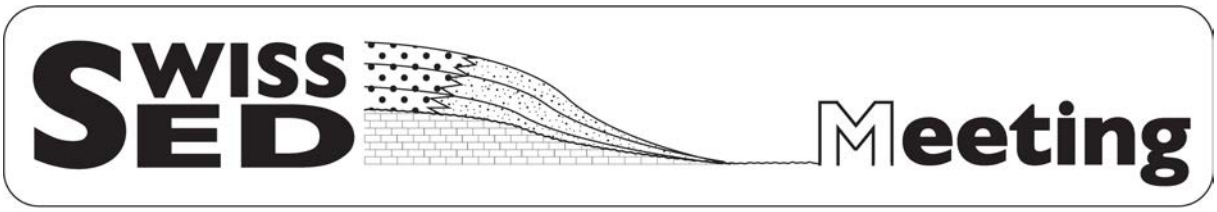

Thirty-first Meeting of Swiss Sedimentologists

Saturday, March 8, 2025

University of Fribourg

Program and abstracts

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SwissSed is an informal group of (not only) Swiss sedimentologists. It promotes contacts, exchange of ideas, and information on current developments in sedimentology. Membership is free, but SwissSed lives by the interest and initiative of its members.

To become a member, please contact one of the steering committee members below or email to swisssed@unifr.ch.

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31th SwissSed

March 8, 2025

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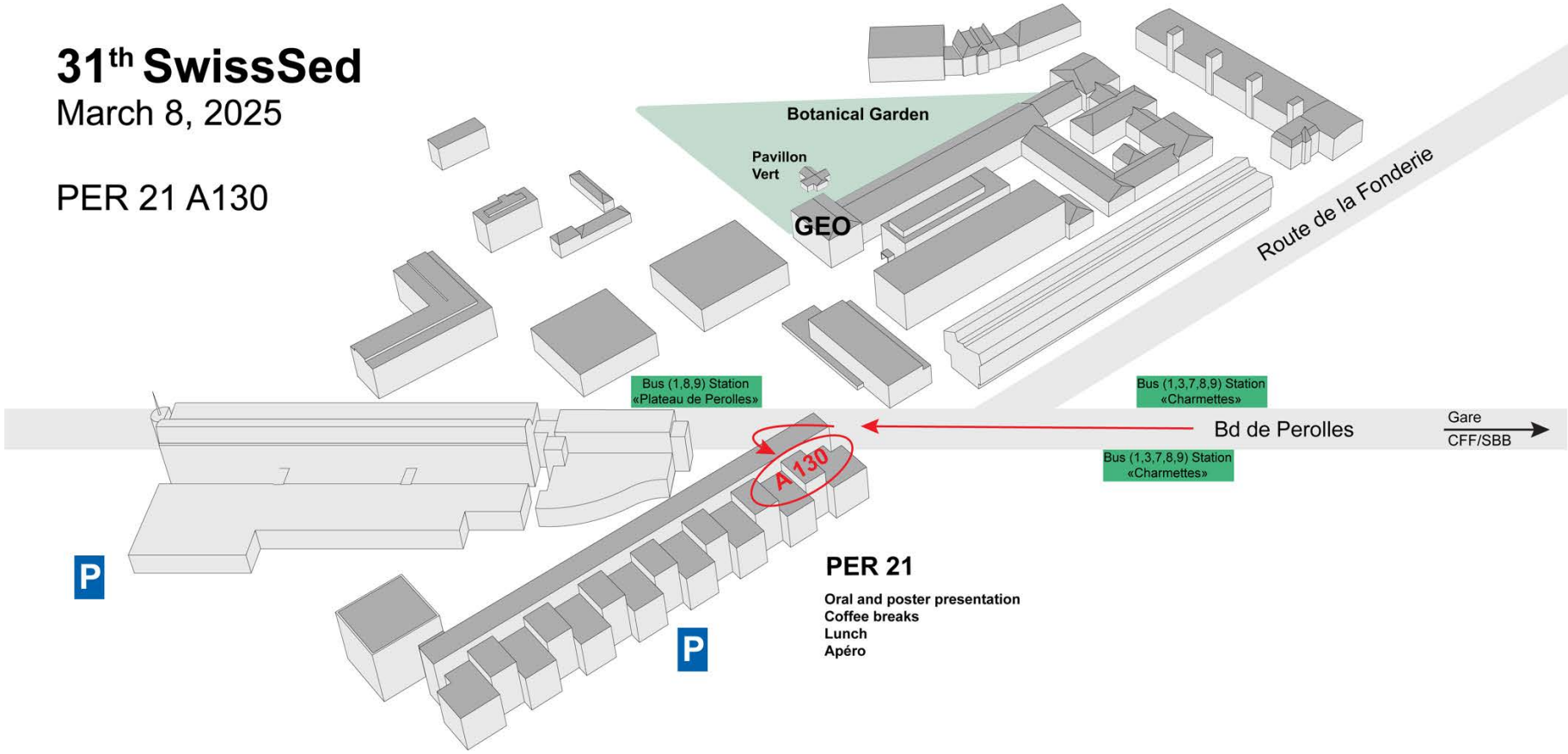

In Memoriam: Silvia Spezzaferri

Silvia Spezzaferri, active Steering Committee member of SwissSed, passed away on 30th July 2024.

(Picture courtesy of Stephanie Hayman)

Silvia was a dynamic scientist and – especially – dedicated micropaleontologist. Through her endeavor she conquered oceans and the world of foraminifera from Recent until Mesozoic times and from the tropics to the deep and cold-water coral world. She had a long career at the University of Fribourg. First, as maitresse assistante from 2002 until 2004, and then as maitresse d'enseignement et de recherche since November 2004.

She received her PhD in Earth Sciences at the Department of Earth Sciences of the University of Milan (Italy) in 1992 followed by a Post-Doc fellowship at the same institute. From 1995 until 1999, Silvia was active as associate researcher and science coordinator of the European Science Foundation Scientific Committee for Ocean Drilling at the Institute of Geology, ETH Zürich (Switzerland). Between 2000 and 2002, she was associate researcher at the Institute of Paleontology at the University of Vienna (Austria) before moving back to Switzerland at the University of Fribourg.

Silvia was a renowned and respected scientist. Her core research axis focused on the thorough understanding of foraminifera as paleo-environmental tracers. Silvia has been very active in steering the FOraminiferal BIoMOnitoring initiative (FOBIMO) – developing international standardized protocols for benthic foraminiferal studies. She had a very active publication policy and was leading many national and international research projects. She has been member and/or representative of many scientific committees, working groups and societies.

Silvia had a very colorful personality, driven by the in-depth understanding of the micropaleontological microcosmos. With that, she had a profound impact on many research careers leaving behind nice memories and moments.

We will miss her endeavor and dynamism, as well as her contributions to the SwissSed community and to the yearly meetings!

Anneleen Foubert

(On behalf of the SwissSed Steering Committee and the Department of Geosciences, UNIFR)

PROGRAMME

09.00 - 09.30 Morning coffee and croissant

09:30 - 09:45 *Opening:* Anneleen Foubert

09:45 - 10:30 **Maria Giuditta Fellin *(Keynote)***
Late Miocene Uplift and Exhumation of the Central-Eastern Alps recorded in the Southern Foreland Basin: A Source-to-Sink Approach

10:30 - 10:50 **G. Zimmerli**, S. Wohlwend, G. Deplazes, A. Foubert
New basin-wide insights in the depositional conditions of the Opalinus Clay

10:50 - 11:10 **S. Hosmann**, M. Rindlisbacher, S.C. Fabbri, M.W. Büchi, M. Hilbe, A. Bauder, F.S. Anselmetti
Exploring below the retreating ice: Swath bathymetry reveals sub-to-proglacial depositional processes and longevity of future glacial lakes

11:10 - 11:30 **I. Argadestya**, F. Schlunegger, F.S. Anselmetti, A. Pommerol, N. Thomas
Paleoshoreline detected from fan-delta deposits on Mars' Valles Marineris

11:30 - 12:00 **One-slide Poster presentations** (all poster presenters)

12:00 - 12:45 Lunch

12:45 – 13:30 Posters session

13:30 - 14:00 **Thierry Adatte *(Invited talk)***
Insights and limitations in comparing the PETM and the Anthropocene: Greenhouse warming, carbon cycle disruptions, and biotic responses

14:00 - 14:20 **C. Schmidt**, D. Mair, F. Schlunegger, B. McArdell, M. Christl, N. Haghipour, N. Akçar
From Overland Flow to Landslides: Deciphering Sediment Flux and Erosion Histories with Cosmogenic ^{10}Be, ^{26}Al, and ^{14}C

14:20 - 14:40 **P. Garefalakis**, F. Schlunegger, A.H. Do Prado, D. Mair, A.C. Whittaker
Constant size and mobility of grains in the Oligo-Miocene megafan deposits in the Swiss Molasse Basin

14:40 - 15:30 Coffee break Posters session

15:30 - 15:50 **L. Gegg**
The Quaternary sediment record of the Upper Rhine Graben

15:50 - 16:10 **S. Lazarev**, O. Mandic, K. Koiava, M. Stoica, D. Pas, S. Ćorić, M. Harzhauser, W. Krijgsman, D. Vasilyan
Middle-Late Miocene hydrological isolation of the Paratethys: from hydrological and ecosystem collapse to the Earth's refrigerator?

