

TUSHAR MITTAL

CONTACT INFORMATION

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Sciences,
Massachusetts Institute of Technology,
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EDUCATION

Massachusetts Institute of Technology,
MIT Crosby Postdoctoral Fellow
Department of Earth, Atmospheric and Planetary Sciences - **Spring 2020-Present**

University of California, Berkeley,
PhD

Advisor : Mark Richards
Earth & Planetary Science Department -

Fall 2013-Feb 2020

Johns Hopkins University, Baltimore, MD
B.S (With Honors) in Physics

Fall 2009- Fall 2012

PUBLICATIONS

36. *Mayotte 2018 Eruption likely sourced from a magmatic mush*, **Tushar Mittal**, Jacob S. Jordan, Lise Retailleau, Francois Beauducel, and Aline Peltier, EPSL in review **2021**
35. *Deccan Volcanism Near the K-Pg Boundary*, **Tushar Mittal**, Courtney Sprain, Paul Renne, and Mark Richards, GSA Bulletin in review (conditionally accepted) **2021**
34. *Magmatic architecture of continental flood basalts I : Observations from Deccan Traps*, **Tushar Mittal**, Mark Richards, Isabel Fendley, JGR:Solid Earth in review **2021a** <https://www.essoar.org/doi/abs/10.1002/essoar.10506091.1>
33. *Magmatic architecture of continental flood basalts II : A new conceptual model*, **Tushar Mittal**, and Mark Richards, JGR:Solid Earth in review **2021b** <https://www.essoar.org/doi/abs/10.1002/essoar.10506092.1>
32. *Understanding Deccan Volcanism : A Volcanological Perspective*, Stephen Self, **Tushar Mittal**, Gauri Dole, Loyc Vanderkluysen, Annual Reviews of Earth and Planetary Sciences in review (conditionally accepted) **2021**
31. *Cooling history and emplacement dynamics within rully lava flows, southern Deccan Traps: insights from textural variations and crystal size distributions*, Aristle Monteiro, Raymond A. Duraiswami, **Tushar Mittal**, Shrishail Pujari, Upananda Low, Ahsan Absar, Bulletin of Volcanology in review **2021**
30. *How does salinity shape ocean circulation and ice geometry on Enceladus and other icy satellites?*, Wanying Kang, **Tushar Mittal**, Suyash Bire, Jean-Michel Campin, and John Marshal, Nat. Astronomy in review **2021**
29. *Calcium isotope evidence for early Archaean carbonates and subduction of oceanic crust*, Michael Antonelli, Jillian Kendrick, Chris Yakymchuck, Martin Guitreau, **Tushar Mittal**, Frdric Moynier, Nature Communications **2021**

