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INSTAAR Research Scientist 1
Institute of Arctic and Alpine Research
University of Colorado
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Boulder, CO 80302

EDUCATION

Boston University, Boston MA
Major: Earth Sciences, Minor: Mathematics
B.A., summa cum laude, 2012
Thesis advisor: Dr. Andrew Kurtz

University of Rochester, Rochester NY
Major: Geosciences
Ph.D., 2020
Thesis advisor: Dr. Vasilii V. Petrenko

PROFESSIONAL APPOINTMENTS

2023-present : Research Scientist 1, Institute of Arctic and Alpine Research
2020-2023 : Postdoctoral researcher, Niels Bohr Institute – Physics of Ice Climate and Earth
2012-2020 : Research and teaching assistant, University of Rochester

AWARDS

2020 (offer declined) : Marie Skłodowska-Curie Individual Postdoc Fellowship, University of Bern
2012 : Departmental Honors, Boston University Department of Earth Sciences
2008-2012 : Boston University Dean's List

PUBLICATIONS

In review

- Hmiel, B., Petrenko, V. V., Buizert, C., Smith, A. M., **Dyonisius, M. N.**, Place, P., ... & Murray, L. T. (2023). Characterization of in situ cosmogenic ¹⁴C production, retention and loss in firn and shallow ice at Summit, Greenland. *The Cryosphere Discussions*, 2023, 1-27.
- Petrenko, V. V., BenZvi, S., **Dyonisius, M.N.**, Hmiel, B., Smith, A. M., & Buizert, C. (2024). The potential of in situ cosmogenic ¹⁴C in ice cores as a proxy for galactic cosmic ray flux variations. *EGU Sphere*, 2024, 1-18.

Published

- Nisbet, E.G., Manning, M.R., Dlugokencky, E.J., Michel, S.E., Lan, X., Röckmann, T., Denier van der Gon, H.A., Schmitt, J., Palmer, P.I., **Dyonisius, M.N.** and Oh, Y., 2023. Atmospheric methane: Comparison between methane's record in 2006–2022 and during glacial terminations. *Global Biogeochemical Cycles*, 37(8)
- Brosius, L. S., Walter Anthony, K. M., Treat, C. C., Jones, M. C., **Dyonisius, M.N.** & Grosse, G. (2023). Panarctic lakes exerted a small positive feedback on early Holocene warming due to deglacial release of methane. *Nature Communications Earth & Environment*, 4(1), 271
- Dyonisius, M.N.**, Petrenko, V., Smith, A., Hmiel, B., Neff, P., Yang, B., ... & McConnell, J. (2023). Using ice core measurements from Taylor Glacier, Antarctica to calibrate in situ cosmogenic ¹⁴C production rates by muons. *The Cryosphere*, 17(2), 843-863
- Menking, J.A., Shackleton, S.A., Buffen, A., Bauska, T.K., Brook, E.J., Barker, S., Severinghaus, J.P., **Dyonisius, M.N.**, Petrenko, V.V. (2022). Multiple Carbon Cycle Mechanisms Associated with The Glaciation of Marine Isotope Stage 4. *Nature communications*, 13(1), 5443
- Shackleton, S., Menking, J. A., Brook, E., Buizert, C., **Dyonisius, M.N.**, Petrenko, V. V., ... & Severinghaus, J. P. (2021). Evolution of mean ocean temperature in Marine Isotope Stage 4. *Climate of the Past*, 17(5), 2273-2289.
- Dyonisius, M.N.**, Petrenko, V. V., Smith, A. M., Hua, Q., Yang, B., Schmitt, J., ... & Weiss, R. F. (2020). Old carbon reservoirs were not important in the deglacial methane budget. *Science*, 367(6480), 907-910.
- Hmiel, B., Petrenko, V. V., **Dyonisius, M.N.**, Buizert, C., Smith, A. M., Place, P. F., ... & Dlugokencky, E. (2020). Preindustrial ¹⁴CH₄ indicates greater anthropogenic fossil CH₄ emissions. *Nature*, 578(7795), 409-412.
- Menking, J. A., Brook, E. J., Schilt, A., Shackleton, S., **Dyonisius, M.N.**, Severinghaus, J. P., & Petrenko, V. V. (2020). Millennial-scale changes in terrestrial and marine nitrous oxide emissions at the onset and termination of Marine Isotope Stage 4. *Geophysical Research Letters*, 47(22), e2020GL089110.
- Shackleton, S., Baggenstos, D., Menking, J. A., **Dyonisius, M.N.**, Bereiter, B., Bauska, T. K., ... & Severinghaus, J. P. (2020). Global ocean heat content in the Last Interglacial. *Nature Geoscience*, 13(1), 77-81.
- Menking, J. A., Brook, E. J., Shackleton, S. A., Severinghaus, J. P., **Dyonisius, M.N.**, Petrenko, V., ... & Barker, S. (2019). Spatial pattern of accumulation at Taylor Dome during Marine Isotope Stage 4: stratigraphic constraints from Taylor Glacier. *Climate of the Past*, 15(4), 1537-1556.