16:15 Best presentations award ceremony
Closure of the meeting

16:30 Apéro and Posters session

POSTER PRESENTATIONS

Jaccard, S., Delaney, I.A., **Biderbost, L.**: *Evolution of marine sedimentation within a glacial retreat area in the Disko Bay in Greenland*

Curty, A., **Bomou, B.**, Kocsis, L., Adatte, T.: *Palaeoenvironmental changes in the Villamartin Section during the Coniacian-Santonian OAE 3*

Dector, S., Fantasia, A., Foubert, A.: *Stromatolites in extreme environments: an example from a Jurassic paleolake from Argentina*

Duris, E., Bomou, B., odet, A., Adatte, T.: *Palaeoenvironmental changes in the Urgonian carbonate Platform induced by Volcanism?*

Felder, M.H., Hosmann, S., Camoin, G., Eisenhauer, A., Gischler, E., De Jonge, C., Kremer, K., Lecchini, D., Milne, G., Vogel, H., Anselmetti, F.S.: *Multiple interglacial sequences in a Darwin-type barrier-reef lagoon: Implications for paleoclimate, sea-level changes and subsidence since the Late-Pleistocene*

Gavillet, L., Fantasia, A., Bodin, S., Hesselbo, S.P., Adatte, T., Mattioli, E.: *Characterization of the paleoenvironmental conditions across the Bathonian-Callovian boundary at the Ravin des Vas locality, France*

Hosmann, S.L., Fabbri, S.C., Anselmetti, F.S., Gischler, E.: *Morphology of the Belize Barrier Reef as indicators for postglacial Atlantic sea-level changes*

Irzik, N., Bomou, B., Gueriau, P.: *The Toarcian ichthyological fauna of the Creux de l'Ours (FR, Switzerland): Systematic, Sedimentological, and Taphonomic aspects*

Laakkonen, A., Rast, D., Kremer, K., Janssen, D., Thomas, C., Vogel, H.: *Diagenetic minerals as indicators of past changes: case study from Alpine lake sediments*

Meister, P.: *Ostwald's step rule: rule of thumb or strict physical law?*

Parel, P., Fantasia, A., Abdi, A., Mattioli, E., Bomou, B.: *Paleoenvironmental characterization of the Sinemurian-Pliensbachian transition : New insights from the Kermanshah Basin, Western Iran*

Pomper, J., Schuster, B., Preusser, F., Gegg, L.: *Overdeepening-fill profiles in southwestern Germany*

Russo, N., Richter, N., Lattaud, J., Dubois, N.: *High-Resolution Water Column Study of Alkenone Production in Lac de Taney to Establish a Spring Paleothermometer*

Thomas, C., Laakonen, A., Ceriotti, G., Moser-Roeggla, P., Adolph, M.-L., Foubert, A., Berg, J., Kipfer R., Henderson, A.C.G., Clarke, L., Zhu, L., Wang, J., Ju, J., Haberzettl, T., Vogel, H.: *First Insights from the NamCore ICDP Drilling Project: Investigating Sedimentary Archives of long-term environmental change on the Tibetan Plateau*

Thomas, C., Arrieta-Martinez, M.C., Chiarella, D., Englert, R., Lloyd, J.C., Hême de Lacotte, V., Marchegiano, M., Privat A., TahirKheli, F.S., Zuchuat, V., Vaucher, R., and the copy editorial and editorial boards of Sedimentologika: *Sedimentologika: publish your sedimentology work in the free-for-all and community-based scientific journal*

van Wolde, Y., Jaccard, S., Delaney, I., Bomou, B.: *Analysis of the sediment budget in a fjord in South Greenland: Influence of ocean- and land-terminating glaciers on sedimentation.*

Werner, P., Pasquier, V., Bosco-Santos, A., Berg, J., Marin-Carbonne, J.: *Diagenetic fate of greigite in sediment from Lake St. Moritz, Switzerland*

Wienhues, G., Zahajská, P., Vogel, H., Grosjean, M.: *Hyperspectral imaging of sediment archives for high-resolution paleoenvironmental reconstruction*

SwissSed Meeting 2025 - List of participants *(status 04.03.2025, 20:00)*

Adams, Arthur	Lausanne
Adatte, Thierry	Lausanne
Anselmetti, Flavio	Bern
Argadestya, Indi	Bern
Ariztegui, Daniel	Geneva
Biderbost, Loïc	Lausanne
Bomou, Brahimsamba	Lausanne
Büchi, M.	Zürich
Damanik, Adrianus	UNIBE
Dector, Sananda	Fribourg
Deplazes, Gaudenz	Wettingen
Dubois, Nathalie	Zürich
Duret, Madeline	Fribourg
Duris, Emma	Lausanne
Fantasia, Alicia	Fribourg
Felder, Martin H.	Bern
Fellin, Maria Giudatta	Zürich
Foubert, Anneleen	Fribourg
Garefalakis, Philippos	Bern
Garipova, Sofia	Bern
Gavillet, Leonard	Fribourg
Gegg, Lukas	Freiburg (D)
Gilli, Adrian	Zürich
Hosmann, Siro Luca	Bern
Irzik, Nora	Lausanne
Laakonen, Aliisa	Bern
Lazarev, Sergei	Fribourg
Mangiagalli, Matteo	Fribourg
Meister, Patrick	Vienna
Neame, Oliver	Fribourg
Parel, Alisée	Fribourg
Pomper, Johannes	Freiburg (D)
Quirino Ferreira, Jaqueline	Geneva
Rindlisbacher, Margit	UNIBE
Rohas, Maïlys	Lyon (F)
Rüggeberg, Andres	Fribourg
Russo, Nicole	Zürich
Samankassou, Elias	Geneva
Schaller, Sebastian	Bern
Schlunegger, Fritz	Bern
Schmidt, Chantal	Bern
Strasser, André	Fribourg
Swaton, Sophia	Bern
Thomas, Camille	Bern
Vasilyan, Davit	Porrentruy
Van Wolde, Youri	Lausanne
Vogel, Hendrik	Bern
Wangritthikraikul, Kannika	Zürich
Werner, Philip	Geneva
Wetzel, Andreas	Basel
Wienhues, Giulia	Bern
Zimmerli, Geraldine	Fribourg
Zhang, Jianguang	Bern
Zwaan, Frank	Potsdam

Abstracts
(in alphabetical order)

Paleoshoreline detected from fan-delta deposits on Mars' Valles Marineris

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[2] *University of Bern, Institute of Physics, Space Research and Planetary Sciences Division, Sidlerstrasse 5, CH-3012 Bern, Switzerland*

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The dynamics of fan-delta deposits in Southeast Coprates Chasma using orbital images taken from multiple spacecraft and instruments provide novel data on past water levels on Mars. The Colour and Stereo Surface Imaging System (CaSSIS) is the main imaging system onboard the European Space Agency's ExoMars Trace Gas Orbiter (TGO) built at the University of Bern, which was launched on March 2016 and is currently active in acquiring images on Mars' surface (Thomas et al., 2017). Here, we combine CaSSIS along with Context Imager (CTX; Dickson et al., 2024), High-Resolution Stereo Camera (HRSC; Gwinner et al., 2016), Mars Orbiter Laser Altimetry (MOLA; Smith et al., 2001), and High-Resolution Imaging Science Experiment (HiRISE; McEwen et al., 2024) to: (1) identify fan-delta deposits along the Southeast Coprates Chasma, (2) perform geomorphological analysis on the fan-delta deposits, (3) trace the lateral extent of the fan-delta deposits along the South East Coprates Chasma, and (4) predict the presence of paleoshoreline in the region.

Scarp-fronted deposits (SFDs), also referred to as fan-deltas, are important in determining paleoshorelines on Mars because their frontal scarp elevations can indicate the level of a standing body of water into which they were deposited (Morgan et al., 2022), and when multiple SFDs have similar elevations, it suggests they formed within the same paleolake or sea. We detected and performed geomorphological mapping on 3 fan-delta deposits in Southeast Coprates Chasma, where we distinguished the drainage divide, valley infill, scree deposits, and the fan-delta deposit. Each fan-delta deposit is distinguished further with detailed topset, foreset, and bottomset feature delineated, and we made cross-section profile from the Digital Elevation Model (DEM) derived from HRSC-MOLA image.

Distinct fluvial sedimentary textures are visible through HiRISE image, notably desiccation cracks (mudcracks) and soft-sediment deformation, evidence of a past Mars climate that can support water in a now cold and arid Mars environment. We calculated the hypsometric curve for each catchment area of the fan-delta deposits, along with probability density function (PDF) showing sustained fluvial activity and an episodic debris flow that affected the formation of the fan-delta deposits. We observed that fan-delta deposits in Southeast Coprates Chasma have scarps at -3750 m, which we interpret as a paleoshoreline, traceable throughout and 1500 km beyond the site, and potentially marked the highest stand of water level recorded in Valles Marineris and its subsequent basins.

Figure 1. *CaSSIS image of Southeast Coprates Chasma fan-delta deposit (CaSSIS Image ID: MY34_005566_195_1) seen through NIR-PAN-Blue (NPB) filter. Up depicts north, and image size is approximately 5 km from west-east. Notice the fan-delta deposit in the southeast part of the image.*

Selected References:

Thomas, N., Cremonese, G., Ziethe, R. et al. (2017). The Colour and Stereo Surface Imaging System (CaSSIS) for the ExoMars Trace Gas Orbiter. Space Sci Rev 212, p.1897–1944.

Dickson, J. L., Ehlmann, B. L., Kerber, L., & Fassett, C. I. (2024). The Global Context Camera (CTX) Mosaic of Mars: A product of information-preserving image data processing. Earth and Space Science, 11, e2024EA003555.

