

Devan Nisson

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Education

Princeton University (2020 -)

Princeton, NJ

Doctor of Philosophy (PhD) Candidate in Geosciences (In progress)

Advisor(s): Dr. Tullis Onstott (Sept. 2018 - Oct. 2021; deceased), Dr. Bess Ward (Oct. 2021 -)

Princeton University (2018 –2020)

Princeton, NJ

Masters (M.A.) in Geosciences

Advisor: Dr. Tullis Onstott

University of California, Irvine (2014 - 2018)

Irvine, CA

Bachelor of Science (BS with Honors) in Ecology and Evolutionary Biology

Magna Cum Laude

Advisor: Dr. Steven Allison

Research Interests

I am interested in the taxonomic diversity and metabolic functioning of halophilic microbial communities of the deep terrestrial subsurface, and how current community adaptations to extreme salinity, pressure, and temperature can reveal the evolutionary history of early life. Specifically, I employ a combination of metagenomic and environmental geochemical analysis to understand how community major metabolic groups change with increasing depth, and what these changes signal regarding the origins and development of subsurface life across the geologic time scale. Additionally, due to similarities in subsurface abiotic conditions with those of extraterrestrial environments, I explore how deep life hosting habitats can serve as analogues for potential life-harboring environments on Mars and beyond.

Research and Professional Experience

Graduate Research Assistant

September 2018 –

Department of Geosciences, Princeton University. Princeton, NJ.

Advisor(s): Dr. Tullis Onstott (Sept. 2018 - Oct. 2021; deceased), Dr. Bess Ward (Oct. 2021 -)

Bio 199 Undergraduate Research Student

March 2016 – June 2018

Department of Ecology and Evolutionary Biology, University of California, Irvine. Irvine, CA.

Advisor: Dr. Steven Allison

Student Research Assistant

September 2016 – March 2017

Department of Ecology and Evolutionary Biology, University of California, Irvine. Irvine, CA.

Peer-Reviewed Publications

- Nisson, D.M.**, Kieft, T.L., Drake, H., Warr, O., Sherwood Lollar, B., Ogasawara, H., Perl, S.M., Friefeld, B.M., Castillo, J., Whitehouse, M.J., Kooijman, E., Onstott, T.C., Hydrogeochemical and Isotopic Signatures Elucidate Deep Subsurface Hypersaline Brine Formation through Radiolysis Driven Water-Rock Interaction, *Geochimica et Cosmochimica Acta* (2022), doi: <https://doi.org/10.1016/j.gca.2022.11.015>
- Warr O., C.J. Ballentine, T.C. Onstott, **D.M. Nisson**, T.L. Kieft, D.J. Hillegonds, B. Sherwood Lollar (2022) ^{86}Kr excess and other noble gases identify a billion-year-old radiogenically-enriched groundwater system. *Nature Communications*. 13: 3768. <https://doi.org/10.1038/s41467-022-31412-2>.
- Warr O., T. Giunta, T.C. Onstott, T.L. Kieft, R.L. Harris, **D.M. Nisson**, B. Sherwood Lollar (2021) The role of low-temperature ^{18}O exchange in the isotopic evolution of deep subsurface fluids. *Chemical Geology*. p.120027. <https://doi.org/10.1016/j.chemgeo.2020.120027>.
- Nisson D.M.**, S.D. Allison (2020) Litter microbial respiration and enzymatic resistance to drought stress. *Elementa: Science of the Anthropocene*. 8:45. <https://doi.org/10.1525/elementa.442>.

In Review or Working Publications

- Nisson, D.M.**, Walter C.C., Chacon, M., Weisbrod, C., Kieft, T.L., Sherwood Lollar, B., Warr, O., Castillo, J., Perl, S., Cason, E., Freifeld, B.M., Onstott, T.C. Organic matter contributes to limited habitability in an ancient, thermal, and radiogenic subsurface brine. *In prep*.
- Liu, W., Chen, Y., Peng, Z., Chang, P., Liu, C., **Nisson, D.**, Ru, J. Soil extracellular enzyme kinetics of V_{max} and K_m drive soil microbial respiration responses to altered precipitation. *Biology and Fertility of Soils*. *In Review*.

Other Academic Publications and White Papers

- Alfonso D., Cable M., Catling D., Cleaves J., Eigenbrode J., **Nisson D.**, Nuevo M., Johnson S., Steele A., Stern J. 2020. Astrobiology on Mars: Organic Chemical Evolution on an Earth-like Planet. National Academy of Sciences Planetary Science and Astrobiology Decadal Survey, 2023 - 2033.
- Nisson, D.M.**, S.D. Allison. 2019. Adaptive Metabolic Response of Desert Microorganisms to Drought and Moisture Pulses. UCI Undergraduate Research Journal. *The Journal* Vol. XXVII.

