Julie COSMIDIS, Ph.D.

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Professional Appointments

July 2017-Present	**Assistant Professor**, Department of Geosciences, Pennsylvania State University Associate, Earth and Environmental Systems Institute, Pennsylvania State University
2014-2016	**Research Associate**, Geomicrobiology Laboratory, Department of Geological Sciences, University of Colorado, Boulder

Education

2010-2013	**Ph.D. in Geochemistry, Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie (IMPMC) and Institut de Physique du Globe de Paris (IPGP)** Title: "Bacterial biomineralization of modern and fossil calcium- and iron-phosphates"
2009-2010	**Master degree in Earth Sciences, Institut de Physique du Globe de Paris (IPGP) and Université Paris Diderot (Paris 7)** Specialization: Geochemistry
2008-2009	**Agrégation in Life and Earth Sciences** National competition for the French higher public education system recruitment
2006-2008	**Bachelor degree in Earth Sciences, Ecole Normale Supérieure (ENS) de Lyon** Specialization: Geochemistry and Geophysics

Professional Training

May-July 2008	**Graduate Research Assistant, Institut de Physique du Globe de Paris (IPGP)**
Jan-March 2008	**Undergraduate Research Assistant, Ecole Normale Supérieure de Lyon (ENS)**
June-July 2007	**Summer Intern, Lunar and Planetary Institute, Houston, Texas**

Awards

2018 **Young Investigator Excellence Award** from the Canadian Light Source

2014 **Prix Haüy-Lacroix** for the best doctoral thesis in Mineralogy, Geochemistry and Material Sciences received from the French Society of Mineralogy and Crystallography (SFMC) and the French Geological Society (SGF)

Grants and Other Funding Awards

2019 **Blue Sky Initiative, Department of Geosciences, Penn State University** (40,000$), "Phosphate recycling from human waste using biomineralizing bacteria: A proof-of-concept study" (PI)

2018 **The Penn State University Energy and Environmental Sustainability Laboratories *Green Bucks* Program** (1,500$), "Time series ion analysis of a meromictic lake to investigate biologically-induced calcium-carbonate whiting production" (PI)

2017 **The Penn State University Energy and Environmental Sustainability Laboratories *Green* Program** ($1,400), "Evaluation of S^0 as a biosignature through investigation of bio- and organomineralized S^0 in laboratory and field experiments" (PI)

2015 **Colorado Advanced Industries Accelerator Program** ($80,000), "Multidimensional sulfur-carbon networks for optimized cathodes in next-generation Li-S batteries" (Co-PI with Prof. Alexis Templeton)

2012 **Institut National des Sciences de l'Univers, French National Center for Scientific Research** (€13,860), "Calcium-phosphate biomineralization by microbial phosphatase enzymes: study of modern and ancient samples" (Proposal co-written with Elodie Duprat and Karim Benzerara, PIs)

2011 **Student travel grant, French Society of Mineralogy and Crystallography** (to the International School on Minerals and Biosphere, Campliglia Marittima, Italy)

Teaching

2017-Present Pennsylvania State University:
GEOSC 497: Analytical Methods in Mineralogy
GEOSC 502: Evolution of the Biosphere
GEOSC 597: Special Topics – Biominerals
GEOSC 202: Chemical Processes in Geology

2010-2013 Teaching Assistant, Université Paris Diderot (Paris 7), Geobiology labs – Graduate level

2010-2013 Teaching Assistant, Université Paris Diderot (Paris 7), Aqueous Geochemistry labs – Undergraduate level

Mentoring

Graduate Students

Fall 2018-Present	Julia Lafond, PhD student Formation and preservation of false biosignatures in Precambrian sulfidic environments
	Claire Webster, PhD student Phosphate recycling and fertilizer production from human waste
2017-2019	Chloe Stanton, MS student Microbially-driven whitings at Fayetteville Green Lake, NY

Post-doctoral Mentoring

2017-2018	Dr. Brandi Cron Kamermans, Distinguished Postdoctoral Fellowship (co-advised with Prof. Jennifer Macalady)