Gwinner, K., Jaumann, R., Hauber, E., Hoffmann, H. et al. (2016). The High-Resolution Stereo Camera (HRSC) of Mars Express and its approach to science analysis and mapping for Mars and its satellites. Planetary and Space Science, 126, p.93-138.

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McEwen, A.S., Byrne, S., Hansen, C., Daubar, I. J., Sutton, S., et al. (2024). The high-resolution imaging science experiment (HiRISE) in the MRO extended science phases (2009–2023). Icarus, 2023, pp.115795.

Morgan, A. M., Wilson, S. A., and Howard, A. D. (2022). The global distribution and morphologic characteristics of fan-shaped sedimentary landforms on Mars. Icarus, 385, 115137.

Evolution of marine sedimentation within a glacial retreat area in the Disko Bay in Greenland

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The contribution focuses on a 94-cm long sediment core that has been retrieved from a fjord in front of Eqip Sermia along western Greenland (red rectangle in Figure 1). This glacier has been losing mass and has been gradually retreating as a consequence of climate change.

The main objective of the BSc thesis is to document the evolution of sediment accumulation as the glacier retreats. The aim is to determine the provenance and changes in the composition of the glacio-marine sediment sequence through recent times. A combination of sedimentological and geochemical methods will provide constraints about the provenance, mineralogy, granulometry and organic matter content of the sediment. The new measurements will be compared with existing results of cores nearby our area of study.

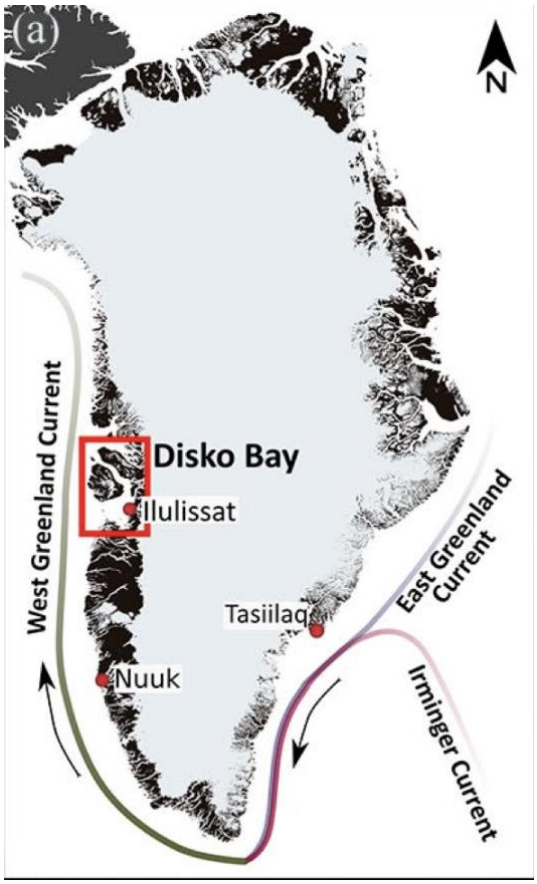

Figure 1. *Map of Greenland (Morlighem et al., 2017) and relevant ocean currents (Straneo et al., 2012).*
From Johansson et al 2020.

References :

Johansson, F.E., Wangner, D.J., Andresen, C.S., Bakke, J., Støren, E.N., Schmidt, S., Vieli, A. (2020) Glacier and ocean variability in Ata Sund, west Greenland, since 1400 CE. The Holocene, 30(12):1681 –1693. DOI: 10.1177/0959683620950431.

Morlighem, M., Williams, C.N., Rignot, E. et al. (2017) BedMachine v3: Complete bed topography and ocean bathymetry mapping of Greenland from multibeam echo sounding combined with mass conservation. *Geophysical Research Letters* 44(21):11051–11061.

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Palaeoenvironmental changes in the Villamartin Section during the Coniacian-Santonian OAE 3

Audrey Curty [(1)], Brahimsamba Bomou*[(2)], Laszlo Kocsis[(3)] and Thierry Adatte[(2)]

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The Coniacian-Santonian Ocean Anoxic Event 3 (OAE3) has long been considered to be local, diachronous and restricted to limited basins. However, some recent syntheses have suggested a global carbon isotopic perturbation with some correlatable isotopic events. Furthermore, the mechanisms leading to this perturbation are poorly understood, particularly in relation to the marine phosphorus cycle and climatic conditions in general. In order to investigate these issues further, a well-developed section will be studied: the Villamartin section (Spain). Compared to the official GSSP of Olazagutia, this section, located 150 km to the east, presents the advantage of a better biostratigraphic constraint (ammonites, inoceraminds, foraminifera, etc..). This study is based on mineralogy (bulk), geochemistry (stable isotopes, organic matter, phosphorus) to characterise changes in climate and primary productivity across the OAE3.

The studied section from Villamartin is compared with the reference section from Olazagutia. Both sections, deposited under oxygenated conditions, record the $\delta^{13}C$ patterns that characterise the Coniacian-Santonian OAE3 interval, in particular the positive carbon isotope excursions comprising the K2, Michel Dean and Bedwell isotopic events.

Based on mineralogy, similar climatic changes are observed in both intervals. The climate shifted synchronously from relatively drier to warmer and wetter conditions above the Coniacian-Santonian boundary (C-S boundary) from the Michel Dean event to above the Bedwell event during the Early Santonian. Fluctuations in total phosphorus appear to have been mainly driven by changes in detrital input and consequently climate change.

Stromatolites in extreme environments: an example from a Jurassic paleolake from Argentina

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The Cañadón Asfalto Basin (Chubut Province, Argentina) offers unique sedimentary Middle-Late Jurassic records of lacustrine systems that developed in a volcanic-hydrothermal context. This study focuses on the Quebrada Subsidiaria paleolake, which has been dated to the Toarcian using precise geochronological data (U/Pb: 177.27 ± 0.40 Ma). The sedimentary record includes alternating lacustrine, volcanic, and fluvial deposits, all influenced by significant hydrothermal activity in a warm-temperate, highly seasonal climate. As such, the lithology consists of organic matter-rich mudstone, sandstone, conglomerate, as well as stromatolitic limestones and stromatolitic cherts.

This study aims to document the microbial sedimentary textures, mineralogy, organic geochemistry and diagenetic structures of the stromatolitic levels to understand their formation in a volcanically-driven environment, with a focus on organo-mineral processes. Here, we present the first results of fluorescence, cathodoluminescence microscopy, and microtomography. This study is crucial as it fills a gap in our understanding of stromatolites throughout Earth's history, particularly those formed under different paleoatmospheric and paleoclimatic conditions. As such, this study will bring new insights into our knowledge of stromatolite formation, the preservation of organic matter, and microbial and diagenetic processes operating at extreme conditions. Consequently, it contributes to our understanding of the evolution and origin of life.

Palaeoenvironmental changes in the Urgonian carbonate Platform induced by Volcanism?

Emma Duris [(1)], Brahimsamba Bomou[(1)], and Alexis Godet[(2)] Thierry Adatte[(1)]

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During the early Cretaceous, the palaeoenvironmental and palaeoclimatic conditions, characterised by a warmer and equable global climate, favoured the extensive settlement of a carbonate platform, especially in subtropical to equatorial latitudes. However, the development of this carbonate platform was punctuated by several crises affecting the atmospheric and marine global carbon cycle. One of these took place during the late Early Aptian, with a significant positive excursion in carbon isotopes. This event, known as the Oceanic Anoxic Event OAE1a, is recognised at global scale and is characterised by global demise of carbonate platform and accumulation of black shale in deeper environment.

Prior to the definitive drowning of the Urgonian carbonate platform during the OAE1a, some precursor episodes occurred during the Barremian-Aptian transition with the deposition of marls strongly enriched in orbitolinids. The orbitolinids are generally associated with mesotrophic conditions with high nutrient inputs. This episode, called the “Lower Orbitolina Beds”, suggests a significant climatic change, characterised by wetter and warmer conditions, leading to an increase in detritism and a change in carbonate production. This increase in warm and humid conditions may have been triggered by a phase of intensified volcanic activity associated with the onset of the Ontong Java large igneous province.

To confirm the relationship between volcanism and the deposition of the Lower Orbitolina Beds, mercury measurements were conducted in several sections of the Urgonian carbonate platform in the Vercors area. Mercury is commonly used as an indicator of volcanic activity. The Ecouges section, along with the Gorges du Nan and Gorges du Frou sections, show significant increases in mercury levels in the marly intervals and paleosoils associated with the Lower Orbitolina Beds.

These indications of volcanism during the Barremian-Aptian interval confirm the connection with the onset of the Ontong Java Plateau and the eutrophication of the Urgonian Carbonate Platform as a precursor to Oceanic Anoxic Event 1a in shallow marine environments.

