



DR. MELISSA SOPHIA SCHWAB

ISOTOPE BIOGEOCHEMIST

 Department of Earth and Environmental Sciences
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PROFILE STATEMENT

I am a highly self-motivated and enthusiastic scientist with expertise in sedimentary, inorganic, and organic geochemistry. I combine established and novel analytical and statistical approaches to advance understanding of biogeochemical cycles and their influence on atmospheric CO₂ concentrations. My research focuses on the deconvolution of riverine and marine organic carbon export, residence times, and climatic factors regulating organic carbon cycling.

RESEARCH APPOINTMENTS

Assistant Professor | Earth and Environmental Sciences | Dalhousie University | Canada | 2025/12 – present

Associate Project Scientist | University of California Irvine | Jet Propulsion Laboratory | California Institute of Technology | USA | 2024/07 – 2025/03

JPL Postdoctoral Researcher | Jet Propulsion Laboratory | California Institute of Technology | USA | 2023/03 – 2024/07

NASA Postdoctoral Program Fellow | Jet Propulsion Laboratory | California Institute of Technology | USA | 2021/03 – 2023/03

EDUCATION

Doctor of Science | Biogeochemistry | ETH Zurich | Switzerland

2021 | *Radiocarbon Constraints on Carbon Dynamics in River Basins* | Dr. Timothy I. Eglinton (ETH Zurich), Dr. Robert G. Hilton (Durham University), Dr. Maarten Lupker (ETH Zurich), Dr. Miguel Goñi (Oregon State University)

Master of Science | Earth Sciences | ETH Zurich | Switzerland

2015 | *Coupled Organic and Inorganic Tracers of Particle Flux Processes in the North American Arctic Ocean* | Dr. Timothy I. Eglinton, Dr. Derek Vance, Dr. Jörg D. Rickli

Bachelor of Science | Earth Sciences | Ruprecht Karl University of Heidelberg | Germany

2013 | *An Outcrop Analog for Geothermal Reservoir Rocks: Diagenesis and Facies of the Middle Buntsandstein near Ettlingen (Baden)* | Dr. Thilo Bechstädt

PUBLICATIONS: PEER-REVIEWED JOURNAL ARTICLES | 04|26

- [J10] Bertin, C., Carroll, D., Menemenlis, D., Dutkiewicz, S., Zhang, H., **Schwab, M. S.**, Savelli, R., Matsuoka, A., Manizza, M., Miller, C. E., Bowring, S., Guenet, B., and Le Fouest, V. (2025). Paving the Way for Improved Representation of Coupled Physical and Biogeochemical Processes in Arctic River Plumes—A Case Study of the Mackenzie Shelf. *Permafrost and Periglacial Processes* **36**(3), 363-377, <https://doi.org/10.1002/ppp.2271>.
- [J9] **Schwab, M. S.**, Haghipour, N., and Eglinton, T. I. (2025). Hydrodynamic, Seasonal, and Climatic Factors Affecting the Terrestrial-to-Aquatic Export of Plant-Derived Biomarkers. *Geochimica et Cosmochimica Acta* **391**, 31-48, <https://doi.org/10.1016/j.gca.2024.12.009>.
- [J8] Hilton, R. G., **Schwab, M. S.**, and Galy, V. (2025). Dynamics of Particulate Organic Carbon Mobilization, Storage, and Export Across River Sedimentary Systems. *Treatise on Geochemistry* (Third Edition) **3**, 215-250, <https://doi.org/10.1016/B978-0-323-99762-1.00021-8>.
- [J7] **Schwab, M. S.**, Elder, C. D., Xu, X., Czimczik, C. I., and Miller, C. E. (2024). Isotopic Seasonality of Fluvial-Derived Greenhouse Gases Implies Active Layer Deepening. *Environmental Research Letters* **19**(11), 114096, <https://doi.org/10.1088/1748-9326/ad820f>.
- [J6] Gies, H., Lupker, M., Galy, V., Hemingway, J., Boehman, B., **Schwab, M. S.**, Haghipour, N., and Eglinton, T. I. (2023). Multi-molecular ¹⁴C Evidence for Mineral Control on Terrestrial Carbon Storage and Export. *Philosophical Transactions of the Royal Society A* **381**, 20220328, <https://doi.org/10.1098/rsta.2022.0328>.
- [J5] **Schwab, M. S.**, Gies, H., Freymond, C. V., Lupker, M., Haghipour, N., and Eglinton, T. I. (2022). Environmental and Hydrologic Controls on Sediment and Organic Carbon Export from a Subalpine Catchment: Insights from a Time-Series. *Biogeosciences* **19**, 5591-5616, <https://doi.org/10.5194/bg-19-5591-2022>.

