

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

CONTACT INFORMATION

Jet Propulsion Laboratory
M/S 183-301
4800 Oak Grove Drive
Pasadena, CA 91109
Phone: +1 (626) 298-2075
Email: michael.s.bramble@jpl.nasa.gov

RESEARCH INTERESTS

- Advancing spectroscopy for quantitative analysis of physical and chemical properties of planetary surfaces
- Investigating mineral spectral alterations from cold, irradiated, and vacuum conditions to aid in deriving physical and chemical properties
- Using remote sensing to characterize the mineralogy, geological history, and surface processes observed on planetary surfaces
- Development of quantitative analytical techniques and instrumentation in the geological sciences

EDUCATION

2020 *PhD*, Earth, Environmental, and Planetary Sciences
Brown University, Providence, RI
Dissertation: “Advancing Thermal Emission Spectroscopy for Asteroid Compositional and Thermophysical Analyses with Laboratory Experiments in a Simulated Asteroid Environment”
Advisors: Dr. R. E. Milliken and Dr. J. F. Mustard

2016 *MSc*, Earth, Environmental, and Planetary Sciences
Brown University, Providence, RI
Thesis: “The geological history of Northeast Syrtis Major, Mars”
Advisor: Dr. J. F. Mustard

2014 *BSc*, Honors Specialization in Planetary Science
The University of Western Ontario, London, ON
Thesis: “Quantitative grain size determination by two-dimensional micro-X-ray diffraction and its application to the planetary sciences”
Advisors: Dr. R. L. Flemming and Dr. P. J. A. McCausland

2010 *BMus (Hons)*, Music Theory and Composition
Memorial University of Newfoundland, St. John’s, NL

PROFESSIONAL EXPERIENCE

Scientist, Planetary Science, Small Bodies Group	2023 – Present
Jet Propulsion Laboratory, California Institute of Technology	
Postdoctoral Fellow	2020 – 2023
Jet Propulsion Laboratory, California Institute of Technology	
Postdoctoral Research Associate	2020
Department of Earth, Environmental, and Planetary Sciences, Brown University	
Graduate Student Research Assistant	2014 – 2020
Department of Earth, Environmental, and Planetary Sciences, Brown University	

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

RESEARCH & DEVELOPMENT SKILL SET

- **Laboratory Experimentation in the Geosciences:** Experience in planning and executing scientific laboratory experiments. This includes devising methodologies for testing hypotheses as well as having the knowledge of different approaches and techniques to answer the questions developed.
- **Remote Sensing Spectroscopy and Imaging:** Experience in scientific analysis of remotely-sensed spectral and imaging data sets to probe scientific questions. Skilled working with data from many instruments: MRO CRISM, HiRISE, CTX; DAWN VIR and Framing Camera; M3; Galileo NIMS and SSI; Cassini VIMS; EMIT; & Landsat.
- **Operation of Scientific Instrumentation and Equipment:** Experience in the operation and maintenance of various forms of scientific instruments at a high level of precision and repeatability. Mastery of: Spectral instruments, including UV/VIS/near-IR/mid-IR spectrometers; reflectance, thermal emission, FTIR, and absorption spectroscopy; mass spectroscopy and X-ray diffraction. Additional formal training in: Microscopy, petrography, SEM-EDX, He pycnometry, magnetic susceptibility, and X-ray micro-CT scanning.
- **Spacecraft Operations:** Experience in operational roles for active spacecraft missions, as well as knowledge in mission design and implementation. For Mars 2020 Perseverance Rover: Surface operations support including staffing Targeting Scientist, Tactical Science Support, and Documentation roles. For MRO/CRISM: Targeting of CRISM observations.
- **Thermal Vacuum and Cryogenic Chamber Operations:** Extensive experience in operating environmental chambers at non-ambient temperatures and pressures, handling of compressed gasses and refrigerated liquids, and working in a cleanroom environment. Experience operating ultra high vacuum equipment, turbomolecular and rough pumps, pressure gauges, thermocouples, and ammeters. Knowledgeable of material properties at high-vacuum and cryogenics
- **Programming and Data Analysis:** Experience in the design and application of data analysis tasks using the MATLAB and python programming languages. Other languages with high proficiency: Bash/UNIX, IDL, and $\text{\LaTeX}$. Proficient and highly experienced with ArcGIS, QGIS, ENVI, ISIS, GDAL, JMARS, ImageJ, GIMP, InDesign, Photoshop, and Illustrator. Proficient with Windows, Macintosh, and Linux-based operating systems.
- **Analysis and Handling of Large Data Sets:** Experience in performing scientific analyses on large spectral and imaging data sets using automated programming techniques to process, analyse, interpret, and report on data sets comprising thousands of images and billions of spectra. Highly experienced with NASA Planetary Data System data retrieval, image processing, and analysis for major data sets of Mars, Ceres, Europa, and Enceladus.

TEACHING EXPERIENCE

Graduate Teaching Assistant, Laboratory instructor

Remote Sensing of Earth and Planetary Surfaces (GEOL 1710)

Fall 2019, 10 students

Department of Earth, Environmental, and Planetary Sciences, Brown University

- Taught weekly lab sections; graded all assignments and held office hours

Graduate Teaching Assistant, Laboratory instructor

Global Environmental Remote Sensing (GEOL 1330)

Spring 2016, 24 students, and Spring 2017, 23 students

Department of Earth, Environmental, and Planetary Sciences, Brown University

- Taught weekly lab sections, updated laboratory assignments
- Aided students in developing and executing semester research projects
- Graded all assignments and held office hours