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Multiple interglacial sequences in a Darwin-type barrier-reef lagoon: Implications for paleoclimate, sea-level changes and subsidence since the Late-Pleistocene

Martin H. Felder*[1,2], Siro Hosmann[1,2], Gilbert Camoin[3], Anton Eisenhauer[4], Eberhard Gischler[5], Cindy De Jonge[6], Katrina Kremer[1,2], David Lecchini[7], Glenn Milne[8], Hendrik Vogel[1,2], Flavio S. Anselmetti[1,2]

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Charles Darwin described in 1842 the island of Bora Bora (Society Islands, Central South Pacific) as key example for a subsiding basaltic oceanic island with related reef development. He recognized that the Bora Bora lagoon developed between an outer barrier reef with a sand apron and an inner fringing reef attached to the shore of the volcanic island. In order to quantify past sea-level and paleoenvironmental changes and island subsidence, the lagoonal sediments were cored in 2024 in the context of the Bora^{2}coring project. Previous shorter cores indicated that the Holocene lagoonal sediments are of a mixed-carbonate-siliciclastic nature: the carbonate fraction is formed in-situ in the shallow-water depositional environment, whereas the siliciclastic fraction originates from the volcanic island. A recent seismic survey documented that below the Holocene sequence, several stacked depositional sequences occur, which must reflect the combined effect of sea-level fluctuations and ongoing island subsidence. To unravel the complex depositional history, a full suite of sedimentological, paleontological, petrophysical and geochemical analysis of the cores are conducted. In addition, samples of recent soil and lagoonal sediment will provide a data set to calibrate the measured proxies from the cores.

A total of 33 m of sediment cores were recovered and spliced into a composite section with a length of 18.2 m. The composite section reveals variable lithologies. A 4.5 m thick Holocene carbonate mud overlays a stiff, red to grey-bluish mottled, carbonate-free clay, forming the next underlying sequence. Coarse-grained carbonate sediments reappear at a depth of 9 m. Below this second carbonate unit, carbonate-free, grey-to-brown clay occurs, with occasional interbeds of white carbonate. Downcore, the clay becomes reddish again.

These sediments will be interpreted in the context of the interplay between sea-level, island subsidence and resulting accommodation space. A permanent connection to the open ocean seems to have existed only during the Holocene. In contrast, the deposition of siliciclastic fines during glacial phases suggests a distal alluvial or even shallow lacustrine depositional environment with no carbonate production within the lagoon. The occurrence of carbonates in 9 m depth indicate an older marine transgression and regression cycle presumably during an interglacial period overlying another glacial sequence.

All the different analyses will eventually merge toward an improved knowledge of island subsidence and the chronology and amplitudes of sea-level changes. The siliciclastic fines will additionally serve as an excellent proxy for hydroclimate-dependent weathering and erosion processes on the island.

Late Miocene Uplift and Exhumation of the Central-Eastern Alps recorded in the Southern Foreland Basin: A Source-to-Sink Approach

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Tectono-stratigraphic data indicate that the late Miocene was a period of intense deformation and orogenic growth in the Central-Eastern Alps, particularly in the Southern Alps. However, the spatiotemporal evolution of uplift, exhumation, landscape development, and sediment dispersal into the foreland—shaped by diachronous deformation—can only be understood by integrating bedrock and detrital records. Low-temperature thermochronology of basement rocks reveals rapid late Miocene exhumation, notably in the Adamello Batholith (Reverman et al., 2012), in the Southern Alps west of the South Giudicarie Line, and both south (Zattin et al., 2006; Heberer et al., 2017) and north (e.g., Eizenhöfer et al., 2021) of the Periadriatic Lineament east of the South Giudicarie Line. The detrital record further constrains surface processes. Quartz arenites buried in a cave indicate that, west of the South Giudicarie Line, the late Miocene landscape in the Adamello-Brenta Group experienced rapid uplift and exhumation without significant fluvial incision, allowing efficient sediment transfer across the Periadriatic Lineament (Sauro et al., 2021). While some material was temporarily stored in cave systems, most was transported southward, eventually reaching the Laga Basin in front of the submerged Central Apennines (Stalder et al., 2018). In contrast, east of the South Giudicarie Line, rapid surface uplift triggered a major drainage divide shift, blocking sediment transfer from the north of the Periadriatic Lineament (Stefani et al., 2007). As a result, the Venetian foreland briefly received detrital material exclusively from the eastern Southern Alps (Stefani et al., 2007).

These observations highlight the highly dynamic nature of the Late Miocene orogenic system, where deformation and uplift profoundly reshaped both the emerged landscape and the evolving foreland basin. The interplay between tectonics, surface processes, and sediment transport reveals a system in rapid transformation, with direct consequences for basin development and sedimentary routing across the region.

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Constant size and mobility of grains in the Oligo-Miocene megafan deposits in the Swiss Molasse Basin

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The Swiss Molasse Basin, north of the Central European Alps, records the tectono-geomorphological evolution of the foreland basin and the mountain belt. Changes in Alpine tectonics, climate, or both impacted the volumes of supplied sediments transferred to the foreland on alluvial megafans. Grain size preserved in conglomerates are commonly used as a proxy to infer geodynamic changes, allowing us to explore shifts in the environment conditions at the scale of the Swiss Molasse Basin. To this end, we measured about 50,000 grain sizes >2 mm from 15 stratigraphic sections (31-13 Ma-old deposits). Using this dataset, we have also modelled the transfer probability of the supplied material in the paleo streams.

Facies analyzes revealed that the investigated fan deposits were either deposited close to the fan apex or in the basin axis, approximately >10 km away from the Alpine thrust front (Fig. 1A). If the grain size data is averaged for each entire section, the D_{50} and D_{84} grain size percentiles scatter around 4 and 8 cm, respectively, and were nearly constant throughout 18 Myrs (Fig. 1B). The grain size values of individual stratigraphic sections show a coarsening up-section, particularly for systems where the fan apex is preserved. In contrast, sections at farther positions from the Alpine thrust front do not reveal a distinct change in grain size up-section. In addition, our modelled transport probability for all sections showed that the streams preferentially entrained particles <11 mm, with coarser grains being stored on the fans. As such, the grains corresponding to the D_{50} and D_{84} grain size percentiles had a transport-probability of c. 25% and 12%, respectively (Fig. 1C), and were likely transported by large, intermittent floods.

From the preserved sedimentary facies and the modelled transport probabilities of the grains, we conclude that the transport processes were likely similar for all fan systems, which seemed to be controlled mainly by autogenic processes. However, for the sections recording a proximal facies and with a preserved paleo-apex, a coarsening of the material occurred simultaneously with an increase of the supplied sediment to the Molasse basin. These supply signals were, however, not recorded by the conglomerates preserved in the basin axis, or the signals were shredded by autogenic processes on the fan systems.

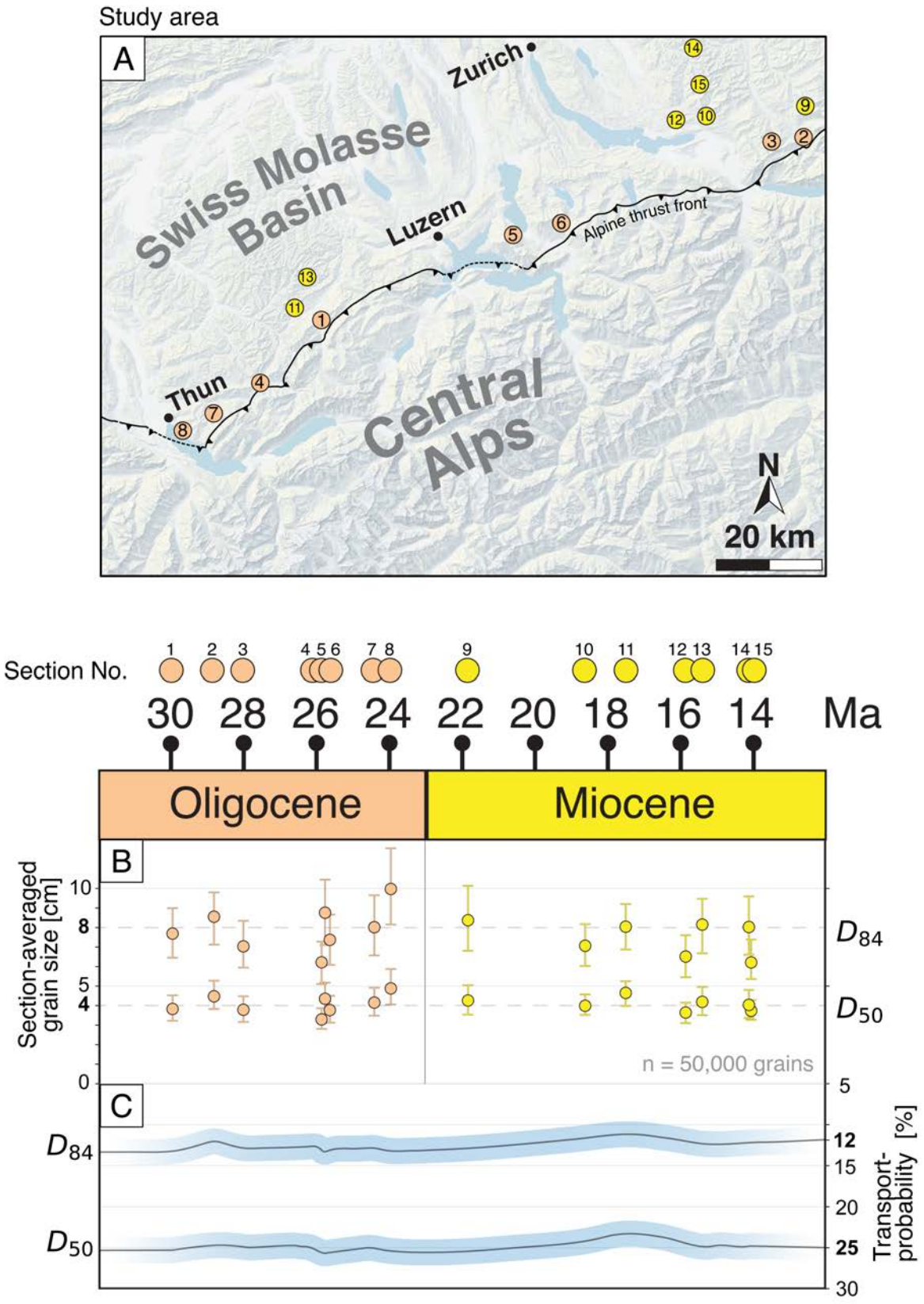

Figure 1: *A) Study area and location of analyzed stratigraphic sections in the Swiss Molasse Basin. B) Age distribution of the sections and section-averaged grain size values (D_{50} and D_{84}). C) Modelled transport probability of the corresponding grain size percentiles.*

Characterization of the paleoenvironmental conditions across the Bathonian-Callovian boundary at the Ravin des Vas locality, France.