- [J4] **Schwab, M. S.**, Hilton, R. G., Haghypour, N., Baronas, J. J., and Eglinton, T. I. (2022). Vegetal Undercurrents – Obscured Riverine Dynamics of Plant Debris. *Journal of Geophysical Research: Biogeosciences* **127**(3), e2021JG006726, <https://doi.org/10.1029/2021jg006726>.
- [J3] **Schwab, M. S.**, Rickli, J. D., Macdonald, R. W., Harvey, H. R., Haghypour, N., and Eglinton, T. I. (2021). Detrital Neodymium and (Radio)Carbon as Complementary Sedimentary Bedfellows? The Western Arctic Ocean as a Testbed. *Geochimica et Cosmochimica Acta* **315**, 101-126, <https://doi.org/10.1016/j.gca.2021.08.019>.
- [J2] Eglinton, T. I., Galy, V. V., Hemingway, J. D., Feng, X., Bao, H., Blattmann, T. M., Dickens, A. F., Gies, H., Giosan, L., Haghypour, N., Hou, P., Lupker, M., McIntyre, C. P., Montluçon, D. B., Peucker-Ehrenbrink, B., Ponton, C., Schefuß, E., **Schwab, M. S.**, Voss, B. M., Wacker, L., Wu, Y., and Zhao, M. (2021). Climate Control on Terrestrial Biospheric Carbon Turnover. *Proceedings of the National Academy of Sciences* **118**(8), e2011585118, <https://doi.org/10.1073/pnas.2011585118>.
- [J1] **Schwab, M. S.**, Hilton, R. G., Raymond, P. A., Haghypour, N., Amos, E., Tank, S. E., Holmes, R. M., Tipper, E. T., and Eglinton, T. I. (2020). An Abrupt Aging of Dissolved Organic Carbon in Large Arctic Rivers. *Geophysical Research Letters* **47**(23), e2020GL088823, <https://doi.org/10.1029/2020GL088823>.

OTHER PUBLICATIONS & MANUSCRIPTS IN PROGRESS

- [1] Wojciechowski, N., Tzortziou, M., **Schwab, M.**, et al. (2024). *Arctic-COLORS Implementation Plan*. Arctic-COLORS Science Definition Team, NASA Ocean Biology & Biogeochemistry, https://cce.nasa.gov/ocean_biology_biogeochemistry/docs/Arctic_COLORS_Implementation_Plan_FINAL.pdf
- [2] Coppola, A. I., **Schwab, M. S.**, van Gervink, M., Bertin, C., Buman, B., Haghypour, N., Galy, V., Hilton, R. G., Jones, M., Veraverbeke, S., and Eglinton, T. I. Arctic fire-driven pyrogenic carbon budget reveals efficient land to ocean transfers and continental shelf sequestration. Submitted to *Nature Communications*.
- [3] Czimczik, C. I., **Schwab, M. S.**, Pedron, S. A., and Welker, J. M. Are We Digging Deep Enough? Submitted to *Nature Communications*.
- [4] De Jonge, C., Anjewierden, P., Peterse, F., Freymond, C., Gies, H., **Schwab, M. S.**, and Eglinton, T. I. Seasonal and hydrological controls on riverine brGDGT export. In prep. *Geochimica et Cosmochimica Acta*.
- [5] **Schwab, M. S.**, Elder, C. D., Xu, X., Czimczik, C. I., and Miller, C. E. Detecting and Understanding Abrupt Thermokarsting and Its Causes in Arctic Watersheds. In prep. *Proceedings of the National Academy of Sciences*.
- [6] **Schwab, M.S.**, Rickli, J. D., Blusztajn, J., Forest, A., Krishfield, R., Haghypour, N., Manganini, S. J., and Eglinton, T. I. Tracking Carbon and Neodymium Across the River-Shelf-Basin Transect: Seasonal Variations in Particle Export and Organic Carbon Dynamics. In prep. *Journal of Geophysical Research: Oceans*.
- [7] **Schwab, M. S.**, Matsuoka, A., and Miller, C. E. Capturing Subchannel Dynamics of Dissolved Organic Matter in an Arctic Braided River System using AVIRIS-NG. In prep. *Remote Sensing*.