22. **M. S. Bramble** and K. P. Hand. 2024. 10 keV Electron Irradiation of Methane Ices at Ocean World Surface Temperatures. *Icarus*, 421, 116214.
21. K. G. Hanley, Q. McKown, E. M. Cangi, C. Sands, N. North, P. M. Miklavčič, **M. S. Bramble**, J. M. Bretzfelder, B. D. Byron, J. Caggiano, J. T. Haber, S. J. Laham, D. Morrison-Fogel, K. A. Napier, R. F. Phillips, S. Ray, M. Sandford, P. Sinha, T. Hudson, J. E. C. Scully, and L. Lowes. 2024. The Vulcan Mission to Io: Lessons Learned during the 2022 JPL Planetary Science Summer School. *The Planetary Science Journal*, 5, 164.
20. **M. S. Bramble** and K. P. Hand. 2024. Spectral evidence for irradiated halite on Mars. *Scientific Reports*, 14, 5503.
19. Y. Yang, R. E. Milliken, **M. S. Bramble**, W. R. Patterson, Y. Zou, and Y. Liu. 2024. Laboratory Thermal Emission Spectral Measurement and Calibration Methods for Planetary Science Research. *Chinese Journal of Space Science*, 44, 1–17.
18. **M. S. Bramble** and K. P. Hand. 2022. Spectral evidence for irradiated sodium chloride on the surface of 1 Ceres. *Geophysical Research Letters* 49, e2021GL096973.
17. R. Ketzner, V. Ravindra, and **M. Bramble**. 2022. A robust, fast, and accurate algorithm for point in spherical polygon classification with applications in geoscience and remote sensing. *Computers & Geosciences*, Volume 167, 105185.
16. K. P. Hand, C.B. Phillips, A. Murray, [and 284 others, including **M. S. Bramble**]. 2022. Science Goals and Mission Architecture of the Europa Lander Mission Concept. *Planetary Science Journal* 3, 22.
15. **M. S. Bramble**, R. E. Milliken, and W. R. Patterson III. 2021. Thermal emission measurements of ordinary chondrite mineral analogs in a simulated asteroid environment: 1. Constituent mineral phases. *Icarus* 369, 114561.
14. **M. S. Bramble**, R. E. Milliken, and W. R. Patterson III. 2021. Thermal emission measurements of ordinary chondrite mineral analogs in a simulated asteroid environment: 2. Representative mineral mixtures. *Icarus* 369, 114251.
13. J. D. Tarnas, J. F. Mustard, H. Lin, T. A. Goudge, E. S. Amador-French, **M. S. Bramble**, C. H. Kremer, X. Zhang, Y. Itoh, M. Parente. 2019. Constraining the origin of hydrated silica in Jezero crater, Mars. *Geophysical Research Letters* 46, 12771–12782.
12. **M. S. Bramble**, Y. Yang, W. R. Patterson III, R. E. Milliken, J. F. Mustard, and K. L. Donaldson Hanna. 2019. Radiometric Calibration of Thermal Infrared Data from the Asteroid and Lunar Environment Chamber (ALEC). *Review of Scientific Instruments* 90, 093101.
11. 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. Togle, G. Casey, A. G. Pimentel, J. W. Head, K. R. Ramsley, U. Shah, A. Kothandhapani, H. P. Gokul, J. Mehta, and V. Vatsal. 2019. Scientific exploration of Mare Imbrium with OrbitBeyond Inc.: Characterizing the regional volcanic history of the Moon. *New Space* 7, 137–150.
10. C. H. Kremer, J. F. Mustard, and **M. S. Bramble**. 2019. A widespread ultra-mafic ash on Mars. *Geology* 47, 677–681.
9. **M. S. Bramble**, T. A. Goudge, R. E. Milliken, and J. F. Mustard. 2019. Testing the Deltaic Origin of Fan Deposits at Bradbury Crater, Mars. *Icarus* 319, 363–366.

8. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, **M. S. Bramble**, K. M. Cannon, A. M. Palumbo, and A.-C. Plesa. 2018. Radiolytic H₂ Production on Noachian Mars: Implications for Habitability. *Earth and Planetary Science Letters* 502, 133–145.
 7. A. N. Deutsch, J. W. Head, K. R. Ramsley, C. M. Pieters, R. W. K. Potter, A. M. Palumbo, **M. S. Bramble**, J. P. Cassanelli, E. R. Jawin, L. M. Jozwiak, H. H. Kaplan, C. F. Lynch, A. C. Pascuzzo, L. Qiao, D. K. Weiss. 2018. Science exploration architecture for Phobos and Deimos: The role of Phobos and Deimos in the future exploration of Mars. *Advances in Space Research* 62, 2174–2186.
 6. M. R. Salvatore, T. A. Goudge, **M. S. Bramble**, C. S. Edwards, J. L. Bandfield, E. S. Amador, J. F. Mustard, and P. R. Christensen. 2018. Bulk mineralogy of the NE Syrtis and Jezero crater regions of Mars derived through thermal infrared spectral analyses. *Icarus* 301, 76–96.
 5. **M. S. Bramble**, J. F. Mustard, and M. R. Salvatore. 2017. The Geological History of Northeast Syrtis Major, Mars. *Icarus* 293, 66–93.
 4. M. A. McCraig, G. R. Osinski, E. A. Cloutis, R. L. Flemming, M. R. M. Izawa, V. Reddy, S. K. Fieber-Beyer, L. Pompilio, F. van der Meer, J. A. Berger, **M. S. Bramble**, and D. M. Applin. 2017. Fitting the curve in Excel: Systematic curve fitting of laboratory and remotely sensed planetary spectra. *Computers & Geosciences* 100, 103–114.
 3. **M. S. Bramble**, R. L. Flemming, and P. J. A. McCausland. 2015. Grain size measurement from two-dimensional micro-X-ray diffraction: Laboratory application of a radial integration technique. *American Mineralogist* 100, 1899–1911.
 2. **M. S. Bramble**, R. L. Flemming, J. L. Hutter, M. M. Battler, G. R. Osinski, and N. R. Banerjee. 2014. A temperature-controlled sample stage for in situ micro-X-ray diffraction: Application to Mars analog mirabilite-bearing perennial cold spring precipitate mineralogy. *American Mineralogist* 99, 943–947.
 1. J. R. de Bruyn, M. Goiko, M. Mozaffari, D. Bator, R. L. Dauphinee, Y. Liao, R. L. Flemming, **M. S. Bramble**, G. K. Hunter, and H. A. Goldberg. 2013. Dynamic Light Scattering Study of Inhibition of Nucleation and Growth of Hydroxyapatite Crystals by Osteopontin. *PLoS ONE* 8(2): e56764.
-
- FIRST-AUTHOR
CONFERENCE
PROCEEDINGS**

26. **M. S. Bramble**, K. D. Chadwick, P. G. Brodrick, J. Montgomery, and R. O. Green. 2024. Assessing acid mine drainage hazard with remotely-sensed mineralogy from the Earth Surface Mineral Dust Source Investigation (EMIT). *GSA Annual Meeting*, abstract 403258 (talk)
 25. **M. S. Bramble** and K. P. Hand. 2024. Investigating the habitability of Mars via the chloride salt-bearing deposits. *Astrobiology Science Conference 2024*, paper 1500507, abstract 107-02 (talk)
 24. **M. S. Bramble** and K. P. Hand. 2023. Irradiation of Methane and Water Ices at 100 K: Implications for Radiation Products at Ocean Worlds. *AGU Fall Meeting*, paper 1357853, abstract P53A-09 (talk)
 23. **M. S. Bramble** and K. P. Hand. 2023. Electron Irradiation of Methane and Methane/Water Ices at 20 K Through 100 K. *Lunar and Planetary Science Conference LIV*, abstract 2464 (poster)
 22. **M. S. Bramble** and K. P. Hand. 2022. Radiation-Formed Color Centers of Sodium Chloride on Inner Solar System Bodies. *AGU Fall Meeting*, paper P25F-2184, abstract 1178685 (poster)