Undergraduate Mentoring and Theses

2019-2020	John Fulgitini - Senior's thesis: "Investigating elemental sulfur formation mechanisms in Green Lake (NY)"
2018-2019	Johanna Jacobson – Senior's thesis: "Experimental investigation of the role of the urease in phosphate minerals precipitation from urine"
	Aiden Price – Senior's thesis: "Formation of protocells from prebiotic organic compounds in sulfidic environments"
2017-2018	Thomas Margetanski – Senior's thesis: "The Efficiency of Different Urine-Isolated *E. coli* Strains in Precipitating Phosphate Minerals"
July-August 2017	Rumya Ravi (Carleton College), co-advised with Dr. Cron Kamermans and Prof. Jennifer Macalady
2010-2012	Supervised four undergraduate students for research projects in Geomicrobiology

PhD or Master thesis committee member

- John Gardiner, Penn State Huck Life Sciences Institute. Advisor: Timothy Meredith.
- Rebecca Payne, Penn State Geosciences. Advisor: Prof. James Kasting.
- Andrew Hyde, Penn State Geosciences. Advisor: Prof. Christopher House.
- Alan Reyes, Penn State Astronomy and Astrophysics. Advisor: Prof. Jason Wright.
- Allison Fox, Penn State Geosciences. Advisor: Prof. Katherine Freeman.
- Gregory Wong, Penn State Geosciences. Advisor: Prof. Christopher House.
- Jared Carte, Penn State Department of Geosciences. Advisor: Prof. Matthew Fantle.
- Si Chen, Penn State Department of Geosciences. Advisor: Prof. Peter Heaney.

PhD thesis defense jury member

Joti Rouillard, "Tracing microfossils in Archean rocks", Institut de Physique du Globe de Paris, École doctorale STEP'UP–ED N°560. Examinator, December 2018.

Service

Departmental Service

2019 **Member of the search committee**, Earth History tenure-track position, Penn State Department of Geosciences

Member of the Strategic Planning committee, College of Earth and Mineral Sciences, Penn State University

2019-present **Ombudsperson for the graduate students**, Penn State Department of Geosciences

2018-present **Member of the Undergraduate Program Committee**, Penn State Department of Geosciences

Editorial service

- **Editorial Board Member**, *Geobiology*
- **Review Editor on the Editorial Board of Microbiological Chemistry and Geomicrobiology** (specialty section of *Frontiers in Chemistry, Frontiers in Earth Science, Frontiers in Environmental Science* and *Frontiers in Microbiology*)
- **Guest editor, Special issue on "Microbial biomineralization"** in *Geosciences*
- **Peer reviewer for:** *Nature Communications, Geobiology, ISME Journal, Precambrian Research, Minerals, Geology, Geochimica et Cosmochimica Acta, Nature Scientific Reports, Colloids and Surfaces B: Biointerfaces, The Science of Nature – Naturwissenschaften, Annales Societatis Geologorum Poloniae*

Conference organization

2020 **Theme coordinator, Goldschmidt Conference, Hawai'i**
"New Approaches in Geochemistry: Nanoscale to Big Data"

2017 **Session convenor, Goldschmidt Conference, Paris, France**
"Microbial biomineralization: mechanisms, impacts and applications"

2015 **Session convenor, Goldschmidt Conference, Prague, Czech Republic**
"Phosphorus biogeochemistry in past and present environments"

Proposal reviews

Reviewer for the Stanford synchrotron (SSRL) competitive time-allocation process
Reviewer and panel member for the NASA postdoctoral program

Public Outreach

2010-2013 **Fête de la Science, Paris, France (annual event)**
Organization of scientific experiments and demonstrations for K12 students

Publications

Citations : >675. h-index : 13.
*: publications by mentees

20. *Cron B, Henri P, Chan C, Macalady J, **Cosmidis J**, Elemental sulfur formation by *Sulfuricurvum kujiense* is mediated by extracellular organic compounds, *Frontiers in Microbiology*, 10, 2710 (2019)

19. Picard A, Gartman A, **Cosmidis J**, Obst M, Vidoudez C, Clarke DR, Girgis PR, Authigenic iron sulfide minerals preserve organic carbon in anoxic environments, *Chemical Geology*, 530, 119343 (2019)