28. *Thickness characteristics of phoehoe lavas in the Deccan Province, Western Ghats, India, and in continental flood basalt provinces elsewhere*, Stephen Self, **Tushar Mittal**, Anne Jay, *Frontiers in Earth Science*, doi: 10.3389/feart.2020.630604 **2020**
27. *No Cretaceous-Paleogene Boundary in Exposed Rajahmundry Traps: A Refined Chronology of the Longest Deccan Lava Flows From $40\text{Ar}/39\text{Ar}$ Dates, Magnetostratigraphy, and Biostratigraphy*, Isabel M. Fendley, Courtney J. Sprain, Paul R. Renne, Ignacio Arenillas, Jos A. Arz, Vicente Gilabert, Stephen Self, **Tushar Mittal**, *Geochemistry, Geophysics, Geosystems*, 21(9), e2020GC009149 **2020**
26. *Bristle-state' friction: How to simulate high-velocity rupture experiments using rate and state dependent constitutive relations, towards a loading-independent 'universal' friction*, Seth Saltiel, **Tushar Mittal**, Jorge Crempien; Jaime Campos. *Frontiers in Earth Science*, 8, 373 **2020**
25. *Assessing the environmental consequences of the generation and alteration of mafic volcanoclastic deposits during Large Igneous Province emplacement*, Benjamin Black, **Tushar Mittal**, Francesca Lingo, Jeff Karson, Kristina Walowski, Andres Hernandez, Ellen Gales, *Large Igneous Provinces: A Driver of Global Environmental and Biotic Changes 255: 117*, Book - AGU Publications. **2020**
24. *Precipitation of multiple light elements to power Earth's early dynamo*, **Tushar Mittal**, Nicholas Knezek, Sarah M. Arveson, Chris P. McGuire, Curtis D. Williams, Timothy D. Jones, and Jie Li. *EPSL* 532 116030. **2020**
23. *Ongoing Dispersal of the August 7, 2019 Pumice Raft from the Tonga Arc in the Southwestern Pacific Ocean*, Martin Jutzeler, Erik Van Seville, Robert Marsh, **Tushar Mittal**, Rebecca Carey, Kristen Fauria, Michael Manga, Jocelyn McPhie. *Geophysical Research Letters* (47.5), e2019GL086768. **2020**
22. *Volatile Degassing From Magma Chambers as a Control on Volcanic Eruptions* **Tushar Mittal**, MA Richards, *J. Geophys. Res Solid Earth*, 124(8), 7869-7901. **2019**
21. *Ca isotopes record rapid crystal growth in volcanic and sub-volcanic systems* Michael A Anontelli, **Tushar Mittal**, Anders McCarthy, Barbara Tripoli, James M. Watkins, and Donald J. DePaolo., *PNAS* 116 (41), 20315-20321 **2019**
20. *Detection of submarine eruptions using Argo floats and its implications for ocean dynamics*, **Tushar Mittal**, and Delbridge, Brent, *EPSL* 511, 105-116 **2019**
19. *Shell Structure of Enceladus from Satellite Gravity and Topography*, Doug Hemingway and **Tushar Mittal**, *Icarus* 332, 111-131 **2019**
18. *Kinetic and equilibrium Ca isotope effects in high-T rocks and minerals*, Antonelli, Michael A., Martin Schiller, Edwin A. Schauble, **Tushar Mittal**, Donald J. DePaolo, Thomas Chacko, Edward S. Grew, and Barbara Tripoli, *EPSL* 517, 71-82 **2019**
17. *Mercury Chemostratigraphy Records for Terrestrial Deccan Volcanism* Isabel Fendley, **Tushar Mittal**, Courtney Sprain, Mark Marvin Di Pasquale, Paul Renne, *EPSL* 524, 115721 **2019**
16. *The Eruptive Tempo of Deccan Volcanism in Relation to the Cretaceous-Paleogene Boundary*, Courtney Sprain, Paul Renne, Loyc Vanderkluysen, Kanchan Pande, Steve Self, **Tushar Mittal**, *Science* 363 (6429), 866-870 **2019**

