

# **Benjamin D. Boatwright, Ph.D.**

Planetary Science Institute

Planetary Geosciences Group, Dept. of Earth, Environmental and Planetary Sciences  
Brown University

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## **Positions Held**

Associate Research Scientist, 2023–present

Planetary Science Institute

Postdoctoral Research Associate, 2022–present

Dept. of Earth, Environmental and Planetary Sciences, Brown University

## **Education**

Ph.D. Brown University, 2022

Earth, Environmental and Planetary Sciences

Advisor: James W. Head

Dissertation title: “Early Mars Landform Evolution: Understanding Geologic Change and Climate History through Observation and Modeling of Surface Processes”

M.S. Brown University, 2019

Earth, Environmental and Planetary Sciences

Advisor: James W. Head

Thesis title: “Simulating Early Mars Hydrology with the MARSSIM Landform Evolution Model: New Insights from an Integrated System of Precipitation, Infiltration, and Groundwater Flow”

M.A. Harvard University, 2017

Earth and Planetary Sciences

Origins of Life Graduate Consortium

Advisor: Stein B. Jacobsen

B.A. Amherst College, 2014

Geology *magna cum laude* with distinction

Phi Beta Kappa, Sigma Xi

Advisors: Caleb Fassett (Mt. Holyoke College Dept. of Astronomy), Anna Martini

Thesis title: “Exploring the Morphometry of Martian Valley Networks and Drainage Basins Using the MARSSIM Landform Evolution Model”

## **Honors, Awards & Memberships**

Brown University Library Innovation Prize for Rigor, Transparency & Reproducibility, 2022

Doctorate Dissertation Fellowship, Brown University Dept. of Earth, Environmental and Planetary Sciences, 2021-2022

Brown University Graduate School and Graduate Student Council Conference Travel Awards, 2018-2020

Walter F. Pond Prize for best undergraduate thesis, Amherst College Dept. of Geology, 2014

Member, Next Generation Lunar Scientists and Engineers

Member, OpenPlanetary

Member GSA, AGU, AAS

## Teaching & Mentoring

Brown University Sheridan Center Teaching and Course Design Certificates, 2022-2023

First-year graduate student mentor, Brown University Dept. of Earth, Environmental and Planetary Sciences, 2021-2023

Teaching Assistant, Brown University Dept. of Earth, Environmental and Planetary Sciences  
Mars, Moon, and the Earth: Fall 2020  
Planetary Geology: Spring 2020, Spring 2021

Head Teaching Fellow, Harvard University Dept. of Applied Mathematics (SEAS)  
Ordinary and Partial Differential Equations: Fall 2016

## Mission Design & Consultation

Artemis III candidate landing region characterization (Malapert Massif), 2023-

Science consultant for “Hadley Max” extended Apollo 15 design reference mission, 2022-

Science instrument advisor for Brown Space Engineering Venus flying wing mission concept, 2020-2021

JPL Planetary Science Summer School, 2020: Mission design for variable-altitude Venus balloon concept (VALENTInE)

SpaceIL *Beresheet* lunar mission landing site characterization, 2019

OrbitBeyond, Inc. lunar design reference mission traverse team, 2018

## Professional Service & Outreach

Panel co-chair, “Lessons Learned from the Current Era of Lunar Exploration,” LEAG 2023

NextGen knowledge capture agent for Artemis III Candidate Landing Sites Workshop, 2023

Research computing and server reconstruction lead for Head Lab, 2022-

NASA ROSES review panelist, 2023; external reviewer, 2021

Peer reviewer for *Icarus*, *JGR: Planets*, *Nature Geoscience*, *Nature Scientific Reports*, *Nature Communications Earth and Environment*, and *Advances in Space Research*

Organized LPSC@Brown alternative online event with research talks, 2020

Co-organized RI Space Grant tent at Apollo 50<sup>th</sup> anniversary Waterfire event, 2019

Resident geologist for Ladd Observatory and Northeast Planetary Data Center public outreach events, 2017-2019

## Peer-Reviewed Publications

1. **B.D. Boatwright** and J.W. Head (2019). “Simulating Early Mars Hydrology with the MARSSIM Landform Evolution Model: New Insights from an Integrated System of Precipitation, Infiltration, and Groundwater Flow.” *Planetary and Space Science* 171, 17-33. <https://doi.org/10.1016/j.pss.2019.04.001>
2. A.M. Palumbo, A.N. Deutsch, M.S. Bramble, J.D. Tarnas, **B.D. Boatwright**, L.H. Lark, E.M. Nathan, J.A. Wilner, Y. Chen, B.A. Anzures, C.A. Denton, L. Tokle, G. Casey, A.G. Pimentel, J.W. Head, K.R. Ramsley, U. Shah, A. Kothandhapani, H.P. Gokul, J. Mehta, V. Vatsal (2019). “Scientific Exploration of Mare Imbrium with OrbitBeyond, Inc.: Characterizing the Regional Volcanic History of the Moon.” *New Space* 7, 137-150. <https://doi.org/10.1089/space.2019.0016>

