

Michael L Whittaker

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Education

Lawrence Berkeley National Laboratory and UC Berkeley 2017-Present

Postdoctoral Researcher, Energy Geosciences and Earth and Planetary Sciences

Advisors: Benjamin Gilbert (LBNL) and Jillian Banfield (UC Berkeley)

Research focus: Atomic-scale characterization of clay structure and assembly

Northwestern University 2012-2017

Ph.D. Materials Science and Engineering

Advisor: Derk Joester

Dissertation: "Pathways for Metastable Carbonate Synthesis"

University of Utah 2011-2012

M.S. Materials Science and Engineering (BS/MS degree)

Advisor: Raymond Cutler

Dr. David and Hanne Duke full tuition scholarship

University of Utah 2006-2012

Honors B.S. Materials Science and Engineering, Chemistry Minor

Full tuition scholarship 2009-10, 2010-11

Physics and Anthropology of Renewable Energy (Costa Rica, summer semester)

Publications

Peer-Reviewed Journal Articles

1. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Dynamic barriers to crystallization within the metastability window of barium calcium carbonates" *Submitted 2019*
2. **M. L. Whittaker**, S. Carrero Romero, B. Gilbert, J. Banfield "Nanoscale chemical-mechanical coupling controls ion exchange in hydrated montmorillonite" *Submitted 2019*
3. J. Cavanaugh, **M. L. Whittaker**, D. Joester "Crystallization kinetics of amorphous calcium carbonate in confinement" *Chemical Science* **2019**. In press. DOI: [10.1039/C8SC05634J](https://doi.org/10.1039/C8SC05634J)
Impact factor (2018): **9.06**
4. A. Dierieh, I. Chang, **M. L. Whittaker**, S. Weigand, D. Keane, J. Rix, J. T. Germaine, D. Joester, P. Flemings. "Particle arrangements in clay suspensions: the case against the honeycomb structure" *Applied Clay Science* **152**, 166-172 **2018**. DOI: [10.1016/j.clay.2017.11.010](https://doi.org/10.1016/j.clay.2017.11.010). Impact Factor (2018): **3.64**
5. **M. L. Whittaker**, P. J. M. Smeets, H. Asayesh-Ardakani, R. Shahbazian-Yassar, D. Joester. "Multi-step crystallization of barium carbonate: rapid interconversion of amorphous and crystalline precursors" *Angewandte Chemie*, **129**, 16244-16247 **2017**. DOI: [10.1002/anie.201709526](https://doi.org/10.1002/anie.201709526). Impact Factor (2017): **12.01**

6. **M. L. Whittaker**, D. Joester. "ACBC to balcrite: bioinspired synthesis of a highly substituted high-temperature phase from an amorphous precursor" *Advanced Materials* 29, 1606730 **2017**. DOI: [10.1002/adma.201606730](https://doi.org/10.1002/adma.201606730). Impact Factor (2016): **19.79**
7. **M. L. Whittaker**, W. Sun, K. DeRocher, S. Jayaraman, G. Ceder, D. Joester. "Structural basis for metastability in amorphous calcium barium carbonate" *Advanced Functional Materials*, 1704202 **2017**. DOI: [10.1002/adfm.201704202](https://doi.org/10.1002/adfm.201704202). Impact Factor (2016): **12.12**
8. **M. L. Whittaker**, P. Dove, D. Joester. "Nucleation on surfaces and in confinement" *MRS Bulletin* 41(5): 388-392 **2016**. DOI: [10.1557/mrs.2016.90](https://doi.org/10.1557/mrs.2016.90). Impact Factor (2016): **5.20**
9. C. C. Tester, **M. L. Whittaker**, D. Joester. "Controlling nucleation in giant liposomes" *Chemical Communications*. 50.42: 5619-5622 **2014**. DOI: [10.1039/C4CC01457J](https://doi.org/10.1039/C4CC01457J) Impact Factor (2014): **6.32**
10. **M. L. Whittaker**, H. Y. Sohn, R. A. Cutler. "Oxidation kinetics of aluminum diboride." *Journal of Solid State Chemistry*, 207:163-169 **2013**. DOI: [10.1016/j.jssc.2013.09.028](https://doi.org/10.1016/j.jssc.2013.09.028) Impact Factor (2013): **2.20**
11. **M. L. Whittaker**, R. A. Cutler. "Effect of synthesis atmosphere, wetting, and compaction on the Purity of AlB₂." *Journal of Solid State Chemistry*, 201:93-100, **2013**. DOI: [10.1016/j.jssc.2013.02.027](https://doi.org/10.1016/j.jssc.2013.02.027) Impact Factor (2013): **2.20**