21. **M. S. Bramble** and K. P. Hand. 2022. Spectral Evidence for Halite in the Faculae on Ceres as Observed by the Dawn VIR Spectrometer. *Lunar and Planetary Science Conference LIII*, abstract 2835 (poster)
20. **M. S. Bramble** and K. P. Hand. 2022. Consideration of the Martian Chloride Salt-bearing Deposits as a Target for a Low-cost Science Mission. *Low-Cost Science Mission Concepts for Mars Exploration*, abstract 5064 (poster)
19. **M. S. Bramble** and R. E. Milliken. 2020. The Thermal Emission of Ordinary Chondrites and Analog Mixtures at Simulated Asteroid Conditions. *Lunar and Planetary Science Conference LI*, abstract 2498 (poster)
18. **M. S. Bramble** and R. E. Milliken. 2019. Thermal Emission Spectroscopy of Ordinary Chondrites at Simulated Asteroid Conditions with Implications for Asteroid Thermophysical and Compositional Interpretations. *Asteroid Science in the Age of Hayabusa2 and OSIRIS-REx*, abstract 2139 (poster)
17. **M. S. Bramble**, R. E. Milliken, W. R. Patterson III, and J. F. Mustard. 2019. Thermal Infrared Characterization of Ordinary Chondrite Analogs in a Simulated Asteroid Environment with Implications for the Remote Analysis of Asteroid Mineralogy. *Lunar and Planetary Science Conference L*, abstract 2101 (talk)
16. **M. S. Bramble**, R. E. Milliken, W. R. Patterson III, and J. F. Mustard. 2018. Thermal infrared characterization of ordinary chondrite analogs in a simulated asteroid environment with implications for the interpretation of asteroid physical and chemical properties. *AGU Fall Meeting*, paper P53D-2997, abstract 458541 (poster)
15. **M. S. Bramble**, J. F. Mustard, and C. H. Kremer. 2018. Geological Continuity Between the Midway and NE Syrtis Candidate Landing Sites for the Mars 2020 Rover Mission. *4th Landing Site Workshop for the 2020 Mars Rover Mission* (talk)
14. **M. S. Bramble**, W. R. Patterson III, R. E. Milliken, Y. Yang, K. L. Donaldson Hanna, and J. F. Mustard. 2018. Radiometric Calibration of Thermal Emission Data from the Asteroid and Lunar Environment Chamber (ALEC). *Lunar and Planetary Science Conference XLIX*, abstract 1598 (poster)
13. **M. S. Bramble**, J. F. Mustard, C. I. Fassett, and T. A. Goudge. 2018. Stratigraphy of the Northeast Syrtis Major Mars 2020 Landing Site and the Ejecta of Jezero Crater, Mars. *Lunar and Planetary Science Conference XLIX*, abstract 1705 (poster)
12. **M. S. Bramble**, T. A. Goudge, R. E. Milliken, and J. F. Mustard. 2017. Testing the Deltaic. Origin of Fan Deposits at Bradbury Crater, Mars. *Lunar and Planetary Science Conference XLVIII*, abstract 2210 (poster)
11. **M. S. Bramble**, J. F. Mustard, and K. M. Cannon. 2017. Testing Carbonate Formation Mechanisms at Northeast Syrtis Major Using Manual and Automated Hyperspectral Analyses. *Lunar and Planetary Science Conference XLVIII*, abstract 2815 (talk)
10. **M. S. Bramble**, J. F. Mustard, B. L. Ehlmann, and M. R. Salvatore. 2017. Stratigraphy and Quantitative Mineralogy of Northeast Syrtis Major: Constraints on Hypothesis of Formation and Evolution of the Region. *3rd Landing Site Workshop for the 2020 Mars Rover Mission* (talk)
9. **M. S. Bramble** and J. F. Mustard. 2016. Spectral stratigraphy constraining carbonate formation mechanisms at Nili Fossae, Mars. *GSA Annual Meeting*, abstract 284602 (poster)

8. **M. S. Bramble** and J. F. Mustard. 2016. Constraining H_2 production from the Noachian crust: Elemental composition, water capacity, and implications for habitability. *GSA Annual Meeting*, abstract 284609 (poster)
7. **M. S. Bramble** and J. F. Mustard. 2016. Stratigraphic Relationships in Northeast Syrtis Major, Mars: Approximately 250 Million Years of Geological History Spanning the Noachian–Hesperian Boundary. *Lunar and Planetary Science Conference XLVII*, abstract 2582 (talk)
6. **M. S. Bramble** and J. F. Mustard. 2016. Investigating the Antarctic meteorite analog of carbonate formation on Mars. *Lunar and Planetary Science Conference XLVII*, abstract 2553 (poster)
5. **M. S. Bramble** and J. F. Mustard. 2015. Stratigraphy of Olivine–Carbonate–Bearing Units Forming Mesas and Linear Features in Northeast Syrtis Major: Implications for Emplacement. *Lunar and Planetary Science Conference XLVI*, abstract 2090 (poster)
4. **M. S. Bramble**, P. J. A. McCausland, R. L. Flemming, and M. R. M. Izawa. 2014. Micro-X-ray diffraction and scanning electron microscopy investigation of enigmatic dun-coloured veins in the Tagish Lake carbonaceous chondrite. *GAC-MAC Annual Meeting*, abstract 263 (poster)
3. **M. S. Bramble**, R. L. Flemming, and P. J. A. McCausland. 2014. Grain Size, ‘Spotty’ XRD Rings, and CheMin: Two-Dimensional X-ray Diffraction as a Proxy for Grain Size Measurement in Planetary Materials. *Lunar and Planetary Science Conference XLV*, abstract 1658 (poster).
—Also presented at the 2014 *NASA Year of the Solar System Undergraduate Planetary Science Research Conference*, abstract 1008
2. **M. S. Bramble**, R. L. Flemming, and J. L. Hutter. 2013. A Temperature-Controlled Sample Stage for Micro-X-Ray Diffraction of Mirabilite-Containing Samples from Wolf Spring, Axel Heiberg Island, Nunavut, Canada. *Lunar and Planetary Science Conference XLIV*, abstract 1729 (poster).
—Also presented at the 2013 *NASA Year of the Solar System Undergraduate Planetary Science Research Conference*, abstract 3
1. **M. S. Bramble**, J. L. Hutter, and R. L. Flemming. 2012. A temperature-controlled cold stage for micro-X-ray diffraction of sodium sulphate bearing samples from the Canadian High Arctic. *CAMBR Distinguished Lecturer and Research Day*, abstract 76 (talk)