3. **B.D. Boatwright** and J.W. Head (2021). “A Noachian Proglacial Paleolake on Mars: Fluvial Activity and Lake Formation within a Closed-Source Drainage Basin Crater and Implications for Early Mars Climate.” *The Planetary Science Journal* 2, 52. <https://doi.org/10.3847/PSJ/abe773>
4. **B.D. Boatwright** and J.W. Head (2022). “Noachian Proglacial Paleolakes on Mars: Regionally Recurrent Fluvial Activity and Lake Formation within Closed-Source Drainage Basin Craters.” *The Planetary Science Journal* 3, 38. <https://doi.org/10.3847/PSJ/ac4d36>
5. A. Arredondo, A. Hodges, J.N.H. Abrahams, C.C. Bedford, **B.D. Boatwright**, J. Buz, C. Cantrall, J. Clark, A. Erwin, S. Krishnamoorthy, L. Magaña, R.M. McCabe, E.C. McIntosh, J.L. Noviello, M. Pellegrino, C. Ray, M.J. Styczinski, P. Wiegel (2022). “VALENTInE: A Concept for a New Frontiers–Class Long-duration In Situ Balloon-based Aerobot Mission to Venus.” *The Planetary Science Journal* 3, 152. <https://doi.org/10.3847/PSJ/ac7324>
6. **B.D. Boatwright** and J.W. Head (2022). “Pit-floored craters and layered terrains in the circum-Hellas region, Mars: Morphology, topography, stratigraphy, and relation to Late Noachian–Early Hesperian climate.” *Planetary and Space Science* 222, 105574. <https://doi.org/10.1016/j.pss.2022.105574>
7. **B.D. Boatwright** and J.W. Head (2022). “Constraining early Mars glacial conditions from paleodischarge estimates of intracrater inverted channels.” *Geophysical Research Letters*, e2022GL101227. <https://doi.org/10.1029/2022GL101227>
8. **B.D. Boatwright** and J.W. Head (2023). “Inverted fluvial channels in Terra Sabaea, Mars: Geomorphic evidence for proglacial paleolakes and widespread highlands glaciation in the Late Noachian–Early Hesperian.” *Planetary and Space Science* 225, 105621. <https://doi.org/10.1016/j.pss.2022.105621>

### Conference Abstracts

(\*indicates oral presentation)

- 1-3. **B.D. Boatwright** and C.I. Fassett (2014). “Exploring the Morphometry of Martian Valley Networks and Drainage Basins Using the MARSSIM Landform Evolution Model.” *LPSC 45*, #2478; *Year of the Solar System Undergrad Research Conference*, #1022; *NE GSA* 49, #28-6.
4. **B.D. Boatwright** (2015). “Southern Nectaris Fossae: A Microcosm of Martian Geology.” *First Landing Site/Exploration Zone Workshop for Human Missions to the Surface of Mars*, #1005\*.
5. S.B. Jacobsen, M.I. Petaev, **B.D. Boatwright**, S.J. Lock, S.T. Stewart (2016). “A New Model for Lunar Origin: Elemental and Isotopic Constraints.” *LPSC 47*, #2713.
- 6-7. **B.D. Boatwright** and J.W. Head (2017). “MARSSIM Landform Evolution Model: Hydrologic Constraints on the Noachian Early Dry Period.” *8<sup>th</sup> Moscow Solar System Symposium*, #PG-16\*; *4<sup>th</sup> International Conference on Early Mars*, #3029.
8. **B.D. Boatwright** and J.W. Head (2018). “Synthesis of Nonlocal, Nonlinear, and Noisy Models of Sediment Transport: Applications to Planetary Landform Evolution Modeling.” *LPSC 49*, #2617.
9. **B.D. Boatwright** and J.W. Head (2018). “Evolution of Crater Depth-Diameter Power Laws as a Proxy for Degradation.” *LPSC 49*, #2630.
10. **B.D. Boatwright** and J.W. Head (2018). “An Integrated Model of Precipitation, Infiltration, and Groundwater Flow on Mars.” *9<sup>th</sup> Moscow Solar System Symposium*, #MS-11\*.
11. **B.D. Boatwright** and J.W. Head (2019). “Early Mars Crater Degradation Processes: Testing the Effectiveness of Small Impact Bombardment with Numerical Simulations.” *LPSC 50*, #2612.
12. **B.D. Boatwright** and J.W. Head (2019). “Fluvial Geology of the Northwest Hellas Region, Mars: Evidence for Localized Drainage and Terrain Inversion.” *LPSC 50*, #2688.
13. L. Togle, A. Palumbo, A. Deutsch, B. Anzures, **B. Boatwright**, M. Bramble, G. Casey, Y. Chen, C. Denton, L. Lark, E. Nathan, A. Pimentel, J. Tarnas, J. Wilner, J. Head, K. Ramsley, U. Shah, A. Kothandhapani, H. Prasad Gokul, J. Mehta, V. Vatsal (2019). “Scientific Exploration of Mare Imbrium with OrbitBeyond, Inc.: Characterizing the Regional Volcanic History of the Moon.” *LPSC 50*, #2484.

