

J. BRIAN BALTA

Staff Scientist, Lunar and Planetary Institute
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EDUCATION

CALIFORNIA INSTITUTE OF TECHNOLOGY

Pasadena, CA

Ph.D. in Geology

May, 2010

M.S. in Geology

June, 2009

Research Advisor: Paul D. Asimow

GPA: 3.40/4.00

- Thesis title: (1.) *Experimental investigation of hydrous melting of the Earth's upper mantle and (2.) Olivine abundances and compositions in Hawaiian lavas*

INDIANA UNIVERSITY

Bloomington, IN

Bachelor of Science with Highest Honors in Geological Sciences

Winter, 2002

Minors in History & Math

GPA: 3.97/4.00

- Indiana Memorial Union Board Director (2002), Geological Sciences Student of the Year (2001 & 2002), Dean's List (1999 – 2002), and Indiana University Honors College Scholarship (1999 – 2002) Awards Recipient
- Member of Phi Beta Kappa Honor Society, National Society of Collegiate Scholars, Alpha Lambda Delta National Honor Society, and Phi Eta Sigma Honor Society

RESEARCH EXPERIENCE

LUNAR AND PLANETARY INSTITUTE

Houston, TX

Staff Scientist

2022-present

CORNELL UNIVERSITY

Ithaca, NY

Postdoctoral Research Associate

2020-2022

- Department of Energy funded research project designed to test ability of engineered bacteria to mobilize rare earth elements.
 - My role: synthesizing and characterizing monazite grains for use in experiments and measuring composition of produced solutions.
 - Successfully edited published procedures for use in this lab
 - Recognized additional component (REE-Oxide) produced as byproduct of reaction, characterizing its properties in order to publish technique.
 - Current Advisors: Drs. Esteban Gazel and Megan Holycross
- Additional projects in process
 - Characterizing olivine-hosted melt inclusions from El Hierro volcano, Canary Islands
 - Processing olivine compositions measured from Canary Islands

PLANETARY SCIENCE INSTITUTE

Tucson, AZ

Associate Research Scientist

2021-2022

- Submitting funding proposals for ongoing planetary research projects.
- Provided quotes to Popular Science article on InSIGHT mission results

- Peer reviewer, journals including *Journal of Petrology*, *American Mineralogist*, *Geochimica et Cosmochimica Acta*
- Participating in proposal funding review process, panel service

TEXAS A&M UNIVERSITY

Visiting Professor/Instructor

2016-2020

- Projects included:
 - MELTS algorithm modeling of melting in the martian mantle – to be resubmitted in next research position.
 - Minor element mapping of diogenite meteorites – led to 2 abstracts at Geological Society of America meetings, presented by undergraduate students in 2018-2019.
 - Characterizing drilled igneous rocks from Trans-Mexican Volcanic Belt – provided undergraduate research experience for 20 students. Multiple students were in preparation for internal department research fair presentations prior to COVID-19 pandemic.

UNIVERSITY OF PITTSBURGH

Visiting Professor

2014-2016

- Projects included:
 - Completing previous papers characterizing martian meteorites.
 - Leading undergraduate research project on rare earth element abundances during crystallization of martian magmas – presented at Lunar and Planetary Science Conference in 2016.

UNIVERSITY OF TENNESSEE

Postdoctoral Research Associate

2010-2016

- Projects included:
 - Characterizing 4 martian meteorites as part of a multi-university group.
 - Modeling crystallization and water contents of martian magmas.
 - Characterizing minor element abundances in diogenite meteorites.

CALIFORNIA INSTITUTE OF TECHNOLOGY

Graduate Research Assistant

2003-2009

- Projects included:
 - Experimental melting of water-bearing samples of Earth's upper mantle in piston-cylinder instruments.
 - Calibrating reaction of iron with surrounding Au-Pd capsules and crucibles.
 - Measuring minor element partitioning under upper mantle conditions.
 - Characterizing olivine phenocryst and sulfide mineral abundances and compositions in Hawaiian lavas.