Conference Proceedings

1. **M. L. Whittaker**, Christian Kisielowski, Elizabeth A. Montabana, Benjamin Gilbert, Jillian Banfield. "Atomic structure, defects, and stacking of clay particles by low-dose, high resolution (cryo)-TEM" *Microscopy and Microanalysis*, 24 **2018** 1958-1959
2. **M. L. Whittaker**, R. A. Cutler and P. E. Anderson. "Boride-based materials for energetic applications." *MRS Proceedings*, **2012**, 1405, mrsf11-1405-y11-02 doi:10.1557/opl.2012.64
3. **M. L. Whittaker**, R. A. Cutler, J. Campbell, J. LaSalvia. "Microstructure, mechanical properties, and performance of magnesium aluminum boride (MgAlB₁₄)" *Ceramic Engineering and Science Proceedings*. **2010**, 31

Leadership and Awards

Leadership

- **Co-chair** of the Gordon Research Seminar (GRS): Biomineralization, (international scientific conference) 2016
- **Elected co-chair** of the Gordon Research Seminar (GRS): Crystal Growth and Assembly, (international scientific conference, not held due to organizational changes) 2015
- **President**, Materials Science Student Association – Northwestern University (2013-2014)
- **Chair**, Graduate Student Advisory Committee – University of Utah (2012)
- **Chair**, Undergraduate Student Advisory Committee – University of Utah (2011)
- **Board Member**, Illinois Bright Promises Foundation junior board (2014-2017)

Awards

- **Gordon Research Conference on Crystal Growth and Assembly**, Travel Award (2019)
- **Dean's postdoctoral fellowship**, Weizmann Institute, Rehovot, Israel (2017, declined)
- **Student Keynote Speaker**, Advanced Photon Source Users Meeting (2017)
- **Dr. David and Hanne Duke graduate scholarship** (2011-2012)

- **Materials Science & Engineering Full Tuition scholarship** (2009-10, 2010-11)
- **Young Investigator Travel Award**, International Conference on the Chemistry and Biology of Mineralized Tissue (ICCBMT, 2013)
- **'Undergraduate Research Scholar' award** (2012)
- **'Most Outstanding Senior' award**, Materials Science and Engineering (2012)
- **Phi Eta Sigma, Mortar Board, and National Society of Collegiate Scholars Honor Societies** (2006-2012)
- **Fundamentals of Engineering (FE) certified** (12967-12350)

Mentoring and Teaching

Mentoring

Mentor, Undergraduate Intern, UC Berkeley

- Korbinian T. Earth and Planetary Science, UC Berkeley

Mentor, PhD candidate, UC Berkeley

- Cole R. Materials Science and Earth and Planetary Science, UC Berkeley

Mentor, master's student (Summer 2016), undergraduate student (Fall 2013-Summer 2016), National Science Foundation Research Experiences for Undergraduates (summer 2013)

- Jack C., Northwestern University
- *First-author publication from student (see publication #4)*

Mentor, high school researcher from low-income household (Summer 2016)

- Laura M., Northside College Prep, Chicago, IL
- "Quantifying dynamic properties of hydrogels using fluorescent nanoparticles"
 - Article in 'Helix' magazine
 - <https://helix.northwestern.edu/article/diving-deep-end-being-high-school-researcher-northwestern>

Mentor, National Science Foundation Research Experiences for Undergraduates (summer 2014)

- Keara S., North Carolina State University
- currently a PhD Student at University of Michigan
- "Understanding mineral precipitation in synthetic liposomes"

Mentor, National Science Foundation Research Experiences for Undergraduates (summer 2016)

- David C., UT San Antonio
- "Synthesis of microfluidically produced, lipid-stabilized emulsions"
- NSF Graduate Research Fellow Recipient (UCSD, 2018)

Tutor for high school student (2014)

- Nathan S., Evanston Township High School

Mentor, 10 year-old foster child (2016-2017)

Classroom Teaching

- Research in Earth Science (UC Berkeley)
Classes taught: Clay minerals and life
- Introduction to Geology (UC Berkeley)
Classes taught: Clay minerals
- Materials Science Seminar (UC Berkeley)
- Introduction to Materials Science (Northwestern)
Classes taught: Phase Diagrams, Crystal Systems, Diffraction

Teaching Assistant

- TA for labs and new lab development, 'Microstructural Dynamics' (Fall 2014, NU)
- TA for labs and new lab development, 'Microstructural Dynamics' (Fall 2013, NU)

- TA for labs and new lab development, 'Advanced Characterization Techniques' (Spring 2011, Utah)
- TA and discussion section leader, Introduction to Materials Science (Fall 2011, Utah)