14. **B.D. Boatwright** and J.W. Head (2019). “Mars Before the Valley Networks: Outstanding Questions on Noachian Crater Degradation and Early Climate.” *9<sup>th</sup> International Conference on Mars*, #6096.
15. **B.D. Boatwright** and J.W. Head (2019). “Testing the Effectiveness of Impact Bombardment on Early Mars Landscape Degradation.” *10<sup>th</sup> Moscow Solar System Symposium*, #PS-01.
16. **B.D. Boatwright** and J.W. Head (2020). “A Pristine Inverted Channel System in Terra Sabaea: Evidence of Intracrater Glaciofluvial Activity in the Late Noachian–Early Hesperian.” *LPSC 51*, #2009\*.
17. **B.D. Boatwright**, J.W. Head, M.A. Kreslavsky (2020). “Early Mars Crater Degradation Processes: Automated Crater Wall Slope Measurements and Regional Trends in Tyrrena Terra.” *LPSC 51*, #2376.
- 18-23. **B.D. Boatwright** and J.W. Head (2020). “Fluvial Activity and Lake Formation in a Noachian Closed-Source Drainage Basin Crater.” *11<sup>th</sup> Planetary Crater Consortium Meeting*, #2064\*; *EPSC 2020*, #976\*; *11<sup>th</sup> Moscow Solar System Symposium*, #MS-24\*; *GSA 2020*, #249-4\*; *DPS 52*, #311.04\*; *AGU 2020*, #P073-03\*.
- 24-25. J.W. Head, **B.D. Boatwright**, A.M. Palumbo, D.K. Weiss, M.A. Kreslavsky, J.L. Fastook (2020). “Revisiting Noachian-Hesperian Crater Degradation: Processes and Potential Effects.” *11<sup>th</sup> Planetary Crater Consortium Meeting*, #2066; *EPSC 2021*, #426\*.
- 26-27. **B.D. Boatwright**, J.W. Head, A.M. Palumbo (2021). “Inverted Fluvial Channels in Terra Sabaea, Mars: Geomorphic Evidence for Proglacial Lakes and Widespread Highlands Glaciation in the Late Noachian.” *LPSC 52*, #1641\*; *EGU 2021*, #8504\*.
28. **B.D. Boatwright**, J.W. Head, M.A. Kreslavsky (2021). “Improved Crater Wall Slope Detection Using a Hough Circle Transform with Applications to Mars Crater Morphometry and Climate History.” *LPSC 52*, #1651.
29. A. Arredondo, A. Hodges, J.N.H. Abrahams, C.C. Bedford, **B.D. Boatwright**, J. Buz, C. Cantrall, A. Erwin, S. Krishnamoorthy, L. Magaña, R.M. McCabe, E.C. McIntosh, J.L. Noviello, M. Pellegrino, C. Ray, M. Styczinski, P. Weigel (2021). “VALENTInE: A Concept for a New Frontiers Class Long Duration In-Situ Balloon Mission to Venus.” *LPSC 52*, #1526.
- 30-31. **B.D. Boatwright** and J.W. Head (2021). “Mars Crater Modification in the Late Noachian II: Updated Criteria for Identifying Cold-Based Crater Wall Glaciation.” *12<sup>th</sup> Planetary Crater Consortium Meeting*, #2028\*; *12<sup>th</sup> Moscow Solar System Symposium*, #MS-08\*.
32. **B.D. Boatwright** and J.W. Head (2021). “Noachian Proglacial Paleolakes on Mars: Possible Glacial Origins of Linear Ridges and Pitted Crater Floors in the Circum-Hellas Region.” *AGU 2021*, #EP22B-01\*.
33. **B.D. Boatwright** and J.W. Head (2022). “Pitted Crater Floors in the Circum-Hellas Region, Mars: New Insights into Possible Glacial Origins from Pit Depth Measurements.” *LPSC 53*, #1438.
34. **B.D. Boatwright** and J.W. Head (2022). “Hellas Basin: Witness Plate for Deconvolving the Geologic and Climatic History of Mars.” *LPSC 53*, #2069.
35. **B.D. Boatwright**, J.W. Head, M.A. Kreslavsky (2022). “Topographic Diffusion of Impact Craters on Mars: Sources, Atmospheric Effects, and Dependence on Climate.” *13<sup>th</sup> Planetary Crater Consortium Meeting*, #2007\*.
- 36-37. **B.D. Boatwright** and J.W. Head (2022). “Constraining Early Mars Glacial Conditions from Paleodischarge Estimates of Intracrater Inverted Channels.” *GSA 2022*, #207-7; *13<sup>th</sup> Moscow Solar System Symposium*, #MS-12\*.
38. **B.D. Boatwright** and J.W. Head (2023). “New Volume Estimates and Timing of Proglacial Lake Formation in a Noachian Closed-Source Drainage Basin Crater.” *LPSC 54*, #1162.
39. **B.D. Boatwright** and J.W. Head (2023). “Hellas Basin Witness Plate: Sequence and Timing of Altitude-Dependent Glacial Features on Early Mars.” *LPSC 54*, #1248.
40. A.T. Basilevsky, J.W. Head, S.S. Krasilnikov, M.A. Ivanov, M.I. Malenkov, G.G. Michael, T. Liu, D.R. Scott, L. Lark, **B.D. Boatwright**, C. Wu, W.L. Mickey (2023). “Exploration of Mons Malapert: Topographic, Geologic and Trafficability Considerations.” *Artemis III Candidate Landing Regions Workshop*, #2011.

