

# Emily L. Cardarelli

JPL Postdoctoral Fellow, Astrobiology & Ocean Worlds

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91109

## CURRENT ROLES

**Instrument Interface**, Mars 2020 Project Science Office, NASA-JPL, Pasadena, CA.

- Initiates productive communications and leads interactions between Instrument Data Systems Operations and Mars 2020 Instrument Teams for on-time product deliveries to Planetary Data System, for public data releases 3 and 4.
- Leads weekly team meeting with attendees from Instrument Data System Operations Instrument Operations Teams

**Mission Operations on Mars 2020**, NASA-JPL, Pasadena, CA.

- Mars 2020 Science Team Member and SHERLOC Instrument Collaborator
- Over 100 shifts staffed to date (Sols 9-365); 8 teammates trained.
- Roles (5): Tactical Science Lead, Targeting Scientist, SHERLOC Spectroscopy Science Payload Uplink Lead, Tactical Documentarian, Campaign Implementation Documentarian
- Working Group Contributor: Regolith, Return Sample Science, Geological Context

**JPL Postdoctoral Research Fellow**, Astrobiogeochemistry, NASA-JPL, Pasadena, CA.

- Microscopy (SEM/EDS) and geochemical techniques employed for spatial analyses conducted across scales, including (SIMS, deep UV Raman, native fluorescence)
- Investigating Mars analog systems for microbial biosignatures, specifically within modern and ancient magnesite precipitating environments and weathered ultramafics
- Advancing a novel Mg-isotope method and standard for SIMS with implications for Mg-bearing carbonates on Mars

## EDUCATION

**Stanford University, Stanford, CA (2021)** — Ph.D. in Earth System Science.

Thesis: The microbial ecology and biogeochemistry of alluvial subsurface systems

Thesis Advisory Committee: John Bargar, Paula Welander, Jane Willenbring, Scott Fendorf

Advisor: Christopher Francis

**Stanford University, Stanford, CA (2015)** — M.S. in Environmental Earth System Science.

**Tulane University, New Orleans, LA (2012)** — B.S. in Environmental Science, Geology Minor, *magna cum laude* with departmental honors.

Thesis: Seasonal impacts influencing denitrification in wetlands.

Advisor: Brad Rosenheim

### *Additional training*

2016            **Department of Energy-Joint Genome Institute**, Microbial Genomics & Metagenomics Course, Walnut Creek, CA

2013            **Marine Biological Laboratory**, Microbial Diversity Course, Woods Hole, MA

## PEER-REVIEWED PUBLICATIONS

*In-prep & submitted manuscripts, available upon request*

- [16] 2022        **Cardarelli, E.L.**, Y. Guan, C. Ma, K. Williford, C. Swindle, S. Bhattacharjee, P. Vasuolos, T. Present, J. Eiler, K. Farley, & J. Grotzinger. Proposing a Mg-isotope standard for  $\delta^{26}\text{Mg}$  magnesite SIMS with implications for the Mg-bearing carbonates of Mars. *Chemical Geology*. In-prep.

