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Selby Hearth

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Education & Work History

- Associate Professor, Bryn Mawr College (2017 – present)
- Assistant Professor, Bryn Mawr College (July 2011 – February 2017)
- Visiting Scholar Fellowship, Freie Universität, Berlin (Summer 2013)
- Ph.D., Earth & Planetary Sciences, Washington University in St. Louis (December 2010)
- M.S., Earth & Planetary Sciences, Washington University in St. Louis (May 2008)
- M.S., Science Writing, Massachusetts Institute of Technology (May 2006)
- B.A., Geology, Hampshire College (May 2005)

General Research Interests

- Mineralogy of Acid Mine Drainage (AMD) systems on Earth
- History of Geology in a colonial context
- Mineralogy and geochemistry of the Martian surface
- Science communication, especially in the context of museums of geologic collections

Peer-Reviewed Publications

Student co-authors are underlined and their graduation year is indicated after their names.

1. **Hearth, Selby** (2023) "Geologists as colonial scouts: The Rogers Expedition to Otavi and Tsumeb, Namibia, 1892–1895." *Earth Sciences History* 42(20): 385–415.

2. **Hearth, Selby** and Bronwen Densmore (2023) "Mineral-specific issues in 3D scanning and printing for digital collections, outreach, and display." *Journal of Natural Science Collections* 11: pages 88 - 97.

3. **Hearth, Selby**, and Carrie Robbins (2022) "Mineral displays as manifestations of geologic thought and colonial invisibility." *Journal of Natural Science Collections* 10, pp.3-17.

4. **Hearth, Selby** (2021) "The 'World's Greatest Mineral Locality:' Haillom, Ndonga, Herero, and the Early Colonial Histories of Tsumeb, Namibia." *Earth Sciences History* 41(2): 433–460.

5. **Cull-Hearth, Selby**, and M. Caroline Clark (BMC '16) (2017) "A Composite Mineralogical Map of Ganges Chasma and Surroundings, Valles Marineris, Mars." *Planetary & Space Sciences* 142: 1-8.

6. **Cull-Hearth, Selby**, Alexis van Venrooy (BMC '16), M. Caroline Clark (BMC '16), Adriana Cvitkovic (HC '16) (2016) Acid-sulfate spectral mixtures in natural samples from Río

Tinto, Spain: Implications for Mars. *Icarus* 271: 387-399. doi:10.1016/j.icarus.2016.01.001

7. **Cull, Selby,** Patrick McGuire, Christoph Gross, Jenna Myers (BMC '14), Nina Shmorhun (BMC '15) (2014) A new type of jarosite deposit on Mars: Evidence for past glaciation in Valles Marineris? *Geology* 42: 959-962. doi: 10.1130/G36152.1

8. **Cull, Selby,** Charles Cravotta, Chloe Weeks (BMC '13), Julia Grace Klinges (HC '14) (2014) Spectral masking of goethite in abandoned mine drainage systems: Implications for remote sensing and Mars. *Earth & Planetary Science Letters* 403: 217-224. doi: 10.1016/j.epsl.2014.06.045.

9. **Cull, Selby**, Erin Kennedy (BMC '13), Alice Clark (HC '12) (2014) Aqueous and Non-Aqueous Soil Processes on the Northern Plains of Modern Mars: Insights from the Distribution of Perchlorate Salts at the Phoenix Landing Site and in Earth Analog Environments. *Planetary and Space Science* 96: 29-34. doi: 10.1016/j.pss.2014.02.011.

10. Shaw, A, M Wolff, F Seelos, S Wiseman, **Selby Cull** (2013) Surface scattering properties at the Opportunity Mars rover's traverse region measured by CRISM. *Journal of Geophysical Research*, 118: doi: 10.1002/jgre.20119.

11. McEwen, A, L Ojha, C Dundas, S Mattson, S Byrne, J Wray, **Selby Cull**, S Murchie, N Thomas, V Gulick (2011) Seasonal flows on warm Martian slopes. *Science* 333: 740. doi: 10.1126/science.1204816

12. **Cull, Selby,** R Arvidson, M Mellon, S Wiseman, R Clark, T Titus, RV Morris, P McGuire (2010d) The Seasonal H_2O and CO_2 Ice Cycle at the Mars Phoenix Landing Site: I. Pre-Landing CRISM and HiRISE Observations. *Journal of Geophysical Research*, 115: doi:10.1029/2009JE003340.