INDIANA UNIVERSITY

Undergraduate research assistant

2000-2002

- Projects included:
 - Experimental synthesis of basalt-sulfide pairs and measuring partitioning of nickel between these phases.

PUBLICATIONS

- Dunham, E.T., **Balta, J.B.**, Wadhwa, M, Sharp, T.G., and McSween, H.Y. (2019) “Petrology and geochemistry of olivine-phyric shergottites LAR 12095 and LAR 12240: Implications for their petrogenetic history on Mars”. *Meteoritics & Planetary Science* 54(4), 811-835, doi: 10.1111/maps.13262.
- **Balta, J.B.**, Sanborn, M. E., Mayne, R. G., Wadhwa, M., McSween, H. Y., & Crossley, S. D. (2017). Northwest Africa 5790: A previously unsampled portion of the upper part of the nakhlite pile. *Meteoritics & Planetary Science*, 52(1), 36-59. doi:10.1111/maps.12744.
- Mane, P., Hervig, R., Wadhwa, M., Garvie, L. A. J., **Balta, J. B.**, & McSween, H. Y. (2016). Hydrogen isotopic composition of the Martian mantle inferred from the newest Martian meteorite fall, Tissint. *Meteoritics & Planetary Science*, 51(11), 2073-2091. doi:10.1111/maps.12717.
- He Q., Xiao L., **Balta J. B.**, Baziotis I. P., Hsu W., and Guan Y. (2015) “Petrography and geochemistry of the enriched basaltic shergottite Northwest Africa 2975.” *Meteoritics & Planetary Science* 50(12), 2024-2044.
- **Balta, J.B.**, Sanborn, M., Udry, A. McSween, H.Y., and Wadhwa, M. (2015) “Petrology and trace-element geochemistry of Tissint, the newest shergottite fall.” *Meteoritics & Planetary Science* 50(1), 63-85.
- Udry, A., **Balta J.B.**, and McSween H.Y. (2014). Exploring fractionation models for martian magmas. *Journal of Geophysical Research: Planets*, 2013JE004445.
- Howarth G. H., Pernet-Fisher J. F., **Balta J. B.**, Barry P. H., Bodnar R. J., and Taylor L. A. (2014) Two-stage polybaric formation of the new enriched, pyroxene-oikocrystic, lherzolitic shergottite, NWA 7397. *Meteoritics & Planetary Science* 49(10), 1812-1830.
- **Balta, J.B.**, and McSween, H.Y. (2013). “Water and the composition of martian magmas.” *Geology*, 41(10), 1115-1118.
- **Balta, J.B.**, Sanborn, M., McSween, H.Y., and Wadhwa, M. (2013). “Magmatic history and parental melt composition of olivine-phyric shergottite LAR 06319: Importance of magmatic degassing and olivine antecrysts in martian magmatism.” *Meteoritics and Planetary Science*, 48(8), 1359-1382.
- **Balta, J.B.**, and McSween, H.Y. (2013) “Applicability of the MELTS algorithm to martian compositions and implications for magma crystallization”. *Journal of Geophysical Research Planets*, 2013JE04461.
- Liu Y., **Balta J. B.**, Goodrich C. A., McSween, H. Y., and Taylor, L. A. (2013). “New constraints on the formation of shergottite Elephant Moraine 79001 lithology A.” *Geochimica et Cosmochimica Acta* 108, 1-20.