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- [15] 2022 **Cardarelli, E.L.**, K. Boye, V. Noël, J.R. Bargar, & C.A. Francis. Vertical microbial community assembly patterns within the alluvial subsurface. *Environmental Science and Technology*. In-prep.
- [14] 2022 Wogsland, B., et al. Science and Science-Enabling Activities of the SHERLOC and WATSON Imaging Systems in Jezero Crater, Mars. *Journal of Geophysical Research: Planets*. In review, manuscript number: 2022JE007442.
- [13] 2022 Hausrath, L., et al. An Examination of Soil Crusts on the Floor of Jezero crater, Mars. *Journal of Geophysical Research: Planets*. In review, manuscript number: 2022JE007433.
- [12] 2022 Corpolongo, A., et al. SHERLOC Raman mineral detections of the Mars 2020 Crater Floor Campaign. *Journal of Geophysical Research: Planets*. In review, manuscript number: 2022JE007455.
- [11] 2022 Sharma, S., et al. Mapping organic-mineral associations in Jezero crater: Implications for Martian Organic Geochemistry. *Nature*. In review, manuscript number: 2022-06-08920
- [10] 2022 Vaughan, A., Minitti, M., **Cardarelli, E.L.**, et al. Regolith of the crater floor units, Jezero crater, Mars: textures, composition and implications for provenance. *Journal of Geophysical Research: Planets*. In review, manuscript number: 2022JE007437.
- [9] 2022 Fries, M., et al. The SHERLOC Calibration Target on the Mars 2020 Perseverance Rover: Design, Operations, Outreach, and Future Human Exploration Functions. *Space Science Reviews*. Accepted.
- [8] 2022 Scheller, E., Hollis, J., **Cardarelli, E.L.** et al. Aqueous alteration processes and implications for organic geochemistry in Jezero crater, Mars. *Science*. In review, manuscript number: abo5204.
- [7] 2022 Liu, Y. et al. An olivine cumulate outcrop on the floor of Jezero crater, Mars. *Science*. In review, manuscript number: abo2756.
- [6] 2022 Farley, K. et al. Aqueously altered igneous rocks on the floor of Jezero crater, Mars. *Science*. In-review, manuscript number: abo2196
- Published*
- [5] 2021 Reji, L.R., **Cardarelli, E.L.**, Bargar, J.R., & Francis, C.A. Diverse ecophysiological adaptations of subsurface *Thaumarchaeota* in floodplain sediments. *International Society for Microbial Ecology Journal*. DOI: 10.1038/s41396-021-01167-7
- [4] 2020 **Cardarelli, E.L.**, Bargar, J.R., & Francis, C.A. Diverse *Thaumarchaeota* dominate subsurface ammonia-oxidizing communities in semi-arid floodplains in the Western United States. *Microbial Ecology*. DOI: 10.1007/s00248-020-01534-5
- [3] 2017 Noël, V., Boye, K., Kukkadapu, R. K., Bone, S., Lezama-Pacheco, J., **Cardarelli, E.**, Janot, N., Fendorf, S., & Bargar, J. R. Understanding controls on redox processes in floodplain sediments of the Upper Colorado River Basin. *Science of The Total Environment*. 603: 663-675. DOI: 10.1016/j.scitotenv.2017.01.109
- [2] 2017 Noël, V., Boye, K., Lezama-Pacheco, J., Bone, S., Janot, N., **Cardarelli, E.**, Williams, K., & Bargar, J. Redox controls over the stability of U(IV) in floodplains of the Upper Colorado River Basin. *Environmental Science and Technology*. 51: 10954-10964. DOI: 10.1021/acs.est.7b02203
- [1] 2017 Peay, K., von Sperber, C., **Cardarelli, E.**, Toju, H., Francis, C., Chadwick, O., & Vitousek, P. Convergence and contrast in the community structure of Bacteria,

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Fungi and Archaea along a tropical elevation-climate gradient. *FEMS Microbiology Ecology*. 93. DOI: 10.1093/femsec/fix045

## *Internal publications*

- 2020 **Cardarelli, E.L.** and K. Gonzales. Cultivating diversity and normalizing inclusion within the Geosciences. Internal White Paper for Stanford University.
- 2013 **Cardarelli, E.L.** Unraveling the black box of aquaria biofilter function: FISHing for novel ammonia-oxidizing archaea associations. Online Publication, *Marine Biological Laboratory*, Woods' Hole, MA. **online:** [goo.gl/s1pAa7](http://goo.gl/s1pAa7)

## FIELD CAMPAIGNS AND MISSIONS

### *Sample Collection*

- 2021 Tactical Science Lead; Jezero Crater, Mars, NASA Mars 2020 Perseverance Rover, led core collection on Sol 300 and 5+ planning sols.
- 2016 Chief Scientist; Riverton, WY, DOE-LM site formerly processed U- and V-ore, core collection.
- 2014-2016 Lead Microbiologist for more than 10 field campaigns; [1-5] R/V *Rachel Carson*, MBARI, Monterey Canyon, CA - water column monthly time-series sampling; [6] Rifle, CO, DOE-LM site formerly processed U-ore - core collection; [7] Grand Junction, CO, DOE-LM site formerly processed U-ore - core collection; [8] Naturita, CO, DOE-LM site formerly processed U-ore - core collection; [9] Shiprock, NM, DOE-LM site formerly processed U-ore - core collection; [10, 11] Riverton, WY, DOE-LM site formerly processed U-ore - core collection
- 2014 R/V *Questuary*, Sacramento River/San Francisco Bay, CA; water column sampling.
- 2013, 2014 Chief Scientist; Elkhorn Slough Estuary, CA; intact sediment coring for lab-based manipulations.
- 2011 Chief Scientist; Davis Pond River Diversion, Boutte, LA; seasonal water column/sediment and plant collection.