ADDITIONAL CONFERENCE PROCEEDINGS

64. H. A. Bender, C. H. Kremer, J. F. Mustard, S. W. Parman, R. O. Green, C. M. Pieters, Q. Vinckier, **M. S. Bramble**, and S. D. Gunapala. 2024. Intermediate Infrared Imaging Spectrometer (IIRIS) for Mafic Mineral Composition and Direct H₂O Detection. *SPIE Optics + Photonics 2024*, abstract 13144-4
63. K. D. Chadwick, E. Bolch, P. Brodrick, N. Bohn, **M. Bramble**, A. Friesz, C. Krehbiel, B. Lind, K. Luis, D. R. Thompson, A. Thorpe, and R. O. Green. 2024. Earth Surface Mineral Dust Source Investigation Application Areas and Open Science Resource Development. *IEEE International Geoscience and Remote Sensing Symposium*, paper TH1.R10.4
62. M. C. Deahn, B. Horgan, F. Calef III, J. Schroeder, K. M. Stack, N. R. Williams, S. Alwmark, C. C. Bedford, **M. Bramble**, L. Crumpler, D. Flannery, B. Garczynski, S. Gwizd, L. Ives, L. Kah, A. Klidas, C. Lesh, H. Manelski, L. E. Mayhew, C. Miller, M. Nachon, C. Quantin-Nataf, N. Randazzo, E. Ravanis, P. Russell, T. Del Sesto, J. I. Simon, and J. R. C. Voigt. 2024. Jezero Crater Rim

-
- from Orbit: Mapping Diverse Targets for the Mars 2020 Rover. *Tenth International Conference on Mars*, abstract 3151
61. B. M. Toner, S. L. Matzen, **M. S. Bramble**, T. Ely, A. A. Wackett, M. Pacheco, Z. Gainsforth, A. Gartman, C. R. German, and K. P. Hand. 2024. Iron nanoparticles as biogeochemical tracers of hydrothermal activity on icy ocean worlds: Effects of Europa surface-like radiation on particulate chemistry and morphology. *Astrobiology Science Conference 2024*, paper 1500677, abstract 221-100
 60. K. Dana Chadwick, R. O. Green, D. R. Thompson, P. G. Brodrick, K. Luis, N. Bohn, **M. Bramble**, A. Thorpe, E. Bolch, B. Lind, M. Jami, A. Friesz, and C. Krehbiel. 2024. EMIT Applications and Data Accessibility. *13th EARSeL Workshop on Imaging Spectroscopy*, abstract 303
 59. M. C. Deahn, B. Horgan, F. Calef III, J. Schroeder, K. M. Stack, N. R. Williams, S. Alwmark, C. C. Bedford, **M. Bramble**, L. Crumpler, D. Flannery, B. Garczynski, S. Gwizd, L. Ives, A. Klidas, C. Lesh, H. Manelski, C. Miller, M. Nachon, C. Quantin-Nataf, N. Randazzo, E. Ravanis, P. Russell, T. Del Sesto, J. I. Simon, J. R. C. Voigt. 2024. An Orbital Photogeologic Map of the Jezero Crater Rim: Diverse Targets for Mars 2020 Future Exploration. *Lunar and Planetary Science Conference LV*, abstract 2302
 58. S. W. Parman, J. F. Mustard, C. M. Pieters, C. H. Kremer, R. O. Green, **M. S. Bramble**, and L. Johnson. 2024. Mercury Scout: A Solar Sail Mission to the Innermost Planet. *Lunar and Planetary Science Conference LV*, abstract 2314
 57. S. W. Parman, J. F. Mustard, C. M. Pieters, C. H. Kremer, **M. S. Bramble**, R. O. Green, and L. Johnson. 2024. Mercury Scout: Mapping Minerals and Ices. *Mercury Exploration Assessment Group (MExAG) Annual Meeting 2024*, abstract 6041
 56. K. P. Hand, **M. S. Bramble**, D. F. Berisford, A. Macias, J. Foster, Z. Wong, and A. Hsu. 2023. The Morphologic, Chemical, and Radiolytic Evolution of Ocean Water Under Surface Conditions Comparable to Europa. *AGU Fall Meeting*, paper 1437536, abstract P44A-07
 55. H. Bender, C. Kremer, J. F. Mustard, C. M. Pieters, R. O. Green, Q. P. Vinckier, S. Gunapala, **M. S. Bramble**, and S. W. Parman. 2023. Lunar Intermediate Infrared Imaging Spectrometer (LIIRIS) for Mafic Mineral Composition and Direct H₂O Detection. *AGU Fall Meeting*, paper 1401295, abstract P33B-02
 54. W. B. Sparks, T. A. Germer, F. Robb, K. P. Hand, and **M. S. Bramble**. 2023. Detecting the Fundamental Chiral Building Blocks of Life. *AGU Fall Meeting*, paper 1433317, abstract P41G-3261
 53. C. H. Kremer, H. A. Bender, J. F. Mustard, C. M. Pieters, R. O. Green, Q. Vinckier, S. D. Gunapala, **M. S. Bramble**, and S. W. Parman. 2023. Lunar Intermediate Infrared Imaging Spectrometer (LIIRIS) for Mafic Mineral Composition and Direct H₂O Detection. *Annual Meeting of the Lunar Exploration Analysis Group*, abstract 2963
 52. C. H. Kremer, H. A. Bender, J. F. Mustard, C. M. Pieters, R. O. Green, Q. Vinckier, S. D. Gunapala, **M. S. Bramble**, and S. W. Parman. 2023. Lunar Intermediate Infrared Imaging Spectrometer (LIIRIS) for Mafic Mineral Composition and Direct H₂O Detection. *Endurance Science Workshop*, abstract 3017
 51. C. H. Kremer, H. A. Bender, J. F. Mustard, C. M. Pieters, R. O. Green, Q. Vinckier, S. D. Gunapala, **M. S. Bramble**, and S. W. Parman. 2023. Lunar Intermediate Infrared Imaging Spectrometer (LIIRIS) for Mafic Mineral Composition and Direct H₂O Detection. *NASA Exploration Science Forum*