- He Q., Xiao L., Hsu W., **Balta J. B.**, McSween H. Y., and Liu, Y. (2013). “The water content and parental magma of the second chassignite NWA 2737: Clues from trapped melt inclusions in olivine.” *Meteoritics & Planetary Science* 48(3), 474-492.
- **Balta, J.B.**, Balta, J. B., Asimow, P. D., and Mosenfelder, J. L. (2011). “Hydrous, Low-carbon melting of garnet peridotite.” *Journal of Petrology* 52, 2079-2105.
- **Balta, J.B.**, Asimow, P. D., and Mosenfelder, J. L. (2011). “Manganese partitioning during hydrous melting of peridotite.” *Geochimica et Cosmochimica Acta* 75, 5819-5833.
- **Balta J. B.**, Beckett, J. R., and Asimow, P. D., (2011). “Thermodynamic properties of alloys of gold-74/palladium-26 with variable amounts of iron and the use of Au-Pd-Fe alloys as containers for experimental petrology.” *American Mineralogist* 96, 1467-1474.
- He, Q., Xiao, L., **Balta, J.B.**, Gao, R., and Chen, J. (2010). “Variety and complexity of the Late-Permian Emeishan basalts: Reappraisal of plume-lithosphere interaction processes.” *Lithos*, 119 (1-2), 91-107
- Ghosh, P., Adkins, J., Affek, H., **Balta, J.B.**, Guo, W. F, Schauble, E. A., Schrag, D. and Eiler, J. M. (2006). "C-13-O-18 bonds in carbonate minerals: A new kind of paleothermometer." *Geochimica et Cosmochimica Acta* 70 (6): 1439-1456.
- Seaman, C., Sherman, S. B., Garcia, M. O., Baker, M. B. **Balta, J.B.**, and Stolper, E.M. (2004). "Volatiles in glasses from the HSDP2 drill core." *Geochemistry Geophysics Geosystems* 5, 2003GC000596.

MANUSCRIPTS IN PROGRESS

- Peluso, D.O., **Balta, J.B.** “Impact of recharging magma chambers on martian magma compositions.” In preparation by former student.
- **Balta, J.B.**, “Simulating fractional melting of the martian mantle using the pMELTS algorithm.” To be resubmitted soon.

PENDING FUNDING PROPOSALS

- Minor element distributions in diogenite meteorites – In preparation for submission to NASA’s Emerging Worlds program – Fall 2021, PI J. Brian Balta.
- Geochemical Modeling of the Martian Mantle – To be resubmitted to NASA’s Solar System Workings program– Spring 2022. PI J. Brian Balta.
- Uncovering new records of oxidation during the petrogenesis of shergottite meteorites – To be resubmitted to NASA’s Solar System Workings program– Spring 2022 – PI N. Castle, Co-I J. Brian Balta.
- Spectral characterization of representative mixtures of minerals and glasses – To be resubmitted to NASA’s Solar System Workings program– Spring 2022 – PI J. Brian Balta.