## GRANTS

- 2021 Raise the Bar Award (awarded: \$4,000), 3X Engineering and Science Directorate, NASA Jet Propulsion Laboratory
- 2018-2021 Contributed to DE-SC0019119, "Response of Subsurface Nitrogen-Cycling Microbial Communities to Environmental Fluctuations" (awarded: \$539,400) PI: Chris Francis, Stanford University
- 2016 Contributed to Proposal 1927, "Metagenomic Characterization of Nitrogen-Cycling Microbial Communities Impacting Uranium Release in the Upper Colorado River Basin" (awarded: 16S rRNA gene sequencing (276 samples), metagenomic sequencing (50 samples), metatranscriptomic sequencing (10 samples)) PI: Chris Francis, Stanford University; DOI: 10.25585/1488139
- 2013, 2014 McGee/Levorsen Research Grant Recipient, Stanford University (awarded: \$2,060; \$3,940)
- 2011-2012 Research Grant Proposal Author, Department of the U.S. Army (awarded: \$450,000) PI: Naomi Verdugo, Manpower and Reserve Affairs, U.S. Army
- 2011 Undergraduate Research Opportunity Program Grant, Louisiana SeaGrant (awarded: \$2,500)

## PROFESSIONAL EXPERIENCE

- Aug. 2020- **Postdoctoral Research Fellow**, Astrobiogeochemistry, NASA-JPL, Pasadena, CA.

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- Member of Mars 2020 Science Team and key contributor to the Regolith Working Group, analyzing rock-regolith transitions with multiple on-board spectroscopic instruments as well as the biosignature preservation potential of carbonated olivines and organomineral associations.
- Investigating Mars analog systems for microbial biosignatures, specifically within modern and ancient magnesite precipitating environments through microscopy (SEM/EDS) and geochemical techniques including those for bulk solid-phase (CF-EA-irMS, XAS, SIMS [Mg isotopes]) and compound-specific approaches (GC-MS/MS, GC-irMS)
- Member of the SHERLOC (Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals) Instrument Team Member (deep UV Raman, native fluorescence)

2012-2020     **Graduate Research Assistant**, Stanford University, Stanford, CA

- Examined the size, structure, and potential geochemical controls of microbial communities belowground using molecular biology techniques (functional genes, qPCR, FISH, metagenomics), geochemical characterization techniques for solid-phase elemental analysis (EA, XRF, ICP-MS/OES, XAS\*) and multivariate statistics (nonparametric hypothesis testing, principal component analyses, regression analyses (ex. LASSO, Ridge, linear)) from >500 samples collected from 17 cores (2-10 m down) over five sites in the American West. \*XAS — for uranium, completed on ~20 samples
- Evaluated the size and diversity of nitrogen cycling communities at five sites and from the topsoil to 10 m below-ground; found AOA and AOB ecotypes within these terrestrial subsurface soils are primarily associated with conditions influenced by water table position, location of the naturally reduced zone, or both conditions.
- Elucidated microbial diversity, niche partitioning, and succession patterns in semi-arid terrestrial subsurface environments are shaped by hydrologic conditions and seasonal disturbances (i.e. drought to flood conditions)
- Determined native microbial communities *in-situ* limit uranium's movement from floodplain soils to water bodies

2010-2012     **Undergraduate Research Assistant**, Tulane University, New Orleans, LA.

- Developed a new area of research centered on nitrogen cycling within the Rosenheim Lab through an undergraduate research grant funded in full (\$2,500) by the Louisiana SeaGrant Program, NOAA
- Utilized natural abundance carbon and nitrogen isotope measurements made by elemental analysis isotope ratio mass spectrometry (EA-irMS) to evaluate spatiotemporal particulate organic carbon and nitrogen transformation trends within the water column of a newly constructed wetland

2009-2011     **Summer Research Assistant**, Department of the U.S. Army, Pentagon, Washington, D.C.

- Authored a research proposal (funded for \$450,000) to examine the lifecycle of behavioral healthcare providers in the private and public sectors
- Prepared reports to the Secretary of the Army on recruiting and retention of behavioral healthcare professionals and bonus incentives' effectivity for attracting/retaining different demographics

## LEADERSHIP ROLES AND PROFESSIONAL AFFILIATIONS

*Departmental/Institutional Service and Leadership*

Since 2021     Founding Chair, American Geophysical Union Biogeosciences DEI Committee

- Lead of the B-DEI Steering Committee (a dozen scientists selected for committee development and to generate feedback to AGU's Biogeosciences Executive Committee) and guide of participation into focus areas to advance progress on DEI activities.
- Lead of the B-DEI Working Group, facilitating initiatives including: a DEI Travel Grant program (administering \$4,000 and enabling 6 early career scientists to attend the Fall Meeting),

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founded the GEOspire program connecting scientists to K-12 teachers within the Fall Meeting host city, and redefining the Sulzman Award to be open to all early- to mid-career scientists independent of sex or gender, with an emphasis on acknowledging an educator and mentor furthering diversity in the Earth Sciences.