50. S. W. Parman, J. F. Mustard, C. M. Pieters, C. H. Kremer, R. O. Green, **M. S. Bramble**, and L. Johnson. 2023. Mercury Scout: Mapping Mercury’s Mineralogy. *Lunar and Planetary Science Conference LIV*, abstract 1607
49. J. M. Bretzfelder, K. G. Hanley, Q. McKown, E. M. Cangi, C. Sands, N. North, P. M. Miklavcic, **M. S. Bramble**, B. D. Byron, J. Caggiano, J. T. Haber, S. J. Laham, D. Morrison-Fogel, K. A. Napier, R. F. Phillips, S. Ray, M. Sandford, P. Sinha, T. Hudson, J. E. C. Scully, and L. Lowes. 2023. VULCAN: A Mission Concept to Explore Tidal Heating and Extreme Volcanism at Io. *Lunar and Planetary Science Conference LIV*, abstract 2861
48. C. H. Kremer, J. F. Mustard, C. M. Pieters, R. O. Green, S. W. Parman, and **M. S. Bramble**. 2023. Imaging Spectrometer for Lunar Silicate Compositional Determination and Direct Detection of H₂O in the 4-8 Micron Intermediate Infrared (IMIR) Spectral Range. *Lunar and Planetary Science Conference LIV*, abstract 2151
47. S. A. Pérez-López, C. H. Kremer, J. F. Mustard, **M. S. Bramble**, C. M. Pieters, and R. O. Green. 2023. Consequences of Signal to Noise Ratio and Spectral Sampling for the Determination of Olivine Composition in the Intermediate Infrared Region. *Lunar and Planetary Science Conference LIV*, abstract 2388
46. S. W. Parman, J. F. Mustard, C. M. Pieters, C. H. Kremer, **M. S. Bramble**, R. O. Green, and L. Johnson. 2023. Mercury Scout: Mineral Mapping and High-Resolution Imaging. *Mercury Exploration Assessment Group (MEXAG) Annual Meeting 2023*, abstract 6030
45. C. H. Kremer, J. F. Mustard, C. M. Pieters, R. O. Green, S. W. Parman, and **M. S. Bramble**. 2023. Mercury Science Questions Addressed with Imaging Spectroscopy Observations Across the New Intermediate Infrared (IMIR) Spectral Range. *Mercury Exploration Assessment Group (MEXAG) Annual Meeting 2023*, abstract 6035
44. S. Parman, J. Mustard, C. Pieters, C. Kremer, **M. Bramble**, R. Green, and L. Johnson. 2023. Mercury Scout. *2023 Technology Showcase for Future NASA Planetary Science Missions*
43. K. G. Hanley, Q. McKown, E. M. Cangi, C. Sands, N. North, P. Miklavcic, **M. S. Bramble**, J. M. Bretzfelder, B. D. Byron, J. Caggiano, J. T. Haber, S. Laham, D. Morrison-Fogle, K. A. Napier, R. Phillips, S. Ray, M. Sandford, P. Sinha, J. E. C. Scully, and T. Hudson. 2022. Vulcan: Exploring Tidal Heating & Extreme Volcanism at Io. *AGU Fall Meeting*, paper P55E-1612, abstract 1073625
42. M. E. Cameron, K. P. Hand, C. B. Phillips, J. Pitesky, E. J. Leonard, J. E. C. Scully, **M. S. Bramble**, S. M. Brooks, M. L. Cable, K. L. Craft, J. D. Hofgartner, A. E. Hofmann, K. J. Hurst, B. Kennedy, E. Klonicki, K. Kriechbaum, S. MacKenzie, M. Meacham, T. A. Nordheim, C. Paranicas, R. Perkins, D. M. Persaud, G. E. Reeves, L. R. Shiraishi, G. Tan-Wang, and the Europa Lander pre-Project Science and Engineering Teams. 2022. Science-driven Preparations for Europa Surface Operations. *AGU Fall Meeting*, paper P55G-1648, abstract 1162278
41. S. L. Matzen, **M. S. Bramble**, T. Ely, A. A. Wackett, M. Pacheco, C. R. German, A. Gartman, K. P. Hand, and B. M. Toner. 2022. Pyrite nanoparticles as biogeochemical tracers of hydrothermal activity on icy ocean moons. *Astrobiology Science Conference 2022*, abstract 212-04
40. K. P. Hand, C. B. Phillips, K. L. Craft, S. M. Brooks, J. Pitesky, J. E. C. Scully, E. J. Leonard, J. D. Hofgartner, D. M. Persaud, T. Nordheim, **M. S. Bramble**, K. J. Hurst, S. MacKenzie, C. Paranicas, G. Tan-Wang, G. E. Reeves, B. Kennedy, M. E. Cameron, L. R. Shiraishi, Europa Lander Science Definition

-
- Team, Project Science Team, and Project Engineering Team. 2022. Science Goals and Mission Architecture of the Europa Lander Mission Concept. *Astrobiology Science Conference 2022*, abstract 430-01
39. M. E. Cameron, K. P. Hand, C. B. Phillips, J. Pitesky, **M. Bramble**, S. M. Brooks, M. L. Cable, K. L. Craft, E. R. Duffy, J. D. Hofgartner, A. E. Hofmann, K. J. Hurst, B. Kennedy, E. Klonicki, K. Kriechbaum, E. J. Leonard, S. MacKenzie, M. Meacham, T. Nordheim, C. Paranicas, R. Perkins, D. M. Persaud, G. E. Reeves, J. E. C. Scully, L. R. Shiraishi, G. Tan-Wang, and Europa Lander Mission Concept Team. 2022. Destination Europa: Science-driven preparations for Touching an Unknown Surface. *Astrobiology Science Conference 2022*, abstract 406-01
 38. K. P. Hand, C. B. Phillips, K. Craft, J. E. Pitesky, M. E. Cameron, E. J. Leonard, **M. Bramble**, S. M. Brooks, J. Hofgartner, K. Hurst, B. A. Kennedy, S. M. MacKenzie, T. A. Nordheim, C. P. Paranicas, M. Meacham, D. M. Persaud, J. E. C. Scully, E. Maize, G. E. Reeves, J. McNamee, L. R. Shiraishi, G. H. Tan-Wang and the Science Definition team and Project Engineering team. 2022. Science Goals and Mission Architecture of the Europa Lander Mission Concept. *Lunar and Planetary Science Conference LIII*, abstract 1788
 37. M. E. Cameron, K. P. Hand, C. B. Phillips, J. E. Pitesky, **M. S. Bramble**, S. M. Brooks, M. L. Cable, K. Craft, E. R. Duffy, J. Hofgartner, A. E. Hofmann, K. Hurst, B. A. Kennedy, E. Klonicki, K. Kriechbaum, E. J. Leonard, S. M. MacKenzie, M. Meacham, T. A. Nordheim, C. P. Paranicas, R. Perkins, D. M. Persaud, G. E. Reeves, J. E. C. Scully, L. R. Shiraishi, G. H. Tan-Wang. 2022. Science-Driven Preparations for Landing on Europa. *Lunar and Planetary Science Conference LIII*, abstract 2470.
 36. M. E. Cameron, K. P. Hand, C. B. Phillips, [and 13 others including **M. S. Bramble**]. 2021. Terrain specification: Science-driven preparations for landing on Europa. *AGU Fall Meeting*, paper P25E-2190, abstract 913013.
 35. S. M. Brooks, K. P. Hand, C.B. Phillips, [and 20 others, including **M. S. Bramble**]. 2021. The Europa Lander Mission Concept: Future Surface Exploration of a Potentially Habitable World. *53rd Annual Meeting of the Division For Planetary Sciences*, abstract 412.03.
 34. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, O. Warr, K. M. Cannon, A. M. Palumbo, A.-C. Plesa, and **M. S. Bramble**. 2019. Abiotic CH₄ flux from the Precambrian Shield on Earth and during the Noachian, Hesperian, and Amazonian periods on Mars. *AGU Fall Meeting*, paper EP54B-03, abstract 519226.
 33. C. H. Kremer, **M. S. Bramble**, and J. F. Mustard. 2019. An Integrated Sedimentary Geological System at Nili Fossae, Mars. *Ninth International Conference on Mars*, abstract 6332
 32. J. F. Mustard, **M. S. Bramble**, C. H. Kremer, J. D. Tarnas, A. C. Pascuzzo, and J. W. Head. 2019. A Record of the First Billion Years of Solar System History at the Mars 2020 Landing Site. *Ninth International Conference on Mars*, abstract 6404
 31. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, K. M. Cannon, A. M. Palumbo, A.-C. Plesa, and **M. S. Bramble**. 2019. Mars Could have been Warmed by Eccentricity Variations or a Subsurface Biosphere. *Ninth International Conference on Mars*, abstract 6345
 30. M. R. Salvatore, T. A. Goudge, **M. S. Bramble**, Y. Liu, and C. S. Edwards. 2019. The Composition and Thermophysical Character of Jezero Crater and its Surrounding Watershed. *Ninth International Conference on Mars*, abstract 6264

29. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, K. M. Cannon, A. M. Palumbo, A.-C. Plesa, and **M. S. Bramble**. 2019. Is Abiotic Methane Production Sufficient for Warming Noachian and Hesperian Mars? *Astrobiology Science Conference 2019*, abstract 3381
28. M. R. Salvatore, T. A. Goudge, Y. Liu, and **M. S. Bramble**. 2019. The Composition of NASA's Mars 2020 Rover Landing Site at Jezero Crater: A Summary of Remote Spectral Analyses. *Lunar and Planetary Science Conference L*, abstract 1454
27. C. H. Kremer, **M. S. Bramble**, and J. F. Mustard. 2019. Lithologically Diverse Yardangs in the Circum-Isidis Region: Implications for Yardang Evolution Controls and In Situ Study at the Mars 2020 Landing Site. *Lunar and Planetary Science Conference L*, abstract 1639
26. C. H. Kremer, **M. S. Bramble**, and J. F. Mustard. 2019. A Hemispherically Integrated Sedimentary Geological System at Nili Fossae, Mars. *Lunar and Planetary Science Conference L*, abstract 1656
25. J. D. Tarnas, J. F. Mustard, H. Lin, T. A. Goudge, E. S. Amador, **M. S. Bramble**, and X. Zhang. 2019. Hydrated Silica in the Jezero Deltas. *Lunar and Planetary Science Conference L*, abstract 2551
24. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, K. M. Cannon, A. M. Palumbo, A.-C. Plesa, and **M. S. Bramble**. 2019. An Insufficient Methane Budget for Warming Noachian and Hesperian Mars. *Lunar and Planetary Science Conference L*, abstract 2029
23. L. Tokle, 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, and V. Vatsal. 2019. Scientific Exploration of Mare Imbrium with OrbitBeyond, Inc.: Characterizing the Regional Volcanic History of the Moon. *Lunar and Planetary Science Conference L*, abstract 2484
22. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, **M. S. Bramble**, K. M. Cannon, A. M. Palumbo, and A.-C. Plesa. 2018. H_2 and CH_4 Production, Storage, and Release Over 4.5 Gyr of Martian History: Implications for Atmospheric Warming, Habitability, and ISRU. *AGU Fall Meeting*, paper P24D-03, abstract 437871
21. C. H. Kremer, **M. S. Bramble**, and J. F. Mustard. 2018. A hemispherically integrated sedimentary geological system at Nili Fossae, Mars. *GSA Annual Meeting*, paper 15-11, abstract 323706
20. C. H. Kremer, J. F. Mustard, and **M. S. Bramble**. 2018. A widespread ultramafic sandstone on Mars. *GSA Annual Meeting*, paper 15-3, abstract 320588
19. J. F. Mustard, **M. S. Bramble**, C. H. Kremer, and A. C. Pascuzzo. 2018. Outstanding Mars and Planetary Science Questions from Returned Samples Collected from NE Syrtis, Midway and/or Jezero Delta. *4th Landing Site Workshop for the 2020 Mars Rover Mission*
18. C. H. Kremer, J. F. Mustard, and **M. S. Bramble**. 2018. Possible Clastic Origin for Olivine-Rich Rocks in the Nili Fossae Region: Implications for NE Syrtis, Midway, and Jezero Landing Site Science. *4th Landing Site Workshop for the 2020 Mars Rover Mission*
17. J. D. Tarnas, J. F. Mustard, H. Lin, E. S. Amador, T. A. Goudge, **M. S. Bramble**, and X. Zhang. 2018. Application of Dynamic Aperture Factor Analysis/Target Transformation for Mineral Detection: Presence of Opaline Silica in