18. *Nims C, Cron B, Wetherington M, Macalady J, **Cosmidis J**, Low frequency Raman Spectroscopy for micron-scale and in vivo characterization of elemental sulfur in microbial samples, *Nature Scientific Reports*, 9, 7971 (2019)

17. **Cosmidis J**, Nims C, Diercks D, Templeton A, Formation and stabilization of elemental sulfur through organomineralization, *Geochimica et Cosmochimica Acta*, 247, 59–82 (2019)

16. Johnson J E, Muhling J R, **Cosmidis J**, Rasmussen B, Templeton A S, Low-Fe(III) Greenalite Was a Primary Mineral from Neoarchean Oceans, *Geophysical Research Letters* (2018)

15. Skouri-Panet F, Benzerara K, **Cosmidis J,** Férard C, Caumes G, De Luca G, Heuilin T, Duprat E, *In Vitro* and *in Silico* Evidence of Phosphatase Diversity in the Biomineralizing Bacterium *Ramlibacter tataouinensis*, *Frontiers in Microbiology*, 8, 2592 (2018)

14. Lau G, **Cosmidis J**, Grasby S, Trivedi C, Spear J, Templeton A, Low-temperature formation and stabilization of rare allotropes of cyclooctasulfur (β-S_8 and γ-S_8) in the presence of organic carbon at a sulfur-rich glacial site in the Canadian High Arctic, *Geochimica et Cosmochimica Acta*, 200, 218–231 (2017)

13. **Cosmidis J,** Templeton A, Self-assembly of biomorphic carbon/sulfur microstructures in sulfidic environments, *Nature Communications*, 7, 12812 (2016)

12. Li J, Margaret-Oliver I, Cam N, Boudier T, Blondeau M, Leroy E, **Cosmidis J**, Skouri-Panet F, Guigner J-M, Ferard C, Poinsot M, Moreira D, Lopez-Garcia P, Cassier-Chauvat C, Chauvat F, Benzerara K, Biomineralization patterns of intracellular carbonatogenesis in cyanobacteria: Molecular hypotheses, *Minerals*, 6:1, 10 (2016)

11. **Cosmidis J**, Benzerara K, Guyot F, Skouri-Panet F, Duprat E, Férard C, Guigner J-M, Babonneau F, Coehlo C, Calcium-phosphate biomineralization induced by alkaline phosphatase activity in *Escherichia coli*: localization, kinetics and potential signatures in the fossil record, *Frontiers in Earth Science*, 3, 84 (2015)

10. Jain R, Seder-Colomina M, Jordan N, Dessi P, **Cosmidis J**, van Hullebusch E, Weiss S, Farges F, Lens P, Entrapped elemental selenium nanoparticles affect physicochemical properties of selenium fed activated sludge, *Journal of hazardous materials*, 295, 193–200 (2015)

9. Zatoń M, Niedźwiedzki G, Marynowski L, Benzerara K, Pott C, **Cosmidis J**, Krzykawski T, Filipiak P, Coprolites of Late Triassic carnivorous vertebrates from Poland: An integrative approach, *Palaeogeography Palaeoclimatology Palaeoecology*, 430, 21–46 (2015)

8. **Cosmidis J**, Benzerara K, Nassif N, Tyliszczak T, Bourdelle F, Characterization of Ca-phosphate biological materials by Scanning Transmission X-ray Microscopy (STXM) at the Ca $L_{2,3}$-, P $L_{2,3}$- and C K-edges, *Acta Biomaterialia*, 12, 260–269 (2015)

7. Li J, Bernard S, Benzerara K, Beyssac O, Allard T, **Cosmidis J**, Moussou J, Impact of biomineralization on the preservation of microorganisms during fossilization: An experimental perspective, *Earth and Planetary Science Letters*, 400, 113–122 (2014)

6. Benzerara K, Skouri-Panet F, Li J, Ferard C, Gugger M, Laurent T, Couradeau E, Ragon M, **Cosmidis J**, Menguy N, Margaret-Oliver I, Tavera R, Lopez-Garcia P, Moreira D, Intracellular Ca-carbonate biomineralization is widespread in cyanobacteria, *Proceedings of the National Academy of Sciences*, 111, 10933–10938 (2014).

