

Cecilia B. Sanders

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Education

- 2018 – present **Ph.D. Candidate in Geobiology, Caltech** Geological and Planetary Sciences.
Working thesis title: *The writing of a microbial fossil record in authigenic francolite, chert, and carbonate – Insights from sedimentology, stratigraphy, and microanalysis of Precambrian rocks.*
- 2016 – 2018 **M.Sc. Planetary Science, Caltech** Geological and Planetary Sciences.
- 2012 – 2016 **B.A. Earth and Planetary Sciences and Astrophysics, Harvard University**
Senior thesis title: *Impact gardening as a mechanism for hydrothermal alteration and atmospheric evolution on Noachian Mars.*
Junior thesis title: *When planets breathe – Models constrain the circumstances for detection of biomarker gases on the terrestrial exoplanets of M Dwarfs.*

Research Experience

- 2018 – present **Exploring mechanisms of phosphogenesis in Ediacaran Carbonate formations of the Sao Francisco Craton, Eastern Brazil, through sedimentology, stratigraphy, petrography, and microanalytical methods.** Caltech Division of Geological and Planetary Sciences. Advised by Prof. John Grotzinger.
- 2016 – 2018 **Cultivation and detection of microbial biosignatures on Mars-analog materials.** Caltech Division of Geological and Planetary Sciences. Advised by Profs. Bethany Ehlmann and Victoria Orphan.
- 2016 – 2019 **SIMS analysis for C-isotopes of microfossils in Gunflint Chert.** Caltech Division of Geological and Planetary Sciences. Advised by Prof. John Grotzinger and Kenneth Williford.
- 2015 – 2016 **Combined petrographic and theoretical study of meteor impacts as drivers of hydrothermal processes on Noachian Mars and analogs.** Harvard University Department of Earth and Planetary Sciences. Advised by Profs. Robin Wordsworth and Francis Macdonald.
- 2014 – 2015 **Modeling of transmission spectra of oxygen- and methane-bearing atmospheres of Earth-like planets around M-dwarf stars.** Harvard-Smithsonian Center for Astrophysics. Advised by Prof. David Charbonneau.
- Summer 2014 **Modeling of argon-trapping by amorphous ices in solar nebulae: a possible mechanism for noble-gas delivery to young planets.** University of Chicago, Leadership Alliance. Advised by Prof. Fred Ciesla.
- 2013 – 2014 **Preparation of samples for rare sulfur isotope analysis.** Harvard University Department of Earth and Planetary Sciences. Advised by Prof. David Johnston.
- Summer 2013 **Characterization of Mars-analog geological samples using remote IR spectroscopy.** Caltech Division of Geological and Planetary Sciences, Jet Propulsion Laboratory, Summer Undergraduate Research Fellowship (SURF) Program. Advised by Prof. Bethany Ehlmann and Glenn Sellar.

Research Experience (continued)

- Summer 2012 **Remote detection of methane on Mars via echelle spectroscopy data from Keck2.** NASA Goddard Space Flight Center, Center for Astrobiology. Advised by Geronimo Villanueva.
- Summer 2011 **Characterization of surface ices on Saturn's icy moons via Cassini's Composite Infrared Spectrometer data.** NASA Goddard Space Flight Center. Advised by Terry Hurford.

Research Publications

Journal Articles

- 1 **Sanders, C. B., & Grotzinger, J. P.** (2021). Sedimentological and stratigraphic constraints on depositional environment for Ediacaran carbonate rocks of the São Francisco Craton. *Precambrian Research*, 363. <https://doi.org/10.1016/j.precamres.2021.106328>
- 2 Wordsworth, R., Kalugina, Y., Lokshtanov, S., Viagasın, A., Ehlmann, B., Head, J., **Sanders, C. B., & Wang, H.** (2014). Transient reducing greenhouse warming on early Mars. *Geophysical Research Letters*, 44(2), 665–671. <https://doi.org/10.1002/2016GL071766>
- 3 **Sanders, C. B., & Grotzinger, J. P.** (in prep). Paragenesis of salitre formation phosphorites: Insights from clumped isotopes in carbonate and phosphate.