-
- Jezero Crater and the Surrounding NE Syrtis Region. *4th Landing Site Workshop for the 2020 Mars Rover Mission*
16. C. H. Kremer, J. F. Mustard, and **M. S. Bramble**. 2018. A Pyroclastic Protolith for the most Widespread Serpentine- and Carbonate-Bearing Ultramafic Rock on the Martian Surface. *Goldschmidt 2018*
 15. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, **M. S. Bramble**, K. M. Cannon, A.-C. Plesa, and A. M. Palumbo. 2018. Production of H_2 on Mars Through Radiolysis and Implications for Habitability. *Goldschmidt 2018*
 14. C. H. Kremer, J. F. Mustard, and **M. S. Bramble**. 2018. Origin and Emplacement of the Circum-Isidis Olivine-Rich Unit. *Lunar and Planetary Science Conference XLIX*, abstract 1545
 13. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, **M. S. Bramble**, K. M. Cannon, A. M. Palumbo, and A.-C. Plesa. 2018. Radiolytic H_2 Production, Transport, and Dissolution on Noachian Mars. *Lunar and Planetary Science Conference XLIX*, abstract 2073
 12. Y. Yang, R. E. Milliken, W. R. Patterson III, **M. S. Bramble**, K. L. Donaldson Hanna, and H. Zhang. 2018. Data Reduction of FTIR Thermal Emission Measurements Under Cold Vacuum Conditions: Processing of Interferograms vs. Spectra. *Lunar and Planetary Science Conference XLIX*, abstract 1803
 11. M. R. Salvatore, T. A. Goudge, **M. S. Bramble**, C. S. Edwards, J. L. Bandfield, E. S. Amador, J. F. Mustard, and P. R. Christensen. 2017. Bulk Mineralogy of the Northeast Syrtis and Jezero Crater Regions of Mars Derived Through Thermal Infrared Spectral Analyses. 2017. *The Fourth International Conference on Early Mars*, abstract 3058
 10. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, **M. S. Bramble**, K. M. Cannon, and A. M. Palumbo. 2017. Radiolytic H_2 Production on Noachian Mars: Implications for Subsurface Habitability. *The Fourth International Conference on Early Mars*, abstract 3039
 9. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, and **M. S. Bramble**. 2017. Radiolytic Hydrogen Production on Noachian Mars. *Astrobiology Science Conference 2017*, abstract 3381
 8. P. D. Cavanagh, **M. S. Bramble**, and L. M. Pratt. 2017. Efflorescence of Gypsum and Jarosite During Exposure of Sulfidic Lacustrine Sediment, Western Greenland. *Lunar and Planetary Science Conference XLVIII*, abstract 2677
 7. J. D. Tarnas, J. F. Mustard, B. Sherwood Lollar, and **M. S. Bramble**. 2017. Radiolytic Hydrogen Production on Noachian Mars. *Lunar and Planetary Science Conference XLVIII*, abstract 2030
 6. M. R. Salvatore, T. A. Goudge, **M. S. Bramble**, C. S. Edwards, J. L. Bandfield, E. S. Amador, J. F. Mustard, and P. R. Christensen. 2017. Bulk Mineralogy of the Northwest Isidis Region of Mars Derived Through Thermal Infrared Spectral Analyses. *Lunar and Planetary Science Conference XLVIII*, abstract 1154
 5. J. F. Mustard, B. L. Ehlmann, **M. S. Bramble**, K. M. Cannon, J. W. Head, J. R. Skok, T. A. Goudge, and E. S. Amador. 2017. Northeast Syrtis Major: The Key to Unlocking the First 0.5 Billion Years of Mars' History. *3rd landing site workshop for the 2020 Mars Rover Mission*
 4. P. J. A. McCausland, **M. S. Bramble**, P. G. Brown, J. U. Umoh, and D. W. Holdsworth. 2016. Many meteorites in one: Spatial scale and range of variation in bulk physical and lithological properties of the Tagish Lake C2 chondrite. *GAC-MAC Annual Meeting*, abstract 166

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

3. K. R. Ramsley, **M. S. Bramble**, J. P. Cassanelli, A. N. Deutsch, A. M. Horan, E. R. Jawin, L. M. Jozwiak, H. H. Kaplan, C. F. Lynch, A. C. Pascuzzo, R. W. K. Potter, L. Qiao, D. K. Weiss, J. W. Head. 2016. Science Exploration Architecture for Phobos and Deimos: Are the Moons of Mars in the Critical Pathway of Human Exploration of Mars? *Lunar and Planetary Science Conference XLVII*, abstract 2345
2. J. F. Mustard, T. A. Goudge, **M. S. Bramble**, B. L. Ehlmann, J. W. Head, J. L. Dickson, C. I. Fassett, and K. M. Cannon. 2015. Jezero Crater Watershed, Isidis Basin, Sulfate Deposits and Syrtis Major: A Compelling Exploration Zone for Human Exploration. *First Landing Site / Exploration Zone Workshop for Human Missions to the Surface of Mars*, abstract 1034
1. J. F. Mustard, B. L. Ehlmann, S. M. Wiseman, **M. S. Bramble**, K. M. Cannon, T. A. Goudge, C. E. Viviano-Beck, J. R. Skok, E. S. Amador, D. J. Des Marais, J. W. Head, M. R. Salvatore, R. E. Milliken, and D. P. Quinn. 2015. Multiple Habitable Environments across the Noachian-Hesperian Environmental Transition: Phyllosilicates, Carbonate, Sulfates, and Multiple Igneous Units in Stratigraphy at the Isidis-Syrtis Major Contact. *2nd Landing Site Workshop for the 2020 Mars Rover Mission*

RESEARCH EXPERIENCE

- Mars 2020 Perseverance mission 2023 – present
Member of the Science Team
Member of the Surface Operations Team
Member of the SHERLOC Team
- Earth Surface Mineral Dust Source Investigation (EMIT) 2023 – present
Member of the EMIT Applications Team
- Europa Lander mission concept 2020 – 2023
Member of the Project Science Team
- Mars 2020 Landing Site Selection 2014 – 2018
Leading advocate for Northeast Syrtis Major as a landing site for Mars2020
- Compact Reconnaissance Imaging Spectrometer for Mars 2014 – 2018
Science Team member at large; Data liaison between SOC and ESA and ISRO
- *Graduate Research Assistant* 2014 – 2020
Planetary Geosciences Group, Brown University, Providence, RI
- *Undergraduate Research Assistant* 2014
NSERC Undergraduate Research Award; Advisor: Dr. L. L. Tornabene
- *Curatorial Assistant* 2013 – 2014
Advisor: Dr. P. J. A. McCausland, Western University meteorite collection
- *Undergraduate Research Assistant* 2013
NSERC Undergraduate Research Award; Advisor: Dr. P. J. A. McCausland
- *Research Assistant – X-Ray Diffraction Laboratory* 2012 – 2013
Advisor: Dr. R. L. Flemming
- *CAMBR Undergraduate Research Award* 2012
Advisors: Dr. R. L. Flemming and Dr. J. L. Hutter
- *Research Assistant – Musicology* 2008 – 2010
Dr. C. J. Gosine at Memorial University of Newfoundland, St. John's, NL
- *Research Assistant – Musicology* 2006 – 2010
Dr. T. Gordon at Memorial University of Newfoundland, St. John's, NL

SHORT COURSES

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

NASA Science Mission Design School

May – August 2022

Planetary Science Summer School (PSSS)

- Research and development of all aspects of a planetary mission to Io.
- Focus on spacecraft power systems for collaboration with JPL's Team-X.

Planetary Science Short Course

2–8 September 2013

Centre for Planetary Science and Exploration, Western University, London, ON

- Lectures and laboratories in cosmogony, planetary interiors, planetary surfaces, planetary atmospheres, astrobiology, and exoplanets.
- Mission planning group project designing a Mars sample return mission including objectives and landing site selection as well as spacecraft design.

Bruker AXS 2-Dimensional X-Ray Diffraction Short Course

12 June 2013

Bruker AXS, McMaster University, Hamilton, ON

- Techniques and applications of 2-dimensional detectors in the study of various materials by X-ray diffraction.

CSA-ASTRO Astromaterials Short Course

13–15 May 2013

Canadian Space Agency, London, ON

- Talks and hands-on experience with astromaterials, missions, and laboratory methods including stable isotopes, radiogenic isotopes, micro-XRD, ZAPlab SEM, X-ray micro-computed tomography, and meteor physics.

