

Dr. Patrick Blaser

born 10.03.1987; German; married; 2 children

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Google Scholar &
Research Gate: Patrick Blaser

Web site: <https://patrick-blaser.github.io/>

Marie Skłodowska-Curie Postdoctoral Fellow

at

University of Lausanne (Switzerland)
Faculty of Geosciences and Environment
Institute of Earth Sciences
Section for *Paleoenvironment, Evolution of Life and Ocean Dynamics*
Laboratory for Biogeochemical Oceanography Across Time (BOAT)



and

GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany)
Research Division 1: *Ocean Circulation and Climate Dynamics*
Research Unit *Paleo-Oceanography*



CV summary

Positions	Expertise	Research	Teaching experience	Funding proposals
MSCA Fellow (UNIL & GEOMAR)	(Paleo) Climate	21 articles published (19 peer reviewed)	1 full course	5 successful as PI (~ 880 000€)
Postdoc Earth Sciences (UNIL)	(Isotope) Geochemistry	> 1000 citations	2 individual lectures	2 unsuccessful
Postdoc Earth Sciences	Oceanography	9 invited talks	16 students supervised	agencies: (DFG, SNSF, ERC)
PhD Physics MSc Physics BSc Physics	Trace Metals (MC) ICP-MS Data Analysis	h-index: 12 16 articles reviewed founding member of PAGES PO2 WG	2 practical courses	

Employment history:

- since 03.2023: Marie Skłodowska-Curie Postdoctoral Fellow,
University of Lausanne (Switzerland),
Institute of Earth Sciences,
Laboratory for Biogeochemical Oceanography Across Time
(with Samuel Jaccard, and Martin Frank at GEOMAR, Kiel, Germany)
- 03.2021 – 02.2023: Post-Doctoral Research Assistant, University of Lausanne (Switzerland),
Institute of Earth Sciences,
Laboratory for Biogeochemical Oceanography Across Time
(with Samuel Jaccard)
- 07.2017 – 10.2020: Post-Doctoral Research Assistant, Heidelberg University (Germany),
Institute of Earth Sciences,
Past Ocean Dynamics (with Jörg Lippold)
- 08.2013 – 06.2017: Doctoral Research Assistant, Heidelberg University (Germany),
Institute of Environmental Physics,
Physics of Environmental Archives (with Norbert Frank)

Education:

- PhD. in Physics at Heidelberg University, Institute of Environmental Physics (2013 – 2017)
- MSc. in Physics at Heidelberg University (2011 – 2013)
- BSc. in Physics at Heidelberg University (2007 – 2011)
(including one Erasmus exchange semester at the University of Manchester, UK, in 2009)

Work and research philosophy:

As a scientist at a public university, I contribute to societal advancement through fundamental research in climate and environmental science and teaching to students and the public. I commit to fostering a diverse and comprehensive education including laboratory and numerical methods, philosophical considerations, societal aspects, and a robust technical foundation.

My interdisciplinary approach, rooted in a physics education with a keen interest in chemistry, spans (palaeo-)climatology and marine isotope geochemistry. I prioritize detailed discussions of research and particularly value diverse perspectives to enhance interpretations of complex data. Collaborating with experts across disciplines is thus integral to my methodology.

In the laboratory, I ensure robust and efficient analyses by leveraging a deep understanding of the applied methods. This allows me to generate larger, more meaningful datasets, providing enhanced spatial and temporal coverage in palaeoclimatology. I often employ statistical analyses and simple box models to illuminate obscured processes in uncertain data, reinforcing the significance and confidence in interpretations while mitigating risks for biases.

