

# M. GRACE ANDREWS

## RESEARCH INTERESTS

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Chemical weathering, Enhanced Weathering, Negative Emission Technologies (NETs), climate change, novel stable isotope systems

## EDUCATION

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**Ph.D.**, Earth and Planetary Sciences, Northwestern University Dec. 2017

**M.S.**, Earth and Planetary Sciences, Northwestern University June 2014

*Advisor:* Andrew D. Jacobson

*Thesis:* "Carbon cycling of glaciated landscapes on modern and geologic timescales: Investigation with strontium and carbon isotope geochemistry"

**B.A. with distinction and honors**, Earth Sciences, Boston University June 2010

*Advisor:* Ethan F. Baxter

*Thesis:* "Development of a TIMS Total Evaporation method for measurement of stable strontium isotope fractionation"

## PROFESSIONAL APPOINTMENTS

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**VP of Scientific Research**, Project Vesta, PBC Nov. 2021 –  
Project Vesta is a private-sector Public Benefit Corporation (PBC) developing the science and business model behind Coastal Enhanced Weathering, an emerging Ocean Alkalinity Enhancement NET.

**Director of Scientific Operations**, Project Vesta (non-profit) April – Nov. 2021

**Visiting Academic**, Ocean and Earth Science, Uni. of Southampton, National Oceanography Centre Southampton March 2020 –

**Post-doctoral Research Fellow** Jan. 2017 – Feb. 2020

Ocean and Earth Science, University of Southampton at the National Oceanography Centre, Southampton, UK

P.I.'s: Rachael James & Christopher Pearce

**Research Scientist** (*joint position*) Leverhulme Centre for Climate Change Mitigation (LC3M; non-profit), Sheffield, UK

## TEACHING

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**Module Instructor**, University of Southampton 2017

*Contemporary Topics (SOES6001)*; An upper level undergraduate and masters level course. Staff members ask questions about topics in the geosciences presently under debate, provide key readings, and grade presentations and reports.

*Module:* "Controls on long-term climate"

**Teaching Certificate Program**, Northwestern University 2015 – 2016

A program that prepares participants for university-level teaching through seminars and workshops. Participants also receive mentoring as they build and implement a university-level course. *Teaching Certification acquired.*

**Teaching Assistant**, Northwestern University 2013 – 2016

*Earth Systems Revealed (Earth 201)*; An undergraduate level, introductory geology course that combines combination lecture, lab, and fieldwork. Duties included weekly lab instruction and field instruction.

## STUDENTS

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**Xavier Dupla**, Ph.D. student, University of Lausanne, Switzerland; *Thesis Committee* 2021

**Zoe Hibbert**, M. Res., University of Southampton, UK; *Thesis Advisor* 2019

## SERVICE

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**G3 (Geology, Geochemistry and Geophysics) Seminar organizer**, National Oceanography Centre, UK 2018 – 2019

## GRANTS

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**Geologists' Association Research Award**, Geologists' Association 2017

**Goldschmidt Travel Grant**, NSF 2016

**Takken Student Research Presentation Travel Award**, Association for Women Geoscientists 2016

**Goldschmidt Travel Grant**, NSF 2010

**UROP Conference Participation Award**, Boston University 2010

**AWARDS**

<b>Editors' Citation for Excellence in Refereeing</b> , Geophysical Research Letters	2020
<b>Horace A. Scott Graduate Award for Outstanding Research</b> , Earth & Planetary Sciences, Northwestern University	2016
<b>Sloss Award for Outstanding Graduate Teaching Assistant</b> , Earth & Planetary Sciences, Northwestern University	2016
<b>Departmental Prize for Excellence in Earth Science</b> , Earth Science, Boston University	2010

**LARGE COLLABORATIONS**

<b>Oman Drilling Project</b> , Phase 2 Science Party P.I.'s: Juerg Matter (University of Southampton) and Peter Kelemen (Lamont-Doherty Earth Observatory)	2018
<b>Kangerlussuaq International Research Network (KAIRN)</b> Organizers: Jasmine Saros (University of Maine) and John Anderson (Loughborough University)	2016

**INVITED TALKS**

<b>University of North Carolina Wilmington</b> , Dept. of Earth and Ocean Sciences	2022
<b>Northwestern University</b> , Environmental Culture and Policy Program	2022
<b>Woods Hole Oceanographic Institute</b>	2022
<b>National Oceanography Center &amp; University of Southampton</b> , Ocean and Earth Science Seminar	2021
<b>Woods Hole Group</b> , Company Headquarters	2021
<b>Montclair State University</b> , Dept. of Earth & Environmental Studies	2021
<b>Second Global Enhanced Weathering Working Webinar</b> , Climate Cleanup Foundation	2021
<b>University of Sheffield</b> , LC3M Annual Meeting	2017 - 2020
<b>Geological Society of London</b> , Lyell Meeting, <i>Keynote</i>	2019
<b>University of Minnesota Twin Cities</b> , Dept. of Earth Sciences	2019
<b>University of Illinois at Urbana – Champaign</b> , Dept. of Plant Biology	2016

**CONFERENCE ABSTRACTS**

Romaniello, S.J., Sulpis, O., Cole, D.B., Syverson, D.D., Monserrat, F., Moreau, C., Walworth, N.G. and **Andrews, M.G.** (2022) Impacts of Enhanced Olivine Weathering in Nearshore Marine Environments. Goldschmidt Conference. *Submitted*.