15. *An ExoKuiper Belt with an Extended Halo around HD 191089 in Scattered Light.* Ren, B., Choquet, E., Perrin, M. D. ... **Tushar Mittal** et al. *The Astrophysical Journal*, 882(1), 64. **2019**
14. *Plume-ridge interaction via melt channelization at Galpagos and other near - ridge hotspot provinces* **Tushar Mittal**, MA Richards, *Geochemistry, Geophysics, Geosystems* 18 (4), 1711-1738 **2017**
13. *The demise of Phobos and development of a Martian ring system* BA Black, **T Mittal**, *Nature Geoscience* 8 (12), 913 - **2015**
12. *Fast Modes and Dusty Horseshoes in Transitional Disks*, **T Mittal**, and E Chiang; *The Astrophysical Journal Letters* 798 (1), L25 21 **2014**
11. *The Spitzer infrared spectrograph debris disk catalog. II. Silicate feature analysis of unresolved targets*, **T Mittal**, CH Chen, H Jang-Condell, P Manoj, BA Sargent, DM Watson; *The Astrophysical Journal* 798 (2), 87 25 **2014**
10. *The Spitzer infrared spectrograph debris disk catalog. I. Continuum analysis of unresolved targets* CH Chen, **T Mittal**, M Kuchner, WJ Forrest, CM Lisse, P Manoj, *The Astrophysical Journal Supplement Series* 211 (2), 25 22 **2014**
9. *Experimental measurements and bristle friction modeling of nonlinear hysteresis loops and harmonic generation in rock fractures*, Seth Saltiel, B Bonner, **T Mittal**, B Delbridge, J Ajo-Franklin, *Journal of Geophysical Research: Solid Earth* - **2017**
8. *Infrared Spectroscopy of HR 4796A's Bright Outer Cometary Ring+ Tenuous Inner Hot Dust Cloud*, Carey Lisse, ML Sitko, ..., **T. Mittal**, *The Astronomical Journal* 154 (5), 182 - **2017**
7. *Spectral Evidence for an Inner Carbon-rich Circumstellar Belt in the Young HD 36546 A-star System*, CM Lisse, ML Sitko, ..., **T Mittal**, *The Astrophysical Journal Letters* 840 (2), L20 - **2017**
6. *IRTF/SPEX Observations of the HR 4796A Cometary Ring System*, CM Lisse, ML Sitko, ..., **T Mittal**, *Astron. J* - **2017**
5. *Discovery and spectroscopy of the young jovian planet 51 Eri b with the Gemini Planet Imager*, B Macintosh, JR Graham, ... **T. Mittal** *Science* 350 (6256), 64-67 169 **2015**
4. *IRS Spectra of Debris Disks in the Scorpius-Centaurus OB Association*, H Jang-Condell, CH Chen, **T. Mittal**, P Manoj, D Watson, CM Lisse, *The Astrophysical Journal* 808 (2), 167 13 **2015**
3. *Discovery of resolved debris disk around HD 131835*, LW Hung, MP Fitzgerald, CH Chen, **T. Mittal**, PG Kalas, JR Graham *The Astrophysical Journal* 802 (2), 138 8 **2015**
2. *Polarimetry with the Gemini planet imager: methods, performance at first light, and the circumstellar ring around HR 4796A* MD Perrin, G Duchene, ..., **T. Mittal** *The Astrophysical Journal* 799 (2), 182 68 **2015**
1. *Five debris disks newly revealed in scattered light from the Hubble space telescope NICMOS archive*, R Soummer, MD Perrin, ..., **T. Mittal**; *The Astrophysical Journal Letters* 786 (2), L23 39 **2014**

SELECT ORAL
PRESENTATIONS

Remote Detection of Pumice Rafts and Discolored Water from Submarine Volcanic Eruptions Using Satellite Imagery, Maggie Zheng, Tushar Mittal, Kristen Fauria **Student Talk**, AGU Fall Meeting Meeting 2020

Magmatic Architecture of Continental Flood Basalts A New Deccan Traps Perspective, **Talk**, AGU Fall Meeting Meeting 2020

Development of an open source, machine learning based toolset for the identification of dikes in satellite images through semantic segmentation, Ryan Gray, Tushar Mittal **Student Talk**, GSA Meeting 2020

Development of an open source, machine learning based toolset for the identification of dikes in satellite images through semantic segmentation, Matthew Bogumil, Tushar Mittal, Carolina Lithgow-Bertelloni, **Student Talk**, GSA Meeting 2020

Magmatic Architecture of Continental Flood Basalts A Deccan Traps Perspective, **Talk**, Godschmidt Meeting 2020

Podcast: Et tu, Etna? Lisa Lester, Eos, 101 (Discussing work done by student Rafael Castro, Tushar Mittal, et al., presented at AGU Fall Meeting 2019) **AGU Press Conference and Podcast-** <https://eos.org/articles/podcast-et-tu-etna>, 2020