RESEARCH AWARDS (in USD)

NSERC Discovery Grant (RGPIN-2026-07474) | PI | COARSE: Coarse Organic Carbon Assessment of River Storage and Export | 2026 – 2031 | \$151,200

NASA Postdoctoral Program Fellowship | Oak Ridge Associated Universities | USA | 2021 – 2023 | \$139,000

TEACHING ACTIVITIES

Dalhousie University: EARTH 4601 Advanced Biogeochemical Cycles (2026/27 – present)

UNDERGRADUATE

Supervisor

- [1] Kaelyn Collins, Honours | Environmental Sciences | Dalhousie University | Canada | 2026/27

External Examiner

- [2] Isaac Bahler, Honours | Environmental Sciences | Dalhousie University | Canada | 2025/26
- [1] Alexis Gauvin, Honours | Environmental Sciences | Dalhousie University | Canada | 2025/26

GRADUATE

Co-Supervisor / Committee Member

- [1] Lauren O'Reilly, Ph.D | Earth and Environmental Sciences | Dalhousie University | Canada | 2025 – present

External Examiner

- [1] Adam Argiro, M.Sc. | Civil and Resource Engineering | Dalhousie University | Canada | 2025 – present

SYNERGISTIC ACTIVITIES

Leadership & Working Groups

Hydrology, Permafrost & Wetlands Working Group Co-Lead | NASA Arctic-Boreal Vulnerability Experiment (ABoVE) | 2023 – present

Geographic Domain Working Group Lead | NASA Arctic-COastal Land Ocean inteRactionS (Arctic-COLORS) Science Definition Team | 2023/03 – 2024/10

University Service

Faculty Representative | Dalhousie University Senate | Dalhousie University | Canada | 2026 – present

Graduate Affairs Committee | Department of Earth and Environmental Sciences | Dalhousie University | Canada | 2026 – present

Member | Teaching Commission | Department of Earth Sciences | ETH Zurich | Switzerland | 2016 – 2019

Member | Geological Institute Full Board | Department of Earth Sciences | ETH Zurich | Switzerland | 2016 – 2019

Chair | Doctoral Retreat | Department of Earth Sciences | ETH Zurich | Switzerland | 2016 – 2017

Peer Review

Journal Reviewer | *Earth Surface Dynamics, Frontiers in Earth Sciences, Geomorphology, Geophysical Research Letters, Global Biogeochemical Cycles, Global Change Biology, Journal of Geophysical Research: Biogeosciences, Scientific Reports.*

NASA Reviewer | Established Program to Stimulate Competitive Research (EPSCoR), Future Investigators in NASA Earth and Space Science and Technology (FINESST).