13. **Cull, Selby,** R Arvidson, R Morris, M Wolff, M Mellon, M Lemmon (2010c) Seasonal ice cycle at the Mars Phoenix landing site: 2. Postlanding CRISM and ground observations. *Journal of Geophysical Research*, 115, E00E19, doi:10.1029/2009JE003410.

14. **Cull, Selby**, R Arvidson, J Catalano, D Ming, R Morris, M Mellon, M Lemmon (2010b) Concentrated perchlorate at the Mars Phoenix landing site: Evidence for thin film liquid water on Mars. *Geophysical Research Letters*, 37, doi:10.1029/2010GL045269

15. **Cull, Selby**, R Arvidson, M Mellon, P Skemer, A Shaw, R Morris, D Blaney (201a0) Compositions of subsurface ices at the Mars Phoenix landing site. *Geophysical Research Letters*, 37, L24203, doi:10.1029/2010GL045372.

16. Searls, M, M Mellon, **Selby Cull**, C Hansen, H Sizemore (2010) Seasonal defrosting of the Phoenix landing site. *Journal of Geophysical Research,* 115, E00E24, doi:10.1029/2009JE003438.

17. Byrne, S, C Dundas, M Kennedy, M Mellon, A McEwen, **Selby Cull**, I Daubar, D Shean, K Seelos, S Murchie, B Cantor, R Arvidson, K Edgett, A Reufer, N Thomas, T Harrison, L Posiolova, F Seelos (2009) Distribution of mid-latitude ground-ice on Mars from new impact craters. *Science*, 325(5948): 1674-1676. doi: 10.1126/science.1175307

18. Heet, T, R Arvidson, **Selby Cull,** M Mellon, K Seelos (2009) Geomorphic and Geologic Settings of the Phoenix Lander Mission Landing Site. *Journal of Geophysical Research*, doi:10.1029/2009JE003416

19. Mellon, M, R Arvidson, H Sizemore, M Searls, D Blaney, **Selby Cull**, M Hecht, T Heet, H Keller, M Lemmon, W Markiewicz, D Ming, R Morris, W Pike, A Zent (2009) Ground ice at the Phoenix landing site: Stability state and origin. *Journal of Geophysical Research*, doi:10.1029/2009JE003417

20. Arvidson, R, R Bonitz, M Robinson, J Carsten, M Mellon, P Chu, K Davis, J Wilson, A Shaw, R Greenberger, K Siebach, T Stein, **Selby Cull**, W Goetz, R Morris, D Ming, H Keller, M Lemmon, H Sizemore, M Mehta (2009) Results from the Mars Phoenix Lander Robotic Arm Experiment. *Journal of Geophysical Research*, doi:10.1029/2009JE003408

21. Seelos, K, R Arvidson, **Selby Cull,** C Hash, T Heet, E Guinness, P McGuire, R Morris, S Murchie, T Parker, T Roush, F Seelos, M Wolff (2008) Geomorphic and mineralogic characterization of the northern plains of Mars at the Phoenix Mission candidate landing sites. *Journal of Geophysical Research* 113, E00A13, doi:10.1029/2008JE003088.

22. Arvidson, R, D Adams, G Bonfiglio, P Christensen, **Selby Cull,** M Golombek, J Guinn, E Guinness, T Heet, R Kirk, A Knudson, M Malin, M Mellon, A McEwen, A Mushkin, T Parker, F Seelos, K Seelos, P Smith, D Spencer, T Stein, L Tamppari (2008) Mars Exploration Program 2007 Phoenix landing site selection and characteristics. *Journal of Geophysical Research* 113: E00A03, doi:10.1029/2007JE003021.

23. McGuire, P, M Wolff, M Smith, R Arvidson, S Murchie, T Clancy, T Roush, **Selby Cull,** K Lichtenberg, S Wiseman, R Green, T Martin, R Milliken, and the CRISM Team (2008) MRO/CRISM Retrieval of Surface Lambert Albedos for Multispectral Mapping of Mars with DISORT-Based Radiative Transfer Modeling: Phase 1. *IEEE Transactions on Geoscience and Remote Sensing* 46(12): 4020.

Conference Abstracts

Student co-authors are underlined and their graduation year is indicated after their names.

