Christine McCarthy

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Born: Lynwood, California; October 31, 1971 Citizenship: U.S.A.
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EDUCATION

Brown University, Providence, Rhode Island
Ph.D. Geological Science, Spring 2009, Advisor: Reid Cooper — May 2009
Sc.M. Geological Science, Spring 2005 — May 2005

University of Oregon, Eugene, Oregon
B.S. Geophysics, 2003, Advisor: Douglas Toomey — May 2003

RESEARCH INTERESTS

Mechanical properties of Earth and planetary materials (seismic attenuation; elastic, transient and steady-state behavior of ice and rock analogue; friction); phase equilibria (thermodynamics; morphology and kinetics of solidification microstructures, including eutectic and amorphous; equilibrium solid + melt structure); application of rheological data to glacial and planetary geophysics (particularly with non-steady state tidal forcings)

EXPERIENCE

Columbia University, Lamont-Doherty Earth Observatory Rock Mechanics Lab
Lamont Associate Research Professor — 7/19 - present
Lamont Assistant Research Professor — 2/15 – 6/19
Lamont-Doherty Postdoctoral Fellow — 8/11 – 1/15

University of Tokyo, Earthquake Research Institute (ERI), Earth Mechanics Lab
Visiting Researcher — 3/14 – 5/14
Postdoctoral Researcher — 6/09 – 7/11

Brown University, Geological Sciences, Kinetics and Rheology Lab
Doctoral Student — 9/03 – 5/09

AWARDS and FELLOWSHIPS

Lamont-Doherty Postdoctoral Fellowship — 2011
Outstanding Student Paper Award, Mineral and Rock Physics division, AGU — 2009
Stephen E. Dwornik Student Paper Award, Geological Society of America — 2006
Undergraduate degree conferred with honors, University of Oregon — 2003
NASA Planetary Geology and Geophysics Undergraduate Research award — 2002

FUNDING

- McCarthy, Park, Kelemen and Spiegelman (2019) "Carbon mineralization in peridotite for CO_2 removal from air and solid storage: Chemo-mechanical feedbacks and kinetics", Sloan Foundation 1.48M

- McCarthy, Savage, Skarbek (2019) "Laboratory study of frictional stability and tidal triggering in ice mixtures", NASA-SSA, $501K
- McCarthy, Savage (2019) "Laboratory Study of Substrate Control and Cryoseismicity of Glacier Basal Motion", NSF-OPP, $379K
- McCarthy, Goldsby, Holtzman (2019) "Collaborative Research: Seismic attenuation and anelasticity in the upper mantle: the effect of continuous far-field dislocation creep", NSF-EAR, $471K
- Craft, et al. (2019) "Europa STI – Exploring Communication Techniques and Strategies for Sending Signals Through the Ice (STI) for an Ice-Ocean Probe". NASA-SESAME, LDEO Sub-Award, $432K
- McCarthy, Stark, and Li (2016) "Laboratory study of glacier-bedrock dynamics using centrifuge-enhanced gravity"; Columbia University Research Initiatives in Science & Engineering, $160K
- McCarthy and Savage (2012) "Laboratory study of shear heating on faults and ridges of icy satellites using transient friction experiments"; NASA-NRA: NNH12ZDA001N-OPR, $256K
- NASA Early Career Fellow (2012); Early career start-up funds (2017) $99K
- McCarthy, Savage, and Nettles (2012) "Laboratory study of ice deformation under tidal loading conditions with application to Antarctic glaciers"; NSF-ANT 12-45871, $285K +$12K supplemental funding for technical support (2013)
- "Effects of dislocations on seismic wave dispersion and attenuation", International office of ERI, University of Tokyo, travel and lodging for 70-day research visit in 2013-2014
- Brinson Foundation postdoctoral fellowship funding, LDEO, 2012 and 2013
- Lamont-Doherty Advisory Board Innovation Fund, 2011
- Micro-DIce exchange grant from the European Science Foundation, 2011
- Visiting Researcher, International office of ERI, University of Tokyo, 2011

PUBLICATIONS

McCarthy, C., M. Nielson, A. Coonin, J. Minker, and A. Domingos (2019) Acoustic and microstructural properties of partially molten samples in the ice-ammonia system, *Interiors of Icy Ocean Worlds, Geosciences 9, 327.*

Sasaki, Y., Y. Takei**, C. McCarthy**, and J. F. Rudge (2019) Experimental study of dislocation damping using a rock analogue, *Journal of Geophysical Research: Solid Earth, 124*

Lipovsky, B. P., C. R. Meyer, L. K. Zoet, **C. McCarthy**, D. D. Hansen, A. W. Rempel, and F. Gimbert (2019) Glacier sliding, seismicity, and sediment entrainment, *Annals of Glaciology* 60(79), 182-192.

McCarthy, C., H. Savage, and M. Nettles (2017) Temperature dependence of ice-on-rock friction at realistic glacier conditions, *Philosophical Transactions of the Royal Society A, 375(2086),* 20150348.