Professional Memberships

Atlantic Geoscience Society (AGS), American Geophysical Union (AGU), Canadian Geophysical Union (CGU), Earth Science Women's Network (ESWN), European Association of Geochemistry (EAG), Interagency Arctic Research Policy Committee (IARPC)

PRESENTATIONS – Conferences, Seminars, and Science Team Meetings

- [P24] **Schwab, M. S.**, Cziczik, C. I., Pedron, S. A., and Welker, J. M. (2026) Are We Digging Deep Enough to Get Permafrost Carbon? *Atlantic Geoscience Society (AGS) Colloquium and Annual Meeting*, Truro, NS, Canada. *ORAL*.
- [P23] Rawlins, M. A., Connolly, C., McClelland, J. W., Kimball, J. S., Tzortziou, M., Du, J., Sherman, J., Moses, W., **Schwab, M. S.**, and Mizukami, N. (2024). Integrated Assessment of the Changing Hydrology of Arctic Coastal Basins and Associated Impacts on Riverine Exports and Coastal Biogeochemistry in Northern Alaska. *American Geophysical Union (AGU) Annual Meeting*, New Orleans, LA, USA. *POSTER*.
- [P22] Hilton, R. G., **Schwab, M. S.**, and Galy, V. (2024). Dynamics of Particulate Organic Carbon Mobilization, Storage, and Export Across River Sedimentary Systems. *Goldschmidt Conference*, Chicago, IL, USA. *ORAL*.
- [P21] **Schwab, M. S.**, Elder, C. D., Xu, X., Cziczik, C. I., Miller, C. E. (2024). Seasonal Changes of Isotopic Fingerprints of Fluvial-Derived Greenhouse Gases Imply Pervasive Permafrost Thaw. *10th Arctic-Boreal Vulnerability Experiment (ABoVE) Science Team Meeting (ASTM-10)*, Boulder, CO, USA. *POSTER*.
- [P20] Rhyner, T., Mittelbach, B., White, M., Broeder, L., Raymond, O., Haghypour, N., Brunmayr, A., Storck, F., Passera, L., **Schwab, M. S.**, Hilton, R. G., Zobrist, J., and Eglinton, T. I. (2024). Radiocarbon as a Key Constraint for Prediction of River Carbon Biogeochemistry. *European Geosciences Union (EGU) General Assembly*, Vienna, Austria. *POSTER*.
- [P19] **Schwab, M. S.**, Elder, C. D., Xu, X., Cziczik, C. I., and Miller, C. E. (2023). Isotopic Fingerprints of Fluvial-Derived Greenhouse Gases Document Pervasive Permafrost Thaw. *American Geophysical Union (AGU) Annual Meeting*, San Francisco, CA, USA. *ORAL*.
- [P18] **Schwab, M. S.**, Elder, C. D., Xu, X., Cziczik, C. I., and Miller, C. E. (2023). Isotopic Fingerprints of Fluvial-Derived Greenhouse Gases Document Pervasive Permafrost Thaw. *Goldschmidt Conference*, Lyon, France. *ORAL*.
- [P17] **Schwab, M. S.**, Elder, C. D., Xu, X., Cziczik, C. I., Miller, C. E. (2023). Following the White Rabbit: Tracing the Fate of Permafrost-Derived Carbon in Arctic Tundra River Networks. *9th Arctic-Boreal Vulnerability Experiment (ABoVE) Science Team Meeting (ASTM-9)*, San Diego, CA, USA. *POSTER*.
- [P16] Eglinton, T. I., Paradis, S., Gies, H., Haghypour, N., Schnepfer, C., **Schwab, M. S.**, and Bruni, E. (2022). ISODRAPES: Spatial Variability in the Provenance, Vintage and Quality of Organic Carbon accumulating on the Ocean Floor. *The Ocean Floor Symposium 2022 (MARUM)*, Bremen, Germany. *ORAL*.
- [P15] **Schwab, M. S.**, Hilton, R. G., Haghypour, N., Baronas, J. J., and Eglinton, T. I. (2022). Vegetal Undercurrents - Obscured Riverine Dynamics of Plant Debris. *Goldschmidt Conference*, Honolulu, HI, USA. *ORAL*.
- [P14] **Schwab, M. S.**, Hilton, R. G., Haghypour, N., Baronas, J. J., Eglinton, T. I., Elder, C. D., Xu, X., Cziczik, C. I., and Miller, C. E. (2022). Tracing the Fate of Permafrost-Derived Carbon in Arctic River Networks. *University of Southern California (USC)*, Los Angeles, CA, USA. *INVITED SEMINAR*.
- [P13] **Schwab, M. S.**, Thompson, D. R., Baskaran, L. M., and Miller, C. E. (2022). Comparing Open Water Indices Using Hyperspectral Imagery. *8th Arctic-Boreal Vulnerability Experiment (ABoVE) Science Team Meeting (ASTM-8)*, Fairbanks, AK, USA. *POSTER*.
- [P12] **Schwab, M. S.**, Hilton, R. G., Raymond, P. A., Haghypour, N., Amos, E., Tank, S. E., Holmes, R. M., Tipper, E. T., and Eglinton, T. I. (2020). An Abrupt Aging of Dissolved Organic Carbon in Large Arctic Rivers. *Japan Agency for Marine-Earth Science and Technology (JAMSTEC)*, Yokosuka, Japan. *INVITED SEMINAR*.