Field expeditions:

- 2023: RV Polarstern Expedition 140
“East Antarctic Ice Sheet Instabilities 2:
Southern Ocean Deep Water Circulation and
the Interaction with the East Antarctic Ice Sheet”
PI: Marcus Gutjahr
(Onshore participant for sediment pore water oxygen utilisation;
Indian sector of the Southern Ocean)
- 2021: GEOTRACES process study cruise GApr16 “MetalGate”
PI: Rob Middag
(Onshore participant for seawater Nd isotope analysis;
Subpolar North Atlantic and Nordic Seas around Iceland)
- 2018: Research cruise M151 onboard RV Meteor
PI: Norbert Frank
(CTD and multi-corer operations, sediment pore water extractions;
Eastern North Atlantic and Azores Plateau)
- 2017: Research cruise M141-2 onboard RV Meteor
PI: Norbert Frank
(CTD operations; Eastern North Atlantic and Mediterranean Sea)

Work in external Laboratories:

- 2019 - Repeated research visits at University of Cologne (Germany) for ICP-QMS measurements
2020: and scientific exchange
- 2013 - Research visits at MARUM (Bremen, Germany), University of Bordeaux (France), Ifremer
2020: (Brest, France), and LSCE (Gif-sur-Yvette, France) for marine sediment sampling and
scientific exchange
- 2013 - Repeated research visits at GEOMAR (Kiel, Germany) for MC-ICP-MS measurements and
2016: scientific exchange
- 2011: Internship at Southampton Oceanographic Centre (UK) in Prof. Gavin Foster’s research
group, working on boron isotope analyses from planktonic foraminifera

Invited Talks:

- 2023: Institute of Environmental Sciences at Heidelberg University, Institute’s seminar series
- 2022: - PAGES’ *Ocean Circulation and Carbon Cycling* virtual seminar series
- Woods Hole Oceanographic Institution (USA), Climate and Paleo seminar series
- University of Bonn (Germany), Environmental Geology group
- Max Planck Institute for Chemistry (Mainz, Germany), Climate Geochemistry Seminar

- 2021: Department of Geography of University College London (UK)
- 2020: - School of Earth Sciences at University of Bristol (UK)
- Solicited presentation at EGU General Assembly (Sharing Geoscience Online) session
“*Tracers in the Paleo Sea*”
- 2018: Lamont-Doherty Earth Observatory (USA)

Workshops and Conferences:

- 2023: Co-organiser of 1-day workshop
“*What can marine authigenic Nd isotopes be reliably used for?*”
at the Goldschmidt Conference on geochemistry
- 2021: Convenor of Goldschmidt Conference on geochemistry session
“*Drivers of the climate system over the Cenozoic Era*”
- 2019: Lead convenor of EGU General Assembly session “*The role of ocean circulation in glacial-interglacial climates*”
- 2018: Participation and presentation at PAGES’ OC3 / IPODS workshop (Cambridge, UK)
- 2017: Nature Geoscience Poster Award at Pages Young Scientists Meeting (Zaragoza, Spain)
- 2013: Participation at ECORD Summer School “*Deep-Sea Sediments – From Stratigraphy to Age Models*” at MARUM (Bremen, Germany)
- Regular active participation at international conferences such as AGU Fall meeting, EGU’s General Assembly, Goldschmidt Conference on geochemistry, International Conference on Paleoceanography and others (1 – 2 per year).

Public outreach:

- 2020: Presentation and discussion about climate change for A-level students at “Akademie für Kommunikation” secondary school, Karlsruhe, Germany

Career development trainings:

- Leadership in academia and beyond
- Negotiation: mindset and tools
- Online representation skills
- Project management for researchers
- Presentation skills

Others:

- Founding member and communication officer of the ongoing PAGES (Past Global Changes) working group *Past Ocean Oxygenation* (PO2)
- Founding member of the currently proposed PAGES (Past Global Changes) working group *Proxies of Ocean Circulation and Water Properties: Evaluation, Reconstruction and Simulation* (POWERS)
- Post-Doc representative at the Institute of Earth Sciences at the University of Lausanne since 2023

Skills:

Languages: German (native speaker), English (excellent command), French (good command), Spanish (basic command)

Programming: R (good proficiency), Visual Basic (intermediate), Python (basics)

Laboratory methods: sequential sediment leaching and total digestion, liquid column chromatography, clean laboratory set up, use, and management, ICP-MS use and management, identifying and picking sediment particles such as foraminifera or ice rafted debris, ship-based CTD and sediment multi-corer operations and sampling