LABORATORY RESEARCH

INSTAAR Laboratory for AMS Radiocarbon Preparation and Research (NSRL), Fall 2023 - present

- Expansion of NSRL graphite line
- Analysis of atmospheric $^{14}\text{CH}_4$ time series

INSTAAR Stable Isotope Lab (SIL), Fall 2023 - present

- Development of continuous-flow, gas chromatography isotope ratio mass spectrometer (GC-IRMS) for $\delta^{13}\text{C-CO}$ and $\delta^{18}\text{O-CO}$ measurements (*Thermo Delta Q*)

Niels Bohr Institute, Physics of Ice and Climate Gaslab, Spring 2020-Fall 2023

- Development and extensive troubleshooting of online, continuous-flow gas chromatography isotope ratio mass spectrometer (GC-IRMS) system for high precision measurement of $\delta^{13}\text{C-CH}_4$. (*Thermo MAT 253-Plus*).
- Designing a GC-pyrolysis-IRMS system for online, continuous-flow measurement of $\delta\text{D-CH}_4$ using palladium-silver membrane to separate post-pyrolysis H_2 . (*Thermo MAT 253-Plus*).
- Development of modular gas extraction system (melting, dry extraction, and sublimation) for CH_4 isotope analysis in dust-rich Greenland ice.
- Using dual-inlet isotope ratio mass spectrometry (DI-IRMS) for mean ocean temperature reconstruction using $\delta\text{Kr/Ar}$ measurements (peak jumping, *Thermo MAT 253-Plus*).
- Extensive troubleshooting of dual-inlet isotope ratio mass spectrometry (DI-IRMS) system for $\delta^{15}\text{N-N}_2$, $\delta^{18}\text{O}_{\text{atm}}$, and $\delta^{40}\text{Ar}$ measurements. (*Thermo Delta V Plus* and *Thermo MAT 253-Plus*).

University of Rochester Ice Core & Atmospheric Chemistry Lab, August 2012-2020

- Ultra-high vacuum and gas extraction methods to isolate CH_4 and CO from large volume ice core samples.
- Development of a sublimation system to extract CO_2 in ice core for $^{14}\text{CO}_2$ analysis.

RESEARCH EXPEDITIONS

Taylor Glacier, McMurdo Dry Valleys, Antarctica. 2013-2014, 2014-2015, 2015-2016 austral summer field season.

Run an on-site large volume ice extraction system. Run on-site laboratory CH_4 GC (gas chromatograph) measurements. Drill assistant for the BID (Blue Ice Drill). Operates the IDDO (Ice Designs and Drilling Operations) hand auger with Sidewinder attachment. Lead the field logistics and field gear preparation for the 14-15 and 15-16 season.

Summit, Greenland. Summer 2014, summer 2015 field season.

Run an on-site large volume ice extraction system. Run on site laboratory CO and CH_4 measurements. Drill assistant for the BID (Blue Ice Drill). Co-lead the field logistics and field gear preparations.

Beacon Valley, McMurdo Dry Valleys, Antarctica. 2011-2012 austral summer field season.

Run 80, 200 and 400 MHz GPR (Ground Penetration Radar) and high precision GPS altimetry survey across Mullins and Friedman Valley Glacier.

OTHER LABORATORY VISITS / SECONDMENTS

University of Rochester Atmospheric Chemistry Modeling Group, Spring-Summer 2017

Implementation of $^{13}\text{CH}_4$ tracer into the GEOS-Chem atmospheric chemistry model.

Australian Nuclear Science and Technology Organization (ANSTO), January – March 2016

Graphitizing and preparing carbon samples for ^{14}C analyses on Accelerator Mass Spectrometry (AMS).

Boston University ICP-MS lab, December 2011 – July 2012

Sample preparation for marine sediments and porewater for ICP-MS measurements in a clean room facility.

SUPERVISING & MENTORING

Master student thesis

- Alexander Erik Friisnæs. University of Copenhagen 2021. *Measurements of $\delta^{15}\text{N}$ and $\delta^{40}\text{Ar}$ of NEEM air with oxygen removal from a perovskite membrane.*
- Maureen Eyers Bøge Jørgensen. University of Copenhagen 2021. *Optimizing an O_2 extraction system to measure atmospheric $\delta^{18}\text{O}$ in ice core.*
- Rebekka Frøystad. University of Copenhagen 2021. *Measuring $\delta^{18}\text{O}$ of atmospheric oxygen for synchronizing ice core records.*

Bachelor senior thesis

- Nicolai Riisbjerg Jørgensen. University of Copenhagen 2022. *Isotope-Ratio Mass Spectrometry: Optimization and Measurements.*

Undergraduate student

- Emily Mesiti. University of Rochester, *Spring-Summer 2017*. Development of an analytical system to produce large volume gas free ice for sublimation $^{14}\text{CO}_2$ analysis (undergraduate summer research project).
- Matthew Paccico. University of Rochester, *Spring-Summer 2015*. Field gear preparation, testing, and shipping logistics for Taylor Glacier 2015-2016 field season.
- Melisa Diaz. University of Rochester, *Summer 2014*. Field gear preparation, testing, and shipping logistics for Taylor Glacier 2014-2015 field season.