- Raised over \$1000 for programming at the AGU Fall 2022 Meeting.

Since 2020      Steering Committee, Asian Americans and Pacific Islanders in the Geosciences  
2019-2021      Chief Strategy Officer and Horse Manager, Stanford Polo Club, Stanford University  
2017-2019      Chair, ESS Student-Invited Seminar Committee, Stanford University  
2014-2015      Vice-President, Graduate Student Advisory Council, Stanford University  
2013-2014      Secretary, Graduate Student Advisory Council, Stanford University  
2013-2014      Student Liaison to Faculty, ESS Geobiology Faculty Search Committee

## *Affiliations*

Since 2022      Reviewer, Advances in Space Research  
Since 2022      Reviewer, Acta Astronautica  
Since 2021      Member, Geological Society of America  
Since 2021      Member, Veterans of Foreign Wars Auxiliary  
Since 2019      Member, United States Polo Association  
Since 2017      Reviewer, Journal of Geophysical Research: Biogeosciences  
Since 2016      Member, International Society of Microbial Ecology  
Since 2013      Member, American Geophysical Union

## CONFERENCE/INVITED PRESENTATIONS

### *Oral,*

- [19] 2022      **Cardarelli, E.L.**, Willis, P.A., Mayhew, L.E., Fornaro, T., Tuite, M.L., Williams, A.J., Astrobiology Investigations Enabled by the NASA Mars 2020 Mission and Sample Return. Astrobiology Conference, Atlanta, GA. **[Session Convener]**
- [19] 2022      **Cardarelli, E.L.** Assessing Organic Preservation and the Implications for Potential Biosignatures in the Bastide Member of the Séítah Formation, Jezero Crater. Astrobiology Conference, Atlanta, GA.
- [19] 2022      **Cardarelli, E.L.** ‘Seeing with SHERLOC’: from the rocks to the regolith in Jezero. After Dark Series: Mars! Exploratorium, San Francisco, CA. **[Invited Speaker]**
- [18] 2022      **Cardarelli, E.L.** 300+ Sols on Perseverance: The Mars 2020 Perseverance Rover Mission in Jezero crater, Mars. After Dark Series: Mars! Exploratorium, San Francisco, CA. **[Invited Speaker]**
- [17] 2022      **Cardarelli, E.L.**, S. Sharma, A.E. Murphy, J. Tarnas, C. Lee, R. Bhartia, L.W. Beegle. Assessing the biosignature preservation potential of the Bastide Member in the Séítah Formation, Jezero crater. American Geophysical Union Astrobiology Science Conference, Atlanta, GA.
- [16] 2022      **Cardarelli, E.L.**, A. Vaughan, M.E. Minitti, L. Beegle, M. Rice, J.R. Johnson, B. Horgan, A. Cousin, L.C. Kah, E.M. Hausrath, and S. Siljestrom. Regolith at Jezero crater, Mars: spectral diversity, textures, and implications for provenance. Lunar and Planetary Science Conference. The Woodlands, TX.
- [15] 2022      **Cardarelli, E.L.** From the rocks to the regolith of Jezero crater: the first 300 sols on the Mars 2020 rover. University of Nevada-Las Vegas Department of Geosciences, Las Vegas, NV. **[Invited Seminar]**
- [14] 2021      **Cardarelli, E.L.**, K.H. Williford, C. Lee, E.L. Berger, A. Cousin, K.S. Edgett, M.R. Kennedy, S. Shkolyar, L.P. DeFlores, W. Abbey, R. Bhartia, R.C. Wiens and L.W. Beegle. Exploring rock-regolith interfaces in Jezero crater with Mars 2020 SHERLOC. American Geophysical Union Fall Meeting, New Orleans, LA.