Reflectance Spectroscopy Short Course

15 June 2012

Dr. E. Cloutis at Western University, London, ON

- Topics include: Principles of reflectance spectroscopy, instrumentation (lab, spacecraft), calibration and absolute reflectance, causes of absorption bands, and applications.

CSA-ASTRO Astromaterials Short Course

22–23 May 2012

Canadian Space Agency, Toronto, ON

- Introduction with hands-on experience of meteorites and planetary materials, and discussions of analytical and classification techniques.

LABORATORY EXPERIENCE

- Extensive experience in scientific laboratory equipment operation and maintenance, and data collection and analysis, including: thermal emission spectroscopy, reflectance spectroscopy, micro- and powder-XRD, Rietveld refinement, petrography, SEM–EDX, He pycnometry, magnetic susceptibility, and X-ray micro-CT scanning.
- Extensive experience in operating environmental chambers at non-ambient temperatures and pressures, handling of compress gasses and refrigerated liquids, and working in a pressurized cleanroom environment.
- Proficient at sample preparation, including: powdered samples, thin sections, meteorites, whole rock samples, SEM pins, and coated samples; and handling temperature-sensitive, time-sensitive, precious, and radioactive materials.
- Laboratory instruments with formal training and experience:
 - Analytical Spectral Devices Field/Lab-Spec Spectroradiometers
 - Nicolet Nexus 870 FT–IR Spectrometer
 - Nicolet iG50/iS50 FTIR Spectrometers
 - Bruker D8 Discover micro-X-ray Diffractometer
 - Bruker D2 PHASER X-ray Diffractometer
 - MIDAC M4500 series Illuminator FTIR Spectrometer
 - Princeton Instruments Acton grating spectrometer

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

- Rigaku Geigerflex D/MAX X-ray Diffractometer
- Hitachi 3400-N Variable Pressure Scanning Electron Microscope
- Quantachrome Instruments Multipycnometer
- Sapphire Instruments SI2B Magnetic Susceptibility and Anisotropy Meter

FIELD EXPERIENCE

- Triangle Lake, near Kangerlussuaq, Greenland (5 days, October 2016)
—Study of acidic lake precipitates with Indiana University colleagues
- NASA Planetary Volcanology Field Workshop (7 days, July 2016)
—Study of volcanic features at Hawaiian volcanoes analogous to those on Mars
- Brown University
Sedimentary Rock Cycle of Earth and Mars Field Trip (5 days, June 2016)
—Permian Platform and Basin Outcrops of the Guadalupe Mountains
Geoscience Graduate Trip (7 days, August 2014)
—Overviewing survey of the geology of Colorado
- The University of Western Ontario
Bancroft Igneous Petrology Field Trip (3 days, October 2012)
—Field relationships of igneous and metamorphic rocks
Geo-Traversal of Georgian Bay (4 days, Fall 2011)
—Overviewing survey of the geology of the Georgian Bay area

SELECT AWARDS AND DISTINCTIONS

ACADEMIC

Dissertation Fellowship, Brown University, 2018, Providence, RI
Postgraduate Scholarship–Doctoral, NSERC, 2016, Canada
First Year Graduate Fellowship, Brown University, 2014, Providence, RI
Donald R. Hay Prize, Western University, 2014, London, ON
Western University Gold Medal – Honors Specialization in Planetary Science, 2014
Undergraduate Student Research Award, NSERC, 2014, London, ON
Undergraduate Student Research Award, NSERC, 2013, London, ON
Solomon Family Award in Planetary Science, 2012, London, ON
Marion and Arthur Knight Bursary, 2012, London, ON
Advanced Materials and Biomaterials Interdisciplinary Undergraduate Research Award,
Centre for Advanced Materials and Biomaterials Research, 2012, London, ON
Master of Arts, Musicology, 2 year Fellowship Award, University of Toronto, 2011,
Toronto, ON (Declined)
Various scholarships and bursaries, Memorial University of Newfoundland, 2006–2010
Valedictorian Fredericton High School
Lord Strathcona Trust Fund Medal, 2005, Fredericton, NB

MUSIC COMPOSITION

Composition Commission by the Gower Community Band, 2011, St. John's, NL
–*Heart of a Community* [Concert Band with Organ]
Terra Nova Composition Contest, 2009, St. John's, NL
–2nd Place, *Chorale Prelude: Ich ruf zu dir* [Concert Band]
Memorial University Chamber Orchestra, 2007, St. John's, NL
–Winner, Composition Competition, *Sadness for those to come* [Chamber Orchestra]

Michael S. Bramble

NASA Jet Propulsion Laboratory
+1 (626) 298-2075 – www.mbramble.com

TALKS AND PRESENTA- TIONS

Geological Society of America, Connects 2024, 22 SEP 2024
Astrobiology Science Conference, 6 MAY 2024
American Geophysical Union, Fall Meeting, 16 DEC 2023
JPL Postdoc Seminar Series, 10 NOV 2022
Sippican Philosophical Society, 6 MAY 2019
Lunar and Planetary Science Conference L, 21 MAR 2019
4th Landing Site Workshop for the 2020 Mars Rover Mission, 17 OCT 2018
Planetary Science Seminar, Caltech, 16 OCT 2018
Planetary Lunchtime Seminar, Brown University, 26 APR 2018
New Bedford Science Cafe, 3 APR 2018
Lunar and Planetary Science Conference XLVIII, 22 MAR 2017
3rd Landing Site Workshop for the 2020 Mars Rover Mission, 9 FEB 2017
Planetary Lunchtime Seminar, Brown University, 26 JAN 2017
Lunar and Planetary Science Conference XLVII, 21 MAR 2017
CRISM Team Meeting, Applied Physics Lab, 6 NOV 2015
Planetary Lunchtime Seminar, Brown University, 1 OCT 2015
CAMBR Distinguished Lecturer and Research Day, Western University, 13 NOV 2012

COMMUNITY SERVICE

Reviewer for *Icarus*, *Journal of Geophysical Research: Planets, Earth and Space Science*, *Space Science Reviews*, *ApJ Letters*, *Swedish National Space Agency (SNSA)*, and NASA ROSES
Panelist, NASA Review Panel (2020)
Executive Secretary, NASA Review Panel (2019)
Professional development leader (2016–2019)
—Geoscience Graduate Student Club, Brown University
Safety Officer, Geoscience Graduate Student Club, Brown University (2018–2019)
Mentor, 1st Year Graduate Mentoring Program, Brown University (2017–2018)
Data liaison person between the CRISM Science Operations Center and the European and Indian Space Agencies (2015–2018)
Treasurer, Geoscience Graduate Student Club, Brown University (2015–2016)

CERTIFICATIONS

- Private Pilots License, Moncton Flight College (2005)
- Glider Pilots License, Atlantic Regional Gliding School (2004)
- Restricted Radio Operator Certificate (Transport Canada)