FORMAL TEACHING

- **Teaching Assistant**, University of Rochester EES119 Energy and Society
- **Teaching Assistant**, University of Rochester EES209 Introduction to Geochemistry
- **Substitute Lecturer & problem set design**, University of Rochester EES218/418 Atmospheric Chemistry
- **Substitute Lecturer & problem set design**, University of Rochester EES266/466 Ice Core Records of Environmental Change

INVITED TALKS

- “Contributions of old carbon reservoirs to the deglacial CH₄ budget – perspective from top down (ice core) and bottom up (thermokarst lake initiation dates).” *The Centre for Arctic Gas Hydrate, Environment and Climate (CAGE) International Conference on Methane in a Changing Arctic*. 14-16th September 2022. Tromsø, Norway. (Keynote speaker).
- “Towards radiocarbon dating of ice core samples.” *15th International Conference of Accelerator Mass Spectrometry*. 15 – 19 November 2021. Sydney, Australia.
- “Panel discussions: Paleo-permafrost carbon dynamics.” *Permafrost Carbon Network 11th Annual Meeting*.
- “Glacial-interglacial methane cycle, what we know and don't know.” *American Geophysical Union*. Fall 2020.

SELECTED CONFERENCE PROCEEDINGS (first-author only)

- **Dyonisius, M.N.**, Döring, M., Blunier, T. Development of ice sublimation device for analyses of methane isotopes in ice with high impurities. *European Geophysical Union*. Spring 2022.
- **Dyonisius, M.N.**, Hmiel, B., Petrenko, V. V., Ventakesh, J., Schmitt, J., & Blunier, T. Development of ice sublimation device for analyses of trapped trace gases in ice cores, future outlook and applications. *American Geophysical Union*. Fall 2020. Poster Presentation.
- **Dyonisius, M.N.**, Hmiel, B., Petrenko, V. V., Smith, A. M., Hua, Q., Yang, B., ... & Weiss, R. F. Assessing the in-situ cosmogenic ¹⁴C production rates by muons using ¹⁴CO₂, ¹⁴CO, and ¹⁴CH₄ measurements in ice cores. *American Geophysical Union*. Fall 2019. San Fransisco, USA. Oral presentation.
- **Dyonisius, M.N.**, Petrenko, V.V, Smith, A.M, Hua, Q., Yang, B., ... & Weiss, R.F. The contribution of geologic emissions, thawing permafrost and methane hydrates to the global methane budget – perspective from ice core records. *American Geophysical Union*. Fall 2018, Washington DC, USA. Oral presentation.

PROFESSIONAL SERVICE

Journal reviewer

Atmospheric Chemistry and Physics, Climate of the Past, Quaternary Science Reviews, Geophysical Research Letters,

Session convener

European Geophysical Union 2022, 2023. The state-of-the-art in ice coring sciences

PROFESSIONAL SOCIETIES

American Geophysical Union

European Geophysical Union

Ice Core Young Scientists – PAGES group

Permafrost Carbon Network

OTHER MEDIA

EOS highlight article. “The Catcher in the Ice.” January 22, 2021. (<https://eos.org/articles/the-catcher-in-the-ice>)

PROGRAMMING & COMPUTER SKILLS

- ISODAT and ISL-language programming for Thermo Scientific Mass Spectrometer
- Extensive use of MATLAB for data analysis and box modelling of atmospheric trace gases and isotopes (CO₂, CH₄, ethane)
- Google Sketchup and AutoCAD for 3D designs of vacuum line systems
- Igor Pro, Mathematica, Adobe Illustrator, Inkscape
- UNIX & Fortran

REFERENCES AVAILABLE ON REQUEST

- **Dr. Scott Lehman** (email: scott.lehman@colorado.edu)
Senior Research Associate, Institute of Arctic and Alpine Research
- **Dr. Vasilii V. Petrenko** (email: vpetrenk@ur.rochester.edu)
Associate Professor, Department of Earth and Environmental Sciences, University of Rochester
- **Dr. Thomas Blunier** (email: blunier@nbi.ku.dk)
Professor, Niels Bohr Institute Physics of Ice Climate and Earth, University of Copenhagen
- **Dr. Edward Brook** (email: brooke@geo.oregonstate.edu;)
Professor, College of Earth, Ocean and Atmospheric Sciences, Oregon State University
- **Dr. Jeffrey Severinghaus** (email: jseveringhaus@ucsd.edu;)
Professor, Scripps Institution of Oceanography, University of San Diego