5. **Cosmidis J**, Benzerara K, Morin G, Busigny V, Jézéquel D, et al., Biomineralization of iron phosphates in the anoxic water column of Lake Pavin (Massif Central, France), *Geochemica et Cosmochemica Acta*, 126:78–96 (2014).

4. **Cosmidis J**, Benzerara K, Menguy N, Arning E, Microscopy evidence of bacterial microfossils in phosphorite crusts of the Peruvian shelf: implications for phosphogenesis mechanisms, *Chemical Geology*, 359, 10–22 (2013)

3. Baumgartner J, Morin G, Menguy N, Perez Gonzalez T, Widdrat M, **Cosmidis J**, Faivre D, Magnetotactic bacteria form magnetite from a phosphate-rich ferric hydroxide via nanometric ferric (hydr)oxide intermediates, *Proceedings of the National Academy of Sciences*, 110, 14883–14888 (2013)

2. Bourdelle F, Benzerara K, Beyssac O, **Cosmidis J**, Neuville D R, Brown G E Jr., Paineau E, Quantification of the ferric/ferrous iron ratio in silicates by scanning transmission X-ray microscopy at the Fe L2,3 edges, *Contributions to Mineralogy and Petrology*, 166, 423–434 (2013)

1. **Cosmidis J**, Benzerara K, Gheerbrant E, Estève I, Bouya B and Amaghzaz M, Nanometer scale characterization of exceptionally preserved bacterial fossils in Paleocene phosphorites from Ouled Abdoun (Morocco), *Geobiology*, 11:2, 139–153 (2013)

Book Chapters

2. Busigny V, Jézéquel D, **Cosmidis J**, Viollier E, Benzerara K, Planavsky N, Albéric P, Lebeau O, Sarazin G and Michard G, The Iron Wheel in Lac Pavin: Interaction with Phosphorus Cycle. In: *Lake Pavin: History, biogeochemistry, and sedimentology of a deep meromictic maar lake*, T Sime-Ngando, P Boivin, E Chapron, D Jezequel, and M Meybeck (eds.), Springer International Publishing, pp. 205–220 (2016)

1. **Cosmidis J,** Benzerara K, Soft X-ray Scanning Transmission Micro-Spectroscopy, In: *Biomineralization Sourcebook: Characterization of Biominerals and Biomimetic Materials*, Laurie Gower and Elaine DiMasi (eds.), Taylor and Francis, London, pp. 115–133 (2014)

Submitted articles *(manuscript available upon request)*

*Nims C, Lafond J, Alleon J, Templeton A, **Cosmidis J,** Experimental silicification of organic biomorphs: questioning the early microfossil record. Submitted to *PNAS.*

Bralower T, **Cosmidis J**, Fantle M, Lowery C, et al., The habitat of the nascent Chicxulub crater. Submitted to *AGU Advances*.

Bralower T, **Cosmidis J**, Heaney P, Kump L, et al., Global microbial blooms during the immediate aftermath of the Cretaceous-Paleogene boundary impact. In review at *Nature Geosciences*.

Patents

Cosmidis J and Templeton A, "Sulfur-Carbon Tubes and/or Spheres, and Methods of Making Same", International Patent Application Published under the Patent Cooperation Treaty, International Application No. PCT/US2016/047180, filed on August 16, 2016

Cosmidis J and Templeton A, "Novel Sulfur-Carbon Tubes and/or Spheres, and Methods of Making Same", US Patent and Trademark Office Provisional Application No. 62/205,960, filed on August 17, 2015

Selected Conference Abstracts

Invited: Cosmidis J, Cron B, Macalady J, Investigating the role of extracellular organics in microbial sulfur formation, ACS National Meeting, Philadelphia, PA, March 2020.

Invited: Cosmidis J, The Role of Microbial Organics in Elemental Sulfur Formation, Geobiology Gordon Research Conference, Galveston, TX, January 2020.

Invited: Cosmidis J, Nims C, Lafond J, Kamermans B, Macalady J, Templeton A, How to fabricate a microfossil: new insights on the formation and preservation of false microbial biosignatures in the rock record. Geological Society of America Annual Meeting, Phoenix, AZ, September 2019.