Presentations

- T. Kieft, B. Sherwood Lollar, O. Warr, M. Chacon, R. Rogers, C. Walters, **D. Nisson**. The Legacy of T.C. Onstott: Investigations into Geomicrobiology of the Witwatersrand Basin and their Applications to Astrobiology. (2022) International Symposium on Microbial Ecology (ISME), Lausanne, Switzerland, 14-19 August. (Oral).
- S.M. Perl, **D.M. Nisson**, T.C. Onstott. Detections and Validations of Single Cell Microorganism Preservation and Associated Biosignature Activity. (2022) AbSciCon, Atlanta, GA, May 15-20. (Oral).
- D.M. Nisson**, C. Walters, M. Chacon, T.L. Kieft, R. Liang, B. Sherwood Lollar, O. Warr, T.C. Onstott. Abiotic Organic Chemistry in an Ancient Hypersaline Brine: Evaluating Bioenergetic Support for Microbial Life Inhabiting 3.2km Deep Fracture Fluid in South

- Africa. (2022) Princeton High Meadows Environmental Institute Research Discovery Day, Princeton, NJ, April 27th. (Poster).
- D.M. Nisson**, T.L. Kieft, J. Hernandez, S. Perl, R. Stepanauskas, O. Warr, B. Sherwood Lollar, R. Yokochi, G. Chmiel, M. Caffee, B. Liebenberg, T.C. Onstott. Influence of Alpha Particle Radiolysis on the Formation and Microbial Metabolic Composition of a Deep Subsurface Hypersaline Brine in the Witwatersrand Basin, South Africa. (2021) American Geophysical Union Fall Meeting, New Orleans, December 13-17. (Oral).
- S.M. Perl, A.J. Celestian, C.S. Cockell, C. Basu, J. Filiberto, S. Potter-McIntyre, K. Olsson-Francis, S.P. Schwenzer, J.R. Crandall, B.K. Baxter, T.C. Onstott, J. Bowman, K. Bywaters, M. Winzler, J. Valera, Z. Cooper, **D. Nisson**, M. Garner, B. Baharier, P. Tasoff. (2021). Preservation of Dynamic Biological Processes From Extant Halophilic Life: In-Situ Lessons Learned From Planetary Analogue Brines And Evaporites. LPI Modern Brines Virtual Meeting, October 25-28. (Oral).
- Nisson, D.**, Warr, O., Lollar, B.S., Kieft, T.L. and Onstott, T.C. 2020. The Impact of High Salinity on Radiolytic H₂ Yield and the Evolution of Subsurface Brine. American Geophysical Union Fall Meeting. (Poster and Oral).
- Warr, O., Ballentine, C.J., Onstott, T.C., **Nisson, D.**, Kieft, T.L. and Lollar, B.S. 2020. Novel Radiogenic Noble Gas Signatures in the Crust: The Krypton Factor. American Geophysical Union Fall Meeting. (Oral).
- Warr O., Giunta T., Onstott T.C., Kieft T.L., Harris R.L., **Nisson D.**, Sherwood Lollar, B. 2020. Subsurface ¹⁸O Exchange at Low Temperatures: The (GMWL) Plot Thickens. Goldschmidt Annual Meeting. (Oral).
- Ogasawara H., B. Liebenberg, Y. Yabe, Y. Yokoyama, T. Hirono, **D.M. Nisson**, T.C. Onstott, T.L. Kieft, E. van Heerden, T. Wiersberg, T. Noda, M.S.D. Manzi, S.B. Mngadi, R.J. Durrheim, Y. Yamamoto, T. Ito, A. Funato, M. Ziegler, J.J. Mori, C. Dinske, and the ICDP DSeis team. 2020. The seismogenic zones of an M2.0-5.5 earthquakes successfully recovered in deep South African gold mines: the outcomes and the follow-up plan. European Geophysical Union Spring Meeting. Vienna, Austria. (Oral). Postponed due to COVID-19.
- Nisson, D.M.**, Kieft, T.L., Warr, O., Walters, C.C., van Heerden, E., Cason, E.D., Hernandez, J.C., Vermeulen, J., Freifeld, B., Ogasawara, H., Durrheim, R.J., Lollar, B.S., Liebenberg, B., Onstott, T.C. 2019. Abiotic (Prebiotic?) Organic Chemistry in a Potentially Ancient Hypersaline Brine: New Insights on the Limits of Microbial Life Inhabiting 3.1 km Deep Fracture Fluid in South Africa. American Geophysical Union Fall Meeting. San Francisco, CA. (Poster).
- Onstott, T.C., Kieft, T.L., **Nisson, D.**, Warr, O., Lollar, B.S., Freifeld, B.M., Lau, C.Y.M., Ogasawara, H., Webb, S.J., Garvin, Z.K. and Harris, R.L.L., 2019. Deep subsurface, Precambrian hypersaline environments as training sites for exploration of the Martian subsurface. American Geophysical Union Fall Meeting. San Francisco, CA.
- Onstott, T.C., B.L. Ehlmann, H. Sapers, J. Marlow, M. Ivarsson, A. Neubeck, **D. Nisson**, R. Harris, Z. Garvin, P. Niles, and M. Coleman. 2018. How Mars 2020 Could Look for Life in the Noachian Stratigraphy at NE Syrtis or Midway. Fourth Mars 2020 Landing Site Workshop. Glendale, CA. (Oral).
- Nisson, D.M.**, S.D. Allison. 2018. Adaptive Metabolic Response of Desert Microorganisms to Drought and Moisture Pulses. UCI Excellence in Research Symposium, Ecology and Evolutionary Biology. Irvine, CA. (Poster and Oral).