Measurement techniques: MC-ICP-MS (expert), ICP-QMS (expert), HR-ICP-MS (experienced), ICP-OES (basic knowledge), TIMS (basic knowledge) XRF (basic knowledge), XRD (basic knowledge), RockEval (basic knowledge)

Data science: data base management
statistical data analysis
visualisation of complex data
numerical model development and application
geospatial data analysis and visualisation

Safety: training in fire protection, handling of dangerous chemicals, handling of hydrofluoric acid, field safety and inclusivity

Ongoing research projects:

Atlantic deep water circulation since the Last Glacial Maximum

The last glacial maximum about 20 thousand years ago, and the following deglaciation and warm Holocene form the best and most precisely investigated time interval for palaeoclimate research. My primary goal is to further question and improve our understanding of the changes that occurred in this period in the oceans and the whole climate system. I am particularly interested in investigating this problem from different angles with different sedimentary proxies such as stable isotopes in foraminifera shells, the neodymium (Nd) isotope composition of authigenic precipitates, or the ratio of the two uranium-derived isotopes protactinium and thorium. Combining different proxies allows for more comprehensive and accurate conclusions and the evasion of biases that may occur if we only investigate one proxy at a time. Most of our established views of changes in the distribution of water masses in the deep ocean rely on nutrient-based proxies and, for example, Nd isotopes as an inorganic water mass provenance tracer can add a complementing different view to these studies.

Biological productivity, ocean circulation, and carbon storage in the Southern Ocean

The Southern Ocean connects all world oceans and hosts formation of the densest waters that fill the deep ocean basins. Active vertical mixing around its frontal systems leads to high primary productivity. Apart from its ecological importance, this productivity binds the greenhouse gas carbon dioxide from the atmosphere and exports it to the deep ocean via sinking organic particles, where it can be stored for hundreds and thousands of years. Therefore, the circulation and productivity of the Southern Ocean are an integral modulator of global climate. In this project I investigate both these processes with biogenic and non-biogenic proxies across the last glacial cycle.

Marine sediments as sinks and sources of dissolved trace metals

The oceans are full of trace metals that reside in the water column for different durations, depending on their chemical speciation and specific conditions of the seawater. Marine sediments are a major sink for most of them, leading to their long time storage and geological recycling. Thus, the distribution of these trace metals in the seawater-derived phase of sediments can yield information about the conditions of past seawater. For example, the speciation and thus reactivity and residence time of many trace metals depends on the seawater redox conditions, which are tightly linked to oxygen concentrations and can therefore serve as a proxy for past deep ocean oxygenation.

My current EU-funded Marie Skłodowska-Curie project “**OxyQuant**” combines all these topics. It is based on the investigation of trace element behaviour during early diagenesis in order to use these elements as proxies for past ocean oxygenation, and thus past ocean circulation and carbon storage.

Scientific articles:

Google Scholar: h-index: 12; i10-index: 15; 1017 citations

*: First author was or is a student under my direct supervision

Articles in preparation:

- Blaser P., Haine T. (in preparation). Spicy Arctic deep waters during the last glacial cycle?
- Bruggmann S., **Blaser P.**, Crosta X., Martinez-Garcia A., Jaccard S.L. (in preparation). Productivity changes from the Holocene to the ice age evidenced by chromium isotopes.
- *Bollen M., **Blaser P.**, Bruggmann S., Müller J., Gutjahr M., Jaccard S.L. (in preparation). Unveiling glacial retreat dynamics through multi-faceted analysis of a Weddell Sea sediment core across Termination 1.
- Layla Creac'h, Manuel Ehnis, Manuel Ruben, Huang Huang, Marcus Gutjahr, Patrick Blaser (in preparation). Marine sedimentary porewaters oxygen and pH measurements using contactless sensors.

Articles in review:

- **Blaser P.**, Waelbroeck C., Thornalley D.J., Lippold J., Pöppelmeier F., Kaboth-Bahr S., Repschläger J., Jaccard S.L. Prevalent glacial North Atlantic Deep Water despite Arctic freshwater input. In revision at *Nature Geoscience*.
- Sarnthein M., **Blaser P.** (in review at *Quaternary Science Reviews*). Peak Glacial-to-Heinrich-1 changes in Denmark Strait Overflow and seawater stratification formed the Nordic Seas' switchboard of changes in Atlantic Meridional Overturning Circulation and the Nordic Heat Pump.
- Du J., Haley B.A., McManus J., **Blaser P.**, Rickli J., Vance D. (in revision for *Nature*). Abyssal seafloor as a key driver of marine biogeochemical cycles.