Conference Proceedings

- 1 **Sanders, C. B., Orphan, V. J., Ehlmann, B. L., & Grotzinger, J. P.** (2019). Oral Presentation: Sweet Honey in the Rock – Cultivating and characterizing the biosignatures of chemolithotrophic microorganisms on Mars analog substrates, In *16th Annual Southern California Geobiology Symposium*, Pasadena, CA.
- 2 **Sanders, C. B., Orphan, V. J., Ehlmann, B. L., & Grotzinger, J. P.** (2018a). Poster: Sweet Honey in the Rock – Cultivating and characterizing the biosignatures of chemolithotrophic microorganisms on Mars analog substrates, In *American Geophysical Union Fall Meeting 2018*, Washington, DC.
- 3 **Sanders, C. B., Orphan, V. J., Ehlmann, B. L., & Grotzinger, J. P.** (2018b). Poster: Sweet Honey in the Rock – Cultivating and characterizing the biosignatures of chemolithotrophic microorganisms on Mars analog substrates, In *Simons Collaboration on the Origins of Life*, New York, NY.
- 4 **Sanders, C. B., & Wordsworth, R.** (2016). Oral presentation: Impact gardening as a mechanism for hydrothermal alteration and atmospheric evolution on Noachian Mars (ABSTRACT 2634), In *47th lunar and planetary science conference*, The Woodlands, TX.
- 5 **Sanders, C. B., & Ciesla, F.** (2014). Poster: Explaining the noble gas content of the planets – Theoretical models for argon-trapping by amorphous ices in the solar nebula, In *American Geophysical Union Fall Meeting (ICEE 2014)*, San Francisco, CA.

Skills




- Analytical Methods **SEM/EDS/EBSD, XRF, Raman Spectroscopy, IR Spectroscopy, SIMS/nanoSIMS, GCMS, Optical Petrography / Thin Section Microscopy, chemical assays for sulfur and iron species, maintenance of microbial cultures, and preparation of mineralogical and biological samples for any of the previously listed methods, and field geology (campaign logistics, mapping, description, measurement, and sample collection).**
- Coding **Python, Matlab, L^AT_EX**

Skills (continued)











- Misc.  Scientific writing, hand and digital illustration, graphic design (logos, posters, documents, infographics), public speaking, in-classroom teaching (K-12, undergraduate, and graduate-level courses)

Miscellaneous

Awards and Achievements

- 2016 – present  **NSF Graduate Research Fellowship**, National Science Foundation.
- 2020  **Award for educational outreach**, Caltech Division of Geological and Planetary Sciences.
- 2015  **Leo Goldberg Prize in Astronomy**, Harvard-Smithsonian Center for Astrophysics. Junior thesis award.

Outreach, Teaching, and Science Communication

- 2017 – present  **Visiting Scientist Program.** *Caltech Center for Teaching, Learning, and Outreach (CTLO) and Pasadena Unified School System (PUSD).* Science curriculum design and both in-person and virtual in-class teaching experience with Grades K-5.
-  **Science Night Exhibitions.** *Caltech Center for Teaching, Learning, and Outreach (CTLO) and Pasadena Unified School System (PUSD).* Series of extra-curricular STEM expos for K-12 students and families in Pasadena.
- 2018 – 2019  **Teaching Assistant.** *Caltech Division of Geological and Planetary Sciences. Ge 11b/104: Introduction to Geobiology.*
- Jul. 2019  **Caltech Astro Virtual Lecture Series.** *Caltech Astronomy.* Virtual public lecture. *You'll know it when you see it: Defining, describing, and detecting life in the universe.* <https://youtu.be/VyzQpk2m5Hk>
- Jun. 2019  **Real Science.** CaltechLive! virtual public talk, discussion mediation for Grades 3-8. *Beyond Bones: Interrogating the fossil record of small, soft, profoundly Earth-shaping organisms in the Precambrian.*
- Nov. 2019  **Southern California Paleontological Society Lecture Series.** Public lecture for all ages. *Micropaleontology: Interrogating the fossil record of small, soft, profoundly Earth-shaping organisms in the Precambrian.*
- May 2019  **Astronomy On Tap – Los Angeles.** Public talk. *Pebbles on the shore: Reconstructing ancient alien habitats on Earth and Mars.*
- Apr. 2019  **Science Symposium Talk.** Lecture at Sequoyah High School Science Symposium. *Geomicrobiology.*
-  **Reel Science.** CaltechLive! Public talk, discussion mediation for Grades 3-8. *Galapagos: The islands that changed the world.*
- Feb. 2017  **Caltech Astro Lecture Series.** *Caltech Astronomy.* Panelist, facilitating discussion after public lecture. *The Science of Star Trek – Michael Wong, Ph.D.*

References

Available on Request