ABSTRACTS

- Fischer E.S.C., Robertson A.P, and **Balta, J.B.** (2019) Distributions and abundances of major and minor elements in diogenite MIL 11201. Geological Society of America 2019 fall meeting.
- **Balta, J.B.**, Castle, N, Ennis, M.E., McSween, H.Y. Widespread oxidation in shergottite magmas recorded by exsolved spinel in olivine (2019). 50th Lunar and Planetary Science Conference, abstract #1709.
- Hobart, K. and **Balta, J.B.** (2018) “Geochemistry and Petrology of MIL 07001 and GRA 98108: Comparing textures of two unbrecciated diogenites”. Geological Society of America 2018 fall meeting.
- **Balta, J.B.** (2016) “Impact of the Martian Lithosphere on Mantle Melting and Magma Transport”. Geological Society of America, abstract # 285886, 10.1130/abs/2016AM-285886.
- Peluso, D.O., **Balta, J.B.** “Rare Earth Element Variations In Recharging Martian Magma Chambers: Impact On Shergottite Compositions” (2016). 47th Lunar and Planetary Science Conference, abstract #1789.
- **Balta, J.B.** “Modeling Melting of the Martian Mantle Using pMELTS” (2016). 47th Lunar and Planetary Science Conference, abstract #1674.
- Dunham E., Wadhwa M., Tucker K., **Balta J.B.**, and McSween H. (2015) Rare Earth Element Geochemistry of the Shergottites LAR 12095, 12240, and 12011. *78th Annual Meeting of the Meteoritical Society*, pp. 5289.
- **Balta, J.B.**, Sanborn, M.E., Udry, A. Wadhwa, M., and McSween, H.Y. “Igneous petrology and geochemistry of the Tissint meteorite.” (2015) 46th Lunar and Planetary Science Conference, abstract #1267.
- **Balta, J.B.**, Tucker, K. Wadhwa, M., and McSween, H.Y. “Petrology and geochemistry of new Antarctic shergottites: LAR 12011, LAR 12095, and LAR 12240. 46th Lunar and Planetary Science Conference, abstract #2294.
- **Balta, J.B.**, and McSween, H.Y. (2014). “Water as a driver of martian magmatism”. 2014 Goldschmidt conference, invited.
- **Balta, J.B.**, and McSween, H.Y. (2014). “Application of the MELTS algorithm to the composition of martian (and other extraterrestrial magmas).” 45th Lunar and Planetary Science Conference, abstract #1365.
- **Balta, J.B.**, and McSween, H.Y. (2013). “Evolution of the martian mantle as recorded by igneous rocks”. EOS Transactions AGU 94 Fall Meeting Supplement, abstract # P51H-06.
- **Balta, J.B.**, and McSween, H.Y. (2013). “Et-then, a possible martian magma”. Geological Society of America, abstract # 226617.
- **Balta, J.B.**, and McSween, H.Y. (2013). “The second shergottite age paradox”. 44th Lunar and Planetary Science Conference, abstract #1510.
- Udry, A., McSween, H.Y., & **Balta, J.B.** (2013). “Exploring fractionation models for some martian primary magmas”. *Mineralogical Magazine*, 77(5) 2372.

- Udry, A., **Balta, J.B.**, and McSween, H.Y. (2013). “CSD measurements on olivine grains in the Tissint meteorite”. 44th Lunar and Planetary Science Conference, abstract # 1266.
- Udry, A., **Balta, J.B.**, and McSween, H.Y. (2013). “Polybaric crystallization of Gusev alkali basalts”. 44th Lunar and Planetary Science Conference, abstract # 1265.
- Mane P., Hervig R., Wadhwa M., **Balta J. B.** and McSween H. Y. (2013) “Hydrogen isotopic composition of Tissint, the newest martian meteorite fall 44th Lunar and Planetary Science Conference, abstract # 2220.
- **Balta, J.B.**, Beck, A.W., and McSween, H.Y. (2012). Trace Elements record complex histories in diogenites. EOS Transactions AGU 93 Fall Meeting Supplement, abstract # 31A-1879.
- **Balta, J.B.**, McSween, H.Y, Sanborn, M.E., and Wadhwa, M. (2012) “Multiple lines of evidence for degassing of water from olivine-phyric shergottite LAR 06319”. Geological Society of America, abstract # 212405.
- Sanborn, M., Wadhwa, M., **Balta, J.B.**, and McSween, H.Y. (2012) "Trace element geochemistry of Tissint, the newest shergottite fall". 75th Annual Meeting of the Meteoritical Society, Cairns, Australia, 12-17 August, 2012, abstract # 5100.
- **Balta, J.B.**, and McSween, H.Y. (2012). “High silica contents in martian basalts and its relationship to magmatic water.” 43rd Lunar and Planetary Science Conference, abstract # 1190.
- **Balta, J.B.**, Beck, A.W., McSween, (2011). “Trace elements reveal complex histories in Diogenites.” 43rd Lunar and Planetary Science Conference, abstract # 1189.
- **Balta, J.B.**, and McSween, H.Y. (2011). “Why do martian magmas erupt”? EOS Transactions AGU 93 Fall Meeting Supplement, abstract # P31B-1713.
- **Balta, J.B.**, Baker, M.B., and Stolper, E.M. (2011). “Olivine control lines in Hawaiian rocks”. Geological Society of America, abstract # 195133.
- Sanborn, M., Wadhwa, M., **Balta, J.B.**, McSween, H.Y., and Mayne, R. (2011). “Trace element geochemistry of the nakhlite Northwest Africa 5790.” Meteoritics and Planetary Science, Special Issue: 74th Annual Meeting of the Meteoritical Society, August 8-12, 2011, London, U.K. abstract # 5122.
- **Balta, J.B.**, and McSween, H.Y. (2011). “Are megacrysts in olivine-phyric shergottites phenocrysts, xenocrysts, or something else?” 42nd Lunar and Planetary Science Conference, abstract #1033.
- **Balta, J.B.**, Beck, A.W., McSween, (2011). “Magmatic cumulate textures preserved by trace elements in Diogenite meteorites”. 42nd Lunar and Planetary Science Conference, abstract #1107.
- **Balta, J.B.**, and McSween, H.Y. (2010). “Preservation of sharp olivine-composition boundaries within olivine-phyric shergottite LAR 06319.” Geochemistry Geophysics Geosystems, 74(12, supplement 1), abstract 01h/10/Mo.