Presentations

Oral

1. **M. L. Whittaker**, Benjamin Gilbert, Jillian Banfield. "Atomic Structure, Defects, and Stacking of Clay Particles by Low-Dose, High Resolution (Cryo)-TEM" DOE BES Geochemistry Investigators Meeting, Gaithersburg, MD (July **2018**)
2. **M. L. Whittaker**, Christian Kisielowski, Elizabeth A. Montabana, Benjamin Gilbert, Jillian Banfield. "Atomic Structure, Defects, and Stacking of Clay Particles by Low-Dose, High Resolution (Cryo)-TEM" Microscopy and Microanalysis, Baltimore, MD (July **2018**)
3. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Synthesis of High-temperature Materials from Amorphous Precursors at Ambient Conditions" Advanced Photon Source Users Meeting, Lemont, IL (**2017**)
4. **M. L. Whittaker**, W. Sun, K. DeRocher, G. Ceder, D. Joester. "Synthesis of High-temperature Materials from Amorphous Precursors at Ambient Conditions" Northwestern Hilliard Symposium (3rd place), Evanston, IL (**2017**)
5. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Enhanced Properties through Non-Equilibrium Compositions: A Biomineralization Approach", Materials Research Society fall meeting, 2016. Boston, MA **2016**
6. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Structural Basis for Stability and Transformation of Amorphous Carbonates", Gordon Research Conference. Girona, Spain **2016**
7. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Solution Processing of High Temperature Materials: A Biomineralization Approach", Denver X-ray Conference. Rosemont, IL **2016**
8. **M. L. Whittaker**, D. Joester. "Amorphous Structure, Destabilization, and Crystallization Pathways in Amorphous Barium Calcium Carbonate", Gordon Research Conference on Crystal Growth and Assembly. New Biddeford, ME **2015**
9. **M. L. Whittaker**, C. C. Tester, D. Joester. "Interfacial chemistry and stability of membrane-bound mineral precursors", Materials Research Society fall meeting. Boston, MA **2014**
10. **M. L. Whittaker**, A. Opathalage, D. Gerz, S. Fradden, D. Joester. "Nanoliter oil-in-water emulsions as biomimetic reactors", Materials Research Society fall meeting. Boston, MA **2014**
11. **M. L. Whittaker**, C. C. Tester, D. Joester. "Probing the limit of ACC stability", Gordon Research Seminar on Biomineralization. New London, NH, **2014**
12. **M. L. Whittaker**, C. C. Tester, D. Joester. "Controlling nucleation in giant liposomes", Gordon Research Seminar on Crystal Growth and Assembly. New Biddeford, ME, **2013**
13. **M. L. Whittaker**, P. E. Anderson, R. A. Cutler. "Boride-based materials for energetic applications", Materials Research Society fall meeting. Boston, MA **2011**
14. **M. L. Whittaker**, R. A. Cutler, J. Campbell, J. LaSalvia. "Microstructure, mechanical properties, and performance of magnesium aluminum boride (MgAlB₁₄)", 34th International Symposium on Advanced Ceramics and Composites. Daytona Beach, FL. **2010**

Poster

15. **M. L. Whittaker**, Colin Ophus, Benjamin Gilbert, Jillian Banfield. "Atomic Structure, Defects, and Stacking of Clay Particles by Low-Dose, High Resolution (Cryo)-TEM" NEXTEM Conference, Pacific Northwest National Laboratory, Richland WA (October 2018)
16. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Structural Basis for Stability and Transformation of Amorphous Carbonates", Gordon Research Conference. Girona, Spain **2016**
17. **M. L. Whittaker**, W. Sun, G. Ceder, D. Joester. "Room Temperature Processing of High Temperature Materials: A Biomineralization Approach", APS Users Meeting. Lemont, IL **2016**
18. **M. L. Whittaker**, D. Joester. "Amorphous Structure, Destabilization, and Crystallization Pathways in Amorphous Barium Calcium Carbonate", Gordon Research Conference on Crystal Growth and Assembly. New Biddeford, ME **2015**
19. **M. L. Whittaker**, C. C. Tester, D. Joester. "Probing the limit of ACC stability", Gordon Research Conference. New London, NH, **2014**
20. **M. L. Whittaker**, C. C. Tester, D. Joester. "Probing the limit of ACC stability", Gordon Research Seminar. New London, NH, **2014**
21. **M. L. Whittaker**, C. C. Tester, D. Joester. "Controlling nucleation in giant liposomes", International Conference on the Chemistry and Biology of Mineralized Tissue. Lake Geneva, WI, **2013**
22. **M. L. Whittaker**, C. C. Tester, D. Joester. "Controlling nucleation in giant liposomes", Gordon Research Conference. New Biddeford, ME, **2013**
23. **M. L. Whittaker**, C. C. Tester, D. Joester. "Controlling nucleation in giant liposomes", Gordon Research Seminar. New Biddeford, ME, **2013**

Work Experience

Ceramatec

2009-2012

2425 S. 900 W. Salt Lake City, UT 84119. (801)-972-2455. Advisor: Raymond Cutler

Research Associate (2011-2012) - synthesis and characterization of advanced ceramics for ballistic armor, hydrodynamic seals, and oxygen separation membranes.

Research Intern (2009-2011) - synthesis and characterization of advanced intermetallic materials for ballistic armor and magnetic refrigeration