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- [13] 2021 Hausrath, E., A.J. Brown, **E.L. Cardarelli**, A. Cousin, F. Gomez, Y. Goreva, J. Lasue, C. Legett, J. Manuel Madariaga, L. Mandon, G. Martinez, J. Martinez-Frías, T.H. McConnochie, P. Meslin, M. Zorzano, S. Siljeström, S. Schröder, S.K. Sharma, A. Steele, R.J. Sullivan Jr, A. Udry, R.C. Wiens, S. Shkolyar, the SuperCam Team and the Regolith Working Group. Examining Soil Surface Processes at Jezero crater, Mars. American Geophysical Union Fall Meeting, New Orleans, LA.
- [12] 2021 Beegle, L.W., L.P. DeFlores, R. Bhartia, W. Abbey, J.J. Razzell Hollis, K. Uckert, B. Zachary, K.S. Edgett, M.R. Kennedy, C. Lee, S.A. Asher, E.L. Berger, A. Burton, S. Bykov, **E.L. Cardarelli**, B.L. Carrier, S.M. Clegg, P. Conrad, B.L. Ehlmann, D.M. Fey, A. Fox, M. Fries, T.G. Graff, W. Hug, K.P. Hand, D. Harker, J. Huggett, R. Jakubek, L.C. Kah, A. Magee, M.E. Minitti, K.R. Moore, K.H. Nealon, B. Nixon, M.A. Ravine, R.D. Roppel, K.B. Steadman, E.L. Scheller, S. Siljeström, C.L. Smith, P. Sobron, A. Steele, M.L. Tuite Jr, A. Werynski, R.C. Wiens, K. Winchell, K.H. Williford, B. Wogsland, A. Yanchilina, W. Yingling and R.A. Yingst. An overview of SHERLOC Raman and fluorescence spectroscopy results obtained during Perseverance's Green Zone Campaign at Jezero crater, Mars. American Geophysical Union Fall Meeting, New Orleans, LA.
- [11] 2021 **Cardarelli, E.L.** Microbe-mineral interactions and possible biosignatures within semiarid alluvial deposits of the Western United States and beyond. Georgia Institute of Technology Astrobiology and Planetary Science Seminar, Atlanta, GA. **[Invited Seminar, recorded]**
- [10] 2021 **Cardarelli, E.L.**, J. Tarnas, and M. Rice. The Mars 2020 Perseverance Rover in Jezero Crater. Geological Society of America Annual Meeting, Portland, OR. **[Invited Keynote]**
- [9] 2021 **Cardarelli, E.L.**, E. Hausrath, R. Sullivan, J. Johnson, S. Siljeström, J. Manuel Madariaga, P. Meslin, L. Mandon, A. Cousin, K. Williford. Insights into Jezero Crater geology from rock-regolith interfaces. Geological Society of America Annual Meeting, Portland, OR.
- [8] 2021 **Cardarelli, E.L.** Microbe-mineral interactions and possible biosignatures within semiarid alluvial deposits of the Western United States and beyond. Johns Hopkins Osher Lifelong Learning Institute at Johns Hopkins University, Baltimore, MD. **[Invited Seminar]**
- [7] 2020 **Cardarelli, E.L.** Illuminating the microbial ecology, biogeochemistry, and possible biosignatures within semiarid alluvial deposits of the Western United States and beyond. Caltech GPS Division 'Geoclub' Seminar, Pasadena, CA. **[Invited Seminar]**
- [6] 2019 **Cardarelli, E.L.**, Bargar, J.R., and C.A. Francis. Microbes in the American West: subsurface spatiotemporal dynamics reveal depth-specific metabolic strategies and critical water cycle interactions. American Geophysical Union Fall Meeting, San Francisco, CA
- [5] 2019 **Cardarelli, E.L.** and K. Gonzales. Cultivating a Cohort of Change Agents: Launching Diversity and Inclusion in the Geosciences Curricula at Stanford University. American Geophysical Union Fall Meeting, San Francisco, CA.
- [4] 2019 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Microbes in the American West: subsurface spatiotemporal dynamics reveal new taxa and critical water cycle interactions. Caltech GPS Division 'Geoclub' Seminar, Pasadena, CA. **[Invited Seminar]**