- **Balta, J.B.**, Asimow, P.D., and Mosenfelder, J.L. (2009). “Hydrous, low-carbon melting of garnet peridotite.” EOS Transactions AGU 90 Fall Meeting Supplement, abstract # V14C-05.
- **Balta, J.B.**, P. D. Asimow, J. L. Mosenfelder (2008). “Carbon-free melting of fertile garnet peridotite in water-undersaturated Systems.” EOS Transactions AGU 89 Fall Meeting Supplement, abstract # V43B-2149.

INVITED TALKS

- ***The igneous history of Mars***
Eu in time RISE Workshop on Geochronology and Mars Exploration, UT Austin, 2019
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
University of Alaska Fairbanks Seminar, 2018
- ***The Geologic Exploration of Mars***
Allegheny Observatory Public Lecture Series, 2016
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
University of New Mexico/Institute of Meteoritics seminar, 2015
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
Indiana University of Pennsylvania Seminar, 2014
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
University of Pittsburgh Seminar, 2014
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
Rutgers University seminar, 2014
- ***The geochemical evolution of Mars as recorded by the igneous rocks***
University of Tennessee seminar, 2013
- ***Water and the composition of martian magmas***
University of Alabama, 2013
- ***Water and the composition of martian magmas***
University of Rochester, 2013
- ***Water in martian igneous rocks: from single grains to the whole planet***
Jet Propulsion Laboratory seminar, 2012
- ***Why does Mars have volcanoes?***
Mississippi State University Seminar, 2012
- ***Is there water in Mars?***
University of Texas – Arlington Seminar, 2012
- ***Why does Mars have volcanoes?***
University of Arkansas – Little Rock Seminar, 2012
- ***Hydrous, low-carbon melting of the Earth’s upper mantle***
University of Oregon Seminar, 2011
- ***Hydrous, low-carbon melting of the Earth’s upper mantle***
Lunar and Planetary Institute Seminar, 2009