The eruptive timescale and magmatic architecture of the Deccan Traps flood basalt, **Talk**, UC Berkeley Department Seminar 2019

Melt transport through the mantle lithosphere - Challenges of a dike based mode, **Talk**, RCN Fluid and melt Transport, Invited Talk 2019

The eruptive timescale and magmatic architecture of the Deccan Traps flood basalt, **Talk**, UCLA Invited Talk 2019

Detection of submarine eruptions using Argo floats and its implications for ocean dynamics, **Talk**, Harvard Invited Talk 2018

Submarine eruption detection using Argo floats, **Talk**, WHOI Invited Talk 2018

Submarine Volcanism : How to detect it ?, **Talk**, Columbia-Lamont Invited Talk 2018

Influence of volatile degassing on eruptibility of LIP magmatic systems, **Talk**, American Geophysical Union, Fall Meeting 2017

Volatile degassing as a control on volcanic eruptions, **Talk**, IAVCEI 2017

Volatile degassing as a control on the magnitude and frequency of volcanic eruptions, **Talk**, USGS Menlo Park - Volcano Science Seminar April 2017

A Future Martian Ring System? **Talk**, Mars Institute "Asaph Hall Best Student Paper Award" Talk - Third International Conference on the Exploration of Phobos and Deimos, Nasa Ames, June 2016

Spitzer IRS Spectroscopy of Debris Disks : A comprehensive Survey, **Talk**, Department Seminar/Journal Club, Earth and Planetary Sciences Department, JHU - May 2012

Analysis of Dust Mineralogy using Spitzer IRS Spectroscopy of Debris Disks, **Talk**, Signposts of Planets Conference, 2011

SELECT POSTER
PRESENTATIONS

Combining the Role of Sulfur and Carbon in long-duration models to assess the climatic impact of Large Igneous Provinces, Hee Jun Cheong, Tushar Mittal, Isabel Fendley, Courtney Jean Sprain and Matthew Bogumil, AGU Fall Meeting 2020

Improving the Resolution of Rates and Dates by Integrating Paleomagnetic and High-precision Geochronological Techniques, Courtney Jean Sprain, Tushar Mittal, Isabel Fendley et al. AGU Fall Meeting 2020

LIP flows may not have been as thick as they appear, Jonas Katona, Xiaojing Fu, Tushar Mittal, Michael Manga, and Stephen Self, AGU Fall Meeting 2020, Earth and Space Science Open Archive ESSOAr (2020)

Tidal pumping and heating of Enceladus porous core., **Poster**, Ocean Sciences Meeting 2020, Noah Randolph-Flagg, Tushar Mittal, and Douglas Hemingway.

Constraining the Eruptive Tempo of the Deccan Traps to understand potential climate consequences., **Poster**, AGU Fall Meeting 2019 Mittal, Tushar; Sprain, Courtney Jean; Fendley, Isabel; Self, Stephen; Renne, Paul R; Richards, Mark A

The importance of paleobathymetry in understanding the variations in paleo-ocean carbonate compensation depths and carbonate subduction fluxes over the last 100Myr, **Poster**, AGU Fall Meeting 2019 - Bogumil, Matthew; Mittal, Tushar; Lithgow-Bertelloni, Carolina R

Thickness characteristics of phoehoe lavas in the Deccan province, Western Ghats, India, and in continental flood basalt provinces elsewhere”, **Poster**, AGU Fall Meeting 2019 Jay, Anne E; Self, Stephen; Mittal, Tushar

Rapid cooling of submarine lava domes and caldera hydrothermal systems, 2012 Havre eruption”, **Poster**, AGU Fall Meeting 2019 Randolph-Flagg, Noah G; Manga, Michael; Fauria, Kristen; Tani, Kenichiro; Mittal, Tushar; Carey, Rebecca