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The Jurassic was characterized by significant global climate and environmental changes that often define the stage boundaries. Whereas most studies have been focusing on major events such as mass extinctions and hyperthermal events, only few studies have so far focused on the Bathonian-Callovian boundary and on the paleoenvironmental conditions. There is however evidence that major palaeoceanographic reorganisation associated with volcanic activity, climate warming, biotic turnover, and a carbon cycle disturbance occurred during this time interval. The lack of multi-proxy records prevents the determination of the causes and consequences of the environmental perturbations. As such, this lack of data complicates the attribution of the attribution of a Global Boundary Stratotype Section and Point (GSSP) for the Bathonian-Callovian.

The goal of this study is to characterise the paleoenvironmental conditions across the Bathonian-Callovian boundary by providing a multi-proxy analysis of a 100-meter-thick succession of dark marls from the Ravin des Vas section (SE France). For this study, we have used stable carbon isotopes to trace the carbon cycle dynamics, clay mineralogy to evaluate the chemical weathering, mercury concentrations as a proxy for volcanic activity, and phosphorus concentration to trace nutrient influx. Altogether, these analyses contribute to a better understanding of the potential role of volcanic activity in triggering the paleoenvironmental changes and carbon cycle perturbation. This multi-proxy study will bring new insights into our understanding of the paleoenvironmental conditions across the Bathonian-Callovian transition and hence provide a reference framework for further studies on this yet poorly known time interval.

The Quaternary sediment record of the Upper Rhine Graben

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The Upper Rhine Graben (URG) is the central part of the European Cenozoic Rift System, a tectonic basin that has been repeatedly subsiding since ca. 50 ka. Consequently, it has been filled by a kilometre-thick sediment sequence including several hundred metres of Quaternary strata. Fed by the Rhine and its tributaries, the URG collects deposits derived from the Alps as well as from the graben shoulders and their hinterlands – deposits that have built up a significant stratigraphic archive.

The work summarised here is based mainly on drill cores that recovered diverse successions and illustrate the Quaternary infill of the URG along a transect from south to north. It begins with (glacio-)fluvial gravels and sands as the distal signal of the Pleistocene glaciations of the Alps. Towards the north, these interfinger with aeolian, palustrine, and lacustrine deposits, which contain remains of biological indicators of climatic conditions and the general environmental setting. The architecture of the deposits is determined by patterns of differential subsidence, most strikingly at the depocentre in the northern graben part, and provides evidence of neotectonic activity. Overall, this highlights the interdisciplinary value of the URG's sediment fill that is still largely untapped.

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Morphology of the Belize Barrier Reef as indicators for postglacial Atlantic sea-level changes

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The mixed carbonate-siliciclastic barrier and atoll reef system offshore Belize is the largest modern tropical reef complex in the Atlantic Ocean, highly sensitive to past and future sea-level changes. The deglaciation and increasing temperatures after the Last Glacial Maximum caused a rise in sea level characterized by multiple melt-water pulses and stillstands, which left their characteristic marks in the morphology and growth pattern of the Belize Barrier Reef. Such postglacial sea-level change indicators provide thus critical details to reconstruct how sea level rose from the full glacial to Late Holocene levels. We present a study that was done within the framework of the active IODP proposal "Postglacial Atlantic sea-level and climate reconstruction through drilling the Belize Barrier Reef (BBRdrill)". To gain better insight into the morphological details, we acquired a high-resolution (1 x 1 m) topographic dataset of the Belize Barrier Reef with a state-of-the-art multibeam bathymetric device. Moreover, by investigating the entire point cloud of sonar reflections, we were even able to visualize the rarely investigated overhanging reef walls in great detail.

Concise morphological features indicating stagnant or slow-change phases were mapped in detail. They comprise elongated ridges at various water depths, indicating reef build-up to past sea level, which are aligned in single or multiple parallel lines, connecting hook-like structures, or complex honeycomb patterns. We hypothesize that older, postglacial and glacial reefs are stacked more or less vertically below the outermost ridge and the wall. The walls contain various erosional notches indicating still stands of sea level causing enhanced erosion in the quasi-vertical structure. This vertical stacking of the barrier reef crests gets affected towards the submarine outflow area of the English Cay Channel, where turbid waters likely challenged reef growth so that the aggradation eventually stopped and reefs drowned forming a reef line deepening towards the channel.

We provide a statistical distribution of features indicative for sea levels over 100 km length of Belize Barrier Reef, indicating the different slow-downs or stillstands of sea levels since the last glacial maximum. Several levels of erosional notches could be mapped at water depths of ~ -60 to -110 m, whereas the single or multiple reef crest occurs within a range of ~ -15 to -40 m water depth relating to sea levels ~13-16 ka and ~8-11 ka, respectively. The bathymetric distribution of notches and reefs suggests also the existence of a vertical tectonic displacement in the reef.

Exploring below the retreating ice: Swath bathymetry reveals sub-to-proglacial depositional processes and longevity of future glacial lakes

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The formation of subglacial overdeepenings is widely debated, yet essential for understanding glacial systems and their geomorphic processes. Knowledge of how glaciations formed landscapes is particularly important as receding glaciers currently uncover subglacial landscapes that are prone to a series of natural hazards. We present high-resolution (1x1 m) swath bathymetric data of a proglacial lake in front of the Rhonegletscher (Swiss Alps) that started to form in the early 2000s allowing an unprecedented look into a freshly uncovered glacier bed with all its depositional processes in an overdeepened setting. The lake floor is characterized by a series of subaquatic moraines that exhibit various sedimentary features, such as delta fans and subaquatic delta channels. The data allow us to correlate the succession of these moraines with the glacier's retreat history as seen on aerial photos, providing critical understanding of when, where and how such subaquatic moraines form. Sub- and englacial conduits control the location of active and inactive lake-inflow channels. These conduits carry large amounts of sediments that rapidly infill the inherited subglacial landscape produced by the deglaciation. Comparing three surveys from 2015, 2021 and 2024 allows a quantification of the accumulation and erosion processes in the lake. A backscatter intensity map differentiates between fine- and coarse-grained sediment and bedrock, and short gravity cores allow quantifying recent sedimentation. Towards the glacier front, which still extends subaquatically into the lake, our high-resolution data visualizes how the submerged ice front is interacting with its proglacial lake. This highly dynamic environment is characterized by iceberg calving (as observed in September 2021), melting of dead ice, fluctuating outflow conduits, rapid sedimentation due to particle-laden meltwaters and dumped glacial debris. A reflection seismic survey from 2024 documents that several meters of basinal sediments accumulated within a few years of lake formation.
Assuming constant sediment yield, the Rhone Lake will persist for ~300 years. However, as intense glacier retreat will lead to new overdeepened lakes in the next decades that efficiently trap sediments upstream, this and similar chains of proglacial lakes will persist much longer with implications for natural hazards as well as opportunities for hydropower, water resources and tourism.

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The Toarcian ichthyological fauna of the Creux de l'Ours (FR, Switzerland): Systematic, Sedimentological, and Taphonomic aspects

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The recent discovery of an actinopterygian fish fossil within the Toarcian deposits of *Creux de l'Ours*, located in the canton of *Fribourg*, provides a key foundation for this Bachelor's research study.

The Toarcian stage is characterized by a significant anoxic event, the Toarcian Oceanic Anoxic Event (T-OAE), driven by the prevailing warm and humid climate of the Early Jurassic. The study site is situated within the former Sub-Briançonnais Basin, which constituted part of the sedimentary environments of the Tethys Ocean. The geochemical and isotopic history of the deposits at *Creux de l'Ours* will be investigated through analyses of field-collected samples.

Key parameters such as total organic carbon (TOC) content will be quantified via Rock-Eval pyrolysis, mineralogical composition will be determined through X-ray diffraction (XRD), and paleo-productivity rates will be assessed through phosphorus analyses, among other methodologies. These results, integrated with existing published data, will enable a refined stratigraphic positioning of the collected samples within the geological time scale.

To refine the understanding of the anatomical features of the recovered specimen, advanced imaging techniques, trace element mapping, and UV-visible luminescence spectroscopy will be employed to extract additional phenotypic information and elucidate taphonomic modifications. Additionally, comparative analyses with museum specimens, if available, will be conducted. The findings will be compared with the broader paleoenvironmental and taphonomic framework of the Posidonia Shale Formation (e.g., southwestern Germany, northwestern Switzerland), recognized as a lateral equivalent of the study site.

The pronounced anoxic conditions that prevailed during the Toarcian facilitated exceptional fossil preservation, as evidenced by the state of the recovered specimen and the preservation of the original aragonitic mineralogy in ammonites from these strata.