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- [3] 2018 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Microbes of the West: niche partitioning and new phyla in the depths of the terrestrial subsurface. Southern California Geobiology Symposium, Riverside, CA.
- [2] 2016 **Cardarelli, E.L.**, V. Noël, J.R. Bargar, K. Williams, W. Dam, and C.A. Francis. Biogeochemical constraints on uranium cycling in redox active floodplain sediments. American Geophysical Union Fall Meeting, San Francisco, CA.
- [1] 2015 **Cardarelli, E.L.**, J.R. Bargar, K. Williams, W. Dam, and C.A. Francis. Subsurface nitrogen-cycling microbial communities at uranium contaminated sites in the Colorado River Basin. American Geophysical Union Fall Meeting, San Francisco, CA. **online:** [goo.gl/URuhMx](http://goo.gl/URuhMx)
- Poster,*
- [19] 2021 **Cardarelli, E.L.** and M.B. Wilhelm. Microbe-mineral interactions preserved across scales. American Geophysical Union Fall Meeting, New Orleans, LA. **[Session Chair and Convener]**
- [18] 2021 **\*\*Abrahams, L.S., \*\*S.J. Tumber-Davila, E.L. Cardarelli.** Diversity and Inclusion in the Geosciences (DIG): a student-led initiative empowering trainees to make institutional change. American Geophysical Union Fall Meeting, New Orleans, LA.
- [17] 2021 Cousin, A., P. Meslin, E. Hausrath, J. Lasue, **E.L. Cardarelli**, O. Beyssac, O. Forni, E. Dehouck, L. Mandon, O. Gasnault, C. Quantin Nataf, S. Schröder, S.M. Clegg, R.B. Anderson, P. Pilleri, A.J. Brown, S. Maurice, R.C. Wiens and SuperCam Team. Fine-grained regolith on Mars: Comparison between Gale and Jezero craters using ChemCam and SuperCam LIBS data. American Geophysical Union Fall Meeting, New Orleans, LA.
- [16] 2021 Lee, C., T.G. Graff, M. Fries, V.D. Tran, R.H. Weiner, M.J. Calaway, D.H. Garrison, R.S. Jakubek, R.S. Harrington, K. Davis, E.L. Berger, A. Burton, F. McCubbin, A.J. Ross, A. Fox, C.L. Smith, R. Bhartia, L.W. Beegle, L.P. DeFlores, W. Abbey, K. Uckert, J.J. Razzell Hollis, **E.L. Cardarelli**, M.R. Kennedy, A. Werynski, K. Winchell and K.S. Edgett. Calibration and validation of the SHERLOC instrument operating in Jezero crater, Mars. American Geophysical Union Fall Meeting, New Orleans, LA.
- [15] 2019 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Microbes in the American West: comparative metagenomics of subsurface communities reveals depth-specific metabolic strategies and potential water cycle interactions. Department of Energy Joint Genome Institute User Meeting, San Francisco, CA.
- [14] 2019 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Comparative metagenomics below-ground and potential water cycle interactions in the American West. Southern California Geobiology Symposium, Pasadena, CA.
- [13] 2018 **Cardarelli, E.L.**, J.R. Bargar, W. Dam, and C.A. Francis. Microbial niche partitioning at the soil-groundwater interface in transiently reduced floodplains. Department of Energy Earth System Science PI Meeting, Potomac, MD. **online:** [goo.gl/4y5Rz4](http://goo.gl/4y5Rz4)
- [12] 2018 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Hydrologic perturbations support niche partitioning at the soil-groundwater interface and reveal new phyla in the West. Department of Energy Joint Genome Institute User Meeting, San Francisco, CA.
- [11] 2017 **Cardarelli, E.L.**, J.R. Bargar, W. Dam, and C.A. Francis. Effects of microbial communities on uranium oxidation and mobilization in the presence of nitrate, nitrite, and oxygen. Department of Energy SSRL/LCLS Users' Meeting, Menlo Park, CA. **online:** [goo.gl/PM4ZKG](http://goo.gl/PM4ZKG)