Re-evaluating the crustal contribution to volcanism along the Izu-Bonin arc: a geospatial and geochemical approach., **Poster**, AGU Fall Meeting 2019 Mutch, Euan James Forsyth; Wall, Kellie T; Buckland, Hannah; Mitchell, Samuel J; Mittal, Tushar; Carey, Rebecca; O’Hara, Daniel; Karlstrom, Leif; Cashman, Katharine V; Abers, Geoffrey A

The hunt for a universal friction law: a bristle-based rate and state dependent constitutive relation simulates high velocity rupture experiments, connecting fault friction across loading conditions”, **Poster**, AGU Fall Meeting 2019 Saltiel, Seth; Mittal, Tushar; Crempien, Jorge GF; Campos, Jaime A; Venegas-Aravena, Patricio [2pt] *Observations of Subaerial Ash and SO₂ during the Havre 2012 eruption with satellite imagery.*, **Poster**, AGU Fall Meeting 2019 Reath, Kevin; Mittal, Tushar; Fauria, Kristen E; Manga, Michael; Castro, Rafael Cristian

Mercury Chemostratigraphy and Geochemical Box Model Constraints on Large Igneous Province Eruption Rates: Case Studies from the Deccan and Siberian Traps., **Poster**, AGU Fall Meeting 2019 Fendley, Isabel; Mittal, Tushar; Renne, Paul R; Marvin-DiPasquale, Mark C

Coupled Precipitation of Light Elements from the Core into the Mantle: Importance for Powering Earth’s Dynamo., **Poster**, AGU Fall Meeting 2019 Arveson, Sarah M; Mittal, Tushar; Knezek, Nicholas R; McGuire, Chris P; Williams, Curtis D; Jones, Timothy D; Li, Jie

Et tu Etna: Volcanism, Climate, and Death of Caesar”, **Poster**, AGU Fall Meeting 2019 Castro, Rafael Cristian; Randolph-Flagg, Noah G; Mittal, Tushar; Fendley, Isabel; King, Morgan **Featured with a AGU Press Conference**

Validity of the Deccan Chemostratigraphy and Extent of Deccan Formations Beyond the Western Ghats (India)., **Poster**, AGU Fall Meeting 2019 Vanderkluysen, Loc; Carey, Emily; Barber, Nicholas; Jay, Anne E; Self, Stephen; Mittal, Tushar; Renne, Paul R

Dike transport in the lithosphere - Challenges of transporting melt to crustal magmatic systems, **Poster**, AGU Fall Meeting 2018 - Tushar Mittal, Mark Richards

3D flow inside dikes using analog experiments and its control on conduit formation., **Poster**, IAVCEI 2017 - Tushar Mittal, Owen Nelson, Brent Delbridge, Noah Randolph-Flagg, Michael Manga

Implications of melt channelization in Galapagos plume-ridge interaction., **Poster**, Tushar Mittal and Mark Richards, Melts in the Mantle Newton Workshop, Summer 2016

Evidence for melt channelization in Galapagos plume-ridge interaction., **Poster**, Tushar Mittal and Mark Richards, AGU Fall Meeting 2015

Fast Modes and Dusty Horseshoes in Transitional Disks, **Poster**, Tushar Mittal and Eugene Chiang, Gordon Research Conference Origins of Solar System, 2015

Spitzer IRS Debris Disks Catalog : Disk Structure and Dust Properties, **Poster**, Tushar Mittal, Christine Chen, et al., Gordon Research Conference Origins of Solar System, 2013

Spitzer IRS Spectroscopy of Dust Debris Around Main Sequence Stars, **Poster**, Gordon Research Conference Origins of Solar System, 2011

Experimental measurements and bristle friction modeling of nonlinear hysteresis loops and harmonic generation in rock fractures **Poster** Seth Saltiel, Brian Bonner, Tushar Mittal, Brent Delbridge, Jonathan Ajo-Franklin; The Journal of the Acoustical Society of America, ASA 2017