Nisson, D.M., S.D. Allison. 2017. Adaptive Metabolic Ability of Desert Microbial Communities to Rapidly Decompose Litter when Triggered by Sudden Moisture Availability. UCI Undergraduate Research Opportunities Symposium. Irvine, CA. (Poster).

Awards

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| Princeton HMEI Walbridge Fund Graduate Award for Environmental Research | 2021 |
| Laura Bassi Scholarship | 2021 |
| National Science Foundation Graduate Research Fellowship | 2020-2025 |
| NASA Astrobiology Early Career Collaboration Award | 2018-2019 |
| UCI Departmental Award - Excellence in Research in Biological Sciences | 2018 |
| Honorable Mention, National Science Foundation Graduate Research Fellowship | 2018 |
| Rose Hills Undergraduate Science and Engineering Scholarship Recipient | 2016-2017 |
| Dean's Honor List | 2014-2018 (All Quarters) |

Grants

NASA Jet Propulsion Laboratory Strategic University Research Partnerships Program.
(SURP). "Exploring abiotic constraints on microbial habitability in subsurface hypersaline brines". Student External Investigator. (JPL Co-I Dr. Scott Perl) 2020-2023
Undergraduate Research Opportunities Program Grant Recipient 2017

Mentoring and Teaching Experience

"Science Mondays": New York City Department of Education May 2021

I shared my career development as a scientist and discussed strategies to pursue an advanced degree in STEM fields with 5th graders in an accelerated learning program run by Anne Orenstein in Brooklyn, New York.

Assistant in Instruction – Life in the Universe

Department of Geosciences, Princeton University; Department of Astronomy, Princeton University; Department of Chemistry, Princeton University September 2019 – January 2020

Assistant in teaching Princeton University Undergraduates for the course Life in the Universe, where I hosted paper discussions and assisted with course material concerning formation and chemistry of potentially habitable extraterrestrial bodies as well as looking for extremophile microbial candidates and biosignatures on Earth that could assist in the search for life.

Peer Scholars Program Mentor May 2017—September 2017

Scholarship Opportunities Program, University of California, Irvine

Mentoring a UCI STEM undergraduate female and minority student and prospective national scholarship applicant.

Biology Peer Tutor – Molecular Biology April 2017 – June 2017

Biological Sciences Peer Tutoring, University of California, Irvine

Assisted in teaching UC Irvine Undergraduates for the course Molecular Biology, where I hosted office hours and assisted with teaching course material on basic molecular techniques and cellular processes.

Biological Sciences Student Council Member January 2016 – June 2017

Biological Sciences Student Council, University of California, Irvine

Served as an undergraduate representative for the UCI School of Biological Sciences.

American Association for the University Women (AAUW) Volunteer October 2013 -

I serve as a counselor and mentor for the American Association of the University Women (AAUW) and its Tech Trek STEM program for young girls (6-8th grade) interested in math and the sciences. My role with the AAUW organization has been to share my own experiences as a past Tech Trek member and how I came to pursue advanced degrees in STEM fields.

Field Work

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| Boulby Mine and Underground Laboratory, Whitby, England | 2022 |
| Moab Khotsong Mine, Orkney, South Africa | 2019, 2020 |
| University of California Natural Reserve System (Boyd Deep Canyon, Burns Piñon, and James Woods Reserves) | 2016 |

Professional Societies and Memberships

Sigma Xi
American Geophysical Union (AGU)
International Society for Microbial Ecology (ISME)
NASA Astrobiology Network for Life Detection (NfoLD)
Future Leaders of Ocean Worlds (FLOW)