This research will contribute to the taxonomic identification of the *Creux de l'Ours* specimen, the reconstruction of its paleoenvironment, and a deeper understanding of the mechanisms and consequences associated with the Toarcian Oceanic Anoxic Event.

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Diagenetic minerals as indicators of past changes: case study from Alpine lake sediments

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Often, biotic remains such as pollen, invertebrate, shells, and lipid biomarkers are used as palaeoclimatological proxies. In the absence of these kinds of remains, authigenic minerals, precipitated in the water column, can offer an alternative approach to study past environmental conditions. Minerals forming in the water column record the prevailing environmental conditions during deposition (Gebregiorgis et al. 2020). Authigenic minerals have been utilized, for instance, in the study of past atmospheric and environmental conditions (Gebregiorgis et al. 2020, Holland et al. 2006). This approach assumes that nothing has happened to the minerals after deposition. Yet, postdepositional processes such as diagenesis can cause alteration in mineralogy, structure and/or chemistry of deposited sediments. Diagenesis is a process which can happen abiotically or be mediated by microbial activity (Johnson et al. 2013, Vuillemin et al. 2013).

Here, sediment samples from a Swiss Alpine lake, Arnensee (BE), are examined to study authigenic and early diagenetic mineral formation, with the aim of characterising their modes of formation. To do this, we obtained sediment cores and analysed the sedimentology, mineralogy, microbiology and geochemistry of sediments and pore waters. Combining high-resolution X-ray tomography (µCT) with X-ray fluorescence scanning, we aim to identify the specific sedimentary conditions that promote mineral formation and diagenetic processes at deeper levels of the sediment column.

Analysis of the four micro-CT samples revealed small amounts of pyrite (FeS) in the bottom two samples, with the lowest sample also containing a significant amount of barite ($BaSO_4$). Pyrite typically forms in reducing environments, whereas barite can precipitate when Ba and S-rich fluids mix (Torres et al. 2003), during diagenesis (Lambert et al. 1978), or through microbial processes (Senko et al. 2004). One potential hypothesis is that microbes within the sediments are oxidising pyrite into barite.

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Middle-Late Miocene hydrological isolation of the Paratethys: from hydrological and ecosystem collapse to the Earth's refrigerator?

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The Cenozoic history of West Eurasia has been tightly linked with the evolution of the Paratethys – a vast epicontinental sea that was once stretching from modern-day France to Central Kazakhstan.

Between 12.65 and 7.65 Ma, the Paratethys underwent a remarkable phase of hydrological isolation from the global ocean, presumably driven by the tectonic closure of the Slovenian Strait. This period of time, known in the largest Eastern Paratethys (Caspian, Black Sea and Dacian basins) as the Volhynian, Bessarabian and Khersonian stages, was accompanied by strong biotic and hydrological perturbations. During the post-isolation Volhynian, the water level was stable and the ecosystems compiled the rare survived pre-isolation marine taxa admixed with numerous new endemics. With the onset of the Bessarabian, the water level of the Paratethys strongly expanded, extending the basin far into Central Asia. The Bessarabian ecosystems were characterised by the disappearance of the marine forms and the radiation of endemics. The situation drastically changed in the Khersonian when a series of high amplitude (up to 200-300 m) water level drops potentially disconnected the Paratethyan subbasins and nearly fully vanished the aquatic ecosystem.

The drivers of the biotic and hydrological perturbations in the basin remained unclear due to the lack of comprehensive paleoenvironmental and age constraints. This abstract presents our new integrated stratigraphic and sedimentological data from several key outcrops across the Eastern Paratethys. We will also present our new understanding of the Paratethyan hydrological and biotic evolution focusing on three major problems: Bessarabian-Khersonian extreme water level fluctuations; Khersonian Ecological Crisis; a hidden role of the Paratethys in the Late Miocene global cooling.

Ostwald's step rule: rule of thumb or strict physical law?

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In his 1897 article, Friedrich Wilhelm Ostwald wrote that "during departure from any state, and the transition to a more stable one, not the under given circumstances most stable state is reached, but the nearest one". The word "nearest" essentially gave rise to the widespread interpretation that during a phase transition not the thermodynamically most stable but a metastable phase forms first, which is usually referred to as Ostwald's step rule. It is considered a general rule rather than strict physical law, although its precise physical basis seems not fully understood on a mechanistic level, despite its potential importance for mineral formation under Earth's surface conditions.

While Ostwald's step rule is commonly explained through the classical nucleation theory, there are several inconsistencies that are not explained by this theory. One is that a transition to the stable phase cannot be forced by strongly increasing the driving force (supersaturation), and also adding seed crystals may not help (Land, 1998). This conundrum particularly applies to the two most abundant minerals in Earth's sedimentary record, dolomite and quartz (Meister et al., 2014), which are observed not to precipitate directly from aqueous solution as long as the solution remains supersaturated with respect to one of their metastable polymorphs.

Here, an alternative concept is proposed that would be consistent with Ostwald's (1897) original formulation and with several observations from natural environments and laboratory experiments. The difference lies in the translation of the word "nearest", not in a thermodynamic sense as "having a similar Gibbs energy", but kinetically as "having the smallest energy barrier" (Fig. 1). In the latter case, Ostwald's step rule would become an actual physical law, equivalent to the Arrhenius law. This goes along with the concept that not the thermodynamic barrier of nucleation but some kinetic barrier, not affected by supersaturation, is responsible for the efficient inhibition of the phase. Inhibition (giving rise to Ostwald's step rule) would then not be a matter of nucleation but of growth.

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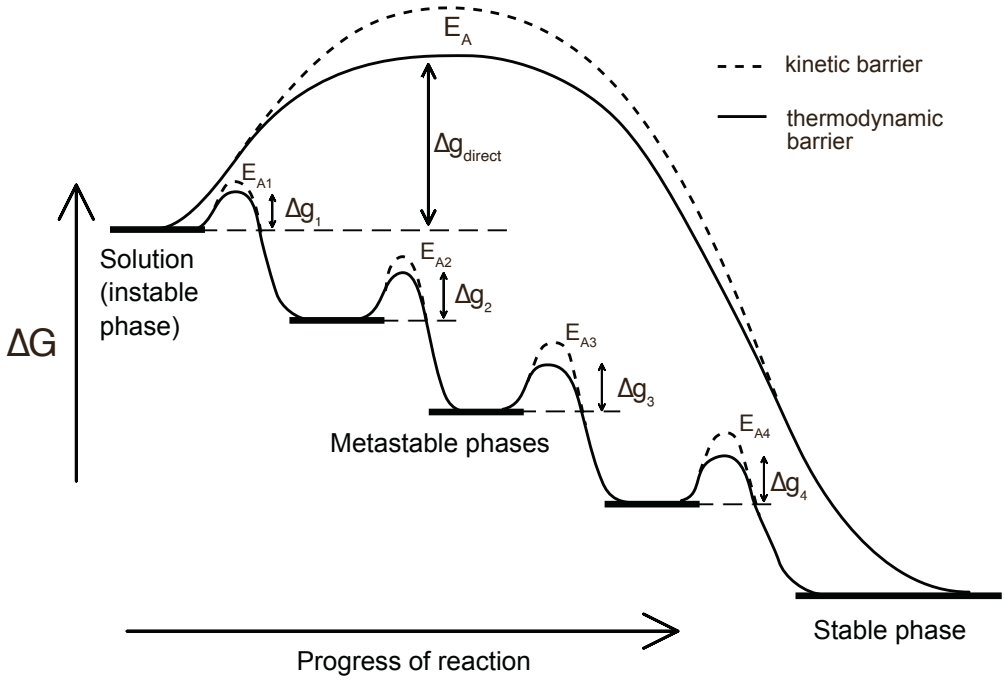

Figure 1. *Schematic representation of Ostwald's step rule (Meister, in press; modified after Cölfen & Mann, 2003). Energy barriers (Δg) and superimposed kinetic barriers (EA) are much lower for stepwise transition via metastable intermediate phases than for a one-step transition to the stable phase. Hence, the phases showing lower energy barriers should form first.*

Paleoenvironmental characterization of the Sinemurian-Pliensbachian transition: New insights from the Kermanshah Basin, Western Iran

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The Early Jurassic was marked by important palaeoceanographic, climate and environmental changes associated with carbon cycle perturbations likely triggered by major tectonic reorganization and associated volcanic activity. To date, most studies have been focusing on major events such as the Triassic-Jurassic mass extinction and the Toarcian hyperthermal event. On the other hand, only few studies have provided multiproxy records of the Sinemurian-Pliensbachian transition although there is evidence of important climate and environmental changes. Current available data indicate that the Sinemurian-Pliensbachian transition was marked by carbon cycle perturbation expressed as a negative carbon isotope shift. However, the processes leading to this carbon cycle perturbation, and to the climate and environmental changes are largely unknown. Therefore, this study aims to characterize the paleoenvironmental and palaeoclimatic conditions across the Sinemurian-Pliensbachian transition and to determine the driving mechanisms and how this impacted the biosphere.