TEACHING EXPERIENCE

TEXAS A&M UNIVERSITY
Visiting Professor of Petrology
Instructor

College Station, TX
2016-2019
2019-2020

▪ **Courses Taught**

- *Mineralogy* (2016-2019): taught in 7 semesters, course enrollments ranged from 10 to 120. Fully updated labs and homework exercises.
- *Petrology* (2016-2018): taught in 5 semesters, course enrollments ranged from 10 to 110, all semesters included 1-to-2-day field trip to central Texas.
- *Environmental Geology* (2019): 20 enrolled students, applied for and approved for university designation as “Intensive writing” course.
- *Regional Geology of the Western United States* (2019): Organized and ran week-long field trip to Death Valley National Park for 14 students over winter break.
- *Disasters and Society* (2020): Newly designed course submitted and approved as part of Texas A&M Core Curriculum and met *Cultural Discourse* course requirements.
- *Senior Geology Project* (2019): 13 students enrolled in senior-level Capstone research project course involving independent student research.
- *Summer Geology Field Camp* (2017, 2018, 2020): taught field mapping for students in Western Montana (2017-2018) including managing students in field, maintaining student health and morale/dealing with personal issues, organizing logistics of student travel (2018), leading project grading.
- Courses transitioned online during COVID-19 Pandemic: Summer Geology Field Camp (2020) and Disasters and Society.
- **“Aggies Celebrate Teaching! – Recognizing Transformational Learning”**, 2018-2019 student-nominated, University-wide, Center for Teaching Excellence award recipient based on work in Mineralogy and Petrology courses.
- Completed training courses in LGBTQ Allyship, Domestic violence intervention, and sexual harassment and intervention.
- **Student Mentoring**
 - Recruited large groups of student volunteers for multiple projects (maximum 22 students working in 1 semester).
 - Trained student lab managers to supervise other students.
 - Running weekly reading and study groups.
 - Student-led conference abstracts and presentations at annual meeting of Geological Society of America, 2018 and 2019.
- **Service and outreach activities**
 - Faculty Advisor for *Geology and Geophysics Society* student group.
 - Outreach presentations at Brazos Valley Museum, local home for seniors, Camp Kubena summer camp.
 - Organized annual outreach and demonstration table at Texas A&M Chemistry Day – staffed by undergraduate students from Geology & Geophysics Department, visited by several hundred grade school aged students each year.
 - Contributing to Pearson Education textbook development.
 - Advising support for students, including presentations on “How to apply for and prepare for graduate school”.

- Peer review for journals including *Journal of Petrology*, *Contributions to Mineralogy and Petrology*, *Meteoritics and Planetary Science*, *Journal of Geophysical Research*, *Geochimica et Cosmochimica Acta*.

PUBLIC OUTREACH

- Manager for Facebook pages “*The Earth Story*” and “*The Universe*”
 - Write 10+ articles per week on Earth Science for public outreach.
 - Manage multiple social media accounts.
 - Train new volunteers on writing and outreach skills.
 - Over 800,000 total followers, individual stories regularly reach 20,000+ readers worldwide.

UNIVERSITY OF PITTSBURGH
Visiting Professor of Petrology

Pittsburgh, PA
 2014-2016

▪ **Courses Taught**

- Petrology* (2015-2016): including organizing and running 2-day field trip to Maryland each year.
- Physical Geology* (2014-2015): course enrollment 150-180 students.
- Natural Disasters* (2015): Course enrollment 320 students.
- The Planets* (2015-2016): Introductory planetary science course for non-majors, enrollment 100 students.
- Advanced Igneous Petrology* (2014-2015): reading and discussion course for 10 graduate students and senior undergraduates.
- Exploration Geophysics* (2015): for senior level undergraduates.

▪ **Student Mentoring**

- Student-led conference abstract and presentation at 2016 Lunar and Planetary Science Conference.

▪ **Service and outreach activities**

- Outreach presentation at Allegheny Observatory.
- Peer reviewer for journals including *Contributions to Mineralogy and Petrology*, *Icarus*, *JGR*.

UNIVERSITY OF TENNESSEE
Postdoctoral Research Associate

Knoxville, TN
 2012

- Volunteered to teach “*Geochemistry*” for senior level undergraduates and graduate students under supervision of Dr. Larry Taylor.
- Completed training in teaching techniques, grant proposal writing, and active learning

CALIFORNIA INSTITUTE OF TECHNOLOGY
Graduate Teaching Assistant

Pasadena, CA
 2004-2009

- Teaching Assistant responsibilities included: *Introductory Geology and Geochemistry*, *Advanced Field and Structural Geology*, *Regional Geology of Southern California*, and *Metamorphic Petrology*.
 - Duties include running and updating labs, giving lab lectures, giving substitute lectures, arranging and running weekend and week-long field trips.
- GPS Division Teaching Assistant Award (2009).

- Caltech Alumni Fund Student Phone Program Manager (2007 – 2009).