- [P11] **Schwab, M. S.**, Haghypour, N., and Eglinton, T. I. (2019). Temporal Aliasing of Molecular Proxy Signals Carried by a Sub-Alpine River. *International Meeting on Organic Geochemistry (IMOG)*, Gothenburg, Sweden. *ORAL*.
- [P10] **Schwab, M. S.**, Hilton, R. G., Raymond, P. A., Haghypour, N., and Eglinton, T. I. (2019). A Smoking Gun for the Carbon Cycle Change in the Canadian Arctic? *Goldschmidt Conference*, Barcelona, Spain. *ORAL*.
- [P9] Anjewierden, P., de Jonge, C., **Schwab, M. S.**, and Eglinton, T. I. (2019). Seasonal and Hydrological Controls on Riverine brGDGT Export. *Goldschmidt Conference*, Barcelona, Spain. *POSTER*.
- [P8] **Schwab, M. S.**, Hilton, R. G., Galy, V., Haghypour, N., GrafPannatier, E., Macdonald, R., and Eglinton, T. I. (2018). Organic Carbon Export from the Mackenzie Basin: Insights from Observations Spanning 30 years. *Goldschmidt Conference*, Boston, MA, USA. *ORAL*.
- [P7] Hilton, R. G., Tipper, E., Galy, V., Garnett, M., Dellinger, M., **Schwab, M. S.**, Tank, S., Bryant, C., Ascough, P., and Eglinton, T. I. (2018). Old Dissolved Inorganic Carbon in the Mackenzie River Basin: A Smoking Gun for the Degradation of Aged Organic Matter? *Goldschmidt Conference*, Boston, MA, USA. *ORAL*.
- [P6] **Schwab, M. S.**, Hilton, R. G., Galy, V., Haghypour, N., GrafPannatier, E., Macdonald, R. W., and Eglinton, T. I. (2018). Organic Carbon Export from the Mackenzie Basin: Insights from Observations Spanning 30 years. *Organic Geochemistry, Gordon Research Conference*, Holderness, NH, USA. *POSTER*.
- [P5] **Schwab, M. S.**, Rickli, J. D., Blusztajn, J., Manganini, S., Harvey, H. R., Macdonald, R. W., Vance, D., McIntyre, C., and Eglinton, T. I. (2018). Geochemical Constraints on Particle Flux Processes in the Western Arctic Ocean. *Polar2018*, Davos, Switzerland. *ORAL*.
- [P4] **Schwab, M. S.**, Hilton, R. G., Haghypour, N., and Eglinton, T. I. (2018). Carbon Export by the Mackenzie River during the Spring Freshet. *Polar2018*, Davos, Switzerland. *POSTER*.
- [P3] **Schwab, M. S.**, Hilton, R. G., and Eglinton, T. I. (2018). Intra-Channel Variability of Biomarker Transport in the Mackenzie River. *Arctic Partner Forum*, Stockholm, Sweden. *POSTER*.
- [P2] **Schwab, M. S.**, Haghypour, N., and Eglinton, T. I. (2017). Terrestrial Organic Carbon and Plant Wax Biomarker Export from Scottish River Systems. *Goldschmidt Conference*, Paris, France. *POSTER*.
- [P1] **Schwab, M. S.**, Rickli, J. D., Blusztajn, J., Manganini, S., Harvey, H. R., Vance, D., McIntyre, C., and Eglinton, T. I. (2015). Coupled Organic & Inorganic Tracers of Particle Flux Processes in the Western Arctic Ocean. *Goldschmidt Conference*, Prague, Czech Republic. *POSTER*.