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- [10] 2017 **Cardarelli, E.L.**, J.R. Bargar, W. Dam, and C.A. Francis. Effects of microbial communities on uranium oxidation and mobilization in the presence of nitrate, nitrite, and oxygen. Department of Energy Environmental System Science PI Meeting, Potomac, MD.
- [9] 2017 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Subsurface microbial communities involved in nitrogen cycling with implications for uranium release in the Upper Colorado River Basin. Department of Energy Joint Genome Institute User Meeting, Walnut Creek, MD.
- [8] 2016 **Cardarelli, E.L.**, C.A. Francis, K. Boye, S. Bone, V. Noël, J. Lezama-Pacheco, W. Dam, R.H. Johnson, K.H. Williams, and J.R. Bargar. Diversity and biogeography of subsurface nitrogen-cycling communities at uranium contaminated DOE-LM sites in the Upper Colorado River Basin. Department of Energy Environmental System Science PI Meeting, Potomac, MD. **online:** [goo.gl/gSWNfq](https://goo.gl/gSWNfq)
- [7] 2016 **Cardarelli, E.L.**, J.R. Bargar, and C.A. Francis. Subsurface microbial communities involved in nitrogen cycling with implications for uranium release in the Upper Colorado River Basin. Department of Energy Joint Genome Institute User Meeting, Walnut Creek, MD.
- [6] 2016 **Cardarelli, E.L.**, J.R. Bargar, W. Dam, and C.A. Francis. Characterization of nitrogen-cycling microbial communities impacting uranium release in the Colorado River Basin. International Society for Microbial Ecology Meeting, Montreal, QC, Canada.
- [5] 2015 Noël, V., P. Lefebvre, K. Boye, J. Bargar, K. Maher, J. Lezama-Pacheco, **E.L. Cardarelli**, S. Bone, W.L. Dam, and R.H. Johnson. Combining U speciation and U isotope fractionation to evaluate the importance of naturally reduced sediments in controlling the mobility of uranium in the upper Colorado River Basin American Geophysical Union Fall Meeting, San Francisco, CA.
- [4] 2015 **Cardarelli, E.L.**, J.R. Bargar, K.H. Williams, and C.A. Francis. Subsurface microbial nitrogen-cycling communities of uranium contaminated sites. Department of Energy Environmental System Science PI Meeting, Potomac, M.D.
- [3] 2014 **Cardarelli, E.L.** and C.A. Francis. The abundance and activity of nitrate-reducing microbial populations in estuarine sediments. American Geophysical Union Fall Meeting, San Francisco, CA.
- [2] 2014 \*\*McLean, C., **E.L. Cardarelli**, J.A. Lee, and C.A. Francis. The Impact of Salinity on the Diversity of Microbial Sediment Communities. American Geophysical Union Fall Meeting, San Francisco, CA.
- [1] 2013 **Cardarelli, E.L.** and C.A. Francis. The relative importance of microbial nitrate reduction processes in an agriculturally-impacted estuary. American Geophysical Union Fall Meeting, San Francisco, CA

### OUTREACH ACTIVITIES

- Since 2021 AGU Local Science Partners Ambassador, inaugural cohort of scientists building sustainable partnerships with policymakers, American Geophysical Union. Media coverage: 'AGU welcomes first cohort of Local Science Partners', <https://thebridge.agu.org/2021/12/10/agu-welcomes-first-cohort-of-local-science-partners/>
- Since 2021 Guest Coach, Stanford Polo Team, Stanford University, Stanford, CA.
- 2020-2021 Speaker (monthly), Para Los Ninos Middle School, Los Angeles, CA (100 students)
- 2018 Floodplain dynamics demonstration and discussion, University of San Francisco (12 undergraduate students)



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- 2015, 2016 Host and Tour Guide of Stanford, Hillsdale High School (20 high school students)  
2012-2016 Instructor, GeoKids (1,000 children per year), Stanford University  
2009 Intern, Mayor's Office of Recovery and Development, City of New Orleans, LA  
(developed urban soil science curricula for 24 middle school students)  
2009 Volunteer, Gulf Restoration Network, New Orleans, LA

## FELLOWSHIPS AND AWARDS

- 2021 **Earth Service Award for DEI**, awarded in recognition for outstanding individual efforts and a long-term contribution to advancing DEI at Stanford Earth, Stanford University  
2020 **Community Impact Award**, awarded for dedication and meaningful impact on the Stanford community, Stanford Alumni Association, Stanford University  
2019 **Rising Environmental Leaders Fellow**, Woods Institute for the Environment, Stanford University  
2018 **Preparing Future Professor Fellow**, Vice Provost for Graduate Education, Stanford University  
2016 **Outstanding Achievement in Mentoring Award (\$300)**, Stanford University  
2015 **Student Travel Fellowship (\$2,000)**, Department of Energy, Office of Biological and Environmental Research, Environmental System Science Principal Investigator's Meeting  
2013, 2014 **Graduate Research Fellowship Honorable Mention Recipient in Geobiology**, National Science Foundation  
2013 **Microbial Diversity Course Scholarship (\$6,180)**, National Science Foundation  
2012 **Tulane 34 Award**, given for leadership, service, and academic contributions to the Tulane University community  
2012 **Earth and Environmental Science Senior Honors' Scholar**, awarded for top thesis in Earth and Environmental Science at Tulane University  
2012 **Chairman's Award**, awarded for high academic standing and research contributions in Earth and Environmental Science at Tulane University  
2012 **Harold A. Vokes Award**, awarded for high academic standing in Environmental Science at Tulane University  
2012 **The Under the Oaks Award**, awarded by the Newcomb Institute for advancing women's education at Tulane University  
2012 **Oak Wreath Award**, awarded by the Newcomb Institute for leadership in student activities and contributions to the Newcomb-Tulane community at Tulane University  
2011 **Air and Waste Management Association Scholarship (\$2,000)**, Louisiana Section of the Air and Waste Management Association  
2010 **Certificate of Achievement Award**, Department of the U.S. Army  
2008-2011 **Dean's List**, Dean of Students, Tulane University  
2008-2012 **Tulane Presidential Scholars Award**, Tulane University