1. Hearth, Selby and Carrie Robbins (2023) “Minerals as lenses to illustrate the relationships between Geology and colonialism,” European Geoscience Union General Assembly 2023.
2. Hofstetter, Maya, Hearth, Selby And Robbins, Carrie “Cataloging Mineral Collections: Centering Connections To Colonialism” GSA 2023.
3. Low, Mishelley (HC ‘25) and Selby Hearth (2022) “Investigating Pigment Production Of Acid Mine Drainage In Pennsylvania’s Anthracite Coal Belt” GSA Denver.
4. Hearth, Selby, Carrie Robbins, Marianne Weldon, Aha Anderson, Rosa Bieber-Stanley, April Chernila, Helen Christ, Hannah Cosgrove, Morgan Hanson-Rosenberg, Carly Hill2, Maya Hofstetter, Emily Lazo, Izzie Ludlow, Samantha Lyster, Rachel Myers, Al Nash, Georgia Reed, Julia Saint-Amour (2022) “Colonial legacies in mineral collections: a structured approach to student collaboration” Unearthing the Collection, GCG and SMMP 2022.

5. Ramo, Kirtee (BMC ‘22) and Selby Hearth (2021) “Stratigraphic Boundary of Jezero’s Deltaic Materials and Mottled Terrain.” AGU 2021.
6. Parker, Carey (BMC ‘22) and Selby Hearth (2021) “Using pottery to tell a story about the geologic past to further our understanding of how Earth systems change.” AGU 2021.
7. Lee, Elena (SC ‘24) and Selby Hearth (2021) “Geomorphology of Serpentine and Carbonate-Bearing Terrains in Nili Fossae, Jezero Crater, and Gusev Crater” AGU 2021.
8. Hearth, Selby, Carrie Robbins, Ankitha Kannad (BMC ‘19), Cristian Clothier (HC ‘19) “Colonialism and Geologic Collections: Re-Thinking How We Display Rocks and Minerals,” AGU 2020.
9. Hearth, Selby (2020) “Teaching the History of Geology: Recognizing and Addressing Geology’s Ties to Colonialism and Imperialism.” North-Central Geological Society of America *Abstracts with Programs.* Vol. 52, No. 5
10. Bonanno, Angie (BMC ‘22) and Selby Hearth (2020) “Incorporating Place-Based Marginalized Perspectives into Geologic Field Trips,” AGU 2020.
11. Widzowski, Stephanie (HC ‘19) and Selby Cull-Hearth (2018) “Creating Complex And Accessible Exhibits At Bryn Mawr College: Making Geology Relevant.” Geological Society of America *Abstracts with Programs.* Vol. 50, No.6.
12. Kampmeyer, Emily (BMC ’18), Abby Ackerman (BMC ’17), Matthew Willig (HC ’18), Chloe Li (BMC ’18), Angela Bertagni, and Selby Cull-Hearth (2016) Digital tools for curating local rock and mineral samples. Geological Society of America Meeting, Colorado, Abstract #330-4.
13. Ackerman, Abby (BMC ’17), Emily Kampmeyer (BMC ’18), Matthew Willig (HC ’18), Chloe Li (BMC ’18), Angela Bertagni, and Selby Cull-Hearth (2016) Turning college collections into online rock and mineral databases for teaching and research. Geological Society of America Meeting, Colorado, Abstract #156-11.
14. Li, Chloe (BMC ’18), Abby Ackerman (BMC ’17), Emily Kampmeyer (BMC ’18), Matthew Willig (HC ’18), Selby Cull-Hearth (2016) Composite mineralogic stratigraphy of Melas Chasma, Mars. Geological Society of America Meeting, Colorado, Abstract #338-4.
15. Willig, Matthew (HC ’18), Chloe Li (BMC ’18), Abby Ackerman (BMC ’17), Emily Kampmeyer (BMC ’18), Selby Cull-Hearth (2016) Accounting for spectral masking in imaging spectroscopy of martian outcrops containing ferrihydrite. Geological Society of America Meeting, Colorado, Abstract #338-3.
16. Cull-Hearth, Selby and M. Caroline Clark (BMC ’16) (2015) Mineralogical Stratigraphy of Ganges Chasma, Mars. *American Astronomical Society Division of Planetary Sciences Conference* 2015.
17. Cull-Hearth, Selby, Alexis van Venrooy (BMC ’16), M. Caroline Clark (BMC ’16), A. Cvitkovic (HC ’16) (2015) Rio Tinto acid-sulfate mixtures: spectral masking relationships and implications for Mars. *Geological Society of America Meeting*, Baltimore, MD. Abstract #307-12.
18. Cull-Hearth, Selby (2015) Hydrated and mafic mineralogy of Ganges Chasma, Mars. *Geological Society of America Meeting*, Baltimore, MD. Abstract #133-6.
19. Cull-Hearth, Selby (2015) Spectral masking in mixtures of Mars-relevant minerals: comparison of laboratory end-members and natural mixtures. *American Geophysical Union Fall Meeting*. Abstract #P43D-2140.
20. Cull, Selby, Patrick C. McGuire; Christoph Gross; Alexander Dumke (2013) Stratigraphic mapping of hydrated phases in Western Ius Chasma, Mars. *American Geophysical Union Fall Meeting*, P23F-1844.