McCarthy, C., H. M. Savage, T. Koczynski, and M. A. Nielson (2016) An apparatus to measure frictional, anelastic, and viscous behavior in ice at temperate and planetary conditions, *Review of Scientific Instruments 87,* 055112.

McCarthy, C. and R. F. Cooper (2016) Tidal dissipation in creeping ice and the thermal evolution of Europa, *Earth and Planetary Science Letters 443,* 185-194.

Abers, G. A., K. M. Fischer, G. Hirth, D. A. Wiens, T. A. Plank, B. K. Holtzman, **C. McCarthy**, and E. Gazel (2014) Reconciling mantle attenuation-temperature relationships from seismology, petrology and laboratory measurements, *Geochemistry, Geophysics, Geosystems* 15(9), 3521-3542.

McCarthy, C. and J. C. Castillo-Rogez (2013) Planetary ices: attenuation Properties, in: *The Science of Solar System Ices*, Astrophysics and Space Science Library 356, Eds.: M. Gudipati and J. Castillo-Rogez, Springer, New York, 183-225.

McCarthy, C., J. R. Blackford, and C. E. Jeffree (2012) Low-temperature-SEM study of dihedral angles in the ice-I/sulfuric acid partially molten system, *Journal of Microscopy 249(2),* 150-157.

McCarthy, C. and Y. Takei (2011) Anelasticity and viscosity of partially molten rock analogue: toward seismic detection of small quantities of melt, *Geophysical Research Letters 38(18)*, L18306.

Takei, Y., K. Fujisawa, and **C. McCarthy** (2011) Experimental study of attenuation and dispersion over a broad frequency range: 1. The apparatus, *Journal of Geophysical Research: Solid Earth 116(B9),* B09204.

McCarthy, C., Y. Takei and T. Hiraga (2011) Experimental study of attenuation and dispersion over a broad frequency range: 2. The universal scaling of polycrystalline materials, *Journal of Geophysical Research: Solid Earth 116(B9)*, B09207.

McCarthy, C., R. F. Cooper, D. L. Goldsby, W. B. Durham, and S. H. Kirby (2011) Transient and steady-state creep response of ice-I and magnesium sulfate hydrate rutectic aggregates, *Journal of Geophysical Research: Planets 116(E4),* E04007.

McCarthy, C., R. F. Cooper, S. H. Kirby, K. D. Rieck, and L. A. Stern (2007) Solidification and microstructures of binary ice I/hydrate eutectic aggregates, *American Mineralogist 92(10)*, 1550-1560.

McCarthy, C., K. D. Rieck, S. H. Kirby, W. B. Durham, L. A. Stern and R. F. Cooper (2007) Crystal growth of ice I/hydrate eutectic binary solutions, *Physics and Chemistry of Ice*, Ed. W.F. Kuhs, RSC Publishing, Cambridge, 391-398.

MANUSCRIPTS IN REVIEW

McCarthy, C., P. B. Kelemen, R. Skarbek, and D. L. Goldsby, A viscous mechanism for periodic strain rate variations in glaciers, *submitted to Journal of Geophysical Research: Earth Surface*

MANUSCRIPTS IN PREPARATION

McCarthy, C., R. Skarbek, and H. M. Savage, Tidally modulated glacier flow and the ice frictional stability transition, *in preparation for Journal of Geophysical Research: Earth Surface*

Caswell, T., R. F. Cooper, and **C. McCarthy**, Attenuation at Creep-Stress-Sensitive Length Scales: An Experimental Study on Polycrystalline Water Ice, *in preparation*

Zhong, D., E. Aharonov, **C. McCarthy,** and C. Scholz, Power law creep-based friction constitutive law at high homologous temperature, *in preparation*

Klimczak and **C. McCarthy**, Chapter 3: Planetary Geomechanics, in Comparative Planetology Across the Solar System, Volume 2: Planetary Tectonism Across the Solar System, *in preparation*

SELECTED INVITED TALKS

"Heat generating mechanisms in an icy crust as potential sources for cryovolcanism in the outer solar system" CalTech Seismo Lab Seminar, May 2019

"Tidal controls on ice stream sliding speed and stability" Stanford Geophysics Department Colloquium, May 2019

"Slip Sliding Away: mapping the sliding behavior of ice streams " Harvard EPS Colloquium, January 2019

"Tidal control of ice stream flow and stability: lessons from the laboratory" Penn State Colloquium, January 2009

"How tidal forcing influences frictional stability in ice (and ice Mixtures) across homologous temperature space: From glaciers to icy satellites" Gordon Research Seminar on Rock Deformation, 2018

"Time dependent behavior and mechanisms of heating in the brittle and ductile regimes of icy satellites" Keynote speaker at COMPRES Annual Meeting, 2018

"Heat generating processes and their affects on ice and ice mixtures: on the potential origins of Cryovolcanism in the Solar System" Cryovolcanism in the Solar System Workshop, 2018

"Tidally modulated ice stream flow and the stability transition of ice friction" Univ. of Penn colloquium Sept 2017