For this purpose, we have selected the Dar Bario succession (southwest Iran, Kermanshah Basin), which encompasses the Sinemurian-Pliensbachian transition and mostly consists of shales, cherts and pelagic limestones. In order to determine if volcanic activity played a role in the Sinemurian-Pliensbachian event and to characterize the palaeoenvironmental conditions, we have used different environmental proxies: Hg concentrations as a tracer for volcanism, clay mineralogy to determine the weathering conditions, total phosphorus concentrations to trace nutrient changes, and Rock-Eval pyrolysis to characterize the type and preservation of organic matter. Correlation and comparison of the Dar Bario record with coeval sites allow to detangle the role of local and global processes on the observed trends. This study provides the first multiproxy record from southwest Iran, bringing new insights into our understanding of the Sinemurian-Pliensbachian events in terms of paleoclimate, paleoenvironment and paleoecology.

Overdeepening-fill profiles in southwestern Germany

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Overdeepenings are closed basins incised into the bedrock by subglacial erosion, and following ice retreat, they become infilled with water and sediments. The sedimentary fillings, some of which are composed of multiple cycles representing separate glaciations, are archives of enormous scientific value. Investigation of overdeepenings and their infills is the key to understanding the processes and drivers of subglacial erosion, the timing and sequence of past glaciations, and thus their cumulated impact on landscape and topography. We present the stratigraphic successions of three high-quality drill cores from Upper Swabia in the North of the Lake Constance area (southwestern Germany), which are part of the project “Drilling Overdeepened Alpine Valleys” (DOVE; Anselmetti et al. 2022) supported by the International Continental Scientific Drilling Program (ICDP).

These drill cores recovered the complete Quaternary succession at each site, including the infill of two, potentially three separate overdeepenings (Lichtenegg Basin, Gaisbeuren Basin?, Tannwald Basins. These were selected because they should represent, according to previous studies (Ellwanger et al., 2011), large parts of the Early and early Middle Pleistocene (i.e. pre-Holsteinian) and are therefore excellent candidates for the investigation of a time interval that is currently only poorly understood in the northern Alpine foreland.

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High-Resolution Water Column Study of Alkenone Production in Lac de Taney to Establish a Spring Paleothermometer

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Alpine regions in Switzerland have undergone notable warming over the last century, with homogenized records from 1864 to 2000 indicating a mean temperature increase of approximately 1 °C per century in Canton Valais, Switzerland (*Begert et al., 2005*).
Understanding how alpine ecosystems responded to past climate variations can provide critical insights into ongoing changes. Paleoclimate records can help in understanding how ecosystems such as lakes will respond to this ongoing change, as temperatures have been warmer during certain intervals of the recent past, such as the Medieval Period (*García-Alix et al., 2020*) or the Holocene Climatic Optimum (*Kalis et al., 2003*).
Lakes act as essential archives, preserving detailed records that enable the study of long-term climate variability. Lac de Taney, nestled in a nature reserve in western Valais at an elevation of 1400 m, presents an ideal site for high-resolution paleoenvironmental reconstructions. Its singular environment, safeguarded from strong winds by surrounding hills and featuring a relatively small surface area (0.17 km²) compared to its 35 m summer depth, allows undisturbed sediment deposition.

Alkenones, lipid biomarkers synthesized by haptophyte algae, represent a promising tool for reconstructing past lake temperatures. Alkenones are well-preserved in lake sediments, and their degree of unsaturation is linked to the water temperature at the time of algal growth in the water column *(Longo et al. 2016, Theroux et al. 2019).* In high latitude lakes, these long-chain ketones have been shown to reach high concentrations shortly after ice-off during the early spring phytoplankton bloom (*Toney et al., 2010*). Understanding modern alkenone production and seasonal dynamics is key to improving temperature calibrations and refining continental paleotemperature reconstructions. This study assesses the environmental factors influencing alkenone production in a mid-latitude alpine lake system: Lac de Taney. The primary aim is to create an in-situ alkenone-temperature calibration that will be applied to the sediment archive to create a longer paleoclimate record.

Here we present results from a high-resolution sampling campaign from late March to September 2024 (weekly after the ice break and monthly thereafter). We monitored lake characteristics using sensors (a thermistor chain) and discrete sampling to capture variations in alkenone distributions in the water column throughout the spring and summer seasons. In addition, we collected monthly sediment trap samples.
At the start of the sampling campaign, on April 5, one and a half weeks after the start of the ice-off period, chlorophyll-a peaked in the surface waters. Five days later, as the bloom progressed, chlorophyll-a concentrations decreased and alkenone concentration reached the maximum recorded concentration for the season 2024 at 5 meters water depth (Figure 1).

This suggests that alkenone-producing haptophytes could be influenced by reduced competition or more favorable environmental conditions in the surface waters, such as increased nutrient availability or temperature variations.

The phytoplankton bloom persisted for approximately three and a half weeks and gradually declined thereafter. Despite decreasing chlorophyll-a concentrations, the prolonged presence of alkenones indicates that their production is not synchronised with dominant phytoplankton producers and is regulated by different environmental drivers. These preliminary results suggest that alkenone could be used as spring temperature proxies in mid-latitude and high-altitude lakes. A temperature calibration will be developed for Lac de Taney using the temperature recorded by the thermistor chain.

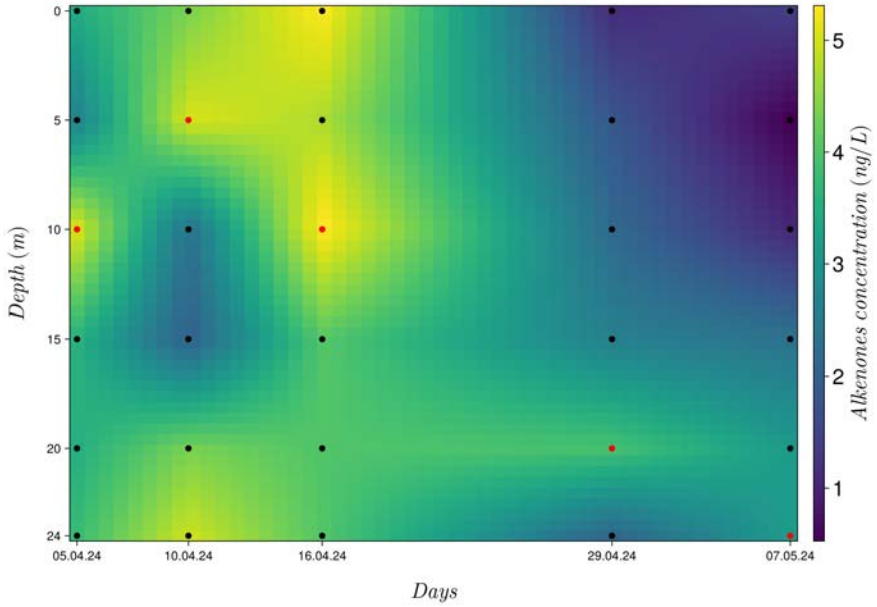

Figure 1. *Time–depth heatmap of alkenone concentrations (ng L^{-1}) in Lac de Taney from 05 April to 07 May 2024. The horizontal axis represents the sampling dates, the vertical axis shows water depth (m), and the color scale indicates alkenone concentration (warmer colors = higher values). Data captures the progression of alkenone production during the early spring bloom period.*

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From Overland Flow to Landslides: Deciphering Sediment Flux and Erosion Histories with Cosmogenic ^{10}Be, ^{26}Al, and ^{14}C

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Quantifying erosion in a catchment across different spatial and time scales is key to understand landslide hazards and the role in long-term sediment generation. In this context, disentangling the contributions of localized landslides to catchment-wide erosion remains challenging due to their stochastic nature and the occurrence of sediment storage. To address this, we measured cosmogenic ^{10}Be, ^{26}Al and ^{14}C concentrations in detrital quartz across a dense network of nested sub-catchments to quantify denudation rates, assess sediment production variability, and trace the source-to-sink cascade within a 12 km^2 basin.

The study area, the Gürbe catchment, is located at the northern margin of the Swiss Alps and comprises two distinct geomorphological zones. The upper zone, (c. 1,800–1,200 m a.s.l.), is characterized by steeply dipping Mesozoic limestone cliffs transitioning into Mesozoic-Cenozoic Flysch hills overlain by till. Mapping indicates that sediment production here is dominated by overland flow and channel erosion, with minimal connectivity between hillslopes and channels. In contrast, the lower zone, starting at an elevation of 1,200 m a.s.l. and extending to the Gürbe fan at c. 800 m a.s.l., is underlain by Flysch bedrock, partially mantled by till and interspersed with Neogene Molasse formations. The boundary between the upper and lower zone is marked by a glacially conditioned knickzone, indicating the onset of intensive channel incision. Mapping shows that this lower zone is characterized by a complex topography with pronounced scarps and depressions indicative of deep-seated landslides, some of which are directly coupled to the Gürbe trunk channel, while others supply material via tributary excavation.

Cosmogenic nuclide concentrations reveal distinct patterns. In the upper zone, ^{10}Be and ^{26}Al concentrations are high, yielding denudation rates of c. 0.1 mm/yr. However, concentrations are lowest in the lower zone tributaries leading to a concentration decrease downstream along the Gürbe trunk channel. Accordingly, ^{10}Be and ^{26}Al-based denudation rates calculated for the tributaries in the lower zone are significantly higher, reaching values up to 0.3 mm/yr. In addition, ^{26}Al/^{10}Be ratios in the upper zone align with the surface production ratio 6.75, consistent with sediment production through overland flow erosion. Contrarily, in the tributary material, ^{26}Al/^{10}Be ratios are up to 8.8, suggesting that a significant proportion of this sediment originates from deep-seated landslides. The ^{14}C derived denudation rates are two to three times higher than the ^{10}Be derived denudation rates ranging from 0.2 mm/yr in the upper zone to 1 mm/yr in the most active tributary of the lower zone. We interpret the ^{14}C data as a combined effect of sediment storage and subsequent stochastic, unpredictable and rapid release of substantial amounts of deep material into the system, leading to apparent ^{14}C-based erosion rates that are much higher than the long-term averages measured with in-situ ^{10}Be.