21. Cull, Selby, Jennifer Spohrer; Samyuktha Natarajan (BMC '15); Mia Chin (BMC '12) (2013) Blended Learning Tools in Geosciences: A New Set of Online Tools to Help Students Master Skills. *American Geophysical Union Fall Meeting*, ED44A-04.
22. Cull, Selby, E Kennedy (BMC '13), A Clark (HC '12) (2013) Complex distribution of perchlorate at the Mars Phoenix landing site. *Lunar and Planetary Science Conference*. Abstract #1593.
23. Cull, Selby, E Kennedy (BMC '13), A Clark (HC '12), G Swayze, R Clark (2012) Soil-column distribution of perchlorate at the Phoenix landing site from SSI, CRISM, and laboratory mixing experiments. *American Geophysical Union Fall Meeting*. Abstract #P11E-1858.
24. Cull, Selby, C Dundas, M Mellon, S Byrne (2012) CRISM observations of fresh icy craters in mid- to high-latitudes on Mars. *Lunar and Planetary Science Conference*. Abstract #2145.
25. Cull, Selby (2012) Perchlorate on Mars: An Overview of Distribution and Processes. *iPLEX Meeting: Ices and Organics in the Inner Solar System*, University of California Los Angeles
26. Cull, Selby, R. Morris, and G. Swayze (2011) Detailed mapping of perchlorate distributions with Phoenix and CRISM and evidence of modern aqueous redistribution. *American Geophysical Union Fall Meeting*, Abstract #P23A-1692.
27. Mellon, M.T., Hansen, C.J., Selby Cull, R. Arvidson, M. Searls (2011) Martian seasonal CO2 frost indicating decameter-scale variability in buried water ice. *American Geophysical Union Fall Meeting*, Abstract #P23A-1691.
28. Guiness, E., R. Arvidson, A. McEwen, Selby Cull (2011) Dust accumulation on MER solar panels. *American Geophysical Union Fall Meeting*, Abstract #P23A-1704.
29. Shaw, A., R. Arvidson, M. Wolff, F. Seelos, S. Wiseman, Selby Cull (2011) CRISM-derived spectral scattering parameters for surfaces in the vicinity of Opportunity Mars Rover traverses. *American Geophysical Union Fall Meeting*, Abstract #P23B-1715.
30. Cull, Selby, R. Arvidson, M Mellon, P Skemer, A Shaw, RV Morris (2010) Subsurface ices at the Mars Phoenix Landing Site: Assessing emplacement mechanisms. *American Geophysical Union Fall Meeting*. Abstract #P53A-1481.
31. Cull, Selby, R. Arvidson, J Catalano, D Ming, M Mellon, M Lemmon, R Morris (2010) Distribution of perchlorate salts at the Mars Phoenix landing site: Initial results from spectral mapping. *Geological Society of America Annual Meeting,* Denver. Paper No. 213-14.
32. Cull, Selby, R. Arvidson, F Seelos, F Poulet (2010) Mineral abundances and soil properties for Mars Science Laboratory candidate landing sites derived from CRISM observations and mineralogical modeling. *Geological Society of America Annual Meeting,* Denver, Paper No. 117-2.
33. Cull, Selby, R. Arvidson, FS Seelos, F Poulet, B Ehlmann (2010) Mineral abundances at top candidate landing sites for Mars Science Laboratory. *Mars Science Laboratory Science Team Meeting*, Pasadena, CA.
34. Cull, Selby, R. Arvidson, FS Seelos, MG Wolff (2010) Photometric properties of soils at the Mars Phoenix landing site: Preliminary analysis from CRISM EPF data. *Lunar and Planetary Science Conference.* Abstract #1416.
35. Cull, Selby, R Arvidson, M Mellon, S Wiseman, P McGuire, R Clark, T Titus, M Searls (2009) Seasonal ices at the Mars Phoenix Landing Site: Observations from HiRISE and CRISM. *Lunar and Planetary Science Conference*: Abstract #1814.
36. Cull, Selby, R Arvidson, RV Morris, M Wolff, MT Mellon, MT Lemmon (2009) Summer-Fall Seasonal Ices at the Mars Phoenix Landing Site: Results from CRISM Observations. *American Geophysical Union Fall Meeting*, Abstract #P23A-1228.

