 1st WEF/AWWA Student Conference, Golden, Colorado, May 2004

PROFESSIONAL SERVICES AND AFFILIATIONS

- Peer review for scientific journals: *Geochim. Cosmochim. Acta, Environ. Sci. Techn., Water Resour. Res., Appl. Geochem., Radiochim. Acta, J. Contam. Hydrol., Soil Sediment Contam., Environ. Pollut., J. Environ. Qual.*
- Project Advisory Committee Member for American Water Works Assoc. Research Foundation: Project 4020
- American Chemical Society (ACS) member: 2007-present
- Geological Society of America (GSA) member: 2007-present
- American Geophysical Union (AGU) member: 2004-present

SELECTED CONFERENCE ABSTRACTS AND PRESENTATIONS

- Tournassat, C.; **Tinnacher, R. M.**; Grangeon, S.; Davis, J. A. Modeling Uranium(VI) Adsorption onto Montmorillonite Under Varying Carbonate Concentrations: A Surface Complexation Model Accounting for the Spillover Effect on Surface Potential. Oral presentation at 16th International Conference on Chemistry and Migration Behaviour of Actinides and Fission Products in the Geosphere. September 10-15 2017, Barcelona, Spain.
- Tinnacher, R. M.**; Bhattacharyya, A.; Fox, P. M.; Nico P. S. Organic Carbon Release from Groundwater Sediments under Changing Geochemical Conditions. Poster presentation at AGU Fall Meeting, San Francisco, CA, Dec. 12-16, 2016.
- Tinnacher, R. M.**; Davis, J. A.; Tournassat, C.; Birkholzer, J. T. Effects of Clay Microstructure on Uranium(VI) Sorption and Diffusion. Invited talk at Annual Meeting of the Geological Society of America. September 25-28 2016, Denver, CO.

- Tinnacher, R. M.;** Davis, J. A.; Tournassat, C.; Birkholzer, J. T. Uranium(VI) Diffusion in Sodium-Montmorillonite at Alkaline pH. Oral presentation at 251st ACS National Meeting & Exposition. March 13-17 2016, San Diego, CA.
- Tinnacher, R. M.;** Davis, J. A.; Cheshire, M. C.; Caporuscio, F. A. Potential Differences in Uranium(VI) Sorption to Sodium-Montmorillonite, and Untreated and Heat-treated Bentonite. Poster presentation at 15th International Conference on the Chemistry and Migration Behaviour of Actinides and Fission Products in the Geosphere. September 13-18 2015, Santa Fe, N.M.
- Tinnacher, R. M.;** Davis, J. A. Relevance of Pore Structure and Diffusion-Accessible Porosity for Calcium-Bromide Diffusion in Na-Montmorillonite. Oral presentation at AGU Fall Meeting, San Francisco, CA, Dec. 9-13, 2013.
- Zheng, L.; **Tinnacher, R. M.;** Varadharajan, C.; Spycher, N. F.; Bianchi, M.; Nico, P. S.; Birkholzer, J. T.; Trautz, R. C.; Pugh, J. D. Numerical Interpretation of Laboratory and Field Data Showing CO₂-Induced Groundwater Changes. Goldschmidt Conference, Florence, Italy, Aug. 25-30, 2013.
- Tinnacher, R. M.;** Davis, J. A. Relevance of Chemical Solution Conditions for Uranium(VI) Diffusion in Clays. Oral presentation at Annual UFD Meeting, Las Vegas, NV, May 21-23, 2013.
- Tinnacher, R. M.;** Begg, J.; Powell, B. A.; Zavarin, M.; Kersting, A. B. Influence of Fulvic Acid Coatings on Plutonium Sorption to Goethite Colloids. Oral presentation at AGU Fall Meeting, San Francisco, CA, Dec. 5-9, 2011.
- Tinnacher, R. M.;** Powell, B. A.; Kersting, A. B.; Zavarin, M. A New Approach to Simulate the Kinetics of Metal Desorption from Mineral Surfaces. Oral presentation, AGU Fall Meeting, San Francisco, CA, Dec. 13-17, 2010.
- Honeyman, B. D.; **Tinnacher, R. M.** Changes in the Kinetics of Uranium(VI) Sorption Reactions to Mineral Surfaces in the Presence of Fulvic Acid. Poster presentation at AGU Fall Meeting, San Francisco, CA, Dec. 13-17, 2010.
- Tinnacher, R. M.;** Zhao, P.; Williams, R. W.; Zavarin, M.; Kersting, A. B. Neptunium-237 Concentrations in Groundwater from Nevada Test Site Wells. Poster presentation at Pu Futures: The Science 2010, Keystone, CO, Sept. 19-23, 2010.
- Tinnacher, R. M.;** Zhao, P.; Williams, R. W.; Zavarin, M.; Kersting, A. B. A Survey of Neptunium-237 Concentrations in Nevada Test Site Hot Wells. Poster presentation at UGTA Technical Information Exchange (TIE) Meeting, Las Vegas, NV, April 27, 2010.
- Tinnacher, R. M.;** Powell, B. A.; Kersting, A. B.; Zavarin, M. Modeling the Sorption and Desorption Kinetics of Np(V) and Pu(V) on Goethite. Oral presentation at Migration '09 Conference, Kennewick, WA, Sept. 2009.
- Tinnacher, R. M.;** Honeyman, B. D. Effects of Fulvic Acid on Uranium(VI) Sorption and Transport Behavior: The Role of Fulvic Acid Concentrations and System Kinetics. Oral presentation at 2007 GSA Annual Meeting and Exposition, Denver, Colorado, October 28-31, 2007.
- Tinnacher, R. M.;** Honeyman, B. D. Remobilization of Sorbed Plutonium(IV) by Extracellular Polymeric Substances (EPS). Poster presentation at 11th International Conference on Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere, Migration 2007, Munich, Germany, August 26-31, 2007.
- Tinnacher, R. M.;** Honeyman, B. D. Effects of Extracellular Polymeric Substances on the Sorption and Mobility of Plutonium(IV). Oral presentation at 20th Annual Meeting of Rocky Mountain SETAC Chapter, Golden, Colorado, April 12-13, 2007.
- Tinnacher, R. M.;** Honeyman, B. D.; Leenheer, J. A. A New Method to Radiolabel Fulvic Acids with Tritium for the Purpose of Tracing Organic Matter Transport at Low Concentrations. Poster presentation at 10th International Conference on Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere, Migration 2005, Avignon, France, September 18-23, 2005.
- Tinnacher, R. M.;** Honeyman, B. D. Effects of Fulvic Acid on the Sorption and Transport of Uranium(VI) in Saturated Groundwater Systems in Comparison to Citric Acid. Oral presentation at Uranium Geochemistry 2003, Nancy, France, April 13-16, 2003.