"From micro to macro: the role of defects in the mechanical response of Earth and planetary materials", EGU 2015

"Cyclic loading experiments to measure material response over a broad frequency range: From tickling of rocks to squeezing of moons", AGU 2014

"Creep strength and dynamic friction of ice and ice/hydrate aggregates", Gordon Research Seminar on Rock Deformation 2014

"Through rise and fall: Tidal effects on ice friction and flow" LDEO Director's Circle 2014

"Changing earth: Exploring the science of ice, rock, and magma across the world" Columbia Undergraduate Scholars Program Speaker Series, NY 2014

"From micro to macro: The role of defects in the anelastic response of Earth and planetary materials", MIT, Boston, MA 2013

"Attenuation and dispersion in Earth and planetary materials", Geology & Geophysics group, Yale University 2012

"Anelasticity of Earth and planetary materials", Astrobiology and Planetary Exploration Meeting, UC London 2011

"The role of grain boundaries and dislocations in the attenuation of planetary ices", AOGS 2009, Singapore

"Microstructure and strength of salty Ice: An experimental study of materials likely found on Europa", Physics and Chemistry of Ice Seminar Series, NASA/JPL, Pasadena, CA 2006

STUDENTS SUPERVISED

Vishaal Sinh (ASU graduate student)	2019
Maheenuz Zaman (Cornell undergrad)	2019

Jessica Minker (Brown undergrad)	2018
Allie Coonin (Brown undergrad)	2018
Daning Zhong (visiting graduate student from Beijing)	2017-2018
David Claflin Newtown (CU undergrad senior thesis)	2017-2018
Armando Domingos (CU undergrad) intern and senior thesis	2016-2017
Channing Prend (CU undergrad)	2015
Michael Nielson (CU undergrad senior thesis)	2014-2015
Zachary Wiles (CU undergrad)	2014
Ben Robinson (CU undergrad)	2013

TEACHING/LECTURER EXPERIENCE

- "Pompeii, Vesuvius, and the Flaming Fields", Guest lecturer on Cryovolcanism, NYU Spring 2019
- KISS (Keck Inst. for Space Studies) "Tidal Heating of Rocky and Ocean Worlds", Short Course Lecturer on "Planetary materials and their response to tidal deformation"
- Crustal Deformation, Guest/Substitute lecturer (4 classes), Columbia Univ. Fall 2018
- Cresskill High School research program, mentor (4 students), Fall 2018
- CCL High School intern program, mentor (4 students), Summer 2018
- CCL High School intern program, mentor (4 students), Summer 2017
- Columbia Alumni Travel 2017 Guest lecturer on Tectonics, Earthquakes, and Volcanism for Inland Sea of Japan cruise
- CIDER 2015 Guest lecturer on the topic of Rheology/Viscoelasticity
- Mechanisms and Measurement of Seismic Attenuation (co-taught), Lamont Fall 2012
- Harriet W. Sheridan Center for Teaching and Learning Certificate I, Brown Univ. 2008
- Geochemistry Lab Teaching Assistant, Brown Univ., Spring 2005, Spring 2009
- Geology Lab Teaching Assistant, Bryant Univ., Smithfield, RI, Spring 2006 - Fall 2007
- Brown-sponsored Science Outreach Program to 4th and 2nd grade classes, Vartan Gregorian Elementary, 2005 – 2008

SERVICE, PROFESSIONAL AFFILIATIONS

LDEO Service

LDEO Executive Committee, Jr. Staff rep, 2019 - present
Campus Life Committee, LDEO, 1/2017 – 2019
Observatory Technical and Innovation Center Steering Committee, 9/2017 - present
LDEO Geodynamics Seminar, co-organizer, 1/2017 – present
LDEO Seismology/Geology/Tectonophysics Seminar, co-organizer, 9/2012 - 5/2013

Community

Invitation-only Keck Workshop: "Tidal heating of rocky and ocean worlds" 2018
Invitation-only Keck Workshop: "Accessing the subsurface oceans of icy worlds" 2017
AGU session convener, "Ice microstructures and deformation behavior: On Earth and beyond", Fall 2015 and "Physical Properties of Earth Materials (PPEM): Rheology and processes of transient and steady state rock deformation" Fall 2017
NASA Panelist: Outer Planets Res.; Solar System Workings, Habitable Worlds, CDAP
NSF Panelist: Geophysics
Gordon Research Seminar (Rock Deformation) 2014 Co-Chair
Physical Properties of Earth Materials (PPEM) webmaster 2016-2019; Chair 2020
Science Cheerleaders

MEDIA, PUBLIC

Interviewed for *@_womenofstem*
Performed/Wrote *Survival Guide to the New Goldilocks' Zone*, CAVEAT 6/25/2018
Interviewed on *You're the Expert Podcast*, 4/15/2018
Interviewed on *People behind the Science Podcast*, 5/23/2016
Interviewed on *SciTech Now*, aired 4/22/2015
Panelist on non-traditional/male-dominated careers at *9th Annual Women & Influence Conference* hosted by Women's Way, 12/3/2011