- 41-42. **B.D. Boatwright** and J.W. Head (2023). “Shape-from-Shading Topography: Applications to Upcoming Human and Robotic Exploration of the Moon.” *Artemis III Candidate Landing Regions Workshop*, #2030; *LEAG 2023*, #2947.
43. **B.D. Boatwright** (2023). “Improved Workflow and Automation of CTX and HiRISE Stereo DEM Production with USGS ISIS and Ames Stereo Pipeline.” *6<sup>th</sup> Planetary Data Workshop*, #7009\*.

### Invited Talks

- 1-3. “Exploring the Morphometry of Martian Valley Networks and Drainage Basins Using the MARSSIM Landform Evolution Model”  
 Amherst Explorations: Amherst College, 2014  
 Five College Astronomy Spring Meeting: UMass Amherst, 2014  
 Harvard EPS Solid Earth Grad Student Seminar: Harvard University, 2015
4. “The Hf-W Isotope System: Insights into Early Solar System Processes.” Harvard EPS First-Year Symposium: Harvard University, 2015.
5. “Crunching the Numbers on Mars: An Integrated Model of Precipitation, Infiltration, and Groundwater Flow.” Planetary Lunch Seminar: Brown University, 2018.
6. “Planetary Science Summer School 2020.” Planetary Lunch Seminar: Brown University, 2021 (with A. Pascuzzo)
7. “Noachian Proglacial Paleolakes: A New Observational Framework for the Early Mars Climate.” Planetary Lunch Seminar: Brown University, 2021.
8. “A River Runs Through It: Paleohydrology of Inverted Glaciofluvial Channels on Mars.” Planetary Lunch Seminar: Brown University, 2022.
9. Invited panelist, “Career Development Discussion: Finding a Postdoc Position.” Planetary Lunch Seminar: Brown University, 2023.

### Published Data Repositories

- HiRISE Stereo Digital Elevation Models of Intracrater Inverted Channels, Harvard Dataverse.  
<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/22IU7S>
- CTX Stereo Digital Elevation Models of Noachian Proglacial Paleolakes and Pit-Floored Craters, Harvard Dataverse. <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/YHEOOK>
- Ames Stereo Pipeline (ASP) and Desktop Exploration of Remote Terrain (DERT) for CTX & HiRISE, Github.  
<https://github.com/bboatwright/aspcheatsheet>

### Media

- “The Upside-Down in Terra Sabaea.” HiRISE Picture of the Day, December 7, 2022.  
[https://www.uahirise.org/hipod/ESP\\_076432\\_1595](https://www.uahirise.org/hipod/ESP_076432_1595)
- 1st place winner in LPSC 2022 haiku contest. <https://www.hou.usra.edu/meetings/lpsc2022/haiku/>
- “Very strange crater lake on Mars.” *The Daily Galaxy*, April 1, 2021. <https://dailygalaxy.com/2021/04/very-strange-crater-lake-on-mars-no-evidence-of-the-source-of-the-water/>
- “Researchers discover new type of ancient crater lake on Mars.” *News from Brown*, March 30, 2021.  
<https://www.brown.edu/news/2021-03-30/crater-lake>
- “Brown students team with space exploration company on Moon mission planning.” *News from Brown*, February 25, 2019. <https://www.brown.edu/news/2019-02-25/moonmission>