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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

Running the LDEO Rock and Ice Mechanics lab. Specializing in the 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 phases; 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 and Ice Mechanics Lab

Lamont Associate Research Professor

7/19–present

Maternity Leave

6/16–10/16

Maternity Leave

6/13–1/13

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

G. Unger Vetlesen Foundation Salary Support

2020

NASA Early Career Fellow

2012

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

STUDENTS and POSTDOCS SUPERVISED

Hatsuki Yamauchi (Postdoc)	current
Catalina Sanchez-Roa (Postdoc)	current
James Leong (Postdoc, Project Co-Advisor)	current
Maheenuz Zaman (CU graduate student)	current
Seth Saltiel (Postdoctoral Fellow)	current
Owen Evans (Grad student, Project Co-Advisor)	current
Vishaal Singh (ASU graduate student, Project Advisor)	current
Elizabeth Case (CU thesis committee)	current
Jessica Minker (Brown undergrad)	2018
Allie Coonin (Brown undergrad)	2018
Tess Caswell (Postdoc)	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

FUNDING

- Craft, et al. (2021) “Technologies for Sending Signals Through the Ice (STI) on Ocean Worlds”. NASA-COLDTech, LDEO Sub-Award, \$413K
- McCarthy, Park, Kelemen and Spiegelman (2019) “Carbon mineralization in peridotite for CO₂ 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-SSW, \$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
- NASA Early Career start-up funds (2017) \$99K
- 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
- 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 (students and postdocs* denoted by asterisks)**

- *Saltiel, S., **C. McCarthy**, T.T. Creyts, and H.M. Savage (2021) Experimental evidence of velocity-weakening friction during ice slip over frozen till: implications for basal seismicity in fast moving, soft-bed glaciers and ice streams, *Seismological Research Letters-D-20-00480R2*
- 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, 6523-6541.
- 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. Koczyński, 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 eutectic 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

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

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 Frontiers in Earth Science, special issue on: Ice Sheet Shear Margins in Warming Climate: Process and Trends*

Skarbek, R.M., C. McCarthy, and H.M. Savage, Oscillatory loading can alter the velocity rate dependence of ice-on-rock friction, *in preparation for G^3*

Singh, V., C. McCarthy et al. Surviving in Ocean Worlds: and experimental characterization of mechanical and optical transmission performance of fiber optic tethers across ice Faults, *in preparation*

Suer, T.A., **C. McCarthy**, M. Whitaker, F. Brisset, K. Baldwin, L. Li, and D. Weidner, Rheological transition in olivine under sinusoidal stress fields

*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*

SELECTED INVITED TALKS

“Dynamics of ice here and there: experimental studies to understand the mechanical behavior of both terrestrial and planetary ice” U.T. Austin, DeFord speaker series, April 2021

- “How lab experiments on the physical properties of Earth and Planetary Materials can aid Ocean World Exploration” Ocean Worlds and Dwarf Planets panel on Lab Experiments for Ocean World Exploration, March 2021
- “Science and Solutions at LDEO: The Rock and Ice Mechanics Lab”, Radical Ecologies Lab (Virtual) Seminar (via NYU), May 2020
- “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 2019
- “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

TEACHING/LECTURER EXPERIENCE

- “Pompeii, Vesuvius, and the Flaming Fields”, Guest lecturer on Cryovolcanism, NYU Spring 2019, Fall 2019, Spring 2021
- 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

Columbia University Climate School working group on Habitable Planets, 2021

LDEO working group on Decarbonization, 2021

LDEO Vision Committee, Co-Chair, 2020

LDEO Executive Committee, Jr. Staff rep, 2019 - present

LDEO Campus Life Committee, 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

Organizer/Panelist: In-situ Rock Deformation Res. Coord. Network Workshop 2020

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 Fall 2021 Meeting Program Committee

AGU session convener, “Ice microstructures and deformation behavior: On Earth and beyond”, Fall 2015; “Physical Properties of Earth Materials (PPEM): Rheology and processes of transient and steady state rock deformation” Fall 2017; “Passing Through Purgatory: Architectures, Technologies, and Considerations for Accessing Ocean World Interiors”, “PPEM: From Rapid to Slow and from Microtectonics to Plate Tectonics, I, II, and III”, and “Damage and Anelastic Deformation Across Scales”, Fall 2019; “PPEM: Using the whole toolbox to understand rock deformation”, Fall 2020.

NASA Panelist/Group Chief: 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-present

MEDIA, PUBLIC

Science Cheerleaders

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