Detection and Characterization of the Sub-km Asteroid Population in the Main Asteroid Belt, Tushar Mittal, D Goldstein, P Nugent; Lunar and Planetary Science Conference 45, 2905 2014

Skaergaard vs Sudbury: Solidification Times and Crystal Sizes, **Poster**, Co-Author, American Geophysical Union, Fall Meeting 2010

Insights from analog gelatin experiments on the effect of bedding dip on sill morphology and crystal load, **Poster**, Co-Author American Geophysical Union, Fall Meeting 2010

PROFESSIONAL ACTIVITY

1. *Review Editor : Frontiers in Earth Sciences (Volcanology) : 2020 - Present*
2. *Reviewer for GRL, JGR, Geosciences, Astrophysical Journal, Lithos, GSA Bulletin, and NASA Review Panel*
3. *Panelist on AGU Podcast : Third Pod from the Sun, March 2020 - Featuring work by student Rafael Castro* <https://thirdpodfromthesun.com/2020/03/24/et-tu-etna/>
4. *Submarine Volcanism: Advances in Observations, Methods, and Models I*, **Session Chair**, AGU Fall Meeting 2020 - Lise Retailleau, Tushar Mittal, Adam Soule
5. *Environmental Effects and Eruptive Dynamics of Large Igneous Provinces: A Multidisciplinary Perspective*, **Session Convener and Chair**, AGU Fall Meeting 2019 - Fendley, Isabel; Mittal, Tushar; Schmidt, Anja; Hull, Pincelli M;
6. *Environmental Effects and Eruptive Dynamics of Large Igneous Provinces: A Multidisciplinary Perspective II Posters*, **Session Convener**, AGU Fall Meeting 2019 - Fendley, Isabel; Mittal, Tushar; Schmidt, Anja; Hull, Pincelli M;
7. *Hydrovolcanic, Submarine, and Subglacial Eruptions: Exploring Hydrosphere-Volcano Interactions III*, **Session Chair**, AGU Fall Meeting 2019 - Kristen Fauria, Tushar Mittal et al.

AWARDS

- George D. Louderback Graduate Student Award, EPS Department, UC Berkeley 2018
- Mars Institute “Asaph Hall Best Student Paper Award” - Third International Conference on the Exploration of Phobos and Deimos, Nasa Ames, Summer 2016
- Financial funding and travel award for 2016 Newton Workshop - Melts in the Mantle, Summer Workshop
- Graduate Student Internship, STScI : February 2013 - July 2013
- Summer internship at the Department of Mineral Sciences as part of Smithsonian Natural History Museum Summer Research Experience program, May - July 2012
- Financial funding and travel award for 2012 Sagan Exoplanet Summer Workshop
- Space Telescope Science Institute Summer Internship program, May - July 2011
- Sigma Pi Sigma National Physics Honor Society

- SOFTWARE SKILLS
- Programming experience in Julia, Python, MATLAB, IDL, C + +, C, Java, UNIX shell scripting, SQLite, ImageJ, LaTeX as well as cloud computing (Google Cloud computing).
 - Expertise in doing Large-Scale Numerical Simulations and analysis of large datasets (oceanographic, astronomical, remote sensing).
 - Machine Learning and time-series analysis

TEACHING *Graduate Student Instructor, UCB* **Fall 2015-16**

- EXPERIENCE
- Course: Geodynamics (EPS 108, Lecture)

Teaching Assistant, JHU

Fall 2011-12

- Course: Freshman Seminar: Conversation with the Earth (AS.270.102, Lecture)

Class Lectures, JHU

- Course: Nature of the Solid Planets
(AS.270.340, 4 Lectures - Planet Formation Theory; Fall 2011-12)
- Course: Freshman Seminar: Conversation with the Earth
(AS.270.102, 1 Lecture - Scientific Method; Fall 2011-12)