Published articles:

2022

- Pöppelmeier F., Lippold J., **Blaser P.**, Gutjahr M., Frank M., Stocker T.F. (2022). Neodymium isotopes as a paleo-water mass tracer: A model-data reassessment. *Quaternary Science Reviews* 279, 107404.

2021

- Pöppelmeier F., Gutjahr M., **Blaser P.**, Schulz H., Sufke F., Lippold J. (2021). Stable Atlantic Deep Water Mass Sourcing on Glacial-Interglacial Timescales. *Geophysical Research Letters* 48, e2021GL092722.
- Jakob K.A., Pross J., Link J.M., **Blaser P.**, Hauge Braaten A., Friedrich O. (2021). Deep-ocean circulation in the North Atlantic during the Plio-Pleistocene intensification of Northern Hemisphere Glaciation (~2.65–2.4 Ma). *Marine Micropaleontology* 165, 101998.

2020

- Pöppelmeier F., Scheen J., **Blaser P.**, Lippold J., Gutjahr M., Stocker T.F. (2020). Influence of Elevated Nd Fluxes on the Northern Nd Isotope End Member of the Atlantic During the Early Holocene. *Paleoceanography and Paleoclimatology* 35, e2020PA003973.
- *Pöppelmeier F., **Blaser P.**, Gutjahr M., Jaccard S. L., Frank M., Max L., Lippold J. (2020) Northern-Sourced Water Dominated the Atlantic Ocean during the Last Glacial Maximum. *Geology*, 48 (8), 826–829.
- **Blaser P.**, Gutjahr M., Pöppelmeier F., Frank M., Kaboth-Bahr S., Lippold J. (2020). Labrador Sea bottom water provenance and REE exchange during the past 35,000 years. *Earth and Planetary Science Letters* 542, 116299.
- *Pöppelmeier F., Gutjahr M., **Blaser P.**, Oppo D.W., Jaccard S.L., Regelous M., Huang K.-F., Sufke F., Lippold J. (2020). Water mass gradients of the mid-depth Southwest Atlantic during the past 25,000 years. *Earth and Planetary Science Letters* 531, 115963.
- Sufke, F. Schulz, H. Scheen, J. Szidat, S., Regelous M., **Blaser P.**, Pöppelmeier F., Goepfert T.J., Stocker, T.F. Lippold J. (2020). Inverse response of $^{231}\text{Pa}/^{230}\text{Th}$ to variations of the Atlantic meridional overturning circulation in the North Atlantic intermediate water. *Geo-Marine Letters* 40, 75–87.
- *Vogt-Vincent N., Lippold J., Kaboth-Bahr S., **Blaser P.** (2020). Ice-rafted debris as a source of non-conservative behaviour for the ϵNd palaeotracer: insights from a simple model. *Geo-Marine Letters* 40, 325–340.

2019

- Sufke F., Pöppelmeier F., Goepfert T. J., Regelous M., Koutsodendris A., **Blaser P.**, Gutjahr M. and Lippold J. (2019). Constraints on the northwestern Atlantic deep water circulation from $^{231}\text{Pa}/^{230}\text{Th}$ during the last 30,000 years. *Paleoceanography and Paleoclimatology* 34, 1945–1958.
- **Blaser P.**, Frank M. and van de Flierdt T. (2019). Revealing past ocean circulation with neodymium isotopes. *Past Global Changes Magazine* 27, 54–55.
- *Pöppelmeier F., **Blaser P.**, Gutjahr M., Sufke F., Thornalley D. J. R., Grützner J., Jakob K. A., Link J. M., Szidat S. and Lippold J. (2019). Influence of Ocean Circulation and Benthic

Exchange on Deep Northwest Atlantic Nd Isotope Records During the Past 30,000 Years. *Geochemistry, Geophysics, Geosystems* 20, 4457–4469.