## MENTORING AND MANAGING EXPERIENCE

- 2017-2019 Enhancing Diversity in Graduate Education (EDGE) Mentor, Stanford University  
2017, *Summer* Evan Baldonado; Stanford University '23, Stanford Young Investigators Program  
2017, *Summer* Rijul Amin; Thomas Jefferson High School '18, University of Pittsburgh '23  
2017, *Summer* Natalie Wright; STEM teacher researcher, STAR Program  
2017, *Summer* Alexandra Gutierrez; STEM teacher researcher, STAR Program  
2016, *Summer* Kolyne DeJesus; STEM teacher researcher, STAR Program  
2015-2016 Alan Wei; Stanford University '18, Presently: Ph.D. student, Johns Hopkins University  
2015, *Summer* Madison Jackson; University of Miami '17, UC Berkeley-UCSF '18  
2015, *Summer* Emilie Dirck; California State Monterey Bay '17  
2014, *Summer* Craig McLean; University of Arkansas '16, Presently: Ph.D. student, MIT/WHOI

# Emily L. Cardarelli

2014, *Spring* Angela Khov; Sequoia High School '18, UC Davis '22

2015-2018 Lab Manager for the Francis Lab

## UNIVERSITY TEACHING

2019 **Instructor, Course Developer;** EARTH 203: Diversity and Inclusion in the Geosciences, Stanford University, Stanford, CA

- Developed and taught a new course for students in the earth sciences on the value of diversity and inclusion for fostering innovative and interdisciplinary research, now offered annually and the centerpiece of DEI education in the Stanford School of Earth. Through experiential learning, class discussions, and written reflections, students evaluated current practices and identified interventions for broadening participation and improving inclusion. Imagining an initiative an individual could implement that would improve inclusion in the earth sciences, possibly at every level of higher education, the students developed these achievable solutions over the course of the quarter.
- EARTH 203 culminated in a school-wide symposium where students share their projects, which imagine and detail initiatives for current students that improve diversity and inclusion at Stanford and beyond, with their peers.
- **Media coverage:** 'Cultivating diverse communities', <https://earth.stanford.edu/spotlights/cultivating-diverse-communities#gs.s0p42l>

2018 **Teaching Assistant;** ESS 253: Hopkins Microbiology Course, Hopkins Marine Station of Stanford University, Pacific Grove, CA

- Designed new content and laboratory tutorials for an experiential graduate microbiology class focused on applying multivariate statistics to microbial data and environmental metadata.
- Introduced basic coding skills and statistics and taught students how to manipulate existing R programs commonly used to analyze microbial and environmental data concurrently. Integrated student-generated observations from the environment and led enrichment modules for culturing/isolating purple non-sulfur bacteria, among others.

2017 **Guest Lecturer;** Geology 015: Physical Geology, San Jose Community College, San Jose, CA

- Engaged students by integrating their prior knowledge on the Water Cycle in California with figures from scientific papers and figures from my own research and fostered student-guided discussions on ecosystem processes that spatially scale from microbes ( $\mu\text{m}$ ) to watersheds (km) as well as water in the American West.

2017 **Teaching Assistant;** Stanford Earth Young Investigators, Stanford University, Stanford, CA

- Mentored and assisted 17 incoming undergraduate/high school students from a diversity of backgrounds beginning research in the earth sciences.

2013 **Teaching Assistant;** ESS 212: Measurements in Earth Systems, Stanford University, Stanford, CA

- Team-taught incoming interdisciplinary graduate students field-sampling techniques for marine, freshwater, and terrestrial environments. Incorporated microbial and geochemical analytical techniques including DNA/RNA isolation, PCR, and solid-/aqueous-phase chemical characterization using elemental analysis.