EXPEDITIONS & FIELD CAMPAIGNS

- Sagavanirktok & Kuparuk Rivers** | Alaska, USA | Chief Scientist | 4 weeks | 2022
- Sihl River** | Zurich, Switzerland | Chief Scientist | Time-series (78 samples) | 2016 – 2019
- Mackenzie River** | Northwest Territories, Canada | Chief Scientist | 2 weeks | 2019
- Mackenzie River** | Northwest Territories, Canada | 2 weeks | 2018
- Mackenzie River** | Northwest Territories, Canada | 2 weeks | 2017
- Diverse Scottish rivers** | Scotland, UK | Chief Scientist | 1 week | 2017
- Diverse Scottish rivers** | Scotland, UK | Chief Scientist | 2 weeks | 2016
- Beaufort Gyre Exploration Project** | WHOI | Western Arctic Ocean | 5 weeks | 2014

TECHNICAL SKILLS

- Compound-specific radiocarbon isotopic measurements (preparative capillary gas chromatography, MICADAS).
- Radiocarbon analyses of solid, dissolved, and gaseous phases (MICADAS).
- Organic matter solvent extraction (EDGE, Microwave), gas chromatography, and high-performance liquid chromatography.
- Stable isotopic measurements of H, C, N, and O (Picarro, EA-IRMS).
- Sequential leaching and analyses of Nd and Sr isotopic compositions (ICP-MS, MC-ICP-MS).
- Sedimentological analyses (grain size, surface area).
- Spectrophotometry.
- Ion chromatography.
- Supervised and semi-supervised machine learning frameworks.
- Bayesian modeling.
- Proficient in Python, R, ArcGIS/QGIS, LaTeX, graphic design (Adobe).

PROFESSIONAL DEVELOPMENT

- Transform to Open Science | NASA (online) | USA | 2024/01
- Short Course on Bayesian Models for Ecologists | Colorado State University | Fort Collins | USA | 2023/06
- Caltech Project for Effective Teaching | Center for Teaching, Learning, & Outreach | Caltech | Pasadena | USA | 2022 – 2023
- Machine Learning, Deep Learning, Convolutional Neural Networks | Coursera (online) | 2021/12
- Arctic Partner Forum | Stockholm University | Stockholm | Sweden | 2018/05
- Radiocarbon in Ecology and Earth System Science | Max Planck Institute | Jena | Germany | 2017/09

- Carbon-CASCADES Mini-Conference - From Land to the Ocean: Processes and Budgets | ETH Zurich | Zurich | Switzerland | 2017/01
- Summer School 'Land to Ocean Aquatic Carbon (LOAC)' - Integrative science of LOAC, processes, observations, and modelling | France | University of Exeter | 2016/08 – 09

LANGUAGES & OTHER SKILLS

- German (native), English (proficient), French (beginner), Japanese (beginner)
- Latin, Ancient Greek, Akkadian
- Kendo (Japanese martial art) | 3-Dan | 2015 – present
- Dressage | 2006 – present
- Violin/Viola | 2001 – present

RESEARCH INTERESTS

- Riverine export of organic carbon from continental reservoirs to the ocean.
- Understanding exchange processes between particulate, dissolved, and gaseous organic carbon pools.
- Monitoring changes in carbon cycling in response to climate warming.
- Tracking the fate of organic carbon in the pedosphere and hydrosphere using compound-specific biomarker analyses.
- Bridging the gap between local and regional carbon cycles using ground truthing and remote sensing.
- Provenance analysis using radiogenic geochemistry (ϵ_{Nd} , $^{87}\text{Sr}/^{86}\text{Sr}$).
- Radiocarbon dating (bulk, compound-specific).
- Geospatial modeling and machine learning frameworks.