- Lippold J., Pöppelmeier F., Süfke F., Gutjahr M., Goepfert T. J., **Blaser P.**, Friedrich O., Link J. M., Wacker L., Rheinberger S. and Jaccard S. L. (2019). Constraining the Variability of the Atlantic Meridional Overturning Circulation During the Holocene. *Geophysical Research Letters* 46, 11338–11346
- **Blaser P.**, Pöppelmeier F., Schulz H., Gutjahr M., Frank M., Lippold J., Heinrich H., Link J. M., Hoffmann J., Szidat S. and Frank N. (2019). The resilience and sensitivity of Northeast Atlantic deep water ϵNd to overprinting by detrital fluxes over the past 30,000 years. *Geochimica et Cosmochimica Acta* 245, 79–97.

2018

- **Blaser P.** and Jacek R. (2018). Undisturbed Measurements of Oxygen in Deep Sea Sediments with Oxygen Sensitive Foil, *Application Note*, Heidelberg. Available at: <https://www.presens.de/knowledge/publications/application-note/undisturbed-measurements-of-oxygen-in-deep-sea-sediments-with-oxygen-sensitive-foil-1598.html>
- *Pöppelmeier F., Gutjahr M., **Blaser P.**, Keigwin L. D. and Lippold J. (2018). Origin of Abyssal NW Atlantic Water Masses Since the Last Glacial Maximum. *Paleoceanography and Paleoclimatology* 33, 530–543.

2017

- Wefing A.-M., Arps J., **Blaser P.**, Wienberg C., Hebbeln D. and Frank N. (2017). High precision U-series dating of scleractinian cold-water corals using an automated chromatographic U and Th extraction. *Chemical Geology* 475, 140–148.

2016

- Lippold J., Gutjahr M., **Blaser P.**, Christner E., de Carvalho Ferreira M. L., Mulitza S., Christl M., Wombacher F., Böhm E., Antz B., Cartapanis O., Vogel H. and Jaccard S. L. (2016). Deep water provenance and dynamics of the (de)glacial Atlantic meridional overturning circulation. *Earth and Planetary Science Letters* 445, 68–78.
- **Blaser P.**, Lippold J., Gutjahr M., Frank N., Link J. M. and Frank M. (2016). Extracting foraminiferal seawater Nd isotope signatures from bulk deep sea sediment by chemical leaching. *Chemical Geology* 439, 189–204.

2015

- Böhm E., Lippold J., Gutjahr M., Frank M., **Blaser P.**, Antz B., Fohlmeister J., Frank N., Andersen M. B. and Deininger M. (2015). Strong and deep Atlantic meridional overturning circulation during the last glacial cycle. *Nature* 517, 73–76.

Review activity:

Journals

- Chemical Geology
- Climate of the Past
- Geochemistry, Geophysics, Geosystems
- Geochimica et Cosmochimica Acta
- Marine Geology
- Minerals
- Nature
- Nature Geoscience
- Quaternary Science Reviews
- Rapid Communications in Mass Spectrometry

Organisations

- UK Research and Innovation (UKRI)

Acquired funding:

- 2022: European Commission Marie Skłodowska-Curie Global Fellowship for 3 year project on the use of trace metal geochemistry in marine sediments for the reconstruction of bottom water oxygen concentrations (~ 320 000 €)
- 2022: SNSF Swiss Postdoctoral Fellowship for 2 year project on the use of trace metal geochemistry in marine sediments for the reconstruction of bottom water oxygen concentrations (~ 226 000 CHF, declined by me due to parallel project)
- 2021: SNSF Flexibility Grant (~ 35 000 €)
- 2015: DFG research grant for 3 year PhD project on ocean circulation reconstruction of the past 1 Million years with Nd isotopes, proposed together with Jörg Lippold and Norbert Frank (~ 150 000 €)
- 2013: DFG research grant for own 3 year PhD project on Last Glacial Maximum ocean circulation reconstruction with Nd isotopes, proposed together with Jörg Lippold (~ 150 000 €)