In summary, this study demonstrates that by combining field-based mapping with the analysis of multiple cosmogenic nuclides, it is possible to (i) identify the origin of the sediment, (ii) determine the corresponding mechanisms of sediment generation, and (iii) estimate the time scale for sediment transfer across a geomorphologically diverse catchment.

First Insights from the NamCore ICDP Drilling Project: Investigating Sedimentary Archives of long-term environmental change on the Tibetan Plateau

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In summer of 2024, the NamCore ICDP drilling project retrieved ~1000 m of sediment cores from Lake Nam Co, Tibet (4700 m a.s.l) extending to a depth of more than 500 m below the lake floor (Henderson et al., 2024). These new sediment cores provide a unique, high-altitude archive of environmental change that have the potential to capture monsoon dynamics, westerly jet circulation and climate evolution spanning approximately the last one million years. Preliminary sedimentological observations reveal predominantly fine-grained lake muds with variable carbonate content and mineralogy together with distinct changes in lithology, textures and structures. Alternations in sediment composition suggest the Nam Co archive is likely to be sensitive to orbital- to millennial-scale hydroclimatic variability. Finely dispersed, nodular and fracture-bound iron sulfide mineralizations are abundant throughout the entire record, indicating the recycling of organic matter and re-precipitation of secondary minerals by the subsurface biosphere, possibly as a function of specific paleoclimatic conditions.

The SNSF DIGESTED Sinergia research project leverages this unique sedimentary archive to investigate diagenetic processes that may alter primary paleoenvironmental signals (Thomas et al., 2024). While local climate and catchment dynamics drives lake productivity and hydrology by influencing water chemistry and biology; the resulting geochemical changes form a diagenetic signal that is created by interactions between the geosphere and the biosphere. Microbial communities play a key role in mineral dissolution and precipitation, and their activity is influenced by sediment physicochemical properties. Additionally, fluid advection along tectonic fault planes observed within the NamCore sediments, can overprint

ancient mineral and isotopic records, complicating paleoclimatic reconstructions and interpretations. Our research consortium aims to disentangle primary climatic signals from secondary diagenetic imprints. We use a comprehensive approach that includes analyses of the sediment physical and chemical properties, water column and pore fluid gas and solute compositions, sedimentary environmental DNA signatures and laboratory experimental approaches to enhance the robustness of environmental reconstructions from sedimentary records.

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The journal opened in November 2022 for submission and has since published 3 issues totalizing 31 articles as of February 2025. It is a member of the Free Journal Network and has been awarded the DOAJ Seal demonstrating best practices in Open Access publishing, within the Directory of Open Access Journals. *Sedimentologika* aims to to foster an inclusive and diverse environment within sedimentology, stratigraphy, and related fields (Thomas et al., 2023).

Thomas, C., Privat, A., Vaucher, R., Spychala, Y., Zuchuat, V., Marchegiano, M., Poyatos-Moré, M., Kane, I., & Chiarella, D. (2023). Sedimentologika : A community-driven diamond open access journal in sedimentology. *Sedimentologika*, *1*.

Analysis of the sediment budget in a fjord in South Greenland: Influence of ocean- and land-terminating glaciers on sedimentation

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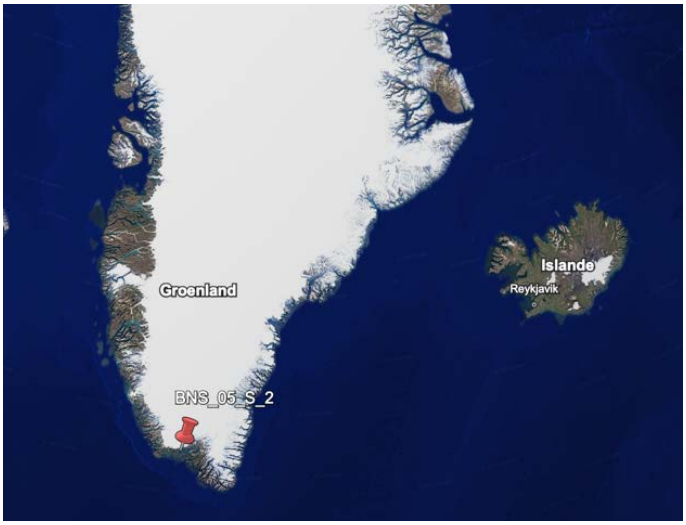

This bachelor project involves the analysis of a marine sediment core from southern Greenland to determine the influence of glacier type on sedimentation processes. In the context of global warming, the acceleration of glacier retreat is leading to a transition from marine to terrestrial glaciers. These changes have a huge impact on biodiversity, sediment budget and on CO_2 sequestration.

The erosive capacity of a glacier is exponentially related to its flow velocity. The objective of this work is thus to estimate changes in sediment accumulation through time, with a focus on the last decades, and document how the transition from ocean- to land-terminating conditions affect sediment composition, in particular its grain size distribution and mineralogy.

Different types of analyses will be conducted on the sediment samples, including MSCL, CT scanning, core-scanning XRF, XRD, as well as physical and geochimical analyses (P, TOC, grain size).

Diagenetic fate of greigite in sediment from Lake St. Moritz, Switzerland

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Biogeochemical processes in lake systems are recorded in their sediments, leaving a legacy that continues to influence water chemistry, create ecological niches for microbial communities, and control sediment chemistry throughout diagenesis. With respect to Fe and S, microbial activity facilitates the formation of iron-sulfur minerals, first through the precipitation of metastable minerals such as greigite (Fe_3S_4), which are then preserved in sediment and sedimentary rocks as pyrite (FeS_2). Here, we re-investigate Lake St. Moritz (Switzerland), an organic-rich freshwater lake influenced by ferruginous groundwater, where greigite was first described nearly 30 years ago (Ariztegui & Dopson, 1996). Our goal is to better understand the local conditions leading to greigite formation, its preservation, and potential transformation during early diagenesis. Contrary to previous observations, we did not detect greigite in the lake's modern sediments. Based on preliminary downcore data—including bulk S-C-N isotopes and porewater physico-chemical properties—we propose that the absence of greigite could result from changes in the lake water and/or sediment redox conditions over recent decades. Ongoing microscale morphological analyses aim to determine whether greigite has transformed into pyrite.

References:

Ariztegui, D., & Dobson, J. (1996). Magnetic investigations of framboidal greigite formation: a record of anthropogenic environmental changes in eutrophic Lake St Moritz, Switzerland. The Holocene, 6(2), 235-241.

Hyperspectral imaging of sediment archives for high-resolution paleoenvironmental reconstruction

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Hyperspectral Imaging (HSI) core scanning provides a powerful, non-destructive way to examine the biogeochemical makeup of sediment archives. In Bern, this technique captures detailed spectral reflectance profiles (400–2500 nm) at high resolution (40–300 µm) directly from fresh core surfaces. This allows for rapid, detailed analysis of lake sediments, peat, and ice cores, enabling us to quantify changes in pigments, organic matter, grain size, and mineral composition.

HSI helps reconstruct past climate, productivity, and anoxic events across various timescales. Notably, analyzing varved sediments allows direct comparison with meteorological records and reconstructions of vegetation and catchment dynamics, revealing high-frequency environmental changes. We can trace seasonal and inter-annual variability within varves, as well as longer-term changes spanning glacial-interglacial periods (>10,000 years). HSI effectively tracks sediment features related to low-oxygen conditions, dust input, volcanic eruptions, and earthquake/flood events.

Moreover, HSI allows us to detect and quantify compounds that are difficult to extract using standard methods, such as phycocyanin, a cyanobacterial biomarker—highlighting the benefits of non-destructive analysis. Ultimately, HSI core scanning represents a significant step forward in sediment analysis, offering a robust platform for generating high-resolution data and transforming our understanding of environmental processes.

New basin-wide insights in the depositional conditions of the Opalinus Clay

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The Opalinus Clay, a silty to sandy claystone formation, was deposited during the latest Toarcian to Aalenian in an epicontinental sea. This epicontinental sea was localized in the southern part of the Laurasian Seaway. This Seaway connected the northern margin of the Tethys with the Boreal Arctic Sea. The aim of the present study is to revisit the depositional model of the Opalinus Clay taking a basin-wide perspective. Existing depositional models explain facies variations by the presence of storm deposits, while thickness variations are related to synsedimentary tectonic activity. In this study, we explore the influence of current dynamics as potential source for thickness and facies variations. As integrative, comparative and quantitative grain size analyses are lacking for the formation of the Opalinus Clay, detailed grain size measurements were performed using laser particle size analyses. The mean sortable silt (10 to 63 µm fraction) was calculated and used to reconstruct past current velocities in the Opalinus Clay Basin. To obtain a basin-wide perspective, an integrative database with all accessible Opalinus Clay drill cores in Switzerland, Germany and France has been compiled. This allowed the reconstruction of an isopach map for the Opalinus Clay showing a NE-SW trending basin with maximum thickness in the Black Forest and Swabian Jura regions and thinnest parts at the basin margins. The observed complex lateral and vertical facies and grain size variability show that the influence of bottom currents has been underestimated so far and imply that the Opalinus Clay accumulated largely as a result of drift deposits.