37. Cull, Selby, R Arvidson, RV Morris, D Fisher (2009) Remote sensing of perchlorate salts across the northern plains of Mars. *Phoenix Science Team Meeting*, Houston, TX.
38. Cull, Selby, R Arvidson, G Swayze, R Clark, RV Morris, D Fisher, R Milliken (2009) The search for perchlorate salts using CRISM. *CRISM Science Team Meeting*, Baltimore, MD.
39. Cull, Selby, R Arvidson, D Blaney, R Morris (2008) Spectral Modeling of Ground Ices Exposed by Trenching at the Phoenix Mars Landing Site. *American Geophysical Union Fall Meeting*, Abstract # U11B-0027.
40. Cull, Selby, R Arvidson, D Blaney, RV Morris, M Mellon, T Titus, S Wiseman, R Clark (2008) Spectral modeling of ices at the Phoenix landing site: Results from SSI, CRISM, and HiRISE Observations. *Phoenix Team Science Meeting,* Mountain View, CA.

Invited Talks

1. "Geologists, knowledge production, and colonial legacies" (2023), University of Bonn.
2. "Unearthing the Collection: The minerals that currently live at Bryn Mawr College" (2022) University of Delaware "Unearthing the Collection" project.
3. "Geochemistry of Mars: Using Earth to Understand Martian Processes" – Haverford College Chemistry Department Colloquium (October 2015)
4. "Mineralogy of Mars: Clues to the Past and Present" – Wagner Free Science Institute (September 2015)
5. "Mapping Past Environments on Mars Using Earth Analogues" – University of Illinois Chicago Colloquium Speaker Series (September 2015)
6. "Minerals of Mars" – Philadelphia Geological Society (April 2015)
7. "Phoenix on Mars: The Forgotten Data Set" – University of Pennsylvania Department Colloquium Speaker Series (October 2014)
8. "Remote Sensing of Hydrated Minerals and Other Surface Compositions on Mars" – Clark University Department of Geography Colloquium Speaker Series (November 2013)
9. "Perchlorate and the Water Cycle of Modern Mars: Insights from the Phoenix Mission" – University of Massachusetts Department of Geosciences Lecture Series (November 2013)
10. "Integrating Datasets from the Mars Phoenix Mission into CRISM, HiRISE, HRSC, and OMEGA Datasets" – Freie Universität, Berlin, Department of Earth Science Summer Lecture Series (July 2013)
11. "The Water Cycle at the Mars Phoenix Landing Site" – Mars Habitability, iPlex Meeting, University of California at Los Angeles (February 2013)
12. "Salts and Water on Modern Mars" – Temple University Geology Department Colloquia (March 2012)
13. "Perchlorate on Mars: An Overview" – Ices in the Inner Solar System, iPlex Meeting, University of California at Los Angeles (February 2012)
14. "What Happened to Mars?" – Philadelphia Mineralogical Society (November 2012)

Courses Taught at Bryn Mawr College (Fall 2011-Spring 2024)

1. GEOL 101 – How Earth Works (F13, F16, F18)
2. GEOL 104 – The Science of Climate Change (S21, S22, S23, S24)
3. GEOL 107 – Geology of Coal, Oil, and Nuclear Energy (F23)
4. GEOL 110 – Focus: Exploring Mars (S14, S17)
5. GEOL 202 – Mineralogy and Crystal Chemistry + Lab (F11, F12, F13, S16, F16, F18, F19, F20, F21 F22, F23)
6. GEOL 299 – Geology Field Short Course (S14, S19)
7. GEOL 302 – Low-Temperature Geochemistry (S12)
8. GEOL 305 – Igneous and Metamorphic Petrology (S13, S19, S22, S24)
9. GEOL 350 – Advanced Topics in Geology: Planetary Science (S12, S16, F19, S21)
10. GEOL 350 – Advanced Topics in Geology: Acid Mine Drainage (F12, S17)
11. GEOL 350 – Advanced Topics in Geology: Colonialism and Geology (F20, F22)
12. GEOL 350 – Petrotectonics (co-taught with Arlo Weil; S14)
13. GEOL 399 – Senior Seminar (S13)
14. GEOL 399 – Senior Capstone Seminar (co-taught with Geo. faculty; F13, S14, S16, F16, F18, S18, F19)
15. Emily Bach Seminar: The Art and Urgency of the Science Documentary (F21)
16. STEMLA Summer Program: STML 112: Geology of Energy and Extraction (Su22)