Teaching:

- *Orbital- and millennial-scale CO₂ variability during the Pleistocene*
3h lecture in the series *Climate and paleoclimate: from deep time to the Anthropocene*
- *Ocean Circulation and Marine Biogeochemistry*
4h lecture in the series *Geochemical cycles and rates of geological processes*
- *Introduction to Paleoclimate*
5 day x 3h lecture course within the frame work of the 51st Heidelberg Physics Graduate Days of the Heidelberg Graduate School of Fundamental Physics

Supervision:

as principal or specialist supervisor

- Curchod M. (2022) *Évolution de la productivité primaire en lien avec le fer dans l'océan Indien subantarctique depuis le dernier maximum glaciaire*. **Bachelor's thesis.**
- Pfannschmidt J. (2020) *Can concentration changes of Atlantic deep water Nd be estimated from Holocene end member variations?* **Bachelor's thesis.**
- Goetze G. L. (2019) *Neodymium isotopic signature: Paleo scavenging versus water mass mixing*. **Bachelor's thesis.**
- Vogt-Vincent N. (2018) *Ice-rafted debris as a source of non-conservative behaviour for the ϵ Nd palaeotracer: insights from a simple model*. **Visiting student project** from Oxford University, UK.
- Tagliavini M. (2018) *Extraction of Rare Earth Elements from seawater employing sep-pak C18 cartridges*. **Bachelor's thesis.**
- Pöppelmeier F. (2016) *Investigations of Authigenic Neodymium Sediment-Pore Water Interaction and Reconstruction of Deep Water Mass Sourcing in the North-East Atlantic*. **Master's thesis.**
- Link J. M. (2015) *Rekonstruktion der Ozeanzirkulation im Nordatlantik während ausgewählter glazialer Terminationen der letzten 900 ka anhand von Neodymisotopen*. **Master's thesis.**
- Dietrich R. (2014) *Konzentrationsbestimmungen Seltener Eden am ICP-QMS*. **Bachelor's thesis.**
- Förstel J. (2014) *Messung von Lithium-Magnesium-Verhältnissen an einem iCAP QTM Quadrupol-Massenspektrometer mit induktiv gekoppelter Plasmaionenquelle*. **Bachelor's thesis.**

- Eisinger P. (2014) *Analysis and evaluation of a leaching procedure for the extraction of authigenic rare earth elements (REE) from marine sediments of the North Atlantic*. **Bachelor's thesis.**
- de Carvalho Ferreira M. L. (2013) *Water mass reconstruction by Nd isotopic analysis from mid Atlantic ocean sediments*. **Bachelor's thesis.**

as co-supervisor

- Bollen M. (ongoing) *Constraining past changes in remineralized carbon sequestration in Southern Ocean subsurface ocean water masses across the last glacial cycle*. **PhD thesis.**
- Schwabe E. (2023) *Untersuchungen zum Island Mass Effect bei den Crozet Inseln mittels Opalanalysen*. **Bachelor's thesis.**
- Pöppelmeier F. (2019) *The Atlantic water mass structure since the Last Glacial Maximum: New insights from Nd isotopes*. **PhD thesis.**
- Süfke F. (2020) *The application of Pa/Th in the Atlantic Ocean for the reconstruction of past circulation strength*. **PhD thesis.**
- Link J. M. (2021) *900 ka of Nd-isotope changes in the deep North Atlantic*. **PhD thesis.**
- Kullik V. (2017) *Rekonstruktion der Zirkulation im NO-Atlantik der letzten 30 ka unter dem Einfluss von Mittelmeerwasser anhand der Neodymisotopie*. **Master's thesis.**
- Hauck L. (2017) *Rekonstruktion der Zirkulation im westlichen Nordatlantik über die letzten 30 ka mittels der Neodymisotopie von Blake Bahama Outer Ridge Sedimenten*. **Master's thesis.**

Supervised experimental courses

- practical training course in physics for earth scientists
(execution, description, and evaluation of physical laboratory experiments)
- practical field experiments in physical limnology
(CTD measurements on an artificial lake and radon decay counting in the laboratory)