Invited: Cosmidis J, Kamermans B, Macalady J, Microbial formation of extracellular S(0) minerals: the role of organic-minerals interactions. Geobiology Society Conference, Banff, Canada, June 2019.

Stanton C, **Cosmidis J**, Kump L, Field and Laboratory Investigations of Bio-induced Calcium-carbonate Precipitation Mechanisms at the Origin of Whiting Events. AGU Fall Meeting, Washington, DC, December 2018.

Invited: Cosmidis J, Nims C, Kamermans B, Macalady J, Templeton A. S(0) Formation Mechanisms in the Proterozoic Ocean – Potential Signatures in the Rock Record. Goldschmidt Conference, Boston, MA, August 2018.

Nims C, **Cosmidis J**. Experimental Silicification of Sulfur-Oxidizing Bacteria and Carbon-Sulfur Biomorphs. Goldschmidt Conference, Boston, MA, August 2018.

Kamermans B, **Cosmidis J**, Templeton A, Macalady J. Evaluation of S^0 as a Biosignature in Laboratory and Field Experiments. Goldschmidt Conference, Boston, MA, August 2018.

Invited: Cosmidis J. "True" and "False" Biosignatures. Workshop: "Puzzles and Solutions in Astrobiology", Earth-Life Science Institute (ELSI), Tokyo, Japan, May 2018.

Keynote: Cosmidis J, Templeton A, Benzerara K, Skouri-Panet F, Duprat E, Macalady J. Chemistry Versus Biology – "True" and "False" Biosignatures Formed Through Biomineralization and Organomineralization Processes. Goldschmidt Conference, Paris, France, August 2017.

Invited: Cosmidis J, Nims C, Lau G, Kane T, Templeton A. Sulfur Organomineralization: Significance and Mechanism. Goldschmidt Conference, Paris, France, August 2017.

Benzerara K, Cam N, **Cosmidis J**, Duprat E, Garcia-Lopez P, Moreira D, Saghai A, Skouri-Panet F, Zeyen N. Microbial calcification in the rock record: learning from field- and laboratory-based studies down to the nm-scale. Goldschmidt Conference, Yokohama, Japan, June 2016.

Cosmidis J, Templeton A. A novel elemental sulfur biomineralization mechanism. Goldschmidt Conference, Prague, Czech Republic, August 2015.

Templeton A, Lau G, **Cosmidis J**, Trivedi C, Spear J, Grasby S. Sulfur oxidation and biomineralization processes in sulfidic ice ecosystems. Goldschmidt Conference, Prague, Czech Republic, August 2015.

Benzerara K, **Cosmidis J**, Miot J, Bourdelle F, Swaraj S. Spectromicroscopy study of mineral-microbe interactions by soft x-ray scanning transmission x-ray microscopy. 9 ème édition des Journées de l'EELS, Roscoff, France, June 2014.

Morin G, Adra A, **Cosmidis J**, Dublet G, Maillot F, Noël V, Benzerara K, Fritsch E, Juillot F, Ona-Nguema G. Structure and reactivity of iron minerals in the environment. ENVIronmEnt at SOLEIL 2014, Soleil Synchrotron, Saint Aubin, France, May 2014.

Cosmidis J, Benzerara K, Morin G, Busigny V, Jézéquel D, et al. Bacterial formation of Fe-phosphates in the water column of meromictic ferruginous Lake Pavin (Massif Central, France). Goldschmidt Conference, Florence, Italy, August 2013.

Cosmidis J, Benzerara K, Morin G, Busigny V, Jézéquel D, et al. Bulk EXAFS And STXM Study Of Bacterially Formed Fe-Phosphates In The Water Column Of the Meromictic Lake Pavin (Massif Central, France). Soleil User Meeting, Soleil Synchrotron, Saint Aubin, France, January 2013.

Benzerara K, **Cosmidis J**, Li JH Sr, Miot J, Couradeau E. Biomineralization and Fossilization of Bacteria: what do we learn from field and experimental studies? GSA annual meeting, Charlotte, USA, November 2012.

Cosmidis J, Benzerara K, Estève I, Gheerbrant E. Nanometer Scale Characterization of Fossil Bacteria in a Paleocene Phosphorite Sample. Goldschmidt Conference, Montreal, Canada, June 2012.