Larkin, C.S., **Andrews, M.G.**, James, R.H., Pearce, C.R., Goring-Harford, H., Epihov, D., Beerling, D.J. (2022) CO<sub>2</sub> removal associated with enhanced rock weathering in arable croplands in Norfolk, UK. Goldschmidt Conference. *Submitted*.

**Andrews, M.G.**, Romaniello, S.J., Sulpis, O., Syverson, D., Hsu, T.-J., Rafati, Y., Zhang, J., Calantoni, J., Monserrat, F., Walworth, N., Moreau, C., Lopez, P., Hayden, M., and Green, T. (2021) Advancing Coastal Enhanced Weathering as a climate change mitigation technology through strategic, interdisciplinary research. WHOI Ocean Carbon & Biochemistry (OCB) Summer Workshop.

Larkin, C.S., **Andrews, M.G.**, James, R.H., Pearce, C.R., Collins, A., Goring-Harford, H., Jardine, G., Kantola, I.B., DeLucia, E.H., Masters, M.D., Yeong, K.L., Beerling, D.J. (2021) Quantifying CO<sub>2</sub> removal via enhanced rock weathering in contrasting croplands. Goldschmidt Conference.

**Andrews, M.G.**, Epihov, D., Pearce, C.R., James, R.H., Beerling, D.J. (2020) CO<sub>2</sub> sequestration by Enhanced Weathering of agricultural soils in Norfolk, UK. Fall American Geophysical Union.

James, R.H., **Andrews, M.G.**, Pearce, C.R., Jardine, G., Goring-Harford, H., Epihov, D., Masters, M., Yeong, B., and Beerling, D.J. (2020) Carbon Dioxide Removal via Enhanced Rock Weathering With Agriculture in Large-Scale Field Trials. Fall American Geophysical Union.

**Andrews, M.G.**, Pearce, C.R., James, R.H., Masters, M.D., Kantola, I.B., Yeong, K.L., Hanapi, M.J., Benedick, S., Reynolds, G., DeLucia, E.H., and Beerling, D.J. (2019) Field trials of Enhanced Weathering in two contrasting climate zones. Goldschmidt Conference, Barcelona, Spain. *Invited presentation*.

**Andrews, M.G.**, Pearce, C.R., James, R.H., Masters, M.D., Kantola, I.B., DeLucia, E.H., and Beerling, D.J. (2018) Enhanced rock weathering in agroecosystem field trials, Illinois, USA. Goldschmidt Conference, Boston, MA, USA.

**Andrews, M.G.**, Jacobson, A.D., Osburn, M.R., and Flynn, T.F. (2017) Microbial CO<sub>2</sub> production at the Greenland Ice Sheet margin. Goldschmidt Conference, Paris, France. *Oral presentation*.

Jacobson, A.D., and **Andrews, M.G.** (2017) The impact of subsurface silicate weathering on the long-term C cycle. Goldschmidt Conference, Paris, France. *Oral presentation*.

**Andrews, M.G.** and Jacobson, A.D. (2016) Radiogenic and stable Sr isotope ratios as tracers of silicate and carbonate weathering in Iceland. Goldschmidt Conference, Yokohama, Japan. *Oral presentation*.

**Andrews, M.G.** and Jacobson, A.D. (2015) Seasonal variation and controls on subglacial riverine CO<sub>2</sub> concentrations from a small catchment, west Greenland Ice Sheet. Fall American Geophysical Union, San Francisco, CA, USA.

**Andrews, M.G.**, Jacobson, A.D., and Lehn, G.O. (2014) Stable strontium isotopes ( $\delta^{88/86}\text{Sr}$ ) as a tracer of Sr sources and biogeochemical cycling in two catchments draining Fiordland, New Zealand. Fall American Geophysical Union, San Francisco, CA, USA.

**Andrews, M.G.**, Baxter, E.F., Pollington, A.D., Spicuzza, M. and Valley, J.W. (2010) Oxygen and strontium isotope zonation in a shear zone garnet: evidence for open system exchange. Goldschmidt Conference, Knoxville, TN, USA.

## PUBLICATIONS

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Beerling D.J., Kantzas E., Lomas M.R., Wade P., Eufrazio R.M., Renforth P., Quirk J., Sarkar B., **Andrews M.G.**, James R.H., Pearce C.R., Khanna M., Koh L., Quegan S., Pidgeon N.F., Janssens I.A., Hansen J. and Banwart S.A. (2020) Potential for large-scale CO<sub>2</sub> removal via enhanced rock weathering with croplands. *Nature* 583, 242 - 248.

Kelland, M.E., Wade, P.W., Lewis, A.L., Taylor, L.L., Sarkar, B., **Andrews, M.G.**, Lomas, M.R., Cotton, T.E.A., Kemp, S.J., James, R.H., Pearce, C.R., Hartley, S.E., Hodson, M.E., Leake, J.R., Banwart, S.A., and Beerling, D.J. (2020) Increased yield and CO<sub>2</sub> sequestration potential with the C<sub>4</sub> cereal *Sorghum bicolor* cultivated in basaltic rock dust-amended agricultural soil. *Global Change Biology* 26, 3658-3676.

Griffith, E.M., Schmitt, A.D, **Andrews, M.G.**, and Fantle, M.S. (2020) Elucidating modern geochemical cycles at local, regional, and global scales using calcium isotopes. *Chemical Geology* 538, 119445.

**Andrews, M.G.** and Taylor, L.L. (2019) Combating climate change through Enhanced Weathering of agricultural soils. *Elements* 15(4).

Saros, J., Anderson, N. J., Juggins, S., McGowan, S., Yde, J., Telling, J., Bullard, J., Yallop, M., Heathcote, A., Burpee, B., Fowler, F., Barry, C., Northington, R., Osburn, C., Pla-Rabes, S., Mernild, S.H., Whiteford, E., **Andrews, M.G.**, Kerby, J., and Post, E. (2019) Arctic climate shifts drive rapid ecosystem responses across the West Greenland landscape. *Environmental Research Letters*. DOI: 10.1088/1748-9326/ab2928

**Andrews, M.G.** and Jacobson, A.D. (2018) Controls on the solute geochemistry of subglacial discharge from the Russell Glacier, Greenland Ice Sheet determined by radiogenic and stable Sr isotope ratios. *Geochimica et Cosmochimica Acta* 238, 312 - 329.

**Andrews, M.G.**, Jacobson, A.D., Osburn, M.R., and Flynn, T.M. (2018) Dissolved carbon dynamics in meltwaters from the Russell Glacier, Greenland Ice Sheet. *Journal of Geophysical Research – Biogeosciences*. DOI: 10.1029/2018JG004458

**Andrews, M.G.** and Jacobson, A.D. (2017) The radiogenic and stable Sr isotope geochemistry of basalt weathering in Iceland: Role of hydrothermal calcite and implications for long-term climate regulation. *Geochimica et Cosmochimica Acta* 215, 247 – 262.

**Andrews, M.G.**, Jacobson, A.D., Lehn, G.O., Horton, T.W., and Craw, D. (2016) Radiogenic and stable Sr isotope ratios ( $^{87}\text{Sr}/^{86}\text{Sr}$ ,  $\delta^{88/86}\text{Sr}$ ) as tracers of riverine cation sources and biogeochemical cycling in the Milford Sound region of Fiordland, New Zealand. *Geochimica et Cosmochimica Acta* 173, 284 – 303.

Jacobson, A.D., **Andrews, M.G.**, Lehn, G.O., and Holmden, C. (2015) Silicate versus carbonate weathering in Iceland: New insights from Ca isotopes. *Earth and Planetary Science Letters* 416, 132 – 142.

## OUTREACH

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### Authority Magazine

Article: “Project Vesta: Dr. Grace Andrews’ Big Idea That Might Change the World” (Fotis Georgiadis, March 24) 2022

### Earth Day Web Event, Project Vesta

Featured Scientist: “Ask us Anything” Q&A with the public 2021

### BBC World Service: People Fixing the World

Podcast Interview for episode “Can capturing carbon buy us time to tackle climate change?” (Tom Colls, 11 June). 2019

### Pint of Science Festival, Southampton, UK

Event Host; this three-day festival brings science to the public as university researchers give informal talks about their work. 2018

### Bright Club, Southampton, UK

Podcast interview; Episode 16. A conversation about the science behind my routine for this science-based stand-up comedy club. 2018

### Café Scientifique featuring Bright Club, Salisbury, UK

Comedian; at this merger event, researchers performed stand-up comedy and hosted a Q&A with the public. 2017

- Bright Club**, Southampton, UK 2017  
*Comedian*; this science-based stand-up comedy club combines laughs and research to educate and entertain a diverse public audience.
- Pint of Science Festival**, Southampton, UK 2017  
*Organizer*; this three-day festival brings science to the public as university researchers give informal talks about their work.
- STEAM Research and Design Program**, Northwestern University 2016  
*Graduate Student Mentor*; this program brings high school students, interested in pursuing university STEM degrees, to shadow graduate students and design their own research project.
- New York Times** 2015  
*Article*; “*Climate research at the end of the world*” (Josh Haner, 26 Nov.)
- NASA Television** 2015  
*Interview*; “*Rising Seas: Science on the Greenland Ice Sheet*”
- Project EXCITE**, Northwestern University 2014, 2015  
*Module Presenter*: “*Evidence for paleoclimates through leaf margin analysis*”; EXCITE addresses the achievement gap between minority and non-minority students by providing extracurricular opportunities in mathematics and the sciences.
- Girls Do Hack**, Adler Planetarium, Chicago, IL 2014  
*Mentor*; GDH is designed to encourage female high school students to pursue STEM careers by partnering them with female mentors in STEM fields.
- Research Magazine**, Boston University 2010  
*Interview*: “*Rock of Ages*”; a profile on my undergraduate research at Boston University.